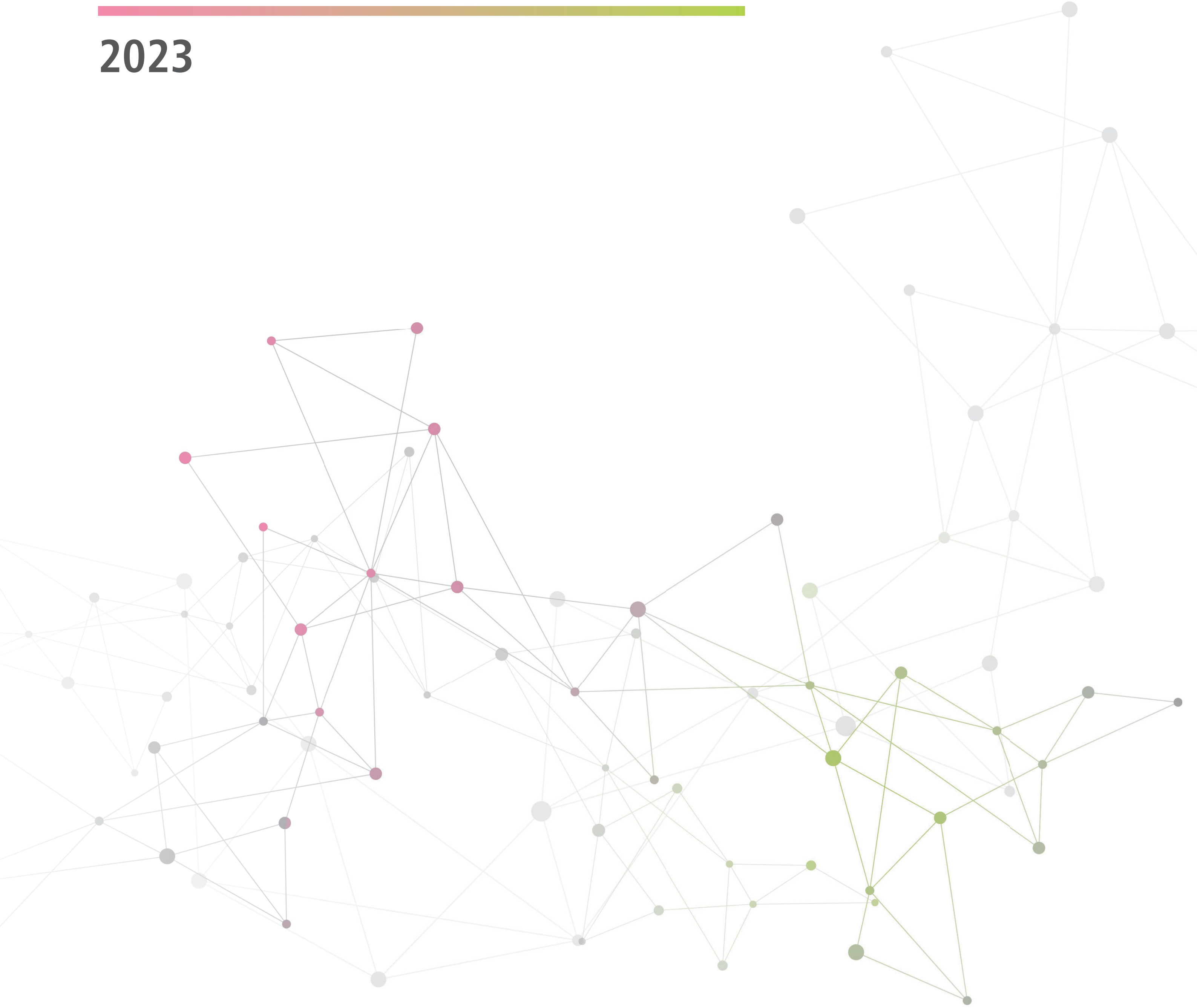
Anritsu

Electronic Measuring Instruments

2023



Since 1895

Anritsu

Electronic Measuring Instruments

Optical Measuring Instruments

p.14

- Network Master Pro
  - OTDR Module
- Network Master
  - μOTDR Module
- ACCESS Master
- Coherent OTDR
- Optical Loss Tester/Light Source/Optical Power Meter
- Optical Spectrum Analyzer
- Video Inspection Probe Series
  - Autofocus Video Inspection Probe
  - Video Inspection Probe
- Bare Fiber Adapter

Bit Error Rate Testers (BERT)/Oscilloscopes

p.59

- Signal Quality Analyzer-R
- BERTWave

Transport and Ethernet Testing

p.89

- Network Master Pro
  - 400G (QSFP-DD) Multirate Module
  - 400G (OSFP) Multirate Module
  - 100G Multirate Module
  - 10G Multirate Module
  - High Performance GNSS Disciplined Oscillator
- Site Over Remote Access
- Network Master
  - Gigabit Ethernet Modules

Mobile/Wireless Communications Measuring Instruments

p.111

- Radio Communication Test Station
  - SmartStudio NR
- Shield Box
- RF Chamber
- CATR Anechoic Chamber
- Signalling Testers
- Rapid Test Designer (RTD)
- 5G NR Mobile Device Test Platform
- LTE-Advanced Mobile Device Test Platform
- New Radio RF Conformance Test System
- LTE-Advanced RF Conformance Test System
- RF Regulatory Test System
- Simple Conformance Test System
- Radio Communication Analyzers
- Universal Wireless Test Set
- Vector Signal Generator
- IQ Fiber Master
- Handheld Direction Finding System
- Mobile Interference Hunting System
- Bluetooth Test Set
- Wireless Connectivity Test Set
- NEON Signal Mapper
- LMR Master
- Site Masters
- Microwave Site Master

Signal Analyzers/Spectrum Analyzers

p.312

- Signal Analyzers
- High Performance Waveguide Mixer
- Field Master
- Field Master Pro Spectrum Analyzer
- Spectrum Master
- Remote RF Signal Monitoring
- Remote Spectrum Monitor
- Spectrum Monitoring System

Vector Network Analyzers

p.520

- VectorStar
  - Broadband Vector Network Analyzers
  - Opto-Electronic Network Analyzer
  - Microwave Vector Network Analyzer
- ShockLine Family
- VNA Masters
- VNA Calibration Kits
- VNA Verification Kits
- O/E Calibration Module
- ShockLine 2-Port and 4-Port SmartCal Calibration Units

Signal Generators

p.621

- RF/Microwave Signal Generators
- Analog Signal Generator

RF Microwave Measuring Instruments

p.657

- Power Meters
- Inline Peak Power Sensor
- USB Power Sensors
- Microwave Universal USB Power Sensors
- Microwave CW USB Power Sensors
- mmWave Power Analyzer
- USB Peak Power Sensors

Components

p.689

- Fixed Attenuators for High Power Measurement
- Fixed Attenuators
- Four-port Junction Pad
- 2Way/4Way Low Amplitude Error Divider
- Resistive Power Tap
- RF Fuse Holder
- Fuse Element
- Precision RF & Microwave Components
- H-Field/E-Field sensor
- E-Field Isotropic Antenna
- Kelvin Bias Tee

Peripheral Equipment

p.702

- Coaxial Cords, Adapters
- Power Cord Plugs
- F-series Cabinets

The Anritsu Group was established in 1895, when radio communication experiments were being successfully carried out for the first time in the world, and is celebrating its 127th anniversary in 2022. Our long history has been a story of challenges as we have always been pioneers in the information and communication field. Various innovations in communication infrastructure have changed our society dramatically, at the same time as providing the rich sense of "connection" to people that helps advance social progress globally. Regarding "measurement" technology as a core competency, Anritsu has been strongly supporting its progress.

Currently, Anritsu Test and Measurement business provides timely solutions that correspond to the full-scale 5G commercialization of each country around the world. We are aiming to be a solution partner contributing to realize a society where people and things can be reliably connected and high-quality information and communication services can be received, by supporting all industries related to information and communication with cutting-edge technology.

The Anritsu Group continues to develop a safe and secure infrastructure and contributes to the creation of industries and promotion of innovation that will lead to the creation of a sustainable society.

Headquarters

Corporate Information

Headquarters

ANRITSU CORPORATION
5-1-1 Onna, Atsugi-shi, Kanagawa 243-8555, Japan

First founded as Sekisan-sha in 1895.

Established as Anritsu Electric Corporation on March 17, 1931.

Paid-up capital: 19,189 million yen (as of March 31, 2022)

Sales volume: 105,387 million yen (consolidated)
(Year ended March 31, 2022)

Employees: 4,168 (consolidated) (as of March 31, 2022)
1,758 (non-consolidated) (as of March 31, 2022)

Sales Network

Anritsu Americas Sales Company (United State)
Anritsu Infivis Inc. (United State)
Anritsu Electronics Ltd. (Canada)
Anritsu Eletrônica Ltda. (Brazil)
Anritsu Company S.A. de C.V. (Mexico)
Anritsu EMEA GmbH (Austria)
Anritsu EMEA Ltd. (United Kingdom)
Anritsu Infivis Ltd. (United Kingdom)
Anritsu S.A. (France)
Anritsu GmbH (Germany)
Anritsu S.r.l. (Italy)
Anritsu Infivis B.V. (Netherlands)
Anritsu AB (Sweden/Finland)
Anritsu EMEA Ltd. Representation Office in Spain (Spain)
Anritsu EMEA Ltd. Dubai Liaison Office (United Arab Emirates)
Anritsu A/S Dubai (United Arab Emirates)
Anritsu (China) Co., Ltd. (P.R. China, Shanghai)
Anritsu (China) Co., Ltd. Beijing Branch Office (P.R. China)
Anritsu Company Ltd. (Hong Kong)
Anritsu Industrial Solutions (Shanghai) Co., Ltd. (P.R. China)
Anritsu Corporation (Japan)
Anritsu Company Inc. (Taiwan)
Anritsu Corporation, Ltd. (South Korea)
Anritsu Pte. Ltd. (Singapore)
Anritsu India Private Limited (India)
Anritsu Pty. Ltd. (Australia)
Anritsu Company Limited (Vietnam)

R&D and Manufacturing

Anritsu Corporation (Japan)
Tohoku Anritsu Co. Ltd. (Japan)
Anritsu Company (United States)
Azimuth Systems, Inc. (United States)
Anritsu Ltd. (United Kingdom)
Anritsu A/S (Denmark)
Anritsu Solutions S.r.l. (Italy)
Anritsu Solutions S.R.L. (Romania)
Anritsu Solutions SK, s.r.o. (Slovakia)
Anritsu A/S Czech Republic (Czech Republic)
Anritsu Philippines, Inc.(Philippines)
Anritsu Infivis (THAILAND) Co., Ltd. (Thailand)

Quality, Reliability Assurance System, Effort for Environmental Considerations

Anritsu Corporation has established quality policies and action guidelines under its corporate philosophy, "Contribute to the development of a safe, secure, and prosperous global society by offering Original & High Level products and services with sincerity, harmony, and enthusiasm," and has been firmly implementing them in order to provide products and services that satisfy customers and society. Anritsu has been certified under the ISO 9001 international quality management standards for quality assurance since 1993 and has developed a consistent global framework, from product design and development to production, services, and maintenance. Anritsu is addressed in the continuous Quality Initiative by the quality management system through our global operations of entire group: Improvements through the integration of the management system, Responsive process improvements, Establish a global product information sharing system and Continuous education related to legal matters and the quality management system.

ISO9001/14001

Electronic Measurement Instruments products contained in this catalogue are manufactured under a quality management system and environment management system in conformance to the ISO international standards.

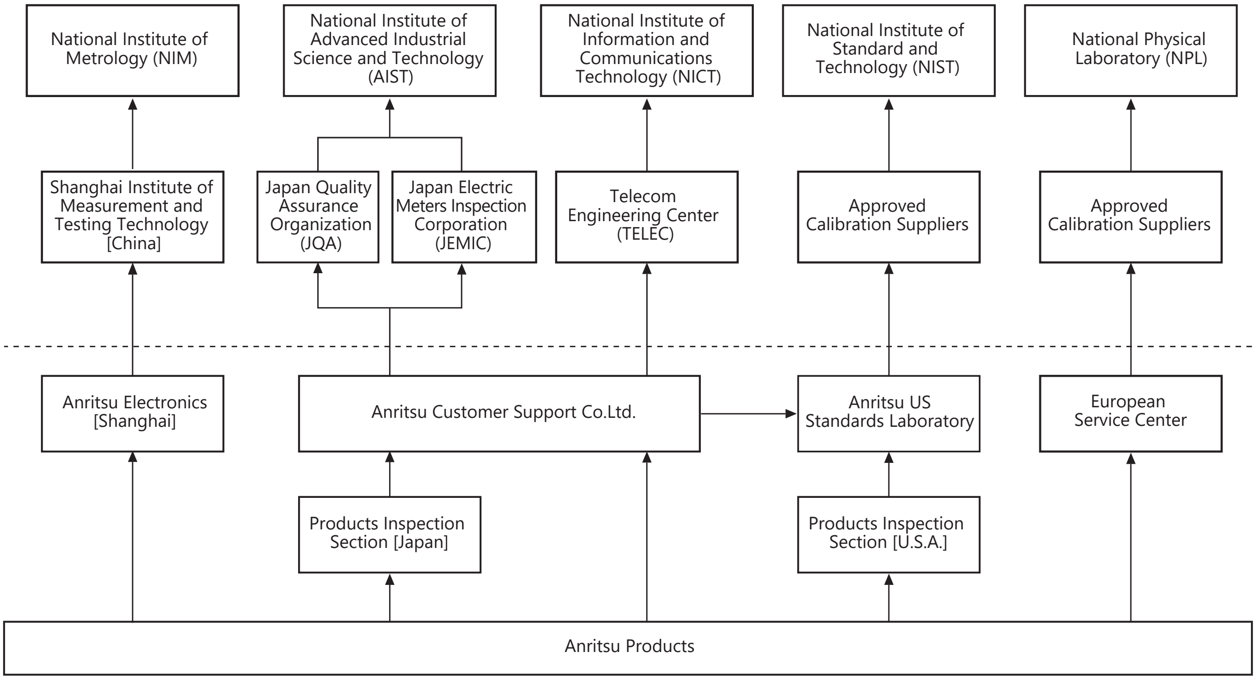
https://www.anritsu.com/en-us/about-anritsu/quality-policy
https://www.anritsu.com/en-us/about-anritsu/sustainability/environment

Factory Location	Standards	Certificate Number	Registration Date	Certification Body
Atsugi, Japan	ISO9001	JQA-0316	Nov. 15, 1993	Japan Quality Assurance Organization (JQA)
	ISO14001	JQA-EM0210	Aug. 28, 1998	
Tohoku, Japan	ISO9001	JQA-0316	Nov. 15, 1993	
	ISO14001	JQA-EM0210	Aug. 28, 1998	
U.S.A.	ISO9001	13013	Apr. 27, 1995	National Quality Assurance, U.S.A.
	ISO14001	AGS-USEMS-051618-1/2	Mar. 29, 2007	American Global Standards, LLC

Traceability Assurance

Anritsu has traceability system for calibration, property of a measurement result whereby the result can be related to a reference, usually national or international standards, through a documented unbroken chain of calibrations. Below is the traceability chart.

Traceability System



General Catalog

Anritsu's Measurement Business provides the global market with measuring instruments and test systems, which are essential tools for the establishment and spread of communication technologies.

New Products

Identifies products introduced in the period from November 2021 to October 2022.

Products conformed to environment-friendly criteria uniquely set by ourselves is called "Excellent Eco Product."
For the details of the mark and environment-friendly criteria, please refer to Anritsu Corporation home page.

List of Non-Compliant CE Mark and RoHS Products

The products in this catalog that do not meet EU CE Mark and RoHS requirements are listed below.
Although these products comply fully with the RoHS Directive, depending on the combination of purchased and ordered models/names, the system may not be fully compliant. Contact our Business Section for more details. In addition, contact the same section for more information about CE marks and RoHS compliance/non-compliance of accessories.

RoHS Non-compliant Products	
MOBILE/WIRELESS COMMUNICATIONS MEASURING INSTRUMENTS	
NEON Signal Mapper	MA8100A
RF MICROWAVE MEASURING INSTRUMENTS	
Power Meters	ML2430A Series
Precision RF & Microwave Components	RF/µWave Components
COMPONENTS	
H-Field/E-Field sensor/E-Field Isotropic Antenna	2000-1800-R/2000-1791-R/2000-1792-R
Some Options are not RoHS compliant	
MOBILE/WIRELESS COMMUNICATIONS MEASURING INSTRUMENTS	
LTE-Advanced Mobile Device Test Platform	ME7834LA
LTE-Advanced RF Conformance Test System	ME7873LA
SIGNAL ANALYZERS/SPECTRUM ANALYZERS	
Signal Analyzers	MS2690A/MS2691A*/MS2692A*

*: Please note that it is only for the Conformance Test System and cannot be purchased separately.

For products, please contact our business section.

Products or specifications in the catalog are subject to change without notice. Refer to the product catalog for the latest specifications.

Discontinuance of Physical Media attachments in Shipments

We would like to announce that we will, in principle, no longer include any physical data storage media such as CDs, DVDs or others containing operation manuals for measuring instruments as part of our efforts to contribute to the achievement of the SDGs. The operation manuals can currently be downloaded from Anritsu's website, whereas they were provided as physical media. If physical media is required, we will include it in the shipments in response to customer needs. In addition, please note in advance that the components included in products shipped without physical media may differ from those described in the operation manuals, catalogs, etc.

Warranty Period

Anritsu takes all possible measures to assure the quality of its products. However, if a product does unfortunately develop a fault due to a manufacturing error within the warranty period following delivery, Anritsu will repair the affected product free-of-charge. If Anritsu deems the fault to have been either the result of misuse or abuse outside normal usage conditions, or the result of natural events beyond foreseeable avoidance, such as fire or flood, the repair will not be covered by the free-of-charge warranty and will be charged at the normal repair rates.

Extended Warranty Period

To assure long, reliable, worry-free use after delivery, Anritsu offers various charged extended warranty periods. If a product develops a fault within the extended warranty period, Anritsu’s service company will repair the product free-of-charge. For more details, please contact our business section.

Inspection Surcharge

An inspection surcharge is applied to all orders requiring inspection by government agencies or individually appointed inspectors at our factory.

- Windows® is a registered trademark of Microsoft Corporation in the USA and other countries.
- Pentium® is a registered trademarks of Intel Corporation or its subsidiaries in the USA and other countries.
- LTE logo is a trademark of the European Telecommunications Standards Institute (ETSI).
- WiMAX® is a trademark or registered trademark of WiMAX Forum.
- CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA).
- Bluetooth® and related logomarks are owned by Bluetooth SIG, Inc. and are used by Anritsu under license.
- LabWindows and LabVIEW are registered trademarks of National Instruments.
- MATLAB® is a registered trademark of The MathWorks, Inc.
- Other companies, product names and service names are registered trademarks of their respective companies.

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Phone: +43-(0)1-717-28-710

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OPTICAL MEASURING INSTRUMENTS

BIT ERROR RATE TESTERS (BERT)/OSCILLOSCOPES

TRANSPORT AND ETHERNET TESTING

MOBILE/WIRELESS COMMUNICATIONS MEASURING INSTRUMENTS

SIGNAL ANALYZERS/SPECTRUM ANALYZERS

VECTOR NETWORK ANALYZERS

SIGNAL GENERATORS

RF MICROWAVE MEASURING INSTRUMENTS

COMPONENTS

PERIPHERAL EQUIPMENT

Handheld RF Spectrum Analyzer

Field Master™

MS2070A

9 kHz to 3 GHz

The Field Master™ MS2070A from Anritsu offers an unrivalled combination of performance and features for standard spectrum analysis to 3 GHz. It builds on Anritsu's experience of developing handheld instruments that delivers in both field and laboratory environments. The large 10-inch high resolution multi-touch screen presents results and instrument configuration in a clear and easy to use style. At under 4 kg weight, with the integrated battery typically providing three hours of operation all in a convenient soft carry case, it is ideal for measurements in the field. Key applications include HF, VHF, UHF transmitter measurements, interference hunting, EMI/EMC pre-compliance testing and PIM hunting.

(For further information see page 467)

Handheld RF Spectrum Analyzer

Field Master™

MS2080A

9 kHz to 4 GHz

The Field Master™ MS2080A is a spectrum analyzer that integrates RF field technician's most commonly used instruments into a single package. That means less to carry and a single user interface to learn, making time in the field more productive. Integrating a high performance spectrum analyzer with RTSA, interference analyzer tools, LTE/5GNR transmitter analysis and cable and antenna line sweep measurements the MS2080A addresses the full complement of the RF field technicians requirements. Designed to withstand the knocks and blows inevitable when working at remote transmitter sites. Weighing less than 4 kg, the Field Master MS2080A is small, compact, and easy to carry. An optional shoulder harness attaches to the supplied soft case to ease long-term use outdoors, especially with over six hours of continuous operation when adding the extended power pack. An environmental rating of IP52 in the soft case protects the instrument from dust and water, ensuring it is always ready to make the measurements you need in the location you need them.

(For further information see page 468)

For Remote RF Signal Monitoring

Remote Spectrum Monitor

MS27201A

9 kHz to 43.5 GHz

The MS27201A Spectrum Monitor is designed to facilitate wide-area spectrum monitoring up to 43.5 GHz. This provides the MS27201A the ability to cover all standard LMR, cellar, satellite, and electronic defense bands.

(For further information see page 505)

Delivering the Highest Purity and Frequency Stability Levels in an RF/Microwave Signal Generator

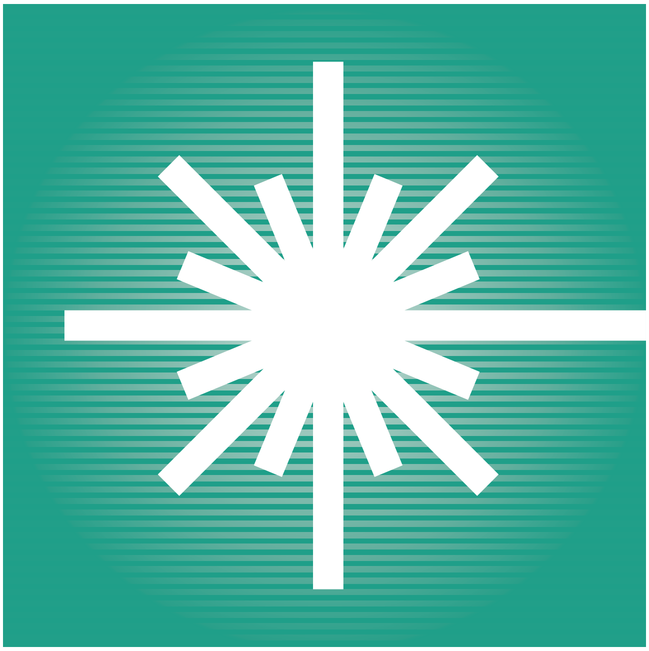
RF/Microwave Signal Generator

MG362x1A

9 kHz to 20 GHz/43.5 GHz

Signal purity determines quality of measurements in several applications such as radar, transceiver, ADC/DAC, and components testing.
The MG362x1A pushes the envelope in phase noise performance with its low and ultra-low phase noise options. Coupled with bestin-class harmonic and spurious performance, Rubidium signal generator offers industry leading overall signal purity performance, that enable customers to make more accurate measurements. The MG362x1A offers atomic clock frequency stability with an internal rubidium frequency reference option. Alternatively, customers can also get exceptional frequency stability by locking an internal oven controlled crystal oscillator (OCXO) reference to an external GNSS/GPS signal. The exceptional frequency stability makes Rubidium an ideal signal generator for Metrology and high speed clock applications.

(For further information see page 638)



OPTICAL MEASURING INSTRUMENTS

Selection Guide

Model/Name \ Application		Optical Power		Light Source Wavelength		Loss			Optical Identification		Optical Return Loss Measurement	Fiber Evaluation		Laser Diode Testing	Others	Remarks
		Low Level	Medium/High Level	Spectrum	Wavelength	High-loss	High Accuracy	Loss-wavelength	Identification	Loss		Fault Location	Splice Loss			
Light Source/ Handheld Power Meter	CMA5 Series	✓	✓			✓	✓	✓	✓	✓						0.85 µm to 1.625 µm
Optical Spectrum Analyzer	MS9740B	✓	✓	✓	✓	✓		✓						✓		0.6 µm to 1.75 µm
ACCESS Master	MT9085A/B/C		✓				✓		✓	✓	✓	✓	✓			0.85/1.3 µm (MM), 1.31/1.49/1.55/1.625/1.65 µm (SM)
Coherent OTDR	MW90010A						✓		✓	✓	✓	✓	✓			1535.03 nm to 1565.08 nm
Network Master Pro	MU100020A/MU100021A/ MU100022A/MU100023A		✓				✓		✓	✓	✓	✓	✓			0.85/1.3 µm (MM), 1.31/1.55/1.625/1.65 µm (SM)
Network Master	MU909014/15		✓				✓		✓	✓	✓	✓	✓			1.31/1.55/1.625/1.65 µm
Video Inspection Probe	G0382A/G0306C														✓	

Optical Connector Options for Anritsu Optical Measuring Instruments

A variety of optical connectors are used with optical fibers.

Specify the option number, model name, and number of the optical connector from the table below according to the type of optical connector you use. If no specification is made, an FC-type connector will be supplied.

For combinations marked with "✓" symbols in the table, the required instrument can be supplied according to the order.

For connectors without "✓" symbols or which do not appear in the table, consult your sales representative. For measuring equipment with more than one control panel, specify only the connector connected to the measured fiber. Be sure to consult us before ordering, particularly for optical connectors for single-mode fibers, to avoid trouble with connectors not fitting.

Optical connectors may be designed for either flat-polished or PC-polished ends. Some measuring instruments use connectors only for PC-polished ends; consult the literature on the instrument before specifying the connector option.

Model/Name		Connector Option Number						
		25	26	37	38	39	40	43
		FC-APC key width 2.0 mm*1	SC-APC*1	FC	ST	DIN 47256	SC	HMS-10/A (SM)*2
Light Source/Optical Power Meter	CMA5 Series	For connector and product numbers, please refer to individual product page.						
Optical Spectrum Analyzer	MS9740B			✓*3	✓*3	✓*3	✓*3	
ACCESS Master	MT9085A/B/C	✓	✓	✓*3	✓*3		✓*3	
Network Master Pro	MU100020A/MU100021A/ MU100022A/MU100023A	✓	✓	✓*3			✓*3	
Network Master	MU909014/15			✓*3			✓*3	
Coherent OTDR	MW90010A			✓*3	✓*3	✓*3	✓*3	✓*3

*1: Ferrule type; APC (angled PC)

*2: Ferrule type; PC

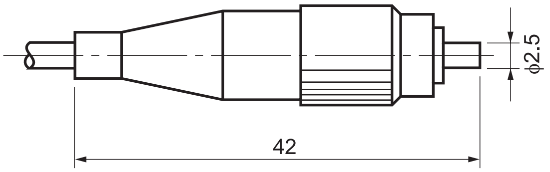
*3: Ferrule type; PC (user replaceable and cleanable)

No marking: Ferrule type; Flat and PC.

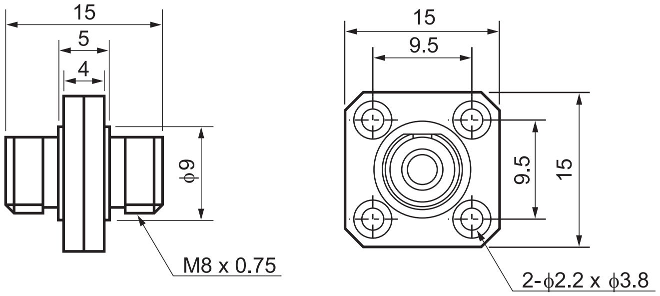
Unit in mm

Option 25: FC-APC key width 2.0 mm (angled convex)
Option 37: FC (flat, convex)

Plug

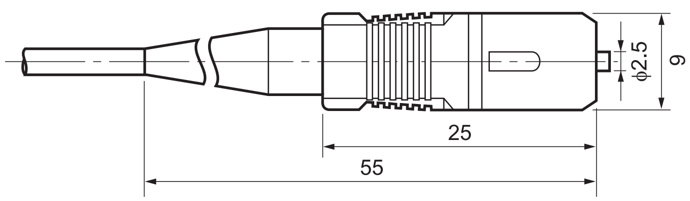


Adapter

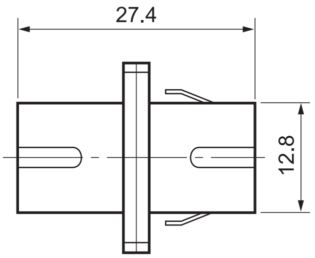


Option 26: SC-APC (angled convex)
Option 40: SC (flat, convex: PC)

Plug

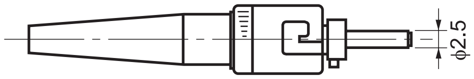


Adapter

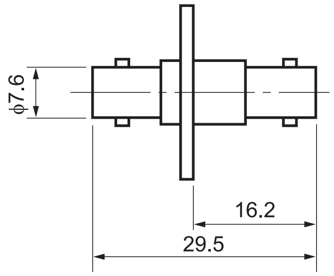


Option 38: ST (flat, convex: PC)

Plug

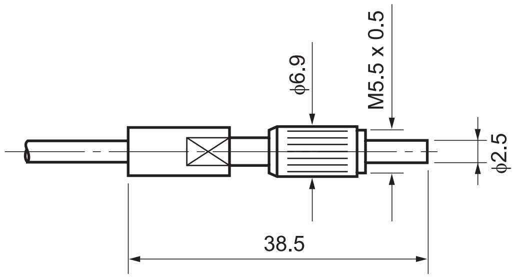


Adapter

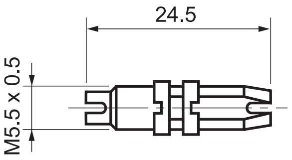


Option 39: DIN 47256 (flat, convex: PC)

Plug

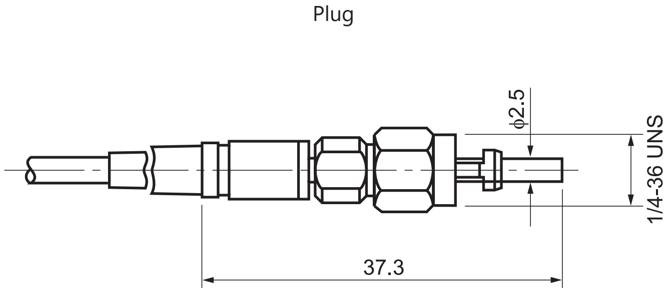


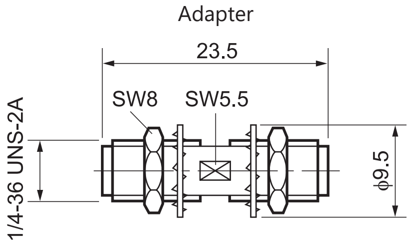
Adapter



Unit in mm

Option 43: HMS-10/A (SM, convex: PC)





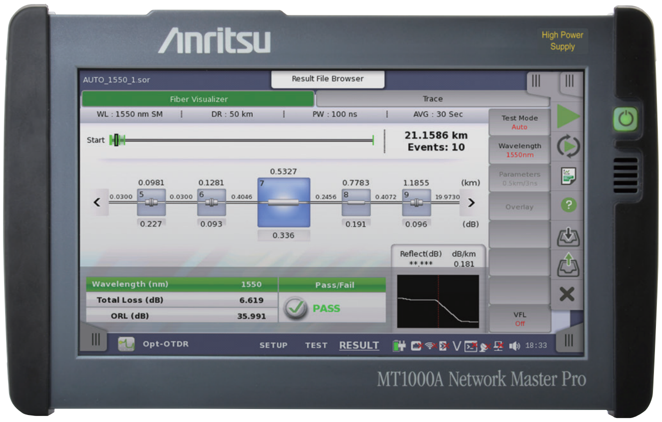
Network Master™ Series

MT1000A Network Master Pro
MU100020A/MU100021A/MU100022A/MU100023A OTDR Module

1310/1550 nm SMF, 1310/1550/850/1300 nm SMF/MMF, 1310/1550/1625 nm SMF, 1310/1550/1650 nm SMF

Remote Control
Ethernet | **USB**

For Mobile Network I&M



Network Master Pro
FiberVisualizer

The worldwide spread of mobile devices, such as smartphones and tablets using SNS, video streaming, etc., is causing an explosive increase in data traffic volumes. Mobile network base stations have various configurations; as well as shifting towards using smaller remote radio head (RRH) installations, optical fiber fault-finding and transport quality tests are required as the network environment evolves.

Installing the Transport Module MU100010A (10G Multirate)/MU100011A (100G Multirate) and OTDR Module MU100020A/MU100021A/ MU100022A/MU100023A in the Network Master Pro MT1000A supports all-in-one optical-fiber fault finding and transport quality tests.

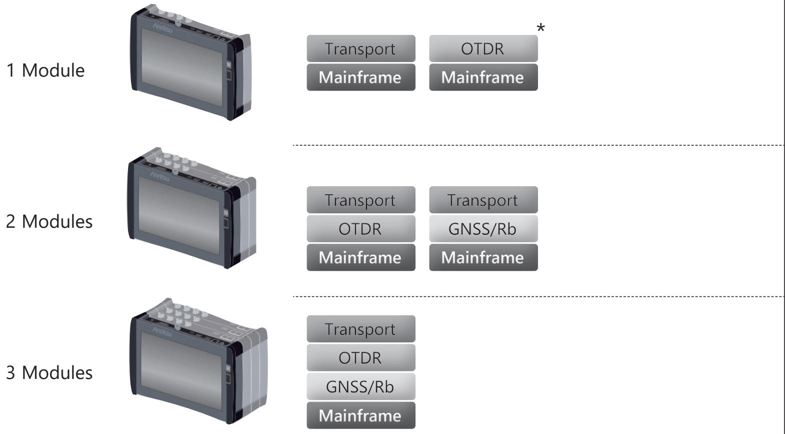
Using the MU100020A/MU100021A/MU100022A/MU100023A, scratched or dirty connectors at fiber cable connections can be detected as fault locations from the excessive optical reflections to support fault finding and troubleshooting of Mobile optical networks. Additionally, work efficiency is greatly improved using the Fiber Visualizer function supporting Easy-to-Use/Easy-to-Report testing.

Network Master Pro MT1000A Series

- All-in-One Optical/Transport Tester Install OTDR Module and 10G/100G Multirate Module in one main frame
- Easy-to-Use Intuitive GUI Menus
- Compact Lightweight Design for Onsite Testing
- Modular Design for Maximized Investment Efficiency

Network Master Pro MT1000A Module Line up

Any modular combination as shown in a figure.



Mainframe Network Master Pro
MT1000A

Transport Transport Module
10G Multirate MU100010A
100G Multirate MU100011A

OTDR OTDR Module
1310/1550 nm SMF MU100020A
1310/1550/850/1300 nm SMF/MMF MU100021A
1310/1550/1625 nm SMF MU100022A
1310/1550 nm, 1650 nm SMF MU100023A

GNSS/Rb Sync Module
High Performance GPS Disciplined Oscillator MU100090A
High Performance GNSS Disciplined Oscillator MU100090B

*: Required if the transport modules is not used rear cover (B0720A).

Key Applications

Mobile Network I&M

Mobile Fronthaul and Backhaul Optical Loss and Reflection Attenuation Measurements

- Supports SM fiber (1310/1550/1625 nm, 1650 nm), MM fiber (850 nm/ 1300 nm) models
- All-in-one OTDR, light source, optical power meter, visible light source (option)
- High-accuracy event detection
- CPRI/OBSAI measurement with simultaneously installed Multirate Module MU100010A/MU100011A

Easy-to-Use, Easy-to-Report

- Graphical summary and Pass/Fail evaluation display using Fiber Visualizer function
- OTDR simple test mode operation using touch panel
- One-touch button PDF report output

Core and Metro Network Long Range I&M

- Measures Trunk Fibers of 100 km or more and PON Networks with up to 1×128 Splitters
- Supports three SM fiber (1310 nm/1550 nm) models (Standard, Enhanced, High-Performance)
- Supporting Construction using Multi-core Fiber Cables
- Supports other Mobile network applications

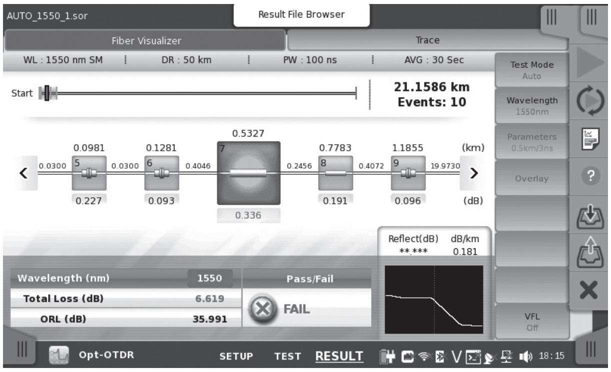
All-in-One

Network I&M is supported by installing the MU100020A/MU100021A/MU100022A/MU100023A and MU100010A/MU100011A in the MT1000A. The OTDR Module lineup includes the MU100021A for OTDR measurements of both SM and MM fibers in high demand by the Mobile network I&M, plus the MU100020A/MU100022A/MU100023A for OTDR measurements of SM fiber used by PON networks and long- range measurements in Core/Metro networks.

With 10G/100G Multirate Module and OTDR Module

Easy-to-Use GUI

The MT1000A GUI design simulates onsite operations to help increase evaluation efficiency at network installation and to speed-up fault troubleshooting and isolation. Additionally, the intuitive user interface operations also help cut training time.



AUTO_1550_1.sor

WL : 1550 nm SM | DR : 50 km | PW : 100 ns | AVG : 30 Sec

21.1586 km
Events: 10

Test Mode Auto

Wavelength 1550nm

Parameters 0.5km/3ns

Reflect(dB) **.***
dB/km 0.181

Wavelength (nm)	1550
Total Loss (dB)	6.619
ORL (dB)	35.991

Pass/Fail
FAIL

VFL Off

Easy-to-Read and Easy-to-Use 9-inch High-Resolution Touch Screen

The large 9-inch high-resolution, full-color, touch screen is easy to use and displays easy-to-read measurement results, helping improve onsite work efficiency.

Portable

All test functions required for network verification are built into the compact MT1000A cabinet for easy, all-in-one onsite support of most communications standards; the standard soft carry bag accessory is also ideal for carrying the MT1000A onsite.

Long Battery Life

Since AC power is not commonly available onsite, the MT1000A can run for up to 6 hours (with OTDR Module) on just one battery charge. And the optional car 12 Vdc adapter offers in-vehicle charging, helping facilitate uninterrupted work when moving between sites.

All-in-One Functions Required by Physical Layer I&M Tests

The MU100020A/MU100021A/MU100022A/MU100023A built-in light source and power meter functions can be used for optical loss tests in addition to OTDR tests. An optional (Option 002) visible light source can be installed as well.

Moreover, the presence of scratches and dirt on the fiber end face can be checked using the Video Inspection Probe (VIP).

*: Separately sold Video Inspection Probe (External G0382A/G0306C)

G0382A

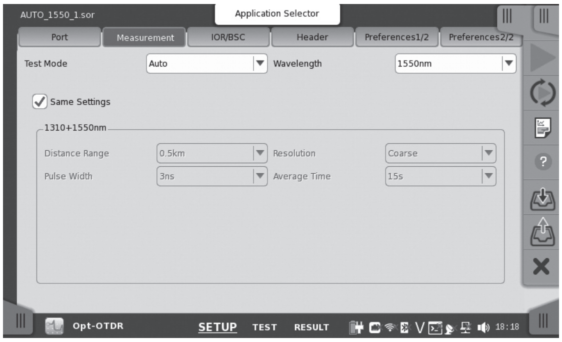
G0306C

OTDR Module Applications

Generally, depending on the optical fiber measurement environment, OTDR measurements require multiple settings such as distance range, pulse width, measurement time, etc., making work difficult for technicians who do not generally use an OTDR. When performing Pass/Fail evaluation of an optical network for a report, a simple intuitive GUI is key to improving work efficiency.
The MU100020A/MU100021A/MU100022A/MU100023A emphasizes easy-to-understand operability using four application measurement modes: Standard OTDR Measurement, FTTA Measurement, Construction Mode and OLTS Measurement.

Standard OTDR Measurements

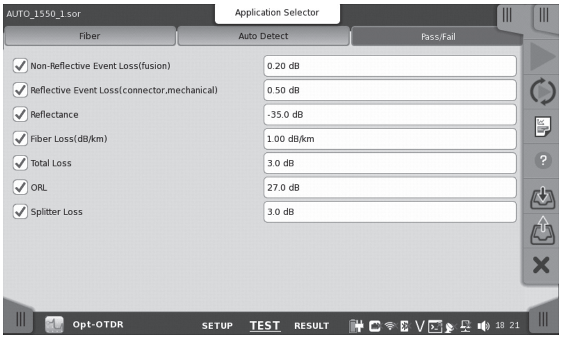
Graphical Display Based on Three-Window Operation: SETUP/TEST/RESULT



Test Mode: Auto
Wavelength: 1550nm
☑ Same Settings
1310+1550nm
Distance Range: 0.5km
Resolution: Coarse
Pulse Width: 3ns
Average Time: 15s

SETUP

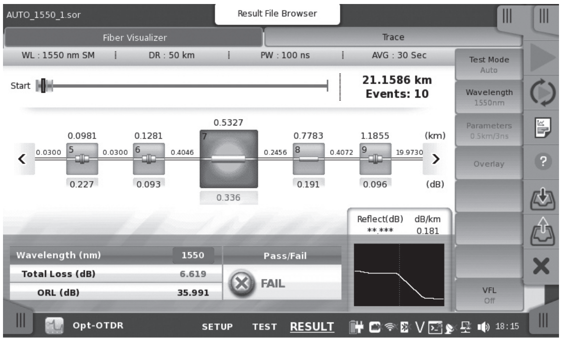
This sets the measurement wavelength.
Other conditions, such as distance range, measurement time, etc., are measured at the Auto setting conditions.



☑ Non-Reflective Event Loss(fusion): 0.20 dB
☑ Reflective Event Loss(connector,mechanical): 0.50 dB
☑ Reflectance: -35.0 dB
☑ Fiber Loss(dB/km): 1.00 dB/km
☑ Total Loss: 3.0 dB
☑ ORL: 27.0 dB
☑ Splitter Loss: 3.0 dB

TEST

This sets the detection conditions for optical fiber connectors and splices as well as the Pass/Fail evaluation threshold values, and starts measurement.



WL : 1550 nm SM | DR : 50 km | PW : 100 ns | AVG : 30 Sec

21.1586 km
Events: 10

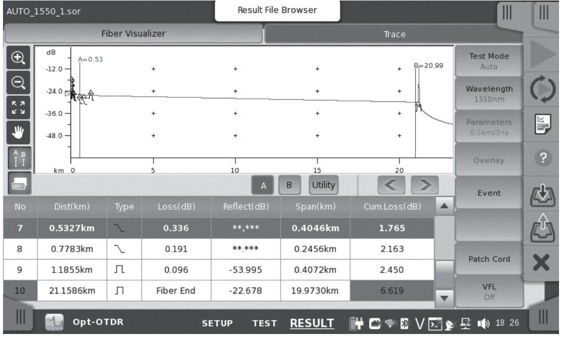
Reflect(dB): **.***
dB/km: 0.181

Wavelength (nm): 1550
Total Loss (dB): 6.619
ORL (dB): 35.991
Pass/Fail: FAIL

RESULT

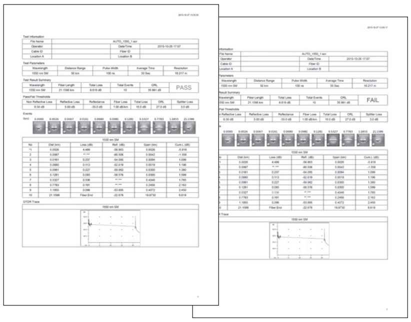
This displays the Pass/Fail evaluation results for each event graphically at the Fiber Visualizer screen.
Additionally, waveform analysis is supported by switching to the Trace screen.

One-Button Screen Switch



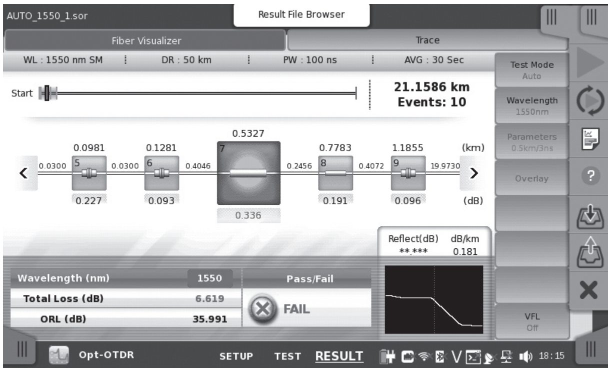
No	Dist(km)	Type	Loss(dB)	Reflect(dB)	Span(km)	Cum.Loss(dB)
7	0.5327km	╲	0.336	**.***	0.4046km	1.765
8	0.7783km	╲	0.191	**.***	0.2456km	2.163
9	1.1855km	⎍	0.096	-53.995	0.4072km	2.450
10	21.1586km	⎍	Fiber End	-22.678	19.9730km	6.619

The measured data are output as a PDF report by an easy one-button operation.



Easy Pass/Fail Evaluation Using Fiber Visualizer

The OTDR measurement results are displayed as a trace showing the optical fiber length, losses and size of reflections, as well as an easy-to-view summary of the analysis results on the Fiber Visualizer screen.



WL : 1550 nm SM | DR : 50 km | PW : 100 ns | AVG : 30 Sec

21.1586 km
Events: 10

Reflect(dB) **.*** dB/km 0.181

Wavelength (nm)	1550
Total Loss (dB)	6.619
ORL (dB)	35.991

Pass/Fail: FAIL

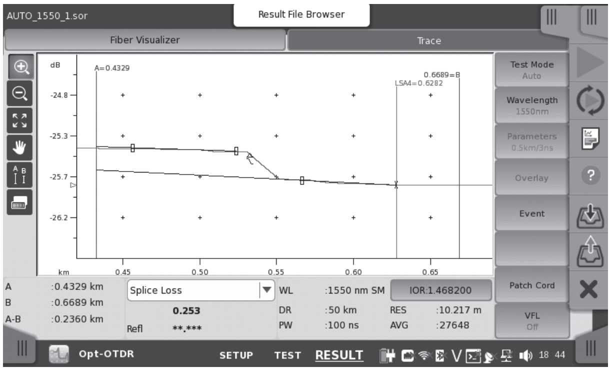
Fiber Visualizer Screen

- Event icons showing characteristics of each connector, splice, and far end
- Pass/Fail evaluations based on user-settable threshold values

The user can set any threshold value for each event. If the Pass/Fail evaluation settings prescribed in the engineering manual are set beforehand, the measured optical fiber loss status can be easily distinguished visually at the same time as measurement ends.

Intuitive Manual Waveform Analysis Using Touch Panel Operation

Using the Trace screen, it is also possible to perform manual analysis while moving the cursor on the captured waveform. Since the MT1000A has a touch panel, the optical fiber length, loss, and reflection attenuation can be analyzed manually using intuitive direct operations on the waveform.



A :0.4329 km
B :0.6689 km
A-B :0.2360 km

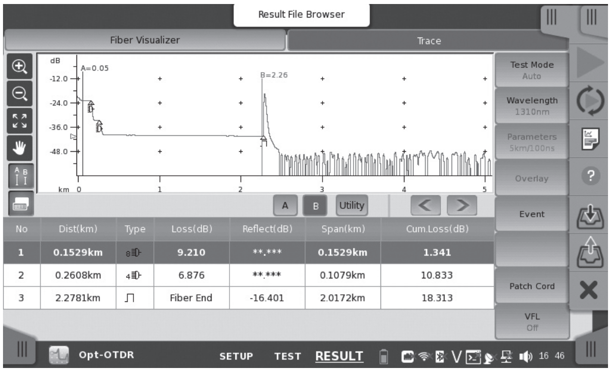
Splice Loss 0.253
Refl **.***

WL :1550 nm SM IOR:1.468200
DR :50 km RES :10.217 m
PW :100 ns AVG :27648

Manual Analysis Screen

Supports Long-Distance Optical Fibers and PON Network Measurements with 1 × 128 Splitters

OTDR measurements of long optical fibers exceeding 100 km as well as PON networks including many splitters require an OTDR with high dynamic-range performance.
With its high dynamic range of 46 dB (typ.), the MU100020A/MU100022A/MU100023A is ideal for evaluating Core/Metro/Access optical fiber networks.

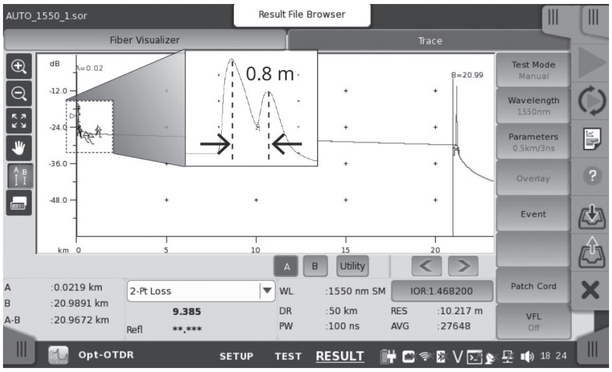


No	Dist(km)	Type	Loss(dB)	Reflect(dB)	Span(km)	Cum.Loss(dB)
1	0.1529km	8	9.210	**.***	0.1529km	1.341
2	0.2608km	4	6.876	**.***	0.1079km	10.833
3	2.2781km	⎍	Fiber End	-16.401	2.0172km	18.313

PON Measurement Screen

Various Functions and Performance for Precision OTDR Measurements

- 0.8-m Event Dead Zone
  Events can be detected with a dead zone of just 0.8 m (typ.).
  This is ideal for measurements in a mixed environment including short optical fibers, such as patch cords.



A :0.0219 km
B :20.9891 km
A-B :20.9672 km

2-Pt Loss 9.385
Refl **.***

WL :1550 nm SM IOR:1.468200
DR :50 km RES :10.217 m
PW :100 ns AVG :27648

0.8-m Event Dead Zone

- 250,001 Sampling Points Max.
  Up to 250,001 sampling points are supported, offering a minimum resolution of 2 cm, and a resolution of 2 m for a distance range of 300 km.

- Optical Communications/Connection Check Functions
  If an optical data signal is being input to the OTDR from an external source, the optical fiber connection status will be poor, making it impossible to perform accurate measurement and analysis. When an optical data signal is detected at the start of OTDR measurement using these functions, the optical fiber connection status is evaluated as poor, a warning is displayed, and measurement is stopped.

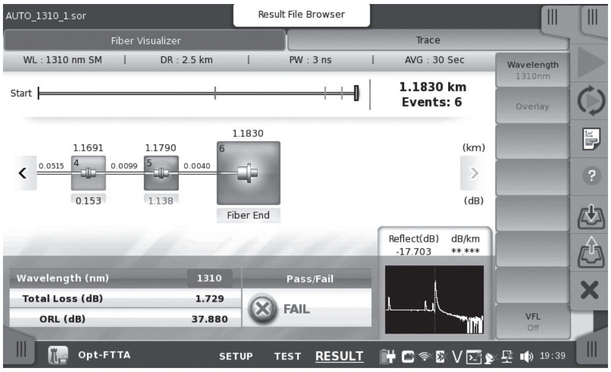
- Supports OTDR Data Sharing Format
  The measured waveform and analysis results data from the Fiber Visualizer and waveform screens are saved in the same common OTDR format described in the Telcordia SR-4731 (issue 2) standards. Not only can saved data be read by these instruments, it can also be read by the "NETWORKS" Analysis Software running on a PC.
  *: The PC Analysis Software does not support the Fiber Visualizer function.

- Macro Bend Detection/Analysis
  Macro bends can be detected and analyzed by comparing two waveform (1310/1550 nm, 1310/1625 nm) measurements using wavelength bend characteristics, permitting confirmation of bending faults in optical fibers, which is a difficult evaluation using measurement only one wavelength.

- Multi-waveform Measurement and Display Functions
  This is very convenient for comparison with saved waveform data captured at network commissioning as well as for comparison with abnormal waveform data, such as that captured at macro bend measurements.

FTTA Measurements

Comparatively short optical fibers of around several hundred meters in length are usually installed at the Mobile fronthaul FTTA. In this type of measurement environment, measurements made by different operators under different conditions commonly have inconsistency problems at later data processing.
At FTTA measurement, the optical fiber installation measurement conditions are fixed previously, so measurements are always made under the same conditions.
Like the OTDR measurement function, each measurement result can be analyzed at the Trace and Fiber Visualizer screens.



AUTO_1310_1.sor

WL : 1310 nm SM | DR : 2.5 km | PW : 3 ns | AVG : 30 Sec

1.1830 km
Events: 6

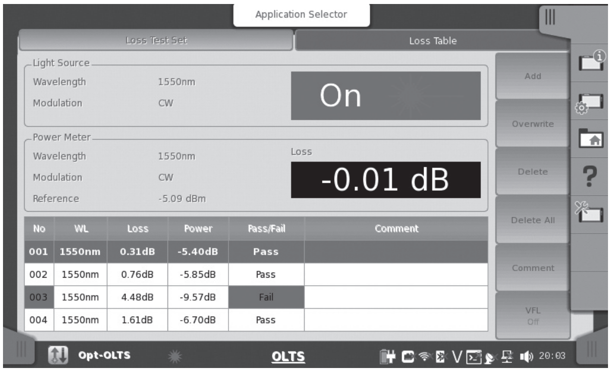
Reflect(dB) -17.703
dB/km **.***

Wavelength (nm)	1310	Pass/Fail
Total Loss (dB)	1.729	FAIL
ORL (dB)	37.880	

FTTA Measurements

OLTS Measurements

At measurement of the optical fiber, the first basic measurement is loss measurement using a light source and power meter. With a built-in light source and power meter as standard, the MU100020A/MU100021A/MU100022A/MU100023A can be used as an optical loss test set (OLTS). In addition, measurement results can be managed at the Loss Table for Pass/Fail evaluation of individual data based on set threshold values.



Light Source
Wavelength 1550nm
Modulation CW
On

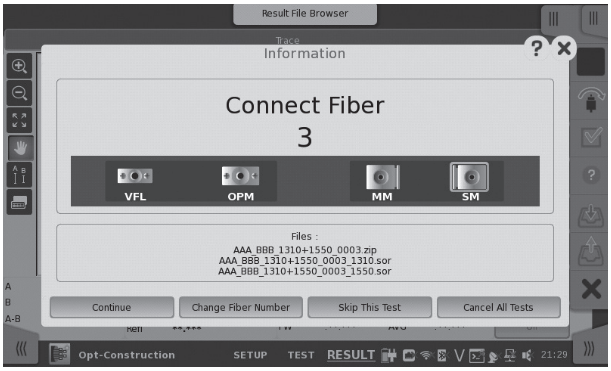
Power Meter
Wavelength 1550nm
Modulation CW
Reference -5.09 dBm
Loss -0.01 dB

No	WL	Loss	Power	Pass/Fail	Comment
001	1550nm	0.31dB	-5.40dB	Pass	
002	1550nm	0.76dB	-5.85dB	Pass	
003	1550nm	4.48dB	-9.57dB	Fail	
004	1550nm	1.61dB	-6.70dB	Pass	

OLTS Measurement Loss Table

Construction Mode

The "Construction Mode" simplifies installation work and is especially useful when pulling multi-core fiber cables. Work mistakes are eliminated by automated operation using pre-settings, such as project data (number of fibers, file names, etc.) and measurement conditions, to facilitate efficient measurement of multi-core fiber cables.



Information

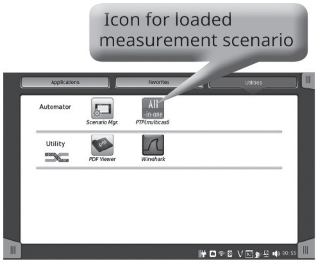
Connect Fiber
3

Files :
AAA_BBB_1310+1550_0003.zip
AAA_BBB_1310+1550_0003_1310.sor
AAA_BBB_1310+1550_0003_1550.sor

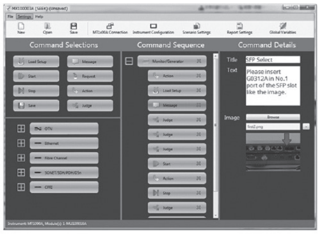
Construction Mode

Value of Offering Automatic Measurement Solutions

Simplifies multiple testing work, shortens on-site test time, and eliminates human operation errors. Supports simultaneous multiple tests. Download free editing software (MX100003A) to create scenarios without need for programing skills.



Automation Test Select



SEEK (Scenario Edit Environment Kit)
MX100003A

Specifications

MT1000A + MU100020A/MU100021A/MU100022A/MU100023A

Display		9-inch active TFT display (800 × 480 pixels) and touch screen
Supported Languages		User selectable (English, Japanese, Simplified Chinese, Russian, French, Spanish, Finnish, Korean, German)
USB Data Interface		MT1000A operates as host: USB 2.0 type A (2 ports), MT1000A operates as device: USB 2.0 type Mini-B (1 port)
Ethernet Interface		Ethernet 10M/100M/1000M, Connector: RJ45
WLAN Interface*1		IEEE 802.11 b/g/n
Bluetooth® Interface*2		Bluetooth 2.1 +EDR
Audio Interface		For connection of head set, Connector: 3.5-mm diameter jack
AUX Connector		For connection of optional G0325A GPS receiver
Built-in Loudspeaker		Monitors speech of voice channel, Output level: user-controlled from user Interface
Ext. Clock Input		For connection of external clock signals: SETS (E1: 2.048 Mbps), BITS (DS1: 1.544 Mbps) or 2.048 MHz TTL signal in accordance with ITU-T G.703, 10 MHz TTL signal in accordance with ITU-T G.703, Connector: BNC
Dimensions and Mass		MU100020A/MU100021A/MU100022A/MU100023A: 257.6 (W) × 163 (H) × 25 (D) mm (without rear panel), ≤0.8 kg with MT1000A: 257.6 (W) × 163 (H) × 84.3 (D) mm, 2.7 kg including battery (G0310A) with MT1000A/MU100010A: 257.6 (W) × 163 (H) × 102.2 (D) mm, 3.5 kg including battery (G0310A)
Mains Adapter		Input: 100 VAC to 240 VAC, 50 Hz/60 Hz Output: 18 V(dc), 3.62 A (max.) Power Consumption: ≤65 W With MT1000A-006 Input: 100 VAC to 240 VAC, 50 Hz/60 Hz Output: 18 V(dc), 6.6 A (max.) Power Consumption: ≤120 W
Battery		10.8 V rechargeable and replaceable intelligent Li-ion battery Operating time: 6.0 h (with MU100020A/MU100021A/MU100022A/MU100023A), Telcordia GR-196-CORE Issue2, September 2010, 25°C
Environmental Conditions		Operating Temperature: 0° to +50°C, ≤85%RH (non-condensing) (with MU100020A/MU100021A/MU100022A/MU100023A) Charging Temperature: 0° to +50°C, ≤85%RH (non-condensing) Storage Temperature: –30° to +60°C, ≤90%RH (non-condensing) (without battery or AC adapter, with MU100020A/MU100021A/MU100022A/MU100023A) –20° to +50°C, ≤90%RH (non-condensing) (with battery and AC adapter, with MU100020A/MU100021A/MU100022A/MU100023A)
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000:2018

*1: Available for certified countries and regions including USA, Canada, Japan and EU countries. Please visit the Anritsu web site for updated information.

*2: The Bluetooth® mark and logs are owned by Bluetooth SIG, Inc. and are used by Anritsu under license.

MU100020A/MU100021A/MU100022A/MU100023A OTDR Module Common Specifications

IOR Setting	1.300000 to 1.700000 (0.000001 steps)
Units	km, m, kft, ft, mi
Sampling Points	Up to 250,001
Sampling Resolution	0.02, 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 40 m
Loss measurement accuracy (linearity)	±0.05 dB/dB or ±0.1 dB (whichever is greater)
Reflectance Accuracy	Single mode: ±2 dB, Multimode: ±4 dB
Distance Accuracy	±1 m ±3 × measurement distance × 10-5 ± marker resolution (excluding IOR uncertainty)
Distance Range (IOR = 1.50000)	Single mode: 0.5, 1, 2.5, 5, 10, 25, 50, 100, 200, 300 km Multimode: 0.5, 1, 2.5, 5, 10, 25, 50, 100 km
Realtime Sweep Time	≤0.2 sec. (Test Mode: Manual, Distance Range: 50 km, Resolution: Coarse)
Testing Modes	Standard OTDR application: Selectable automatic or manual set-up, Fiber Visualizer, Trace analysis, Light source, Power meter, Visual fault locator (Optional) FTTA application: Automatic set-up, Fiber Visualizer, Trace analysis, Light source, Power meter, Visual fault locator (Optional) Construction application: OTDR Measurement, Auto Save, Multi-core fiber measurements, Power meter, Visual fault locator (Optional) OLTS application: Power meter and Light source, Loss Table, Visual fault locator (Optional)
Fiber Event Analysis	Fiber condition setup: Patch-cord setup (Launch/Receive), Splitter Setup (Up to 128 branch) User defined Auto detect threshold: Event loss (Reflective and non-reflective), Reflectance, Fiber end, Macro bend detect ON/OFF, Splitter detect: Up to 128 branch User defined PASS/FAIL thresholds: Non-reflective event loss (fusion), Reflective event loss (connector, mechanical), Reflectance, Fiber loss (dB/km), Total loss, ORL, Splitter loss (Up to 128 branch)
OTDR Trace Format	Telcordia universal. SOR, issue 2 (SR-4731)
Other Functions	Loss modes: Splice loss, 2-pt loss, 2-pt LSA, dB/km loss, dB/km LSA, ORL Averaging modes: Timed (5, 10, 15, 30 sec, 1, 2, 3, 5, 10 min.) Live Fiber detect : Verifies presence of communication light in optical fiber Connection check: Automatic check of OTDR to FUT connection quality Remote Operation, Both-End Measurement

MU100020A OTDR Module

Options	Wavelength*1	Fiber Type	Pulse Width	Dynamic Range*2, *3	Deadzone (Fresnel)*4 (IOR = 1.500000)	Deadzone (Backscatter)*5 (IOR = 1.500000)
MU100020A-020	1310 nm/1550 nm ±25 nm	Single Mode Fiber (SMF) 10 µm/125 µm ITU-T G.652	3, 10, 20, 50, 100, 200, 500, 1000, 2000, 4000, 10000, 20000 ns	39 dB/37.5 dB*6	≤80 cm (typ.)	≤3.8 m/4.3 m
MU100020A-021				42 dB/41 dB*6		
MU100020A-022				46 dB/46 dB*6 25 dB/25 dB*6 (Pulse width: 100 ns)		

MU100021A OTDR Module

Options	Wavelength*1	Fiber Type	Pulse Width	Dynamic Range*2, *3	Deadzone (Fresnel)*4 (IOR = 1.500000)	Deadzone (Backscatter)*5 (IOR = 1.500000)
MU100021A-021	1310 nm/1550 nm ±25 nm 850 nm/1300 nm ±30 nm	Single Mode Fiber (SMF) 10 µm/125 µm ITU-T G.652 GI Fiber 62.5 µm/125 µm*7	SMF: Same as MU100020A 1300 nm (MMF): 3, 10, 20, 50, 100, 200, 500, 1000, 2000, 4000 ns 850 nm (MMF): 3, 10, 20, 50, 100, 200, 500 ns	42 dB/41 dB*6 29 dB/28 dB*6	≤80 cm (typ.)	≤3.8 m/4.3 m ≤4.0 m/5.0 m

MU100022A OTDR Module

Options	Wavelength*1	Fiber Type	Pulse Width	Dynamic Range*2, *3	Deadzone (Fresnel)*4 (IOR = 1.500000)	Deadzone (Backscatter)*5 (IOR = 1.500000)
MU100022A-022	1310/1550/1625 nm ±25 nm	Single Mode Fiber (SMF) 10 µm/125 µm ITU-T G.652	3, 10, 20, 50, 100, 200, 500, 1000, 2000, 4000, 10000, 20000 ns	46/46/44 dB*6 25/25/23 dB*6 (Pulse width: 100 ns)	≤80 cm (typ.)	≤3.8/4.3/4.8 m

MU100023A OTDR Module

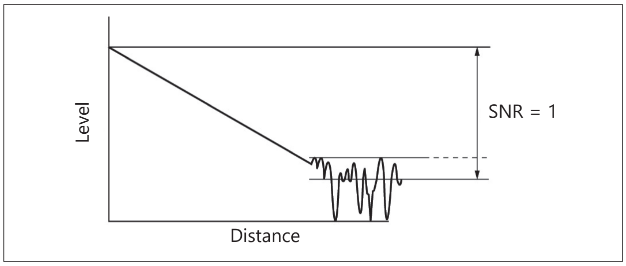
Options	Wavelength*1	Fiber Type	Pulse Width	Dynamic Range*2, *3, *8	Deadzone (Fresnel)*4 (IOR = 1.500000)	Deadzone (Backscatter)*5 (IOR = 1.500000)
MU100023A-021	1310/1550 nm ± 25 nm 1645 nm to 1655 nm	Single Mode Fiber (SMF) 10 µm/125 µm ITU-T G.652	3, 10, 20, 50, 100, 200, 500, 1000, 2000, 4000, 10000, 20000 ns	42/41/35 dB*6	≤80 cm (typ.)	≤5.0/5.5/6.5 m

Laser Safety*9	IEC 60825-1: 2007 CLASS 1M: 21 CFR1040.10 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007

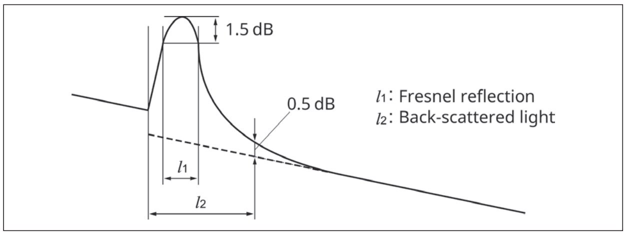
*1: 25°C, Pulse width: 1 µs (1310/1550/1625/1650 nm), 100 ns (850 nm/1300 nm),
Except for when charging the battery.

*2: Pulse widths: 20 µs (1310/1550/1625/1650 nm), 500 ns/4 µs (850 nm/1300 nm)
Distance range: 100 km (1310/1550/1625/1650 nm), 25 km (850 nm/1300 nm)
Averaging: 180 sec., SNR = 1, 25°C
Except for when charging the battery.

*3: Dynamic range (one-way back-scattered light), SNR = 1: The level difference between the RMS noise level and the level where near end back-scattering occurs.



*4: Pulse width: 3 ns, Return loss: 40 dB, 25°C (Refer to the figure below)
Except for when charging the battery.



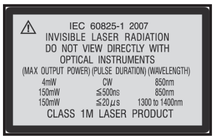
*5: Pulse width 10 ns, return loss 55 dB, Deviation ±0.5 dB, 25°C±5°C

*6: Typical. Subtract 1 dB for guarantee

*7: At measurement of 50 µm/125 µm MM Fiber, the dynamic range drops by about 3.0 dB

*8: At 1650 nm: With background light, 1310/1550 nm, –19 dBm CW light

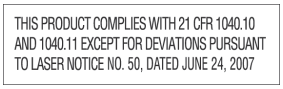
*9: Safety measures for laser products
This product complies with optical safety standards in IEC 60825-1, 21CFR1040.10 and 1040.11; the following descriptive labels are affixed to the product.



IEC 60825-1 2007
INVISIBLE LASER RADIATION
DO NOT VIEW DIRECTLY WITH
OPTICAL INSTRUMENTS

(MAX OUTPUT POWER)	(PULSE DURATION)	(WAVELENGTH)
4mW	CW	850nm
150mW	≦500ns	850nm
150mW	≦20µs	1300 to 1400nm

CLASS 1M LASER PRODUCT



THIS PRODUCT COMPLIES WITH 21 CFR 1040.10
AND 1040.11 EXCEPT FOR DEVIATIONS PURSUANT
TO LASER NOTICE NO. 50, DATED JUNE 24, 2007

Light Source Specifications

Standard on all models

Stabilized Light Source (through OTDR port)				
Options	MU100020A	MU100021A	MU100022A	MU100023A
Wavelength*1	1310 nm/1550 nm ±30 nm	1310 nm/1550 nm ±30 nm 850 nm/1300 nm ±30 nm	1310/1550/1625 nm ±30 nm	1310/1550 nm ±30 nm 1650 nm ±5 nm
Spectral Width*1	≤5 nm (1310 nm) ≤10 nm (850/1300/1550/1625 nm) ≤3 nm (1650 nm)			
Fiber Type	Single Mode Fiber (SMF) 10 µm/125 µm ITU-T G.652	Single Mode Fiber (SMF) 10 µm/125 µm ITU-T G.652 GI Fiber 62.5 µm/125 µm	Single Mode Fiber (SMF) 10 µm/125 µm ITU-T G.652	Single Mode Fiber (SMF) 10 µm/125 µm ITU-T G.652
Optical Connector	Same as OTDR			
Output Power*1	–5 ±1.5 dBm			
Output Stability*2	≤0.1 dB (1310/1550/1625/1650 nm)			
Modes of Operation	CW, 270 Hz, 1 kHz, 2 kHz			
Warm up time	10 min.			
Laser Safety	Same as OTDR			

Power Meter Specifications

Standard on all models

Standard Power Meter (Dedicated port)	
Fiber Type	Single Mode (SMF) 10 µm/125 µm ITU-T G.652, GI Fiber 62.5 µm/125 µm
Wavelength Range	800 nm to 1700 nm
Setting Wavelengths	1310, 1490, 1550, 1625, 1650, 850, 1300 nm
Measurement Range	–67 to +6 dBm (CW, 1550 nm, –60 to +3 dBm @850 nm) –70 to +3 dBm (Modulation, 1550 nm, –63 to 0 dBm @850 nm)
Optical Connector	2.5 mm/1.25 mm Universal
Accuracy*3	±5% (–10 dBm, 1310 nm/1550 nm, CW, 25°C, Using Master FC fiber and 2.5 mm universal connector) ±10% (–10 dBm, 850 nm, CW, 25°C, Using Master FC fiber and 2.5 mm universal connector)
Modes of Operation	CW, 270 Hz, 1 kHz, 2 kHz

Visible Light Source (Option 002)	
Central Wavelength	650 nm ±15 nm (at 25°C)
Optical Output	0 ±3 dBm (CW, 25°C)
Output Optical Fiber	10 µm/125 µm, SMF (ITU-T G.652)
Optical Connector	2.5 mm universal
Output Function	OFF, CW, Blink
Laser Safety*4	IEC 60825-1: 2007 CLASS 3R 21CFR1040.10 and 1040.11 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007

*1: CW, 25°C

*2: CW, –10°C to +50°C (±1°C) difference between max/min. values over 1 minute, SM fiber 2 m, when an optical power meter with 40 dB or greater return loss is used (SM),after warming up.

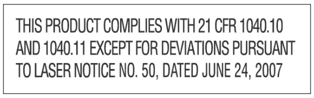
*3: After zero offset

*4: Safety measures for laser products
This option complies with optical safety standards in IEC 60825-1, 21CFR1040.10 and 1040.11; the following descriptive labels are affixed to the product

IEC 60825-1:2007
VISIBLE LASER RADIATION
AVOID DIRECT EYE EXPOSURE

(MAX OUTPUT POWER)	(PULSE DURATION)	(WAVELENGTH)
5mW	CW	650±15nm

CLASS 3R LASER PRODUCT



THIS PRODUCT COMPLIES WITH 21 CFR 1040.10
AND 1040.11 EXCEPT FOR DEVIATIONS PURSUANT
TO LASER NOTICE NO. 50, DATED JUNE 24, 2007

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

1) Main Frame

Model/Order No.	Name	
MT1000A	Network Master Pro	
	Standard Accessories	
MT1000A-006*1	High Power Supply:	Installed
	Line Cord*2:	1 pc
B0745A	Softcase:	1 pc
B0728A*3	Rear Panel kit:	1 pc
G0385A*4	High Power AC Adaptor:	1 pc
G0310A	Li-ion Battery:	1 pc
Z1746A	Stylus:	1 pc
Z1747A*5	Carrying Strap:	1 pc
Z1748A*6	Handle:	1 pc
Z1817A*7	Utilities ROM:	1 pc
	Main Frame Option	
MT1000A-003*8	Connectivity for WLAN/Bluetooth	
MT1000A-005*9	AUX I/O	

*1: The presence of the MT1000A-006 option can be recognized at the top right of the front panel. To retrofit to the already shipped item, please contact us.

Without MT1000A-006

With in MT1000A-006

*2: One line cord is attached to the area to shipment.
*3: Set of B0720A (Rear Cover) and B0732A (Screw Kit). Please refer to next page "Module Configuration" for details.
*4: The MT1000A with MT1000A-006 can be used. Use the AC adapter when using the MT1000A without MT1000A-006 installed.
*5: Shoulder strap for MT1000A.
*6: Hand strap for MT1000A.
*7 :This DVD includes PDF files and formatting tools of each product's instruction manual (such as W3933AE, W3810AE, W3736AE, W3946AE).
*8: WLAN is available for certified countries and regions including USA, Canada, Japan and EU countries. Please visit the Anritsu web site for updated information.
*9: MT1000A-005 is required for MU100090B. To retrofit to the already shipped item, please contact us.

2) Select OTDR Module

Select the OTDR module configuration according to the procedures in items 2-1) and 2-2) below.

2-1) Select Base Module

Select one of the following models.

Model/Order No.*10	Name	
MU100020A	OTDR Module (1310/1550 nm SMF)	
MU100021A	OTDR Module (1310/1550/850/1300 nm SMF/MMF)	
MU100022A	OTDR Module (1310/1550/1625 nm SMF)	
MU100023A	OTDR Module (1310/1550/1650 nm SMF)	
	Standard Accessories	
J1693A	Universal Connector 2.5 mm for OPM:	1 pc
J1694A	Universal Connector 1.25 mm for OPM:	1 pc
W3811AE	Quick Reference Guide:	1 pc

*10: Factory installed option only and cannot be retrofitted.

2-2) Select Dynamic Range Type

Select one of the following models.

Model/Order No.*11	Name
MU100020A-020	Standard Dynamic Range (1310/1550 nm: 39/37.5 dB)
MU100020A-021	Enhanced Dynamic Range (1310/1550 nm: 42/41 dB)
MU100020A-022	High-Performance Dynamic Range (1310/1550 nm: 46/46 dB)
MU100021A-021	Enhanced Dynamic Range (1310/1550/850/1300 nm: 42/41/29/28 dB)
MU100022A-022	High-Performance Dynamic Range (1310/1550/1625 nm: 46/46/44 dB)
MU100023A-021	Enhanced Dynamic Range (1310/1550 nm: 42/41 dB, 1650 nm: 35 dB)

*11: Factory installed option only and cannot be retrofitted.

3) Select Connector Types

Select a module polish type and connector adapter according to the procedures in items 3-1) and 3-2).

3-1) Polish Types

Specify one connector polish type.

Model/Order No.*12	Name
MU100020A-010	UPC Polish
MU100020A-011*13	APC Polish
MU100021A-010	UPC Polish
MU100021A-011*13	APC Polish
MU100022A-010	UPC Polish
MU100022A-011*13	APC Polish
MU100023A-010	UPC Polish
MU100023A-011*13	APC Polish

*12: Factory installed option only and cannot be retrofitted.
*13: Used by SM port. An APC connector cannot be specified for the MM port, which uses a UPC connector.

3-2) Select Connector Adapter type

Specify one type of connector adapter.

Model/Order No.	Name
	For UPC Polish with Option 010
MU100020A-037*14	FC Connector
MU100020A-039*14	DIN 47256 Connector
MU100020A-040*14	SC Connector
MU100021A-037*15	FC Connector
MU100021A-039*15	DIN 47256 Connector
MU100021A-040*15	SC Connector
MU100022A-037*14	FC Connector
MU100022A-039*14	DIN 47256 Connector
MU100022A-040*14	SC Connector
MU100023A-037*18	FC Connector
MU100023A-039*18	DIN 47256 Connector
MU100023A-040*18	SC Connector
	For APC Polish with Option 011
MU100020A-025*14	FC Connector key width 2.0 mm
MU100020A-026*14	SC Connector
MU100021A-025*16	FC Connector key width 2.0 mm
MU100021A-026*17	SC Connector
MU100022A-025*14	FC Connector key width 2.0 mm
MU100022A-026*14	SC Connector
MU100023A-025*18	FC Connector key width 2.0 mm
MU100023A-026*18	SC Connector

*14: One specified connector adapter supplied free of charge.
*15: One each of same connector adapter for SM port and MM port supplied free of charge. Cannot specify different connector adapters for each port.
*16: One connector adapter for SM port supplied free of charge. One connector adapter equivalent to Option 37 (FC/UPC) for MM port supplied free of charge.
*17: One specified connector adapter for SM port supplied free of charge. One connector adapter equivalent to Option 40 (SC/UPC) for MM port supplied free of charge.
*18: One each of same connector adapter for SM port (1310/1550 nm) and SM port (1650 nm) port supplied free of charge. Cannot specify different connector adapters for each port.

4) VFL

Model/Order No.*19	Name
MU100020A-002*20	Visual Fault Locator
MU100021A-002*20	Visual Fault Locator
MU100022A-002*20	Visual Fault Locator
MU100023A-002*20	Visual Fault Locator

*19: Factory installed option only and cannot be retrofitted.
*20: Installs dedicated port for visible light source; 2.5 mm universal light receiver type (connector adapter not required). J1335A required to connect 1.25 mm fiber.

5) Replacement Adapters

Model/Order No.	MU100020A MU100022A MU100023A*21	MU100021A	
For UPC Polish			
	SM port	SM port	MM port
J0617B (FC/UPC)	✓	✓	✓
J0619B (SC/UPC)	✓	✓	✓
For APC Polish			
	SM port	SM port	MM port
J0739A (FC/APC)	✓	✓	N/A
J1697A (SC/APC)	✓	✓	N/A

*21: There are two SM ports — one for 1310/1550 nm, and another for 1650 nm.

6) Select Accessories & Replacement Items*

Model/Order No.	Name	Description
For MT1000A Mainframe		
B0691B	Hard Case	Up to two installed modules
G0324A	Battery Charger	
G0382A	Autofocus Video Inspection Probe	Fixed x400 magnification (USB Autofocus type). For visually verifying fiber end-face condition using MT1000A Utility application
G0306C	Video Inspection Probe (X400)	Fixed x400 magnification (USB Standard type). For visually verifying fiber end-face condition using MT1000A Utility application
G0309A	AC Adapter	Use the AC Adapter when using the MT1000A without MT1000A-006 installed
B0720A	Rear Cover	MT1000A Rear Cover
B0728A	Rear Panel Kit	Rear Panel and Screw kit (Same as Standard accessory)
B0729A	Screw 1U	1 unit screw set (Total 4 pcs)
B0730A	Screw 2U	2 units screw set (Total 4 pcs)
B0731A	Screw 3U	3 units screw set (Total 4 pcs)
B0732A	Screw Kit	1U, 2U, 3U screw set (Total 12 pcs)
For MU100020A/MU100021A/MU100022A/MU100023A OTDR Modules		
W3810AE	MT1000A MU100020A Network Master Pro Operation Manual	Printed Matter
J1335A	MU/LC Connector Adapter	Converts ferrule connector diameter from 2.5 mm → 1.25 mm for visible light source (Option 002)
J1530A	SC Plug-in Converter (UPC(P)-APC(J))	SC/UPC → SC/APC Adapter
J1531A	SC Plug-in Converter (APC(P)-UPC(J))	SC/APC → SC/UPC Adapter
J1532A	FC Plug-in Converter (UPC(P)-APC(J))	FC/UPC → FC/APC Adapter
J1533A	FC Plug-in Converter (APC(P)-UPC(J))	FC/APC → FC/UPC Adapter
J1534A	LC-SC Plug-in Converter (for SM, SC(P)-LC(J))	SC/UPC → LC/UPC Adapter for SM fiber
J1535A	LC-SC Plug-in Converter (for MM, SC(P)-LC(J))	SC/UPC → LC/UPC Adapter for MM fiber
NETWORKS	PC Emulation Software for Data Analysis and Reporting	
J1579A	Optical cable SM LC/PC to LC/PC 3 m	
J1581A	Optical cable MM LC/PC to LC/PC 3 meter	
J1575A	Optical cable SM LC/PC to FC/PC 3 m	
J1571A	Optical cable SM LC/PC to SC/PC 3 m	

*: Standard Accessories and Optional Accessories cannot be repaired.

7) Maintenance Service

Model/Order No.	Description	Supported Modules
MU100020A-ES210	2 Years Extended Warranty Service	MU100020A
MU100020A-ES310	3 Years Extended Warranty Service	
MU100020A-ES510	5 Years Extended Warranty Service	
MU100021A-ES210	2 Years Extended Warranty Service	MU100021A
MU100021A-ES310	3 Years Extended Warranty Service	
MU100021A-ES510	5 Years Extended Warranty Service	
MU100022A-ES210	2 Years Extended Warranty Service	MU100022A
MU100022A-ES310	3 Years Extended Warranty Service	
MU100022A-ES510	5 Years Extended Warranty Service	
MU100023A-ES210	2 Years Extended Warranty Service	MU100023A
MU100023A-ES310	3 Years Extended Warranty Service	
MU100023A-ES510	5 Years Extended Warranty Service	

Example of Ordering Configuration

1)	MT1000A	Network Master Pro
2-1)	MU100020A	OTDR Module (1310/1550 nm SMF)
2-2)	MU100020A-020	Standard Dynamic Range
3-1)	MU100020A-010	UPC Connector
3-2)	MU100020A-037	FC Connector

1)	MT1000A	Network Master Pro
2-1)	MU100021A	OTDR Module (1310/1550/850/1300 nm SMF/MMF)
2-2)	MU100021A-021	Enhanced Dynamic Range
3-1)	MU100021A-011	APC Connector
3-2)	MU100021A-025	FC Connector key width 2.0 mm
4)	MU100021A-002	Visual Fault Locator Option
5)	J0619B	Replaceable Optical Connector (SC)

- One must be specified from items 1), 2-1), 2-2), 3-1), and 3-2), but specification from 1) is not required if the MT1000A main frame is not required.
- When the MU100020A is specified in item 2-1), select from the MU100020A options for models for item 2-2) and later.

Network Master Series

MT9090A Mainframe
MU909014A1/B/B1/C/C6, MU909015A6/B/B1/C/C6 µOTDR Module™

Field Optical Testing Redefined

Network Master FiberVisualizer

MT9090A with MU909014/15 Overview

There are many handheld OTDRs on the market that appear to be a good value until they are put into action and the user quickly finds out that they lack the performance needed to install and maintain today's networks.

The new µOTDR Module series MU909014/15 for the Network Master MT9090A platform from Anritsu finally addresses this need by providing all of the features and performance required for installation and maintenance of optical fibers in a compact, modular test set.

The MT9090A represents an unmatched level of value and ease of use, while not compromising performance. Data sampling of 2 centimeters, dead zones of 0.8-meter and dynamic range up to 38 dB ensure accurate and complete fiber evaluation of any network type – premise to access, metro to core...including PON-based FTTx networks featuring up to a 1 × 64 split.

The MT9090A with MU909014/15 module represents a new era in optical fiber testing!

Key Features

- Tri-wavelength OTDR for both installation and maintenance (1310 nm/1550 nm plus filtered 1650 nm or 1625 nm)
- Built-in PON Power Meter, Loss Test Set and Light Source functions
- High-end OTDR performance in a pocket-size package with unique battery operation
- "Fiber Visualizer" mode simplifies operation, no OTDR knowledge needed
- Complete PON testing through splitters up to 1 × 64
- Bluetooth, WLAN and Ethernet connectivity*

*: These features use an USB Ethernet converter, USB WLAN dongle, or USB Bluetooth dongle.

The Bluetooth® mark and logos are owned by Bluetooth SIG, Inc. and are used by Anritsu under license.
Network Master™ and µOTDR Module™ are trademarks of Anritsu Corporation.

A Truly Revolutionary OTDR

Introducing the first handheld OTDR that does not compromise performance – the new µOTDR from Anritsu. With performance that rivals traditional OTDRs that are four times the size and more than double the price, the Network Master MT9090A µOTDR has created a new class of test instruments. It features 2 cm resolution for accurate mapping of events, dead zones of 0.8-meter (2.6-feet) and a dynamic range of up to 38 dB – enough to test over 150 km (90+ miles).

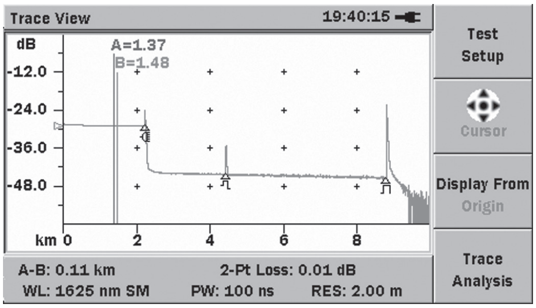
The MT9090A µOTDR also takes portability to a new level by being the first handheld OTDR that truly fits in the palm of your hand.

Complete Testing Tool - Premise to Core

With a dynamic range of up to 38 dB, the µOTDR evolves far beyond the premise/access applications that other handheld OTDRs service. Metro links can be tested with lower pulsewidths which provides greater detail and better resolution while long haul fibers up to 175 km (108 miles) can also be completely evaluated.

FTTx and PON Ready

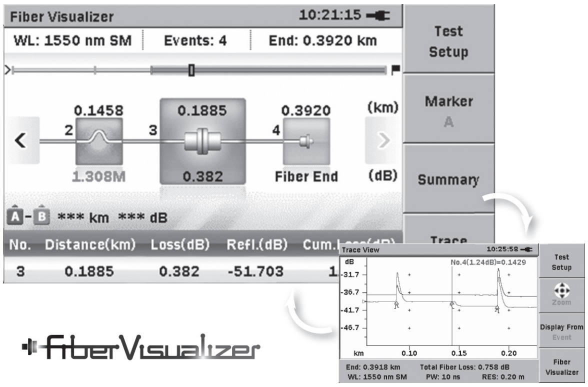
With splitter-based fiber-to-the-x (FTTx) deployments becoming more popular, the need for test equipment to thoroughly test and maintain them has risen. The µOTDR series features the ability to test up to a 1 × 64 split completely from end-to-end and with high resolution.



A-B: 0.11 km
2-Pt Loss: 0.01 dB
WL: 1625 nm SM
PW: 100 ns
RES: 2.00 m

Easy Operation and Analysis

“Fiber Visualizer” is a new fault location function designed to simplify the entire testing process. Fiber Visualizer automatically selects the testing parameters to ensure the correct setup and provides a simple, graphical summary of the fiber under test within seconds.
A comprehensive PDF report can then be customized and generated, completing the testing process.



Fiber Visualizer 10:21:15

WL: 1550 nm SM | Events: 4 | End: 0.3920 km

A-B *** km *** dB

No.	Distance(km)	Loss(dB)	Refl.(dB)	Cum.Loss(dB)
3	0.1885	0.382	-51.703	1

Trace View 10:25:58

No.4(1.24dB)=0.1429

End: 0.3918 km Total Fiber Loss: 0.758 dB
WL: 1550 nm SM PW: 10 ns RES: 0.20 m

0.8-m Dead Zone for Short Fiber Analysis

With 0.8-meter dead zones, the MT9090A is perfect for evaluating central office, FTTx and intra building cables.

Fast Real Time Sweeping

The MT9090A μOTDR features real-time updates as quickly as 0.25 seconds. This is useful for connector and splice optimizations as well as verifications of parameter selection.

Portable

The MT9090A μOTDR takes portability to a whole new level. With dimensions of just 19 cm × 9.6 cm × 4.8 cm (7.5” × 3.8” × 1.9”) and a weight of only 700 g (1.54 lbs.), the μOTDR is the smallest and lightest OTDR on the market. With its lightweight design and user friendly dimensions, the MT9090A is perfect for the outside plant environment and can easily be managed with one hand.
The standard soft case with shoulder strap further increases portability when traveling from the truck to the testing site.

Bluetooth, WLAN and Ethernet Connectivity

The Bluetooth feature enables you to share files between the μOTDR series and a PC. The WLAN and Ethernet features enable you to share files as well as use the remote GUI feature. You can connect the μOTDR and PC, and control the μOTDR series from a browser.

Bluetooth:
- Share file folder

WLAN and Ethernet
- Share file folder
- Remote GUI

4.3-inch Wide Screen Display for Easy Viewing

The high resolution, full color, 4.3-inch wide screen display is the perfect format for viewing OTDR results. It also provides excellent readability both indoors and outdoors.

Integrated Launch Fiber

To further simplify testing, the MU909014/15 series is the only handheld OTDR that features an integrated launch cable. A ten meter (30-feet) fiber is built-in so initial fiber connections can be verified without the need for additional patchcords or launch fibers.

Reliable. Capable.

When buying products, you tend to choose ones that are innovative and from established companies.
When you need to install and maintain optical networks, this should also apply. With over 50 years of combined OTDR design, Anritsu, which now includes NetTest, delivers the features that matter.
Having been in the test and measurement business for a long time, we understand the importance of performance, portability, reliability, easy operation and of course price.

Event Table with User Defined Thresholds

PASS/FAIL thresholds for key acceptance criteria such as splice loss, reflectance and total span loss can be set in the MT9090A allowing technicians to easily assess a fiber’s condition. Failing values are clearly highlighted in the event table alerting technicians of potential problems.

Unique Battery Operation

Since AC power is not always available where you need it, especially at fiber pedestals, the MT9090A typically provides 8 hours of testing on a single charge. This coupled with an optional car cigarette lighter cord guarantees the MT9090A is ready when you are. μOTDR supports widely available NiMH and Alkaline batteries for truly unique battery operation.

Quick Startup

The MT9090A is ready for measurement in under 15 seconds so productive work can start immediately.

Video Inspection Probe Support

When equipped with the optional connector video inspection probe (G0306C), the μOTDR becomes a powerful tool for evaluating connector cleanliness and quality. The G0306C can reduce issues by verifying the condition and cleanliness of connector end faces during the installation phase.
The G0306C has added a Pass/Fail analysis function to the conventional VIP.
This new function inspects the state of the connector end using video. It can automatically inspect the end of the optical connector for defects and scratches (The automatic pass/fail determination is made in accordance with the IEC61300-3-35 standard.)
You can also create a PDF report on the μOTDR series.

VIP 15:59:16

Core PASS
Cladding FAIL
Adhesive PASS
Contact FAIL
FAIL

Press Start for Live Image

Screen Capture Function

Screen shots are sometimes useful for adding to reports so the MT9090A features the ability to save screen shots as Bitmap images.

Functions for FTTx

One μOTDR module supports FTTx installation and maintenance (PON Power Meter, Loss Test Set, Light Source) in addition to μOTDR functions. (See page 31 for details.)

Installation and Maintenance Simplified

Since the MT9090A is designed for technicians of any level, its hardware and user interface are optimized for simplicity. A customizable testing sequence and "Full Auto" mode automates testing and guides novice users. Specialized maintenance wavelengths are also available to eliminate equipment damage and transmission interruptions.

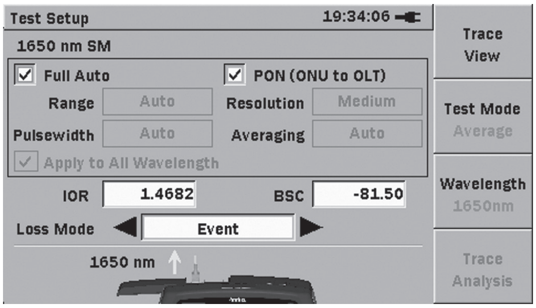
Installation Simplified

The MU909014/15 µOTDR Module series provides easy and accurate verification of fiber installations at 1310 nm, 1490 nm and 1550 nm to ensure your network is ready for any transmission type. The user simply connects the fiber, selects "Full Auto" and presses "Start" - all settings are automatically selected to ensure accurate and constant results for any skill level. Upon completion, all key fiber characteristics are displayed within seconds. Experienced users can also "fine tune" all testing parameters and make manual measurements.

Step 1 – Connect fiber and Power on

Step 2 – Select "Full Auto" and Press "Start"

All testing parameters are automatically selected.



Test Setup 19:34:06

1650 nm SM

☑ Full Auto ☑ PON (ONU to OLT)

Range: Auto
Resolution: Medium
Pulsewidth: Auto
Averaging: Auto

☑ Apply to All Wavelength

IOR: 1.4682
BSC: -81.50

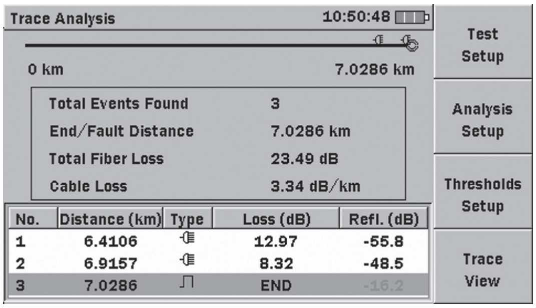
Loss Mode: Event

1650 nm

*: The screen items depend on the selected module.

Step 3 – Read Results

Test results including all splices and connectors, as well as total fiber length and loss are shown in an easy to read table.



Trace Analysis 10:50:48

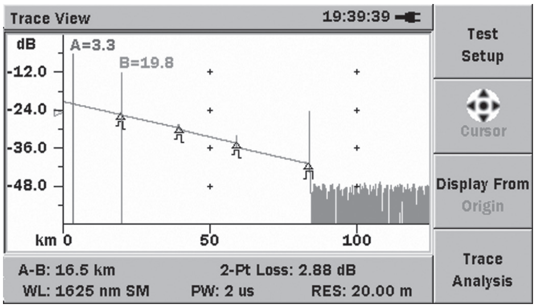
0 km 7.0286 km

Total Events Found	3
End/Fault Distance	7.0286 km
Total Fiber Loss	23.49 dB
Cable Loss	3.34 dB/km

No.	Distance (km)	Type	Loss (dB)	Refl. (dB)
1	6.4106	⫤	12.97	-55.8
2	6.9157	⫤	8.32	-48.5
3	7.0286	⎍	END	-16.2

Step 4 – View Trace

View trace if desired to see the complete fiber trace and make any manual measurements.



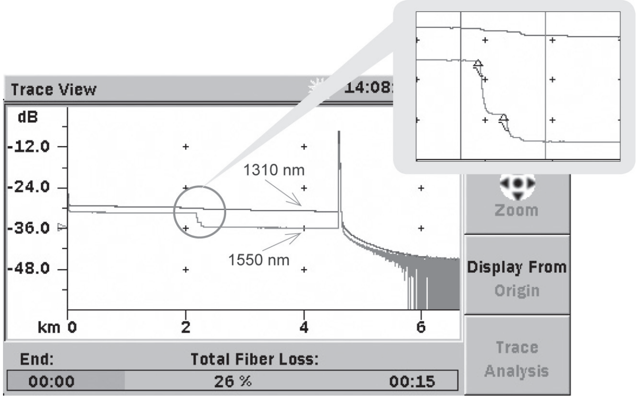
Trace View 19:39:39

A-B: 16.5 km
2-Pt Loss: 2.88 dB
WL: 1625 nm SM
PW: 2 us
RES: 20.00 m

Maintenance Simplified

Being able to test active fibers is a key requirement for network maintenance since multiple users often share portions of the network and taking them all out of service is not an option. To address this need, special modules are available in the MT9090A µOTDR series. 1650 nm is recommended by the ITU-T L.41 for extensive maintenance since it features 100 nm of isolation from the nearest 1550 nm transmission wavelength. The 1650 nm OTDR also features an integrated filter to block transmissions from damaging the OTDR. 1625 nm is also available and can be used for in-service testing or as an "extra" test to verify installation for stresses such as macrobends.

- Added Macro Bending analysis function
  The µOTDR series finds macro bending points by comparing data from two traces: one 1310 nm and the other 1550 nm.

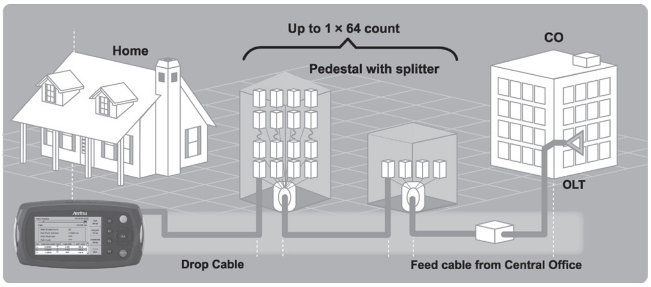


Trace View 14:08

End: 00:00
Total Fiber Loss: 26 %
00:15

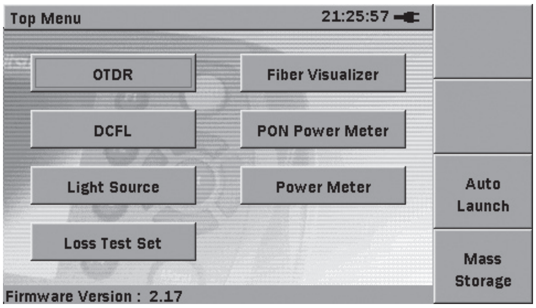
Network Documentation Simplified

- Simple Data Storage
  With internal data storage plus support for external USB memory devices, the MT9090A is more than capable. Add to this auto file saving and naming for easy, error-free documenting of your network.
- Common OTDR Data Format
  The MT9090A supports the universal Telcordia SR-4731 format making it compatible with not only legacy Anritsu and NetTest products, but with many other vendors data.
- Free and Simple Software Upgrades
  Firmware upgrades are easily performed via USB and available from the Anritsu website for registered users or through Anritsu customer support.



All-in-one FTTx Installation and Maintenance Functions

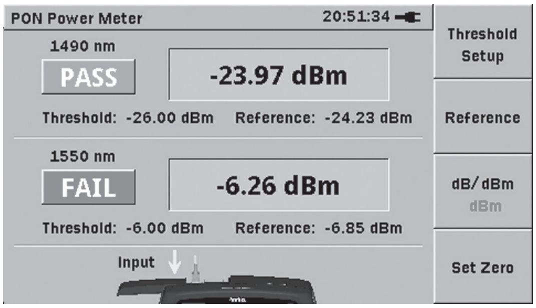
There are three types of μOTDR module: single wavelength (1625 nm or 1650 nm) for the FTTx maintenance market including Metro networks, dual wavelength (1310 nm/1550 nm) for the installation market, and triple wavelength for both these markets.
These all-in-one μOTDR modules support every function required at fiber installation and maintenance, as well as OTDR functions.
The PON Power Meter and Power Meter are ideal for loss measurements required for quality measurements and basic fault tests.



Firmware Version : 2.17

PON Power Meter (1490 nm/1550 nm)

Generally, PON communications use three wavelengths: 1310 nm, 1490 nm, and 1550 nm. Data (1490 nm) and video (1550 nm) signals are sent to subscribers through one optical fiber but a general-purpose optical power meter cannot separate the two wavelengths, making it difficult to locate faults using optical level measurements.
The PON Power Meter can identify and measure the two 1490 nm and 1550 nm signals to support PASS/FAIL evaluations based on a set threshold and reference value. Additionally, power measurements and μOTDR tests are quick and easy without changing the optical fiber because the PON Power Meter port is shared with the μOTDR function.

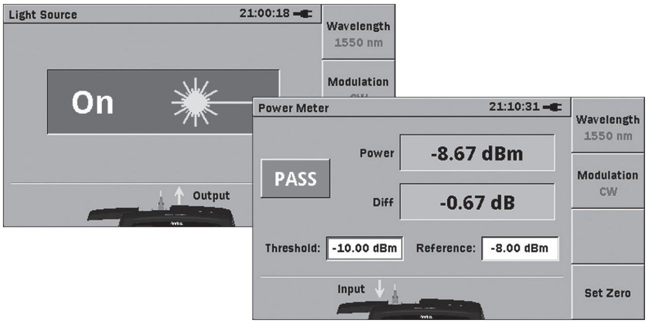


1490 nm
PASS -23.97 dBm
Threshold: -26.00 dBm Reference: -24.23 dBm

1550 nm
FAIL -6.26 dBm
Threshold: -6.00 dBm Reference: -6.85 dBm

Light Source/Power Meter

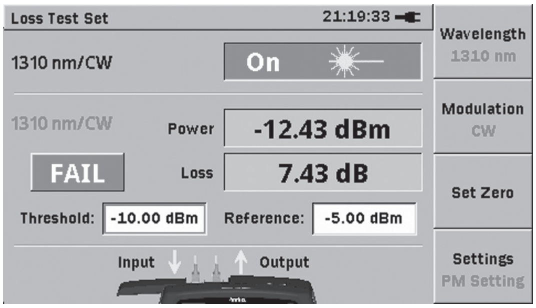
The μOTDR module can be used as a light source to identify an optical fiber and measure the loss by connecting an optical fiber identifier and optical power meter at the other end of the fiber. Since all wavelengths are shared by one μOTDR port, the fiber identification, loss, and μOTDR measurements can all be performed as a single task without changing the fiber connection. Both modulation (270 Hz, 1 kHz, 2 kHz) and CW signals are supported.
The simple power meter function is ideal for checking optical levels to confirm a fault occurrence using total received power. Setting a threshold and reference value makes PASS/FAIL evaluation easy too. In addition, power measurements and μOTDR tests are quick and easy without changing the optical fiber, because the Power Meter port is shared with the μOTDR.



PASS
Power -8.67 dBm
Diff -0.67 dB
Threshold: -10.00 dBm Reference: -8.00 dBm

Loss Test Set

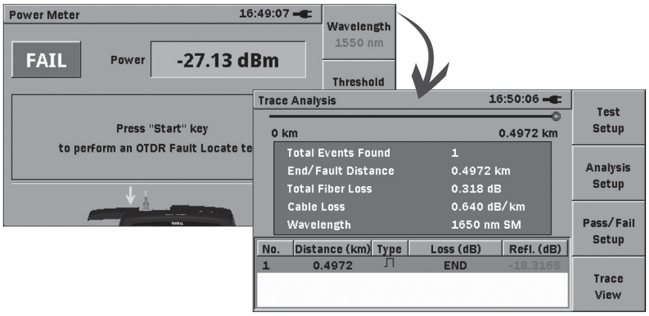
Combining the μOTDR module light source with the Power Meter supports use as a Loss Test Set.
The loss at both 1310 nm and 1550 nm can be measured with one μOTDR by looping-back the optical fiber. And both modulation (270 Hz, 1 kHz, 2 kHz) and CW signals are supported. Just setting the threshold and reference value makes PASS/FAIL evaluation easy.



1310 nm/CW On
1310 nm/CW
Power -12.43 dBm
FAIL Loss 7.43 dB
Threshold: -10.00 dBm Reference: -5.00 dBm

DCFL Function

The Drop Cable Fault Locate (DCFL) mode is a useful function to investigate faults occurring in a drop cable. It consists of the Power Meter function and OTDR function, so you are not required to switch measuring instruments or applications.



FAIL Power -27.13 dBm

Press "Start" key
to perform an OTDR Fault Locate te

0 km 0.4972 km

Total Events Found	1
End/Fault Distance	0.4972 km
Total Fiber Loss	0.318 dB
Cable Loss	0.640 dB/km
Wavelength	1650 nm SM

No.	Distance (km)	Type	Loss (dB)	Refl. (dB)
1	0.4972		END	-18.316

Visible Laser Diode

The optional visible red LD light source makes it easy to spot faults in splices and connectors and well as to manage fibers.

*: The PON Power Meter, Light Source, Power Meter, Loss Test Set, and Visible Laser Diode functions have different menus, depending on the selected module. See the Ordering Information for details.
*: The Visible Laser Diode is operated from the μOTDR and Power Meter menus.
*: The screen items depend on the selected module.

Specifications

Mainframe MT9090A

Dimensions and Mass	190 (W) × 96 (H) × 48 (D) mm (7.5″ × 3.8″ × 1.9″) (including Mainframe and Module) <700 g (1.54 lbs.) (including Mainframe, Module and Standard battery)
Display	4.3-inch TFT Color LCD (480 × 272 pixels, Transmissive)
Interface	USB 1.1, Type A × 1 (memory), Type B × 1 (USB mass storage)

µOTDR Module Common (MU909014C/C6, MU909015C/C6, MU909014A1/B/B1 and MU909015B/B1, MU909015A6)

Fiber Type		10 µm/125 µm SMF (ITU-T G.652)
Optical Connector		FC, SC adapter are changeable
Distance Range		0.5, 1, 2.5, 5, 10, 25, 50, 75, 125, 250 km (IOR = 1.500000)
Pulse Width		5, 10, 20, 50, 100, 200, 500 ns, 1, 2, 5, 10, 20 µs
Linearity		Which ever is greater ±0.05 dB/dB or ±0.1 dB
Return Loss Measurement Accuracy*1		±2 dB
Distance Measurement Accuracy		±1 m ±3 × Measurement distance × 10^{-5} ±Marker resolution (excluding IOR uncertainty)
Data Storage		Internal memory: 40 MB (<1,000 traces) External (USB Memory): 1 GB (<30,000 traces)
IOR Setting		1.3000 to 1.7000 (0.0001 steps)
Units		km, m, kft, ft, mi
Other Functions		Integrated launch fiber: 10 m (30 ft) Connection check: Automatic check of OTDR to FUT connection quality Live fiber detect: Verifies presence of communication light in fiber Real time sweep: <1 sec (typ.) Macro bend analysis (without single-wavelength model) Bluetooth, WLAN and Ethernet connectivity "Fiber Visualizer (FV)" function "DCFL" function (differs with selected module) Password protect function Video inspection probe (Option)
Language		User selectable (English, Simplified Chinese, Traditional Chinese, Korean, Japanese, French, German, Italian, Spanish, Polish, Portuguese, Finnish, Danish, Swedish, Spanish (Latin America), Russian and Dutch)
Power Supply		9 V(dc), 100 VAC to 240 VAC, Allowable Input voltage range: 90 VAC to 264 VAC, 50 Hz/60 Hz
Fiber Event Analysis		Automatic, Displayed in table format based on user defined PASS/FAIL thresholds
Loss Measurement Modes		2-point loss, Splice loss, dB/km Loss LSA, ORL, Event
OTDR Trace Format		Telcordia universal (.SOR) issue 2 (SR-4731)
Battery		NiMH (Standard battery), NiMH (AA Type), Alkaline Dry Battery (AA Type)*2 Operating time (Standard battery): 8 hours (typ.)*3, Telcordia GR-196-CORE Issue2, September 2010 Recharging time: <4 hours (typ.)*4
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000: 2018

µOTDR Module MU909014C/C6 and MU909015C/C6

Model Name		MU909015C/C6-057 MU909015C/C6-067	MU909015C/C6-058 MU909015C/C6-068	MU909015C/C6-059 MU909015C/C6-069	MU909014C/C6-057 MU909014C/C6-067	MU909014C/C6-058 MU909014C/C6-068
Center Wavelength*5		1310/1550 ±20 nm*6 1625 ±15 nm	1310/1550 ±20 nm*6 1650 ±15 nm	1310/1490/1550 ±20 nm*6	1310/1550 ±20 nm*6 1625 ±15 nm	1310/1550 ±20 nm*6 1650 ±15 nm
Dynamic Range*7, *8	PW = 20 µs	38 dB/37 dB/35 dB*9, *10	38 dB/37 dB/35 dB*9, *10	36 dB/35 dB/35 dB	32.5 dB/31 dB/32.5 dB*9, *11	32.5 dB/31 dB/32.5 dB*9, *11
	PW = 500 ns	27 dB/26 dB/25 dB*9, *10	27 dB/26 dB/24 dB*9, *10	25 dB/24 dB/24 dB	24.5 dB/23 dB/24 dB*9, *11	24.5 dB/23 dB/24 dB*9, *11
Dead Zone*12 (IOR = 1.500000)		Fresnel: ≤0.8 m (typ.) Backscatter: ≤4.0 m (1310 nm, typ.), ≤4.5 m (1490/1550/1625/1650 nm, typ.)				
Number of Sampling Points*13		<250,001 pts (Course: <7,501 pts, Medium: <20,001 pts, Fine: <250,001 pts)				
Sampling Resolution		2 cm (min.)				
Testing Modes		OTDR (Full automatic, Manual, Real time), Power Meter, [Video Inspection Probe (Option)] [PON Power Meter, Loss Test Set, Light Source (MU909015C6, MU909014C6)]				
Power Meter		Please refer to the spec "Power Meter"				
PON Power Meter (only for MU909015C6/14C6)		Please refer to the spec "PON Power Meter"				
Light Source (only for MU909015C6/14C6)		Please refer to the spec "Light Source"				
Loss Test Set (only for MU909015C6/14C6)		Please refer to the spec "Loss Test Set"				
Environment		Temperature and Humidity Operating: –10°C to +50°C, <95% (no condensation) Storage: –30°C to +70°C, <95% (no condensation) Vibration: MIL-T-28800E Class 3, Dust and Drip proof: IP51				
Laser Safety*14		IEC Pub 60825-1: 2007 Class 1M, 21CFR1040.10				

μOTDR Module MU909014A1/B/B1 and MU909015B/B1

Model name		MU909015B/B1-056 MU909015B/B1-066	MU909014B/B1-056 MU909014B/B1-066	MU909014A1-053 MU909014A1-063	MU909014A1-054 MU909014A1-064
Center Wavelength*5		1310/1550 ±20 nm*6		1625 ±15 nm	1650 ±15 nm
Dynamic Range*7, *8	PW = 20 μs	37 dB/36 dB	32.5 dB/31 dB	32.5 dB*9, *11	
	PW = 500 ns	28 dB/26 dB	24.5 dB/23 dB	24.5 dB*9, *11	24 dB*9, *11
Dead Zone*12 (IOR = 1.500000)		Fresnel: ≤1 m Backscatter: ≤5 m			
Number of Sampling Points*13		<125,001 pts (Course: <6,251 pts, Medium: <25,001 pts, Fine: <125,001 pts)			
Sampling Resolution		5 cm (min.)			
Testing Modes		OTDR (Full automatic, Manual, Real time), Power Meter, [Visible Fault Locator (Option)], [Video Inspection Prove (Option)]			
Power Meter (only for MU909014B/B1/15B/15B1)		Please refer to the spec "Power Meter"		Not applicable	
Visible Fault Locator (only for MU909014A1/B1/15B1)		Connector: 2.5 mm universal Wavelength: 650 ±15 nm (CW, +25°C) Output power: 0 ±3 dBm (CW, +25°C) Modulation: CW, 1 Hz			
Environment		Temperature and Humidity Operating: –5°C to +40°C, <80% (no condensation) Storage: –20°C to +60°C, <80% (no condensation) Vibration: MIL-T-28800E Class 3, Dust and Drip proof: IP51			
Laser Safety*14		IEC Pub 60825-1: 2007 Class 1, IEC Pub 60825-1: 2007 Class 1M, IEC Pub 60825-1: 2007 Class 3R (VLD Option), 21CFR1040.10			

μOTDR Module MU909015A6

Model Name		MU909015A6-053 MU909015A6-063	MU909015A6-054 MU909015A6-064
Center Wavelength*5		1625 ±15 nm	1650 ±15 nm
Dynamic Range*7, *8	PW = 20 μs	35 dB*9, *10	
	PW = 500 ns	25 dB*9, *10	24 dB*9, *10
Dead Zone*12 (IOR = 1.500000)		Fresnel: ≤0.8 m (typ.) Backscatter: ≤4.5 m (typ.)	
Number of Sampling Points*13		<250,001 pts (Course: <7,501 pts, Medium: <20,001 pts, Fine: <250,001 pts)	
Sampling Resolution		2 cm (min.)	
Testing Modes		OTDR (Full automatic, Manual, Real time), Power Meter, [Video Inspection Probe (Option)] [PON Power Meter, Light Source]	
Power Meter		Please refer to the spec "Power Meter"	
PON Power Meter		Please refer to the spec "PON Power Meter"	
Light Source		Please refer to the spec "Light Source"	
Environment		Temperature and Humidity Operating: –10°C to +50°C, <95% (no condensation) Storage: –30°C to +70°C, <95% (no condensation) Vibration: MIL-T-28800E Class 3, Dust and Drip proof: IP51	
Laser Safety*14		IEC Pub 60825-1: 2007 Class 1, 21CFR1040.10	

*1: Design assurance. Distance range: 25 km, Pulse width: 2 μs, 20 km open the fiber-end. BSC: –78.5 (1310 nm), –80.1 (1490 nm), –81.5 (1550 nm), –82.5 (1625 nm/1650 nm)

*2: All specifications are guaranteed by standard battery.

*3: Back light low, Sweeping halted, +25°C

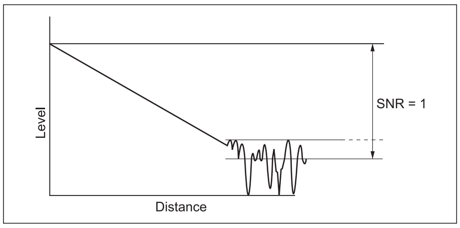
*4: +10 to +30°C, Power off

*5: At +25°C, 1 μs, except charging battery

*6: Typical value, ±25 nm is Guaranteed

*7: Typical value, Distance range: 125 km, Averaging: 180 sec, SNR = 1, +25°C, Except while charging battery, Subtract 1 dB for guarantee

*8: Dynamic range (one-way back-scattered light)
SNR = 1: The level difference between the RMS nose level and the level where near end back-scattering occurs.

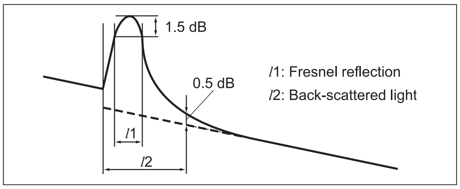


*9: 1490 nm/1550 nm cut filter included (1625 nm or 1650 nm port)

*10: Specified without background light (1625 nm, 1650 nm)

*11: In service Signal is –20 dBm (CW) at 1310 nm/1550 nm

*12: Return Loss 45 dB, +25°C
Fresnel: PW = 5 ns, 1.5 dB down from the peak of Fresnel
Backscatter: PW = 5 ns, Deviation ±0.5 dB



*13: Either medium and fine density value is selected depends on distance range

*14: Safety measures for laser products
This option complies with optical safety standards, in Class1, 1M, 3R of IEC 60825-1; the following descriptive labels are affixed to the product.

IEC 60825-1:2007
CLASS 1 LASER PRODUCT

THIS PRODUCT COMPLIES WITH 21 CFR 1040. 10 AND 1040. 11 EXCEPT FOR DEVIATIONS PURSUANT TO LASER NOTICE NO. 50 DATED JUNE 24, 2007

IEC 60825-1:2007
INVISIBLE LASER RADIATION DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS
(MAX OUTPUT POWER) (PULSE DURATION) (WAVELENGTH)
150mW ≤20μs 1310nm
CLASS 1M LASER PRODUCT

If VLD option is available

IEC 60825-1:2007
VISIBLE LASER RADIATION
AVOID DIRECT EYE EXPOSURE
(MAX OUTPUT POWER) (PULSE DURATION) (WAVELENGTH)
5mW CW 650±15nm
CLASS 3R LASER PRODUCT

Light Source Function

Models	MU909015C6/14C6, MU909015A6
Wavelength*15	1310/1550 ±25 nm (MU909015C6/14C6) 1490 ±25 nm (MU909015C6-059, MU909015C6-069) 1625 ±25 nm (MU909015C6/14C6-057, MU909015A6-053, MU909015C6/14C6-067, MU909015A6-063) 1650 ±25 nm (MU909015C6/14C6-058, MU909015A6-054, MU909015C6/14C6-068, MU909015A6-064)
Fiber Type	10 µm/125 µm SMF (ITU-T G.652)
Output Port	Shared with OTDR port
Output Power*15, *16	–5 ±1.5 dBm
Output Stability*17	≤0.2 dB
Modes of Operation	CW, 270 Hz, 1 kHz, 2 kHz
Laser Safety	Same as OTDR

Power Meter Function

Models	MU909015C6/14C6, MU909015A6	MU909015C/14C	MU909015B/B1, MU909014B/B1
Setting Wavelength	1310/1490/1550/1625/1650 nm	1310/1490/1550 nm	1310/1490/1550/1625/1650 nm
Fiber Type	10 µm/125 µm SMF (ITU-T G.652)		
Measurement Range*18	–50 to +26 dBm (CW) –40 to +13 dBm (270 Hz, 1 kHz, 2 kHz)	–50 to –5 dBm (CW)	
Measurement Port	Shared with OTDR port 1625 nm or 1650 nm OTDR port Dedicated port (Options 059 and 069)	Shared with OTDR port 1310 nm/1550 nm OTDR port (Except options 059 and 069) 1310 nm/1490 nm/1550 nm OTDR port (Options 059 and 069)	
Measurement Accuracy*19	±0.5 dB		
Modes of Operation	CW, 270 Hz, 1 kHz, 2 kHz	CW	

PON Power Meter Function (1490 nm/1550 nm)

Models	MU909015C6/14C6, MU909015A6
Wavelength	1490 nm/1550 nm
Fiber Type	10 µm/125 µm SMF (ITU-T G.652)
Measurement Range	–50 to +13 dBm (1490 nm, CW) –50 to +26 dBm (1550 nm, CW)
Measurement Port	Shared with OTDR port (1625 nm or 1650 nm) Dedicated port (Options 059 and 069)
Measurement Accuracy*20	±0.5 dB
Isolation*21	1490 nm: >35 dB, 1550 nm: >50 dB

Loss Test Set Function

Models	MU909015C6/14C6
Fiber Type	10 µm/125 µm SMF (ITU-T G.652)
Measurement Port	Light Source: Shared with OTDR port 1310 nm/1550 nm OTDR port (Except options 059 and 069) 1310 nm/1490 nm/1550 nm OTDR port (Options 059 and 069) Power Meter: Shared with OTDR port 1625 nm or 1650 nm OTDR port (Except options 059 and 069) Dedicated port (Options 059 and 069)
Light Source	
Wavelength	1310 ±25 nm, 1550 ±25 nm (Except options 059 and 069) 1310 ±25 nm, 1490 ±25 nm, 1550 ±25 nm (Options 059 and 069)
Output Power*15, *16	–5 ±1.5 dBm (CW, 25°C)
Output Stability*17	≤0.2 dB
Modes of Operation	CW, 270 Hz, 1 kHz, 2 kHz
Laser Safety	Same as OTDR
Power Meter	
Setting Wavelength	1310/1490/1550/1625/1650 nm
Measurement Range*18	–50 to +26 dBm (CW) –40 to +13 dBm (270 Hz, 1 kHz, 2 kHz)
Measurement Accuracy*19	±0.5 dB
Modes of Operation	CW, 270 Hz, 1 kHz, 2 kHz

*15: At +25°C, CW
*16: Fiber length 2 m, after the warm-up.
*17: Wavelength 1310 nm/1550 nm, CW, ±1°C at one point within –10°C to +50°C, deference between the largest value and shortest value for one minute, single mode fiber 2 m, when the optical power meter with return loss of 40 dB or more is used. After the warm-up time (10 minutes) passed.
*18: At 1550 nm
*19: 1310 nm/1490 nm/1550 nm, CW, –20 dBm, +25°C, Using Anritsu's reference single mode fiber with FC/UPC connector, after zero offset execution.
*20: 1490 nm/1550 nm, CW, –20 dBm, +25°C, Using Anritsu's reference single mode fiber with FC/UPC connector, after zero offset execution.
*21: Design assurance.

Ordering information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Select Main Frame

Includes battery pack, AC charger/adapter, standard soft case, strap and protector.

Model/Order No.	Description
Main Frame	
MT9090A	Mainframe
Main Frame Option (Remember to specify)	
MT9090A-001	Dedicated for µOTDR Module

*1: When ordering MT9090A and MT9090A-001, two matching G0202A battery packs are supplied as standard accessories.
*2: This can be used as a neck strap to support waist-level operation.

Model/Order No.	Description
Standard Accessories for MT9090A	
G0202A*1	Replacement NiMH Battery Pack
G0203A	Replacement AC Charger/Adapter
B0601B	For MT9090A with/without Protector. This soft case is a standard accessory for the MT9090A main frame.
Z1023A	Replacement Strap
B0663A*2	Protector
Standard Accessories for MT9090A-001	
G0202A*1	Replacement NiMH Battery Pack

Select Base Module

Model/Order No.	Description
MU909014A1*3	µOTDR (Single wavelength, 30 dB class OTDR with VLD)
MU909015A6*4	µOTDR (Single wavelength, 35 dB class OTDR with PM, PON-PM and LS)
MU909014B*3	µOTDR (2-wavelength, 30 dB class OTDR)
MU909014B1*3	µOTDR (2-wavelength, 30 dB class OTDR with VLD)
MU909015B*3	µOTDR (2-wavelength, 35 dB class OTDR)
MU909015B1*3	µOTDR (2-wavelength, 35 dB class OTDR with VLD)
MU909014C*6	µOTDR (3-wavelength, 30 dB class OTDR)
MU909014C6*6	µOTDR (3-wavelength, 30 dB class OTDR with PM, PON-PM, LTS and LS)
MU909015C*5, *6	µOTDR (3-wavelength, 35 dB class OTDR)
MU909015C6*6, *7	µOTDR (3-wavelength, 35 dB class OTDR with PM, PON-PM, LTS and LS)

*3: One OTDR port (any of 1310 nm/1550 nm, 1625 nm, 1650 nm) and visible light source (option) (Fig. 1)
*4: One OTDR port (1625 nm or 1650 nm) (Fig. 2)
*5: One OTDR port (1310 nm/1490 nm/1550 nm; Options 059 and 069) (Fig. 2)
*6: Two OTDR ports (1310 nm/1550 nm, and 1625 nm or 1650 nm; Except options 059 and 069) (Fig. 3)
*7: One OTDR port and dedicated power meter port (1310 nm/1490 nm/1550 nm, and power meter; Options 059 and 069) (Fig. 3)


Fig. 1


Fig. 2

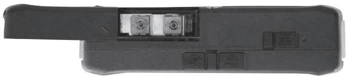


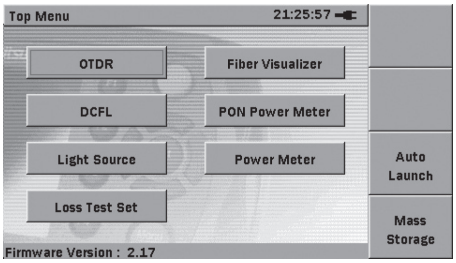
Fig. 3

Select Module, Connector Interface and Testing Options

Includes operation manual and quick reference guide.

Model/Order No.		Description	PM	PON-PM	LTS	LS*7	VLD*8	FV	DCFL
UPC type	APC type	Installation and Maintenance Models							
MU909014C-057	MU909014C-067	µOTDR (1310/1550/1625 nm, 32.5/31/32.5 dB)	✓*1					✓	
MU909014C-058	MU909014C-068	µOTDR (1310/1550/1650 nm, 32.5/31/32.5 dB)	✓*1					✓	
MU909015C-057	MU909015C-067	µOTDR (1310/1550/1625 nm, 38/37/35 dB)	✓*1					✓	
MU909015C-058	MU909015C-068	µOTDR (1310/1550/1650 nm, 38/37/35 dB)	✓*1					✓	
MU909015C-059	MU909015C-069	µOTDR (1310/1490/1550 nm, 36/35/35 dB)	✓*1					✓	
MU909014C6-057	MU909014C6-067	µOTDR (1310/1550/1625 nm, 32.5/31/32.5 dB)	✓*1	✓*3	✓*5	✓		✓	✓
MU909014C6-058	MU909014C6-068	µOTDR (1310/1550/1650 nm, 32.5/31/32.5 dB)	✓*1	✓*3	✓*5	✓		✓	✓
MU909015C6-057	MU909015C6-067	µOTDR (1310/1550/1625 nm, 38/37/35 dB)	✓*1	✓*3	✓*5	✓		✓	✓
MU909015C6-058	MU909015C6-068	µOTDR (1310/1550/1650 nm, 38/37/35 dB)	✓*1	✓*3	✓*5	✓		✓	✓
MU909015C6-059	MU909015C6-069	µOTDR (1310/1490/1550 nm, 36/35/35 dB)	✓*2	✓*4	✓*6	✓		✓	
UPC type	APC type	General Purpose Models							
MU909014B-056	MU909014B-066	µOTDR (1310/1550 nm, 32.5/31 dB)	✓*1					✓	
MU909014B1-056	MU909014B1-066	µOTDR (1310/1550 nm, 32.5/31 dB)	✓*1				✓	✓	
MU909015B-056	MU909015B-066	µOTDR (1310/1550 nm, 37/36 dB)	✓*1					✓	
MU909015B1-056	MU909015B1-066	µOTDR (1310/1550 nm, 37/36 dB)	✓*1				✓	✓	
UPC type	APC type	Maintenance Models							
MU909014A1-053	MU909014A1-063	µOTDR (1625 nm, 32.5 dB)					✓	✓	
MU909014A1-054	MU909014A1-064	µOTDR (1650 nm, 32.5 dB)					✓	✓	
MU909015A6-053	MU909015A6-063	µOTDR (1625 nm, 35 dB)	✓*1	✓*3		✓		✓	✓
MU909015A6-054	MU909015A6-064	µOTDR (1650 nm, 35 dB)	✓*1	✓*3		✓		✓	✓

*8: PM (Power Meter) function shared with OTDR port.
*9: Dedicated PM port.
*10: PON-PM (PON Power Meter) shared with 1625 nm or 1650 nm OTDR port. Identifies and measures 1490 nm and 1550 nm wavelengths.
*11: Dedicated PON-PM port. Identifies and measures 1490 nm and 1550 nm wavelengths.
*12: LTS (Loss Test Set) function for measuring 1310/1550 nm wavelengths. Light source shared with 1310/1550 nm OTDR port. Power meter shared with 1625 nm or 1650 nm OTDR port.
*13: LTS function for measuring 1310/1490/1550 nm wavelengths. Light source shared with 1310/1490/1550 nm OTDR port. Power meter is dedicated port.
*14: LS (Stabilized Light Source) shared with OTDR port for each wavelength.
*15: VLD (Visible Laser Diode) function with visible light source port operated from OTDR or Power Meter.



Top Menu differs with selected module

Select Connector Adapter

Adapter included at no charge – must be added as a separate line item.

Model/Order No.	Description
MU909014A/B/C-025 MU909015A/B/C-025	FC-APC Connector key width 2.0 mm (APC: Models -063, 064, 066, 067, 068, and 069)
MU909014A/B/C-026 MU909015A/B/C-026	SC-APC Connector (APC: Models -063, 064, 066, 067, 068, and 069)
MU909014A/B/C-037 MU909015A/B/C-037	FC Connector (UPC: Models -053, 054, 056, 057, 058, and 059)
MU909014A/B/C-040 MU909015A/B/C-040	SC Connector (UPC: Models -053, 054, 056, 057, 058, and 059)

Select Accessories*1

Must be added as separate line items.

Model/Order No.	Description
Z1580A*2	Protector & Soft Case
B0663A*3	Protector
G0203A	AC Adapter (for Replacement)
G0202A	NiMH battery pack (for Replacement)
B0602B	Deluxe Soft Case (for MT9090A)
B0601B	Standard Soft Case
B0600B	Hard Case (for MT9090A)
Z1023A	Strap
J1402A	Car Plug Cord
J1530A	SC Plug-in Converter (UPC(P)-APC(J))
J1531A	SC Plug-in Converter (APC(P)-UPC(J))
J1532A	FC Plug-in Converter (UPC(P)-APC(J))
J1533A	FC Plug-in Converter (APC(P)-UPC(J))
J1534A	LC-SC Plug-in Converter (for SM, SC(P)-LC(J))
J1535A	LC-SC Plug-in Converter (for MM, SC(P)-LC(J))
W3585AE	Quick Reference Guide (English, Printed)
W3586AE	Operation Manual (English, Printed)
Z1579A	Operation Manual (English and Japanese, Electronic (CD-R))
G0306C	Video Inspection Probe (× 400)
NETWORKS	PC Emulation Software for Data Analysis and Reporting

*1: Optional Accessories cannot be repaired.
*2: The protector (B0663A) and standard soft case (B0601B) from a set.
The protector includes a shoulder strap.
*3: The shoulder strap can be used to hang the instrument around the neck while working.

Replacement Adaptors

Must be added as separate line items.

Model/Order No.	Description
J0617B	FC (UPC: Models -053, -054, -056, -057, -058)
J0619B	Replaceable Optical Connector SC (UPC: Models -053, -054, -056, -057, -058) (APC: Models -063, -064, -066, -067, -068)
J0739A	FC (APC: Models -063, -064, -066, -067, -068)
J1602A	Replaceable optical connector (SC) Phosphor bronze
J1603A	Replaceable optical connector (FC) Phosphor bronze

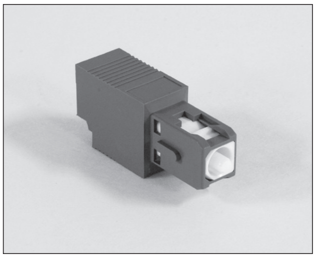
Standard Soft Case B0601B
This standard accessory accommodates the mainframe with fitted protector.

Deluxe Soft Case B0602B
Full Network Master operation without removal from the case. Provides excellent protection for use in hash conditions.
This does not accommodate the mainframe if the protector is fitted.

Hard Case B0600B
This accommodates two mainframes (with or without fitted protector), accessories (light source or power meter, backup battery, fiber cleaner, etc.).

Mainframe with Protector

Protector B0663A (Standard accessory)
The mainframe with fitted protector.



J1530A to J1535A
Plug-in Converter
(The photo shows the J1534A)

G0306C
Video Inspection Probe
(× 400)

ACCESS Master

MT9085 Series

1.31/1.55/1.49/1.625/1.65 μm (SMF), 0.85/1.3 μm (MMF)

For Fiber Installation and Maintenance

The ACCESS Master MT9085 series is a compact handheld all-in-one tester for performing OTDR tests, optical loss/power measurements, and optical fiber end-face inspections. It has a wide variety of applications, ranging from installation and maintenance (I&M) of trunk fibers (Core, Metro, Access, Mobile Fronthaul, Mobile Backhaul) to troubleshooting Access networks, such as breaks in drop cables.

8-inch
Wide Touch Screen

Hard keys
Easy Operation

The easy to use rotary knob and hard keys support efficient manual waveform analysis.

Easy Analysis
Fiber Visualizer

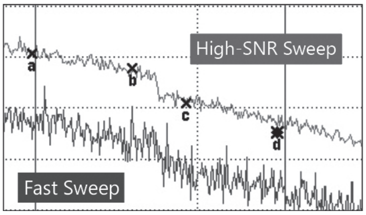
Fiber events, such as splices, connectors, splitters, etc., are displayed as schematic icons along with loss and reflectance Pass/Fail evaluation results for at-a-glance confirmation.

FiberVisualizer

Fast Realtime Sweep Mode with High SNR

Supports Various Measurement Environments

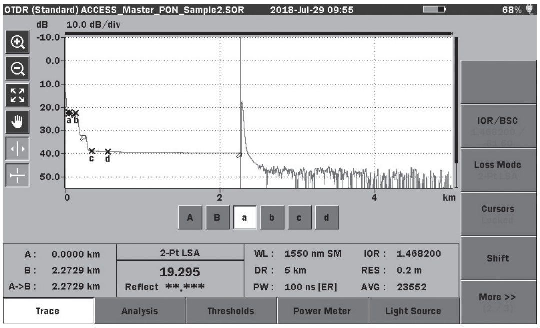
Realtime measurement, fast sweeping is useful for position identification by bending the fiber, while high-SNR sweeping makes it easy to view the waveform. These two sweep modes can be applied in various measurement environments.



Up to 1 × 128 Branches

Identify Events for Each Splitter and Branch Information

Multiple PON splitters can be identified using high-quality waveforms, and events at each splitter are Pass/Fail evaluated based on preset threshold values.


OTDR (Standard) ACCESS_Master_PON_Sample2.SOR 2018-Jul-29 09:55 68%

A : 0.0000 km
B : 2.2729 km
A->B : 2.2729 km

2-Pt LSA
19.295
Reflect **.***

WL : 1550 nm SM
DR : 5 km
PW : 100 ns [ER]
IOR : 1.468200
RES : 0.2 m
AVG : 23552

Accurate Event Detection and Loss Measurement

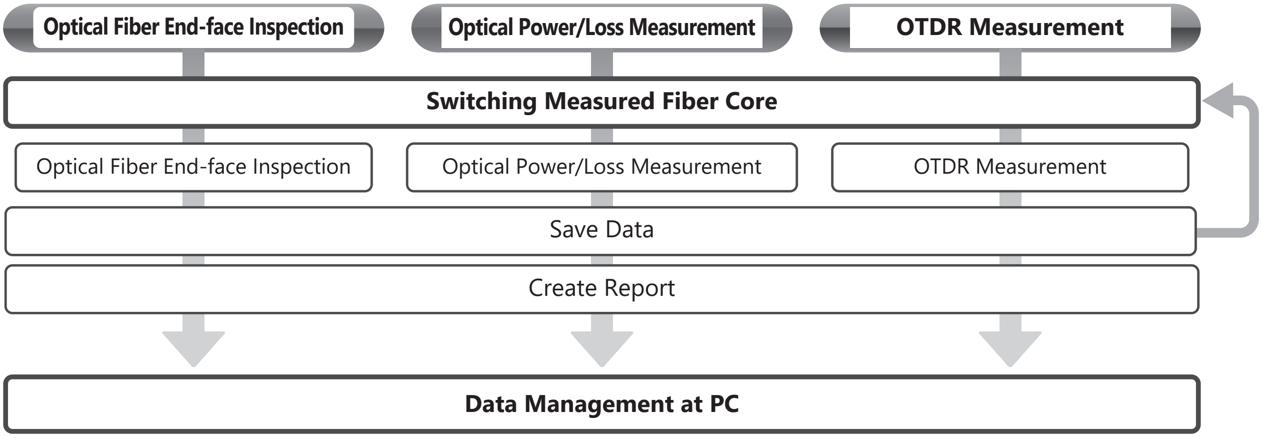
Multi-pulse Measurement is Supported with a 46-dB max. Dynamic Range and a Dead Zone of 0.8 m.

Measurement of both short fibers of a few meters to long fibers of more than 100 km is supported. Multi-pulse measurements enable accurate loss and reflection measurements between events separated by short distances.

Basic Applications

Optical Fiber Path Evaluation process

Multiple test are completed when evaluating optical fiber which include, fiber end-face inspection, and optical power/optical loss and OTDR measurements. these test can all be executed using a single MT9085 series unit (require built-in options and external hardware options).
In addition, data file saved for each measurement can be transferred over WLAN or Bluetooth network connection for further management and processing using dedicated PC tools.

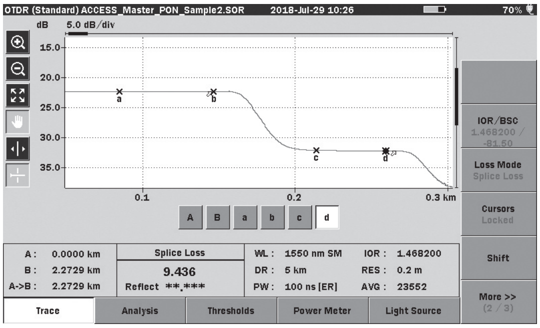


OTDR Measurement

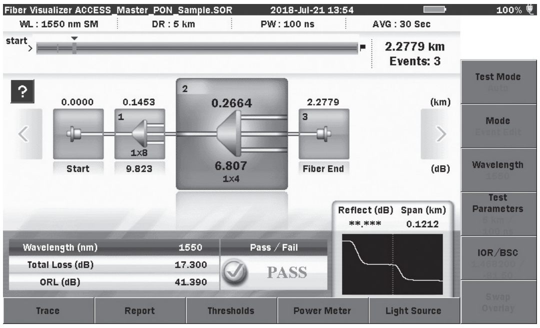
OTDR measurement is a basic function of the MT9085 series. The models in the series support different wavelengths matching the measurement environment. The Fiber Visualizer function displays fiber events as schematic icons for at-a-glance confirmation of splices and connectors along the fiber length with automatic Pass/Fail evaluation of fiber loss and reflectance. Moreover, manual analysis of loss and reflectance using a combination of the rotary knob, hard keys and marker operations assures the same easy operability as previous ACCESS Master series. The excellent waveform quality supports both PON measurements as well as realtime short to long-distance fiber measurements.

MT9085 Series OTDR Product Line

Option	Wavelength	Dynamic Range	Feature
MT9085C-053	1310/1550 nm SM	46/46 dB	General-purpose model for installation and maintenance (I&M)
MT9085C-057	1310/1550/1625 nm SM	46/46/44 dB	Model for effective wavelength maintenance using macrobend analysis
MT9085B-053	1310/1550 nm SM	42/41 dB	General-purpose model for installation and I&M
MT9085B-055	1310/1550 nm, 1650nm SM	41/41 dB, 35 dB	Model with built-in filters for live circuit maintenance
MT9085B-056	1310/1490/1550 nm SM	42/41/41 dB	Model for FTTx/PON I&M
MT9085B-057	1310/1550/1625 nm SM	40/39/38 dB	Model for effective wavelength maintenance using macrobend analysis
MT9085B-058	1310/1490/1550/1625 nm SM	42/41/41/40 dB	Model for FTTx/PON I&M; supports sectioned evaluation of CWDM wavelength band
MT9085B-063	1310/1550 nm SM 850/1300 nm MM	42/41 dB, 29/28 dB	All-in-one model for SMF and MMF I&M
MT9085A-053	1310/1550 nm SM	39/37.5 dB	General-purpose model for installation and I&M
MT9085A-057	1310/1550/1625 nm SM	37/35.5/32.5 dB	Model for effective wavelength maintenance using macrobend analysis
MT9085A-063	1310/1550 nm SM 850/1300 nm MM	39/37.5 dB, 29/28 dB	All-in-one model for SMF and MMF I&M


OTDR (Standard) ACCESS_Master_PON_Sample2.SOR 2018-Jul-29 10:26 70%

A : 0.0000 km
B : 2.2729 km
A->B : 2.2729 km
Splice Loss 9.436
Reflect **.***
WL : 1550 nm SM
DR : 5 km
PW : 100 ns [ER]
IOR : 1.468200
RES : 0.2 m
AVG : 23552


Fiber Visualizer ACCESS_Master_PON_Sample.SOR 2018-Jul-21 13:54 100%

WL : 1550 nm SM
DR : 5 km
PW : 100 ns
AVG : 30 Sec
2.2779 km
Events: 3

Wavelength (nm) 1550
Total Loss (dB) 17.300
ORL (dB) 41.390
Pass / Fail PASS
Reflect (dB) **.***
Span (km) 0.1212

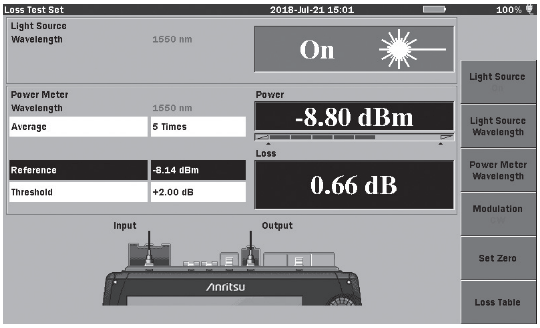
Optical Power/Loss Measurement

Optical power and loss measurement is a key basic function for confirming the optical fiber installation condition and fault status.
The OTDR measurement module functions as a light source outputting laser light. The optical power meter function built into a dedicated port option supports optical loss measurements (OLTS) using one tester.

MT9085 Series Optical Power Meter (Option) Product Line

These are specified as OTDR module options.

Option	Outline	Measurement Range
MT9085A/B/C-004	SMF Optical Power Meter	–50 to +23 dBm
MT9085A/B/C-005	SMF High Input Optical Power Meter	–43 to +30 dBm
MT9085A/B/C-007	SMF/MMF Optical Power Meter	–67 to +6 dBm



Loss Test Set 2018-Jul-21 15:01 100%

Light Source Wavelength 1550 nm

On

Power Meter Wavelength 1550 nm

Average 5 Times

Reference -8.14 dBm

Threshold +2.00 dB

Power -8.80 dBm

Loss 0.66 dB

CMA5 Series: Light Source/Optical Power Meter

The CMA5 series is an optical power meter and optical loss tester for optical power and loss measurements.
For more details, see the separate catalog for the CMA5 series.

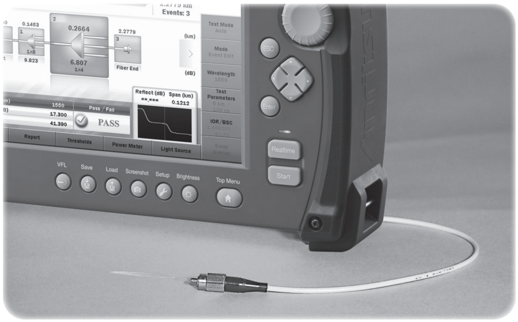
Visual Light Source Test

The visual light source is used when monitoring light leaking from the optical fiber core at fiber breaks.

MT9085 Series Visual Light Source (Option) Product Line

It is specified as an OTDR module option.

Option	Outline
MT9085A/B/C-002	Visual Fault Locator



Optical Fiber End-face Inspection

Scratches and dirt on the ferrule end face of connectors is a main cause of signal transmission loss and reflections, which severely degrade transmission quality. Moreover, the optical fiber end face requires inspection and cleaning to assure accurate OTDR and optical power/loss measurements.
Using the MT9085 series in combination with the Video Inspection Probe G0306C external option (sold separately) supports end-face inspections.

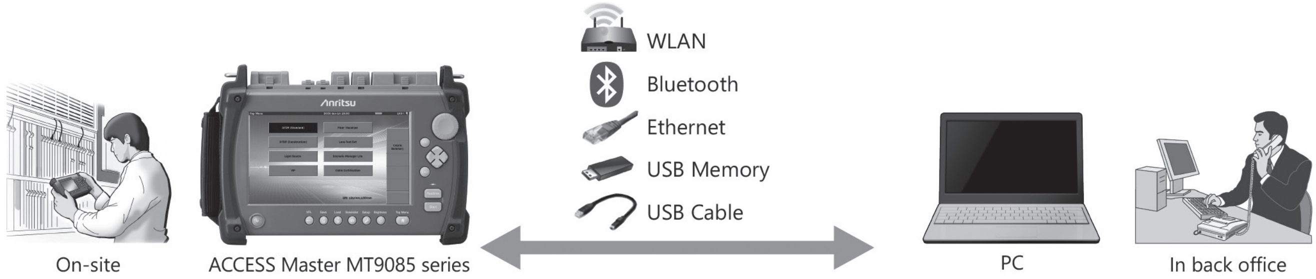
Video Inspection Probe (External Attachment Option) Product Line

Option	Outline
G0306C	Video Inspection Probe

Saving Data Files and Creating Reports

On-site measurement data captured using the MT9085 series can be saved in each original measurement application data file format as well as in various other formats, including PDF reports. Moreover, these data can be shared with a PC via interfaces such as WLAN, Bluetooth, USB Memory, etc., for further waveform analysis and reporting at the PC using dedicated software tools based on the on-site captured original data files.

* Communications over WLAN and Bluetooth require a USB dongle adapter. Files can also be shared via Ethernet, USB memory, and USB cable.



MT9085 Series Measured Data Save Methods

	Original Data Files	Screen Capture	.csv File	PDF Report Output
OTDR	✓	✓		✓
OLTS		✓	✓	
VIP	✓	✓		✓

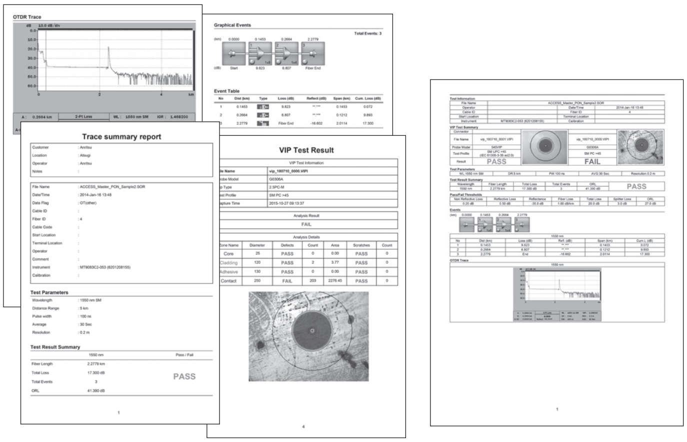
Windows PC Analysis Tools

OTDR	NETWORKS • Waveform analysis of original data file (.sor) saved by MT9085 • Report creation
VIP	Connector Master MX900030A • Analysis of loaded data file (.vipi) originally saved by MT9085 + G0306C

Managing Measured Data

Each OTDR, OLTS, and VIP data set measured on-site using the MT9085 series can be saved as the original data file or as a .csv file. The screen capture function is useful when wanting to keep a simple record of the measured data. Saving is easy using the shortcut key at the bottom of the screen.

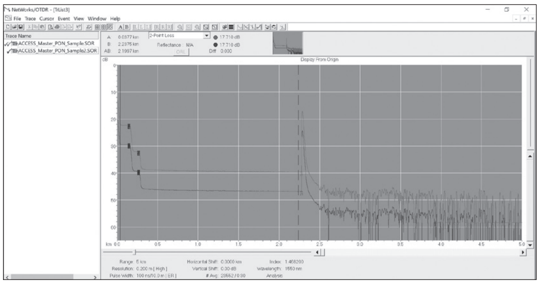
At OTDR and VIP measurement, saving the file in the original data format (.sor, .vipi) is useful for further waveform data analysis back at the office either by reloading the data onto the MT9085 series or onto a PC. Moreover, in addition to creating a PDF report, reports combining the OTDR and VIP measurements results can also be created.



PDF Report Output

Waveform analysis and report creation for on-site OTDR measurement data results (.sor) on a PC can be performed using the dedicated Analysis Software NETWORKS (sold separately).

Similarly, VIP measurement data can also be analyzed on a PC using the dedicated Connector Master MX900030A software.



Waveform Analysis and Report Creation using NETWORKS

External Data File Transmission and Communications Control

In addition to transferring data files from the MT9085 series to a PC using either USB memory or a USB cable, data can also be transferred using WLAN and Bluetooth networks (requires external USB WLAN adapter). Communications over either WLAN or Ethernet interface can be controlled remotely using a Web browser GUI or remote commands. (Ethernet connection requires an external USB-Ethernet conversion cable.)

Remote GUI Control by Web Browser

Specifications

ACCESS Master MT9085A/B/C Common

Dimensions and Mass	Without Protector	Dimensions: 270 (W) × 165 (H) × 61 (D) mm, 10.6 × 6.5 × 2.4 inches
		Mass: 1.6 kg without battery, 1.9 kg including battery
	With Protector (option 010)	Dimensions: 284 (W) × 200 (H) × 77 (D) mm, 11.2 × 7.9 × 3 inches
		Mass: 2.6 kg including battery
Display	8-inch touch screen TFT-Color LCD	
Interface	USB 2.0: Type A × 3 (memory), USB1.1: MicroB × 1 (USB mass storage) * USB power supply is 500 mA	
Wireless Interface	WLAN/Bluetooth * via USB adapter connected to USB port	
Data Storage	Internal memory: 1 GB (up to 50,000 traces), External memory (USB): up to 32 GB	
Power Supply	12 V(dc), 100 VAC to 240 VAC, Allowable input voltage range: 90 V to 264 V, 50 Hz/60 Hz	
Battery	Type: Lithium ion Operating Time*1: 12 hours, Telcordia GR-196-CORE Issue 2, September 2010 Recharge Time: <5 hours (power off)	
Power Consumption	20 W max (recharging), 4 W standard (low backlight, sweep stopped)	
Power Saving Functions	Backlight off: Disable/1 to 99 minutes Auto shutdown: Disable/1 to 99 minutes	
Vertical Scale	0.1, 0.2, 0.5, 1.0, 2.0, 5.0, 10.0 dB/div	
IOR Setting	1.300000 to 1.700000 (0.000001 steps)	
Units	km, m, kft, ft, mi	
Languages	User selectable (English, Simplified Chinese, Traditional Chinese, French, German, Italian, Korean, Portuguese, Russian, Spanish, Swedish and Japanese)	
Sampling Points*2	Up to 150,001	
Sampling Resolution	0.05 m to 60 m	
Reflectance Accuracy	Single mode: ±2 dB (When measuring the non-connected end of an approximately 25 km length fiber, Distance range: 50 km, Pulse width: 2 µs) Multimode: ±4 dB (When measuring the non-connected end of an approximately 4.5 km length fiber, Distance range: 10 km, Pulse width: 100 ns)	
Distance Accuracy	±1 m ±3 × measurement distance × 10^{-5} ± marker resolution (excluding IOR uncertainty)	
Loss Measurement Accuracy (Linearity)	±0.05 dB/dB or ±0.1 dB (whichever is greater)	
Distance Range	Single mode: 0.5, 1, 2.5, 5, 10, 25, 50, 100, 200, 300 km Multimode: 0.5, 1, 2.5, 5, 10, 25, 50, 100 km	
Testing Modes	Fiber Visualizer: Provides end/break location, end to end loss, fiber length, easy graphical summary, PDF report, Standard OTDR: User selectable automatic or manual set-up Construction OTDR: Automated, multi-wavelength testing Light source: Stabilized Light source (CW, 270 Hz, 1 kHz, 2 kHz output) Loss test set (optional): Power meter and Light source Connector Video Inspection Probe (optional) Visual fault locator (optional): Visible red light for fiber identification and troubleshooting	
Fiber Event Analysis	Auto or manual operation, displayed in table format User defined Pass/Fail thresholds: Reflective and non-reflective events: 0.01 to 9.99 dB (0.01-dB steps) Reflectance: 70.0 to 20.0 dB (0.1-dB steps) Fiber end/break: 1 to 99 dB (1-dB steps) Number of detected events: up to 99 Macrobend detection	
OTDR Trace Format	Telcordia universal. SOR, issue 2 (SR-4731)	
Other Functions	Real time sweep*3: 0.15 sec. Loss modes: 2-point loss, dB/km, 2-point LSA, splice loss, ORL Averaging modes: Timed (1 to 3600 s) Live Fiber detect: Verifies presence of communication light in optical fiber Connection check: Automatic check of OTDR to FUT connection quality Trace overlay and comparison, Template function, USB keyboard support, Remote control, Remote GUI Password protection feature	
Environmental Conditions	Operating temperature and humidity: –10°C to +50°C, <80% (non-condensing) Storage temperature and humidity: –20°C to +60°C, <80% (non-condensing) Vibration: Conforming to MIL-T-28800E Class 3 Dust proof: MIL-T-28800E (Dust Exposure) Class 2 Drip proof: IP51 (IEC 60529), JIS C 0920 TYPE I complied Shock: MIL-T-28800E Style A (46 cm height , 8 corners, 6 faces ; 14 drops in total, power off), Bump: IEC 60068-2-27, JIS C60068-2-27, Shock-on-desk: MIL-T-28800E(45° angle or 100 mm lifted edge, 4 drops in total , power on)	
CE	EMC: 2014/30/EU, EN61326-1, EN61000-3-2 LVD: 2014/35/EU, EN61010-1 RoHS: 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018	
UKCA	EMC: S.I. 2016 No.1091, EN 61326-1, EN61000-3-2 LVD: S.I. 2016 No.1101, EN 61010-1 RoHS: S.I. 2012 No.3032, EN IEC 63000: 2018	

*1: Typical, backlight Low, sweeping halted at 25˚C

*2: Either high density value is selected depending on distance range

*3: Resolution: Low Density

OTDR

MT9085C							
Options	HR/ER Mode*4	Wavelength*5	Fiber Type	Pulse width	Dynamic Range*6, *7	Dead Zone (Fresnel)*8 (IOR = 1.500000)	Dead Zone (Backscatter)*9 (IOR = 1.500000)
MT9085C-053	✓	1310/1550 nm ±25 nm	Single Mode (SMF) 10/125 µm ITU-T G.652	3, 10, 20, 30, 50, 100, 200, 500, 1000, 2000, 4000, 10000, 20000 ns	46/46 dB*11 25/25 dB*10 (Pulse width: 100 ns)	≤1 m, 0.8 m (typ.)	≤3.8/4.3 m
MT9085C-057	✓	1310/1550/1625 nm ±25 nm			46/46/44 dB*11 25/25/23 dB*10 (Pulse width: 100 ns)		≤3.8/4.3/4.8 m

MT9085B							
Options	HR/ER Mode*4	Wavelength*5	Fiber Type	Pulse width	Dynamic Range*6, *7, *13	Dead Zone (Fresnel)*8 (IOR = 1.500000)	Dead Zone (Backscatter)*9 (IOR = 1.500000)
MT9085B-053	✓	1310/1550 nm ±25 nm	Single Mode (SMF) 10/125 µm ITU-T G.652	3, 10, 20, 30, 50, 100, 200, 500, 1000, 2000, 4000, 10000, 20000 ns	42/41 dB*11	≤1 m 0.8 m (typ.)	≤5/5.5 m
MT9085B-055	✓	1310/1550 nm ±25 nm, 1645 nm to 1655 nm			42/41/35 dB*11		≤5/5.5/6.5 m
MT9085B-056	✓	1310/1490/1550 nm ±25 nm			42/41/41 dB*11		≤6/6.5/6.5 m
MT9085B-057	✓	1310/1550/1625 nm ±25 nm			40/39/38 dB*11		≤6/6.5/7.5 m
MT9085B-058	✓	1310/1490/1550/ 1625 nm ±25 nm			42/41/41/40 dB*11		≤7/7.5/7.5/8.5 m
MT9085B-063	✓	1310/1550 nm ±25 nm, 850/1300 nm ±30 nm	HYBRID (SMF/MMF)*12	SMF: above MMF: 3, 10, 20, 30, 50, 100, 200, 500, 1000, 2000, 4000 ns 850 nm: Does not support 1000, 2000, 4000 ns	42/41 dB*11 29/28 dB*11		≤5/5.5 m, ≤4/5 m (3/4 m typ.)

MT9085A							
Options	HR/ER Mode*4	Wavelength*5	Fiber Type	Pulse width	Dynamic Range*6, *7	Dead Zone (Fresnel)*8 (IOR = 1.500000)	Dead Zone (Backscatter)*9 (IOR = 1.500000)
MT9085A-053	✓	1310/1550 nm ±25 nm	Single Mode (SMF) 10/125 µm ITU-T G.652	3, 10, 20, 30, 50, 100, 200, 500, 1000, 2000, 4000, 10000, 20000 ns	39/37.5 dB*11	≤1 m 0.8 m (typ.)	≤5/5.5 m
MT9085A-057	✓	1310/1550/1625 nm ±25 nm			37/35.5/32.5 dB*11		≤6/6.5/7.5 m
MT9085A-063	✓	1310/1550 nm ±25 nm, 850/1300 nm ±30 nm	HYBRID (SMF/MMF)*12	SMF: above MMF: 3, 10, 20, 30, 50, 100, 200, 500, 1000, 2000, 4000 ns 850 nm: Does not support 1000, 2000, 4000 ns	39/37.5 dB*11 29/28 dB*11		≤5/5.5 m, ≤4/5 m (3/4 m typ.)

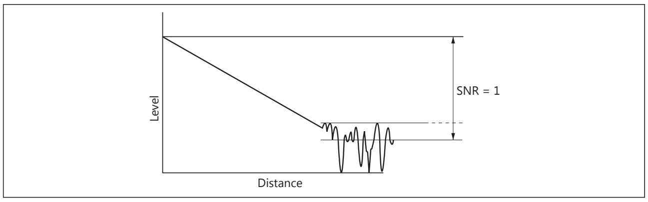
Laser Safety*14	IEC 60825-1:2007 CLASS 1M: option 053, 055, 056, 057, 058, 063 21CFR1040.10 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007

*4: HR: High Resolution mode for Short dead zone.
ER: Enhanced Range mode for PON measurement.

*5: 25°C, Pulse width: 1 µs (all except 850 nm, 1300 nm), 850 nm/1300 nm: 100 ns

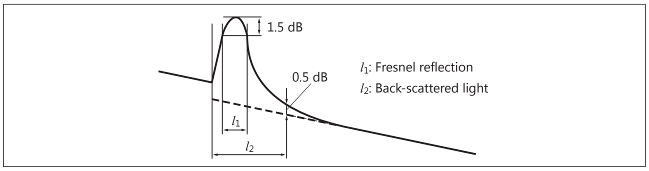
*6: Pulse widths: 20 µs (Options 053, 055, 056, 057, 058, 063, 1310 nm/1550 nm) at Distance range: 100 km
Pulse width: 4 µs (Option 063, 1300 nm) at Distance range: 25 km
Pulse width: 500 ns (Option 063, 850 nm) at Distance range: 25 km
Averaging: 180 sec., SNR = 1, 25°C

*7: Dynamic range (one-way back-scattered light), SNR = 1: The level difference between the RMS noise level and the level where near end back-scattering occurs.



*8: Pulse width: 3 ns (Options 053, 055, 056, 057, 058, 063.)
Return loss: 40 dB, 25˚C (Refer to the figure below)

*9: Pulse width 10 ns, return loss 55 dB, Deviation ±0.5 dB, 25°C (Options 053, 055, 056, 057, 058, 063. All except 850 nm/1300 nm)
Pulse width 3 ns, return loss 40 dB, Deviation ±0.5 dB, 25°C (Option 063, 850 nm/1300 nm)



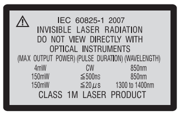
*10: Pulse width: 100 ns (ER Mode), Distance range: 100 km
Averaging: 180 sec., SNR = 1, 25°C

*11: Typical. Subtract 1 dB for guarantee

*12: At measurement of 50 µm/125 µm MM Fiber, the dynamic range drops by about 3.0 dB

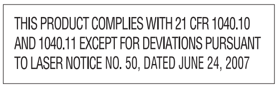
*13: At 1650 nm: With background light, 1310/1550 nm, –19 dBm CW light

*14: Safety measures for laser products
This product complies with optical safety standards in IEC 60825-1, 21CFR1040.10 and 1040.11; the following descriptive labels are affixed to the product.


IEC 60825-1 2007
INVISIBLE LASER RADIATION
DO NOT VIEW DIRECTLY WITH
OPTICAL INSTRUMENTS

(MAX OUTPUT POWER)	(PULSE DURATION)	(WAVELENGTH)
4mW	CW	850nm
150mW	≦500ns	850nm
150mW	≦20 µs	1300 to 1400nm

CLASS 1M LASER PRODUCT


THIS PRODUCT COMPLIES WITH 21 CFR 1040.10
AND 1040.11 EXCEPT FOR DEVIATIONS PURSUANT
TO LASER NOTICE NO. 50, DATED JUNE 24, 2007

Light Source Specifications – Standard on all models*15	
Stabilized Light Source (through OTDR port)	
Wavelength*17	Same as OTDR
Spectral Width*17	≤5 nm (1310 nm) ≤10 nm (850/1300/1490/1550/1625 nm) ≤3 nm (1650 nm)
Wavelength Accuracy*17	850/1300/1310/1490/1550/1625 nm: ±30 nm 1650 nm: ±5 nm
Fiber Type	Same as OTDR
Optical Connector	Same as OTDR
Output Power*17	–5 ±1.5 dBm
Output Stability*18	≤0.1 dB
Modes of Operation*19	CW, 270 Hz, 1 kHz, 2 kHz
Laser Safety	Same as OTDR

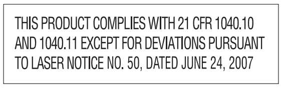
Power Meter Specifications – Standard on all models*15	
Standard Integrated Power Meter*16 (through OTDR port)	
Maximum Input	+10 dBm
Measurement Range	–50 to –5 dBm
Fiber Type	Same as OTDR
Optical Connector	Same as OTDR
Accuracy*20	±6.5%
Setting Wavelengths	1310, 1550, 1625, 1650 nm (Options 053, 055, 057, 063) 1310, 1490, 1550, 1625 nm (Options 056, 058)
Features	Store reference, loss table

Loss Test Set Specifications – Optional on all Models*17, *18			
Power meters (004, 005 and 007)			
Option	MT9085A/B/C-007	MT9085A/B/C-004	MT9085A/B/C-005
Fiber Type	Single Mode: 10 µm/125 µm (G.652), Multimode: 62.5 µm/125 µm	Single Mode: 10 µm/125 µm (G.652) *PC only for UPC connector	Single Mode: 10 µm/125 µm (G.652)
Measurement Range*21	–67 to +6 dBm*22 (CW, 1310 nm)	–50 to +23 dBm (CW, 1550 nm)	–43 to +30 dBm (CW, 1550 nm)
Wavelength Range	800 nm to 1700 nm	1200 nm to 1700 nm	
Setting Wavelengths	850, 1300, 1310, 1383, 1490, 1550, 1625, 1650 nm	1310, 1383, 1490, 1550, 1625, 1650 nm	
Optical Connector	Universal – uses LP-XX adapters	Universal – uses JXXXX adapters (same as OTDR)	Universal – uses MA9005B adapters
Accuracy	±5% (1310 nm/1550 nm)*23, ±0.5 dB (850 nm)*23	±5% (1310 nm/1550 nm)*24	
Reflectance	—	≥36 dB*25	—
Modulation	CW, 270 Hz, 1 kHz, 2 kHz		
Features	Save reference, loss table		
Environmental	Operating temperature and humidity: 0°C to +50°C, <80% (non-condensing)		

Visual light Source (Option 002)	
Central Wavelength	650 nm ±15 nm (at 25˚C)
Optical Output	0 ±3 dBm (CW)
Output Optical Fiber	10 µm/125 µm, SMF (ITU-T G.652)
Optical Connector	2.5 mm universal
Laser Safety*26	IEC 60825-1: 2007 CLASS 3R 21CFR1040.10 and 1040.11 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007
Environmental	Operating temperature and humidity: 0°C to +50°C, <80% (non-condensing)

*15: Some models do not support power meter (See next page)
*16: If Opttion 004, 005 or 007 is ordered, the standard integrated power meter is not available
*17: CW, 25°C
*18: CW, –10°C to +50°C (±1°C) difference between max/min. values over 1 minute, SM fiber 2 m
*19: Modulation +1.5% with 10 minute warm up
*20: CW input, –20 dBm at 1550 nm, 23°C±2, Using Anritsu's reference single mode fiber with FC/UPC connector
*21: Peak power, subtract 3 dB for modulated tones
*22: –60 to +3 dBm (Option 007 @850 nm)
*23: CW, at –10 dBm (1310/1550 nm), At –10 dBm (850 nm), 25°C, Using Anritsu's reference single mode fiber with FC/UPC connector, After zero offset
*24: CW, at 0 dBm (1310/1550 nm), 25°C, Using Anritsu's reference single mode fiber with FC/UPC connector, After zero offset
*25: Using SM fiber (ITU-T G.652). Reflectance: ≥45 dB
*26: Safety measures for laser products
This option complies with optical safety standards in IEC 60825-1, 21CFR1040.10 and 1040.11; the following descriptive labels are affixed to the product.


IEC 60825-1:2007
VISIBLE LASER RADIATION
AVOID DIRECT EYE EXPOSURE
(MAX OUTPUT POWER) 5mW (PULSE DURATION) CW (WAVELENGTH) 650±15nm
CLASS 3R LASER PRODUCT


THIS PRODUCT COMPLIES WITH 21 CFR 1040.10
AND 1040.11 EXCEPT FOR DEVIATIONS PURSUANT
TO LASER NOTICE NO. 50, DATED JUNE 24, 2007

Standard Light Source and Power Meter Built-in

LS: MT9085A/B/C standard built-in stabilized Light Source, OPM: MT9085A/B/C standard built-in Optical Power Meter

Options	Optical Port	LS	OPM
MT9085A/B/C-053	1310/1550 nm SM	✓	✓
MT9085B-055	1310/1550 nm SM	✓	✓
	1650 nm SM	✓	✓
MT9085B-056	1310/1490/1550 nm SM	✓	✓
MT9085A/B/C-057	1310/1550/1625 nm SM	✓	✓
MT9085B-058	1310/1490/1550/1625 nm SM	✓	✓
MT9085A/B-063	850/1300 nm MM	✓	—
	1310/1550 nm SM	✓	✓

Battery Pack: Z0921A

Battery	Lithium Ion secondary battery
Voltage, Capacity	11.1 V, 4200 mAh
Dimensions and Mass	53 (W) × 19 (H) × 215 (D) mm, 330 g (typ.)
Environmental Conditions	Charging: +5°C to +30°C, ≤80% RH
	Discharging: –20°C to +60°C, ≤80% RH
	Storage: –20°C to +50°C, ≤80% RH

AC Adapter: Z1625A

Rated AC Input	100 VAC to 240 VAC, 50 Hz/60 Hz
Rated DC Output	12 V(dc), 5 A
Environmental Conditions	Operating: 0°C to +45°C, 20 to 80% RH
	Storage: –20°C to +70°C, 10 to 90% RH

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

1) Specify at least one main unit.

Model/Order No.	Name
	Main Unit
MT9085C	ACCESS Master High Performance Dynamic Range
MT9085B	ACCESS Master Enhanced Dynamic Range
MT9085A	ACCESS Master Standard Dynamic Range
	Standard Accessories
Z1991A[*1]	ACCESS Master Operation Manual CD: 1 pc
W3974AE	MT9085 Series Quick Guide: 1 pc
Z1625A[*2]	AC adapter: 1 pc
	Line cord: 1 pc
Z0921A	Battery Pack: 1 pc

2) Specify at least one module option (wavelength).

Model/Order No.	Name
	Module Option (OTDR)[*4]
	High Performance Model
MT9085C-053	SMF 1.31/1.55 µm OTDR
MT9085C-057	SMF 1.31/1.55/1.625 µm OTDR
	Enhanced Model
MT9085B-053	SMF 1.31/1.55 µm OTDR
MT9085B-055	SMF 1.31/1.55/1.65 µm OTDR
MT9085B-056	SMF 1.31/1.49/1.55 µm OTDR
MT9085B-057	SMF 1.31/1.55/1.625 µm OTDR
MT9085B-058	SMF 1.31/1.49/1.55/1.625 µm OTDR
MT9085B-063	MMF 0.85/1.3 µm & SMF 1.31/1.55 µm OTDR
	Standard Model
MT9085A-053	SMF 1.31/1.55 µm OTDR
MT9085A-057	SMF 1.31/1.55/1.625 µm OTDR
MT9085A-063	MMF 0.85/1.3 µm & SMF 1.31/1.55 µm OTDR

3) Specify at least one optical connector.

Model/Order No.[*5]	Name
	Option (Connector)
MT9085x-025[*3]	FC-APC Connector Key width 2.0 mm
MT9085x-026[*3]	SC-APC Connector
MT9085x-037[*4]	FC Connector
MT9085x-038[*4]	ST Connector
MT9085x-040[*4]	SC Connector

4) Choose from the following options.

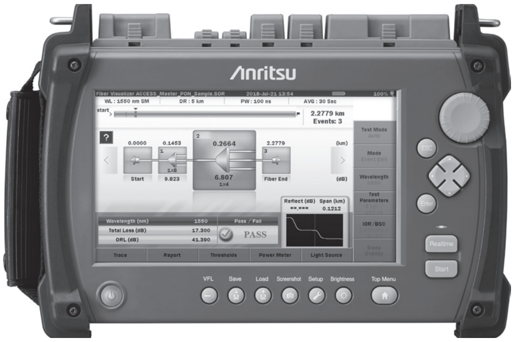
Model/Order No.[*5]	Name
	Option (Visual light Source)
MT9085x-002	Visual Fault Locator
	Option (Power Meter)[*6]
MT9085x-004	SMF Optical Power Meter
MT9085x-005	SMF High Power Optical Power Meter
MT9085x-007	SMF/MMF Optical Power Meter
	Option (Others)
MT9085x-010[*7]	Protector

*1: Stores operation manual and quick guide
*2: Power cord (J0979) supplied at separate purchase
*3: Can only connect APC-type optical fiber
*4: Cannot only connect APC-type optical fiber
*5: Specify A, B, or C at "x"
*6: Same optical connector or connector adapter supplied as type specified for optical pulse tester
*7: Front Protector B0584A cover supplied with belt as standard

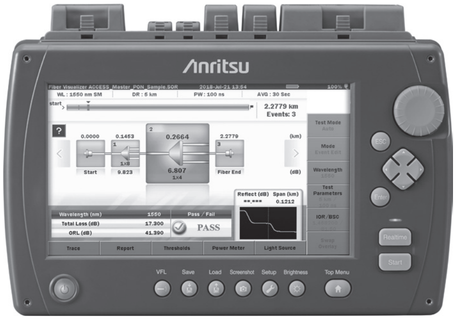
Example of Ordering Configuration

1)	MT9085B	ACCESS Master Enhanced Dynamic Range
2)	MT9085B-053	SMF 1.31/1.55µm OTDR
3)	MT9085B-040	SC Connector
4)	MT9085B-002	Visual Fault Locator
4)	MT9085B-007	SMF/MMF Optical Power Meter
4)	MT9085B-010	Protector

- Requires one each for items 1) to 3)
  When specifying Model B, select from B-type options for items 2) to 4).
- 3) When specifying SC connector at 3), SC connector will be used at power meter in item 4).



With Protector (Option)
(The Protector Cover B0584A is supplied with a carrying strap as standard.)



Without Protector

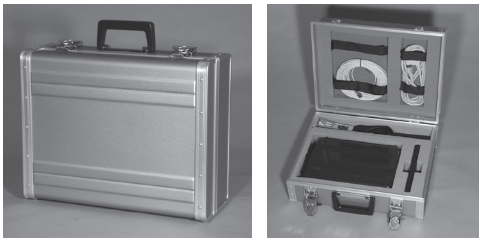
5) Choose from the following when specifying application parts, peripherals, consumables, etc.*

Model/Order No.	Name	Description
	Application Parts	
W3971AE	MT9085 Series Operation Manual	Printed. Electronic version included on accessory CD Z1991A.
W3972AE	MT9085 Series SCPI Remote Control Operation Manual	Printed. Electronic version included on accessory CD Z1991A.
B0745A	Softcase	
B0582A	Soft carrying case	With shoulder strap. Can also accommodate main unit with fitted Option 010 Protector
B0583A	Hard transit case	Dimensions 420 (W) × 330 (H) × 148(D) mm
B0549	HARD CARRYING CASE	
B0584A	Front cover	Option 010 Protector cover only
Z0921A	Battery Pack	Li-ion Secondary battery, 11.1 V(dc), 4200 mAh
Z1632A	Battery Charger	Li-ion battery charger
J1295	CAR PLUG CORD	
J0617B	Replaceable optical connector (FC-PC)	For OTDR port, For option power meter port (MT9085A/B/C)
J0618D	Replaceable optical connector (ST)	For OTDR port, For option power meter port (MT9085A/B/C)
J0618F	Replaceable optical connector (HMS-10/A)	For OTDR port, For option power meter port (MT9085A/B/C)
J0619B	Replaceable optical connector (SC-PC)	For OTDR port, For option power meter port (MT9085A/B/C)
J0739A	Replaceable optical connector (FC-APC)	For OTDR port (MT9085A/B/C)
J1697A	Replaceable optical connector (SC-APC)	For OTDR port (MT9085A/B/C)
J0057	OPTICAL ADAPTER FC TYPE	FC-FC connector (JJ adapter)
J1335A	MU/LC connector adapter	Ferrule connection adapter 1.25 mm → 2.5 mm for visual light source (Option 002 only)
MA9005B-37	FOR FC CONNECTOR	For option power meter port (MT9085A/B/C-005)
MA9005B-38	FOR ST CONNECTOR	For option power meter port (MT9085A/B/C-005)
MA9005B-40	FOR SC CONNECTOR	For option power meter port (MT9085A/B/C-005)
LP-FC	FC-PC POWER METER ADAPTER	For option power meter port (MT9085A/B/C-007)
LP-ST	ST-PC POWER METER ADAPTER	For option power meter port (MT9085A/B/C-007)
LP-SC	SC-PC POWER METER ADAPTER	For option power meter port (MT9085A/B/C-007)
J1530A	SC PLUG IN CONVERTER (UPC(P)-APC(J))	Converts main unit SC/UPC connector to SC/APC
J1531A	SC PLUG IN CONVERTER (APC(P)-UPC(J))	Converts main unit SC/APC connector to SC/UPC
J1532A	FC PLUG IN CONVERTER (UPC(P)-APC(J))	Converts main unit FC/UPC connector to FC/APC
J1533A	FC PLUG IN CONVERTER (APC(P)-UPC(J))	Converts main unit FC/APC connector to FC/UPC
J1534A	LC-SC Plug-in Converter (for SM, SC(P)-LC(J))	Converts main unit SC connector to LC (SMF only)
J1535A	LC-SC Plug-in Converter (for MM, SC(P)-LC(J))	Converts main unit SC connector to LC (MMF 62.5/125 µm only)
Z0914A	Ferrule cleaner	1 pc
Z0915A	Replacement reel for ferrule cleaner	6 pcs for Z0914A
Z0284	Adapter Cleaner	Stick type (200 pcs/set)
G0306C	Video Inspection Probe	× 400 magnification fixed. Displays fiber end-face condition on ACCESS Master screen and performs Pass/Fail evaluation Also supports end-face evaluation on PC running MX900030A software downloaded from Anritsu web site.
J1480A	USB-Ethernet converter	For remote GUI connection
	PC Software	
NETWORKS	NETWORKS	Microsoft Windows 10 (32 bit, 64 bit), Windows 8/8.1 (32 bit, 64 bit), Windows 7 (32 bit), Windows XP SP3 (currently Ver. 5.00 at November 2022)

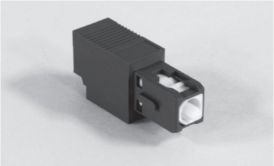
*: Optional Accessories cannot be repaired.


Softcase (B0745A)

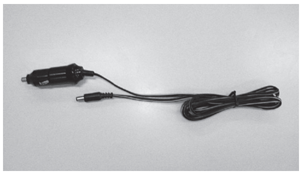
Soft Carrying Case (B0582A)


Hard Carrying Case (B0583A)-Attache style


Hard Carrying Case
(B0549)


J1530A to J1535A
Plug-in Converter
(The photo shows the J1534A)


Battery Pack (Z0921A)


CAR PLUG CORD (J1295)

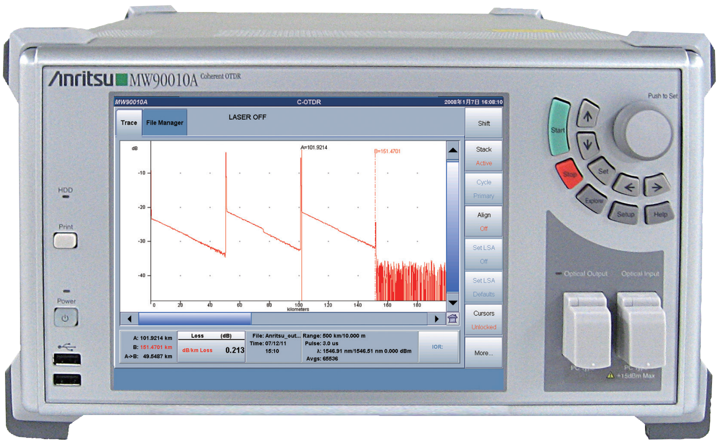
Video Inspection Probe (× 400)
(G0306C)

Coherent OTDR

MW90010A

Remote Control
Ethernet

Measure Submarine Cables up to 12,000 km Long with 10 m Resolution



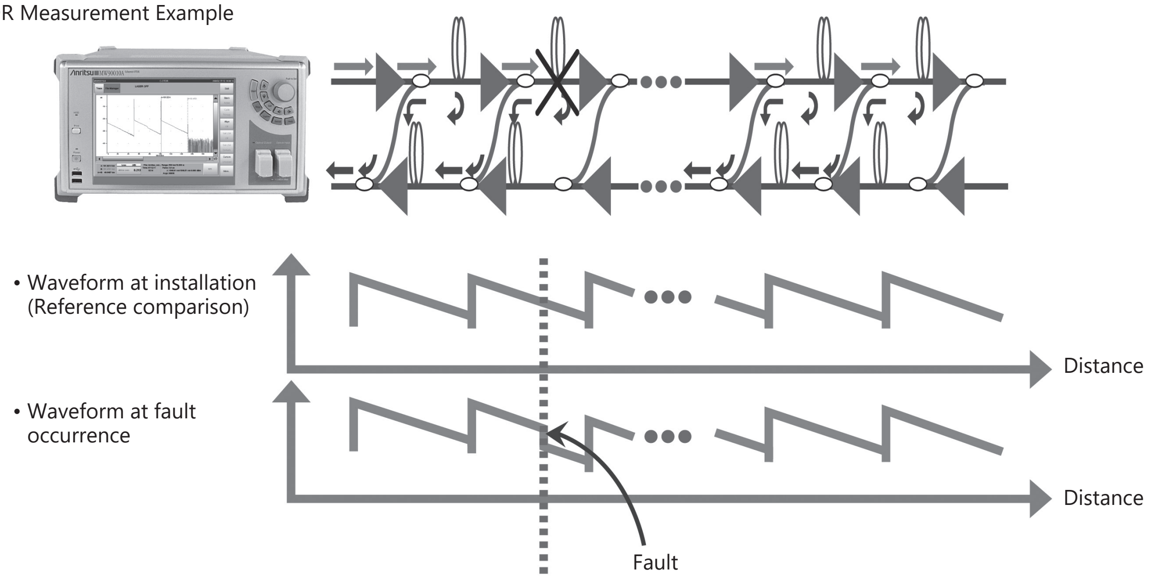
The Coherent OTDR (C-OTDR) MW90010A is a measuring instrument for detecting faults in ultra-long optical submarine cables of up to 12,000 km including multiple repeaters (EDFAs). It is the ideal solution for evaluating new cables at service deployment as well as for troubleshooting in-service faults.
Ultra-long optical submarine cables use optical amplifiers to boost signals. Successful OTDR measurement through the repeaters requires configuring a backscatter detection system using up and down links. The MW90010A can measure the backscatter light through all repeaters by using coherent detection. As a result, it can display every fault condition, such as optical loss between repeaters, bending loss, distances, breaks, etc., on-screen for waveform data analysis.

Features

- Fault detection with 10 m distance resolution
- Compact and lightweight all-in-one design for on-site portability [320 (W) × 177 (H) × 451 (D) mm, 17 kg Max.]
- Simple and easy touch-panel operation for easy first-time use by any operator
- Wide dynamic range supporting fault detection and troubleshooting of submarine cables with repeaters at 80 km or wider intervals
- Built-in tunable light source with high wavelength accuracy of ±0.2 nm for wavelength setting range of 1535.03 nm to 1565.08 nm
- Adjustable output power from 0 to +13 dBm

Application

C-OTDR Measurement Example



Measure Submarine Cables up to 12,000 km Long with 10 m Resolution

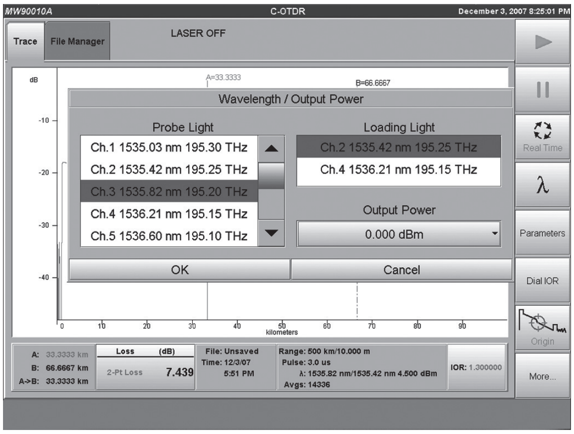
The MW90010A can capture data from up to 1.2 million points on the horizontal axis at a fixed resolution of 10 m with no dependency on measured distance. As a result, faults can be located with very high resolution even in fibers longer than 10,000 km.

Lightweight and Compact

In comparison to previous optical submarine cable measuring equipment, the MW90010A is less than half the weight (17 kg max.) and size.
The all-in-one design incorporates a tunable light source for easy on-site portability and troubleshooting.

Excellent GUI

Every stage from setting parameters to starting measurement is made easy using the touch-screen. The rotary knob and keypad can be used for operation too. The easy-to-use design coupled with standard interfaces for USB memory, USB mouse, keyboard, and VGA OUT, makes measurement simple even for novice OTDR operators.



MW90010A C-OTDR December 3, 2007 8:25:01 PM

LASER OFF

Wavelength / Output Power

Probe Light:
Ch.1 1535.03 nm 195.30 THz
Ch.2 1535.42 nm 195.25 THz
Ch.3 1535.82 nm 195.20 THz
Ch.4 1536.21 nm 195.15 THz
Ch.5 1536.60 nm 195.10 THz

Loading Light:
Ch.2 1535.42 nm 195.25 THz
Ch.4 1536.21 nm 195.15 THz

Output Power: 0.000 dBm

A: 33.3333 km
B: 66.6667 km
A->B: 33.3333 km
Loss (dB) 2-Pt Loss 7.439
File: Unsaved
Time: 12/3/07 5:51 PM
Range: 500 km/10.000 m
Pulse: 3.0 us
λ: 1535.82 nm/1535.42 nm 4.500 dBm
Avgs: 14336
IOR: 1.300000

Remote Operation Function

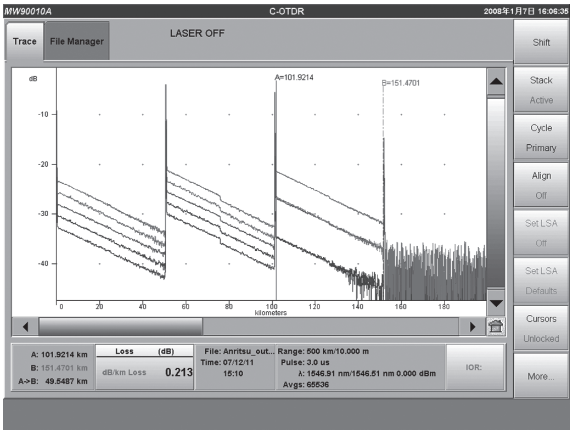
The MW90010A has a built-in VNC server. When the MW90010A (server) is connected over Ethernet to a PC (client) running either a Windows or Linux OS, the MW90010A GUI can be remotely controlled from the PC to transfer files between the server and client.

Wide Dynamic Range

Typical optical submarine cables are designed with repeaters every 50 km to 60 km but the high resolution of the MW90010A easily supports fiber loss measurement of these systems as well as fault location of cables with repeaters spaced at more than 80 km.

Simultaneous Display of 8 Waveforms (max.)

Installation and maintenance of optical submarine cables requires comparison of current waveform data with data at cable installation to monitor aging changes. The MW90010A makes this comparison easy because it can display up to 8 waveforms simultaneously, allowing faults to be seen at glance by comparing the install waveform with the fault waveform on one screen.



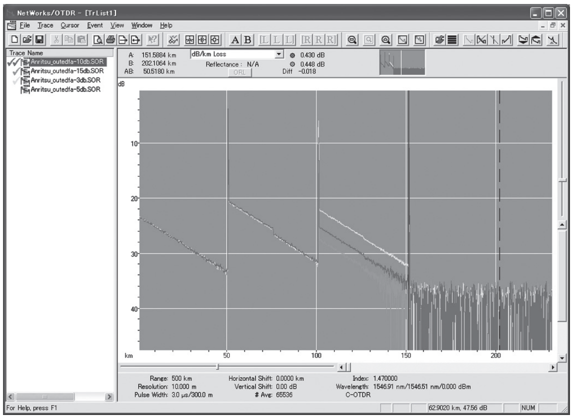
MW90010A C-OTDR 2008年1月7日 16:06:35

LASER OFF

A: 101.9214 km
B: 151.4701 km
A->B: 49.5487 km
Loss (dB) dB/km Loss 0.213
File: Anritsu_out...
Time: 07/12/11 15:10
Range: 500 km/10.000 m
Pulse: 3.0 us
λ: 1546.91 nm/1546.51 nm 0.000 dBm
Avgs: 65536
IOR:

Waveform Analysis using Emulation Software

Waveform data measured and saved by the MW90010A can be analyzed on a PC running a Windows OS using the optional NETWORKS (version 4.1 or newer) emulation software (sold separately).



NetWorks/OTDR - [TrList1]

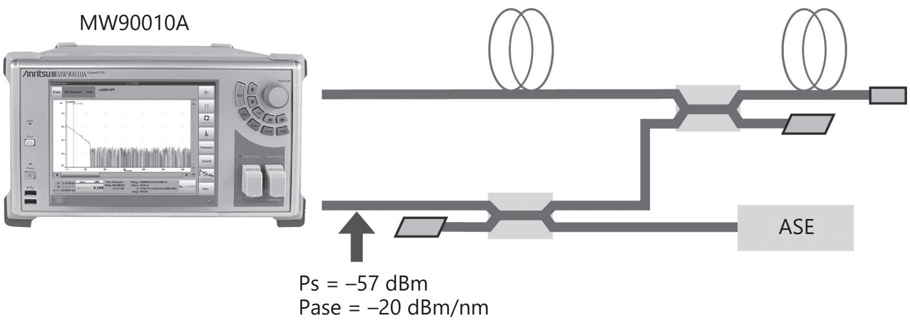
Trace Name
Anritsu_outedfa-10db.SOR
Anritsu_outedfa-15db.SOR
Anritsu_outedfa-3db.SOR
Anritsu_outedfa-5db.SOR

A: 151.5884 km
B: 202.1064 km
AB: 50.5180 km
dB/km Loss
Reflectance : N/A
0.430 dB
0.448 dB
Diff -0.018

Range: 500 km
Resolution: 10.000 m
Pulse Width: 3.0 µs/300.0 m
Horizontal Shift: 0.0000 km
Vertical Shift: 0.00 dB
Avg: 65536
Index: 1.470000
Wavelength: 1546.91 nm/1546.51 nm/0.000 dBm
C-OTDR

For Help, press F1
62.9020 km, 47.56 dB
NUM

Measurement setup for Dynamic Range



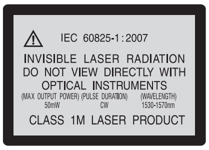
Specifications

Coherent OTDR MW90010A

Fiber Under Test		ITU-T G.653 (DSF)
Optical Connector		FC, SC, DIN, HSM-10/A, ST (Replaceable, PC type)
Wavelength (Probe Light)		1535.03 nm to 1565.08 nm (ITU-T Grid, Wavelength in vacuum setting with 50 GHz steps)
Wavelength Accuracy		±0.2 nm (+20°C to +30°C)
Warm-up Time		30 minutes (+20°C to +30°C)
Loading Light Source (Dummy)		" wavelength of probe light " +50 GHz or –50 GHz The loading wavelength can be selectable at +50 GHz or –50 GHz of the probe (OTDR) wavelength.
Pulse Width		3, 10, 30, 60, 100 μs
Optical Output Power		0 to +13 dBm, 0.5 dB steps
Dynamic Range (one way, S/N=1) (See the block diagram on previous page)		>17 dB Measurement Conditions: Pulse width: 10 μs, Average times: 2^{16}, Distance range: 1000 km, Smoothing: On, Ps: –57 dBm @ Pin[*1] Pase: –20 dBm/nm @ Pin[*1]
Dead Zone		0.5 km (Pulse width: 3 μs)
Distance Measurement Accuracy		±10 m ±0.5 × 10^{-6} × measurement value (m) This does not include optical fiber refraction index (IOR) based uncertainty.
Vertical Scale		0.02, 0.05, 0.1, 0.2, 0.5, 1.0, 2.0, 5.0, 10.0 dB/div
Distance Range		100 km, 500 km to 12,000 km (in 500 km steps)
Sampling Resolution (IOR = 1.500000)		10 m
Measurement Time		15 minutes (Distance range: 1000 km, Average times: 2^{16})
Average Times		2^8 to 2^{24}
Ior Settings		1.300000 to 1.700000 (0.000001 steps)
Monitor Output		–25 to –15 dBm (for OTDR Wavelength Monitor)
Other Functions		• Real Time Measurement • Multiple Trace Display (8 Waveforms max.) • Zoom & Shift • Loss Calculation Splice Loss, 2Pt Loss, 2Pt LSA, dB/ km Loss, dB/km LSA, 2Pt & dB/km, 2Pt & dB/km LSA • File Save formats GR-196, SR4731 • USB Memory support • Internal Memory (2.8 GB) • Print External printer, Hard copy (file: PDF) • Distance Unit miles, feet, kilofeet, meters, kilometers • File Utility File: Copy, Paste, Delete Folder: Create new • Help function • Remote Control Function (Option)
Display		8.4 inch, XGA (1024 × 768) color LCD with touch panel
Interface		USB (2 ports, REV1.1), Mouse (USB), Keyboard (PS/2), VGA
Power Supply		100 VAC to 120 VAC/200 VAC to 240 VAC, 50 Hz to 60 Hz, ≤300 VA
Dimensions and Mass		320 (W) × 177 (H) × 451 (D) mm, <17 kg
Environmental Conditions		Temperature: +10°C to +35°C (operating), –10°C to +50°C (storage) Humidity: <85% RH Vibration: Conforms to MIL-STD-810D
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000: 2018
Laser Safety Level[*2]		IEC 60825-1: 2007 CLASS 1M: Optical Output Port CLASS 1: Monitor Port 21CFR1040.10 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007

*1: Ps: Maximum backscatter level at the input [dBm]
Pase: ASE level at the input [dBm]

*2: Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10 and IEC 60825-1; the following descriptive labels are affixed to the product.



⚠ IEC 60825-1 : 2007
INVISIBLE LASER RADIATION
DO NOT VIEW DIRECTLY WITH
OPTICAL INSTRUMENTS

(MAX OUTPUT POWER)	(PULSE DURATION)	(WAVELENGTH)
50mW	CW	1530-1570nm

CLASS 1M LASER PRODUCT

IDENTIFICATION LABEL
ANRITSU CORP.
5-1-1,ONNA,ATSUGI-SHI
KANAGAWA 243-8555,JAPAN
MANUFACTURED AT:TOHOKU ANRITSU CO., LTD
KORIYAMA PLANT, .20

⚠ IEC 60825-1:2007
CLASS 1 LASER PRODUCT

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MW90010A	Coherent OTDR
	Standard Accessories
	Power Cord: 1 pc
W3030AE	MW90010A Operation Manual (CD-R): 1 copy
	Options
MW90010A-001	Remote Control Function
MW90010A-002*1	OS Upgrade to WES2009
MW90010A-101	Remote Control Function Retrofit
MW90010A-102*2	OS Upgrade to WES2009 Retrofit
	Options (Optical Connector)
MW90010A-037*3	FC Connector
MW90010A-038*3	ST Connector
MW90010A-039*3	DIN 47256 Connector
MW90010A-040*3	SC Connector
MW90010A-043*3	HMS-10/A Diamond Connector
	Application Parts
NETWORKS	Emulation Software (Version 4.1 or newer)
B0335C	Carrying Case
B0604A	Rack Mount Kit
J0617B	Replaceable Optical Connector (FC-PC)
J1409A	Replaceable Optical Connector (ST)
J1410A	Replaceable Optical Connector (DIN)
J1411A	Replaceable Optical Connector (SC)
J1412A	Replaceable Optical Connector (HMS-10/A)
J0057	Optical Adapter FC type
J0635*4	Optical Fiber Cord with FC-PC at both ends (SM, with FC-PC at both ends)
J0952A	FC · PC-FC · APC(SG)-1M-SM
Z0914A	Ferrule Cleaner
Z0915A	Replacement Reel for Ferrule Cleaner (6 pcs/set)
Z0284	Adapter Cleaner (Stick type, 200 pcs/set)
W3024AE	MW90010A Operation Manual (Printed version)
Z0397A*5	FC Adapter Cap
Z0412A*5	DIN Adapter Cap
Z0413A*5	SC Adapter Cap
Z0414A*5	HMS-10 Adapter Cap

*1: Please be sure to specify.
*2: Factory (in Japan) option.
*3: Required option
Specify the optical connector type. The same type of connector will be supplied for the optical output port, optical input port, and optical monitor port.
*4: Specify the optical fiber length as A, B or C (A: 1 m, B: 2 m, C: 3 m)
*5: Monitor Output Port optical connector cap. Specify exchangeable optical connectors (J1409A, J1410A, J1411A, J1412A and J0617B) as a pair.

Optical Loss Tester/Light Source/Optical Power Meter

CMA5 Series

Optical Loss Tester/Light Source 850, 1300, 1310, 1550 nm/Optical Power Meter 850, 1300, 1310, 1490, 1550, 1625 nm

Compact and Lightweight for Optical Fiber Installation and Maintenance

The CMA5 series (Optical Loss Tester/Light Source/Optical Power Meter) measures optical loss and power for optical fiber I&M.
The CMA5 series are compact and lightweight, its excellent cost performance and simple operation with the required minimum number of functions make it ideal for onsite I&M. Service engineers can choose from three models — optical loss tester, optical source, and optical power meter — to match the onsite application.

Features

Optical Loss Tester

- All-in-one light source and optical power meter supporting SM (1310 nm/1550 nm) and MM (850 nm/1300 nm) fiber
- Compact and lightweight (300 g)
- Measures +23 dBm max. optical power[*1]
- 20 hours of battery (dry cell) operation[*2]
- Useful fiber identification modulation function (270 Hz, 1 kHz, 2 kHz and CW)

*1: SM type (CATV model) only
*2: With 9-V alkaline batteries using optical source and optical power meter

Light Source

- Supports MM model (850 nm/1300 nm), SM model (1310 nm/1550 nm)
- Lightweight at only 250 g
- 16 hours of continuous running with 9 V alkaline battery
- Light source for fiber identification (270 Hz, 1 kHz, 2 kHz and CW)

Optical Power Meter

- Lightweight at only 250 g
- 40 hours of continuous running with 9 V alkaline battery
- Measures up to +23 dBm optical power[*3]

*3: CATV model

Specifications

Optical Loss Tester

Optical Loss Tester*	
SM Model	1310 nm/1550 nm (Power Meter: Standard)
	1310 nm/1550 nm (Power Meter: CATV)
MM Model	850 nm/1300 nm

*: One 9 V alkaline battery as standard. No AC adapter.

Model/Order No.	5LT35	5LT35C	5LT83
Light Source Port			
Supported Optical Fiber	10 µm/125 µm SM fiber, PC-polished		62.5 µm/125 µm MM fiber, PC-polished
Emitter Type	LD		
Wavelength	1310 nm/1550 nm ±20 nm		850 nm/1300 nm ±20 nm
Output Power	≥–7 dBm		≥–7 dBm[*1]
Source Line Width (FWHNM)	≤5 nm		
Modulation Output	CW, 270 Hz, 1 kHz, 2 kHz (±2%)		
Stability	±0.05 dB/15 minutes		
	±0.10 dB/8 hours (1310 nm/1550 nm) ±0.15 dB/8 hours (850 nm/1300 nm)		
Connector Type	FC/PC, SC/PC, ST/PC (user replaceable)		
Optical Power Meter Port			
Supported Optical Fiber	SM (10 µm/125 µm) MM (50 µm/125 µm, 62.5 µm/125 µm)		
Detector Type	InGaAs		
Calibrated Wavelength	850, 1300, 1310, 1490, 1550, 1625 nm		
Measurement Range[*2]	–60 to +5 dBm –50 to +10 dBm (850 nm)	–40 to +23 dBm	–60 to +5 dBm –5 to +10 dBm (850 nm)
Accuracy[*2]	±0.2 dB @ –10 dBm (±0.5 dB @ 850 nm)		
Linearity[*2]	±0.2 dB		±0.5 dB
Display Resolution	0.01 dB		
Auto-Zero Setting	Supported		
Warm-up Time	60 s		
Connector Type	FC, SC, ST (user replaceable)		
General Specifications			
Input Power	9 V (9 V alkaline battery)		
AC Adapter (Option)	Input: 100 V to 240 V, 50 Hz to 60 Hz Output: 7.5 V		
Battery Operation	40 hours min. (Optical Power Meter) 20 hours min. (Optical Power Meter & Light Source)		
Auto Off Function	5 minutes		
Others	Reference setting function, Loop loss testing function		
Operating Temperature Range	–10°C to +50°C		
Storage Temperature Range	–25°C to +60°C		
Relative Humidity	0 to 95% (no condensation)		
Dimensions	75 (W) × 145 (H) × 25 (D) mm (excl. rubber cover)		

Continued on next page

Model/Order No.		5LT35	5LT35C	5LT83
Mass		300 g (0.66 lbs) or less (excl. rubber cover and 9 V alkaline battery)		
Warranty		3 years		
Laser Safety*3		IEC 60825-1: 2007 CLASS1, 21CFR 1040.10 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007		
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2		
	LVD	2014/35/EU, EN61010-1		
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018		
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2		
	LVD	S.I. 2016 No.1101, EN 61010-1		
	RoHS	S.I. 2012 No.3032, EN IEC 63000: 2018		

Specifications assured at 25°C (±3°C)

*1: If a 50 µm/125 µm MM fiber is connected to the optical output port, the rated output power (≥–7 dBm) can not be obtained due to differences in core diameter, NA, and fiber excitation condition. The optical output power can drop by about 2 to 10 dB from the rated output power.

*2: When GI fiber (62.5 µm/125 µm) is connected to optical power meter port.

*3: Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10 and IEC60825-1; the following descriptive labels are affixed to the product.

⚠ IEC 60825-1: 2007
CLASS 1 LASER PRODUCT

THIS PRODUCT COMPLIES WITH 21 CFR 1040. 10 AND 1040. 11 EXCEPT FOR DEVIATIONS PURSUANT TO LASER NOTICE NO. 50, DATED JUNE 24, 2007

Light Source

	Light Source*
SM Model	1310 nm/1550 nm
MM Model	850 nm/1300 nm

*: One 9 V alkaline battery as standard. No AC adapter.

Model/Order No.		5L83	5L35
Emitter Type		LD	
Wavelength		850/1300 ±20 nm	1310/1550 ±20 nm
Output Power*1		–7 dBm*2 (62.5 µm/ 125 µm MM fiber)	–7 dBm (SM fiber)
Source Line Width (FWHM)		<5 nm	
Modulation Output		CW, 270 Hz, 1 kHz, 2 kHz	
Stability (8 hours)		±0.1 dB (25°C)	
Connector Type		FC, ST, SC (User replaceable)	
Battery Operation Time		16 h (9 V alkaline battery)	
Input Power		9 V (9 V alkaline battery)	
AC Adapter (Option)		Input: 100 V to 240 V, 50 Hz to 60 Hz Output: 7.5 V	
Operating Temperature Range		–10°C to +50°C	
Storage Temperature Range		–25°C to +60°C	
Relative Humidity		0 to 95% (no condensation)	
Dimensions		75 (W) × 145 (H) × 25 (D) mm (excl. rubber cover)	
Mass		250 g	
Warranty		3 years	
Laser Safety*3		IEC 60825-1: 2007 CLASS 1 21CFR 1040.10 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007	
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2	
	LVD	2014/35/EU, EN61010-1	
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018	
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2	
	LVD	S.I. 2016 No.1101, EN 61010-1	
	RoHS	S.I. 2012 No.3032, EN IEC 63000: 2018	

*1: Typical (25°C)

*2: If a 50 µm/125 µm MM fiber is connected to the optical output port, the rated output power (≥–7 dBm) can not be obtained due to differences in core diameter, NA, and fiber excitation condition. The optical output power can drop by about 2 to 10 dB from the rated output power.

*3: Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10 and IEC 60825-1; the following descriptive labels are affixed to the product.

⚠ IEC 60825-1: 2007
CLASS 1 LASER PRODUCT

THIS PRODUCT COMPLIES WITH 21 CFR 1040. 10 AND 1040. 11 EXCEPT FOR DEVIATIONS PURSUANT TO LASER NOTICE NO. 50, DATED JUNE 24, 2007

Optical Power Meter

	Optical Power Meter* (Calibrated for 850, 1300, 1310, 1490, 1550, and 1625 nm)
Standard Model	–60 to +10 dBm
CATV Model	–50 to +23 dBm

*: One 9 V alkaline battery as standard. No AC adapter.

Model/Order No.		5P100	5P100C
Connector Type		FC, SC, ST (User replaceable)	
Fiber Type		MM, SM	
Detector Type		InGaAs	
Calibrated Wavelength		850/1300/1310/1490/1550/1625 nm	
Measurement Range		–60 to +10 dBm –50 to +10 dBm (850 nm)	–50 to +23 dBm
Accuracy*1		±0.2 dB, ±0.5 dB (850 nm)	
Linearity*2		±0.2 dB @ 1310/1550 nm (–60 to +5 dBm) ±0.5 dB @ 850 nm (–50 to +5 dBm)	±0.2 dB @ 1310/1550 nm (–40 to +23 dBm) ±0.5 dB @ 850 nm (–40 to +23 dBm)
Display Resolution		0.01 dB	
Modulation Detection		2 kHz modulation	
Display		4-digit, 7-segment display LCD	
Others		Reference setting function, battery level display, automatic power OFF	
Battery Operation Time		40 hours min. (9 V alkaline battery)	
Input Power		9 V (one alkaline battery)	
AC Adapter (Option)		Input: 100 V to 240 V, 50 Hz to 60 Hz Output: 7.5 V	
Operating Temperature Range		–10°C to +50°C	
Storage Temperature Range		–25°C to +60°C	
Relative Humidity		0 to 95% (no condensation)	
Dimensions		75 (W) × 145 (H) × 25 (D) mm (excl. rubber cover)	
Mass		250 g	
Warranty		3 years	
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2	
	LVD	2014/35/EU, EN61010-1	
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018	
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2	
	LVD	S.I. 2016 No.1101, EN 61010-1	
	RoHS	S.I. 2012 No.3032, EN IEC 63000: 2018	

*1: –10 dBm, 25°C (typ.)

*2: 25°C

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Optical Loss Tester

Model/Order No.	Description
	Main Frame
5LT35-YY*	Optical Loss Tester 1310 nm/1550 nm (Standard Power Meter)
5LT35C-YY*	Optical Loss Tester 1310 nm/1550 nm (CATV Power Meter)
5LT83-YY*	Optical Loss Tester 850 nm/1300 nm (Standard Power Meter)
	Standard Accessories
	CMA5 Optical Loss Tester Operation Manual: 1 pc
	Rubber Protective Cover: 1 pc
	9 V Alkaline Battery: 1 pc
	Accessories
GN-3HH-CASE	Hard Case (for two CMA5 series)
CMA5-POUCH-A	Carrying Pouch/Shoulder Strap
CMA5-BAT	9 V Alkaline Battery
Z1525A	AC Adapter (CMA5)
CMA5-AD-LS-FC	FC Connector Adapter (Light Source Port)
CMA5-AD-LS-SC	SC Connector Adapter (Light Source Port)
CMA5-AD-LS-ST	ST Connector Adapter (Light Source Port)
CMA5-AD-LS-ALL3	Connector Adapter (FC, SC and ST)
CMA5-AD-PM-FC	FC Connector Adapter (Power Meter Port)
CMA5-AD-PM-SC	SC Connector Adapter (Power Meter Port)
CMA5-AD-PM-ST	ST Connector Adapter (Power Meter Port)
CMA5-AD-PM-ALL3	Connector Adapter (FC, SC and ST)
J1530A	SC Plug-in Converter (UPC(P)-APC(J))
J1532A	FC Plug-in Converter (UPC(P)-APC(J))
J1534A	LC-SC Plug-in Converter (for SM, SC(P)-LC(J))
J1535A	LC-SC Plug-in Converter (for MM, SC(P)-LC(J)) *62.5 µm/125 µm type

*: Specify one connector adapter at YY (FU = FC/PC, SU = SC/PC, TU = ST/PC).

The specified connector adapter is fitted at each optical source and power meter connector.

Light Source

Model/Order No.	Description
	Main Frame
5L35-YY*	Light Source: 1310 nm/1550 nm (Dual wavelength for SM fiber)
5L83-YY*	Light Source: 850 nm/1300 nm (Four wavelength for MM fiber)
	Standard Accessories
	CMA5 Operation Manual: 1 pc
	Rubber Protective Cover: 1 pc
	9 V Alkaline Battery: 1 pc
	Accessories
GN-3HH-CASE	Hard Case (for two CMA5 series)
CMA5-POUCH-A	Carrying Pouch/Shoulder Strap
CMA5-BAT	9 V Alkaline Battery
Z1525A	AC Adapter (CMA5)
CMA5-AD-LS-FC	FC Connector Adapter
CMA5-AD-LS-SC	SC Connector Adapter
CMA5-AD-LS-ST	ST Connector Adapter
CMA5-AD-LS-ALL3	Connector Adapter (FC, SC and ST)

*: Specify one connector adapter for YY.
FU = FC/PC, SU = SC/PC, TU = ST/PC, FA = FC/APC, SA = SC/APC
(FA = FC/APC and SA = SC/APC cannot be selected for 5L83-YY.)

Optical Power Meter

Model/Order No.	Description
	Main Frame
5P100-YY*	Optical Power Meter (Standard): –60 to +10 dBm
5P100C-YY*	Optical Power Meter (CATV): –50 to +23 dBm
	Standard Accessories
	CMA5 Operation Manual: 1 pc
	Rubber Protective Cover: 1 pc
	9 V Alkaline Battery: 1 pc
	Accessories
GN-3HH-CASE	Hard Case (for two CMA5 series)
CMA5-POUCH-A	Carrying Pouch/Shoulder Strap
CMA5-BAT	9 V Alkaline Battery
Z1525A	AC Adapter (CMA5)
CMA5-AD-PM-FC	FC Connector Adapter
CMA5-AD-PM-SC	SC Connector Adapter
CMA5-AD-PM-ST	ST Connector Adapter
CMA5-AD-PM-ALL3	Connector Adapter (FC, SC and ST)

*: Specify one of FC, SC or ST connector adaptor for YY.

Optical Spectrum Analyzer

MS9740B

600 nm to 1750 nm

Remote Control
GPIB OPTION | Ethernet

Reduce the measurement processing times by up to half compared

Excellent Eco Product

Reduce the measurement processing times by up to half compared to the earlier model while assuring high performance and complete test menus brings higher-efficiency inspection of active optical devices.

Ideal All-in-One Design for Active Optical Device Evaluation

With all functions and performance needed for evaluating active optical devices, including optical transceivers, VCSL, DFB light sources, etc.

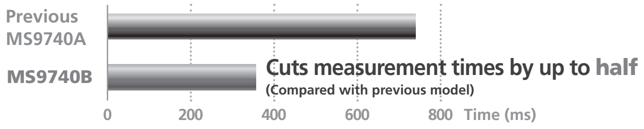
- Wavelength sweeping time <0.35 s[*1,*4]
- Maximum wavelength sweeping time <0.2 s[*2]
- All-in-one function (MM mode) supporting SM and MM fiber[*3]
- Supports LC connectors (using adapter)

[*1] Typical. value. Reduce the sweep time by 50% compared to previous models. VBW: 1 kHz_Fast, Resolution: 0.1 nm, Sweep Width: 30 nm, Sampling point: 1,001

[*2] VBW: 10 kHz, Resolution: 0.1 nm, Sweep Width: 5 nm, Sampling point: 501

[*3] The MS9740B-009 Multimode Fiber Interface option is designed for multimode connections to the optical input section; it supports measurements with high optical sensitivity and high sweep speeds when using a MM fiber with a core diameter of 62.5 μm and a NA of ≤0.275. Although the MS9740B-009 option can also be used to measure SM fiber, some features are different from the standard MS9740B model. For details refer to the MS9740B and MS9740B-009 specifications.

[*4] GPIB Interface, SMSR Measurement Time (DFB Light Source), VBW: 1 kHz_Fast (MS9740B)/1 kHz (MS9740A) Setting, 0.1-nm Resolution, 30-nm Sweep Width, 1001 Sample Points



High Resolution and Wide Dynamic Range

Supports signal evaluation requiring wide dynamic range and high resolution, such as OSNR analysis of WDM signals.

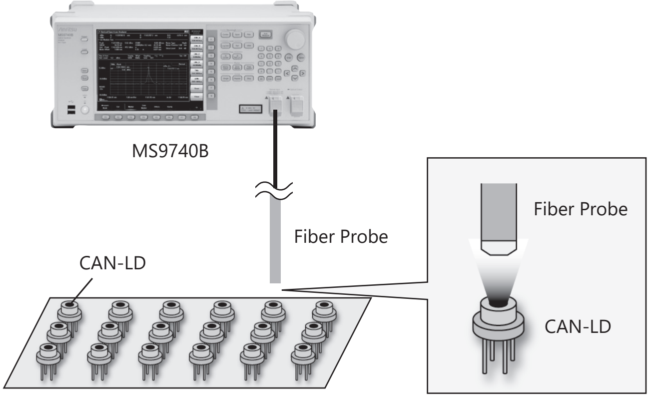
- Dynamic range >58 dB (at ±0.4 nm from peak wavelength)
- –90 dBm lowest optical sensitivity
- 30 pm minimum resolution
- ±20 pm wavelength accuracy (C/L band, at wavelength calibration using wavelength calibration light source)
- Supports signal level integration function supporting modulation signals
- Accurate noise position estimation using noise fitting function
- Supports optical axis alignment, wavelength calibration, effective resolution calibration functions

Supports Nine Application Modes

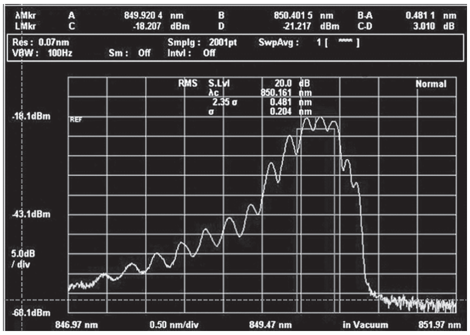
Efficient fast measurement is assured by complete menus containing all test items required by various applications plus all-at-once analyses with best items.

Application Name	Test Items
DFB-LD	Spectrum analysis of single longitudinal mode laser
FP-LD	Spectrum analysis of multiple longitudinal mode laser
LED	Spectrum analysis of wideband light source
PMD	PMD characteristics evaluation of optical fiber
Opt. Amp Opt. Amp (Multi-channel)	Evaluation of fiber amp (EDFA) gain and NF characteristics
WDM	Spectrum evaluation of WDM for up to 300 wavelengths (channels)
LD Module	Evaluation of optical transceiver characteristics
WDM Filter	Analysis of optical bandpass filter

Optical Chip/CAN Device Evaluation



Example of Device Characteristics Evaluation



850 nm VCSEL Spectrum Measurement Example

With a built-in Fast mode, the MS9740B supports both a wide dynamic range and high-speed measurement at Rx optical bandwidths (200 Hz and 1 kHz) used most commonly by optical-device production lines. At the same Rx optical bandwidth setting, it retains the same measurement sensitivity as its MS9740A predecessor while cutting measurement times by 50% for better production efficiency.

Specifications

Common

Power Supply		100 VAC to 120 VAC/200 VAC to 240 VAC, 50 Hz to 60 Hz, ≤75 VA
Dimensions and Mass		426 (W) × 177 (H) × 350 (D) mm (excluding projections), ≤15.0 kg (without options)
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000: 2018

Optical Spectrum Analyzer MS9740B

Supported Optical Fiber	SM fiber (ITU-T G.652), 50 µm/125 µm GI fiber*1, PC Connector (reflection attenuation 40 dB or more)
Wavelength Measurement Range	600 nm to 1750 nm
Wavelength Accuracy*2	±20 pm (1520 nm to 1620 nm, Resolution: 0.03 nm to 0.2 nm)*3, ±100 pm (1520 nm to 1620 nm, Resolution: 0.5 nm, 1.0 nm)*3
	±300 pm (600 nm to 1520 nm)*4, ±200 pm (1520 nm to 1570 nm)*4, ±300 pm (1570 nm to 1750 nm)*4
Setting Resolution	0.03, 0.05, 0.07, 0.1, 0.2, 0.5, 1.0 nm (RBW: 3 dB optical filter: transmission bandwidth)
Dynamic Range*2	High dynamic range: 70 dB (±1 nm from peak wavelength), 60 dB (±0.4 nm from peak wavelength), 42 dB (±0.2 nm from peak wavelength) Normal dynamic range: 62 dB (±1 nm from peak wavelength), 58 dB (±0.4 nm from peak wavelength), 42 dB (±0.2 nm from peak wavelength) [Wavelength: 1550 nm, Resolution: 0.05 nm, Optical Att: Off, 20°C to 30°C]
Sweep*2	Sweep width: 0.2 nm to 1200 nm, 0 nm
	Sweep time: ≤0.2 s (span: 5 nm, Resolution: 0.1 nm), ≤0.3 s (span: 500 nm) [VBW: 10 kHz, Normal dynamic range, center 1550 nm (span: 5 nm), 1200 nm (span: 500 nm), sweep start to stop, no optical input, sampling point: ≤501] Sweep time: 0.35 s/30 nm (typ.) [VBW: 1 kHz-Fast, dynamic range, center 1550 nm, Resolution: 0.1 nm, sweep start to stop, optical input –10 dBm, sampling point: 1001] Sweep time: 1.65 s/30 nm (typ.) [VBW: 200 Hz-Fast, dynamic range, center 1550 nm, Resolution: 0.1 nm, sweep start to stop, optical input –10 dBm, sampling point: 1001]

*1: The connection loss when connecting 50 µm/125 µm multimode optical fiber degrades the minimum light reception sensitivity.
The MS9740B has an MM mode function to correct correction loss when connecting 50 µm/125 µm multimode optical fiber and to display the level.
The optical loss level is corrected when the MM mode is On. It corrects the level by 14 dB (sum).
Level display errors occur if light is input under other excitation conditions.

*2: Warm-up the instrument for at least 2 hours before measurement by performing repeated sweeping at span ≥100 nm, VBW ≥10 kHz. Perform waveform calibration after auto-optical alignment (Wl Cal) and keep the instrument at the same temperature unless stated otherwise. Use either SM fiber (ITU-T G.652) or GI fiber (50 µm/125 µm) with a return loss of >40 dB, or GI fiber (62.5 µm/125 µm) with a return loss of >38 dB.

*3: Built-in MS9740B-002, after Wl cal (ref) wavelength calibration execution, at stable room temperature

*4: After Wl cal (Ext) wavelength calibration execution by external light source, such as Single Longitudinal mode laser (DFB-LD)

Multimode Fiber Interface (50/62.5 µm) MS9740B-009

Supported Optical Fiber	SM fiber (ITU-T G.652), 50 µm/125 µm GI fiber[*1], 62.5 µm/125 µm GI fiber[*1], PC Connector SM (ITU-T G.652), GI (50 µm/125 µm): reflection attenuation 40 dB or more, GI (62.5 µm/125 µm): reflection attenuation 38 dB or more
Wavelength Measurement Range	600 nm to 1750 nm
Wavelength Accuracy[*2]	±50 pm (1530 nm to 1570 nm)[*3], ±100 pm (1530 nm to 1570 nm)[*4] ±300 pm (600 nm to 1750 nm)[*5]
Setting Resolution	0.07, 0.1, 0.2, 0.5, 1.0 nm (RBW: 3 dB optical filter: transmission bandwidth)
Dynamic Range[*2]	High dynamic range: 70 dB (±1 nm from peak wavelength, 20°C to 30°C), 60 dB (±0.5 nm from peak wavelength, 20°C to 30°C) 65 dB (±1 nm from peak wavelength, 5°C to 45°C), 55 dB (±0.5 nm from peak wavelength, 5°C to 45°C) Normal dynamic range: 62 dB (±1 nm from peak wavelength, 20°C to 30°C), 58 dB (±0.5 nm from peak wavelength, 20°C to 30°C) 57 dB (±1 nm from peak wavelength, 5°C to 45°C), 53 dB (±0.5 nm from peak wavelength, 5°C to 45°C) [Wavelength: 1550 nm, Resolution: 0.07 nm, using SM fiber, Optical Att: Off]
Sweep[*2]	Sweep width: 0.2 nm to 1200 nm, 0 nm Sweep time: ≤0.2 s (span: 5 nm, Resolution: 0.1 nm), ≤0.3 s (span: 500 nm) [VBW: 10 kHz, Normal dynamic range, center 1550 nm (span: 5 nm), 1200 nm (span: 500 nm), sweep start to stop, no optical input, sampling point: ≤501] Sweep time: 0.35 s/30 nm (typ.) [VBW: 1 kHz- Fast, dynamic range, center 1550 nm, Resolution: 0.1 nm, sweep start to stop, optical input –10 dBm, sampling point: 1001] Sweep time: 1.65 s/30 nm (typ.) [VBW: 200 Hz-Fast, dynamic range, center 1550 nm, Resolution: 0.1 nm, sweep start to stop, optical input –10 dBm, sampling point: 1001]

*1: The NA is 0.2 for 50 µm/125 µm GI fiber and 0.275 for 62.5 µm/125 µm GI fiber.

*2: Warm-up the instrument for at least 2 hours before measurement by performing repeated sweeping at span ≥100 nm, VBW ≥10 kHz. Perform waveform calibration after auto-optical alignment (WI Cal) and keep the instrument at the same temperature unless stated otherwise. Use either SM fiber (ITU-T G.652) or GI fiber (50 µm/125 µm) with a return loss of >40 dB, or GI fiber (62.5 µm/125 µm) with a return loss of >38 dB.

*3: Built-in MS9740B-002, after WI Cal (Ref), with SM fiber and resolution at 0.07 nm to 0.2 nm

*4: Built-in MS9740B-002, after WI Cal (Ref), with SM fiber and resolution at 0.5 nm/1.0 nm

*5: After WI cal (Ext) wavelength calibration execution by external light source, such as DFB-LD, using SM fiber or GI fiber (50 µm/125 µm or 62.5 µm/125 µm)

Please enquire for other details about standard values, such as electrical performance.

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

(1) Specify the mainframe

Model/Order No.	Name
	Main Frame
MS9740B	Optical Spectrum Analyzer
	Standard Accessories
Z2024A[*1]	MS9740B Operation Manual (CD): 1 pc Power Cord: 1 pc

(2) Specify one optical connector

Model/Order No.	Name
	Options (Optical Connector)[*2]
MS9740B-037	FC Connector
MS9740B-038	ST Connector
MS9740B-039	DIN 47256 Connector
MS9740B-040	SC Connector

(3) Select an option from the list

Model/Order No.	Name
	Options (Interface)
MS9740B-001	GPIB Interface
MS9740B-101	GPIB Interface Retrofit
	Options (Light Source for Wavelength Calibration)[*3, *4]
MS9740B-002	Light Source for Wavelength Calibration
MS9740B-102	Light Source for Wavelength Calibration Retrofit
	Option (Multimode Fiber Interface)[*5, *6]
MS9740B-009	Multimode Fiber Interface (50/62.5 µm)
	Options (Windows OS)
MS9740B-108[*7]	OS Upgrade to Win10 Retrofit

*1: CD contains Operation Manual for Main Frame and Remote Control.

*2: One free specified optical connector for optical input port.

*3: When MS9740B-002 selected, one more connector specified in (2) supplied free.

*4: Executing wavelength calibration with this option secures ±20 pm (1520 nm to 1620 nm, without MS9740B-009) accuracy.
The MS9740B supports wavelength calibration with the external light source, such as DFB-LD, but this option assures higher accuracy.
Refer to the specifications for details.

*5: Factory option and Retrofit not supported.

*6: Optical Spectrum Analyzer MS9740B standard not guaranteed. Refer to Multimode Fiber Interface Option MS9740B-009 Standard.

*7: This option upgrades the Windows Embedded Standard 7 to the Windows 10 Enterprise LTSC. It is performed by Anritsu factory or service center return.

Refer to the separate Catalog for details of functions and specifications.
Contact your Anritsu sales representative for details.

Video Inspection Probe Series

G0382A Autofocus Video Inspection Probe
G0306C Video Inspection Probe

Optical Connector End Face Inspection

Scratches and stains to optic fiber ferrule endfaces are often said to have a negative impact on transmission quality.
When the external optical fiberscope (G0382A USB Autofocus type, G0306C USB Standard type: sold separately) is connected, scratches and dirt on the optical connector endface can be confirmed visually.
The Video Inspection Probe can be connected to the Network Master Pro MT1040A/MT1000A, ACCESS Master MT9085 Series, µOTDR MU909014x/15x Anritsu products and PC.

Products Support

	G0382A	G0306C
Network Master Pro MT1040A	✓	✓
Network Master Pro MT1000A	✓	✓
ACCESS Master MT9085 Series	NA	✓
µOTDR MU909014x/15x	NA	✓
Autofocus VIP Software (For PC) MX900031A	✓	NA
Connector Master (For PC) MX900030A	NA	✓

Features

	G0382A	G0306C
	USB Autofocus type. Based on Auto Operation.	USB Standard type. Based on Manual Operation.
Automatic Focus Adjustment	✓	NA
Automatic Fiber Image Centering	✓	NA
Automatic Image Capture	✓	NA ✓ (MT1040A/MT1000A)*
Pass/Fail Analysis on Screen	✓	✓
Pass/Fail LED	✓	NA
LED Light	NA	✓

*: It is available to MT1040A/MT1000A VIP application only.

* G0382A and G0306C cannot be repaired.

Specifications

G0382A

Magnification	400 times
Resolution	640*480
Focus	Automatic
Power	2 W
Interface	USB 2.0
Dimensions	182 (W) × 25 (H) × 48 (D) mm
Mass	152 g
Operation Temperature	–10°C to +50°C
Storage Temperature	–40°C to +70°C
Vibration/Shock proof	MIL-T-28800E (Class3)
CE	EMC: 2014/30/EU, EN61326-1, EN61000-3-2 LVD: 2014/35/EU, EN61010-1 RoHS: 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC: S.I. 2016 No.1091, EN 61326-1, EN61000-3-2 LVD: S.I. 2016 No.1101, EN 61010-1 RoHS: S.I. 2012 No.3032, EN IEC 63000: 2018
RCM	Australia, New Zealand: AS/NZS 4417:2012

G0306C

Items	Parameter
Interface	USB 2.0 (Compatible USB 1.1)
Display Resolution	640*480
Resolution	<1 µm
Field of View	0.365*0.273 mm
Focus Mode	Manual
Operating Voltage	5 ±0.2 V
Operating Temperature	–10°C to +50°C
Storage Temperature	–40°C to +70°C
Dimensions	33 (W) × 44 (H) × 211 (D) mm
Mass	188 g
Cable Length	1.5 m
CE	EMC: 2014/30/EU, EN61326-1, EN61000-3-2 LVD: 2014/35/EU, EN61010-1 RoHS: 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC: S.I. 2016 No.1091, EN 61326-1, EN61000-3-2 LVD: S.I. 2016 No.1101, EN 61010-1 RoHS: S.I. 2012 No.3032, EN IEC 63000: 2018
RCM	Australia, New Zealand: AS/NZS 4417:2012

Ordering information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

G0382A

Model/Order No.	Name
	Main Frame
G0382A	Autofocus Video Inspection Probe
	Standard Accessories
H0383A	1.25PC-M (1.25 mm PC Universal)
H0382A	2.5PC-M (2.5 mm PC Universal)
H0387A	2.5APC-M (2.5 mm APC Universal)
H0385A	LC-PC-F (LC PC Bulk)
H0386A	FC-PC-F (FC PC Bulk)
H0384A	SC-PC-F (SC PC Bulk)
H0398A	SC-APC-F (SC APC Bulk)
	Quick Reference Guide
	Application Parts
H0388A	1.25APC-M (1.25 mm APC Universal)
H0395A	FC-APC-F (FC APC Bulk)
H0393A	LC-PC-F-L (LC PC Long Bulk)
H0394A	LC-APC-F-L (LC APC Long Bulk)
H0396A	ST-PC-F (ST PC Bulk)
H0397A	MU-PC-F (MU PC Bulk)
H0390A	E2000-PC-F (E2000 PC Bulk)
H0392A*	MPO-PC/APC-F (MPO PC/APC Bulk)

Operation Manual and Autofocus VIP Software (For PC) MX900031A can be downloaded from Anritsu public Web site.

*: It is not available to Autofocus and Pass/Fail functions operation.

G0306C

Model/Order No.	Name
	Main Frame
G0306C	Video Inspection Probe
	Standard Accessories
H0383A	1.25PC-M (1.25 mm PC Universal)
H0382A	2.5PC-M (2.5 mm PC Universal)
H0387A	2.5APC-M (2.5 mm APC Universal)
H0385A	LC-PC-F (LC PC Bulk)
H0386A	FC-PC-F (FC PC Bulk)
H0384A	SC-PC-F (SC PC Bulk)
H0398A	SC-APC-F (SC APC Bulk)
	Operation Manual (Printed)
	Application Parts
H0388A	1.25APC-M (1.25 mm APC Universal)
H0395A	FC-APC-F (FC APC Bulk)
H0393A	LC-PC-F-L (LC PC Long Bulk)
H0394A	LC-APC-F-L (LC APC Long Bulk)
H0396A	ST-PC-F (ST PC Bulk)
H0397A	MU-PC-F (MU PC Bulk)
H0390A	E2000-PC-F (E2000 PC Bulk)
H0391A	E2000-PC-M (E2000 PC Universal)
H0389A	E2000-APC-M (E2000 APC Universal)
H0403A	60-LC-PC-F (LC PC Universal)

Connector Master (For PC analysis) MX900030A can be downloaded from Anritsu public Web site.

Bare Fiber Adapter

FiberConnect

Coupling Unterminated Fiber or Optical Components to Test Equipment

The FiberConnect is the ultimate time saving solution for coupling unterminated fiber or optical components to test equipment.
By allowing the user to perform optical measurements without terminating, which requires additional equipment and procedures, test time can be significantly reduced over 50% compared to other methods.
The low loss and highly repeatable connection made using the FiberConnect is similar to that of connectorized fiber.

Optical Specifications

Fiber Type Single-mode	9 µm/125 µm
Multimode	62.5 µm/125 µm or 50 µm/125 µm
Pigtail Length	1 m
Insertion Loss	<0.6 dB (typ.)
Number of Insertions	2000 (min.)
Back Reflectance	<–50 dB

General Specifications

Temperature Range	Operating: –10°C to +50°C (14°F to 122°F) Storage: –40°C to +60°C (–40°F to 140°F)
Connector Types	FC, ST, SC, D4, E2000, LC, DIN
Weight (With Cable)	≤90 g (3.2 oz)
Unit Size (with suction cup)	35 (W) × 32 (H) × 35 (D) mm (1.375 × 1.25 × 1.375 inches)
Case Size	240 (W) × 80 (H) × 200 (D) mm (9.5 × 3.5 × 8 inches)

Ordering Information

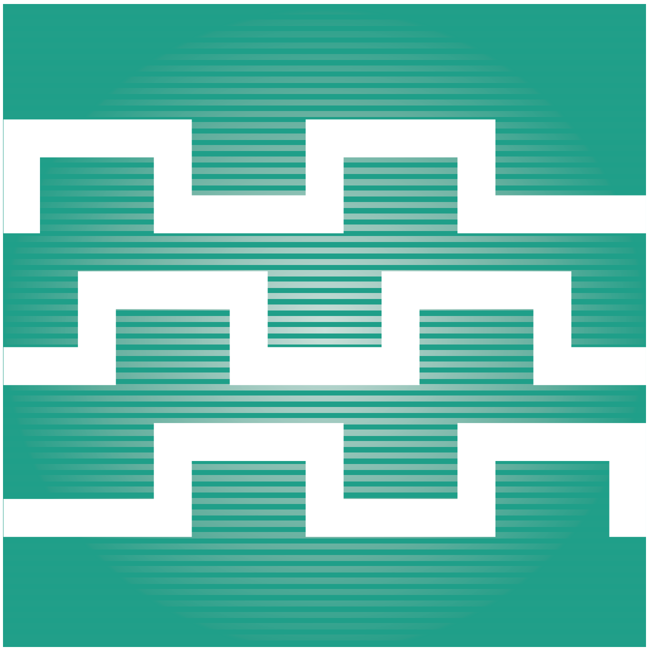
Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

FiberConnect-X-XXX
X = 1: Single-mode 9 µm/125 µm
X = 2: Multimode 62.5 µm/125 µm
X = 3: Multimode 50 µm/125 µm

XXX = Connector and polish
UFC = Ultra FC
USC = Ultra SC
UST = Ultra ST
AFC = Angled FC (single mode only)
ASC = Angled SC (single mode only)

Package Includes

- FiberConnect
- Maintenance kit
- Magnetic stand
- Manual
- Cleaning brush
- Carrying case
- Index matching oil
- Spare pigtail
- 90 days warranty



BIT ERROR RATE TESTERS (BERT)/ OSCILLOSCOPES

Selection Guide

Model Application	Signal Quality Analyzer-R MP1900A	BERTWave MP2110A
25 Gbit/s to 800 Gbit/s Optical Module Test	✓	✓
Active Optical Cable (AOC) Test	✓	✓
16G/32G/64G FC, InfiniBand FDR/EDR/HDR	✓	✓
28G/32G bit/s Interconnect Test	✓	✓
26G/53G/64G baud PAM4 Interconnect Test	✓	
PCI Express/USB/Thunderbolt/SAS/DP1.4 Receiver Test	✓	

Signal Quality Analyzer-R

MP1900A

Remote Control
GPIB | **LAN**

Support 400 GbE/800 GbE and PCIe Gen5/6

Due to the explosive growth of data traffic resulting from the popularity of smartphones and mobile terminals, network interfaces are transitioning to faster 400G/800 GbE standards, and PCI bus interface speeds exceed 10G. In addition, the equipment and chipsets using these interfaces support multi-channels and multi-protocols. The MP1900A is a high-performance BERT with excellent expandability for supporting Physical layer evaluations of these high-speed interfaces. The all-in-one design is ideal for early stage R&D evaluations of all interfaces covering next-generation Ethernet networks to bus interconnects.

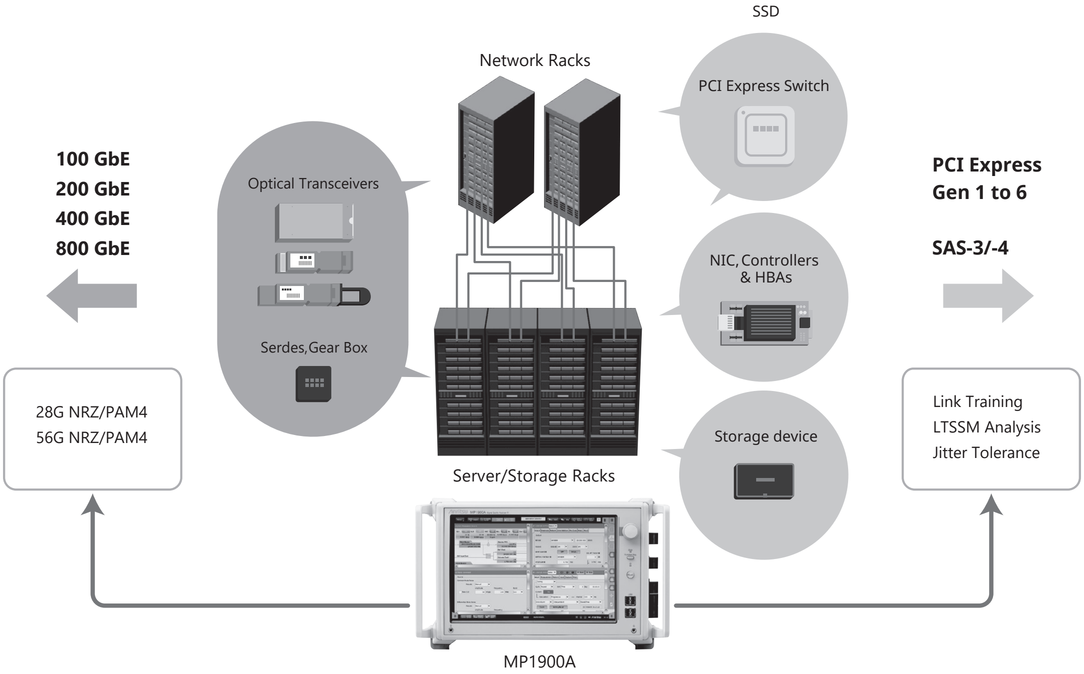
Wide Application Support

100 GbE/200 GbE/400 GbE/800 GbE, CEI-25G/28G/56G/112G, InfiniBand EDR/HDR, Fibre Channel
PCI Express Gen 1/2/3/4/5/6, Thunderbolt 1/2/3, USB3.2/4 Type C, SAS-3/-4, DP1.4
Optical module, SERDES, AOC, High-speed Interconnect

Excellent Expandability

All-in-One Support for Evaluating Next-Generation NRZ/PAM4 Network Interfaces and High-Speed Serial Buses

The Signal Quality Analyzer–R MP1900A is a modular Bit Error Rate Tester (BERT) supporting equipment external interfaces, such as next-generation Ethernet, by installing a pulse pattern generator (PPG) for outputting high-quality multi-channel NRZ/PAM4 signals over a wide bandwidth of 2.4 Gbaud to 64.2 Gbaud, a high-sensitivity input error detector (ED), Jitter modulation sources for Jitter Tolerance tests, etc.
Additionally, optional noise generation and 10Tap Emphasis functions can be installed for Voltage Noise Tolerance tests, etc., and installing the High-Speed Serial Data Test Software MX183000A software enables efficient design evaluation for increasingly faster PCIe, USB, Thunderbolt, SAS and DP receivers.



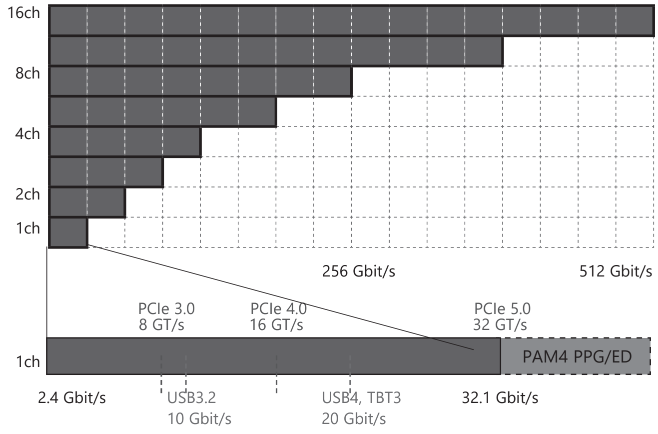
High Transmission Capacity and Excellent Expandability

Easy Multichannel Measurement Support

The MP1900A series is an 8-slot, modular, high-performance BERT.
Installing multiple 64G PAM4 PPG module boards in the slots provides the performance for measuring not only 400 GbE systems but also future 800 GbE systems as well. This flexible expandability helps customers maximize product development-cost efficiencies and bring products to market early.

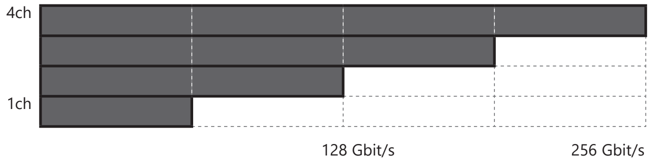
SI PPG/ED Module Expandability

- NRZ (Max. 32 Gbit/s at 1ch)

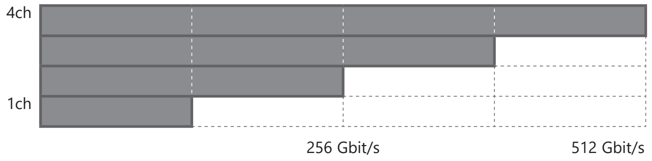


PAM4 PPG/ED Expandability*

- NRZ (Max. 64 Gbit/s at 1ch)



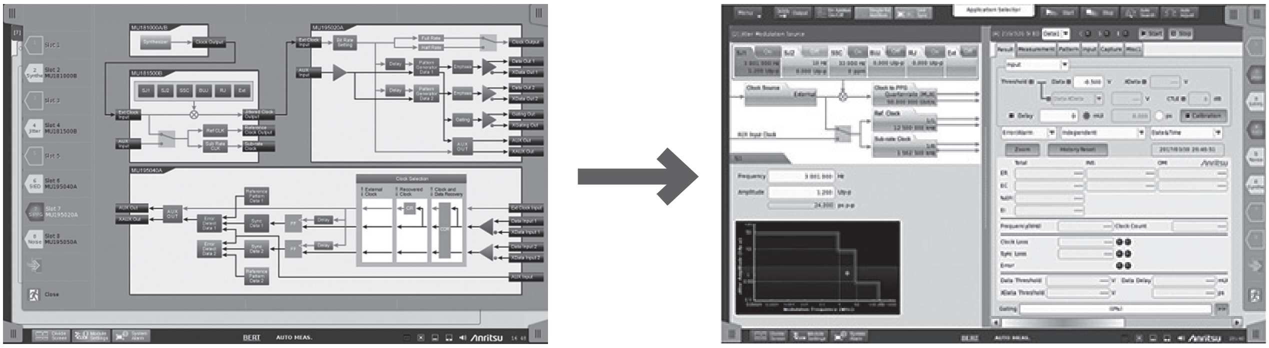
- PAM4 (Max. 64 Gbaud at 1ch)

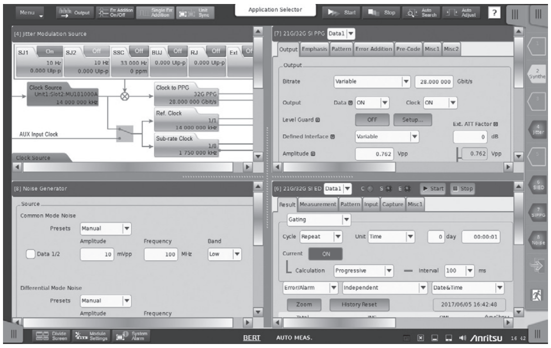


*: Refer to the 32G/64G NRZ/PAM4 Signal Integrity Test Solution Catalog (MP1900A_64G-E-A-1) for details of PAM4 PPG/ED.

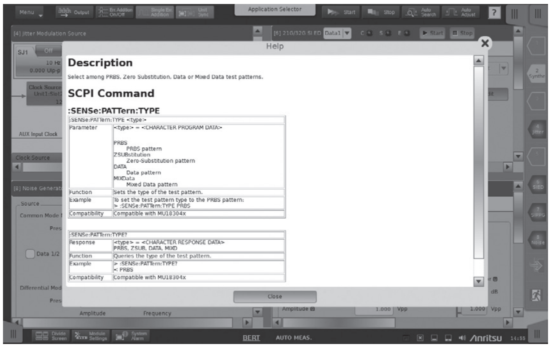
Improved Operability with New System View, User Interface, and Multi-windows

The MP1900A features easy intuitive operability based on a redesigned GUI and large 12.1-inch touch-panel LCD. Fast mistake-free settings help shorten measurement times.
The newly developed system view displays system functions as easy-to-understand blocks, supporting smooth settings and easy operation of each module.





Four split screens help improve the efficiency of multi-channel measurements.

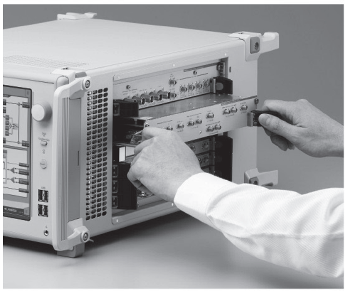


The Help function displays the remote commands corresponding to GUI operations, which simplifies automated system configurations.

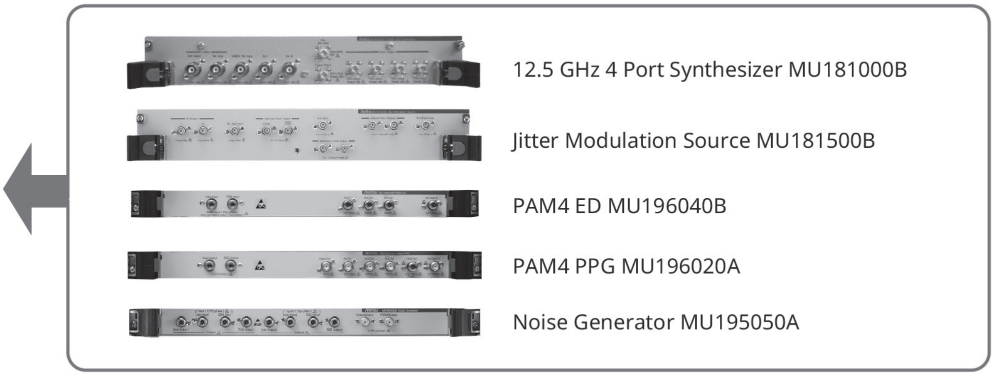
One Box PAM4 BER Test Solution

All-in-One Measurement Solution

8-slot main unit accommodates various modules, including PPG/ED, synthesizer, Jitter modulation source, and noise generator.
A compact, high cost-performance, next-generation, all-in-one measurement solution can be configured without other external instruments.



MP1900A

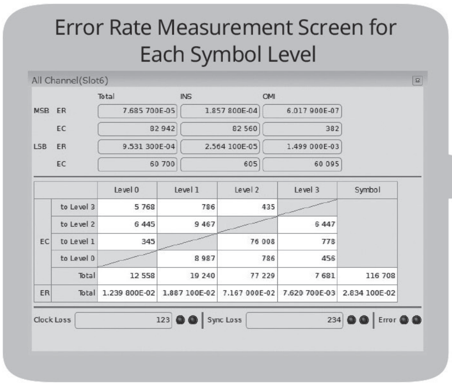


*: Refer to the MP1900A Selection Guide for details of supported multichannel configurations and module combinations.
Consult your sales representative for module configurations not described in the MP1900A Selection Guide.

64 Gbaud All-in-One NRZ/PAM4 BER Measurement

BER can be measured in real-time without using external equipment. In addition, permits error evaluation at each PAM4 symbol.

- World-first all-in-one solution without requiring external equipment
- Baud rates of 2.4 Gbaud to 58.2 Gbaud (PAM4)/64.2 Gbaud (NRZ)
- Module with built-in Clock Recovery (MU196040B-021, 022, 023), 2.4 Gbaud to 32.1 Gbaud, 51 Gbaud to 58.2 Gbaud
- PAM4 Symbol BER evaluation (MU196040B-041)
- Real-time FEC Symbol Error(MU196040B-042) and FEC Based Jitter Tolerance Measurements



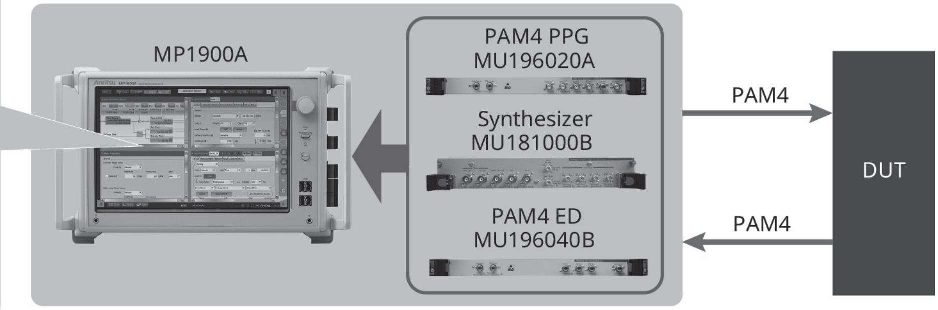
Error Rate Measurement Screen for Each Symbol Level

All Channel(Slot6)

		Total	INS	OMI
MSB	ER	7.685 700E-05	1.857 800E-04	6.017 900E-07
	EC	82 942	82 560	382
LSB	ER	9.531 300E-04	2.564 100E-05	1.499 000E-03
	EC	60 700	605	60 095

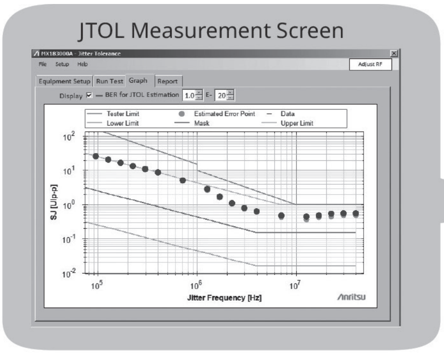
		Level 0	Level 1	Level 2	Level 3	Symbol
EC	to Level 3	5 768	786	435		
	to Level 2	6 445	9 467		6 447	
	to Level 1	345		76 008	778	
	to Level 0		8 987	786	456	
	Total	12 558	19 240	77 229	7 681	116 708
ER	Total	1.239 800E-02	1.887 100E-02	7.167 000E-02	7.620 700E-03	2.834 100E-02

Clock Loss 123 ● ● | Sync Loss 234 ● ● | Error ● ●



Jitter Tolerance Measurement using DUT BER Counter (MX183000A-PL031)

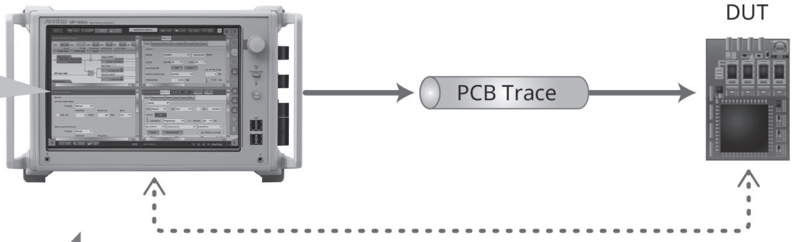
When the DUT has a bit error counter, combination with the MP1900A PPG makes it easy to configure a highly cost-effective Jitter Tolerance measurement environment.



JTOL Measurement Screen

MX183000A - Jitter Tolerance

Display ☑ — BER for JTOL Estimation 1.0 E- 20

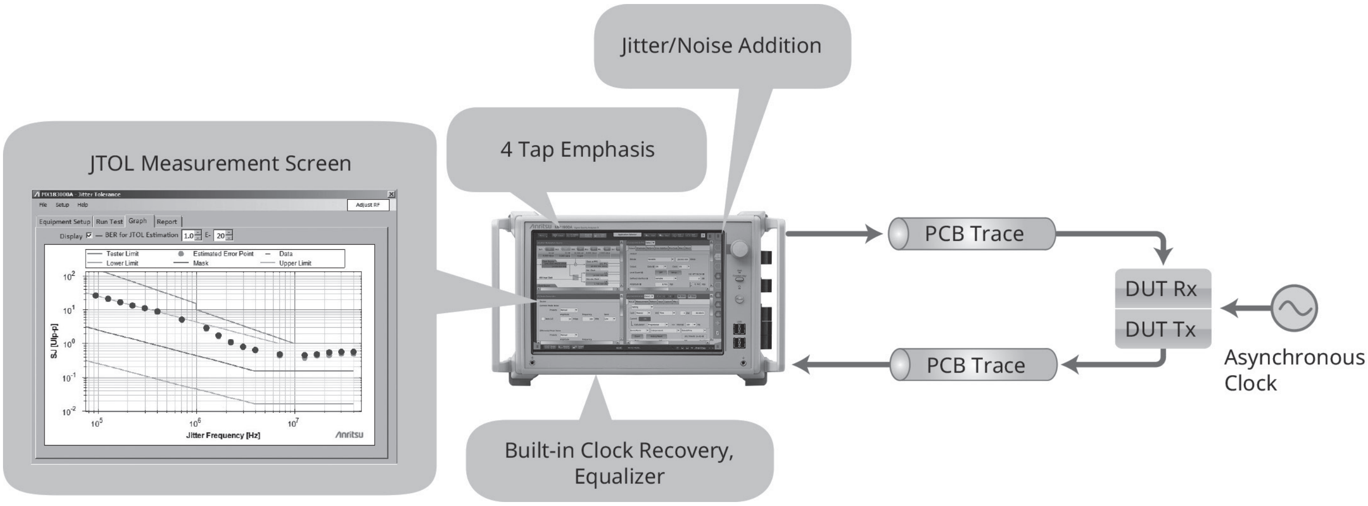


Measure Jitter Tolerance using captured error count ← Capture error count via USB or Ethernet connection

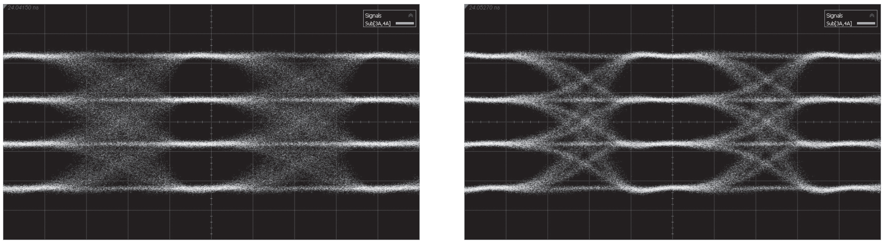
Versatile Jitter/Noise Addition Function for Jitter Tolerance Tests without Other External Equipment (MX183000A-PL001)

The DUT receiver input stress tolerance test measures the BER under the worst conditions using a stressed signal with added jitter and voltage noise. Adding the Jitter Modulation Source MU181500B and MU195050A for adding CM/DM/White Voltage Noise to the MP1900A series supports all-in-one receiver stress tests for various interface standards. Using the MP1900A high-quality signal prior to jitter and noise addition along with the high-linearity jitter and noise addition function offers powerful support for receiver stress tolerance tests.

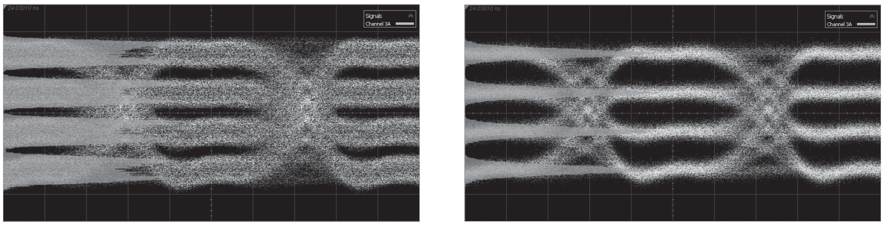
- Easy Jitter Tolerance measurement
- PHY device Jitter Tolerance test with impressed SJ/RJ/BUJ
- Mask measurements supporting various standards
- Shorter measurement times using low error rate (1E-12, 1E-15, etc.) estimation function
- Tolerance measurement for device characteristics using four Binary, Upward, Downward, and Binary + Linear measurement methods
- Built-in Jitter Tolerance Mask standards for 200/400G including IEEE 802.3, CEI, etc.
- Support for both user-defined masks and new standards



PAM4 Signal Jitter Tolerance Test using One MP1900A



Sine Wave Jitter (SJ) Random Jitter (RJ)



CM/DM Noise White Noise

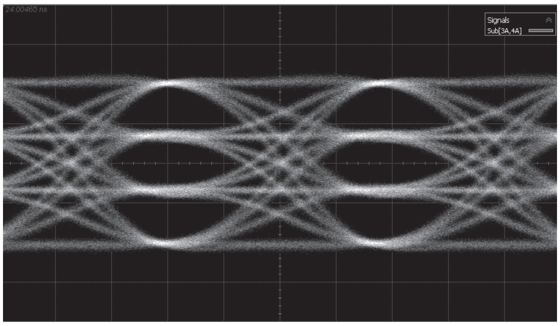
Jitter/Noise Types*

*: The upper noise addition rate is 32.1G.

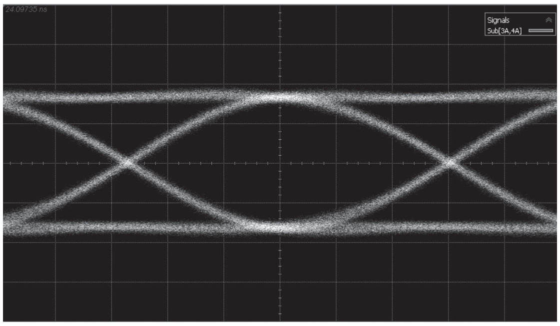
High-Quality Waveforms PAM4 PPG

High-Quality Data Output with High-Speed Tr/Tf and Low Intrinsic Jitter

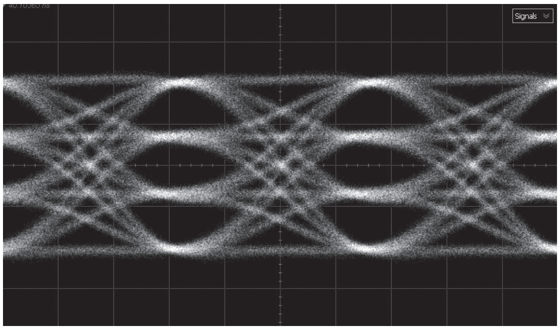
The PAM4 PPG MU196020A supports high-quality data output with low noise and low distortion over high analog band with Tr/Tf of 8.5 ms and Intrinsic Jitter of 170 fs rms. High-reproducibility measurement supported by PAM4 signals with open 3-Eye waveform. Additionally, Emphasis and Linearity control functions optimize PAM4 data output to DUT.



53.125 Gbaud PAM4



58 Gbaud NRZ



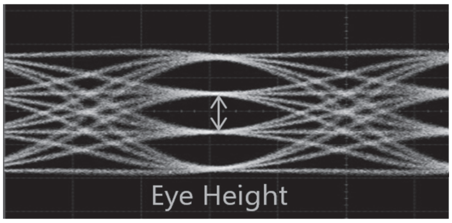
58 Gbaud PAM4

Typical Output Waveform (J1789A 40 cm Cable, 1400 mV Differential, PRBS15)

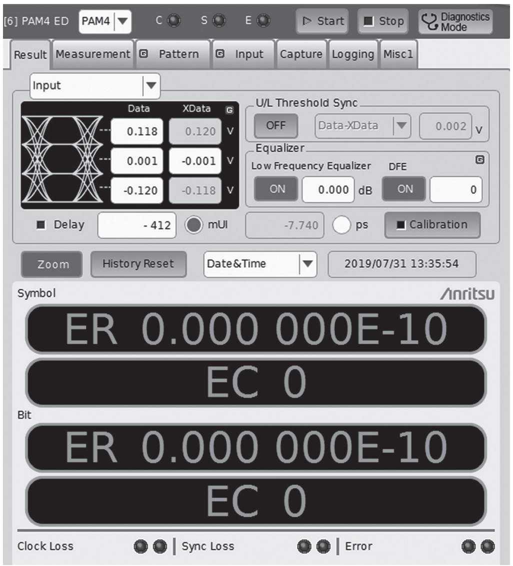
High-Sensitivity, Wideband PAM4 ED

116-Gbit/s PAM4 Signal Error-Free BER Measurement using High Input Sensitivity Function

Combining the PAM4 ED MU196040B with the PAM4 PPG supports BER measurements of 116-Gbit/s (58 Gbaud) PAM4 signals. Error-free BER measurement is achieved by the industry-best high sensitivity performance of 23 mV @26 Gbaud and 36 mV @53 Gbaud. The resulting high-accuracy BER measurements make it easy to troubleshoot previously difficult-to-analyze PAM4 devices. In addition, true DUT performance can be verified because even CEI-112G-VSR-defined worst-case stressed signals can be received at low-error rates (<E-8), exceeding the specifications.



Error-Free Measurement of PAM3 Signals at 23 mV @26 Gbaud, and 36 mV @53Gbaud



[6] PAM4 ED PAM4

Input

Data	XData	
0.118	0.120	V
0.001	-0.001	V
-0.120	-0.118	V

U/L Threshold Sync: OFF Data-XData 0.002 V

Equalizer: Low Frequency Equalizer ON 0.000 dB DFE ON 0

■ Delay - 412 ● mUI -7.740 ○ ps

Date&Time 2019/07/31 13:35:54

Symbol

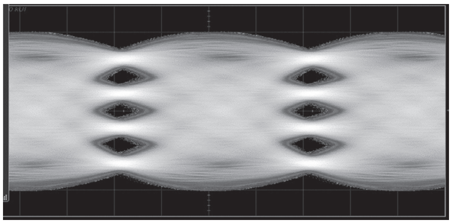
ER 0.000 000E-10

EC 0

Bit

ER 0.000 000E-10

EC 0

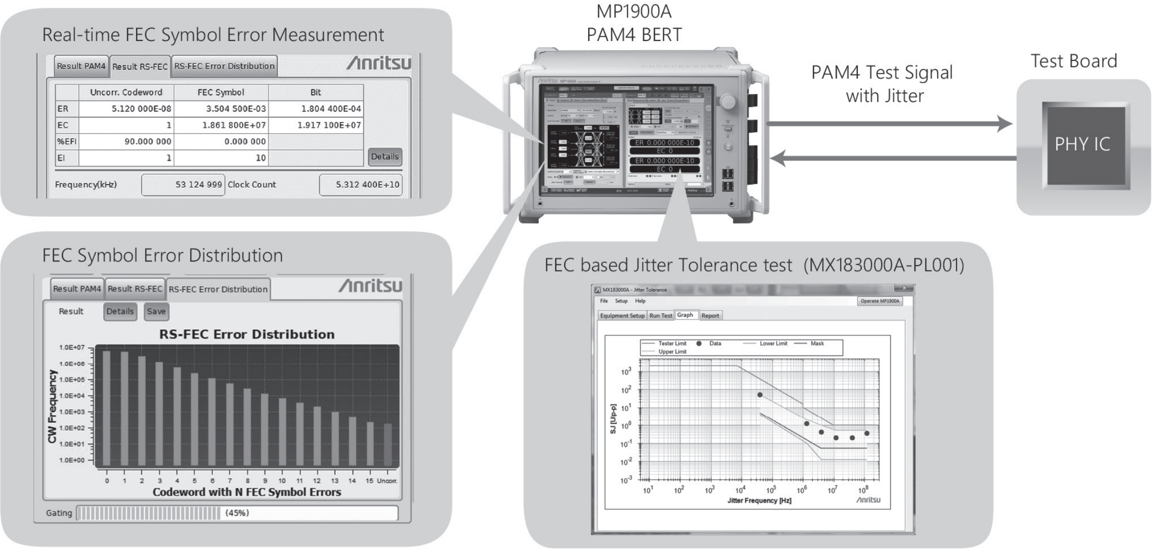


CEI-112G-VSR-defined Worst-Case Stressed PAM4 Signal

PAM4 BER Measurement Screen

Real-time FEC Symbol Error and FEC Based Jitter Tolerance Measurement Functions

Uncorrectable Codeword and FEC Symbol Errors can be measured and displayed on one screen in real-time simultaneously with bit error measurements. Measurement of jitter tolerance and FEC Symbol Error per codeword distribution based on correctable/uncorrectable FEC is supported (MU196040B-042).
Both bit error and FEC Symbol Errors are measured at high speed.



	Uncorr. Codeword	FEC Symbol	Bit
ER	5.120 000E-08	3.504 500E-03	1.804 400E-04
EC	1	1.861 800E+07	1.917 100E+07
%EFI	90.000 000	0.000 000	
EI	1	10	

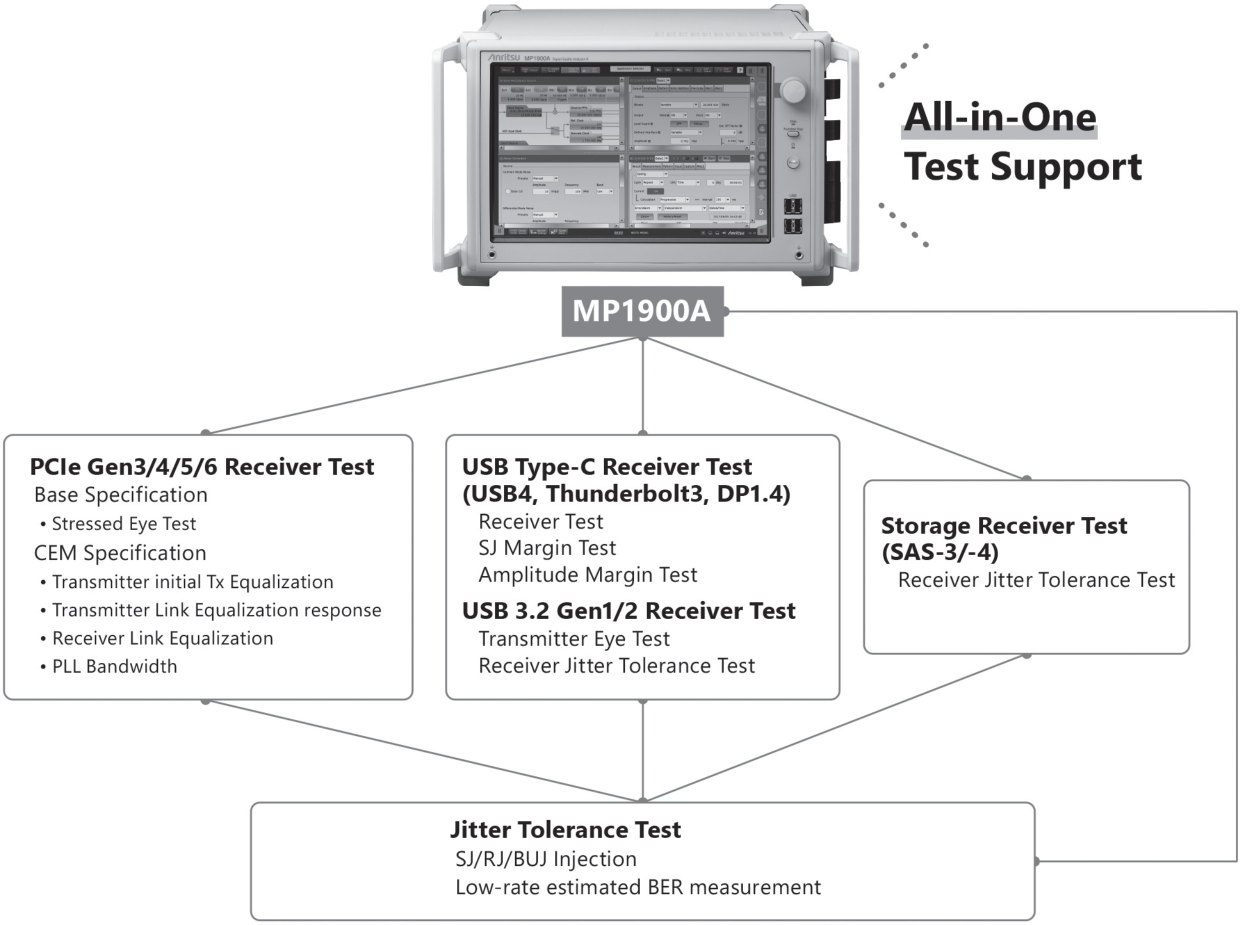
Frequency(kHz) 53 124 999
Clock Count 5.312 400E+10

Multi Interface

Next-Generation High-Speed Digital Interface Receiver Test

The growth of IoT and Cloud computing applications is driving the need for digital equipment with high-speed serial interfaces handling large data volumes. To meet this need, the PCI Express (PCIe) and USB interfaces used by this digital equipment are transitioning to both next-generation PCIe Gen5 supporting speeds up to 32 GT/s as well as to Type-C USB3.2 Gen2 supporting 10 Gbit/s and USB4 supporting 20 Gbit/s, which is also compatible with Thunderbolt.

The MP1900A is a wideband BERT with a built-in Gbit/s-class PPG, ED, and Jitter/Noise addition functions as well as application software supporting measurement of next-generation, high-speed digital-interface standards (CEI-28G/56G/112G, InfiniBand, 100G/400G/800G Ethernet, Fibre Channel, Thunderbolt 3, PCIe, USB, SAS, DP) from development through to manufacturing.



All-in-One Test Support

MP1900A

PCIe Gen3/4/5/6 Receiver Test
Base Specification
- Stressed Eye Test

CEM Specification
- Transmitter initial Tx Equalization
- Transmitter Link Equalization response
- Receiver Link Equalization
- PLL Bandwidth

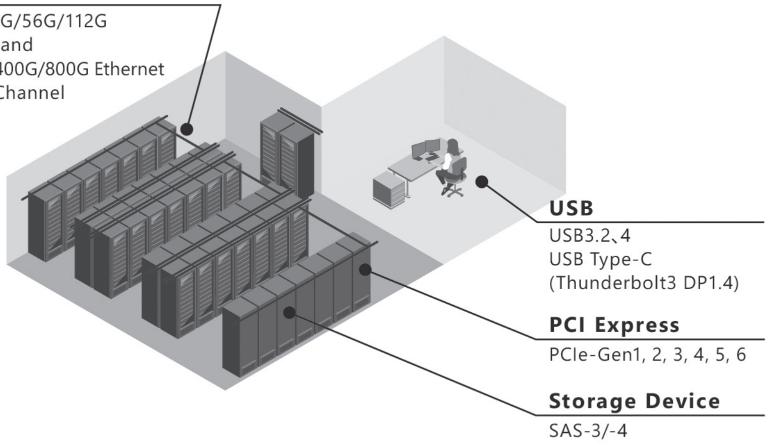
USB Type-C Receiver Test (USB4, Thunderbolt3, DP1.4)
Receiver Test
SJ Margin Test
Amplitude Margin Test

USB 3.2 Gen1/2 Receiver Test
Transmitter Eye Test
Receiver Jitter Tolerance Test

Storage Receiver Test (SAS-3/-4)
Receiver Jitter Tolerance Test

Jitter Tolerance Test
SJ/RJ/BUJ Injection
Low-rate estimated BER measurement

Target Applications



General Interfaces
CEI-28G/56G/112G
InfiniBand
100G/400G/800G Ethernet
Fibre Channel

USB
USB3.2、4
USB Type-C
(Thunderbolt3 DP1.4)

PCI Express
PCIe-Gen1, 2, 3, 4, 5, 6

Storage Device
SAS-3/-4

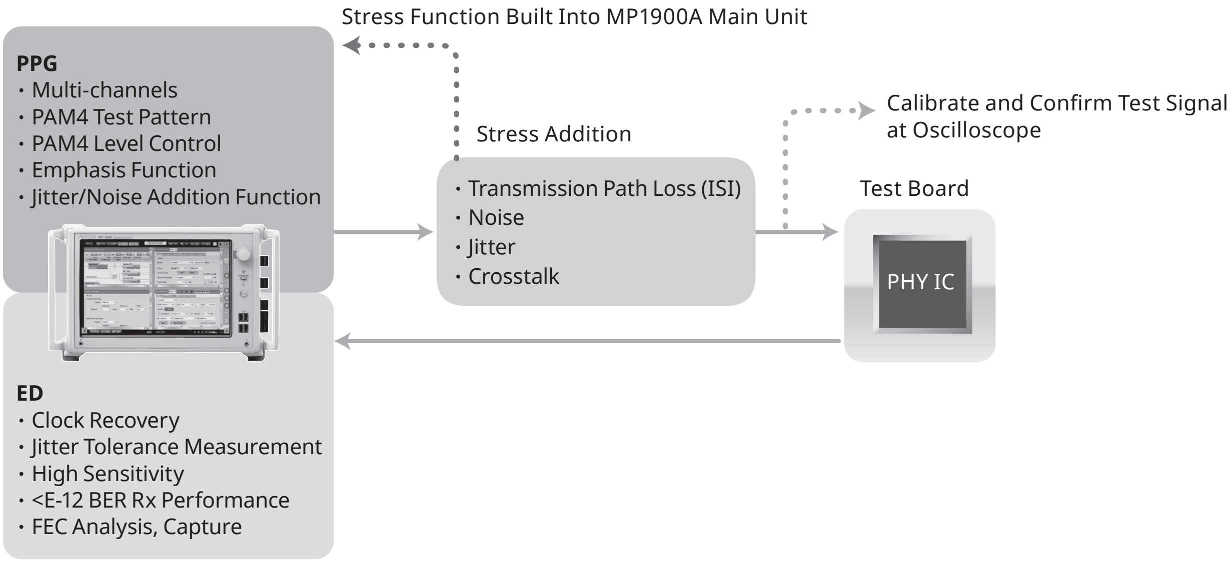
Various Applications

Internal and external interfaces, such as Ethernet, PCIe, and SAS, are supported along with USB3.2, 3.4, and Thunderbolt via USB Type-C connectors and cables, and Display Port.

MP1900A supports PCIe 3.0, 4.0, 5.0 and 6.0 as well as SAS using the same configuration.

PAM4 PPG/ED Application Example

PAM4 SERDES IC, CDR IC Evaluations

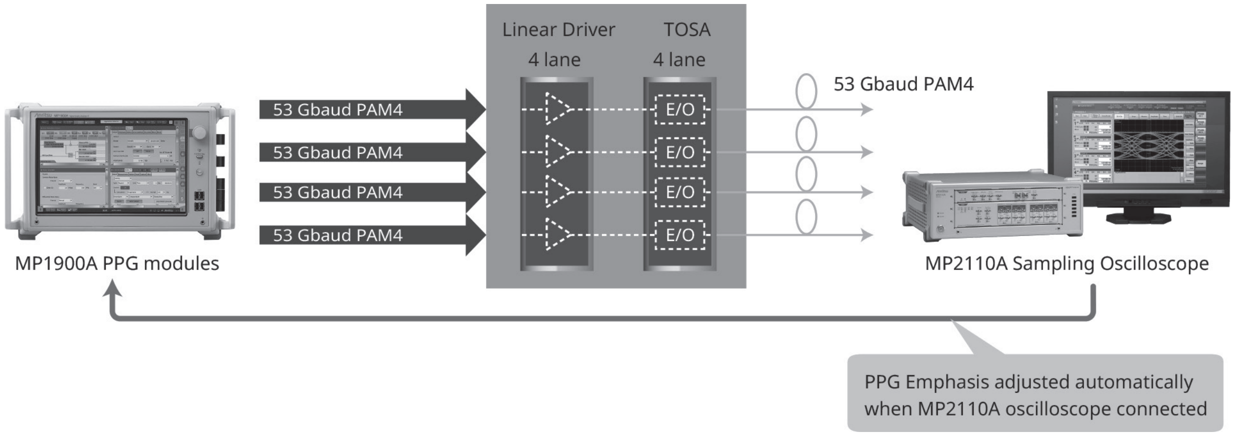


Required Test Items

- Stress Test
- BER and FEC Based Jitter Tolerance Test
- Burst error analysis with FEC symbol capture

TOSA, Driver IC Evaluations

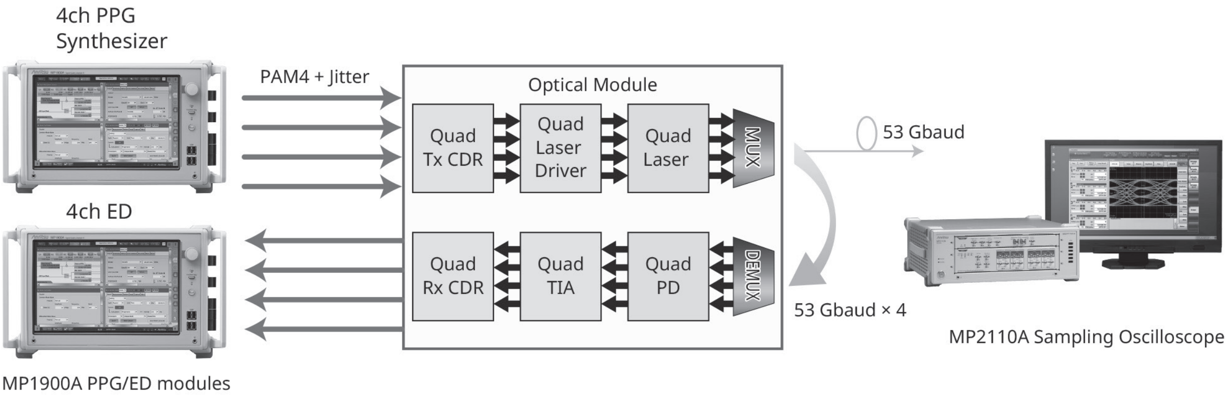
Since the test-signal performance affects the IC performance at evaluation of parts such as TOSA and driver ICs used by optical transceivers requiring analog high-frequency performance, a reference test signal source with fast Tr/Tf and low Intrinsic Jitter is required.



Required Test Items

- Multi-channel synchronous measurement
- Optimized TOSA TDECQ value using Emphasis and Linearity settings

Optical Module Evaluation

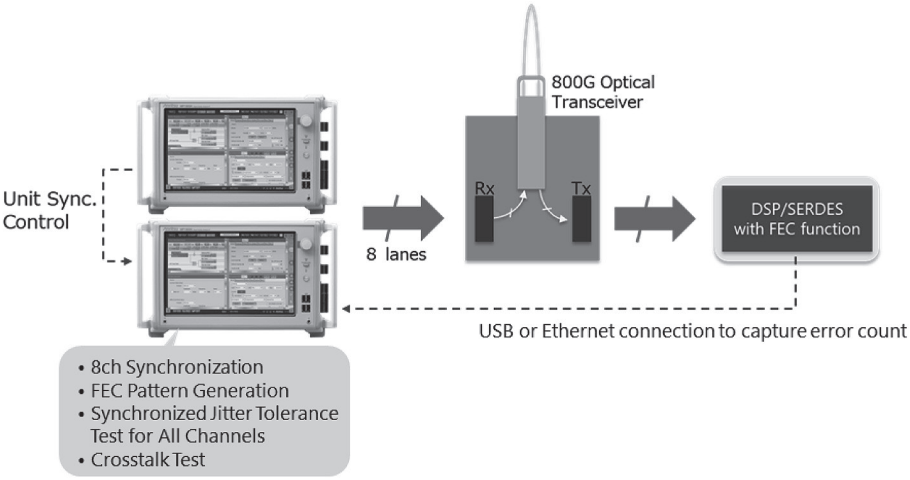


Required Test Items

- Simultaneous 4ch BER Measurement
- Optical output waveform optimized using Emphasis and Linearity Control
- Skew and Crosstalk Tests
- Jitter Tolerance Test

Multilane FEC Evaluation

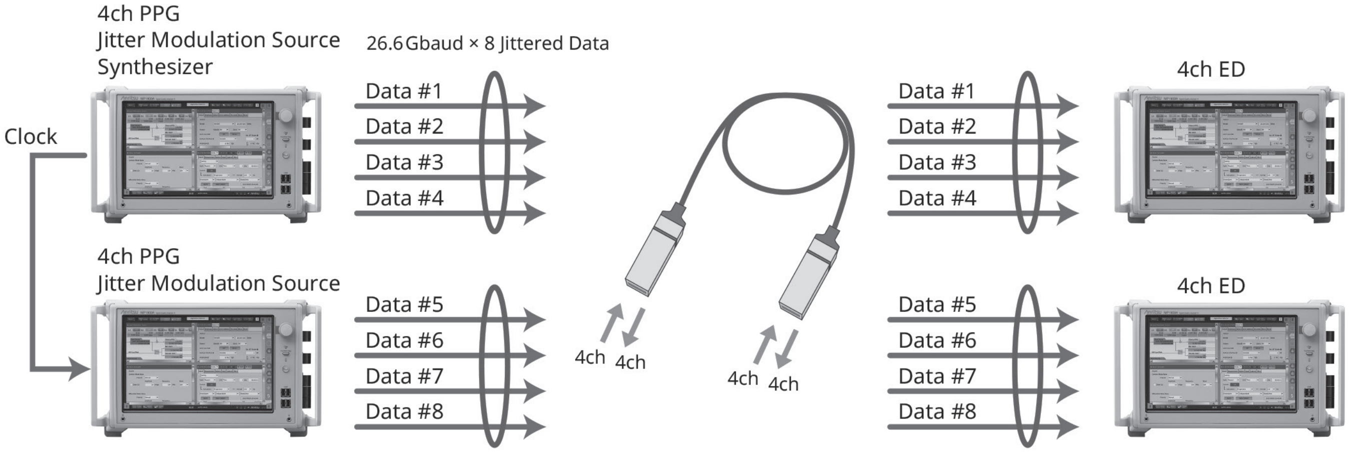
FEC can be evaluated by combining the FEC pattern generation, error insertion, and reading the DUT bit error count.



Required Test Items

- Generates synchronized multichannel FEC patterns for DUT-supported standards
- Supports shorter measurement time with simultaneous jittered and stressed measurement of all channels
- Measures FEC Symbol Error-based jitter tolerance
- Supports burst-error analysis and debugging using ED Capture Function

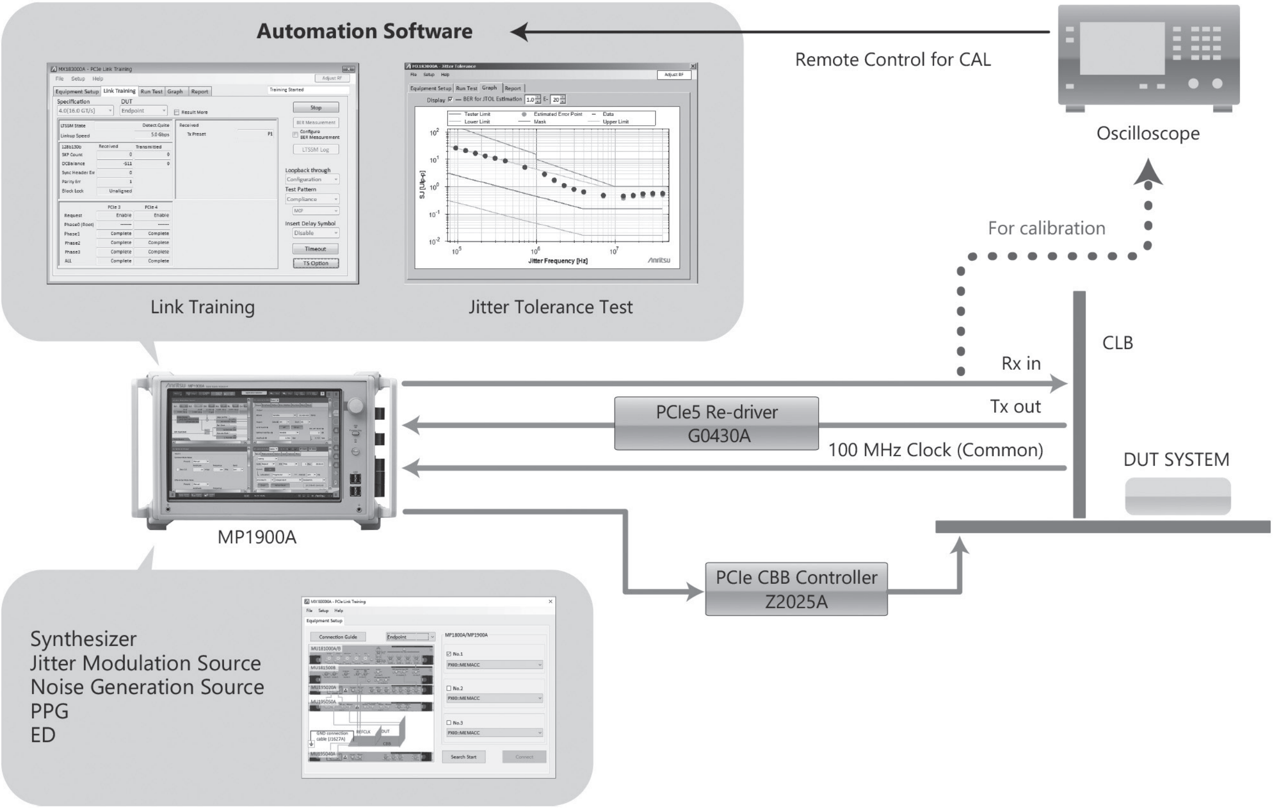
Active Cable Evaluation



Required Test Items

- 8ch Simultaneous PAM4 BER Measurement (4ch both ways)
- Crosstalk Test
- Jitter Tolerance Test

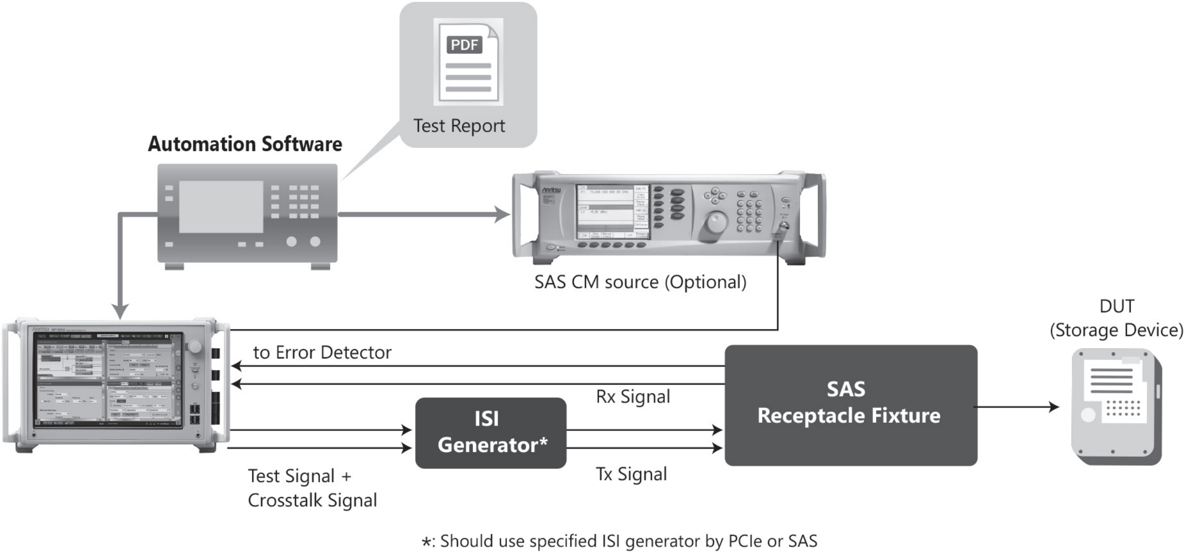
PCIe Gen3/4/5 CEM Receiver Test



Required Items

- Link Training function
- Jitter Tolerance Test
- Emphasis Effect Validation
- Supports Common/Separate Clock Architecture

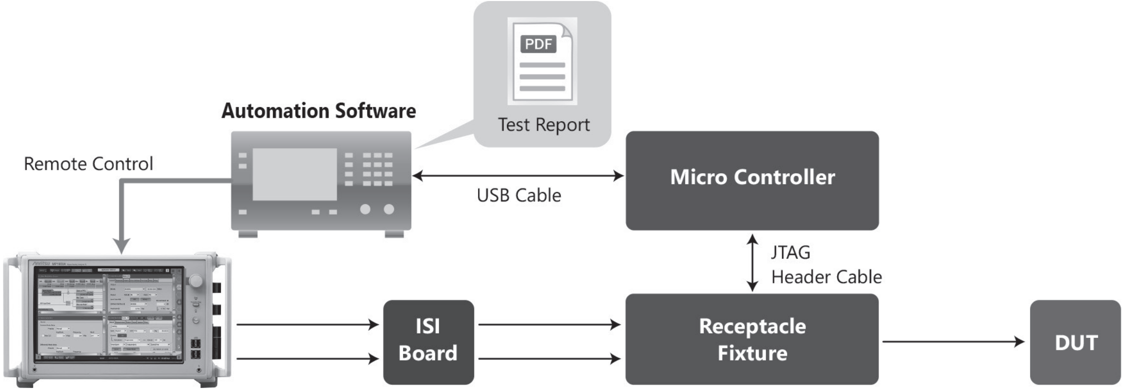
SAS-3/-4 Receiver Test



Required Functions

- 12 Gbit/s to 22.5 Gbit/s BERTS
- Stressed Signal Calibration and Test
- Jitter Margin Test

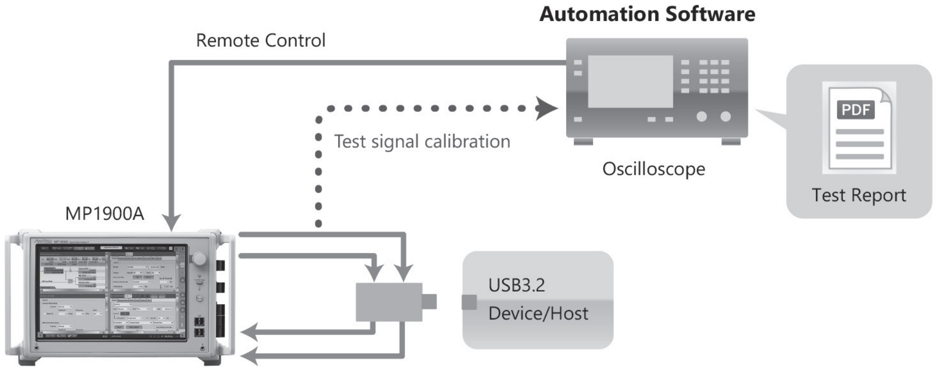
USB Type-C Receiver Test (USB4, Thunderbolt3)



Required Functions

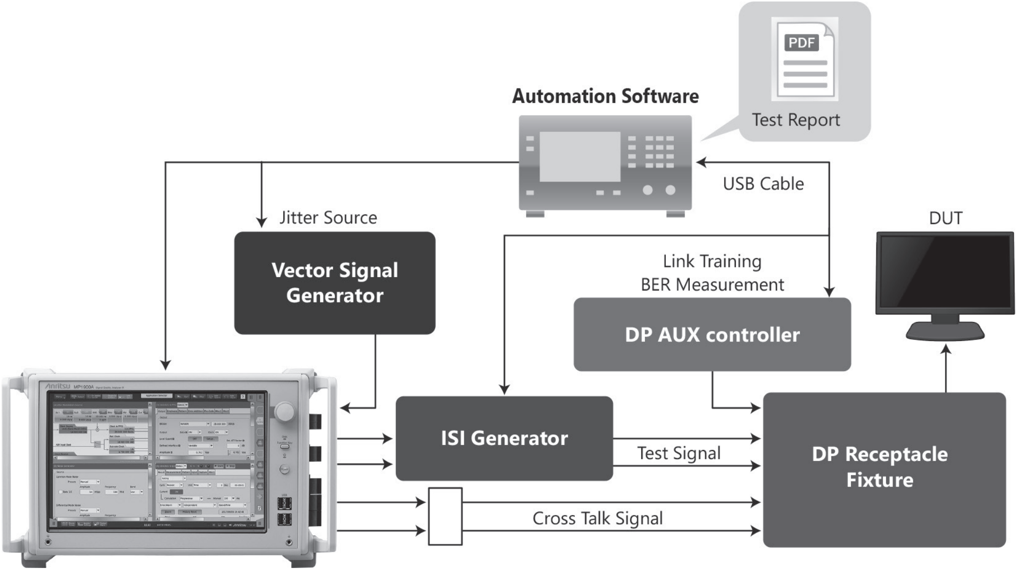
- 20 Gbit/s PPG
- Stressed Signal Calibration Function
- Jitter Tolerance Function

USB 3.2 Gen1/2 Device/Host/Retimer Receiver Test



Required Functions
- Loopback State Setting Function
- Jitter Tolerance Function
- Automatic Receiver Test Function
- Link Training Function

DisplayPort1.4 Sink Test



Required Functions
- 2.7 Gbit/s to 8.1 Gbit/s PPG
- Stressed Signal Calibration and Test
- USB Type-C Alternative Mode Operation

Specifications

Refer to the MP1900A Data Sheet for detailed specifications.

Signal Quality Analyzer-R MP1900A

LCD		12.1" WXGA 1280 × 800
Remote Interface		GPIB, LAN
Module Slots		8
External Equipment Interface		USB × 6, VGA × 1, HDMI × 1
OS		Windows 10
Power Supply		100 VAC to 120 VAC, 200 VAC to 240 VAC, 50 Hz to 60 Hz Power consumption: 1350 VA max.
Dimensions and Mass		340 (W) × 222.5 (H) × 451 (D) mm, 20 kg (excluding modules)
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000:2018

12.5 GHz 4 Port Synthesizer MU181000B

Clock Output	Number of Output: 4 Frequency Range: 0.1 GHz to 12.5 GHz, Steps: 1 kHz/1 MHz Level: 0.4 Vp-p to 1 Vp-p (AC) Connector: SMA (f), Termination: 50Ω/GND
10 MHz Input	Frequency: 10 MHz ±10 ppm Level: 0.5 Vp-p to 2.0 Vp-p Connector: BNC, Termination: 50Ω/GND
10 MHz Output	Level: 1.0 Vp-p ±30% (AC) Connector: BNC, Termination: 50Ω/GND
100 MHz Reference Signal Input (SSC Extension MU181000B-002)	Outputs either 100 MHz with phase deviation x25, x50, or x80 frequency-multiplied clock from Clock Output connector Supports PCI Express Host Reflclk input Modulation Frequency: 30 kHz to 33 kHz Level: 0.15 Vp-p to 1.3 Vp-p (AC) Connector: BNC

Jitter Modulation Source MU181500B

External Clock Input	Frequency Range: 0.800 000 GHz to 15.000 000 GHz Amplitude: 0.4 Vp-p to 1.0 Vp-p Connector: SMA (f), Termination: 50Ω/AC Coupling
Jittered Clock Output	Number of Output: 2 Amplitude: 0.4 Vp-p to 1.0 Vp-p Connector: SMA (f), Termination: 50Ω/AC Coupling
SJ1	Modulation Frequency: 10 Hz to 250 MHz Amplitude: 0 to 2000 UI @Modulation Frequency 10 kHz to 100 kHz 0 to 1 UI @Modulation Frequency 10 MHz to 250 MHz (Different depending on the operating bit rate)
Built-in SJ2	Modulation Frequency: 33 kHz, 87 MHz, 100 MHz, 210 MHz
Spread Spectrum Clocking (SSC)	Modulation Frequency: 28 kHz to 37 kHz Deviation: 0 to 7000 ppm
Random Jitter (RJ)	Bandwidth: 10 kHz to 1 GHz Amplitude: 0 to 0.5 UI (Different depending on the operating frequency)
Bounded Uncorrelated Jitter (BUJ)	PRBS Pattern Length: 2^{n} – 1 (n = 7, 9, 11, 15, 23, or 31) BUJ Rate: 0.1 Gbit/s to 3.2 Gbit/s, 4.9 Gbit/s to 6.25 Gbit/s, 9.8 Gbit/s to 12.5 Gbit/s Filter Type (LPF 3 dB Bandwidth): 50, 100, 200, 300, 500 MHz, Through Amplitude: 0 to 0.5 UI (Different depending on the operating frequency)
External Jitter	Bandwidth: 10 kHz to 1 GHz

Noise Generator MU195050A

Number of Channels	2
Insertion Loss	–3 dB
CMI: Common Mode Noise	0.1 GHz to 6 GHz: Sinusoidal wave
DMI: Differential Mode Noise	2 GHz to 10 GHz: Sinusoidal wave
White Noise	10 MHz to 10 GHz
Crest Factor	>5

21G/32G bit/s SI PPG MU195020A

Operation Rate (NRZ)	2.4 Gbit/s to 21 Gbit/s or 32.1 Gbit/s
Number of Channels	1 or 2
Output Amplitude	0.1 Vp-p to 1.3 Vp-p (Single-end) 0.2 Vp-p to 2.6 Vp-p (Differential)
Emphasis	10Tap
Channel Emulator	Normal: Emulates Insertion Loss using S-parameter data Inverse: Performs De-Emphasis compensation for S-parameter Insertion Loss S-Parameter file: S2P,S4P
ISI	Emulates ISI output using CEI-28G/25G Nyquist frequency loss setting Supports loss control in combination with ISI Board J1758A accessory Insertion Loss setting: 1.5 to 25 dB, 0.01 dB step, Nyquist frequency 0 to 25 dB, 0.01 dB step, 1/2 Nyquist frequency
Tr/Tf (20 to 80%)	12 ps (typ.)
Random Jitter	115 fs rms (typ.)
PCIe, USB Link Training	Supported (MX183000A-PL021, MX183000A-PL022)
Output Connector	K (f)

21G/32G bit/s SI ED MU195040A

Operation Rate (NRZ)	2.4 Gbit/s to 21 Gbit/s or 32.1 Gbit/s
Number of Channels	1 or 2
Input Attitude	0.05 Vp-p to 1.0 Vp-p (Single-End) 0.1 Vp-p to 2.0 Vp-p (Differential)
Input Sensitivity (Eye Height)	15 mV (28.1 Gbit/s, NRZ) 30 mV/Eye (28.1 Gbaud, PRBS15, PAM4)
CTLE	Peak Frequency: 14, 8, 4 GHz Gain: 0 to –12 dB
Clock Recovery	Yes, supports SSC
PCIe, USB Link Training	Supported (MX183000A-PL021, MX183000A-PL022)
Input Connector	K (f)

PAM4 PPG MU196020A

Operation Rate (PAM4/NRZ)	2.4 Gbaud to 32.1/58.2/64.2 Gbaud (option selection)
No. of Channels	1
Output Amplitude	70 mVp-p to 800 mVp-p (Single-end) 140 mVp-p to 1600 mVp-p (Differential)
Offset	–2 V to +3.3 V
Emphasis	4 Tap, –20 to +20 dB
Channel Emulator	Generates waveform with insertion loss and simulates waveform with corrected insertion loss Set by loading S-Parameter file (S2 P, S4 P)
ISI	Simulates ISI generation waveform Set using loss (–8.00 to 8.00 dB) at CEI-specified Nyquist frequency Used in combination with channel board, such as J1800A/J1758A (optional accessories parts), or Noise Module MU195050A
Independently Variable PAM4 3 Eye	20 to 50% (PAM4 Amplitude 0/3 level = 100%)
PAM4 Pattern	SSPRQ, PRBS13Q, PRBS31Q, RS-FEC, etc.
PAM4 Pattern Error Addition	MSB Error, LSB Error, LSB&MSB Error, RS-FEC Symbol Error
Tr/Tf (20 to 80%)	8.5 ps (typ., NRZ)
Random Jitter	170 fs rms (typ., NRZ)
Output Connector	V (f)

PAM4 ED MU196040B

Operation Rates (PAM4/NRZ)	2.4 Gbaud to either 32.1 Gbaud, or 58.2 Gbaud (PAM4)/64.2 Gbaud (NRZ) (option selection)
No. of Channels	1
Input Amplitude	NRZ: ≤32.1G: 0.05 Vp-p to 1.0 Vp-p, >32.1G: 0.1 Vp-p to 1.0 Vp-p PAM4: ≤32.1G: 0.3 Vp-p to 1.0 Vp-p, >32.1G: 0.4 Vp-p to 1.0 Vp-p
Input Sensitivity (Eye Height)	NRZ: 19 mV @ 26.5625 Gbaud, 21 mV @ 53.125 Gbaud PAM4: 23 mV @ 26.5625 Gbaud, 36 mV @ 53.125 Gbaud
Clock Recovery (Option)	2.4 Gbaud to 32.1 Gbaud, 51 Gbaud to 58.2 Gbaud
Equalizer (Option)	Low-frequency Equalizer (≤1 GHz, 2 dB typ.) + DFE (1.4 dB typ.)
PAM4 Patterns	SSPRQ, PRBS13Q, PRBS31Q, etc.
PAM4 Counter	MSB, LSB, Symbol 0 to 3 (Option)
Input Connector	V (f)

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

MP1900A

Model/Order No.	Name
	Main Frame[*1]
MP1900A	Signal Quality Analyzer-R
	Standard Accessories
G0342A	ESD DISCHARGER: 1
J1211	POWER CORD. 3M: 1
J1627A	GND connection cable: 1
P0031A	USB Memory: 1
Z0306A	Wrist Strap: 1
MX190000A	Signal Quality Analyzer-R Control Software[*2]
MX183000A	High-Speed Serial Data Test Software[*3, *4]
	Retrofit Option
MP1900A-110	Windows10 Upgrade Retrofit[*5]
	Maintenance Service
MP1900A-ES310	Three Years Extended Warranty Service
MP1900A-ES510	Five Years Extended Warranty Service

[*1] The Windows 10 OS will be installed in all orders from July 1, 2020.
[*2] Standard software pre-installed in Signal Quality Analyzer-R MP1900A
[*3] Trial software pre-installed in Signal Quality Analyzer-R MP1900A for extending functions with 30-day free trial period following first launch. When requiring the official version after the 30-day trial period, obtain the official license by purchasing the separate MX183000A-PLxx software license.
Refer to the software license.
[*4] The PAM4 Control function is bundled with the MX183000A as a standard function and can be used without a license.
[*5] MP1900A main units running Windows Embedded Standard 7 are retrofitted to Windows 10 using a hardware upgrade. Anritsu destroys the unnecessary, post-upgrade Windows Embedded Standard 7 parts.
For details, contact our sales representative.

MU181000B

Model/Order No.	Name
	Module
MU181000B	12.5 GHz 4port Synthesizer
	Standard Accessories
J1624A	Coaxial Cable 0.3 m (SMA, DC to 18 GHz): 4 pcs
	Option
MU181000B-001	Jitter Modulation
MU181000B-002	SSC Extension
	Retrofit Option
MU181000B-101	Jitter Modulation Retrofit
MU181000B-102	SSC Extension Retrofit
	Maintenance Service
MU181000B-ES310	Three Years Extended Warranty Service
MU181000B-ES510	Five Years Extended Warranty Service

MU181500B

Model/Order No.	Name
	Module
MU181500B	Jitter Modulation Source
	Standard Accessories
J1624A	Coaxial Cable 0.3 m (SMA, DC to 18 GHz): 1 pc
J1508A	BNC-SMA Connector Cable (30 cm): 2 pcs
J1137	Terminator: 6 pcs
J1341A	Open: 2 pcs
Z0897A	MP1800A Manual CD: 1 pc
Z0918A	MX180000A Software CD: 1 pc
	Maintenance Service
MU181500B-ES310	Three Years Extended Warranty Service
MU181500B-ES510	Five Years Extended Warranty Service

MU195050A

Model/Order No.	Name
	Module
MU195050A	Noise Generator
	Standard Accessories
J1632A	Terminator: 4
J1359A	Coaxial Adapter (K-P, K-J, SMA): 4
J1717A	COAXIAL ADAPTOR (SMA-P, SMA-J): 2
J1341A	Open: 6
J1746A	Skew Match Pair Semrigid Cable (K connector, Data Input1): 1 set
J1747A	Skew Match Pair Semrigid Cable (K connector, Data Input2): 1 set
J1792A	Skew Match Pair Semrigid Cable (V-K connector, MU196020A PPG Output to MU195050A Noise Data Input1): 1 set
	Option
MU195050A-001	White Noise
	Retrofit Option
MU195050A-101	White Noise Retrofit
	Maintenance Service
MU195050A-ES310	Three Years Extended Warranty Service
MU195050A-ES510	Five Years Extended Warranty Service

MU195020A

Model/Order No.	Name
	Module
MU195020A	21G/32G bit/s SI PPG
	Standard Accessories
J1632A	Terminator: 5
J1341A	Open: 2
J1359A	Coaxial Adapter (K-P, K-J, SMA): 1
J1717A	COAXIAL ADAPTOR (SMA-P, SMA-J): 6
	Option
MU195020A-001	32G bit/s Extension
MU195020A-010	1ch Data Output
MU195020A-020	2ch Data Output
MU195020A-011	1ch 10Tap Emphasis
MU195020A-021	2ch 10Tap Emphasis
MU195020A-030	1ch Data Delay
MU195020A-031	2ch Data Delay
MU195020A-040	1ch Variable ISI
MU195020A-041	2ch Variable ISI
MU195020A-050	Sequence Editor Function[*6]
MU195020A-051	Sequence Editor Function PCIe 5 Extension[*6]
	Retrofit Options
MU195020A-101	32G bit/s Extension Retrofit
MU195020A-120	2ch Data Output Retrofit
MU195020A-111	1ch 10Tap Emphasis Retrofit
MU195020A-121	2ch 10Tap Emphasis Retrofit
MU195020A-130	1ch Data Delay Retrofit
MU195020A-131	2ch Data Delay Retrofit
MU195020A-140	1ch Variable ISI Retrofit
MU195020A-141	2ch Variable ISI Retrofit
MU195020A-350	Sequence Editor Function Retrofit
	When Option 010/110 Installed
J1632A	Terminator: 2
J1359A	Coaxial Adapter (K-P, K-J, SMA): 2
	When Option 020/120 Installed
J1632A	Terminator: 4
J1359A	Coaxial Adapter (K-P, K-J, SMA): 4
	Maintenance Service
MU195020A-ES310	Three Years Extended Warranty Service
MU195020A-ES510	Five Years Extended Warranty Service

[*6] Option 050 supports PCIe Gen 1 to Gen 4, and USB 3.2 ×1.
Option 051 supports PCIe Gen5. Option 050 is required when adding Option 051.

MU196020A*[11]

Model/Order No.	Name	
	Module	
MU196020A	PAM4 PPG	
	Standard Accessories	
J1632A	TERMINATOR:	4
V210	TERMINATOR (V):	2
J1341A	OPEN:	2
J1359A	COAXIAL ADAPTOR (K-P.K-J,SMA):	1
J1717A	COAXIAL ADAPTOR(SMA-P.SMA-J):	5
	Option	
MU196020A-001	32G baud*	
MU196020A-002	58G baud*	
MU196020A-003	64G baud*	
MU196020A-011	4Tap Emphasis	
MU196020A-030	Data Delay	
MU196020A-040	Adjustable ISI	
MU196020A-042	FEC Pattern Generation	
MU196020A-050	Inter-Module Synchronization	
	Retrofit Options	
MU196020A-112	32G to 58G baud Extension Retrofit	
MU196020A-113	32G to 64G baud Retrofit	
MU196020A-123	58G to 64G baud Retrofit	
MU196020A-111	4Tap Emphasis Retrofit	
MU196020A-130	Data Delay Retrofit	
MU196020A-140	Adjustable ISI Retrofit	
MU196020A-142	FEC Pattern Generation Retrofit	
MU196020A-150	Inter-Module Synchronization Retrofit	
	Maintenance Service	
MU196020A-ES310	Three Years Extended Warranty Service	
MU196020A-ES510	Five Years Extended Warranty Service	

*: Select any one

MU195040A

Model/Order No.	Name	
	Module	
MU195040A	21G/32G bit/s SI ED	
	Standard Accessories	
J1632A	Terminator:	2
J1341A	Open:	1
J1717A	COAXIAL ADAPTOR (SMA-P, SMA-J):	4
	Option	
MU195040A-001	32G bit/s Extension	
MU195040A-010	1ch ED	
MU195040A-020	2ch ED	
MU195040A-011	1ch CTLE	
MU195040A-021	2ch CTLE	
MU195040A-022	Clock Recovery	
	Retrofit Options	
MU195040A-101	32G bit/s Extension Retrofit	
MU195040A-120	2ch ED Retrofit	
MU195040A-111	1ch CTLE Retrofit	
MU195040A-121	2ch CTLE Retrofit	
MU195040A-122	Clock Recovery Retrofit	
	When Option 010/110 Installed	
J1341A	Open:	3
J1359A	Coaxial Adapter (K-P, K-J, SMA):	2
41KC-6	Fixed Attenuator 6 dB:	2
	When Option 020/120 Installed	
J1341A	Open:	5
J1359A	Coaxial Adapter (K-P, K-J, SMA):	4
41KC-6	Fixed Attenuator 6 dB:	4
	Maintenance Service	
MU195040A-ES310	Three Years Extended Warranty Service	
MU195040A-ES510	Five Years Extended Warranty Service	

MU196040B*[11]

Model/Order No.	Name	
	Module	
MU196040B	PAM4 ED	
	Standard Accessories	
J1632A	TERMINATOR:	2
V210	TERMINATOR (V):	2
J1341A	OPEN:	2
J1359A	COAXIAL ADAPTOR (K-P.K-J,SMA):	1
J1717A	COAXIAL ADAPTOR (SMA-P.SMA-J):	3
41V-6	Fixed Attenuator 6 dB:	2
	Option	
MU196040B-001	32G baud (2.4G to 32.1G)	
MU196040B-002	58G baud (NRZ: 2.4G to 64.2G, PAM4: 2.4G to 58.2G)	
MU196040B-011	Equalizer	
MU196040B-021	29G baud Clock Recovery (2.4G to 29G)	
MU196040B-022	32G baud Clock Recovery (2.4G to 32.1G)	
MU196040B-023	58G baud Clock Recovery Extension (51G to 58.2G)	
MU196040B-041	SER Measurement	
MU196040B-042	FEC Analysis	
	Retrofit Options	
MU196040B-111	Equalizer Retrofit	
MU196040B-112	32G to 58G baud Extension Retrofit	
MU196040B-121	29G baud Clock Recovery Retrofit	
MU196040B-122	32G baud Clock Recovery Retrofit	
MU196040B-123	58G baud Clock Recovery Extension Retrofit	
MU196040B-124	32G baud Clock Recovery Extension Retrofit	
MU196040B-141	SER Measurement Retrofit	
MU196040B-342	FEC Analysis Retrofit	
	Maintenance Service	
MU196040B-ES310	Three Years Extended Warranty Service	
MU196040B-ES510	Five Years Extended Warranty Service	

Software License

Model/Order No.	Name
MX183000A	High-Speed Serial Data Test Software
MX183000A-PL001	Jitter Tolerance Test
MX183000A-PL011	PCIe Link Sequence
MX183000A-PL021	PCIe Link Training*[7]
MX183000A-PL022	USB Link Training*[8]
MX183000A-PL023	USB 3.2 × 2 Link Training*[7]
MX183000A-PL025	PCIe 5 Link Training*[8]
MX183000A-PL031	DUT Error Counts Import

*7: The PL021 option supports PCIe Gen1 to Gen4.
The PL025 option supports PCIe Gen5. PL021 is required to add PL025.

*8: PL022 supports USB 3.2 ×1. PL023 supports USB 3.2 ×2.
PL022 is required to add PL023.

On Using VISA*[9]

The National Instruments™ (NI hereafter) NI-VISA*[10] software must be installed to use the MX183000A (this product hereafter). We recommend using NI-VISA saved on the product USB memory stick. Customers may only use NI-VISA saved on the product memory stick. NI-VISA on the memory stick may not be used for other applications with other products.
When uninstalling this product from the controller PC, etc., also uninstall NI-VISA from the USB memory.

*9: Abbreviation for Virtual Instrument Software Architecture. This is I/O software for remote control of measuring instruments via GPIB, Ethernet and USB interfaces.

*10: NI-VISA was developed by National Instruments for VXI Plug&Play Alliance standards compliant I/O interfaces.
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Optional Accessories

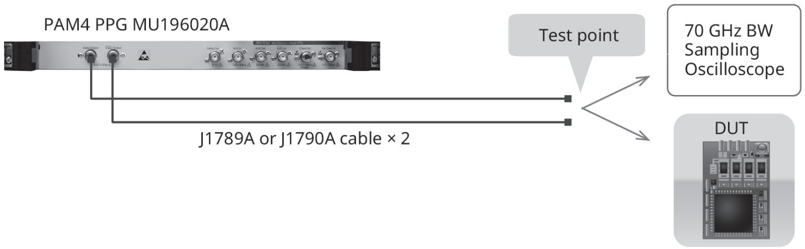
Model/Order No.	Name
J1632A	Terminator
V210	TERMINATOR (V)
J1678A	ESD Protection Adapter-K
J1679A	ESD Protection Adapter-V
J1359A	Coaxial Adapter (K-P, K-J, SMA)
34VFK50A	Fixed Adapter (V-F, K-M)*11
34VKF50A	Fixed Adapter (V-M. K-F)
41KC-3	Fixed Attenuator 3 dB
41KC-6	Fixed Attenuator 6 dB
41KC-10	Fixed Attenuator 10 dB
41KC-20	Fixed Attenuator 20 dB
41VA-3	Fixed Attenuator 3 dB
41VA-6	Fixed Attenuator 6 dB
41VA-10	Fixed Attenuator 10 dB
41VA-20	Fixed Attenuator 20 dB
J1758A	ISI Board
J1800A	ISI Board V
K261	DC Block
K240C	Precision Power Divider
V240C	Fixed Power divider
J1510A	Pick OFF Tee (K)
J1793A	Pick OFF Tee (V)
K241C	Power Splitter
J1748A	Power Splitter (1.5 GHz to 18 GHz, SMA, using MU195020A × 4 to MU181500B connection)
J1624A	COAXIAL CABLE 0.3 m (18 GHz and SMA)
J1342A	COAXIAL CABLE 0.8 m (APC3.5 connector)
J1439A	Coaxial cable (0.8 m, K connector)
J1625A	Coaxial Cable 1 m (18 GHz, SMA)
J1449A	Measurement kit (J1324A × 2, J1439A × 2, J1625A × 1)
J1550A	Coaxial skew match cable (0.8 m, APC3.5 connector)
J1551A	Coaxial skew match cable (0.8 m, K connector)
J1728A	Electrical Length Specified Coaxial Cable (0.4 m, K Connector)
J1741A	Electrical Length Specified Coaxial Cable (0.8 m, K Connector)
J1789A	Electrical Length Specified Coaxial Cable*11 (0.4 m, V Connector)
J1790A	Electrical Length Specified Coaxial Cable*11 (0.8 m, V Connector)
J1792A	Skew match pair semirigid cable (V-K connector, MU196020A PPG Output to MU195050A Noise Data Input1)
J1761A	PCIe Reference Clock Cable Kit
Z2025A	PCIe CBB Controller
Z2029A	PCIe Reference Clock Buffer
J1890A	PCIe5 Re-Driver Set
G0430A	PCIe5 Re-Driver Set
AH54192A	56Gbaud Differential Linear Amplifier
W3911AE	MP1900A Operation Manual
W3913AE	MX190000A Operation Manual
W3813AE	MX183000A Operation Manual
W3915AE	MU195020/40/50A Operation Manual
W3976AE	MU196020/40A OPERATION MANUAL
B0576A	Blank Panel
B0736A	Front Cover (For MP1900A)
B0737A	Carrying Case (For MP1900A, with B0736A)
B0738A	Rack Mount Kit (For MP1900A)
Z1746A	Stylus
Z0541A	USB Mouse
J0008	GPIB CABLE, 2.0 m
Z0917A	Shielded LAN Cable, 5 m
Z1953A	Gigabit Ethernet Switch (5 Port)
Z0306A	Wrist Strap
Z1964A	Torque Wrench (Right Angle)

J1815A MP1900A PCIe Measurement Component Set

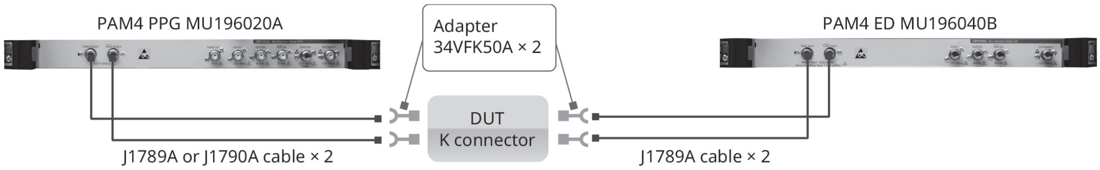
The following table lists the component set required by the PCIe Gen3/4/5 Tx/Rx LEQ test.

<table>
<tr><th>Item</th><th>Description</th><th>Qty.</th><th colspan="3">Remarks</th></tr>
<tr><td rowspan="9">Optional Accessories</td><td rowspan="9">MP1900A
PCIe Measurement Component Set</td><td rowspan="9">1</td><td colspan="3">J1815A</td></tr>
<tr><td>Accessories</td><td>Qty.</td><td>Comment</td></tr>
<tr><td>Coax skew match cable, 0.8 m K connector</td><td>4</td><td>Junflon J12J103220-00-1</td></tr>
<tr><td>AE-TMC-10205</td><td>2</td><td>Coax cable, 1 m, SMA connector</td></tr>
<tr><td>PICK OFF TEE</td><td>2</td><td>Anritsu 3-68231</td></tr>
<tr><td>SMPF-SMAJ-TFLEX-10CM-5PS</td><td>2</td><td>SMP to SMA adapter cable</td></tr>
<tr><td>BNC-SMA cable</td><td>2</td><td></td></tr>
<tr><td>K261</td><td>2</td><td>DC Block</td></tr>
<tr><td>K241C</td><td>2</td><td>Power Splitter</td></tr>
</table>

*11: We recommend using either the J1789A or J1790A as the coaxial cable for the MU196020A data output. Recommend using coaxial cable J1789A for MU196040B Data IN. The MU196020A data output specifications are defined based on the performance observed using a 70-GHz bandwidth oscilloscope connected as shown below.



The MU196020A Data OUT and MU196040B Data IN connectors, and the J1789A/J1790A cables all use V-connectors. Consequently, for K-connectors, use 34VFK50A adapters as shown in the following figure.



DUT Connection Setup for K-connectors

BERTWave™

MP2110A

Remote Control
GPIB | **Ethernet**

Development and Manufacturing of Multi-channel Optical Modules for 10G to 800G

Excellent Eco Product

BERTWave

Data traffic volumes are exploding with the spread of fixed-rate video streaming and cloud services.
As a result, there is a need for optical interfaces for transmission equipment supporting speeds of more than 10 Gbit/s as 100 GbE and even 400 GbE and 800 GbE networks are deployed. However, there are increasing requests for less-expensive optical interfaces due to major problems with how to increase line productivity and cut costs.
The BERTWave MP2110A is an all-in-one instrument with built-in BERT (Bit Error Rate Tester) and Sampling Oscilloscope (Eye pattern analysis) designed for manufacturing inspection of 10G to 800G optical modules. It helps increase line productivity and cuts costs.

All In One	All-in-one 4ch 28.2Gbit/s BERT + 4ch sampling oscilloscope There is a built-in Clock Recovery Unit for Sampling Oscilloscope
Low Cost	Easy, fast and high-sensitivity analysis of PAM4 signals including TDECQ with support for clock recovery
NRZ/ PAM4 Analysis	Customized test systems can be configured as necessary by combining options freely.
250 ksamples/s	The high-speed sampling oscilloscope captures 1 million samples in 4 seconds. Measurement times are slashed by measuring four channels in parallel. Built-in PC for Stable Operation
-15 dBm Sensitivity	The high-sensitivity sampling oscilloscope supports accurate performance even for PAM4 signals with a closed Eye opening, and for optical signals attenuated by optical switches, etc.

Supported Applications:

Evaluation of physical-layer performance for 10G/25G/50G/100G/200G/400G/800G optical transport modules, optical cables, and associated parts used by data centers, Core/Metro networks, 4G/5G mobile backhaul, and 5G mobile fronthaul

Transmission Paths:
Ethernet, eCPRI/RoE, CPRI, SDH/SONET, OTN, InfiniBand, Fibre Channel

Optical Transceiver Modules:
SFP28, QSFP28, CFP2/4/8, SFP56, QSFP56, OSFP, QSFP-DD

Cables:
Active Optical Cables (AOC), Direct Attach Cables (DAC)

Devices:
TOSA, ROSA, High-Speed Optical Engine, PHY, Driver ICs

Configuring Efficient Measurement System: Integrated BERT and Sampling Oscilloscope

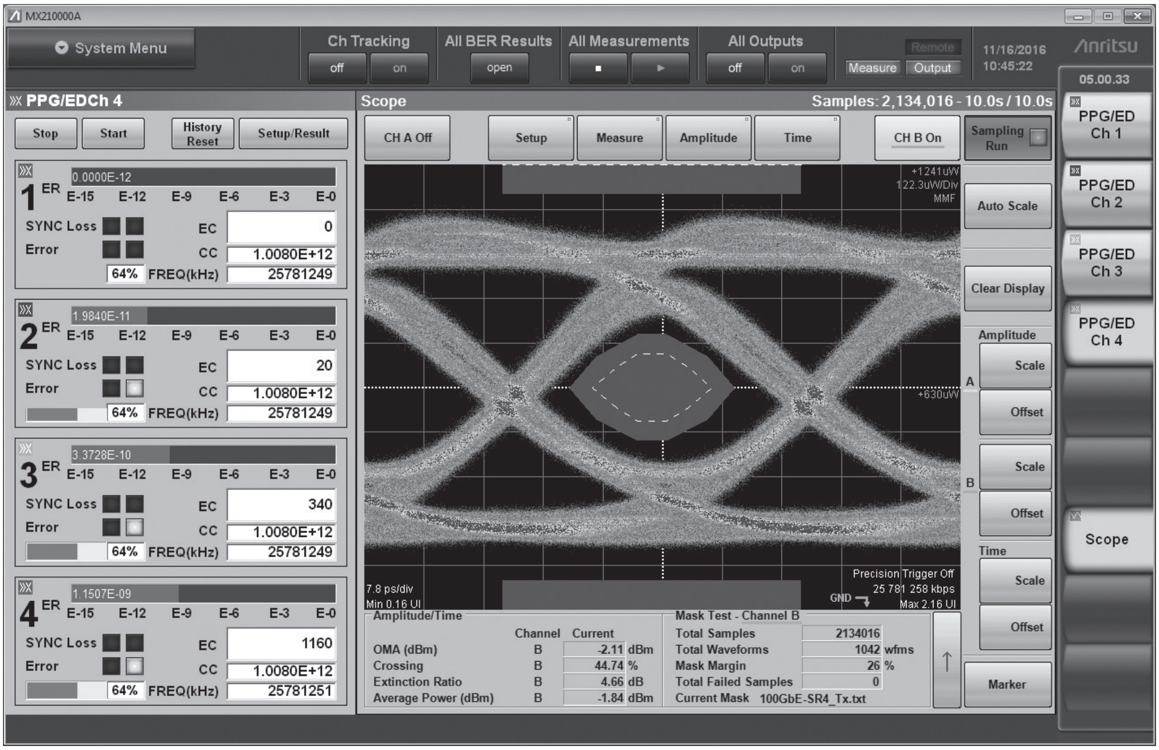
Previous measurement systems were extremely complex due to the need for a separate BERT as the signal source and a sampling oscilloscope for Eye pattern analysis. Incorporating a BERT and sampling oscilloscope into the All-in-one BERTWave MP2110A greatly simplifies measurement system configuration.

Installing the BERT and sampling-oscilloscope options for up to 4ch in one unit makes it easy to implement simultaneous TRx measurements of optical modules, such as multichannel QSFP, and devices using an easily configured and controlled measurement system. This helps cut growing measurement times as the number of channels increases with development of multichannel optical modules and devices.

Poor Efficiency, Long Time

No Switching Necessary, Simple Measurement System

With a BERT and sampling oscilloscope in one box, measurement results can be captured all at once along with simultaneous Eye pattern display. As a result, all the measurement results needed to evaluate multi-channel optical modules and devices can be seen at a glance, reducing measurement times by large margins.



Samples: 2,134,016 - 10.0s / 10.0s

	ER	EC	CC		FREQ(kHz)
1	0.0000E-12	0	1.0080E+12	64%	25781249
2	1.9840E-11	20	1.0080E+12	64%	25781249
3	3.3728E-10	340	1.0080E+12	64%	25781249
4	1.1507E-09	1160	1.0080E+12	64%	25781251

Amplitude/Time

	Channel	Current	
OMA (dBm)	B	-2.11	dBm
Crossing	B	44.74	%
Extinction Ratio	B	4.66	dB
Average Power (dBm)	B	-1.84	dBm

Mask Test - Channel B

Total Samples	2134016	
Total Waveforms	1042	wfms
Mask Margin	26	%
Total Failed Samples	0	

Current Mask 100GbE-SR4_Tx.txt

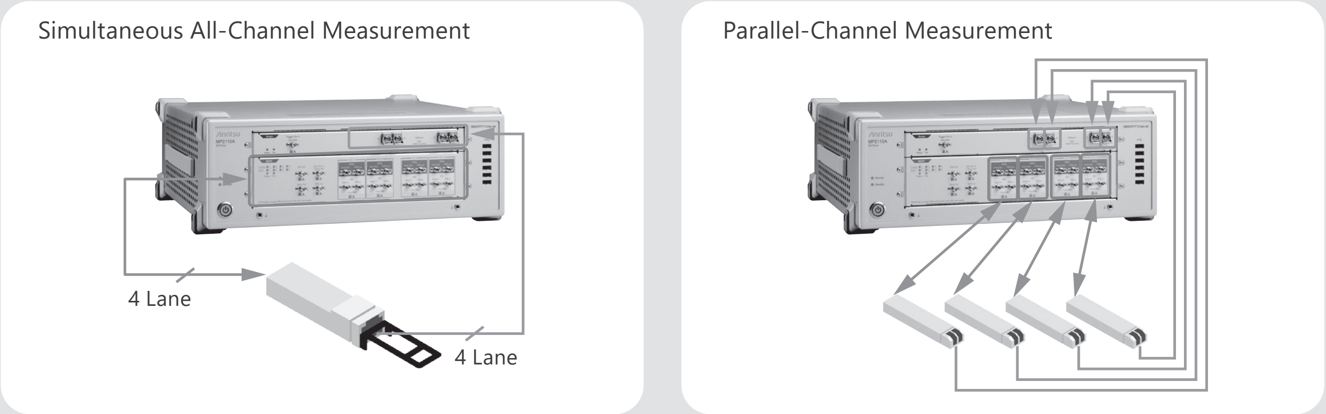
BER measurement results (left) and Eye Pattern analysis results (right) are displayed simultaneously.

Simply setting one channel of the MP2110A sets all channels simultaneously.

Operation is easy with simple settings and user interface. Remote commands are backwards-compatible with all BERTWave series, such as the MP2100B, facilitating instrument upgrades.

Configuring Efficient Measurement System: Both Simultaneous All-Channel and Individual-Channel Measurement

As well as all-at-once simultaneous measurement of all channels using the sampling oscilloscope and BERT, individual channels can be measured separately. An evaluation system matching the application can be configured easily because both multichannel modules and multiple single-channel modules can be measured all at once.



All-at-once test of quad-lane module using simultaneous measurement of all channels

↓

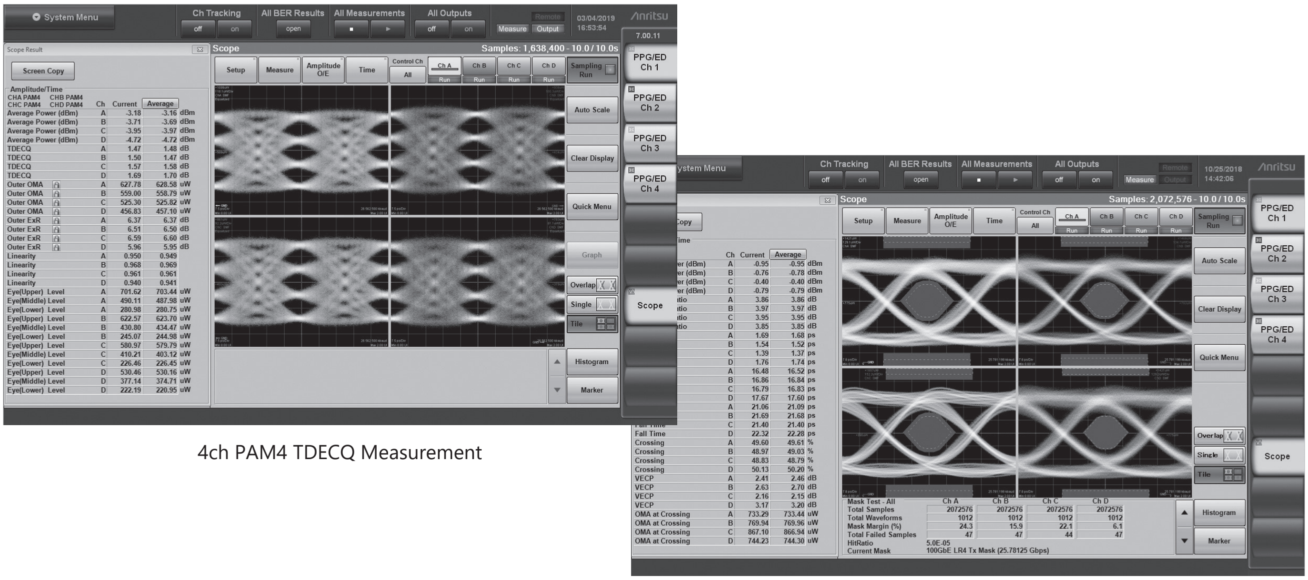
Shorter test times increase throughput

Parallel test of four single-lane modules using separate measurement of each channel

↓

Reduced cost per channel cuts capital investment

Supports both simultaneous and parallel test methods



Amplitude/Time
CHA PAM4 CHB PAM4
CHC PAM4 CHD PAM4

	Ch	Current	Average	
Average Power (dBm)	A	-3.18	-3.16	dBm
Average Power (dBm)	B	-3.71	-3.69	dBm
Average Power (dBm)	C	-3.95	-3.97	dBm
Average Power (dBm)	D	-4.72	-4.72	dBm
TDECQ	A	1.47	1.48	dB
TDECQ	B	1.50	1.47	dB
TDECQ	C	1.57	1.58	dB
TDECQ	D	1.69	1.70	dB
Outer OMA	A	627.78	628.58	uW
Outer OMA	B	559.00	558.79	uW
Outer OMA	C	525.30	525.82	uW
Outer OMA	D	456.83	457.10	uW
Outer ExR	A	6.37	6.37	dB
Outer ExR	B	6.51	6.50	dB
Outer ExR	C	6.59	6.60	dB
Outer ExR	D	5.96	5.95	dB
Linearity	A	0.950	0.949	
Linearity	B	0.968	0.969	
Linearity	C	0.961	0.961	
Linearity	D	0.940	0.941	
Eye(Upper) Level	A	701.62	703.44	uW
Eye(Middle) Level	A	490.11	487.98	uW
Eye(Lower) Level	A	280.98	280.75	uW
Eye(Upper) Level	B	622.57	623.70	uW
Eye(Middle) Level	B	430.80	434.47	uW
Eye(Lower) Level	B	245.07	244.98	uW
Eye(Upper) Level	C	580.97	579.79	uW
Eye(Middle) Level	C	410.21	403.12	uW
Eye(Lower) Level	C	226.46	226.45	uW
Eye(Upper) Level	D	530.46	530.16	uW
Eye(Middle) Level	D	377.14	374.71	uW
Eye(Lower) Level	D	222.19	220.95	uW

4ch PAM4 TDECQ Measurement

	Ch	Current	Average	
er (dBm)	A	-0.95	-0.95	dBm
er (dBm)	B	-0.76	-0.78	dBm
er (dBm)	C	-0.40	-0.40	dBm
er (dBm)	D	-0.79	-0.79	dBm
atio	A	3.86	3.86	dB
atio	B	3.97	3.97	dB
atio	C	3.95	3.95	dB
atio	D	3.85	3.85	dB
	A	1.69	1.68	ps
	B	1.54	1.52	ps
	C	1.39	1.37	ps
	D	1.76	1.74	ps
	A	16.48	16.52	ps
	B	16.86	16.84	ps
	C	16.79	16.83	ps
	D	17.67	17.60	ps
	A	21.06	21.09	ps
	B	21.69	21.68	ps
Fall Time	C	21.40	21.40	ps
Fall Time	D	22.32	22.28	ps
Crossing	A	49.60	49.61	%
Crossing	B	48.97	49.03	%
Crossing	C	48.83	48.79	%
Crossing	D	50.13	50.20	%
VECP	A	2.41	2.46	dB
VECP	B	2.63	2.70	dB
VECP	C	2.16	2.15	dB
VECP	D	3.17	3.20	dB
OMA at Crossing	A	733.29	733.44	uW
OMA at Crossing	B	769.94	769.96	uW
OMA at Crossing	C	867.10	866.94	uW
OMA at Crossing	D	744.23	744.30	uW

Mask Test - All	Ch A	Ch B	Ch C	Ch D
Total Samples	2072576	2072576	2072576	2072576
Total Waveforms	1012	1012	1012	1012
Mask Margin (%)	24.3	15.9	22.1	6.1
Total Failed Samples	47	47	44	47

HitRatio 5.0E-05
Current Mask 100GbE LR4 Tx Mask (25.78125 Gbps)

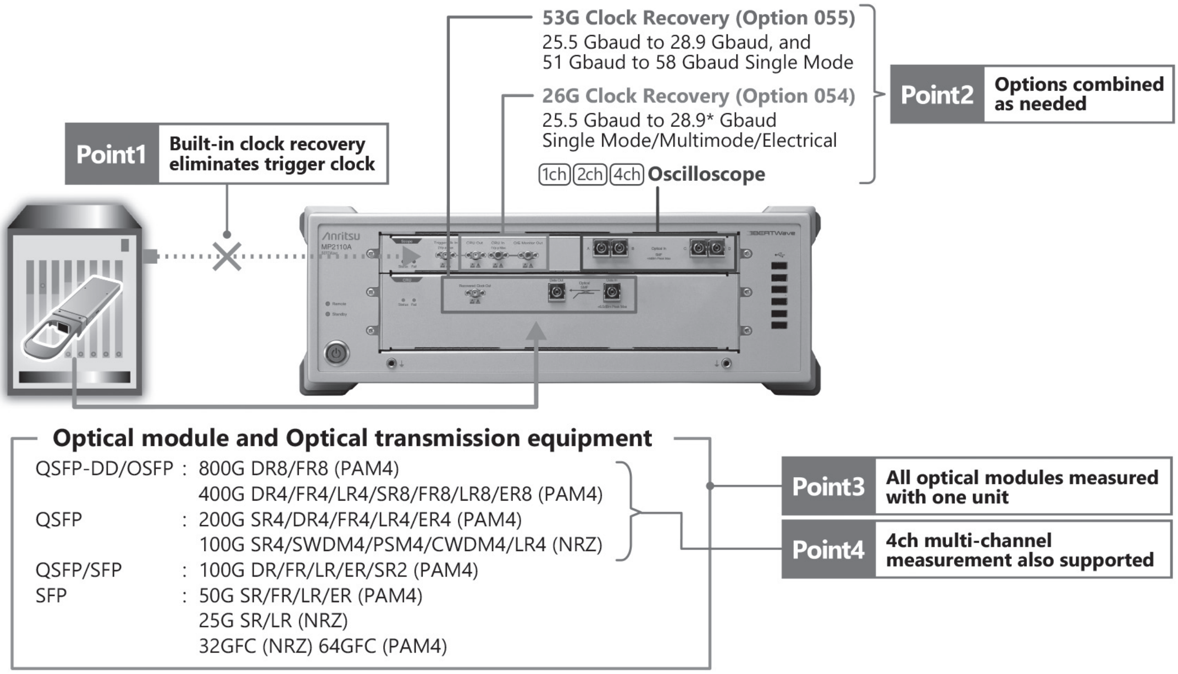
4ch NRZ Mask Margin Measurement

Supports both NRZ and PAM4

Configuring Efficient Measurement System: Built-in Clock Recovery

Accommodates Built-in NRZ/PAM4 Clock Recovery Unit (CRU)

Sampling oscilloscopes for signal waveform quality evaluation require a separate trigger clock signal synchronized with the data signal, but transmission equipment with built-in optical modules and 50G to 800G optical modules outputting PAM4 signals sometimes do not have a trigger signal. In this case, the trigger signal is generated from the data signal using clock recovery. This optional Clock Recovery Unit (CRU) can be installed in the BERTWave MP2110A Sampling Oscilloscope.



53G Clock Recovery (Option 055)
25.5 Gbaud to 28.9 Gbaud, and
51 Gbaud to 58 Gbaud Single Mode

26G Clock Recovery (Option 054)
25.5 Gbaud to 28.9* Gbaud
Single Mode/Multimode/Electrical

1ch 2ch 4ch **Oscilloscope**

Point2 **Options combined as needed**

Point1 **Built-in clock recovery eliminates trigger clock**

Optical module and Optical transmission equipment

QSFP-DD/OSFP : 800G DR8/FR8 (PAM4)
400G DR4/FR4/LR4/SR8/FR8/LR8/ER8 (PAM4)
QSFP : 200G SR4/DR4/FR4/LR4/ER4 (PAM4)
100G SR4/SWDM4/PSM4/CWDM4/LR4 (NRZ)
QSFP/SFP : 100G DR/FR/LR/ER/SR2 (PAM4)
SFP : 50G SR/FR/LR/ER (PAM4)
25G SR/LR (NRZ)
32GFC (NRZ) 64GFC (PAM4)

Point3 **All optical modules measured with one unit**

Point4 **4ch multi-channel measurement also supported**

MP2110A Optical Module Measurement Solution using Clock Recovery Options

Excellent Operability at Lower Cost

Since this clock recovery is built-in, it offers excellent operability at a lower price. The space-saving design and reduced need for complex cable connections as well as the easy-to-use settings help cut initial capital costs.

Wide Range of High-Performance Applications

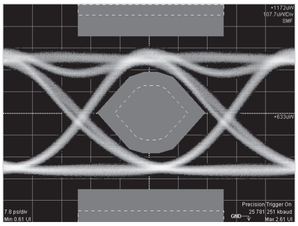
The following clock recovery unit options are available:

- Option 055: Supports 25.5 Gbaud to 28.9 Gbaud & 51 Gbaud to 58 Gbaud single mode
- Option 054: Supports 25.5 Gbaud to 28.9 Gbaud single mode/multimode/electrical

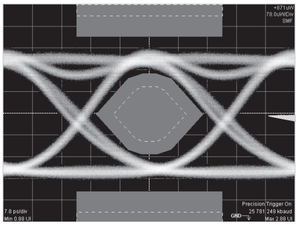
These options can be combined freely to configure a flexible test system matching the site requirements at optimum cost. When all options are installed, various types of 100/200/400 GbE optical modules can be evaluated without a trigger clock using one MP2110A unit.
In addition, combination with a 4ch oscilloscope supports all-at-once measurement using the recovered trigger signal to help cut evaluation times for multichannel optical modules.

High Performance

When using high-sensitivity modules, the impact of insertion loss on the data waveform is minimized by optimizing internal division ratios, demonstrating its usefulness when monitoring signal waveforms requiring high sensitivity. Additionally, there is no waveform degradation due to multimode splitting because Option 054 performs signal splitting for input to the CRU and oscilloscope using electrical signals after O/E conversion.



Without CRU



With CRU

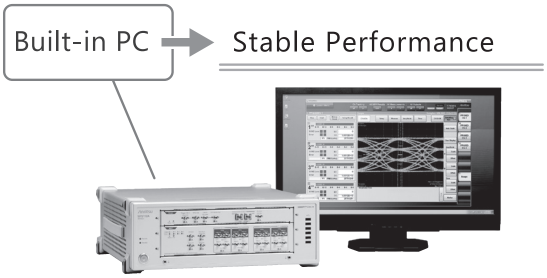
Almost no impact on Mask Margin*

*: Waveform comparison at –2 dBm input

Fast and Stable Measurement Performance

The MP2110A supports high-speed sampling at 250 ksamples/s. Measurement of 1 million samples can be completed in about 5 s, cutting pattern analysis time by about 65% compared to previous instruments.

The MP2110A requires no external Windows PC controller, because it has a built-in PC for measurement processing.
It supports high-speed processing irrespective of external PC controller specifications.



BERTWave MP2110A

More Accurate Performance Confirmation: Sampling Oscilloscope Performance

Sampling Oscilloscope Functions

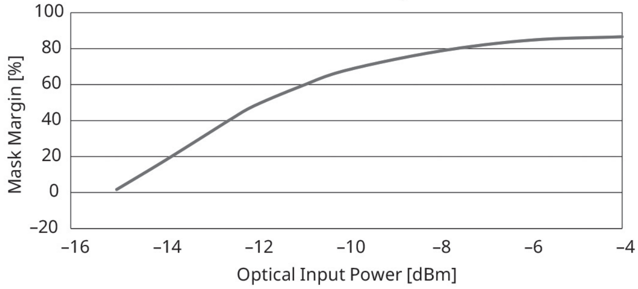
The MP2110A sampling oscilloscope has all the performance necessary for measuring optical modules such as 10G to 800G, and optical devices used by optical modules.

- Bandwidth:
  Optical: 35 GHz (SMF), 25 GHz (MMF)
  Electrical: 40 GHz

- High Sensitivity: –15 dBm (typ. SMF)*
- Low Noise: 3.4 μW (typ. SMF)
- Low-Jitter: 200 fs rms (typ.)

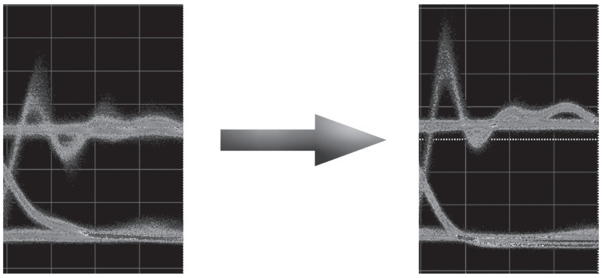
The low-noise and high-sensitivity O/E plus low-jitter trigger support more accurate measurements of narrow Eye openings of PAM4 signals as well as attenuated signals passing through optical switches, etc., helping improve production-line yields.

Mask Sensitivity*



* Estimated optical power when Mask Margin (Hit Count 0) reaches 0% (calculated from optical noise)

In comparison to conventional instruments, the wideband O/E draws accurate patterns of the characteristics of directly driven optical signals and optical modules for long-distance transmissions.



Conventional Instrument
(Filter Off)

MP2110A
(Filter Off)

More Accurate Performance Confirmation: BERT Performance

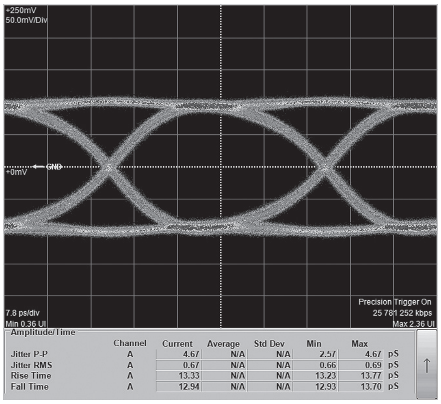
Wideband Operation Frequency

In the standard configuration, the MP2110A BERT operates at bit rates of 24.3 Gbit/s to 28.2 Gbit/s. This range can be extended optionally to support bit rates of 9.5 Gbit/s to 14.2 Gbit/s, enabling use for various applications including 10 GbE and 100 GbE.

PPG/ED Supported Bit Rates	Application Example
24.3 Gbit/s to 28.2 Gbit/s	32G Fibre Channel, CPRI (Option 10), InfiniBand EDR, 100 GbE, 100 GbE FEC, OTU4
9.5 Gbit/s to 14.2 Gbit/s (Option 093)	InfiniBand FDR/QDR, Fibre Channel (16G, 10G, 10G FEC), 10 GbE (WAN, LAN), 40 GbE (4 × 10 Gbit/s), CPRI (Option 8, 9), OC-192/STM-64, OC-192/STM-64 FEC (G.975), OTU1e, OTU2, OTU2e

Excellent PPG/ED Performance

The MP2110A PPG has a low data Jitter of 600 fs rms (typ.) for accurate measurement of the characteristics of optical modules, optical devices, etc. Additionally, the 25 mV (typ.) ED supports BER measurement of low-amplitude signals resulting from transmission path losses, helping improve DUT yields.



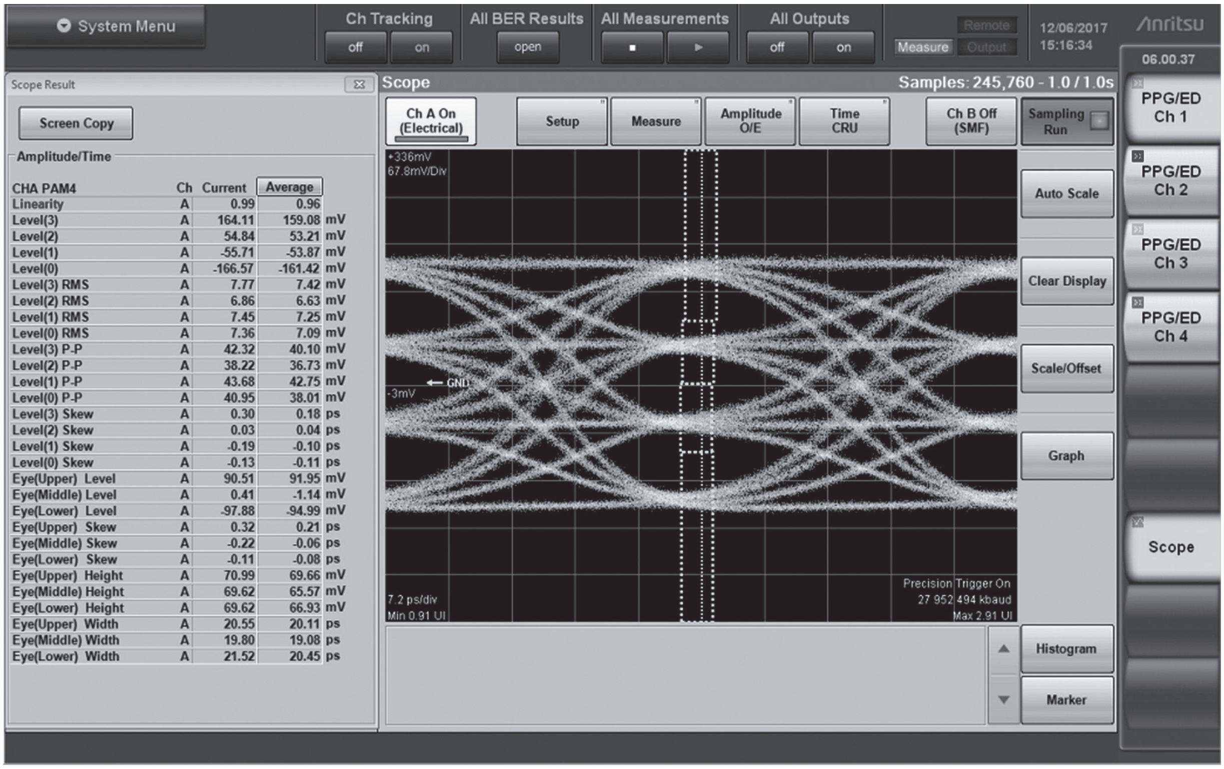
Amplitude/Time

	Channel	Current	Average	Std Dev	Min	Max	
Jitter P-P	A	4.67	N/A	N/A	2.57	4.67	pS
Jitter RMS	A	0.67	N/A	N/A	0.66	0.69	pS
Rise Time	A	13.33	N/A	N/A	13.23	13.77	pS
Fall Time	A	12.94	N/A	N/A	12.93	13.70	pS

Typical PPG Waveform, 25.78125 Gbit/s Electrical Loopback Waveform
(at PRBS 31, 200 mV Amplitude, and Precision Trigger Option On)

Full Range of Measurement Functions (Sampling Oscilloscope)

Sampling oscilloscope supports both NRZ and PAM4 analysis.



Amplitude/Time

CHA PAM4	Ch	Current	Average	
Linearity	A	0.99	0.96	
Level(3)	A	164.11	159.08	mV
Level(2)	A	54.84	53.21	mV
Level(1)	A	-55.71	-53.87	mV
Level(0)	A	-166.57	-161.42	mV
Level(3) RMS	A	7.77	7.42	mV
Level(2) RMS	A	6.86	6.63	mV
Level(1) RMS	A	7.45	7.25	mV
Level(0) RMS	A	7.36	7.09	mV
Level(3) P-P	A	42.32	40.10	mV
Level(2) P-P	A	38.22	36.73	mV
Level(1) P-P	A	43.68	42.75	mV
Level(0) P-P	A	40.95	38.01	mV
Level(3) Skew	A	0.30	0.18	ps
Level(2) Skew	A	0.03	0.04	ps
Level(1) Skew	A	-0.19	-0.10	ps
Level(0) Skew	A	-0.13	-0.11	ps
Eye(Upper) Level	A	90.51	91.95	mV
Eye(Middle) Level	A	0.41	-1.14	mV
Eye(Lower) Level	A	-97.88	-94.99	mV
Eye(Upper) Skew	A	0.32	0.21	ps
Eye(Middle) Skew	A	-0.22	-0.06	ps
Eye(Lower) Skew	A	-0.11	-0.08	ps
Eye(Upper) Height	A	70.99	69.66	mV
Eye(Middle) Height	A	69.62	65.57	mV
Eye(Lower) Height	A	69.62	66.93	mV
Eye(Upper) Width	A	20.55	20.11	ps
Eye(Middle) Width	A	19.80	19.08	ps
Eye(Lower) Width	A	21.52	20.45	ps

Selection of displays for up to 32 measurement items supports confirmation of multiple PAM measurement results at one screen. Additionally, all measurement results, including items not displayed on-screen, can be captured simultaneously using remote control.

NRZ

Average Power (dBm, mW)*1
Mask Margin (%)
Extinction Ratio (dB)*1
OMA (dBm, mW)*1, VMA (mV)*2
VECP (dB)
RIN OMA (dB/Hz)*1, *4
TDEC (dB)*3
One Level, Zero Leve l (µW, mV)*6
Eye Amplitude, Eye Height (µW, mV)*6
Eye Height Ratio
Crossing (%)
SNR
Jitter P-P, RMS (ps)
Rise Time, Fall Time (ps)
Eye Width (ps)
DCD (%)

NRZ Jitter (Option 096)

TJ (J2, J4, J9, User Defined BER), Eye Opening (mUI)
RJ RMS (d-d), RJ RMS (mUI)*5
DJ (d-d) (mUI)
PJ P-P (mUI)*5, PJ Frequency (kHz)*5
DDJ P-P (mUI)*5, DDPWS (mUI)*5
DCD (mUI)*5
ISI P-P (mUI)*5

PAM4 (Option 095)

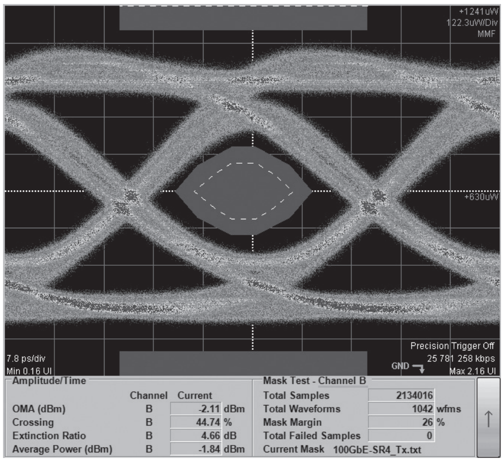
Average Power (dBm, mW)*1
TDECQ, Partial TDECQ, Ceq (dB)
Noise Margin, Partial Noise Margin (µW, mV)*6
Outer Extinction Ratio (dB)*1
Outer OMA (dBm, µW)*1, Outer VMA (mV)*2
RIN OMA (dB/Hz)*1
Transition Time (Rise/Fall/Slowest) (ps)
Over/Under-shoot (%)
Peak-to-Peak Power (dBm)*1
Power Excursion (dBm)
Linearity
Levels 0/1/2/3 (µW, mV)*6
Levels P-P, RMS 0/1/2/3 (µW, mV)*6
Level Skews 0/1/2/3 (ps)
Eye Levels Upper/Middle/Lower (µW, mV)*6
Eye Heights Upper/Middle/Lower (µW, mV)*6
Eye Widths Upper/Middle/Lower (ps)
Eye Skews Upper/Middle/Lower (ps)

*1: Optical channel only
*2: Electrical channel only
*3: No IEEE-compliant 12.6-GHz hardware filter
*4: Option 095 or Option 098
*5: Enabled when Advanced Jitter Mode
*6: µW for optical channels and mV for electrical channels

NRZ Mask Margin Measurement

Testing is simple because Mask Margin tests are performed automatically. Furthermore, since the time required for Mask Margin tests is only about 1 second, line productivity is improved because standards-compliant measurements are performed at high speed in a shorter time.

- Automatic measurement within 1 second
- Real-time margin measurements
- Selectable Count and Rate at Mask Hit



Amplitude/Time

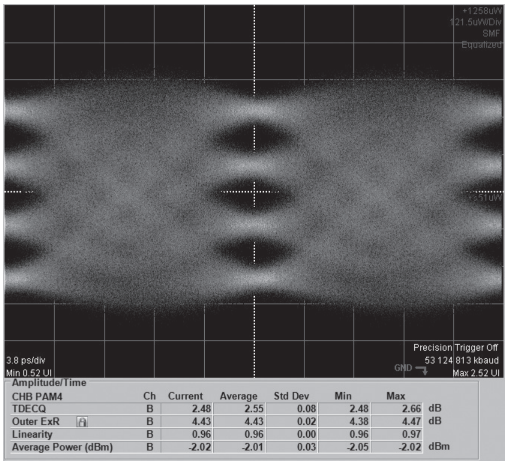
	Channel	Current	
OMA (dBm)	B	-2.11	dBm
Crossing	B	44.74	%
Extinction Ratio	B	4.66	dB
Average Power (dBm)	B	-1.84	dBm

Mask Test - Channel B

Total Samples	2134016	
Total Waveforms	1042	wfms
Mask Margin	26	%
Total Failed Samples	0	
Current Mask	100GbE-SR4_Tx.txt	

PAM4 TDECQ Measurement (Option 095)

Easy capture of measurement results without complex settings. The low-noise (3.4 µW, typ.) high-sensitivity oscilloscope supports high-reproducibility measurement of even small Eye margin PAM4 signals. High-speed sampling shortens the time required for data collection for TDECQ analysis. Shorter measurement times help improve productivity even at PAM4 signal evaluation.



Amplitude/Time

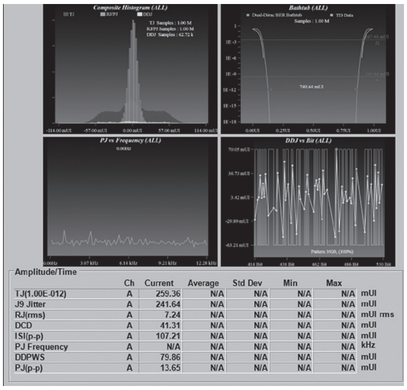
CHB PAM4	Ch	Current	Average	Std Dev	Min	Max	
TDECQ	B	2.48	2.55	0.08	2.48	2.66	dB
Outer ExR	B	4.43	4.43	0.02	4.38	4.47	dB
Linearity	B	0.96	0.96	0.00	0.96	0.97	
Average Power (dBm)	B	-2.02	-2.01	0.03	-2.05	-2.02	dBm

53 Gbaud PAM4 TDECQ Measurement

NRZ Jitter Analysis (Option 096)

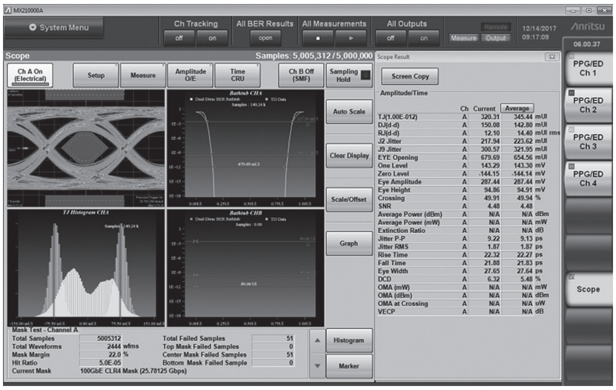
This option supports separate analysis of Jitter components such as TJ, DJ, RJ, etc., with display in various graph formats.

- Fast, easy J2/J9/etc. measurements for manufacturing inspections (Eye Mode)
- Detailed analyses for DJ (Advanced Jitter Mode)
- Simultaneous Jitter Analysis and Eye Mask tests help cut measurement times



Amplitude/Time

	Ch	Current	Average	Std Dev	Min	Max	
TJ(1.00E-012)	A	259.36	N/A	N/A	N/A	N/A	mUI
J9 Jitter	A	241.64	N/A	N/A	N/A	N/A	mUI
RJ(rms)	A	7.24	N/A	N/A	N/A	N/A	mUI rms
DCD	A	41.31	N/A	N/A	N/A	N/A	mUI
ISI(p-p)	A	107.21	N/A	N/A	N/A	N/A	mUI
PJ Frequency	A	N/A	N/A	N/A	N/A	N/A	kHz
DDPWS	A	79.86	N/A	N/A	N/A	N/A	mUI
PJ(p-p)	A	13.65	N/A	N/A	N/A	N/A	mUI



Amplitude/Time

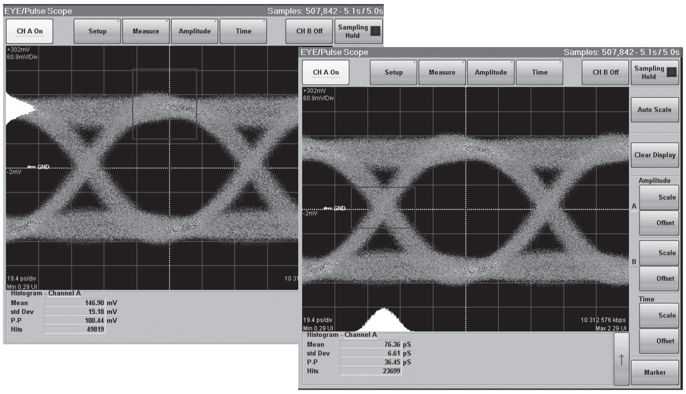
	Ch	Current	Average	
TJ(1.00E-012)	A	320.31	345.44	mUI
DJ(d-d)	A	150.08	142.80	mUI
RJ(d-d)	A	12.10	14.40	mUI rms
J2 Jitter	A	217.94	223.62	mUI
J9 Jitter	A	300.57	321.95	mUI
EYE Opening	A	679.69	654.56	mUI
One Level	A	143.29	143.30	mV
Zero Level	A	-144.15	-144.14	mV
Eye Amplitude	A	287.44	287.44	mV
Eye Height	A	94.86	94.91	mV
Crossing	A	49.91	49.94	%
SNR	A	4.48	4.48	
Average Power (dBm)	A	N/A	N/A	dBm
Average Power (mW)	A	N/A	N/A	mW
Extinction Ratio	A	N/A	N/A	dB
Jitter P-P	A	9.22	9.13	ps
Jitter RMS	A	1.87	1.87	ps
Rise Time	A	22.32	22.27	ps
Fall Time	A	21.88	21.83	ps
Eye Width	A	27.65	27.64	ps
DCD	A	6.32	5.48	%
OMA (mW)	A	N/A	N/A	mW
OMA (dBm)	A	N/A	N/A	dBm
OMA at Crossing	A	N/A	N/A	uW
VECP	A	N/A	N/A	dB

Mask Test - Channel A

Total Samples	5005312		Total Failed Samples	51
Total Waveforms	2444	wfms	Top Mask Failed Samples	0
Mask Margin	22.0	%	Center Mask Failed Samples	51
Hit Ratio	5.0E-05		Bottom Mask Failed Sample	0
Current Mask	100GbE CLR4 Mask (25.78125 Gbps)			

Histogram Measurement

Troubleshooting is made easier because waveform data component analysis can be performed using the mean, standard error, and scatter within the set data distribution.



Histogram - Channel A

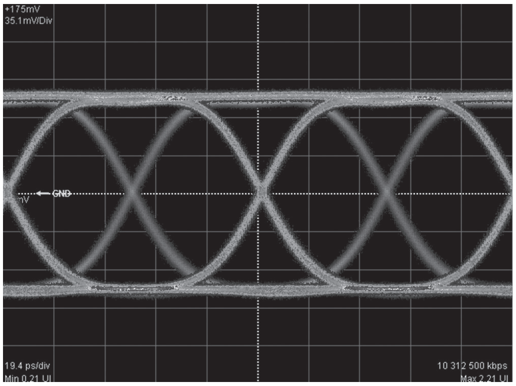
Mean	146.90	mV
std Dev	15.18	mV
P-P	100.44	mV
Hits	49819	

Histogram - Channel A

Mean	76.36	pS
std Dev	6.61	pS
P-P	36.45	pS
Hits	23699	

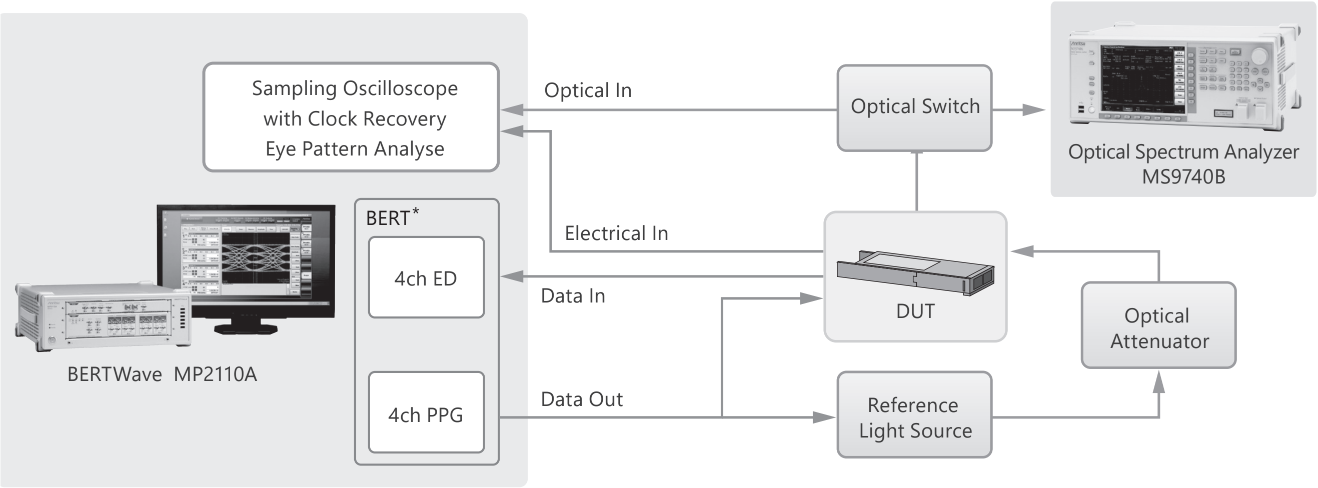
Reference Trace Function

Saving measured waveform data for reference enables comparison of current data with previous data.



Application Examples

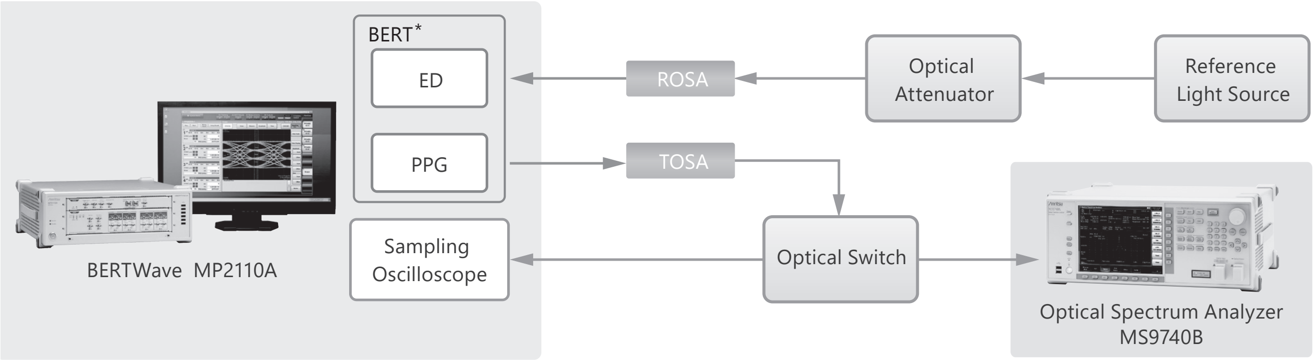
Multi-channel Optical Module Evaluation



Required Test Items

- Rx Electrical Signal Eye Pattern Analysis (NRZ: Mask Margin, Jitter, Tr/Tf, etc.)
- Tx Optical Signal Eye Pattern Analysis
  (Optical Power, NRZ: Mask Margin, Jitter, Tr/Tf, Extinction Ratio, PAM4: TDECQ, Outer OMA/Extinction Ratio, Linearity etc.)
- Rx Signal Rx Sensitivity Test (BER Measurement)

TOSA/ROSA Evaluation

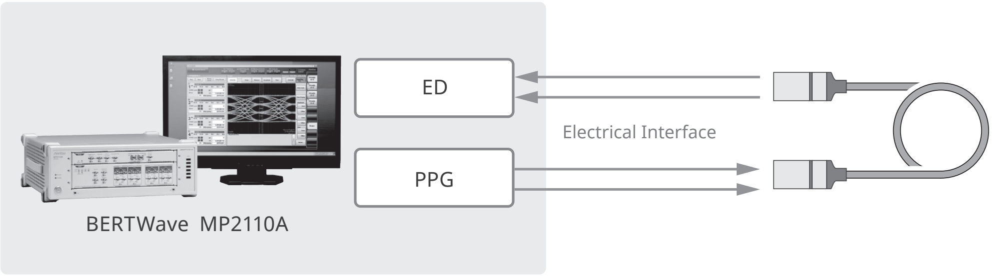


Required Test Items

- Tx Optical Signal Eye Pattern Analysis
  (Optical Power, NRZ: Mask Margin, Jitter, Tr/Tf, Extinction Ratio, PAM4: TDECQ, Outer OMA/Extinction Ratio, Linearity etc.)
- Rx Signal Rx Sensitivity Test (BER Measurement)

*: Use MP1900A/MP1800A PPG/ED, etc., at PAM4 signal evaluation.

Active Optical Cables (AOC)/Direct Attach Cables (DAC) Evaluation



Required Test Items

- 4ch Simultaneous BER Measurement (Crosstalk Test)
- Differential Electrical Signal Eye Pattern Analysis
- Differential Electrical Signal Jitter Analysis

NRZ/PAM4 Differential Electrical Signal Evaluation

The Eye pattern of differential electrical signals can be analyzed using the Differential Electrical Channel Oscilloscope (Option 021) and Signal Processing Option (Option 098).
- A standards-compliant band filter and equalizer, such as CTLE, can be applied.
- The measurement system, such as cables, can be calibrated using the De-embedding function.

Additionally, installing the Clock Recovery Unit (CRU, Option 054) eliminates the need to provide a trigger signal.

Specifications

Common

Operating System		Windows 10
Internal Storage Devices		SSD (60 GB or more)
Input and Output		HDMI, Display Port USB2.0 × 6 (Front), USB3.0 × 4 (Rear) Ethernet × 2 (10/100/1000BASE-T) GPIB
Remote Control		Ethernet, GPIB
Power Voltage		100 VAC to 240 VAC, 50 Hz/60 Hz
Power Consumption		300 VA max.
Operating Temperature		+5°C to +40°C
Storage Temperature		–20°C to +60°C
Dimensions		422 (W) × 142.5 (H) × 389.4 (D) mm (excluding projections)
Mass		11 kg max.
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000:2018

BERT

Operation Bit Rates		24.3 Gbit/s to 28.2 Gbit/s 9.5 Gbit/s to 14.2 Gbit/s (Option 093)
Number of Channels		1, 2, 4 (Differential)
Connector		K (f)
Output	Amplitude	0.1 Vp-p to 0.8 Vp-p (Single-end) 0.2 Vp-p to 1.6 Vp-p (Differential)
	Jitter	600 fs rms (typ.)
	Tr/Tf (20 to 80%)	15 ps (typ.)
Input	Amplitude	0.05 Vp-p to 0.8 Vp-p
	Sensitivity	25 mVp-p (typ.)
Test Pattern		PRBS7, PRBS9, PRBS15, PRBS23, PRBS31 1/2 Clock Pattern, 1/16 Clock Pattern (Output Only)

Sampling Oscilloscope

Optical Channel	Wavelength Range	SMF: 860 nm to 1650 nm, MMF: 800 nm to 860 nm
	Bandwidth	SMF: 35 GHz, MMF: 25 GHz (typ.)
	RMS Noise	SMF: 3.4 µW, MMF: 6.7 µW (typ.)
	Reference Receiver Filter (NRZ)	Built-in: 100 GbE, 100 GbE FEC, OTU4, 32GFC
Electrical Channel	Bandwidth	40 GHz (typ.)
	RMS Noise	1.5 mV (typ.)
Jitter		400 fs rms (typ.), 200 fs rms (typ., Precision Trigger MP2110A-024 On)
Sampling Rate		250 ksamples/s (nominal)
Clock Recovery (Option)		NRZ/PAM4, 25.5 Gbaud to 28.9 Gbaud, 51 Gbaud to 58 Gbaud

Selection Guide

Function and Selection Conditions							Selection/Option Addition
MP2110A	Upper slot	Oscilloscope	Select any one.	1/2ch	Electrical 2ch		021
					Optical SMF/MMF 1ch + Electrical 1ch		043 (or 033*)
					Optical SMF 1ch		045 (or 035*)
					Optical MMF 1ch		046 (or 036*)
					Optical SMF/MMF 2ch		042 (or 032*)
					Select additions.	Precision Trigger	024
				4ch	Optical SMF Input 4ch	Low Noise 1310/1550 nm, 850-940 nm support	040+061
						1310/1550 nm	040 (or 030*)
					Optical MMF Input 4ch	Low Noise 850 nm	049 (or 039*)
			Select additions.	Clock Recovery	SMF/MMF/Electrical, 26G (25.5G to 28.2G)		054
					Select additions.	28.2G to 28.9G Rate Extension	059
				Software	Optical Channel	Fast Pattern Lock Waveform data export Digital Filter RIN OMA	098 or 095
					Electrical Channel	Fast Pattern Lock Waveform data export Differential Skew Adjustment (Software)	
						Digital Filter Embedding/De-embedding CTLE	098
					NRZ Jitter Analysis		096
					PAM4 Analysis, TDECQ Equalizer		095
	Lower slot	Select any one.	Clock Recovery		SMF, 26G/53G (25.5G to 28.9G, 51G to 58G)		055
			BERT	Select any one.	1ch		011
					2ch		012
					4ch		014
				Select additions.	10G Rate Extension		093

*: Only the reference receiver characteristics (bessel filter approximation characteristics) of hardware filter are different for Option 04x and Option 03x.

Ordering Information

When making a contract, determine the configuration by referencing the selection guide and specify the type, model, name, and quantity.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MP2110A	BERTWave
	Standard Accessories
J1627A	Power Cord GND Connection Cable: 1 MX210000A BERTWave Control Software CD-ROM: 1
	Options
MP2110A-011	1ch BERT
MP2110A-012	2ch BERT
MP2110A-014	4ch BERT
MP2110A-021	Dual Electrical Scope
MP2110A-024	Precision Trigger
MP2110A-030	Quad Optical Scope for Singlemode Baseband Flat
MP2110A-032	Dual Optical Scope Baseband Flat
MP2110A-033	Optical and Single-ended Electrical Scope Baseband Flat
MP2110A-035	Optical Scope for Singlemode Baseband Flat
MP2110A-036	Optical Scope for Multimode Baseband Flat
MP2110A-039	Quad Optical Scope for Multimode Baseband Flat
MP2110A-040	Quad Optical Scope for Singlemode
MP2110A-061	Low Noise and Multimode Support for Opt.040
MP2110A-042	Dual Optical Scope
MP2110A-043	Optical and Single-ended Electrical Scope
MP2110A-045	Optical Scope for Singlemode
MP2110A-046	Optical Scope for Multimode
MP2110A-049	Quad Optical Scope for Multimode
MP2110A-054	Clock Recovery (Electrical/Optical)
MP2110A-055	26G/53Gbaud Clock Recovery (SM Optical)
MP2110A-059	25G Clock Recovery Range Extension
MP2110A-060	Optical Scope Custom Gain Adjustment
MP2110A-093	PPG/ED Bit Rate Extension
MP2110A-095	PAM4 Analysis Software
MP2110A-096	Jitter Analysis Software
MP2110A-098	Signal Processing Software

Model/Order No.	Name
	Retrofit Options[*1, *2]
MP2110A-110	Windows10 Upgrade Retrofit[*3]
MP2110A-111	1ch BERT Retrofit
MP2110A-112	2ch BERT Retrofit
MP2110A-114	4ch BERT Retrofit
MP2110A-121	Dual Electrical Scope Retrofit
MP2110A-124	Precision Trigger Retrofit
MP2110A-130	Quad Optical Scope for Singlemode Baseband Flat Retrofit
MP2110A-132	Dual Optical Scope Baseband Flat Retrofit
MP2110A-133	Optical and Single-ended Electrical Scope Baseband Flat Retrofit
MP2110A-135	Optical Scope for Singlemode Baseband Flat Retrofit
MP2110A-136	Optical Scope for Multimode Baseband Flat Retrofit
MP2110A-139	Quad Optical Scope for Multimode Baseband Flat Retrofit
MP2110A-140	Quad Optical Scope for Singlemode Retrofit
MP2110A-142	Dual Optical Scope Retrofit
MP2110A-143	Optical and Single-ended Electrical Scope Retrofit
MP2110A-145	Optical Scope for Singlemode Retrofit
MP2110A-146	Optical Scope for Multimode Retrofit
MP2110A-149	Quad Optical Scope for Multimode Retrofit
MP2110A-154	Clock Recovery (Electrical/Optical) Retrofit
MP2110A-155	26G/53Gbaud Clock Recovery (SM Optical) Retrofit[*4]
MP2110A-159	25G Clock Recovery Range Extension Retrofit[*5]
MP2110A-359	25G Clock Recovery Range Extension Retrofit[*5]
MP2110A-193	PPG/ED Bit Rate Extension Retrofit
MP2110A-195	PAM4 Analysis Software Retrofit
MP2110A-395	PAM4 Analysis Software Retrofit[*6]
MP2110A-196	Jitter Analysis Software Retrofit
MP2110A-396	Jitter Analysis Software Retrofit
MP2110A-198	Signal Processing Software Retrofit
MP2110A-398	Signal Processing Software Retrofit[*7]

Continued on next page

*1: BERT retrofit supported when BERT not installed or to increase number of channels
*2: Oscilloscope retrofit supported when oscilloscope not installed or when changing Option 03x and 04x, same channel configuration.
*3: This option upgrades the Windows Embedded Standard 7 to the Windows 10 Enterprise LTSC. It is performed by Anritsu factory or service center return.
*4: Option 055 can be retrofitted when the BERT is not installed.
*5: If Option 054 is already installed, option 159/359 can be ordered for serial numbers 6262201559 or larger.
*6: Option 395 can be ordered for serial numbers 6261844875 or larger.
*7: Option 398 can be ordered only for optical-channel configurations, or for serial numbers 6272280900 or larger.

In addition, refer to Selection Guide for any restrictions on option configurations.

Model/Order No.	Name	
	Standard Accessories MP2110A-011	
J1632A	Terminator:	3
J1341A	Open:	5
	Standard Accessories MP2110A-012	
J1632A	Terminator:	5
J1341A	Open:	7
	Standard Accessories MP2110A-014	
J1632A	Terminator:	9
J1341A	Open:	11
	Standard Accessories MP2110A-021	
J1341A	Open:	3
	Standard Accessories MP2110A-030/032/039/040/042/049	
J0617B	Replaceable Optical Connector (FC-PC):	4
Z0397A	FC ADAPTER CAP:	4
J1341A	Open:	1
	Standard Accessories MP2110A-033/043	
J0617B	Replaceable Optical Connector (FC-PC):	2
Z0397A	FC ADAPTER CAP:	2
J1341A	Open:	2
	Standard Accessories MP2110A-035/036/045/046	
J0617B	Replaceable Optical Connector (FC-PC):	1
Z0397A	FC ADAPTER CAP:	1
J1341A	Open:	1
	Standard Accessories MP2110A-054	
J1632A	Terminator (Only for optical channel):	1
J1341A	Open:	2
J1763A	U Link Coaxial Cable (K):	1
J1764A	U Link Coaxial Cable (SMA):	1
	Standard Accessories MP2110A-055	
J1341A	Open:	1
Z0397A	FC ADAPTER CAP:	2
	Maintenance Service	
MP2110A-ES310	3 Years Extended Warranty Service	
MP2110A-ES510	5 Years Extended Warranty Service	

Model/Order No.	Name
	Optional Accessories
J1341A	Open (Coaxial connector cover)
J1632A	Terminator
J1359A	Coaxial Adaptor (K-P · K-J, SMA compatible)
J1349A	Coaxial Cable (0.3 m, SMA connector)
J1342A	Coaxial Cable (0.8 m, SMA connector)
J1343A	Coaxial Cable (1 m, SMA connector)
J1439A	Coaxial Cable (0.8 m, K connector)
J1551A	Coaxial Skew Match Cable (0.8 m, K connector)
J1763A	U Link Coaxial Cable for Option 054 (K connector)
J1764A	U Link Coaxial Cable for Option 054 (SMA connector)
J1819A	U Link Coaxial Cable for Option 055 (SMA connector)
J1510A	Pick OFF Tee
Z0397A	FC ADAPTER CAP
J1824A	Fixed Optical Attenuator (SM, 1 dB)
J1825A	Fixed Optical Attenuator (SM, 2 dB)
J1826A	Fixed Optical Attenuator (SM, 3 dB)
J1827A	Fixed Optical Attenuator (SM, 5 dB)
J0617B	Replaceable Optical Connector (FC-PC)
J0618D	Replaceable Optical Connector (ST)
J0618E	Replaceable Optical Connector (DIN)
J0619B	Replaceable Optical Connector (SC)
J0635A	FC/PC-FC/PC-1M-SM
J1139A	FC/PC-LC/PC-1M-SM
J1344A	LC/PC-LC/PC-1M-SM
J1345A	SC/PC-LC/PC-1M-SM
J0660A	SC/PC-SC/PC-1M-SM
J0893A	FC/PC-FC/PC-1M-GI (50/125)
J1347A	FC/PC-LC/PC-1M-GI (62.5/125)
J1346A	LC/PC-LC/PC-1M-GI (62.5/125)
J1348A	SC/PC-LC/PC-1M-GI (62.5/125)
J0839A	SC/PC-SC/PC-1M-GI (50/125)
J1519A	Optical Fiber Cord (MM, 12FIBER, MPO,3 m)
J1681A	MPO Loopback Cable
J1682A	MPO to FC convert cable
G0364A	100G LR4 1310 nm QSFP28
G0366A	100G SR4 850 nm QSFP28
Z0914A	Ferrule Cleaner
Z0915A	Replacement Reel for Ferrule Cleaner
G0306C	Video Inspection Probe
G0342A	ESD DISCHARGER
Z0306A	Wrist Strap
Z0541A	USB Mouse
Z1944A	LCD Monitor
B0734A	Carrying Case
B0735A	Rack Mount Kit
W3831AE	MP2110A BERTWave Operation Manual
W3773AE	BERTWave Series Remote Control Operation Manual

TRANSPORT AND ETHERNET TESTING

Selection Guide

Interface

Model Interface	MT1040A/MU104014A/ MU104015A	MT1000A/MU100010A	MT1000A/MU100011A	MT9090A/MU909060Ax
10M/100M/Gigabit Ethernet	✓	✓	✓	✓
10 Gigabit Ethernet	✓	✓	✓	
25 Gigabit Ethernet	✓		✓	
40 Gigabit Ethernet	✓		✓	
100 Gigabit Ethernet	✓		✓	
400 Gigabit Ethernet	✓			
OTU1, OTU2	✓	✓	✓	
OTU1e, 2e, 1f, 2f	✓	✓	✓	
OTU3, 3e1, 3e2, 4	✓		✓	
STM-1, 4, 16, 64/OC-3, 12, 48, 192	✓	✓	✓	
STM-256/OC-768	✓			
eCPRI/RoE (IEEE1914.3)	✓	✓	✓	
CPRI Option 1, 2, 3, 4, 5, 6, 7, 8	✓	✓	✓	
CPRI Option 9, 10	✓		✓	
OBSAI 1X, 2X, 3X, 4X, 8X	✓	✓	✓	
DS1, DS3, E1, E3, E4		✓		
1G, 2G, 4G, 8G, 10G FC	✓	✓	✓	
16G FC	✓		✓	

Measurement Functions

Model Measurement Functions		MT1040A/MU104014A/ MU104015A	MT1000A/MU100010A	MT1000A/MU100011A	MT9090A/MU909060Ax
Ethernet	Packet Capture	✓	✓	✓	
	Protocol Decoding	✓	✓	✓	
	Protocol Emulation	✓	✓	✓	
	RFC 2544 Automatic Test	✓	✓	✓	✓
	Y.1564 Automatic Test	✓	✓	✓	✓
	RFC 6349 Automatic Test (Up to 10G)	✓	✓	✓	
	Through Mode	✓	✓	✓	✓
	Traffic Monitor	✓	✓	✓	✓
	Full Wire Rate Transmission	✓	✓	✓	✓
	Packet BER Measurement	✓	✓	✓	✓
	Latency	✓	✓	✓	✓
	SyncE		✓	✓	
	IEEE 1588 v2		✓	✓	
OTN/SDH/SONET	OTN Frame	✓	✓	✓	
	SDH/SONET Frame	✓	✓	✓	
	Tandem Connection Pattern G.707	✓	✓	✓	
	Automatic Protection Switch	✓	✓	✓	
	PDH Mapping	✓	✓	✓	
	DSn Mapping	✓	✓	✓	
	GMP Mapping	✓	✓	✓	
	Through Mode	✓	✓	✓	
	Optical Power Measurements	✓	✓	✓	
	Frequency Offset	✓	✓	✓	
	Client Signal Test over OTN	✓	✓	✓	
Mobile xHaul/eCPRI/ RoE (IEEE1914.3)	Full Wire Rate Transmission	✓	✓	✓	
	Packet BER Measurement	✓	✓	✓	
	Latency	✓	✓	✓	
	SyncE		✓	✓	
	IEEE 1588 v2		✓	✓	
Mobile xHaul/CPRI	BERT	✓	✓	✓	
	Error/Alarm Transmission	✓	✓	✓	
	Passive Link Confirmation Test	✓	✓	✓	
	APS	✓	✓	✓	
	Pass Through	✓	✓	✓	
Mobile xHaul/OBSAI	BERT	✓	✓	✓	
	Error/Alarm Transmission	✓	✓	✓	
	APS	✓	✓	✓	
PDH/DSn	Frequency Measurements		✓		
	Error Measurement (G.821, etc.)		✓		
Fibre Channel	BERT	✓	✓	✓	
	Performance Test	✓	✓	✓	
	Reflector	✓	✓	✓	
Remote Control	GUI	✓	✓	✓	✓
	Command	✓	✓	✓	
	Site Over Remote Access	✓	✓	✓	

MT1040A Network Master Pro

MU104014A 400G (QSFP-DD) Multirate Module
MU104015A 400G (OSFP) Multirate Module
MU104011A 100G Multirate Module

Remote Control
Cloud OPTION | WLAN | Bluetooth | Ethernet | USB

Redefining Transport Testing

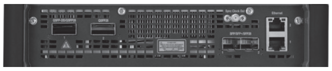
Network Master Pro

Entire Network I&M

The modular design of the Network Master Pro MT1040A platform makes it easy to support I&M for different network configurations. Furthermore, options for each test function can be selected and added as necessary to match the work schedule, helping cut initial capital costs.

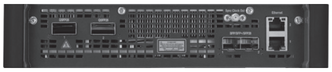
Measurement Modules

	QSFP-DD/ QSFP28/ QSFP+	OSFP	QSFP28/ SFP+	SFP28/ SFP+/SFP	RJ45
MU104014A	1 port		1 port	2 ports	2 ports
MU104015A		1 port	1 port	2 ports	2 ports
MU104011A			2 ports	2 ports	2 ports

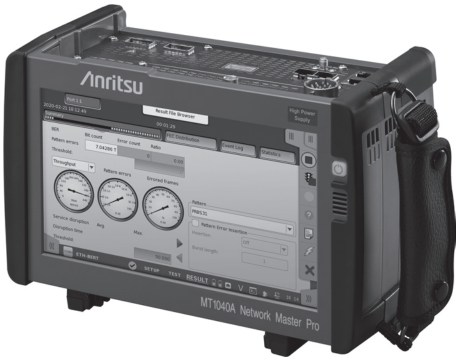


400G (QSFP-DD) Multirate Module
MU104014A

400G (OSFP) Multirate Module
MU104015A

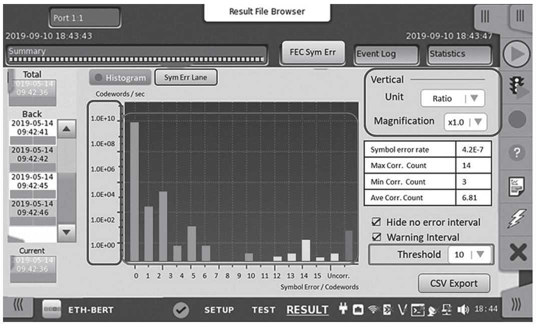


100G Multirate Module
MU104011A



400G Ethernet FEC Analysis

In addition to transmission-path loss margins, 400G Ethernet requires guaranteed loss margins when optical modules are integrated. With a built-in FEC analysis function, the MT1040A graphically displays (as histogram) the approximate number of errors occurring in symbols included in 1 Codeword error-correction units.



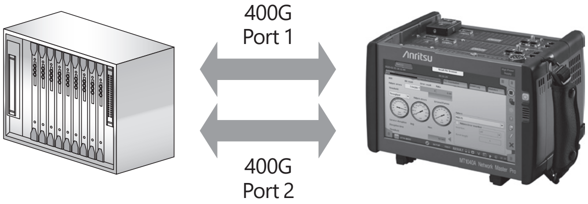
Vertical
Unit: Ratio
Magnification: x1.0

Symbol error rate	4.2E-7
Max Corr. Count	14
Min Corr. Count	3
Ave Corr. Count	6.81

☑ Hide no error interval
☑ Warning Interval
Threshold: 10

400G Ethernet Dual Port Testing

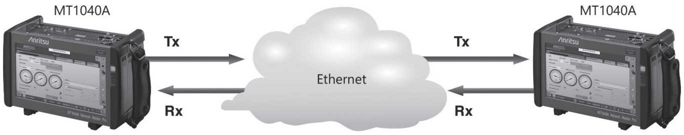
Adding the Activate for 400G Dual/100G Quad Option MT1040A-020 and two measurement modules to one MT1040A main unit supports dual-port 400G measurements.



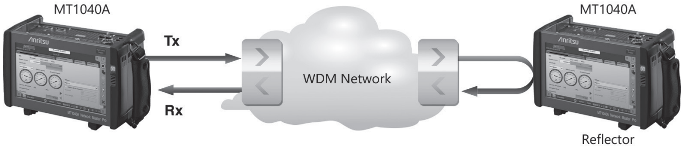
* There are conditions for two-port measurement.

Ethernet Installation and Troubleshooting

Network operators are introducing new carrier-class technologies, such as VLAN, Q-in-Q, Ethernet OAM, etc., to their Ethernet service menus, increasing test complexity and test time for field technicians.
With connectivity, bandwidth, QoS (Quality of Service), and service-related test functions, the MT1040A is ideal for commissioning and troubleshooting Ethernet networks at speeds up to 400 Gbps.



Ethernet Test: End-to-End



WDM Test

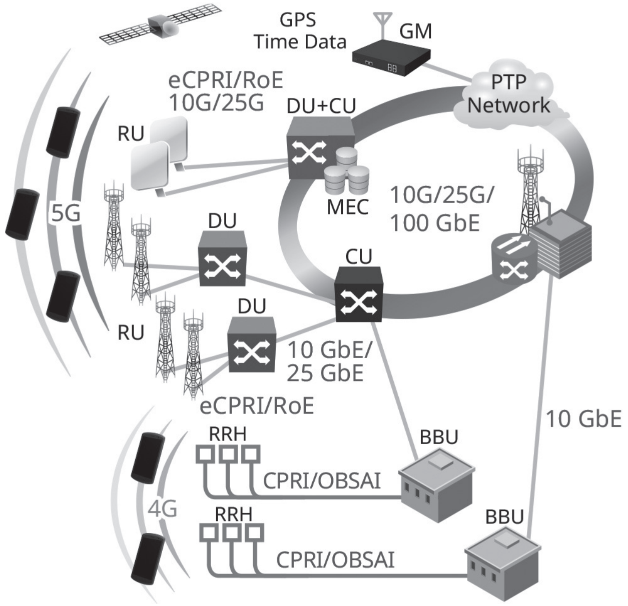
- BER tests – include Frame Loss and Sequence Error tests
- FEC Analysis
- Automated RFC 2544 tests of Throughput, Frame Loss, Latency or Packet Jitter, Burstability
- Filters . to extract relevant parts of traffic
- Separate pass/fail threshold settings
- Multistream Tx/Rx function (QoS/CoS test)
- Stacked VLAN (Q-in-Q)
- Link Fault Signaling (LFS) Emulation (10 Gbps to 400 Gbps)

Mobile xHaul Network Tests

In addition to mobile network speed increases supporting commercial rollout of 5G services, networks must also offer high reliability, low latency, and multiple simultaneous connections, which requires:

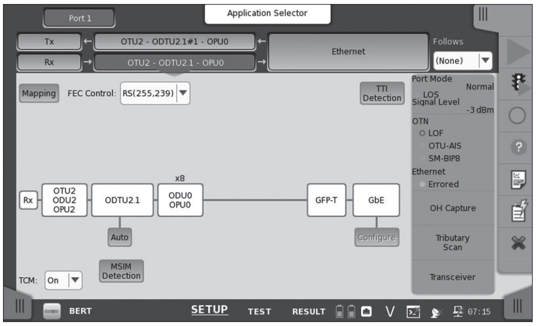
- Switching to eCPRI/RoE (IEEE1914.3)
- Improving time synchronization accuracy
- Cutting latency

The MT1040A support these requirements with interface, maximum throughput rate, and latency measurements.



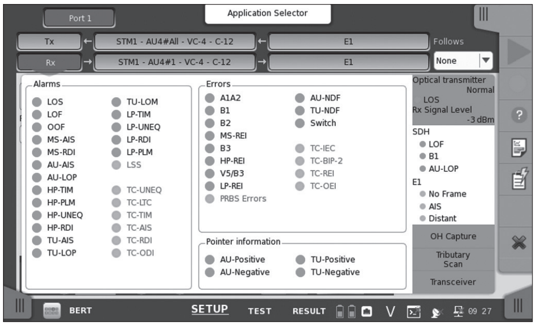
OTN/SDH/SONET Network Tests

Ethernet, CPRI, Fibre Channel, and SDH/SONET can be chosen as the client signal for testing OTN circuits in a live environment. In addition, ODUflex OTN mapping offers strong support for testing OTN equipment featuring new client signals.
Moreover, functions for simulating random signal errors mimicking the live environment as well as for generating errors using the ITU-T O.182 Poisson error distribution are useful for accurate evaluation of high-speed network line quality. And all-in-one support for both new and legacy technologies, including SDH/SONET tests, helps users optimize operation costs by retiring older tester inventory.



Tx ← OTU2 - ODTU2.1#1 - OPU0 ← Ethernet
Rx → OTU2 - ODTU2.1 - OPU0 → Ethernet
Follows: (None)
FEC Control: RS(255,239)
TCM: On
Port Mode: Normal
Signal Level: -3 dBm

OTN Mapping Setting

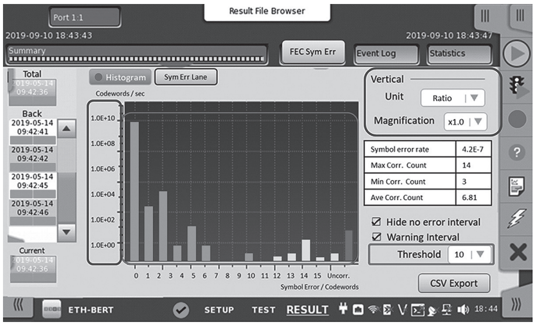


Tx ← STM1 - AU4#All - VC-4 - C-12 ← E1
Rx → STM1 - AU4#1 - VC-4 - C-12 → E1
Follows: None
Optical transmitter: Normal
Rx Signal Level: -3 dBm

SDH/SONET Line Error/Alarm Status Display

MT1040A 400G Measurements

The MT1040A has a function for monitoring the FEC status in real-time. Periodic network monitoring using this function confirms the network load conditions, helping prevent problems.



2019-09-10 18:43:43
2019-09-10 18:43:47

Total 2019-05-14 09:42:36
Back
2019-05-14 09:42:41
2019-05-14 09:42:42
2019-05-14 09:42:45
2019-05-14 09:42:46
Current 2019-05-14 09:42:36

Vertical
Unit: Ratio
Magnification: x1.0

Symbol error rate	4.2E-7
Max Corr. Count	14
Min Corr. Count	3
Ave Corr. Count	6.81

☑ Hide no error interval
☑ Warning Interval
Threshold: 10

One Button Testing

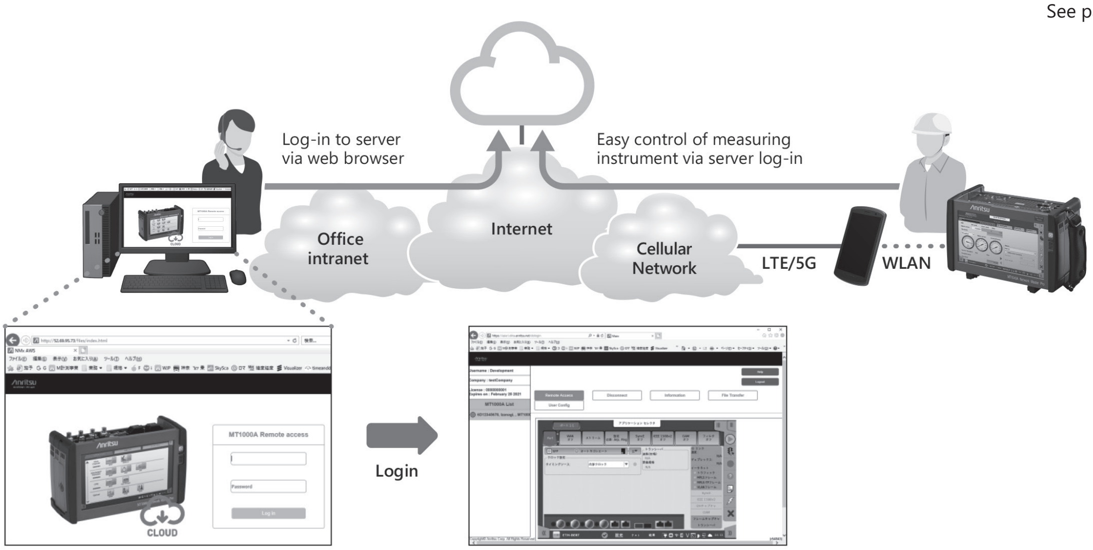
The MT1040A has automatic test functions for simple and efficient network commissioning. These MT1040A automated test functions run scenario files created in advance on a PC to perform tests automatically using preset measurement items, procedures, and pass/fail evaluation conditions. Since the scenario also handles report creation, evaluation and results, inexperienced workers can run accurate tests without operation mistakes and re-tests.

Setting Test Equipment:	Manual	Setting Test Equipment:	Not necessary
Executing Test:	Manual	Executing Test:	Not necessary
Evaluating Results:	Based on data	Evaluating Results:	Not necessary

Easy Connections Anywhere Using SORA (Site Over Remote Access)

Using the Site Over Remote Access MX109020A (SORA hereafter) software measuring instruments can be remotely controlled easily anywhere. The SORA cloud-based service allows office users to log-in to an Internet webpage to control the measuring instrument from the office via a smartphone.

See page 103 for details



Login screen

Remote control screen

Specifications

Storage Capacity		7 Gbyte	
Battery		11.25 V rechargeable and replaceable intelligent Li-ion battery × 2 Operating time: 1 hours (typ., in case of 400 GbE) Charging time: 9 hours (Max.) (2 pcs) Remaining capacity indication: %	
Mains Adapter		G0418A (MT1040A Standard Accessory)	G0419A (MT1040A-020 Accessory)
		Input: 100 VAC to 240 VAC, 50 Hz/60 Hz Rated output: 19 VDC, 13.2 A max. Power consumption: 250 W max.	Input: 100 VAC to 240 VAC, 50 Hz/60 Hz Rated output 18 VDC, 22.2 A max. Power consumption: 420 W max.
Dimensions and Mass		262 (W) × 167 (H) × 68 (D) mm (Exclude Projection, MT1040A) 262 (W) × 167 (H) × 134 (D) mm (Exclude Projection, MT1040A + MU104014A) 262 (W) × 167 (H) × 154 (D) mm (Exclude Projection, MT1040A + MU104014A + MU100020A) 262 (W) × 167 (H) × 187 (D) mm (Exclude Projection, MT1040A + MU104014A + MU104014A) ≤4.7 kg (including MT1040A, MU104014A and battery) ≤5.5 kg (including MT1040A, MU104014A, MU100020A and battery) ≤6.5 kg (including MT1040A, MU104014A, MU104014A and battery)	
Environmental		Operating Temperature: 0°C to +50°C, Humidity: ≤85% RH (non-condensing) Charging Temperature: 0°C to +40°C, Humidity: ≤85% RH (non-condensing) Storage Temperature: –30°C to +60°C, Humidity: ≤90% RH (non-condensing, without battery and AC adapter) –20°C to +50°C, Humidity: ≤90% RH (non-condensing, with battery and AC adapter)	
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2	
	LVD	2014/35/EU, EN61010-1	
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018	
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2	
	LVD	S.I. 2016 No.1101, EN 61010-1	
	RoHS	S.I. 2012 No.3032, EN IEC 63000: 2018	

Ordering Information

This table lists the key configurataion part only.

For details, refer to the Product Brochure or consult our sales representative.

MT1040A Mainframe

Model/Order No.	Name	
MT1040A	Network Master Pro	
	Standard Accessories	
MT1040A-006	High Power Supply*1:	1 pc
	Line Cord*2:	1 pc
B0745A	Softcase:	1 pc
B0771A*3	MT1040A Rear Panel kit:	1 pc
G0409A	AC Adaptor:	1 pc
G0423A	Two LiION Batteries:	1 pc

Software Options*4

Model/Order No.	Name
MT1040A-003*5	Connectivity for WLAN/Bluetooth
MT1040A-011	Site Over Remote Access Connect

Option for Two Transport Modules*6

Model/Order No.	Name
MT1040A-020	Activate for 400G Dual/100G Quad Option
	Standard Accessories
G0419A	AC Adapter (400 W)

Multirate Module

Model/Order No.	Name
MU104014A	400G (QSFP-DD) Multirate Module
MU104015A	400G (OSFP) Multirate Module
MU104011A	100G Multirate Module

Protocol Options

Model/Order No.	Name
MU104014A-015	Ethernet 100G Single Channel
MU104014A-016	Ethernet 100G Dual Channel
MU104014A-033	Ethernet 400G Single Channel
MU104015A-015	Ethernet 100G Single Channel
MU104015A-033	Ethernet 400G Single Channel
MU104011A-015	Ethernet 100G Single Channel
MU104011A-016	Ethernet 100G Dual Channel

*1: The presence of the MT1040A-006 option can be recognized at the top right of the front panel. To retrofit to the already shipped item, please contact us.

Without MT1040A-006

With in MT1040A-006

*2: One line cord is attached to the area to shipment.

*3: Composed of B0720A, B0730A, B0731A, B740A and B0741A.

*4: These options can be retrofitted. The Model/Order No. of retrofit options is "-3**".
Example
MT1040A-003 Connectivity for WLAN/Bluetooth becomes MT1040A-303 Connectivity for WLAN/Bluetooth Retrofit.
When retrofitting an option, please either specify one of the following media along with the relevant option, or Web download.
Z1849A: DVD-ROM for Retrofit Options
Z1850A: USB Stick for Retrofit Options

*5: WLAN is available for certified countries and regions including USA, Japan and EU countries. Please visit the Anritsu web site for updated information.

*6: Can be added to main unit in which MT1040A-006 already installed. However, battery operation is not possible when using two transponder modules together.

Optical Transceivers Interface List

MU104014A	MU104015A	Model/ Order No.	Name	Form Factor	100M Ethernet	156M STM-1	614M CPRI	622M STM-4	768M OBSAI	1GFC	1.23G CPRI	1.25G Ethernet	1.54G OBSAI	2GFC	2.46G CPRI	2.488G STM-16	2.67G OTU1	3.07G CPRI OBSAI	4GFC	4.92G CPRI	6.14G CPRI OBSAI	8GFC	9.83G CPRI	9.95G STM-64	10.1G CPRI	10.3G Ethernet	10GFC	10.7G OTU2	11.05G OTU1e	11.09G OTU2e	11.27G OTU1f	11.3G OTU2f	16GFC	25G Ethernet	40G Ethernet	40G OTN	100G Ethernet	100G OTN	200G Ethernet	400G Ethernet
✓		G0421A	QSFP56 200GBASE-LR4	QSFP56																																			1310 nm, SM, 10 km	
✓		G0402A	QSFP-DD 400GBASE-DR4	QSFP-DD																																				1310 nm, SM, 0.5 km
✓		G0403A	QSFP-DD 400GBASE-FR4	QSFP-DD																																				1310 nm, SM, 2 km
✓		G0404A	QSFP-DD 400GBASE-LR4	QSFP-DD																																				1310 nm, SM, 10 km
	✓	G0405A	OSFP 400GBASE-DR4	OSFP																																				1310 nm, SM, 0.5 km
	✓	G0406A	OSFP 400GBASE-FR4	OSFP																																				1310 nm, SM, 2 km

Refer to (Optical Modules Selection Guide for MT1000A) on page 99 for optical modules of 100G or less.

*: Standard Accessories and Optional Accessories cannot be repaired.

Network Master Series

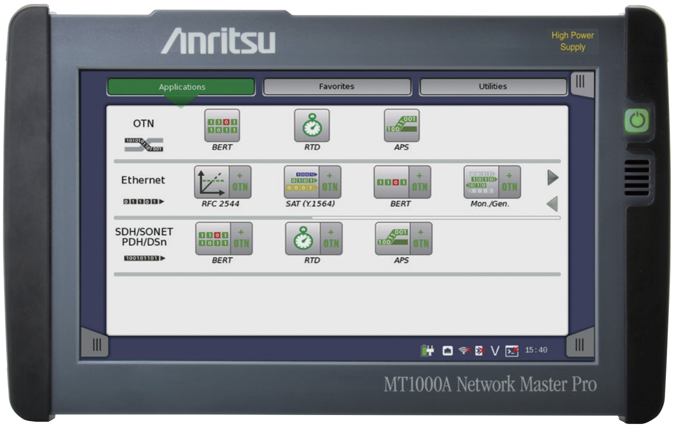
MT1000A Network Master Pro

MU100010A 10G Multirate Module
MU100011A 100G Multirate Module
MU100090B High Performance GNSS Disciplined Oscillator

Remote Control
Cloud OPTION | **WLAN** OPTION | **Bluetooth** OPTION | **Ethernet** | **USB**

Redefining Transport Testing

Excellent Eco Product



Network Master Pro

Networks continue to evolve as standards for transport tests, such as Ethernet, OTN, SDH/SONET, eCPRI/RoE/CPRI/OBSAI, PTP, Fibre Channel, etc., become more diverse, and speeds increase with development of 100G/25G Ethernet and 16G Fibre Channel.
With an easily configured modular design to support changing network standards and an easy-to-use GUI, the Network Master Pro MT1000A is perfect for rapid I&M of wide-area networks.

All in One | I&M | Easy to use

- All transport network field tests in one tester
- Easy-to-read 9-inch touch screen in easy-to-use compact B5-size tester
- Higher work efficiency with multiple tests using one-button automated measurement tools

One Button Testing

The MT1000A has automatic test functions for simple and efficient network commissioning. These MT1000A automated test functions run scenario files created in advance on a PC to perform tests automatically using preset measurement items, procedures, and pass/fail evaluation conditions. Since the scenario also handles report creation, evaluation and results, inexperienced workers can run accurate tests without operation mistakes and re-tests.

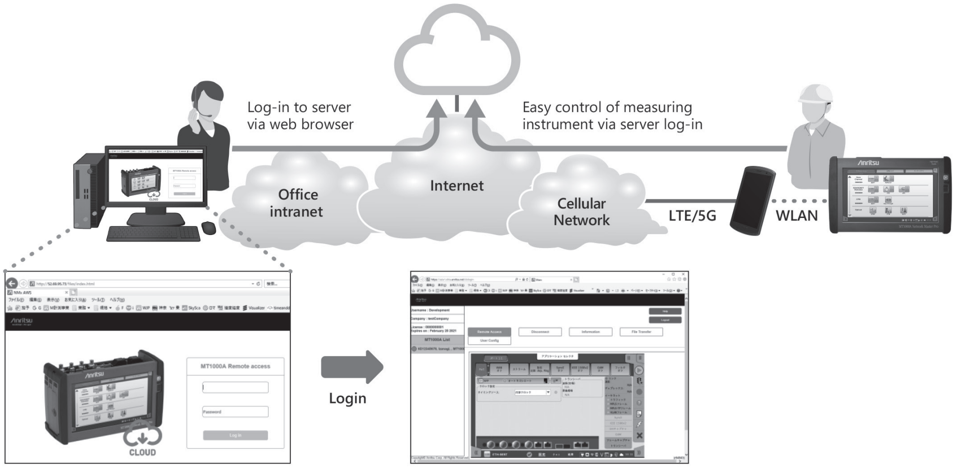
Setting Test Equipment: Manual
Executing Test: Manual
Evaluating Results: Based on data

Setting Test Equipment: **Not necessary**
Executing Test: **Not necessary**
Evaluating Results: **Not necessary**

Easy Connections Anywhere Using SORA (Site Over Remote Access)*

Using the MX109020A Site Over Remote Access (SORA hereafter) software measuring instruments can be remotely controlled easily anywhere.
The SORA cloud-based service allows office users to log-in to an Internet webpage to control the measuring instrument from the office via a smartphone.

See page 103 for details



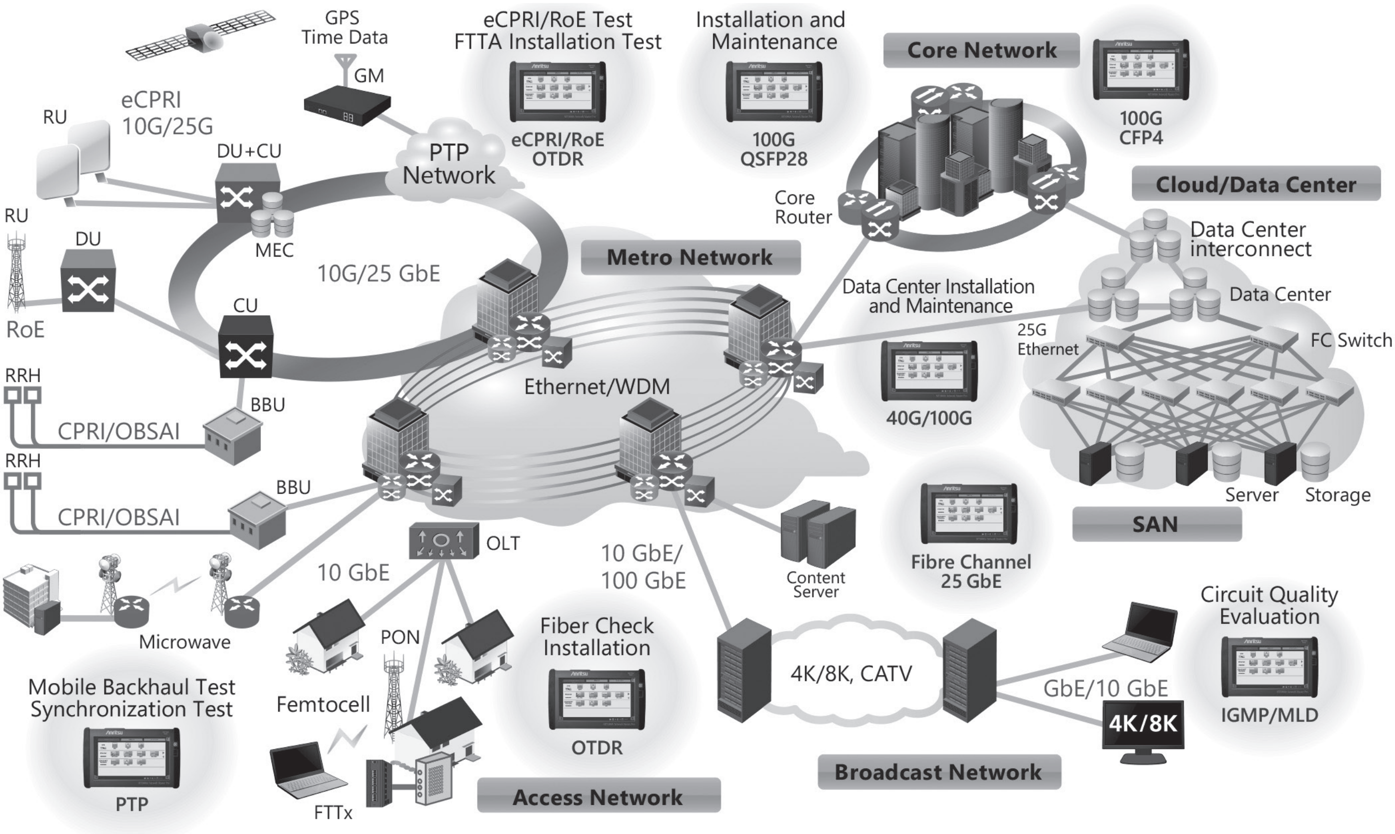
Login screen
Remote control screen

---

* This service can be used in countries and regions where the MT1000A WLAN/Bluetooth option has been approved. For details, contact Anritsu.
* To connect using SORA, you must purchase an option license for the main unit as well as a subscription license. Refer to the MX109020A leaflet and product introduction for more details. You must agree to the service contract before purchasing SORA.
Refer to the service contract at the following URL: https://www.anritsu.com/en-AU/test-measurement/support/downloads/manuals/dwl20059.

I&M Support for All Networks

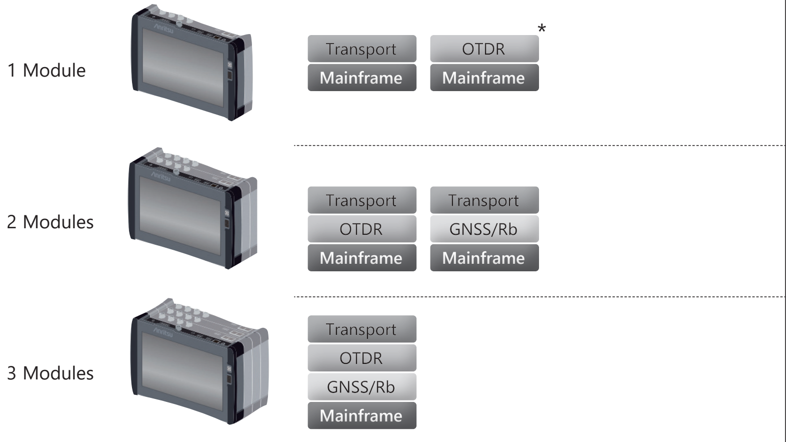
The Network Master supports all types of network I&M.



The modular design of the Network Master Pro MT1000A platform makes it easy to support I&M for different network configurations. Combining it with the 10G Multirate Module MU100010A offers the necessary functions for I&M of networks at speeds from 1.5 Mbps to 10 Gbps. Combining with the 100G Multirate Module MU100011A, it supports more interface standards than any other handheld transport tester on the market such as CFP4/QSFP28, QSFP+, SFP28 (25 GbE), SFP+SFP and RJ45.
Coupled with a compact easy-to-use design and long battery operation, plus a large 9" easy-to-see color touch screen, remote GUI operation via Internet connection, and more, the MT1000A is a key factor in increasing I&M test work efficiency.
Furthermore, options for each test function can be selected and added as necessary to match the work schedule, helping cut initial capital costs.

Network Master Pro MT1000A Module Line up

Any modular combination as shown in a figure.



Mainframe Network Master Pro
MT1000A

Transport Transport Module
10G Multirate MU100010A
100G Multirate MU100011A

OTDR OTDR Module
1310/1550 nm SMF MU100020A
1310/1550/850/1300 nm SMF/MMF MU100021A
1310/1550/1625 nm SMF MU100022A
1310/1550 nm, 1650 nm SMF MU100023A

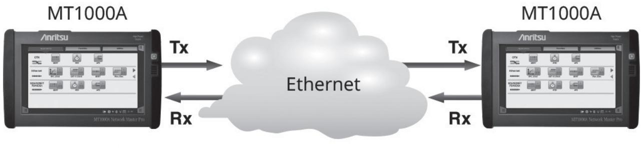
GNSS/Rb Sync Module
High Performance GPS Disciplined Oscillator MU100090A
High Performance GNSS Disciplined Oscillator MU100090B

*: Required if the transport modules is not used rear cover (B0720A).

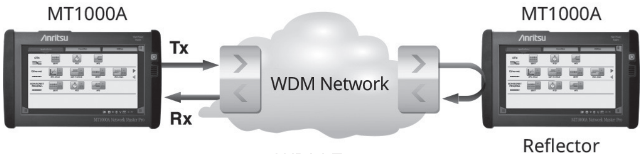
Ethernet Application

Network operators are introducing new carrier-class technologies, such as VLAN, Q-in-Q, Ethernet OAM, MPLS, PBB, MPLS-TP, etc., to their Ethernet service menus, increasing test complexity and test time for field technicians.

The MU100010A/MU100011A Ethernet test functions provide strong support for commissioning and troubleshooting Ethernet networks up to 100G speeds, including connectivity and band tests, QoS tests, and service-related tests.



Ethernet Test: End-to-End



WDM Test

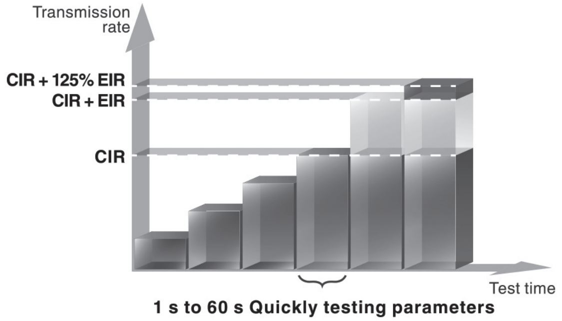
Ethernet Service Activation Test (Y.1564)

With the ability to simultaneously test multiple traffic streams, ITU-T Y.1564 is a new test methodology when deploying Ethernet networks. Today's common RFC 2544 standard completes tests one at the time and does not run all traffic streams simultaneously. ITU-T Y.1564 has the following two test phases.

Service Configuration Test:

This section is completed quickly, within seconds per stream.

It confirms the end-to-end configuration while quickly checking the Information Rate (IR), Frame Transfer Delay (FTD), Frame Delay Variation (FDV), Frame Loss Ratio (FLR), Committed Burst Size (CBS) and Excess Burst Size (EBS) sequentially for all configured traffic streams.

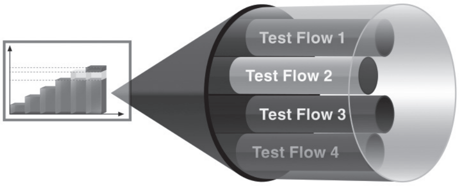


Y.1564 Service Configuration Test

Service Performance Test:

This section is completed based on the M.2110 standard for 15 minutes, 2 hours, 24 hours, or a user-selectable period.

It transmits all configured traffic streams simultaneously at the CIR, confirming that all traffic can traverse the network under full load while checking IR, FTD, FDV, FLR and Availability (AVAIL).

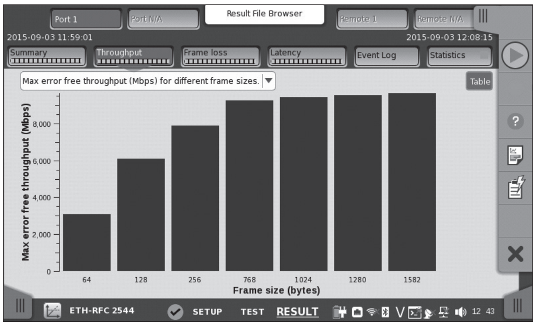


Y.1564 Service Performance Test

Simultaneous testing in the Service Performance Test section greatly reduces the total test time compared to RFC 2544.

RFC 2544 Test

RFC 2544 testing of Throughput, Frame Loss, Latency, Packet Jitter and Burstability is straightforward with the MU100010A/MU100011A. It automates the procedure while still allowing thorough test configuration. For full information on performance at both line sides, the end-to-end test mode allows two MT1000A testers to work together in a local–remote configuration where the user controls both testers and reads results from both locally. Easy to understand tabular screens and bar graph presentations simplifies reading of results. Attractive looking reports can be generated for presentation to end-customers.

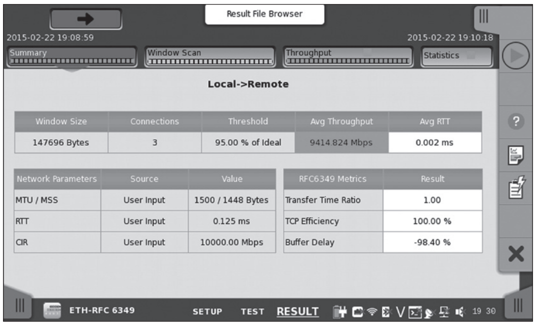


Throughput Graph

TCP Throughput (RFC 6349, iPerf) [Option]

Normally, IP network operators test their communications equipment in accordance with the RFC 2544 and ITU-T Y.1564 standards, but even when the test results are good, sometimes the expected end-to-end data throughput is not achieved. Although data communications use the TCP protocol for guaranteed data transfers, sometimes throughput drops as a result of network delays, poor circuit quality, etc.

The RFC 6349 standard regulates the test methods for assuring operator throughput over the TCP layer, and the MU100010A/MU100011A modules with built-in TCP throughput option support TCP throughput evaluation and testing in accordance with the RFC 6349 standard. The iperf client function for testing TCP throughput is also supported.



Local->Remote

Window Size	Connections	Threshold	Avg Throughput	Avg RTT
147696 Bytes	3	95.00 % of Ideal	9414.824 Mbps	0.002 ms

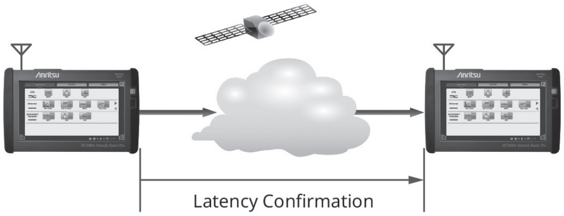
Network Parameters	Source	Value
MTU / MSS	User Input	1500 / 1448 Bytes
RTT	User Input	0.125 ms
CIR	User Input	10000.00 Mbps

RFC6349 Metrics	Result
Transfer Time Ratio	1.00
TCP Efficiency	100.00 %
Buffer Delay	-98.40 %

Test Result

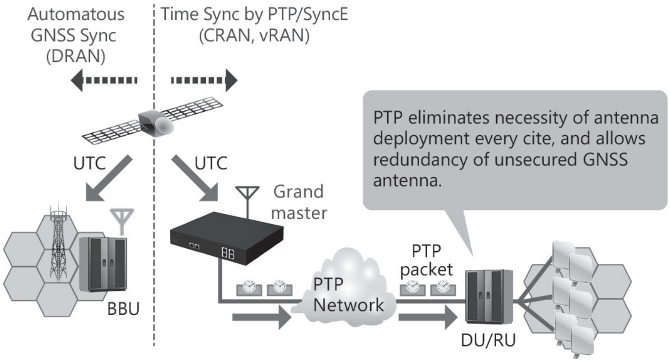
One-way Delay Measurement Using Two MT1000A Units

One-way delay can be measured with high accuracy using two MT1000A/MU100011A units at a distant location with installed MU100090B.



Mobile Backhaul Application

Mobile backhaul networks use IEEE 1588 v2 and synchronous Ethernet (SyncE) technologies. Since in-office base stations generate wireless signals based on a synchronizing signal distributed by the mobile backhaul, any mobile backhaul synchronization fault severely degrades the mobile radio performance. As a result, mobile operators must test that the SyncE and IEEE 1588 v2 technologies are functioning correctly.



Synchronous Ethernet test

The MU100010A/MU100011A support SyncE and IEEE 1588 v2 (G.8265.1, G.8275.1 and G.8275.2) protocol tests and analyses for monitoring SSM messages, and effectively troubleshooting and analyzing network faults, such as interoperability issues caused by abnormal vendor clock devices.

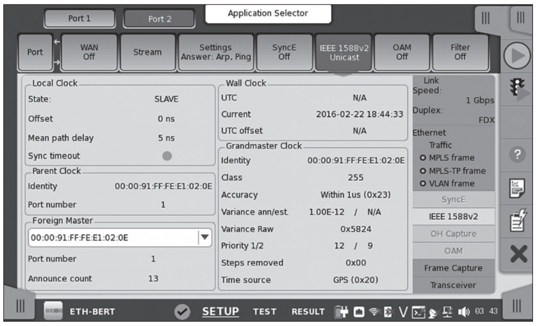
Time/Phase Synchronization Accuracy Tests

Mobile backhaul is starting construction of IEEE 1588 v2 (G.8275.1, G8275.2)-compliant time and phase-synchronized networks.

The High Performance GNSS Disciplined Oscillator MU100090B option measures the time and phase synchronization with high accuracy as a max|TE| (absolute Time Error), cTE (Constant Time Error), and dTE (Dynamic Time Error) matrix.*

Combining it with the MU100010A/MU100011A adds pass/fail evaluation tests for commissioning time and phase-synchronized networks.

*: Peer-to-Peer only supports protocol emulation.



Local Clock
State: SLAVE
Offset 0 ns
Mean path delay 5 ns
Sync timeout

Parent Clock
Identity 00:00:91:FF:FE:E1:02:0E
Port number 1

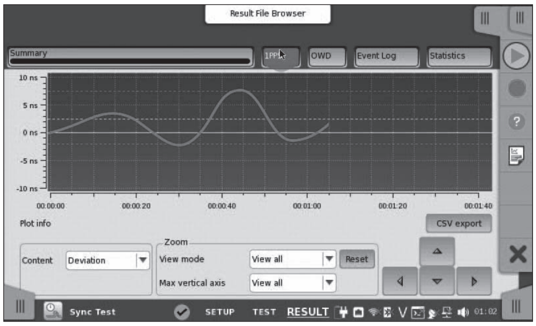
Foreign Master
00:00:91:FF:FE:E1:02:0E
Port number 1
Announce count 13

Wall Clock
UTC N/A
Current 2016-02-22 18:44:33
UTC offset N/A

Grandmaster Clock
Identity 00:00:91:FF:FE:E1:02:0E
Class 255
Accuracy Within 1us (0x23)
Variance ann/est. 1.00E-12 / N/A
Variance Raw 0x5824
Priority 1/2 12 / 9
Steps removed 0x00
Time source GPS (0x20)

Link
Speed: 1 Gbps
Duplex: FDX
Ethernet
○ MPLS frame
○ MPLS-TP frame
○ VLAN frame

Status of IEEE 1588 v2 Slave Clock



Content Deviation
Zoom
View mode View all
Max vertical axis View all

Phase Confirmation using MU100090B

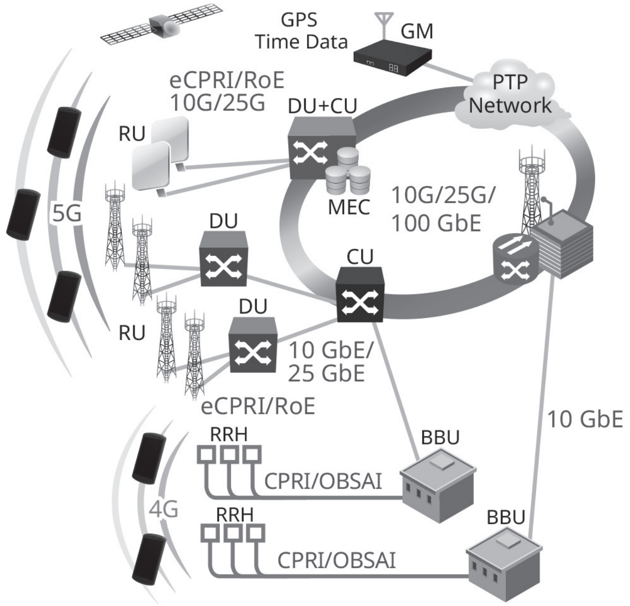
Mobile Fronthaul Application

Operators are supporting the explosive spread of smartphones and tablets by increasing the bandwidth of mobile communications networks, in turn driving a complete change in mobile

So far, mobile front haul has been split into the Base Band Unit (BBU) and Remote Radio Head (RRU) with speed increased and ease of connected supported by using multiple antennas.

However, in addition to faster speeds, the key requirements for next-generation 5G mobile are higher reliability, lower latency, and multiple simultaneous user connections. As a result, mobile front haul requires:

- Change of interface between BBU and RRH from CPRI/OBSAI to eCPRI/RoE (IEEE1914.3)
- Improved time synchronization accuracy
- Large decreases in latency.



eCPRI/RoE (IEEE1914.3) Test

- BER tests using either eCPRI or RoE frame
- One and two-way latency time measurements*1
- Phase/Time synchronization accuracy tests
  - Time synchronization test using IEEE 1588 v2 1 pps TE supporting 1G/10G/25G Ethernet

CPRI Test

- BER tests
- Various error and alarm tests
- Return Time Delay (RTD) tests
- Perform pass-through monitoring*2 and CPRI APS measurements
- Client signal mapped to OTN.

OBSAI Test

- BER tests
- Various error and alarms tests
- Returen Time Delay (RTD)
- Perform OBSAI APS measurements

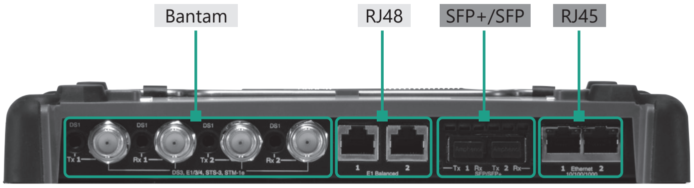
*1: Requires MU100011A for high-resolution measurement; requires two MT1000A/MU100011A/MU100090B units for measurement at distant location

*2: CPRI Option 9 and Option 10 not supported

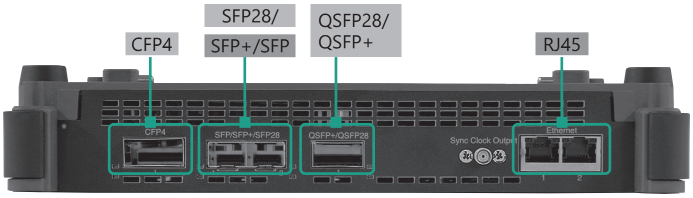
Interface*	Ethernet	OTN	SDH/SONET	Fibre Channel	CPRI/OBSAI	PDH/DSn
CFP4	100 GbE	OTU4	—	—	—	—
QSFP28	100 GbE	OTU4	—	—	—	—
QSFP+	40 GbE	OTU3	—	—	—	—
SFP28	25 GbE	—	—	—	CPRI 10	—
SFP/SFP+	GbE/10 GbE	OTU1x/OTU2x	STM1-64/ OC3-192	1G/2G/4G/8G/10G FC 16G FC	CPRI 1/2/3/4/5/6/7/8 OBSAI 1x/2x/4x/8x CPRI 9	—
RJ45	10/100/1000M	—	—	—	—	—
RJ48	—	—	—	—	—	E1
BNC	—	—	STM-1e/STS-3	—	—	E1/E3/E4/DS3
Bantam	—	—	—	—	—	DS1

░ : MU100010A Only ▒ : MU100011A Only ▓ : Both MU100010A & MU100011A Supported

*: The interface depends on the module. For details, refer to the following.



10G Multirate Module MU100010A



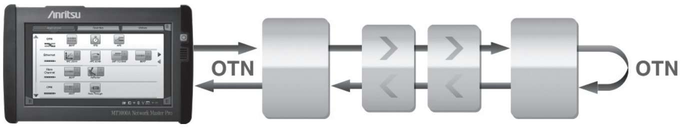
100G Multirate Module MU100011A

Optical Modules Selection Guide

MU100010A	MU100011A	Model/ Order No.	Name	Form Factor	100 Meg Ethernet	156 Meg STM-1	614 Meg CPRI	622 Meg STM-4	768 Meg OBSAI	1GFC	1.23 Gig CPRI	1.25 Gig Ethernet	1.54 Gig OBSAI	2GFC	2.46 Gig CPRI	2.488 Gig STM-16	2.67 Gig OTU1	3.07 Gig CPRI OBSAI	4GFC	4.92 Gig CPRI	6.14 Gig CPRI OBSAI	8GFC	9.83 Gig CPRI	9.95 Gig STM-64	10.1 Gig CPRI	10.3 Gig Ethernet	10GFC	10.7 Gig OTU2	11.05 Gig OTU1e	11.09 Gig OTU2e	11.27 Gig OTU1f	11.3 Gig OTU2f	16GFC	25G Ethernet	40G Ethernet	40G OTN	100G Ethernet	100G OTN
✓	✓	G0332A	100M FX 1310 nm MM SFP	SFP	1310 nm, MM, 2 km	▨																																
✓	✓	G0319A	Up to 2.7G 1310 nm 15 km SFP	SFP		1310 nm, SM, 15 km	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨																					
✓	✓	G0320A	Up to 2.7G 1310 nm 40 km SFP	SFP		1310 nm, SM, 40 km	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨																					
✓	✓	G0321A	Up to 2.7G 1550 nm 80 km SFP	SFP		1550 nm, SM, 80 km	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨																					
✓	✓	G0328A	1G/2G/4G FC 850 nm SFP	SFP						850 nm, MM, 0.5 km	▨	▨	▨	▨	▨				▨																			
✓	✓	G0322A	1G/2G/4G FC 1310 nm SFP	SFP						1310 nm, SM, 10 km	▨	▨	▨	▨	▨				▨																			
✓	✓	G0323A	1G/2G/4G FC 1550 nm SFP	SFP						1550 nm, SM, 40 km	▨	▨	▨	▨	▨				▨																			
✓	✓	G0315A	10G LR/LW 1310 nm SFP+	SFP+																		1310 nm, SM, 10 km	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨						
✓	✓	G0316A	10G ER/EW 1550 nm 40 km SFP+	SFP+																		1550 nm, SM, 40 km	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨						
✓	✓	G0318A	10G ZR/ZW 1550 nm 80 km SFP+	SFP+																		1550 nm, SM, 80 km	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨						
✓	✓	G0329A	10G LR 1310 nm SFP+	SFP+								1310 nm, SM, 10 km	▨	▨	▨			▨	▨	▨	▨	▨	▨		▨	▨	▨		▨	▨	▨							
✓	✓	G0356A	8G FC/10G SR 850 nm SFP+	SFP+																		850 nm, MM, 0.3 km	▨		▨	▨	▨											
	✓	G0386A	16GFC SR 850 nm SFP+	SFP+																													850 nm, MM, 0.5 km					
	✓	G0387A	16GFC LR 1310 nm SFP+	SFP+																													1310 nm, SM, 10 km					
	✓	G0388A	25G SR 850 nm SFP28	SFP28																														850 nm, MM, 0.5 km				
	✓	G0389A	25G LR 1310 nm SFP28	SFP28																														1310 nm, SM, 10 km				
	✓	G0359A	40G SR4 850 nm QSFP+	QSFP+																															850 nm, MM, 0.1 km	▨		
	✓	G0334A	40G LR4 1310 nm QSFP+	QSFP+																															1310 nm, SM, 10 km	▨		
	✓	G0366A	100G SR4 850 nm QSFP28	QSFP28																																	850 nm, MM, 0.1 km	
	✓	G0364A	100G LR4 1310 nm QSFP28	QSFP28																																	1310 nm, SM, 10 km	
	✓	G0365A	100G LR4 Dual Rate 1310 nm QSFP28	QSFP28																																	1310 nm, SM, 10 km	▨
	✓	G0369A	100G LR4 Dual Rate 1310 nm CFP4	CFP4																																	1310 nm, SM, 10 km	▨

OTN Application

Using the MU100010A/MU100011A, OTN lines can be tested at the client signal level with signals like Ethernet, CPRI, Fibre Channel and SDH/SONET, because the OTN mapping function is mandatory for modern OTN transponders. The MT1000A can also test OTN lines at the line rate with bulk signals.
The user can identify problems at all levels in the OTN signal, solving OTN issues efficiently, reducing system downtime, and reducing operating expenses for network operators.



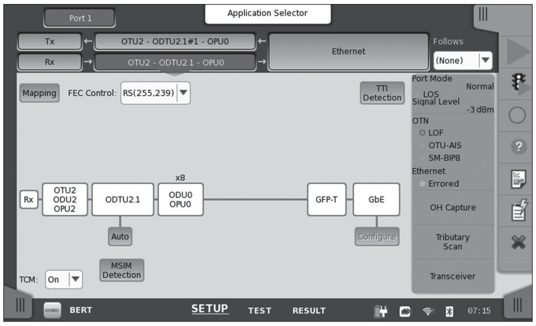
Looping-back test signal from MT1000A at far end supports easy OTN line quality tests

Out-of-service OTN Error and Alarm Statistics

The MU100010A/MU100011A supports powerful statistical measurements for BER tests as well as OTN level alarms and errors for installing/commissioning and troubleshooting out-of-service OTN lines. G.8201 or M.2401 error-performance parameters are calculated during measurement. Stress testing of network elements is supported by inserting errors and alarms, and adjusting overhead bytes in the signal transmitted by the instrument.

Testing Ethernet, CPRI, Fibre Channel, or SDH/SONET Client Signals Mapped onto OTN Signal (Part of ODU Multiplexing Option)

The MU100010A/MU100011A tests OTN links carrying Ethernet, CPRI, Fibre Channel or SDH/SONET client signals, allowing the operator to test embedded client signals.
For example, an RFC 2544 or Y.1564 test can be performed with an Ethernet signal carried over the OTN signal, allowing the service engineer to run tests emulating the real-world requirements of end users.

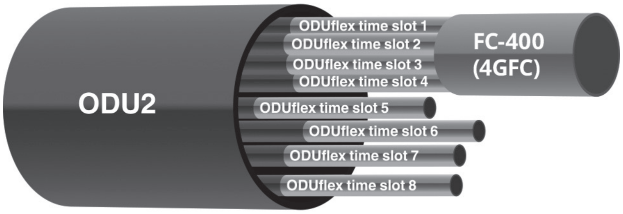


Tx ← OTU2 - ODTU2.1#1 - OPU0
Rx → OTU2 - ODTU2.1 - OPU0
Follows: (None)
FEC Control: RS(255,239)
TCM: On
Port Mode: Normal
LOS Signal Level: -3 dBm

OTN Mapping Setting

ODUflex Test (with ODU Flex Option)

ODUflex is a new feature of OTN supporting flexible allocation of client-signal bandwidth to make best use of OTN capacity.
The MU100010A/MU100011A with ODU Flex option supports ODUflex tests, allowing operators to verify this new technology on their networks.



ODU Flex Option divides capacity of ODU2 into eight 1.25G ODUflex time slots.
In the above example, an FC-400 (4GFC) Fibre Channel signal occupies four ODUflex time slots.

Fibre Channel Application

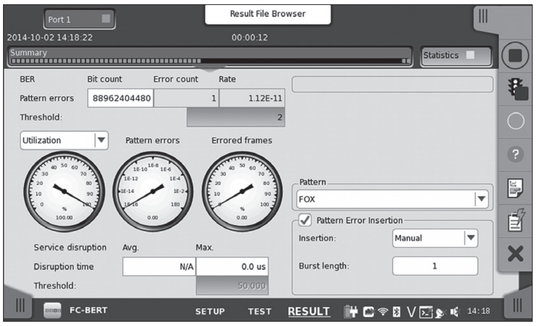
The multi-protocol MU100010A/MU100011A with Fibre Channel option is the perfect tool for deploying Fibre Channel with support for testing links at rates up to 10 Gbps. The all-in-one MT1000A gives the user less equipment to maintain and learn, helping reduce operating expenses.

Latency

High latency is a problem for many applications, including SAN, and network operators and service providers urgently need a tool like the MU100010A/MU100011A with Fibre Channel option to test latency on Fibre Channel lines and equipment.

Fibre Channel BER Tests

The MU100010A/MU100011A with Fibre Channel option supports BER tests to measure the performance of Fibre Channel lines and equipment. Service disruption measurement is also supported.



2014-10-02 14:18:22
00:00:12

BER	Bit count	Error count	Rate
Pattern errors	88962404480	1	1.12E-11
Threshold:			2

Service disruption	Avg.	Max.
Disruption time	N/A	0.0 us
Threshold:		50.000

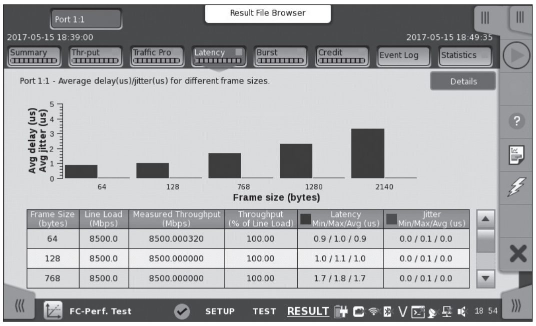
Pattern: FOX
☑ Pattern Error Insertion
Insertion: Manual
Burst length: 1

FC BER Test

Performance Tests

The MU100010A/MU100011A measures the buffer size needed to achieve the required throughput and can play a key role in the following aspects of network I&M.

- Adjusting local parameters at commissioning testing
- Troubleshooting whether buffer size setting or network settings are causing lower throughput than the network design specification



2017-05-15 18:39:00
2017-05-15 18:49:35

Port 1:1 - Average delay(us)/jitter(us) for different frame sizes.

Frame Size (bytes)	Line Load (Mbps)	Measured Throughput (Mbps)	Throughput (% of Line Load)	Latency Min/Max/Avg (us)	Jitter Min/Max/Avg (us)
64	8500.0	8500.000320	100.00	0.9 / 1.0 / 0.9	0.0 / 0.1 / 0.0
128	8500.0	8500.000000	100.00	1.0 / 1.1 / 1.0	0.0 / 0.1 / 0.0
768	8500.0	8500.000000	100.00	1.7 / 1.8 / 1.7	0.0 / 0.1 / 0.0

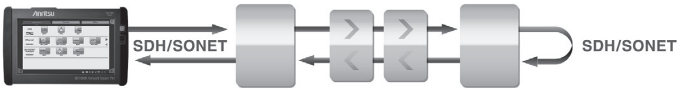
FC Performance Test

SDH/SONET, PDH/DSn Application

Legacy technologies in transport networks can't just be eliminated because of the huge capital investment, but keeping legacy technologies operational can require several testers.
With its SDH/SONET and PDH/DSn test options, the MU100010A/MU100011A is a powerful and easy-to-use tool for testing SDH/SONET up to STM-64/OC-192. PDH/DSn systems (E1, E3, E4, DS1 and DS3) can be tested directly or embedded into SDH/SONET. The MT1000A can support new and legacy technologies, leaving the user less equipment to maintain and learn, and reducing operating expenses.

SDH/SONET and PDH/DSn test features include:

- Powerful testing of SDH (STM-64, STM-16, STM-4, STM-1), SONET (OC-192, OC-48, OC-12, OC-3, STS-3) systems and embedded PDH (E1, E3, E4) and DSn (DS1, DS3) systems



Looping-back test signal from MT1000A at far end supports SDH/SONET line quality tests

Network Master Pro MT1000A Mainframe Specifications

User Interfaces	
Display	9-inch active TFT display (800 × 480 pixels) and touch screen
Supported Languages	English, Chinese, Japanese, French, Russian, Spanish, Finnish, Korean, German

Miscellaneous		
Battery		10.8 V rechargeable and replaceable intelligent Li-ion battery Operating time: 1.5 hours (typ., in case of 100 GbE) Charging time: 6 hours (Max.) Remaining capacity indication: %
Mains Adapter		Input: 100 VAC to 240 VAC, 50 Hz/60 Hz Output: 18 V(dc), 3.62 A (max.) Power Consumption: ≤65 W With MT1000A-006*2 Input: 100 VAC to 240 VAC, 50 Hz/60 Hz Output: 18 V(dc), 6.6 A (max.) Power Consumption: ≤120 W
Dimensions and Mass		257 (W) × 164 (H) × 82 (D) mm (excluding projections, MT1000A + MU100010A) 257 (W) × 164 (H) × 89 (D) mm (excluding projections, MT1000A + MU100011A) 2.7 kg (including MT1000A, MU100010A and battery) 2.7 kg (including MT1000A, MU100011A and battery)
Environmental		Temperature Operating : 0°C to +50°C (non-condensing) Charging: 0°C to +40°C (non-condensing) Storage: –30°C to +60°C (non-condensing, without battery or AC adapter) –20°C to +50°C (non-condensing, with battery and AC adapter) Humidity Operating: ≤85% RH (non-condensing) Storage and Transportation: ≤90% RH (non-condensing, without battery and AC adapter) Storage and Transportation: ≤85% RH (non-condensing, with battery and AC adapter)
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000:2018
Laser Safety*3		IEC 60825-1:2007 Class 1M CFP4: 100GBASE-SR4 QSFP28: 100GBASE-SR4 QSFP+: 40GBASE-SR4 SFP28: 25GBASE-SR IEC 60825-1:2007 Class 1 CFP4: 100GBASE-LR4 QSFP28: 100GBASE-LR4 QSFP+: 40GBASE-LR4 SFP28: 25GBASE-LR SFP+ : 10GBASE-LR/ER/ZR SFP : 1000BASE-SX/LX/ZX SFP: 4G FC (SX), 4G FC (LX), 4G FC (EX), OC-48 LR-1/STM L-16.1, OC-48 LR-2/STM L-16.2, 100BASE-FX/LX FDA 21CFR1040.10 and 1040.11*4

*2: MT1000A-006 is required for MU100011A.

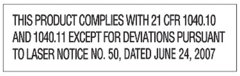
*3: Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10, 1040.11 and IEC 60825-1; the following descriptive labels are affixed to the product.

*4: Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007

IEC 60825-1:2007
INVISIBLE LASER RADIATION
DO NOT VIEW DIRECTLY
WITH OPTICAL INSTRUMENTS

(MAX OUTPUT POWER)	(PULSE DURATION)	(WAVELENGTH)
7.8mW	CW	840 to 860nm

CLASS 1M LASER PRODUCT



THIS PRODUCT COMPLIES WITH 21 CFR 1040.10
AND 1040.11 EXCEPT FOR DEVIATIONS PURSUANT
TO LASER NOTICE NO. 50, DATED JUNE 24, 2007

Ordering Information

This table lists the key configurataion part only.
For details, refer to the Product Brochure or consult our sales representative.

Mainframe

Model/Order No.	Name	
MT1000A	Network Master Pro	
Standard Accessories		
MT1000A-006*1	High Power Supply:	Installed
	Line Cord*2:	1 pc
B0745A	Softcase:	1 pc
B0728A*3	Rear Panel kit:	1 pc
G0385A*4	High Power AC Adaptor:	1 pc
G0310A	Li-ion Battery:	1 pc
Z1746A	Stylus:	1 pc
Z1747A*5	Carrying Strap:	1 pc
Z1748A*6	Handle:	1 pc
Z1817A*7	Utilities ROM:	1 pc
Options		
MT1000A-003*8	Connectivity for WLAN/Bluetooth	
MT1000A-005*9	AUX I/O	
MT1000A-011*10	Site Over Remote Access Connect	
Optional Accessories		
B0691B*11	Hard Case	
G0382A*12	Autofocus Video Inspection Probe	
G0306C*12	Video Inspection Probe	

*1: The presence of the MT1000A-006 option can be recognized at the top right of the front panel. To retrofit to the already shipped item, please contact us.

Without MT1000A-006

With in MT1000A-006

*2: One line cord is attached to the area to shipment.
*3: Composed of B0720A, B0729A, B0730A and B0731A.
Refer to Module Composition for the module combination.
*4: The MT1000A with MT1000A-006 can be used. Use the AC adapter when using the MT1000A without MT1000A-006 installed.
*5: Shoulder strap for MT1000A.
*6: Hand strap for MT1000A.
*7: This DVD includes PDF files and formatting tools of each product's instruction manual (such as W3933AE, W3810AE, W3736AE, W3946AE).
*8: Available for certified countries and regions including USA, Canada, Japan and EU countries. Please visit the Anritsu web site for updated information.
*9: MT1000A-005 is required for MU100090B. To retrofit to the already shipped item, please contact us.
*10: See page 103 for details
*11: Can use module 1 to 2 in combination
*12: This fiberscope uses the VIP function in the MT1000A Utility menu.
Different tip types are used by the G0382A and G0306C.

G0382A

G0306C

Transport Module

10G Multirate Module MU100010A

Model/Order No.	Name	
MU100010A	10G Multirate Module	
Standard Accessories		
W3935AE	MT1000A Transport Module Quick Reference Guide:	1 pc
B0692A*13	ESD Box (for optical modules):	1 pc

*13: Up to four SFP+/SFPs can be stored.

100G Multirate Module MU100011A

Model/Order No.	Name	
MU100011A*14	100G Multirate Module	
Standard Accessories		
W3935AE	MT1000A Transport Module Quick Reference Guide:	1 pc
B0763A*15	ESD Box (for Optical modules):	1 pc

*14: MT1000A-006 is required for MU100011A.
*15: One CFP4 plus either up to two QSFP28s or up to four SFP/SFP+s can be stored.

High Performance GNSS Disciplined Oscillator MU100090B

Model/Order No.	Name
MU100090B*16	High Performance GNSS Disciplined Oscillator
Standard Accessories	
J1705A	AUX Conversion Adaptor
J1886A*17	GNSS Antenna
J1710A	BNC Cable (20 cm) × 2
Z2122A	Tripod for GNSS Antenna
Optional Software	
MU100090B-001	High Stability/Multi-Band
MU100090B-002	Multi-GNSS

*16: Excellent Eco Product non-compliant.
*17: With 5 m cable, IP67 Ingress protection.
MT1000A-005 and Ethernet options are required for MU100090B.

Subscription Option License

Model/Order No.	Name
MX109020A*13, *15, *16, *17	Site Over Remote Access Basic License
MX109020A-TL001*13, *14	Site Over Remote Access 1 Year License
MX109020A-001*15	Site Over Remote Access 8 Units
MX109020A-002*15	Site Over Remote Access Unlimited Units
MX109020A-003*18	Centralized Data Management

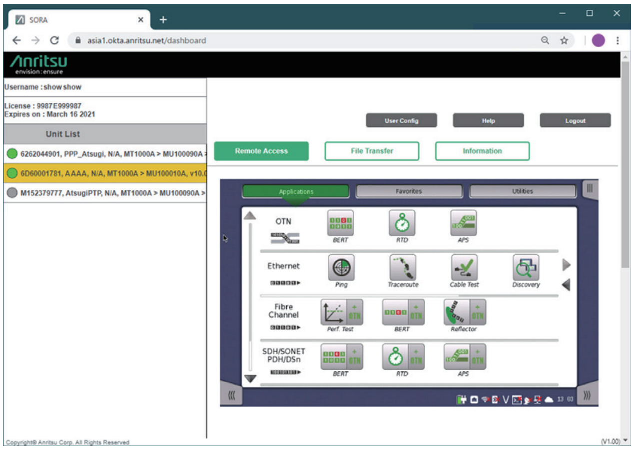
*13: We recommend purchasing a 1-year license in addition to the basic license.
*14: When extending the usage period, we recommend purchasing in 1-year license periods
*15: Up to two measuring instruments can be remotely controlled simultaneously with the basic license.
This number can be increased to up to 8 units by purchasing the MX109020A-001 option, and up to 100 units by purchasing the MX109020A-002 option.
*16: You must agree to the service terms before purchasing SORA.
Refer to the service terms at the following URL: https://www.anritsu.com/en-AU/test-measurement/support/downloads/manuals/dwl20059
*17: This product cannot be used in some regions and countries; please read the service terms for more details.
*18: Users must provide their own storage at the upload destination.

* Standard Accessories and Optional Accessories cannot be repaired.

Site Over Remote Access

MX109020A

Remote Control Over the Cloud, Easy Connections Anywhere



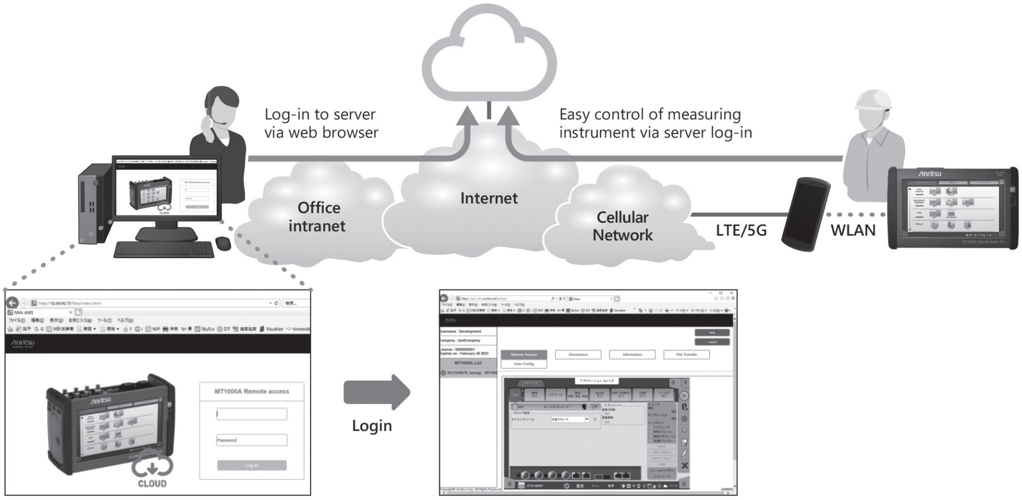
asia1.okta.anritsu.net/dashboard

Username : show show

License : 9987E999987
Expires on : March 16 2021

Unit List
6262044901, PPP_Atsugi, N/A, MT1000A > MU100090A
6D60001781, AAAA, N/A, MT1000A > MU100010A, v10.0
M152379777, AtsugiPTP, N/A, MT1000A > MU100090A >

Using the Site Over Remote Access MX109020A (SORA hereafter) software measuring instruments can be remotely controlled easily anywhere.
The SORA cloud-based service allows office users to log-in to an Internet webpage to control the measuring instrument from the office via a smartphone.

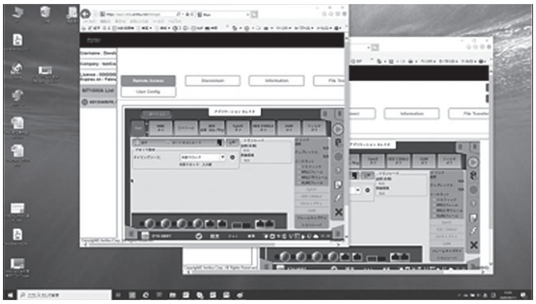


Login screen

Remote control screen

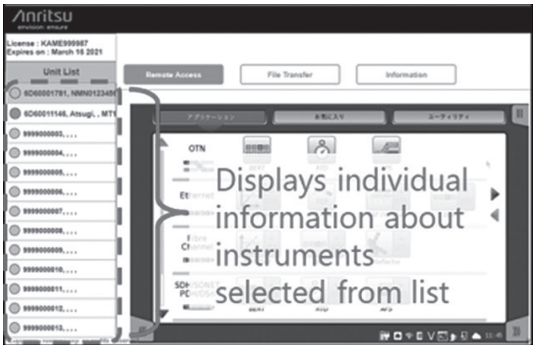
Remote Operation Function

Measuring-instrument screens are displayed as is by the web browser. The PC keyboard and mouse are used to perform instrument operations. PC operations are displayed on the remote instrument screen. Several measuring instruments can be operated on one PC desktop.



Administration Functions

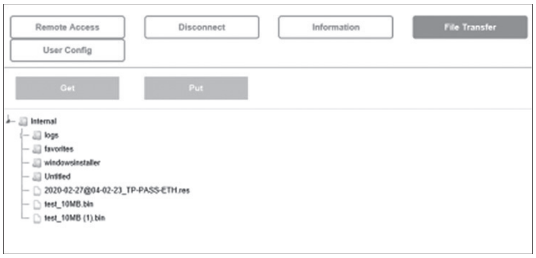
The serial number, firmware version, and available options of measuring instruments at each site can be listed on the PC screen.



License : KAME999987
Expires on : March 16 2021

File Transfer Function

Measurement results, etc., saved in the instrument internal storage can be transferred as a file to the office PC (GET), and files on the PC can be copied to the measuring instrument (PUT).



Remote Software Service

The following licenses must be purchased to use the MX109020A Site Over Remote Access.

Mainframe Option License

Model/Order No.	Name
MT1000A-003*1	WLAN/Bluetooth Connect
MT1000A-011*2	Site Over Remote Access Connect
MT1040A-003*1	WLAN/Bluetooth Connect
MT1040A-011*2	Site Over Remote Access Connect

*1: WLAN is available for certified countries and regions including USA, Canada, Japan and EU countries. Please visit the Anritsu web site for updated information.

*2: Validity period is unlimited. An open TCP port may be required to allow the MT1000A/MT1040A to be connected from an in-company LAN to MX109020A, depending on the LAN security policy.

Subscription Option License

Model/Order No.	Name
MX109020A*3, *5, *6, *7	Site Over Remote Access Basic License
MX109020A-TL001*3, *4	Site Over Remote Access 1 Year License
MX109020A-001*5	Site Over Remote Access 8 Units
MX109020A-002*5	Site Over Remote Access Unlimited Units
MX109020A-003*8	Centralized Data Management

*3: We recommend purchasing a 1-year license in addition to the basic license.

*4: When extending the usage period, we recommend purchasing in 1-year license periods

*5: Up to two measuring instruments can be remotely controlled simultaneously with the basic license.
This number can be increased to up to 8 units by purchasing the MX109020A-001 option, and up to 100 units by purchasing the MX109020A-002 option.

*6: You must agree to the service terms before purchasing SORA.
Refer to the service terms at the following URL: https://www.anritsu.com/en-us/test-measurement/support/downloads/manuals/dwl20059

*7: This product cannot be used in some regions and countries; please read the service terms for more details.

*8: Users must provide their own storage at the upload destination.

Network Master Series

MT9090A Mainframe
MU909060A1/A2/A3 Gigabit Ethernet Modules

Remote Control
Ethernet
OPTION

Gigabit Ethernet Testing Redefined!

Network Master

MT9090A with MU909060A1/A2/A3 Overview

The Ethernet technology is widely deployed, and used for carrier class Ethernet and Mobile backhaul. Therefore easy testing of Ethernet links is very important. When outfitted with the Gigabit Ethernet Module, the very compact battery-powered, easy-to-use Anritsu Network Master is a comprehensive solution for Gigabit Ethernet testing and for installation and troubleshooting Ethernet communication lines. The instrument gives the user facilities for easy bandwidth verification, connectivity testing and service availability verification. The small size and low weight of the instrument makes it very easy to carry around for the field technician working with the Ethernet lines and despite the small size the instrument is equipped with a large display. The user can easily read and interpret information from the tested lines off the large color display with easy-to-understand colors and graphical symbols.
And the graphical user interface makes it a simple task to configure and operate the instrument.

Key Features

- RJ45 and SFP optical interface are selectable for two ports
- Newly released ITU-T standard for End-to-End Ethernet testing ITU-T Y.1564 testing, simultaneously testing of multiple traffic streams emulating real world networks
- Stacked VLAN (Q-in-Q), MPLS, IPv4, IPv6 supported
- Test Automator simplify operation and ensure proper set-up
- Ping, Traceroute, Ramp data generation, RFC 2544 testing
- Upstream/Downstream individual and simultaneous testing with End-to-End RFC 2544
- Service Disruption Time measurement for VoIP and IPTV
- Shorter testing time of multiple port networks by utilizing MT9090-ports
- Optical power level check and electrical cable test for physical layer testing
- In-band pass through and bidirectional monitoring using two ports
- Channel Stats for identifying error streams, top talkers, network attacks
- PDF and CSV report generation for documentation of test results
- Modular platform ensures maximum return on investment
- Compact and lightweight design for maximum portability in the field

Designed for Field Operations

The Network Master Gigabit Ethernet tester (MT9090A with MU909060A) is purpose built for testing Ethernet links in the field. Its hardware and user interface are optimized for simplicity, making it easy to use for any skill level, and it is rugged enough to function in harsh environments.

Quick Startup

The Network Master Gigabit Ethernet tester is ready for measurement in about 15 seconds so productive work can start immediately.

Long Battery Life

Since AC power is not always available where you need it, the Network Master Gigabit Ethernet tester provides up to 3 hours of testing on a single charge, depending on configuration and setup. This coupled with an optional car cigarette lighter cord guarantees the instrument is ready when you are.

Portable

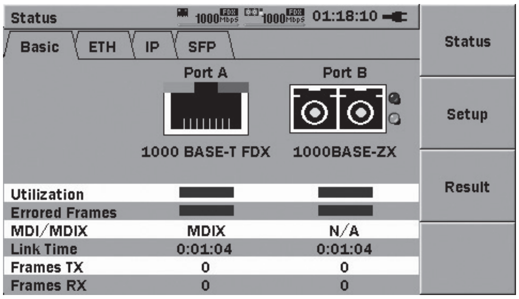
With its lightweight design and user friendly dimensions, the Network Master Gigabit Ethernet tester is perfect for the outside plant environment and can easily be managed with one hand.
The standard softcase with shoulder strap further increases portability when traveling from the truck to the testing site.

Rugged

With no fans or vents to allow dust and moisture to enter the unit, the Network Master Gigabit Ethernet tester was designed for the challenging outside plant environment.
The protector included as standard equipment absorbs the shock to the tester.

4.3-inch Wide Screen Display for Easy Viewing

The high resolution, full color, 4.3-inch wide screen display is the perfect format for viewing Ethernet measurement results. It also provides excellent readability both indoors and outdoors.

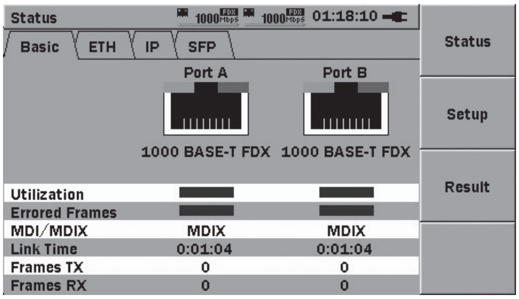

Status 1000 Mbps FDX 1000 Mbps FDX 01:18:10

Basic | ETH | IP | SFP

Status / Setup / Result

	Port A	Port B
	1000 BASE-T FDX	1000BASE-ZX
Utilization	▬	▬
Errored Frames	▬	▬
MDI/MDIX	MDIX	N/A
Link Time	0:01:04	0:01:04
Frames TX	0	0
Frames RX	0	0

MU909060A1

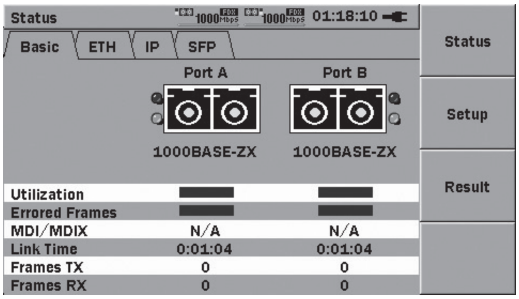

Status 1000 Mbps FDX 1000 Mbps FDX 01:18:10

Basic | ETH | IP | SFP

Status / Setup / Result

	Port A	Port B
	1000 BASE-T FDX	1000 BASE-T FDX
Utilization	▬	▬
Errored Frames	▬	▬
MDI/MDIX	MDIX	MDIX
Link Time	0:01:04	0:01:04
Frames TX	0	0
Frames RX	0	0

MU909060A2


Status 1000 Mbps FDX 1000 Mbps FDX 01:18:10

Basic | ETH | IP | SFP

Status / Setup / Result

	Port A	Port B
	1000BASE-ZX	1000BASE-ZX
Utilization	▬	▬
Errored Frames	▬	▬
MDI/MDIX	N/A	N/A
Link Time	0:01:04	0:01:04
Frames TX	0	0
Frames RX	0	0

MU909060A3

No Experience Required

The expertise is built into the Network Master Gigabit Ethernet tester. With its Test Automator and PASS/FAIL indicators the instrument makes it easy to test and troubleshoot Ethernet connections.

Designed for Network Activation

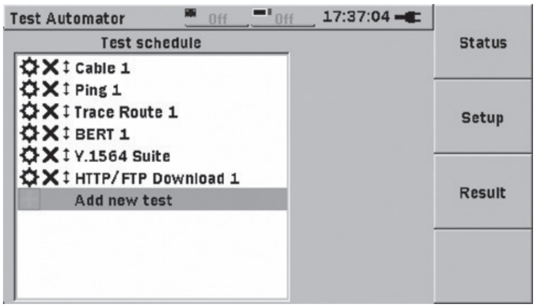
For installation, commissioning and QoS verification the Network Master Gigabit Ethernet tester provides powerful and flexible traffic generation capabilities, allowing you to easily test the network under various conditions, including generation of VLAN tagged traffic. The instrument also provides facilities for BER testing of the lines, performance statistics and QoS statistics.

Single end test with Loopback or Using a Ethernet Reflector,
Two ports simultaneous testing for multiple ports installation.

Bidirectional performance test with End-to-End RFC 2544,
Two ports simultaneous testing for multiple ports installation.

Installation and Maintenance Simplified

Since the Network Master Gigabit Ethernet tester is purposely built for easy testing of Ethernet links in the field, its hardware and user interface are optimized for simplicity. The instrument is easy to setup using its keys and screen. The user can also store setups relevant for a given application and via a USB port distribute the setup to other instruments with the Gigabit Ethernet tester. A Test Automator is provided making it easy to set up a sequence of tests.


Test Automator Off Off 17:37:04

Test schedule

- Cable 1
- Ping 1
- Trace Route 1
- BERT 1
- Y.1564 Suite
- HTTP/FTP Download 1
- Add new test

Status / Setup / Result

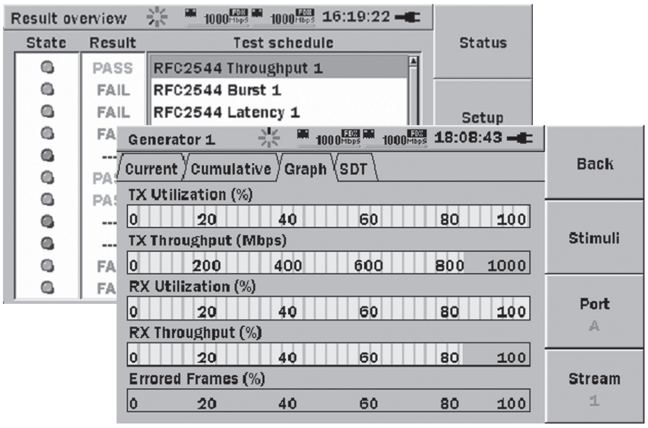
The Test Automator makes it easy to set up a sequence of tests

Report Generation

With the powerful and flexible report generator you can create .pdf or .csv files for selected measurement results. With these files you can provide professional documentation of test results to your customers.

Pass/Fail Indication, Graphical Display

The result can be checked not only value but also PASS/FAIL indicator and graphical display.



Result overview 1000 Mbps 1000 Mbps 16:19:22

State	Result	Test schedule
	PASS	RFC2544 Throughput 1
	FAIL	RFC2544 Burst 1
	FAIL	RFC2544 Latency 1

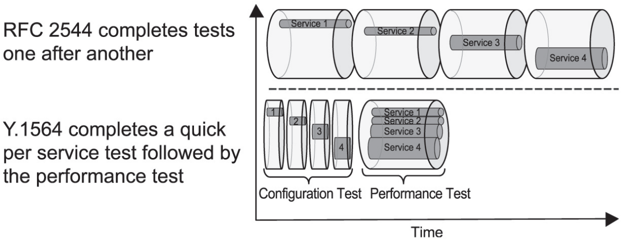
Generator 1 1000 Mbps 1000 Mbps 18:08:43

Y.1564 Test Option

ITU-T Y.1564 is a new test methodology for bring Ethernet networks into service, simultaneously completing multiple traffic streams. RFC 2544 commonly use today completes tests in a serial manner never running all traffic streams at the same time. ITU-T Y.1564 completes this testing in two phases:

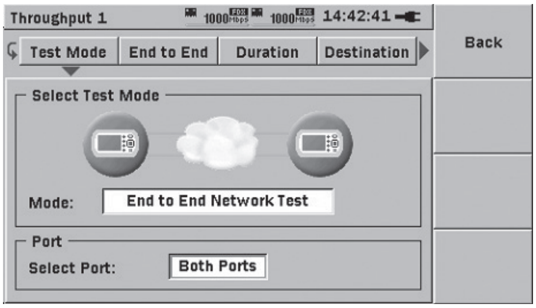
- Service Configuration Test, confirms the end to end configuration while quickly checking the Information Rate (IR), Frame Delay Variation (FDV), Frame Loss Ratio (FLR), Frame Loss Ration at the Service Acceptance Criteria (FLRSAC), Committed Burst Size (CBS) and Excess Burst Size (EBS) sequentially for all configured traffic streams.
- Service Performance Test transmits all configured traffic streams simultaneously at the CIR confirming all traffic is able to transverse the network under full load while checking the following IR, FDV, FLR and Availability (AVAIL).

This two phase approach reduces total testing time.



RFC 2544 Test Option

With the RFC 2544 test option, testing of throughput and frame loss, latency, packet jitter and burstability is straightforward.
The Network Master Gigabit Ethernet tester automates the testing procedure while still allowing you to configure the test to be as thorough as needed.
To get full information on the performance of both sides of a line, the end-to-end test mode allows two Network Master Gigabit Ethernet testers to work together in an in-band control setup whereby the user can control both units and inspect the results of the test from both units on the master instrument.

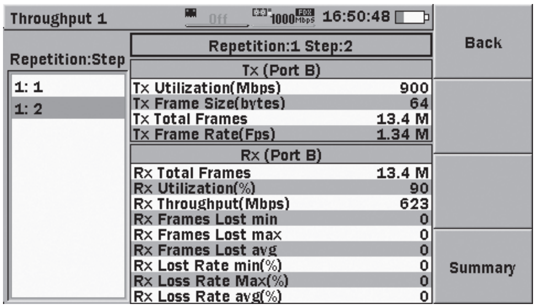


Throughput 1 1000 Mbps 1000 Mbps 14:42:41

Mode: End to End Network Test

Port

Select Port: Both Ports



Throughput 1 Off 1000 Mbps 16:50:48

Repetition:Step

1: 1
1: 2

Repetition:1 Step:2

Tx (Port B)	
Tx Utilization(Mbps)	900
Tx Frame Size(bytes)	64
Tx Total Frames	13.4 M
Tx Frame Rate(Fps)	1.34 M
Rx (Port B)	
Rx Total Frames	13.4 M
Rx Utilization(%)	90
Rx Throughput(Mbps)	623
Rx Frames Lost min	0
Rx Frames Lost max	0
Rx Frames Lost avg	0
Rx Lost Rate min(%)	0
Rx Loss Rate Max(%)	0
Rx Loss Rate avg(%)	0

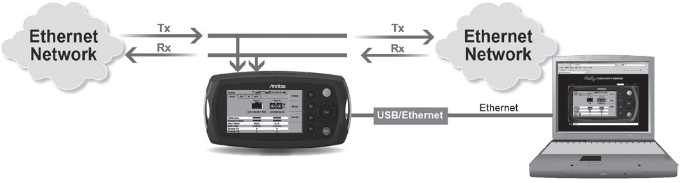
Multistream Option

The Ethernet Multistream option for the Network Master Gigabit Ethernet tester allows testing a congested networks ability to transport high priority traffic rather than lower priority traffic.
The user can activate up to 8 streams with different priority settings on the Ethernet line and detect how they are affected by frame loss through the network.

Simplifying Maintenance and Troubleshooting

The Network Master Gigabit Ethernet tester has maintenance and troubleshooting application in 800 g pocketable package.

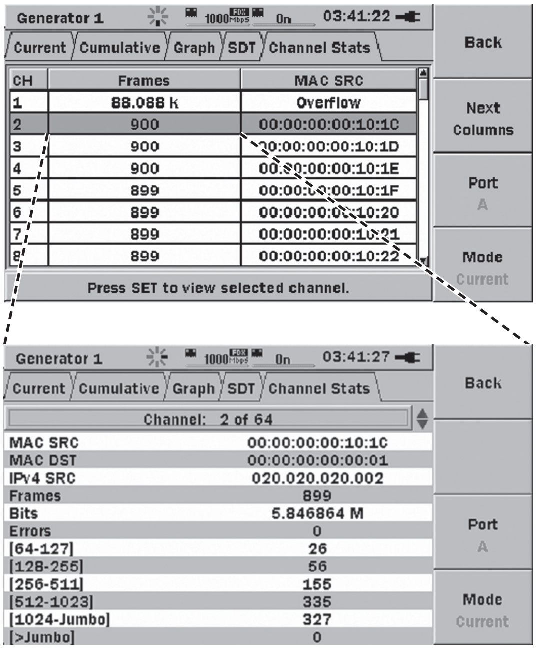
Pass through monitoring by inserting the tester in a network.
Tx and Rx of two ports are used for this application.



Bidirectional monitoring by dividing both signals and put them into the tester. Two Rxs are used for this application.

Channel Stats (Option)

Up to 63 streams can be selected by the filter of Source/Destination addresses, VLAN, MPLS. Those streams can be monitored and displayed in detailed information. It's useful to identify the error streams, top talkers and network attack.



CH	Frames	MAC SRC
1	88.088 k	Overflow
2	900	00:00:00:00:10:1C
3	900	00:00:00:00:10:1D
4	900	00:00:00:00:10:1E
5	899	00:00:00:00:10:1F
6	899	00:00:00:00:10:20
7	899	00:00:00:00:10:21
8	899	00:00:00:00:10:22

Press SET to view selected channel.

Channel: 2 of 64

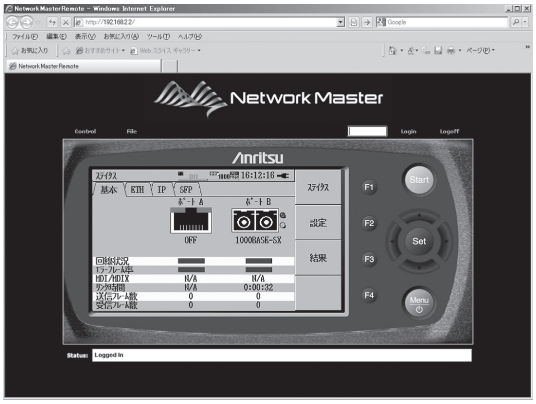
MAC SRC	00:00:00:00:10:1C
MAC DST	00:00:00:00:00:01
IPv4 SRC	020.020.020.002
Frames	899
Bits	5.846864 M
Errors	0
[64-127]	26
[128-255]	56
[256-511]	155
[512-1023]	335
[1024-Jumbo]	327
[>Jumbo]	0

Simultaneous Two Ports Monitoring

Network Master Gigabit Ethernet tester has two ports and they can be used simultaneously. It saves the test time for multiple ports deployment. It is possible to support identification of issues in the network by pass through monitoring and bidirectional monitoring.

Remote GUI Option

Network Master Gigabit Ethernet tester can be operated remotely from the far end operation center using a Web browser. USB-Ethernet Converter (option) connects the Network Master Gigabit Ethernet tester with Ethernet for remote control.



	ポートA	ポートB
	OFF	1000BASE-SX
回線状況		
エラーフレーム率		
MDI/MDIX	N/A	N/A
リンク時間	N/A	0:00:32
送信フレーム数	0	0
受信フレーム数	0	0

Status: Logged In

Specifications

The specification table below applies to the Network Master Mainframe equipped with the Gigabit Ethernet Module.

Ethernet Interfaces	Interfaces	• Electrical interfaces: 10/100/1000 Mbps RJ45 (10BASE-T, 100BASE-TX, 1000BASE-T) • Optical interfaces: 100 or 1000 Mbps LC connector (100BASE-FX, 100BASE-LX, 1000BASE-SX, 1000BASE-LX or 1000BASE-ZX)			
	Interface Configurations	• MU909060A1: Gigabit Ethernet Module with one SFP port and 1 electrical RJ45 port. One optical module can be installed • MU909060A2: Gigabit Ethernet Module with 2 electrical RJ45 ports. • MU909060A3: Gigabit Ethernet Module with two SFP ports. Two electrical or optical modules can be installed			
	Duplex Modes	Full duplex. Electrical 10 Mbps/100 Mbps also half duplex			
	Test Configurations	Monitor/Generate, Pass through, Reflector			
Optical Modules*1	Description	Min. input sensitivity and wavelength		Output power and wavelength	
	1000BASE-SX 850 nm Multimode	–17 dBm	770 nm to 860 nm	–9.5 to –1.5 dBm	830 nm to 860 nm
	1000BASE-LX 1310 nm Singlemode	–20 dBm	1260 nm to 1580 nm	–10 to –3 dBm	1285 nm to 1343 nm
	1000BASE-ZX 1550 nm Singlemode	–22 dBm	1260 nm to 1580 nm	–3 to +5 dBm	1480 nm to 1580 nm
	100BASE-FX 1310 nm Multimode	–31 dBm	1260 nm to 1570 nm	–20 to –14 dBm	1270 nm to 1335 nm
	100BASE-LX 1310 nm Singlemode	–28 dBm	1260 nm to 1570 nm	–15 to –8 dBm	1261 nm to 1360 nm
Generate	Supported Encapsulations	EtherType II (DIX v.2), IEEE 802.3 with 802.2 (LLC1), IEEE 802.3 with SNAP			
	Traffic Generation/Monitor	• Variable line rate traffic generation, up to full line rate • Traffic shaping: Constant, Burst, Ramped • Frame sizes can be set to Constant, Stepped or Random length • Configurable MAC/IP source and destination addresses (supports IPv4 and IPv6), UDP/TCP address and DSCP/TOS byte • Request IP source address from a DHCP server (On/Off) • Adjustable frame size from 46 bytes to 10000 bytes • User defined up to 3 level VLAN ID and VLAN priority (Option) • User defined up to 3 level MPLS label (Option) • User defined traffic mix of unicast and broadcast frames • Generate and respond to pause frames • Answer incoming ARP request (On/Off) • MAC/IP address swapping (reflector configuration) Test Result Current/Cumulative: Total frame, Total bit, Utilization, Throughput, Broadcast frame, Error frame, Frame loss, Frame loss rate Graph: Tx utilization, Tx throughput, Rx utilization, Rx throughput, Error frame Service Disruption Time: Min., Max., Average, Count, Total time, Total SDT (%), Last frame received (interval) timestamp Channel Stats: Total frame, Total bit, Error, Frame size distribution of up to 63 filtered streams			

Continued on next page

Measurements	Status	Link status, Signal and Frames present (utilization), Errored frames, Rx/Tx frame count, Link time, Remote fault, Speed, Full/Half duplex, MDI/MDIX, Interface type, Link partner abilities (Pause capable and Asymmetric pause capable), Local clock (1000 Mbps), DHCP lease time, Optical level for optical interfaces
	Frame Statistics	Link status, Signal and Frames present (utilization), Error frames, Rx/Tx frame count, Link time, Remote fault, Speed, Full/Half duplex, MDI/MDIX, Interface type, Link partner abilities (Pause capable and Asymmetric pause capable), Local clock (1000 Mbps), DHCP lease time, Optical level for optical interfaces
	Event Log	The instrument logs major events during a test with a 1 sec. resolution time stamp. Logged events include: Link/No link and Test Start/Stop
	Report Generation	Generation of test result reports as pdf-files. The report may be customized with a user logo and comments.
Dedicated Tests	Electrical Cable Test (MU909060A1/A2)	• Detection of MDI/MDIX mode, Link speed and status, Cable status and distance to fault (if any), Polarity. For 1000 Mbps also skew • Pin mapping: Tx/Rx for 10/100 Mbps, DA, DB, DC, DD for 1000 Mbps
	BER Test	Generation and detection of test patterns. Count of errors in received test pattern. Pattern generation: Unframed, Framed with IP header or Framed with IP and TCP/UDP header Test patterns supported: FOX, all 0, all 1, 0101, PING, PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31, HF test pattern, CRPAT, JTPAT, SPAT Detection of sequence errors and loss of sequence synchronization.
	Ping Test	For connectivity and configuration check • Round Trip Time (RTT) • Supports IPv4 and IPv6 addressing • Answer incoming Ping requests (On/Off)
	Traceroute Test	Setup: Number of Attempts, Max number of hops, Number of ping each host, Timeout Result: Number of hop, Host IP address, Number of Received/Lost replies, Min/Max/Average time
	ITU-T Y.1564 Test (Option)	Test mode: Single Ended test, Switch/Router test, End-to-End test Configuration Test: Up to 32 services, Up to 6 steps with CBS, EBS Test result: Pass/Fail, IR (Information Rate), FL (Frame Loss), FTD (Frame Transfer Delay), FDV (Frame Delay Variation) Service Performance Test: Up to 32 services Test result: Pass/Fail, IR (Information Rate), FL (Frame Loss), FTD (Frame Transfer Delay), FDV (Frame Delay Variation), AVAIL (Availability), UN-AVAIL (Unavailable seconds), SEQ ERR (Sequence Errors) Test report: Y.1564 Appendix II compliant (CSV or PDF) Parameters: Configurable with MT9090A's Test Automator or the standalone PC application (MX909060A)
	RFC 2544 Installation and Commissioning Tests (Option)	Single ended network test and Switch/Router test modes: Throughput and utilization, Frame loss, Latency, Packet jitter, Back-to-back frames (burstability) End-to-End network test mode (two Network Master Gigabit Ethernet testers in an in-band control setup): Throughput and utilization, Frame loss, Back-to-back frames (burstability) Router latency test mode: IP ping based latency, IP ping based packet jitter
	Multistream Test (Option)	Number of streams: Up to 8 streams can be activated on the Ethernet line available information per stream: Frame loss count/rate, Frames and bytes received, Frames and bytes transmitted
	HTTP/FTP Test	Test mode: HTTP, FTP Setup: Target directory, Download file name, Authentication Result: Received/Total file size, Min/Max/Average throughput
	Reflector Delay	Maximum internal delay when instrument is in reflector configuration: 2.44 µs (1000 Mbps), 5.16 µs (100 Mbps), 31.93 µs (10 Mbps)
General	Internal Memory	Internal memory for storage of results, setups and screen shots: 40 MB
	Stored Configurations	The user can save a number of configuration files for later recall. The configuration files can be transferred to other instruments via the instruments USB port.
	Test Automator	The user can create a macro to run several tests in sequence. The user can also load, save, import and export test macros
	Service Interface	Two USB 1.1 (One type A for USB memory stick, One type B for USB mass storage)
	Display	4.3-inch color LCD (480 × 272 pixels), with LED back light, transmissive
	Language	English, Japanese, Chinese (Simplified, Traditional), Spanish, German, Korean, French, Italian, Portuguese
	Battery	Dedicated battery pack or 4 AA Ni-MH Operating time: Up to 3 hours, depending on configuration and test setup Charging time: 4 hours while power off (typ.), Temperature: +10°C to +30°C Indicator for battery level in display when the unit is turned on
	Power Supply	AC adapter: 9 V(dc), 100 VAC to 240 VAC, Frequency: 50 Hz/60 Hz
	Dimensions and Mass	MT9090A: 190 (W) × 96 (H) × 18 (D) mm, <200 g MU909060A1/A2/A3: 190 (W) × 96 (H) × 30 (D) mm, <600 g
	Environmental	Operational Temperature Range: 0°C to +40°C, Humidity ≤85%, No condensation Storage Temperature Range: –25°C to +60°C, Humidity ≤80%, No condensation Vibration: IEC 60 068-2-6 Fc and IEC 60 068-2-64 Fh, Dust and Drip proof: IP 51
	CE	EMC: 2014/30/EU, EN61326-1, EN61000-3-2 LVD: 2014/35/EU, EN61010-1 RoHS: 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
	UKCA	EMC: S.I. 2016 No.1091, EN 61326-1, EN61000-3-2 LVD: S.I. 2016 No.1101, EN 61010-1 RoHS: S.I. 2012 No.3032, EN IEC 63000: 2018
	Laser Safety*3	IEC 60825-1: 2007 CLASS 1 21CFR1040.10*2: MU909060A1/A3 with optical modules

*1: Correct functioning can only be guaranteed with optical modules from Anritsu for the Network Master Gigabit Ethernet tester.
Modules with extended temperature range (up to +85°C) must be used.

*2: Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007

*3: Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10 and IEC 60825-1; the following descriptive labels are affixed to the product.

⚠ IEC 60825-1:2007
CLASS 1 LASER PRODUCT

THIS PRODUCT COMPLIES WITH 21 CFR 1040.10
AND 1040.11 EXCEPT FOR DEVIATIONS PURSUANT
TO LASER NOTICE NO. 50, DATED JUNE 24, 2007

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Select Mainframe

Model/Order No.	Description
MT9090A	Mainframe (with color LCD)
	Standard Accessories
G0203A	AC Adapter
G0202A	NiMH Battery Pack
Z1023A	Strap
B0601B	Standard Soft Case
B0663A*1	Protector

*1: The shoulder strap can be used to hang the instrument around the neck while working.

Select Base Model*2

Model/Order No.	Description
MU909060A1	Gigabit Ethernet Module (with one SFP slot and one RJ-45 port)
MU909060A2	Gigabit Ethernet Module (with two RJ-45 ports)
MU909060A3	Gigabit Ethernet Module (with two SFP slots)
	Standard Accessories
W3173AE	Gigabit Ethernet Tester Quick Start Guide
Z1234A	Network Master Gigabit Ethernet Tester CD

*2: Not support MT9090A with MT9090A-001.

Select SEP Module Option

One module can be installed in MU909060A1.
Two modules can be installed in MU909060A3

Model/Order No.	Description
G0240A	1000 Mbps SX SFP [850 nm multimode, LC connector (optical)]
G0241A	1000 Mbps LX SFP [1310 nm single mode, LC connector (optical)]
G0242A	1000 Mbps ZX SFP [1550 nm single mode, LC connector (optical)]
G0243A	100 Mbps FX SFP [1310 nm multimode, LC connector (optical)]
G0244A	100 Mbps LX SFP [1310 nm single mode, LC connector (optical)]
G0246A	10/100/1000 Mbps RJ-45 SFP (electrical)

Select Software Option

Model/Order No.	Description
MU909060A1-001	RFC 2544 Test (for MU909060A1)
MU909060A2-001	RFC 2544 Test (for MU909060A2)
MU909060A3-001	RFC 2544 Test (for MU909060A3)
MU909060A1-002	Multistream (for MU909060A1)
MU909060A2-002	Multistream (for MU909060A2)
MU909060A3-002	Multistream (for MU909060A3)
MU909060A1-003	Stacked VLAN (for MU909060A1)
MU909060A2-003	Stacked VLAN (for MU909060A2)
MU909060A3-003	Stacked VLAN (for MU909060A3)
MU909060A1-004	MPLS (for MU909060A1)
MU909060A2-004	MPLS (for MU909060A2)
MU909060A3-004	MPLS (for MU909060A3)
MU909060A1-005*3	Remote GUI (for MU909060A1)
MU909060A2-005*3	Remote GUI (for MU909060A2)
MU909060A3-005*3	Remote GUI (for MU909060A3)
MU909060A1-006	Channel Stats (for MU909060A1)
MU909060A2-006	Channel Stats (for MU909060A2)
MU909060A3-006	Channel Stats (for MU909060A3)
MU909060A1-007	Y.1564 Test (for MU909060A1)
MU909060A2-007	Y.1564 Test (for MU909060A2)
MU909060A3-007	Y.1564 Test (for MU909060A3)

Select Optional Accessories

Must be added as separate line items

Model/Order No.	Description
Z1580A*4	Protector & Soft Case
B0600B	Hard Case
B0602B	Deluxe Soft Case (for MT9090A)
J1402A	Car Plug Cord
W3166AE	MU909060A1/A2/A3 Operation Manual (Hardcopy – English version)
J1480A*5	USB-Ethernet Converter

*3: Requires J1480A USB-Ethernet Converter (sold separately)
*4: The protector (B0663A) and standard soft case (B0601B) from a set. The protector includes a shoulder strap.
*5: Requires MU909060Ax-y05 Remote GUI (sold separately)

Warranty Service

Model/Order No.	Description
MT9090A-ES210	2 Years Extended Warranty Service (for MT9090A)
MT9090A-ES310	3 Years Extended Warranty Service (for MT9090A)
MU909060A1-ES210	2 Years Extended Warranty Service (for MU909060A1)
MU909060A2-ES210	2 Years Extended Warranty Service (for MU909060A2)
MU909060A3-ES210	2 Years Extended Warranty Service (for MU909060A3)
MU909060A1-ES310	3 Years Extended Warranty Service (for MU909060A1)
MU909060A2-ES310	3 Years Extended Warranty Service (for MU909060A2)
MU909060A3-ES310	3 Years Extended Warranty Service (for MU909060A3)

Installed Software Option (Retrofit)

The following software options can be field installed by the customer in already purchased Network Master Gigabit Ethernet testers.

Model/Order No.	Description
MU909060A1-301	RFC 2544 Test Retrofit (for MU909060A1)
MU909060A2-301	RFC 2544 Test Retrofit (for MU909060A2)
MU909060A3-301	RFC 2544 Test Retrofit (for MU909060A3)
MU909060A1-302	Multistream Retrofit (for MU909060A1)
MU909060A2-302	Multistream Retrofit (for MU909060A2)
MU909060A3-302	Multistream Retrofit (for MU909060A3)
MU909060A1-303	Stacked VLAN Retrofit (for MU909060A1)
MU909060A2-303	Stacked VLAN Retrofit (for MU909060A2)
MU909060A3-303	Stacked VLAN Retrofit (for MU909060A3)
MU909060A1-304	MPLS Retrofit (for MU909060A1)
MU909060A2-304	MPLS Retrofit (for MU909060A2)
MU909060A3-304	MPLS Retrofit (for MU909060A3)
MU909060A1-305*3	Remote GUI Retrofit (for MU909060A1)
MU909060A2-305*3	Remote GUI Retrofit (for MU909060A2)
MU909060A3-305*3	Remote GUI Retrofit (for MU909060A3)
MU909060A1-306	Channel Stats Retrofit (for MU909060A1)
MU909060A2-306	Channel Stats Retrofit (for MU909060A2)
MU909060A3-306	Channel Stats Retrofit (for MU909060A3)
MU909060A1-307	Y.1564 Test Retrofit (for MU909060A1)
MU909060A2-307	Y.1564 Test Retrofit (for MU909060A2)
MU909060A3-307	Y.1564 Test Retrofit (for MU909060A3)

Standard Soft Case B0601B
This standard accessory accommodates the mainframe with fitted protector.

Deluxe Soft Case B0602B
Full Network Master operation without removal from the case.
Provides excellent protection for use in hash conditions.
This does not accommodate the mainframe if the protector is fitted.

Hard Case B0600B
This accommodates two mainframes (with or without fitted protector), accessories (light source or power meter, backup battery, fiber cleaner, etc.).

Mainframe with Protector

Protector B0663A (Standard accessory)

* Standard Accessories and Optional Accessories cannot be repaired.

MOBILE/WIRELESS COMMUNICATIONS MEASURING INSTRUMENTS

Mobile Communication Measurement Equipment

(example of an application; various other types of measurement equipment are also available)

Anritsu Model	Mobile Communication System																								Mobile Equipment			Base Station		
	5G NR	LTE-Advanced	LTE FDD	LTE TDD	Cat-M	NB-IoT	W-CDMA	HSDPA	HSUPA	HSPA Evolution	CDMA2000 1X	1xEV-DO	GSM/GPRS	EGPRS	TD-SCDMA	W-LAN (11a/b/g/n)	W-LAN (11ac)	W-LAN (11ax)	W-LAN (11j)	W-LAN (11p)	Mobile WiMAX	Bluetooth	ISDB-T	DVB-T/H	CPRI	R&D	Manufacture	Maintenance/Service	R&D	Manufacture	Construction/Service
MT8000A Radio Communication Test Station	✓	✓	✓	✓																						✓					
MD8430A Signalling Tester		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓												✓					
MX800050A/MX786201A Rapid Test Designer (RTD)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓												✓					
ME7834NR 5G NR Mobile Device Test Platform	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓*1											✓					
ME7834LA LTE-Advanced Mobile Device Test Platform		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓*1											✓					
ME7873NR New Radio RF Conformance Test System	✓																									✓					
ME7873LA LTE-Advanced RF Conformance Test System		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓*1		✓*1											✓					
ME7803NR RF Regulatory Test System	✓																									✓					
ME7800L Simple Conformance Test System		✓	✓	✓	✓	✓																				✓					
MD8475B Signalling Tester		✓	✓	✓			✓	✓	✓	✓		✓	✓	✓	✓											✓					
MT8821C Radio Communication Analyzer		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓											✓					
MT8870A/MT8872A Universal Wireless Test Set	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓			✓				
MG3710E Vector Signal Generator	✓	✓	✓	✓			✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	
MS2690A/MS2691A*5/MS2692A*5 Signal Analyzer	✓	✓	✓	✓*2			✓	✓	✓	✓	✓*2	✓*2	✓	✓	✓	✓	✓		✓	✓					✓	✓	✓		✓	✓	✓
MS2850A Signal Analyzer	✓	✓	✓	✓*2			✓	✓	✓	✓			✓	✓	✓											✓	✓	✓	✓	✓	✓
MS2840A Signal Analyzer																										✓*3			✓*3		
MS2830A Signal Analyzer		✓	✓	✓*2			✓	✓	✓	✓	✓*2	✓*2	✓	✓	✓	✓	✓		✓	✓						✓	✓	✓		✓	✓
MS2090A Field Master Pro	✓	✓	✓	✓																											✓
MS2720T Spectrum Master		✓	✓	✓		✓*4	✓				✓	✓	✓		✓						✓										✓
MS2713E Spectrum Master		✓	✓	✓		✓*4	✓	✓			✓	✓	✓		✓						✓		✓	✓							✓
MT8852B *Bluetooth* Test Set																						✓				✓	✓				
MT8862A Wireless Connectivity Test Set																✓	✓	✓								✓	✓				
MA8100A NEON Signal Mapper											✓	✓			✓						✓										✓
S820E Microwave Site Master																															✓
S412E LMR Master			✓	✓									✓																		✓
S331E S332E S361E S362E Site Master																															✓
S331L Site Master																															✓
S331P Site Master																															✓

*1: Measurement items for InterRAT Handover are available.
*2: Downlink/Forward link only
*3: Available for Spectrum measurement without modulation analysis.
*4: Guard Band, Standalone only
*5: Please note that they are only for the Conformance Test System and cannot be purchased separately.

Radio Communication Test Station

MT8000A

Remote Control
Ethernet

All-in-One 5G Signaling, RF and Functional Tests

Excellent Eco Product

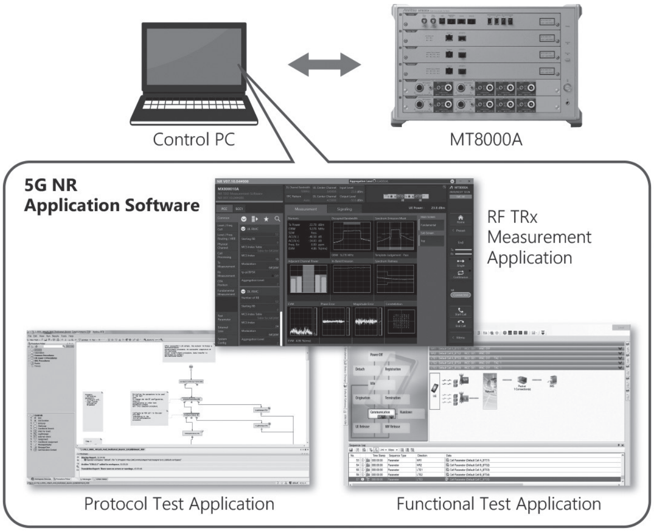
Expandability Supporting 5G

5G NR is a new communications standard intended to increase communications speed and capacity to more than 100 times that of the current LTE standard. It is required to support advances in wireless communications technologies, such as greatly expanded communications bandwidth and use of mmWave, which is not supported by earlier mobile communications.
Anritsu is releasing its new MT8000A solution supporting 5G NR RF Tx measurements, Protocol and Functional tests needed to support advances in communications technologies in line with the development of 5G NR.

Three Features of 5G Test Platform MT8000A

1. Support for Various Test Requirements

MT8000A supports Non-signalling/Signalling RF TRx measurements as well as Protocol tests and Functional Test on all-in-one hardware by switching applications. The leading-edge design with flexibility and scalability uses a modular architecture; in addition to supporting high-order 4×4 MIMO and 8 Carrier Aggregation (8CA) by implementing eMBB (Enhanced Mobile Broadband), the MT8000A offers a flexible test environment for future new applications covering a wide application area by supporting new 5G test needs, including URLLC (Ultra-Reliable and Low Latency Communications) and mMTC (massive Machine Type Communications).



RF TRx Measurement and Protocol Test , Functional Test Environment Image

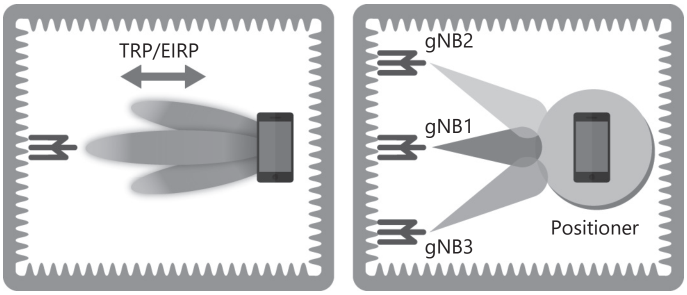
2. Support for 5G mm-Wave Bands

An OTA environment is required to evaluate 5G NR UE in the mmW. The MT8000A also supports the evaluation of 5G NR UEs in the millimeter wave band by combining with the OTA Chamber according to the application.

Beam management test can be performed using RF Chamber MA8171A, which can irradiate millimeter wave signals to UEs from various angles.

Tests related to communication protocols such as mmW Throughput tests and Functional tests use Shield Box MA8161A.
Because it saves space, you can easily test on the desktop.

MA8172A is Far Field Measurement & Black Box Approach OTA test requirements for mmWave RF measurements are supported. The CATR chamber is TRx test main platform for 5G NR chipsets, modules and terminals mmWave development.



RF TRP/EIRP/EIS Measurement

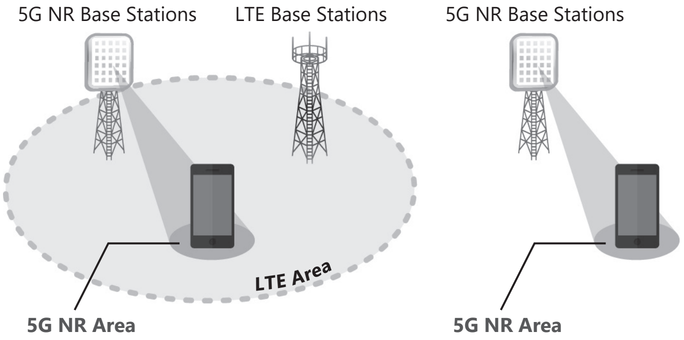
Beam Management Test

Example of Millimeter-wave Band RF/Protocol Test in Combination with RF Chamber

3. Early Support for NSA/SA/FR1+FR2 DC Test Environments

The MT8000A supports NSA (for Non-Standalone, 5G NR and LTE network architectures), SA (for Standalone, 5G NR-only architectures) and FR1+FR2 DC (Dual Connectivity ; 5G SA mode with FR1 and FR2 architectures) test solution.

In addition, customer can utilize Anritsu LTE measurement solutions such as stable LTE test environment and existing test scenario resource, and easy to configure a 5G-LTE coupled test environment. In SA test, customer can test in network where only 5G does both U-Plane and C-Plane communication. In FR1+FR2 DC, customer can test which enhances data throughput per user.



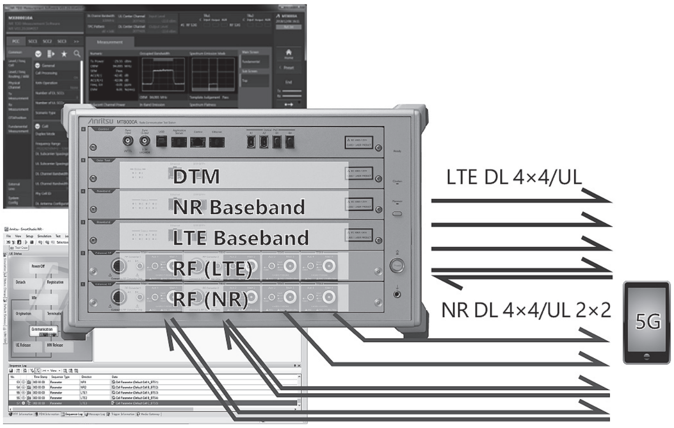
NSA (Non-Standalone)

SA (Standalone)

Image of 5G NR NSA/SA Configuration

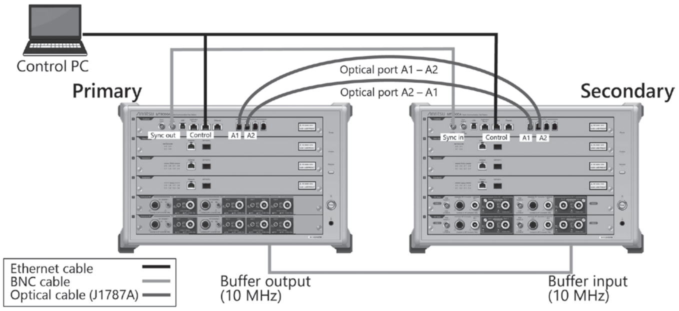
4. Support 5G NR and LTE in one unit

MT8000A supports 5G NR and LTE in one unit. EPS Fallback and EN-DC configuration test (such as ENDC of LTE multiple CA, NR SA after referral) can be supported by one unit. It supports an IP T-put environment sufficient for actual application evaluation, and RF and functional tests can be easily performed simply by switching the FW, realizing an efficient test environment.



5. Support higher-order test by using multiple MT8000A

One application can operate multiple MT8000A. By using multiple MT8000A, testable number of CC is expanded, customer can higher-order test.



Specifications

Dimensions		426 (W) × 265 (H) × 578 (D) mm (excluding projections)
Mass		≤50 kg (with all options)
Environmental Conditions		Operating: +5°C to +40°C (no condensation) Storage: −20°C to +71°C (no condensation)
Power Supply		100 VAC to 120 VAC/200 VAC to 240 VAC 50 Hz/60 Hz ≤1500 VA
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000: 2018

Please contact us for other detailed specifications.

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MT8000A	Radio Communication Test Station
	Standard Accessories
J1211	POWER CORD.3M: 1 pc
J1440A	LAN Cable : 1 pc
W3955AE	MT8000A Radio Communication Test Station Operation Manual: 1 pc
MX800000A	Platform Software
	Options
MT8000A-001	Control Module
MT8000A-009	Multi-box Data connection
MT8000A-011	Baseband Module
MT8000A-012	Data Test Module
MT8000A-020	RF Base Module
MT8000A-021	0.4 GHz-6 GHz RF Sub Module
MT8000A-022	3 GHz-12 GHz RF Sub Module
MT8000A-023	Extend RF 2.4 GHz - 3 GHz
MT8000A-024	Extend RF 6 GHz-7.125 GHz
MT8000A-031	0.4 GHz-6 GHz Multi RF Module
MT8000A-032	0.4 GHz-6 GHz Multi RF Extension
MT8000A-033	0.4 GHz-7.125 GHz Enhanced RF Module
	Please inquire about other options.
	Converter
MA80001A	28 GHz RF Converter
MA80002A	39 GHz RF Converter
MA80003A	Multiband RF Converter
	RF Chamber Related Products
MA8171A	RF Chamber
MA8174A	Position Controller
MA8175A	Positioner
	CATR Chamber Related Products
MA8172A	CATR Anechoic Chamber
MA8178A/B	Position Controller
MA8179A/B	Positioner
	Shield Box Related Products
MA8161A	Shield Box
	Software Options
MX800010A	NR TDD Measurement Software
MX800030A	NR Protocol Platform Software
MX800050A	Rapid Test Designer Platform (RTD)
MX800070A	SmartStudio NR
	Support Service
MX800010A-SS101	5G NR RF Measurement Support Service (Per Year)
MX800050A-SS100	RTD Support Service (Per Year)
MX800070A-SS110	SmartStudio NR Support Service (Per Year)
	Application Parts
	Please inquire details.

For details, please contact our sales department.

Shield Box

MA8161A

For 5G NR mmW OTA Testing

The Shield Box MA8161A provides simple mmW OTA test environment for 5G protocol test.

- Small footprint for easy benchtop use and good handling
- Can be installed on a desktop in a small space
- Easy to test 5G NR mmW call connection

Specifications

Only key specifications are listed. See detail for OTA Product Catalog, or contact your Anritsu sales representative.

Frequency	600 MHz to 6 GHz, 24 GHz to 43.5 GHz
Dimensions and Mass	434 (W) × 271 (H) × 328 (D) mm (excluding projection) ≤16 kg (maximum configuration)

Ordering Information

Only key components are listed. Contact your Anritsu sales representative for detailed ordering information.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MA8161A	Shield Box
	Options
MA8161A-002	Connector Panel 2
MA8161A-AK010	Shield Tube
	Application Parts
Z1999A	28 GHz Antenna Unit
Z2000A	39 GHz Antenna Unit
K241C	Precision Power Splitter, DC to 40 GHz

RF Chamber

MA8171A

Remote Control
Ethernet

For 5G NR mmW OTA Testing

The RF Chamber MA8171A supports 5G NR mmW OTA environment for RF/protocol tests.

- Since multiple antennas can be installed, an OTA test environment can be built flexibly
- Supports 5G NR mmWave TRP/EIRP measurements, etc.

Specifications

Only key specifications are listed. See detail for OTA Product Catalog, or contact your Anritsu sales representative.

Frequency	800 MHz to 3.8 GHz, 24 GHz to 40 GHz
Dimensions and Mass	Main frame of chamber 1460 (W) ×1210 (H) × 1000 (D) mm (excluding projection) ≤150 kg Including chamber rack and converter rack 2080 (W) × 1785 (H) × 1000 (D) mm (excluding projection)

Ordering Information

Only key components are listed. Contact your Anritsu sales representative for detailed ordering information.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MA8171A	RF Chamber
	Application Units and Parts
MA8174A	Position Controller
MA8175A	Positioner
MA8181A	28 GHz Test Antenna
Z1996A	28 GHz/39 GHz Test Antenna
Z2031A	Test Antenna
Z1974A	Reference Antenna
Z2009A	Link Antenna
B0746A	Chamber Rack
B0747A	Converter Rack

CATR Anechoic Chamber

MA8172A

Remote Control
Ethernet

For 5G NR mmW OTA Testing

The CATR Anechoic Chamber MA8172A supports 5G NR OTA environment using 3GPP-compliant Compact Antenna Test Range (CATR) method.

- Compatible with Indirect Far Field & Black Box Approach required for mmWave measurement
- Contributing to the development of mmWave 5G NR chipsets, modules and UEs
- Evaluation of beam characteristics of 5G NR UEs, etc. is possible in a short time
- Compatible with 5G NR mmWave band spurious tests in RF conformance tests

Specifications

Only key specifications are listed. See detail for OTA Product Catalog, or contact your Anritsu sales representative.

Frequency	600 MHz to 87 GHz
Dimensions and Mass	2200 (W) × 1980 (H) × 1200 (D) mm (Including main frame of chamber and rack. Excluding projection) ≤700 kg (Including all options. Excluding rack)

Ordering Information

Only key components are listed. Contact your Anritsu sales representative for detailed ordering information.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

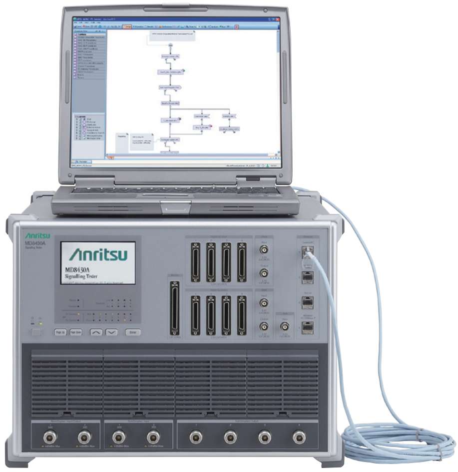
Model/Order No.	Name
	Main Frame
MA8172A	CATR Anechoic Chamber
	Application Units and Parts
MA8172A-010	Temperature Testing Option
MA8172A-021	Test Antenna
MA8172A-022	Test Antenna
MA8172A-023	Test Antenna
MA8172A-AK022	NR FR2 Link Antenna Kit
MA8172A-AK023	LTE Link Antenna Kit
MA8172A-AK024	NR FR2 Link Antenna Kit
MA8178A	Position Controller
MA8179A	Positioner
MA8179A-AK010	DUT-supporting Structure
MA8179A-AK011	DUT Holder
MA8178B	Position Controller
MA8179B	Positioner
MA8179B-AK010	DUT-supporting Structure
MA8179B-AK011	DUT Holder
MA8179B-AK012	DUT Pole mount structure
Z1974A	Reference Antenna
Z2032A	Reference Antenna
Z2096A	Heater Controller

Signalling Tester

MD8430A

Remote Control
Ethernet

Early Support for Developing 5G NSA/LTE-Advanced Pro (CA/MTC) Chipsets and Mobile UEs



LTE-Advanced Pro is faster than LTE/LTE-Advanced and becoming effect radio communications network.
The Signalling Tester MD8430A is a key LTE-Advanced Pro base station simulator for developing LTE/LTE-Advanced/LTE-Advanced Pro-compliant chipsets and mobile UEs. Also supports 5G NSA protocol testing is possible by using in combination with Radio Communication Test Station MT8000A.
Using its extensive experience in 3G markets, Anritsu has developed the MD8430A as a powerful LTE-Advanced Pro protocol R&D test solution to help developers bring LTE/LTE-Advanced/LTE-Advanced Pro terminals to market as fast as possible.

Key Features

- Support LTE-Advanced Pro testing with 6CCs Carrier Aggregation (CA) and less
- Early support 3GPP LTE-Advanced FDD/TDD Release 13
  - TDD-FDD joint operation including CA
  - DL 256QAM
  - LTE MTC (Machine Type Communication)
- One MD8430A support CA handover, 4×4 MIMO, 8×4 MIMO, etc.
- Available to testing of full digital fading
- Support DL 2 Gbps, UL 300 Mbps data throughput
- Optimized investment from first R&D to protocol conformance testing
- Full development and analysis toolset cuts L1, L2 and L3 scenario development time and costs
- Support UMTS Release 10, HSPA Evolution, GSM/GPRS/EGPRS
- Supports 5G NSA protocol testing is possible by using in combination with MT8000A

Main Applications

- Coding/Decoding tests (RF/Baseband)
- Protocol sequence tests
- Throughout and stress tests (Performance test)
- Intra-RAT/Inter-RAT performance tests
- LTE Pre-conformance/Conformance tests
- Network interoperability tests
- LTE network operator acceptance tests (CAT)
- Troubleshooting field test problems
- UE QC inspection
- W-CDMA/HSPA protocol sequence tests

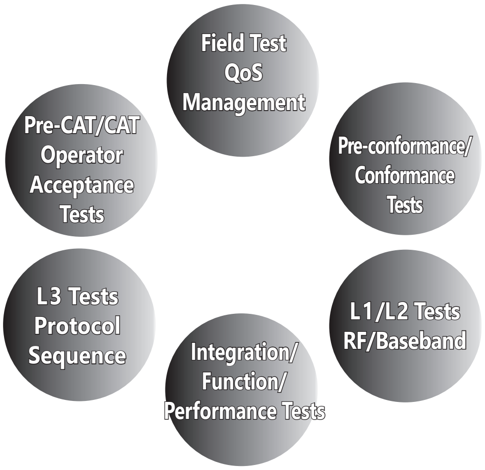
Main Test Functions

- LTE-Advanced Intra-RAT CA handover test (Hard handover)
- LTE ↔ UTRAN/GERAN Inter-RAT handover test
- eMBMS test
- Digital baseband slow clock test
- Protocol sequence analysis (Log analysis)
- Throughput monitoring
- UE scheduling function (Time/MCS/Lowest RB/RB)
- H-ARQ Test (ACK/NACK/DTX)
- VoLTE test (SPS, TTI Bundling, DRX, RoHC, CA+VoLTE)
- W-CDMA/HSPA handover test
- Dual Connectivity
- Licensed Assisted Access (LAA)
- Cellular Internet of Things (C-IoT) Test (Cat-M/NB-IoT)

Basic Functions (LTE-Advanced)

- Transmit downlink (DL) signal (Up to 6 GHz)
- Receive uplink (UL) signal (Up to 6 GHz)
- Call processing
- Transmit power Control (TPC)
- Baseband interface
- DL 2×2/4×2 MIMO, DL 4×4/8×2/8×4 MIMO, UL 2×2 MIMO (Test Model: ETM)
- CA 2CCs/3CCs/4CCs/5CCs/6CCs (Test Model: ETM)
- Ciphering (option)

See Specifications of "Signalling Tester MD8430A models" for detail..



Supports Newest UE Categories

The MD8430A follows UE categories defined on 3GPP specifications, and will support new future categories.

UE category table: 3GPP TS 36.306 V14.5.0 (2017-12)

☐ : MD8430A supported ▨ : MD8430A not supported

UE Category (DL)

UE Category	Maximum number of DL-SCH transport block bits received within a TTI	Maximum number of bits of a DL-SCH transport block received within a TTI	Total number of soft channel bits	Maximum number of supported layers for spatial multiplexing in DL
Category 1	10296	10296	250368	1
Category 2	51024	51024	1237248	2
Category 3	102048	75376	1237248	2
Category 4	150752	75376	1827072	2
Category 5	299552	149776	3667200	4
Category 6	301504	149776 (4 layers, 64QAM) 75376 (2 layers, 64QAM)	3654144	2 or 4
Category 7	301504	149776 (4 layers, 64QAM) 75376 (2 layers, 64QAM)	3654144	2 or 4
Category 8	2998560	299856	35982720	8
Category 9	452256	149776 (4 layers, 64QAM) 75376 (2 layers, 64QAM)	5481216	2 or 4
Category 10	452256	149776 (4 layers, 64QAM) 75376 (2 layers, 64QAM)	5481216	2 or 4
Category 11	603008	149776 (4 layers, 64QAM) 195816 (4 layers, 256QAM) 75376 (2 layers, 64QAM) 97896 (2 layers, 256QAM)	7308288	2 or 4
Category 12	603008	149776 (4 layers, 64QAM) 195816 (4 layers, 256QAM) 75376 (2 layers, 64QAM) 97896 (2 layers, 256QAM)	7308288	2 or 4

UE DL Category

UE DL Category	Maximum number of DL-SCH transport block bits received within a TTI	Maximum number of bits of a DL-SCH transport block received within a TTI	Total number of soft channel bits	Maximum number of supported layers for spatial multiplexing in DL
DL Category M1	1000	1000	25344	1
DL Category M2	4008	4008	73152	1
DL Category 0	1000	1000	25344	1
DL Category 1bis	10296	10296	250368	1
DL Category 4	150752	75376	1827072	2
DL Category 6	301504	149776 (4 layers, 64QAM) 75376 (2 layers, 64QAM)	3654144	2 or 4
DL Category 7	301504	149776 (4 layers, 64QAM) 75376 (2 layers, 64QAM)	3654144	2 or 4
DL Category 9	452256	149776 (4 layers, 64QAM) 75376 (2 layers, 64QAM)	5481216	2 or 4
DL Category 10	452256	149776 (4 layers, 64QAM) 75376 (2 layers, 64QAM)	5481216	2 or 4
DL Category 11	603008	149776 (4 layers, 64QAM) 195816 (4 layers, 256QAM) 75376 (2 layers, 64QAM) 97896 (2 layers, 256QAM)	7308288	2 or 4
DL Category 12	603008	149776 (4 layers, 64QAM) 195816 (4 layers, 256QAM) 75376 (2 layers, 64QAM) 97896 (2 layers, 256QAM)	7308288	2 or 4
DL Category 13	391632	195816 (4 layers, 256QAM) 97896 (2 layers, 256QAM)	3654144	2 or 4
DL Category 14	3916560	391656 (8 layers, 256QAM)	47431680	8
DL Category 15	749856-807744	149776 (4 layers, 64QAM) 195816 (4 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 201936 (4 layers, 256QAM, if alternativeTBS-Index-r14 is supported) 75376 (2 layers, 64QAM) 97896 (2 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 100752 (2 layers, 256QAM, if alternativeTBS-Index-r14 is supported)	9744384	2 or 4
DL Category 16	978960-1051360	149776 (4 layers, 64QAM) 195816 (4 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 201936 (4 layers, 256QAM, if alternativeTBS-Index-r14 is supported) 75376 (2 layers, 64QAM) 97896 (2 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 100752 (2 layers, 256QAM, if alternativeTBS-Index-r14 is supported)	12789504	2 or 4
DL Category 17	25065984	391656 (8 layers, 256QAM)	303562752	8
DL Category 18	1174752-1211616	[299856 (8 layers, 64QAM) 391656 (8 layers, 256QAM)] 149776 (4 layers, 64QAM) 195816 (4 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 201936 (4 layers, 256QAM, if alternativeTBS-Index-r14 is supported) 75376 (2 layers, 64QAM) 97896 (2 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 100752 (2 layers, 256QAM, if alternativeTBS-Index-r14 is supported)	14616576	2 or 4 [or 8]
DL Category 19	1566336-1658272	[299856 (8 layers, 64QAM) 391656 (8 layers, 256QAM)] 149776 (4 layers, 64QAM) 195816 (4 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 201936 (4 layers, 256QAM, if alternativeTBS-Index-r14 is supported) 75376 (2 layers, 64QAM) 97896 (2 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 201936 (4 layers, 256QAM, if alternativeTBS-Index-r14 is supported)	19488768	2 or 4 [or 8]
DL Category 20	1948064 - 2019360	[299856 (8 layers, 64QAM) 391656 (8 layers, 256QAM)] 149776 (4 layers, 64QAM) 195816 (4 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 201936 (4 layers, 256QAM, if alternativeTBS-Index-r14 is supported) 75376 (2 layers, 64QAM) 97896 (2 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 100752 (2 layers, 256QAM, if alternativeTBS-Index-r14 is supported)	24360960	2 or 4 [or 8]

UE Category (UL)

UE Category	Maximum number of UL-SCH transport block bits transmitted within a TTI	Maximum number of bits of an UL-SCH transport block transmitted within a TTI	Support for 64QAM in UL
Category 1	5160	5160	No
Category 2	25456	25456	No
Category 3	51024	51024	No
Category 4	51024	51024	No
Category 5	75376	75376	Yes
Category 6	51024	51024	No
Category 7	102048	51024	No
Category 8	1497760	149776	Yes
Category 9	51024	51024	No
Category 10	102048	51024	No
Category 11	51024	51024	No
Category 12	102048	51024	No

UE UL Category

UE UL Category	Maximum number of UL-SCH transport block bits transmitted within a TTI	Maximum number of bits of an UL-SCH transport block transmitted within a TTI	Support for 64QAM in UL	Support for 256QAM in UL
UL Category M1	1000 or 2984	1000 or 2984	No	No
UL Category M2	6968	6968	No	No
UL Category 0	1000	1000	No	No
UL Category 1 bis	5160	5160	No	No
UL Category 3	51024	51024	No	No
UL Category 5	75376	75376	Yes	No
UL Category 7	102048	51024	No	No
UL Category 8	1497760	149776	Yes	No
UL Category 13	150752	75376	Yes	No
UL Category 14	9585664	149776	Yes	No
UL Category 15	226128	75376	Yes	No
UL Category 16	105528	105528	Yes	Yes
UL Category 17	2119360	211936	Yes	Yes
UL Category 18	211056	105528	Yes	Yes
UL Category 19	13563904	211936	Yes	Yes
UL Category 20	316584	105528	Yes	Yes
UL Category 21	301504	75376	Yes	No

NB-IoT (DL)

UE Category	Maximum number of DL-SCH transport block bits received within a TTI	Maximum number of bits of a DL-SCH transport block received within a TTI	Total number of soft channel bits
Category NB1	680	680	2112
Category NB2	2536	2536	6400

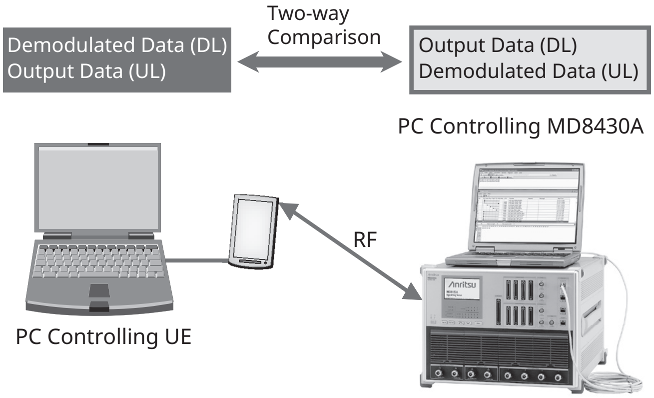
NB-IoT (UL)

UE Category	Maximum number of UL-SCH transport block bits transmitted within a TTI	Maximum number of bits of an UL-SCH transport block transmitted within a TTI
Category NB1	1000	1000
Category NB2	2536	2536

For Developing LTE-Advanced Pro Chipsets and Mobile UEs RF/Baseband Tests

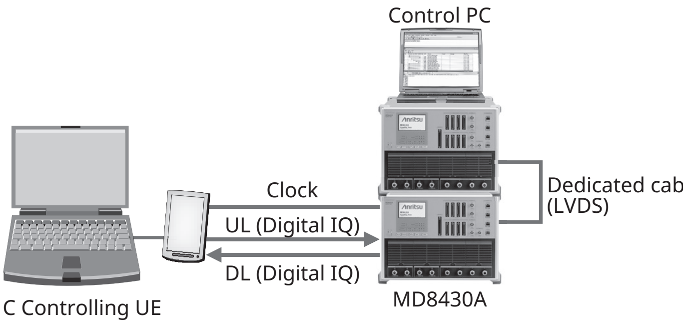
Coding/Decoding Test

Coding/Decoding tests of LTE-Advanced Pro terminals are performed by making the RF connections shown in the following diagram.



Coding/Decoding Test Example (RF, Non-call-processing Test)

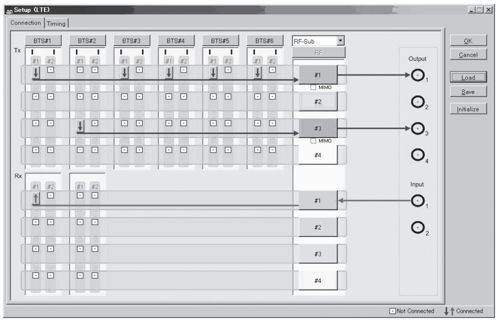
The MD8430A supports digital baseband I/O as standard functions. Using the baseband interface offers high-reproducibility coding/decoding tests free from the RF section, supporting stable evaluation of LTE chipset baseband performance.
Moreover, LTE coding/decoding tests are supported because the baseband chip can be evaluated using a slower clock than the clock frequency. And connecting the second MD8430A fading function to the digital baseband interface supports slow clock evaluations in a fading environment, which are difficult to perform with an RF fading simulator.



Slow Clock Test Setup (Digital Baseband, Fading)

Easy MIMO Test Configuration Settings

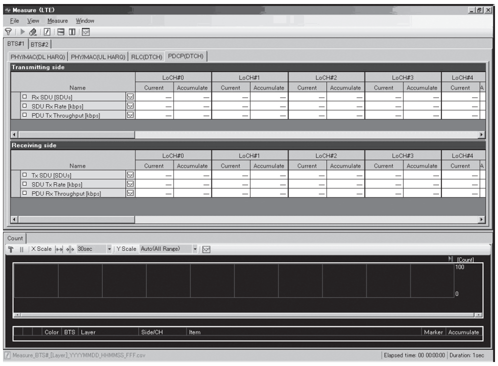
The MD8430A has 8 main and sub RF connectors as well as 8 digital IQ connectors as standard equipment for use with the MX843010A/E LTE Control Software to easily configure and monitor various settings, including RF parameters, channel power, MIMO, fading, connector selections, frame timing, BTS cell selections, etc.



Setup Screen Example

Fully Versatile L1/L2 Monitoring Functions

The MX843010A/E software supports LTE development by processing large volumes of low-layer data at very high speeds using a full line of versatile power monitoring, throughput monitoring and log analysis functions. The Measure (Counter) functions can monitor Layer 1/2 (L1/L2) throughputs in real time by counting parameter values such as ACK/NACK/DTX/CQI.



Transmitting side

Name	LoCH#0		LoCH#1		LoCH#2		LoCH#3		LoCH#4	
	Current	Accumulate	Current	Accumulate	Current	Accumulate	Current	Accumulate	Current	A
☐ Rx SDU [SDUs]	—	—	—	—	—	—	—	—	—	
☐ SDU Rx Rate [kbps]	—	—	—	—	—	—	—	—	—	
☐ PDU Tx Throughput [kbps]	—	—	—	—	—	—	—	—	—	

Receiving side

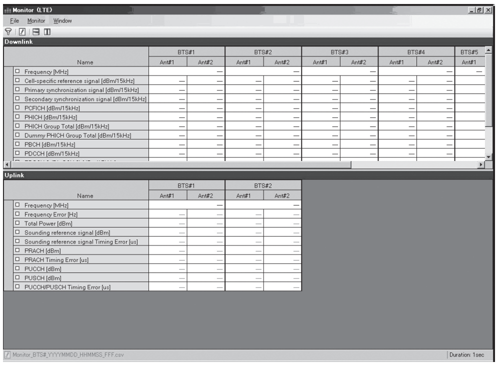
Name	LoCH#0		LoCH#1		LoCH#2		LoCH#3		LoCH#4	
	Current	Accumulate	Current	Accumulate	Current	Accumulate	Current	Accumulate	Current	A
☐ Tx SDU [SDUs]	—	—	—	—	—	—	—	—	—	
☐ SDU Tx Rate [kbps]	—	—	—	—	—	—	—	—	—	
☐ PDU Rx Throughput [kbps]	—	—	—	—	—	—	—	—	—	

Count
X Scale 30sec Y Scale Auto(All Range)
[Count] 100 0

Color	BTS	Layer	Side/CH	Item	Marker	Accumulate

Measure_BTS#_[Layer]_YYYYMMDD_HHMMSS_FFF.csv Elapsed time: 00 00:00:00 Duration: 1sec

Measurement (Counter and Throughput) Screens



Downlink

Name	BTS#1		BTS#2		BTS#3		BTS#4		BTS#5
	Ant#1	Ant#2	Ant#1	Ant#2	Ant#1	Ant#2	Ant#1	Ant#2	Ant#1
☐ Frequency [MHz]	—		—		—		—		—
☐ Cell-specific reference signal [dBm/15kHz]	—	—	—	—	—	—	—	—	
☐ Primary synchronization signal [dBm/15kHz]	—	—	—	—	—	—	—	—	
☐ Secondary synchronization signal [dBm/15kHz]	—	—	—	—	—	—	—	—	
☐ PCFICH [dBm/15kHz]	—	—	—	—	—	—	—	—	
☐ PHICH [dBm/15kHz]	—	—	—	—	—	—	—	—	
☐ PHICH Group Total [dBm/15kHz]	—	—	—	—	—	—	—	—	
☐ Dummy PHICH Group Total [dBm/15kHz]	—	—	—	—	—	—	—	—	
☐ PBCH [dBm/15kHz]	—	—	—	—	—	—	—	—	
☐ PDCCH [dBm/15kHz]	—	—	—	—	—	—	—	—	

Uplink

Name	BTS#1		BTS#2	
	Ant#1	Ant#2	Ant#1	Ant#2
☐ Frequency [MHz]	—		—	
☐ Frequency Error [Hz]	—	—	—	—
☐ Total Power [dBm]	—	—	—	—
☐ Sounding reference signal [dBm]	—	—	—	—
☐ Sounding reference signal Timing Error [us]	—	—	—	—
☐ PRACH [dBm]	—	—	—	—
☐ PRACH Timing Error [us]	—	—	—	—
☐ PUCCH [dBm]	—	—	—	—
☐ PUSCH [dBm]	—	—	—	—
☐ PUCCH/PUSCH Timing Error [us]	—	—	—	—

Monitor_BTS#_YYYYMMDD_HHMMSS_FFF.csv Duration: 1sec

Monitor Screen Example

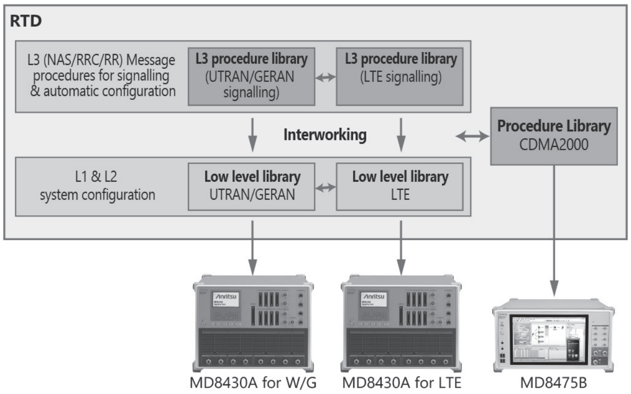
Complete LTE-Advanced Pro Protocol Test Environment

Intelligent Test Creation

The Rapid Test Designer (RTD) MX800050A/MX786201A software tools gives users power to create tests that cannot be done with traditional language based tools. RTD Supports L1/L2/L3 testing using Lower Layer Configuration library and Layer 3 procedure library of UE development. Moreover, each procedure auto-sets the connection with the lower Layers (L1/L2) based on full compliance with the 3GPP standards.
RTD can simulater LTE ↔ UMTS Inter-RAT and LTE ↔ CDMA2000 Interworking by connecting MD8430A and/or MD8475B.
The Reference Library test cases provides a reference to build the customized test cases and libraries with ease.

Cuts Test Case Development Time

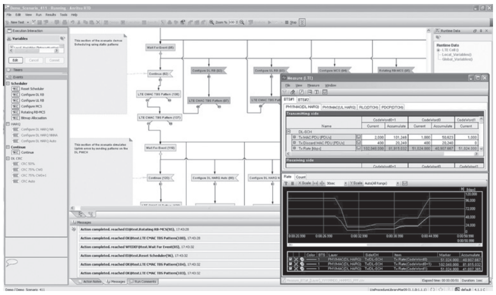
The RTD GUI offers intuitive test case creation by linking procedures with parameters, such as network conditions and message data, at easy-to-understand setting screens, quickly increasing the number of working test cases.
In addition, the Built-in Analyzer function checks for programming errors prior to testing, which can start immediately without recompiling after editing and changing settings.



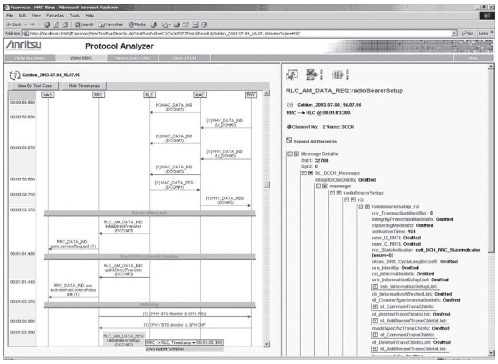
RTD Procedure Block

Flexibility in Testing & Analysis

When the test finishes the execution, the RTD provides a preliminary judgment against predetermined criteria. This avoids the need to study complex message sequences and can show a test outcome explained in a local language. The Integrated protocol analyzer with RTD supports very detailed Message Sequence Analysis and provides a facility to export the Protocol Test logs in to HTML format which can be viewed at any PC with a Browser without a RTD license.



Test Execution Screen (RTD)

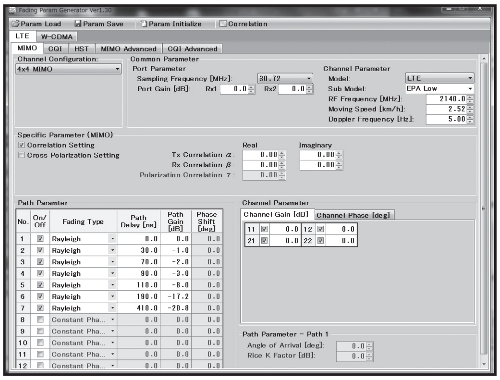


Log Analysis Screen (RTD)

Efficient UE Integration and Performance Tests

Testing Throughput for Various Conditions

The MD8430A supports the latest UE categories with download speeds of 2 Gbps and uploads speeds of 300 Mbps.
The bundled sample scenarios make it easy to change parameters such as bandwidth, scheduling, HARQ, etc., for testing LTE throughputs under various conditions.
In addition, combination with second MD8430A fading function supporting LTE MIMO via the dedicated digital interface simplifies complex power control procedures for easy throughput testing in a fading environment with simple test setup.



Channel Configuration: 4x4 MIMO

Common Parameter

Port Parameter
Sampling Frequency [MHz]: 30.72
Port Gain [dB]: Rx1 0.0 Rx2 0.0

Channel Parameter
Model: LTE
Sub Model: EPA Low
RF Frequency [MHz]: 2140.0
Moving Speed [km/h]: 2.52
Doppler Frequency [Hz]: 5.00

Specific Parameter (MIMO)
☑ Correlation Setting
☐ Cross Polarization Setting

	Real	Imaginary
Tx Correlation α:	0.00	0.00
Rx Correlation β:	0.00	0.00
Polarization Correlation γ:	0.00	

Path Paramter

No.	On/ Off	Fading Type	Path Delay [ns]	Path Gain [dB]	Phase Shift [deg]
1	☑	Rayleigh	0.0	0.0	0.0
2	☑	Rayleigh	30.0	-1.0	0.0
3	☑	Rayleigh	70.0	-2.0	0.0
4	☑	Rayleigh	90.0	-3.0	0.0
5	☑	Rayleigh	110.0	-8.0	0.0
6	☑	Rayleigh	190.0	-17.2	0.0
7	☑	Rayleigh	410.0	-20.8	0.0
8	☐	Constant Pha...	0.0	0.0	0.0
9	☐	Constant Pha...	0.0	0.0	0.0
10	☐	Constant Pha...	0.0	0.0	0.0
11	☐	Constant Pha...	0.0	0.0	0.0
12	☐	Constant Pha...	0.0	0.0	0.0

Channel Parameter
Channel Gain [dB] | Channel Phase [deg]

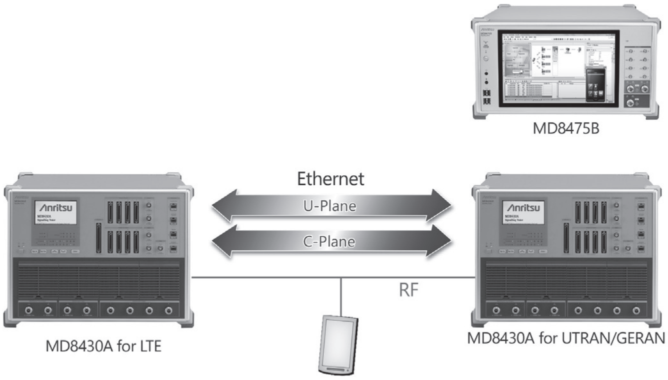
11	☑	0.0	12	☑	0.0
21	☑	0.0	22	☑	0.0

Path Parameter – Path 1
Angle of Arrival [deg]: 0.0
Rice K Factor [dB]: 0.0

Fading Setting Screen (MF6900A Fading Simulator)

Handover Tests Optimizing Hardware Investment

The MD8430A supports up to six cells (Four active cells) allowing handover tests between two LTE BTS with one tester. In addition, LTE-UTRAN/GERAN Inter-RAT handover tests are supported by connecting 2 boxes of MD8430A.
With the Signalling Tester MD8475B, CDMA2000 Interworking tests are supported too, maximizing support for both worldwide communications technologies and investment in hardware.



LTE-UTRAN/GERAN Handover Test Setup

Specifications of Signalling Tester MD8430A Model (ETM)

Model/Name	MD8430A-035 LTE Enhanced Test Model (ETM)
Interface	RF, Digital IQ, Baseband Fading*1
Frequency Band	Max. 20 MHz
UE Category	Category 1, 2, 3, 4, 5, 6, 7, 9*2, 10*2, 11*2, 12*2 DL Category M1, 0, 1 bis, 4, 6, 7, 9*2, 10*2, 11*2, 12*2, 13*2, 15*2, 16*2, 18*2, 19*2, 20*2 UL Category M1, 0, 1 bis, 3, 5, 7, 13, 15, 20 NB Category NB1
Max. Data Rate (DL)	1 Gbps (PHY: 2 Gbps)
Max. Data Rate (UL)	300 Mbps
MIMO	2 × 2 MIMO 4 × 2 MIMO 4 × 4 MIMO*3 8 × 2 MIMO 8 × 4 MIMO*4
Max. No. of Base Station	Active + adjacent BTS: 8*5 (Max. Active BTS: 6)
Hard Handover (including at MIMO)	Available*6
Carrier Aggregation: No. of Component Carriers (DL)*7	6*8, *9, *10
Carrier Aggregation: No. of Component Carriers (UL)*7	3*11

*1: Requires MD8430A-067 and two MD8430A sets for Baseband Fading. (ETM & ETM or ETM & BTM)
*2: Requires two MD8430A sets. (ETM & ETM or ETM & BTM)
*3: Requires MD8430A-075.
*4: Requires MD8430A-076.
*5: Requires two MD8430A sets. (ETM & ETM).
*6: For inter-frequency handover with Carrier Aggregation, requires two MD8430A sets. (ETM & ETM or ETM & BTM)
*7: Requires MD8430A-085.
*8: DL 4 CA operation requires MD8430A-088, DL 5 CA operation requires MD8430A-089, and DL 6 CA operation requires MD8430A-044.
*9: For 3 CA MIMO and 4 CA MIMO, requires two MD8430A sets. (ETM & ETM or ETM & BTM)
*10: For DL 5 CA MIMO and 6 CA MIMO, requires two MD8430A sets (only ETM 2 sets configuration)
*11: UL 3 CA operation requires MD8430A-045.

Powerful Platform for Both Conformance and Operator Acceptance Tests

Optimized Hardware Investment

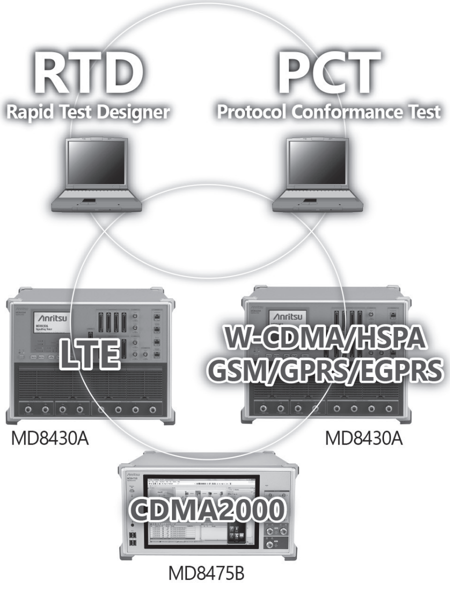
The MD8430A supports to design for early chipset and mobile UE, function tests, and performance tests ranging from carrier acceptance tests to protocol conformance tests as well as retrofit upgrades between models allows developers to tailor their hardware investment to current needs with future flexible upgrade options.
The Protocol Conformance Test Toolkit (PCT) with MD8430A and GCF/PTCRB approved TTCN test package provide an optimum environment for LTE protocol conformance testing. Hence, a Single Hardware Platform that extends its usage from Platform development to Conformance Testing and Operater Acceptance Test.

Instant Firmware Switching

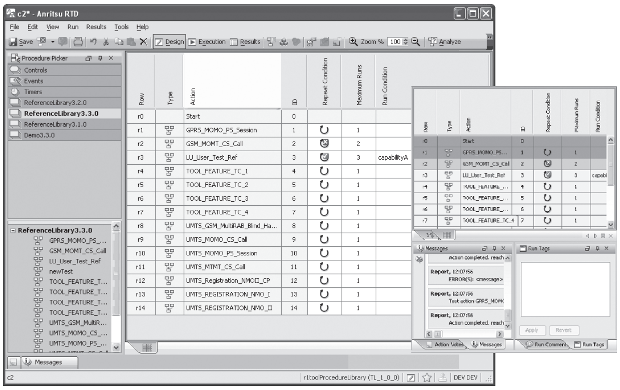
Because the MD8430A saves up to ten firmware versions, the right firmware is selected easily at startup. There is no need to install/uninstall firmware when executing a test case that determines the firmware version.

Powerful Automated Testing

The RTD software supporting the UE control interface makes it easy to setup automated test systems. Furthermore, multiple test cases can be executed continuously and test reports generated automatically, and many functions, including repeat testing under different conditions with multiple settings, can be automated, offering carriers, etc., an ideal turnkey solution for acceptance testing.



Full Line of Versatile L3 Analysis Tools



Example of Test Case Campaign

Easy Test Case Maintenance

Test cases created by the RTD software can be updated easily when new 3GPP standard evolves, reducing the need for re-editing. In addition, guaranteed test case compatibility even when the MD8430A firmware version is changed removes the need to recompile, etc., resulting in greatly reduced costs for maintaining test cases to support regression testing when rolling out new terminals and performing pre-IOT to assure compatibility with network equipment worldwide.

Test Models/Options/Software

Test Models

Basic Test Model (BTM)	MD8430A-025
M2M Test Model (MTM)	MD8430A-027
LTE Enhanced Test Model (ETM)	MD8430A-035

Choose one of the above three models.

*: Please refer to Specifications of Signalling Tester MD8430A Models.

Test Model Upgrade

Required option when upgrading to higher order model.

Upgrade from Function Test Model (FTM)

LTE FTM to ETM Upgrade Kit	Z1670A
LTE FTM to ETM Upgrade Kit (FO)	Z1789A

Upgrade from Standard Test Model (STM)

LTE STM to ETM Upgrade Kit	Z1671A
LTE STM to ETM Upgrade Kit (FO)	Z1790A

Upgrade from Performance Test Model (STM)

LTE PTM to ETM Upgrade Kit	Z1672A
LTE PTM to ETM Upgrade Kit (FO)	Z1791A

Upgrade from Basic Test Model

LTE BTM to ETM Upgrade Kit	Z1873A
LTE BTM to MTM Upgrade Kit	Z1976A

Upgrade from M2M Test Model

LTE MTM to ETM Upgrade Kit	Z1977A

Options

Extended Frequency Range to 3.8 GHz MD8430A-002

Required software option when extending maximum frequency of MD8430A (Tx/Rx) to 3.8 GHz.

Extended Frequency Range to 3.8 GHz Hardware MD8430A-003

Required hardware option when extending maximum frequency of MD8430A (Tx/Rx) to 3.8 GHz.

Enhanced DL Frequency Bandwidth Option MD8430A-004

Required software option when extending downlink frequency bandwidth of MD8430A (Tx) to 60 MHz.

Extended Frequency Range to 3.8 GHz Hardware 2 MD8430A-005

Required hardware option when extending maximum frequency of MD8430A (Tx/Rx) to 3.8 GHz. (Test Model: BTM, ETM)

Extended Frequency Range to 6 GHz MD8430A-006

Required software option when extending maximum frequency of MD8430A (Tx/Rx) to 6 GHz.

Extended Frequency Range to 6 GHz Hardware MD8430A-007

Required hardware option when extending maximum frequency of MD8430A (Tx/Rx) to 6 GHz.

LTE DL 6 Carrier Aggregation Option MD8430A-044

Option for adding Carrier Aggregation (CA) function supporting transmission of up to six component carriers on downlink.

LTE UL 3 Carrier Aggregation Option MD8430A-045

Option for adding Carrier Aggregation (CA) function supporting reception of up to three component carriers on uplink.

W-CDMA Fading Option MD8430A-052

Required software option when W-CDMA fading testing.

SCME Fading Option MD8430A-053

Required software option when SCME fading testing.

LTE 2×2 MIMO Fading Option MD8430A-055

Required software option when LTE 2×2 MIMO fading testing.

LTE 4×2 MIMO Fading Option MD8430A-056

Required software option when LTE 4×2 MIMO fading testing.

LTE 4×4 MIMO Fading Option MD8430A-057

Required software option when LTE 4×4 MIMO fading testing.

LTE 8×2 MIMO Fading Option MD8430A-058

Required software option when LTE 8×2 MIMO fading testing.

LTE 8×4 MIMO Fading Option MD8430A-059

Required software option when LTE 8×4 MIMO fading testing.

LTE FDD Option MD8430A-060

Required option when simulating 3GPP LTE FDD.

LTE TDD Option MD8430A-061

Required option when simulating TD-LTE.

LTE Enhanced MTC Option MD8430A-062

Required option when simulating LTE eMTC.

Narrow Band IoT Option MD8430A-063

Required option when simulating NB-IoT.

LTE Anchor For5G NSA Option MD8430A-064

Option for Protocol tests and IP data evaluations using the 5G NSA in coordination with the MT8000A.

W-CDMA Option MD8430A-065

Required option when simulating W-CDMA.

GSM Option MD8430A-066

Required option when simulating GSM.

RF/Fading Driver Option MD8430A-067

Required software option when extending RF for MD8430A-025 BTM and executing the fading function. (MD8430A-055, 056, 057, 058)

HSPA Multi Carrier Option MD8430A-070

Required option when HSPA multi carrier testing.

W-CDMA/GSM Ciphering Option MD8430A-071

Option for adding ciphering function for W-CDMA, GSM and GPRS. Supporting KASUMI and SNOW 3G to W-CDMA. A5/1, A5/2, A5/3 and A5/4 to GSM. GEA1, GEA2, GEA3 and GEA4 to GPRS.

LTE Licensed Assisted Access (LAA) Option MD8430A-072

Required software option for executing LTE Licensed Assisted Access function.

LTE Dual Connectivity Option MD8430A-073

Required software option for executing Dual Connectivity function.

LTE DL 4×4 MIMO Option MD8430A-075

Required software option when LTE 4×4 MIMO testing.

LTE DL 8×4 MIMO Option MD8430A-076

Required software option when LTE 8×4 MIMO testing.

LTE Internal server Option MD8430A-077

Required software option when IP data communications testing with the built-in server. IP Data Throughput tests up to 1.6Gbps are supported.

LTE UL 2×2 MIMO Option MD8430A-078

Required software option when LTE UL 2×2 MIMO testing.

LTE UL 256QAM Option MD8430A-079

Required software option when LTE UL 256QAM testing.

LTE Ciphering Option MD8430A-080

Option for adding ciphering function supporting EEA0, EEA1, and EEA2 (TS 33.401, TS 36.323) algorithms to LTE.

LTE ROHC Option MD8430A-081

Option for adding LTE ROHC function supporting RTP/UDP/IP (RFC3095, RFC4815), UDP/IP (RFC3095, RFC4815), ESP/IP (RFC3095, RFC4815), and IP (RFC3843, RFC4815).
Required this option for VoLTE testing.

LTE MBMS Option MD8430A-082

Option for adding LTE MBMS function supporting (P) MCH Transmission Scheduling, MCCH Message Transmission, MSI MAC control element Transmission and MTCH Message Transmission described in 3GPP (TS 36.211, TS36.221).

LTE ZUC Ciphering Option MD8430A-083

Option for adding ciphering function supporting EEA3 and EIA3 (TS 33.401, TS 35.221) algorithms to LTE.

LTE Carrier Aggregation Option MD8430A-085

Option for adding Carrier Aggregation (CA) function supporting transmission of up to two component carriers on downlink.

Ciphering Option MD8430A-086

Option for adding ciphering function supporting EEA0, EEA1, EEA2, EEA3 and EIA3 (TS 33.401, TS 35.221, TS 36.323) algorithms to LTE.

LTE CoMP Option MD8430A-087

Required software option when 3GPP Release 11 CoMP feature.
It is available to test Dynamic Point Selection.

LTE DL 4 Carrier Aggregation Option MD8430A-088

Option for adding Carrier Aggregation (CA) function supporting transmission of up to four component carriers on downlink.

LTE DL 5 Carrier Aggregation Option MD8430A-089

Option for adding Carrier Aggregation (CA) function supporting transmission of up to five component carriers on downlink.

Software

LTE Control Software MX843010A

Software for simulating L1 and L2 with test cases in C.

LTE Control Software MX843010E

Software for simulating L1 and L2 with test case in C.
(Test Model: ETM)

W-CDMA/GSM Control Software MX843070E

Software for simulating L1 and L2 with test cases in C.
(Test Model: W-CDMA/GSM)

Rapid Test Designer (RTD) MX800050A/MX786201A

Software for simulating L1 to L3 with test cases described by GUI for automating testing, analyzing test cases and creating reports.

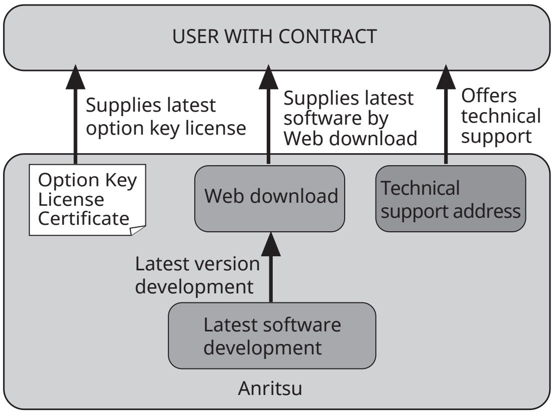
Software Maintenance Contract

Service Provided

- Contract for adding/revising software functions in line with 3GPP revisions
- Technical support for troubleshooting user problems

Annual Support Service (1 year)

Option providing 1 year of service support for MD8430A test functions including web downloads of latest software and technical enquiries. Services depend on option configuration.



MD8430A Support Services

MD8430A Support (FDD)	
1 Year Support Service LTE FDD (ETM)	MD8430A-SS135
MD8430A Support (TDD)	
1 Year Support Service LTE TDD (ETM)	MD8430A-SS136
MD8430A Support (W-CDMA/GSM)	
1 Year Support Service W-CDMA/GSM	MD8430A-SS170
MD8430A Support (LTE eMTC)	
1 Year Support Service for LTE eMTC	MD8430A-SS171
MD8430A Support (NB-IoT)	
1 Year Support Service for NB-IoT	MD8430A-SS172
LTE Control Software Support MX843010A	
1 Year Support Service	MX843010A-SS120
LTE Control Software Support MX843010E	
1 Year Support Service (Test Model: ETM)	MX843010E-SS120

Specifications

Signalling Tester MD8430A

Reference Oscillator	Reference Frequency	10 MHz
	Activation Characteristics	±5 × 10^{-7} (2 minutes after turning on the power) ±5 × 10^{-8} (5 minutes after turning on the power) At 25°C, Based on the frequency 24 hours after turning on the power
	Aging Rate	±1 × 10^{-8}/day (Specification per day, based on the frequency 48 hours after turning on the power) ±1 × 10^{-7}/year (Specification per day, based on the frequency 10 days after turning on the power)
	Temperature Characteristics	±2 × 10^{-8} (0°C to 45°C) Based on the frequency at 25°C
	External Reference Input	Frequency: 10 MHz Operating range: ±1 ppm Input level: –15 dBm ≤ level ≤ +20 dBm (50Ω, AC coupling) Connector: BNC-J, 50Ω (nominal)
	Internal Reference Output	Frequency adjusted at shipment: 10 MHz ±0.02 ppm Output level: ≥0 dBm (50Ω, AC coupling) Connector: BNC-J, 50Ω (nominal)
Transmission Signal	Maximum Output Level	Main connector: –40 dBm (Maximum setting level at Main connector: –20 dBm) Sub connector: 0 dBm
	Level Accuracy	±1.5 dB (350 MHz ≤ Frequency ≤ 3800 MHz) ±2.0 dB (3800 MHz < Frequency ≤ 6000 MHz) Main connector: –113 dBm ≤ Level ≤ –40 dBm Sub connector: –113 dBm ≤ Level ≤ 0 dBm After calibration, 18°C to 28°C, for calibration CW
	Frequency	LTE: 350 MHz to 3.0 GHz, 350 MHz to 3.8 GHz (with MD8430A-002), 350 MHz to 6.0 GHz (with MD8430A-006) W-CDMA: 400 MHz to 3.0 GHz, 400 MHz to 3.8 GHz (with MD8430A-002/006) GSM: 400 MHz to 2.0 GHz Setting resolution: 100 kHz

Continued on next page

Transmission Signal	Access Method	LTE: OFDMA, W-CDMA: CDMA, GSM: TDMA
	Modulation Method	LTE: QPSK, 16QAM, 64QAM, 256QAM W-CDMA: QPSK, 16QAM, 64QAM GSM: GMSK, 8PSK
	Modulation Accuracy	LTE: ≤2%, Sub output: 0 dBm, LTE (OFDM, 64QAM, 20 MHz band) W-CDMA: ≤3.5%, Sub output: 0 dBm, W-CDMA (transmitting CPICH, ICH) GSM: ≤1.5deg., Sub output: 0 dBm, GMSK ≤3.5%, Sub output: 0 dBm, 8PSK * At 18°C to 28°C
Received Signal	Input Level	Setting demodulation range Based on the value set for the reference power QPSK: –28 to +15 dB 16QAM: –21 to +15 dB 64QAM: –15 to +15 dB (Input signal: EVM ≤1%, BER ≤1 × 10^{-12}, 20 MHz band, SC-FDMA) Main connector input: Reference Power setting range: −20 to +20 dBm However, within the input level range from −30 to +35 dBm Sub connector input: Reference power setting range: –35 to +5 dBm However, within the input level range from −45 to +20 dBm
	Level Accuracy	Main connector: ±3.0 dB Sub connector: ±3.0 dB At 18°C to 28°C, for calibration CW, within the Main input level range from −30 to +35 dBm, the Sub input level range from −45 to +20 dBm, and the reference power range of ±15 dB
	Frequency	LTE: 350 MHz to 3.0 GHz, 350 MHz to 3.8 GHz (with MD8430A-002), 350 MHz to 6.0 GHz (with MD8430A-006) W-CDMA: 400 MHz to 3.0 GHz, 400 MHz to 3.8 GHz (with MD8430A-002/006) GSM: 400 MHz to 2.0 GHz (setting resolution: 100 kHz)
	Access Method	LTE: SC-FDMA, W-CDMA: CDMA, GSM: TDMA
	Modulation Method	LTE: QPSK, 16QAM, 64QAM, 256QAM W-CDMA: BPSK, 4PAM GSM: GMSK, 8PSK
	Synchronization Acquirable Range	LTE: ±100 µs (PRACH), ±30 µs (PUSCH) W-CDMA: ±100 chips (PRACH), ±100 chips (DPCCH) GSM: 0 to 63 symbols (SACCH)
RF Connector	Main	Connector: N-J, 50Ω (nom.) VSWR: ≤1.3 (Frequency Range: ≥350 MHz to ≤3800 MHz) ≤1.4 (Frequency Range: >3800 MHz to ≤6000 MHz)
	Sub (Downlink)	Connector: N-J, 50Ω (nom.) VSWR: ≤1.5 (Frequency Range: ≥350 MHz to ≤3800 MHz) ≤1.6 (Frequency Range: >3800 MHz to ≤6000 MHz)
	Sub (Uplink)	Connector: N-J, 50Ω (nom.) VSWR: ≤1.5 (Frequency Range: ≥350 MHz to ≤3800 MHz) ≤1.6 (Frequency Range: >3800 MHz to ≤6000 MHz)
Front Panel Interface	Digital IQ I/F	DX20 connector (50 pin) × 8 Digital IQ signal, IQ: 16 bit
	Monitor I/F	DX20 connector (80 pin), 3.3 V-CMOS level Connection with the Monitor board (G0091)
	Sync Out	BNC connector, 3.3 V-CMOS level Internal Sync Start signal output
	Sync In	BNC connector, 3.3 V-CMOS level External Sync Start signal input
	Clock Out	BNC connector, 3.3 V-CMOS level Internal Clock signal output
	Clock In	BNC connector, 3.3 V-CMOS level, 10 kHz to 30.72 MHz External Clock signal input
MF6900A Interface	Sync Out	Without MD8430A-008/108/208: BNC connector × 3, 3.3 V-CMOS level With MD8430A-008/108/208: BNC connector × 2, 3.3 V-CMOS level Connection with the MF6900A (Sync Start signal)
	Port	Without MD8430A-008/108/208: HIB-B16LFYGA connector × 6, LVDS level With MD8430A-008/108/208: HIB-B16LFYGA connector × 2 (Digital IQ: 2ports/connector), LVDS level HIB-B16LFYGA connector × 4 (Digital IQ: 8ports/connector), LVDS level Connection with the MF6900A (Digital IQ signal)
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000: 2018
Temperature	Operating	0°C to +45°C, ≤90% RH (no condensation) 0°C to +40°C, ≤90% RH (no condensation) (with Enhanced Hardware)
	Storage	–20°C to +60°C, ≤85% RH (no condensation)
Power Supply	Voltage	100 VAC to 120 VAC/200 VAC to 240 VAC (Automatic switching system)
	Frequency	50 Hz/60 Hz (Automatically changeover system)
	Power Consumption	≤1200 VA
Dimensions and Mass	Dimensions	426 (W) × 310 (H) × 500 (D) mm
	Mass	≤40 kg

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	LTE Basic Test Model
MD8430A	Signalling Tester
MD8430A-005	Extended Frequency Range to 3.8 GHz Hardware 2
MD8430A-025	Basic Test Model (BTM)
	M2M Test Model
MD8430A	Signalling Tester
MD8430A-005	Extended Frequency Range to 3.8 GHz Hardware 2
MD8430A-027	M2M Test Model (MTM)
	LTE Enhanced Test Model
MD8430A	Signalling Tester
MD8430A-005	Extended Frequency Range to 3.8 GHz Hardware 2
MD8430A-035	LTE Enhanced Test Model (ETM)
	Standard Accessories
	CD-ROM (Operation Manual and Maintenance Software): 1 pc
J1440A	LAN Cable: 2 pcs
J1211	Power Cord, 3.0 m (15 A): 1 pc
J0127A	Coaxial Cord, 1.0 m (BNC-P · RG58A/U · BNC-P): 1 pc
J0576B	Coaxial Cord, 1.0 m (N-P · 5D-2W · N-P): 2 pcs
J1398A	N-SMA Adaptor: 6 units
G0091	Monitor Board: 1 pc
J1005	Monitor Cable 80: 1 pc
J1459A	Digital IQ Cable (50 cm): 1 pc
	Options
MD8430A-002	Extended Frequency Range to 3.8 GHz
MD8430A-004	Enhanced DL Frequency Bandwidth Option
MD8430A-006	Extended Frequency Range to 6 GHz
MD8430A-007	Extended Frequency Range to 6 GHz Hardware
MD8430A-044	LTE DL 6 Carrier Aggregation Option
MD8430A-045	LTE UL 3 Carrier Aggregation Option
MD8430A-052	W-CDMA Fading Option
MD8430A-053	SCME Fading Option
MD8430A-055	LTE 2×2 MIMO Fading Option
MD8430A-056	LTE 4×2 MIMO Fading Option
MD8430A-057	LTE 4×4 MIMO Fading Option
MD8430A-058	LTE 8×2 MIMO Fading Option
MD8430A-059	LTE 8×4 MIMO Fading Option
MD8430A-060	LTE FDD Option
MD8430A-061	LTE TDD Option
MD8430A-062	LTE Enhanced MTC Option
MD8430A-063	Narrow Band IoT Option
MD8430A-064	LTE Anchor For 5G NSA Option
MD8430A-065	W-CDMA Option
MD8430A-066	GSM Option
MD8430A-067	RF/Fading Driver Option
MD8430A-070	HSPA Multi Carrier Option
MD8430A-071	W-CDMA/GSM Ciphering Option
MD8430A-072	LTE Licensed Assisted Access (LAA) Option
MD8430A-073	LTE Dual Connectivity Option
MD8430A-075	LTE DL 4×4 MIMO Option
MD8430A-076	LTE DL 8×4 MIMO Option
MD8430A-077	LTE Internal server Option
MD8430A-078	LTE UL 2×2 MIMO Option
MD8430A-079	LTE UL 256QAM Option
MD8430A-080	LTE Ciphering Option
MD8430A-081	LTE ROHC Option
MD8430A-082	LTE MBMS Option
MD8430A-083	LTE ZUC Ciphering Option
MD8430A-085	LTE Carrier Aggregation Option
MD8430A-086	Ciphering Option
MD8430A-087	LTE CoMP Option
MD8430A-088	LTE DL 4 Carrier Aggregation Option
MD8430A-089	LTE DL 5 Carrier Aggregation Option
MD8430A-103	Extended Frequency Range to 3.8 GHz Hardware Retrofit (for Asia, Oceania)
MD8430A-107	Extended Frequency Range 3 GHz to 6 GHz Hardware Retrofit (for Asia, Oceania)
MD8430A-117	Extended Frequency Range 3.8 GHz to 6 GHz Hardware Retrofit (for Asia, Oceania)
MD8430A-203	Extended Frequency Range to 3.8 GHz Hardware Retrofit (FO)
MD8430A-207	Extended Frequency Range 3 GHz to 6 GHz Hardware Retrofit (FO)
MD8430A-217	Extended Frequency Range 3.8 GHz to 6 GHz Hardware Retrofit (FO)

Model/Order No.	Name
	Software Options
MX843010A	LTE Control Software
MX843010E	LTE Control Software
MX843070E	W-CDMA/GSM Control Software
MX786201A	Rapid Test Designer (RTD)
MX800050A	Rapid Test Designer Platform (RTD)
	Main frame Support Service **[FDD]**
MD8430A-SS125	1 Year Support Service for LTE FDD (BTM)
MD8430A-SS135	1 Year Support Service for LTE FDD (ETM)
	[TDD]
MD8430A-SS126	1 Year Support Service for LTE TDD (BTM)
MD8430A-SS136	1 Year Support Service for LTE TDD (ETM)
	[W-CDMA/GSM]
MD8430A-SS170	1 Year Support Service for W-CDMA/GSM
	[LTE eMTC]
MD8430A-SS171	1 Year Support Service for LTE eMTC
	[NB-IoT]
MD8430A-SS172	1 Year Support Service for NB-IoT
	LTE Control Software Support Service
MX843010A-SS120	1 Year Support Service
MX843010E-SS120	1 Year Support Service
	Upgrade Options
Z1670A	LTE FTM to ETM Upgrade Kit
Z1789A	LTE FTM to ETM Upgrade Kit (FO)
Z1671A	LTE STM to ETM Upgrade Kit
Z1790A	LTE STM to ETM Upgrade Kit (FO)
Z1672A	LTE PTM to ETM Upgrade Kit
Z1791A	LTE PTM to ETM Upgrade Kit (FO)
Z1873A	LTE BTM to ETM Upgrade Kit
Z1976A	LTE BTM to MTM Upgrade Kit
Z1977A	LTE MTM to ETM Upgrade Kit
	Application Products
MN8150A	RF Combiner Unit
J1416A	LVDS CABLE
J1609A	Signal Divider

: A PC[1] running Microsoft Visual C++ 2010 Express Edition or Microsoft Visual Studio Express 2015 is required to use the MD8430A.
It must be supplied by the customer.

*1: The PC controller for the MD8430A must meet or exceed the following specifications:
OS: Windows 10 Pro (64 bit) or later
CPU: Intel Core i7-6700 3.4 GHz or more
RAM: 8 GB or more
NIC: 1000 BASE-T

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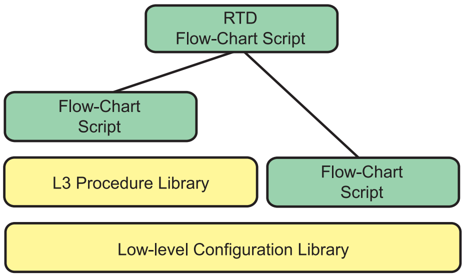
Rapid Test Designer (RTD)

MX800050A/MX786201A



- Faster Test Development
- Easier Test Maintenance
- Automatic Simulator Configuration
- Less Specific Protocol Knowledge Required

The Rapid Test Designer (RTD) MX800050A/MX786201A is a revolutionary tool which speeds up the testing of UMTS and LTE terminals significantly by greatly simplifying the way in which tests are created, executed and analyzed. For 5G, Radio Communication Test Station MT8000A is used, and for LTE, MT8000A and MD8430A can be selected according to the application. This combination makes a comprehensive and flexible solution for the most powerful protocol development system for next generation wireless terminals.
The RTD is already established as a proven multi-standard graphical flow chart tool for many organizations. RTD has the ability to create almost limitless network simulations and is complimented by the MT8000A/MD8430A for LTE, MT8000A for NR and MD8475A for TD-SCDMA.
The RTD is the fastest and most efficient way to ensure that modern terminal behaviour can be comprehensively exercised. Its ability to simulate network scenarios with actual network settings takes it beyond conformance testing and into real world situations.
Network Operators are making use of the RTD's intelligent test tools to ensure that terminals behave correctly on their networks. Terminal development teams simulate conditions in networks that may be thousands of miles away and may not yet support the new functionality present in new handsets hence saving time and money.
Finally, the RTD provides one click, instant execution with no test case build or compilation phase necessary to enable very effective and efficient development of test case libraries for a wide variety of purposes:

- Acceptance Testing
- Integration Testing
- Generating Variants
- Application Testing
- Regression Testing
- Pre-conformance Testing
- Prototyping Testing
- Hardware and Software Integration
- Software Development

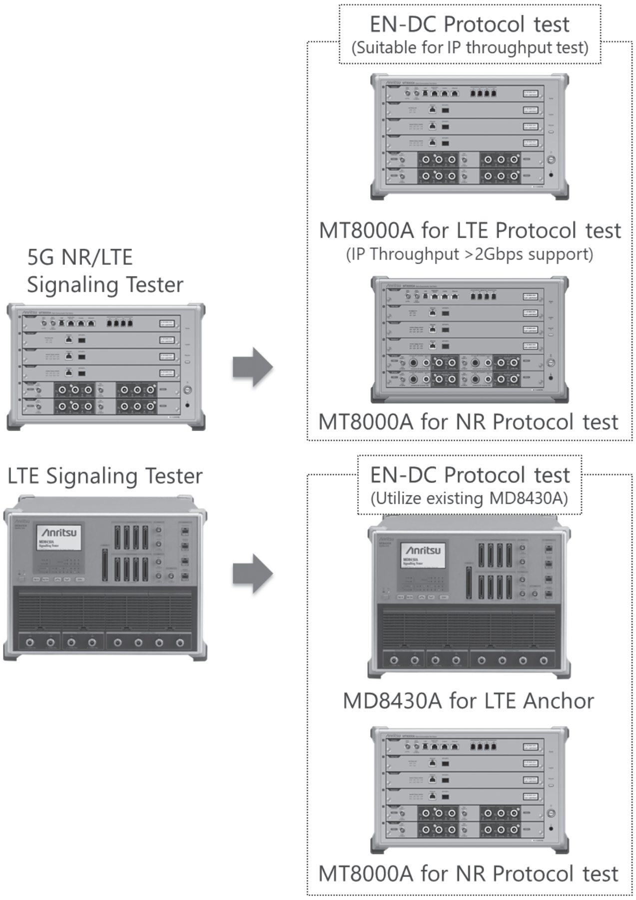
Terminal Development from R&D to Conformance and Beyond

R&D teams will spend thousands of hours developing, integrating and proving their terminal designs. The RTD provides LTE design teams with procedures that test low level configuration as well as L3 protocol. Individually the procedure libraries provide tools for teams at different parts of the design process. By combining and merging them, very detailed proving and integration of designs is possible.
As specifications evolve, the RTD provides a roadmap that reflects the fast moving needs of the developers.
As a consequence increased dependence upon regression testing to ensure changes do not affect the designs. RTD provides all the tools for immediate test definition, analysis and execution.

Time to Market

With competition being so great and staff movement an issue, teams cannot afford to add time to development of new products. The RTD provides an intuitive interface that is easy to learn and provides flexible and informative feedback to the operator.
This allows developers to accelerate the learning curve for new technology and the tools needed for successful designs.

RTD Supports
NR (NSA/SA)
LTE
LTE-Advanced
UMTS
HSPA Evolution
GSM
GPRS
EGPRS
TD-SCDMA



Key Facts

- Development environment for layer 1 to layer 3 signalling
- Integration test packages and software tools for developing LTE terminals
- Extensive procedure library with preconfigured messages and signalling
- Integration of legacy scenarios
- One button upgrade process for existing tests

Regression Testing

Regression testing needs to be performed as new software is introduced into networks. RTD makes it possible to modify test scripts simply by applying a new set of network parameters or making a change to a reference that can populate a suite of tests. The test suite can then be run overnight or unattended, presenting the operator with an executive summary to enable software stability trends to be mapped.

Maintaining Tests

Wireless terminal developers will build up large libraries of tests for ongoing development and regression testing of their designs. The RTD has the ability to update these libraries using the latest 3GPP Release automatically, saving many hours of test re-creation and debugging.

Beyond Conformance

Although conformance tests prove adherence to specifications, they play little part in simulating "real world" conditions where consideration to interfering signals and user plane data is involved. The RTD makes test scenarios easy to create and then iterate as there is no lengthy compilation stage and tests may be adjusted at run time if required.

Roaming and Network Selection

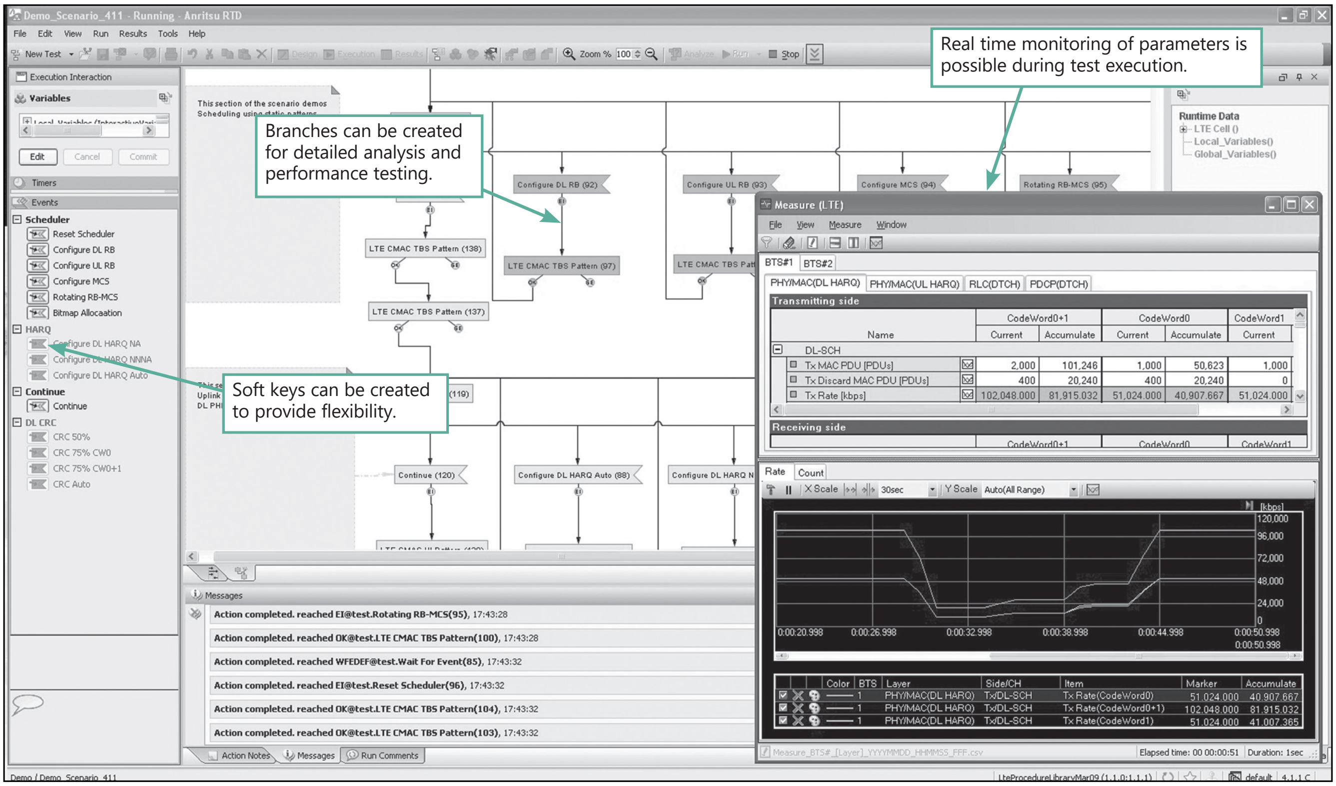
With multi-mode capability, terminals will have complex algorithms that select preferred networks and still maintain acceptable performance. Revenue streams will be threatened if UEs do not behave correctly and Network Operators will exercise them to ensure the best possible behaviour on their network configurations. RTD provides this type of testing which will be crucial to terminal selection - and rejection.

Simulating Live Network Conditions

Traditionally protocol and RF tests have been kept separate.
In order to reduce test times there is a trend to combine fading with protocol tests. The RTD provides a convenient way to add digital baseband fading by using the Signalling Tester MD8430A to the system.

Why a Graphical Flow Chart?

The RTD's unique flowchart display provides a more natural way of creating scenarios and observing test flow and outcomes.
Debugging is especially straightforward as tests can be run and iterative changes made. Because there is no compilation phase, tests can be run immediately and aborted if the wrong path is taken. With well annotated tests, sharing and consolidation is possible and productive.



Real time monitoring of parameters is possible during test execution.

Branches can be created for detailed analysis and performance testing.

Soft keys can be created to provide flexibility.

Messages

```
Action completed. reached EI@test.Rotating RB-MCS(95), 17:43:28
Action completed. reached OK@test.LTE CMAC TBS Pattern(100), 17:43:28
Action completed. reached WFEDEF@test.Wait For Event(85), 17:43:32
Action completed. reached EI@test.Reset Scheduler(96), 17:43:32
Action completed. reached OK@test.LTE CMAC TBS Pattern(104), 17:43:32
Action completed. reached OK@test.LTE CMAC TBS Pattern(103), 17:43:32
```

Transmitting side

Name	CodeWord0+1		CodeWord0		CodeWord1
	Current	Accumulate	Current	Accumulate	Current
DL-SCH					
Tx MAC PDU [PDUs]	2,000	101,246	1,000	50,623	1,000
Tx Discard MAC PDU [PDUs]	400	20,240	400	20,240	0
Tx Rate [kbps]	102,048.000	81,915.032	51,024.000	40,907.667	51,024.000

Receiving side

			Color	BTS	Layer	Side/CH	Item	Marker	Accumulate
☑			——	1	PHY/MAC(DL HARQ)	Tx/DL-SCH	Tx Rate(CodeWord0)	51.024.000	40.907.667
☑			——	1	PHY/MAC(DL HARQ)	Tx/DL-SCH	Tx Rate(CodeWord0+1)	102.048.000	81.915.032
☑			——	1	PHY/MAC(DL HARQ)	Tx/DL-SCH	Tx Rate(CodeWord1)	51.024.000	41.007.365

Measure_BTS#_[Layer]_YYYYMMDD_HHMMSS_FFF.csv

Elapsed time: 00 00:00:51

Duration: 1sec

Acceptance Testing for Network Operators

With finite bandwidth and ever more traffic generated, the biggest challenge is for network operators to optimize their networks and ensure that terminals obey the rules they set. LTE attempts to make more efficient use of the spectrum available but still needs to inter-work with legacy systems. There are also regional variations and network specific requirements that terminals will be expected to conform to. Load balancing may be important to make best use of network resources and although aesthetics and applications may define a terminal's popularity, the behaviour under specific conditions needs to be tested to ensure a reliable and friendly user experience.

Cell Selection and Re-selection

The compromise between battery life and continuous caretaking activities will always challenge terminal designers. Thousands of hours of field trials may still not be able to identify why a terminal fails to maintain service on a preferred network.

Many conditions can only be reliably exercised using a simulation of network conditions in the laboratory. The RTD has the ability to use network logs and create tests that closely resemble the field environment. Iteration of the test is then straightforward to discover and rectify the problem.

Application Testing

As we move to an all packet delivery network, data throughput and integrity is becoming more important.

Scenarios with a variety of radio bearers and configurations are possible with RTD, proving that data is not lost during handovers and reselection. As traffic builds up and volume driven state transitions occur the user needs to remain connected.

Simultaneous applications are now commonplace, so interaction and priority between services needs simulating.

Where high value applications such as financial transactions take place handovers or link failures may be serious. Gaming and social networking may seem less important to test, but is proving to be a differentiator for a young and influential market.

Roaming Partners

Simulation of foreign networks using the RTD's many advanced features allows a convenient way to test roaming between networks with different configurations/parameters and even different ways of implementing procedures. Today the cost of sending engineering teams to perform network testing over many weeks can be a very significant portion of a Network Operator's proving budget.

New Network Services

Most Networks will not allow new terminals onto their live service without some proving. RTD provides a way to test new terminals and also new services that may be ready to be deployed. Future functionality and applications can be proved in a controlled way using a system simulator and problems resolved ahead of deployment.

Stress Testing

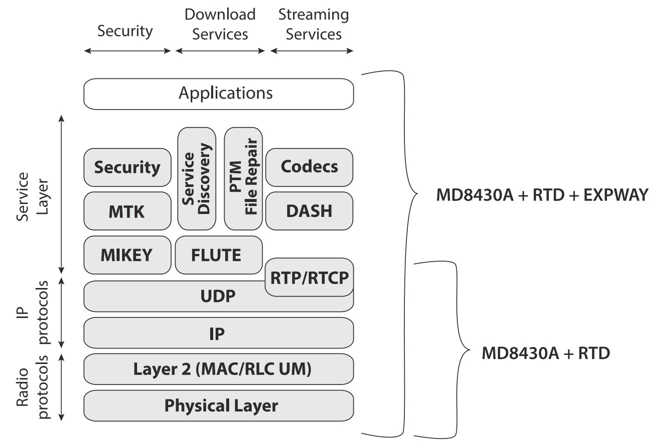
Terminal stress testing can be automated and run overnight using RTD. With the ability to make thousands of reselections, calls, hand-overs etc. Tests that exercise the extremes and limits of the terminal provide quantitive and qualitative data for terminal selection.

RTD for eMBMS Testing

The evolved Multimedia Multicast Broadcast Service (eMBMS) enables the efficient delivery of media content simultaneously to a high number of subscribers. Operators are upgrading their networks to utilize eMBMS technology in order to keep up with the demand for services such as mobile TV.

Devices not only have to implement support for additional radio channels and protocols, but also need to implement a service layer to communicate with additional core network elements for eMBMS. The most important of these is the Broadcast Multicast Service Center (BM-SC).

Anritsu partners with Expway – the leading supplier of BM-SC technology components, top deliver a complete end-to-end eMBMS test solution consisting of the MD8430A Signaling Tester, RTD software and a BM-SC adapted for test purposes. This provides a complete lab simulation to test not only LTE Layer 1 and Layer 2 operation, but also the eMBMS service layer and interactions between the radio modem and the eMBMS middleware.



RTD Top Features

Edit

- Intuitive editing means faster test development
- Easier test maintenance
- Automatic simulator configuration
- Code re-use

Analyze

- Detailed protocol analysis
- Parameter changes can be made at RunTime
- Real time control can be achieved within tests

Automate

- Campaigns created using graphical interface
- Reports generated
- Export to other databases

Regression

- Tests and entire archives can be updated to the latest 3GPP release using a single command
- Backup generated and archived automatically for regression tests

Control

- AT commands can be included in all tests
- Automation of tests using campaigns or from a host system using CLI

Automation

The RTD provides many ways that test execution can be made more efficient using remote control, terminal control and campaign management tools.

Remote Control Interface MX787401A-012

The RTD may be controlled using remote commands and integrated into a total test system. The RTD is compatible with a number of remote commands that allow Tests to be RUN, ANALYZED, etc. In this mode the RTD works as a secondary to an existing test system where existing equipment and data is controlled and collected.

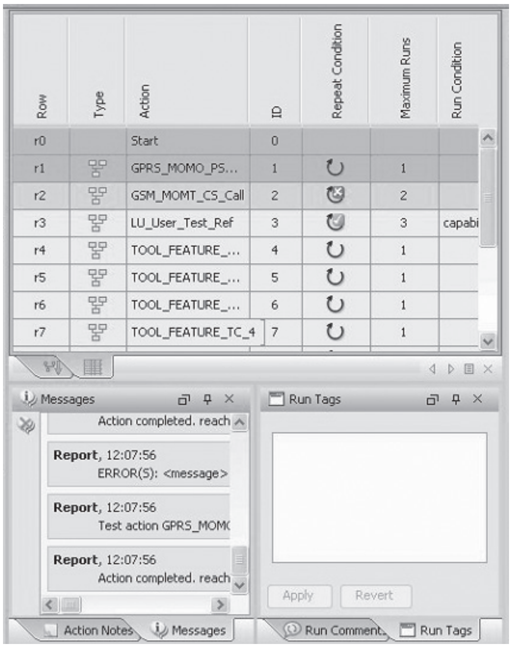
Signalling Application Tool for Terminal Automation MX787401A-013

The RTD provides proxy control of the AT command set to the terminal through the RTD Test Cases. It enables automated testing to be achieved through a serial port on the control PC. The system maybe configured to map the AT/MMI commands to match those supported by the terminal. Prompts on the screen can be suppressed when automation is used. In general automated testing can be carried out via the use of the AT command set [3GPP TS 27.007].

Signalling Application Tool for Test Sequencing MX787401A-014

The RTD includes a campaign management tool. This provides the user with the ability to create test runs that can be run remotely without the need for any further control equipment. Tests can be repeated depending on rules set by the user. Results are generated in a tabular form and can be exported to form part of a formal report.

A campaign may be used to run an entire suite of conformance tests, or inter-operability tests, or any other large grouping of tests. Rules may be set to run all tests and then retest those that fail, making best use of time.



Row	Type	Action	ID	Repeat Condition	Maximum Runs	Run Condition
r0		Start	0			
r1		GPRS_MOMO_PS...	1	↻	1	
r2		GSM_MOMT_CS_Call	2	↻	2	
r3		LU_User_Test_Ref	3	↻	3	capabi
r4		TOOL_FEATURE_...	4	↻	1	
r5		TOOL_FEATURE_...	5	↻	1	
r6		TOOL_FEATURE_...	6	↻	1	
r7		TOOL_FEATURE_TC_4	7	↻	1	

Action completed. reach

Report, 12:07:56
ERROR(S): <message>

Report, 12:07:56
Test action GPRS_MOMC

Report, 12:07:56
Action completed. reach

The Total System Solution

For some, the RTD will be a new concept and we aim to provide the tools and support to make the experience productive and logical.

Using the RTD

An RTD test is constructed and edited using a graphical environment, which supports procedures, loops, delays and interactive dialogs. Compared to traditional "C" and "TTCN" based languages this GUI provides fast and simple test creation. Typically a test that may have taken several days to create may be created in hours using the RTD.

Reference Tests

These reference tests are samples of commonly used functions to act as templates for the user. They allow Network specific parameters to be added manually or by means of a "catalogue" function. Packages of other test cases are also available on request.

Test Execution Engine

RTD tests are run immediately after they have been checked for simple errors, without a compile or build cycle.

Test Criteria Editor

The test operative may use this tool to automatically make objective decisions on whether the right actions have been made by the UE. Criteria may be changed post testing and applied to existing results. This avoids the need to re-run the tests.

Detailed Test Log Analyzer

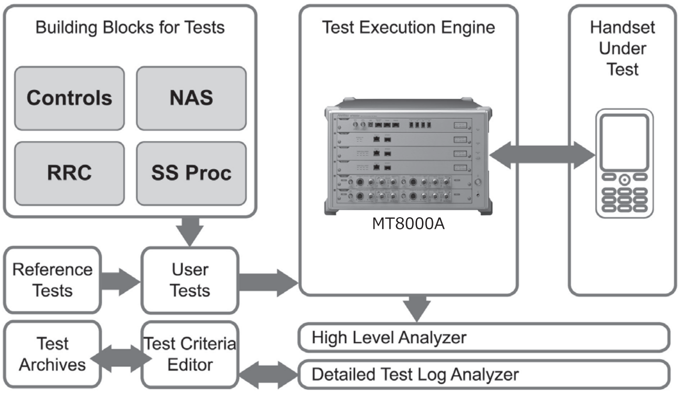
The protocol log analyzer, which maintains the same look and feel as other Anritsu products, is provided to examine the message sequences that are produced by the terminal under test.

Procedure Libraries

Procedures are the building blocks from which all tests are created. The RTD Procedures can be selected from a palette and added to the Test simply by dragging onto the edit page. Compound procedures can be created to allow frequently used scripts to be added in a single action, further simplifying test creation.

These procedures are configured using parameters, which can be changed at three levels :

1) Parameter sets held in catalogues can be selected to parameterise groups of procedures rapidly.
2) The user can edit individual parameters after they have been selected from catalogue components, overriding values if they wish to. These parameters are used to populate the actual protocol messages sent by the procedure.
3) The expert user can edit the individual messages sent by the procedure, if needed, overriding any parameters previously selected or changed.



Ordering Information

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Model/Order No.	Name
	Main Frame
MX800050A	**Rapid Test Designer Platform (RTD)**
MX786201A	RAPID TEST DESIGNER (RTD)
MX787201A	MULTI-RAT FRAME WORK For SIGNALLING TESTING APPLICATIONS
MX787401A	SET OF SIGNALLING APPLICATION SUPPORT TOOLS
MX787401A-012	REMOTE CONTROL INTERFACE
MX787401A-013	SIGNALLING APPLICATION TOOL FOR TERMINAL AUTOMATION
MX787401A-014	SIGNALLING APPLICATION TOOL FOR TEST SEQUENCING
	Options
MX800050A-001	**5G NSA Framework For RTD**
MX800050A-002	**RTD LL/L3 Procedure Libraries (5G)**
MX800050A-003	**Core LTE Framework For RTD**
MX787201A-027	LTE CORE FRAMEWORK FOR SIGNALLING TESTING APPLICATIONS
MX787201A-028	LTE FDD FRAMEWORK FOR SIGNALLING TESTING APPLICATIONS
MX787201A-029	LTE TDD FRAMEWORK FOR SIGNALLING TESTING APPLICATIONS
MX787201A-035	LTE Framework Technology MD8430 ETM Driver
MX786201A-028	LAYER 1/LAYER 2 STATISTICS MONITOR (LTE)
MX786201A-031	RTD LAYER 3 PROCEDURE LIBRARY (LTE)
MX786201A-038	LOW-LEVEL CONFIGURATION LIBRARY FOR RTD (LTE)
MX786201A-40	Ciphering
MX800050A-004	**UTRAN/GERAN Framework For RTD**
MX787201A-021	GERAN FRAMEWORK FOR SIGNALLING TESTING APPLICATIONS
MX787201A-023	FRAMEWORK UTRAN CORE (INCL. HSPA)
MX787201A-025	FRAMEWORK HSPA EVO (R7, R8)
MX787201A-026	FRAMEWORK HSPA EVO (REL-8)
MX787201A-032	UTRAN LCR TDD FRAMEWORK CORE (INCL. HSPA)
MX787201A-037	UTRAN Framework MC-HSDPA (REL-10)
MX786201A-041	RTD LAYER 3 PROCEDURE LIBRARY (UTRAN/GERAN)
MX786201A-048	LOW-LEVEL CONFIGURATION LIBRARY (UTRAN/GERAN)
MX800050A-005	**IMS Framework For RTD**
MX786201A-027	RTD IMS Signaling Library
MX787401A-017	IMS Audio calls on RTD PC (AMR codec)
MX787401A-018	IMS over 3G
MX787401A-019	IMS over WiFi
MX787401A-020	IMS RCS
MX800050A-006	**IoT Framework For RTD**
MX787201A-053	LTE Enhanced MTC Framework
MX787201A-054	Narrow band IoT Framework
MX800050A-007	**LTE-A Framework For RTD**
MX787201A-030	LTE ADVANCED CARRIER AGGREGATION FRAMEWORK
MX787201A-036	LTE-A 3 Carrier Aggregation Framework
MX787201A-041	LTE-A 4 Carrier Aggregation Framework
MX787201A-045	LTE-A 5 Carrier Aggregation Framework
MX787201A-057	LTE-A UL 3 Carrier Aggregation Framework
MX787201A-039	LTE CoMP Framework
MX787201A-043	LTE Dual Connectivity Framework
MX800050A-008	**LTE-A Pro Framework For RTD**
MX787201A-056	LTE-A 6 Carrier Aggregation Framework
MX800050A-009	**LTE MIMO Framework For RTD**
MX787201A-013	LTE UL 2×2 MIMO FRAMEWORK
MX787201A-038	LTE DL 4×4 MIMO FRAMEWORK
MX787201A-042	LTE DL 8×4 MIMO FRAMEWORK
MX800050A-010	**LTE Unlicensed Framework For RTD**
MX787201A-047	LTE Unlicensed 6GHz Framework
MX787201A-048	Extended DL Frequency Bandwidth Framework
MX787201A-050	LTE Licensed Assisted Access (LAA) Framework
MX787401A-061	RTD WLAN Access Point Control Library
MX800050A-011	**LTE/UTRAN/GERAN Fading Library For RTD**
MX787401A-065	RTD Fading Library
MX787401A-066	RTD Fading Library (Higher Order MIMO)
MX787401A-070	RTD Fading Library (UTRAN)
MX787401A-074	RTD Fading Library (LTE 8x2/8x4 MIMO 2Cell extension)
MX787401A-075	RTD Fading Library (LTE 8x2/8x4 MIMO 3Cell extension)
MX787401A-076	RTD Fading Library (SCME)
MX787401A-043	OCNS DRIVER
MX787401A-062	INTERFACE DRIVER FOR MF6900A (FADING SIMULATOR)
MX800050A-012	**5G Fading Library for RTD**
MX800050A-013	**5G SA Framework for RTD**

Model/Order No.	Name
MX800050A-014	**eMBMS Framework For RTD**
MX786201A-025	eMBMS BM-SC Procedure Library
MX787460A	eMBMS BM-SC Server
MX800050A-020	**5G NR Advanced Framework For RTD**
MX800050A-021	**5G NE-DC Framework For RTD**
MX800050A-040	**RTD Test Creation and Editing Tools**
MX786201A-45	RTD TEST CREATION AND EDITING TOOLS
MX800050A-041	**RTD Test Execution Tools**
MX787201A-012	ENABLER FOR MULTIPLE SIGNALLING TESTERS
MX786201A-46	RTD RUN TIME ENGINE
MX800050A-042	**RTD Protocol Analyser**
MX787401A-011	PROTOCOL ANALYSER (RTD)
MX787401A-033	Protocol Analyzer 3- Real Time Log Capture Tool
MX800050A-052	**Modem Log Converter For Qualcomm**
MX800050A-055	**SMIT Advanced Features**
	Support Services
MX800050A-SS100	RTD Support Service (Per Year)
MX800050A-SS101	5G NSA Support Service (Per Year)
MX800050A-SS103	LTE Support Service (Per Year)
MX800050A-SS104	UTRAN/GERAN Support Service (Per Year)
MX800050A-SS105	IMS Support Service (Per Year)
MX800050A-SS106	IoT Support Service (Per Year)
MX800050A-SS107	LTE-A Support Service (Per Year)
MX800050A-SS108	LTE-A Pro Support Service (Per Year)
MX800050A-SS109	MIMO Support Service (Per Year)
MX800050A-SS110	LTE Unlicensed Support Service (Per Year)
MX800050A-SS111	LTE/UTRAN/GERAN Fading Support Service (Per Year)
MX800050A-SS112	5G Fading Support Service
MX800050A-SS113	5G SA Support Service (Per Year)
MX800050A-SS114	eMBMS Support Service (Per Year)
MX800050A-SS120	5G NR Advanced Support Service (Per Year)
MX800050A-SS121	5G NE-DC Support Service (Per Year)
MX800050A-SS152	Modem Log Converter For Qualcomm Support Service (Per Year)
MX800050A-SS155	SMIT Advanced Features Support Service (Per Year)

5G NR Mobile Device Test Platform

ME7834NR

Remote Control
Ethernet

Supporting Protocol Test for 5G NR Mobile Devices

Anritsu has been working on Conformance Test developments from the start of 3G communications until today's upcoming 5G services, and continues providing solutions meeting customers' expectations. Based on our long experience, we deliver timely, trusted solutions incorporating state-of-the-art technology to customers.

All-in-One 5G NR Support for Protocol Conformance Test and Carrier Acceptance Test

The 5G NR Mobile Device Test Platform ME7834NR is for 3GPP- based Protocol Conformance Tests (PCT) and Carrier Acceptance Tests (CAT) of mobile devices incorporating Multiple Radio Access Technologies (RAT). The ME7834NR supports 5G New Radio (NR) Technology in both Standalone (SA) and Non-Standalone (NSA) modes, as well as LTE, LTE-Advanced (LTE-A), LTE-A Pro, and GSM/W-CDMA.

Supports 3GPP-Defined Bands from Sub-6 GHz to mmWave

The ME7834NR covers the 3GPP 5G frequency bands including Sub-6 GHz and mmWave when combined with Anritsu's new OTA Chamber MA8171A and RF converters.

Upgrade Current ME7834 System for 5G

The ME7834NR provides a smooth transition to 5G while still supporting LTE, LTE-A, LTE-A Pro and legacy GSM/W-CDMA technologies. Existing customers can upgrade to 5G while capitalizing on a proven LTE-A test environment and staying abreast of the latest technology evolution.

Adds Support for 3GPP Main Carrier Acceptance Tests

Protocol Conformance Tests continue to follow the 3GPP standards, and the Global Certification Forum (GCF)/PCS Type Certification Review Board (PTCRB) have approved the various test cases for the ME7834NR is registered as a GCF/PTCRB recommended platform TP 251.
The Carrier Acceptance Tests support acceptance inspection by major 5G operators worldwide.

Comprehensive Support System

To assure effective use, each subscription package includes comprehensive after-sales support offering:

- Latest software updates matching latest changes to 3GPP standards
- Consultation and technical support for troubleshooting test problems

These after-sales services assure smooth support for customers' business development.

Specifications

Dimensions

System Rack:
570 (W) × 1980 (H) × 797 (D) mm (1 Rack, excluding protrusions)
1140 (W) × 1980 (H) × 797 (D) mm (2 Rack, excluding protrusions)
OTA Chamber:
2080 (W) × 1785 (H) × 1000 (D) mm
(Including one Converter Rack, excluding protrusions)

Mass

System Rack: ≤650 kg (2 Racks)
OTA Chamber: ≤400 kg
(Including one Converter Rack, excluding protrusions)

Temperature Range

Operating: 15°C to 30°C
(With rack, 30-cm space at back and sides, no condensation)
Storage: 0°C to 30°C (No condensation)

Power Supply

Voltage: 100 VAC to 120 VAC/200 VAC to 240 VAC
Frequency: 50 Hz/60 Hz
Power consumption: ≤8500 VA (Full system configuration)

CE

EMC: 2014/30/EU, EN61326-1, EN61000-3-2
LVD: 2014/35/EU, EN61010-1
RoHS: 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018

UKCA

EMC: S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
LVD: S.I. 2016 No.1101, EN 61010-1
RoHS: S.I. 2012 No.3032, EN IEC 63000: 2018

Test Standards

Protocol Conformance Test (PCT)
3GPP TS 38.523-1 (5G NR)
3GPP TS 37.571-2 (Positioning)
3GPP TS 36.523-1 (LTE)
3GPP TS 34.229-5 (5G IMS)
3GPP TS 34.229-1 (IMS)
3GPP TS 34.123-1 (UMTS)

Carrier Acceptance Test (CAT)

Complies with standard of each supported carrier

Contact your Anritsu sales representative for detailed electrical characteristics, specifications, supported test cases, and carriers.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
ME7834NR	5G NR Mobile Device Test Platform
	Configuration Items
MN8142B	RF Combiner Unit
MT8000A	Radio Communication Test Station
MD8430A	Signalling Tester
	Consult us for other configurations.
	Options **Converters** **OTA Measurement Hardware** **Software Options** **Support Services** **Application Parts**
	Consult us for details.

Contact your Anritsu sales representative for detailed electrical specification, other detailed specification values, supported test cases and supported communication carriers.

LTE-Advanced Mobile Device Test Platform

ME7834LA

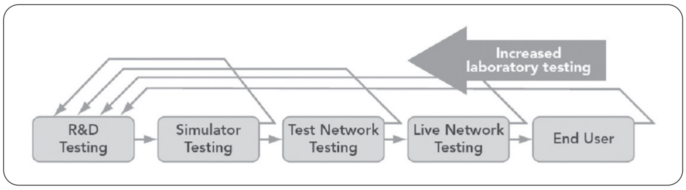
Remote Control
Ethernet

GCF/PTCRB, and Carrier Approved Test System for Mobile Protocol Testing

The ME7834LA is a configurable system that provides flexible protocol test solutions throughout the lifecycle of modern wireless terminals. ME7834LA systems are able to address applications in development and conformance and evolve to provide advanced system simulation. Anritsu led the way with 3G/LTE mobile development programs. It is now delivering intelligent test solutions to LTE-Advanced development teams that need to accelerate their designs to stay competitive.

Protocol Test Solutions

- 2G/3G/LTE/LTE-Advanced
- 4×4 MIMO, 3CC CA/4CC CA/5CC CA
- Development
- Conformance
- Carrier Acceptance



Reduce Costs by finding errors earlier in the process

ME7834LA for Conformance Testing to Meet Evolving Specifications

The Global Certification Forum (GCF) and the PCS Type Certification Review Board (PTCRB) include the ME7834LA as an approved platform to provide test coverage for GERAN, UTRAN, HSPA+, LTE and LTE-Advanced technologies.
The ME7834LA is registered as GCF/PTCRB TP119 and tracks TS 36.523 for LTE and TS 34.123 for UTRAN. It has met critical deadlines set by the industry for test platform approval. The system may also be configured to meet tests mandated by several network operators.

ME7834LA for Acceptance Testing for Carriers

Carriers are making use of the intelligent test tools to ensure that terminals behave correctly on their networks. Terminal development teams simulate conditions in networks that may be thousands of miles away and may not yet support the updated functionality present in new handsets.
The tests are created and validated with the RTD to take advantage of the graphical layout. This makes it straight forward to visualize test flow and hence verify and debug the terminals behavior.
These tests are validated against stringent requirements before they are provided as a commercial test package.
Test packages that keep pace with network requirements Anritsu are able to provide and support a number of carrier specific tests.
(Note: some test packages may need to be obtained directly from carriers)
ME7834LA users now have the ability to purchase carrier acceptance test packages outright or subscribe to them on an annual basis to suit their fiscal needs.

Specifications

Input and Output Connector		N-type, 50Ω
Max. Input Level		+33 dBm
Frequency Range		450 MHz to 6 GHz
Temperature Range		15°C to 35°C (operating), 0°C to 50°C (storage)*1
Power Supply (Rating)		Select either 100 VAC to 120 VAC or 200 VAC to 240 VAC, 50 Hz/60 Hz ≤5000 VA (Full system configuration)
Dimensions		1140 (W) × 1980 (H) × 797 (D) mm*2 (Full system configuration)
Mass		≤650 kg*3 (Full system configuration)
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000: 2018

*1: Ambient temperature
Basic calibration at acceptance inspection must meet this requirement.
Use in air-conditioned room recommended for stable measurement.
*2: Topple prevention
Secure using hooks at rack top recommended.
*3: Mass/Floor Loads
The installation location must be able to safely bear the above floor loads plus 100 kg for basic calibration equipment at acceptance inspection.

Please specify the model/order number, name and quantity when ordering.
Contact your Anritsu sales representative for detailed electrical specification, other detailed specification values, supported test cases and supported communication carriers.

New Radio RF Conformance Test System

ME7873NR

Remote Control
Ethernet

From 5G NR Sub-6 GHz to mmWave—RF/RRM Conformance Test System Supporting SA & NSA Modes

The New Radio RF Conformance Test System ME7873NR automates 3GPP-defined 5G NR RF/RRM tests. With GCF and PTCRB registration as test platform TP250 for 5G NR RF/RRM tests, it provides users with certified results for both the 5G NR standalone (SA) and non-standalone (NSA) modes. In addition to supporting the Sub-6 GHz band, mmWave band tests are supported in a 5G OTA environment by combined use with the CATR Anechoic Chamber MA8172A.
The ME7873NR system configuration is customized easily for the measurement conditions using the wide line of hardware and software options. Furthermore, the earlier ME7873LA supporting LTE, LTE-Advanced (LTE-A), LTE-A Pro, and legacy W-CDMA RF tests as well as Carrier Acceptance Tests (CAT) can be upgraded for 5G support to configure a cost-effective RF conformance test system matching customers' needs.

Feature

Pioneering for GCF*1/PTCRB*2 5G Validation

The New Radio RF Conformance Test System ME7873NR test platform is GCF/PTCRB certified. After its market-leading*3 release in November 2018, it became the first system to start GCF certification for 5G tests in January 2019 and subsequently started PTCRB certification tests in February. Since then, the number of supported test cases has been increasing at each quarterly GCF/PTC RB meeting.
The ME7873NR executes 5G NR Standalone and Non-Standalone mode RF/RRM tests with various types of measuring equipment and dedicated test software when used with the Radio Communication Test Station MT8000A simulating a 5G NR base station and the Signalling Tester MD8430A simulating an LTE base station.

*1: GCF (Global Certification Forum):
Certifies conformance to standards for mobile terminals and test systems. Composed mainly of operators, mobile terminal vendors and chipset vendors and performs certification for frequency bands used in Europe.
*2: PTCRB (PCS Type Certification Review Board):
A similar test system certification organization to GCF composed mainly of N. American carriers and UE vendors and performing conformance certification for frequency bands used in N. America.
*3: According to our research result on the news releases of each company.

Supports Latest 3GPP Standards

It supports execution of 3GPP-compliant 5G mobile RF TRx and RRM performance tests in accordance with the latest 3GPP standards updated every 3 months.

Supports Carrier Acceptance Tests

In addition to 3GPP RF/RRM Conformance Tests, North-American carrier acceptance tests are also supported, offering a wider application range with the same platform.

Easy Upgrade from ME7873LA

A cost-effective easy upgrade to the ME7873NR from the LTEAdvanced RF Conformance Test System ME7873LA is readily available by adding the minimum required hardware. Upgrading to the ME7873NR not only adds 5G NR test items but also keeps support for the ME7873LA test items too.

Supports Global Mobile Terminals

In addition to supporting GCF/PTCRB-certified bands (5G NR bands and LTE bands in 5G NSA mode) now being deployed or expected to be deployed in North America, Europe, and Asia, 3GPP-defined FR1 and FR2 bands are also widely supported. Currently supported bands are shown below. Currently unsupported bands are expected to be supported one-by-one according to market demand.
Please consult our business section for more details.

Easy Control of External Devices

The system software has built-in functions for controlling the DC power supply* and temperature chamber* in the same way as selecting test items. Using these standard functions makes automation easy.

*: Users must provide the DC power supply and temperature chamber.
Refer to the ordering information for recommended models.

Improve Reliability using Correction Function

System measurement stability and reliability are improved by the following three calibration and correction methods:

- Basic calibration at acceptance inspection
- Auto-calibration at work start
- Individual measurement correction

Individual measurement correction immediately before measurement eliminates temperature-related drift and greatly improves the reliability of measurements.
In addition, Anritsu engineers perform basic calibration when installing the system at acceptance inspection, eliminating the need for operators to perform this complex calibration and correction work.

Detailed Support System

An Anritsu Support Service contract keeps the system operating at peak performance, maximizing return on investment, minimizing downtime, and keeping work on schedule.

- Latest software updates matching the latest changes to the 3GPP standards
- Information on 3GPP trends, consultation and technical support for troubleshooting test problems
- Free hardware repair and maintenance with a back-up loan unit

Specifications

Supported Tests

3GPP TS 38.521
NR: User Equipment (UE) conformance specification; Radio transmission and reception

3GPP TS 38.533
NR: User Equipment (UE) conformance specification; Radio Resource Management (RRM)

Dimensions

System Rack:
570 (W) × 1980 (H) × 797 (D) mm (1 rack for FR2 system)
1140 (W) × 1980 (H) × 797 (D) mm (2 racks for FR1 system)
1710 (W) × 1980 (H) × 797 (D) mm (3 racks for FR1+LTE system)

*: Excluding projecting parts.

OTA Chamber:
2200 (W) × 1980 (H) × 120 (D) mm

*: With OTA rack, excluding projecting parts.

Enquire for other details.

Ordering Information

This table lists the key configuration parts only.
Consult our sales representative before ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Unit
ME7873NR	New Radio RF Conformance Test System
	Configuration Parts (FR1)
MT8000A	Radio Communication Test Station
MD8430A	Signalling Tester
MS2692A	Signal Analyzer
MG36221A	Signal Generator, 20 GHz
MG3710E	Vector Signal Generator
MA24218A	Universal USB Power Sensor
MN7446G	Filter Unit
MN7446G-001	Rack Mount Kit
MN7447A	LTE Uplink Signal Filter
MN7447B	UL Amplifier
MN7448A	Uplink Signal Filter
MN7462E	RF Front End
MN7463G	Combining Unit
Z2014A	System control PC (EN)
Z2015A	System control PC (JP)
	Configuration Parts (FR2)
MT8000A	Radio Communication Test Station
MT8821C	Radio Communication Analyzer
MS2840A	Signal Analyzer
MS2850A	Signal Analyzer
MG3697C	Signal Generator
MA8172A	CATR Anechoic Chamber
MA8172B	CATR Anechoic Chamber 2
MD8430A	Signalling Tester
MN74000A	Spurious Measurement Unit
MN74000B	Spurious Measurement Unit
MN74001A	LTE Anchor Unit
MA80003A	Multiband RF Converter
Z2014A	System control PC (EN)
Z2015A	System control PC (JP)
	Software
MX787300NR	Platform Functionality
MX787301NR	LTE Band Capability
MX787302NR	Software Extension
MX787303NR	Extension Test Software
MX787304NR	Software Function Extension
MX787311NR	FDD NR NSA FR1 Test Software
MX787313NR	FDD NR NSA FR1 3CC Test Software
MX787321NR	FDD NR SA FR1 Test Software
MX787322NR	FDD NR SA FR1 2CC Test Software
MX787323NR	FDD NR SA FR1 3CC Test Software
MX787333NR	FDD-TDD NR NSA FR1 3CC Test Software
MX787342NR	FDD-TDD NR SA FR1 2CC Test Software
MX787343NR	FDD-TDD NR SA FR1 3CC Test Software
MX787361NR	TDD NR NSA FR1 Test Software
MX787363NR	TDD NR NSA FR1 3CC Test Software
MX787371NR	TDD NR NSA FR2 Test Software
MX787372NR	TDD NR NSA FR2 UL CA Test Software
MX787373NR	TDD NR NSA FR2 DL CA Test Software
MX787381NR	TDD NR SA FR1 Test Software
MX787382NR	TDD NR SA FR1 2CC Test Software
MX787383NR	TDD NR SA FR1 3CC Test Software

For details, refer to the Product Brochure or consult our sales representative.

LTE-Advanced RF Conformance Test System

ME7873LA

Remote Control
Ethernet

RF/RRM Conformance Test System Supporting Most and First GCF/PTCRB Approved TCs

Supporting Most and First GCF[*1]/PTCRB[*2] Approved Test Cases[*3]

This GCF/PTCRB-compatible test platform targets the most and first Test Cases approved at quarterly GCF/PTCRB meetings.
It uses the Signalling Tester MD8430A as a LTE base station simulator, and is configured from various test instruments and dedicated software.
It supports RF/RRM tests while communicating with LTE mobile terminals.

LTE-Advanced RF Conformance Test System ME7873LA

This system is for testing the RF TRx characteristics, performance requirements, and RRM performance of FDD/TDD LTE mobile terminals in compliance with the requirements of 3GPP TS 36.521-1 Chapter 6 (Transmitter Characteristics), Chapter 7 (Receiver Characteristics), Chapter 8 (Performance Requirement), Chapter 9 (Reporting of Channel State Information), Chapter 10 (MBMS Performance) and TS 36.521-3 RRM[*4] including LTE → GSM/UMTS/CDMA2000/TD-SCDMA Inter-RAT tests.
TS 34.121-1 UMTS → LTE and TS 34.122 TD-SCDMA → LTE Inter-RAT tests are also supported.
Moreover, UMTS 3GPP TS 34.121-1 tests are supported.[*5]

Supports Mobile Terminal Carrier Acceptance Tests

This single, multi-purpose platform supports acceptance tests mainly for North American operators, as well as 3GPP RF/RRM conformance tests.

Supports Global Mobile Terminals

Worldwide Frequency Bands

Not only are GCF/PTCRB-approved Bands planned for use in Europe and North America fully supported, but the following bands defined by 3GPP are also supported too.
Unlisted bands can be supported by request.

Operating Band	UL Frequencies (MHz)	DL Frequencies (MHz)
1	1920 to 1980	2110 to 2170
2	1850 to 1910	1930 to 1990
3	1710 to 1785	1805 to 1880
4	1710 to 1755	2110 to 2155
5	824 to 849	869 to 894
6	830 to 840	875 to 885
7	2500 to 2570	2620 to 2690
8	880 to 915	925 to 960
9	1749.9 to 1784.9	1844.9 to 1879.9
10	1710 to 1770	2110 to 2170
11	1427.9 to 1447.9	1475.9 to 1495.9
12	698 to 716	728 to 746
13	777 to 787	746 to 756
14	788 to 798	758 to 768
17	704 to 716	734 to 746
18	815 to 830	860 to 875
19	830 to 845	875 to 890
20	832 to 862	791 to 821
21	1447.9 to 1462.9	1495.9 to 1510.9
24	1626.5 to 1660.5	1525 to 1559
25	1850 to 1915	1930 to 1995
26	814 to 849	859 to 894
27	807 to 824	852 to 869
28	703 to 748	758 to 803
29	N/A	717 to 728
30	2305 to 2315	2350 to 2360
31	452.5 to 457.5	462.4 to 467.5
32	N/A	1452 to 1496
33	1900 to 1920	1900 to 1920
34	2010 to 2025	2010 to 2025
35	1850 to 1910	1850 to 1910
36	1930 to 1990	1930 to 1990
37	1910 to 1930	1910 to 1930
38	2570 to 2620	2570 to 2620

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*1: GCF (Global Certification Forum):
Certifies conformance to standards for mobile terminals and test systems. Composed mainly of operators, mobile terminal vendors and chipset vendors and performs certification for frequency bands used in Europe.

*2: PTCRB (PCS Type Certification Review Board):
A similar test system certification organization to GCF composed mainly of N. American carriers and UE vendors and performing conformance certification for frequency bands used in N. America.

*3: As of June, 2018.

*4: RRM: Radio Resource Management

*5: In principle, defined by GCF Work Item[*6] and targeting measurement items certified by GCF/PTCRB.
(Contact your Anritsu sales representative for timing of supported items and option configurations.)

*6: Work Item:
Name of function test items selected by GCF for mobile terminal approval.

Operating Band	UL Frequencies (MHz)	DL Frequencies (MHz)
39	1880 to 1920	1880 to 1920
40	2300 to 2400	2300 to 2400
41	2496 to 2690	2496 to 2690
42	3400 to 3600	3400 to 3600
46	5150 to 5925	5150 to 5925
48	3550 to 3700	3550 to 3700
66	1710 to 1780	2110 to 2200
71	663 to 698	617 to 652

Focus on Improving Test Efficiency, Measurement Stability and Reliability

Continuous Testing of Multiple Terminals

Since the standard system configuration has four RF interfaces, it can test up to four terminals continuously. Fully automated testing of multiple terminals is supported by DC power supply and serial control line auto-switching.

Control via Networks

The PC server in the rack can be operated remotely over a network. Measurement progress can be monitored remotely and measurement sequences can be created and edited, allowing tests to be run while working elsewhere.

Easy Control of External Devices

The system software has built-in functions for controlling the DC power supply* and temperature chamber* in the same way as selecting test items. Using these standard functions makes automation easy.

*: Users must provide the DC power supply and temperature chamber.
Refer to the ordering information for recommended models.

RED-compliant Test Items (option)

This option is fully compliant with the European ETSI-defined Radio Equipment Directive (RED) RF TRx test items. Anritsu launched this European-test-house approved option ahead of market competitors. Simple operation supports easy RED-compliant tests like normal test items.

Improve Reliability using Correction Function

System measurement stability and reliability are improved by the following three calibration and correction methods:

1. Basic calibration at acceptance inspection
2. Auto-calibration at work start
3. Individual measurement correction

Individual measurement correction immediately before measurement eliminates temperature-related drift and greatly improves the reliability of measurements.
In addition, Anritsu engineers perform basic calibration when installing the system at acceptance inspection, eliminating the need for operators to perform this complex calibration and correction work.

Detailed Support System

An Anritsu Support Service contract keeps the system operating at peak performance, maximizing return on investment, minimizing downtime, and keeping work on schedule.

- Latest software updates matching the latest changes to the 3GPP standards
- Information on 3GPP trends, consultation and technical support for troubleshooting test problems
- Free hardware repair and maintenance with a back-up loan unit

Specifications

LTE-Advanced RF Conformance Test System ME7873LA

Input and Output Connector		N-type, 50Ω
Max. Input Level		+35 dBm
Reference Oscillator		MS2692A (with option-001/037 Rubidium Reference Oscillator) as standard External oscillator signal input available (Frequency: 10 MHz, Connector: BNC)
Frequency Range		Defined by 3GPP E-UTRA Operating Band 1 to 14, 17 to 21, 24 to 42, 66, 71
Temperature Range		15°C to 35°C (operating), 0°C to 50°C (storage)*1
Power Supply (Rating)		Select either 100 VAC to 120 VAC or 200 VAC to 240 VAC, 50 Hz/60 Hz ≤7700 VA*2 (Full system configuration)
Dimensions		1710 (W) × 1980 (H) × 797 (D) mm*3 (Full system configuration)
Mass		≤830 kg*4 (Full system configuration)
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000: 2018

*1: Ambient temperature
Basic calibration at acceptance inspection must meet this requirement.
Use in air-conditioned room recommended for stable measurement.
*2: Power consumption
Sufficient power (600 VA) for basic calibration at acceptance inspection as well as for ME7873LA must be supplied.
*3: Topple prevention
Secure using hooks at rack top recommended.
*4: Mass/Floor Loads
The installation location must be able to safely bear the above floor loads plus 100 kg for basic calibration equipment at acceptance inspection.

Supported Test Standards

The system design is based on the following standards:

3GPP TS 36.521-1	E-UTRA UE Conformance Specification Radio Transmission and Reception Part 1: Conformance Testing
3GPP TS 36.521-3	E-UTRA UE Conformance Specification Radio Transmission and Reception Part 3: RRM Conformance Testing
3GPP TS 34.121-1	User Equipment (UE) conformance specification; Radio transmission and reception (FDD); Part 1: Conformance specification

Release 8, 9, 10, 11, 12 and 13 of above standards is also supported. Contact our sales representative for detailed of the supported versions.

Ordering Information

This table lists the key configuration part only. For details, refer to the Product Brochure or consult our sales representative.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
ME7873LA	LTE-Advanced RF Conformance Test System
	Configuration Items
MN7462E	RF Front End
MN7463E	Combining Unit
MN7463F	Combiner Unit
MN7463G	Combining Unit
MN7446A	Filter Unit
MN7446B1	Filter Block
MN7446C	Filter Block2
MN7446D	Filter Block3
MN7446G	Filter Unit
MN7446G-001	Rack Mount Kit
MN7447A	LTE Uplink Signal Filter
MN7448A	Uplink Signal Filter
MA24218A	Universal USB Power Sensor
MS2692A	Signal Analyzer
MD8430A	Signalling Tester
MG3710E	Vector Signal Generator
MG3692C	2 GHz - 20 GHz Signal Generator
MG36221A	Signal Generator, 20 GHz
Z1396F	User Operation PC
Z1397F	User Operation PC
Z1392D	Server PC
	Standard Accessory
	ME7873LA Operation Manual (CD-ROM): 1 set
	Options
ME7873LA-001	Common Kit
ME7873LA-002	Antenna Extension
ME7873LA-005	Additional Rack
ME7873LA-011	SS1 Accessory
ME7873LA-012	SS2 Accessory
ME7873LA-013	SS3 Accessory
ME7873LA-014	SS4 Accessory
ME7873LA-017	SS7 Accessory
ME7873LA-021	VSG1 Accessory
ME7873LA-022	VSG2 Accessory
ME7873LA-023	CWSG1 Accessory
ME7873LA-051	Spurious Filter
ME7873LA-052	Spurious Filter2
ME7873LA-064	SS4 Accessory (Fading)
ME7873LA-081	U46G Accessory
ME7873LA-082	U46A Accessory
ME7873LA-083	U48A Accessory
ME7873LA-084	U63G Accessory
ME7873LA-085	SS1 Accessory 2
ME7873LA-086	SS7 Accessory 2
	Software Options
MX787301LA	4Rx Capability
MX787302LA	Flexible Band Combination
MX787310LA	W-CDMA Test Software
MX787311LA	FDD LTE Test Software
MX787361LA	TD-LTE Test Software
MX787312LA	FDD CA Test Software
MX787362LA	TD-LTE CA Test Software
MX787313LA	FDD 3CA Test Software
MX787363LA	TD-LTE 3CA Test Software
MX787314LA	FDD 4CA Test Software
MX787364LA	TDD 4CA Test Software
MX787315LA	FDD 5CA Test Software
MX787322LA	FDD-TDD 2CA Test Software
MX787323LA	FDD-TDD 3CA Test Software
MX787324LA	FDD-TDD 4CA Test Software
MX787325LA	FDD-TDD 5CA Test Software
MX787330LA	LAA Test Software
MX787332LA	LAA 2CA Test Software
MX787371LA	HD-FDD CAT-M1 Test Software
MX787376LA	HD-FDD NB-IoT Test Software
MX787340LA	Supplementary Test Software for Vzw
MX787341LA	Supplementary Test Software for AT&T
MX787343LA	Supplementary Test Software for T-Mobile
MX787350LA	R&TTE Test Software
MX787351LA	TRCC Test Software
MX787300LA	Platform Functionality

In addition to the above-described accessories, the following items are required to use the ME7873LA.

DC Power Supply

One of the following models is required when controlling the power supply using the ME7873LA.

Model	Name	pcs	Manufacturer
N6700C	Main frame	1	Keysight Technologies Inc.
N6732B	8 V, 6.25 A, 50 W DC Power Module[*1]	4	
N6709C	Low-Profile MPS Mainframe Rack Mount Kit	1	
2306-PJ	Dual-Channel Battery/ Charger Simulator with 500 mA Range	2[*2]	Keithley Instruments Inc.

*1: Up to four modules are required according to connected mobiles.
Filler Panel Kit N6708A is required if the number of DC power modules are less than four.
At rack mounting, the maximum current is 2 A. To draw more than 2 A of current, use a separate cable to supply DC to the terminal. However, since this will prevent rack mounting, decide on the installation location for the DC power supply in advance.
When using other DC power module, ask the power supply manufacturer for details.

*2: Two sets of the 2306-PJ are required when testing up to four mobiles continuously.

Temperature Chamber

One of the following equipments is required to control the temperature chamber from the ME7873LA.

Model	Name	Manufacturer
SH-241[*1]	Temperature & Humidity Chamber	ESPEC Corp.
SH-242[*1]		
VT4002[*2]	EMC Shielding with Temperature	Votsch Industrietechnik GmbH
105[*1]	Benchtop Temperature Chamber	TestEquity LLC
107[*1]		
115[*1]	Temperature Chamber	

*1: GPIB Cable (Double-Shield, 2 m) is required to control this chamber automatically.

*2: USB-RS232C Converter Cable (2 m) is required to control this chamber automatically.

For details, refer to the Product Brochure or consult our sales representative.

RF Regulatory Test System

ME7803NR

Remote Control
Ethernet

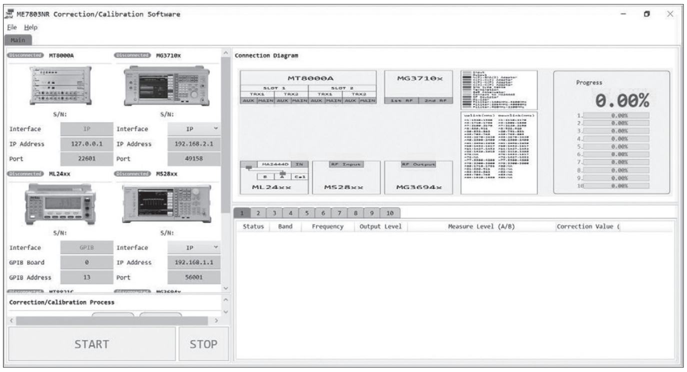
Tests in Compliance with National and Regional Radio Regulations

Supports ARIB/ETSI/FCC 5G RF Regulatory FR1 Tests with Maximizing Customer's Equipment Investment

The 5G RF Regulatory Test System ME7803NR test solution is in compliance with the ARIB/ETSI/FCC-defined TRCC/RED/CFR FR1 tests. Future test changes and updates will also be supported.
This can be combined with customers' own test equipment, such as the MT8000A, MT8821C, MS2840A/MS2850A, MG3710E, and MG3694C to configure the Regulatory Test System by adding just the minimum required hardware, maximizing previous investments in Anritsu equipment.
Especially for MT8000A and MT8821A are available for SAR/OTA/EMC multiuse.

Correction Function for Increased Reliability

Calibration when starting testing is recommended to improve measurement stability and measured-result reliability. Easy-to-understand procedure and execution navigation guides simplify calibration tasks.



MT8000A
S/N:
Interface: IP
IP Address: 127.0.0.1
Port: 22601

MG3710x
S/N:
Interface: IP
IP Address: 192.168.2.1
Port: 49158

ML24xx
S/N:
Interface: GPIB
GPIB Board: 0
GPIB Address: 13

MS28xx
S/N:
Interface: IP
IP Address: 192.168.1.1
Port: 56001

Progress 0.00%

Status	Band	Frequency	Output Level	Measure Level (A/B)	Correction Value (

Correction/Calibration Main Screen

Supports Regional Frequency Bands

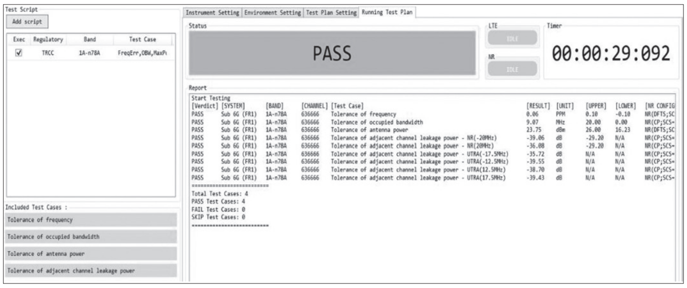
All certified frequency bands (5G NR and LTE band in 5G NSA mode) now deployed or about to be deployed in N. America, Europe, and Asia are supported. In addition, currently unsupported bands will be supported in future according to market requirements.

NR Support Band List

TRCC		
Operating Band	UL Frequencies (MHz)	DL Frequencies (MHz)
77	3300 to 4200	3300 to 4200
78	3300 to 3800	3300 to 3800
79	4400 to 5000	4400 to 5000
RED		
Operating Band	UL Frequencies (MHz)	DL Frequencies (MHz)
1	1920 to 1980	2110 to 2170
3	1710 to 1785	1805 to 1880
7	2500 to 2580	2620 to 2690
8	880 to 915	925 to 960
20	832 to 862	791 to 821
28	703 to 748	758 to 803
38	2570 to 2620	2570 to 2620
40	2300 to 2400	2300 to 2400
41	2496 to 269	2496 to 2690
50	1432 to 1517	1432 to 1517
51	1427 to 1432	1427 to 1432
65	1920 to 2010	2110 to 2200
77	3300 to 4200	3300 to 4200
78	3300 to 3800	3300 to 3800
CFR		
Operating Band	UL Frequencies (MHz)	DL Frequencies (MHz)
5	824 to 849	869 to 894
41	2496 to 2690	2496 to 2690
71	663 to 698	617 to 652

Measured Data Management Function

In addition to confirming ME7803NR measurement results at the Measurement Results screen, results can also be saved either as easy-to-read PDF files or as CSV files for management using the customer's database software.



Test Script

Add script

Exec	Regulatory	Band	Test Case
☑	TRCC	1A-n78A	FreqErr,OBW,MaxP

Included Test Cases :

- Tolerance of frequency
- Tolerance of occupied bandwidth
- Tolerance of antenna power
- Tolerance of adjacent channel leakage power

Instrument Setting | Environment Setting | Test Plan Setting | Running Test Plan

Status: PASS

LTE: IDLE

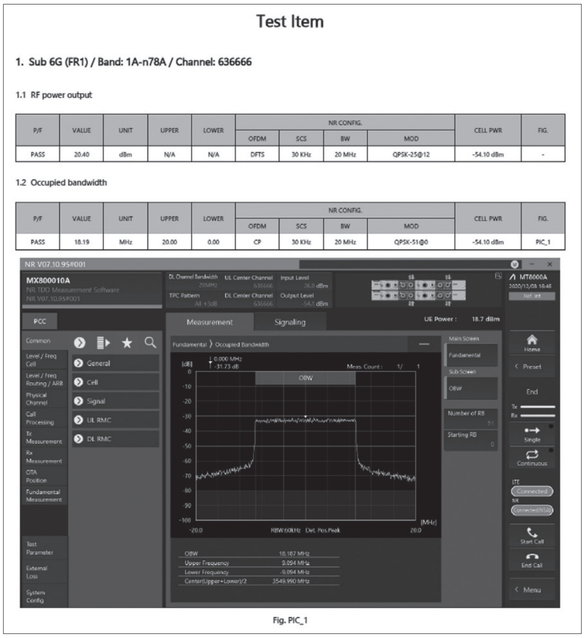
NR: IDLE

Timer: 00:00:29:092

Report

```
Start Testing
[Verdict] [SYSTEM]      [BAND]     [CHANNEL] [Test Case]                                                 [RESULT]  [UNIT]  [UPPER]  [LOWER]  [NR CONFIG
PASS      Sub 6G (FR1)  1A-n78A    636666    Tolerance of frequency                                      0.06      PPM     0.10     -0.10    NR(DFTS;SC
PASS      Sub 6G (FR1)  1A-n78A    636666    Tolerance of occupied bandwidth                             9.07      MHz     20.00    0.00     NR(CP;SCS=
PASS      Sub 6G (FR1)  1A-n78A    636666    Tolerance of antenna power                                  23.75     dBm     26.00    16.23    NR(DFTS;SC
PASS      Sub 6G (FR1)  1A-n78A    636666    Tolerance of adjacent channel leakage power - NR(-20MHz)    -39.06    dB      -29.20   N/A      NR(CP;SCS=
PASS      Sub 6G (FR1)  1A-n78A    636666    Tolerance of adjacent channel leakage power - NR(20MHz)     -36.08    dB      -29.20   N/A      NR(CP;SCS=
PASS      Sub 6G (FR1)  1A-n78A    636666    Tolerance of adjacent channel leakage power - UTRA(-17.5MHz) -35.72   dB      N/A      N/A      NR(CP;SCS=
PASS      Sub 6G (FR1)  1A-n78A    636666    Tolerance of adjacent channel leakage power - UTRA(-12.5MHz) -39.55   dB      N/A      N/A      NR(CP;SCS=
PASS      Sub 6G (FR1)  1A-n78A    636666    Tolerance of adjacent channel leakage power - UTRA(12.5MHz)  -38.70   dB      N/A      N/A      NR(CP;SCS=
PASS      Sub 6G (FR1)  1A-n78A    636666    Tolerance of adjacent channel leakage power - UTRA(17.5MHz)  -39.43   dB      N/A      N/A      NR(CP;SCS=
==========================
Total Test Cases: 4
PASS Test Cases: 4
FAIL Test Cases: 0
SKIP Test Cases: 0
==========================
```

Measurement Result Screen



Test Item

1. Sub 6G (FR1) / Band: 1A-n78A / Channel: 636666

1.1 RF power output

P/F	VALUE	UNIT	UPPER	LOWER	NR CONFIG.				CELL PWR	FIG.
					OFDM	SCS	BW	MOD		
PASS	20.40	dBm	N/A	N/A	DFTS	30 KHz	20 MHz	QPSK-25@12	-54.10 dBm	-

1.2 Occupied bandwidth

P/F	VALUE	UNIT	UPPER	LOWER	NR CONFIG.				CELL PWR	FIG.
					OFDM	SCS	BW	MOD		
PASS	18.19	MHz	20.00	0.00	CP	30 KHz	20 MHz	QPSK-51@0	-54.10 dBm	PIC_1

OBW	18.187 MHz
Upper Frequency	9.094 MHz
Lower Frequency	-9.094 MHz
Center(Upper+Lower)/2	3549.990 MHz

Fig. PIC_1

Measurement Report (PDF)

Test Standards

TRCC (Japan Regulatory): Article 2-1-11-30
RED (ETSI): ETSI EN 301 908-25
CFR (FCC): Tille47 CFR part 2 (common), Part 22, Part 24, Part 27 (FR1)

* Contact our Business Section for details about versions supporting each standard.

Ordering Information

Please specify the model/order number, name and quantity when ordering.

Names in this list may differ slightly from names on the actual equipment.
Choose any required Anritsu parts, ancillaries, accessories, etc.
For more details, contact our Business Section.

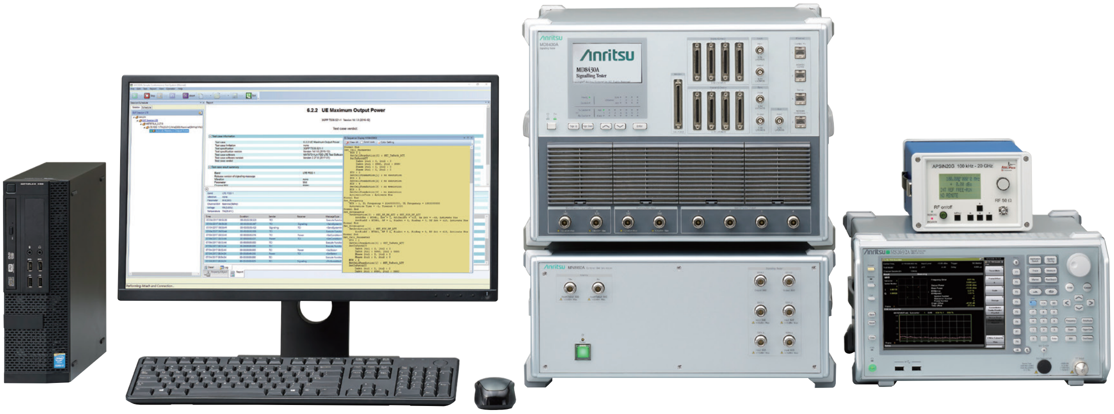
Model/Order No.	Name
	Main Unit
ME7803NR	RF Regulatory Test System
	Ancillary Equipment
MT8000A	Radio Communication Test Station
MT8821C	Radio Communication Analyzer
MG3694C	2 GHz to 40 GHz Signal Generator
MG3710E	Vector Signal Generator
MS2850A	Signal Analyzer
ML2437A	Power Meter
MA2444D	10 MHz-40 GHz High Accuracy Power Sensor
	Other Accessories and Application Parts
ME7803NR-AK001	Accessory Kit for FR1(In-band)
ME7803NR-AK002	Accessory Kit for FR1(spurious)
ME7803NR-AK011	Accessory Kit for FR1 Correction (In-band)
ME7803NR-AK012	Accessory Kit for FR1 Correction (spurious/interferer)
Z2102A	HPF (1700 MHz to 5000 MHz)
Z2103A	HPF (3000 MHz to 7000 MHz)
Z2104A	LPF (DC to 2200 MHz)
J1806A	VJ-VJ Adaptor
Z2091A	GPIB-Ethernet Converter
Z2114A	Control PC (EN)
Z2090A	Ethernet Hub
	Standard Accessory
	ME7803NR Instruction Manual (DVD-ROM)
	Options
MX780300NR	Platform Functionality
MX780302NR	RED Test Software for CE
MX780303NR	CFR Test Software for FCC
MX780304NR	TRCC Test Software for Japan Regulatory

Simple Conformance Test System

ME7800L

Remote Control
Ethernet

The First Step in Future Communications



Partners with Anritsu Conformance Test System

Anritsu's Simple Conformance Test System ME7800L is the ideal system for introducing RF and Protocol Conformance tests of 3GPP-compliant LTE mobile terminals. It covers all the basic LTE test items and also supports evolving communications standards.
Both RF/Performance/RRM tests and protocol tests can be selected and introduced as necessary and work efficiency is maximized by the full range of built-in functions for every stage, ranging from assuring network quality to developing mobile terminals.
The series top-of-the-line LTE-Advanced RF Conformance Test System has won more LTE-Advanced-related certifications than any other company and Anritsu promises to bring the benefits of its long experience in conformance test systems to customers meeting the challenges of verification.

All-in-One RF and Conformance Tests

Using one Signalling Tester MD8430A as a base station simulator with installed RF/RRM and protocol test software supports both RF/RRM and protocol conformance tests.

Support for Spurious Tests

Even the base model in the product line supports the spurious test required at RF measurement.

Compliance with 3GPP Standards include Latest IoT Tests

In addition to RF/RRM and protocol tests, the ME7800L continuously tracks new 3GPP standards include the latest Cat-M and NB-IoT tests to maintain compliance.
Refer to the Specifications section for the supported tests.

GCF*[1]/PTCRB*[2] Approved Conformance Tests

The Simple Conformance Test System ME7800L is a GCF/PTCRB approved test platform with RF/RRM and protocol test cases certified*[3] by GCF/PTCRB.

*1: Abbreviation for Global Certification Forum, an organization certifying mobile equipment and test platform standards compliance. GCF is composed of operators, mobile equipment and chipset makers and certifies standards compliance for the frequency bands used principally in Europe.

*2: Abbreviation for PCS Type Certification Review Board, an organization like the GCF mobile equipment and test platform standards compliance.
Unlike GCF, its main target is frequency bands used principally in N. America.

*3: Registered as GCF Test Platform (TP) 160.

Support for Regional Frequency Bands

In addition to the GCF/PTCRB-certified bands used principally in Europe and N. America, 3GPP-defined bands are also supported.
We also plan increasing support for other bands, depending on market requirements.
Refer to the standards page for the frequency bands.

Easy Control of Peripheral Equipment

A function for controlling the DC power supply and constant temperature chamber required by RF/RRM tests is built-in as standard. Control is easy and performed in the same manner as selecting test items for simple automated testing.

*: The DC power supply and constant temperature chamber must be supplied by the customer. Refer to the ordering information page for recommended models.

Calibration/Correction Functions for Higher Reliability

The following built-in calibration and correction functions improve measurement stability and reliability:

- Factory shipping basic correction
- Start-up auto-calibration
- Correction at each measurement

Since measurement correction is performed immediately before measurement, temperature-related changes in the measurement system are eliminated to greatly improve the measured value reliability. Moreover, factory shipping basic correction eliminates the need for customers to perform complex operations, such as daily calibration and correction.

Excellent Support System

Various support packages provide after-purchase services to help ensure this system is used at its highest efficiency.
They include:

- Software updates assuring full compliance with new 3GPP standards
- Technical support consultations for troubleshooting testing problems

These versatile services help ensure efficient and effective testing work.

Specifications

Connector

TRx port: N-J, 50Ω, Maximum input +35 dBm
Rx port: N-J, 50Ω, Maximum input +30 dBm

Reference Oscillator

10 MHz Buffered Output of MD8430A as standard
External oscillator signal input available
(Frequency: 10 MHz, Connector: BNC)

Temperature Range

Operating: 15°C to 35°C
Storage: 0°C to 50°C

Power Supply

Power voltage: 100 VAC to 120 VAC/200 VAC to 240 VAC
Frequency: 50 Hz/60 Hz
Power consumption: ≤2500 VA

CE Marking

EMC: 2014/30/EU, EN61326-1, EN61000-3-2
LVD: 2014/35/EU, EN61010-1
RoHS: 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018

UKCA Marking

EMC: S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
LVD: S.I. 2016 No.1101, EN 61010-1
RoHS: S.I. 2012 No.3032, EN IEC 63000: 2018

Supported Test Standards

Both RF/RRM and Protocol Testing support Release 8, 9 and 10 (only 2 Downlink Carrier Aggregation) and Release 13 (IoT only) of below standards.

RF/RRM Testing

3GPP TS 36.521-1
E-UTRA UE Conformance Specification Radio Transmission and Reception Part1: Conformance Testing

3GPP TS 36.521-3
E-UTRA UE Conformance Specification Radio Transmission and Reception Part3: RRM Conformance Testing

Protocol Testing

3GPP TS 36.523-1
Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); User Equipment (UE) conformance specification; Part 1: Protocol conformance specification

3GPP TS34.229-1
Internet Protocol (IP) multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); User Equipment (UE) conformance specification; Part 1: Protocol conformance specification

Frequency Range

Operating Band	UL Frequencies (MHz)	DL Frequencies (MHz)
1	1920 to 1980	2110 to 2170
2	1850 to 1910	1930 to 1990
3	1710 to 1785	1805 to 1880
4	1710 to 1755	2110 to 2155
5	824 to 849	869 to 894
7	2500 to 2570	2620 to 2690
8	880 to 915	925 to 960
9	1749.9 to 1784.9	1844.9 to 1879.9
10	1710 to 1770	2110 to 2170
11	1427.9 to 1447.9	1475.9 to 1495.9
12	698 to 716	728 to 746
13	777 to 787	746 to 756
14	788 to 798	758 to 768
17	704 to 716	734 to 746
18	815 to 830	860 to 875
19	830 to 845	875 to 890
20	832 to 862	791 to 821
21	1447.9 to 1462.9	1495.9 to 1510.9
24	1626.5 to 1660.5	1525 to 1559
25	1850 to 1915	1930 to 1995
26	814 to 849	859 to 894
27	807 to 824	852 to 869
28	703 to 748	758 to 803
29	N/A	717 to 728
30	2305 to 2315	2350 to 2360
31	452.5 to 457.5	462.4 to 467.5
32	N/A	1452 to 1496
33	1900 to 1920	1900 to 1920
34	2010 to 2025	2010 to 2025
35	1850 to 1910	1850 to 1910
36	1930 to 1990	1930 to 1990
37	1910 to 1930	1910 to 1930
38	2570 to 2620	2570 to 2620
39	1880 to 1920	1880 to 1920
40	2300 to 2400	2300 to 2400
41	2496 to 2690	2496 to 2690
42	3400 to 3600	3400 to 3600
48	3550 to 3700	3550 to 3700
66	1710 to 1780	2110 to 2200
71	663 to 698	617 to 652

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
ME7800L	Simple Conformance Test System
	Configuration Items
MN8160A	Combiner Unit
Z1938B	Standard PC for SimpleCT (with monitor)
ME7800L-AK000	Accessory Kit for ME7800L
MD8430A	Signalling Tester
MS2692A	Signal Analyzer
MA24218A	Microwave Universal USB Power Sensor (10 MHz-18 GHz)
G0378B	APSIN20 G-HC-AZ1 Signal Generator
	Standard Accessory
	ME7800L Operation Manual (CD-ROM) 1 set
	Options
ME7800L-001	LTE Protocol Test Package
ME7800L-011	IoT Protocol Test Package
ME7800L-051	LTE RF/RRM Test Package
ME7800L-061	IoT RF/RRM Test Package

The following DC power supplies and temperature chamber used for the RF tests can be controlled by the ME7800L.

DC Power Supply

The DC power supply to the mobile can be controlled.

Model	Name	pcs	Manufacturer
N6700C	Main frame	1	Keysight Technologies Inc.
N6732B[*1]	8 V, 6.25 A, 50 W DC Power Module	1	
N6708A	Filler Panel Kit	1	
2306-PJ	Dual-Channel Battery/Charger Simulator with 500 mA Range	1	Keithley Instruments Inc.

*1: When using DC power modules other than the N6732B, the customer must confirm whether the power supply can be installed in the N6700C main unit.

Temperature Chamber

The temperature chamber can be controlled for the mobile temperature test.

Model	Name	Manufacturer
SH-241[*2]	Bench-Top Type Temperature & Humidity Chamber	Espec Corp.
SH-242[*2]		
VT4002[*3]	EMC Shielding with Temperature	Votsch Industrietechnik GmbH
105[*2]	Benchtop Temperature Chamber	TestEquity LLC
107[*2]		
115[*2]	Temperature Chamber	

*2: GPIB cable is required to control this chamber automatically.
*3: USB-RS232C converter cable is required to control this chamber automatically.

Signalling Tester

MD8475B

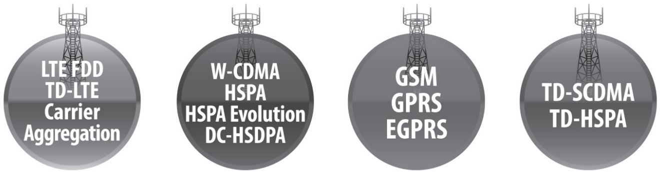
Total Smartphone Application Testing

Excellent Eco Product

SmartStudio

All-in-One Support for LTE and Other Communications Systems

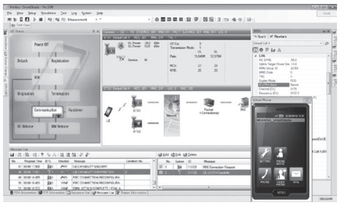
All the world's main communications technologies, such as triple-system LTE/W-CDMA/GSM/GPRS mobiles and TD-LTE/TD-SCDMA/GSM as well as LTE hybrids, can be tested using the all-in-one MD8475B. (Requires installation of optional units and software for each systems).



Scenario-less Smartphone Tests using SmartStudio

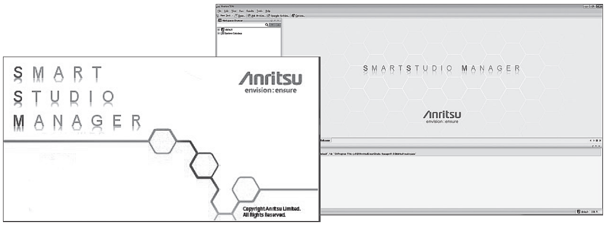
Unlike earlier base station simulators requiring time-consuming creation of complex scenarios, the SmartStudio MX847570B interactive user interface eliminates the need to create scenarios, smoothing UE testing.

SmartStudio



Verifying Existing Smartphone Functions using SmartStudio Manager

Smartphone development requires verification of existing functions. Testing of items that have already been tested many times over, such as voice tests and SMS sending/receiving, are automated using SmartStudio Manager MX847503A to improve development efficiency.



SMART
STUDIO
MANAGER

Anritsu
envision : ensure

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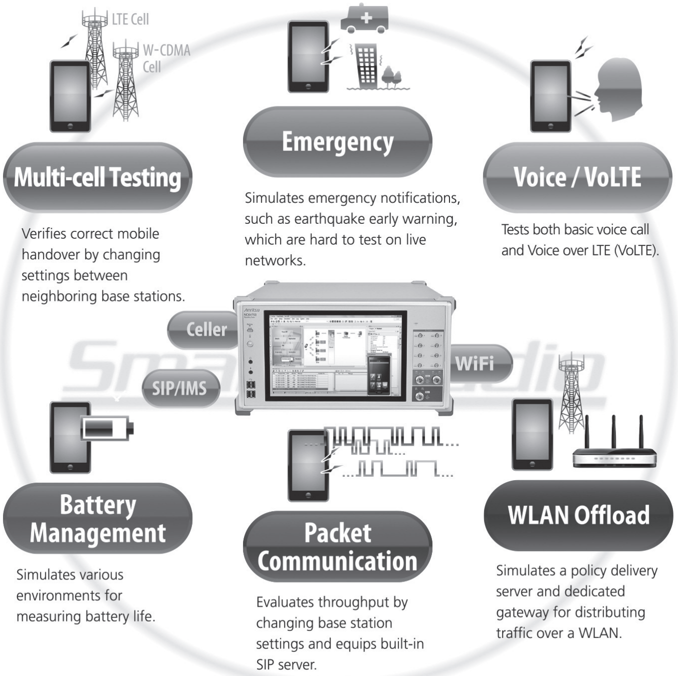
SMARTSTUDIO MANAGER

Supports Versatile Smartphone Tests

Complex tests of multifunction smartphones are supported by the all-in-one MD8475B with interactive SmartStudio interface.



Multi-cell Testing

Verifies correct mobile handover by changing settings between neighboring base stations.

Emergency

Simulates emergency notifications, such as earthquake early warning, which are hard to test on live networks.

Voice / VoLTE

Tests both basic voice call and Voice over LTE (VoLTE).

Battery Management

Simulates various environments for measuring battery life.

Packet Communication

Evaluates throughput by changing base station settings and equips built-in SIP server.

WLAN Offload

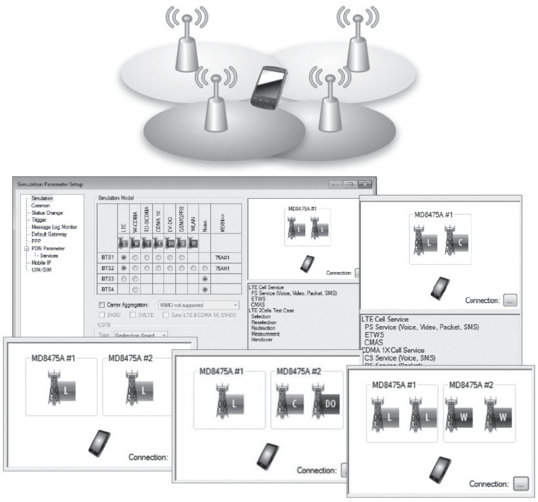
Simulates a policy delivery server and dedicated gateway for distributing traffic over a WLAN.

Configuring Multi-cell Test Environment

Performing UE tests between communications systems (handover tests) usually requires set-up of several measuring instruments and creation of complex scenarios. SmartStudio eliminates these problems by providing a simple test environment for fast and efficient testing.

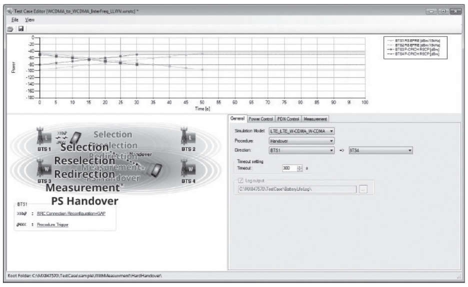
Multi System Configuration

Roaming and power consumption tests of UEs require multi-cell connections. The MD8475B supports up to 8RF tests.
The SmartStudio GUI makes it easy to set multi-system test environments, especially for the latest Carrier Aggregation (CA) wireless standards.



Multi-cell Test Configurations

Tests of UEs moving between cells take the Selection, Redirection, Handover, and other conditions into consideration, depending on the UE and base station conditions. SmartStudio can register these UE and base station conditions, including the RF power, as a test case, making it quick and easy to evaluate UE behaviors and reproduce failures. Test cases are also useful for general UE evaluations when reproducing Handover failures.



Small-cell Switching Tests

Macrocell, small-cell, and femtocell base stations are being installed to provide wide coverage for people moving freely between base stations; SmartStudio provides easy test sequences for preferential capture of small-cells.

2-cell Testing Support by SmartStudio

✓: Supported

Cell 2 / Cell 1	LTE FDD/TDD	W-CDMA/HSPA/HSPA Evolution/DC-HSDPA	GSM/GPRS/EGPRS	TD-SCDMA/ TD-HSPA*	WLAN
LTE FDD/TDD	✓	✓	✓	✓	✓*
W-CDMA/HSPA/HSPA Evolution/DC-HSDPA	✓	✓	✓	—	✓*
GSM/GPRS/EGPRS	✓	✓	✓	✓	✓*
TD-SCDMA/TD-HSPA*	✓	—	✓	✓	✓*
WLAN	✓*	✓*	✓*	✓*	—

*: The WLAN Offload test requires a separate WLAN access point.

Multi-cell Testing Support by SmartStudio

Cell 1	Cell 2	Cell 3	Cell 4
LTE	LTE	LTE	—
LTE	LTE	W-CDMA	—
LTE	LTE	GSM	—
LTE	LTE	TD-SCDMA	—
LTE	LTE	LTE	LTE

Carrier Aggregation Tests

The MD8475B supports LTE CA 2CC/3CC/4CC/5CC for throughput performance tests of UEs, such as smartphones using high-speed data networks.

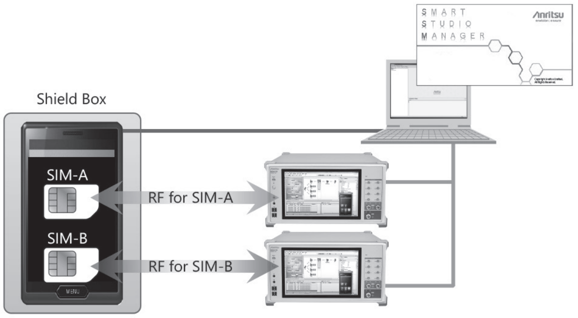
Configuration	MD8475B 
Operation Software	SmartStudio
Required CA Option	MX847550B-040, MX847550B-041 (3CC), MX847550B-042 (4CC), MX847550B-043 (5CC), MX847570B-051
RF	4TX/2RX (standard), 8TX/4RX (option)
Support for DL CA	2CC SISO, 2CC MIMO (2×2), 2CC MIMO (4×4), 3CC SISO, 3CC MIMO (2×2), 3CC MIMO (4×4), 4CC SISO, 4CC MIMO (2×2), 4CC MIMO (4×4), 5CC MIMO (4×4)
UE Category	See 3GPP TS 36.306 V14.10.0 (2019-03) Category List at System Configurations/Option/Software LTE chapter

SIM Connectivity Test

Dual SIM Dual Standby (DSDS) and Dual SIM Dual Active (DSDA) tests of dual-SIM UE can be performed using two sets of MD8475B. Additionally, Single SIM Dual Standby (SSDS) and Single SIM Dual Active (SSDA) of single-SIM UE can be performed using one MD8475B. These test environments can be fully automated using SmartStudio Manager.

Test Example:

The power consumption and throughput of a dual-SIM UE can be confirmed while the UE is making a voice call using SIM1 and transferring packet data using SIM2.



Simple Throughput Test Environment

Throughput testing until now

- It needs to be adjusted for each application about radio layer settings and server settings.
- Performance depends on the PC specification and the load of Ethernet.

Throughput Testing

- Single GUI supports to adjust for each application about radio layer settings and server settings.
- Performance is independent from PC specification and the load of Ethernet.

For the transmission and reception of the UE, use iPerf application which is widely used for throughput testing.

Data Packet Communications

Data packet communication environments are complex, but SmartStudio makes it easy to resolve troublesome packet bottlenecks, shortening evaluation times.

Versatile Server Environment

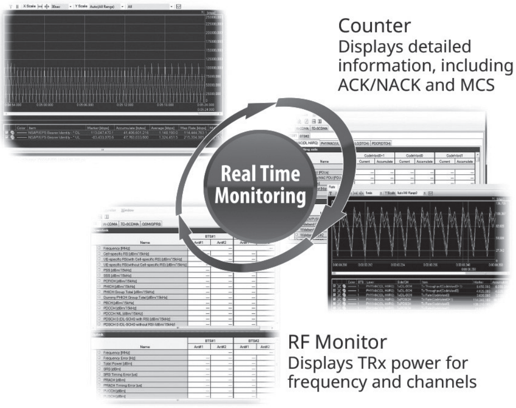
Because the MD8475B pre-installs Windows 10, commercial application servers can be easily installed.

Status Evaluation

A full line of function tools can be used to check communication status, including throughput, ACK/NACK counts, and RF monitoring. Simultaneous checking of multiple layers allows quick troubleshooting during data communications.

Throughput Monitor
Checks data communications each layer for each BTS

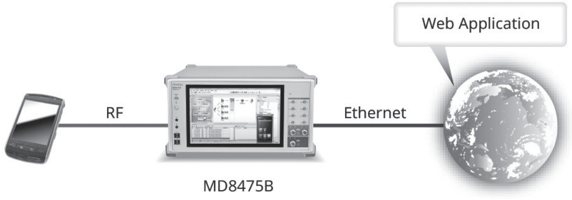
Counter
Displays detailed information, including ACK/NACK and MCS



RF Monitor
Displays TRx power for frequency and channels

Genuine Application Test Environment

Connecting the MD8475B to the Internet supports Web application tests using UEs under development to verify actual in-use power consumption and throughput before market release.



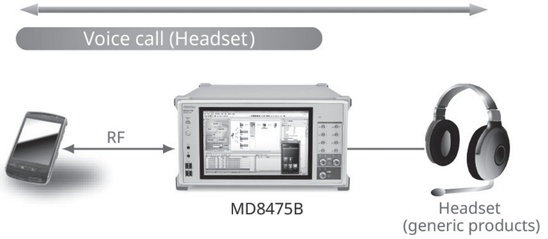
Voice Call Evaluation Environment

The need for voice-call evaluations has not changed even with the spread of LTE services. However, some voice-call test items, such as the access barred condition and emergency calls, are not easily evaluated on live networks. SmartStudio supports comprehensive evaluation of UE under high-load conditions, such as testing of simultaneous voice calls and other functions.

3G/2G Voice Calling Test

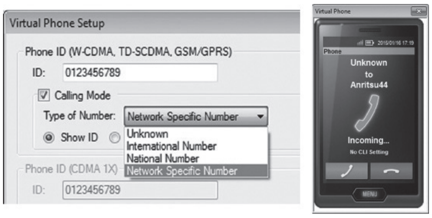
Just making voice settings using SmartStudio is all that is necessary for voice tests with the MD8475B.

- Multimedia Interface Software MX847508B



*: Not supported for LTE.

- Setting Roaming and Registering Address Book
  When performing incoming-call tests of W-CDMA/GSM UE, SmartStudio can display any of 'Public', 'National', 'International', and 'Unknown' on the UE. Additionally, when the incoming call number matches a preregistered number in the address book, the name associated with the number is displayed.



Virtual Phone Setup

Phone ID (W-CDMA, TD-SCDMA, GSM/GPRS)

ID: 0123456789

☑ Calling Mode

Type of Number: Network Specific Number

● Show ID ○

Unknown
International Number
National Number
Network Specific Number

Phone ID (CDMA 1X)

ID: 0123456789

Virtual Phone

2015/01/16 17:19

Phone

Unknown to Anritsu44

Incoming...

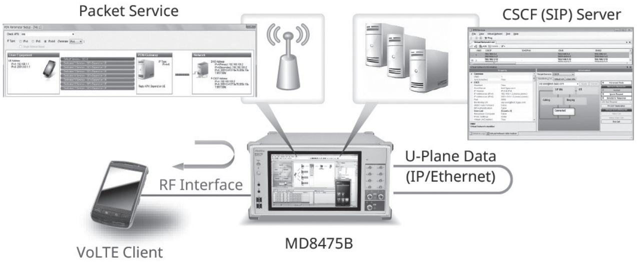
No CLI Setting

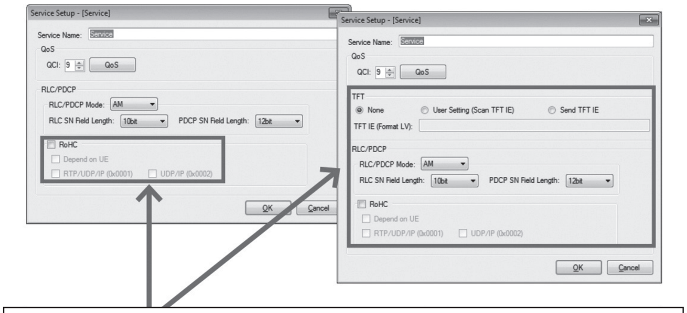
- Setting Identify Type
  When performing incoming call tests of W-CDMA/GSM UEs, either IMSI or TMSI can be chosen for the UE Caller ID using Paging.

Voice over LTE Tests

Since LTE uses the data network, Voice over LTE (VoLTE) communications also use the data network; SmartStudio simplifies VoLTE tests.

- Loopback Tests of VoLTE/Video
  The SmartStudio CSCF function supports VoLTE tests (AMR/W-AMR Codec, etc.) in the loopback mode.
  In addition to an IMS server, VoLTE tests require a variety of LTE settings about multi-PDN. Not only does SmartStudio support multi-PDN*1, but it it also supports packet filter and QoS settings. Additionally, loopback audio data can be changed using the RTP function.
  At VoLTE loopback testing, as well as looping voice data sent to the terminal from the network back from the terminal, the voice data can be changed to the MUTE status or to a fixed pattern to perform communications quality tests and battery consumption measurements requiring good reproducibility.*2





Service Setup - [Service]

Service Name: Service

QoS

QCI: 9

RLC/PDCP

RLC/PDCP Mode: AM

RLC SN Field Length: 10bit PDCP SN Field Length: 12bit

☐ RoHC

☐ Depend on UE

☐ RTP/UDP/IP (0x0001) ☐ UDP/IP (0x0002)

Service Setup - [Service]

Service Name: Service

QoS

QCI: 9

TFT

● None ○ User Setting (Scan TFT IE) ○ Send TFT IE

TFT IE (Format LV):

RLC/PDCP

RLC/PDCP Mode: AM

RLC SN Field Length: 10bit PDCP SN Field Length: 12bit

☐ RoHC

☐ Depend on UE

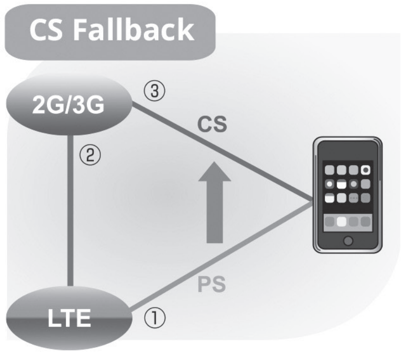
☐ RTP/UDP/IP (0x0001) ☐ UDP/IP (0x0002)

Sets RoHC*3 and TFT filter at Default Bearer and Dedicated Bearer

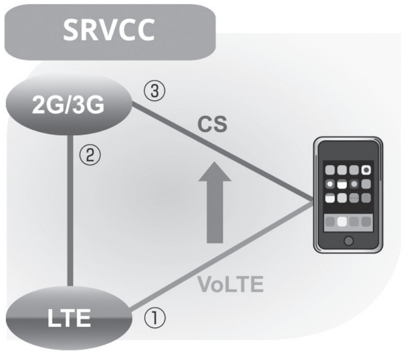
*1: GSM and TD-SCDMA are not supported.
*2: Requires MX847570B-086.
*3: RoHC settings require the MX847550B-060 option.
The RTP/VDP/IP (0x0001) and UDP/IP RoHC (0x0002) profiles are supported.

Testing Voice Calls from LTE to 3G/2G

A variety of technologies are used when a UE moves between systems from an LTE to 3G/2G cell. Configuring a 2-cell test environment using SmartStudio supports LTE and 2G/3G system voice call tests such as CS Fallback and SV-LTE (Simultaneous Voice and LTE).



① LTE: Communications by PS
② Receive call by CS and notify UE of incoming call via LTE from 2G/3G system
③ Connect voice call by CS



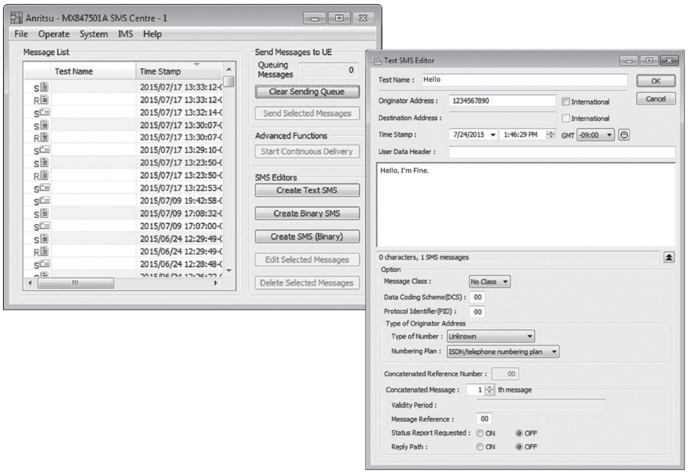
① LTE: Calling over VoLTE
② Transfer 3G/2G information from base station before moving between systems
③ Continue voice call without interruption

SMS Tests

SMS and MMS are popular messaging services used worldwide. Exchanges between UEs as well as the number of verification items are both increasing because more direct control of UE is being attempted now.

Sending/Receiving SMS Text Messages

SmartStudio has a dedicated SMS server supporting sending and receiving of SMS messages at any PS or CS network setting. Multiple SMS messages can be preregistered for continuous sending and CBS messages can be sent too.



Queuing Messages 0

	Test Name	Time Stamp
S		2015/07/17 13:33:12-
R		2015/07/17 13:33:12-
S		2015/07/17 13:32:14-
S		2015/07/17 13:30:07-
R		2015/07/17 13:30:07-
S		2015/07/17 13:29:10-
S		2015/07/17 13:23:50-
R		2015/07/17 13:23:50-
S		2015/07/17 13:22:53-
S		2015/07/09 19:42:58-
S		2015/07/09 17:08:32-
S		2015/07/09 17:07:00-
S		2015/06/24 12:29:49-
R		2015/06/24 12:29:49-
S		2015/06/24 12:28:48-

Test Name : Hello
Originator Address : 1234567890 ☐ International
Destination Address : ☐ International
Time Stamp : 7/24/2015 1:46:29 PM GMT -09:00
User Data Header :

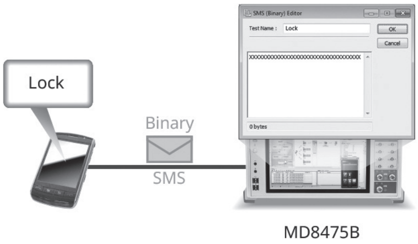
Hello, I'm Fine.

0 characters, 1 SMS messages

Option
Message Class : No Class
Data Coding Scheme(DCS) : 00
Protocol Identifier(PID) : 00
Type of Originator Address
Type of Number : Unknown
Numbering Plan : ISDN/telephone numbering plan
Concatenated Reference Number : 00
Concatenated Message : 1 th message
Validity Period :
Message Reference : 00
Status Report Requested : ○ ON ● OFF
Reply Path : ○ ON ● OFF

Sending Binary SMS

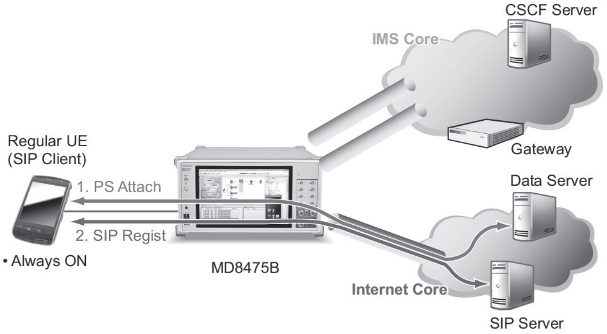
The MD8475B can send binary messages as SMS supporting remote control of the UE. Additionally, general evaluations, such as behavior when receiving an SMS during a voice call, can be evaluated to help prevent problems occurring in the field.



IMS Service Tests

SmartStudio has a built-in standard server environment for running IMS server functions for easy service tests, including VoLTE, SMS over IMS, etc.

- SIP Registration of a Non-IMS UE

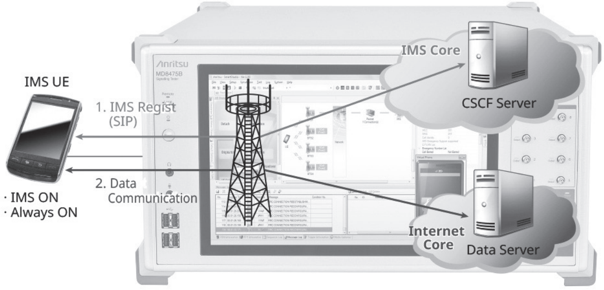


Typical Connection Procedure

1. PS Attach: Connect to Data server.
   → Get address using DNS, etc.
2. SIP Registration:
   → Depends on application.

⇒ One PDN is required.

- SIP Registration of an IMS UE



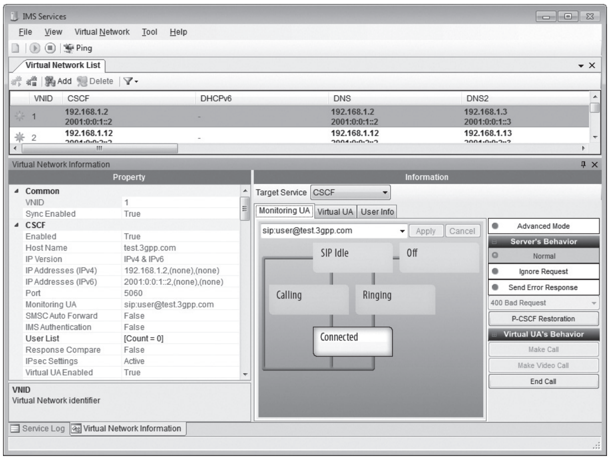
Typical Connection Procedure

1. IMS Registration: Connect to CSCF server using SIP.
2. Data Communication: Connect to Data server.

⇒ Consequently, two or more PDN required.

Standard IMS Server Function

- CSCF (Call Session Control Function)
  Supports standard server function for VoLTE and SMS over IMS tests as well as voice data loopback function. IPsec is supported too.
- DHCPv6 (Dynamic Host Configuration Protocol v6)
  Allocates IPv6 address and notifies DNS/SIP server address to network node.
- DNS (Domain Name System)
  Operates as DNS cache server.
- NDP (Neighbor Discovery Protocol)
  Supports function to transmit RA (Router Advertisement) and periodically transmit RA to RS (Router Solicitation).
- NTP (Network Time Protocol)
  The UE and MD8475B times are synchronized by sending time data in response to an NTP request.
- PSAP (Public Safety Answering Point)
  The UA (User Agent) and voice data loopback function support PSAP simulation for running IMS Emergency tests.
- XCAP (XML Configuration Access Protocol)
  This function supports updating, referencing, and deleting of XML format file data (XCAP documents).



VNID	CSCF	DHCPv6	DNS	DNS2
1	192.168.1.2 2001:0:0:1::2	-	192.168.1.2 2001:0:0:1::2	192.168.1.3 2001:0:0:1::3
2	192.168.1.12	-	192.168.1.12	192.168.1.13

Property	
Common	
VNID	1
Sync Enabled	True
CSCF	
Enabled	True
Host Name	test.3gpp.com
IP Version	IPv4 & IPv6
IP Addresses (IPv4)	192.168.1.2,(none),(none)
IP Addresses (IPv6)	2001:0:0:1::2,(none),(none)
Port	5060
Monitoring UA	sip:user@test.3gpp.com
SMSC Auto Forward	False
IMS Authentication	False
User List	[Count = 0]
Response Compare	False
IPsec Settings	Active
Virtual UA Enabled	True

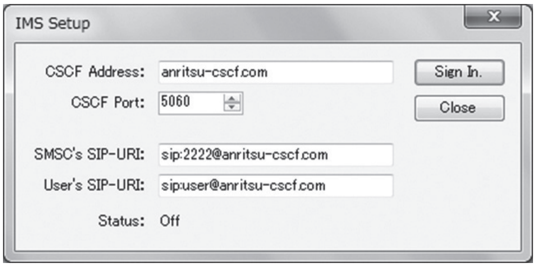
VNID
Virtual Network identifier

Target Service: CSCF

sip:user@test.3gpp.com

SMS over IMS Setting

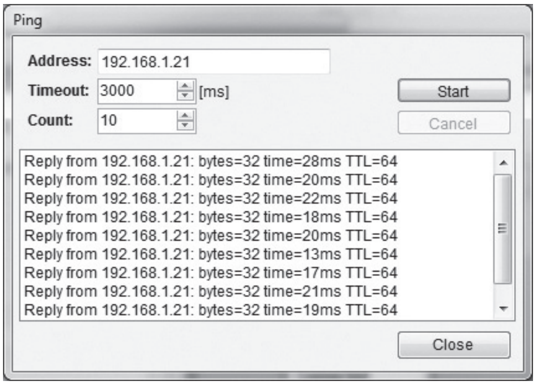
UE can register with CSCF server, and can transmit and receive SMS over IMS.



CSCF Address: anritsu-cscf.com
CSCF Port: 5060
SMSC's SIP-URI: sip:2222@anritsu-cscf.com
User's SIP-URI: sip:user@anritsu-cscf.com
Status: Off

Ping Sending Function

The Ping sending function is used to verify the connection of the device under test to the network.



Address: 192.168.1.21
Timeout: 3000 [ms]
Count: 10

```
Reply from 192.168.1.21: bytes=32 time=28ms TTL=64
Reply from 192.168.1.21: bytes=32 time=20ms TTL=64
Reply from 192.168.1.21: bytes=32 time=22ms TTL=64
Reply from 192.168.1.21: bytes=32 time=18ms TTL=64
Reply from 192.168.1.21: bytes=32 time=20ms TTL=64
Reply from 192.168.1.21: bytes=32 time=13ms TTL=64
Reply from 192.168.1.21: bytes=32 time=17ms TTL=64
Reply from 192.168.1.21: bytes=32 time=21ms TTL=64
Reply from 192.168.1.21: bytes=32 time=19ms TTL=64
```

IMS Options

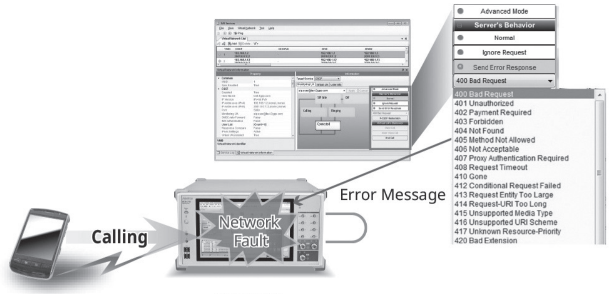
Extended CSCF Option MX847570B-080

Various conditions can be set for VoLTE/Video quasi-normal and abnormal tests. Moreover, VoLTE call and hang-up sequences can both be confirmed from SmartStudio. In addition, VoLTE/Video audio codec switchover tests are supported as well.

- Virtual UA Calling/Release
  VoLTE calling from the SmartStudio simulated UE (Virtual UA) is supported. In addition, any Virtual UA response can be set.

MD8475B

- Network Fault
  The occurrence of a server or network fault can be created.



MD8475B

- Message Blocking
  Ignore and Reply responses to specific messages can be changed arbitrarily.

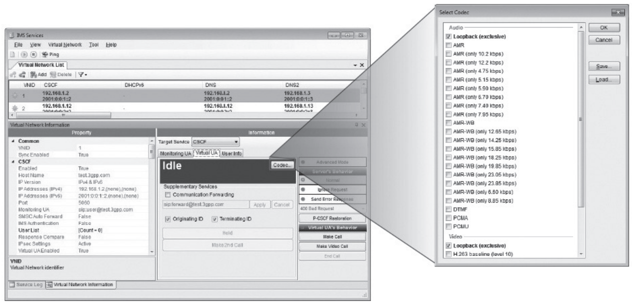
MD8475B

- Multi-P-CSCF Settings
  Up to three types of P-CSCF addresses can be notified to UE by one PDN to confirm correct UE operation for multiple addresses.

① 192.168.1.2 2001:0:0:1::2 ☑ Up
② 192.168.1.3 2001:0:0:1::3 ☑ Up
③ 192.168.1.4 2001:0:0:1::4 ☑ Up

MD8475B

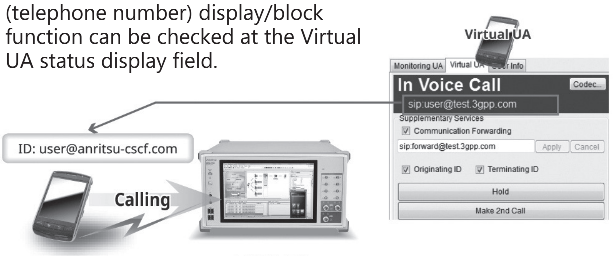
- Voice Codec Switchover
  Any codec can be sent from the MD8475B to the UE, and switchover tests, such as VoLTE → Video, are supported too.



IMS Supplementary Service Option MX847570B-081

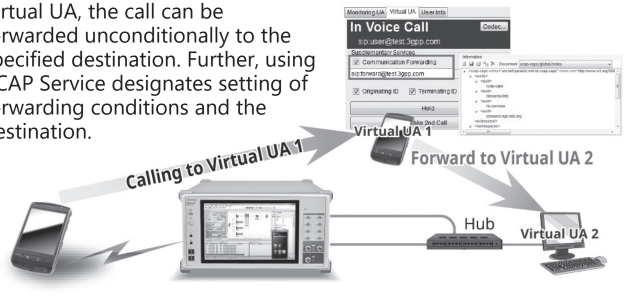
This option adds functions for simulating VoLTE/Video caller ID, call transfer and call hold. Various CSCF and XCAP service settings as well as supplementary service functions can be set.

- Caller ID Display ON/OFF Function
  After a call from the test UE, the caller ID (telephone number) display/block function can be checked at the Virtual UA status display field.



MD8475B

- Forwarding Function
  At calling from the test UE to the Virtual UA, the call can be forwarded unconditionally to the specified destination. Further, using XCAP Service designates setting of forwarding conditions and the destination.



MD8475B

- Call Hold/Resume Function
  Both test UE and Virtual UA hold operations can be verified. In addition, the call can be resumed by pressing the Resume button.

MD8475B

- VoLTE Conference Test
  The 3GPP TS 24.605 defined VoLTE Conference Call functions can be tested.

MD8475B

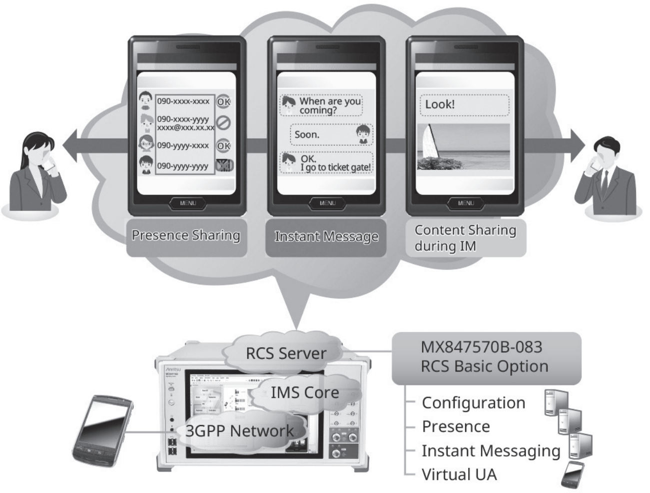
3GPP TS 24.605	
4.5.2.1.1	User joining a conference
4.5.2.1.2	User inviting another user to a conference
4.5.2.1.3	User leaving a conference
4.5.2.1.4	User creating a conference
4.5.2.1.5	Subscription for the conference event package
4.5.2.2.1	Conference focus
4.5.2.2.2	Conference notification service
4.5.2.7	Actions at the destination UE
4.6.1	Communication HOLD (HOLD)
4.6.3	Terminating Identification Restriction (TIR)
4.6.5	Originating Identification Restriction (OIR)

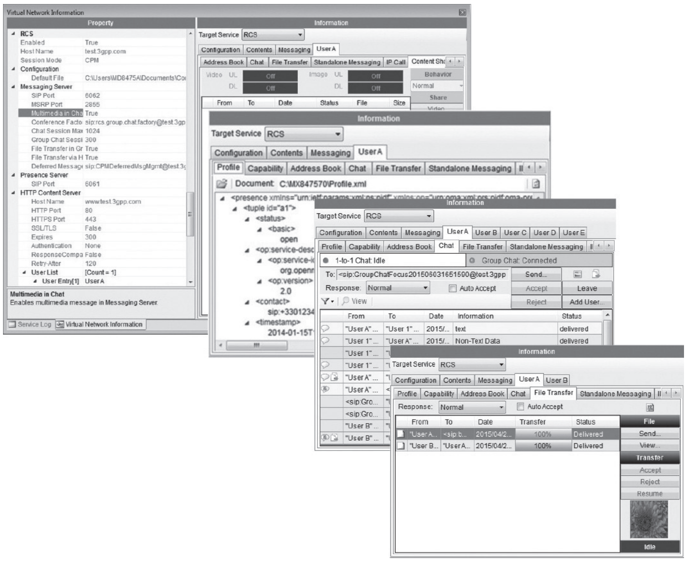
RCS Basic Option MX847570B-083

Rich Communication Suite (RCS) is the next evolutionary step in deploying existing simple voice and messaging (SMS, MMS) services with "rich" communications.
Installing this software supports RCS defined tests of Instant Messaging (IM), Address Book, and Contents sharing.

Item	Note
Configuration & Registration	HTTP (S) based support
Capability Discovery	
Standalone Messaging	
1-to-1 Chat	
Group Chat	
File Transfer	
Content Sharing	
Social Presence Information	Geolocation service not supported
IP Voice Call	IR.92 based support Interaction with other RCS services not supported
IP Video Call (IR.94)	IR.94 based support

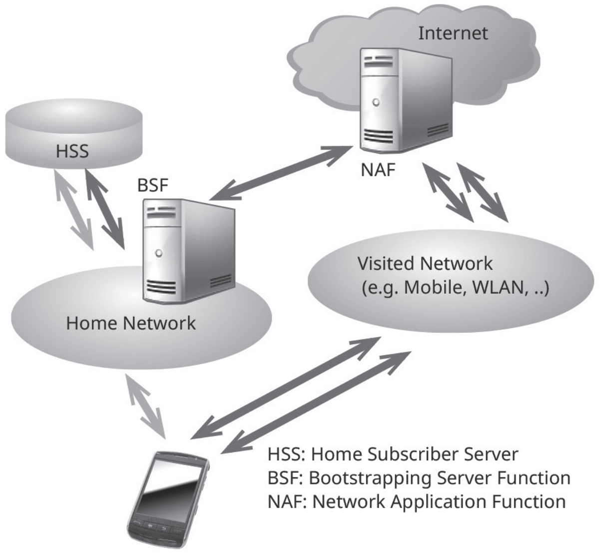
RCS Service Image





GBA Authentication Option MX847570B-084

The software option references the 3GPP GBA Authentication algorithm to simulate the authentication procedure required when connecting to the Internet via networks other than Home Networks.



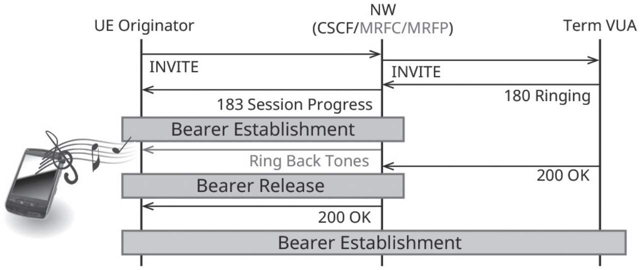
HSS: Home Subscriber Server
BSF: Bootstrapping Server Function
NAF: Network Application Function

IMS Early Media Option MX847570B-085

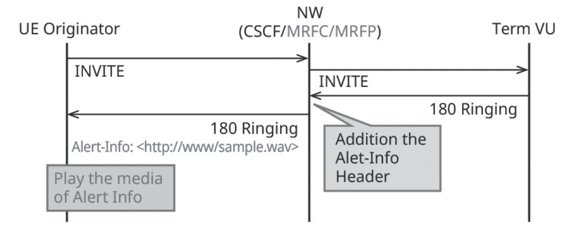
The software option simulates the IMS Early Media sequence.
It supports MRFC, MRFP, etc., nodes and can authenticate service functions such as customized ringtones from the network side.

NRBT: Function for recovering RBT (ring back tone) from network rather than from UE

The recovery status (recovery possible/not possible/recovering/stopped) for each session is displayed on the Information screen.

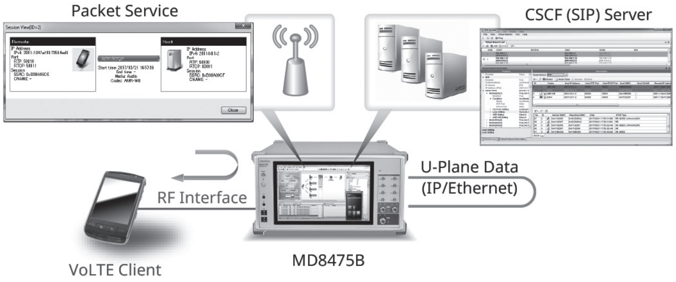


Alert-Info: Provides substitute ring back tone using Alert-Info, one of the Early Media switching function



RTP Frame Control Option MX847570B-086

This software controls the media data (RTP packets) during VoLTE communications. In addition to the MUTE condition and Fixed pattern, the data itself can be delayed; it can be used to configure the static stage required at audio evaluation and battery consumption measurement.

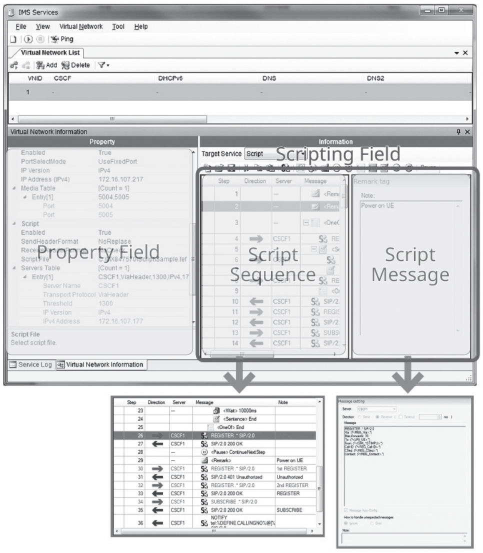


IMS Script Basic Option MX847570B-060
XCAP Script Option MX847570B-061

The software option can be used to edit and create SIP messages/XCAP messages using a ladder sequence to simulate the CSCF server/XCAP server behavior. Not only can configure a test environment from the service designing specification stage, but also user-specific tests, such as quasi-normal and abnormal conditions, can also be tested to easily support every test requirement.

Property Field:
  Network parameters such as IP address are set here.

Scripting Field:
  Sequence messages between the UE and CSCF are edited and executed here.



Script Message

IMS Options

✓: Supported

Section	Function	Outline	MX847570B	GUI Option						Scripting Option*2	
				MX847570B-080	MX847570B-081	MX847570B-083	MX847570B-084	MX847570B-085	MX847570B-086	MX847570B-060	MX847570B-061
General	SIP REGIST Test	Function for verifying CSCF server Bind/Unbind operation	✓	—	—	—	—	—	—	✓	—
	IPsec	Function for on/off of IPsec (3DES, AES).	✓	—	—	—	—	—	—	✓	—
	DNS Server	Function for resolving address using DNS	✓	—	—	—	—	—	—	—	—
	NTP Server	Function for synchronizing time using NTP	✓	—	—	—	—	—	—	—	—
	PSAP Server	Function for looping-back voice for IMS Emergency	✓	—	—	—	—	—	—	✓	—
	X-CAP Server	Function for verifying service using XML file	✓	—	—	—	—	—	—	—	✓
	BSF Server	Function for verifying GBA	—	—	—	—	✓	—	—	—	—
	No Server (Network) Response Test	Function for verifying operation when no response due to error at server or network	—	✓	—	—	—	—	—	✓	✓
	Server Error Test	Function for verifying operation when error response received from server due to the error at server	—	✓	—	—	—	—	—	✓	✓
	Multi P-CSCF	Function for reporting up to three P-CSCF servers to UE	—	✓	—	—	—	—	—	—	—
VoLTE/ Video Telephony	Calling Sequence Test	Function for verifying call sequence from UE	✓	—	—	—	—	—	—	✓	—
	Incoming Call Sequence Test	Function for verifying call sequence to UE	—	✓*1	—	—	—	—	—	✓	—
	Voice Loopback Test	Function for looping-back and sending uplink voice data to verify call at UE side	✓	—	—	—	—	—	—	✓	—
	Voice Loopback Test (fixed pattern)	Function for configuring the static stage required at audio evaluation and battery consumption measurement	✓	—	—	—	—	—	✓	—	—
	Early media Test	Function for verifying early media sequence and Ring Back Tone	—	—	—	—	—	✓	—	—	—
	Disconnection (from UE) Sequence Test	Function for verifying disconnection sequence from UE	✓	—	—	—	—	—	—	✓	—
	Disconnection (from NW) Sequence Test	Function for verifying disconnection sequence from network	—	✓*1	—	—	—	—	—	✓	—
	Called Party Busy Test	Function for verifying operation when called party busy	—	✓	—	—	—	—	—	✓	—
	Called Party Not Found Test	Function for verifying operation when called party not found	—	✓	—	—	—	—	—	✓	—
	Called Party No Response Test	Function for verifying operation when no response from called party	—	✓	—	—	—	—	—	✓	—
	Codec Selection	Function for confirming VoLTE/VT traffic with any codec; also performs loopback	—	✓	—	—	—	—	—	✓	—
	VoLTE/Video Telephony Upgrade/Downgrade	Switches VoLTE/Video Telephony during call	—	✓	—	—	—	—	—	✓	—
	Call ID Display/Block	TS 24.607 verifies IMS test UE caller ID display ON/OFF	—	—	✓	—	—	—	—	✓	✓
	Incoming Call ID Display/Block	TS 24.608 verifies IMS test UE incoming caller ID display ON/OFF	—	—	✓	—	—	—	—	✓	✓
	Call Forwarding, Holding, Catchphone	Function for simulating TS 24.604, TS 24.610, TS 24.615 call forwarding, call holding, and catchphone functions	—	—	✓	—	—	—	—	—	✓
	VoLTE Conference Environment	Function for verifying TS 24.605 VoLTE Conference related tests (Event message, HOLD, etc.)	—	—	✓	—	—	—	—	✓	✓
	Message Waiting Indication	Function for notifying users of voice mail services about arriving voice mail	—	—	✓	—	—	—	—	✓	✓
RCS	Configuration	Function for creating and updating UE configuration data using XML file	—	—	—	✓	—	—	—	—	—
	Presence	Function for referring UE configuration data using XML file	—	—	—	✓	—	—	—	—	—
	Instant Messaging	Function for sending and receiving Instant Message using XML file	—	—	—	✓	—	—	—	—	—
	RCS Address Book	Function for registering and saving UE contacts using RCS	—	—	—	✓	—	—	—	—	—
	1 to 1 Chat (CPM)	Function for 1 to 1 chat by connecting with CPM mode	—	—	—	✓	—	—	—	—	—
	Group Chat	Function for multi party chat (Maximum 5 users)	—	—	—	✓	—	—	—	—	—
	File Transfer	Function for sending and receiving same files between users	—	—	—	✓	—	—	—	—	—
	Contents Sharing	Function for sharing same files between users	—	—	—	✓	—	—	—	—	—
SMS over IMS	SMS Message Send Test	Function for verifying UE SMS message sending	✓	—	—	—	—	—	—	✓	✓
	SMS Message Receive Test	Function for verifying UE SMS message receiving	✓	—	—	—	—	—	—	✓	✓
IPv6 Addressing	IP Address Allocation Test (RA)	Function for verifying IP address setting at RA receiving	✓	—	—	—	—	—	—	—	—
	IP Address Allocation Test (DHCPv6)	Function for verifying IP address setting allocated from DHCPv6 server	✓	—	—	—	—	—	—	—	—
VoLTE Emergency Call	VoLTE Emergency Call (Voice)	Function for verifying IP VoLTE Emergency Call	—	✓	—	—	—	—	—	—	—

∗1: This option is unnecessary when a separate network-side UE is prepared.
∗2: The user must create the test message script.

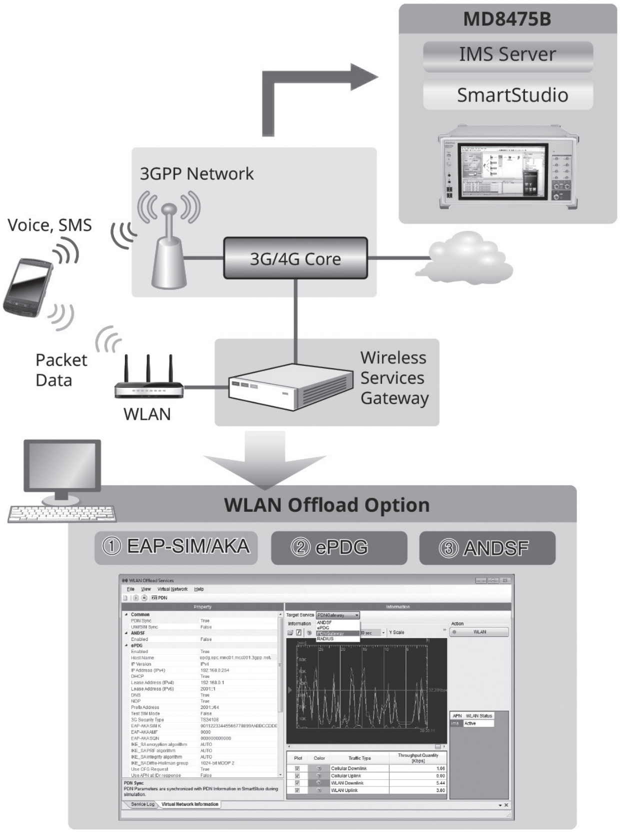
New Services

New network services are being deployed at an increasing rate, requiring more-and-more tests for UEs supporting such new services.
The MD8475B makes it easy to support new mobile test environments.

WLAN Offload Tests

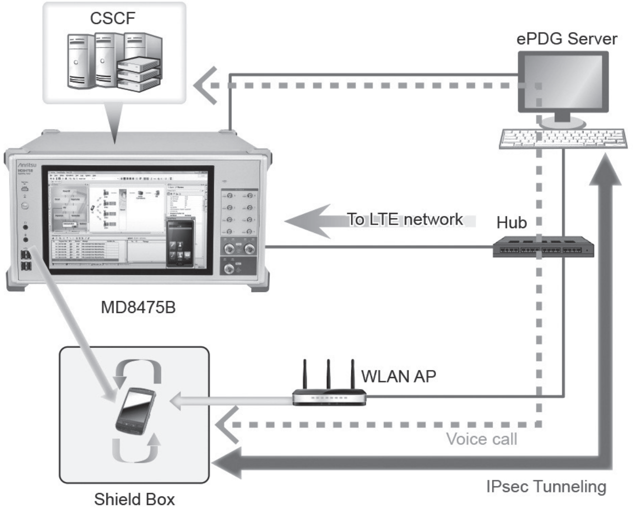
Offloading data traffic to WLAN networks is being deployed as a technology for preventing traffic congestion on mobile networks.
The MD8475B supports a WLAN data offload test environment.

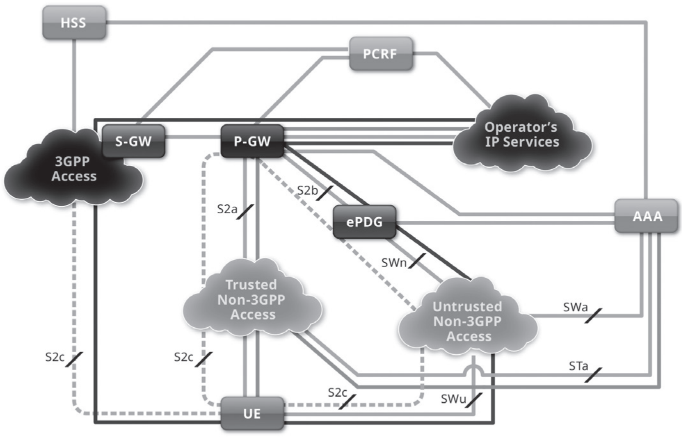
- WLAN Offload Basic Option MX847570B-070
  The software option provides functions for forwarding packets between the UE and networks with both Trusted non-3GPP Access and Untrusted non-3GPP Access authentication functions, as well as for monitoring packets graphically.
- ePDG Option MX847570B-071
  The software option supports the IKEv2 key exchange procedure and IPsec communications functions for Untrusted non-3GPP Access network authentication.
- ANDSF Option MX847570B-072
  The software option supports the function for setting and distributing the system selection policy between 3GPP and WLAN (distributes Policy and Discovery Information according to request from UE, and receives Location and Profile reports from UE).
- Extended ePDG Option MX847570B-073
  The software option supports configuration of an ePDG status fault test environment for inserting errors into the ePDG sequence, setting timeouts, etc. Additionally, this option can be used to support Fast Re-Authentication (EAP-SIM/EAP-AKA) tests without the need to generate UE-side authentication keys.



Wi-Fi Calling Evaluation Environment

Wi-Fi Calling is a function for making voice calls and sending/receiving SMS over WLAN. Using this function, voice calls can be made using the telephone number registered inside the SIM card. Combining the MD8475B with the WLAN option supports verification of Wi-Fi Calling voice calls as well as handover tests from VoLTE to Wi-Fi Calling and vice versa.



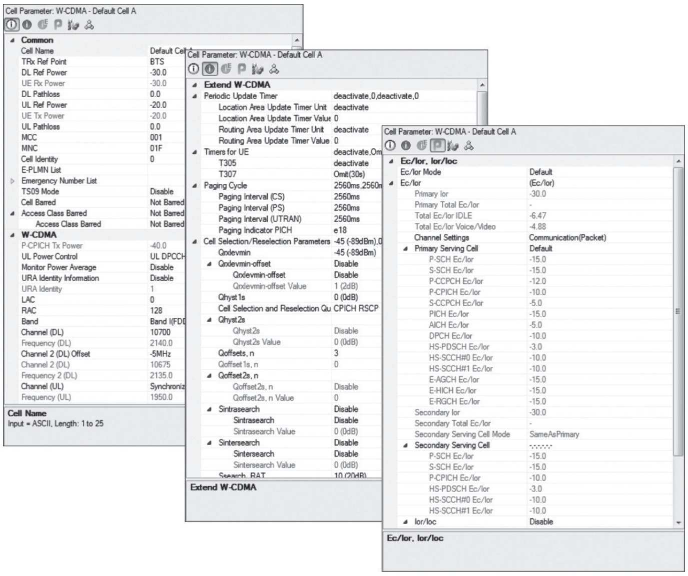


Power Consumption Test

SmartStudio supports detailed settings such as changes to the UE RF output and stopping packet communications.

Base Station Settings

Any messages, such as Paging Cycle, UL TPC, etc., can be sent to the UE*.
Support W-CDMA CPC, Ec/lor, etc.



Cell Parameter: W-CDMA - Default Cell A

Common	
Cell Name	Default Cel
TRx Ref Point	BTS
DL Ref Power	-30.0
UE Rx Power	-30.0
DL Pathloss	0.0
UL Ref Power	-20.0
UE Tx Power	-20.0
UL Pathloss	0.0
MCC	001
MNC	01F
Cell Identity	0
E-PLMN List	
Emergency Number List	
TS09 Mode	Disable
Cell Barred	Not Barred
Access Class Barred	Not Barred
Access Class Barred	Not Barred
W-CDMA	
P-CPICH Tx Power	-40.0
UL Power Control	UL DPCCH
Monitor Power Average	Disable
URA Identity Information	Disable
URA Identity	1
LAC	0
RAC	128
Band	Band I(FD
Channel (DL)	10700
Frequency (DL)	2140.0
Channel 2 (DL) Offset	-5MHz
Channel 2 (DL)	10675
Frequency 2 (DL)	2135.0
Channel (UL)	Synchroniz
Frequency (UL)	1950.0

Cell Name
Input = ASCII, Length: 1 to 25

Cell Parameter: W-CDMA - Default Cell A

Extend W-CDMA	
Periodic Update Timer	deactivate,0,deactivate,0
Location Area Update Timer Unit	deactivate
Location Area Update Timer Value	0
Routing Area Update Timer Unit	deactivate
Routing Area Update Timer Value	0
Timers for UE	deactivate,Om
T305	deactivate
T307	Omit(30s)
Paging Cycle	2560ms,2560
Paging Interval (CS)	2560ms
Paging Interval (PS)	2560ms
Paging Interval (UTRAN)	2560ms
Paging Indicator PICH	e18
Cell Selection/Reselection Parameters	-45 (-89dBm),0
Qrxlevmin	-45 (-89dBm)
Qrxlevmin-offset	Disable
Qrxlevmin-offset	Disable
Qrxlevmin-offset Value	1 (2dB)
Qhyst1s	0 (0dB)
Cell Selection and Reselection Qu	CPICH RSCP
Qhyst2s	
Qhyst2s	Disable
Qhyst2s Value	0 (0dB)
Qoffsets, n	3
Qoffset1s, n	0
Qoffset2s, n	
Qoffset2s, n	Disable
Qoffset2s, n Value	0
Sintrasearch	Disable
Sintrasearch	Disable
Sintrasearch Value	0 (0dB)
Sintersearch	Disable
Sintersearch	Disable
Sintersearch Value	0 (0dB)
Ssearch, RAT	10 (20dB)

Extend W-CDMA

Cell Parameter: W-CDMA - Default Cell A

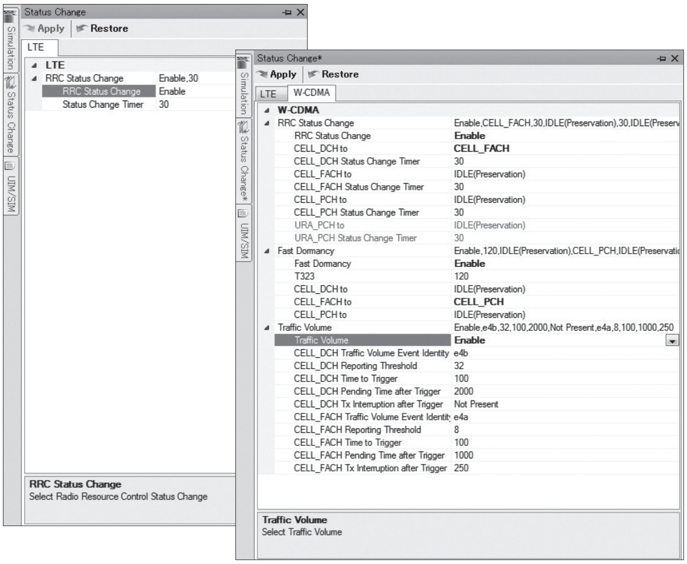
Ec/lor, lor/loc	
Ec/lor Mode	Default
Ec/lor	(Ec/lor)
Primary lor	-30.0
Primary Total Ec/lor	-
Total Ec/lor IDLE	-6.47
Total Ec/lor Voice/Video	-4.88
Channel Settings	Communication(Packet)
Primary Serving Cell	Default
P-SCH Ec/lor	-15.0
S-SCH Ec/lor	-15.0
P-CCPCH Ec/lor	-12.0
P-CPICH Ec/lor	-10.0
S-CCPCH Ec/lor	-5.0
PICH Ec/lor	-15.0
AICH Ec/lor	-5.0
DPCH Ec/lor	-10.0
HS-PDSCH Ec/lor	-3.0
HS-SCCH#0 Ec/lor	-10.0
HS-SCCH#1 Ec/lor	-10.0
E-AGCH Ec/lor	-15.0
E-HICH Ec/lor	-15.0
E-RGCH Ec/lor	-15.0
Secondary lor	-30.0
Secondary Total Ec/lor	-
Secondary Serving Cell Mode	SameAsPrimary
Secondary Serving Cell	-,-,-,-,-,-
P-SCH Ec/lor	-15.0
S-SCH Ec/lor	-15.0
P-CPICH Ec/lor	-10.0
HS-PDSCH Ec/lor	-3.0
HS-SCCH#0 Ec/lor	-10.0
HS-SCCH#1 Ec/lor	-10.0
lor/loc	Disable

Ec/lor, lor/loc

*: The settable items differ by the systems.

Packets Communication State (RRC State Change) Settings

When packets stop passing over the network during data packet communications, the Cell Status can be transitioned at a specific timing to switch the UE to any RRC State. This is useful for configuring a test environment simulating a real network when testing battery life.



Status Change

LTE

LTE	
RRC Status Change	Enable,30
RRC Status Change	Enable
Status Change Timer	30

RRC Status Change
Select Radio Resource Control Status Change

Status Change*

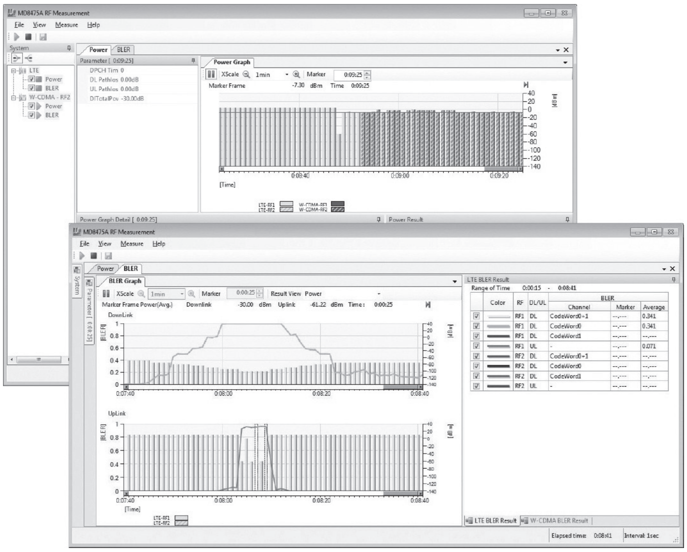
LTE | W-CDMA

W-CDMA	
RRC Status Change	Enable,CELL_FACH,30,IDLE(Preservation),30,IDLE(Preserv
RRC Status Change	**Enable**
CELL_DCH to	**CELL_FACH**
CELL_DCH Status Change Timer	30
CELL_FACH to	IDLE(Preservation)
CELL_FACH Status Change Timer	30
CELL_PCH to	IDLE(Preservation)
CELL_PCH Status Change Timer	30
URA_PCH to	IDLE(Preservation)
URA_PCH Status Change Timer	30
Fast Dormancy	Enable,120,IDLE(Preservation),CELL_PCH,IDLE(Preservati
Fast Dormancy	**Enable**
T323	120
CELL_DCH to	IDLE(Preservation)
CELL_FACH to	**CELL_PCH**
CELL_PCH to	IDLE(Preservation)
Traffic Volume	Enable,e4b,32,100,2000,Not Present,e4a,8,100,1000,250
Traffic Volume	**Enable**
CELL_DCH Traffic Volume Event Identity	e4b
CELL_DCH Reporting Threshold	32
CELL_DCH Time to Trigger	100
CELL_DCH Pending Time after Trigger	2000
CELL_DCH Tx Interruption after Trigger	Not Present
CELL_FACH Traffic Volume Event Identity	e4a
CELL_FACH Reporting Threshold	8
CELL_FACH Time to Trigger	100
CELL_FACH Pending Time after Trigger	1000
CELL_FACH Tx Interruption after Trigger	250

Traffic Volume
Select Traffic Volume

Check UE Tx RF Power

- Quick TRX Diagnosis MX847506B
  Adding RF Measurement supports verification of UE Tx RF power.
  A UE power consumption test environment can be configured easily by combined use with SmartStudio base station settings from the UE. Further, BLER can be verified using graphical or tabulated data.



Parameter [0:09:25]

DPCH Tim	0
DL Pathlos	0.00dB
UL Pathlos	0.00dB
DlTotalPov	-30.00dB

Marker Frame -7.30 dBm Time 0:09:25

Marker Frame Power(Avg.) Downlink -30.00 dBm Uplink -61.22 dBm Time: 0:00:25

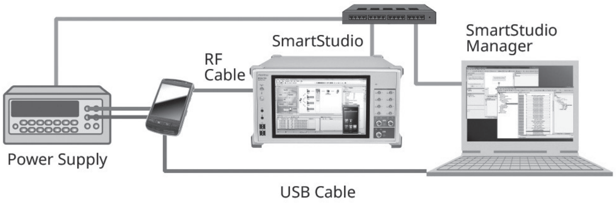
LTE BLER Result

Range of Time 0:00:15 - 0:08:41

	Color	RF	DL/UL	BLER		
				Channel	Marker	Average
☑		RF1	DL	CodeWord0+1	--.---	0.341
☑		RF1	DL	CodeWord0	--.---	0.341
☑		RF1	DL	CodeWord1	--.---	--.---
☑		RF1	UL	-	--.---	0.071
☑		RF2	DL	CodeWord0+1	--.---	--.---
☑		RF2	DL	CodeWord0	--.---	--.---
☑		RF2	DL	CodeWord1	--.---	--.---
☑		RF2	UL	-	--.---	--.---

Power Consumption Test using SmartStudio Manager

The SmartStudio Manager software MX847503A is bundled with test cases for measuring the UE power consumption. In addition, the MX847503A can also control peripheral devices simultaneously, shortening the time required for configuring UE test environments.



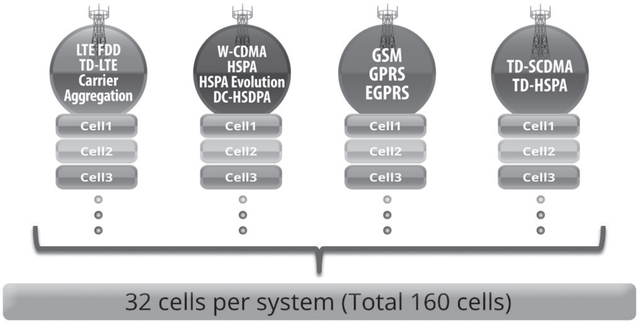
Flexible Base Station Settings

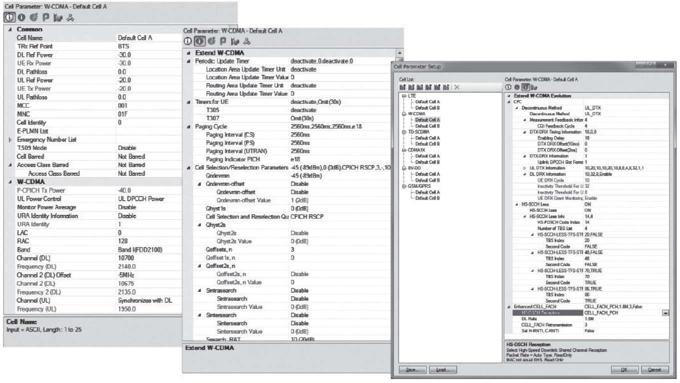
Base station settings are essential for testing UE connections. Not only does SmartStudio support frequency band and Tx and Rx power settings, it can also be set to behave as a real base station.

Setting Base Station Parameters

Cell Parameter Settings

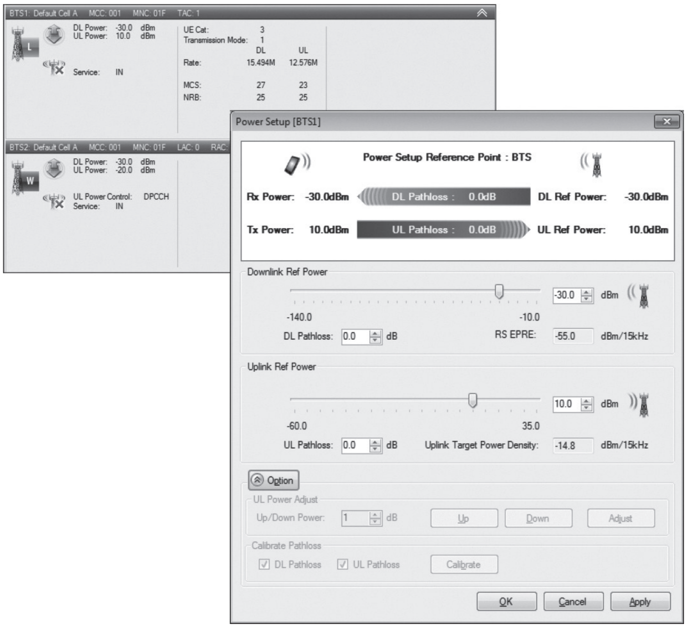
Up to 32 base station parameters can be saved in one file to prevent setting errors and assure fast, smooth testing when making slight changes to frequency and bandwidth before retesting.





Base Station Power Settings

The Tx/Rx power of the base station can be changed during testing to simulate Out-of-Service tests by stopping RF on Smartstudio.



BTS1: Default Cell A MCC: 001 MNC: 01F TAC: 1

DL Power: -30.0 dBm
UL Power: 10.0 dBm
Service: IN

UE Cat: 3
Transmission Mode: 1

	DL	UL
Rate:	15.494M	12.576M
MCS:	27	23
NRB:	25	25

BTS2: Default Cell A MCC: 001 MNC: 01F LAC: 0 RAC:

DL Power: -30.0 dBm
UL Power: -20.0 dBm
UL Power Control: DPCCH
Service: IN

Power Setup [BTS1]

Power Setup Reference Point : BTS

Rx Power: -30.0dBm DL Pathloss : 0.0dB DL Ref Power: -30.0dBm
Tx Power: 10.0dBm UL Pathloss : 0.0dB UL Ref Power: 10.0dBm

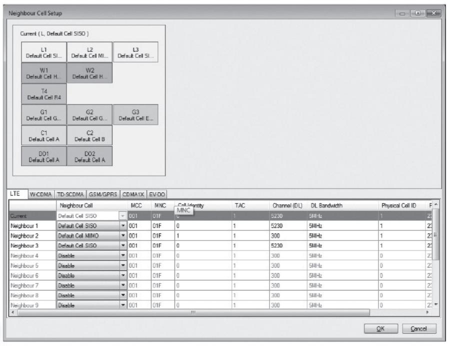
Downlink Ref Power: -30.0 dBm (-140.0 to -10.0)
DL Pathloss: 0.0 dB
RS EPRE: -55.0 dBm/15kHz

Uplink Ref Power: 10.0 dBm (-60.0 to 35.0)
UL Pathloss: 0.0 dB
Uplink Target Power Density: -14.8 dBm/15kHz

Option
UL Power Adjust
Up/Down Power: 1 dB
Calibrate Pathloss
☑ DL Pathloss ☑ UL Pathloss

Setting Neighbor Cells

Neighbor cells can be set to display the mix of multiple cells for a UE graphically.



Neighbour Cell Setup

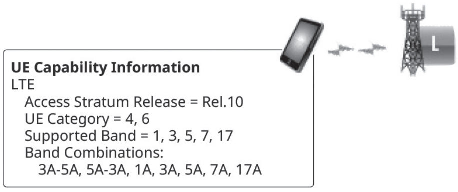
Current (L, Default Cell SISO)

L1 Default Cell SI... | L2 Default Cell MI... | L3 Default Cell SI...
W1 Default Cell H... | W2 Default Cell H...
T4 Default Cell R4
G1 Default Cell G... | G2 Default Cell G... | G3 Default Cell E...
C1 Default Cell A | C2 Default Cell B
DO1 Default Cell A | DO2 Default Cell A

	Neighbour Cell	MCC	MNC	Cell Identity	TAC	Channel (DL)	DL Bandwidth	Physical Cell ID
Current	Default Cell SISO	001	01F	0	1	5230	5MHz	1
Neighbour 1	Default Cell SISO	001	01F	0	1	5230	5MHz	1
Neighbour 2	Default Cell MIMO	001	01F	1	1	300	5MHz	1
Neighbour 3	Default Cell SISO	001	01F	0	1	5230	5MHz	1
Neighbour 4	Disable	001	01F	0	1	300	5MHz	0
Neighbour 5	Disable	001	01F	0	1	300	5MHz	0
Neighbour 6	Disable	001	01F	0	1	300	5MHz	0
Neighbour 7	Disable	001	01F	0	1	300	5MHz	0
Neighbour 8	Disable	001	01F	0	1	300	5MHz	0
Neighbour 9	Disable	001	01F	0	1	300	5MHz	0

At-a-Glance Confirmation of UE Performance

Moving the mouse cursor over the SmartStudio UE icon displays a summary of the UE capability information for easy confirmation of the categories, bands, etc., supported by the UE under test.



UE Capability Information
LTE
  Access Stratum Release = Rel.10
  UE Category = 4, 6
  Supported Band = 1, 3, 5, 7, 17
  Band Combinations:
    3A-5A, 5A-3A, 1A, 3A, 5A, 7A, 17A

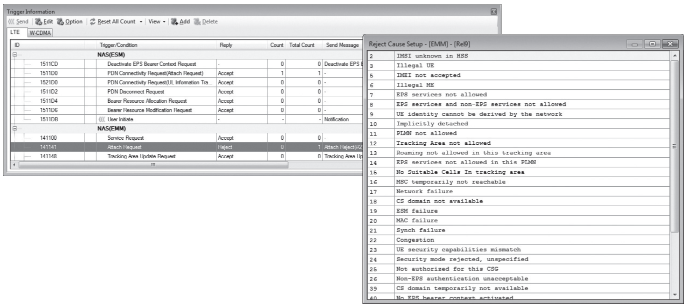
System	Information Element	Example
LTE	Access Stratum Release	Rel.12
	UE Category	4, 6, 9
	Supported Band	1, 2, 3, 4
	Band Combination	1A-2A, 3C
	Band Combination (Rel.11)	1A-2A, 3C
W-CDMA	Access Stratum Release	Rel.10
	HSDPA Category (Rel.7/Rel.8)	10 (14/24)
	HSUPA Category	6
	Supported Band	I, II
TD-SCDMA	Access Stratum Release	Rel.9
	HSDPA Category	15
	HSUPA Category	6
	Supported Band	a, f
GSM/GPRS	GPRS Multislot Class	12
	EGPRS Multislot Class	12
	Supported Band	GSM E

Creating Environment for Difficult Tests on Live Network

Some UE tests cannot be run on a commercial live network and are difficult on a test network.
SmartStudio makes it easy to support these tests.

Reject Tests

- Attach Reject/Ignore
  By setting specific messages, UE connection request can be rejected when the UE tries to connect the base station.
  In addition, the base station ignores messages from the UE by setting 'Ignore', enabling confirmation of the UE behavior when messages are ignored.

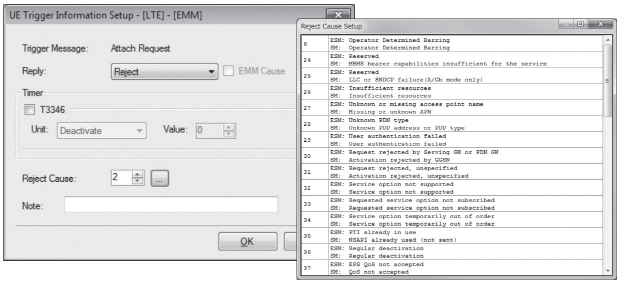


ID	Trigger/Condition	Reply	Count	Total Count	Send Message
	NAS(ESM)				
1511CD	Deactivate EPS Bearer Context Request	-	0	0	Deactivate EPS E
1511D0	PDN Connectivity Request(Attach Request)	Accept	1	1	-
1521D0	PDN Connectivity Request(UL Information Tra...	Accept	0	0	-
1511D2	PDN Disconnect Request	Accept	0	0	-
1511D4	Bearer Resource Allocation Request	Accept	0	0	-
1511D6	Bearer Resource Modification Request	Accept	0	0	-
1511DB	User Initiate	-	-	-	Notification
	NAS(EMM)				
141100	Service Request	Accept	0	0	-
141141	Attach Request	Reject	0	1	Attach Reject(#2
141148	Tracking Area Update Request	Accept	0	0	Tracking Area Up

Reject Cause Setup - [EMM] - [Rel9]

2	IMSI unknown in HSS
3	Illegal UE
5	IMEI not accepted
6	Illegal ME
7	EPS services not allowed
8	EPS services and non-EPS services not allowed
9	UE identity cannot be derived by the network
10	Implicitly detached
11	PLMN not allowed
12	Tracking Area not allowed
13	Roaming not allowed in this tracking area
14	EPS services not allowed in this PLMN
15	No Suitable Cells In tracking area
16	MSC temporarily not reachable
17	Network failure
18	CS domain not available
19	ESM failure
20	MAC failure
21	Synch failure
22	Congestion
23	UE security capabilities mismatch
24	Security mode rejected, unspecified
25	Not authorized for this CSG
26	Non-EPS authentication unacceptable
39	CS domain temporarily not available
40	No EPS bearer context activated

- APN Reject
  By setting specific messages, UE connection request can be rejected when the UE connects to the network.



Trigger Message: Attach Request
Reply: Reject
Timer
☐ T3346
Unit: Deactivate
Value: 0
Reject Cause: 2
Note:

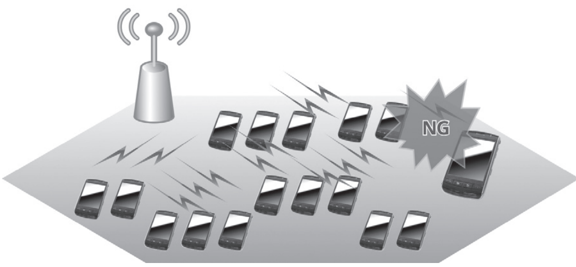
Reject Cause Setup

8	ESM: Operator Determined Barring SM: Operator Determined Barring
24	ESM: Reserved SM: MBMS bearer capabilities insufficient for the service
25	ESM: Reserved SM: LLC or SNDCP failure(A/Gb mode only)
26	ESM: Insufficient resources SM: Insufficient resources
27	ESM: Unknown or missing access point name SM: Missing or unknown APN
28	ESM: Unknown PDN type SM: Unknown PDP address or PDP type
29	ESM: User authentication failed SM: User authentication failed
30	ESM: Request rejected by Serving GW or PDN GW SM: Activation rejected by GGSN
31	ESM: Request rejected, unspecified SM: Activation rejected, unspecified
32	ESM: Service option not supported SM: Service option not supported
33	ESM: Requested service option not subscribed SM: Requested service option not subscribed
34	ESM: Service option temporarily out of order SM: Service option temporarily out of order
35	ESM: PTI already in use SM: NSAPI already used (not sent)
36	ESM: Regular deactivation SM: Regular deactivation
37	ESM: EPS QoS not accepted SM: QoS not accepted

Barred Call and Emergency Call Tests

- Access Class Control
  Sometimes, carriers limit access at events where there are too many people trying to call at once or during abnormally busy times like New Year. SmartStudio can configure an access control test environment, which is difficult to do on a live network.
- Emergency Call Test
  Obviously, emergency calls cannot be tested on a live network but this is an essential test that must be performed. SmartStudio offers emergency call test settings and execution.

System	Control Method	Operation
W-CDMA/ GSM	Not Barred	No Access Control
	Barred	Call barring for all communications
	Emergency	Call barring for communications except emergency call

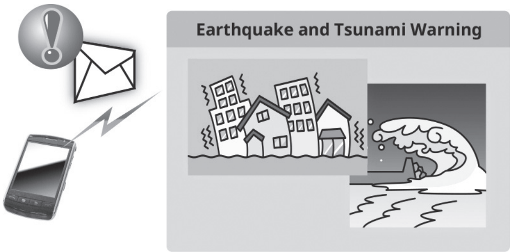


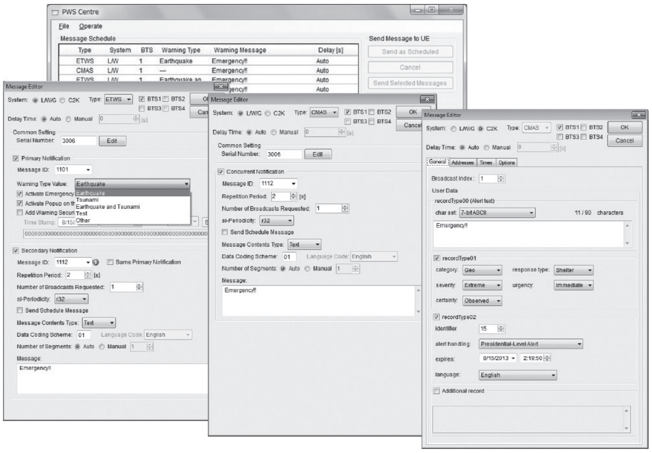
Emergency Alerts Tests

Using the built-in SmartStudio PWS center function supports sending of emergency alerts like earthquake and tsunami warnings to the UE*. ETWS/CMAS messages can be sent at any timing simply by selecting created/edited messages.

- ETWS (Earthquake and Tsunami Warning System used in Japan)
- CMAS (Commercial Mobile Alert System) North American Federal and state government system for sending standard-format text and audio messages to TV broadcast stations

*: Supports LTE/W-CDMA/GSM.





Message Schedule

Type	System	BTS	Warning Type	Warning Message	Delay [s]
ETWS	L/W	1	Earthquake	Emergency!!	Auto
CMAS	L/W	1	---	Emergency!!	Auto
ETWS	L/W	1	Earthquake an	Emergency!!	Auto
				ency!!	Auto

System: ● L/W/G ○ C2K Type: ETWS ☑ BTS1 ☐ BTS2 ☐ BTS3 ☐ BTS4
Delay Time: ● Auto ○ Manual 0 [s]
Common Setting
Serial Number: 3006
☑ Primary Notification
Message ID: 1101
Warning Type Value: Earthquake
Earthquake
Tsunami
Earthquake and Tsunami

System: ● L/W/G ○ C2K Type: CMAS ☑ BTS1 ☐ BTS2 ☐ BTS3 ☐ BTS4
Delay Time: ● Auto ○ Manual 0 [s]
Common Setting
Serial Number: 3006
☑ Concurrent Notification
Message ID: 1112
Repetition Period: 2 [s]
Number of Broadcasts Requested: 1

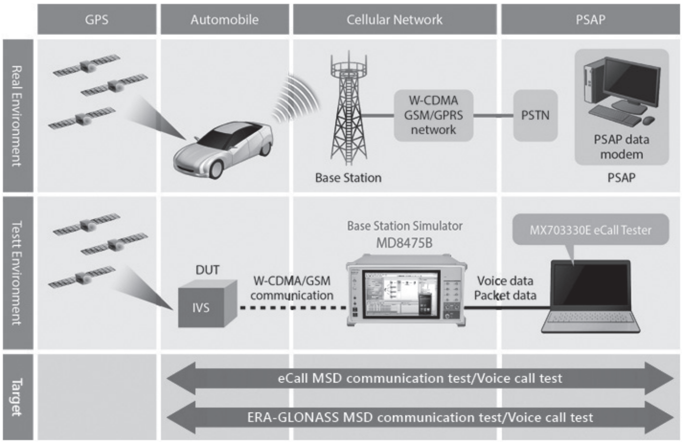
System: ○ L/W/G ● C2K
Delay Time: ● Auto
Broadcast Index: 1
User Data
recordType00 (Alert text)

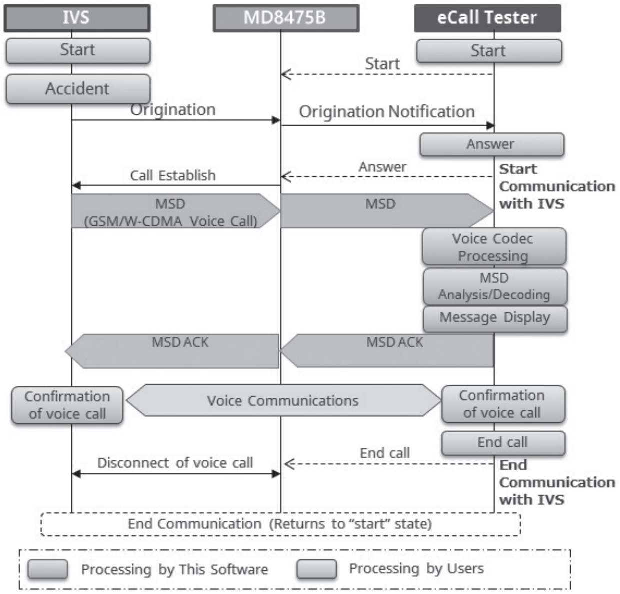
Configuring eCall Compliance to Application Test Environments

This solution makes it easy to configure an environment for emulating the eCall emergency rescue information system for automatically transmitting traffic accident information, including accident location, as well as for making voice calls to an emergency assistance Public Safety Answering Point (PSAP). Since emergency calls cannot be tested on live communications networks, combining the Signalling Tester MD8475B and eCall Tester MX703330E software is the perfect answer to testing IVS (In Vehicle System) communications functions.

eCall Tester MX703330E

The MX703330E emulates the eCall system IVS and PSAP communications sequence. It supports quasi-normal test of MSD timeout that are hard to simulate on a live network, as well as comparison of reference MSD (expected) and received data.





Features

- EN16454-compliant
- Implements communications sequence tests between IVS and PSAP
- Trace-displays status of eCall communications (MSD-Voice) and MSD communications (in-band modem)
- Displays in-band modem sequence and MSD decode data (conversion to meaningful data) execution results and outputs as data file
- Sets reference MSD (expected values) and displays results of comparison with received MSD
- Simulates base station operation in eCall Tester background, making specialist mobile protocol knowledge unnecessary for eCall evaluation
- Performs external control of eCall tester using SmartStudio Manager automation tool to perform PSAP operations

EU eCall Compliance Test

European Commission regulation (EU) 2017/79 approved sale of new M1 and N1 category in-vehicle eCall equipment from 31 March 2018. eCall is an emergency rescue information system for automatically transmitting traffic accident information, including accident location, as well as for making voice calls to an emergency assistance centre, or Public Safety Answering Point (PSAP).

The eCall Tester with EN 16454 PSAP server function supports configuration of the type-certification test environment. Additionally, the interactive GUI simplifies parameter changes, while display of real-time MSD analysis data improves the efficiency of pre-compliance testing, including debugging.

* M1 Category: Passenger vehicles with driver and 8 or less seats
N1 Category: Trucks up to 3.5 tonnes max. load weight

Received MSD Lists

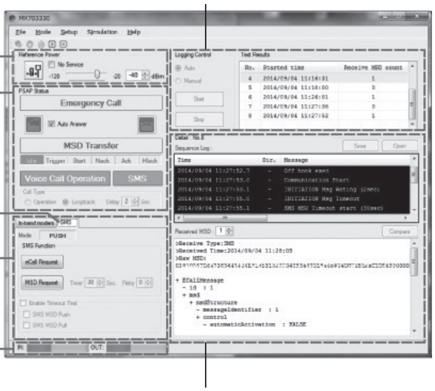
Set DL-Reference Power

PSAP Status
Off Hook: Makes call with IVS unit via SmartStudio
On HooK: Terminates call with IVS unit via SmartStudio

ERA-GLONASS Option
SMS function tab

MSD Condition and Settings
MSD Pull: Transmission to signal PSAP modem (pull mode)
Manual Reset: Force idle
Enable Timeout Test: Timeout setting

Audio Level Meter: Input/Output



```
No.  Started time          Receive MSD count
4    2014/09/04 11:14:31   1
5    2014/09/04 11:18:00   0
6    2014/09/04 11:26:01   1
7    2014/09/04 11:27:36   0
8    2014/09/04 11:27:52   1
```

```
Time                    Dir.  Message
2014/09/04 11:27:52.7   -     Off hook exec
2014/09/04 11:27:53.0   -     Communication Start
2014/09/04 11:27:53.1   -     INITIATION Msg Waiting (2sec)
2014/09/04 11:27:55.0   -     INITIATION Msg Timeout
2014/09/04 11:27:55.1   -     SMS MSD Timeout start (30sec)
```

```
>Receive Type:SMS
>Received Time:2014/09/04 11:28:05
>Raw MSD:

+ ECallMessage
  - id  : 1
  + msd
    + msdStructure
      - messageIdentifier  : 1
      + control
        - automaticActivation  : FALSE
```

MSD Result (sequence and decode)
Save: MSD result save at XML file

NG-eCall Test

This test evaluates the in-vehicle system (IVS) supporting next-generation eCall over LTE (NG-eCall).
Previous eCall systems transmit eCall data (MSD) using 2G GSM and 3G UMTS networks based on the ETSI and CEN standards.
On the other hand, European network operators are beginning to abandon GSM and UMTS networks after 10 years of operations as they transition to 4G LTE and 5G infrastructure.
eCall systems are also following suit and are progressing with development of next-generation NG-eCall emergency response systems using 4G LTE and 5G.
Adding the NG112 LTE eCall option MX703330E-041 to the MX703330E supports performance of the NG-eCall test and end-to-end voice evaluation defined in CEN/TS 17240: 2018 using a simulated LTE network. Furthermore, adding the NG112 LTE eCall Semi Normal Test Option MX703330E-042 facilitates support for the semi-normal test specified in the same standard.

Korean eCall Test

This test evaluates IVS supporting the South Korean eCall over LTE (using NG-eCall standard). Adding the South Korean eCall Option MX703330E-047 to the MX703330E supports performance of the South Korean eCall test and end-to-end voice evaluation defined in ITSK-WD-19003*.

* ITSK-WD-19003: Standard related to methods for testing interface between ITS Korea eCall (uses NG-eCall standard) terminal and remote server.

eCall Application Testing

Some IVS have requirements for both calling and Telematics functions while driving. Figure shows the handover between base stations during driving.

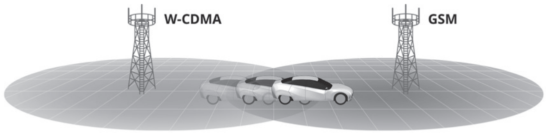
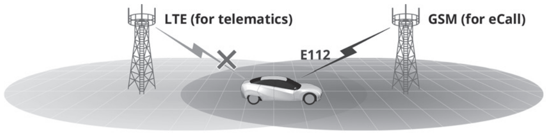


Figure shows the situation when the IVS switches from a 4G network connection used by Telematics services during driving to a 2G/3G network connection for eCall functions when an accident occurs. To emulate this type of test environment, the MD8475B and eCall Tester software perform the handover and CS Fallback switching tests in combination with the eCall function test.

Requires Multi-Cell Option MX703330E-061.



One-touch handover test settings save time and eliminate user worries. The following cells are supported.

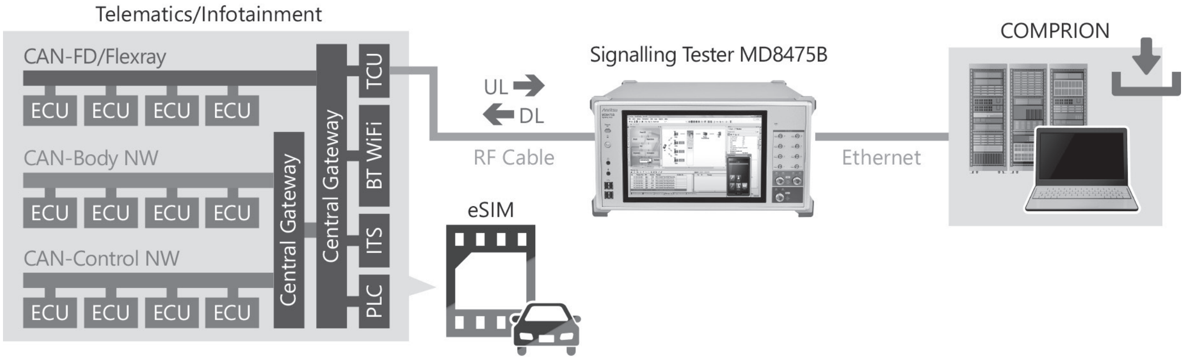
	LTE	W-CDMA	GSM
LTE*	—	✓	✓
W-CDMA	✓	✓	✓
GSM	✓	✓	✓

*: VoLTE not supported

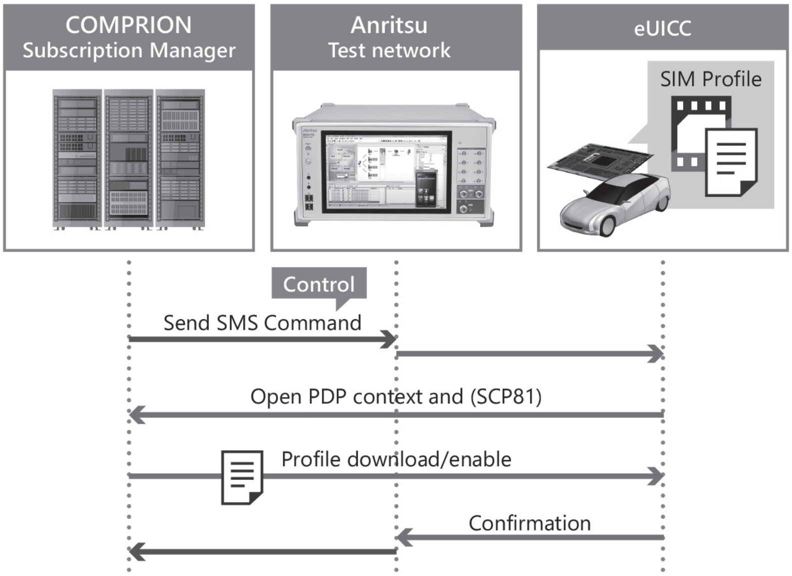
These tests help to greatly improve IVS quality and reliability.

eSIM OTA Verification Solution eUICC Profile Manager Z2002A

MD8475B with COMPRION's software eUICC Profile Manager can performing eSIM (Embedded SIM) test.
eSIM allows the communication protocol information on a SIM to be changed via an OTA (Over the Air) environment.



Sequence Flow



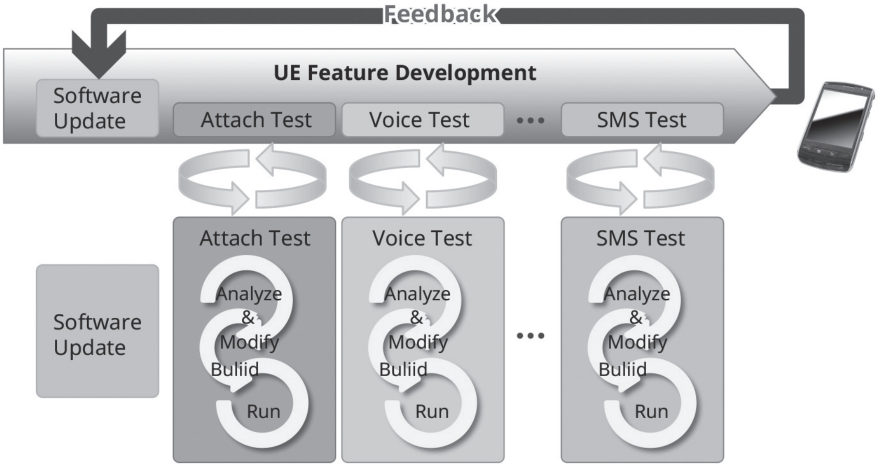
Z2002A include following Software and USB dongle 1pc made by COMPRION.

Model No.	Model name	Quantity
31000449	eUICC Profile Manager Package for Anritsu Z2002A	1

Automation Functions

Regression Tests Necessity

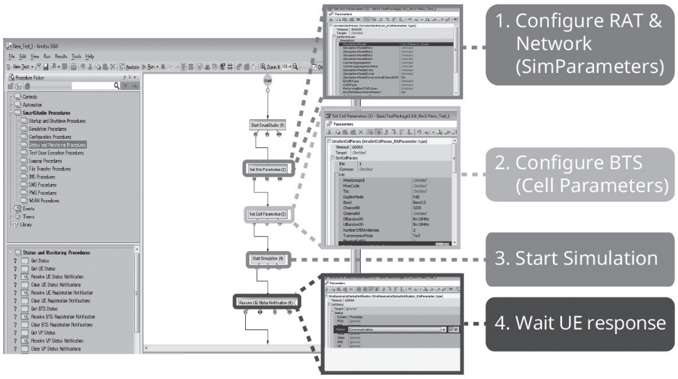
Verification of existing functions and regression testing are key elements of software update testing during UE development. Automated and repeated testing of known items to confirm the absence of new software bugs plays a major role in improving development efficiency and cutting costs.



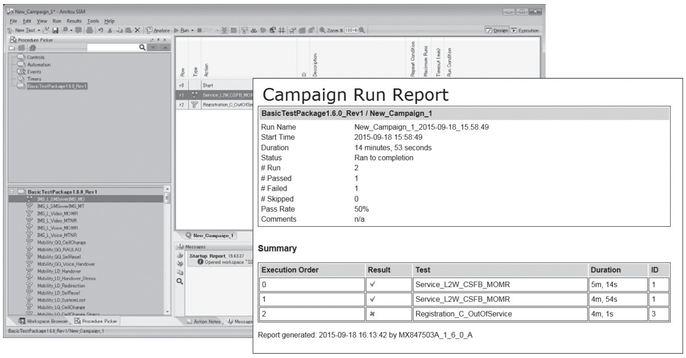
Automated Testing with SmartStudio: SmartStudio Manager MX847503A

The SmartStudio Manager MX847503A software is for editing test sequences and running created test sequences automatically and continuously. This software automates manual testing using the SmartStudio MX847570A software. Automated, unmanned operation test improves efficiency. Additionally, Pass/Fail results can be reported along with the continuous test.

Test Sequence Editing Screen



Test Sequence Continuous Execution Screen



Campaign Run Report

BasicTestPackage1.6.0_Rev1 / New_Campaign_1

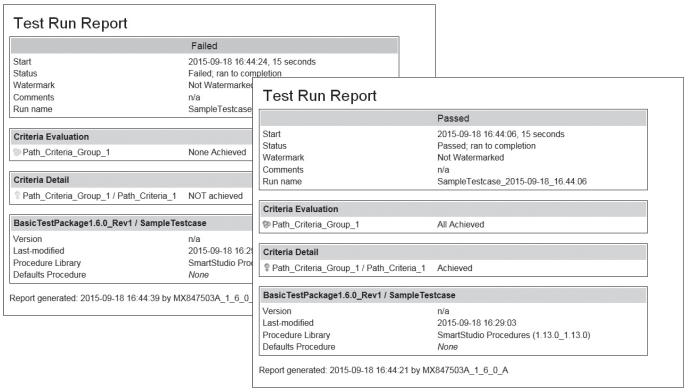
Run Name	New_Campaign_1_2015-09-18_15.58.49
Start Time	2015-09-18 15:58:49
Duration	14 minutes, 53 seconds
Status	Ran to completion
# Run	2
# Passed	1
# Failed	1
# Skipped	0
Pass Rate	50%
Comments	n/a

Summary

Execution Order	Result	Test	Duration	ID
0	✓	Service_L2W_CSFB_MOMR	5m, 14s	1
1	✓	Service_L2W_CSFB_MOMR	4m, 54s	1
2	✗	Registration_C_OutOfService	4m, 1s	3

Report generated: 2015-09-18 16:13:42 by MX847503A_1_6_0_A

Test Sequence Continuous Execution Results Display



Test Run Report

	Failed
Start	2015-09-18 16:44:24, 15 seconds
Status	Failed; ran to completion
Watermark	Not Watermarke
Comments	n/a
Run name	SampleTestcase

Criteria Evaluation	
Path_Criteria_Group_1	None Achieved

Criteria Detail	
Path_Criteria_Group_1 / Path_Criteria_1	NOT achieved

BasicTestPackage1.6.0_Rev1 / SampleTestcase	
Version	n/a
Last-modified	2015-09-18 16:2
Procedure Library	SmartStudio Pro
Defaults Procedure	*None*

Report generated: 2015-09-18 16:44:39 by MX847503A_1_6_0_

Test Run Report

	Passed
Start	2015-09-18 16:44:06, 15 seconds
Status	Passed; ran to completion
Watermark	Not Watermarked
Comments	n/a
Run name	SampleTestcase_2015-09-18_16.44.06

Criteria Evaluation	
Path_Criteria_Group_1	All Achieved

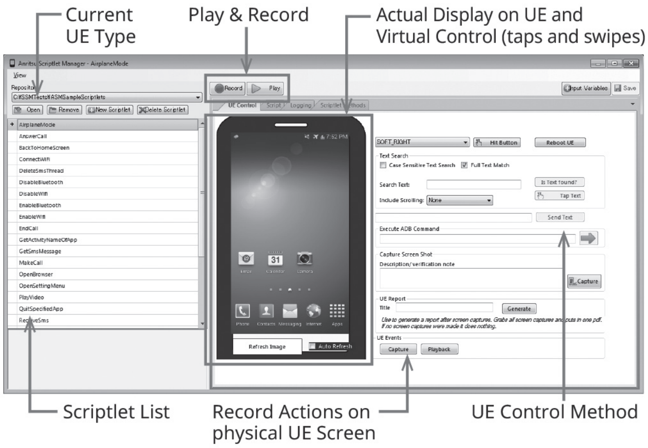
Criteria Detail	
Path_Criteria_Group_1 / Path_Criteria_1	Achieved

BasicTestPackage1.6.0_Rev1 / SampleTestcase	
Version	n/a
Last-modified	2015-09-18 16:29:03
Procedure Library	SmartStudio Procedures (1.13.0_1.13.0)
Defaults Procedure	*None*

Report generated: 2015-09-18 16:44:21 by MX847503A_1_6_0_A

UE Operation Auto-Recording/Auto-Executing: Smartphone Control Platform MX847504A

The MX847504A software option can records Android OS smartphone operations and offers an environment for creating, editing and running UE automated control scripts. Regression and stable operation confirmation testing of UE are easy using the intuitive editing environment with pre-installed scripts and GUI.



Android™ is a trademark of Google Inc.

Regression Tests and Test Sequences

SmartStudio Manager has various test sequences over 180. These test sequences can be used to confirm basic UE operations, such as making and answering voice calls and SMS messages, as well as measuring throughput. Users can use the AT command interface and Smartphone Control Platform MX847504A to control the UE remotely and perform continuous testing without hands-on UE operation.

Test Sequences (extract)

Category	Procedure	Comment
Registration	Attach	Testing UE and base station registration, etc.
	Out of Service	
Voice/Packet/SMS	Voice	Basic UE tests such as voice, data, CFSB, etc.
	Packet	
	SMS over SGs	
	MOMR/MTNR CSFB	
PWS	ETWS Primary + Secondary Notification	Emergency message tests
	CMAS Concurrent Notification	
	CMAS	
Cell Barred	Cell Barred	Network restriction tests
	Access Class Barred	
	PSIST	
CS Emergency	CS emergency	Emergency call tests
	CS emergency CSFB	
Stress Test	Voice	Basic function tests and throughput tests
	Handover	
	Throughput testing	
Mobility	Cell Selection/Reselection	Handover tests
	Handover	
	MOMR/MTNR SRVCC	
WLAN Offload	Untrusted non-3GPP access	WLAN Offload tests
	Trusted non-3GPP access	
IMS/RCS	MO/MT SMS over IMS	IMS/RCS tests
	MOMR: Voice/Video Call Establishment/Release	
	RCS Registration	
TS 09	Stand-by test	TS 09 power consumption tests
	MOMR: Talk time Test	
	MTNR: Talk time Test	
	Packet Switch Transfer Test	
	Browsing Test	
	Streaming Content Test (Video/Audio)	
	Video Telephony Test	
	FTP Download Test	

SmartStudio Test Functions

✓: Supported

Function	Description	MD8475B			
		LTE	W-CDMA*2	GSM*2	TD-SCDMA*2
General					
Position Registration*1	Connects UE and creates test environment	✓	✓	✓	✓
L1/L2 Counter	Counts values for each L1/L2 channel every second	✓	✓	—	✓
Throughput Counter	Simultaneously displays PHY layer and IP Throughput (SDU)	✓	✓	✓	✓
Trace	Displays events for each layer as arrows	✓	✓	✓	✓
Reject	Returns arbitrary reject message when UE connected	✓	✓	✓	✓
Neighbor Cell Setting	Reports information to UE about BTS adjacent to BTS under test	✓	✓	✓	✓
RF Related					
TRx Power Setting	Changes TRx power of BTS during Idle Communication	✓	✓	✓	✓
No Network Setting	Sets BTS Power output to OFF and switches UE to no network status	✓	✓	✓	✓
RF Monitor	Displays frequency, frequency error, and power for each channel such as PDSCH, PUSCH, etc.	✓	✓	✓	✓
TPC Setting	Changes TPC (Transmit Power Control) arbitrarily	✓	✓	✓	✓
AWGN	Sends AWGN in conjunction with normal signal	✓	✓	—	—
RF Measurement Options	Measures UE RF power at each second	✓	✓	✓	—
External Control					
Ethernet	Controls SmartStudio operation (parameter selection, start, etc.) from external PC	✓	✓	✓	✓
GPIB	Controls SmartStudio setting parameters from external PC	✓	✓	✓	✓
Voice/Video Communications					
LTE FDD/TDD					
VoLTE/Video Telephony Calling/Answering (Loopback)	Executes call test for UE supporting Voice over LTE/Video over LTE	✓			
Emergency Call/Originating System	Sets emergency call, and VoLTE/Video call control at LTE	✓			
Codec Change	Changes audio and video codecs arbitrarily and executes UE switchover test	✓			
LTE FDD/TDD, W-CDMA, GSM, TD-SCDMA					
CSFB/eCSFB*3	Auto-switches communication method when other system voice call received during LTE call	✓	✓	✓	✓
SRVCC*3	Performs seamless switch to CS voice call during VoLTE call	✓	✓	✓	—
W-CDMA, GSM, TD-SCDMA					
Voice Call/Answer/On-hook (Loopback/Echoback)	Performs loopback call test*4		✓	✓	✓
Voice Call/Answer/On-hook (Handset)	Performs call test using headset		✓	✓	✓
Emergency Call/Originating	Performs emergency call test with and without Test SIM		✓	✓	✓
Caller ID Setting	Sets Caller ID notification/non-notification/notification disabled/public phone/ international call answer		✓	✓	✓
Call Blocking (Release99) <Barred>	Sets call conditions for Release99 for W-CDMA, GSM, TD-SCDMA and bars all calls		✓	✓	✓
Call Blocking (Release99) <Emergency>	Sets call conditions for Release99 for W-CDMA, GSM, TD-SCDMA and bars all calls except emergency calls		✓	✓	✓
W-CDMA, TD-SCDMA					
Videophone Call/Answer/On-hook (Loopback)	Performs loopback call test*4		✓		✓
Packet Data Communications					
IPv4 Packet Test	Performs data TRx using IPv4	✓	✓	✓	✓
IPv6 Packet Test	Performs data TRx using IPv6	✓	✓	✓	✓
Packet Preservation/Dormant Test	Releases RRC Connection while preserving PDP Context	✓	✓	—	✓
Multiple PDP Context/PDN Connect	Connects multiple PDN and performs multisession packet data test	✓	✓	—	—
State Change	Changes state from BTS during packet data communications	✓	✓	—	✓
IP Data Traffic Functions	Uses built-in packet generator to implement simple measurement system with automated high-reproducibility data throughput test	✓	✓	✓	✓
LTE FDD/TDD					
SISO/MIMO Packet Calling/Answering	Connects server and performs application test using packet data communications	✓			
SISO/MIMO Packet UE Side Disconnect		✓			
SISO/MIMO Packet Network Side Disconnect		✓			
DL2CC Carrier Aggregation	Performs DL2CC carrier application tests	✓			
DL3CC Carrier Aggregation	Performs DL3CC carrier application tests	✓			
DL4CC Carrier Aggregation	Performs DL4CC carrier application tests	✓			
DL5CC Carrier Aggregation	Performs DL5CC carrier application tests	✓			
UL2CC Carrier Aggregation	Performs UL2CC carrier application tests	✓*5			
FDD/TDD Joint Operation	Performs FDD and TDD Joint Operation test	✓*6			
W-CDMA					
W-CDMA/HSPA/HSPA Evolution Packet Calling/Answering	Connects server and performs application test using packet data communications		✓		
W-CDMA/HSPA/HSPA Evolution Packet UE Side Disconnect			✓		
W-CDMA/HSPA/HSPA Evolution Packet Network Side Disconnect			✓		
PPP Packet Calling	Performs DL2CC carrier application tests		✓		
PPP Packet UE Side Disconnect	Performs DL3CC carrier application tests		✓		
PPP Packet Network Side Disconnect	Performs UL2CC carrier application tests		✓		
GSM					
GPRS/EGPRS Packet Calling/Answering	Connects server and performs application test using packet data communications			✓	
GPRS/EGPRS Packet UE Side Disconnect				✓	
GPRS/EGPRS Packet Network Side Disconnect				✓	
TD-SCDMA					
TD-SCDMA/HSPA*7 Packet Calling/Answering	Connects server and performs application test using packet data communications				✓
TD-SCDMA/HSPA*7 Packet UE Side Disconnect					✓
TD-SCDMA/HSPA*7 Packet Network Side Disconnect					✓
Messaging					
ETWS Message Sending	Performs ETWS message send test during Idle or Communication state	✓	✓	—	—
CMAS Message Sending	Performs CMAS message send test during Idle or Communication state	✓	✓	—	—
CBS Message Sending	Performs CBS message send test during Idle or Communication state	—	✓	✓	—
SMS Message Sending/Receiving	Performs SMS (7 bit-ASCII, Unicode, Binary) test using PS and CS networks*4	✓	✓	✓	—
SMS over IMS Test	Performs SMS send/receive test via IMS server	✓	—	—	—
SMS Message Continuous Sending	Sends selected multiple SMS to UE continuously	✓	✓	✓	✓
MMS Sending/Receiving*8	Performs MMS send/receive test	✓	✓	✓	✓

*1: Ciphering function not supported

*2: Support for installing the Enhanced Multi-signalling Unit (MD8475B-071) is expected in future.

*3: Only dual system configuration supported

*4: Two-way tests using two UEs not supported

*5: Limited to 50 Mbps throughput when MD8475B-070 installed

*6: Requires MD8475B-071

*7: DCH Measurement Occasion/Idle Interval Measurement function not supported

*8: Requires separate MMS server

System Configurations/Option/Software

Main Frame Options

Extended RF MD8475B-002

This option is required to simulate the operation of three or more base-station cells. It supports 8Tx/4RX using the MD8475B.

Fading IO Option MD8475B-004

This option combines two MD8475Bs to create a higher-order carrier aggregation (CA) test environment that requires more RF outputs.

IP Extension Option MD8475B-005

This option enables FTP throughput testing with multiple external servers.

Multi-cell Software MX847502B

This option is required when simultaneously activating two or more cells such as at handover tests within the same system, Inter-RAT tests between different systems, LTE Carrier Aggregation tests, etc.

Multimedia Interface Software MX847508B

This option is required when performing end-to-end voice tests with microphones and speakers (headset) connected to the MD8475B. It can be used for W-CDMA and GSM AMR-NB (AMR Narrowband), GSM EFR (Enhanced Full Rate Speech), FR (Full Rate Speech), and HR (Half Rate Speech) codecs.

AMR-WB MX847508B-001

This option supports the W-CDMA AMR-WB (AMR Wideband) codec. It requires the MX847508B.

Supported voice codec list

Supported Codecs	Multimedia Interface Software MX847508B	AMR-WB MX847508B-001
AMR-NB (W-CDMA/GSM)	✓	—
GSM-EFR (GSM)	✓	—
GSM-FR (GSM)	✓	—
GSM-HR (GSM)	✓	—
AMR-WB (W-CDMA)	—	✓

SmartStudio MX847570B

This software supports the user interface for scenario-less testing. In addition to offering functions such as sending and receiving SMS messages, sending and receiving ETWS/CMAS messages, making and receiving voice calls, and sending and receiving data packets, it also supports CSCF server functions required for IMS service tests.

- Support Service

MX847570B 1Year Support Service MX847570B-SS110

This service contract offers customers 1 year of support for technical enquiries as well as updates to the latest software versions adding extra functionality and bug fixes via downloads from the web page.

W-CDMA

- Basic Configuration (Voice/Video/Packet)

Multi-signalling Unit MD8475B-070
W-CDMA Simulation Software MX847510B
W-CDMA Option MX847570B-010

These are for basic W-CDMA configuration. These tests support voice, videophone, packet, and SMS tests.

- Options

HSPA Evolution/DC-HSDPA Option MX847510B-011
HSPA Evolution/DC-HSDPA Option MX847570B-011

These options support HSPA Evolution and DC-HSPA packet communications tests for high-speed packet services used by W-CDMA systems.

3GPP TS 25.306 Category List

HSDPA

HS-DSCH Category	HS-DSCH Codes	Minimum Inter-TTI	TB-Sizes	Total Number of Soft Channel Bits	Modulation	Maximum Throughput [bps]
5*	5	1	7298	57600	QPSK/16QAM	3649000
6	5	1	7298	67200	QPSK/16QAM	3649000
7*	10	1	14411	115200	QPSK/16QAM	7205500
8	10	1	14411	134400	QPSK/16QAM	7205500
9	15	1	20251	172800	QPSK/16QAM	10125500
10	15	1	27952	172800	QPSK/16QAM	13976000
12	5	1	3630	28800	QPSK	1815000
13	15	1	35280	259200	Not Applicable (dual cell operation not supported)	17640000
14	15	1	42192	259200		21096000
21	15	1	23370	345600	QPSK/16QAM	23370000
22	15	1	27952	345600	QPSK/16QAM	27952000
23	15	1	35280	518400	QPSK/16QAM 64QAM	35280000
24	15	1	42192	518400		42192000

HSUPA

E-DCH Category	E-DCH Codes	Minimum Spreading Factor	Support for TTI EDCH	TB-Sizes E-DCH TTI	Maximum Throughput [bps]
3	2	SF4	10 ms TTI	14484	1459500
5	2	SF2	10 ms TTI	20000	2918500
6	4	SF2	10 ms TTI	14484	5760000

*: Not supported when UE specifies a category

LTE

- Basic Configuration
  Multi-signalling Unit MD8475B-070
  Enhanced Multi-signalling Unit MD8475B-071
  LTE Simulation Software MX847550B
  LTE Option MX847570B-050
    These are for basic LTE FDD/TDD configuration. It supports both FDD and TDD technologies. These tests support confirmation of connections with LTE UEs during SISO, packet communications, and SMS sending/receiving. In addition, multi-cell tests are supported by installing the Multi-cell Software MX847502B.

3GPP TS 36.306 V14.10.0 (2019-03) Category List
Downlink physical layer parameter values set by the field UE-Category

UE DL Category	Maximum number of DL-SCH transport block bits received within a TTI	Maximum number of bits of a DL-SCH transport block received within a TTI	Total number of soft channel bits	Maximum number of supported layers for spatial multiplexing in DL
DL Category M1	1000	1000	25344	1
DL Category M2	4008	4008	73152	1
DL Category 0	1000	1000	25344	1
DL Category 1 bis	10296	10296	250368	1
DL Category 4	150752	75376	1827072	2
DL Category 6	301504	149776 (4 layers, 64QAM) 75376 (2 layers, 64QAM)	3654144	2 or 4
DL Category 7	301504	149776 (4 layers, 64QAM) 75376 (2 layers, 64QAM)	3654144	2 or 4
DL Category 9	452256	149776 (4 layers, 64QAM) 75376 (2 layers, 64QAM)	5481216	2 or 4
DL Category 10	452256	149776 (4 layers, 64QAM) 75376 (2 layers, 64QAM)	5481216	2 or 4
DL Category 11	603008	149776 (4 layers, 64QAM) 195816 (4 layers, 256QAM) 75376 (2 layers, 64QAM) 97896 (2 layers, 256QAM)	7308288	2 or 4
DL Category 12	603008	149776 (4 layers, 64QAM) 195816 (4 layers, 256QAM) 75376 (2 layers, 64QAM) 97896 (2 layers, 256QAM)	7308288	2 or 4
DL Category 13	391632	195816 (4 layers, 256QAM) 97896 (2 layers, 256QAM)	3654144	2 or 4
DL Category 14	3916560	391656 (8 layers, 256QAM)	47431680	8
DL Category 15	749856-807744	149776 (4 layers, 64QAM) 195816 (4 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 201936 (4 layers, 256QAM, if alternativeTBS-Index-r14 is supported) 75376 (2 layers, 64QAM) 97896 (2 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 100752 (2 layers, 256QAM, if alternativeTBS-Index-r14 is supported)	9744384	2 or 4
DL Category 16	978960-1051360	149776 (4 layers, 64QAM) 195816 (4 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 201936 (4 layers, 256QAM, if alternativeTBS-Index-r14 is supported) 75376 (2 layers, 64QAM) 97896 (2 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 100752 (2 layers, 256QAM, if alternativeTBS-Index-r14 is supported)	12789504	2 or 4
DL Category 17	25065984	391656 (8 layers, 256QAM)	303562752	8
DL Category 18	1174752-1211616	[299856 (8 layers, 64QAM) 391656 (8 layers, 256QAM)] 149776 (4 layers, 64QAM) 195816 (4 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 201936 (4 layers, 256QAM, if alternativeTBS-Index-r14 is supported) 75376 (2 layers, 64QAM) 97896 (2 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 100752 (2 layers, 256QAM, if alternativeTBS-Index-r14 is supported)	14616576	2 or 4 [or 8]
DL Category 19	1566336-1658272	[299856 (8 layers, 64QAM) 391656 (8 layers, 256QAM)] 149776 (4 layers, 64QAM) 195816 (4 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 201936 (4 layers, 256QAM, if alternativeTBS-Index-r14 is supported) 75376 (2 layers, 64QAM) 97896 (2 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 100752 (2 layers, 256QAM, if alternativeTBS-Index-r14 is supported)	19488768	2 or 4 [or 8]
DL Category 20	1948064-2019360	[299856 (8 layers, 64QAM) 391656 (8 layers, 256QAM)] 149776 (4 layers, 64QAM) 195816 (4 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 201936 (4 layers, 256QAM, if alternativeTBS-Index-r14 is supported) 75376 (2 layers, 64QAM) 97896 (2 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 100752 (2 layers, 256QAM, if alternativeTBS-Index-r14 is supported)	24360960	2 or 4 [or 8]
DL Category 21	1348960-1413120	149776 (4 layers, 64QAM) 195816 (4 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 201936 (4 layers, 256QAM, if alternativeTBS-Index-r14 is supported) 75376 (2 layers, 64QAM) 97896 (2 layers, 256QAM, if alternativeTBS-Index-r14 is not supported) 100752 (2 layers, 256QAM, if alternativeTBS-Index-r14 is supported)	17052672	2 or 4

Uplink physical layer parameter values set by the field UE-Category

UE UL Category	Maximum number of UL-SCH transport block bits transmitted within a TTI	Maximum number of bits of an UL-SCH transport block transmitted within a TTI	Support for 64QAM in UL	Support for 256QAM in UL
UL Category M1	1000 or 2984	1000 or 2984	No	No
UL Category M2	6968	6968	No	No
UL Category 0	1000	1000	No	No
UL Category 1 bis	5160	5160	No	No
UL Category 3	51024	51024	No	No
UL Category 5	75376	75376	Yes	No
UL Category 7	102048	51024	No	No
UL Category 8	1497760	149776	Yes	No
UL Category 13	150752	75376	Yes	No
UL Category 14	9585664	149776	Yes	No
UL Category 15	226128	75376	Yes	No
UL Category 16	105528	105528	Yes	Yes
UL Category 17	2119360	211936	Yes	Yes
UL Category 18	211056	105528	Yes	Yes
UL Category 19	13563904	211936	Yes	Yes
UL Category 20	316584	105528	Yes	Yes
UL Category 21	301504	75376	Yes	No

* These UE Category tables show the case when MD8475B-071 is installed.

- Options
  - LTE 2×2 MIMO Option MX847550B-020
    This option adds 2×2 MIMO to the MX847550B.
  - LTE 4×4 MIMO Option MX847550B-021
    This option adds 4×4 MIMO to the MX847550B.
  - LTE Licensed Assisted Access (LAA) Option MX847550B-030
    This software option provides LTE Licensed Assisted Access (LAA) capability that can be used with the MIMO options and the Carrier Aggregation Options.
  - LTE Carrier Aggregation Option MX847550B-040
    This software option supports LTE 2CC Carrier Aggregation. It supports the 2CC SISO test environment. Additionally, installing the MX847550B-020 software supports the 2CC MIMO test environment.
  - LTE Carrier Aggregation DL3CCs Option MX847550B-041
    This software option supports LTE 3CC Carrier Aggregation. It supports the 3CC SISO test environment. Additionally, installing the MX847550B-020 software supports the 3CC MIMO test environment.
  - LTE Carrier Aggregation DL4CCs Option MX847550B-042
    This software option supports LTE 4CC Carrier Aggregation. It supports the 4CC SISO test environment. Additionally, installing the MX847550B-020 software supports the 4CC MIMO test environment.
  - LTE Carrier Aggregation DL5CCs Option MX847550B-043
    This software option supports LTE 5CC Carrier Aggregation. It supports the 5CC SISO test environment. Additionally, installing the MX847550B-020 software supports the 5CC MIMO test environment.
  - LTE RoHC Option MX847550B-060
    This option adds better compression algorithms to improve LTE IP packet transfer efficiency.

Supported Profiles

IP	Profile
0x0000	No compression (LTE)/Uncompressed (UMTS)
0x0001	RTP/UDP/IP
0x0002	UDP/IP

LTE 20 Layers Extension Option MX847550B-070
This option enables LTE 20 Layers (LTE 5CC, 4×4 MIMO) testing. If this option is not installed, LTE 16 Layers (4×4 MIMO for 3CCs and 2×2 MIMO for 2CCs out of LTE 5CCs) is maximum.

GSM

- Basic Configuration
  GSM Signalling Unit MD8475B-020
  GSM/GPRS Simulation Software MX847520B
  GSM Option MX847570B-020
  This is the basic configuration for performing GSM/GPRS tests. It supports voice and packet communications tests, SMS sending and receiving, etc. Additionally, it can be used for evaluating application functions using EGPRS communications for EGPRS high-speed data communications.

Supported EGPRS Specifications

Layer 1	Frequency Bandwidth	850, 900, 1800, 1900 MHz
	Modulation & Coding Scheme	MCS 1, 2, 3, 4 (GMSK) MCS 5, 6, 7, 8, 9 (8PSK)
	Number of Slots	Up to Multi Slot Class 12 (DL: 4/UL: 4/SUM: 5)
	Channel Combination	Combination 11 & 13
Layer 2, 3	Broadcasting Control Channel	BCCH/CCCH, PBCCH/PCCH
	ARQ Type	Type 1
	Window Size	64 to 192
Standard		3GPP Release 99

TD-SCDMA

- Basic Configuration
  - TD-SCDMA Signalling Unit MD8475B-040
  - TD-SCDMA Simulation Software MX847540B
  - TD-SCDMA Option MX847570B-040

These are for basic TD-SCDMA/TD-HSUPA*1 configuration which support voice, videophone, packet, and SMS tests.

3GPP TS 25.306

TD-HSDPA

HS-DSCH category	Maximum number of HSDSCH codes per timeslot	Maximum number of HSDSCH timeslots per TTI	Maximum number of HSDSCH transport channel bits can be received within an HSDSCH TTI	Total number of soft channel bits	Maximum Throughput [bps]
Category 1 to 3	16	2	2788	11264	557600
Category 4 to 6	16	2	5600	22528	1120000
Category 7 to 9	16	3	8416	33792	1688200
Category 10 to 12	16	4	11226	45056	2245200
Category 13 to 15	16	5	14043	56320	2808600

TD-HSUPA

E-DCH category	Maximum number of E-DCH timeslots per TTI	Maximum number of E-DCH transport channel bits that can be received within an E-DCH TTI	Maximum Throughput [bps]
Category 1	2*2	2754	550800
Category 2	3*2	4162	832400
Category 3	2*2	5532	1106400
Category 4	3*2	8348	1669600
Category 5	4*2	11160	2232000
Category 6	5*2	11160	2232000

*1: MX847570B supports Category 6 only.
*2: One timeslot supports two physical channels when 16QAM not used.

IMS Options

IMS Script Basic Option MX847570B-060

This software supports scripting of the communication procedure between the test UE and CSCF server using a ladder sequence to provide a very flexible and expandable test environment.

XCAP Script Option MX847570B-061

This option provides a test environment with high flexibility and expandability for creating scripts using a ladder sequence to edit XCAP messages between the UE and server without the need to prepare an actual server.

IMS Log Import Option MX847570B-062

This software option enables importing Wireshark logs, and create IMS script automatically. This Script is editable using Add-in Sever window. This option help flexible evaluation of IMS.

Extended CSCF Option MX847570B-080

This software option adds functions for calling from the network to UE as well as extended functions for CSCF-server-side network congestion and no response status.

IMS Supplementary Service Option MX847570B-081

This software option adds other service tests, including VoLTE caller ID display, call forwarding, call holding, etc.

RCS Basic Option MX847570B-083

This software option simulates RCS services. It is used to perform tests including RCS Configuration, Registration, Instant Messaging, etc.

GBA Authentication Option MX847570B-084

This option has the 3GPP GBA Authentication algorithm, authentication procedure and parameter settings for simulating GBA operations.

IMS Early Media Option MX847570B-085

This software supports IMS Early Media sequence tests. It can be used to confirm customized call tone services at the network side, such as NRBT (Network Ring Back Tone) and CAT (Customized Alerting Tone).

RTP Frame Control Option MX847570B-086

This option is for controlling media data (RTP packets) during VoLTE communications. It can be used to configure a voice environment in the MUTE status and with fixed data; a measurement environment can be configured for abnormal audio quality verification and battery power consumption tests in a fixed state. This option also supports UN-R144 compliant VoLTE (EVS) audio call tests. It can be used for WB AMR 12.65 kbps and EVS 13.2 kbps codecs.

- Support Service (IMS options)

MX847570B-060 1 Year Technical Support Service MX847570B-TS160

This contract offers customers support for technical enquiries for 1 year.

MX847570B-061 1 Year Technical Support Service MX847570B-TS161

This contract offers customers support for technical enquiries for 1 year.

WLAN Offload Options

WLAN Offload Basic Option MX847570B-070

This software option provides an EAP authentication server for performing EAP over RADIUS communications (EAP-SIM/EAP- AKA) between a WLAN access point and the EAP authentication server. Additionally, data access by the physical bearers is displayed to verify the 3GPP/WLAN switchover.

ePDG Option MX847570B-071

This software option provides an ePDG server for testing the UE functions at Untrusted non-3GPP Access by running IKEv2 key exchanges and IPsec communications between the UE and ePDG. It requires the MX847570B-070 option as well.

ANDSF Option MX847570B-072

This software option provides the ANDSF function for testing the UE functions after ANDSF policy distribution to the UE. It requires the MX847570B-070 options as well.

Extended ePDG Option MX847570B-073

This software option supports configuration of an ePDG status fault test environment for inserting errors into the ePDG sequence, setting timeouts, etc. Additionally, this option can be used to support Fast Re-Authentication (EAP-SIM/EAP-AKA) tests without the need to generate UE-side authentication keys. It requires the MX847570B-070/MX847570B-071.

eCall Options

eCall Tester (USB License) MX703330E-PL010
eCall Tester (Software License) MX703330E-PL020

This option simulates the PSAP used by eCall services to support the eCall sequence (MSD call → Voice call) between the IVS and PSAP at a road accident.

The following test standards are supported:

- TS 26 .267 V8.6.0 (2011-03)
- TS 26 .268 V8.6.0 (2011-03)
- EN15722: 2015
- EN16062: 2015
- EN16454: 2015
- ISO3779: 2009

This option can be used as a test environment for model authentication in accordance with the EN16454 recommendations.
This option provides audio replay and record functions.
The MX703330E-PL010 license is supplied using a USB stick (dongle); use it by inserting the USB dongle into the PC.
The MX703330E-PL020 license is supplied as software; use it by installing the software in the PC without using a USB dongle. Either license method can be selected.

MSD ERA GLONASS Option MX703330E-031

This option supports the MSD data communications function over SMS used by the ERA-GLONASS system

The following test standards are supported:

- GOST R 54619-2011
- GOST R 54620-2011
- GOST R 54721-2011
- GOST R 55530-2013

EGTS Server ERA GLONASS Option MX703330E-032

This option provides a test environment to send/receive and encode/decode EGTS messages defined in the GOST R 54619/54620. MX703330E-031 is separately required.

NG112 LTE eCall Option MX703330E-041

This option provides functional tests for MSD data communication and voice call over IMS defined in the CEN/TS 17240: 2018 standard.

NG112 LTE eCall Semi Normal test Option MX703330E-042

Supports semi-normal test defined in CEN/TS 17240: 2018.

South Korean eCall Option MX703330E-047

Supports South Korean eCall test and end-to-end voice evaluation defined in ITSK-WD-19003.

Multi-Cell Option MX703330E-061

This option provides the handover test environment required when setting two or more cells as well as the CS Fallback test environment at the eCall environment. Practical eCall module tests are supported using this option.
The cell combinations are as follows:

	LTE	W-CDMA	GSM
LTE*	—	✓	✓
W-CDMA	✓	✓	✓
GSM	✓	✓	✓

*: VoLTE is not supported

- Support Service

MX703330E 1-Year Support Service MX703330E-SS110

This service contract offers customers 1 year of support for technical enquiries as well as updates to the latest software versions adding extra functionality and bug fixes via downloads from the web page.

SSM Test PKG European eCall MX847503A-601

This test package provides automated test environment. Opening the test case on the SSM, it shows test procedures of test items defined in the (EC) 2017/79 and EN16454, and automatically configures the setting of MD8475B and eCall tester.
This test package also has report functions for each standards.

SSM Test PKG GOST 33467 MX847503A-701

This test package provides automated test environment. Opening the test case on the SSM, it shows test procedures of test items defined in the GOST33467, and automatically configures the setting of MD8475B and eCall tester.
This test package also has report functions for each standards.

Scenario Tools

SIDE Software MX847580B
SIP Option MX847580B-018

These software are for executing scenarios created using the MX843080A Scenario Integrated Development Environment in combination with the MX847510B, MX847520B, and MX847550B software.

Ciphering Option

W-CDMA Ciphering Option MX847510B-050

This option adds the W-CDMA ciphering function*1, *2 and supports for KASUMI (3GPP-recommended algorithm).

GSM/GPRS Ciphering Option MX847520B-050

This option adds the GSM/GPRS ciphering function*1, *2 and supports both the GSM A5/1, A5/2, and A5/3 ciphering algorithms as well as the GPRS GEA/1, GEA/2, and GEA/3 ciphering algorithms.

TD-SCDMA Ciphering Option MX847540B-050

This option adds the TD-SCDMA ciphering function*1, *2 and supports SNOW 3G (3GPP-recommended algorithm).

LTE Ciphering Option MX847550B-050

This option adds the LTE ciphering function*1, *2 and supports SNOW 3G (3GPP-recommended algorithm) and AES.

*1: Does not work with MX847570B.
*2: The Integrity Algorithm does not require this option.

Upgrade Kits*

MD8475A to MD8475B Upgrade MD8475B-UG101
MD8475A to MD8475B Upgrade (with Ciphering) MD8475B-UG102
MD8475A to MD8475B Upgrade (with SIDE) MD8475B-UG103
MD8475A to MD8475B Upgrade (with Ciphering/SIDE) MD8475B-UG104
Windows 7 to Windows 10 Upgrade MD8475B-UG105
MD8475A to MD8475B Upgrade MD8475B-UG201
MD8475A to MD8475B Upgrade (with Ciphering) MD8475B-UG202
MD8475A to MD8475B Upgrade (with SIDE) MD8475B-UG203
MD8475A to MD8475B Upgrade (with Ciphering/SIDE) MD8475B-UG204
Windows 7 to Windows 10 Upgrade MD8475B-UG205

These retrofit kits upgrade the MD8475A in use to the MD8475B.

MSU Upgrade MD8475B-UG170
MSU Upgrade MD8475B-UG270

When upgrading the MD8475A in use to the MD8475B specifications, if a legacy unit such as the MD8475A-010 or MD8475A-040 is installed that cannot be transferred to the Multi-signalling Unit MD8475B-070, the legacy unit must be changed to the MD8475B-070 with these retrofit kits.

*: Upgrade kit models vary according to the configuration of the MD8475A options in use; contact our sales section for more details.

eMSU Upgrade MD8475B-UG171
eMSU Upgrade MD8475B-UG271

The MD8475A-011, MD8475A-050 and MD8475A-070 can be changed to the MD8475B-071 when upgrading the MD8475A to the MD8475B.

eMSU Upgrade MD8475B-UG179
eMSU Upgrade MD8475B-UG279

The MD8475B-070 can be changed to the MD8475B-071.

Automation Tool

SmartStudio Manager MX847503A

This option increases the efficiency of evaluations by automating manual tests performed by the SmartStudio MX847570B software. In addition, the package includes test sequences required for evaluating basic functions.

Smartphone Control Platform MX847504A

Using this option, Android OS smartphone operations can be recorded via ADB and UE automated control scripts can be created, edited and run. As well as supporting automated control from the MX847503A, two-way automatic control of the measuring instrument and UE supports an operator-free test environment for higher test efficiency.

SmartStudio System Configuration

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<tr><td colspan="2">Unit</td><td colspan="5">Signalling Tester MD8475B</td></tr>
<tr><td colspan="2" rowspan="2">Unit Option</td><td colspan="5">Extended RF MD8475B-002</td></tr>
<tr><td colspan="5">Fading IO Option MD8475B-004</td></tr>
<tr><td colspan="2" rowspan="3">Platform Software</td><td colspan="5">Multi-cell Software MX847502B</td></tr>
<tr><td colspan="2">—</td><td colspan="3">Multimedia Interface Software MX847508B</td></tr>
<tr><td colspan="2">—</td><td>AMR-WB MX847508B-001</td><td>—</td><td>—</td></tr>
<tr><td rowspan="3">Basic Configuration</td><td rowspan="2">Hardware</td><td colspan="4">Multi Signalling Unit MD8475B-070</td><td>GSM Signalling Unit MD8475B-020</td></tr>
<tr><td colspan="2">Enhanced Multi-signalling Unit MD8475B-071</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td>Software</td><td colspan="2">LTE Simulation Software MX847550B</td><td>W-CDMA Simulation Software MX847510B</td><td>TD-SCDMA Simulation Software MX847540B</td><td>GSM/GPRS Simulation Software MX847520B</td></tr>
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<tr><td colspan="2">LTE 4×4 MIMO Option MX847550B-021</td></tr>
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<tr><td>LTE Carrier Aggregation Option MX847550B-040</td></tr>
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<tr><td colspan="2">User Interface</td><td colspan="5">SmartStudio MX847570B</td></tr>
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<tr><td>LTE Carrier Aggregation Option MX847570B-051</td><td rowspan="2">—</td><td rowspan="2">HSPA Evolution/ DC-HSDPA Option MX847570B-011</td></tr>
<tr><td>LTE Licensed Assisted Access (LAA) Option MX847570B-052</td></tr>
<tr><td rowspan="6">IMS</td><td colspan="5">Extended CSCF Option MX847570B-080</td></tr>
<tr><td colspan="5">IMS Supplementary Service Option MX847570B-081</td></tr>
<tr><td colspan="5">RCS Basic Option MX847570B-083</td></tr>
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<tr><td colspan="5">IMS Early Media Option MX847570B-085</td></tr>
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<tr><td rowspan="4">WLAN</td><td colspan="5">WLAN Offload Basic Option MX847570B-070</td></tr>
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<tr><td colspan="5">ANDSF Option MX847570B-072</td></tr>
<tr><td colspan="5">Extended ePDG Option MX847570B-073</td></tr>
<tr><td rowspan="2">Scripting Option</td><td colspan="5">IMS Script Basic Option MX847570B-060</td></tr>
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<tr><td rowspan="2">Technical Support Service</td><td colspan="5">MX847570B-060 1 Year Technical Support Service MX847570B-TS160</td></tr>
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<tr><td colspan="2" rowspan="3">Remote Interface</td><td colspan="5">Quick TRX Diagnosis MX847506B</td></tr>
<tr><td colspan="5">SmartStudio Manager MX847503A</td></tr>
<tr><td colspan="5">Smartphone Control Platform MX847504A</td></tr>
<tr><td colspan="2" rowspan="9">eCall Option</td><td colspan="2">eCall Tester (USB License) MX703330E-PL010</td><td>eCall Tester (USB License) MX703330E-PL010</td><td>—</td><td>eCall Tester (USB License) MX703330E-PL010</td></tr>
<tr><td colspan="2">eCall Tester (Software License) MX703330E-PL020</td><td>eCall Tester (Software License) MX703330E-PL020</td><td>—</td><td>eCall Tester (Software License) MX703330E-PL020</td></tr>
<tr><td colspan="2">—</td><td>MSD ERA GLONASS Option MX703330E-031</td><td>—</td><td>MSD ERA GLONASS Option MX703330E-031</td></tr>
<tr><td colspan="2">—</td><td>EGTS Server ERA GLONASS Option MX703330E-032</td><td>—</td><td>EGTS Server ERA GLONASS Option MX703330E-032</td></tr>
<tr><td colspan="2">NG112 LTE eCall Option MX703330E-041</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td colspan="2">NG112 LTE eCall Semi Normal Test Option MX703330E-042</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td colspan="2">South Korean eCall Option MX703330E-047</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td colspan="2">Multi-Cell Option MX703330E-061</td><td>Multi-Cell Option MX703330E-061</td><td>—</td><td>Multi-Cell Option MX703330E-061</td></tr>
<tr><td colspan="2">MX703330E 1 Year Support Service MX703330E-SS110</td><td>MX703330E 1 Year Support Service MX703330E-SS110</td><td>—</td><td>MX703330E 1 Year Support Service MX703330E-SS110</td></tr>
</table>

Specifications

RF Connector		RF Input/Output connector (Main, Aux 1, Aux 2) Connector: N (j) type, Impedance: 50Ω VSWR (Main): ≤1.9 (350 MHz to 3.8 GHz), ≤2.0 (3.8 GHz to 6.0 GHz) VSWR (Aux1, 2): ≤1.5 (350 MHz to 3.8 GHz), ≤1.6 (3.8 GHz to 6.0 GHz) Output connector (DL Output 1 to 8) Connector: SMA (j) type, Impedance: 50Ω VSWR: ≤1.5 (350 MHz to 3.8 GHz), ≤1.6 (3.8 GHz to 6.0 GHz) Reference oscillator Frequency: 10 MHz Level: TTL level Connector: BNC (j) type Startup characteristics: ≤5 × 10^{-8} (10 minutes after power-on, referenced to frequency 24 hours after power-on) Aging rate: 2 × 10^{-8}/day, ≤1 × 10^{-7}/year (referenced to frequency 24 hours after power-on) Temperature characteristics: ≤5 × 10^{-8} Frequency Accuracy at Shipment: ±2.2 × 10^{-8} (At +20°C to +30°C, 1 hour after power-up) External reference input Frequency: 10 MHz, Acceptable frequency range: ±1.0 ppm, Level: ≥0 dBm, Impedance: 50Ω, Connector: BNC (j) type
Transmission Characteristics		Frequency Frequency range: 350 MHz to 6.0 GHz Setting resolution: 100 kHz (Depending on MX847501B used) Accuracy: Based on reference oscillator accuracy Output level Level range: (Main, Aux1, Aux2): LTE : –130 to –27 dBm (350 MHz to 3.8 GHz), –130 to –32 dBm (3.8 GHz to 6.0 GHz) W-CDMA : –130 to –27 dBm (350 MHz to 3.6 GHz) Others: –130 to –25 dBm (350 MHz to 3.6 GHz) Level Range (DL Output 1 to 8): LTE : –115 to –5 dBm (350 MHz to 3.8 GHz), –115 to –10 dBm (3.8 GHz to 6.0 GHz) W-CDMA: –115 to –5 dBm (350 MHz to 3.6 GHz) Others: –115 to –3 dBm (350 MHz to 3.6 GHz) Resolution: 0.1 dB Level Accuracy (Main): –120 dBm ≤ Output Level, after CAL, excluding other effects of internal signal generator ±1.7 dB (350 MHz to 3.8 GHz, +20°C to +30°C) ±2.0 dB (3.8 GHz to 6.0 GHz, +20°C to +30°C) Level Accuracy (Aux 1, Aux 2): –120 dBm ≤ Output Level, after CAL, excluding other effects of internal signal generator ±1.0 dB ±1.0 dB (350 MHz to 3.8 GHz, +20°C to +30°C) ±1.3 dB (3.8 GHz to 6.0 GHz, +20°C to +30°C) Level Accuracy (DL Output 1 to 8): –110 dBm ≤ Output Level, after CAL ±1.0 dB (350 MHz to 3.8 GHz, +20°C to +30°C) ±1.3 dB (3.8 GHz to 6.0 GHz, +20°C to +30°C) Signal purity Non-harmonic spurious: ≤–30 dBc (at ≥100 kHz frequency offset) Harmonics: ≤–25 dBc Modulation Accuracy : At +20°C to +30°C W-CDMA: ≤3.5%rms (350 MHz to 2.7 GHz) GSM: ≤1.5°rms (350 MHz to 2.7 GHz) LTE: ≤3.5%rms (400 MHz to 6.0 GHz)
Reception Characteristics		Frequency Frequency range: 350 MHz to 6.0 GHz Setting resolution: 100 kHz (Depending on MX847501B used) Level Maximum input level: +35 dBm (Average)
General		Display: Color TFT LCD screen, 12.1 inches (WXGA), 1280 × 800 dots External interface Trigger I/O: BNC (j) Call Processing Timing I/O: 15-pin mini D-Sub (f) connector Call Processing Ethernet A/B: RJ-45 connector, 10Base-T/100Base-TX/1000Base-T Measure Ethernet: RJ-45 connector, 10Base-T/100Base-TX/1000Base-T Headphone: 3.5-mm dia. headphone jack Microphone: 3.5-mm dia. microphone jack USB (Type-A) × 2 (Back Panel) USB (Type-A) × 4 (Front Panel) GPIB: IEEE488 connector VGA: Mini D-Sub connector Ethernet 0/1: RJ-45 connector, 10Base-T/100Base-TX/1000Base-T ARB : Mini D-sub connector Sync Input: BNC (j) x 1, Output : BNC (j) ×2
Power Supply		100 VAC to 120 VAC (±10%)/200 VAC to 240 VAC (–10%/+10%, Max.: 250 Vac), 50 Hz to 60 Hz (Rating), ≤1350 VA (Max.)
Dimensions and Mass		426 (W) × 221.5 (H) × 578 (D) mm (excl. protrusions), <40 kg (with all options)
Temperature Range & Humidity		Operation: +5°C to +40°C, Storage: –20°C to +60°C, ≤90% (no condensation)
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000: 2018

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MD8475B	Signalling Tester
	Standard Accessories
MX847500B	Platform Software
MX847501B	Control Software
J1211	POWER CORD.3M
P0031A	USB Memory
J1440A	LAN Cable (3 m)
Z0541A	USB Mouse
Z0975A	Keyboard (USB)
A0131A	Handset
	Hardware Options
MD8475B-002	Extended RF
MD8475B-004	Fading IO Option
MD8475B-005	IP Extension Option
	Software Options
MX847502B	Multi-cell Software
MX847506B	Quick TRX Diagnosis
MX847508B	Multimedia Interface Software
MX847508B-001	AMR-WB
	User Interface
MX847570B	SmartStudio
MX847570B-010	W-CDMA Option
MX847570B-011	HSPA Evolution/DC-HSDPA Option
MX847570B-020	GSM Option
MX847570B-050	LTE Option
MX847570B-051	LTE Carrier Aggregation Option
MX847570B-052	LTE Licensed Assisted Access (LAA) Option
MX847570B-060	IMS Script Basic Option
MX847570B-061	XCAP Script Option
MX847570B-062	IMS Log Import Option
MX847570B-070	WLAN Offload Basic Option
MX847570B-071	ePDG Option
MX847570B-072	ANDSF Option
MX847570B-073	Extended ePDG Option
MX847570B-080	Extended CSCF Option
MX847570B-081	IMS Supplementary Service Option
MX847570B-083	RCS Basic Option
MX847570B-084	GBA Authentication Option
MX847570B-085	IMS Early Media Option
MX847570B-086	RTP Frame Control Option
	LTE System
MD8475B-070	Multi-signalling Unit
MD8475B-071	Enhanced Multi-signalling Unit
MX847550B	LTE Simulation Software
MX847550B-020	LTE 2×2 MIMO Option
MX847550B-021	LTE 4×4 MIMO Option
MX847550B-030	LTE Licensed Assisted Access (LAA) Option
MX847550B-040	LTE Carrier Aggregation Option
MX847550B-041	LTE Carrier Aggregation DL3CCs Option
MX847550B-042	LTE Carrier Aggregation DL4CCs Option
MX847550B-043	LTE Carrier Aggregation DL5CCs Option
MX847550B-060	LTE RoHC Option
MX847550B-070	LTE 20 Layers Extension Option
MX847550B-090	LTE Anchor For 5GNR Option
	W-CDMA System
MD8475B-070	Multi-signalling Unit
MX847510B	W-CDMA Simulation Software
MX847510B-011	HSPA Evolution/DC-HSDPA Option
	GSM System
MD8475B-020	GSM Signalling Unit
MX847520B	GSM/GPRS Simulation Software
	TD-SCDMA System
MD8475B-070	Multi-signalling Unit
MD8475B-071	Enhanced Multi-signalling Unit
MX847540B	TD-SCDMA Simulation Software
	Automation Tools
MX847503A	SmartStudio Manager
MX847503A-601	SSM Test PKG European eCall
MX847503A-701	SSM Test PKG GOST 33467
MX847503A-923	eCall Tester Control Library
MX847504A	Smartphone Control Platform
Z1813A	USB Dongle (Automation)
	Scenario Tools
MX847580B	SIDE Execution Software
MX847580B-018	SIP Execution Option

Model/Order No.	Name
	Automotive Applications
MX703330E-PL010	eCall Tester (USB License)
MX703330E-PL020	eCall Tester (Software License)
MX703330E-UP020	eCall Tester (Switching from USB license to software license)
MX703330E-031	MSD ERA GLONASS Option
MX703330E-032	EGTS Server ERA GLONASS Option
MX703330E-041	NG112 LTE eCall Option
MX703330E-042	NG112 LTE eCall Semi Normal Test Option
MX703330E-047	South Korean eCall Option
MX703330E-061	Multi-Cell Option
	Ciphering Options
MX847510B-050	W-CDMA Ciphering Option
MX847520B-050	GSM/GPRS Ciphering Option
MX847540B-050	TD-SCDMA Ciphering Option
MX847550B-050	LTE Ciphering Option
	Software Support Services
MX847570B-SS110	MX847570B 1 Year Support Service
MX703330E-SS110	MX703330E 1 Year Support Service
	Technical Support Services
MX847570B-TS160	MX847570B-060 1 Year Technical Support Service
MX847570B-TS161	MX847570B-061 1 Year Technical Support Service
MX703330E-TS110	MX703330E 1 Year Technical Support Service
	Upgrade Kits*
MD8475B-UG□01	MD8475A to MD8475B Upgrade
MD8475B-UG□02	MD8475A to MD8475B Upgrade (with Ciphering)
MD8475B-UG□03	MD8475A to MD8475B Upgrade (with SIDE)
MD8475B-UG□04	MD8475A to MD8475B Upgrade (with Ciphering/SIDE)
MD8475B-UG□05	Windows 7 to Windows 10 Upgrade
MD8475B-UG□70	MSU Upgrade
MD8475B-UG□71	eMSU Upgrade (MD8475A to MD8475B)
MD8475B-UG□79	eMSU Upgrade (MD8475B-070 to MD8475B-071)
	Warranty
MD8475B-ES210	2 Years Extended Warranty Service
MD8475B-ES310	3 Years Extended Warranty Service
MD8475B-ES510	5 Years Extended Warranty Service
	Application Parts
B0703A	Rack Mount Kit
B0726A	Carrying Case
J0004	Coaxial Adaptor (N (male)-SMA (female))
J0127A	Coaxial Cord, 1.0 m (BNC-P · RG58A/U · BNC-P)
J0127B	Coaxial Cord, 2.0 m (BNC-P · RG58A/U · BNC-P)
J0322B	Coaxial Cord, 1.0 m
J0322D	Coaxial Cord, 2.0 m
J0658	Adapter (SMA male-female L-type)
J0576B	Coaxial Cord, 1.0 m (N-P · 5D-2W · N-P)
J0576D	Coaxial Cord, 2.0 m (N-P · 5D-2W · N-P)
J1263	W-CDMA Interface Cable (UE connection cable)
J1287	HDD-SUB15P Cable (milli-inch, for connecting MN8110B)
J1333A	HDD-SUB15P Crossover Cable (inch)
J1398A	N-SMA ADAPTOR
J1416A	LVDS Cable
J1440A	LAN Cable
J1489A	PP2S OUTPUT CABLE
J1524A	Dsub15-BNC Conversion Cable
J1651A	MD8475A Sync In Cable (for 3CC Test)
J1674A	SMA/P-SMA/P Soft Rigid Cable
J1674E	SMA/P-SMA/P Soft Rigid Cable (5 pcs)
J1674K	SMA/P-SMA/P Soft Rigid Cable (10 pcs)
MN8150A	RF Combiner Unit
P0135C6	Anritsu Test UICC GA (nano UICC Size)
P0135C7	Anritsu Test UICC GA (Micro UICC Size)
P0250C6	Anritsu Test UICC GT (nano UICC Size)
P0250C7	Anritsu Test UICC GT (Micro UICC Size)
P0260C6	Anritsu Test UICC GM (nano UICC Size)
P0260C7	Anritsu Test UICC GM (Micro UICC Size)
Z0749	MN8110B + Inch Screw Cable (for call processing I/O)
Z1858A	Divider (2 way)
Z1859A	Divider (3 way)
Z1908E	Standard Desktop for SSM
Z1919B	Standard Desktop for WLAN

*: MD8475B-UG □ ##
□: Select from the following according to the option type.
1: Retrofit option (Must be returned to factory in Japan)
2: Retrofit option (Must be returned to service center outside of Japan)

Radio Communication Analyzer

MT8821C

30 MHz to 3.8 GHz, 3.8 GHz to 6.0 GHz (Option)

Remote Control
GPIB | **Ethernet**

Tomorrow's Wireless Test Capability Today

Excellent Eco Product

The Radio Communication Analyzer MT8821C is designed for R&D into mobile devices (User Equipment: UE), such as smartphones, tablets and M2M modules. It builds on the technologies of its popular predecessor, the MT8820C used worldwide by UE and chipset vendors. It operates as a base station simulator using standard call processing sequences compliant with test standards to support a versatile test lineup, starting with RF tests.

Support Systems

- LTE/LTE-Advanced/Cat-M/NB-IoT (Cat-NB1, 2)
- W-CDMA/HSPA
- GSM/EGPRS
- TD-SCDMA/HSPA

More Efficient RF Testing Supporting LTE-Advanced UE Measurement

With the introduction of LTE-Advanced, wireless communications are starting to use Carrier Aggregation (CA) technology offering continuing extendibility to wider bandwidths and more frequency bands. Additionally, such as 2×2 and 4×4 Multiple Input Multiple Output (MIMO) to improve frequency usage efficiency, means that measurement technologies are also becoming increasingly complex.

Enhanced GUI for Efficient Operability

Better operability and visibility have been achieved using an enhanced next-generation GUI and easy-to-use large touch panel.
As well as operating screens by touching and swiping, easy operation is supported by one-touch switching between grouped/individual graph lists and results outline/detail displays.
Further, the efficiency of complex setting work is improved by a parameter search function, bookmarking function for commonly used parameters, and a function for setting test parameters using one-touch button operation.

3.2 Gbps PHY TPUT	Supports physical layer downlink maximum throughput 3.2 Gbps measurement* *: Under the condition of 8CC 4×4 MIMO (32 layer)
8 CA 4×4MIMO	Supports LTE-Advanced 8CC 4×4 MIMO tests
4 CA 2×2MIMO	Supports LTE-Advanced 4CC 2×2 MIMO tests in one unit
160 MHz BW	160 MHz wide frequency bandwidth (Generator/Analyzer) supports evolving UE technologies

Cellular IoT	Support RF measurement and IP data transfer test of LTE Category M1 and NB-IoT Category NB1,2
LAA	Supports tests of 5 GHz Unlicensed Band used by LAA and LTE-U
HPUE	Supports tests of HPUE (High Power User Equipment) which is the specification to improve communication environment by increasing out put power of UE
5G NSA Anchor	Supports 5G NSA (Non-Standalone) tests by interlocking with Radio Communication Test Station MT8000A

RF TRX Measurement

3GPP UE RF Measurement

The UE TRX characteristics must be evaluated for compliance with 3GPP/3GPP2 standards at chipset and UE development, evaluation, and acceptance testing by network operators, etc. UE circuits are becoming increasingly complex as more communications technologies and frequency bands are supported; with built-in support for the UE RF TRX tests compliant with the various communications standards, the MT8821C is the ideal test solution whatever the measurement scenario.

Supported 3GPP/3GPP2 Standards

Support Systems	RF TRX Measurements
LTE FDD/TDD (DL CA 2CC/3CC/4CC/5CC/6CC/7CC/8CC, UL CA 2CC)	3GPP TS 36.521-1 Chapter 6, 7
Cat-M1	
NB-IoT (Cat-NB1, 2)	
W-CDMA (HSPA, HSPA Evolution, (DB-)DC-HSDPA, 3C/4C-HSDPA, DC-HSUPA)	3GPP TS 34.121-1 Chapter 5, 6
GSM (GPRS, EGPRS)	3GPP TS 51.010-1 Chapter 12, 13, 14
TD-SCDMA (HSPA, HSPA Evolution)	3GPP TS 34.122 Chapter 5, 6

One-touch Settings and PASS/FAIL Judgment

With preset measurement parameters based on the 3GPP RF test standard cases, the MT8821C simplifies measurement. In addition, PASS/FAIL judgment of measurement results according to the test standard conditions is automated and results are confirmed at a glance. Until now, LTE CA measurements have required complex Component Carrier (CC) settings, making operation difficult, but the MT8821C integrates multiple related parameters settings into one operation, greatly simplifying each operation stage to reduce setting operations and time.

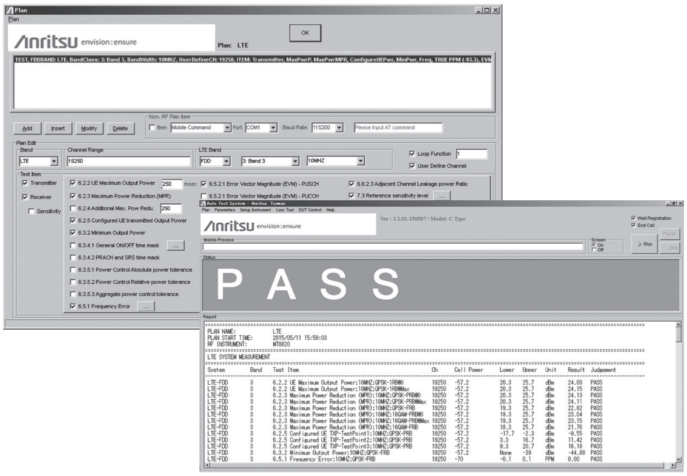
For example, only the following three steps are required using the LTE measurement software to measure the 3GPP TS 36.521-1 6.5.2.1 Error Vector Magnitude (EVM):

① Select test parameters
② Start measurement
③ Confirm PASS/FAIL judgment

3GPP RF Test Example

Remote Control Sample Tool

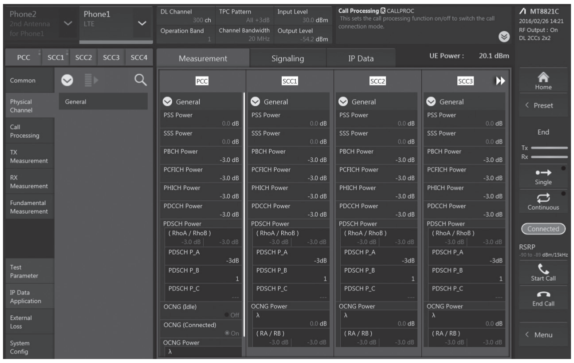
The MT8821C can be configured in an automated test system using either GPIB or Ethernet for remote control. Anritsu also provides the 3GPP RF test standard compliant automatic remote control sample tool. Operation is as simple as selecting the required test case from RF test items in the remote control sample tool, so even new users can easily configure automated test environment.



Remote Control Sample Tool

Flexible Parameter Setting

The MT8821C runs TRX measurements using parameters specified by the 3GPP/3GPP2 RF test standards. In addition, flexible parameter settings support both RF parametric and a range of protocol testing.



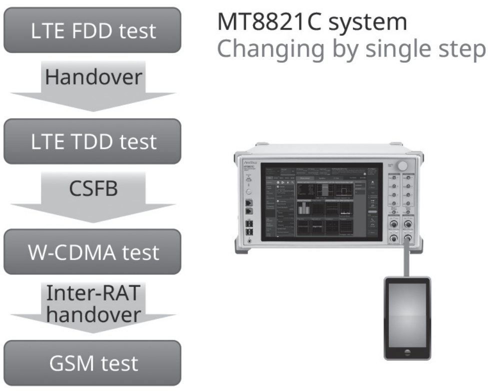
LTE Parameters Example

High Efficiency with Shorter Test Time

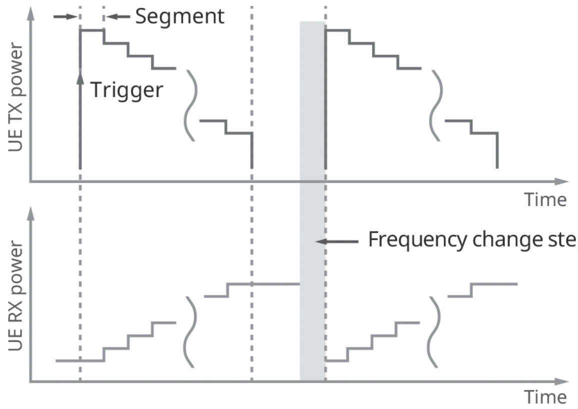
Test time is shortened for better efficiency by integrating multi-systems (several communications technologies) into one test by leveraging functions such as Circuit Switched fallback (CSFB), Inter-RAT handover, etc. These functions support testing without needing to switch between tester RF connectors or power-down and up again repeatedly.

RF Calibration

Recent UE designs support multiple frequency bands, requiring a lot of time for RF calibration. With high-speed measurement supported by chipsets vendors, the MT8821C increases measurement efficiency by reducing time required for RF calibration.



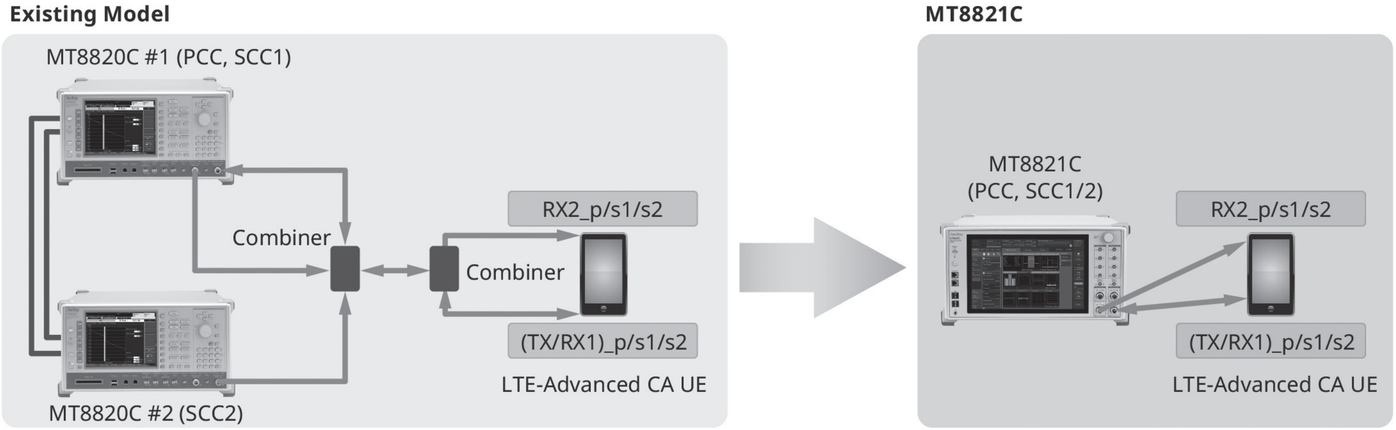
Test Example



UE TRX Calibration Example

Built-in Combiner

With its built-in combiner, the MT8821C eliminates the need to configure a complex test system using external parts, as well as troublesome calibration.

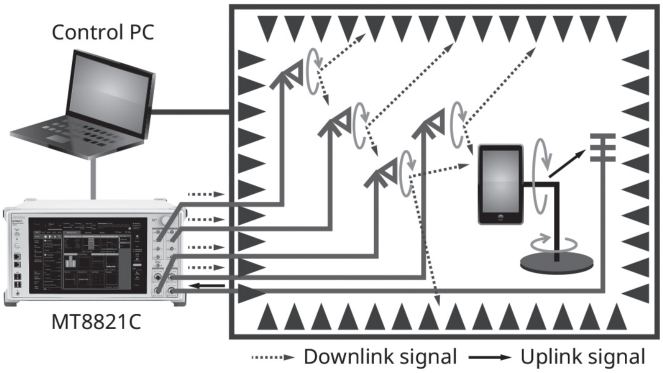


LTE-Advanced DL CA 3CC (SISO) Connection Example

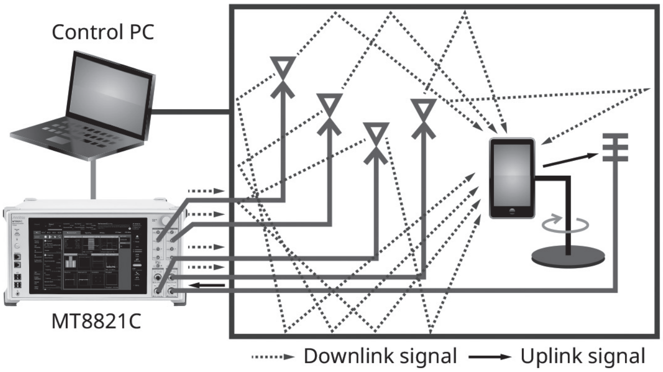
Functional Testing

Over The Air (OTA) Testing

The UE TRX performance is affected by factors such as the antenna form and characteristics. The OTA test measures the total UE TRX performance using actual radio waves reaching the antennas.
The MT8821C supports the various OTA vendor test system configurations in compliance with the 3GPP TS 34.114 and CTIA Total Radiated Power (TRP), and Total Radiated Sensitivity (TRS) test standards.



Anechoic Chamber

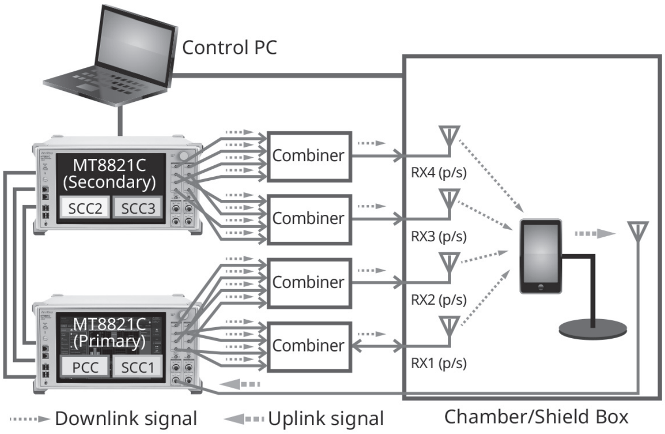


Reverberation Chamber

Moreover, it also supports the increasing number of test conditions demanded by higher antenna counts in UE units supporting LTE-Advanced CA and MIMO standards. Last, the shorter test time resulting from stable call processing performance is a key advantage of the MT8821C in various OTA test systems.

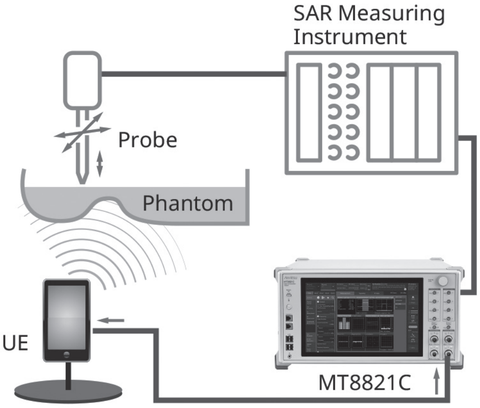
Support Systems	TRP	TRS	Comment
LTE FDD	✓	✓	SISO, 2×2 MIMO, DL CA 2CC/3CC/4CC/5CC/6CC/7CC/8CC, UL CA 2CC
LTE TDD	✓	✓	SISO, 2×2 MIMO, 4×4 MIMO, DL CA 2CC/3CC/4CC/5CC/6CC/7CC/8CC, UL CA 2CC
Cat-M1	✓	✓	
NB-IoT	✓	✓	Cat-NB1, 2
W-CDMA	✓	✓	HSPA, HSPA Evolution, DC-HSDPA
GSM	✓	✓	
GPRS/EGPRS	✓	✓	
TD-SCDMA	✓	✓	HSPA

Although one MT8821C unit can output up to 8 independent signals, DL 4CA 4×4 MIMO measurements require output of 16 signals. Using two linked MT8821C units supports unrestricted frequency allocation and bandwidth settings for all four CCs, enabling DL 4CA 4×4 MIMO measurements.



SAR (Specific Absorption Rate) Test

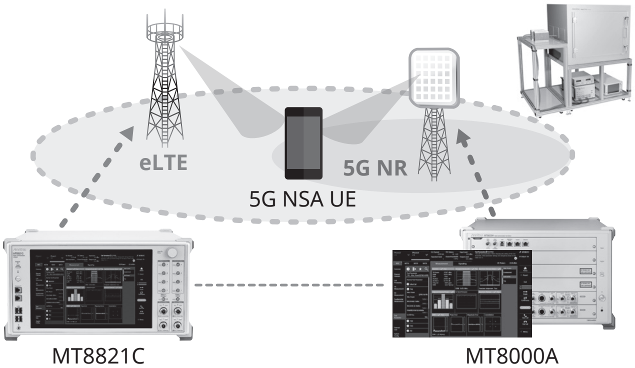
The SAR test evaluates the amount of energy in the electromagnetic waves radiated from a UE that is absorbed by a jig called a ‘phantom’ mimicking the human body. This test is designed to protect the health of UE users from the effects of electromagnetic waves.
The basic amount of absorbed energy is determined by the standard for each country and region.
The MT8821C supports the SAR test for each type of communication system.



SAR Test Setup Example

5G NSA (Non-Standalone) Testing

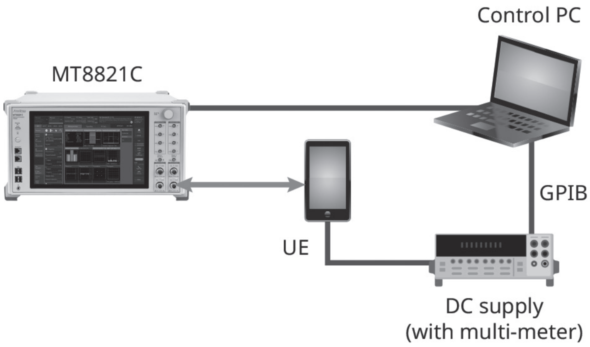
At the initial stage of 5G, NSA is considered as the main service form by many network operators who consider to realize 5G first network by adding 5G cell function to the existing LTE network. MT8821C can be the Anchor at 5G NSA call processing test by combining with Radio Communication Test Station MT8000A.



NSA-NR Network Configuration Example

Power Consumption Testing

Battery power consumption is a key point in differentiating chipsets and smartphones. As well as supporting the GSMA-defined power consumption tests, the MT8821C also supports power consumption tests at the maximum IP data throughput.

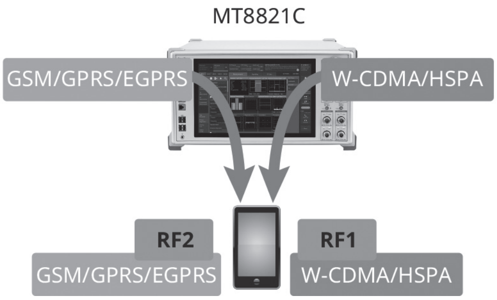


Power Consumption Test Example

Category	Procedure	Support Systems	Packet Rate (bps)
Power Consumption	Stan dBy Time Test	GSM	
		W-CDMA	
		LTE	
	MOMR: Talk Time Test	GSM	
		W-CDMA	
	MTNR: Talk Time Test	GSM	
		W-CDMA	
	Video Telephony Test	W-CDMA	
	Packet Switch Transfer Test (Download)	LTE	DL 5.16M, UL 5.54M @ 10 MHz
	Packet Switch Transfer Test (Upload)	LTE	DL 5.16M, UL 5.54M @ 10 MHz
	Packet Switch Transfer Test (Download/Upload)	LTE	DL 21.4M, UL 22.9M @ 10 MHz

Inter-RAT Measurement, DSDA RF Testing

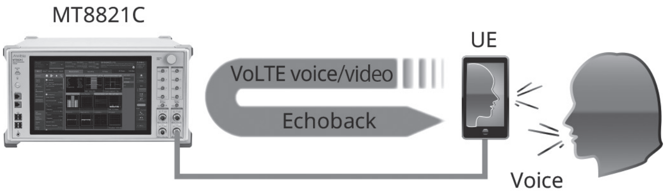
The all-in-one MT8821C can test two communications technologies simultaneously. As well as testing two UE units at the same time, it can also perform RF tests of a Dual SIM Dual Active (DSDA) dual-mode UE with two separate communications technologies for stan dBy and communications. It also supports Inter-RAT tests reporting the TX powers of base stations using different communications technologies to the UE.



VoLTE Voice/Video Echoback Testing

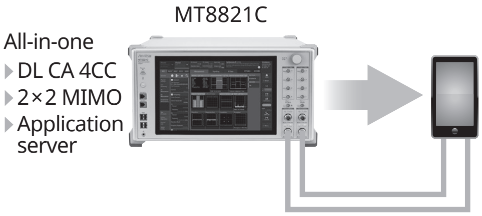
As VoLTE offering high-quality and low-latency voice calls becomes the de facto communications technology for recent UE, there is increasing demand for power consumption measurements during VoLTE calls as well as for confirmation of VoLTE call operations. However, setting the VoLTE IMS server is difficult.

With its built-in IMS server, the MT8821C reduces test preparation time and supports efficient VoLTE voice/video echoback tests, because the LTE measurement software GUI operations are also reflected at the IMS server.



End-to-End Communication Testing

As well as evaluating UE RF performance, the MT8821C also supports functional tests, such as IP data throughput, audio/video tests, etc. Video calls between two UE units can be tested using one MT8821C with installed Parallel Phone measurement option. Furthermore, with its built-in application server function, smartphone and tablet IP data throughput tests require only the MT8821C and UE.

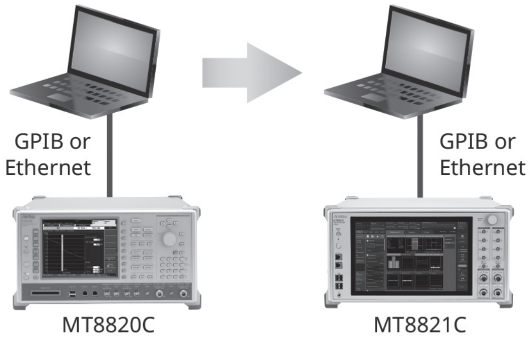


Backwards Compatibility

Remote Command

Since the MT8821C remote commands maintain good backwards compatibility with legacy MT8820 series, previously used remote tools are supported, helping reduce costs when configuring automated test environments.

Same PC tool can work



MT8820C to MT8821C Upgrade

Anritsu offers an upgrade path from the MT8820C to the MT8821C making full use of the existing MT8820C hardware and software to maximize previous investment in the MT8820C and keep MT8821C costs down.

System Configurations/Options/Software

Support Systems		LTE		IoT		W-CDMA	GSM	TD-SCDMA	HSPA	SEQ
		FDD	TDD	Cat-M	NB-IoT					
Main Frame		MT8821C Radio Communication Analyzer								
Unit Options		MT8821C-012 Parallel Phone Measurement Hardware								
		MT8821C-025 2nd RF for Phone1		—						
		MT8821C-026 3rd RF for Phone1								
		MT8821C-027 4th RF for Phone1								
		MT8821C-028 2nd RF for Phone2								
		MT8821C-029 3rd RF for Phone2								
		MT8821C-030 4th RF for Phone2								
Basic Configurations	Soft ware	MX882112C LTE FDD Measurement Software	MX882113C LTE TDD Measurement Software	MX882116C LTE Category M1 Measurement Software	MX882117C NB-IoT Measurement Software	MX882100C W-CDMA Measurement Software	MX882101C GSM Measurement Software	MX882107C TD-SCDMA Measurement Software	MX882115C W-CDMA HSPA Evolution IP Data Transfer	MX882120C Sequence Measurement Software
	Hard ware	MT8821C-008 LTE Measurement Hardware				MT8821C-001 W-CDMA Measurement Hardware	MT8821C-002 TDMA Measurement Hardware	MT8821C-001 W-CDMA Measurement Hardware MT8821C-007 TD-SCDMA Measurement Hardware	MT8821C-008 LTE Measurement Hardware	—
Options		MX882164C LTE VoLTE Echoback		—						
		MX882112C-010 LTE FDD Anchor For 5G NSA	MX882113C-010 LTE TDD Anchor For 5G NSA	MX882116C-006 LTE Category M1 IP Data Transfer	M882117C-001 NB-IoT Category NB-2 Measurement Software	MX882100C-019 W-CDMA HSPA Measurement Software	MX882101C-011 EGPRS Measurement Software	MX882107C-011 TD-SCDMA HSDPA Measurement Software	MX882115C-001 DC-HSDPA IP Data Transfer	MX882120C-001 W-CDMA Measurement Software
		MX882112C-021 LTE-Advanced FDD DL CA Measurement Software	MX882113C-021 LTE-Advanced TDD DL CA Measurement Software	—	MX882117C-002 NB-IoT Multi Carrier	MX882100C-032 DC-HSDPA Measurement Software	—	MX882107C-012 TD-SCDMA HSDPA Evolution Measurement Software	—	MX882120C-002 GSM Measurement Software
		MX882112C-022 LTE-Advanced FDD UL CA Measurement Software	MX882113C-022 LTE-Advanced TDD UL CA Measurement Software		MX882117C-006 NB-IoT IP Data Transfer	MX882100C-033 DC-HSUPA Measurement Software		MX882107C-021 TD-SCDMA HSUPA Measurement Software		MX882120C-004 LTE Measurement Software
		MX882112C-031 LTE-Advanced FDD DL CA 3CCs Measurement Software	MX882113C-031 LTE-Advanced TDD DL CA 3CCs Measurement Software		—	MX882100C-034 4C-HSDPA Measurement Software		—		MX882120C-005 TD-SCDMA Measurement Software
		MX882112C-041 LTE-Advanced FDD DL CA 4CCs Measurement Software	MX882113C-041 LTE-Advanced TDD DL CA 4CCs Measurement Software			—				—
		MX882112C-051 LTE-Advanced FDD DL CA 5CCs Measurement Software	MX882113C-051 LTE-Advanced TDD DL CA 5CCs Measurement Software							
		MX882112C-061 LTE-Advanced FDD DL CA 6CCs Measurement Software	MX882113C-061 LTE-Advanced TDD DL CA 6CCs Measurement Software							
		MX882112C-071 LTE-Advanced FDD DL CA 7CCs Measurement Software	MX882113C-071 LTE-Advanced TDD DL CA 7CCs Measurement Software							
		MX882112C-081 LTE-Advanced FDD DL CA 8CCs Measurement Software	MX882113C-081 LTE-Advanced TDD DL CA 8CCs Measurement Software							
		MX882112C-011 LTE FDD 2×2 MIMO DL	MX882113C-011 LTE TDD 2×2 MIMO DL							
		MX882112C-012 LTE FDD 4×4 MIMO DL	MX882113C-012 LTE TDD 4×4 MIMO DL							
		MX882112C-006 LTE FDD IP Data Transfer	MX882113C-006 LTE TDD IP Data Transfer							
		MX882112C-026 LTE-Advanced FDD DL CA IP Data Transfer	MX882113C-026 LTE-Advanced TDD DL CA IP Data Transfer							
		MX882112C-036 LTE-Advanced FDD DL CA 3CCs IP Data Transfer	MX882113C-036 LTE-Advanced TDD DL CA 3CCs IP Data Transfer							
		MX882112C-046 LTE-Advanced FDD DL CA 4CCs IP Data Transfer	MX882113C-046 LTE-Advanced TDD DL CA 4CCs IP Data Transfer							

Specifications

Radio Communication Analyzer MT8821C

Receiver	Frequency range: 30 MHz to 3.8 GHz 30 MHz to 6.0 GHz (with MT8821C-019) Maximum input level: +35 dBm (Main 1, 2) +10 dBm (SG Input)
Transmitter	Frequency Output frequency range: 30 MHz to 3.8 GHz 30 MHz to 6.0 GHz (with MT8821C-019) Setting resolution: 1 Hz Accuracy: Depends on reference oscillator accuracy Output level Level range Main 1, 2: –140 to –10 dBm (Internal signal generator TX 1 output) –140 to –16 dBm (Internal signal generator TX 2, 3, or 4 output) (with MT8821C-025, 026, 027 or with MT8821C-012, 028, 029, 030) Aux 1, 2, 3, 4: –125 to +5 dBm (Aux 2, 3, 4: With MT8821C-025, 026, 027 or with MT8821C-012, 028, 029, 030) Resolution: 0.1 dB Level accuracy 10°C to 40°C, After Cal Main 1, 2 Level: ≥–120 dBm, SG Input: Off When outputting from either of Main 1 or 2. Except effect of noise floor from the other internal signal generators. ±1.5 dB (Frequency < 350 MHz, Internal signal generator TX 1 output) ±1.0 dB, ±0.7 dB (typ.) (350 MHz ≤ Frequency ≤ 3.8 GHz) ±1.3 dB, ±1.0 dB (typ.) (3.8 GHz < Frequency ≤ 6.0 GHz) Aux 1, 2, 3, 4 Level: ≥–110 dBm ±1.5 dB (Frequency < 350 MHz) ±1.0 dB, ±0.7 dB (typ.) (350 MHz ≤ Frequency ≤ 3.8 GHz) ±1.3 dB, ±1.0 dB (typ.) (3.8 GHz < Frequency ≤ 6.0 GHz) Signal purity Non-harmonic spurious: ≤–30 dBc (offset frequency: ≥100 kHz) Harmonics: ≤–25 dBc
Reference Oscillator	Reference oscillator Frequency: 10 MHz Start-up characteristics: ≤5 × 10^{-8} (10 min. after power-on referenced to frequency 24-hour after power-on) Aging rate: ≤2 × 10^{-8}/day, ≤1 × 10^{-7}/year (referenced to frequency 24-hour after power-on) Temperature characteristics: ≤5 × 10^{-8} Frequency accuracy before shipment: ±2.2 × 10^{-8} (20°C to 30°C, 1 hour after power-on) Output connector: BNC-J, Level: TTL External reference input Frequency: 10 MHz or 13 MHz Operating range: ±1 ppm
Display	12.1-inch WXGA, 1280 × 800 pixels, color TFT LCD Touch panel: Projected capacitive type, multi-touch gestures
Front-panel Connectors	RF input/output Main 1, 2 Connector: N-J, 50Ω (nom.) VSWR: ≤1.35 (30 MHz ≤ Frequency < 350 MHz) ≤1.30 (350 MHz ≤ Frequency < 450 MHz) ≤1.20 (450 MHz ≤ Frequency ≤ 1.6 GHz) ≤1.30 (1.6 GHz < Frequency ≤ 3.8 GHz) (Main 1) ≤1.30 (1.6 GHz < Frequency ≤ 2.7 GHz) (Main 2) ≤1.35 (2.7 GHz < Frequency < 2.9 GHz) (Main 2) ≤1.30 (2.9 GHz ≤ Frequency ≤ 3.8 GHz) (Main 2) ≤1.40 (3.8 GHz < Frequency ≤ 6.0 GHz) Aux 1, 2, 3, 4 Connector: SMA-J, 50Ω (nom.) VSWR: SG output level: ≤–10 dBm ≤1.40 (30 MHz ≤ Frequency < 300 MHz) ≤1.30 (300 MHz ≤ Frequency ≤ 3.8 GHz) ≤1.60 (3.8 GHz < Frequency ≤ 6.0 GHz) SG Input Connector: SMA-J, 50Ω (nom.) VSWR: ≤1.40 (300 MHz ≤ Frequency ≤ 3.8 GHz) ≤1.60 (3.8 GHz < Frequency ≤ 6.0 GHz) Monitor Connector: SMA-J, 50Ω (nom.) VSWR: ≤1.30 (300 MHz ≤ Frequency ≤ 3.8 GHz) ≤1.60 (3.8 GHz < Frequency ≤ 6.0 GHz) Other Handset 1, 2: For dedicated handset Connector: RJ-12 USB Connector: USB 2.0, 4 ports

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Rear-panel Connectors		Reference signal 10 MHz Buf Out: For internal reference oscillator output Connector: BNC-J Frequency: 10 MHz Level: TTL 10 MHz/13 MHz Ref In: For external reference signal input Connector: BNC-J, 50Ω (nom.) Level: ≥0 dBm Control GPIB 1, 2: For remote control Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2 Connector: GPIB (IEEE 488) Remote 1, 2 (Ethernet): For remote control Connector: RJ-45 (10/100/1000BASE-T) Data input/output Application Server 1, 2: For data transfer tests Connector: RJ-45 (1000BASE-T) RS-232C 1, 2: For data transfer tests Connector: D-sub 9-pin (RS-232) Call Proc I/O 1, 2: For call processing timing signal input/output Connector: Mini D-sub 15-pin Signal level: TTL, LVCMOS 10BASE-T 1, 2: For data transfer tests Connector: RJ-45 (10BASE-T) 1000BASE-T 1, 2: For data transfer tests Connector: RJ-45 (1000BASE-T) Aux: For ARB input/output Connector: Mini D-sub 15-pin Signal level: LVCMOS Trigger Frame Trig Output 1, 2: For frame trigger output Event Trig Input 1, 2: For event trigger input Event Trig Output 1, 2: For event trigger output Connector: BNC-J Signal level: TTL Audio AF Output 1, 2: For AF output Connector: BNC-J AF Input 1, 2: For AF input Connector: BNC-J Maximum input level: 30 V (RMS) Other USB: For general-purpose I/F Connector: USB 3.0, 2 ports VGA: For external display Connector: Mini D-sub 15-pin Signal level: Analog RGB MEAS 1, 2: Not used Connector: RJ-45
Storage Device		2.5-inch SSD
Power Supply		100 VAC to 120 VAC/200 VAC to 240 VAC (250 V max.), 50 Hz/60 Hz ≤1200 VA (with all options)
Dimensions and Mass		426 (W) × 221.5 (H) × 578 (D) mm (excluding projections) ≤40 kg (with all options)
Environmental Conditions		Temperature and Humidity Operating: +5°C to +40°C, ≤90% RH (no condensation) Storage: –20°C to +60°C, ≤85% RH (no condensation)
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000: 2018

LTE Measurement Hardware MT8821C-008, LTE FDD Measurement Software MX882112C, LTE TDD Measurement Software MX882113C

Frequency/Modulation Measurement	Frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 5.0 GHz (with MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE operating band 31) Input level: –40 to +35 dBm (Main1, 2) Carrier frequency accuracy: ± (Set frequency × Reference oscillator accuracy + 15 Hz) Modulation accuracy (residual vector error): ≤2.5% (400 MHz ≤ frequency ≤ 3.8 GHz, Measurement count: 20) ≤3.5% (3.8 GHz < frequency ≤ 5.0 GHz, Measurement count: 20) In-band emissions: ≤–40 dB (≥–10 dBm, Allocated RB: ≤18) Measurement object: PUSCH, PRACH, PUCCH

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Amplitude Measurement	Frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 5.0 GHz (with MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE operating band 31) Input level: –60 to +35 dBm (Main1, 2) Measurement accuracy 10°C to 40°C, After Cal, 400 MHz ≤ frequency ≤ 3.8 GHz ±0.3 dB (typ.), ±0.5 dB (–20 to +35 dBm), ±0.7 dB (–50 to –20 dBm), ±0.9 dB (–60 to –50 dBm) 20°C to 30°C, After Cal, 3.8 GHz < frequency ≤ 5.0 GHz ±0.7 dB (–20 to +35 dBm), ±0.9 dB (–50 to –20 dBm), ±1.1 dB (–60 to –50 dBm) Linearity 400 MHz to 5.0 GHz, –40 to 0 dB ±0.2 dB (≥–50 dBm), ±0.4 dB (≥–60 dBm) Measurement object: PUSCH, PUCCH, PRACH
Occupied Bandwidth	Frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 5.0 GHz (with MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE operating band 31) Input level: –10 to +35 dBm (Main1, 2) Channel bandwidth: 1.4, 3, 5 MHz (452.5 MHz ≤ UL frequency ≤ 457.5 MHz) 1.4, 3, 5, 10, 15, 20 MHz (500 MHz ≤ UL frequency)
Adjacent Channel Leakage Power	Frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 5.0 GHz (with MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE operating band 31) Input level: –10 to +35 dBm (Main1, 2) Measurement point: E-UTRA ACLR 1, UTRA ACLR 1, UTRA ACLR 2 Measurement range: ≥45 dB (E-UTRA ACLR1), ≥50 dB (UTRA ACLR1), ≥55 dB (UTRA ACLR2) Channel bandwidth: 1.4, 3, 5 MHz (452.5 MHz ≤ UL frequency ≤ 457.5 MHz) 1.4, 3, 5, 10, 15, 20 MHz (500 MHz ≤ UL frequency)
Spectrum Emission Mask	Frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 5.0 GHz (with MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE operating band 31) Input level: –10 to +35 dBm (Main1, 2) Channel bandwidth: 1.4, 3, 5 MHz (452.5 MHz ≤ UL frequency ≤ 457.5 MHz) 1.4, 3, 5, 10, 15, 20 MHz (500 MHz ≤ UL frequency)
RF Signal Generator	Output frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 6.0 GHz (with MT8821C-019) 1 Hz steps Output level Main: –140 to –10 dBm (Modulation: Off), –142 to –12 dBm (Modulation: On) Aux: –125 to +5 dBm (Modulation: Off), –127 to +3 dBm (Modulation: On) AWGN level: Off, –20 to +5 dB (0.1 dB steps, relative level to Ior) AWGN level accuracy: ±0.2 dB (relative level accuracy to Ior)
Throughput Measurement	Measures throughput using RMC Measurement object: ACK and NACK reported from UE
Call Processing	Call control: Location registration, Call processing using RMC (executes each 3GPP-defined processing and performs Pass/Fail evaluation) UE control: Output level (executes each 3GPP-defined UE control)

LTE FDD/TDD Anchor For 5G NSA MX882112C/13C-010

Function	Supports call processing test of 5G Non-Standalone environment as the Anchor between 5G supported UE.

LTE Category M1 Measurement Software MX882116C

Function	RF TRX measurement for LTE Category M1
Frequency/ Modulation Measurement	Frequency range: 400 MHz to 3.8 GHz 3.8 GHz to 5.0 GHz (With MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz≤frequency≤457.5 MHz (LTE Operating Band 31) Input level: -40 to +35 dBm (Main1, 2) Carrier frequency accuracy: ± (Set frequency × Reference oscillator accuracy + 15 Hz) Modulation accuracy (residual vector error): ≤2.5% (400 MHz≤frequency≤3.8 GHz, Measurement count: 20) ≤3.5% (3.8 GHz<frequency≤5.0 GHz, Measurement count: 20) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz≤frequency≤457.5 MHz (LTE Operating Band 31) In-band Emmisions: ≤–40 dB (≥–10 dBm, Allocated RB≤18) Measurement object: PUSCH
Amplitude Measurement	Frequency range: 400 MHz to 3.8 GHz 3.8 GHz to 5.0 GHz (With MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz≤frequency≤457.5 MHz (LTE Operating Band 31) Input level: –60 to +35 dBm (Main1, 2) Measurement accuracy: ±0.5 dB, ±0.3 dB (typ.) (–20 to +35 dBm), ±0.7 dB (–50 to –20 dBm), ±0.9 dB (–60 to –50 dBm), 400 MHz≤frequency≤3.8 GHz, After Cal, 10°C to 40°C ±0.7 dB (–20 to +35 dBm), ±0.9 dB (–50 to –20 dBm), ±1.1 dB (–60 to –50 dBm), 3.8 GHz<frequency≤5.0 GHz, After Cal, 20°C to 30°C ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz≤frequency≤457.5 MHz (LTE Operating Band 31) Linearity: ±0.2 dB (–40 to 0 dB, ≥–50 dBm), ±0.4 dB (–40 to 0 dB, ≥–60 dBm), 400 MHz≤frequency≤5000 MHz ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz≤frequency≤457.5 MHz (LTE Operating Band 31) Measurement object: PUSCH

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Occupied Bandwidth	Frequency range: 400 MHz to 3.8 GHz 3.8 GHz to 5.0 GHz (With MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE Operating Band 31) Input level: –10 to +35 dBm (Main1, 2) Channel bandwidth: 1.4 MHz, 3 MHz, 5 MHz (452.5 MHz≤UL frequency≤457.5 MHz) 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz (500 MHz≤UL frequency)
Adjacent Channel Leakage Power	Frequency range: 400 MHz to 3 .8 GHz 3.8 GHz to 5.0 GHz (With MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE Operating Band 31) Input level: –10 to +35 dBm (Main1, 2) Measurement point: E-UTRA ACLR1, UTRA ACLR1, UTRA ACLR2 Measurement range: ≥45 dB (E-UTRA ACLR1), ≥50 dB (UTRA ACLR1), ≥55 dB (UTRA ACLR2) Channel bandwidth: 1.4 MHz, 3 MHz, 5 MHz (452 .5 MHz≤UL frequency≤457 .5 MHz) 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz (500 MHz≤UL frequency)
Spectrum Emission Mask	Frequency range: 400 MHz to 3 .8 GHz 3.8 GHz to 5.0 GHz (With MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452 .5 MHz to 457 .5 MHz (LTE Operating Band 31) Input level: –10 to +35 dBm (Main1, 2) Channel bandwidth: 1.4 MHz, 3 MHz, 5 MHz (452 .5 MHz≤UL frequency≤457 .5 MHz) 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz (500 MHz≤UL frequency)
RF Signal Generator	Output frequency range: 400 MHz to 3.8 GHz (1Hz steps) 3.8 GHz to 6.0 GHz (1Hz steps) (With MT8821C-019)
Throughput Measurement	Measures throughput using RMC Measurement object: ACK and NACK reported from UE
Call Processing	Call control: Location registration, Call processing using RMC (executes each 3GPP-defined processing and performs Pass/Fail evaluation) UE control: Output level (executes each 3GPP-defined UE control)

NB-IoT Measurement Software MX882117C, NB-IoT Category NB-2 Measurement Software NX882117C-001

Function	RF TRX measurement for NB-IoT
Frequency/ Modulation Measurement	Frequency range: 400 MHz to 3.8 GHz 3.8 GHz to 5.0 GHz (With MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz≤frequency≤457.5 MHz (LTE Operating Band 31) Input level: –40 to +35 dBm (Main1, 2) Carrier frequency accuracy: ± (Set frequency × Reference oscillator accuracy + 15 Hz) Modulation accuracy (residual vector error): ≤2.5% (400 MHz≤frequency≤3.8 GHz, Measurement count: 20) ≤3.5% (3.8 GHz<frequency≤5.0 GHz, Measurement count: 20) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz≤frequency≤457.5 MHz (LTE Operating Band 31) In-band Emmisions: ≤–40 dB (≥–10 dBm, Allocated RB≤18) Measurement object: NPUSCH
Amplitude Measurement	Frequency range: 400 MHz to 3.8 GHz 3.8 GHz to 5.0 GHz (With MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz≤frequency≤457.5 MHz (LTE Operating Band 31) Input level: –60 to +35 dBm (Main1, 2) Measurement accuracy: ±0.5 dB, ±0.3 dB (typ.) (–20 to +35 dBm), ±0.7 dB (–50 to –20 dBm), ±0.9 dB (–60 to –50 dBm), 400 MHz≤frequency≤3.8 GHz, After Cal, 10°C to 40°C ±0.7 dB (–20 to +35 dBm), ±0.9 dB (–50 to –20 dBm), ±1.1 dB (–60 to –50 dBm), 3.8 GHz<frequency≤5.0 GHz, After Cal, 20°C to 30°C ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz≤frequency≤ 457.5 MHz (LTE Operating Band 31) Linearity: ±0.2 dB (–40 to 0 dB, ≥–50 dBm), ±0.4 dB (–40 to 0 dB, ≥–60 dBm), 400 MHz≤frequency≤5000 MHz ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz≤frequency≤457.5 MHz (LTE Operating Band 31) Measurement object: NPUSCH
Occupied Bandwidth	Frequency range: 400 MHz to 3.8 GHz 3.8 GHz to 5.0 GHz (With MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE Operating Band 31) Input level: –10 to +35 dBm (Main1, 2)
Adjacent Channel Leakage Power	Frequency range: 400 MHz to 3.8 GHz 3.8 GHz to 5.0 GHz (With MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE Operating Band 31) Input level: –10 to +35 dBm (Main1, 2) Measurement point: GSMACLR, UTRA ACLR Measurement range: ≥33 dB (GSMACLR), ≥50 dB (UTRA ACLR)
Spectrum Emission Mask	Frequency range: 400 MHz to 3 .8 GHz 3.8 GHz to 5.0 GHz (With MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452 .5 MHz to 457 .5 MHz (LTE Operating Band 31) Input level: –10 to +35 dBm (Main1, 2)
RF Signal Generator	Output frequency range: 400 MHz to 3.8 GHz (1Hz steps) 3.8 GHz to 6.0 GHz (1Hz steps) (With MT8821C-019)
Throughput Measurement	Measures throughput using RMC Measurement object: ACK and NACK reported from UE
Call Processing	Call control: Location registration, Call processing using RMC (executes each 3GPP-defined processing) UE control: Output level (executes each 3GPP-defined UE control)

LTE-Advanced FDD/TDD DL CA Measurement Software MX882112C/13C-021

Function	This option for the MX882112C/13C measures DL CA RX performance.
RF Signal Generator	Output frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 6.0 GHz (with MT8821C-019) 1 Hz steps Output level Main output (CC output levels at Carrier Aggregation) –140 to –16 dBm (Modulation Off) –142 to –18 dBm (Modulation On) Aux output –125 to +5 dBm (Modulation Off) –127 to +3 dBm (Modulation On)
Throughput Measurement	Function Throughput measurement using RMC Measurement target ACK and NACK reported from UE

LTE-Advanced FDD/TDD UL CA Measurement Software MX882112C/13C-022

Function	This option for the MX882112C/13C measures the UL CA 2CC TRX performance.
Frequency/Modulation Measurement	Depends on MX882112C/13C performance except frequency range and modulation accuracy at CC measurement. Frequency range: 500 MHz to 3.8 GHz, 3.8 GHz to 4.2 GHz (with MT8821C-019) Modulation accuracy (residual vector error): ≤2.5% (500 MHz ≤ frequency ≤ 3.8 GHz, Measurement count: 20) ≤3.5% (3.8 GHz < frequency ≤ 4.2 GHz, Measurement count: 20) Measurement object: PUSCH
Amplitude Measurement	Depends on MX882112C/13C performance except frequency range, measurement accuracy and linearity at CC measurement. Frequency range: 500 MHz to 3.8 GHz, 3.8 GHz to 4.2 GHz (with MT8821C-019) Measurement accuracy Except intraband contiguous CA SCC and PCC+SCC measurement 10°C to 40°C, After Cal, 500 MHz ≤ frequency ≤ 3.8 GHz ±0.3 dB (typ.), ±0.5 dB (–20 to +35 dBm), ±0.7 dB (–50 to –20 dBm), ±0.9 dB (–60 to –50 dBm) 20°C to 30°C, After Cal, 3.8 GHz < frequency ≤ 4.2 GHz ±0.7 dB (–20 to +35 dBm), ±0.9 dB (–50 to –20 dBm), ±1.1 dB (–60 to –50 dBm) Intraband contiguous CA SCC and PCC+SCC measurement 10°C to 40°C, After Cal, 500 MHz ≤ frequency ≤ 3.0 GHz ±0.7 dB (–50 to +35 dBm), ±0.9 dB (–60 to –50 dBm) 10°C to 40°C, After Cal, 3.0 GHz ≤ frequency ≤ 3.8 GHz ±1.0 dB (–50 to +35 dBm), ±1.3 dB (–60 to –50 dBm) 20°C to 30°C, After Cal, 3.8 GHz < frequency ≤ 4.2 GHz ±1.0 dB (–50 to +35 dBm), ±1.3 dB (–60 to –50 dBm) Linearity 20°C to 30°C, –40 to 0 dB ±0.2 dB (≥–50 dBm), ±0.4 dB (≥–60 dBm)
Occupied Bandwidth	Depends on MX882112C/13C performance except frequency range at CC or contiguous CC measurement. Frequency range: 500 MHz to 3.8 GHz, 3.8 GHz to 4.2 GHz (with MT8821C-019) Measurement object: PUSCH
Adjacent Channel Leakage Power	Depends on MX882112C/13C performance except frequency range and measurement range at CC or contiguous CC measurement. Frequency range: 500 MHz to 3.8 GHz, 3.8 GHz to 4.2 GHz (with MT8821C-019) Measurement range: ≥45 dB (E-UTRA ACLR1), ≥50 dB (UTRA ACLR1), ≥55 dB (UTRA ACLR2) Measurement object: PUSCH
Spectrum Emission Mask	Depends on MX882112C/13C performance except frequency range at CC or contiguous CC measurement. Frequency range: 500 MHz to 3.8 GHz, 3.8 GHz to 4.2 GHz (with MT8821C-019) Measurement object: PUSCH
RF Signal Generator	Output frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 6.0 GHz (with MT8821C-019) 1 Hz steps Output level range (output level range for each CC when CC signals combined and output) Main: –140 to –16 dBm (Modulation: Off), –142 to –18 dBm (Modulation: On) Aux: –125 to +5 dBm (Modulation: Off), –127 to +3 dBm (Modulation: On)
Throughput Measurement	Measures throughput using RMC Measurement object: ACK and NACK reported from UE

LTE-Advanced FDD/TDD DL CA 3CCs Measurement Software MX882112C/13C-031

Function	This option for the MX882112C/13C measures DL CA 3CC/UL CA 1CC RX performance.
RF Signal Generator	Output frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 6.0 GHz (with MT8821C-019) 1 Hz steps Output level Main output (CC output levels at Carrier Aggregation) –140 to –16 dBm (Modulation Off) –142 to –18 dBm (Modulation On) Aux output –125 to +5 dBm (Modulation Off) –127 to +3 dBm (Modulation On)
Throughput Measurement	Function Throughput measurement using RMC Measurement target ACK and NACK reported from UE

LTE-Advanced FDD/TDD DL CA 4CCs Measurement Software MX882112C/13C-041

Function	This option for the MX882112C/13C measures DL CA 4CC/UL CA 1CC RX performance.
RF Signal Generator	Output frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 6.0 GHz (with MT8821C-019) 1 Hz steps Output level Main output (CC output levels at Carrier Aggregation) –140 to –16 dBm (Modulation Off) –142 to –18 dBm (Modulation On) Aux output –125 to +5 dBm (Modulation Off) –127 to +3 dBm (Modulation On)
Throughput Measurement	Function Throughput measurement using RMC Measurement target ACK and NACK reported from UE

LTE-Advanced FDD/TDD DL CA 5CCs Measurement Software MX882112C/13C-051

Function	This option for the MX882112C/13C measures DL CA 5CC/UL CA 1CC RX performance
RF Signal Generator	Output frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 6.0 GHz (with MT8821C-019) 1 Hz per step Output level Main output (CC output levels at Carrier Aggregation) –140 to –16 dBm (Modulation Off), –142 to –18 dBm (Modulation On) Aux output –125 to +5 dBm (Modulation Off), –127 to +3 dBm (Modulation On)
Throughput Measurement	Function Throughput measurement using RMC Measurement target ACK and NACK reported from UE

LTE-Advanced FDD/TDD DL CA 6CCs Measurement Software MX882112C/13C-061

Function	This option for the MX882112C measures DL CA 6CC/UL CA 1CC RX performance
RF Signal Generator	Output frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 6.0 GHz (with MT8821C-019) 1 Hz per step Output level Main output (CC output levels at Carrier Aggregation) –140 to –16 dBm (Modulation Off), –142 to –18 dBm (Modulation On) Aux output –125 to +5 dBm (Modulation Off), –127 to +3 dBm (Modulation On)
Throughput Measurement	Function Throughput measurement using RMC Measurement target ACK and NACK reported from UE

LTE-Advanced FDD/TDD DL CA 7CCs Measurement Software MX882112C/13C-071

Function	This option for the MX882112C measures DL CA 7CC/UL CA 1CC RX performance
RF Signal Generator	Output frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 6.0 GHz (with MT8821C-019) 1 Hz per step Output level Main output (CC output levels at Carrier Aggregation) –140 to –16 dBm (Modulation Off), –142 to –18 dBm (Modulation On) Aux output –125 to +5 dBm (Modulation Off), –127 to +3 dBm (Modulation On)
Throughput Measurement	Function Throughput measurement using RMC Measurement target ACK and NACK reported from UE

LTE-Advanced FDD/TDD DL CA 8CCs Measurement Software MX882112C/13C-081

Function	This option for the MX882112C measures DL CA 8CC/UL CA 1CC RX performance
RF Signal Generator	Output frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 6.0 GHz (with MT8821C-019) 1 Hz per step Output level Main output (CC output levels at Carrier Aggregation) –140 to –16 dBm (Modulation Off), –142 to –18 dBm (Modulation On) Aux output –125 to +5 dBm (Modulation Off), –127 to +3 dBm (Modulation On)
Throughput Measurement	Function Throughput measurement using RMC Measurement target ACK and NACK reported from UE

W-CDMA Measurement Hardware MT8821C-001, W-CDMA Measurement Software MX882100C

Frequency/ Modulation Measurement	Frequency range: 350 MHz to 2.7 GHz ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE operating band 31) Input level: –30 to +35 dBm (Main1, 2) Carrier frequency accuracy: ± (Set frequency × Reference oscillator accuracy + 10 Hz) Modulation accuracy (residual vector error): ≤2.5% (input signal: one DPCCH and one DPDCH)
Amplitude Measurement	Frequency range: 350 MHz to 2.7 GHz ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE operating band 31) Input level: –65 to +35 dBm (Main1, 2) Measurement accuracy 10°C to 40°C, After Cal ±0.3 dB (typ.), ±0.5 dB (–30 to +35 dBm), ±0.7 dB (–55 to –30 dBm), ±0.9 dB (–65 to –55 dBm) Linearity: ±0.2 dB (–40 to 0 dB, ≥–55 dBm), ±0.4 dB (–40 to 0 dB, ≥–65 dBm) Relative Measurement Error: ±0.10 dB (–40 to 0 dB, ≥–50 dBm) (range: <2 dB) Measurement object: DPCH, PRACH
Occupied Bandwidth	Frequency range: 350 MHz to 2.7 GHz ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE operating band 31) Input level: –10 to +35 dBm (Main1, 2)
Adjacent Channel Leakage Power	Frequency range: 350 MHz to 2.7 GHz ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE operating band 31) Input level: –10 to +35 dBm (Main1, 2) Measurement range: ≥50 dB (±5 MHz), ≥55 dB (±10 MHz)
RF Signal Generator	Output frequency range: 300 MHz to 2.7 GHz, 1 Hz steps Channel level CPICH, P-CCPCH, SCH, PICH, DPCH, S-CCPCH, AICH: Off, –30 to 0 dB (0.1 dB steps, relative level to Ior) OCNS: Off, Automatic setting Channel level accuracy: ±0.2 dB (relative level accuracy to Ior) AWGN level: Off, –20 to +5 dB (0.1 dB steps, relative level to Ior) AWGN level accuracy: ±0.2 dB (relative level accuracy to Ior)
Error Rate Measurement	Measures BER, BLER Measurement object: Loopback data on uplink DTCH Serial data input from call processing I/O port (rear panel) (BER)
Call Processing	Call control: Location registration, Call origination, Call termination, Network-side release, UE-side release (executes each 3GPP-defined processing and performs Pass/Fail evaluation) UE control: Output level, Loopback (executes each 3GPP-defined UE control)

W-CDMA HSPA Measurement Software MX882100C-019

Function	This option for the MX882100C measures W-CDMA HSPA/HSPA Evolution TRX performance, and performs HSDPA-related peak-rate throughput tests for H-Set 6 and 8, and Category 6, 8, 9, 10, 13 and 14 UE.
Amplitude Measurement	Depends on MX882100C performance Measurement object: DPCH, HS-DPCCH, E-DPCCH, E-DPDCH
Throughput Measurement	Measures throughput using H-Set or throughput using peak-rate equivalent HS-SCCH and HS-PDSCH at H-Set 6 and 8 Category 6, 8, 9, 10, 13 and 14 UE. Measurement object: HS-DPCCH ACK and NACK
Call Processing	Call control: Location registration, Fixed Reference Channel, E-DCH RF Test (executes each 3GPP-defined processing and performs Pass/Fail evaluation) UE control: Output level (executes each 3GPP-defined UE control) Monitoring: Monitors E-TFCI included in uplink E-DPCCH and measures E-DCH throughput

DC-HSDPA Measurement Software MX882100C-032

Function	This option for the MX882100C measures DC-HSDPA RX performance.
Throughput Measurement	Measures throughput using H-Set or throughput using peak-rate equivalent HS-SCCH and HS-PDSCH at H-Set 6 and 8 Category 22 and 24 UE. Measurement object: HS-DPCCH ACK and NACK
CQI Measurement	Measurement object: HS-DPCCH CQI reported periodically from UE
Call Processing	Call control: Location registration, Fixed Reference Channel (executes each 3GPP-defined processing and performs Pass/Fail evaluation) UE control: Output level (executes each 3GPP-defined UE control)

DC-HSUPA Measurement Software MX882100C-033

Function	This option for the MX882100C measures DC-HSUPA TX performance.
Amplitude Measurement	Depends on MX882100C performance Measurement object: DPCH, HS-DPCCH, E-DPCCH, E-DPDCH
Call Processing	Call control: Location registration, E-DCH RF Test (executes each 3GPP-defined processing and performs Pass/Fail evaluation) UE control: Output level (executes each 3GPP-defined UE control)

4C-HSDPA Measurement Software MX882100C-034

Function	This option for the MX882100C measures 4C-HSDPA RX performance.
Throughput Measurement	Measures throughput using H-Set or throughput using peak-rate equivalent HS-SCCH and HS-PDSCH at H-Set 6 and 8 Category 29 and 31 UE. Measurement object: HS-DPCCH ACK and NACK
CQI Measurement	Measurement object: HS-DPCCH CQI reported periodically from UE
Call Processing	Call control: Location registration, Fixed Reference Channel (executes each 3GPP-defined processing and performs Pass/Fail evaluation) UE control: Output level (executes each 3GPP-defined UE control)

TDMA Measurement Hardware MT8821C-002, GSM Measurement Software MX882101C

Frequency/Modulation Measurement	Frequency range: 350 MHz to 2.7 GHz ≤500 MHz: Only the following frequency range meets the specifications. 380.2 MHz to 389.8 MHz (T-GSM380 band) 410.2 MHz to 419.8 MHz (T-GSM410 band) 450.4 MHz to 457.6 MHz (GSM450 band) 478.8 MHz to 486.0 MHz (GSM480 band) Input level: –30 to +40 dBm (Main1, 2) (average power in bursts) Carrier frequency accuracy: ± (Set frequency × Reference oscillator accuracy + 10 Hz) (Normal burst) ± (Set frequency × Reference oscillator accuracy + 20 Hz) (RACH) Modulation accuracy (Residual phase error): ≤0.5° RMS, 2° peak Measurement object: Normal burst, RACH
Amplitude Measurement	Frequency range: 350 MHz to 2.7 GHz ≤500 MHz: Only the following frequency range meets the specifications. 380.2 MHz to 389.8 MHz (T-GSM380 band) 410.2 MHz to 419.8 MHz (T-GSM410 band) 450.4 MHz to 457.6 MHz (GSM450 band) 478.8 MHz to 486.0 MHz (GSM480 band) Input level: –30 to +40 dBm (Main1, 2) (average power in bursts) Measurement accuracy 10°C to 40°C, After Cal ±0.3 dB (typ.), ±0.5 dB (–30 to +40 dBm) Linearity: ±0.2 dB (–40 to 0 dB, ≥–30 dBm) Power measurement range (carrier off): ≥65 dB (≥–10 dBm), ≥45 dB (≥–30 to –10 dBm) Burst wave display: Rise, Fall, Slot, On-interval Measurement object: Normal burst, RACH
Output Spectrum Measurement (Output RF Spectrum)	Frequency range: 350 MHz to 2.7 GHz ≤500 MHz: Only the following frequency range meets the specifications. 380.2 MHz to 389.8 MHz (T-GSM380 band) 410.2 MHz to 419.8 MHz (T-GSM410 band) 450.4 MHz to 457.6 MHz (GSM450 band) 478.8 MHz to 486.0 MHz (GSM480 band) Input level: –10 to +40 dBm (Main1, 2) (average power in bursts) Measurement range (modulation) Averaged with 10 measurements ≤–55 dB (≤250 kHz offset), ≤–66 dB (≥400 kHz offset) Measurement range (transient): ≤–57 dB (≥400 kHz offset) Measurement point: ±100 kHz, ±200 kHz, ±250 kHz, ±400 kHz, ±600 kHz, ±800 kHz, ±1000 kHz, ±1200 kHz, ±1400 kHz, ±1600 kHz, ±1800 kHz, ±2000 kHz Measurement object: Normal burst
RF Signal Generator	Output frequency range: 350 MHz to 2.7 GHz, 1 Hz steps Output pattern: CCH, TCH, CCH + TCH Channel coding: FS, EFS, HS0, HS1, AFS, AHS0, AHS1, CS-1, CS-2, CS-3, CS-4 TCH data: PN9, PN15, All0, All1, Fixed pattern (PAT0 to PAT9) USF: 0 to 7 (GPRS)
Error Rate Measurement	Measures error rate of frame, bit, and CRC Measurement object: Loopback data on uplink TCH Serial data input from call processing I/O port (rear panel) UE RX block count on GPRS uplink TCH GPRS UE USF RX block count
Call Processing	Call control: Location registration, Call origination, Call termination, Network-side termination, UE-side termination, Connection, termination and data transfer via GPRS UE control: Output level, Time slot, Timing advance, Loopback On/Off, GPRS test mode Channel coding: FS, EFS, HS0, HS1, AFS, AHS, CS-1, CS-2, CS-3, CS-4 Frequency band: GSM450, GSM480, GSM850, P-GSM, E-GSM, R-GSM, GSM710, T-GSM810, GSM750, DCS1800, PCS1900

EGPRS Measurement Software MX882101C-011

Function	This option for the MX882101C measures EGPRS TRX performance.
Frequency/Modulation Measurement	Frequency range: 350 MHz to 2.7 GHz ≤500 MHz: Only the following frequency range meets the specifications. 380.2 MHz to 389.8 MHz (T-GSM380 band) 410.2 MHz to 419.8 MHz (T-GSM410 band) 450.4 MHz to 457.6 MHz (GSM450 band) 478.8 MHz to 486.0 MHz (GSM480 band) Input level: –30 to +40 dBm (Main1, 2) (average power in bursts) Carrier frequency accuracy: ± (Set frequency × Reference oscillator accuracy + 10 Hz) (Normal burst) ± (Set frequency × Reference oscillator accuracy + 20 Hz) (RACH) Modulation accuracy (Residual phase error): ≤0.5° RMS, 2° peak Residual EVM: ≤1.5% RMS (8PSK) Measurement object: Normal burst (GMSK, 8PSK), RACH
Amplitude Measurement	Frequency range: 350 MHz to 2.7 GHz ≤500 MHz: Only the following frequency range meets the specifications. 380.2 MHz to 389.8 MHz (T-GSM380 band) 410.2 MHz to 419.8 MHz (T-GSM410 band) 450.4 MHz to 457.6 MHz (GSM450 band) 478.8 MHz to 486.0 MHz (GSM480 band) Input level: –30 to +40 dBm (Main1, 2) (average power in bursts) Measurement accuracy 10°C to 40°C, After Cal ±0.3 dB (typ.), ±0.5 dB (–30 to +40 dBm) Linearity: ±0.2 dB (–40 to 0 dB, ≥–30 dBm) Power measurement range (carrier off): ≥65 dB (≥–10 dBm), ≥45 dB (≥–30 to –10 dBm) Burst wave display: Rise, Fall, Slot, On-interval Measurement object: Normal burst (GMSK, 8PSK), RACH
Output Spectrum Measurement (Output RF Spectrum)	Frequency range: 350 MHz to 2.7 GHz ≤500 MHz: Only the following frequency range meets the specifications. 380.2 MHz to 389.8 MHz (T-GSM380 band) 410.2 MHz to 419.8 MHz (T-GSM410 band) 450.4 MHz to 457.6 MHz (GSM450 band) 478.8 MHz to 486.0 MHz (GSM480 band) Input level: –10 to +40 dBm (Main1, 2) (average power in bursts) Measurement range (modulation) Averaged with 10 measurements ≤–55 dB (≤250 kHz offset), ≤–66 dB (≥400 kHz offset) Measurement range (transient): ≤–57 dB (≥400 kHz offset) Measurement point: ±100 kHz, ±200 kHz, ±250 kHz, ±400 kHz, ±600 kHz, ±800 kHz, ±1000 kHz, ±1200 kHz, ±1400 kHz, ±1600 kHz, ±1800 kHz, ±2000 kHz Measurement object: Normal burst (GMSK, 8PSK)
RF Signal Generator	Output frequency range: Depends on MX882101C performance Phase error: Depends on MX882101C performance Modulation accuracy: ≤3% (RMS) Output pattern: CCH, TCH, CCH + TCH Coding scheme: MCS-1, MCS-2, MCS-3, MCS-4, MCS-5, MCS-6, MCS-7, MCS-8, MCS-9 Puncturing scheme: P1, P2, P3 TCH data: PN9, PN15, All0, All1, Fixed pattern (PAT0 to PAT9)
Error Rate Measurement	Measures bit error rate Measurement object: Loopback data on uplink TCH (GMSK, 8PSK) UE RX block count on EGPRS uplink TCH EGPRS UE USF RX block count
Call Processing	Call control: Location registration, Connection, termination and data transfer via EGPRS UE control: Output level, Time slot, Timing advance, EGPRS test mode Coding scheme: MCS-1, MCS-2, MCS-3, MCS-4, MCS-5, MCS-6, MCS-7, MCS-8, MCS-9 Puncturing scheme: P1, P2, P3 Frequency band: GSM450, GSM480, GSM710, GSM750, T-GSM810, GSM850, P-GSM, E-GSM, R-GSM, DCS1800, PCS1900

W-CDMA Measurement Hardware MT8821C-001, TD-SCDMA Measurement Hardware MT8821C-007, TD-SCDMA Measurement Software MX882107C

Frequency/Modulation Measurement	Frequency range: 350 MHz to 2.7 GHz ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE operating band 31) Input level: –30 to +35 dBm (Main1, 2) Carrier frequency accuracy: ± (Set frequency × Reference oscillator accuracy + 10 Hz) Modulation accuracy (residual vector error): ≤2.5% (single code)
Amplitude Measurement	Frequency range: 350 MHz to 2.7 GHz ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE operating band 31) Input level: –70 to +35 dBm (Main1, 2) Measurement accuracy 10°C to 40°C, After Cal ±0.3 dB (typ.), ±0.5 dB (–30 to +35 dBm), ±0.7 dB (–55 to –30 dBm), ±0.9 dB (–70 to –55 dBm) Linearity: ±0.2 dB (–40 to 0 dB, ≥–55 dBm), ±0.4 dB (–40 to 0 dB, ≥–65 dBm) Measurement object: DPCH, UpPCH

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Occupied Bandwidth	Frequency range: 350 MHz to 2.7 GHz ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE operating band 31) Input level: –10 to +35 dBm (Main1, 2)
Adjacent Channel Leakage Power	Frequency range: 350 MHz to 2.7 GHz ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE operating band 31) Input level: –10 to +35 dBm (Main1, 2) Measurement point: ±1.6 MHz, ±3.2 MHz Measurement range: ≥50 dB (±1.6 MHz), ≥55 dB (±3.2 MHz)
RF Signal Generator	Output frequency range: 300 MHz to 2.7 GHz, 1 Hz steps Channel level: –30.0 to 0.0 dBm (DPCH), 0.1 dB steps Channel level accuracy: ±0.2 dB AWGN level: Off, –20 to +5 dB, 0.1 dB steps AWGN level accuracy: ±0.2 dB EVM: ≤3% RMS
Error Rate Measurement	Function: Applying PN9 or PN15 pattern to DTCH Measures BER, BLER Measurement object: Loopback data on uplink DTCH
Call Processing	Call control: Location registration, Call origination, Call termination, Network-side release, UE-side release (executes each 3GPP-defined processing and performs Pass/Fail evaluation) UE control: Output level, Loopback (executes each 3GPP-defined UE control)

TD-SCDMA HSDPA Measurement Software MX882107C-011

Function	This option for the MX882107C measures HSDPA RX performance.
Reference Channel	RMC 0.5Mbps UE class (QPSK), RMC 1.1Mbps UE class (QPSK), RMC 1.1Mbps UE class (16QAM), RMC 1.6Mbps UE class (QPSK), RMC 1.6Mbps UE class (16QAM), RMC 2.2Mbps UE class (QPSK), RMC 2.2Mbps UE class (16QAM), RMC 2.8Mbps UE class (QPSK), RMC 2.8Mbps UE class (16QAM)
Throughput Measurement	Measures throughput using RMC Measurement object: HS-SICH ACK and NACK
CQI Measurement	Measurement object: HS-SICH CQI (RTBS, RMF) reported periodically from UE
Call Processing	Call control: Location registration, Call processing using RMC (executes each 3GPP-defined processing and performs Pass/Fail evaluation) UE control: Output level (executes each 3GPP-defined UE control)

TD-SCDMA HSDPA Evolution Measurement Software MX882107C-012

Function	This option for the MX882107C measures HSDPA Evolution RX performance.
Reference Channel	RMC Category 16 to 18 UE (64QAM), RMC Category 19 to 21 UE (64QAM), RMC Category 22 to 24 UE (64QAM), RMC Category 18 max., RMC Category 21 max., RMC Category 24 max.
Throughput Measurement	Throughput measurement using RMC Measurement object: HS-SICH ACK and NACK
CQI Measurement	Measurement object: HS-SICH CQI (RTBS) reported periodically from UE
Call Processing	Call control: Location registration, Call processing using RMC (executes each 3GPP-defined processing and performs Pass/Fail evaluation) UE control: Output level (executes each 3GPP-defined UE control)

TD-SCDMA HSUPA Measurement Software MX882107C-021

Function	This option for the MX882107C measures HSUPA, HSUPA Evolution TX performance.
Modulation Measurement	Depends on MX882107C performance
Call Processing	Call control: Location registration, Call processing using FRC1 and FRC2 (executes each 3GPP-defined processing and performs Pass/Fail evaluation) UE control: Output level (executes each 3GPP-defined UE control)

CDMA2000 Measurement Software Lite MX882132C

Electrical Characteristics	Typical values (typ.) are only for reference and are not guaranteed.
Frequency/Modulation Measurement	Frequency range: 300 MHz to 2.7 GHz Input level: –30 to +35 dBm Carrier frequency accuracy: ± (Set frequency × Reference oscillator + 10 Hz) Modulation accuracy Residual waveform quality: >0.999
Amplitude Measurement	Frequency range: 300 MHz to 2.7 GHz Input level: –65 to +35 dBm (Main1/2) Measurement accuracy Filtered power measurement, after Full Cal, Input level setting, 10°C to 40°C ±0.5 dB (–30 to +35 dBm), typ. ±0.3 dB (–30 to +35 dBm), ±0.7 dB (–55 to –30 dBm), ±0.9 dB (–65 to –55 dBm) Linearity Filtered power measurement, Input level setting for reference ±0.2 dB (–40 to 0 dB, ≥–55 dBm), ±0.4 dB (–40 to 0 dB, ≥–65 dBm)
Occupied Bandwidth	Frequency range: 300 MHz to 2.7 GHz Input level: –10 to +35 dBm (Main1/2)
Code Domain Power	Can be measured when Reverse-RC is set to RC 3 or RC 4. Measurement level range: –30 to +35 dBm Measurement accuracy: ±0.2 dB (Code power ≥–15 dBc), ±0.4 dB (Code power ≥–23 dBc)

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RF Signal Generator	Output frequency range: 300 MHz to 2.7 GHz, 1 Hz steps CDMA2000 1X Waveform quality: >0.99
AF Input	Input frequency Frequency range: 50 Hz to 10 kHz Input level Input voltage range: 1 mV peak to 5 V peak (AF input connector) Maximum allowable input voltage: 30 V rms Frequency measurement accuracy: ± (Reference oscillator accuracy + 0.5 Hz) Level measurement accuracy: ±0.2 dB (≥10 mV peak), ±0.4 dB (≥1 mV peak, ≥1 kHz) SINAD measurement range At frequency 1 kHz ≥60 dB (≥1000 mV peak), ≥54 dB (>50 mV peak), ≥46 dB (≥10 mV peak) Distortion measurement range At frequency 1 kHz ≤–60 dB (≥1000 mV peak), ≤–54 dB (>50 mV peak), ≤–46 dB (≥10 mV peak) Input impedance: 100 kΩ
AF Output	Output frequency Frequency range: 30 Hz to 10 kHz Resolution: 1 Hz Accuracy: ± (Set frequency × Reference oscillator accuracy + 0.1 Hz) Output level Range: 0 to 5 V peak (AF output connector) Resolution: 1 mV (≤5 V peak), 100 µV (≤500 mV peak), 10 µV (≤50 mV peak) Accuracy: ±0.2 dB (≥10 mV peak, ≥50 Hz), ±0.3 dB (≥10 mV peak, <50 Hz) Waveform distortion: ≤30 kHz band ≤–60 dB (≥500 mV peak, ≤5 kHz), ≤–54 dB (≥70 mV peak) Output impedance: ≤1 Ω Max. output current: 100 mA

1xEV-DO Measurement Software Lite MX882136C

Frequency/Modulation Measurement	Frequency range: 300 MHz to 2.7 GHz Input level: –30 to +35 dBm (Main1/2) Carrier frequency accuracy: ± (Set frequency × Reference oscillator accuracy + 10 Hz) Modulation accuracy Rresidual waveform quality: >0.999
Amplitude Measurement	Depends on MX882132C performance
Occupied Bandwidth	Depends on MX882132C performance
Code Domain Power	Input level: –30 to +35 dBm (Main1, 2) Measurement accuracy: ±0.2 dB (Code power: ≥–15 dBc), ±0.4 dB (Code power: ≥–23 dBc)
RF Signal Generator	Output frequency range: 300 MHz to 2.7 GHz, 1 Hz steps Channel level (relative level to Ior): 0 dB (Pilot channel, MAC channel, Control channel, Traffic channel) Waveform quality: >0.999

LTE FDD Measurement Software Lite MX882142C, LTE TDD Measurement Software Lite MX882143C

Frequency/Modulation Measurement	Frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 5.0 GHz (with MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE operating band 31) Input level: –40 to +35 dBm (Main1, 2) Carrier frequency accuracy: ± (Set frequency × Reference oscillator accuracy + 15 Hz) Modulation accuracy (residual vector error): ≤2.5% (400 MHz ≤ frequency ≤ 3.8 GHz, Measurement count: 20) ≤3.5% (3.8 GHz < frequency ≤ 5.0 GHz, Measurement count: 20) In-band Emissions: ≤–40 dB (≥–10 dBm, Allocated RB: ≤18) Measurement object: PUSCH
Amplitude Measurement	Frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 5.0 GHz (with MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE operating band 31) Input level: –60 to +35 dBm (Main1, 2) Measurement accuracy 10°C to 40°C, After Cal, 400 MHz ≤ frequency ≤ 3.8 GHz ±0.3 dB (typ.), ±0.5 dB (–20 to +35 dBm), ±0.7 dB (–50 to –20 dBm), ±0.9 dB (–60 to –50 dBm) 20°C to 30°C, After Cal, 3.8 GHz < frequency ≤ 5.0 GHz ±0.7 dB (–20 to +35 dBm), ±0.9 dB (–50 to –20 dBm), ±1.1 dB (–60 to –50 dBm) Linearity 400 MHz to 5.0 GHz, –40 to 0 dB ±0.2 dB (≥–50 dBm), ±0.4 dB (≥–60 dBm) Measurement object: PUSCH
Occupied Bandwidth	Frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 5.0 GHz (with MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE operating band 31) Input level: –10 to +35 dBm (Main1, 2) Channel bandwidth: 1.4, 3, 5 MHz (452.5 MHz ≤ UL frequency ≤ 457.5 MHz) 1.4, 3, 5, 10, 15, 20 MHz (500 MHz ≤ UL frequency)

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Adjacent Channel Leakage Power	Frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 5.0 GHz (with MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE operating band 31) Input level: –10 to +35 dBm (Main1, 2) Measurement range: ≥45 dB (E-UTRA ACLR1), ≥50 dB (UTRA ACLR1), ≥55 dB (UTRA ACLR2) Channel bandwidth: 1.4, 3, 5 MHz (452.5 MHz ≤ UL frequency ≤ 457.5 MHz) 1.4, 3, 5, 10, 15, 20 MHz (500 MHz ≤ UL frequency)
Spectrum Emission Mask	Frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 5.0 GHz (with MT8821C-019) ≤500 MHz: Only the following frequency range meets the specifications. 452.5 MHz to 457.5 MHz (LTE operating band 31) Input level: –10 to +35 dBm (Main1, 2) Channel bandwidth: 1.4, 3, 5 MHz (452.5 MHz ≤ UL frequency ≤ 457.5 MHz) 1.4, 3, 5, 10, 15, 20 MHz (500 MHz ≤ UL frequency)
RF Signal Generator	Output frequency range: 400 MHz to 3.8 GHz, 3.8 GHz to 6.0 GHz (with MT8821C-019) 1 Hz steps Output level Main: –140 to –10 dBm (Modulation: Off), –142 to –12 dBm (Modulation: On) Aux: –125 to +5 dBm (Modulation: Off), –127 to +3 dBm (Modulation: On)

Sequence Measurement Software MX882120C

Amplitude Measurement	Frequency: 400 MHz to 3.8 GHz 3.8 GHz to 5.0 GHz (when MT8821C-019 is installed) For the frequencies below 500 MHz, only the following range meets the specifications: 452.5 MHz to 457.5 MHz (LTE Operating Band 31) 410.0 MHz to 419.975 MHz (CDMA2000 Band Class 5, 11) 450.0 MHz to 459.990 MHz (CDMA2000 Band Class 5, 11) 479.0 MHz to 483.480 MHz (CDMA2000 Band Class 5, 11) 410.2 MHz to 419.8 MHz (Band T-GSM410) 450.4 MHz to 457.6 MHz (Band GSM450) 478.8 MHz to 486.0 MHz (Band GSM480) Input level: –70 to +35 dBm (Main1, 2) Measurement accuracy ±0.5 dB (–20 to +35 dBm) (typ.) ±0.3 dB (–20 to +35 dBm), ±0.7 dB (–50 to –20 dBm), ±0.9 dB (–60 to –50 dBm) For measurement bandwidth of ≤ 5 MHz ±0.5 dB (–30 to +35 dBm) (typ.) ±0.3 dB (–30 to +35 dBm), ±0.7 dB (–55 to –30 dBm), ±0.9 dB (–65 to –55 dBm) For measurement bandwidth of ≤2 MHz ±0.5 dB (–30 to +35 dBm) (typ.) ±0.3 dB (–30 to +35 dBm), ±0.7 dB (–55 to –30 dBm), ±0.9 dB (–70 to –55 dBm), 400 MHz ≤ freq. ≤ 3.8 GHz, after calibration, 10 to 40°C ±0.7 dB (–20 to +35 dBm), ±0.9 dB (–50 to –20 dBm), ±1.1 dB (–60 to –50 dBm), 3.8 GHz < freq. ≤ 5.0 GHz, after calibration, 20°C to 30°C Linearity ±0.2 dB (–40 to 0 dB, ≥–50 dBm), ±0.4 dB (–40 to 0 dB, ≥–60 dBm) For measurement bandwidth of ≤5 MHz ±0.2 dB (–40 to 0 dB, ≥–55 dBm), ±0.4 dB (–40 to 0 dB, ≥–65 dBm), 400 MHz ≤ freq. ≤ 3.8 GHz, 10°C to 40°C ±0.2 dB (–40 to 0 dB, ≥–50 dBm), ±0.4 dB (–40 to 0 dB, ≥–60 dBm), 3.8 GHz < freq. ≤ 5.0 GHz, 10°C to 40°C Relative measurement error: Range <2 dB (typ.) ±0.10 dB (–40 to 0 dB, ≥–50 dBm)
RF Signal Generator	Output frequency: 400 MHz to 3.8 GHz, 3.8 GHz to 6 GHz (when MT8821C-019 is installed) 1 Hz steps Output level Main output –140.0 to –10.0 dBm (Modulation Off), –142.0 to –12.0 dBm (Modulation On) AUX output –125.0 to +5.0 dBm (Modulation Off), –127.0 to +3.0 dBm (Modulation On)

W-CDMA Measurement Software MX882120C-001

Frequency/Modulation Measurement	Frequency: 400 MHz to 2.7 GHz For the frequencies below 500 MHz, only the following range meets the specifications: 452.5 MHz to 457.5 MHz (LTE Operating Band 31) Input level: –30 to +35 dBm (Main1, 2) Carrier frequency accuracy: ± (Set frequency × Reference oscillator accuracy + 10 Hz) Modulation accuracy: ≤2.5% (when one DPCCH and one DPDCH are input)
Amplitude Measurement	Frequency: 400 MHz to 2.7 GHz For the frequencies below 500 MHz, only the following range meets the specifications: 452.5 MHz to 457.5 MHz (LTE Operating Band 31) Input level: –65 to +35 dBm (Main1, 2) Measurement accuracy: ±0.5 dB (–30 to +35 dBm) (typ.) ±0.3 dB (–30 to +35 dBm), ±0.7 dB (–55 to –30 dBm), ±0.9 dB (–65 to –55 dBm), after calibration, 10°C to 40°C Linearity: ±0.2 dB (–40 to 0 dB, ≥–55 dBm), ±0.4 dB (–40 to 0 dB, ≥–65 dBm), 10°C to 40°C Measurement object: DPCH
Occupied Bandwidth	Frequency: 400 MHz to 2.7 GHz For the frequencies below 500 MHz, only the following range meets the specifications: 452.5 MHz to 457.5 MHz (LTE Operating Band 31) Input level: –10 to +35 dBm (Main1, 2)
Adjacent Channel Leakage Power	Frequency: 400 MHz to 2.7 GHz For the frequencies below 500 MHz, only the following range meets the specifications: 452.5 MHz to 457.5 MHz (LTE Operating Band 31) Input level: –10 to +35 dBm (Main1, 2) Measurement range: ≥50 dB (±5 MHz), ≥55 dB (±10 MHz)

GSM Measurement Software MX882120C-002

Frequency/Modulation Measurement	Frequency: 400 MHz to 2.7 GHz For the frequencies below 500 MHz, only the following range meets the specifications: 410.2 MHz to 419.8 MHz (Band T-GSM410) 450.4 MHz to 457.6 MHz (Band GSM450) 478.8 MHz to 486 MHz (Band GSM480) Input level: –30 to +35 dBm (average power in bursts, Main1, 2) Carrier frequency accuracy: ± (Set frequency × Reference oscillator accuracy + 10 Hz) Modulation accuracy: Residual phase error ≤0.5 deg. (rms), ≤2 deg. (peak) (GMSK) Residual EVM ≤1.5% (rms) (8PSK) Measurement object: Normal burst (GMSK, 8PSK)
Amplitude Measurement	Frequency: 400 MHz to 2.7 GHz For the frequencies below 500 MHz, only the following range meets the specifications: 410.2 MHz to 419.8 MHz (Band T-GSM410) 450.4 MHz to 457.6 MHz (Band GSM450) 478.8 MHz to 486 MHz (Band GSM480) Input level: –30 to +35 dBm (average power in bursts, Main1, 2) Measurement accuracy: ±0.5 dB (–30 to +35 dBm) (typ.) ±0.3 dB (–30 to +35 dBm), after calibration, 10°C to 40°C Linearity: ±0.2 dB (–40 to 0 dB, ≥–30 dBm), 10°C to 40°C Power measurement range when carrier Off: ≥65 dB (≥–10 dBm), ≥45 dB (–30 to –10 dBm) Measurement object: Normal burst (GMSK, 8PSK)
Output Spectrum Measurement (Output RF Spectrum)	Frequency: 400 MHz to 2.7 GHz For the frequencies below 500 MHz, only the following range meets the specifications: 410.2 MHz to 419.8 MHz (Band T-GSM410) 450.4 MHz to 457.6 MHz (Band GSM450) 478.8 MHz to 486 MHz (Band GSM480) Input level: –10 to +35 dBm (average power in bursts, Main1, 2) Measurement point: ±100 kHz, ±200 kHz, ±250 kHz, ±400 kHz, ±600 kHz, ±800 kHz, ±1000 kHz, ±1200 kHz, ±1400 kHz, ±1600 kHz, ±1800 kHz, ±2000 kHz Modulation part measurement range: Averaged over 10 measurements, ≤–55 dB (≤250 kHz offset), ≤–66 dB (≥400 kHz offset) Transient part measurement range: ≤–57 dB (≥400 kHz offset) Measurement object: Normal burst (GMSK, 8PSK)

LTE Measurement Software MX882120C-004

Frequency/Modulation Measurement	Frequency: 400 MHz to 3.8 GHz 3.8 GHz to 5.0 GHz (when MT8821C-019 is installed) For the frequencies below 500 MHz, only the following range meets the specifications: 452.5 MHz to 457.5 MHz (LTE Operating Band 31) Input level: –40 to +35 dBm (Main1, 2) Carrier frequency accuracy: ± (Set frequency × Reference oscillator accuracy + 15 Hz) Modulation accuracy: Residual vector error ≤ 2.5% (400 MHz ≤ freq. ≤ 3.8 GHz) (when measurement count is 20), ≤3.5% (3.8 GHz < freq. ≤ 5.0 GHz) (when measurement count is 20) For the frequencies below 500 MHz, only the following range meets the specifications: 452.5 MHz to 457.5 MHz (LTE Operating Band 31) In-Band Emissions: ≤ –40 dB (≥–10 dBm, Allocated RB ≤18) Measurement object: PUSCH
Amplitude Measurement	Frequency: 400 MHz to 3.8 GHz 3.8 GHz to 5.0 GHz (when MT8821C-019 is installed) For the frequencies below 500 MHz, only the following range meets the specifications: 452.5 MHz to 457.5 MHz (LTE Operating Band 31) Input level: –60 to +35 dBm (Main1, 2) Measurement accuracy: ±0.5 dB (–20 to +35 dBm) (typ.) ±0.3 dB (–20 to +35 dBm), ±0.7 dB (–50 to –20 dBm), ±0.9 dB (–60 to –50 dBm), 400 MHz ≤ freq. ≤ 3.8 GHz, after calibration, 10°C to 40°C ±0.7 dB (–20 to +35 dBm), ±0.9 dB (–50 to –20 dBm), ±1.1 dB (–60 to –50 dBm), 3.8 GHz < freq. ≤ 5.0 GHz, after calibration, 20°C to 30°C Linearity: ±0.2 dB (–40 to 0 dB, ≥–50 dBm), ±0.4 dB (–40 to 0 dB, ≥–60 dBm), 400 MHz ≤ freq. ≤ 3.8 GHz, 10°C to 40°C ±0.2 dB (–40 to 0 dB, ≥–50 dBm), ±0.4 dB (–40 to 0 dB, ≥–60 dBm), 3.8 GHz < freq. ≤ 5.0 GHz, 10°C to 40°C Measurement object: PUSCH
Occupied Bandwidth	Frequency: 400 MHz to 3.8 GHz 3.8 GHz to 5.0 GHz (when MT8821C-019 is installed) For the frequencies below 500 MHz, only the following range meets the specifications: 452.5 MHz to 457.5 MHz (LTE Operating Band 31) Input level: –10 to +35 dBm (Main1, 2) Channel bandwidth: 1.4, 3, 5 MHz (452.5 MHz ≤ UL frequency ≤ 457.5 MHz) 1.4, 3, 5, 10, 15213, 20 MHz (500 MHz ≤ UL frequency)
Adjacent Channel Leakage Power	Frequency: 400 MHz to 3.8 GHz 3.8 GHz to 5.0 GHz (when MT8821C-019 is installed) For the frequencies below 500 MHz, only the following range meets the specifications: 452.5 MHz to 457.5 MHz (LTE Operating Band 31) Input level: –10 to +35 dBm (Main1, 2) Measurement range: ≥45 dB (E-UTRA ACLR1), ≥50 dB (UTRA ACLR1), ≥55 dB (UTRA ACLR2) 400 MHz to 5.0 GHz For the frequencies below 500 MHz, only the following range meets the specifications: 452.5 MHz to 457.5 MHz (LTE Operating Band 31) Channel bandwidth: 1.4, 3, 5 MHz (452.5 MHz ≤ UL frequency ≤ 457.5 MHz) 1.4, 3, 5, 10, 15, 20 MHz (500 MHz ≤ UL frequency)
Spectrum Emission Mask	Frequency: 400 MHz to 3.8 GHz 3.8 GHz to 5.0 GHz (when MT8821C-019 is installed) For the frequencies below 500 MHz, only the following range meets the specifications: 452.5 MHz to 457.5 MHz (LTE Operating Band 31) Input level: –10 to +35 dBm (Main1, 2) Channel bandwidth: 1.4, 3, 5 MHz (452.5 MHz ≤ UL frequency ≤ 457.5 MHz) 1.4, 3, 5, 10, 15, 20 MHz (500 MHz ≤ UL frequency)

TD-SCDMA Measurement Software MX882120C-005

Frequency/Modulation Measurement	Frequency: 400 MHz to 2.7 GHz For the frequencies below 500 MHz, only the following range meets the specifications: 452.5 MHz to 457.5 MHz (LTE Operating Band 31) Input level: –30 to +35 dBm (Main1, 2) Carrier frequency accuracy: ± (Set frequency × Reference oscillator accuracy + 10 Hz) Modulation accuracy: Residual vector error ≤2.5% (Single code)
Amplitude Measurement	Frequency: 400 MHz to 2.7 GHz For the frequencies below 500 MHz, only the following range meets the specifications: 452.5 MHz to 457.5 MHz (LTE Operating Band 31) Input level: –70 to +35 dBm (Main1, 2) Measurement accuracy: ±0.5 dB (–30 to +35 dBm) (typ.) ±0.3 dB (–30 to +35 dBm), ±0.7 dB (–55 to –30 dBm), ±0.9 dB (–70 to –55 dBm), after calibration, 10°C to 40°C Linearity: ±0.2 dB (–40 to 0 dB, ≥–55 dBm), ±0.4 dB (–40 to 0 dB, ≥–65 dBm), 10°C to 40°C Measurement object: DPCH
Occupied Bandwidth	Frequency: 400 MHz to 2.7 GHz For the frequencies below 500 MHz, only the following range meets the specifications: 452.5 MHz to 457.5 MHz (LTE Operating Band 31) Input level: –10 to +35 dBm (Main1, 2)
Adjacent Channel Leakage Power	Frequency: 400 MHz to 2.7 GHz For the frequencies below 500 MHz, only the following range meets the specifications: 452.5 MHz to 457.5 MHz (LTE Operating Band 31) Input level: –10 to +35 dBm (Main1, 2) Measurement point: ±1.6 MHz, ±3.2 MHz Measurement range: ≥50 dB (±1.6 MHz), ≥ 55 dB (±3.2 MHz)

Typical (typ.): Performance not warranted. Most products meet typical performance.
Nominal (nom.): Values not warranted. Included to facilitate application of product.

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name	Remarks
	Main Frame	
MT8821C	Radio Communication Analyzer	
	Standard Accessories	
	Power Cord: 1 pc	
P0031A	USB Memory: 1 pc	
W3753AE	MT8821C Operation Manual: 1 pc	USB memory
	Options	
MT8821C-001	W-CDMA Measurement Hardware	
MT8821C-002	TDMA Measurement Hardware	
MT8821C-007	TD-SCDMA Measurement Hardware	Requires MT8821C-001
MT8821C-008	LTE Measurement Hardware	
MT8821C-012	Parallel Phone Measurement Hardware*1	
MT8821C-019	Extended RF 3.8 GHz to 6 GHz	
MT8821C-025	2nd RF for Phone1	
MT8821C-026	3rd RF for Phone1	Requires MT8821C-025
MT8821C-027	4th RF for Phone1	Requires MT8821C-026
MT8821C-028	2nd RF for Phone2	Requires MT8821C-012
MT8821C-029	3rd RF for Phone2	Requires MT8821C-028
MT8821C-030	4th RF for Phone2	Requires MT8821C-029
	Retrofit Options*2	
MT8821C-□01	W-CDMA Measurement Hardware Retrofit	
MT8821C-□02	TDMA Measurement Hardware Retrofit	
MT8821C-□07	TD-SCDMA Measurement Hardware Retrofit	Requires MT8821C-001
MT8821C-□08	LTE Measurement Hardware Retrofit	
MT8821C-□12	Parallel Phone Measurement Hardware Retrofit*1	

Continued on next page

Model/Order No.	Name	Remarks
	Software Options	
MX882100C	W-CDMA Measurement Software	Requires MT8821C-001
MX882100C-002	W-CDMA External Packet Data	Requires MX882100C
MX882100C-003	W-CDMA Video Phone Test*3	Requires MX882100C
MX882100C-005	W-CDMA A-GPS	Requires MX882100C
MX882100C-019	W-CDMA HSPA Measurement Software*3	Requires MX882100C
MX882100C-032	DC-HSDPA Measurement Software	Requires MT8821C-001 (2 sets), MT8821C-012, MX882100C and MX882100C-019
MX882100C-033	DC-HSUPA Measurement Software	Requires MX882100C-032
MX882100C-034	4C-HSDPA Measurement Software	Requires MX882100C-032
MX882170C	W-CDMA Ciphering Software*3	Requires MX882100C
MX882101C	GSM Measurement Software	Requires MT8821C-002
MX882101C-002	GSM External Packet Data	Requires MX882101C
MX882101C-005	GSM A-GPS	Requires MX882101C
MX882101C-011	EGPRS Measurement Software	Requires MX882101C
MX882107C	TD-SCDMA Measurement Software	Requires MT8821C-007
MX882107C-002	TD-SCDMA External Packet Data	Requires MX882107C
MX882107C-003	TD-SCDMA Video Phone Test	Requires MX882107C
MX882107C-011	TD-SCDMA HSDPA Measurement Software	Requires MX882107C
MX882107C-012	TD-SCDMA HSDPA Evolution Measurement Software	Requires MX882107C-011
MX882107C-021	TD-SCDMA HSUPA Measurement Software	Requires MX882107C-011
MX882112C	LTE FDD Measurement Software	Requires MT8821C-008
MX882112C-006	LTE FDD IP Data Transfer	Requires MX882112C
MX882112C-010	LTE FDD Anchor For 5G NSA	Requires MT8000A and MX882112C
MX882112C-011	LTE FDD 2×2 MIMO DL	Requires MT8821C-012 and MX882112C
MX882112C-012	LTE FDD 4×4 MIMO DL	Requires MT8821C-026, MT8821C-029 and MX882112C-011
MX882112C-016	LTE FDD CS Fallback to W-CDMA/GSM	Requires MX882112C and MX882100C or MX882101C
MX882112C-021	LTE-Advanced FDD DL CA Measurement Software	Requires MT8821C-025 and MX882112C Requires MT8821C-028 when MX882112C-011 installed
MX882112C-022	LTE-Advanced FDD UL CA Measurement Software	Requires MX882112C-021
MX882112C-026	LTE-Advanced FDD DL CA IP Data Transfer	Requires MX882112C-006 and MX882112C-021
MX882112C-031	LTE-Advanced FDD DL CA 3CCs Measurement Software	Requires MT8821C-008 (2 sets), MT8821C-026 and MX882112C-021 Requires MT8821C-029 when MX882112C-011 installed
MX882112C-036	LTE-Advanced FDD DL CA 3CCs IP Data Transfer	Requires MX882112C-026 and MX882112C-031
MX882112C-041	LTE-Advanced FDD DL CA 4CCs Measurement Software	Requires MT8821C-027 and MX882112C-031 Requires MT8821C-030 when MX882112C-011 installed
MX882112C-046	LTE-Advanced FDD DL CA 4CCs IP Data Transfer	Requires MX882112C-036 and MX882112C-041
MX882112C-051	LTE-Advanced FDD DL CA 5CCs Measurement Software	Requires MT8821C-012 and MX882112C-041
MX882112C-061	LTE-Advanced FDD DL CA 6CCs Measurement Software	Requires MX882112C-051
MX882112C-071	LTE-Advanced FDD DL CA 7CCs Measurement Software	Requires MX882112C-061
MX882112C-081	LTE-Advanced FDD DL CA 8CCs Measurement Software	Requires MX882112C-071
MX882113C	LTE TDD Measurement Software	Requires MT8821C-008
MX882113C-006	LTE TDD IP Data Transfer	Requires MX882113C
MX882113C-010	LTE TDD Anchor For 5G NSA	Requires MT8000A and MX882113C
MX882113C-011	LTE TDD 2×2 MIMO DL	Requires MT8821C-012 and MX882113C
MX882113C-012	LTE TDD 4×4 MIMO DL	Requires MT8821C-026, MT8821C-029 and MX882113C-011
MX882113C-016	LTE TDD CS Fallback to W-CDMA/GSM	Requires MX882113C and MX882100C or MX882101C
MX882113C-018	LTE TDD CS Fallback to TD-SCDMA/GSM	Requires MX882113C and MX882101C or MX882107C
MX882113C-021	LTE-Advanced TDD DL CA Measurement Software	Requires MT8821C-025 and MX882113C Requires MT8821C-028 when MX882113C-011 installed
MX882113C-022	LTE-Advanced TDD UL CA Measurement Software	Requires MX882113C-021
MX882113C-026	LTE-Advanced TDD DL CA IP Data Transfer	Requires MX882113C-006 and MX882113C-021
MX882113C-031	LTE-Advanced TDD DL CA 3CCs Measurement Software	Requires MT8821C-008 (2 sets), MT8821C-026 and MX882113C-021 Requires MT8821C-029 when MX882113C-011 installed
MX882113C-036	LTE-Advanced TDD DL CA 3CCs IP Data Transfer	Requires MX882113C-026 and MX882113C-031
MX882113C-041	LTE-Advanced TDD DL CA 4CCs Measurement Software	Requires MT8821C-027 and MX882113C-031 Requires MT8821C-030 when MX882113C-011 installed
MX882113C-046	LTE-Advanced TDD DL CA 4CCs IP Data Transfer	Requires MX882113C-036 and MX882113C-041
MX882113C-051	LTE-Advanced TDD DL CA 5CCs Measurement Software	Requires MT8821C-012 and MX882113C-041
MX882113C-061	LTE-Advanced TDD DL CA 6CCs Measurement Software	Requires MX882113C-051
MX882113C-071	LTE-Advanced TDD DL CA 7CCs Measurement Software	Requires MX882113C-061
MX882113C-081	LTE-Advanced TDD DL CA 8CCs Measurement Software	Requires MX882113C-071
MX882115C	W-CDMA HSPA Evolution IP Data Transfer	Requires MT8821C-008
MX882115C-001	DC-HSDPA IP Data Transfer	Requires MX882115C
MX882116C	LTE Category M1 Measurement Software	Requires MT8821C-008
MX882116C-006	LTE Category M1 IP Data Transfer	Requires MX882116C
MX882117C	NB-IoT Measurement Software	Requires MT8821C-008
MX882117C-001	NB-IoT Category NB-2 Measurement Software	Requires MX882117C
MX882117C-002	NB-IoT Multi Carrier	Requires MX882117C
MX882117C-006	NB-IoT IP Data Transfer	Requires MX882117C
MX882120C	Sequence Measurement Software	
MX882120C-001	W-CDMA Measurement Software	Requires MX882120C
MX882120C-002	GSM Measurement Software	Requires MX882120C
MX882120C-004	LTE Measurement Software	Requires MX882120C
MX882120C-005	TD-SCDMA Measurement Software	Requires MX882120C
MX882132C	CDMA2000 Measurement Software Lite	
MX882136C	1xEV-DO Measurement Software Lite	
MX882142C	LTE FDD Measurement Software Lite	
MX882143C	LTE TDD Measurement Software Lite	
MX882164C	LTE VoLTE Echoback	Requires MX882112C for LTE FDD, requires MX882113C for LTE TDD

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Model/Order No.	Name	Remarks
	Upgrade Kits*2	
MT8821C-UG□01	SPM Upgrade Kit from MT8820C	
MT8821C-UG□02	PPM Upgrade Kit from MT8820C	
MT8821C-UG□03	SPM Upgrade Kit from MT8820C with MX88207xC	
MT8821C-UG□04	PPM Upgrade Kit from MT8820C with MX88207xC	
MT8821C-UG011	Software Upgrade Kit	Required for additional purchase of software options, etc.
MT8821C-UG□10	CPU/Windows10 Upgrade Retrofit	
	Warranty Service	
MT8821C-ES210	2 years Extended Warranty Service	
MT8821C-ES310	3 years Extended Warranty Service	
MT8821C-ES510	5 years Extended Warranty Service	
	Application Parts	
P0035B	W-CDMA/GSM Test USIM	
P0035B7	W-CDMA/GSM Test USIM*4	Micro UICC size
P0135C6	Anritsu Test UICC GA*4, *5	Nano UICC size
P0135C7	Anritsu Test UICC GA*4, *5	Micro UICC size
P0135D6	Anritsu Test UICC GA*4, *5	Nano UICC size
P0135D7	Anritsu Test UICC GA*4, *5	Micro UICC size
P0250C6	Anritsu Test UICC GT*4, *5	Nano UICC size
P0250C7	Anritsu Test UICC GT*4, *5	Micro UICC size
P0250D6	Anritsu Test UICC GT*4, *5	Nano UICC size
P0250D7	Anritsu Test UICC GT*4, *5	Micro UICC size
P0260C6	Anritsu Test UICC GM*4, *5	Nano UICC size
P0260C7	Anritsu Test UICC GM*4, *5	Micro UICC size
P0260D6	Anritsu Test UICC GM*4, *5	Nano UICC size
P0260D7	Anritsu Test UICC GM*4, *5	Micro UICC size
P0551A	Anritsu Test UICC TM*4, *5	
P0551B	Anritsu Test UICC TM*4, *5	
P0435A6	Anritsu Test UICC GA for eDRX*4	Nano UICC size (for eDRX test)
P0435A7	Anritsu Test UICC GA for eDRX*4	Micro UICC size (for eDRX test)
A0058A	Handset	
P0031A	USB Memory	
Z0541A	USB Mouse	
Z1898A	Connector Cap	
J1643A	U Link	N-P · UT-141 · SMA-P (for connecting Phone 2 Main1 - SG input)
J1644A	U Link	N-P · UT-141 · SMA-P (for connecting Phone 2 Main1 - Monitor)
J0004	Coaxial Adaptor	
J1195A	PP2S Output Cable	
J1249	CDMA2000 Cable	D-sub (15-pin, P-type) · D-sub (15-pin, P-type), used in combination with J1267 (sold separately)
J1267	CDMA2000 Cross Cable	D-sub (9-pin, P-type) · D-sub (9-pin, P-type), reverse cable used in combination with J1249 (sold separately)
J1606A	Cable	D-sub (15-pin, P-type) · D-sub (15-pin, P-type) · D-sub (15-pin, P-type)
J0576B	Coaxial Cord, 1 m	N-P · 5D-2W · N-P
J0576D	Coaxial Cord, 2 m	N-P · 5D-2W · N-P
J0127A	Coaxial Cord, 1 m	BNC-P · RG58A/U · BNC-P
J0127C	Coaxial Cord, 0.5 m	BNC-P · RG58A/U · BNC-P
J0007	GPIB Cable, 1 m	
J0008	GPIB Cable, 2 m	
J1261A	Ethernet Cable (Shield Type)	1 m, straight
J1261B	Ethernet Cable (Shield Type)	3 m, straight
MN8110B	I/O Adapter	For call processing I/O
B0332	Joint Plate	4 pcs/set
B0703A	Rack Mount Kit (MT8821C)	
B0701A	Carrying Case*6	Hard type (with protective cover and casters)
B0702A	Carrying Case	Hard type (with protective cover, without casters)
Z1858A	Divider	2-way divider
Z1859A	Divider	3-way divider
J0322A	Coaxial Cord, 0.5 m	SMA-P · SMA-P, DC to 18 GHz, 50Ω
J0322B	Coaxial Cord, 1.0 m	SMA-P · SMA-P, DC to 18 GHz, 50Ω
J0322C	Coaxial Cord, 1.5 m	SMA-P · SMA-P, DC to 18 GHz, 50Ω
J0322D	Coaxial Cord, 2.0 m	SMA-P · SMA-P, DC to 18 GHz, 50Ω
J1398A	N-SMA ADAPTOR	
J1802A	Sync Cable	

*1: The following measurement hardware support the Parallelphone measurement option: MT8821C-001, MT8821C-002, MT8821C-007 and MT8821C-008.
All the measurement hardware can be installed simultaneously.

*2: MT8821C- □ ##
□: Select from the following according to the option type.
1: Retrofit option (Must be returned to factory in Japan)
2: Retrofit option (Must be returned to service center outside of Japan)

*3: For UE connectivity, contact your Anritsu sales representative.

*4: A commercial SIM adapter CANNOT be used. If used, it may jam and break in the UE.

*5: Refer to the P0135x/P0250x/P0260x/P0551x leaflet for details.

*6: RoHS non-compliant product. Cannot be shipped to the EU, UK and EFTA.

Parallelphone™ is a trademark of Anritsu Corporation.

Universal Wireless Test Set

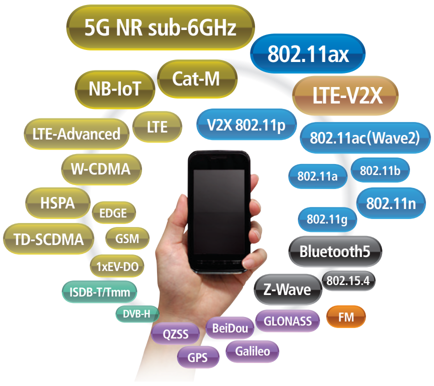
MT8870A/MT8872A

MU887000A/MU887001A/MU887002A

Remote Control
GPIB | **Ethernet**

For Production Lines for Smartphones and Wireless Modules

Excellent Eco Product



Supports 5G NR Sub-6 GHz and IEEE 802.11ax (Wi-Fi 6E) with Efficient Non-Signaling Measurements

Wireless communications devices, such as smartphones and IoT devices, continue remarkable development and the market is expanding.
In addition, wireless standards are also evolving with more products supporting diversifying standards. Against this background, manufacturers of wireless communication devices require flexible test equipment supporting various communication standards while improving production efficiency.
The Universal Wireless Test Set MT8870A/MT8872A main chassis are two Anritsu solutions with the flexibility to swap plug-in test units according to the production-line rate. They support 5G NR Sub-6 GHz and IEEE 802.11ax (Wi-Fi 6E) for efficient non-signaling measurements.

Versatile Modular Design

The versatile modular MT8870A/MT8872A design supports tailored infrastructure investment by swapping test units according to the customer’s line density and operation rate.
The standard MT8870A 19-inch rackmount chassis has four slots for test units, supporting efficient tests even on high-density production lines and contributing to higher productivity.
The more compact MT8872A chassis is fully compatible with the MT8870A. It is designed for use in tighter spaces than the standard rackmount for better space saving.
In addition, the measurement software supports evolving wireless standards. Licenses are installed in the MT8870A/MT8872A, and one license is shared by multiple test units, helping cut costs.

High-Performance Test Units with Flexibility and Expandability

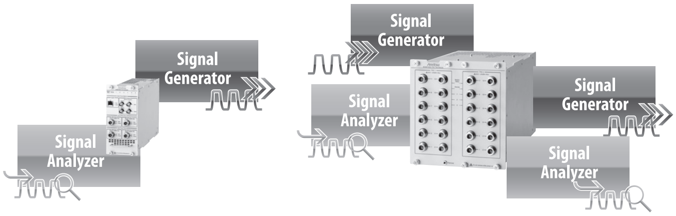
MU887000A

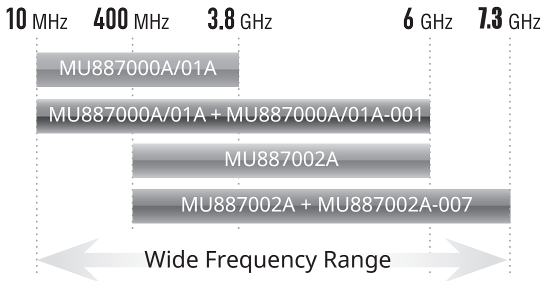
MU887001A

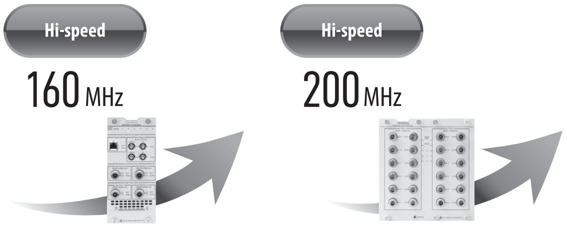
MU887002A

MU887002A
(with Option 007)

Customers can select the three MU887000A/MU887001A/MU887002A test units for the MT8870A/MT8872A according to measurement requirements.
The MU887000A/MU887001A units have four RF test ports per unit and one high-performance signal generator and signal analyzer set.
The standard RF frequency upper limit is 3.8 GHz, which can be extended to 6 GHz as an option. A 160-MHz measurement bandwidth is supported as standard. In addition, installing the Audio Measurement Hardware option provides one high-performance audio analyzer and audio generator set to measure stereo and monaural audio.
The MU887002A test unit with 24 RF test ports and two high-performance signal generators and signal analyzers occupies two slots. The standard RF frequency upper limit is 6 GHz, which can be extended to 7.3 GHz as an option. A 200-MHz measurement bandwidth is supported as standard. In addition, the MU887002A can output the same signal from up to 12 RF test ports simultaneously, contributing to configuration of a more efficient production line.
Since each test unit is functionally compatible, changes to the customer's measurement system are minimized even when replacing a test unit.





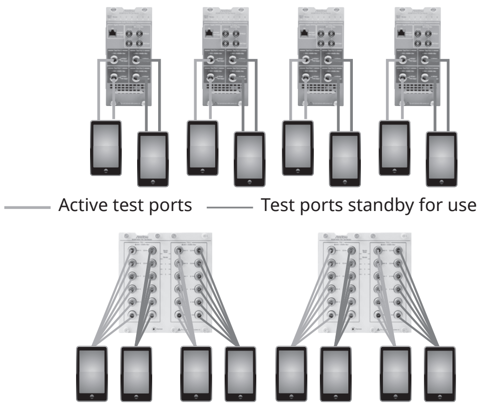


Various Efficient Measurement Methods

Anritsu supports various efficient measurement methods using the MT8870A/MT8872A.

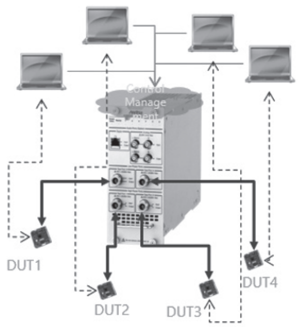
Ping-Pong Method

The Ping-Pong measurement method alternately measures two Devices Under Test (DUT) connected to the tester to increase production-line efficiency. Since up to four test modules can be installed in the MT8870A, four connected devices can be tested alternately. Using the MT8872A, two connected devices can be tested alternately.



Multi-DUT Measurement Scheduler

Installing the Multi-DUT Measurement Scheduler MX887090A software supports management of the tester software and hardware resources by the internal controller, so one test unit can be operated virtually as multiple testers, which optimizes the test unit operation rate and shortens the test time per device.



Specifications

MT8870A/MT8872A

	MT8870A	MT8872A
Slots	4	2
Dimensions	426 (W) × 221.5 (H) × 498 (D) mm	250 (W) × 221.5 (H) × 498 (D) mm
Mass	≤11.5 kg (excluding options and modules) ≤30 kg (including options and modules)	≤9.5 kg (excluding options and modules) ≤17.5 kg (including options and modules)

MU887000A/MU887001A/MU887002A

	MU887000A/MU887001A	MU887002A
RF Test Ports	4	12 × 2
VSA/VSG	1	2
Frequency Range	10 MHz to 3.8 GHz, 3.8 GHz to 6.0 GHz (Option)	400 MHz to 6.0 GHz, 6.0 GHz to 7.3 GHz (Option, Ports 5 to 12)
Remote Control	Ethernet, GPIB (Option)	Ethernet
Broadcast Output	Not supported	Supported
FM/Audio	Supported	Not supported

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Chassis
MT8870A	Universal Wireless Test Set
MT8872A	Universal Wireless Test Set
	Test Module
MU887000A	TRX Test Module
MU887001A	TRX Test Module
MU887002A	TRX Test Module
	Options
MU887000A-001	6 GHz Frequency Extension
MU887000A-002	Audio Measurement Hardware
MU887001A-001	6 GHz Frequency Extension
MU887001A-002	Audio Measurement Hardware
MU887002A-007	7 GHz Extension Function

* Refer to the catalog for details of functions and specifications, or contact your Anritsu sales representative for details.

Vector Signal Generator

MG3710E

100 kHz to 2.7 GHz/4.0 GHz/6.0 GHz

Remote Control
GPIB | Ethernet | USB

Multi-Band/Multi-System/Multi-Channel – Cut Costs for New Wireless Tests –

Excellent Eco Product

The MG3710E is a vector signal generator with 6-GHz upper frequency limit and 160-MHz*/120-MHz wide RF modulation baseband generator. It outputs various radio systems signals for cellular communications, such as 5G, LTE FDD/TDD, W-CDMA, GSM as well as narrowband communications, such as WLAN, Bluetooth and GPS.

Cuts Equipment Costs

The dual waveform memory cuts equipment costs for tests, such as ACS, Blocking and IM, which require two modulation signal sources.
The dual RF cuts MIMO equipment costs and reduces workloads for phase synchronization between equipment.
It is important for tests using separate signals, such as Multi-Standard Radio (MSR) and multi-band.

Improves Yield

The high quality signal generator ACLR and SSB phase noise reduces the effect on wideband and narrow-band measurements to improve test margins and yields.

–68 dBc @W-CDMA, TestModel1, 64DPCH, 2 GHz
<–140 dBc/Hz (nom.) @100 MHz, 20 kHz offset, CW

Cuts Tact Time

The List/Sweep mode switches the frequency and level faster than 600 µs. Moreover, the 4-GB waveform memory upgrade can load many waveform patterns while instantaneous switching eliminates time wasted reloading waveform patterns.

*: Supports firmware version 2.00.00 and later. Can generate 160-MHz bandwidth signals (WLAN 802.11ac) only when using WLAN IQproducer MX370111A and 802.11ac (160 MHz) option MX370111A-002.
The latest version can be downloaded from the Anritsu homepage.
<https://login.anritsu.com/signin>

Key Features

Dual RF & Dual Waveform Memory

- One Unit Supports Two RF Outputs Max.
  Frequency Range
  1stRF: 100 kHz to 2.7/4.0/6.0 GHz [MG3710E-032/034/036]
  2ndRF: 100 kHz to 2.7/4.0/6.0 GHz [MG3710E-062/064/066]
  Independent Baseband and RF Outputs
- Output Two Signals from One RF Out [MG3710E-048/078]
  Wanted Signal + Interfere Signal
  Wanted Signal + Delayed Signal, etc.

Basic Performance

- ACLR Performance
  –68 dBc @W-CDMA, TestModel1, 64 DPCH, 2 GHz
- High-power Output [MG3710E-041/071]
  +23 dBm @CW, 400 MHz to 3 GHz
- High-speed Switching
  < 600 µs @List/Sweep mode
- High Level Accuracy
  Absolute Level Accuracy: ±0.5 dB
  Linearity: ±0.2 dB (typ.)
- Choice of Reference Oscillators
  Standard
  Aging rate ±1 × 10^{-6}/year, ±1 × 10^{-7}/day
  High Stability Reference Oscillator [MG3710E-002]
  Aging rate ±1 × 10^{-7}/year, ±1 × 10^{-8}/day
  Rubidium Reference Oscillator [MG3710E-001]
  Aging rate ±1 × 10^{-10}/month
- SSB Phase Noise Performance

<–140 dBc/Hz (nom.)	@100 MHz, 20-kHz offset, CW
<–131 dBc/Hz (typ.)	@1 GHz, 20-kHz offset, CW
<–125 dBc/Hz (typ.)	@2 GHz, 20-kHz offset, CW

High All-purpose Baseband Performance

- Wide Vector Modulation Bandwidth
  160 MHz*/120 MHz (using Internal baseband signal generator)
  160 MHz (using External IQ input)
  *: Supports firmware version 2.00.00 and later. Can generate 160-MHz bandwidth signals (WLAN 802.11ac) only when using WLAN IQproducer MX370111A and 802.11ac (160 MHz) option MX370111A-002.
- Large-capacity Waveform Memory
- Arbitrary Waveform Generation

Expandability

- BER Test Function [MG3710E-021]
- Built-in analog modulation (AM/FM/ΦM) functions and pulse modulation (PM) functions [Standard]
- Adding additional analog modulation input options [MG3710E-050/080]
- AWGN Generator [MG3710E-049/079]
- USB Power Sensors [Sold separately]
- Local Signal I/O for MIMO Signal Source [MG3710E-017]

Operability

- Simple Touch-panel Operation
- Signal Flowcharts with Signal Block Diagrams
- Frequency Channel Table

Connections with External Equipment

- Remote Control Interfaces
- USB Connections
- Analog IQ Input/Output [MG3710E-018]
- Trigger Input
- Marker Output Editing
  Marker 1 output [Standard]
  Marker 2 and 3 output [Requires J1539A AUX Conversion Adapter]

Security

- User Data Storage on 2ndary HDD [MG3710E-011]

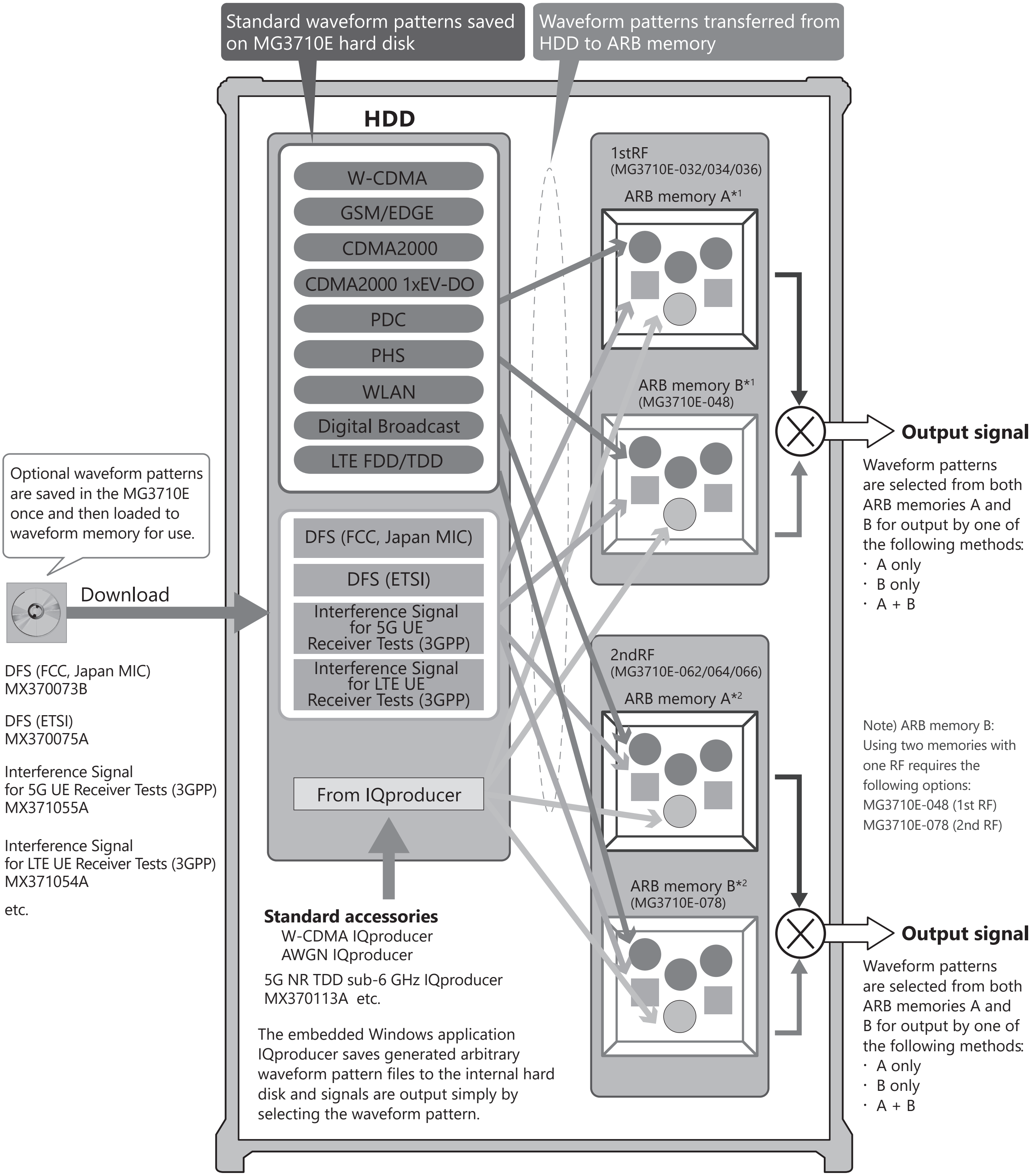
Pre-installed Key Waveform Patterns

- Waveform Patterns [Pre-installed]
  Waveform patterns for the world's main communications systems (below) are pre-installed in the MG3710E for license-free use.
    - LTE FDD (E-TM1.1 to E-TM3.3)
    - LTE TDD (E-TM1.1 to E-TM3.3)
    - W-CDMA/HSDPA
    - GSM/EDGE
    - CDMA2000 1X/1xEV-DO
    - Bluetooth®
    - GPS
    - PDC
    - PHS
    - Digital Broadcast (ISDB-T/BS/CS/CATV)
    - WLAN (802.11a/b/g)

Waveform Pattern Options and Generation

- Optional Waveform Pattern [Optional License]
  DFS Radar Pattern (For FCC & Japan MIC)
  DFS (ETSI) Waveform Pattern
  ISDB-Tmm Waveform Pattern
  Interference Signal for 5G UE Receiver Tests Waveform Pattern
  Interference Signal for LTE UE Receiver Tests Waveform Pattern
- IQproducer Waveform Generation Software [Optional License]
  5G NR TDD sub-6 GHz
  5G NR FDD sub-6 GHz
  LTE FDD/LTE-Advanced FDD
  LTE TDD/LTE-Advanced TDD
  HSDPA/HSUPA/W-CDMA
  TD-SCDMA
  CDMA2000 1xEV-DO
  WLAN (802.11a/b/g/n/j/p/ac)
  TDMA (PDC, PHS, PMR/LMR)
  DVB-T/H
  Multi-carrier
  Fading

Vector Signal Generator MG3710E



Optional waveform patterns are saved in the MG3710E once and then loaded to waveform memory for use.

DFS (FCC, Japan MIC)
MX370073B

DFS (ETSI)
MX370075A

Interference Signal
for 5G UE Receiver Tests (3GPP)
MX371055A

Interference Signal
for LTE UE Receiver Tests (3GPP)
MX371054A

etc.

Standard accessories
W-CDMA IQproducer
AWGN IQproducer

5G NR TDD sub-6 GHz IQproducer
MX370113A etc.

The embedded Windows application IQproducer saves generated arbitrary waveform pattern files to the internal hard disk and signals are output simply by selecting the waveform pattern.

Output signal

Waveform patterns are selected from both ARB memories A and B for output by one of the following methods:
- A only
- B only
- A + B

Note) ARB memory B:
Using two memories with one RF requires the following options:
MG3710E-048 (1st RF)
MG3710E-078 (2nd RF)

Output signal

Waveform patterns are selected from both ARB memories A and B for output by one of the following methods:
- A only
- B only
- A + B

*1: 1stRF ARB memory size
256 MB × 1 pc = 64 Msamples (Std.)
1 GB × 1 pc = 256 Msamples × 1 pc (MG3710E-045)
1 GB × 2 pcs = 256 Msamples × 2 pcs (MG3710E-045 + MG3710E-048)
4 GB × 1 pc = 1024 Msamples × 1 pc (MG3710E-046)
4 GB × 2 pcs = 1024 Msamples × 2 pcs (MG3710E-046 + MG3710E-048)

*2: 2ndRF ARB memory size
256 MB × 1 pc = 64 Msamples (Std.)
1 GB × 1 pc = 256 Msamples × 1 pc (MG3710E-075)
1 GB × 2 pcs = 256 Msamples × 2 pcs (MG3710E-075 + MG3710E-078)
4 GB × 1 pc = 1024 Msamples × 1 pc (MG3710E-076)
4 GB × 2 pcs = 1024 Msamples × 2 pcs (MG3710E-076 + MG3710E-078)

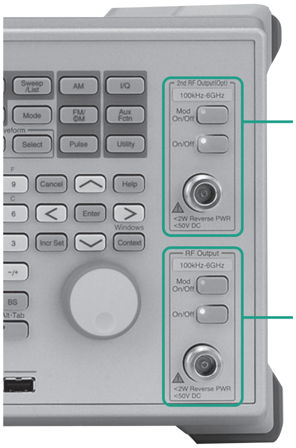
Dual RF & Dual Waveform Memory

Dual VSG: Two RF Outputs

The MG3710E supports two RF outputs (1stRF/2ndRF) max. in one unit. Moreover, different frequencies can be set independently at 1stRF and 2ndRF.

Not only different frequencies but also different levels and waveform patterns can be set independently at each SG while each is tracking the other. This is convenient in the R&D phase for evaluating interference between two different systems using different frequency bands.

Notes: Supported frequency bands cannot be changed after shipment.
IQ input is supported only by SG1 (1stRF) and requires MG3710E-017.



2ndRF
Frequency Range:
2ndRF 100 kHz to 2.7 GHz [MG3710E-062]
2ndRF 100 kHz to 4.0 GHz [MG3710E-064]
2ndRF 100 kHz to 6.0 GHz [MG3710E-066]
* Whether or not install and the frequency model can be selected at any time.

1stRF
Frequency Range:
1stRF 100 kHz to 2.7 GHz [MG3710E-032]
1stRF 100 kHz to 4.0 GHz [MG3710E-034]
1stRF 100 kHz to 6.0 GHz [MG3710E-036]
* Must install any one of these.

Dual Waveform Memory: Four Waveform Outputs Max.

In the standard configuration, one VSG (1stRF or 2ndRF) has one waveform memory. However, adding the baseband signal combine option (MG3710E-048/078) upgrades to two memories for one VSG. In other words, models with two VSGs (1stRF and 2ndRF) installed can have a maximum of four waveform memories. Two waveform patterns can be set easily on-screen for one VSG, each with different frequency offset, level offset and delay time settings to output a combined baseband RF signal. With this setup, one MG3710E supports the following test environment — a setup that previously required two expensive signal generators:

Wanted Signal + Interference Signal
Wanted Signal + Delayed Signal

Synthesizing Signals with Different Sampling Rates
- Rate Matching Function -

When signals with different sampling rates are set in memory A and memory B, a synthesized signal maintaining each of the different sampling rates can be output. This is useful when synthesizing signals for standards with different rates, such as multi-standard signals. However, depending on the combination of waveform sampling rates, sometimes it may not be possible to match rates due to internal operation clock limitations. The Mismatch warning dialog is displayed in this case.

Level Setting
Setting Range: –80 to +80 dB
Resolution: 0.01 dB

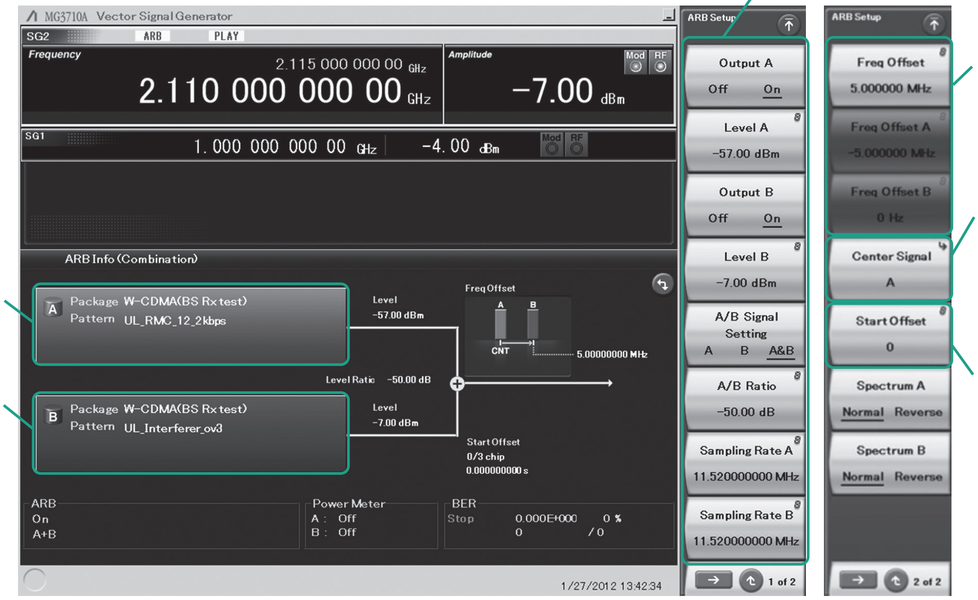
Frequency Offset Setting
Setting Range:
–100 to +100 MHz
Resolution: 1 Hz

Center Frequency Selection
A: Pattern A center
B: Pattern B center
Baseband DC:
Centered at baseband DC position

Time Offset Setting
Setting Range:
0 to pattern B sampling data count – 1

Waveform Pattern A
Example:
Wanted Signal

Waveform Pattern B
Example:
Interference Signal,
Delayed Signal



MG3710A Vector Signal Generator
SG2 ARB PLAY
Frequency 2.115 000 000 00 GHz
2.110 000 000 00 GHz
Amplitude –7.00 dBm
SG1 1. 000 000 000 00 GHz -4. 00 dBm

ARB Info (Combination)
A Package W-CDMA(BS Rx test)
Pattern UL_RMC_12_2kbps
Level –57.00 dBm
B Package W-CDMA(BS Rx test)
Pattern UL_Interferer_ov3
Level –7.00 dBm
Level Ratio –50.00 dB
Freq Offset 5.00000000 MHz
Start Offset
0/3 chip
0.000000000 s

ARB
On
A+B

Power Meter
A : Off
B : Off

BER
Stop 0.000E+000 0 %
0 / 0

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ARB Setup
Output A: Off On
Level A: –57.00 dBm
Output B: Off On
Level B: –7.00 dBm
A/B Signal Setting: A B A&B
A/B Ratio: –50.00 dB
Sampling Rate A: 11.520000000 MHz
Sampling Rate B: 11.520000000 MHz
1 of 2

ARB Setup
Freq Offset: 5.000000 MHz
Freq Offset A: –5.000000 MHz
Freq Offset B: 0 Hz
Center Signal: A
Start Offset: 0
Spectrum A: Normal Reverse
Spectrum B: Normal Reverse
2 of 2

Baseband Signal Combine Example

Basic Performance

Vector Accuracy (EVM)

- W-CDMA (Test Model 4)
  Output Frequency: 800 MHz to 900 MHz, 1.8 GHz to 2.2 GHz
  ≤0.62%(rms)
  ≤0.6%(rms) (typ.)
- LTE (20 MHz Test Model 3.1)
  Output Frequency: 600 MHz to 2.7 GHz, 3.4 GHz to 3.8 GHz
  ≤0.82%(rms)
  ≤0.8%(rms) (typ.)

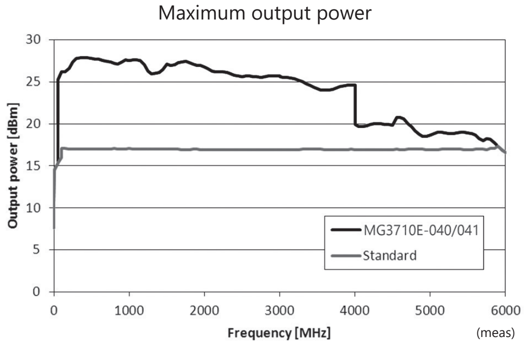
High-power Output [MG3710E-041*[1]/071*[2]]

*1: High Power Extension for 1stRF [MG3710E-041]
*2: High Power Extension for 2ndRF [MG3710E-071]

Level Accuracy is assured at high levels (CW)

Frequency Range	Standard	MG3710E-041/071
100 kHz ≤ f < 10 MHz	+5 dBm	+5 dBm
10 MHz ≤ f < 50 MHz	+10 dBm	+10 dBm
50 MHz ≤ f < 400 MHz	+13 dBm	**+20 dBm**
400 MHz ≤ f ≤ 3 GHz		**+23 dBm**
3 GHz < f ≤ 4 GHz		**+20 dBm**
4 GHz < f ≤ 5 GHz		+13 dBm
5 GHz < f ≤ 6 GHz	+11 dBm	+11 dBm

These options expand the MG3710E RF output upper limit. They are used when compensating for level losses of parts in the measurement path.

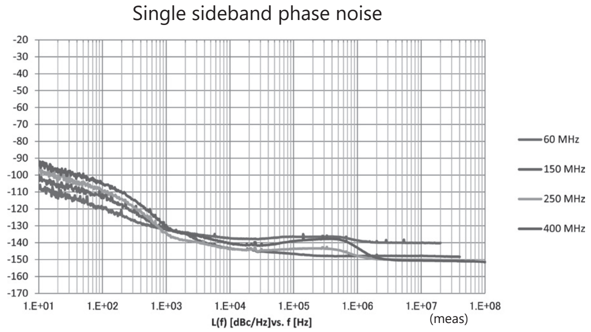


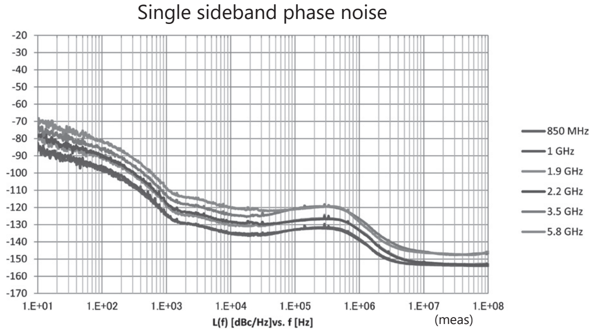
SSB Phase Noise

<–140 dBc/Hz (nom.)	@100 MHz, 20-kHz offset, CW
<–131 dBc/Hz (typ.)	@1 GHz, 20-kHz offset, CW
<–125 dBc/Hz (typ.)	@2 GHz, 20-kHz offset, CW

SSB phase noise is an important performance index for signal generators. For example, when using a signal generator for the following purposes, it is important to pre-confirm that the signal generator performance satisfies the measurement specifications.

- Communications with narrow bandwidth of several kHz
- OFDM Signals with narrow subcarrier gap
- CW interference waveforms





SSB Phase Noise
(Phase Noise Optimization <200 kHz, CW,
Optimize S/N Off, with MG3710E-002)

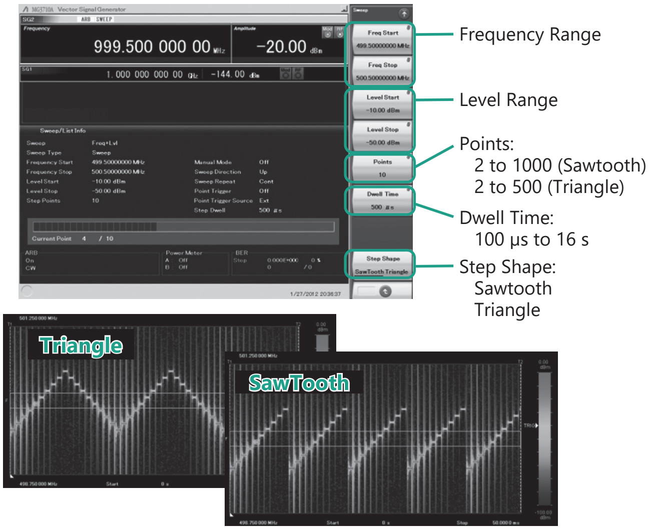
High-speed Switching

<600 µs @List/Sweep mode

To shorten tact times on production lines the MG3710E supports two standard modes each with high-speed frequency and level switching.

- Sweep Mode

  In this mode, the dwell time per point or number of points is split between the frequency range and level range (Start/Stop).
  This mode is used when matching dwell time per point and frequency/level steps.



999.500 000 00 MHz
–20.00 dBm
1.000 000 000 00 GHz
-144.00 dBm

Sweep/List Info

Sweep Freq+Lvl
Sweep Type Sweep
Frequency Start 499.50000000 MHz
Frequency Stop 500.50000000 MHz
Level Start -10.00 dBm
Level Stop -50.00 dBm
Step Points 10
Manual Mode Off
Sweep Direction Up
Sweep Repeat Cont
Point Trigger Off
Point Trigger Source Ext
Step Dwell 500 µs
Current Point 4 / 10

ARB
On
CW
Power Meter
A : Off
B : Off
BER
Stop 0.000E+000 0 %
0 / 0

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Freq Start 499.50000000 MHz
Freq Stop 500.50000000 MHz
Level Start -10.00 dBm
Level Stop -50.00 dBm
Points 10
Dwell Time 500 µs
Step Shape SawTooth Triangle

Frequency Range

Level Range

Points:
2 to 1000 (Sawtooth)
2 to 500 (Triangle)

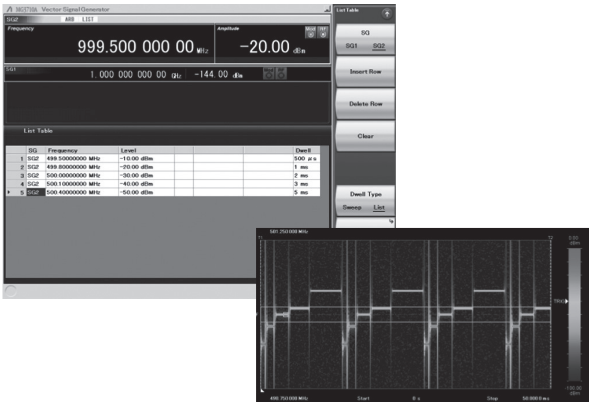
Dwell Time:
100 µs to 16 s

Step Shape:
Sawtooth
Triangle

10 points, 500-µs Dwell Time

- List Mode

  In this mode, the frequency, level and dwell time can be set for each of up to 500 points. This mode is used when wanting to set any dwell time, and frequency/level step per point.



999.500 000 00 MHz
–20.00 dBm
1.000 000 000 00 GHz
-144.00 dBm

List Table

	SG	Frequency	Level				Dwell
1	SG2	499.50000000 MHz	-10.00 dBm				500 µs
2	SG2	499.80000000 MHz	-20.00 dBm				1 ms
3	SG2	500.00000000 MHz	-30.00 dBm				2 ms
4	SG2	500.10000000 MHz	-40.00 dBm				3 ms
5	SG2	500.40000000 MHz	-50.00 dBm				5 ms

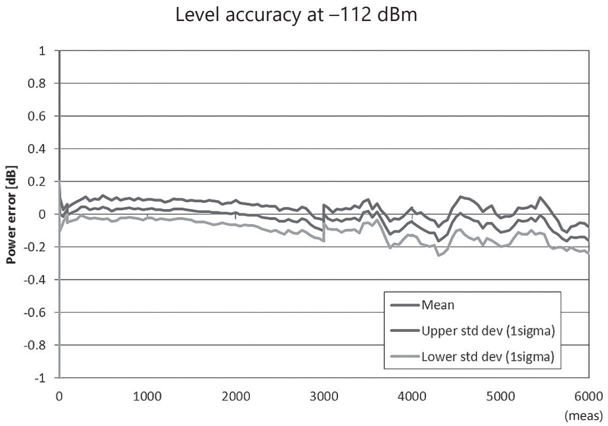
5 points, Any Dwell Time

High Level Accuracy

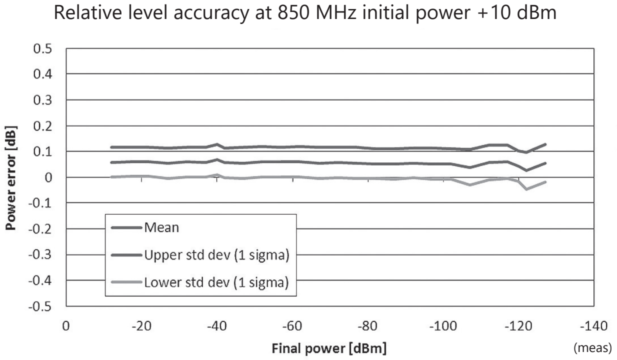
Absolute Level Accuracy: ±0.5 dB[*1]
Linearity: ±0.2 dB (typ.)[*2]

*1: 400 MHz to 3 GHz, –110 to +10 dBm
*2: 50 MHz to 3 GHz, –110 to –1 dBm

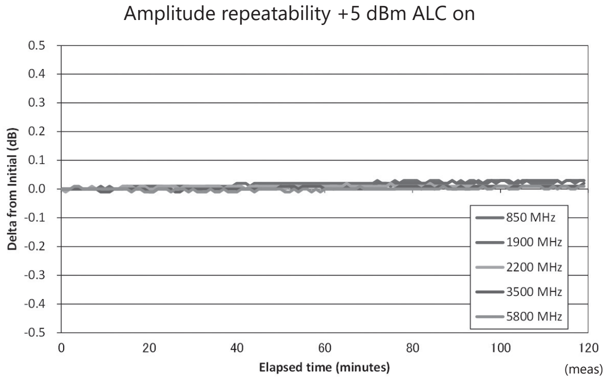
Excellent level accuracy and linearity are key factors with a large impact on measurement accuracy.



Frequency Characteristic



Linearity



Aging

Supports Rubidium Reference Oscillator (Option)

Three reference oscillator options are supported. Select the high-stability reference oscillator option [MG3710E-002] when requiring high accuracy depending on the measurement conditions; for even higher accuracy, select the rubidium reference oscillator [MG3710E-001]. However, if external high-accuracy reference signals are available, selecting the standard reference oscillator option helps reduce unnecessary costs.

- Reference Oscillator
  - Standard
    - Aging Rate: ±1 × 10^{-6}/year, ±1 × 10^{-7}/day
    - Temperature Stability: ±2.5 × 10^{-6} (5°C to 45°C)
  - High Stability Reference Oscillator [MG3710E-002]
    - Aging Rate: ±1 × 10^{-7}/year, ±1 × 10^{-8}/day
    - Temperature Stability: ±2 × 10^{-8} (5°C to 45°C)
    - Start-up Characteristics*: ±5 × 10^{-7} (2 minutes after power-on)
      ±5 × 10^{-8} (5 minutes after power-on)
  - Rubidium Reference Oscillator [MG3710E-001]
    - Aging Rate: ±1 × 10^{-10}/month
    - Temperature Stability: ±2 × 10^{-9} (5°C to 45°C)
    - Start-up Characteristics*: ±1 × 10^{-9} (7.5 minutes after power-on)

*: Compared to frequency after 24-h warm-up at 23°C

High All-purpose Baseband Performance

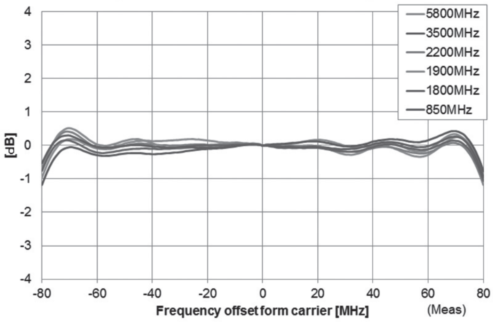
Wide Vector Modulation Bandwidth

160 MHz*/120 MHz (using Internal baseband signal generator)
160 MHz (using External IQ input)

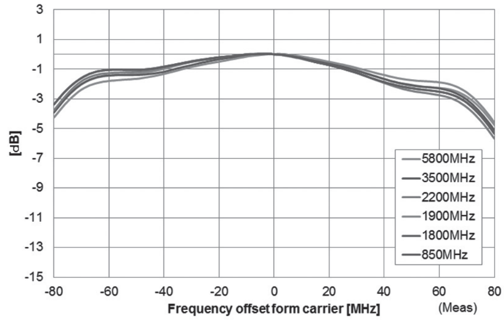
Using the standard internal baseband signal generator offers a wide vector modulation bandwidth of 160 MHz.

*: Supports firmware version 2.00.00 and later. Can generate 160-MHz bandwidth signals (Wireless LAN IEEE802.11ac) only when using WLAN IQproducer MX370111A and 802.11ac (160 MHz) option MX370111A-002.
The latest version can be downloaded from the Anritsu homepage.
<https://login.anritsu.com/signin>

I/Q bandwidth plot using optional internal baseband generator
(Internal Channel Corrections ON)



I/Q bandwidth plot using optional internal baseband generator



Point:

One unit supports WLAN 802.11ac signal generation and output.

- Upper Frequency Limit: 6 GHz
- RF Modulation Bandwidth: 160 MHz
- Dual RF: Two RF Outputs
- Waveform Generation Software: WLAN IQproducer (MX370111A & MX370111A-002)

The MG3710E supports output from 160-MHz bandwidth signals to non-contiguous 80 MHz + 80 MHz signals in one unit, which generally requires two signal generators.

Example: Support WLAN 802.11ac signal generation and output

11ac Bandwidth	20/40/80/160 MHz	80 MHz + 80 MHz (non-contiguous)
MG3710E*1	✓	✓*2

*1: WLAN IQproducer MX370111A and 802.11ac (160 MHz) option MX370111A-002 installed. For detail, refer to the IQproducer catalog.
*2: 2ndRF option MG3710E-062 (2.7 GHz)/064 (4 GHz)/066 (6 GHz) installed.

Large-capacity Waveform Memory

64 Msamples (256 MB) [with 1stRF, 2ndRF]
256 Msamples (1 GB) [MG3710E-045*1/075*2]
1024 Msamples (4 GB) [MG3710E-046*1/076*2]

*1: ARB Memory Upgrade 256 Msample for 1stRF [MG3710E-045]
ARB Memory Upgrade 1024 Msample for 1stRF [MG3710E-046]
*2: ARB Memory Upgrade 256 Msample for 2ndRF [MG3710E-075]
ARB Memory Upgrade 1024 Msample for 2ndRF [MG3710E-076]

Memory size is the most important specification for arbitrary waveform memory. If the memory is small, large waveform patterns cannot be handled and the number of cases when multiple waveform patterns cannot be loaded increases. When this happens, the time to reload another waveform pattern wastes evaluation time and lowers efficiency. The MG3710E has a large 64 Msamples memory as standard and this can be upgraded to either 4 times (256 Msamples) or 16 times (1024 Msamples) by adding these options.

Point

Adding the baseband signal combine function (MG3710E-048/078) supports waveform memories which can either be used separately or linked to multiply the memory size.

*: When attempting to load a waveform pattern exceeding the size of one memory, the memories are linked automatically to load the large pattern. However, in this case, other waveform patterns cannot be loaded into any remaining free space.
When dealing with many waveform patterns, we recommend upgrading the ARB memory size. If the waveform pattern can be handled by one memory, other waveform patterns can be loaded into the remaining free space and the other memory.
The maximum size per waveform pattern supported by the MG3710E varies with the IQproducer version.

Maximum Waveform Pattern Size and Required Options for Simultaneous Use

1stRF (MG3710E-032/034/036)

Combination of Baseband Signal (MG3710E-048)	ARB Memory Upgrade 256 Msample (MG3710E-045) ARB Memory Upgrade 1024 Msample (MG3710E-046)		
	W/O	With MG3710E-045	With MG3710E-046
W/O	64 Msamples × 1 pc	256 Msamples × 1 pc	1024 Msamples × 1 pc*1
With MG3710E-048*2	64 Msamples × 2 pcs 128 Msamples × 1 pc	256 Msamples × 2 pcs 512 Msamples × 1 pc	1024 Msamples × 2 pcs*1

2ndRF (MG3710E-062/064/066)

Combination of Baseband Signal (MG3710E-078)	ARB Memory Upgrade 256 Msample (MG3710E-075) ARB Memory Upgrade 1024 Msample (MG3710E-076)		
	W/O	With MG3710E-075	With MG3710E-076
W/O	64 Msamples × 1 pc	256 Msamples × 1 pc	1024 Msamples × 1 pc*1
With MG3710E-078*2	64 Msamples × 2 pcs 128 Msamples × 1 pc	256 Msamples × 2 pcs 512 Msamples × 1 pc	1024 Msamples × 2 pcs*1

*1: The maximum size per waveform pattern supported by the MG3710E varies with the IQproducer version.
*2: The Baseband Signal Combine option supports two ARB memories and can either set two different waveform patterns or combine them as one memory to support one large waveform pattern.

Free Waveform Generation

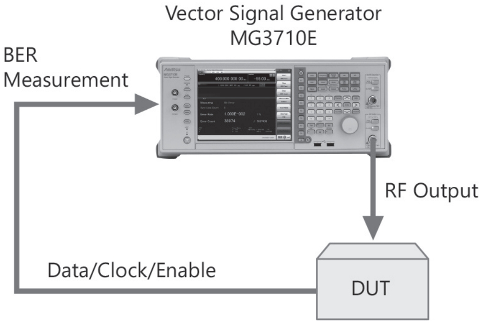
ASCII-format IQ sample data files created by other general-purpose EDA tools, such as MATLAB, can be converted into MG3710E waveform pattern files. Support for customer waveform pattern file creation makes the MG3710E ideal for R&D simulation applications too.

Expandability

BER Test Function [MG3710E-021]

This option installs a BER measurement function for measuring error rates between 100 bps and 40 Mbps using the DUT demodulated Data/Clock/Enable signals. The results are displayed on the MG3710E screen.

- Input Bit Rate: 100 bps to 40 Mbps
- Input Signal: Data, Clock, Enable (Polarity reversal supported)
- Input Level: TTL
- Measured Patterns: PN9/11/15/20/23, ALL1, ALL0,
  Alternate (0101...), User Data,
  PN9fix/11fix/15fix/20fix/23fix
- Count Mode
  Data: Measures until specified Data count
  Error: Measures until specified Error count
- Measurable Bit Count: $\leq 2^{32} - 1$ (4,294,967,295 bits)
- Measurement Mode
  Single: Measures specified measurement bit count once
  Continuous: Repeats Single measurement
  Endless: Continues measurement to upper limit of measurement bits

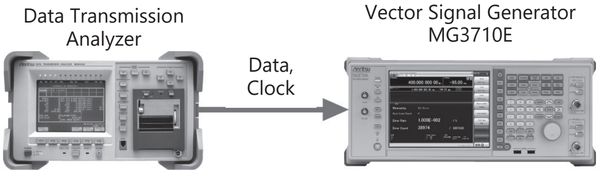


The BER can be measured using the DUT-demodulated Data/Clock/Enable.

BER Measurement Upper Limit

The table below shows one example of a BER measurement that indicates SyncLoss. Actual results depend on the specific communication systems and data rate, and will not necessarily match the measurement values below.

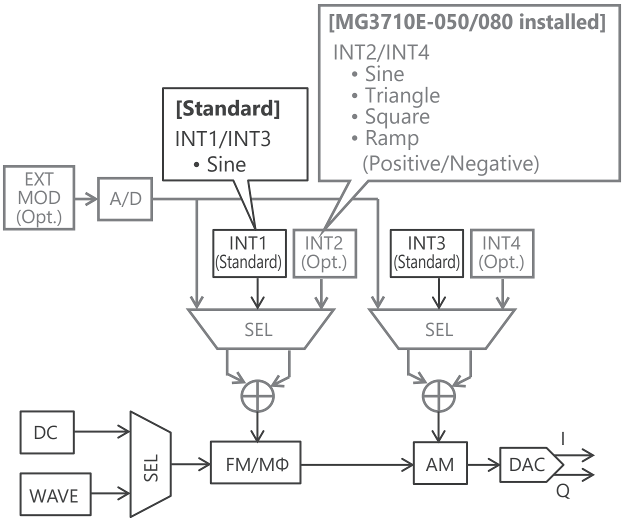
Error Rate	PN9	PN11	PN15	PN20	PN23
6.0%	–	–	–	–	–
5.0%	OK	–	–	–	–
4.0%	OK	OK	–	–	–
3.0%	OK	OK	OK	–	–
2.5%	OK	OK	OK	–	–
2.0%	OK	OK	OK	OK	OK
1.0%	OK	OK	OK	OK	OK



AM/FM/ΦM/PM Function

This option supports the following modulation functions as standard.
Analog modulations (AM/FM/ΦM) are performed on CW signals or arbitral (ARB) waveform pattern signals.
Pulse modulation can be performed at any cycle or timing and also supports modulation using an external input signal.

- Amplitude Modulation (Internal Modulation Source)
  Depth: 0 to 100% (Linear)
  0 to 10 dB (Exponential)
  Modulation Frequency: 0.1 Hz to 50 MHz
- Frequency Modulation (Internal Modulation Source)
  Deviation: 0 to 40 MHz
  Modulation Frequency: 0.1 Hz to 40 MHz, or (50 MHz-FM Rate), whichever smaller
- Φ-Modulation (Internal Modulation Source)
  Deviation angle: 0 to 160 rad.
  or (40 MHz/ΦM Rate) rad., whichever smaller
  Modulation Frequency: 0.1 Hz to 40 MHz,
  or (40 MHz/ΦM Deviation),
  whichever smaller
- Pulse Modulation (Internal Modulation Source)
  Modulation Frequency: 0.1 Hz to 10 MHz
  Modulation Period: 10 ns to 20 s
- Additional Analog Modulation Input [MG3710E-050/080]
  Adding additional analog modulation input options (MG3710E-050/080) extends to two internal modulation sources (AM/FM/ΦM) and one external modulation source supporting simultaneous two-signal modulation.
  AM + FM
  AM + ΦM
  Internal 1 + Internal 2
  Internal + External
  *: FM + ΦM does not support.

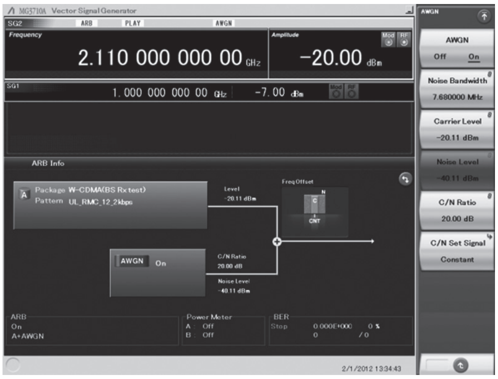


AWGN Generator [MG3710E-049*[1]/079*[2]]

*1: AWGN for 1stRF [MG3710E-049]
*2: AWGN for 2ndRF [MG3710E-079]

This option adds internally generated AWGN to the wanted signal. The AWGN output is switched on and off just by pressing the On/Off button.

Absolute C/N Ratio: ≤40 dB



Frequency 2.110 000 000 00 GHz
Amplitude −20.00 dBm
SG1 1. 000 000 000 00 GHz −7. 00 dBm
Package W-CDMA(BS Rx test)
Pattern UL_RMC_12_2kbps
Level −20.11 dBm
AWGN On
C/N Ratio 20.00 dB
Noise Level −40.11 dBm
ARB On A+AWGN
Power Meter A : Off B : Off
BER Stop 0.000E+000 0 % 0 / 0
2/1/2012 13:34:43
AWGN On
Noise Bandwidth 7.680000 MHz
Carrier Level −20.11 dBm
Noise Level −40.11 dBm
C/N Ratio 20.00 dB
C/N Set Signal Constant

AWGN Signal Addition Screen

USB Power Sensors [Sold separately]

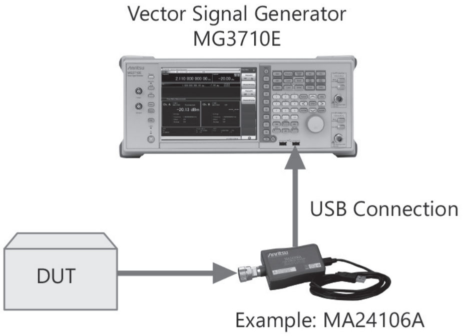
Up to two USB power sensors can be connected to the MG3710E to display the measurement results on the MG3710E screen.

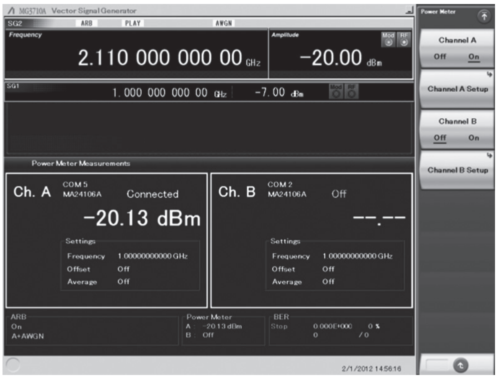
Compatible USB power sensors

Model	Frequency Range	Dynamic Range
MA24104A*	600 MHz to 4 GHz	+3 to +51.76 dBm
MA24105A	350 MHz to 4 GHz	+3 to +51.76 dBm
MA24106A	50 MHz to 6 GHz	–40 to +23 dBm
MA24108A	10 MHz to 8 GHz	–40 to +20 dBm
MA24118A	10 MHz to 18 GHz	–40 to +20 dBm
MA24126A	10 MHz to 26 GHz	–40 to +20 dBm

*: MA24104A has been discontinued. Replacement model is MA24105A.

Level Offset: –100 to +100 dB
Average: 1 to 2048
Unit: dBm, W
COM Port: 2 to 8





Frequency 2.110 000 000 00 GHz
Amplitude −20.00 dBm
SG1 1. 000 000 000 00 GHz −7. 00 dBm
Ch. A COM 5 MA24106A Connected
−20.13 dBm
Settings
Frequency 1.00000000000 GHz
Offset Off
Average Off
Ch. B COM 2 MA24106A Off
--.--
Settings
Frequency 1.00000000000 GHz
Offset Off
Average Off
ARB On A+AWGN
Power Meter A : −20.13 dBm B : Off
BER Stop 0.000E+000 0 % 0 / 0
2/1/2012 14:56:16

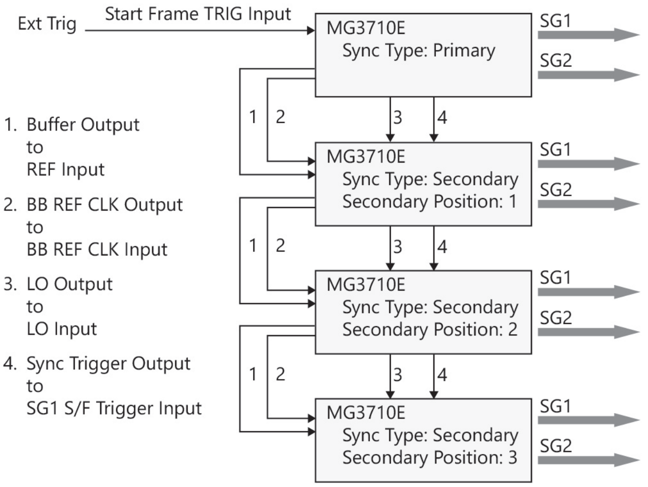
Power Meter Measurement Screen

Local Signal I/O for MIMO Signal Source [MG3710E-017]

The Sync Multi SG function shares local, baseband and trigger signals between multiple MG3710E units to output phase coherency signals synchronized with the signal output timing.
An 8×8 MIMO test system is configured easily from four MG3710E units composed of one primary and three secondaries.

Synchronization mode: Primary, Secondary, SG1 & 2
Number of Secondaries: 1 to 3
Secondary Position: 1 to 3
Local Synchronization: On/Off
IQ Phase Adjustment: –360 deg. to +360 deg.,
Resolution 0.01 deg.
IQ Delay: –400 ns to +400 ns, Resolution 1 ps

Common Setting
Number of Secondaries: 3
LO Sync: On

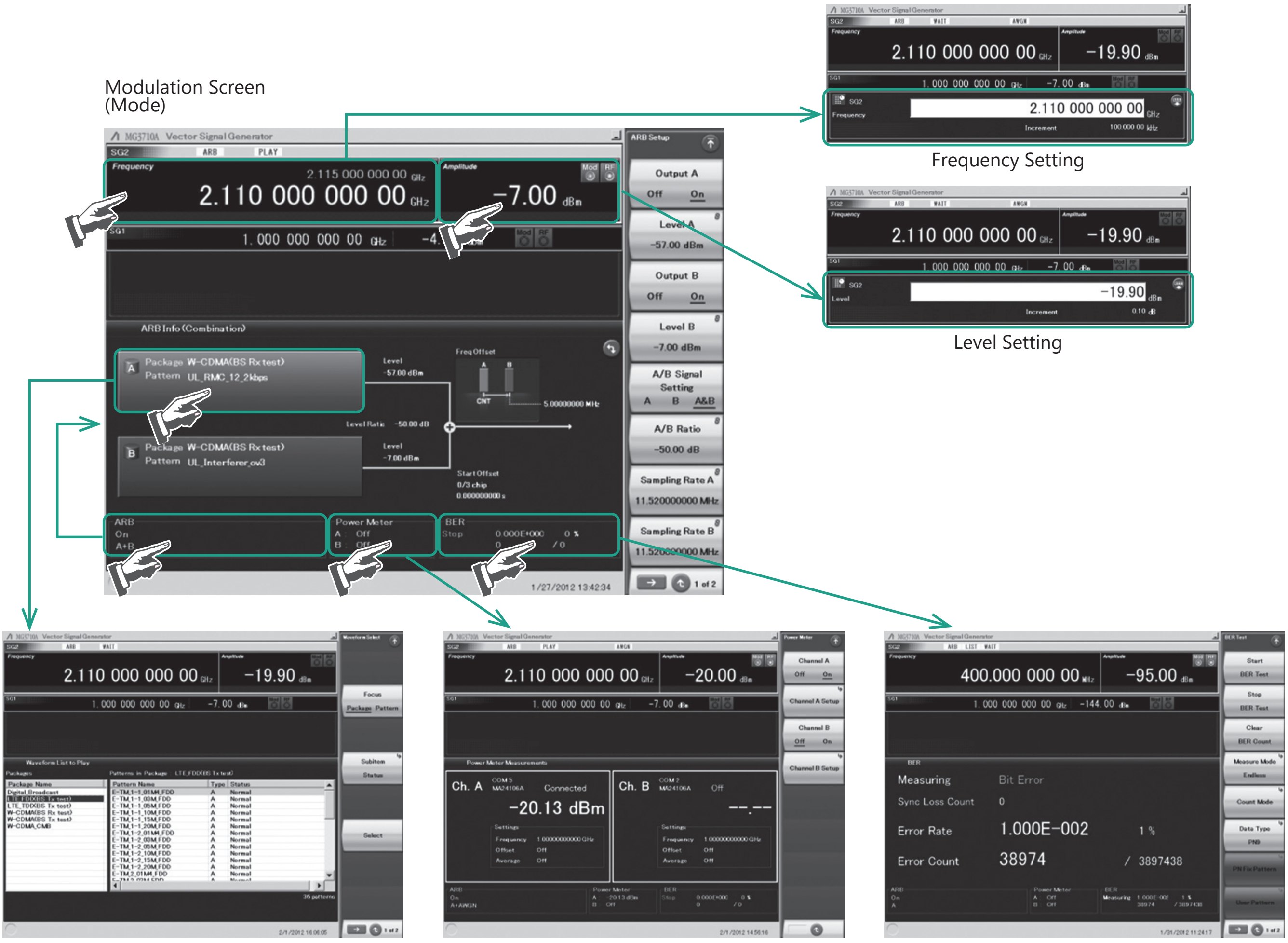


Note: Option-017 is not required when synchronizing the local signal and baseband clock of SG1 (1stRF) and SG2 (2ndRF) installed in one MG3710E unit.

Operability

Easy Touch-panel Operation

Simply touching parts of the screen display with a finger fetches related function keys and numeric inputs, offering a fast and easy way of navigating through multilayer menus.



Modulation Screen (Mode)

Frequency Setting

Level Setting

Waveform Pattern Selection

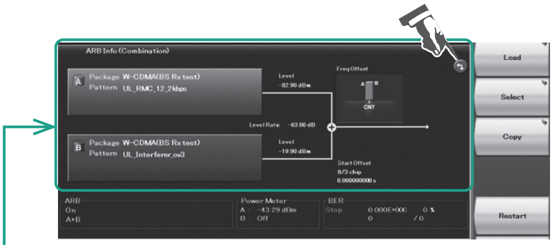
Power Meter Function

BER Function

Two Signal Flowcharts

Pressing the on-screen ↻ button toggles instantly between the Hardware Block Chart and the ARB Info screens.

The Hardware Block Chart is a quick-and-easy way to grasp the status of each block (ARB, AWGN, I/Q, Analog Mod, Pulse Mod, Local) at a glance. The ARB Info screen displays more details about the ARB/AWGN block showing the baseband signal combine status of memory A + memory B, memory A + AWGN, etc.


ARB Info (Combination)

A Package W-CDMA(BS Rx test)
Pattern UL_RMC_12_2kbps
Level -82.90 dBm

B Package W-CDMA(BS Rx test)
Pattern UL_Interferer_ov3
Level -19.90 dBm

Level Ratio -63.00 dB

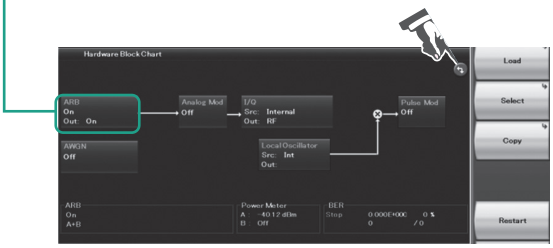
Start Offset
0/3 chip
0.000000000 s

ARB
On
A+B

Power Meter
A : -43.29 dBm
B : Off

BER
Stop 0.000E+000 0 %
0 / 0

ARB Info Screen


Hardware Block Chart

ARB
On
Out: On

Analog Mod
Off

I/Q
Src: Internal
Out: RF

Pulse Mod
Off

AWGN
Off

Local Oscillator
Src: Int
Out:

ARB
On
A+B

Power Meter
A : -40.12 dBm
B : Off

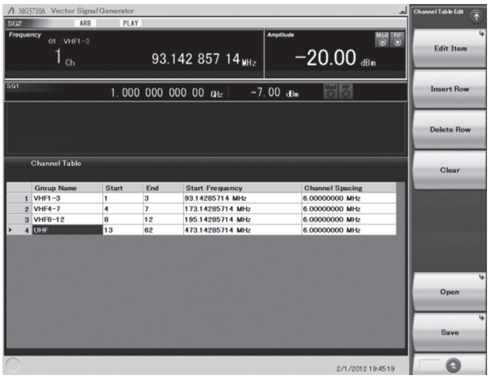
BER
Stop 0.000E+000 0 %
0 / 0

Hardware Block Chart Screen

Frequency Channel Table

Sometimes frequencies need setting by Channel No. The built-in frequency channel table where frequencies are set by channel number is ideal for this application. Once set and saved, these pre-settings can be read whenever needed.

- Channel Table Setting
  Group: 1 to 19
  Start Channel: 0 to 20000
  End Channel: (Start Channel) to 20000
  Start Frequency
  Channel Spacing


MG3710A Vector Signal Generator

SG2 ARB PLAY

Frequency 01 : VHF1-3
1 Ch 93.142 857 14 MHz

Amplitude −20.00 dBm

SG1 1. 000 000 000 00 GHz -7. 00 dBm

Channel Table

	Group Name	Start	End	Start Frequency	Channel Spacing
1	VHF1-3	1	3	93.14285714 MHz	6.00000000 MHz
2	VHF4-7	4	7	173.14285714 MHz	6.00000000 MHz
3	VHF8-12	8	12	195.14285714 MHz	6.00000000 MHz
▸ 4	UHF	13	62	473.14285714 MHz	6.00000000 MHz

2/1/2012 19:45:19

Channel Table Setting Screen

Connection with External Equipment

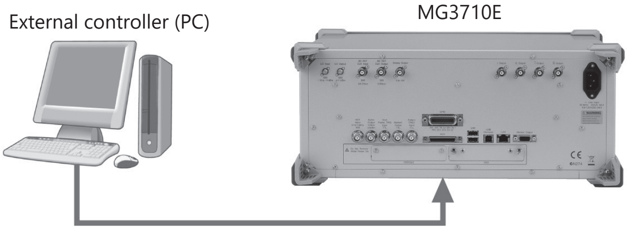
Remote Control Interfaces

The MG3710E has GPIB, Ethernet and USB interfaces as standard, supporting the following functions:

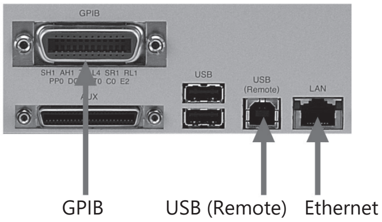
- Control all functions, except power switch
- Read all status conditions and settings
- Interrupts and serial polls

While in the Local status, the interface is determined automatically by the communication start command from the external controller (PC). To change the interface, put the MG3710E into the Local status again by pressing the Local key on the front panel and then send a command via the desired interface.

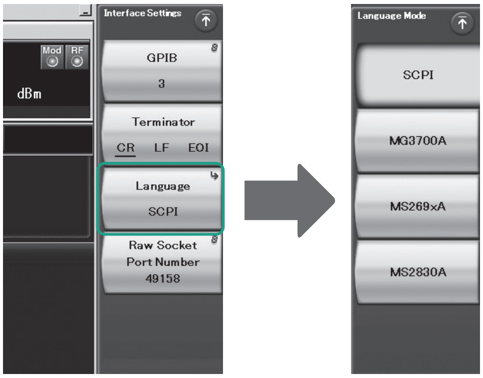
- GPIB: Conforms to IEEE 488.1/IEEE 488.2 standards
  SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2
- Ethernet: Conforms to VXI-11 protocol using TCP/IP Control programs
  SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0
- USB: Conforms to USBTMC-USB488 protocols
  SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0n



Connect to GPIB, Ethernet or USB port



Remote control command is in common with the MG3710A and the MG3710E. Either select the SCPI mode command format defined by the SCPI Consortium, or select backwards compatible modes supporting earlier MG3700A, MS269xA, and MS2830A commands.


Interface Settings
GPIB 3
Terminator CR LF EOI
Language SCPI
Raw Socket Port Number 49158

Language Mode

Command Format Setting Example

USB Connections

The two type-A USB2.0 connectors on the front and rear panels support keyboard, mouse and USB memory connections. Supported USB power sensors can be connected too.

USB Power Sensor [Sold separately]

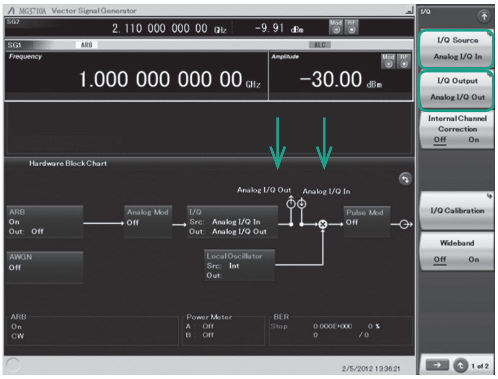
Frequency Range:	600 MHz to 4 GHz	[MA24104A]*
	350 MHz to 4 GHz	[MA24105A]
	50 MHz to 6 GHz	[MA24106A]
	10 MHz to 8 GHz	[MA24108A]
	10 MHz to 18 GHz	[MA24118A]
	10 MHz to 26 GHz	[MA24126A]

*: MA24104A has been discontinued. Replacement model is MA24105A.

Analog IQ Input/Output [MG3710E-018]

This option adds analog IQ input and output connectors to the front and rear panels, respectively. It only supports SG1 (1stRF).

Input: I Input, Q Input
Output: I Output, $\overline{I}$ Output, Q Output, $\overline{Q}$ Output,



I/Q Source: Analog I/Q In
I/Q Output: Analog I/Q Out
Internal Channel Correction: Off On
Wideband: Off On
ARB On, Out: Off
Analog Mod Off
I/Q Src: Analog I/Q In, Out: Analog I/Q Out
Pulse Mod Off
AWGN Off
Local Oscillator Src: Int, Out:
ARB On CW
Power Meter A: Off B: Off
BER Stop 0.000E+000 0 % 0 / 0
2/5/2012 13:36:21

Analog IQ I/O Setting Screen

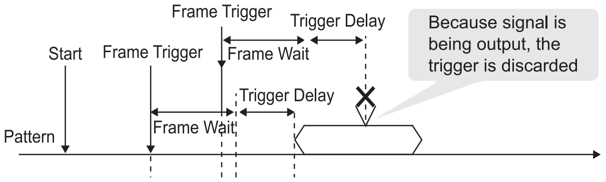
- Analog IQ Input Adjustment
  Setting Range: –100 mV to +100 mV
- Analog IQ Output Adjustment
  Output Voltage: 0.0 to 120.0%
  In-phase DC offset: –2.5 V to +5.0 V
  Differential DC offset: –50 mV to +50 mV

Trigger Input

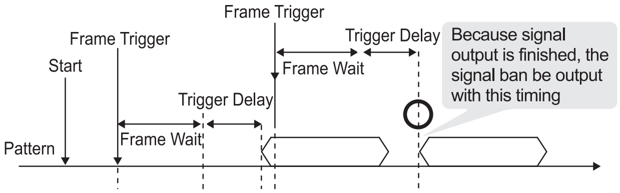
Start and Frame triggers are installed as standard for outputting waveform patterns synchronized with externally input trigger signals.

- Start Trigger Operation
  At Start Trigger operation, after the waveform pattern is selected, output is started and continued by the rise timing of the first external trigger signal. Second and subsequent input external trigger signals are disabled. This is used when receiving a Start Trigger signal and reference frequency signal from the DUT at the MG3710E.
- Frame Trigger Operation
  At Frame Trigger operation, one frame of the waveform pattern is output at the rise timing of the external trigger signal. When frame output is finished, the trigger wait state is returned. This is used when receiving a Frame Trigger signal from the DUT at the MG3710E. Frame Trigger supports three operations as follows:

(1) No Retrigger
Ignores triggers received during pattern output (default setting)

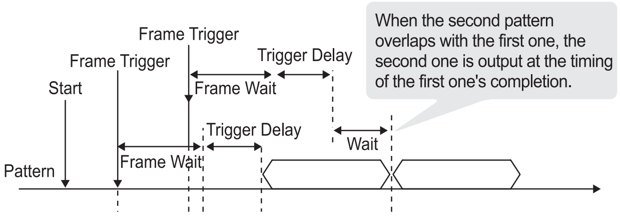


Because signal is being output, the trigger is discarded



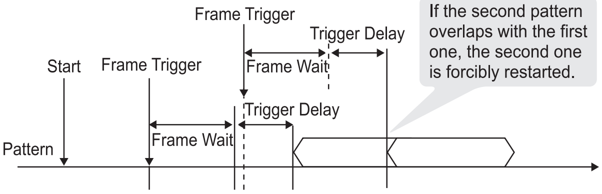
Because signal output is finished, the signal ban be output with this timing

(2) Buffered Trig
Holds triggers received during pattern output until current pattern output completed and then outputs next frame



When the second pattern overlaps with the first one, the second one is output at the timing of the first one's completion.

(3) Restart on Trig
Immediately restarts pattern when trigger received during pattern output

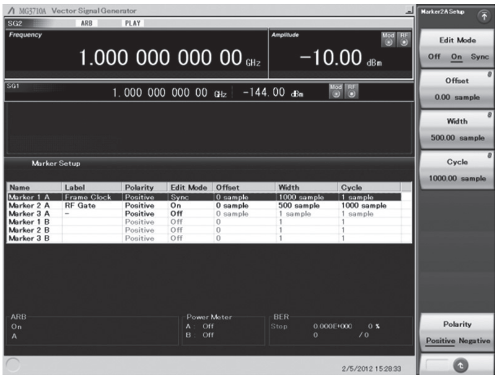


If the second pattern overlaps with the first one, the second one is forcibly restarted.

Marker Output Editing

- Marker 1 Output [Standard]
- Marker 2 & Marker 3 Output [Requires J1539A AUX Conversion Adapter]

When the Marker Setup function Edit Mode is Off, a marker signal combining the preset waveform pattern with marker information is output. When the Edit Mode is On, any marker for output can be set at the MG3710E screen. Up to 12 markers can be set for SG1/SG2, memory A/B and Marker 1 to 3.



SG2 Frequency 1.000 000 000 00 GHz

Amplitude −10.00 dBm

SG1 1. 000 000 000 00 GHz -144. 00 dBm

Offset 0.00 sample

Width 500.00 sample

Cycle 1000.00 sample

Marker Setup

Name	Label	Polarity	Edit Mode	Offset	Width	Cycle
Marker 1 A	Frame Clock	Positive	Sync	0 sample	1000 sample	1 sample
Marker 2 A	RF Gate	Positive	On	0 sample	500 sample	1000 sample
Marker 3 A	–	Positive	Off	0 sample	1 sample	1 sample
Marker 1 B		Positive	Off	0	1	1
Marker 2 B		Positive	Off	0	1	1
Marker 3 B		Positive	Off	0	1	1

ARB
On
A

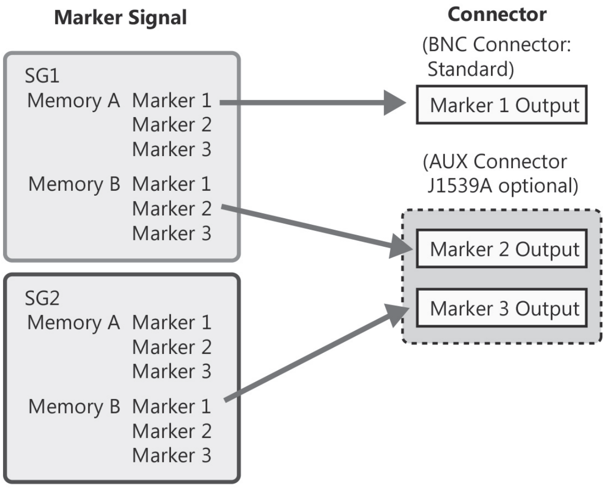
Power Meter
A : Off
B : Off

BER
Stop 0.000E+000 0 %
0 / 0

2/5/2012 15:28:33

SG2 Marker Setup Screen
Memory A (1A/2A/3A), Memory B (1B/2B/3B)

There are three output connectors: Marker 1 Output on the rear panel and the AUX connector (Marker 2 Output and Marker 3 Output). The connector output signal layout can be selected freely.



The defaults are as follows:

Marker Signal	Connector
SG1/Memory A/Marker 1	Marker 1 Output
SG1/Memory A/Marker 2	Marker 2 (@AUX)
SG1/Memory A/Marker 3	Marker 3 (@AUX)

Waveform Patterns & License

* Read the "Waveform Pattern catalog" for details.

DFS Radar Pattern MX370073B
Sets pulse signals for testing 5-GHz band WLAN DFS functions. The MX370073B supports the waveform patterns for the FCC and Japan MIC test specifications. Pulse signals are output simply by selecting the pattern.

DFS (ETSI) Waveform Pattern MX370075A
Sets pulse signals for testing 5-GHz band WLAN DFS functions. The MX370075A supports the waveform patterns for the ETSI specifications. Pulse signals are output simply by selecting the pattern.

> What is DFS?
> 5-GHz band wireless LAN devices like meteorological radar, marine radar, etc., have a Dynamic Frequency Selection (DFS) function for switching to an empty channel when detecting a radio wave. At testing, pulse, chirping and hopping signals like those used by radar are output from the SG to the WLAN equipment to check that it does not output signals in that channel.

ISDB-Tmm Waveform Pattern MX370084A
Archive of ARIB STD-B46 waveform patterns. Supports MER and spectrum evaluation of Tx characteristics tests and sensitivity/simple BER tests at Rx characteristics tests.

Interference Waveform Pattern for LTE Receiver Test MX371054A
Set of main interference waveform patterns for LTE UE Rx sensitivity and throughput tests. Interference signals are output simply by selecting the pattern.
Standard: 3GPP TS 36.521-1V16
Test items: Adjacent Channel Selectivity, In-band blocking, Wideband intermodulation

Interference Waveform Pattern for 5G NR Receiver Test MX371055A
Main modulated interference signals for 5G UE receiver sensitivity and throughput tests. Interference signals are output simply by selecting the pattern.
Standard: 3GPP TS 38.521-1V17
Test items: Adjacent Channel Selectivity, In-band blocking, Wideband intermodulation

IQproducer License

IQproducer is PC application software for generating waveform patterns. The parameters are set using IQproducer and the waveform pattern is created to output the signal by selection at the MG3710E. This one software application includes all the following systems.
Since it runs on any PC, the supported functions and parameter range can be verified before purchase.
When outputting a waveform pattern from the MG3710E, no signal is output unless a license for that system is installed in the main frame.
*: Read the "IQproducer catalog" for details.

HSDPA/HSUPA IQproducer MX370101A
Sets parameters according to HSDPA/HSUPA (Uplink and Downlink) specifications, and generates HSDPA/HSUPA waveform patterns including Fixed Reference Channel (3GPP TS 25.101 Annex A.7).

TDMA IQproducer MX370102A
Sets required parameters for TDMA waveform patterns and generates various waveform patterns. Setting parameters include Modulation, Frame, Slot, Data, Filter, etc. Supports wide application range including public wireless.

CDMA2000 1xEV-DO IQproducer MX370103A
Sets parameters according to CDMA2000 1xEV-DO Forward/Reverse specifications and generates 1xEV-DO waveform patterns.

Multi-carrier IQproducer MX370104A
Generates multi-carrier waveform patterns combination files using MG3710E Baseband Signal Combine function.
*: Requires MG3710E-048/078.

DVB-T/H IQproducer MX370106A
Sets parameters according to ETSI EN 300 744 V1.5.1 (2004-11) physical layer standard and generates DVB-T/H waveform patterns. Generated waveform patterns can be used for device TRx characteristics evaluation tests (Error Correction, BER graphics).

Fading IQproducer MX370107A

Performs IQ channel fading processing, correlation matrix calculation, AWGN combination. Input data file created by selecting waveform pattern file created with other IQproducer software, and IQ data (ASCII) created with other general-purpose simulation tools.

LTE IQproducer MX370108A

Generates wanted waveform patterns with parameters modified according to 3GPP TS 36.211, TS 36.212, TS 36.213 LTE FDD specifications.

LTE-Advanced FDD Option MX370108A-001

Installing in the MX370108A supports simple generation of carrier aggregation signals added by 3GPP Rel. 10. Additionally, clustered SC-FDMA signals can be generated at Uplink.

*: Requires MX370108A

LTE TDD IQproducer MX370110A

Generates wanted waveform patterns with parameters modified according to 3GPP TS 36.211, TS 36.212, TS 36.213 LTE TDD specifications.

LTE-Advanced TDD Option MX370110A-001

Installing in the MX370110A supports simple generation of carrier aggregation signals added by 3GPP Rel. 10. Additionally, clustered SC-FDMA signals can be generated at Uplink.

*: Requires MX370110A

WLAN IQproducer MX370111A

Generates waveform patterns for IEEE Std 802.11-2007 and IEEE Std 802.11n-2009 IEEE 802.11a/b/g/j/n/p specifications.

802.11ac (160 MHz) Option MX370111A-002

Installing in the MX370111A supports waveform patterns generation compliant with WLAN 802.11ac specifications.

*: Requires MX370111A. Only for MG3710E.

TD-SCDMA IQproducer MX370112A

Generates wanted waveform patterns with parameters modified according to TD-SCDMA specifications standardized by TRx characteristics evaluation tests (excluding performance tests) for 3GPP TS 25.221, TS 25.222, TS 25.223, TS 25.105, TS 25.142

5G NR TDD sub-6 GHz IQproducer MX370113A
5G NR FDD sub-6 GHz IQproducer MX370114A

Generates 3GPP TS 38.211, TS 38.212, and TS 38.213 defined waveform patterns in compliance with the 5G NR FR1 (sub-6 GHz) specifications.

Supported LTE-Advanced Carrier Aggregation Modes (Vector Signal Generator series)

Vector Signal Generator Series Carrier Aggregation Mode	Vector Signal Generator		Vector Signal Generator Option for Signal Analyzer	
	MG3710E/MG3710A*1	MG3700A*1	MS2690A series Option 020*2	MS2830A Option 020/021*2
Intra-band contiguous Carrier Aggregation, Intra-band non-contiguous Carrier Aggregation	✓ (1 unit)	✓ (1 unit)	✓ (1 unit)	✓ (1 unit)
Inter-band non-contiguous Carrier Aggregation	✓ (2 RF 1 unit*3, or 1 RF 2 units)	✓ (2 units)	✓ (2 units)	✓ (2 units)

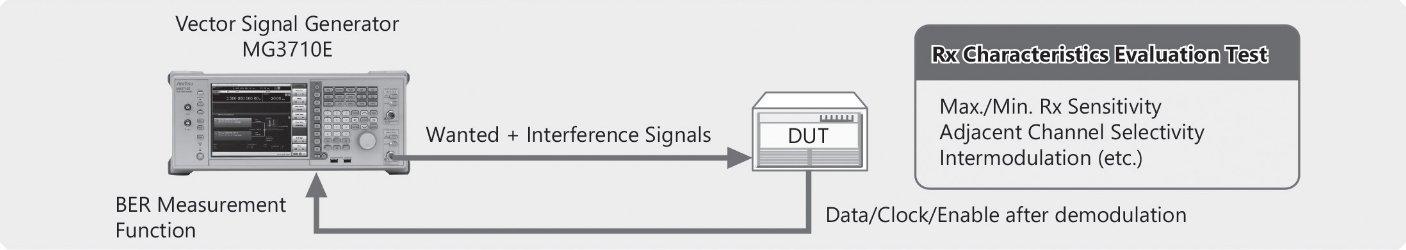
*1: LTE IQproducer MX370108A and LTE-Advanced FDD Option MX370108A-001 installed.
LTE TDD IQproducer MX370110A and LTE-Advanced TDD Option MX370110A-001 installed.
*2: LTE IQproducer MX269908A and LTE-Advanced FDD Option MX269908A-001 installed.
LTE TDD IQproducer MX269910A and LTE-Advanced TDD Option MX269910A-001 installed.
*3: 2ndRF Option MG3710E-062 (2.7 GHz)/064 (4 GHz)/066 (6 GHz) or MG3710A-062 (2.7 GHz)/064 (4 GHz)/066 (6 GHz) installed.

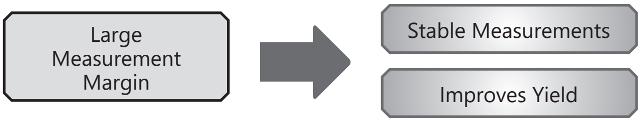
Supported WLAN 802.11ac Signal Bandwidth (Vector Signal Generator series)

Vector Signal Generator Series IEEE802.11ac Signal Bandwidth	Vector Signal Generator		Vector Signal Generator Option for Signal Analyzer	
	MG3710E/MG3710A*1	MG3700A*2	MS2690A series Option 020*3	MS2830A Option 020/021*3
20 MHz/40 MHz/80 MHz	✓ (1 unit)	✓ (1 unit)	✓ (1 unit)	✓ (1 unit)
160 MHz	✓ (1 unit)	—	—	—
80 MHz + 80 MHz (non-contiguous)	✓ (2 RF 1 unit*4, or 1 RF 2 units)	✓ (2 units)	✓ (2 units)	✓ (2 units)

*1: WLAN IQproducer MX370111A and 802.11ac (160 MHz) Option MX370111A-002 installed.
*2: WLAN IQproducer MX370111A and 802.11ac (80 MHz) Option MX370111A-001 installed.
*3: WLAN IQproducer MX269911A and 802.11ac (80 MHz) Option MX269911A-001 installed.
*4: 2ndRF Option MG3710E-062 (2.7 GHz)/064 (4 GHz)/066 (6 GHz) or MG3710A-062 (2.7 GHz)/064 (4 GHz)/066 (6 GHz) installed.

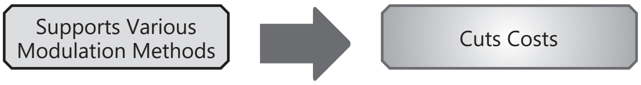
Rx Characteristics Evaluation Tests for Digital Narrowband Communications, Public Safety, etc.





Supports SSB Phase Noise Performance –140 dBc/Hz nom. (@100 MHz)
Phase noise performance affects measurement results at narrow bandwidths of several kHz. In particular, high phase-noise performance is required for interference waveforms.
Improved SSB phase noise supports wider specification margins and stable measurements to improve yields.

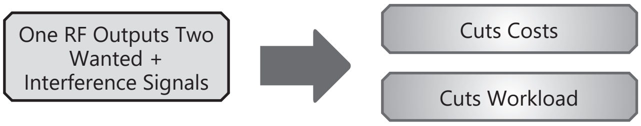
<–140 dBc/Hz (nom.)	@100 MHz, 20-kHz offset, CW
<–131 dBc/Hz (typ.)	@1 GHz, 20-kHz offset, CW
<–125 dBc/Hz (typ.)	@2 GHz, 20-kHz offset, CW



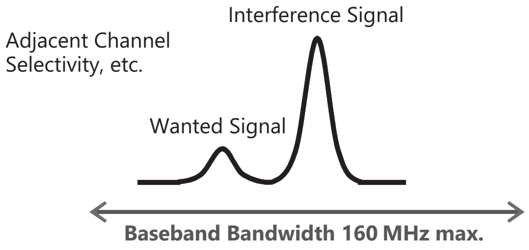
TDMA IQproducer [MX370102A] Supports Following Modulation Methods

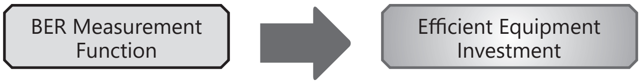
BPSK, DBPSK, PI/2DBPSK, QPSK, DQPSK, PI/4DQPSK,
8PSK, D8PSK, 16QAM, 32QAM, 256QAM, ASK, 2FSK, 4FSK,

The TDMA IQproducer PC software generates waveform patterns with any frame format or filter settings. One software package supports various narrowband digital communications.



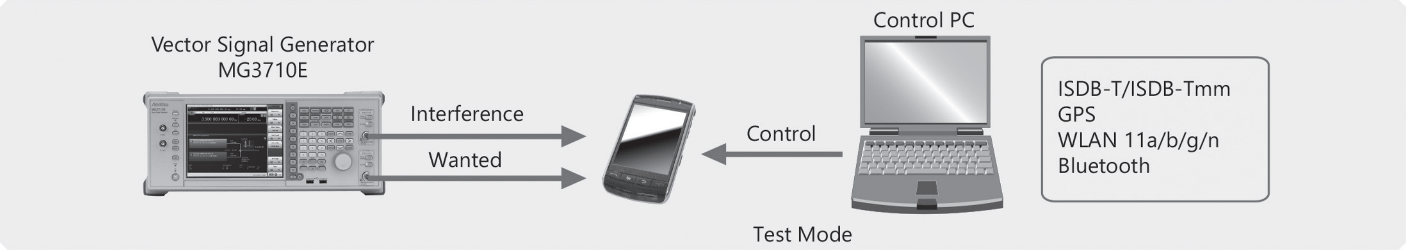
Two modulation signals can be output from one RF output using the baseband signal combine function (MG3710E-048/078). The level ratio (C/N = 80 dB) and the frequency offset (±80 MHz max.) can be set as well. Usually, tests using two modulation signals, such as adjacent channel selectivity (ACS) and intermodulation characteristics (IM) require two signal generators as well as a software license for each signal generator.
The MG3710E has two waveform memories for each RF output for setting and outputting different waveform data. One RF outputs the combined wanted + interference signals for a baseband bandwidth. Not only are equipment costs greatly reduced, but fewer external equipment, such as couplers, level adjusters, etc., as well as less setup time are required.





Supports BER Measurement Function [MG3710E-021]
The BER can be measured using the DUT-demodulated Data/Clock/Enable. The measurement results are displayed on the MG3710E screen.
Input Bit Rate: 100 bps to 40 Mbps

Rx Sensitivity Tests for Multi-system Mobile Terminals, etc.



Large 4-GB Memory Max. → Reduces Reload Times / Cuts Test Times

The MG3710E can save up to 1024 Msamples (4 GB) per RF. Memory size is one of the most important specifications for an arbitrary waveform signal generator. Small memory cannot save multiple waveform data and requires time-wasting reloading and measurement to output different signals each time.

With large waveform memory
- Switch loaded waveform data instantaneously
- Load multiple test waveforms
  → Reduce number of reloads → Cuts times

Pre-installed Waveform Patterns → Cuts Costs

License-free Pre-installed Waveform Patterns

WLAN 11a/b/g, Bluetooth, GPS, etc.

The following waveform patterns are available as options.

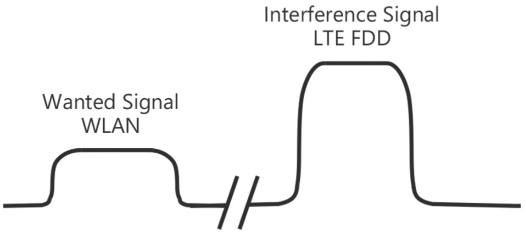
ISDB-Tmm	(MX370084A)

Optional waveform generation tools are also available (license separately sold):

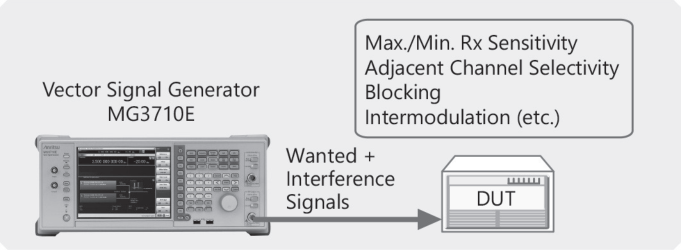
DVB-T/H	(MX370106A)
WLAN 11a/b/g/n/j/p	(MX370111A)
WLAN 11ac	(MX370111A-002)

Dual RF outputs → Cuts Costs

Two RF outputs can be installed as an option.
Additionally, two RF output models with different frequencies can be installed. For example, if WLAN 11b/g are the wanted waveforms, mobile signals for LTE FDD, LTE TDD, W-CDMA, GSM, etc., are considered interference signals. Generally, these tests have high hardware and software costs because two separate signal generators are required. Using the MG3710E, the total investment costs for interference tests under simulated service conditions, such as WLAN + LTE FDD, or ISDB-T + W-CDMA, are reduced by selecting models with different frequencies for the 1stRF and 2ndRF outputs.

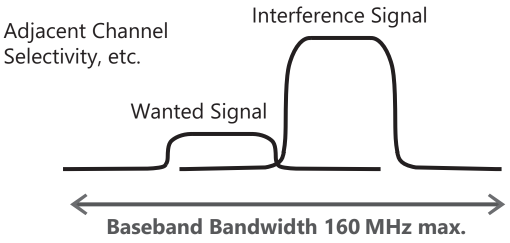


Wanted and Interference Waveforms for Rx Characteristics Evaluations of Cellular Base Station, etc.



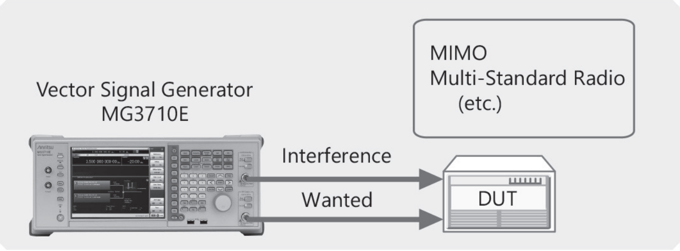
One RF Output Outputs Two Signals: Wanted + Interference → Cuts Costs, Cuts Workload

Two modulation signals can be output from one RF output using the baseband signal combine function (MG3710E-048/078). The level ratio (CN = 80 dB) and the frequency offset (±80 MHz max.) can be set as well. Tests using two modulation signals, such as Adjacent Channel Selectivity (ACS), Blocking, and Intermodulation (IM), etc., require two separate signal generators and a license for each, greatly increasing equipment costs and setting work loads.
The MG3710E has two waveform memories for each RF output for setting and outputting different waveform data. One RF outputs the combined wanted + interference signals for a baseband bandwidth. Not only are equipment costs greatly reduced, but fewer external equipment, such as couplers, level adjusters, etc., as well as less setup time are required. In comparison to previous Anritsu instruments, frequency offsets can be set for both memory A and B, and the sampling rate for memory A and B can be adjusted automatically.



BER Measurement Function, AWGN Generation Function → Efficient Equipment Investment

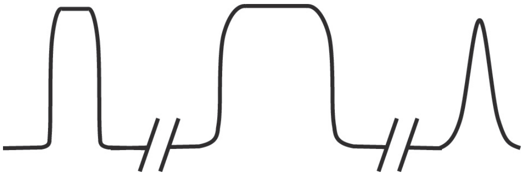
Installing the BER measurement (MG3710E-021) and AWGN Generation (MG3710E-049/079) options supports the extra functions required for Rx tests of each type of communications system.



Dual RF outputs → Cuts Costs

Two RF outputs can be installed as an option.
A different frequency, level and waveform pattern/CW can be set for each RF output, which is ideal for Rx tests using two signals for frequency offset that cannot be set using the baseband combine function. For example, sometimes at MSR, multiple signals must be output simultaneously in the 200-MHz band, requiring two RF outputs.

Multi-Standard Radio Rx Characteristics Tests



Lower-cost, Easy-to-operate SG for MIMO Evaluations → Cuts Costs, Cuts Workload

Installing two RF units in one MG3710E unit makes it easy to synchronize between channels. And adding the Universal Input/Output option (MG3710E-017) supports Local Signal I/O for synchronizing with other MG3710E units.
The IQproducer waveform generation software can be used with one license when two RF units are installed. For example, for LTE 2×2 MIMO tests, LTE IQproducer can generate two patterns for the Tx antenna signals and Fading IQproducer can generate two patterns with spatial multiplexing for the Rx antennas. Previously, using two signal generators required two separate licenses for LTE and fading, but now only one license is required to use IQproducer with the MG3710E with two RF units installed, helping cut software costs too.

Specifications

Refer to the Data Sheet for specification details such as guaranteed setting ranges, etc.

Frequency Setting Range

1stRF

MG3710E-032	9 kHz to 2.7 GHz
MG3710E-034	9 kHz to 4 GHz
MG3710E-036	9 kHz to 6 GHz

2ndRF

MG3710E-062	9 kHz to 2.7 GHz
MG3710E-064	9 kHz to 4 GHz
MG3710E-066	9 kHz to 6 GHz

Switching Speed (List Mode)

Frequency ≤600 μs
Level ≤600 μs

Amplitude Setting Range

Options	Setting Range [dBm]	
	without Reverse Power Protection	with Reverse Power Protection
Standard	–110 to +17	–110 to +17
with High-power Extension	–110 to +30	–110 to +25
with Low-power Extension	–144 to +17	–144 to +17
with High-power Extension and Low-power Extension	–144 to +30	–144 to +25

Level Accuracy is assured at high levels (CW)

Frequency Range	Standard	MG3710E-041/071
100 kHz ≤ f < 10 MHz	+5 dBm	+5 dBm
10 MHz ≤ f < 50 MHz	+10 dBm	+10 dBm
50 MHz ≤ f < 400 MHz	+13 dBm	**+20 dBm**
400 MHz ≤ f ≤ 3 GHz		**+23 dBm**
3 GHz < f ≤ 4 GHz		**+20 dBm**
4 GHz < f ≤ 5 GHz		+13 dBm
5 GHz < f ≤ 6 GHz	+11 dBm	+11 dBm

Absolute Level Accuracy

CW, 18°C to 28°C, –110 to +5 dBm

±0.5 dB (typ.)	(100 kHz ≤ f < 50 MHz)
±0.5 dB	(50 MHz ≤ f ≤ 3 GHz)
±0.7 dB	(3 GHz < f ≤ 4 GHz)
±0.8 dB	(4 GHz < f ≤ 6 GHz)

Harmonics

<–30 dBc

Non-Harmonics

Output level ≤+5 dBm, CW, Frequency offset ≥10 kHz
<–62 dBc (100 kHz ≤ f ≤ 187.5 MHz)
<–68 dBc (187.5 MHz < f ≤ 750 MHz)
<–62 dBc (750 MHz < f ≤ 1.5 GHz)
<–56 dBc (1.5 GHz < f ≤ 3 GHz)
<–50 dBc (3 GHz < f ≤ 6 GHz)

Single Sideband Phase Noise

CW, 20 kHz offset

<–140 dBc/Hz (nom.)	(100 MHz)
<–131 dBc/Hz (typ.)	(1 GHz)
<–125 dBc/Hz (typ.)	(2 GHz)

Analog Modulation

- Amplitude Modulation (Internal Modulation Source)
  Depth: 0 to 100% (Linear)
  0 to 10 dB (Log)
  Modulation Frequency: 0.1 Hz to 50 MHz
- Frequency Modulation (Internal Modulation Source)
  Deviation: 0 Hz to 40 MHz
  Modulation Frequency: 0.1 Hz to 40 MHz, or (50-MHz FM Rate), whichever smaller
- Φ-Modulation (Internal Modulation Source)
  Deviation angle: 0 to 160 rad., or (40 MHz/ΦM Rate) rad., whichever smaller
  Modulation Frequency: 0.1 Hz to 40 MHz, or (40 MHz/ΦM Deviation), whichever smaller
- Pulse Modulation (Internal Modulation Source)
  Modulation Frequency: 0.1 Hz to 10 MHz
  Modulation Period: 10 ns to 20 s

Baseband Performance

- RF Modulation Bandwidth
  160 MHz*/120 MHz (using Internal baseband signal generator)
- ARB Memory Size

64 Msamples (256 MB)	[with 1stRF, 2ndRF]
256 Msamples (1 GB)	[MG3710E-045/075]
1024 Msamples (4 GB)	[MG3710E-046/076]

- Sampling Rate
  20 kHz to 200 MHz*/160 MHz
- DAC Resolution
  14/15/16 bits

*: Supports firmware version 2.00.00 and later. Only when using WLAN IQproducer MX370111A and 802.11ac (160 MHz) option MX370111A-002.

EVM Performance

18°C to 28°C, After CAL

- W-CDMA (Test Model 4):
  Output Frequency: 800 MHz to 900 MHz, 1.8 GHz to 2.2 GHz
  ≤0.62% (rms)
  ≤0.6% (rms) (typ.)
- GSM:
  Output Frequency: 800 MHz to 900 MHz, 1.8 GHz to 1.9 GHz
  ≤0.84° (rms)
  ≤0.8° (rms) (typ.)
- EDGE:
  Output Frequency: 800 MHz to 900 MHz, 1.8 GHz to 1.9 GHz
  ≤0.84% (rms)
  ≤0.8% (rms) (typ.)
- LTE (20 MHz Test Model 3.1):
  Output Frequency: 600 MHz to 2.7 GHz
  ≤0.82% (rms)
  ≤0.8% (rms) (typ.)

Dimensions, Mass

426 (W) × 177 (H) × 390 (D) mm
≤13.7 kg (with 1stRF, excluding other option)

Power Supply

100 VAC to 120 VAC, 200 VAC to 240 VAC
50 Hz to 60 Hz

CE Marking

EMC: 2014/30/EU, EN61326-1, EN61000-3-2
LVD: 2014/35/EU, EN61010-1
RoHS: 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018

UKCA Marking

EMC: S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
LVD: S.I. 2016 No.1101, EN 61010-1
RoHS: S.I. 2012 No.3032, EN IEC 63000: 2018

Typical (typ.): Performance not warranted. Must products meet typical performance.
Nominal (nom.): Values not warranted. Included to facilitate application of product.
Measured (meas): Performance not warranted. Data actually measured by randomly selected measuring instruments.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name	Remarks
	Main Frame	
MG3710E	Vector Signal Generator	
	Standard Accessories	
	Power Cord: 1 pc	
P0031A	USB Memory	USB2.0 Flash Driver, ≥256 MB
	Install CD-ROM	Operation manual (PDF) and application software (IQproducer)
	Options	
	(Common Parts)	
MG3710E-001	Rubidium Reference Oscillator	Select when ordering main frame, aging rate: ±1 × 10^{-10}/month
MG3710E-002	High Stability Reference Oscillator	Select when ordering main frame, aging rate: ±1 × 10^{-7}/year
MG3710E-011	2ndary HDD	Select when ordering main frame, spare HDD for saving user data without Windows OS
MG3710E-017	Universal Input/Output	Select when ordering main frame, Adds BNC connectors for following signals to rear panel of main frame, includes AUX Conversion Adapter J1539A (Baseband Reference Clock Input/Output, Sweep Output, Local Signal Input/Output)
MG3710E-021	BER Test Function	Select when ordering main frame, Built-in BER measurement, Bit Rate: 100 bps to 40 Mbps AUX Conversion Adapter J1539A required for Data/Clock/Enable signal input
MG3710E-101	Rubidium Reference Oscillator Retrofit	Retrofitted to shipped MG3710E
MG3710E-102	High Stability Reference Oscillator Retrofit	Retrofitted to shipped MG3710E
MG3710E-111	2ndary HDD Retrofit	Retrofitted to shipped MG3710E
MG3710E-117	Universal Input/Output Retrofit	Retrofitted to shipped MG3710E
MG3710E-121	BER Test Function Retrofit	Retrofitted to shipped MG3710E
MG3710E-182	CPU/Windows10 Upgrade Retrofit	Retrofitted to shipped MG3710E
MG3710E-282	CPU/Windows10 Upgrade Retrofit	Retrofitted to shipped MG3710E
		Option 2xx is the option for customers to upgrade at their nearest local service center outside Japan.
	(For 1stRF)	
MG3710E-032	1stRF 100 kHz to 2.7 GHz	Select when ordering main frame, select 1stRF frequency range, frequency cannot be changed after installation
MG3710E-034	1stRF 100 kHz to 4 GHz	Select when ordering main frame, select 1stRF frequency range, frequency cannot be changed after installation
MG3710E-036	1stRF 100 kHz to 6 GHz	Select when ordering main frame, select 1stRF frequency range, frequency cannot be changed after installation
MG3710E-041	High Power Extension for 1stRF	Select when ordering main frame, increases upper limit of output signal power setting range
MG3710E-042	Low Power Extension for 1stRF	Select when ordering main frame, increases lower limit of output signal power setting range
MG3710E-043	Reverse Power Protection for 1stRF	Select when ordering main frame, prevents damage caused by reverse input to output connector
MG3710E-045	ARB Memory Upgrade 256 Msample for 1stRF	Select when ordering main frame, expands ARB memory capacity
MG3710E-046	ARB Memory Upgrade 1024 Msample for 1stRF	Select when ordering main frame, expands ARB memory capacity
MG3710E-048	Combination of Baseband Signal for 1stRF	Select when ordering main frame, adds baseband combine function
MG3710E-049	AWGN for 1stRF	Select when ordering main frame, adds AWGN combine function
MG3710E-050	Additional Analog Modulation Input for 1stRF	Select when ordering main frame, Adds BNC connector for inputting external signals to rear panel of mainframe.
MG3710E-018	Analog IQ Input/Output	Select when ordering main frame, installs IQ input/output BNC connector in main frame
MG3710E-141	High Power Extension for 1stRF Retrofit	Retrofitted to shipped MG3710E
MG3710E-142	Low Power Extension for 1stRF Retrofit	Retrofitted to shipped MG3710E
MG3710E-143	Reverse Power Protection for 1stRF Retrofit	Retrofitted to shipped MG3710E
MG3710E-145	ARB Memory Upgrade 256 Msample for 1stRF Retrofit	Retrofitted to shipped MG3710E
MG3710E-146	ARB Memory Upgrade 1024 Msample for 1stRF Retrofit	Retrofitted to shipped MG3710E
MG3710E-148	Combination of Baseband Signal for 1stRF Retrofit	Retrofitted to shipped MG3710E
MG3710E-149	AWGN for 1stRF Retrofit	Retrofitted to shipped MG3710E
MG3710E-150	Additional Analog Modulation Input for 1stRF Retrofit	Retrofitted to shipped MG3710E
MG3710E-118	Analog IQ Input/Output Retrofit	Retrofitted to shipped MG3710E
	(For 2ndRF)	
MG3710E-062	2ndRF 100 kHz to 2.7 GHz	Select when ordering main frame, select 2ndRF frequency range, frequency cannot be changed after installation
MG3710E-064	2ndRF 100 kHz to 4 GHz	Select when ordering main frame, select 2ndRF frequency range, frequency cannot be changed after installation
MG3710E-066	2ndRF 100 kHz to 6 GHz	Select when ordering main frame, select 2ndRF frequency range, frequency cannot be changed after installation
MG3710E-071	High Power Extension for 2ndRF	Select when ordering main frame, increases upper limit of output signal power setting range
MG3710E-072	Low Power Extension for 2ndRF	Select when ordering main frame, increases lower limit of output signal power setting range
MG3710E-073	Reverse Power Protection for 2ndRF	Select when ordering main frame, prevents damage caused by reverse input to output connector
MG3710E-075	ARB Memory Upgrade 256 Msample for 2ndRF	Select when ordering main frame, expands ARB memory capacity
MG3710E-076	ARB Memory Upgrade 1024 Msample for 2ndRF	Select when ordering main frame, expands ARB memory capacity
MG3710E-078	Combination of Baseband Signal for 2ndRF	Select when ordering main frame, adds baseband combine function
MG3710E-079	AWGN for 2ndRF	Select when ordering main frame, adds AWGN combine function
MG3710E-080	Additional Analog Modulation Input for 2ndRF	Select when ordering main frame, Adds BNC connector for inputting external signals to rear panel of mainframe.
MG3710E-162	2ndRF 100 kHz to 2.7 GHz Retrofit	Retrofitted to shipped MG3710E when 2ndRF not installed
MG3710E-164	2ndRF 100 kHz to 4 GHz Retrofit	Retrofitted to shipped MG3710E when 2ndRF not installed
MG3710E-166	2ndRF 100 kHz to 6 GHz Retrofit	Retrofitted to shipped MG3710E when 2ndRF not installed
MG3710E-171	High Power Extension for 2ndRF Retrofit	Retrofitted to shipped MG3710E
MG3710E-172	Low Power Extension for 2ndRF Retrofit	Retrofitted to shipped MG3710E
MG3710E-173	Reverse Power Protection for 2ndRF Retrofit	Retrofitted to shipped MG3710E
MG3710E-175	ARB Memory Upgrade 256 Msample for 2ndRF Retrofit	Retrofitted to shipped MG3710E
MG3710E-176	ARB Memory Upgrade 1024 Msample for 2ndRF Retrofit	Retrofitted to shipped MG3710E
MG3710E-178	Combination of Baseband Signal for 2ndRF Retrofit	Retrofitted to shipped MG3710E
MG3710E-179	AWGN for 2ndRF Retrofit	Retrofitted to shipped MG3710E
MG3710E-180	Additional Analog Modulation Input for 2ndRF Retrofit	Retrofitted to shipped MG3710E
	Maintenance Service	
MG3710E-ES210	2 Years Extended Warranty Service	
MG3710E-ES310	3 Years Extended Warranty Service	
MG3710E-ES510	5 Years Extended Warranty Service	

Continued on next page

Model/Order No.	Name	Remarks
	Softwares (Waveform Pattern)	(License for waveform patterns)
MX370073B	DFS Radar Pattern	WLAN 5.3/5.6 GHz band DFS tests (for FCC and Japan MIC) waveform pattern, license for main frame, manual (PDF)
MX370075A	DFS (ETSI) Waveform Pattern	WLAN 5.3/5.6 GHz DFS test (ETSI) waveform pattern, license for main frame, manual (PDF)
MX370084A	ISDB-Tmm Waveform Pattern	ISDB-Tmm Waveform Patterns, license for main frame, manual (PDF)
MX371054A	Interference Waveform Pattern for LTE Receiver Test	3GPP-compliant modulated interference signal for LTE UE receiver sensitivity and throughput tests, license for main frame, manual (PDF)
MX371055A	Interference Waveform Pattern for 5G NR Receiver Test	3GPP-compliant modulated interference signal for 5G UE receiver sensitivity and throughput tests, license for main frame, manual (PDF)
	Softwares (IQproducer)	(License for IQproducer)
MX370101A	HSDPA/HSUPA IQproducer	IQproducer software, license for main frame, manual (PDF)
MX370102A	TDMA IQproducer	IQproducer software, license for main frame, manual (PDF)
MX370103A	CDMA2000 1xEV-DO IQproducer	IQproducer software, license for main frame, manual (PDF)
MX370104A	Multi-carrier IQproducer	IQproducer software, license for main frame, manual (PDF)
MX370106A	DVB-T/H IQproducer	IQproducer software, license for main frame, manual (PDF)
MX370107A	Fading IQproducer	IQproducer software, license for main frame, manual (PDF)
MX370108A	LTE IQproducer	IQproducer software, license for main frame, manual (PDF)
MX370108A-001	LTE-Advanced FDD Option	IQproducer software, license for main frame, manual (PDF). Requires MX370108A.
MX370110A	LTE TDD IQproducer	IQproducer software, license for main frame, manual (PDF)
MX370110A-001	LTE-Advanced TDD Option	IQproducer software, license for main frame, manual (PDF). Requires MX370110A.
MX370111A	WLAN IQproducer	IQproducer software, license for main frame, manual (PDF)
MX370111A-002	802.11ac (160 MHz) Option	IQproducer software, license for main frame, manual (PDF). Only for MG3710E/MG3710A. Requires MX370111A
MX370112A	TD-SCDMA IQproducer	IQproducer software, license for main frame, manual (PDF)
MX370113A	5G NR TDD sub-6 GHz IQproducer	IQproducer software, license for main frame, manual (PDF)
MX370114A	5G NR FDD sub-6 GHz IQproducer	IQproducer software, license for main frame, manual (PDF)
	Optional Accessories	
W3580AE	MG3710A/MG3710E/MG3740A Operation Manual (Main Unit)	Booklet, for MG3710A/MG3710E/MG3740A Main Frame (Operation, Remote Control)
W2496AE	MG3710A/MG3710E/MG3740A Operation Manual (IQproducer)	Booklet, for IQproducer (Operation for Common Parts)
W3581AE	MG3710A/MG3710E Operation Manual (Pre-installed Waveform Patterns)	Booklet, for Pre-installed Waveform Patterns (Usage, Detailed Parameters)
W3986AE	MX370073B Operation Manual	Booklet, for DFS (for FCC and Japan MIC) Waveform Patterns
W3597AE	MX370075A Operation Manual	Booklet, for DFS (ETSI) Waveform Patterns
W3508AE	MX370084A Operation Manual	Booklet, for ISDB-Tmm Waveform Patterns
W4073AE	MX371054A Operation Manual	Booklet, for Interference Waveform Pattern for LTE Receiver Test
W4074AE	MX371055A Operation Manual	Booklet, for Interference Waveform Pattern for 5G NR Receiver Test
W2915AE	MX370101A Operation Manual	Booklet, for HSDPA/HSUPA IQproducer
W2916AE	MX370102A Operation Manual	Booklet, for TDMA IQproducer
W2505AE	MX370103A Operation Manual	Booklet, for CDMA2000 1xEV-DO IQproducer
W2917AE	MX370104A Operation Manual	Booklet, for Multi-carrier IQproducer
W2798AE	MX370106A Operation Manual	Booklet, for DVB-T/H IQproducer
W2995AE	MX370107A Operation Manual	Booklet, for Fading IQproducer
W3023AE	MX370108A Operation Manual	Booklet, for LTE IQproducer/LTE-Advanced FDD Option
W3221AE	MX370110A Operation Manual	Booklet, for LTE TDD IQproducer/LTE-Advanced TDD Option
W3488AE	MX370111A Operation Manual	Booklet, for WLAN IQproducer/802.11ac Option
W3582AE	MX370112A Operation Manual	Booklet, for TD-SCDMA IQproducer
W3984AE	MX370113A Operation Manual	Booklet, for 5G NR TDD sub-6 GHz IQproducer
W4033AE	MX370114A Operation Manual	Booklet, for 5G NR FDD sub-6 GHz IQproducer
J1539A	AUX Conversion Adapter	Converts MG3710E/MG3710A rear-panel AUX connector to BNC connector
Z1572A	Installation Kit	Required when retrofitting hardware options or installing IQproducer (MX3701xxA)
Z1594A	Standard Waveform Pattern for Backup	Latest MG3710E/MG3710A Pre-installed waveform pattern set for backup
MA24105A	Inline Peak Power Sensor	350 MHz to 4 GHz, Inline type, with USB A to micro-B Cable
MA24106A	USB Power Sensor	50 MHz to 6 GHz, with USB A to mini-B Cable
MA24108A	Microwave USB Power Sensor	10 MHz to 8 GHz, with USB A to micro-B Cable
MA24118A	Microwave USB Power Sensor	10 MHz to 18 GHz, with USB A to micro-B Cable
MA24126A	Microwave USB Power Sensor	10 MHz to 26 GHz, with USB A to micro-B Cable
K240B	Power Divider (K connector)	DC to 26.5 GHz, K-J, 50Ω, 1 Wmax
MA1612A	Four-Port Junction Pad	5 MHz to 3 GHz, N-J
J0576B	Coaxial Cord, 1.0 m	N-P · 5D-2W · N-P
J0576D	Coaxial Cord, 2.0 m	N-P · 5D-2W · N-P
J0127A	Coaxial Cord, 1.0 m	BNC-P · RG-58A/U · BNC-P
J0127B	Coaxial Cord, 2.0 m	BNC-P · RG-58A/U · BNC-P
J0127C	Coaxial Cord, 0.5 m	BNC-P · RG-58A/U · BNC-P
J0322A	Coaxial Cord, 0.5 m	SMA-P · SMA-P, DC to 18 GHz, 50Ω
J0322B	Coaxial Cord, 1.0 m	SMA-P · SMA-P, DC to 18 GHz, 50Ω
J0322C	Coaxial Cord, 1.5 m	SMA-P · SMA-P, DC to 18 GHz, 50Ω
J0322D	Coaxial Cord, 2.0 m	SMA-P · SMA-P, DC to 18 GHz, 50Ω
J0004	Coaxial Adapter	N-P · SMA-J Conversion Adapter, DC to 12.4 GHz
J1261B	Ethernet Cable (Shield Type)	Straight-through, 3 m
J1261D	Ethernet Cable (Shield Type)	Crossover, 3 m
J0008	GPIB Cable, 2.0 m	
B0635A	Rack Mount Kit	EIA
B0657A	Rack Mount Kit (JIS)	JIS
B0636C	Carrying Case	Hard Type. With Casters and Front Cover B0671A
B0671A	Front Cover for 1MW4U	
Z0975A	Keyboard (USB)	
Z0541A	USB Mouse	

The following option is installed as standard when ordering the MG3710E. It does not require a separate order.
MX371099A MG3710A Standard Waveform Pattern

Trademarks:

IQproducer™ is a registered trademark of Anritsu Corporation.
MATLAB® is a registered trademark of The MathWorks, Inc.
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IQ Fiber Master

MT2780A

9 kHz to 9/14/20/26.5/32/43.5/54 GHz

Remote Control
Ethernet

The IQ Fiber Master is a standalone and economical multi-port CPRI-based RF and PIM analyzer

PIM and RF analysis have never been so light weight, portable, and easy-to-use. Anritsu's PIM over CPRI measurements (option 754), LTE RF over CPRI measurements (option 752), and PIM analytics (option 755) are ideal tools for troubleshooting interference and PIM issues in LTE networks from ground level by accessing the CPRI IQ data stream (uplink (UL) and downlink (DL)) between the baseband unit (BBU) and the remote radio head (RRH). The IQ Fiber Master MT2780A PIM and RF analyzer is a CPRI-based solution that provides critical PIM diagnosis across multiple bands and sectors using live traffic. Cell sites remain active during testing as this instrument uses a non-invasive process to report real-time results. The IQ Fiber Master can identify PIM levels, locations, and conduct RF spectrum analysis to efficiently hunt and debug PIM and interference issues. By using live traffic to get an accurate picture of cell site environments, there is no site turn down and no tower climb needed. The MT2780A can monitor up to three downlinks and one uplink during PIM over CPRI testing for analysis of multi-band sites or 4×4 MIMO antennas. It can also resolve intermittent PIM problems by continuously monitoring cell sites remotely for days or weeks automatically record and capture PIM events with time stamping to make debugging easier.

Key Features

- RF over CPRI for interference measurements
- PIM over CPRI for any frequency PIM measurement
- PIM analytics for long-tern PIM monitoring
- 4 SFP ports
- 4×4 MIMO support
- CPRI line Rate 1 – 8 support
- PIM location (distance-to-PIM = DTP)
- Support all Tier 1 LTE base station radio manufacturers
- Up to 12 AxC traces simultaneously for multiple sector/carriers
- Uses MX280020A PC software; free download from Anritsu.com website

Specifications

IQ Fiber Master MT2780A (Requires Option 752)

Optical Inputs		Up to four Small Form Pluggable (SFP) transceivers Supports Rate 1 to Rate 8 CPRI (SFP dependent) Line bit rate 1 614.1 Mbit/s Line bit rate 2 1228.8 Mbit/ Line bit rate 3 2457.6 Mbit/s Line bit rate 4 3072.0 Mbit/s Line bit rate 5 4915.2 Mbit/s Line bit rate 6 6144.0 Mbit/s Line bit rate 7 9830.4 Mbit/s Line bit rate 8 10137.6 Mbit/s
Rear Panel Connectors	VDC	Input voltage 12 VDC @ 2 A
	Ethernet 1	PC connection
	Ethernet 2 and 3	For future applications
	USB B	For future applications
	USB C	For future applications
Power Requirements	Voltage	12 VDC from supplied AC adapter
	Current	2 A
	Power Consumption	30 W
PC Requirements (Minimum specifications)	Processor	Intel core i3-6100 or AMD FX4350 processor (Recommended, Intel core i7)
	RAM	8 GB of RAM (recommended 16 GB)
	Ports	Ethernet, USB C and USB 2.0
	Operating System	Windows 7 (or higher, 64-bit only)

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Regulatory Compliance	CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: (EU) 2015/863
	Australia and New Zealand	RCM AS/NZS 4417:2012
	South Korea	KCC-REM-A21-0004
Environmental	Operating Temperature	0°C to +45°C (based on SFP specs)
	Storage Temperature Range	–40°C to +71°C
	Maximum Relative Humidity	95% RH at 40°C, non-condensing
Dimensions and Mass		133 (W) × 55 (H) × 185 (D) mm (7.3 × 5.2 × 2.1 in), 1 kg (2.2 lbs.)
Warranty	Duration	Standard, 3-year on the sensor, 1-year on the accessories

LTE RF over CPRI (Option 752) (Requires MT2780A)

General	Supported Vendors	ALU, Ericsson, Huawei, Nokia, Samsungs
	LTE Bandwidth	5 MHz, 10 MHz, 15 MHz, and 20 MHz
Measurement	Measurements	Spectral analysis of CPRI IQ streams, absolute or relative frequency LTE UL or DL
Setup Parameters	Auto-detect	CPRI parameter set up support (detects CPRI line rate, LTE air std (5 MHz, 10 MHz, 15 MHz, and 20 MHz BW), sampling, and number of antenna ports) and AxC group
	LTE Bandwidth	5 MHz, 10 MHz, 15 MHz, and 20 MHz (LTE5, LTE10, LTE15, and LTE20)
	Plot	Up to six plots containing up to 12 AxC traces (up to 12 AxC traces in one plot or distributed across six plots)
	Windowing	Rectangle, Hamming, Hanning, Bartlett, Blackman, Gaussian, Flat top
	Axes	x-axis (center, span, and auto-scale) y-axis (ref level, dB/div, and number of divisions)
	Sweep	Normal, max hold, min hold, hold, average, # averages (1 to 100)
	Resolution	Resolution Bandwidth (RBW) 117 Hz to 30 KHz, #FFTs 1024 to 262144, based on 30.72 MB/s CPRI data rate, will vary for other CPRI data rates
	Markers	Markers 1 to 6, each with a Delta marker, marker-to-peak, marker-to-center, marker-to-ref, and marker delta-to-span; also frequency, power, or combined marker
	Traces	Normal, max hold, min hold, hold, average. Persistence, restart, add, and remove Up to 12 simultaneous traces per plot or one per plot
	Spectrogram	Waterfall feature, scalable from 25 to 75 % of display window
Frequency	Frequency Range	Supports all LTE bands (CPRI IQ is baseband information)
Measurement Update	Rate	100 ms (10 frames per second) (typical) (dependent on PC performance, number of streams, data volume to be transferred to PC)
Results		Spectrum plots can be exported as PNG (whole screen, center only, or current plot)

PIM over CPRI (Option 754) (Requires Option 752)

General	Supported Vendors	ALU, Ericsson, Huawei, Nokia, Samsung
	LTE Bandwidth	5 MHz, 10 MHz, 15 MHz, and 20 MHz
	MIMO Support	SISO, 1×2, 2×2, 2×4, 4×4
PIM Measurements	Supported PIM Configuration	Multiband dual carrier: IM3 to IM5 Single carrier: IM3 to IM5 Single carrier harmonic: H2 and H3
	PIM Power Level	PIM measurement in dB relative to thermal noise floor (measurements in dBm or dBsb)
	PIM Power Level Accuracy	±1 dB (typical) (RMS level of digital PIM power on CPRI). Absolute (dBm) PIM accuracy will depend on UL gain accuracy of RRH
	PIM Power Level Range	–10 dB below to +50 dB above RRH thermal noise (–112 to –57 dBm for LTE 10 RRH with 2.5 dB NF (typical)
	Measurement Time - Acquisition	One minute (typical), subsequent measurement 4 seconds per UL (typical)
Setup Parameters	Advanced Settings	PIM Desensitization pass/fail limit (dB) Noise floor auto-calibration of RRH under test Measurement result units (dBm, dBFS)
	LTE Bandwidth	5 MHz, 10 MHz, 15 MHz, and 20 MHz (LTE5, LTE10, LTE15, and LTE20)
	IQ Fiber Master Status	Connected/disconnected, SFP status indication (LOS, LOF, CPRI data), internal temperature
	Configuration Check	Color-coded, interactive fiber diagram associated with each test scenario Rules-based check (editable by user): Optical connectivity, CPRI connectivity, IQ stream capture, RSSI/TSSI, bandwidth, and LTE ID TX configuration
	Measurement State	Measurement process update (acquiring, measuring, switching UL)
	UL Under Test	Cycle sequentially through all ULs Test ULs individually (UL1, UL2, UL3, UL4) against all DLs
Distance-to-PIM Measurements	Accuracy	±1 m (typical) PIM 10 dB or more above UL noise, quiet channel, single PIM source)
	Calibration	Verified PIM source (PIM source; part number 2000-1982-R) required. Calibration reference is antenna radome)
	Range	0 to 1000 m (free space, typical)
	Measurement Time	60 seconds per UL (typical)
Results and Reports	Report Header	Site, Operator, and instrument details (report saved in PDF format)
	Configuration Check	Pass/fail with detail
	Pass/Fail	Pass/fail per UL, with internal/external indication and PIM level (dBm or dBFS)
	Spectrum	UL spectrum and PIM spectrum per antenna branch
	DTP (Distance-to-PIM)	Graph showing distance (from a calibration point) to dominant PIM source

PIM Analytics (Option 755) (Requires Options 752 and 754)

PIM Analytics Measurements	PIM vs. Time	Long-term monitoring function (limited only by available hard drive space). Provides daily reports, graphs, and summary reports. Basic event report available (CSV format) for post-processing
	PIM Distribution	CDF plot (depicting distribution of measurements exceeding predefined) and editable threshold (percent) against PIM level (dBm)
	PIM Daily	Histogram (of percentage of measurements exceeding threshold) against time-of-day (24 hour)
	Heat Map	Visual matrix to highlight the dominant RF power source causing PIM at the cell site
Setup Parameters	Advanced Settings	PIM Desensitization pass/fail limit (dB) Noise floor auto-calibration of RRH under test Bandwidth: 5 MHz, 10 MHz, 15 MHz, and 20 MHz Measurement result units (dBm, dBFS)
	IQ Fiber Master Status	Connected/disconnected, SFP status indication (LOS, LOF, CPRI data), and internal temperature
	Configuration Check	Color-coded, interactive fiber diagram associated with each test scenario Rules-based check (editable by user): Optical connectivity, CPRI connectivity, IQ stream capture, RSSI/TSSI, bandwidth, and LTE ID TX configuration
	Measurement State	Measurement process update (acquiring, measuring, switching UL)
	UL Under Test	Cycle sequentially through all ULs Test ULs individually (UL1, UL2, UL3, UL4) against all DLs
Results and Reports (Includes all the PIM Analytics Measurements)	Report Header	Site, operator, and instrument details (report saved in PDF format)
	Configuration Check	Pass/fail with detail
	Long Term Monitoring	Graph per 24-hour period. Summary report (maximum, minimum, and mean PIM level, and occurrence and duration of maximum PIM level)
	Pass/Fail	Pass/fail per UL with internal/external indication and PIM level (dBm or dBFS)
	Spectrum	UL spectrum and PIM spectrum per antenna branch

Optical 3-Port Tap

Tap Wavelength Connectors	Single-Mode (SM) 2000-1977-R	1310/1550 nm
	Multi-Mode (MM) 2000-1978-R	850/1300 nm
	Optical Split	50/50 optical split, three fiber taps
	Fiber Standard	For SM Om3. Om4, and Om5 for MM
Dimensions and Mass		185 × 133 × 55 mm (2.1 in × 7.3 in × 5.2 in), 0.75 kg (1.6 lbs.)

Ordering Information

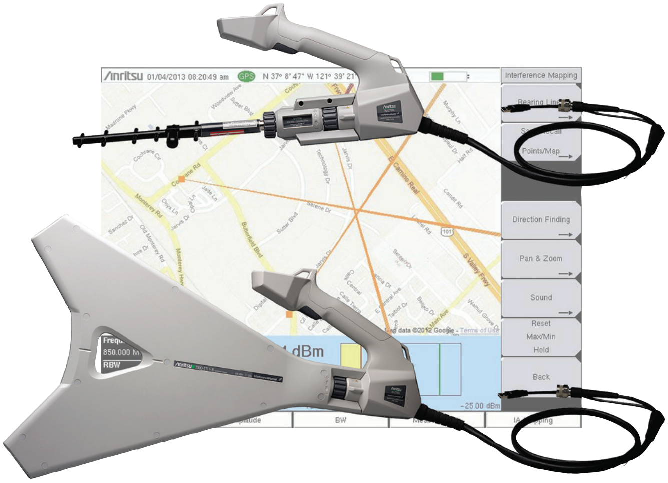
Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
MX280020A	IQ Fiber Master Control Software (no cost; download from Anritsu.com)
MT2780A	IQ Fiber Master (requires option 752 minimum); shown with optional SPFs. See Optional Accessories
MT2780A-0752	LTE RF over CPRI (requires MT2780A)
MT2780A-0754	PIM over CPRI (requires option 752)
MT2780A-0755	PIM Analytics (requires options 752 and 754)
	Standard Accessories
2000-1979-R	SM Fiber Optic Cable Kit, 30 cm, Simplex
2000-1980-R	MM Fiber Optic Cable Kit, 30 cm, Simplex
2000-1371-R	Ethernet Cable, 2 m
40-187-R	AC Power Supply (and adapter for local AC line outlets)
	Optional Accessories
68-11-R	SFP+ (Optical Module), SM 10.5 Gbps, 1310 nm (common for front-haul CPRI)
68-12-R	SFP+ (Optical Module), MM 10.5 Gbps, 850 nm (common for front-haul CPRI)
68-16-R	SFP+ (Optical Module), SM 9.83 Gbps, 1310 nm (common for front-haul CPRI)
808-16-R	Fiber Optic Cable, 3 m, Duplex MM 1.6 mm LC/PC LC/PC 50 µm
808-17-R	Fiber Optic Cable, 3 m, Simplex MM 1.6 mm LC/UPC LC/UPC 50 µm
808-18-R	Fiber Optic Cable, 3 m, Ruggedized Simplex SM LC/UPC LC/UPC
808-19-R	Fiber Optic Cable, 3 m, Ruggedized Duplex SM LC/UPC LC/UPC
2100-29-R	Fiber Optic Cable, 3 m, Simplex SM LC/UPC
2100-30-R	Fiber Optic Cable, 10 m, Simplex MM LC-SC
2100-31-R	Fiber Optic Cable, 3 m, Duplex SM LC/UPC
971-14-R	Ferrule Cleaner, 2.5 mm SC
971-15-R	Ferrule Cleaner, 1.25 mm LC
971-16-R	Fiber Ferrule Cleaner
2000-1849-R	SFP 4-slot ESD Box
2000-1977-R	3-port SM 1310/1550 nm TAP (includes 2000-1979-R) (shown)
2000-1978-R	3-port MM 850/1300 nm TAP (includes 2000-1980-R)
2000-1982-R	PIM Calibration Kit
2000-1981-R	Hard transit case

Handheld Direction Finding System

MA2700A Handheld InterferenceHunter™

Includes GPS and Electronic Compass



Simplify your interference hunting tasks with the Handheld InterferenceHunter™ from Anritsu Company. This broadband, easy-to-use handheld direction finding antenna system includes everything you need to find the sources of signals. With a broadband preamplifier, the system is sensitive. With a GPS receiver, it knows where it is. With the electronic compass it knows where it is aimed. With an antenna attached, the InterferenceHunter captures a direction and signal level when the user presses the trigger on the ergonomic handle.

The adjustable shoulder strap conveniently holds the handheld InteferfenceHunter MA2700A when out in the field. The ergonomic handle can be used with antennas having a female Type-N connector located at the back of the antenna. The coupling nut allows for easy antenna connection. Compatible antennas in many cellular bands are available from Anritsu. For details on these antennas including frequency range, gain, and pattern information, refer to the Directional Antennas Technical Data Sheet (11410-00376) available for download from the Anritsu website.

Combined with Interference Analysis (Option 25) on Anritsu handheld instruments with spectrum analyzers, the captured location and bearing data is displayed on the instrument.

How to Use the MA2700A

Connections

- Connect an antenna to the male N-connector (inside the coupling nut).
- Connect USB cable between the MA2700A and the instrument. Connect coaxial cable between the MA2700A and the instrument's RF Input connector.

Instrument Setup

- Confirm that the instrument has SPA module V6.00 or higher.
- Select the Interference Analysis (Option 25) mode on the instrument, then select Interference Mapping measurement.
- The instrument will detect the connected MA2700A and display the message **MA2700 detected – Device is ready to use**. After GPS lock, the instrument will use GPS data from the MA2700A.
- To manually select the MA2700A: In the Measurements menu, press Interference Mapping twice. Choose the Direction Finding submenu then Direction Finding Antenna Selection, and select MA2700A Handheld.

Mapping

- Anritsu easyMap Tools™ is used to create maps that are displayed on the Anritsu instrument. The software is available from the Anritsu website: www.anritsu.com

Specifications

All specifications and characteristics apply to Revision 1 instruments. All published specifications are typical.

Power Consumption	Preamplifier On: 0.6 Watts Preamplifier Off: 0.5 Watts
Bandwidth	9 kHz to 6 GHz
Preamplifier	Bandwidth: 10 MHz to 6 GHz Gain: ≥8 dB: 10 MHz to 2.4 GHz ≥5 dB: >2.4 GHz to 4 GHz ≥3 dB: >4 GHz to 6 GHz
Electronic Compass	Power: Powered from USB Accuracy: ≤5° (nom.) Interface: USB
GPS Receiver	Satellites Tracked: 12 (max.) GPS Locking Time Cold start: 30 s (typ.), with a clear view of the sky Warm start: 2 s (typ.), with a clear view of the sky Position Uncertainty: ±2 m (typ.)
Cables	USB cable terminated with a USB Type A Female Plug, 1.5 m Coaxial cable with Type-N male connector, 1.5 m
Tripod Mount	1/4 - 20 UNC × 7 mm
CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: (EU) 2015/863
RCM	Australia and New Zealand RCM AS/NZS 4417:2012
KCC	South Korea KCC-REM-A21-0004
Environmental	Operating Temperature: –10°C to +55°C Storage: –40°C to +71°C Maximum Humidity: 95% non-condensing Altitude: 4600 m Shock: MIL-PRF-28800F Class 2
Dimensions and Mass (antenna not included)	303 (W) × 220 (H) × 70 (D) mm (11.9 × 8.7 × 2.76 in), <1 kg (2.2 lb)

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MA2700A	InterferenceHunter™
	Standard Accessories (included with instrument)
2000-1729-R	Shoulder Strap
	Optional Accessories
	Directional Antennas
2000-1777-R	9 kHz to 20 MHz, N (f), Loop (requires Port Extender 2000-1798-R)
2000-1778-R	20 MHz to 200 MHz, N (f), Loop (requires Port Extender 2000-1798-R)
2000-1779-R	200 MHz to 500 MHz, N (f), Loop (requires Port Extender 2000-1798-R)
2000-1812-R	450 MHz to 512 MHz, N (f), 5 dBd, Yagi
2000-1659-R	698 MHz to 787 MHz, N (f), 8 dBd, Yagi
2000-1411-R	822 MHz to 900 MHz, N (f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N (f), 10 dBd, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N (f), 12 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N (f), 10 dBd, Yagi
2000-1414-R	1850 MHz to 1990 MHz, N (f), 9.3 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N (f), 10 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N (f), 10 dBd, Yagi
2000-1726-R	2500 MHz to 2700 MHz, N (f), 12 dBd, Yagi
2000-1747-R	300 MHz to 5000 MHz, N (f), Log Periodic
2000-1748-R	1 GHz to 18 GHz, N (f), Log Periodic
2000-1715-R	698 MHz to 2.5 GHz, N (f), Bi-blade Directional Antenna
	Bandpass Filters and Port Extender
2000-1825-R	Portable Yagi Antenna, 450 MHz to 512 MHz, N (f), 7.1 dBi
2000-1798-R	Portable Yagi Antenna, 380 MHz to 430 MHz, N (f), 7.1 dBi
2000-1734-R	699 MHz to 715 MHz, N (m) to N (f), 50Ω
2000-1735-R	776 MHz to 788 MHz, N (m) to N (f), 50Ω
2000-1736-R	815 MHz to 850 MHz, N (m) to N (f), 50Ω
2000-1737-R	1711 MHz to 1756 MHz, N (m) to N (f), 50Ω
2000-1738-R	1850 MHz to 1910 MHz, N (m) to N (f), 50Ω
2000-1739-R	880 MHz to 915 MHz, N (m) to N (f), 50Ω
2000-1740-R	1710 MHz to 1785 MHz, N (m) to N (f), 50Ω
2000-1741-R	1920 MHz to 1980 MHz, N (m) to N (f), 50Ω
2000-1742-R	832 MHz to 862 MHz, N (m) to N (f), 50Ω
2000-1743-R	2500 MHz to 2570 MHz, N (m) to N (f), 50Ω
2000-1799-R	2305 MHz to 2320 MHz, N (m) to N (f), 50Ω
2000-1911-R	703 MHz to 748 MHz, N (m) to N (f), 50Ω
2000-1912-R	788 MHz to 798 MHz, N (m) to N (f), 50Ω
2000-1925-R	663 MHz to 698 MHz, N (m) to N (f), 50Ω
2000-1926-R	776 MHz to 806 MHz, N (m) to N (f), 50Ω

Model/Order No.	Name
	MA2700A Transit Cases
760-261-R	Large Transit Case with Wheels and Handle 63.1 × 50 × 30 cm (24.83" × 19.69" × 11.88"), space for MA2700A, antennas, filters, instrument inside soft case, and other interferencehunting accessories/tools
760-262-R	Transit Case for MA2700A, holds several Yagi antennas and filters/port extender 96.8 × 40.6 × 15.5 cm (38.12" × 16.00" × 6.12")
2000-1727	Monopod, extends to 180 cm (72 in)
	Additional Documents and Software • The *User Guide* and *Spectrum Analyzer Measurement Guide* applicable for your Anritsu instrument. The Interference Analysis chapter will include a section on "Interference Mapping" with information on setup and selecting the MA2700A as the Direction Finding Antenna. • Anritsu easyMap Tools software creates Geo-enabled maps which are viewed on the Anritsu instruments during interference hunting. • Directional Antennas Technical Data Sheet (11410-00376) lists compatible antennas in many frequency bands and applications. These documents and programs, along with additional applications notes, white papers, and videos covering interference analysis are available from the Anritsu website (www.anritsu.com).

Mobile Interference Hunting System

MX280007A InterferenceHunter™

Anritsu Mobile InterferenceHunter™ – 5G Ready

Network operators have a strong interest in interference reduction that is driven by their customer's adoption of an online lifestyle. The increasing demand for connectivity anytime and anywhere leads directly to the need to rapidly increase capacity and throughput. Anritsu's Mobile InterferenceHunter MX280007A is well-equipped to locate many types of interference. The RF power mapping capability, guided Area Scan mode, optional hand-offs from Anritsu's remote spectrum monitoring systems, and the data-generated heat map enable users to locate interference sources quickly and reliably.

Applications

- Locating interference – even in the presence of uplink signals
- CATV leakage location
- Simplified spectrum clearing

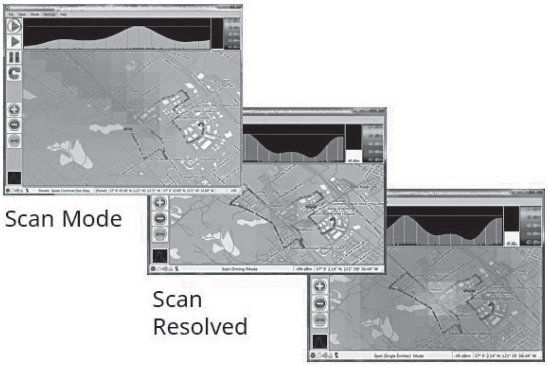
Key Features

- 5G ready to 54 GHz
- Guided Area Scan™ mode
- Post-capture analysis
- Deals with RF reflections, shadows, and multi-path
- Accepts spectrum monitor hand-offs
- Signal library
- Quick setup

Hunting Equipment Faults or Intentional Interference

Traditionally, interference hunts are done with a spectrum analyzer and a directional (Yagi) antenna. Directional antennas have trouble differentiating between the direct signal and reflections (multi-path) and can lead even the most experienced user astray. They also have issues with RF shadows caused by buildings or terrain. This creates somewhat erratic power measurements as the antenna is moved around.

The MX280007A RF power mapping, Area Scan, and heat map capabilities get around this problem by taking and processing many measurements per minute, averaging them, and plotting the result. This is done while the user is driving. There is no need to stop the car, get out and take a bearing, then drive to a new location and repeat the process. Because so many power measurements are taken and averaged, multi-path does not affect the results. Reflections tend to be eliminated because of increased path loss, as well as absorption from the reflecting surface. RF shadowing becomes apparent, since areas of low signal power can quickly be spotted and either allowed for or ignored. Also, since the MX280007A uses channel power for its measurements, it can deal with signals that wander in frequency, such as oscillating cell phone repeaters.



Scan Mode

Scan Resolved

Heat Map

Field Master Pro MS2090A

Dash-mounted Windows PC Tablet
with Mobile InterferenceHunter MX280007A
Software and 2000-1801-R mounting hardware

2000-1647-R Broadband Magnet Mount
Omnidirectional Antenna 700 MHz to 6 GHz with
GPS Antenna in one housing
(recommended antenna for users operating in this
frequency range)

Anritsu Mobile Interference Hunting System Overview

Available through Anritsu:

MX280007A Configuration Guide	Handheld Spectrum Analyzer	Remote Spectrum Monitor MS27101A	Anritsu P/N
Mobile InterferenceHunter with key	×	×	MX280007A
Instrument GPS option	×	×	Opt 31Inst
Instrument ethernet port	×	×	Opt 411 if not standard
Omni antenna with GPS	×	×	2000-1647-R
USB-based GPS			2000-1723-R
USB 3.0 hub			2000-1910-R
Bandpass filters	×	×	See accessory list
Directional antenna	×	×	See accessory list
N-to-N cable for antenna	×	×	15NN50-1.5C
Mounting hardware for tablet	×	×	2000-1801-R
Pocket Wi-Fi router	×	×	2000-1552-R
Automotive power adapter for instrument	×	×	806-141-R
Antenna or antenna cable to instrument adapter			

Available through third parties:

- Tablet/laptop running Windows 7, 8, or 10 with Wi-Fi capability. A computer with a Core i5 processor equivalent or greater is preferred.

Maps

Three types of mapping solutions are available using the MX280007A:

- **Google Maps** – a free service offering the user the flexibility to automatically download maps for many parts of the world. However, an internet connection must be set up and maintained during the entirety of the interference hunt. In many cases, a cellular USB modem is used for this connection.
- **Baidu Maps** – a free service popular in Asia (similar to Google Maps). An internet connection must be maintained to use this map source.
- **OpenStreetMap** – an open source database of maps that must be downloaded to the hard drive of the tablet before the interference hunt begins. Users can create their own maps using an easy 4-step process, or Anritsu has provided downloads for many metro areas worldwide.
- **Picture Files** – picture files (JPG and PNG supported) can be used for off-line mapping. These maps have GPS coordinates embedded to enable geo-location. Picture maps can be panned and zoomed quickly. This is helpful in urban areas where large file sizes are used. Information on using picture files for off-line mapping can be found in the Mobile InterferenceHunter User's Guide 10580-00416.

Summary – 5G Ready to 54 GHz

The MX280007A is a quick and reliable way to find multiple or single emitters even in difficult reception conditions. The ability to work with multiple signal sources, reflections, RF shadows, and multi-path distinguish the MX280007A from conventional systems that depend solely on directional antennas. The ability to work with signals that are intermittent, bursty, or drift rapidly in frequency separate this solution from more expensive ones targeted at a single, fixed-frequency interferer.

The MX280007A's post-capture analysis capability allows users to modify search parameters without re-driving the route. This allows re-analysis of the captured data and the opportunity to consult with experts when needed.

The MX280007A works with the broad array of Anritsu handheld spectrum analyzers, providing interference hunting and spectrum clearing capability from 9 kHz to 54 GHz. The MX280007A is a quick, reliable, and multi-emitter enabled solution to your interference hunting and spectrum clearing needs.

OpenStreetMap™ displayed on Windows PC tablet.
Inteference hunt screen capture.
Dots shown along drive path are coliored according to signal strength.

Compatible Analyzers

The following current Anritsu handheld spectrum analyzer models may be utilized in the Anritsu mobile interference hunting system.

Spectrum Master™	MS2712E/MS2713E
	MS2720T
BTS Master™	MT8220T
Cell Master™	MT8213E
Site Master™	S332E/S362E
LMR Master™	S412E
VNA Master™	MS2034B/MS2035B
	MS2036C/MS2037C/MS2038C
Field Master Pro™	MS2090A

Ordering Information

Mobile InterferenceHunter™ Software	Model Number	Description
	MX280007A	Mobile InterferenceHunter Software (Spectrum Analyzer must have GPS Receiver)
Important: When placing order, an email address is always needed. For Spectrum Analyzers previously owned, the model and serial number of the analyzer must also be provided.		
	Part Number	Description
	MX280007A-PL001	Perpetual license ordered with a new Spectrum Analyzer
	MX280007A-PL002	Perpetual license ordered with an existing Spectrum Analyzer

Note: Customers order one of the two part numbers listed above to obtain a license. An email is then sent with a link to download the MX280007A along with the license key. Multiple licenses may also be ordered that work with a corresponding number of Anritsu handheld spectrum analyzers.

Accessories

- Tablet/laptop running Windows 7, 8 or 10 (tablet running Windows 10 highly recommended for touchscreen capability)
- Off-the-shelf magnet mount omnidirectional antenna (Anritsu P/N 3-2000-1647-R or equivalent) This part also contains an integrated GPS antenna.
- Mounting hardware for tablet (Anritsu P/N 2000-1801-R or equivalent)
- Magnet mount GPS antenna (Anritsu P/N 2000-1528-R or equivalent) Required only if omnidirectional antenna used does not incorporate a GPS antenna.
- USB A - 5-PIN Mini-B Cable (Anritsu P/N 3-2000-1498 or equiv alent) This cable is provided as an accessory for compatible Anritsu handheld spectrum analyzers.
- Optional audio cable or Bluetooth transmitter to connect the tablet speaker to the car audio system

Model/Order No.	Name
	Additional Accessories
	Bandpass Filters
1030-106-R	1710 MHz to 1790 MHz, N (m) to N (f), 50Ω
1030-107-R	1910 MHz to 1990 MHz, N (m) to N (f), 50Ω
1030-109-R	824 MHz to 849 MHz, N (m) to SMA (f), 50Ω
1030-110-R	880 MHz to 915 MHz, N (m) to SMA (f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N (m) to SMA (f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N (m) to SMA (f), 50Ω
1030-114-R	806 MHz to 869 MHz, N (m) to SMA (f), 50Ω
1030-155-R	2496 MHz to 2690 MHz, N (m) to N (f), 0.8 dB loss, 50Ω
1030-178-R	1920 MHz to 1980 MHz, N (m) to N (f), 50Ω
1030-179-R	777 MHz to 798 MHz, N (m) to N (f), 50Ω
1030-180-R	2500 MHz to 2570 MHz, N (m) to N (f), 50Ω
2000-1684-R	791 MHz to 821 MHz, N (m) to N (f), 50Ω
	Bandpass Filters (used with InterferenceHunter™ MA2700A)
2000-1734-R	699 MHz to 715 MHz, N (m) to N (f), 50Ω
2000-1735-R	776 MHz to 788 MHz, N (m) to N (f), 50Ω
2000-1736-R	815 MHz to 850 MHz, N (m) to N (f), 50Ω
2000-1737-R	1711 MHz to 1756 MHz, N (m) to N (f), 50Ω
2000-1738-R	1850 MHz to 1910 MHz, N (m) to N (f), 50Ω
2000-1739-R	880 MHz to 915 MHz, N (m) to N (f), 50Ω
2000-1740-R	1710 MHz to 1785 MHz, N (m) to N (f), 50Ω
2000-1741-R	1920 MHz to 1980 MHz, N (m) to N (f), 50Ω
2000-1742-R	832 MHz to 862 MHz, N (m) to N (f), 50Ω
2000-1743-R	2500 MHz to 2570 MHz, N (m) to N (f), 50Ω
2000-1799-R	2305 MHz to 2320 MHz, N (m) to N (f), 50Ω
	Highpass/Lowpass Filters
1030-149-R	Hi-Pass, 150 MHz, N (m) to N (f), 50Ω
1030-150-R	Hi-Pass, 400 MHz, N (m) to N (f), 50Ω
1030-151-R	Hi-Pass, 700 MHz, N (m) to N (f), 50Ω
1030-152-R	Lo-Pass, 200 MHz, N (m) to N (f), 50Ω
1030-153-R	Lo-Pass, 550 MHz, N (m) to N (f), 50Ω

Model/Order No.	Name
	Directional Antennas
2000-1677-R	300 MHz to 3 GHz, SMA (m), Log Periodic
2000-1659-R	698 MHz to 787 MHz, N (f), 8 dBd, Yagi
2000-1411-R	822 MHz to 900 MHz, N (f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N (f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N (f), 10 dBd, Yagi
2000-1414-R	1850 MHz to 1990 MHz, N (f), 9.3 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N (f), 10 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N (f), 10 dBd, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N (f), 12 dBd, Yagi
2000-1715-R	Directional Antenna, 698 MHz to 2500 MHz N (f), gain of 2 dBi to 10 dBi, typical
2000-1726-R	Antenna, Yagi 2500 MHz to 2700 MHz N (f), 12 dBd
2000-1747-R	Antenna, Log Periodic, 300 MHz to 5000 MHz N (f), 5.1 dBi (typ.)
2000-1748-R	Antenna, Log Periodic, 1 GHz to 18 GHz, N (f), 6 dBi (typ.)
2000-1777-R	Portable Directional Antenna, 9 kHz to 20 MHz, N (f)
2000-1778-R	Portable Directional Antenna, 20 MHz to 200 MHz, N (f)
2000-1779-R	Portable Directional Antenna, 200 MHz to 500 MHz, N (f)
	Other Accessories
2000-1647-R	Mag mount broadband antenna Cable 1: 698 MHz to 1200 MHz 2 dBi peak gain, 1700 MHz to 2700 MHz, 5 dBi peak gain, N (m) 50Ω, 10 ft Cable 2: 3000 MHz to 6000 MHz, 5 dBi peak gain, N (m), 50Ω, 10 ft Cable 3: GPS 26 dB gain, SMA (m), 50Ω, 10 ft
2000-1946-R	Magnet mount broadband antenna Cable 1: 617 MHz to 960 MHz, 3 dBi peak gain, 1710 MHz to 3700 MHz, 4 dBi peak gain, N (m) 50Ω, 10 ft Cable 2: 3000 MHz to 6000 MHz, 5 dBi peak gain, N (m), 50Ω, 10 ft Cable 3: GPS 26 dB gain, SMA (m), 50Ω, 10 ft
2000-1723-R	USB-based GPS
2000-1910-R	USB 3.0 Hub
15NN50-1.5C	N (m) to N (m) cable for external antennas
2000-1801-R	Hardware for mounting Windows tablet onto car dash
2000-1648-R	Mag mount omnidirectional antenna, 1700 MHz to 6000 MHz, 3 dBi peak gain, N (m) 50Ω, 10 ft
2000-1752-R	Wireless Router (TP Link Model TL-WR802N)
2000-1689	EMI Near Field Probe Kit
2000-1653	Anti-glare Screen Cover (package of 2)
633-75	High Capacity Battery Pack, 7500 mAh
806-141-R	Automotive Power Adapter, 12 VDC, 60 W
MA2700A	Handheld InterferenceHunter (Refer to TDS 11410-00692 for full specifications)
2000-1528-R	GPS Antenna, SMA (m) with 5 m (15 ft) cable, 3 dBi gain, requires 5 VDC

Bluetooth Test Set

MT8852B

2.4 GHz Reference Bluetooth Transceiver

Remote Control
GPIB

Test Bluetooth® Modules and Products with a Bluetooth Interface

The Bluetooth Test Set MT8852B is the market leading RF measuring instrument for design proving and production test of a wide range of products that integrate *Bluetooth*® technology, including phones, headsets, computers, audio-visual and gaming products as well as modules. Anritsu is the leading supplier of instruments to test the quality of products manufactured with embedded Bluetooth technology. As members of the Bluetooth Special Interest Group (SIG) since 1999, Anritsu has actively participated in the development of the standard from the first Core Specification version 1.0 release through to the current Core Specification version 5.3 release. The MT8852B Bluetooth Test Set builds on this experience to offer an optimized radio layer test instrument. And, MT8852B supports tests for new direction finding technology (Angle of Arrival/ Angle of Departur) added in core specification version 5.1 (No RF test additions or changes in version 5.3).
As a manufacturer of Bluetooth products, you need above all else to maintain your reputation for quality and reliability. The complex demands of new technologies such as Bluetooth will require the adoption of new testing techniques. When tested on the MT8852B, you can ship products to your customers with confidence that they will work perfectly.

The *Bluetooth*® mark and logos are owned by Bluetooth SIG, Inc. and are used by Anritsu under license.

Features

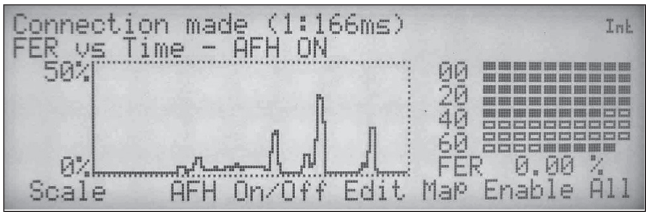
- Qualified by Bluetooth SIG for measurements
- Compliant with Bluetooth Test Specification RF.TS.p33 and RFPHY.TS.p18
- Basic Rate and EDR measurement performed in Bluetooth test mode – Loopback or Tx mode supported
- Signal generator and transmitter analyzer modes for protocol free applications
- “Quick Test” script validates Basic Rate, EDR and Bluetooth low energy test performance in under 15 seconds
- “Full Test” script performs full Bluetooth SIG compliant testing from single key press
- For design proving and production test
- Full implementation of Basic Rate, EDR and Bluetooth low energy dirty transmitter for Bluetooth SIG RF test specification compliant measurements
- Audio test capability, 3 SCO channels with CVSD, µ-Law and A-Law air interface
- Adaptive Frequency Hopping (AFH) measurements (MT8852B-015)
- Easy operation – one-touch testing with “Run” key
- BlueSuite Pro3 PC software displays; FSK modulation, power burst profile, PSK constellation diagrams and sensitivity searches graphically
- CombiTest software automates tests with test script generator and results data base
- GPIB and RS232 remote programming interfaces
- Initialization and control of test devices through USB, RS232 and USB-Adapter HCI control port
- Built-in support for Bluetooth low energy 2-Wire control interface
- Small size (half rack) and low weight (≤3.8 kg)

Options

Adaptive Frequency Hopping (AFH) Option MT8852B-015

- Connect to an EUT using the Bluetooth Core Specification v1.2 faster connection and display the connection time in milliseconds.
- Read the EUT Local Assessment Scheme in the presence of an external interfering signal (e.g. WLAN).
- Manually define additional channels to mask in the MT8852B Pseudo Local Assessment Map.
- Display a graph of channel utilization against time to measure the speed with which an EUT masks channels when an interfering source is activated.
- Display a graph of Frame Error Rate (FER) against time to validate that an EUT identifies all “Bad” channels and maintains a zero or low FER.
- Establish an audio SCO link so that the audio quality can be monitored in the presence of interfering signals, and ensure that the AFH functionality maintains a high quality audio path.

This screen presents a graph with 1 second resolution of the FER of the Bluetooth link with AFH enabled. When an interfering source such as a 802.11 WLAN access point is activated, the FER can be seen to increase immediately. As the EUT’s local assessment scheme identifies the "bad" channels and reports its assessment to the MT8852B, the FER will decrease as the channels are removed from the hopping plan.



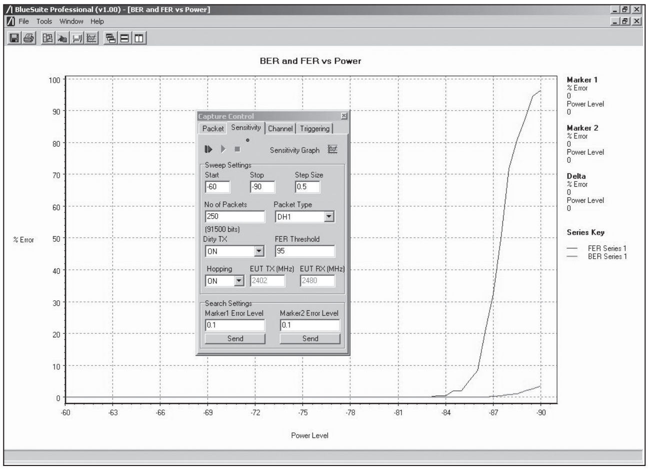
```
Connection made (1:166ms)                    Int
FER vs Time - AFH ON
  50%                                  00
                                       20
                                       40
   0%                                  60
                                       FER   0.00 %
 Scale      AFH On/Off  Edit  Map  Enable All
```

Frame Error Rate against time with AFH active

BlueSuite Pro3

BlueSuite Pro3 is a comprehensive software tool that enables a greater understanding of all aspects of a device's RF characteristics. Running on a standard PC, BlueSuite Pro3 interfaces to the MT8852B through a GPIB interface. Use BlueSuite Pro3 to;

- Monitor the real-time state of the EUT through the display of frequency deviation, power burst, IQ constellation and vector graphs.
- Configure and run sensitivity sweeps and display the results graphically.
- Configure and run measurement sweeps for seven different tests and display the results graphically for each of the 79 Bluetooth channels.
- Configure and run audio tests and display the results graphically.
- Configure and run a power control test and display the results graphically.
- Read and write script and limit settings to and from the MT8852B.
- Edit and run a complete test script and generate a detailed report of the results.
- Step through individual connection and test mode controls to determine the cause of problems otherwise difficult to isolate.



Sweep Settings
Start: -60
Stop: -90
Step Size: 0.5
No of Packets: 250 (91500 bits)
Packet Type: DH1
Dirty TX: ON
FER Threshold: 95
Hopping: ON
EUT TX (MHz): 2402
EUT RX (MHz): 2480

Search Settings
Marker1 Error Level: 0.1
Marker2 Error Level: 0.1

Marker 1
% Error
0
Power Level
0

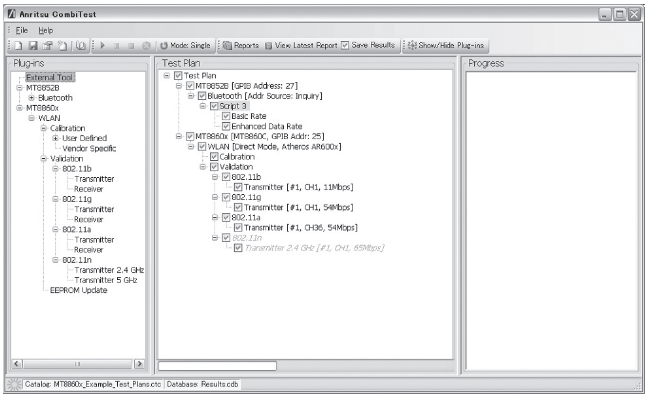
Marker 2
% Error
0
Power Level
0

Delta
% Error
0
Power Level
0

Automatic sensitivity search measurements display the FER/BER performance of an EUT with decreasing power into the receiver. Tests can be performed on all supported standard rate and EDR packet types.

CombiTest

CombiTest is a software application used to remotely control Anritsu Bluetooth test sets using a user-configured test plan of measurements. It is ideal for creating design-verification or production test plans for Bluetooth radios.

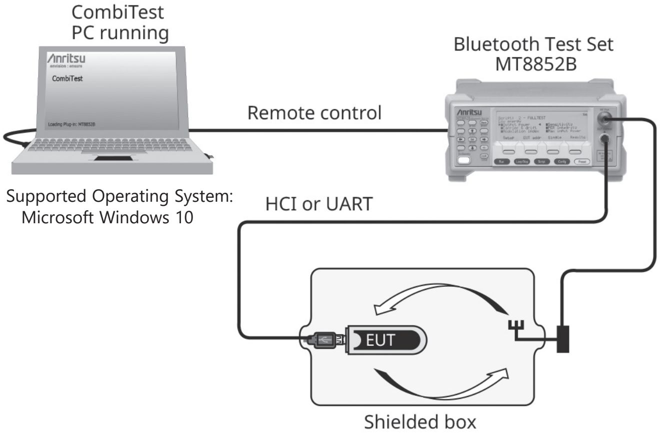


Plug-ins
- External Tool
- MT8852B
  - Bluetooth
- MT8860x
  - WLAN
    - Calibration
      - User Defined
      - Vendor Specific
    - Validation
      - 802.11b
        - Transmitter
        - Receiver
      - 802.11g
        - Transmitter
        - Receiver
      - 802.11a
        - Transmitter
        - Receiver
      - 802.11n
        - Transmitter 2.4 GHz
        - Transmitter 5 GHz
    - EEPROM Update

Test Plan
- ☑ Test Plan
  - ☑ MT8852B [GPIB Address: 27]
    - ☑ Bluetooth [Addr Source: Inquiry]
      - ☑ Script 3
        - ☑ Basic Rate
        - ☑ Enhanced Data Rate
  - ☑ MT8860x [MT8860C, GPIB Addr: 25]
    - ☑ WLAN [Direct Mode, Atheros AR600x]
      - ☑ Calibration
      - ☑ Validation
        - ☑ 802.11b
          - ☑ Transmitter [#1, CH1, 11Mbps]
        - ☑ 802.11g
          - ☑ Transmitter [#1, CH1, 54Mbps]
        - ☑ 802.11a
          - ☑ Transmitter [#1, CH36, 54Mbps]
        - ☑ *802.11n*
          - ☑ *Transmitter 2.4 GHz [#1, CH1, 65Mbps]*

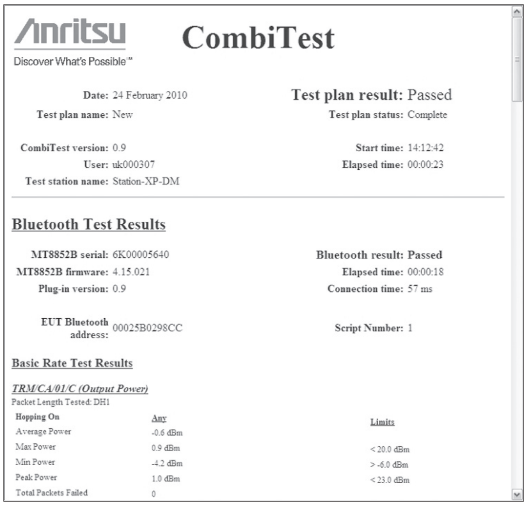
Catalog: MT8860x_Example_Test_Plans.ctc | Database: Results.cdb

Setup



CombiTest features:

- Plug-in for Bluetooth Test Set MT8852B
- Bluetooth test mode measurements
- Rapid creation and execution of test plans
- Run an entire test plan or just the selected components
- Detailed report of test results with database of previous tests



CombiTest

Date: 24 February 2010
Test plan result: Passed
Test plan name: New
Test plan status: Complete
CombiTest version: 0.9
Start time: 14:12:42
User: uk000307
Elapsed time: 00:00:23
Test station name: Station-XP-DM

Bluetooth Test Results

MT8852B serial: 6K00005640
Bluetooth result: Passed
MT8852B firmware: 4.15.021
Elapsed time: 00:00:18
Plug-in version: 0.9
Connection time: 57 ms
EUT Bluetooth address: 00025B0298CC
Script Number: 1

Basic Rate Test Results

TRM/CA/01/C (Output Power)
Packet Length Tested: DH1

Hopping On	Any	Limits
Average Power	-0.6 dBm	
Max Power	0.9 dBm	< 20.0 dBm
Min Power	-4.2 dBm	> -6.0 dBm
Peak Power	1.0 dBm	< 23.0 dBm
Total Packets Failed	0	

CombiTest reports clearly present full set up and results details of each device tested. Results are automatically archived into a database.

Specifications

Basic Rate Measurements

Basic Rate measurements made in compliance with Bluetooth RF Test Specification RF.TS.p33.

Characteristic/Parameter	Specification
Output Power (RF/TRM/CA/BV-01-C)	
Measurement Configuration	Hopping: Off or On – measure at defined, all, or any frequencies Loopback, Tx mode Payload: PRBS9 Packet type: DH1, DH3, DH5
Displayed Results	Average power Peak power
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Measurement Range	–50 to +22 dBm (average power), +23 dBm (peak power)
Resolution	0.1 dB
Accuracy	±1.0 dB (–35 to +20 dBm) ±1.5 dB (+20 to +22 dBm)
Power Control (RF/TRM/CA/BV-03-C)	
Measurement Configuration	Hopping: Off Loopback, Tx mode Payload: PRBS9 Packet type: DH1, DH3, DH5
Displayed Result	Maximum power, Minimum power, Maximum step size, Minimum step size, Power at each power step
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Measurement Range	–35 to +22 dBm (average power), +23 dBm (peak power)
Resolution	0.1 dB
Accuracy	±1.0 dB (–35 to +20 dBm) ±1.5 dB (+20 to +22 dBm)
Modulation Characteristics (RF/TRM/CA/BV-07-C)	
Measurement Configuration	Hopping: Off Loopback, Tx mode Payload: 11110000 and 10101010 Packet type: DH1, DH3, DH5
Displayed Results	Frequency deviation: Δf1max, Δf2max, Δf1avg, Δf2avg, Δf2avg/Δf1avg plus % of Δf2max <115 kHz
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
RF Input Measurement Range	–35 to +20 dBm
Deviation Measurement Range	0 to 350 kHz (peak power)
Deviation Resolution	1 kHz
Accuracy	1% for modulation index 0.32
Initial Carrier Frequency Tolerance (RF/TRM/CA/BV-08-C)	
Measurement Configuration	Hopping: Off or On – measure at defined, all, or any frequencies Loopback, Tx mode Payload: PRBS9 Packet type: DH1
Displayed Results	Average initial frequency error Maximum positive frequency error Maximum negative frequency error
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
RF Input Measurement Range	–35 to +20 dBm
Initial Frequency Error Measurement Range	0 to ±150 kHz
Frequency Resolution	1 kHz
Accuracy	500 Hz ±frequency standard
Carrier Frequency Drift (RF/TRM/CA/BV-09-C)	
Measurement Configuration	Hopping: Off or On – measure at defined, all, or any frequencies Loopback, Tx mode Payload: 10101010 Packet type: DH1, DH3, DH5
Displayed Results	Carrier frequency drift Drift rate
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
RF Input Measurement Range	–35 to +20 dBm
Frequency Drift Measurement Range	0 to 200 kHz, and >2000 µs/50 µs
Frequency Resolution	1 kHz

Continued on next page

Characteristic/Parameter	Specification
Enhanced Power Control (RF/TRM/CA/BV-14-C)	
Measurement Configuration	Hopping: Off Loopback, Tx mode Payload: PRBS9 Packet type: DH1, 3, 5, 2-DH1, 3, 5 and 3-DH1, 3, 5
Displayed Result	Maximum power for each packet type Minimum power for each packet type Maximum power step for each packet type Minimum power step for each packet type Maximum power difference at any step between DHn and 2DHn or 3DHn packets
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Measurement Range	–35 to +22 dBm (average power), +23 dBm (peak power)
Resolution	0.1 dB
Accuracy	±1.0 dB (–35 to +20 dBm) ±1.5 dB (+20 to +22 dBm)
Sensitivity – single slot packets (RF/RCV/CA/BV-01-C)	
Measurement Configuration	Hopping: Off or On, user selectable Loopback only Payload: PRBS9 Packet type: DH1 Dirty transmitter (as defined in the RF test spec): On or Off, user defined
Displayed Results	BER (percentage) Total number of bit errors and FER
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Number of Measured Bits	1 to 10000 packets (216 bits to 2160000 bits)
Output Power Range	–90 to 0 dBm, resolution: 0.1 dB
Output Power Accuracy	±1 dB (–80 to 0 dBm)
BER/FER Measurement Range	0 to 100%
BER/FER Resolution	0.001%
Sensitivity – multi-slot packets (RF/RCV/CA/BV-02-C)	
Measurement Configuration	Hopping: Off or On, user selectable Loopback only Payload: PRBS9 Packet type: DH3, DH5 Dirty transmitter (as defined in RF test spec): On or Off, user defined
Displayed Results	BER (percentage) Total number of bit errors and FER
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Number of Measured Bits	1 to 10000 packets (for DH3, 1464 bits to 14640000 bits), (for DH5, 2712 bits to 27120000 bits)
Output Power Range	–90 to 0 dBm, resolution: 0.1 dB
Output Power Accuracy	±1 dB (–80 to 0 dBm)
BER/FER Measurement Range	0 to 100%
BER/FER Resolution	0.001%
Maximum Input Level (RF/RCV/CA/BV-06-C)	
Measurement Configuration	Hopping: Off Loopback only Payload: PRBS9 Packet type: DH1
Displayed Results	BER (percentage) Total number of bit errors and FER
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Number of Measured Bits	1 to 10000 packets (216 bits to 2160000 bits)
Output Power Range	–90 to 0 dBm, resolution: 0.1 dB
Output Power Accuracy	±1 dB (–80 to 0 dBm)

Enhanced Data Rate (EDR) Measurements

Enhanced Data Rate measurements made in compliance with Bluetooth RF Test Specification RF.TS.p33.

Characteristic/Parameter	Specification
EDR Relative Transmit Power (RF/TRM/CA/BV-10-C)	
Measurement Configuration	Hopping: Off and On – measure at defined, all, or any frequencies Modulations: π/4DQPSK and 8DPSK Packet type: 2-DH1, 3, 5 and 3-DH1, 3, 5 Loopback, Tx mode EUT power level: Max. and Min.
Displayed Results	Max. differential power (from all packets) Min. differential power (from all packets) Average differential power (over all packets)
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Measurement Range	–35 to +20 dBm (average power), +23 dBm (peak power)
Relative Power Resolution	0.01 dB, GFSK to π/4DQPSK and 8DPSK
Relative Power Accuracy	Relative power measurement accuracy between GFSK and π/4DQPSK or 8DPSK, 0.2 dB typical for a power difference of <6 dB
Relative Power Measurement Range	Relative power measurement range between GFSK and π/4DQPSK or 8DPSK, $(P_{GFSK} – 8\ dB) < P_{DPSK} < (P_{GFSK} + 4\ dB)$

Continued on next page

Characteristic/Parameter	Specification
EDR Carrier Frequency Stability and Modulation Accuracy (RF/TRM/CA/BV-11-C)	
Measurement Configuration	Hopping: Off and On – measure at defined, all, or any frequencies Modulations: π/4DQPSK and 8DPSK Packet type: 2-DH1, 3, 5 and 3-DH1, 3, 5 Loopback, Tx mode EUT power level: Max. and Min.
Displayed Results	Initial frequency error ω_i Frequency error ω_o Frequency error $\omega_i + \omega_o$ RMS DEVM (block with greatest DEVM value displayed) Peak DEVM 99% DEVM Average RMS DEVM (average DEVM for all blocks measured)
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Carrier Frequency Stability Measurement Range	0 to ±100 kHz
Carrier Frequency Stability Accuracy	500 Hz ±frequency standard
Carrier Frequency Stability Resolution	1 kHz
RMS DEVM Range	30% π/4DQPSK, 20% 8DPSK
RMS DEVM Resolution	0.1% π/4DQPSK and 8DPSK
Peak DEVM Range	0 to 50% π/4DQPSK, 0 to 30% 8DPSK
Peak DEVM Resolution	0.1% π/4DQPSK and 8DPSK
EDR Differential Phase Encoding (RF/TRM/CA/BV-12-C)	
Measurement Configuration	Hopping: Off and On, user selectable Modulations: π/4DQPSK and 8DPSK Packet type: 2-DH1, 3, 5 and 3-DH1, 3, 5. Number of test packets: default 100 Tx mode only
Displayed Results	Number of packets received Number of packets with payload data errors Percentage of errored packets
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
EDR Guard Time (RF/TP/TRM/CA/BV-15-C)	
Measurement Configuration	Hopping: Off Modulations: π/4DQPSK and 8DPSK Packet type: 2-DH1, 3, 5 and 3-DH1, 3, 5. Number of test packets: default 100 Loopback or Tx mode
Displayed Results	Maximum guard time Minimum guard time Packet in error Percentage of passed packets
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
EDR Synchronization Sequence and Trailer (RF/TP/TRM/CA/BV-16-C)	
Measurement Configuration	Hopping: Off Modulations: π/4DQPSK and 8DPSK Packet type: 2-DH1, 3, 5 and 3-DH1, 3, 5. Number of test packets: default 50 Loopback or Tx mode
Displayed Results	Number of synchronization sequence bits received Number of synchronization sequence error bits Number of trailer bits received Number of trailer error bits
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
EDR Sensitivity (RF/RCV/CA/BV-07-C)	
Measurement Configuration	Hopping: Off and On, user selectable Modulations: π/4DQPSK and 8DPSK Packet type: 2-DH1, 3, 5 and 3-DH1, 3, 5. Bit threshold control: Threshold 1, 1.6 million bits, Threshold 2, 16 million bits (user editable) Loopback only Dirty transmitter (as defined in RF test spec): On or Off, user selectable
Displayed Results	Overall BER (displayed in exponential format) Number of bits in error Number of packets sent by test set Number of packets received in error by EUT
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Output Power Range	–90 to 0 dBm, resolution: 0.1 dB
Output Power Accuracy	±1 dB (–80 to 0 dBm)

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Characteristic/Parameter	Specification
EDR BER Floor Performance (RF/RCV/CA/BV-08-C)	
Measurement Configuration	Hopping: Off and On, user selectable Modulations: π/4DQPSK and 8DPSK Packet type: 2-DH1, 3, 5 and 3-DH1, 3, 5 Bit threshold control: Threshold 1, 8 million bits, Threshold 2, 160 million bits (user editable) Loopback only
Displayed Results	Overall BER (displayed in exponential format) Number of bits in error Number of packets sent by test set Number of packets received in error by EUT
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Output Power Range	–90 to 0 dBm, resolution: 0.1 dB
Output Power Accuracy	±1 dB (–80 to 0 dBm)
EDR Maximum Input Level (RF/RCV/CA/BV-10-C)	
Measurement Configuration	Hopping: Off and On, user selectable Modulations: π/4DQPSK and 8DPSK Packet type: 2-DH1, 3, 5 and 3-DH1, 3, 5 Number of bits: default 1.6 million (user editable) Loopback only
Displayed Results	Overall BER (displayed in exponential format) Number of bits in error Number of packets sent by test set Number of packets received in error by EUT
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Output Power Range	–90 to 0 dBm, resolution: 0.1 dB
Output Power Accuracy	±1 dB (–80 to 0 dBm)

Bluetooth Low Energy Measurements

Bluetooth Low Energy measurements made in compliance with Bluetooth RF test specification RFPHY.TS.p18.

Characteristic/Parameter	Specification
Output power (RFPHY/TRM/BV-01-C, RFPHY/TRM/BV-15-C, RFPHY/TRM/BV-18-C, RFPHY/TRM/BV-19-C, RFPHY/TRM/BV-20-C, RFPHY/TRM/BV-21-C, RFPHY/TRM/BV-22-C, RFPHY/TRM/BV-23-C)	
Measurement Configuration	EUT configured to transmit test reference packets Packet payload: PRBS9 AoA Constant Tone Extensions
Displayed Results	Average power Peak to average power
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Measurement Range	–50 to +22 dBm (average power), +23 dBm (peak power)
Resolution	0.1 dB
Accuracy	±1.0 dB (–35 to +20 dBm) ±1.5 dB (+20 to +22 dBm)
Modulation Characteristics (RFPHY/TRM/BV-05-C, RFPHY/TRM/BV-10-C, RFPHY/TRM/BV-13-C)	
Measurement Configuration	EUT configured to transmit test reference packets Packet payload: 10101010 and 11110000 (BLE and 2LE) Packet payload: 11111111 (BLR S = 8)
Displayed Results	Frequency deviation: Δf1max, Δf2max (BLE and 2LE), Δf1avg, Δf2avg (BLE and 2LE), Δf2avg/Δf1avg ratio (BLE and 2LE), %Δf2max > 185 kHz (BLE), %Δf2max > 370 kHz (2LE)
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Measurement Range	RF input: –35 to +20 dBm Deviation: 0 to 500 kHz peak (except 2LE)
Resolution	Deviation: 1 kHz
Accuracy	1% for modulation index 0.5
Carrier frequency offset and drift (RFPHY/TRM/BV-06-C, RFPHY/TRM/BV-12-C, RFPHY/TRM/BV-14-C, RFPHY/TRM/BV-16-C, RFPHY/TRM/BV-17-C)	
Measurement Configuration	EUT configured to transmit test reference packets Packet payload: 10101010 (BLE and 2LE) Packet payload: 11111111 (BLR S = 8) Packet payload: 11110000 (BLE-CTE and 2LE-CTE) AoA Constant Tone Extensions
Displayed Results	Carrier frequency error Frequency drift Drift rate Initial drift rate
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Measurement Range	RF input: –35 to +20 dBm Frequency: 500 kHz
Frequency Resolution	1 kHz
Accuracy	500 Hz ±frequency standard
Receiver sensitivity (RFPHY/RCV/BV-01-C, RFPHY/RCV/BV-08-C, RFPHY/RCV/BV-26-C, RFPHY/RCV/BV-27-C)	
Measurement Configuration	EUT configured to receive test reference packets Packet payload: PRBS9 Full support of dirty transmitter as defined in test specification
Displayed Results	Receiver PER. Requires EUT to support HCI or 2-Wire interface for automated PER results
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Output Power Range	–90 to 0 dBm, resolution: 0.1 dB
Output Power Accuracy	±1 dB (–80 to 0 dBm)

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Characteristic/Parameter	Specification
Maximum input signal level (RFPHY/RCV/BV-06-C, RFPHY/RCV/BV-12-C)	
Measurement Configuration	EUT configured to receive test reference packets Packet payload: PRBS9
Displayed Results	Receiver PER. Requires EUT to support HCI or 2-Wire interface for automated PER results
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Output Power Range	–90 to 0 dBm, resolution: 0.1 dB
Output Power Accuracy	±1 dB (–80 to 0 dBm)
PER Report Integrity (RFPHY/RCV/BV-07-C, RFPHY/RCV/BV-13-C, RFPHY/RCV/BV-30-C, RFPHY/RCV/BV-31-C)	
Measurement Configuration	EUT configured to receive test reference packets Packet payload: PRBS9 CRC corruption: Alternate packets Number of test packets: Random [100 ≤ RND ≤ 1500]
Displayed Results	Receiver PER. Requires EUT to support HCI or 2-Wire interface for automated PER results
Number of Measurement Frequencies	One, default to RF Test Specification or user defined
Output Power Range	–90 to 0 dBm, resolution: 0.1 dB
Output Power Accuracy	±1 dBm (–80 to 0 dBm)
Tx Power Stability (RFPHY/TRM/PS/BV-01-C, RFPHY/TRM/PS/BV-02-C, RFPHY/TRM/PS/BV-03-C, RFPHY/TRM/PS/BV-04-C)	
Measurement Configuration	EUT configured to transmit Test Reference Packets No payload AoD Constant Tone Extensions
Displayed Results	Maximum deviation to average power during reference period Maximum deviation to average power for each transmit slot
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Measurement Range	–50 to +22 dBm (average power), +23 dBm (peak power)
Resolution	0.01 dB

Signal Generator

Characteristic/Parameter	Specification
Frequency	
Frequency Range	2.4 GHz to 2.5 GHz
Frequency Resolution	1 kHz
Frequency Accuracy	As frequency standard ±500 Hz
Level	
Amplitude Range	–90 to 0 dBm
Amplitude Accuracy	±1 dB (–80 to 0 dBm)
Amplitude Resolution	±0.1 dB
Output Impedance	50Ω (nom.)
Output VSWR	1.5:1 1.3:1 (typ.) Adjacent channels 3 or higher –40 dBc
GFSK Modulation * Supports low energy signal generator compliant with Bluetooth Core Specification v5.3	
Modulation Index	Variable, 0.25 to 0.50 (125 kHz to 250 kHz)
Modulation Index Resolution	0.01
Modulation Index Accuracy	1% (nom.) for modulation index = 0.32
Baseband Filter	BT = 0.5
π/4DQPSK Modulation	
Modulation Index Accuracy	<5% RMS DEVM
Baseband Filter	BT = 0.4
8DPSK Modulation	
Modulation Index Accuracy	<5% RMS DEVM
Baseband Filter	BT = 0.4

Measuring Receiver

Characteristic/Parameter	Specification
Frequency	
Frequency Range	2.4 GHz to 2.5 GHz
Frequency Resolution	1 kHz
Frequency Accuracy	As frequency standard ±500 Hz
Level	
Range	–55 to +22 dBm (average power)
Power Measurement Accuracy	±1 dB (–35 to +20 dBm)
Input VSWR	1.5:1
Damage Level	+25 dBm
Resolution	0.1 dB
GFSK Modulation	
Deviation Measurement Range	0 to 350 kHz (peak power)
Accuracy	1% for modulation index 0.32

EUT Control Interface

Characteristic/Parameter	Specification
RS232 HCI Commands	The EUT control interface provides RS232 HCI commands to the EUT through a standard RS232 interface. The interface meets the requirements of the Bluetooth specification for HCI UART transport layer. An RS232 cable is supplied.
USB HCI Commands	The EUT control interface provides USB HCI commands to the EUT through a standard USB interface. The interface meets the requirements of the Bluetooth specification section H:2. A USB cable is supplied.
2-Wire Control	For test control of Bluetooth Low Energy devices the EUT control interface supports the 2-Wire specification
USB to RS232 HCI Command	For use with EUTs fitted with USB to RS232 FTDI chips

Audio Specifications

Characteristic/Parameter	Specification
Number of SCO Channels Supported	3
Codec Air Interfaces Supported	CVSD, A-Law, µ-Law
Frequency Response	(–3 dB) measured CODEC in to CODEC out: 160 Hz to 3.5 kHz. Measured with 50Ω source impedance and 10MΩ load impedance
Maximum Input/Output Signal Level	3.4 V_{pk-pk} = 1.2 V RMS
Distortion/Noise	A law: –37 dB (typical) (1 kHz, 1 V RMS) µ law: –37 dB (typical) (1 kHz, 1 V RMS) CVSD: –30 dB (typical) (300 Hz, 1 V RMS)
Input/Output Connectors	3.5 mm audio jack plugs (one for each SCO channel)
Input Impedance	20kΩ
Minimum Output Load	600Ω
Internal Audio Source	1 kHz fixed frequency

Adaptive Frequency Hopping (MT8852B-015)

Supported in ACL and SCO connections

Characteristic/Parameter	Specification
Displays	Active channel vs. time, FER vs. time
Other Features	ACL connection timer, resolution: 1 ms

Electrical Characteristics

Characteristic/Parameter	Specification
Frequency Standard	
Frequency	10 MHz
Temperature Stability	±0.5 ppm (–10°C to +85°C)
Aging (1st year)	±1.0 ppm
Aging (over 10 years)	±2.5 ppm (including year 1)
Rear Panel Connectors	
External Frequency Standard Input	Rear panel, BNC connector, 50Ω, 1 V
Output 1	TTL output for TX ON, TX DATA, RX DATA, and correlator
Output 2	TTL output for RX ON, TX DATA, RX DATA, and correlator
Input 1	For service use only
GPIB	
IEEE 488.2	Offers full instrument control as standard
RS232	
RS232	Offers full instrument control as standard

General

Characteristic/Parameter		Specification
Power Supply		
Rated Voltage		100 VAC to 120 VAC/200 VAC to 240 VAC
Rated Frequency		50 Hz/60 Hz
Power Consumption		150 VA Max.
Environmental		
Operating Temperature		+5°C to +40°C
Operating Humidity		20 to 75%
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000:2018
Dimensions and Mass		
Dimensions		216.5 (W) × 88 (H) × 380 (D) mm
Mass		<3.8 kg

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Description
	Main frame
MT8852B	Bluetooth Test Set (With EDR and Audio)
MT8852B-040	Bluetooth Test Set (With no EDR and no Audio)
MT8852B-041	Bluetooth Test Set (With no EDR and with Audio)
MT8852B-042	Bluetooth Test Set (With EDR and no Audio)
MT8852B-043	Bluetooth Test Set (With Low Energy Measurements only)
	Standard accessories
	MT8852B Bluetooth Test Set Operation Manual
	MT8852B Bluetooth Test Set Operation Manual Remote Control
J1783A	USB HCI control interface lead
J1784A	RS232 HCI Control Interface Lead
J1785A	RS232 Cable for Firmware Updates
	Power Cord
	BlueSuite Software (Standard version)
	Bluetooth Low Energy Measurement Software application
	MT8852B Bootloader
J1786A	3.5 mm Jack Plugs (Qty. 3, Audio Version Only)
	Options and accessories
MT8852B-015	Adaptive Frequency Hopping option
MT8852B-017	IQ data output
MT8852B-027	Bluetooth low energy measurements
MT8852B-034[*1]	BLE Data Length Extension Option
MT8852B-035[*1, *2]	BLE 2LE Option (2 Mbps Low Energy)
MT8852B-036[*1, *2, *3]	BLE BLR Option (Bluetooth Long Range)
MT8852B-037[*1, *2, *3]	BLE AoA/AoD Option (Angle of Arrival/Angle of Departure)
MT8852B-070	Platform Enhancement Option
MT8852B-315[*4]	Retrofit Adaptive Frequency Hopping option
MT8852B-317[*4]	Retrofit IQ data output
MT8852B-319[*4]	Retrofit Audio to MT8852B
MT8852B-325[*4]	Retrofit EDR to MT8852B
MT8852B-327	Retrofit Bluetooth low energy measurements
MT8852B-330	Retrofit Basic Rate Measurement to MT8852B
MT8852B-334[*1]	Retrofit BLE Data Length Extension Option
MT8852B-335[*1, *2]	Retrofit BLE 2LE Option
MT8852B-336[*1, *2, *3]	BLE BLR Option Retrofit
MT8852B-337[*1, *2, *3]	BLE AoA/AoD Option Retrofit
MT8852B-170	Platform Enhancement Option Retrofit (For units where the first three characters of the serial number are not “6A6 or 626”)
MT8852B-270	Platform Enhancement Option Retrofit (For units where the first three characters of the serial number are not “6A6 or 626” (FO))
MT8852B-370	Platform Enhancement Option Retrofit (For units where the first three characters of the serial number are “6A6 or 626”)
MX885201B	BlueSuite Pro3 software application
MX885201B-301	BlueSuite Pro2 to Pro3 Upgrade
Z1992A	2.4 GHz Antenna and Adapter
B0748A	Soft Carry Bag
B0749A	Rack Mount Kit
J0006	GP-IB CABLE, 0.5M
J0007	GPIB CABLE, 1.0M
J0008	GPIB CABLE, 2.0M
J0127A	COAXIAL CORD, 1.0M
J0127B	COAXIAL CORD, 2.0M
J0127C	COAXIAL CORD, 0.5M

*1: MT8852B-034 (334) requires MT8852B-027 (327) or MT8852B-043.

*2: MT8852B-035 (335) , MT8852B-036 (336) and MT8852B-037 (337) requires MT8852B-034 (334).

*3: MT8852B-036 (336) and MT8852B-037 (337) requires MT8852B-070 (270, 370).

*4: When installing MT8852B-315/317/319/325 to MT8852B-043, MT8852B-330 is necessary.

Wireless Connectivity Test Set

MT8862A

2.4 GHz/5 GHz/6 GHz bands

Remote Control
Ethernet

Ideal for RF TRx Tests of WLAN Devices

Excellent Eco Product

RF TRx Measurements of WLAN Equipment

The Wireless Connectivity Test Set MT8862A is designed for measuring the RF TRx characteristics of WLAN equipment. It has standard WLAN protocol messaging (WLAN signalling) to connect with the device under test (DUT) for measuring the TRx performance items as Network Mode. It is the biggest feature of MT8862A. MT8862A gives manifold inspections for WLAN equipment because it also supports Direct Mode.

Supported Communications Standards • Security encryption

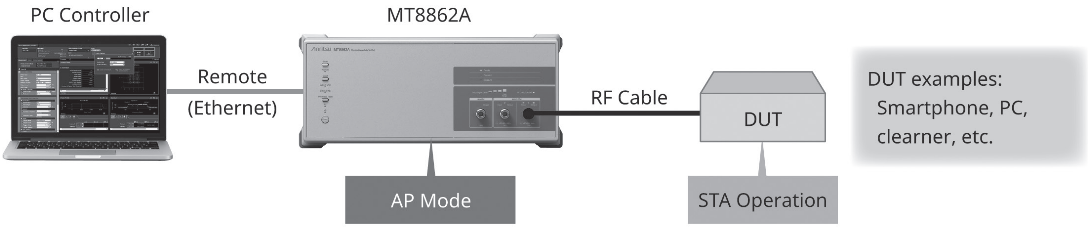
WLAN IEEE802.11a/b/g/n/ac/ax (2.4 GHz, 5 GHz and 6 GHz bands) [AP/STA]
WEP, WPA-Personal, WPA2-Personal and WPA3-Personal

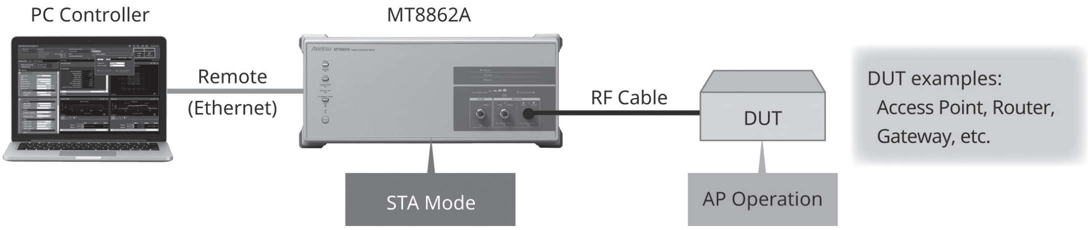
RF Performance Measurement under Actual Operation Conditions (Network Mode)

By using the MT8862A Network Mode, RF TRx characteristics, such as Tx power, modulation accuracy (EVM), etc., can be measured with the WLAN device in actual operation conditions. It is not necessary to put the DUT into dedicated test mode and directly control the DUT.
The DUT RF performance can be quantified under the firmware conditions at actual shipment.

Easy Measurement Environment Configuration

The MT8862A can simulate access points (AP) and station (STA) to establish the DUT network connection using IEEE802.11a/b/g/n/ac/ax WLAN protocol messaging. Each WEP, WPA-Personal, WPA2-Personal and WPA3-Personal secure connection method is supported, and TKIP and AES encryption schemes can be selected by combination with each standard. When the connection is established, RF measurements can be made using general WLAN communications procedures without requiring special tools and control procedures, eliminating the need for configuring a special measurement environment.

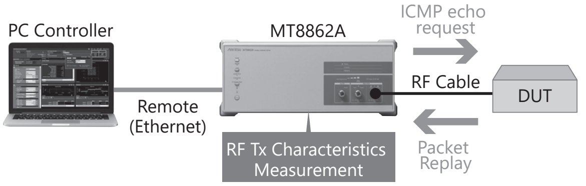




WLAN Measurement Software MX886200A Features

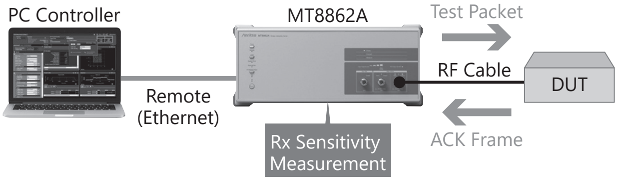
ICMP Echo Request for Tx Measurement

With the ICMP echo request, the MT8862A can measure RF Tx characteristics of reply packets from the DUT. The measurement targets are both data frames and ACK frames.



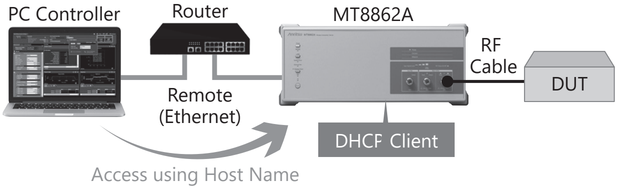
Rx Sensitivity Measurements using ACK Frame Count for Bathtub Curve Generation

The MT8862A supports Rx sensitivity measurements using the ACK frame count; counting the ACK frames sent by the DUT versus the test packets sent from the MT8862A supports calculation of the packet error rate (PER). Packets can be sent while lowering the power level by setting the power level range (0 to −120 dBm) and step size, and the Rx sensitivity Bathtub curve can be generated automatically. Packets including MAC address and payload length can be configured in real-time for measurement at various data rates.



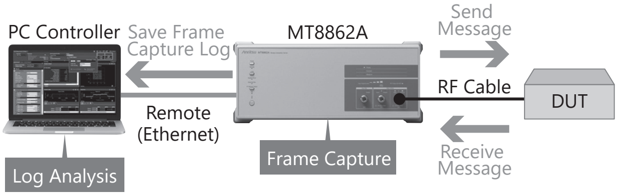
Web Browser GUI Operation Immediately after Connection

Connect the MT8862A to the external PC using an Ethernet cable for instant access from the Web browser to complete setup of the GUI operation environment without requiring test setup operation.
The Web-browser based GUI eliminates usage worries about version matching with the main frame firmware. Additionally, the MT8862A remote control port supports the DHCP client function and both host and domain name settings offer easy control simply by connecting the PC controller and MT8862A to the same network.



Function Test

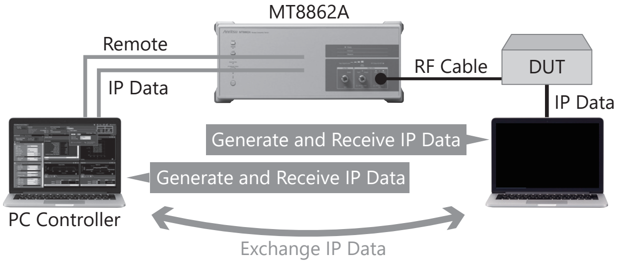
Frame Capture Logging for Troubleshooting Connection Problems
With built-in frame capture logging function, the MT8862A can capture and save frame logs for troubleshooting DUT connection problems. Captured logs are in the *.pcap format for viewing by supported applications, making it easier to analyze DUT connection problems.



IP Data Transfer using Connection Verification Test

The Ethernet port on the back panel of the MT8862A can be used for exchanging IP data with an external server; IP connections between the client PC connected to the DUT and the external server connected to the MT8862A can be checked using the ping function, etc.

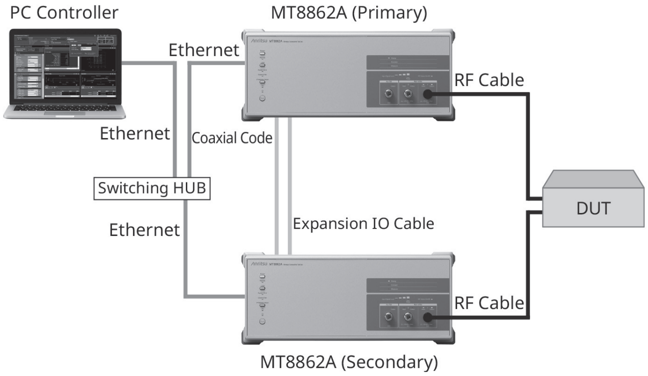
*: MT8862A supports IP data transfer on IEEE802 .11 a/b/g/n/ac and SISO



Receiver Sensitivity and Transmit Power Measurement Function for 2×2 MIMO

Receiver sensitivity and transmit power measurement under 2×2 MIMO communication can be tested by using 2 sets of MT8862A. This is suitable for RF performance evaluation for completed products.

*: MT8862A supports 2x2 MIMO on IEEE802 .11n/ac.

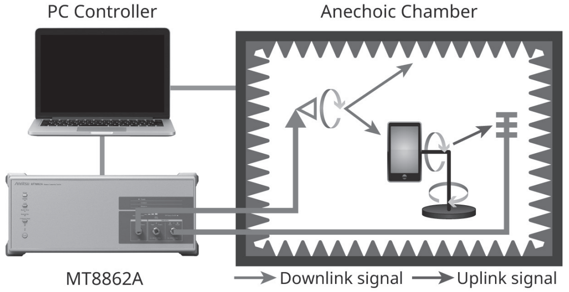


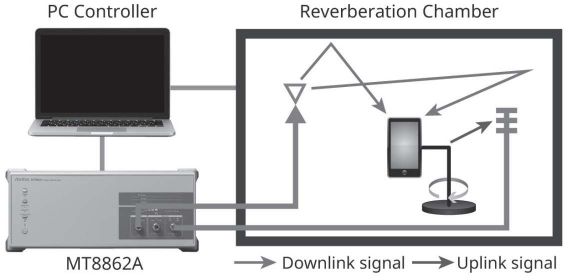
Application Test

Network Mode for Over The Air (OTA) Test

The TRx performance of wireless terminals is affected by factors such as the terminal form and antenna characteristics. The OTA test measures the general TRx performance of the wireless terminal using actual radio waves. The WLAN OTA test measures RF performance specifications in accordance with the recommendations of CTIA* and the Converged Wireless Group (CWG) of the Wi-Fi Alliance, including Total Radiated Power (TRP), Total Isotropic Sensitivity (TIS), System integrators have test solution using MT8862A.

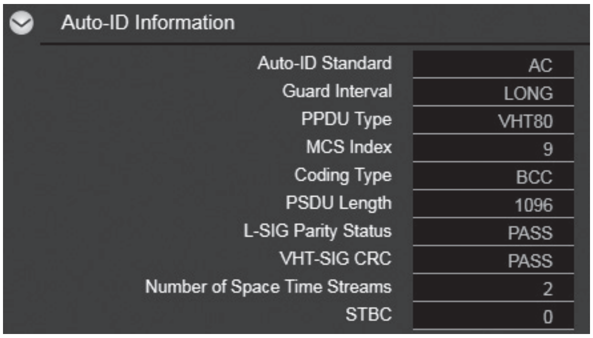
*: Cellular Telecommunications & Internet Association; international non-profit organization composed of wireless-communications-related businesses, manufacturers, service providers, etc.





Auto-ID information display

MT8862A displays header information of packets used for transmit measurement as Auto-ID Information.



Auto-ID Information

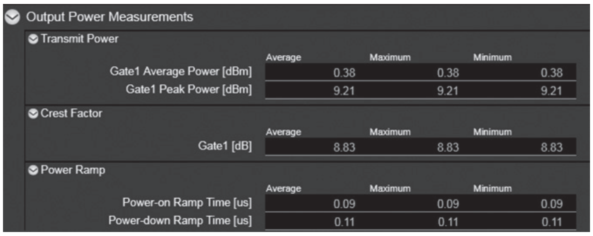
Auto-ID Standard	AC
Guard Interval	LONG
PPDU Type	VHT80
MCS Index	9
Coding Type	BCC
PSDU Length	1096
L-SIG Parity Status	PASS
VHT-SIG CRC	PASS
Number of Space Time Streams	2
STBC	0

WLAN Measurement Software MX886200A Key Functions

RF Tx Test

Tx Power Measurement and Power Profile Display

The MT8862A measures the Tx power and displays the average and peak power. The crest factor indicating the difference between the average power and peak power and the power-on ramp time and power-off ramp time indicating the time of ringing and falling are also displayed. The power profile is displayed as a graph of the power vs time for the signal.



Output Power Measurements

Transmit Power

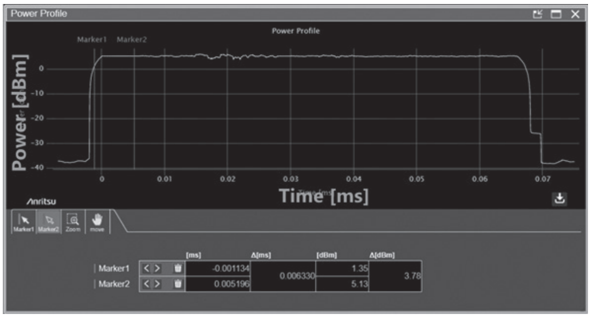
	Average	Maximum	Minimum
Gate1 Average Power [dBm]	0.38	0.38	0.38
Gate1 Peak Power [dBm]	9.21	9.21	9.21

Crest Factor

	Average	Maximum	Minimum
Gate1 [dB]	8.83	8.83	8.83

Power Ramp

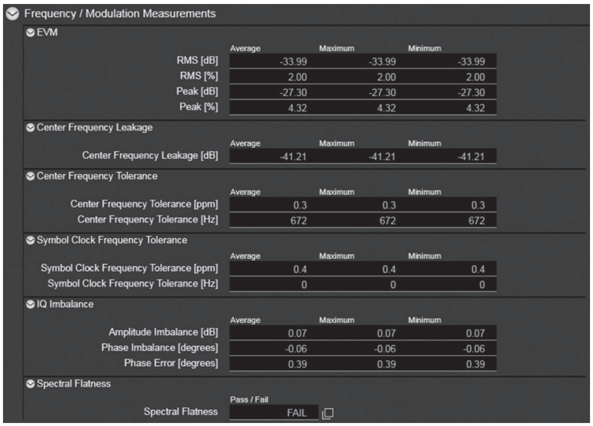
	Average	Maximum	Minimum
Power-on Ramp Time [us]	0.09	0.09	0.09
Power-down Ramp Time [us]	0.11	0.11	0.11



	[ms]	Δ[ms]	[dBm]	Δ[dBm]
Marker1	-0.001134	0.006330	1.35	3.78
Marker2	0.005196		5.13	

Frequency and Modulation Analysis/IQ Constellation Display/Spectrum Display

The MT8862A performs frequency and modulation analyses to measure the Error Vector Magnitude (EVM), which is a good of overall indicator of transmitter quality. When the numerical EVM is bad, the Packet Error Rate (PER) is usually high at WLAN connection. The RMS EVM and Peak EVM for DSSS- and OFDM-modulated carrier waves are expressed as % and dB values, respectively.
In case of OFDM modulation, in addition to EVM, Center Frequency Leakage, Center Frequency Tolerance, Symbol Clock Frequency Tolerance, IQ Imbalance, and Spectral Flatness are also displayed. In case of DSSS modulation, in addition to EVM, Center Frequency Tolerance, IQ Offset, Phase & Magnitude Error, IQ Imbalance, Chip Clock Frequency Tolerance, and Carrier Suppression from IQ Offset are also displayed. Furthermore, the IQ constellation, spectrum flatness, and spectrum analysis results are displayed as graphs.



Frequency / Modulation Measurements

EVM

	Average	Maximum	Minimum
RMS [dB]	-33.99	-33.99	-33.99
RMS [%]	2.00	2.00	2.00
Peak [dB]	-27.30	-27.30	-27.30
Peak [%]	4.32	4.32	4.32

Center Frequency Leakage

	Average	Maximum	Minimum
Center Frequency Leakage [dB]	-41.21	-41.21	-41.21

Center Frequency Tolerance

	Average	Maximum	Minimum
Center Frequency Tolerance [ppm]	0.3	0.3	0.3
Center Frequency Tolerance [Hz]	672	672	672

Symbol Clock Frequency Tolerance

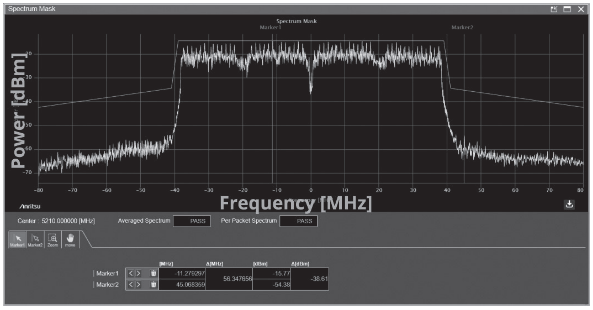
	Average	Maximum	Minimum
Symbol Clock Frequency Tolerance [ppm]	0.4	0.4	0.4
Symbol Clock Frequency Tolerance [Hz]	0	0	0

IQ Imbalance

	Average	Maximum	Minimum
Amplitude Imbalance [dB]	0.07	0.07	0.07
Phase Imbalance [degrees]	-0.06	-0.06	-0.06
Phase Error [degrees]	0.39	0.39	0.39

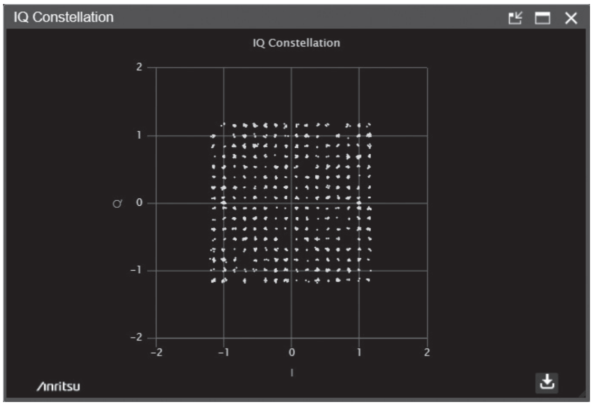
Spectral Flatness

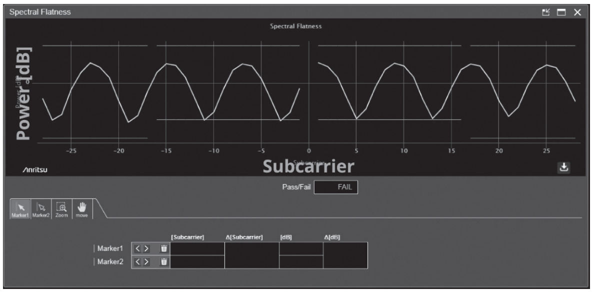
	Pass / Fail
Spectral Flatness	FAIL



Center : 5210.000000 [MHz]
Averaged Spectrum: PASS
Per Packet Spectrum: PASS

	[MHz]	Δ[MHz]	[dBm]	Δ[dBm]
Marker1	-11.279297	56.347656	-15.77	-38.61
Marker2	45.068359		-54.38	





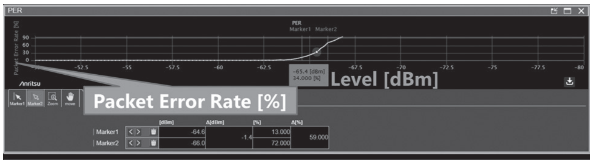
Pass/Fail: FAIL

	[Subcarrier]	Δ[Subcarrier]	[dB]	Δ[dB]
Marker1				
Marker2				

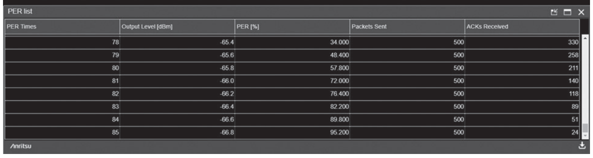
RF Rx Test

Packet Error Rate (PER)

The MT8862A Network Mode is a unique function that can use general communication method and instead automatically implements the 802.11a/b/g/n/ac device sensitivity search measurement to output the Bathtub curve. By using this function, the device performance can be analyzed at high speed for each data rate, offering a convenient measurement solution for verifying compliance with the 802.11b minimum receiver sensitivity test specifications. This is a flexible test solution because the number of packets sent at each power level can be specified both as the start and stop search level and as step size.



	[dBm]	Δ[dBm]	[%]	Δ[%]
Marker1	-64.6	-1.4	13.000	59.000
Marker2	-66.0		72.000	

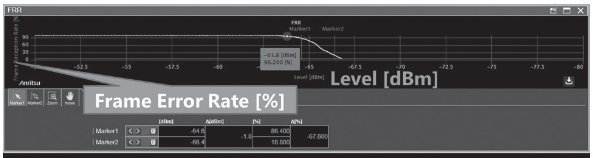


PER list

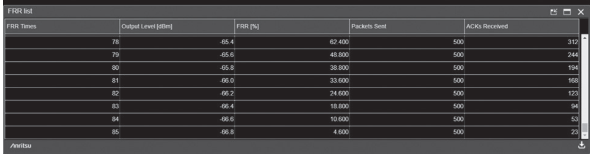
PER Times	Output Level [dBm]	PER [%]	Packets Sent	ACKs Received
78	-65.4	34.000	500	330
79	-65.6	48.400	500	258
80	-65.8	57.800	500	211
81	-66.0	72.000	500	140
82	-66.2	76.400	500	118
83	-66.4	82.200	500	89
84	-66.6	89.800	500	51
85	-66.8	95.200	500	24

Frame Rx rate (FRR)

The Frame Rx Rate can be displayed instead of displaying the Packet Rx Error Rate (PER).



	[dBm]	Δ[dBm]	[%]	Δ[%]
Marker1	-64.6	-1.8	86.400	-67.600
Marker2	-66.4		18.800	



FRR list

FRR Times	Output Level [dBm]	FRR [%]	Packets Sent	ACKs Received
78	-65.4	62.400	500	312
79	-65.6	48.800	500	244
80	-65.8	38.800	500	194
81	-66.0	33.600	500	168
82	-66.2	24.600	500	123
83	-66.4	18.800	500	94
84	-66.6	10.600	500	53
85	-66.8	4.600	500	23

WLAN Measurement Software MX886200A Measurement Items

Tx Measurements

Items by Standards

IEEE 802.11-2020: 802.11b Tx Measurements

802.11b	Measurement Items
16.3.7.2	Transmit power levels
16.3.7.4	Transmit spectral mask
16.3.7.5	Transmit center frequency tolerance
16.3.7.6	Chip clock frequency tolerance
16.3.7.7	Transmit power-on and power-down ramp
16.3.7.9	Transmit modulation accuracy

IEEE 802.11ax-2021: 802.11ax Tx Measurements*3

802.11ax	Measurement Items
27.3.15.3	Pre-correction accuracy requirements*4
27.3.19.1	Transmit spectral mask*5
27.3.19.2	Spectral flatness
27.3.19.3	Transmit center frequency and symbol clock frequency tolerance
27.3.19.4.2	Transmit center frequency leakage
27.3.19.4.3	Transmitter constellation error
27.3.19.4.4	Transmitter modulation accuracy (EVM) test

IEEE802.11-2020: 802.11a/g/n/ac Tx Measurements*1

802.11a	802.11g	802.11n	802.11ac	Measurement Items
17.3.9.2	18.4.7.2	19.3.18.3	N/A	Transmit power levels
17.3.9.3	18.4.7.3	19.3.18.1	21.3.17.1	Transmit spectrum mask*2
17.3.9.5	18.4.7.4	19.3.18.4	21.3.17.3	Transmit center frequency tolerance
17.3.9.6	18.4.7.5	19.3.18.6	21.3.17.3	Symbol clock frequency tolerance
17.3.9.7.2	17.3.9.7.2	19.3.18.7.2	21.3.17.4.2	Transmitter center frequency leakage
17.3.9.7.3	17.3.9.7.3	19.3.18.2	21.3.17.2	Transmitter spectral flatness
17.3.9.7.4	17.3.9.7.4	19.3.18.7.3	21.3.17.4.3	Transmitter constellation error
17.3.9.8	17.3.9.8	19.3.18.7.4	21.3.17.4.4	Transmitter modulation accuracy test

*1: 802.11ac Tx measurement requires MX886200A-001
*2: Frequency SPAN of 802.11ac Direct Mode supports up to ±240 MHz, Network Mode supports up to ±80 MHz
*3: 802.11ax Tx measurement requires MX886200A-002
*4: Measure the error between DUT transmission power and Target RSSI
*5: Frequency SPAN of 802.11ax Direct Mode supports up to ±240 MHz, Network Mode supports up to ±80 MHz

Measurement Items

MT8862A 11b	MT8862A 11a/g/n/ac	MT8862A 11ax HE SU (Single User)	MT8862A 11ax HE TB (Multi User)
Transmit power Crest factor Power ramp EVM (Transmit modulation accuracy) Center frequency tolerance IQ offset Phase error Magnitude error Amplitude imbalance Phase imbalance Chip clock frequency tolerance Carrier suppression from IQ offset Spectrum mask	Transmit power Crest factor Power ramp EVM (Transmit modulation accuracy) Center frequency leakage Center frequency tolerance Symbol clock frequency tolerance Amplitude imbalance Phase imbalance Phase error Spectrum flatness Spectrum mask	Transmit power Crest factor Power ramp EVM (Transmit modulation accuracy) Center frequency leakage Center frequency tolerance Symbol clock frequency tolerance Amplitude imbalance Phase imbalance Phase error Spectrum flatness Spectrum mask	Transmit power Power pre-correction accuracy Crest factor Power ramp EVM (Transmit modulation accuracy) Unused tone error Center frequency leakage Center frequency tolerance Center frequency offset Amplitude imbalance Phase imbalance Phase error Spectrum flatness Spectrum mask

Graph Display Items

MT8862A 11b Graph Display Items	MT8862A 11a/g/n/ac Graph Display Items	MT8862A 11ax Graph Display Items
IQ Constellation Power Profile Spectrum Mask	IQ Constellation Power Profile Spectrum Mask Spectrum Flatness	IQ Constellation Power Profile Spectrum Mask Spectrum Flatness Carrier Frequency Offset Error (CCDF)* Unused Tone Error

*: Available on HETB format.

Rx Measurements

Items by Standards

IEEE802.11-2020: 802.11b Rx Measurements

802.11b	Measurement Item
16.3.8.2	Receiver minimum input level sensitivity
16.3.8.3	Receiver maximum input level
16.3.8.4	Receiver adjacent channel rejection*1

IEEE 802.11ax-2021: 802.11ax Rx Measurements*3

802.11ax	Measurement Item
27.3.20.2	Receiver minimum input sensitivity
27.3.20.3	Adjacent channel rejection*1
27.3.20.4	Nonadjacent channel rejection*1
27.3.20.5	Receiver maximum input level

IEEE802.11-2020: 802.11a/g/n/ac Rx Measurements*2

802.11a	802.11g	802.11n	802.11ac	Measurement Item
17.3.10.2	18.4.8.2	19.3.19.1	21.3.18.1	Receiver minimum input level sensitivity
17.3.10.3	18.4.8.3	19.3.19.2	21.3.18.2	Adjacent channel rejection*1
17.3.10.4	17.3.10.4	19.3.19.3	21.3.18.3	Nonadjacent channel rejection*1
17.3.10.5	18.4.8.4	19.3.19.4	21.3.18.4	Receiver maximum input level

*1: Sold separately; requires signal generator
*2: 802.11ac Rx measurement requires MX886200A-001
*3: 802.11ax Rx measurement requires MX886200A-002

Graph Display Items

Measurement Item
Packet Error Rate (PER) Frame Reception Rate (FRR)

WLAN Measurement Software MX886200A Connectivity

Connectivity

	802.11a
Frequency Range	5180 MHz to 5885 MHz[*1]
Operation Mode	—
Modulation	OFDM (BPSK, QPSK, 16QAM, 64QAM)
Data Rate	6, 9, 12, 18, 24, 36, 48, 54 Mbps
Security[*2]	WEP, WPA-Personal, WPA2-Personal, WPA3-Personal

	802.11b	802.11g
Frequency Range	2412 MHz to 2484 MHz	
Operation Mode	—	ERP-OFDM
Modulation	DSSS, CCK	OFDM (BPSK, QPSK, 16QAM, 64QAM)
Data Rate	1, 2, 5.5, 11 Mbps	6, 9, 12, 18, 24, 36, 48, 54 Mbps
Security[*2]	WEP, WPA-Personal, WPA2-Personal, WPA3-Personal	

	802.11n	802.11ac[*5]
Frequency Range	2412 MHz to 2484 MHz and 5180 MHz to 5885 MHz[*1]	5180 MHz to 5885 MHz[*1]
Bandwidth	20 MHz, 40 MHz	20, 40, 80, 160 MHz[*6]
MCS	MCS0 to MCS7, MCS0 to MCS15[*3]	MCS0 to MCS9[*6]
FEC	BCC	BCC
PPDU Format	HT-mixed, HT-greenfield[*4]	VHT
Guard Interval Type	Long, Short	Long, Short
RF Chain	Single (SISO), 2×2MIMO[*3]	Single (SISO), 2×2MIMO[*3]
Security[*2]	WPA-Personal, WPA2-Personal, WPA3-Personal	

	802.11ax[*7]
Frequency Range	2412 MHz to 2484 MHz, 5180 MHz to 5885 MHz, 5955 MHz to 7115 MHz[*1]
Bandwidth	20, 40 MHz (2.4 GHz Band) 20, 40, 80, 160 MHz (5 GHz Band)[*8] 20, 40, 80, 160 MHz (6 GHz Band)[*8]
MCS	MCS0 to MCS11
FEC	BCC, LDPC
PPDU Format	Tx measurement: HE SU, HE TB
Guard Interval Type	Rx measurement: HE SU
Guard interval and HE-LTF type	HE SU 0.8 µs GI, 1xHE-LTF 0.8 µs GI, 2xHE-LTF 1.6 µs GI, 2xHE-LTF 0.8 µs GI, 4xHE-LTF 3.2 µs GI, 4xHE-LTF HE TB 1.6 µs GI, 2xHE-LTF 3.2 µs GI, 4xHE-LTF
RF Chain	Single (SISO)
Security[*2]	WPA-Personal, WPA2 -Personal, WPA3-Personal

*1: The frequencies above 5825 MHz require MT8862A-002 and MT8862A-010.
*2: Secure connections require the MX886200A-020
*3: Available when measure 2×2MIMO receiver sensitivity using MX886200A-010.
*4: Only receiver sensitivity testing is supported in 2×2MIMO.
*5: 802.11ac connection requires MX886200A-001
*6: MCS9 is only available on 40 MHz or 80 MHz bandwidth.
*7: 802.11ax connection requires MX886200A-002
*8: 160 MHz bandwidth require MX886200A-030.

Wireless Connectivity Test Set MT8862A Configuration

System Configurations/Options/Software/PC Controller Operation Environment

System	Wireless LAN
Main Frame	Wireless Connectivity Test Set MT8862A
Basic Configuration (Hardware)	RF Frequency 2.4 GHz, 5 GHz MT8862A-001
Basic Configuration (Software)	WLAN Measurement Software MX886200A
Options (Hardware)	RF Frequency 6 GHz MT8862A-002 Extended RF Hardware MT8862A-010
Options (Software)	WLAN 802.11ac Option MX886200A-001 WLAN 802.11ax Option MX886200A-002 2×2MIMO Measurement Software MX886200A-010 WLAN Security Function MX886200A-020 160 MHz Bandwidth MX886200A-030

Verified PC Operation Environment

PC	Software OS: Windows 10 Browser: Chrome CPU: Intel Core i5 processor Clock: 2.5 GHz Memory: 1 GB minimum Hard Disk: 500 MB minimum free space LAN: 100 Base-T LAN (1000-base T preferred)
Peripherals	Display: WXGA 1024 × 768 minimum

Options Configuration Guide

Hardware

✓ = Require

Name	Retrofit	Hardware Configuration		
		001	002	010
RF Frequency 2.4 GHz, 5 GHz Minimum Configuration		✓		
RF Frequency 2.4/5/6 GHz	Yes	✓	✓	✓

Software

Model	Hardware configurations that can be installed ✓ = Can be installed, No = Cannot be installed		Note
	001 (2.4 GHz, 5 GHz)	001, 002, 010 (2.4 GHz, 5 GHz, 6 GHz)	
WLAN Measurement Software MX886200A	✓	✓	Support 802.11b/g/a/n.
WLAN 802.11ac Option MX886200A-001	✓	✓	
WLAN 802.11ax Option MX886200A-002	✓	✓	
2×2MIMO Measurement Software MX886200A-010	✓	✓	Support 802.11n/ac.
WLAN Security Function MX886200A-020	✓	✓	
160 MHz Bandwidth MX886200A-030	No	✓	

Wireless Connectivity Test Set MT8862A Specifications

Receiver	Frequency Range MT8862A-001 installed: 2.4 GHz to 2.5 GHz, 5.0 GHz to 6.0 GHz MT8862A-002, 010 installed: 6.0 GHz to 7.3 GHz Setting Resolution: 1 Hz Accuracy: Depends on reference oscillator accuracy Level Setting Range: –65 to +25 dBm Setting Resolution: 0.1 dB Accuracy Measurement Conditions: CW, Measurement Bandwidth: 300 kHz, 20°C to 30°C, Input signal lower than setting level and excluded influence of linearity error, after calibration 2.4 GHz ≤ Frequency ≤ 2.5 GHz ±0.7 dB (–30 dBm ≤ Setting Level ≤ +25 dBm) ±0.9 dB (–55 dBm ≤ Setting Level < –30 dBm) ±1.1 dB (–65 dBm ≤ Setting Level < –55 dBm) 5.0 GHz ≤ Frequency ≤ 6.0 GHz ±0.7 dB (–30 dBm ≤ Setting Level ≤ +25 dBm) ±0.9 dB (–55 dBm ≤ Setting Level < –30 dBm) ±1.1 dB (–65 dBm ≤ Setting Level < –55 dBm) 6.0 GHz < Frequency ≤ 7.3 GHz ±0.7 dB (–30 dBm ≤ Setting Level ≤ +25 dBm) ±0.9 dB (–55 dBm ≤ Setting Level < –30 dBm) ±1.1 dB (–65 dBm ≤ Setting Level < –55 dBm) Measurement Conditions: CW, Measurement Bandwidth: 160 MHz, 20°C to 30°C, Input signal lower than setting level and excluded influence of linearity error, after calibration 2.4 GHz ≤ Frequency ≤ 2.5 GHz ±0.7 dB (–30 dBm ≤ Setting Level ≤ +25 dBm) ±1.0 dB (–50 dBm ≤ Setting Level < –30 dBm) 5.0 GHz ≤ Frequency ≤ 6.0 GHz ±0.7 dB (–30 dBm ≤ Setting Level ≤ +25 dBm) ±1.0 dB (–50 dBm ≤ Setting Level < –30 dBm) 6.0 GHz < Frequency ≤ 7.3 GHz ±0.7 dB (–30 dBm ≤ Setting Level ≤ +25 dBm) ±1.0 dB (–50 dBm ≤ Setting Level < –30 dBm) Linearity Measurement Conditions: CW, Measurement Bandwidth: 300 kHz, 0 to –40 dB of setting level ±0.2 dB (–55 dBm ≤ Input Level) ±0.4 dB (–65 dBm ≤ Input Level < –55 dBm) Measurement Conditions: CW, Measurement Bandwidth: 160 MHz, 0 to –40 dB of setting level ±0.4 dB (–40 dBm ≤ Input Level)
Transmitter	Frequency Output Frequency Range MT8862A-001 installed: 2.4 GHz to 2.5 GHz, 5.0 GHz to 6.0 GHz MT8862A-002, 010 installed: 6.0 GHz to 7.3 GHz Setting Resolution: 1 Hz Accuracy: Depends on reference oscillator accuracy Level Setting Range: –120 to 0 dBm Setting Resolution: 0.1 dB Accuracy Output Setting: CW 20°C to 30°C, Output Level: ≥–110 dBm, after Calibration ±1.0 dB, ±0.7 dB (typ.) (2.4 GHz ≤ Frequency ≤ 2.5 GHz) ±1.3 dB, ±1.0 dB (typ.) (5.0 GHz ≤ Frequency ≤ 6.0 GHz) ±1.3 dB, ±1.0 dB (typ.) (6.0 GHz < Frequency ≤ 7.3 GHz) Signal Purity Harmonic: ≤–25 dBc
Reference Oscillator	At Start: $\pm 5 \times 10^{-7}$ (2 minutes after power-on, at 25°C referenced to frequency at 24 hour after power-on) $\pm 5 \times 10^{-8}$ (5 minutes after power-on, at 25°C referenced to frequency at 24 hour after power-on) Aging Rate: $\pm 1 \times 10^{-7}$/year Temperature Characteristics: $\pm 2 \times 10^{-8}$ (5°C to 45°C) Shipped Frequency Accuracy: $\pm 2.2 \times 10^{-8}$ (1 hour after power-on at 20°C to 30°C)
Front Panel Connectors	RF Input/Output Main1, 2 Connector: N-J, 50Ω (nominal) VSWR: ≤1.5 (2.4 GHz ≤ Frequency ≤ 2.5 GHz) ≤1.7 (5.0 GHz ≤ Frequency ≤ 6.0 GHz) ≤1.7 (6.0 GHz < Frequency ≤ 7.3 GHz) Aux Out Connector: N-J, 50Ω (nominal) VSWR: ≤1.5 (2.4 GHz ≤ Frequency ≤ 2.5 GHz) ≤1.6 (5.0 GHz ≤ Frequency ≤ 6.0 GHz) ≤1.6 (6.0 GHz < Frequency ≤ 7.3 GHz)

Continued on next page

Back Panel Connectors	Reference Signal External Reference Input Connector: BNC-J Frequency: 10 MHz, Impedance: 50Ω Operation range: ±1 ppm, Input Level: –15 dBm ≤ Level ≤+20 dBm, 50Ω (AC coupled) Reference Signal Output Connector: BNC-J Frequency: 10 MHz, Impedance: 50Ω Output Level: ≥0 dBm (AC coupled)) External Trigger Trigger Input 1/2 Connector: BNC 1/2, Input Level: TTL Trigger Output 1/2 Connector: BNC 1/2, Output Level: TTL External Interfaces Ethernet (Remote): Required for remote control from external controller Connector: RJ-45, Speed: 1000BASE-T USB: General Purpose, USB 2.0 Connector: USB-A, 2 Ports Expansion I/O: Connector for function expansion Connector: 50 pin (DX10A-50S) Ethernet (IP Data): IP Data Transfer Connector: RJ-45, Speed: 1000BASE-T
Dimensions and Mass	426 (W) × 177 (H) × 390 (D) mm (excluding projections), ≤14 kg
Power Supply	Rated voltage: 100 V(ac) to 120 V(ac) or 200 V(ac) to 240 V(ac) Rated frequency: 50 Hz/60 Hz Power consumption: ≤350 VA
Operating Conditions	Temperature Operating: +5°C to +45°C, Storage: –20°C to +60°C
CE	EMC: 2014/30/EU, EN61326-1, EN61000-3-2 LVD: 2014/35/EU, EN61010-1 RoHS: 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC: S.I. 2016 No.1091, EN 61326-1, EN61000-3-2 LVD: S.I. 2016 No.1101, EN 61010-1 RoHS: S.I. 2012 No.3032, EN IEC 63000: 2018

WLAN Measurement Software MX886200A Specifications

Frequency Range	2.4 GHz Band: 2412 MHz to 2484 MHz (with MT8862A-001 installed) 5 GHz Band: 5180 MHz to 5825 MHz (with MT8862A-001 installed) 5180 MHz to 5885 MHz (with MT8862A-001, 002, 010 installed) 6 GHz Band:5955 MHz to 7115 MHz (with MT8862A-001, 002, 010 installed)
Amplitude Measurement	Input Level Range: –50 to +25 dBm Input Level Accuracy: After calibration at 20°C to 30°C ±0.7 dB (–30 dBm ≤ Input Level ≤+25 dBm) ±1.0 dB (–50 dBm ≤ Input Level <–30 dBm) Linearity: ±0.4 dB (–40 dBm ≤ Input Level, 0 to –30 dB range compared to setting level) Bandwidth: 40 MHz/20 MHz (802.11n), 20 MHz (802.11a/b/g), 160/80/40/20 MHz (802.11ac, with MX886200A-001 installed), 160/80/40/20 MHz (802.11ax, with MX886200A-002, 030 installed)
Spectrum Measurement	Input Level Range: –10 to +25 dBm
EVM (Modulation Accuracy)	EVM Measurement Range: –20 to +25 dBm Residual EVM DSSS: <–28 dB (–20 dBm ≤ Input Level, Average of 20 Packets) OFDM (802.11a/g/n): <–40 dB (–20 dBm ≤ Input Level, Average of 20 Packets, Channel Estimate: Full Packets) OFDM (802.11ac, with MX886200A-001 installed): <–38 dB (–10 dBm ≤ Input Level, Average of 20 Packets, Channel Estimate: Full Packets) OFDM (802.11ac, 160 MHz bandwidth, with MX886200A-001, 030 installed): <–44 dB (nom.) (–10 dBm ≤ Input Level, Average of 20 Packets, Channel Estimate: Full Packets, MCS9) OFDM (802.11ax, with MX886200A-002 installed): <–42 dB (nom.) (–10 dBm ≤ Input Level, Average of 20 Packets, Channel Estimate: Full Packets) OFDM (802.11ax, with MX886200A-002, 030 installed): <–44 dB (nom.) (–10 dBm ≤ Input level, Average of 20 Packets, Channel Estimate: Full packet, MCS11) EVM Data Format: % or dB Measurement Resolution: 0.01% or 0.01 dB
Carrier Frequency Measurement	Measurement Level Range: –20 to +25 dBm Carrier Frequency Accuracy 802.11b: ± (Setting Frequency × Reference Oscillator Accuracy + 1 kHz) (Average of 20 Packets) 802.11a/g/n/ac: ± (Setting Frequency × Reference Oscillator Accuracy + 1 kHz) (Average of 20 Packets, Channel Estimate: Full Packets) 802.11ax: ± (Setting Frequency × Reference Oscillator Accuracy + 5 Hz) (nom.) (more than 100 symbol and 242 tones, and Channel Estimate:Full Packets, Frequency error range: Full packet)
RF Signal Generator	Level Setting Range: –120 to 0 dBm (Aux Out Connector) –120 to 0 dBm (Main 1/2 Connector, Frequency ≤ 6 GHz and Channel Band 2.4 GHz/5 GHz) –120 to –5 dBm (Main 1/2 Connector, Frequency > 6 GHz or Channel Band 6 GHz) EVM: Packet Length 1472 byte 802.11b: ≤–38 dB rms (2412 MHz to 2484 MHz, Long Preamble, Gaussian Filter BT0.5, 5°C to 45°C) 802.11g (OFDM): ≤–40 dB rms(2412 MHz to 2484 MHz, 20°C to 30°C) 802.11a: ≤–38 dB rms (5180 MHz to 5885 MHz, 20°C to 30°C) 802.11n: ≤–40 dB rms (2412 MHz to 2484 MHz, Long GI, HT-mixed format, Channel Bandwidth 40 MHz, 20°C to 30°C) ≤–38 dB rms (5180 MHz to 5885 MHz, Long GI, HT-mixed format, Channel Bandwidth 40 MHz, 20°C to 30°C) 802.11ac: ≤–37 dB rms (5180 MHz to 5885 MHz, Long GI, Channel Bandwidth 80 MHz, 20°C to 30°C) ≤–41 dB rms (5180 MHz to 5885 MHz, Long GI, MCS9, Channel Bandwidth 160 MHz, 20°C to 30°C) 802.11ax: ≤–40 dB rms (nom.) (5180 MHz to 5885 MHz, 0.8 µs GI, Channel Bandwidth 80 MHz, 20°C to 30°C) ≤–41 dB rms (nom.) (5180 MHz to 5885 MHz, 0.8 µs GI, MCS11, Channel Bandwidth 160 MHz, 20°C to 30°C) ≤–41 dB rms (nom.) (5995 MHz to 7115 MHz, 0.8 µs GI, MCS11, Channel Bandwidth 160 MHz, 20°C to 30°C)

Continued on next page

Functions	Network Functions Connection: Network Connection using Messages defined by IEEE802.11 Role: Access Point (AP/STA) Frame Capture: 1, 2, 4, 8, 16, 32, 64, 128, 256 MB Tx Test Measurement Type: Data, ACK Rx Test Measurement Type: Packet Error Rate (PER), Frame Reception Rate (FRR) Payload Type: All 0's, 0101, 1010, PN7, PN9, Random, Counting MIMO signal transmission (with MX886200A-010) – MIMO signals available for receiver testing. Spatial stream N_{SS}: 1 to 2 Space-time-stream N_{STS}: 1 to 2 RF chain N_{TX}: 2 STBC: Supported only with N_{SS} = 1 and N_{STS} = 2 Spatial mapping: Direct mapping Beamforming: Not supported Security encryption (with MX886200A-020 installed) WEP, WPA-Personal, WPA2-Personal, WPA3-Personal

Typical (typ.): Performance not warranted. Most products meet typical performance.
Nominal (nom.): Values not warranted. Included to facilitate application of product.

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MT8862A	Wireless Connectivity Test Set
	Standard Accessories
J0017F	Power Code: 1
	DVD (Operation Manual): 1
W3901AE	MT8862A Operation Manual (Operation) [DVD]
W3902AE	MT8862A Operation Manual (Remote Control) [DVD]
W3903AE	MX886200A WLAN Measurement Software Manual (Operation) [DVD]
W3904AE	MX886200A WLAN Measurement Software Manual (Remote Control) [DVD]
	RF Options
MT8862A-001	RF Frequency 2.4 GHz, 5 GHz
MT8862A-002	RF Frequency 6 GHz
MT8862A-010	Extended RF Hardware
	Retrofit RF Options[*1]
MT8862A-102	RF Frequency 6 GHz Retrofit
MT8862A-202	RF Frequency 6 GHz Retrofit
MT8862A-110	Extended RF Hardware Retrofit
MT8862A-210	Extended RF Hardware Retrofit
MT8862A-310	Extended RF Hardware Retrofit
	Software Options
MX886200A	WLAN Measurement Software (Requires MT8862A-001)
MX886200A-001	WLAN 802.11ac Option
MX886200A-002	WLAN 802.11ax Option
MX886200A-010	2×2MIMO Measurement Software
MX886200A-020	WLAN Security Function
MX886200A-030	160 MHz Bandwidth
MX886200A-070	Remote Control Expansion

Model/Order No.	Name
	Warranty Service
MT8862A-ES210	2 Years Extended Warranty Service
MT8862A-ES310	3 Years Extended Warranty Service
MT8862A-ES510	5 Years Extended Warranty Service
	Application Parts
J0127A	Coaxial Cord, 1 m (BNC-P, RG-58A/U, BNC-P)
J0127B	Coaxial Cord, 2 m (BNC-P, RG-58A/U, BNC-P)
J0127C	Coaxial Cord, 0.5 m (BNC-P, RG-58A/U, BNC-P)
J0576B	Coaxial Cord, 1 m (N-P, 5D-2W, N-P)
J0576D	Coaxial Cord, 2 m (N-P, 5D-2W, N-P)
J0322A	Coaxial Cord, 0.5 m (SMA-P, SMA-P)
J0322B	Coaxial Cord, 1.0 m (SMA-P, SMA-P)
J0322C	Coaxial Cord, 1.5 m (SMA-P, SMA-P)
J0322D	Coaxial Cord, 2.0 m (SMA-P, SMA-P)
J0004	Coaxial Adapter (N-P, SMA-J)
J1261A	Ethernet Cable (Straight, 1 m)
J1261B	Ethernet Cable (Straight, 3 m)
J1261C	Ethernet Cable (Cross, 1 m)
J1261D	Ethernet Cable (Cross, 3 m)
J1777A	Expansion IO Cable
B0635A	Rack Mount Kit (EIA)
B0657A	Rack Mount Kit (JIS)
B0636C[*2]	Carrying Case (Hard type, with a front cover and casters)
B0671A	Front Cover (1MW4U)

[*1] MT8862A- □ ##
□: Select from the following according to the option type.
1: Retrofit option (Must be returned to factory in Japan)
2: Retrofit option (Must be returned to service center outside of Japan)
3: Retrofit option (No need to return)

[*2] The Carrying Case B0636C includes a Front Panel Protective Cover (B0671A).

PIM Master™ Available with Cable & Antenna Analyzer Option

MW82119B PIM Master™

Remote Control
Ethernet | **USB**

Passive Intermodulation Analyzer with Site Master™ Option

Anritsu introduces the first fully integrated Passive Intermodulation (PIM) Analyzer plus Cable and Antenna Analyzer (Option 331) suitable for commissioning and maintaining global wireless networks. This high performance, battery operated unit allows operators to fully characterize infrastructure quality by measuring Return Loss, VSWR, Cable Loss, Passive Intermodulation, Distance-to-Fault, and Distance-to-PIM. Measure PIM with a portable test solution, large outdoor viewable display, intuitive user interface, and optimized for field conditions, available in 1- and 2-port options.
The available 2-port PIM Master solution (Option 0703) for the LTE 700 band now allows technicians to send F1 and F2 CW tones through Bands 17 and 14 antennas simultaneously, with isolation performance of 25 dB between the two ports. Making testing and PIM hunting a FirstNet deployment more efficient. This versatile solution also works as a traditional 1-port LTE 700 PIM test set, ideal for finding PIM in cable and antenna systems and tap testing connectors.

Passive Intermodulation (PIM) Analyzer Highlights

- PIM vs. Time, Swept PIM, Noise Floor, Distance-to-PIM
- 3rd, 5th, and 7th order intermodulation products detected
- 2-Port LTE 700 MHz PIM testing (with option 703)
- Test power: 20 to 46 dBm
- Residual PIM: –125 dBm (typ.)

Cable and Antenna Analyzer (Option 331)

- Measurements: RL, VSWR, Cable Loss, DTF, Phase
- Frequency range: 2 MHz to 3 GHz
- Sweep Speed: 1 ms/data point (typ.)
- Calibration: OSL and FlexCal™

Capabilities and Functional

- Integrated solution
- Battery operated: >3.0 hour run time
- Display: 8.4 in (213 mm) daylight viewable
- IP54 rated for dust and water spray
- MIL-STD-810G drop test rated
- Stainless steel lifting rings
- Padded soft case for extra protection
- Easy-to-use, menu driven user interface
- Quick Name Matrix simplifies naming in the field
- GPS tag measurements (Option 31)
- High Accuracy Power Meter (Option 19)

Definitions

All specifications and characteristics apply to Revision 2 instruments under the following conditions, unless otherwise stated:

Warm-Up Time	After 10 minutes of warm-up time, where the instrument is left in the ON state.
Typical Performance	Typical specifications are not tested and are not warranted. They are generally representative of the nominal characteristic performance.
Uncertainty	A coverage factor of K = 2 is applied to measurement uncertainties.
Calibration Cycle	Recommended calibration cycle is 12 months. All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu web site: www.anritsu.com

General Specifications

PIM Master Connectors	PIM Test Port	7/16 DIN (f) 50Ω
	Port 2 Out	4.3-10 (f) (option 703 only)
	Port 2 Return	SMA (f) (option 703 only)
	Dual USB Type A	2x Type A (connect USB Flash Drive and USB Power Sensor)
	USB Mini-B	1x Mini-B (connect to PC for data transfer)
	GPS	SMA (f) (with GPS option only)
	External Power	2.1 × 5.5 mm barrel connector, 12 VDC to 15 VDC, <5.0 A
	PIM Test Port Damage Level	+10 dBm (10 mW) continuous, (PIM Rx band) +35 dBm (3 W) continuous, (PIM Tx band)*
	VNA Test Port	Type N (f) 50Ω (Option 331)
	VNA Test Port Damage Level	40 dBm continuous * Able to survive full reflection of 2 × 46 dBm PIM test tones generated by the MW82119B.
Display	Size	213 mm (8.4 in) touch screen
	Resolution	800 × 600 Pixel Defects: No more than five defective pixels (99.9989% good pixels)
Battery	Type	Li-Ion
	Battery Operation	3.0 hours (typ.)
	Charging Limits	While charging, battery must be 0°C to +45°C, Relative Humidity ≤80%
Power	AC/DC Adapter	Input: 100 VAC to 240 VAC, 50 Hz/60 Hz Output: 12 VDC
CE	EMC	2014/30/EU, EN61326-1, EN61000-4-2
	LVD	2014/35/EU, EN61010-1
	RoHS	(EU) 2015/863
RCM		Australia and New Zealand RCM AS/NZS 4417:2012
KCC		South Korea KCC-REM-A21-0004
Canada		ICES-001
Environmental, MIL-PRF-28800F Class 2	Operating Temperature Range	–10°C to +55°C
	Storage Temperature Range	–51°C to +71°C
	Maximum Relative Humidity	95% RH at 30°C, non-condensing
	Vibration, Sinusoidal	5 Hz to 55 Hz
	Vibration, Random	10 Hz to 500 Hz
	Half Sine Shock	30 gn
	Altitude	4600 meters, operating and non-operating
	Explosive Atmosphere	MIL-PRF-28800F, Section 4.5.6.3 MIL-STD-810G, Method 511.5, Procedure 1
	Ingress Protection (IP)	IP54, IP67 when enclosed in optional transit case
ESD	PIM Test Port Connector Center Pin	Withstands up to ±15 kV
	VNA RF Out Connector Center Pin	Withstands up to ±15 kV
Dimensions and Mass		Dimensions: 350 (W) × 314 (H) × 152 (D) mm (13.8 × 12.4 × 6.0 in) Mass: 9.2 kg to 12.6 kg (20 lb to 27.8 lb), varies by frequency option

PIM Analyzer Specifications

Measurements		PIM vs. Time Noise Floor Distance-to-PIM Swept PIM
Setup Parameters	Frequency	Carrier F1, Carrier F2, Intermodulation Order
	Amplitude	Ref Value, Scale, Auto Range (On/Off), Amplitude Tone (On/Off)
	Setup	Output Power, Test Duration (1 s to 1,200 s)
	Limit Lines	Limit (Upper/Lower), On/Off, Limit Move, Limit Alarm (On/Off, PASS/FAIL indicator)
	Markers	Markers 1–6 (On/Off), Delta Markers 1 – 6 (On/Off), Marker to Peak/Valley, All Markers Off
	GPS	On/Off, 3.3 V/5.0 V
	DTP	Cable Velocity, Distance
	Save/Recall	Setups (.stp), Measurements (.pim), Limit Lines (.lim), Screen Shots (.jpg) (save only)
1-Port PIM Measurement Ranges	RF Test Power (Both 1-Port and 2-Port)	Two CW tones 20 to 46 dBm, 0.1 dBm steps, Accuracy ±5 dB (excluding uncertainty)
	RF Test Frequency	Accuracy: ±1.0 ppm at 23°C Stability: ±1.0 ppm from –10°C to +55°C (typ.) Aging: ±1.0 ppm/yr aging (typ.)
	Residual PIM Performance	<–117 dBm, <–125 dBm (typ.) (2 × 43 dBm test tones) <–134 dBm, <–140 dBm (typ.) (2 × 20 dBm test tones)
	PIM Measurement Range	–70 to –140 dBm (Revision 1 instruments) –50 to –140 dBm (Revision 2 instruments)

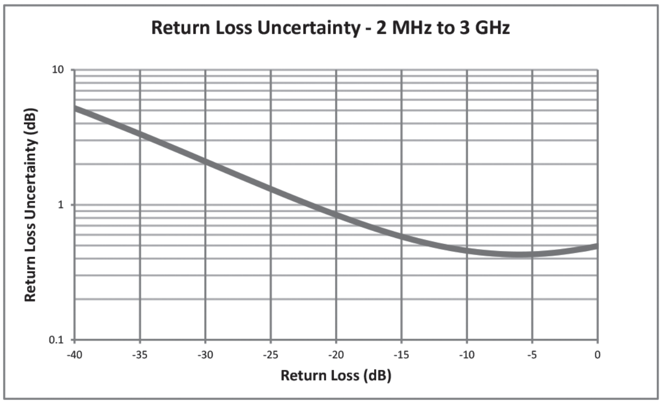
Continued on next page

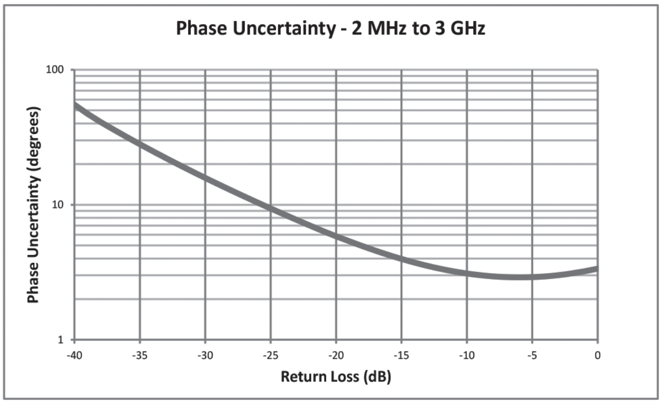
Option	Band	Frequency Range
Option 600	LTE 600 w/1900 MHz	Tx$_1$: 617 MHz to 618 MHz, Tx$_2$: 633 MHz to 652 MHz Rx$_1$: 663 MHz to 698 MHz, Rx$_2$: 1867 MHz to 1888 MHz
Option 700	LTE 700	Tx$_1$: 731 MHz to 734.5 MHz, Tx$_2$: 746 MHz to 768 MHz Rx$_{Lower}$: 698 MHz to 717 MHz, Rx$_{Upper}$: 777 MHz to 806 MHz
Option 701	APT 700	Tx$_1$: 758 MHz to 776 MHz, Tx$_2$: 788 MHz to 803 MHz Rx$_{Lower}$: 710 MHz to 748 MHz, Rx$_{Upper}$: 825 MHz to 845 MHz
Option 703	2-Port LTE 700	Tx$_1$: 731 MHz to 734.5 MHz, Tx$_2$: 746 MHz to 768 MHz Rx$_{Lower}$: 698 MHz to 717 MHz, Rx$_{Upper}$: 777 MHz to 806 MHz
Option 800	LTE 800	Tx$_1$: 791 MHz to 795 MHz, Tx$_2$: 811.5 MHz to 821 MHz Rx: 832 MHz to 862 MHz
Option 850	Cellular 850	Tx$_1$: 869 MHz to 871 MHz, Tx$_2$: 881.5 MHz to 894 MHz Rx: 824 MHz to 849 MHz
Option 900	E-GSM 900	Tx$_1$: 925 MHz to 937.5 MHz, Tx$_2$: 951.5 MHz to 960 MHz Rx: 880 MHz to 915 MHz
Option 180	DCS 1800	Tx$_1$: 1805 MHz to 1837 MHz, Tx$_2$: 1857.5 MHz to 1880 MHz Rx: 1710 MHz to 1785 MHz
Option 194	PCS/AWS	Tx$_1$: 1930 MHz to 1945 MHz, Tx$_2$: 1965 MHz to 1995 MHz, Tx$_3$: 2110 MHz to 2155 MHz Rx$_1$: 1850 MHz to 1910 MHz (using Tx$_1$ and Tx$_2$), Rx$_2$: 1710 MHz to 1755 MHz (using Tx$_1$ and Tx$_3$)
Option 210	UMTS 2100	Tx$_1$: 2110 MHz to 2112.5 MHz, Tx$_2$: 2130 MHz to 2170 MHz Rx$_{Lower}$: 1920 MHz to 1980 MHz, Rx$_{Upper}$: 2050 MHz to 2090 MHz
Option 260	LTE 2600	Tx$_1$: 2620 MHz to 2630 MHz, Tx$_2$: 2650 MHz to 2690 MHz Rx: 2500 MHz to 2570 MHz
1-Port PIM vs. Time	IM product magnitude vs. time	
	Test Frequencies	F1, F2, and IM product frequencies fixed, user selectable
	Measurements	Peak PIM over measurement duration, Instantaneous PIM
1-Port Noise Floor (Time View)	Noise level vs. frequency	
	Test Frequencies	IM product frequency fixed, user selectable
	Measurements	Peak signal level over measurement duration, Instantaneous signal level
1-Port Noise Floor (Spectrum View)	Noise level vs. frequency	
	Test Frequencies	Swept measurement over Rx band of instrument
	Measurements	Peak signal level, Instantaneous signal level
1-Port Distance-to-PIM	IM product magnitude vs. distance	
	Test Frequencies	F1 or F2 frequency swept to produce range of IM product frequencies for analysis
	Fault Resolution	Varies by frequency option, <3 m (<10 ft) (typ.) with Enhanced Resolution activated
	Maximum Range	Varies by frequency option and number of Data Points selected
	Markers	Standard marker functions plus Marker Table (On/Off)
	Trace Overlay	DTP/DTP, DTP/DTF
1-Port Swept PIM	IM product magnitude vs. frequency	
	Test Frequencies	F1 and F2 frequencies swept to produce range of IM product frequencies
	Measurements	Peak PIM over measurement duration, Instantaneous PIM
2-Port PIM Measurement Ranges	RF Test Frequency	Accuracy: ±0.5 ppm at 23°C Stability: ±1.0 ppm from –10°C to +55°C (typ.) Aging: ±1.0 ppm/yr aging (typ.)
	Residual PIM Performance	<–123 dBm (typ.) (2 × 43 dBm test tones) <–115 dBm (typ.) (2 × 46 dBm test tones)
	PIM Isolation Residual PIM Performance	–123 dBm (typ.) (2 × 43 dBm test tones) –115 dBm (typ.) (2 × 46 dBm test tones)
2-Port PIM vs. Time	IM product magnitude vs. time	
	Test Frequencies	F1 PIM Test Port, Port 2 Out, and IM product frequencies fixed, user selectable
	Measurements	Peak PIM over measurement duration, Instantaneous PIM
2-Port Noise Floor (Time View)	Noise level vs. time at IM product frequency	
	Test Frequencies	IM product frequency fixed, user selectable
	Measurements	Peak signal level over measurement duration, Instantaneous signal level
2-Port Noise Floor (Spectrum View)	Noise level vs. frequency	
	Test Frequencies	Swept measurement over Rx band of instrument
	Measurements	Peak signal level, Instantaneous signal level
2-Port Distance-to-PIM	IM product magnitude vs. distance	
	Test Frequencies	F1 PIM Test Port, F2 Port 2 Out frequencies swept to produce range of IM product frequencies for analysis
	Fault Resolution	Varies by frequency option, <3 m (<10 ft) typical with Enhanced Resolution activated
	Maximum Range	Varies by frequency option and number of Data Points selected
	Markers	Standard marker functions plus Marker Table (On/Off)
	Trace	Overlay DTP/DTP, DTP/DTF
2-Port Swept PIM	IM product magnitude vs. frequency	
	Test Frequencies	F1 PIM Test Port, F2 Port 2 Out frequencies swept to produce range of IM product frequencies
	Measurements	Peak PIM over measurement duration, Instantaneous PIM

Cable and Antenna Analyzer (Option 331)

Measurements		VSWR Return Loss Cable Loss Distance-to-Fault (DTF) Return Loss Distance-to-Fault (DTF) VSWR 1-Port Phase Smith Chart (50/75Ω selectable)
Setup Parameters	Measurement Display	Single/Dual Measurement Display with independent markers
	Frequency	Start/Stop, Signal Standard, Start Cal
	DTF	Start/Stop, DTF Aid, Units (m/ft), Cable Loss, Propagation Velocity, Cable, Windowing
	Windowing	Rectangular, Normal Side Lobe, Low Side Lobe, Minimum Side Lobe
	Amplitude	Top, Bottom Auto Scale, Full Scale
	Sweep	Run/Hold, Single/Continuous, RF Immunity (High/Low), Data Points, Averaging/Smoothing, Output Power (High), RF Pwr When Hold (On/Off)
	Data Points	137, 275, 551, 1102, 2204
	Markers	Markers 1-6 (On/Off), Delta Makers 1-6 (On/Off), Marker to Peak/Valley, Peak/Valley Auto, Marker Table (On/Off), All Markers Off
	Traces	Recall, Copy to Display Memory, No Trace Math, Trace ± Memory, Trace Overlay (On/Off)
	Limit Line	On/Off, Single Limit, Multi-segment Edit, Limit Alarm (On/Off), Pass Fail Message (On/Off), Pass/Fail (Unbounded/Bounded), Warning Limit Offset, Clear Limit
	Calibration	Start Cal, Cal Type (Standard/FlexCal™), Disp Valid Cal Temp Range
	Save/Recall	Setups (.stp), Measurements (.vna, .dat), Screen Shots (.jpg) (save only)
	Application Options	Impedance (50Ω, 75Ω, Other)
Frequency	Frequency Accuracy	±1.0 ppm at 23°C
	Stability	±1.0 ppm from –10°C to +55°C (typ.)
	Aging	±1.0 ppm/yr (typ.)
Output Power	Power Level	–4 dBm (typ.)
Interference Immunity	On-Channel	+17 dBm @ >1.0 MHz from carrier frequency
	On-Frequency	0 dBm within ±10 kHz of the carrier frequency
Measurement Speed	Return Loss	≤1.00 ms/data point, RF immunity low (typ.)
	Distance-to-Fault	≤1.25 ms/data point, RF immunity low (typ.)
Return Loss	Measurement Range	0 to 60 dB
	Resolution	0.01 dB
VSWR	Measurement Range	1:1 to 65:1
	Resolution	0.01
Cable Loss	Measurement Range	0 to 30 dB
	Resolution	0.01 dB
Distance-to-Fault	Vertical Range Return Loss	0 to 60 dB
	Vertical Range VSWR	1:1 to 65:1
	Fault Resolution (meters)	(1.5 × 10^8 × vp)/ΔF (vp = velocity propagation constant, ΔF is F2 – F1 in Hz)
	Horizontal Range (meters)	0 to (Data Points – 1) × Fault Resolution, to a maximum of 1500 meters (4921 ft)
1-Port Phase	Measurement Range	–180° to +180°
	Resolution	0.01°
Smith Chart	Resolution	0.01 50Ω/75Ω Selectable
Measurement Accuracy	Corrected Directivity	>42 dB, OSL Calibration

Measurement Uncertainty


Return Loss Uncertainty - 2 MHz to 3 GHz


Phase Uncertainty - 2 MHz to 3 GHz

GPS Receiver Option (Option 31) (Antenna sold separately)

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
GPS Time/ Location Indicator	Time, Latitude, Longitude and Altitude on display
	Time, Latitude, Longitude and Altitude with trace storage
Connector	SMA (f)

High Accuracy Power Meter (Option 19) (Requires external USB Power Sensor)

Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale
Average	# of Running Averages, Max Hold
Zero/Cal	Zero On/Off, Cal Factor (Center Frequency, Signal Standard)
Limits	Limit On/Off, Limit Upper/Lower

Power Sensor Model	MA24105A	MA24106A	MA24108A/18A/26A	MA24208A/18A	MA24330A/40A/50A
Description	Inline High Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor	Microwave Universal USB Power Sensor	Microwave CW USB Power Sensor
Frequency Range	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8/18/26 GHz	10 MHz to 8 GHz/18 GHz	10 MHz to 33/40/50 GHz
Connector	Type N (f), 50Ω	Type N (m), 50Ω	Type N (m), 50Ω (8 GHz/18 GHz) Type K (m), 50Ω (26 GHz)	Type N (m), 50Ω	Type K (m), 50Ω (33 GHz/40 GHz) Type V (m), 50Ω (50 GHz)
Dynamic Range	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 μW to 200 mW)	–40 to +20 dBm (0.1 μW to 100 mW)	–60 to +20 dBm (1 nW to 100 mW)	–70 to +20 dBm (0.1 nW to 100 mW)
Measurand	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power	True-RMS, Slot Power, Burst Average Power	Average Power
Measurement Uncertainty	± 0.17 dB[*1]	± 0.16 dB[*2]	± 0.18 dB[*3]	± 0.17 dB[*4]	± 0.17 dB[*5]
Data sheet (for complete specifications)	11410-00621	11410-00424	11410-00504	11410-00841	11410-00906

*1: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.
*2: Total RSS measurement uncertainty (0°C to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
*3: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
*4: Power uncertainty expressed with two sigma confidence level for CW measurement after zero operation. Includes calibration factor and linearity over temperature uncertainties, but not the effects of mismatch, zero set and drift, or noise.
*5: Includes linearity over temperature uncertainties, but not the effects of calibration factor, mismatch, zero set and drift, and noise.

Line Sweep Tools (for your PC)

Trace Capture	Browse to Instrument	View and copy traces from the test equipment to your PC using Windows Explorer
	Open Current Files	Open PIM or DAT files
	Capture Plots To	The Line Sweep Tools screen, DAT files, Database, or JPEG
Traces	Trace Types	Return Loss, VSWR, DTF-RL, DTF-VSWR, Cable Loss, Smith Chart, PIM vs. Time, Swept PIM, Noise Floor, and DTP
	Trace Formats	DAT, PIM, CSV, PNG, BMP, JPG, HTML, Data Base, and PDF
Report Generation	Report Generator	Includes GPS location along with measurements
	Report Format	Create reports in HTML or PDF format
	Report Setup	Report Title, Company, Prepared for, Location, Date and Time, Filename, Company logo
	Trace Setup	1 Trace Portrait Mode, 2 Trace Portrait Mode, 1 Trace Landscape Mode
	PIM Report	Tabular summary report with pass/fail analysis
Trace Validation	Presets	7 presets allow "one click" setting of up to 6 markers and one limit line
	Marker Controls	6 regular Markers, Marker Peak, Marker Valley, Marker between, and frequency entry
	Delta Markers	6 Delta markers
	Limit Line	Enable and drag or value entry. Also works with presets
	Next Trace Button	Next Trace and Previous trace arrow keys allow quick switching between traces
Tools	Cable Editor	Allows creation of custom cable parameters
	Distance-to-Fault	Converts a Return Loss trace to a Distance-to-Fault trace
	Measurement Calculator	Converts Real, Imaginary, Magnitude, Phase, RL, VSWR, Rho, and Transmit power
	Signal Standard Editor	Creates new band and channel tables
	Renaming Grid	36 user definable phrases for creation of file names, trace titles, and trace subtitles
Connectivity	Connections	USB cable, USB Memory Stick

easyTest Tools (for your PC)

Instrument Mode		PIM Analyzer Mode, Cable & Antenna Analyzer Mode (Option 331)
Commands	Display Image	Allows putting a custom image on the instrument screen
	Recall Setup	Places the instrument into a known state
	Prompt	Displays instructional messages on the instrument screen
	Save	Allows automatic or manual saving of traces
Connectivity	Connections	Ethernet, USB cable or USB memory stick

Web Remote Control

Control	Full instrument control through a browser – all instrument functions except power switch
Connections	RJ45 Ethernet jack Third party Wi-Fi router
Protocol	HTTP/TCP/IP
Physical Layer	Cat 5 Cable, Wi-Fi router compatible
Browser	Designed for use with HTML 5 Compliant Browsers (Google Chrome or Mozilla Firefox preferred)
Operating System	iOS, Windows, Linux, Android operating systems that can host the HTML 5 Compliant browser
Remote Hardware	PCs, Tablets, and Smart Phones with Ethernet or Wi-Fi connections
Download	Individual instrument files downloaded via browser Multiple instrument files and directories zipped and downloaded via browser Screen capture capability File downloads are not supported by iOS
Display Modes	Normal: All modes & displays supported Fast: Not currently supported
Password	The instrument can be password protected Passwords may be used to manage who is controlling the instrument
Users and Devices to Instruments Ratio	One user/device can view and control many instruments

Programmable Remote Control

Functionality	Instrument functionality is available via remote programming. See the MW82119B Programming Manual for details.
Programming Language	Standard Commands for Programmable Instruments (SCPI)
Interfaces	USB, LAN

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MW82119B	PIM Master™ Passive Intermodulation Analyzer (must be ordered with ONE frequency option)
	Frequency Options (must order one, and only one)
MW82119B-0600	LTE 600 w/1900 MHz
MW82119B-0700	LTE 700
MW82119B-0701	APT 700
MW82119B-0703	2-Port LTE 700
MW82119B-0800	LTE 800
MW82119B-0850	Cellular 850
MW82119B-0900	E-GSM 900
MW82119B-0180	DCS 1800
MW82119B-0194	PCS/AWS 1900/2100
MW82119B-0210	UMTS 2100
MW82119B-0260	LTE 2600
	Other Options
MW82119B-0019	High Accuracy Power Meter (Requires USB power sensor)
MW82119B-0031	GPS Receiver (Requires GPS antenna)
MW82119B-0331	Site Master™ Cable and Antenna Analyzer
MW82119B-0098	Standard Calibration to ISO 17025 and/or Z540.1
MW82119B-0099	Premium Calibration to ISO 17025 and/or Z540.1 plus test data
	Standard Accessories
2000-1786-R	Soft Carrying Case, Screen Access
2000-1714-R	Shoulder Strap
2000-1691-R	Stylus with Coiled Tether
2000-1797-R	(Country dependent) AC Power Cable
1091-422-R	Adapter, 7/16 DIN (f) to 7/16 DIN (m), 50Ω (Connector Saver)
633-75	Rechargeable Li-Ion Battery 7500 mAh
40-187-R	AC/DC adapter
	(Country dependent) AC Power Cable
806-141-R	Automotive Power Adapter, 12 VDC, 60 W
2000-1371-R	Ethernet Cable, 7 ft/213 cm
3-2000-1498	USB A to Mini B Cable, 10 ft/305 cm
2000-1991-R	2-Port Loop Cable assembly (Option 703 only)
	Miscellaneous Accessories
2000-1374	External Dual Charger for Li-Ion Batteries
633-75	Rechargeable Li-Ion Battery, 7500 mAh
2000-1884-R	PIM Hunter™ Test Probe (For full specifications, refer to the 2000-1884-R Technical Data Sheet 11410-00999)
2000-1691-R	Stylus with Coiled Tether
01-201	Orque End Wrench, 5/16 in, 0.9 N·m (8 lbf·in), For tightening male devices, for SMA, 3.5 mm, 2.4 mm, K, and V connectors
01-510	Adjustable Wrench
01-513-R	1-1/4 in Torque Wrench
01-528-R	Torque Wrench for coupling torque of 4.3-10 connectors, 22 mm opening
971-9-R	Cleaning Wipes
971-10-R	Cleaning Swabs
	Power Sensors Requires Option 19. (For complete ordering information, see the respective datasheet of each sensor)
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +3 to +51.76 dBm
MA24106A	RF USB Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm
MA24208A	Microwave Universal USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24218A	Microwave Universal USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24330A	Microwave CW USB Power Sensor, 10 MHz to 33 GHz, +20 dBm
MA24340A	Microwave CW USB Power Sensor, 10 MHz to 40 GHz, +20 dBm
MA24350A	Microwave CW USB Power Sensor, 10 MHz to 50 GHz, +20 dBm
MA25100A	RF Power Indicator
	Attenuators (Recommended for power measurements only. Not Low PIM.)
3-1010-122	Attenuator (Bi-directional), 20 dB, 5 W, DC to 12.4 GHz, N (m) to N (f)
3-1010-123	Attenuator (Bi-directional), 30 dB, 50 W, DC to 8.5 GHz, N (m) to N (f)
3-1010-124	Attenuator (Bi-directional), 40 dB, 100 W, DC to 8.5 GHz, N (m) to N (f)

Model/Order No.	Name
	Phase-Stable Test Port Cables, Armored w/Reinforced Grip (Recommended for cable and antenna line sweep applications only. Not low PIM.)
15RNFN50-1.5-R	1.5 m, DC to 6 GHz, N (m) to N (f), 50Ω
15RDFN50-1.5-R	1.5 m, DC to 6 GHz, N (m) to 7/16 DIN (f), 50Ω
15RDN50-1.5-R	1.5 m, DC to 6 GHz, N (m) to 7/16 DIN (m), 50Ω
15RNFN50-3.0-R	3.0 m, DC to 6 GHz, N (m) to N (f), 50Ω
15RDFN50-3.0-R	3.0 m, DC to 6 GHz, N (m) to 7/16 DIN (f), 50Ω
15RDN50-3.0-R	3.0 m, DC to 6 GHz, N (m) to 7/16 DIN (m), 50Ω
	Inter Changeable Adaptor Phase Stable Test Port Cables, Armored w/Reinforced Grip (Recommended for cable and antenna line sweep applications only. Not low PIM.)
15RCN50-1.5-R	1.5 m, DC to 6 GHz, N (m), N (f), 7/16 DIN (m), 7/16 DIN (f), 50Ω
15RCN50-3.0-R	3.0 m, DC to 6 GHz, N (m), N (f), 7/16 DIN (m), 7/16 DIN (f), 50Ω
	Phase-Stable Test Port Cables, Armored (Recommended for cable and antenna line sweep applications only. Not Low PIM. Use with tightly spaced connectors and other general purpose applications.)
15NNF50-1.5C	1.5 m, DC to 6 GHz, N (m) to N (f), 50Ω
15NN50-1.5C	1.5 m, DC to 6 GHz, N (m) to N (m), 50Ω
15NDF50-1.5C	1.5 m, DC to 6 GHz, N (m) to 7/16 DIN (f), 50Ω
15ND50-1.5C	1.5 m, DC to 6 GHz, N (m) to 7/16 DIN (m), 50Ω
15NNF50-3.0C	3.0 m, DC to 6 GHz, N (m) to N (f), 50Ω
15NN50-3.0C	3.0 m, DC to 6 GHz, N (m) to N (m), 50Ω
15NNF50-5.0C	5.0 m, DC to 6 GHz, N (m) to N (f), 50Ω
15NN50-5.0C	5.0 m, DC to 6 GHz, N (m) to N (m), 50Ω
15N43M50-1.5C	Test Port Extension Cable, Armored, 1.5 m, DC to 6 GHz, N (m) to 4.3-10 (m)
15N43F50-1.5C	Test Port Extension Cable, Armored, 1.5 m, DC to 6 GHz, N (m) to 4.3-10 (f)
15N43M50-3.0C	Test Port Extension Cable, Armored, 3 m, DC to 6 GHz, N (m) to 4.3-10 (m)
15N43F50-3.0C	Test Port Extension Cable, Armored, 3 m, DC to 6 GHz, N (m) to 4.3-10 (f)
15NF43M50-1.5C	Test Port Extension Cable, Armored, 1.5 m, DC to 6 GHz, N (f) to 4.3-10 (m)
15NF43F50-1.5C	Test Port Extension Cable, Armored, 1.5 m, DC to 6 GHz, N (f) to 4.3-10 (f)
15NF43M50-3.0C	Test Port Extension Cable, Armored, 3 m, DC to 6 GHz, N (f) to 4.3-10 (m)
15NF43F50-3.0C	Test Port Extension Cable, Armored, 3 m, DC to 6 GHz, N (f) to 4.3-10 (f)
	Precision Adapters (Recommended for cable and antenna line sweep applications only. Not Low PIM.)
34NN50A	N (m) to N (m), DC to 18 GHz, 50Ω
34NFNF50	N (f) to N (f), DC to 18 GHz, 50Ω
1091-26-R	SMA (m) to N (m), DC to 18 GHz, 50Ω
1091-27-R	SMA (f) to N (m), DC to 18 GHz, 50Ω
1091-80-R	SMA (m) to N (f), DC to 18 GHz, 50Ω
1091-81-R	SMA (f) to N (f), DC to 18 GHz, 50Ω
1091-172-R	BNC (f) to N (m), DC to 1.3 GHz, 50Ω
1091-465-R	Adapter, DC to 6 GHz, 4.3-10 (f) to N (f), 50Ω
1091-467-R	Adapter, DC to 6 GHz, 4.3-10 (m) to N (f), 50Ω
510-90-R	7/16 DIN (f) to N (m), DC to 7.5 GHz, 50Ω
510-91-R	7/16 DIN (f) to N (f), DC to 7.5 GHz, 50Ω
510-92-R	7/16 DIN (m) to N (m), DC to 7.5 GHz, 50Ω
510-93-R	7/16 DIN (m) to N (f), DC to 7.5 GHz, 50Ω
510-96-R	7/16 DIN (m) to 7/16 DIN (m), DC to 7.5 GHz, 50Ω
510-97-R	7/16 DIN (f) to 7/16 DIN (f), DC to 7.5 GHz, 50Ω
510-102-R	N (m) to N (m), DC to 11 GHz, 50Ω, 90 degrees right angle
	Manuals (Soft copy at www.anritsu.com)
10100-00065	Product Information Safety and Compliance
10580-00400	PIM Master User Guide
10580-00402	PIM Master Measurement Guide
10580-00403	PIM Master Programming Manual
10580-00240	Power Meter Measurement Guid
10580-00241	Cable and Antenna Analyzer Measurement Guide
10580-00252	Site Master User Guide
11410-00473	Troubleshooting Guide – Cable, Antenna, and Components
11410-00726	Equipment Verification Process
	Anritsu Training Anritsu has designed courses to help you stay up to date with technologies important to your job. For available training courses, visit: www.anritsu.com/training

NEON® Signal Mapper

MA8100A-00x Series

NEON Signal Mapper for 3D In-Building Coverage Mapping

The NEON Signal Mapper (MA8100A-00x) 3D in-building coverage mapping solution can be used with many Anritsu handheld instruments with spectrum analyzer mode. Instruments supported include: Spectrum Master, LMR Master, Site Master, BTS Master, Cell Master, and VNA Master. The NEON Signal Mapper application provides an intuitive Android user interface enabling lightly trained users to map signal and sensor information within buildings. Users can initialize their location, start/stop mapping and load mapping data to the cloud.

RF data is captured by an Anritsu Handheld spectrum analyzer product and the data is sent to the Android device via a USB connection or WiFi using an optional travel router.

The NEON Command PC Software, enables creation and visualization of 3D building maps and provides centralized access to the NEON Cloud Service to access stored maps and measurement data. Android device and PC are NOT included with the MA8100A-00x. Customers must purchase their own Android device and PC.

The MA8100A-00x consists of both hardware and software from TRX Systems, a 3rd party partner. The MA8100A-00x consists of a NEON Tracking Unit, NEON Signal Mapper Software for Android devices and the NEON Command Software for a PC.

The NEON Tracking Unit supports collection and processing of sensor data that delivers 3D location information. The Tracking Unit connects to the NEON Signal Mapper application, which is run on an Android device via a Bluetooth connection.

Key Features

Integrating NEON's capability to automatically collect geo-referenced test data with Anritsu handheld spectrum analyzer products saves valuable time and money by:

- Eliminating the need to manually perform "check-ins" at each test point by automatically calculating indoor location
- Providing vastly more data than is possible with manual processes by recording data with every step
- Removing typical data recording errors caused by "guesstimating" locations in large buildings through automatic indoor location and path estimation
- Delivering actionable data in areas not easily analyzed such as stairways and elevators by recording and referencing measurements in 3D
- Enabling quick analysis of signal coverage and faster problem resolution by delivering the industry's only geo-referenced 3D visualization
- Provides color-graded measurement results in 2D and 3D views. Measurement values can be seen by clicking on each point. A .csv file of all measurements is also provided.
- LTE and 5G measurements on supported instruments.

EU Standards (CE Marking)

2011/65/EU, (EU)2015/863

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	NEON® Signal Mapper Bundles*
MA8100A-000	NEON Signal Mapper with Anritsu Integration and Tracking Unit (P/N 2000-1852-R). (Includes 3-Month NEON Trial Software License with 3 months of maintenance and support and 3 months of Cloud Service (P/N 2300-607))
MA8100A-001	NEON Signal Mapper with Anritsu Integration and Tracking Unit (P/N 2000-1852-R) (Includes 1 year NEON Software License with 1 year of maintenance and support and 1 year of Cloud Service (P/N 2300-574))
MA8100A-003	NEON Signal Mapper with Anritsu Integration and Tracking Unit (P/N 2000-1852-R) (Includes 3 years NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service (P/N 2300-575))
MA8100A-005	NEON Signal Mapper with Anritsu Integration and Tracking Unit (P/N 2000-1852-R) (Includes 5 years NEON Software License with 5 years of maintenance and support and 5 years of Cloud Service (P/N 2300-576))
MA8100A-100	NEON Signal Mapper with Anritsu Integration and Tracking Unit (P/N 2000-1852-R). (Includes Perpetual NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service (P/N 2300-606))
	License Renewal
2300-612	1 year NEON Software License with 1 year of maintenance and support and 1 year of Cloud Service
2300-613	3 years NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service
2300-614	5 years NEON Software License with 5 years of maintenance and support and 5 years of Cloud Service
2300-606	Perpetual NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service

* IMPORTANT: The primary end- user's name, phone number and email address must be provided when the order is placed.

Note: NEON Command Software, which is cloud based, requires a renewable license. 1, 3 or 5 year licenses are available and are ordered as per the available part numbers outlined above. These licenses can be extended when they expire.

LMR Master™ LMR Master Land Mobile Radio Modulation Analyzer

S412E

VNA: 500 kHz to 1.6 GHz/Spectrum Analyzer: 9 kHz to 1.6 GHz

Land Mobile Radio Modulation Analyzer and Signal Analyzer, Vector Network Analyzer, Spectrum Analyzer

The LMR Master S412E is Anritsu's solution for installing and maintaining public safety systems. Built on Anritsu's handheld platform, the S412E combines a high performance receiver/spectrum analyzer with the world's most advanced handheld vector network analyzer plus a powerful vector signal generator with internally adjustable power from 0 to –130 dBm.

Spectrum Analyzer Highlights

- Measurements: Occupied Bandwidth, Channel Power, ACPR, C/I, Coverage Mapping
- Interference Analyzer: Spectrogram, Signal Strength, RSSI, Mapping
- 9 kHz to 1.6 GHz frequency coverage (Optional extension to 6 GHz)
- Dynamic Range: >95 dB in 10 Hz RBW
- DANL: –152 dBm in 10 Hz RBW
- Phase Noise: –100 dBc/Hz max @ 10 kHz offset at 1 GHz
- Frequency Accuracy: 120 ppb standard (25°C±25°C);
  <50 ppb after 3 minutes with GPS lock
- PIM Hunting

VNA Analyzer Highlights

- 1-path, 2-port Vector Network Analyzer (VNA) w/ quad trace display
- 500 kHz to 1.6 GHz frequency coverage (Optional extension to 6 GHz)
- Intuitive Graphical User Interface (GUI) with convenient Touch Screen
- VNA-quality error correction for directivity and source match
- Outstanding calibration stability, up to 16 hours
- Arbitrary data points up to 4001
- IF Bandwidth selections of 10 Hz to 100 kHz
- 100 dB transmission dynamic range
- 850 µs/data point sweep speed

Signal Generator Highlights

- 500 kHz to 1.6 GHz CW/FM/AM Modulation
- FM, 100 Hz to 10 kHz rate, adjustable deviation
- AM, 100 Hz to 10 kHz rate, adjustable depth
- 0.1 dB resolution, 0 to –130 dBm
- CW, FM with CTCSS/DCS/DTMF, FM with CTCSS/DCS/DTMF + Tone Modulation, FM + Tone Modulation

Land Mobile Radio Signal Analyzer Highlights

- Analyzes Narrowband FM analog systems
- Analyzes P25 (TIA-102.CAAA-C), P25 Phase 2 (TIA-102.CCAA), DMR (MOTOTRBO™), NXDN™, dPRM, ITC-R PTC, and TETRA digital systems
- 100 kHz to 1.6 GHz frequency coverage (Optional extension to 6 GHz)
- Internal signal generator: 0.1 dB resolution, 0 to –130 dBm (spec to –120 dBm)
- 2.0 dB signal generator accuracy (typ.)
- P25/P25p2, NXDN, and ETSI DMR BER test patterns including 1011 Hz, 1031 Hz, and V.52/O.153
- Duplex test: Simultaneous analysis and generation of analog or digital LMR signals
- Independent control of both receive/transmit frequencies and test patterns
- TETRA Base Station Receiver Sensitivity Measurements

Capabilities and Functional Highlights

- Analog FM and digital LMR analyzer
- High accuracy internal power meter
- On-screen LMR Coverage Mapping (Outdoor and Indoor)
- GPS tagging of saved traces
- USB data transfer
- Complies with MIL-PRF-28800F Class 2 and MIL-STD-810G
- Certified for use in Explosive Atmosphere per MIL-PRF-28800F 8.4 inch daylight-viewable TFT LCD color resistive touchscreen – allows use while wearing gloves
- Touchscreen keyboard
- USB and Ethernet data transfer
- Web Remote Control
- Master Software Tools™
- 3 hour battery operation time

Definitions

All specifications and characteristics apply under the following conditions, unless otherwise noted:

Warm-Up Time	After 15 minutes of warm-up time in VNA mode, where the instrument is left in the ON state.
Temperature Range	Over the 23°C±5°C temperature range, unless otherwise noted.
Reference Signal	When using internal reference signal.
Typical Performance	Typical specifications that are not in parenthesis are not tested and not warranted. They are generally representative of characteristic performance. Typical specifications in parenthesis () represent the mean value of measured units and do not include any guard-bands or uncertainties. They are not warranted.
Uncertainty	A coverage factor of x1 is applied to the measurement uncertainties to facilitate comparison with other industry handheld analyzers.
Calibration Cycle	Calibration is within the recommended 12 month period (residual specifications also require calibration kit calibration cycle adherence.) All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu web site: www.anritsu.com

Spectrum Analyzer Specifications

Measurements	Smart Measurements	Field Strength (uses antenna calibration tables to measure dBm/m^2 or dBmV/m) Occupied Bandwidth (measures 99 to 1% power channel of a signal) Channel Power (measures the total power in a specified bandwidth) ACPR (Adjacent Channel Power Ratio) AM/FM/SSB Audio Demodulation (Wide/Narrow FM, AM, Upper/Lower SSB) C/I (carrier-to-interference ratio) Emission Mask Coverage Mapping (requires option 431) PIM Alert Application (available for download) PIM Hunting
Setup Parameters	Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #, Channel Increment
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
	Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/RBW
	File	Save, Recall, Delete, Directory Management
	Save	Setups, Measurements, Screen Shots (JPEG), Limit Lines, Spurious Emission Mask
	Save-on-Event	Crossing Limit Line, Sweep Complete, Save-then-Stop, Clear All
	Recall	Setups, Measurements, Limit Lines, Spurious Emission Mask
	Copy	Selected file or files to internal/external memory (USB)
	Delete	Selected file or files from internal/external memory (USB)
	Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)
Sweep Functions	Sweep	Single/Continuous, Manual Trigger, Reset, Detection, Minimum Sweep Time, Trigger Type
	Detection	Peak, RMS, Negative, Sample, Quasi-peak
	Triggers	Free Run, External, Video, Change Position, Manual
Trace Functions	Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations
	Trace A Operations	Normal, Max Hold, Min Hold, Average, # of Averages, (always the live trace)
	Trace B Operations	A → B, B ↔ C, Max Hold, Min Hold
	Trace C Operations	A → C, B ↔ C, Max Hold, Min Hold, A – B → C, B – A → C, Relative Reference (dB), Scale
Marker Functions	Markers	Markers 1-6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off), All Markers Off
	Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker, Marker Auto-Position Peak Search, Next Peak (Right/Left), Peak Threshold %, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level
	Marker Table	1-6 markers frequency and amplitude plus delta markers frequency offset and amplitude
Limit Line Functions	Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, Default Limit
	Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
	Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
	Limit Line Envelope	Create Envelope, Update Amplitude, Points (41 max), Offset, Shape Square/Slope
	Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall
Frequency	Frequency Range	9 kHz to 1.6 GHz, (6 GHz with Option 6)
	Tuning Resolution	1 Hz
	Frequency Reference Aging	±1.0 ppm/year
	Frequency Reference Accuracy	±120 ppb (25°C±25°C) + aging, <50 ppb + aging with GPS lock
	Frequency Span	10 Hz to 1.6 GHz including zero span (10 Hz to 6 GHz with Option 6)
	Sweep Time	100 ms, 7 μs to 3600 seconds in zero span
	Sweep Time Accuracy	±2% in zero span
Bandwidth	Resolution Bandwidth (RBW)	10 Hz to 3 MHz in 1–3 sequence ±10% (1 MHz max in zero-span) (–3 dB bandwidth)
	Video Bandwidth (VBW)	1 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth) (auto or manually selectable)
	RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (–6 dB bandwidth)
	VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1
Spectral Purity	SSB Phase Noise @ 1 GHz	–100 dBc/Hz, –110 dBc/Hz (typ.) @ 10 kHz offset –105 dBc/Hz, –112 dBc/Hz (typ.) @ 100 kHz offset –115 dBc/Hz, –121 dBc/Hz (typ.) @ 1 MHz offset

Continued on next page

Amplitude Ranges	Dynamic Range	>95 dB (2.4 GHz), 2/3 (TOI-DANL) in 10 Hz RBW			
	Measurement Range	DANL to +26 dBm (≥50 MHz) DANL to 0 dBm (<50 MHz)			
	RF In Port Damage Level	+33 dBm peak, ± 50 VDC, Maximum Continuous Input (≥10 dB attenuation)			
	Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed			
	Reference Level Range	–150 to +30 dBm			
	Attenuator Resolution	0 to 55 dB, 5.0 dB steps			
	Amplitude Units	Log Scale Modes: dBW, dBm, dBμW, dBV, dBmV, dBμV, dBA, dBmA, dBμA Linear Scale Modes: nV, μV, mV, V, kV, nW, μW, mW, W, kW, nA, μA, mA, A			
Amplitude Accuracy	(Single sine wave, input power <Ref level and >DANL, Attenuation: Auto, Ambient: –10°C to +50°C after 30 minute warm-up)				
	9 kHz to 100 kHz	±2.0 dB (typ.) (Preamp Off)			
	>100 kHz to 4.0 GHz	±1.25 dB, ±0.5 dB (typ.)			
	>4.0 GHz to 6 GHz	±1.50 dB, ±0.5 dB (typ.)			
Displayed Average Noise Level (DANL)		Preamp Off (Reference Level –20 dBm)		Preamp On (Reference Level –50 dBm)	
	(RBW = 1 Hz, 0 dB attenuation)	Maximum	Typical	Maximum	Typical
	10 MHz to 2.4 GHz	–141 dBm	–146 dBm	–157 dBm	–162 dBm
	>2.4 GHz to 4 GHz	–137 dBm	–141 dBm	–154 dBm	–159 dBm
	>4 GHz to 5 GHz	–134 dBm	–138 dBm	–150 dBm	–155 dBm
	>5 GHz to 6 GHz	–126 dBm	–131 dBm	–143 dBm	–150 dBm
	(RBW = 10 Hz, 0 dB attenuation)				
	10 MHz to 2.4 GHz	–131 dBm	–136 dBm	–147 dBm	–152 dBm
	>2.4 GHz to 4 GHz	–127 dBm	–131 dBm	–144 dBm	–149 dBm
	>4 GHz to 5 GHz	–124 dBm	–128 dBm	–140 dBm	–145 dBm
	>5 GHz to 6 GHz	–116 dBm	–121 dBm	–133 dBm	–140 dBm
Spurs	Residual Spurious	<–90 dBm (RF input terminated, 0 dB input attenuation, >10 MHz)			
	Input-Related Spurious	<–75 dBc (0 dB attenuation, –30 dBm input, span <1.7 GHz, carrier offset >4.5 MHz)			
	Exceptions, typical	<–70 dBc @ <2.5 GHz with 2072.5 MHz Input <–68 dBc @ F1 – 280 MHz with F1 Input <–70 dBc @ F1 + 190.5 MHz with F1 Input <–52 dBc @ 7349 – 2F2 MHz with F2 Input, where F2 <2437.5 MHz <–55 dBc @ 190.5 ±F1/2 MHz, F1 <1 GHz			
Third-Order Intercept (TOI)	(Preamp Off (–20 dBm tones, 100 kHz apart, 10 dB attenuation)				
	800 MHz	+16 dBm			
	2400 MHz	+20 dBm			
	200 MHz to 2200 MHz	+25 dBm (typ.)			
	>2.2 GHz to 5.0 GHz	+28 dBm (typ.)			
	>5.0 GHz to 6.0 GHz	+33 dBm (typ.)			
Second Harmonic Distortion	(Preamp Off, 0 dB input attenuation, –30 dBm input)				
	50 MHz	–56 dBc			
	>50 MHz to 200 MHz	–60 dBc (typ.)			
	>200 MHz to 3000 MHz	–70 dBc (typ.)			
VSWR	2:1 (typ.)				

Vector Network Analyzer

Definitions

All specifications and characteristics apply under the following conditions, unless otherwise stated:

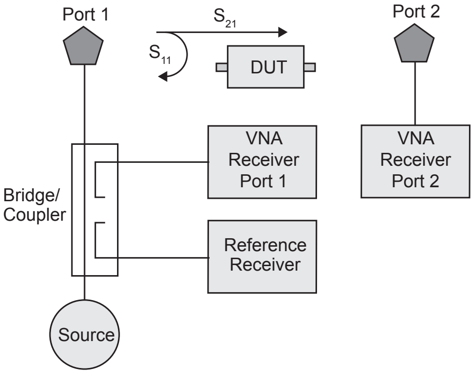
- After 15 minutes of warm-up time, where the instrument is left in the ON state.
- Temperature range is 23°C±5°C.
- All specifications apply when using internal reference.
- All specifications subject to change without notice.
  Please visit www.anritsu.com for most current data sheet.
- Typical performance is the measured performance of an average unit.
- Recommended calibration cycle is 12 months.

Frequency

Frequency Range: 500 kHz to 1.6 GHz
(500 kHz to 6.0 GHz with Option 16)
Frequency Accuracy: 2.5 ppm
Frequency Resolution: 1 Hz

Block Diagram

As shown in the following block diagram, the LMR Master has a 2-port, 1-path architecture that automatically measures 2 S-parameters with error-correction precision inherent to VNA operation.



The above illustration is a simplified block diagram of LMR Master’s 2-port, 1-path architecture. The magnitude and phase information gained from vector network data enables the LMR Master to make significant error corrections and provide improved field measurements.

Test Port Power (typ.)

LMR Master supports selection of either High, Default, or Low test port power. Changing power after calibration can degrade the calibrated performance. Typical test port power by bands is shown in the following table.

Frequency Range	High Port Power	Default Port Power	Low Port Power
500 kHz to ≤3 GHz	+3 dBm	–5 dBm	–25 dBm
3 GHz to ≤6 GHz	0 dBm	–5 dBm	–25 dBm

Transmission Dynamic Range

The transmission dynamic range (the difference between test port power and noise floor) using 10 Hz IF Bandwidth and High Port Power is shown in the following table.

Frequency Range	Dynamic Range
2 MHz to ≤4 GHz	100 dB
4 GHz to ≤6 GHz	90 dB

Sweep Speed (Typ.)

The typical sweep speed for IF Bandwidth of 100 Hz, 1001 data points, and single display is shown in the following table. The two-receiver architecture will simultaneously collect S_{21} and S_{11} in a single sweep.

Frequency Range	Typical Sweep Speed
500 kHz to 6 GHz	850 µs/point

Noise Floor (Typ.)

Frequency Range	Typical Noise Floor
500 kHz to 3 GHz	–100 dBm
3 GHz to 4 GHz	–103 dBm
4 GHz to 6 GHz	–93 dBm

Temperature Stability (S_{11} or S_{21}, Short, 23°C±5°C)

Frequency Range	Magnitude (typ.)	Phase (typ.)
500 kHz to 6 GHz	0.020 dB/°C	0.200 deg/°C

Interference Immunity

On-Channel	+17 dBm at >1.0 MHz from carrier frequency
On-Frequency	0 dBm within ±10 kHz of the carrier frequency

Measurements

Measurement Parameters	S_{11}, S_{21}
Number of Traces	Four: TR1, TR2, TR3, TR4
Trace Format	Single, Dual, Tri, Quad. When used with Number of Traces, overlays are possible including a Single Format with Four trace overlays.
Graph Types	Log Magnitude, SWR, Phase, Real, Imaginary, Group Delay, Smith Chart, Log Mag/2 (1-Port Cable Loss), Linear Polar, Log Polar, Real Impedance, Imaginary Impedance
Domains	Frequency Domain, Distance Domain
Frequency	Start Frequency, Stop Frequency, Center Frequency, Span
Distance	Start Distance, Stop Distance
Frequency Sweep Type: Linear	Single Sweep, Continuous
Data Points	2 to 4001 (arbitrary setting); data points can be reduced without recalibration.
Limit Lines	Upper, Lower, 10 segmented Upper, 10 segmented Lower
Test Limits	Pass/Fail for Upper, Pass/Fail for Lower, Limit Audible Alarm
Data Averaging	Sweep-by-sweep
Smoothing	0 to 20%
IF Bandwidth	10, 20, 50, 100, 200, 500, 1 k, 2 k, 5 k, 10 k, 20 k, 50 k, 100 k (Hz)
Reference Plane	The reference planes of a calibration (or other normalization) can be changed by entering a line length. Assumes no loss, flat magnitude, linear phase, and constant impedance.
Auto Reference Plane Extension	Instead of manually entering a line length, this feature automatically adjusts phase shift from the current calibration (or other normalization) to compensate for external cables (or test fixtures). Assumes no loss, flat magnitude, linear phase, and constant impedance.
Frequency Range	Frequency range of the measurement can be narrowed (reduces number of data points) within the calibration range without recalibration. When Interpolation is On, narrowed frequency range will retain original number of data points.
Group Delay Aperture	Defined as the frequency span over which the phase change is computed at a given frequency point. The aperture can be changed without recalibration. The minimum aperture is the frequency range divided by the number of points in calibration and can be increased to 20% of the frequency range.
Group Delay Range	<180° of phase change within the aperture
Trace Memory	A separate memory for each trace can be used to store measurement data for later display. The trace data can be saved and recalled.

Continued on next page

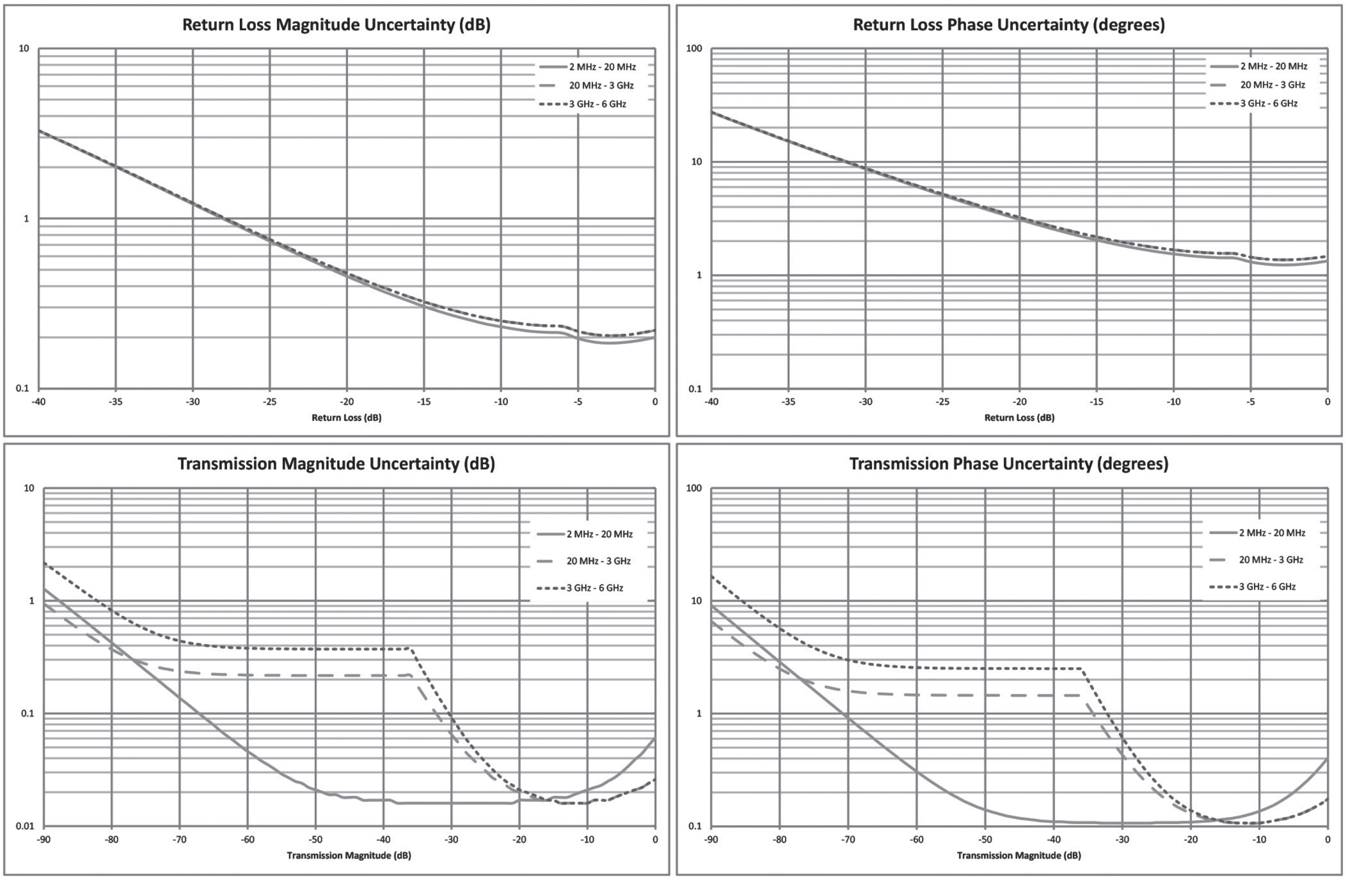
Trace Math	Complex trace math operations of subtraction, addition, multiplication, or division are provided.
Number of Markers	12, arbitrary assignments to any trace
Marker Types	Reference, Delta
Marker Readout Styles	Log Mag, Cable Loss (Log Mag/2), Log Mag and Phase, Phase, Real and Imaginary, SWR, Impedance, Admittance, Normalized Impedance, Normalized Admittance, Polar Impedance, and Group Delay
Marker Search	Peak Search, Valley Search, Find Marker Value
Calibration Type	Full S_{11}, 1-Path, 2-Port (S_{11} and S_{21}), Response S_{11}, Response S_{21}
Calibration Methods	Short-Open-Load-Through (SOLT)
Calibration Standards' Coefficients	Coax: N-Connector, K-Connector, 7/16, TNC, SMA, and four User Defined
Cal Correction Toggle	On/Off
Interpolation	On/Off (Interpolation may be activated before or after calibration)
Impedance Conversion (Smith Chart)	Support for 50Ω and 75Ω are provided.
Units	Meters, Feet
Bias Tee Settings	Internal, Off
Timebase Reference	Internal
File Storage Types	Measurement, Setup (with CAL), Setup (without CAL), S2P (Real/Imag), S2P (Lin Mag/Phase), S2P (Log Mag/Phase), JPEG
Languages	English, French, German, Spanish, Chinese, Japanese, Korean, Italian, Russian, and Portuguese

Corrected System Performance and Uncertainties — High Port Power, N-Type Measurement Accuracy* (OSLN50A-8 or OSLNF50A-8, TOSLN50A-8 or TOSLNF50A-8)

Frequency Range	Directivity (dB)	Source Match (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
<20 MHz	≥42	≥30	±0.01	±0.01
20 MHz to <3 GHz	≥42	≥30	±0.05	±0.01
3 GHz to 6 GHz	≥42	≥30	±0.05	±0.01

*: Full 1-path, 2-port forward path calibration with isolation, high power, 10 Hz IFBW, no averaging, 10 minute warm-up.
OSLN50A-8, OSLNF50A-8, TOSLN50A-8, or TOSLNF50A-8 calibration kit. Reflection and Transmission Tracking are typical.

Corrected Measurement Uncertainty (Transmission from Port 1 to Port 2)



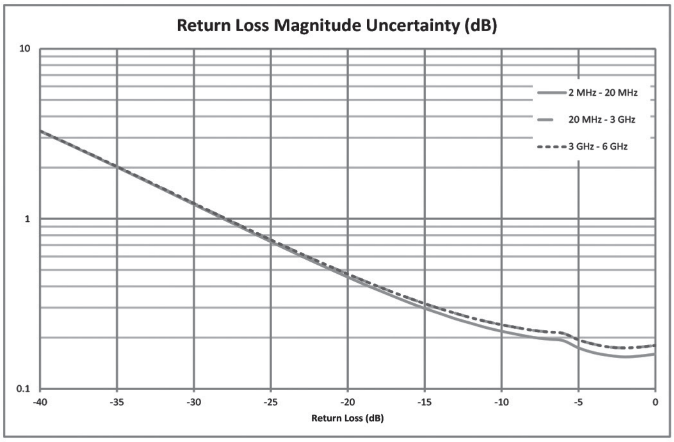
Corrected System Performance and Uncertainties — High Port Power, K-Type

Measurement Accuracy* (OSLK50A-20 or TOSLKF50A-20. Compatible with 3.5 mm and SMA connectors)

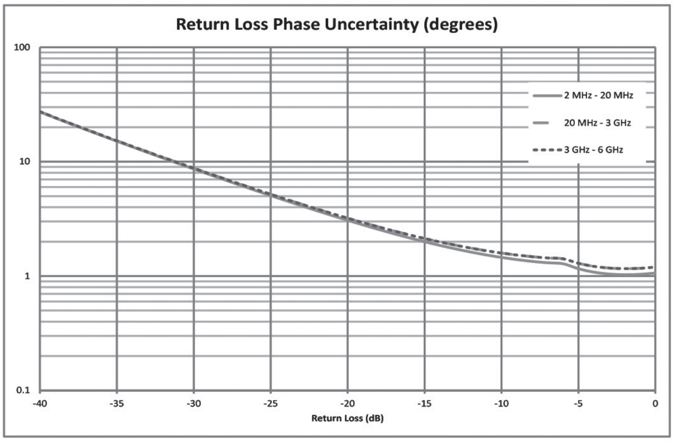
Frequency Range	Directivity (dB)	Source Match (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
<20 MHz	≥42	≥33	±0.01	±0.01
20 MHz to <3 GHz	≥42	≥33	±0.05	±0.01
3 GHz to 6 GHz	≥42	≥33	±0.05	±0.01

*: Full 1-path, 2-port forward path calibration with isolation, high power, 10 Hz IFBW, no averaging, 10 minute warm-up.
TOSLK50A-20, TOSLKF50A-20 calibration kit. Reflection and Transmission Tracking are typical.

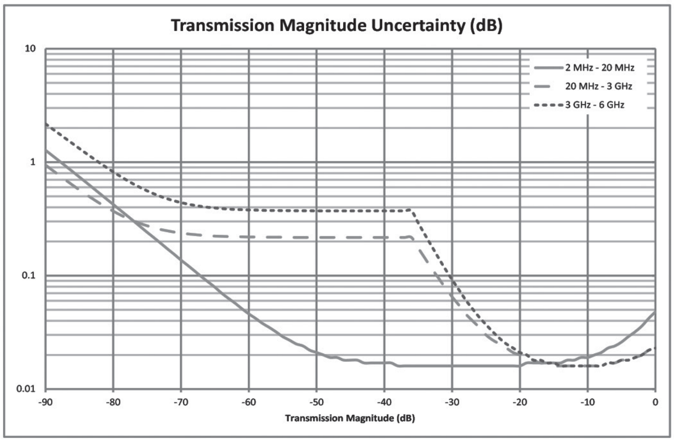
Corrected Measurement Uncertainty (Transmission from Port 1 to Port 2)



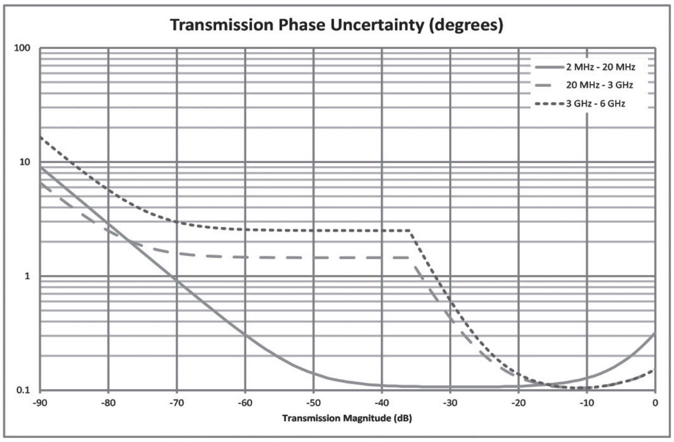
Return Loss Magnitude Uncertainty (dB)



Return Loss Phase Uncertainty (degrees)



Transmission Magnitude Uncertainty (dB)



Transmission Phase Uncertainty (degrees)

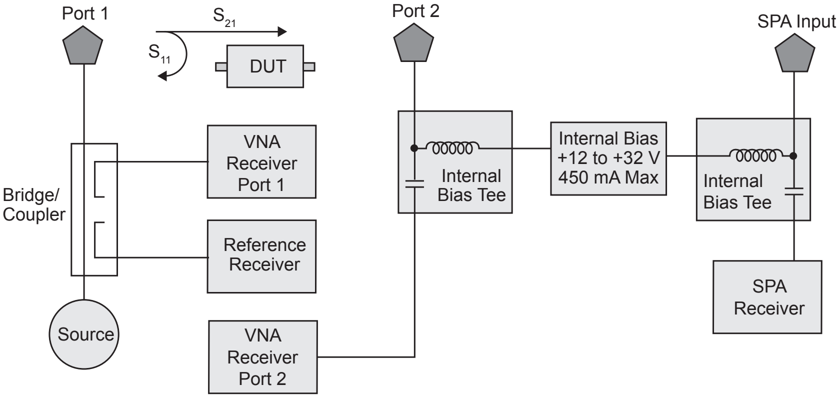
Bias Tee (Option 10)

For tower mounted amplifier tests, the S412E with optional internal bias tees can supply both DC and RF signals on the center conductor of the cable during measurements. For frequency sweeps in excess of 2 MHz, the LMR Master can supply internal voltage control from +12 V to +32 V in 0.1 V steps up to 450 mA. Bias is available on VNA Port 2 and the SPA Input (RF In) for use with antenna pre-amplifiers.

Bias Tee Specifications

Frequency Range	2 MHz to 4 GHz/6 GHz at VNA Port 2
Internal Voltage/Current	+12 V to +32 V at 450 mA (Steady state)
Internal Resolution	0.1 V
Bias Tee Selections	Internal, Off

The Compact LMR Master offers optional integrated bias tee for supplying DC plus RF to the DUT as shown in this simplified block diagram.



Vector Voltmeter (Option 15)

A phased array system relies on phase matched cables for nominal performance. For this class of application, the LMR Master offers this special software mode to simplify phase matching cables at a single frequency. The similarity between the popular vector voltmeter and this software mode ensures minimal training is required to phase match cables. Operation is as simple as configuring the display for absolute or relative measurements. The easy-to-read large fonts show either reflection or transmission measurements using impedance, magnitude, or VSWR readouts. For instrument landing system (ILS) or VHF Omni-directional Range (VOR) applications, a table view improves operator efficiency when phase matching up to twelve cables.

The S412E solution is superior because the signal source is included internally, precluding the need for an external signal generator.

CW Frequency Range	500 kHz to 1.6 GHz (6 GHz with Option 16)
Measurement Display	CW, Table (Twelve Entries, Plus Reference)
Measurement Types	Return Loss, Insertion
Measurement Format	dB/VSWR/Impedance

Distance Domain

Distance-to-Fault Analysis is a powerful field test tool to analyze cables for faults, including minor discontinuities that may occur due to a loose connection, corrosion, or other aging effects. By using Frequency Domain Reflectometry (FDR), the VNA's DTF mode exploits a user-specified band of full power operational frequencies (instead of DC pulses from TDR approaches) to more precisely identify discontinuities. The VNA converts S-parameters from frequency domain into distance domain on the horizontal display axis, using a mathematical computation called Inverse Fourier Transform. Connect a reflection at the opposite end of the cable and the discontinuities appear versus distance to reveal any potential maintenance issues. When access to both ends of the cable is convenient, a similar distance domain analysis is available on transmission measurements. Distance Domain will improve your productivity with displays of the cable in terms of discontinuities versus distance. This readout can then be compared against previous measurements (from stored data) to determine whether any degradations have occurred since installation (or the last maintenance activity). More importantly, you will know precisely where to go to fix the problem and minimize or prevent downtime of the system.

Maximum Distance (4001 data points, 1.6 GHz span)	374.9 m (1,229.9 ft)
Maximum Distance (4001 data points, 6.0 GHz span)	99.9 m (327.75 ft)
Minimum Distance Resolution (1.6 GHz span)	18.7 cm (7.36 in)
Minimum Distance Resolution (6.0 GHz span)	4.99 cm (1.97 in)
Measurement Display	Return Loss, VSWR
Measurement Format	dB, VSWR

Interference Analyzer (Option 25) (GPS Option 31 recommended)

Measurements	Spectrum	Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power Ratio (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB - audio out only) Carrier-to-Interference ratio (C/I)
	Spectrogram	Collect data up to 72 hours
	Signal Strength	Gives visual and aural indication of signal strength
	Signal ID	Up to 12 signals Center Frequency Bandwidth Signal Type: FM, GSM, W-CDMA, CDMA, Wi-Fi Closest Channel Number Number of Carriers
	Signal-to-Nose Ratio (SNR)	>10 dB
	Interference Mapping	Triangulate location of interference with on-display maps
	Application Options	Bias-Tee (On/Off) Impedance (50Ω, 75Ω, Other) Compatible with the InterferenceHunter™ MA2700A Handheld Direction Finding System

GPS Receiver (Option 31) (Antenna sold separately)

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
GPS Time/Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
GPS-Enhanced Frequency Accuracy	<50 ppb with GPS On, 3 minutes after satellite is locked in selected mode (Applies to Spectrum Analyzer, Interference Analyzer, LMR Signal Analyzers)
Connector	SMA (f)

Ethernet Connectivity

Connector	RJ45
LAN Speed	10 Mbps
Mode	Static, DHCP
Static IP settings	IP address Subnet Mask IP Gateway
Remote Control	Remote capability provided with Web Remote Control and SCPI programming
Data Upload	With Line Sweep Tools through Ethernet connection

Coverage Mapping (Options 431)

Measurements	Indoor Mapping	RSSI, ACPR
	Outdoor Mapping	RSSI, ACPR

Setup Parameters	Frequency	Center/Start/Stop, Span, Freq Step, Signal Standard, Channel #, Channel Increment
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
	BW	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/VBW
	Measurement Setup	ACPR, RSSI
	Point Distance/Time Setup	Repeat Type Time Distance
	Save Points Map	Save KML, JPEG, Tab Delimited
	Recall Points Map	Recall Map, Recall KML Points only, Recall KML Points with Map, Recall Default Grid

Channel Scanner (Option 27)

Number of Channels	1 to 20 Channels
Measurements	Graph/Table, Max Hold (On/5 sec/Off), Freq/Channel, Current/Max, Single/Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Customer List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
Frequency Accuracy	±10 Hz + Frequency Reference
Measurement Range	–110 to +26 dBm
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

Electromagnetic Field Test (Option 444)

Measurements	Setup	Limit lines, axis dwell time, measurement time, auto-logging, measurement units, trace display
	Spectrum Analyzer	Field strength is measured
	LTE OTA	P-SS, S-SS, and RS are measured and displayed based on each Cell ID received
	Units	Spectrum Analyzer: dBm/m^2, dBV/m, dBmV/m, dBuV/m, V/m, W/m^2, dBW/m^2, A/m, dBA/m, W/cm^2 LTE OTA: dBm/m^2, V/m, W/m^2
	Results	Maximum, minimum, and average of all measurements conducted
	Display	Measurement status, number of measurements taken, pass/fail indicators

Frequency Range	Supported Antenna	
	2000-1800-R	9 kHz to 300 MHz
	2000-1792-R	30 MHz to 3 GHz
	2000-1791-R	700 MHz to 6 GHz

Modes where EMF Measurements Available	Spectrum Analyzer
	LTE OTA (Option 546)

CW Signal Generator

Setup Parameters	Generator	On/Off
	Tx Output Level	0.1 dB resolution, 0 to –130 dBm (spec to –120 dBm)
	Tx Pattern	CW, AM w/ 1 kHz, FM w/ 1 kHz
RF Characteristics	Power Level Accuracy	2.0 dB (CW Pattern, temperature range 15°C to 35°C, –120 to 0 dBm) (typ.)
	Frequency Range	500 kHz to 1.6 GHz
	Frequency Accuracy	Same as Spectrum Analyzer

Internal Power Meter

Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #, Full Band
Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale
Average	Acquisition Fast/Med/Slow, # of Running Averages
Limits	Limit On/Off, Limit Upper/Lower
Frequency Range	10 MHz to 1.6 GHz (Standard), 10 MHz to 6 GHz (Option 6)
Span	1 kHz to 100 MHz
Display Range	–140 to +30 dBm, ≤ 40 dB span
Measurement Range	–120 to +26 dBm
Offset Range	0 to +100 dB
VSWR	2:1 (typ.)
Maximum Power	Same as RF In Damage Level
Accuracy	Same as Spectrum Analyzer
Application Options	Impedance (50Ω, 75Ω, Other)

High Accuracy Power Meter (Option 19) (Requires external USB Power Sensor)

Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale
Average	# of Running Averages, Max Hold
Zero/Cal	Zero On/Off, Cal Factor (Center Frequency, Signal Standard)
Limits	Limit On/Off, Limit Upper/Lower

Power Sensor Model	MA24105A	MA24106A	MA24108A/18A/26A	MA24208A/18A	MA24330A/40A/50A
Description	Inline High Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor	Microwave Universal USB Power Sensor	Microwave CW USB Power Sensor
Frequency Range	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8 GHz (MA24108A) 10 MHz to 18 GHz (MA24118A) 10 MHz to 26 GHz (MA24126A)	10 MHz to 8/18 GHz	10 MHz to 33/40/50 GHz
Connector	Type N (f), 50Ω	Type N (m), 50Ω	Type N (m), 50Ω (MA24108A/18A) Type K (m), 50Ω (MA24126A)	Type N (m), 50Ω	Type K (m), 50Ω (33/40 GHz) Type V (m), 50Ω (50 GHz)
Dynamic Range	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 µW to 200 mW)	–40 to +20 dBm (0.1 µW to 100 mW)	–60 to +20 dBm (1 nW to 100 mW)	–70 to +20 dBm (0.1 nW to 100 mW)
Measurand	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power	True-RMS, Slot Power, Burst Average Power	Average Power
Measurement Uncertainty	±0.17 dB[*1]	±0.16 dB[*2]	±0.18 dB[*3]	± 0.17 dB[*4]	± 0.17 dB[*5]
Data sheet (for complete specifications)	11410-00621	11410-00424	11410-00504	11410-00841	11410-00906

*1: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than +20 dBm with a matched load.
Measurement results referenced to the input side of the sensor.
*2: Total RSS measurement uncertainty (0°C to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
*3: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
*4: Power uncertainty expressed with two sigma confidence level for CW measurement after zero operation.
Includes calibration factor and linearity over temperature uncertainties, but not the effects of mismatch, zero set and drift, or noise.
*5: Includes linearity over temperature uncertainties, but not the effects of calibration factor, mismatch, zero set and drift, and noise.

NBFM Analyzer and Coverage Mapping

Measurements	
NBFM Analyzer	NBFM Talk-Out Coverage (requires Option 31 GPS and a suitable GPS antenna)
Carrier Power Carrier Frequency Frequency Error FM Deviation (Peak, Average, RMS) Modulation Rate SINAD Quieting THD Occupied Bandwidth (% Int Pwr or >dBc method) Decoded CTCSS/DCS/DTMF Encoded CTCSS/DCS/DTMF	RSSI THD SINAD External SINAD
Graphs	
NBFM Analyzer	NBFM Talk-Out Coverage
Spectrum Audio Spectrum Audio Waveform/Scope Summary Display	Outdoor measured values are overlayed on a geo-tagged map, or displayed on a value vs. time graph. Captured data is exportable to both KML and CSV text (Requires Option 31 GPS and a suitable GPS antenna). Indoor measured values are referenced by creating touchscreen points on a floorplan.

Setup Parameters	Frequency	Receive Frequency, Transmit Frequency, Span, Offset
	Amplitude	Reference level, Scale, Ext Attenuation, Auto Range, Adjust Range
	Setup	Tone Type (CTCSS, DCS, DTMF)
	Filters	High Pass (300 Hz, 3 kHz, None) and Low Pass (300 Hz, 3 kHz, 15 kHz, None) De-emphasis On/Off
	Measurement	NBFM Analyzer, NBFM Coverage, Quieting, SINAD
	Auto Scan	Detection and frequency lock when RF In >+10 dBm, FM or CW signal
	Tx Patterns	CW, FM w/ CTCSS/DCS/DTMF, FM w/ CTCSS/DCS/DTMF + Tone Modulation, FM + Tone Modulation
	NBFM Analyzer	Active Graph, Maximize Active Trace, Graph Type, Audio Span, Audio Sweep Time, Occupied Bandwidth, Frequency Display (Carrier or Error)
	Graph Type	Spectrum, Audio Spectrum, Audio Waveform/Scope, Summary Display
	NBFM Coverage (Requires Option 31 GPS)	Display Type (Map or Time Graph) USB Memory File Format: .nbfm, .kml, both Log data On/Off
RF Measurements (temperature range 15°C to 35°C)	Received Power dBm	±1.25 dB, ±0.5 dB (typ.)
	Frequency Error Hz	±10 Hz + Frequency Reference
	SINAD/Quieting	Audio In port conforms to TIA-603-D for input voltage and impedance
	Additional Summary Measurements	Deviation Modulation Rate THD Occupied Bandwidth
	Tone Decode	CTCSS/DCS (standard tones per TIA-603-D), DTMF
Coverage Measurements	RSSI, SINAD, THD	

NBFM Signal Generator

Setup Parameters	Generator	On/Off
	TX Output Level	0.1 dB resolution, 0 to –130 dBm (spec to –120 dBm)
	Frequency Accuracy	Same as Spectrum Analyzer

P25/P25p2 Analyzer and P25/P25p2 Talk-Out Coverage (Options 521 and 522)

Measurements	
P25/P25p2 Analyzer (Option 521)	P25/P25p2 Talk-Out Coverage (Option 522, requires Option 31 and GPS)
Received Power Frequency Error Modulation Fidelity NAC (hex) Symbol Rate Error BER (1011 for P25, 1031 for P25p2), O.153, Voice, and Control Channel) Symbol Deviation Hexadecimal Display of Control Channel Traffic	BER RSSI Modulation Fidelity
Graphs	
P25/P25p2 Analyzer (Option 521)	P25/P25p2 Talk-Out Coverage (Option 522, requires Option 31 and GPS)
Constellation (P25 only) Linear Constellation Spectrum [Spans (kHz) = 25, 50, 100, 500, 1000, 5000] Histogram Eye Diagram Demodulation Summary Display Base Station Control Channel Summary Displays (Active Control Channel, Band Plan, Backup Control Channel, Adjacent Site Summary) TDMA Power Profile (P25p2 only)	Outdoor measured values are overlayed on a geo-tagged map, or displayed on a value vs time graph, and are exportable to both KML and CSV text (requires Option 31 GPS and a suitable GPS antenna). Indoor measured values are referenced by creating touchscreen points on a floorplan.

Standards Compliance	P25: Relevant sections of TIA-102.CAAA-C P25 Phase 2: Relevant sections of TIA-102.CCAA	
Setup Parameter	Frequency	Receive Frequency, Transmit Frequency, Span, Offset
	Amplitude	Reference level, Scale, Ext Attenuation, Auto Range, Adjust Range
	Setup	P25 Modulation Types: C4FM, CQPSK P25 BER patterns: 1011 Hz, O.153 (V.52), Voice, Control Channel P25 Phase 2 Modulation Types: Base Station (H-DQPSK) & Mobile Station (H-CPM) P25 Phase 2 BER patterns: 1031 Hz, Silence, Voice, Control Channel Averaging, WACN ID, System ID, Color Code, Descrambling (On/Off)
	Measurement	P25 Analyzer, P25 Coverage
	P25/P25p2 Analyzer	Active Graph, Maximize Active Trace, Graph Type, Symbol Span
	Graph Type	Constellation (P25 only), Linear Constellation, Spectrogram, Histogram, Eye Diagram, Demodulation Summary Display, Base Station Control Channel Summary Displays (Active Control Channel, Band Plan, Backup Control Channel, Adjacent Site Summary)
	Eye Diagram Symbol Span	2, 3, 4, 5
	P25/P25p2 Coverage	USB Memory File Format .p25, .kml, both (Option 522, requires Option 31 GPS)
	Log Data	On/Off

RF Measurements (Option 521) (temperature range 15°C to 35°C)

Received Power dBm	±1.25 dB, ±0.5 dB (typ.)
Frequency Error Hz	±10 Hz + Frequency Reference
Additional Summary Measurements	Modulation Fidelity (%) BER/MER (%) Symbol Deviation (Hz) Network Access Code (Hex) Symbol Rate Error (Hz)

Measurements (Option 522)

RSSI, BER, Modulation Fidelity

P25/P25p2 Signal Generator

Setup Parameters	Generator	On/Off
	Tx Output Level	0.1 dB resolution, 0 to –130 dBm (spec to –120 dBm)
	P25 Tx Patterns	P25: 1011, 1011 Cal, Interference, Silence, Busy, Idle, High Dev, Low Dev, O.153 (v. 52) p25_lsm_1011, 511 (O.153/v.52), 1011_cal, Interference, Silence, Busy, Idle, Fidelity CW, AM and FM
	P25p2 Tx Patterns	Base Station (H-DQPSK): 1031, 1031 Cal, Silence Mobile Station (H-CPM, Selectable timeslot): 1031, 1031 Cal, Silence CW, AM, FM
RF Characteristics	Power Level Accuracy	2.0 dB (CW Pattern, temperature range 15°C to 35°C, –120 to 0 dBm) (typ.)
	Frequency Accuracy	Same as Spectrum Analyzer
	Frequency Range	500 kHz to 1.6 GHz
	P25 Modulation Fidelity	<1.25% max, <0.75% (typ.)
	P25p2 Modulation Fidelity	<2.0% max, <1.75% (typ.)

DMR (MOTOTRBO) Analyzer and DMR Talk-Out Coverage (Options 591 and 592)

Measurements	
DMR (MOTOTRBO) Analyzer (Option 591)	DMR Talk-Out Coverage (Option 592, requires Option 31 and 591)
Received Power Frequency Error Modulation Fidelity Color Code (decimal) RX Timeslot (Base Station only) Symbol Rate Error Symbol Deviation Base Station: 1031, 1031-1 % BER, O.153, O.153-1 % BER, Silence, tscc Mobile Station: 1031, 1031-1 % BER, O.153, O.153-1 % BER, Silence CW, AM, FM Repeater Receiver Sensitivity Test	BER RSSI Modulation Fidelity
Graphs	
DMR (MOTOTRBO) Analyzer (Option 591)	DMR Talk-Out Coverage (Option 592, requires Option 31 and 591)
Constellation Linear Constellation Spectrum [Spans (kHz) = 25, 50, 100, 500, 1000, 5000] Histogram Eye Diagram Summary Display DMR Summary Power Profile	Outdoor measured values are overlayed on a geo-tagged map, or displayed on a value vs. time graph, and are exportable to both KML and CSV text (requires Option 31 GPS and a suitable GPS antenna). Indoor measured values are referenced by creating touchscreen points on a floorplan.

Setup Parameters	Frequency	Receive Frequency, Transmit Frequency, Span, Rx/Tx Coupling, Coupling Offset
	Amplitude	Reference level, Scale, Ext Attenuation, Auto Range, Adjust Range
	Setup	Modulation Type (Base Station, Mobile Station), BER pattern (1031, O.153, Voice, Silence)
	Measurement	DMR Analyzer, DMR Coverage, DMR Bit Capture
	DMR Analyzer	Active Graph, Maximize Active Trace, Graph Type, Symbol Span
	Graph Type	Constellation, Linear Constellation, Spectrogram, Histogram, Eye Diagram, Summary, DMR Summary, Power Profile
	Eye Diagram Symbol Span	2, 3, 4, 5
	DMR Coverage (Option 592, requires Option 31 GPS)	USB Memory File Format .dmr2, .kml, both Log data On/Off

RF Measurements (Option 591) (temperature range 15°C to 35°C)

Received Power dBm	±1.25 dB, ±0.5 dB (typ.)
Frequency Error Hz	±10 Hz + Frequency Reference
Summary Measurements	Received Power, Frequency Error, Modulation Fidelity, BER, Symbol Deviation, Color Code, Symbol Rate Error
DMR Summary Measurements	MS ID, Target ID, Talk Group ID, FID, Call Type, Base Station ID

Measurements (Option 592)

RSSI, BER, Modulation Fidelity

DMR Signal Generator

Setup Parameters	Generator	On/Off
	Tx Output Level	0.1 dB resolution, 0 to –130 dBm (spec to –120 dBm)
	Tx Pattern	Base Station: 1031, 1031-1 % BER, O.153, O.153-1 % BER, Silence, tscc Mobile Station: 1031, 1031-1 % BER, O.153, O.153-1 % BER, Silence CW, AM, FM
RF Characteristics	Power Level Accuracy	2.0 dB (CW Pattern, temperature range 15°C to 35°C, –120 to 0 dBm) (typ.)
	Frequency Range	500 kHz to 1.6 GHz
	Modulation Fidelity	1.25% max, 0.75% (typ.)
	Frequency Accuracy	Same as Spectrum Analyzer

dPMR Analyzer (Option 573 and 572)

Measurements	
dPMR RF Analyzer (Option 573)	dPMR Talk-Out Coverage (Option 572, requires Option 31 and 573)
Received Power Frequency Error Modulation Fidelity Symbol Rate Error Symbol Deviation	RSSI Modulation Fidelity
Graphs	
dPMR RF Analyzer (Option 573)	dPMR Talk-Out Coverage (Option 572, requires Option 31 and 573)
Constellation Linear Constellation Spectrum [Spans (kHz) = 25, 50, 100, 500, 1000, 5000] Histogram Eye Diagram Summary Display	Outdoor measured values are overlayed on a geo-tagged map and exportable to both KML and CSV text (requires Option 31 GPS and a suitable GPS antenna). Indoor measured values are referenced by creating touchscreen points on a floorplan.

Setup Parameters	Frequency	Receive Frequency, Transmit Frequency, Span, Offset
	Amplitude	Reference level, Scale, Ext Attenuation, Auto Range, Adjust Range
	Setup	Modulation Bandwidth (6.25 kHz)
	Measurement	dPMR Analyzer, dPMR Coverage
	dPMR Analyzer	Active Graph, Maximize Active Trace, Graph Type, Symbol Span
	Graph Type	Constellation, Linear Constellation, Spectrogram, Histogram, Eye Diagram, Summary
	Eye Diagram Symbol Span	2, 3, 4, 5
	dPMR Coverage	USB Memory File Format .dpmr, .kml, both Log data on/off

RF Measurements (Option 573) (temperature range 15°C to 35°C)

Received Power dBm	±1.25 dB, ±0.5 dB (typ.)
Frequency Error Hz	±10 Hz + Frequency Reference
Additional Summary Measurements	Modulation Fidelity (%) Symbol Deviation (Hz) Symbol Rate Error (Hz)

Measurements (Option 572)

RSSI, Modulation Fidelity

Signal Generator

Setup Parameters	Generator	On/Off
	Tx Output Level	0.1 dB resolution, 0 to –130 dBm (spec to –120 dBm)
	Tx Pattern	CW, AM, FM, O.153
RF Characteristics	Power Level Accuracy	2.0 dB (CW Pattern, temperature range 15°C to 35°C, –120 to 0 dBm) (typ.)
	Frequency Range	500 kHz to 1.6 GHz
	Frequency Accuracy	Same as Spectrum Analyzer

NXDN Analyzer and NXDN Talk-Out Coverage (Options 531 and 532)

Measurements	
NXDN Analyzer (Option 531)	NXDN Talk-Out Coverage (Option 532, requires Option 31 and 531)
Received Power Frequency Error Modulation Fidelity RAN (decimal) Symbol Rate Error BER (1031, O.153, Voice, and Control Channel) Symbol Deviation	BER RSSI Modulation Fidelity
Graphs	
NXDN Analyzer (Option 531)	NXDN Talk-Out Coverage (Option 532, requires Option 31 and 531)
Constellation Linear Constellation Spectrum [Spans (kHz) = 25, 50, 100, 500, 1000, 5000] Histogram Eye Diagram Summary Display	Outdoor measured values are overlayed on a geo-tagged map and exportable to both KML and CSV text (Requires Option 31 GPS and a suitable GPS antenna). Indoor measured values are referenced by creating touchscreen points on a floorplan.

Setup Parameters	Frequency	Receive Frequency, Transmit Frequency, Span, Offset
	Amplitude	Reference level, Scale, Ext Attenuation, Auto Range, Adjust Range
	Setup	Modulation Bandwidth (6.25 kHz and 12.5 kHz), BER pattern (1031, O.153, Voice, Control Channel)
	Measurement	NXDN Analyzer, NXDN Coverage
	NXDN Analyzer	Active Graph, Maximize Active Trace, Graph Type, Symbol Span
	Graph Type	Constellation, Linear Constellation, Spectrogram, Histogram, Eye Diagram, Summary
	Eye Diagram Symbol Span	2, 3, 4, 5
	NXDN Coverage (Option 532, requires Option 31 GPS)	USB Memory File Format .nxdn, .kml, both Log data On/Off

RF Measurements (Option 531) (temperature range 15°C to 35°C)

Received Power dBm	±1.25 dB, ±0.5 dB (typ.)
Frequency Error Hz	±10 Hz + Frequency Reference
Additional Summary Measurements	Modulation Fidelity (%) BER/MER (%) Symbol Deviation (Hz) Radio Access Number (RAN) Decimal Symbol Rate Error (Hz)

Measurements (Option 532)

RSSI, BER, Modulation Fidelity

NXDN Signal Generator

Setup Parameters	Modulation Bandwidth	6.25 kHz, 12.5 kHz
	Generator	On/Off
	Tx Output Level	0.1 dB resolution, 0 to –130 dBm (spec to –120 dBm)
	Tx Patterns (9600 and 4800)	1031, O.153 (v. 52), High Dev, Low Dev, UDCH Pattern 10, CAC, 1031 Hz DTS, FACCH3 DTS, Framed PN9, 1031 Cal. CW, AM, FM
RF Characteristics	Power Level Accuracy	2.0 dB (CW Pattern, temperature range 15°C to 35°C, –120 to 0 dBm) (typ.)
	Frequency Range	500 kHz to 1.6 GHz
	Modulation Fidelity	1.25% max
	Frequency Accuracy	Same as Spectrum Analyzer

TETRA Analyzer and TETRA Coverage Mapping (Options 581 and 582)

<table>
<tr><th colspan="2">Measurements</th></tr>
<tr><th>TETRA Analyzer
(Option 581)</th><th>TETRA Coverage
(Option 582, requires Option 31 and 581)</th></tr>
<tr><td>Received Power
Frequency Error
Vector Error, RMS, and Peak
Bit Error Rate (BER)
Residual Carrier Magnitude
IQ Imbalance
Magnitude & Phase Error
Base Station Extended Color Code
Base Station Receiver Sensitivity Test
Symbol Rate Error</td><td>RSSI
BER
RMS Vector Error (EVM)</td></tr>
<tr><th colspan="2">Graphs</th></tr>
<tr><th>TETRA Analyzer
(Option 581)</th><th>TETRA Coverage
(Option 582, requires Option 31 and 581)</th></tr>
<tr><td>Constellation
Spectrum [Spans (kHz) = 25, 50, 100, 500, 1000, 5000]
Eye Diagram
Summary Display
TETRA Summary</td><td>Outdoor measured values are overlayed on a geo-tagged map and exportable to both KML and CSV text (requires Option 31 GPS and a suitable GPS antenna).
Indoor measured values are referenced by creating touchscreen points on a floorplan.</td></tr>
</table>

Setup Parameters	Frequency	Receive Frequency, Tx Frequency, Rx Coupling, Coupling Offset, Span
	Amplitude	Reference level, Scale, Ext Attenuation, Auto Range, Adjust Range, Tx Output Lvl, Tx Power Offset, Units
	Setup	Mod Type, Rx Pattern, Tx Pattern, Squelch Lvl, Numeric Averaging
	Measurements	TETRA Analyzer, TETRA Coverage, TETRA BS Sensitivity
	TETRA Analyzer	Active Graph, Maximize Active Graph, Graph Type, Symbol Span
	Graph Type	Constellation, Spectrogram, Eye Diagram, Summary, TETRA Summary
	Eye Diagram Symbol Span	2, 3, 4, 5
	TETRA Coverage (Option 582, requires Option 31 GPS)	USB Memory File Format .tetra, .kml, or both Log data On/Off

RF Measurements (Option 581) (temperature range 15°C to 35°C)

Received Power dBm	±1.25 dB, ±0.5 dB (typ.)
Frequency Error Hz	±10 Hz + Frequency Reference
Additional Summary Measurements	Vector Error, RMS and Peak (%) BER Residual Carrier Magnitude (%) IQ Imbalance (dB) Phase Error Degrees Magnitude Error (%) Symbol Rate Error (Hz)
TETRA Summary Measurements	Mobile Color Code (Decimal) Mobile Network Code (Decimal) Base Station Color Code (Decimal) Base Station Extended Color Code (Hex) Location Area Code (Decimal) Mobile Station Maximum Transmit Power (dBm)

Measurements (Option 582)

RSSI, BER, Error Vector Magnitude

TETRA Signal Generator

Setup Parameters	Modulation Type	π/4 (Pi/4) DQPSK
	Generator	On/Off
	Tx Output Level	0.1 dB resolution, 0 to –130 dBm (spec to –120 dBm)
	Base Station Test Patterns	tetra_bs_idle_unallocPCH tetra_bs_busy_allocPCH T1_TCH_7p2 (Airbus TB3, Hytera, Sepura, Motorola, ETELM NeTIS)
RF Characteristics	Power Level Accuracy	2.0 dB (CW Pattern, temperature range 15°C to 35°C, –120 to 0 dBm) (typ.)
	Frequency Range	500 kHz to 1.6 GHz
	EVM	3.5% max
	Frequency Accuracy	Same as Spectrum Analyzer

PTC Analyzer and PTC Talk-Out Coverage (Options 721 and 722)

Measurements	
PTC Analyzer (Option 721)	PTC Talk-Out Coverage (Option 722, requires Option 31 and 721)
Received Power Burst Power Peak Envelope Power Frequency Error π/4 DQPSK: Error Vector Magnitude, BER, IQ Imbalance, Phase Error, Magnitude Error, Symbol Rate Error	BER RSSI Modulation Fidelity
Graphs	
PTC Analyzer (Option 721)	PTC Talk-Out Coverage (Option 722, requires Option 31 and 721)
Constellation Linear Constellation Spectrum [Spans (kHz) = 25, 50, 100, 500, 1000, 5000] Histogram Eye Diagram Summary Display	Outdoor measured values are overlayed on a geo-tagged map, or displayed on a value vs time graph, and are exportable to both KML and CSV text (requires Option 31 GPS and a suitable GPS antenna). Indoor measured values are referenced by creating touchscreen points on a floorplan.

Setup Parameters	Frequency	Receive Frequency, Transmit Frequency, Span, Offset
	Amplitude	Reference level, Scale, Ext Attenuation, Auto Range, Adjust Range
	Setup	RX Pattern (O.153/V.52, PN9 Normal), Symbol Rate (Half Rate 8 ksps, Full Rate 16 ksps), TX Pattern (O.153 Continuous, PN9 Normal Types 1 - 4, PN9 Normal Continuous), CW, AM 1 kHz tone, FM 1 kHz tone
	Measurement	PTC-ITCR Analyzer, PTC-ITCR Coverage
	PTC-ITCR Analyzer	Active Graph, Maximize Active Trace, Graph Type, Symbol Span
	Graph Type	Constellation, Linear Constellation, Spectrogram, Histogram, Eye Diagram, Summary
	Eye Diagram Symbol Span	2, 3, 4, 5
	PTC-ITCR Coverage (Option 722)	USB Memory File Format .ptc, .kml, both (requires Option 31 and 731)
	Log data	On/Off

RF Measurements (Option 721) (temperature range 15°C to 35°C)

Received Power dBm	±1.25 dB, ±0.5 dB (typ.)
Burst Power dBm	±1.25 dB, ±0.5 dB (typ.)
Peak Envelope Power dBm	±1.25 dB, ±0.5 dB (typ.)
Frequency Error Hz	±10 Hz + Frequency Reference
Additional Summary Measurements	Error Vector Magnitude (%) BER (%) IQ Imbalance (dB) Phase Error (degrees) Magnitude Error (%) Symbol Rate Error (Hz)

Measurements (Option 722)

RSSI, BER, Modulation Fidelity

PTC Signal Generator

Setup Parameters	Modulation Type	π/4 DQPSK
	Symbol Rate (ksps)	8 (Half Rate), 16 (Full Rate)
	Generator	On/Off
	Tx Output Level	0.1 dB resolution, 0 to –130 dBm (spec to –120 dBm)
	Tx Pattern	PN9 Continuous, PN9 Burst, CW, AM, FM
RF Characteristics	Power Level Accuracy	2.0 dB (CW Pattern, temperature range 15°C to 35°C, –120 to 0 dBm) (typ.)
	Frequency Range	500 kHz to 1.6 GHz
	EVM	3.5% max.
	Frequency Accuracy	Same as Spectrum Analyzer

AM/FM/PM Signal Analyzers (Option 509)

	Measurements							
Display Type	RF Spectrum (AM/FM/PM)	Audio Spectrum (AM)	Audio Spectrum (FM/PM)	Audio Waveform (AM)	Audio Waveform (FM/PM)	Summary (AM)	Summary (FM/PM)
Graphic Display	Power (dBm) vs. Frequency	Depth (%) vs. Modulation Frequency	Deviation (kHz/rad) vs. Modulation Frequency	Depth (%) vs. Time	Deviation (kHz/rad) vs. Time	None	None
Numerical Displays	Carrier Power Carrier Frequency Occupied Bandwidth	AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Deviation (Pk-Pk)/2 Deviation SINAD* THD* Distortion/Total Vrms*	AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	RMS Depth (AM) Peak + Depth Peak – Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*	RMS Deviation (FM/PM) Peak + Depth Peak – Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*

*: Requires Sinewave modulation

Setup Parameters	Frequency	Center Freq, Span, Freq Step, Signal Standard, Channel, Channel Increment, Set Carrier Freq
	Amplitude	Scale, Power Offset, Adjust Range
	Setup	Demod Type (AM, FM, PM), IFBW, Auto IFBW
	Measurements	RF Spectrum AM/FM/PM, Audio Spectrum (AM/FM/PM), Audio Waveform (AM/FM/PM), Summary (AM/FM/PM), Average
	Marker	On/Off, Delta, Peak Search, Marker Freq to Center, Marker to Ref Lvl, Marker Table, All Markers Off
Specifications	AM	Modulation Rate: ±1 Hz (<100 Hz), ±2% (>100 Hz) Depth: ±5% for modulation rates 10 Hz to 100 kHz
	FM	Modulation Rate: ±1 Hz (<100 Hz); ±2% (100 Hz to 100 kHz) Deviation Accuracy: ±5% (100 Hz to 100 kHz, IFBW must be greater than 95% occupied BW)
	PM	Modulation Rate: ±1 Hz (<100 Hz); ±2% (100 Hz to 100 kHz) Deviation Accuracy: ±5% (deviation 0 to 93 Rad, rate 10 Hz to 5 kHz, IFBW must be greater than 95% occupied BW)
	IF Bandwidth	1 kHz to 300 kHz in 1-3 sequence
	Frequency Span	RF Spectrum: 10 kHz to 10 MHz Audio Spectrum: 2 kHz, 5 kHz, 10 kHz, 20 kHz
	RBW/VBW	30
	Span/RBW	100
	Sweep time	50 µs to 50 ms (Audio Waveform)

LTE Signal Analyzers (Options 541, 542 and 546)

Measurements			
RF (Option 541)	Demodulation (Option 542 and 886)	Over-the-Air (OTA) (Option 546)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth ACPR Spectral Emission Mask Category A or B (Opt 0001) RF Summary	Power vs. Resource Block (RB) RB Power (PDSCH) Active RBs, Utilization%, Channel Power, Cell ID OSTP, Frame EVM by modulation Constellation QPSK, 16 QAM, 64 QAM 256QAM Demod (Option 886) Modulation Results Ref Signal Power (RS) Sync Signal Power (SS) EVM – rms, peak, max hold Frequency Error – Hz, ppm Carrier Frequency Cell ID Control Channel Power Bar Graph or Table View RS, P-SS, S-SS PBCH, PCFICH, PHICH, PDCCH Total Power (Table View) EVM Modulation Results Tx Time Alignment Modulation Summary Includes EVM by modulation Antenna Icons Detects active antennas (1/2)	Scanner Cell ID (Group, Sector) S-SS Power, RSRP, RSRQ, SINR Dominance Modulation Results – On/Off Tx Test Scanner RS Power of MIMO antennas (2 × 2, 4 × 4) Cell ID, Average Power Delta Power (Max-Min) Graph of Antenna Power Modulation Results – On/Off Mapping On-screen S-SS Power, RSRP, RSRQ, or SINR Scanner Modulation Results – Off	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth ACLR Frequency Error Carrier Frequency Dominance EVM peak, rms RS Power RS EVM SS, P-SS, S-SS Power SS, P-SS, S-SS EVM PBCH Power PBCH EVM PCFICH Power PCFICH EVM PHICH Power, EVM PDCCH Power, EVM Cell, Group, Sector ID OSTP Tx Time Alignment

Setup Parameters	Frequency	E-UTRA bands 1 – 5, 7 – 14, 17 – 21, 23 – 32, 66A (tunable 10 MHz to 6.0 GHz with Option 6) Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Bandwidth	1.4, 3, 5, 10 MHz
	Span	Auto, 1.4, 3, 5, 10, 15, 20, 30 MHz
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous, Trigger Sweep
	EVM Mode	Auto, PBCH only
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements

RF Measurements (Options 541)

RF Channel Power Accuracy	±1.5 dB, ±1.0 dB (typ.), (RF input –50 to +10 dBm)

Demodulation Measurements (Options 542)

Frequency Error	±10 Hz + Frequency Reference, 99% confidence level
Residual EVM (rms)	2.0% (typ.) (E-UTRA Test Model 3.1, RF Input –50 to +10 dBm) for BW ≤10 MHz

Over-the-Air (OTA) Measurements (Options 546)

Scanner	Six strongest signals if present Auto Save — Sync Signal Power and Modulation Results with GPS tagging
Auto Save	Scanner — three strongest signals if present RS Power — strongest signal
Mapping	Map On-screen S-SS Power, RSRP, RSRQ, or SINR of Cell ID with strongest signal Scanner — three strongest signals if present Save and Export Scanner data: *.kml, *.mtd (tab delimited)

IEEE 802.16 Fixed WiMAX Signal Analyzers (Options 46 and 47)

Measurements			
RF (Option 46)	Demodulation (Option 47)	Over-the-Air (OTA)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Channel Power Preamble Power Data Burst Power Crest Factor ACPR	Constellation RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error Carrier Frequency Base Station ID Spectral Flatness Adjacent Subcarrier Flatness EVM vs. Subcarrier/Symbol RCE EVM Frequency Error Carrier Frequency Base Station ID	There are no additional OTA Measurements. RF Measurements and Demodulation can be made OTA.	Channel Power Occupied Bandwidth Burst Power Preamble Power Crest Factor Frequency Error Carrier Frequency EVM RCE Base Station ID

Setup Parameters	Bandwidth	1.25, 1.50, 2.50, 3.50, 5.00, 5.50, 6.00, 7.00, 10.00 MHz
	Cyclic Prefix Ratio (CP)	1/4, 1/8, 1/16, 1/32
	Span	5, 10, 15, 20 MHz
	Frame Length	2.5, 5.0, 10.0 ms
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 46) (temperature range 15°C to 35°C)

RF Channel Power Accuracy	±1.5 dB, ±1.0 dB (typ.), (RF input –50 to +20 dBm) (Option 541)

Demodulation (Option 47) (temperature range 15°C to 35°C)

Frequency Error	0.07 ppm + Frequency Reference, 99% confidence level
Residual EVM (rms)	3% (typ.), 3.5% max (RF Input –50 to +20 dBm)

IEEE 802.16 Mobile WiMAX Signal Analyzers (Options 66, 67 and 37)

Measurements			
RF (Option 66)	Demodulation (Option 67)	Over-the-Air (OTA) (Option 37)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Channel Power Preamble Power Downlink Burst Power Uplink Burst Power ACPR	Constellation RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error CINR Base Station ID Sector ID Spectral Flatness Adjacent Subcarrier Flatness EVM vs. Subcarrier/Symbol RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error CINR Base Station ID Sector ID DL-MAP (Tree View)	Channel Power Monitor Preamble Scanner (Six) Preamble Relative Power Cell ID Sector ID PCINR Dominant Preamble Base Station ID	Channel Power Occupied Bandwidth Downlink Burst Power Uplink Burst Power Preamble Power Crest Factor Frequency Error Carrier Frequency EVM RCE Sector ID

Setup Parameters	Zone Type	PUSC
	DL-MAP Auto Decoding	Convolutional Coding (CC), Convolutional Turbo Coding (CTC)
	Bandwidths	3.50, 5.00, 7.00, 8.75, 10.00 MHz
	Cyclic Prefix Ratio (CP)	1/8
	Span	5, 10, 20, 30 MHz
	Frame Lengths	5, 10 ms
	Demodulation	Auto, Manual, FCH
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 66) (temperature range 15°C to 35°C)

RF Channel Power Accuracy	±1.5 dB, ±1.0 dB (typ.), (RF input –50 to +20 dBm)

Demodulation (Option 67) (temperature range 15°C to 35°C)

Frequency Error	0.02 ppm + Frequency Reference, 99% confidence level
Residual EVM (rms)	2.5% (typ.), 3.0% max, (RF Input –50 to +20 dBm)

Over-the-Air (OTA) Measurements (Option 37)

Channel Power Monitor	Over time (one week), measurement time interval 1 to 60 sec
Preamble Scanner	Six Strongest Preambles
Auto Save	Yes
GPS Logging	Yes

General Specifications

System Parameters	System	Status (Temperature, Battery Info, Serial Number, Firmware Version, Options Installed) Self Test, Application Self Test, GPS (see Option 31)
	System Options	Name, Date and Time, Brightness, Volume Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, Russian, Portuguese) Reset (Factory Defaults, Master Reset, Update Firmware)
	Internal Trace/Setup Memory	2,000 traces, 2,000 setups
	External Trace/Setup Memory	Limited by size of USB Flash drive
	Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode
File Management	File Types	Vary with measurement mode
	File	Save, Recall, Copy, Delete
	Save	Setups, Measurements, Screen Shots (JPEG)
	Recall	Setups, Measurements
	Copy	Selected file or files to internal/external memory (USB)
	Delete	Selected file or files from internal/external memory (USB)
	File Sort Method	By Name/Date/Type, Ascend/Descend
Connectors	VNA Port 1, VNA Port 2	N (f), 50Ω
	VNA Port Damage Level	23 dBm, ±50 VDC
	RF In Port	N (f), 50Ω
	RF In Port Damage Level	+33 dBm peak, ±50 VDC, Maximum Continuous Input (≥10 dB attenuation)
	Signal Generator Port	N (f), 50Ω
	Signal Generator Port Damage Level	+27 dBm, ±16 VDC
	GPS	SMA (f)
	External Power	5.5 mm barrel connector, 12.5 VDC to 15 VDC, <4.0 A
	USB Interface (2)	Type A (Connect USB Flash Drive and Power Sensor)
	USB Interface	5-pin mini-B, Connect to PC for data transfer
	Ethernet Interface	RJ45 connector for Ethernet 10-Base T
	Headset Jack	3.5 mm mini-phone plug
	External Reference In	BNC, female, 1 MHz, 1.2288 MHz, 1.544 MHz, 2.048 MHz, 2.4576 MHz, 4.8 MHz, 4.9152 MHz, 5 MHz, 9.8304 MHz, 10 MHz, 13 MHz, and 19.6608 MHz at –10 to +10 dBm
	Audio In (SINAD/Quieting)	BNC, female, Impedance 50kΩ, Maximum Voltage >1.77 Vrms (TIA-603-D compliant)
	External Trigger/ Clock Recovery	BNC, female, Maximum Input ±5 VDC
Display	Type	Resistive TFT Touchscreen
	Size	8.4 inch daylight viewable color LCD
	Resolution	800 × 600
	Pixel Defects	No more than five defective pixel (99.9989% good pixels)
Power	Field Replaceable Battery	Li-Ion, 7500 mAh rated capacity 40 W on battery power only
	DC Power	Universal 110 V/220 V AC/DC Adapter 55 W running off AC/DC adapter while charging battery
	Life Time Charging Cycles	>300 (80% of initial capacity)
	Battery Operation	3.6 hours (typ.)
	Battery Charging Limits	0 to +45°C, Relative Humidity ≤80%
CE	EMC	2014/30/EU, EN 61326:2013, CISPR 11/EN 55011, IEC/EN 61000-4-2/3/4/5/6/8/11
	LVD	2014/35/EU, EN61010-1
	RoHS	(EU) 2015/863
RCM	Australia and New Zealand	RCM AS/NZS 4417:2012
KCC	South Korea	KCC-REM-A21-0004
Environmental	Operating Temperature Range	–10°C to +55°C
	Storage Temperature Range	–51°C to +71°C
	Maximum Humidity	95% RH at +30°C, non-condensing
	Vibration, Sinusoidal	5 Hz to 55 Hz
	Vibration, Random	10 Hz to 500 Hz
	Half Sine Shock	30 g_n
	Explosive Atmosphere	MIL-PRF-28800F, Section 4.5.6.3 MIL-STD-810G, Method 511.5, Procedure 1
	Altitude	4600 m, operating and non-operating
ESD	RF Port Center Pin	Withstands up to ±15 kV
Dimensions and Mass		273 (W) × 199 (H) × 91 (D) mm (10.7 × 7.8 × 3.6 in), 3.6 kg (7.9 lb)
Warranty	Duration	Standard three-year warranty (battery one-year warranty)

Master Software Tools (for your PC)

Database Management	Full Trace Retrieval	Retrieve spectrum analyzer traces from instrument into one PC directory
	Trace Catalog	Index all traces into one catalog
	Trace Rename Utility	Rename measurement traces
	Group Edit	Titles, subtitles, plot scaling, markers and limit lines, simultaneously on similar files
	DAT File Converter	Converts HHST files to MST file format and vice-versa
Data Analysis	Trace Math and Smoothing	Compare multiple traces
	Data Converter	Convert from/to Return Loss, VSWR, Cable Loss, DTF and also into Smith Charts
	Measurement Calculator	Translates into other units
Report Generation	Report Generator	Includes GPS, power level, and calibration status along with measurements
	Edit Graph	Change scale, limit lines, and markers
	Report Format	Create reports in HTML for PDF format
	Export Measurements	Export measurements to *.s2p, *.jpg or *.csv format
	Notes	Annotate measurements
Mapping (GPS Required)	Spectrum Analyzer Mode	MapInfo, MapPoint
Folder Spectrogram (Spectrum Monitoring for Interference Analysis and Spectrum Clearing)	Folder Spectrogram – 2D View	Creates a composite file of multiple traces Peak Power, Total Power, Peak Frequency, Histogram, Average Power (Max/Min) File Filter (Violations over limit lines or deviations from averages) Playback
	Video Folder Spectrogram – 2D View	Create AVI file to export for management review/reports
	Folder Spectrogram – 3D View	Views (Set Threshold, Markers) - 3D (Rotate X, Y, Z Axis, Level Scale, Signal ID) - 2D View (Frequency or Time Domain, Signal ID) - Top Down Playback (Frequency and/or Time Domain)
List/Parameter Editors	Traces	Add, delete, and modify limit lines and markers
	Antennas, Cables, Signal Standards	Modify instrument's Antenna, Cable, and Signal Standard List
	Product Updates	Auto-checks Anritsu website for latest revision firmware
	Languages	Customize non-English language menus
	Display	Modify display settings
Script Master™	Channel Scanner Mode	Automate scan up to 1200 channels, repeat for sets of 20 channels, repeat all channels
Connectivity	Connections	Connect to PC using USB, LAN, or Direct Ethernet connection
	Network Search	Find all Anritsu handheld instruments on local network
	Download	Download measurements and live traces to PC for storage and analysis
	Upload	Upload measurements from PC to instrument
	Export	Measurements can be saved in various formats, depending on the measurement type, including JPEG, CSV, and Anritsu DAT format
	Printing	Print individual or all measurement screens

easyTest Tools™ (for your PC)

Instrument Modes	Cable & Antenna Analyzer Spectrum Analyzer
Commands	Display Image: Allows putting a custom image on the instrument screen Recall Setup: Places the instrument into a known state; auto-advance to next command available Prompt: Displays instructional messages on the instrument screen; timed advance to next command available; instrument users can be allowed or disallowed from making setup adjustments Save: Allows automatic or manual saving of traces; auto-advance to next command available

Line Sweep Tools (for your PC)

Line Sweep Tools (LST) is a free PC based program that increases productivity for people who deal with numerous Cable and Antenna traces every day. LST is the next generation of Anritsu's familiar Handheld Software Tools (HHST) and shares its uncomplicated user interface, giving a new face to the term "ease of use."

Trace Capture	Browse to Instrument: View and copy traces from the test equipment to your PC using Windows Explorer Open Legacy Files: Open DAT files captured with Handheld Software Tools v6.61 Open Current Files: Open VNA or DAT files Capture Plots To: The Line Sweep Tools screen, DAT files, Database, or JPEG
Traces	Trace Types: Return Loss, VSWR, DTF-RL, DTF-VSWR, Cable Loss, Smith Chart, and PIM Trace Formats: DAT, VNA, CSV, PNG, BMP, JPG, HTML, Data Base, and PDF
Report Generation	Report Generator: Includes GPS location along with measurements Report Format: Create reports in HTML or PDF format Report Setup: Report Title, Company, Prepared for, Location, Date and Time, Filename, Company logo[*1] Trace Setup: One Trace Portrait Mode, Two Trace Portrait Modes, One Trace Landscape Mode
Trace Validation	Presets: 7 presets allow "one click" setting of up to 6 markers and one limit line Marker Controls: 6 regular Markers, Marker Peak, Marker Valley, Marker between, and frequency entry Delta Markers: 6 Delta markers Limit Line: Enable and drag or value entry. Also works with presets Next Trace Button: Next Trace and Previous Trace arrow keys allow quick switching between traces
Tools	Cable Editor[*2]: Allows creation of custom cable parameters Distance-to-Fault[*3]: Converts a Return Loss trace to a Distance-to-Fault trace Measurement Calculator: Converts Real, Imaginary, Magnitude, Phase, RL, VSWR, Rho, and Transmit power Signal Standard Editor[*2]: Creates new band and channel tables Renaming Grid: 36 user definable phrases for creation of file names, trace titles, and trace subtitles
Connectivity	Connections: Ethernet, USB cable, and USB memory stick

*1: Optionally set by user
*2: Instrument type/model must match original
*3: Only *.dat and *.vna file types supported

Web Remote Control

Control	Full instrument control through a browser – all instrument functions except power switch and rotary knob
Connections	RJ45 Ethernet jack Third party Wi-Fi router
Protocol	HTTP/TCP/IP
Physical Layer	Cat 5 Cable, Wi-Fi router compatible
Software Required	HTML 5-compliant browser – Google Chrome, Mozilla Firefox
Operating System	iOS, Windows, Linux, Android operating systems that can host the HTML 5-compliant browser
Remote Hardware	PCs, tablets, and smart phones with Ethernet or Wi-Fi connection and an HTML 5-compliant browser
Download	Individual instrument files downloaded via browser Multiple instrument files and directories zipped and downloaded via browser File downloads are not supported by iOS Screen capture capability
Display Modes	Normal: All modes and displays supported Fast: Spectrum traces update faster (up to 5 updates per second)
Password	The instrument can be password protected Passwords may be used to manage who is controlling the instrument
Users/Instruments	One user/device can view and control many instruments

Programmable Remote Control

Functionality	Many instrument functions are programmable. See the Programming Manual for details.
Programming Language	Standard Commands for Programmable Instruments (SCPI)
Interfaces	Ethernet, USB
Available Drivers	LabView. Visit NI.com for driver

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
S412E	500 kHz to 1.6 GHz Vector Network Analyzer 9 kHz to 1.6 GHz Spectrum Analyzer 10 MHz to 1.6 GHz Power Meter 500 kHz to 1.6 GHz CW Signal Generator 10 MHz to 1.6 GHz NBFM Analyzer
	Options
S412E-0010	High Voltage Variable Bias Tee
S412E-0031	GPS Receiver (requires suitable GPS antenna)
S412E-0019	High-Accuracy Power Meter (Requires External Power Sensor)
S412E-0025	Interference Analyzer (Option 31 recommended)
S412E-0027	Channel Scanner
S412E-0006	6 GHz Coverage on Spectrum Analyzer
S412E-0016	6 GHz Coverage on Vector Network Analyzer
S412E-0015	Vector Voltmeter
S412E-0431	Coverage Mapping (Requires Option 31)
S412E-0444	EMF Measurements (Requires Anritsu Isotropic Antenna)
S412E-0509	AM/FM/PM Analyzer
S412E-0521	P25/P25p2 Analyzer Measurements
S412E-0522	P25/P25p2 Coverage Measurements (Requires Options 31 and 521)
S412E-0531	NXDN Analyzer Measurements
S412E-0532	NXDN Coverage Measurements (Requires Options 31 and 531)
S412E-0573	dPMR RF Analyzer Measurements
S412E-0572	dPMR Coverage Measurements (Requires Options 31 and 573)
S412E-0581	TETRA Analyzer Measurements
S412E-0582	TETRA Coverage Measurements (Requires Options 31 and 581)
S412E-0591	DMR (MOTOTRBO) Analyzer Measurements
S412E-0592	DMR (MOTOTRBO) Coverage Measurements (Requires Options 31 and 591)
S412E-0731	PTC-ACSES Analyzer (Requires Options 31)
S412E-0733	PTC-ACSES Talk-Out Coverage (Requires Options 31 and 731)
S412E-0721	PTC-ICTR Analyzer
S412E-0722	PTC-ICTR Coverage Measurements (Requires Options 31 and 721)
S412E-0541	LTE RF Measurements
S412E-0542	LTE Modulation Quality
S412E-0551	TDD LTE RF Measurements (Requires Option 541)
S412E-0552	TDD LTE Modulation Quality (Requires Option 542)
S412E-0556	TDD LTE Over-the-Air Measurements (Requires Options 31 and 546)
S412E-0886	LTE 256QAM Demodulation (Requires Option 542 or 552)
S412E-0546	LTE Over-the-Air Measurements (Requires Option 31)
S412E-0046	IEEE 802.16 Fixed WiMAX RF Measurements (Requires Option 6)

Model/Order No.	Name
S412E-0880	GSM/GPRS/EDGE Measurements
S412E-0047	IEEE 802.16 Fixed WiMAX Demodulation (Requires Option 6)
S412E-0066	IEEE 802.16 Mobile WiMAX RF Measurements (Requires Option 6)
S412E-0067	IEEE 802.16 Mobile WiMAX Demodulation (Requires Option 6)
S412E-0037	IEEE 802.16 Mobile WiMAX Over-the-Air Measurements (Requires Option 6, Option 31 required for full functionality)
S412E-0098	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate.
S412E-0099	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate, test report, and uncertainty data.
	Standard Accessories (Included with instrument)
2000-1691-R	Stylus with Coiled Tether
2000-1797-R	Screen Protector Film, 8.4 inch (2, one installed)
2000-1654-R	Soft Carrying Case
633-75	Rechargeable 7500 mAh Li-Ion Battery
40-187-R	AC-DC Adapter
806-141-R	Automotive Power Adapter, 12 VDC, 60 W
3-2000-1498	USB A - 5-PIN Mini-B Cable, 3 meters (10 ft)
	Standard Three Year Warranty (one year on battery) Certificate of Conformance
	Manuals, Related Literature (Soft copy at www.anritsu.com)
10100-00065	Product Information, Compliance, and Safety
10580-00318	LMR Master User Guide
10580-00289	Vector Network Analyzer Measurement Guide
10580-00243	Land Mobile Radio Measurement Guide
10580-00241	Cable and Antenna Analyzer Measurement Guide
10580-00349	Spectrum Analyzer Measurement Guide
10580-00240	Power Meter Measurement Guide - High Accuracy Power Meter
10580-00234	3GPP Signal Analyzer Measurement Guide - GSM/EDGE, W-CDMA/HSDPA, TD-SCDMA/HSDPA, LTE
10580-00236	WiMAX Signal Analyzer Measurement Guide - Fixed WiMAX, Mobile WiMAX
10580-00319	Programming Manual
10580-00455	EMF Measurement Guide
	Troubleshooting Guides (Soft copy at www.anritsu.com)
11410-00551	Spectrum Analyzers
11410-00472	Interference
11410-00566	LTE eNode Testing
11410-00466	GSM/GPRS/EDGE Base Stations
11410-00473	Cable, Antenna, and Component Troubleshooting Guide
11410-00427	Understanding Cable & Antenna Analysis White Paper

Continued on next page

Model/Order No.	Name
	Optional Accessories
	USB Power Sensors
	(For complete ordering information see the respective datasheets of each sensor)
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +3 to +51.76 dBm
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 to –40 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 to –40 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 to –40 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 to –40 dBm
MA24208A	Microwave Universal USB Power Sensor, 10 MHz to 8 GHz, +20 to –60 dBm
MA24218A	Microwave Universal USB Power Sensor, 10 MHz to 18 GHz, +20 to –60 dBm
MA24330A	Microwave CW USB Power Sensor, 10 MHz to 33 GHz, +20 dBm
MA24340A	Microwave CW USB Power Sensor, 10 MHz to 40 GHz, +20 dBm
MA24350A	Microwave CW USB Power Sensor, 10 MHz to 50 GHz, +20 dBm
MA25100A	RF Power Indicator
	NEON® Signal Mapper MA8100A Accessories
MA8100A-001	NEON Signal Mapper with Anritsu Integration and Tracking Unit (2000-1852-R). Includes 1 year NEON Software License with 1 year of maintenance and support and 1 year of Cloud Service
MA8100A-003	NEON Signal Mapper with Anritsu Integration and Tracking Unit (2000-1852-R). Includes 3 year NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service
MA8100A-005	NEON Signal Mapper with Anritsu Integration and Tracking Unit (2000-1852-R). Includes 5 year NEON Software License with 5 years of maintenance and support and 5 years of Cloud Service.
MA8100A-100	NEON Signal Mapper with Anritsu Integration and Tracking Unit (Includes Perpetual TRX NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service)
2300-606	Perpetual NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service
2300-612	Renewal of 1 year NEON Software License with 1 year of maintenance and support and 1 year of Cloud Service
2300-613	Renewal of 3 years NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service
2300-614	Renewal of 5 years NEON Software License with 5 years of maintenance and support and 5 years of Cloud Service
2000-1852-R	NEON Tracking Unit (World Wide)
2000-2015-R	NEON Tracking Unit (Japan Version)
	Full Temperature N-Type Coaxial Calibration Kits
	–10°C to +55°C
	(see individual data sheets on www.anritsu.com)
OSLN50A-8	High Performance Type N (m), DC to 8 GHz, 50Ω
OSLNF50A-8	High Performance Type N (f), DC to 8 GHz, 50Ω
TOSLN50A-8	High Performance with Through, Type N (m), DC to 8 GHz, 50Ω
TOSLNF50A-8	High Performance with Through, Type N (f), DC to 8 GHz, 50Ω
	Coaxial Calibration Components, Other 50Ω, 75Ω
22N50	Precision N (m) Short/Open, 18 GHz
22NF50	Precision N (f) Short/Open, 18 GHz
28N50-2	Precision Termination, DC to 18 GHz, 50Ω, N (m)
28NF50-2	Precision Termination, DC to 18 GHz, 50Ω, N (f)
SM/PL-1	Precision N (m) Load, 42 dB, 6 GHz
SM/PLNF-1	Precision N (f) Load, 42 dB, 6 GHz
2000-1914-R	Precision Open/Short/Load, 4.3-10 (f), DC to 6 GHz, 50Ω
2000-1915-R	Precision Open/Short/Load, 4.3-10 (m), DC to 6 GHz, 50Ω
2000-1618-R	Open/Short/Load, 7/16 DIN (m), DC to 6 GHz 50Ω
2000-1619-R	Open/Short/Load, 7/16 DIN (f), DC to 6 GHz 50Ω
12N50-75B	Matching Pad, DC to 3 GHz, 50Ω to 75Ω
22N75	Open/Short, N (m), DC to 3 GHz, 75Ω
22NF75	Open/Short, N (f), DC to 3 GHz, 75Ω
26N75A	Precision Termination, N (m), DC to 3 GHz, 75Ω
26NF75A	Precision Termination, N (f), DC to 3 GHz, 75Ω
1091-55-R	Open, TNC (f), DC to 18 GHz
1091-53-R	Open, TNC (m), DC to 18 GHz
1091-56-R	Short, TNC (f), DC to 18 GHz
1091-54-R	Short, TNC (m), DC to 18 GHz
1015-54-R	Termination, TNC (f), DC to 18 GHz
1015-55-R	Termination, TNC (m), DC to 18 GHz

Model/Order No.	Name
	Directional Antennas
2000-1411-R	824 MHz to 896 MHz, N (f), 12.3 dBi, Yagi
2000-1412-R	885 MHz to 975 MHz, N (f), 12.6 dBi, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N (f), 12.3 dBi, Yagi
2000-1414-R	1850 MHz to 1990 MHz, N (f), 11.4 dBi, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N (f), 14.1 dBi, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N (f), 14.3 dBi, Yagi
2000-1659-R	698 MHz to 787 MHz, N (f), 10.1 dBi, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N (f), 14.3 dBi, Yagi
2000-1715-R	Directional Antenna, 698 MHz to 2500 MHz, N (f), gain of 2 to 10 dBi, typical
2000-1726-R	Antenna, 2500 MHz to 2700 MHz, N (f), 14.1 dBi, Yagi
2000-1747-R	Antenna, Log Periodic, 300 MHz to 7000 MHz, N (f), 5.1 dBi, typical
2000-1748-R	Antenna, Log Periodic, 1 GHz to 18 GHz, N (f), 6 dBi, typical
2000-1777-R	Portable Directional Antenna, 9 kHz to 20 MHz, N (f)
2000-1778-R	Portable Directional Antenna, 20 MHz to 200 MHz, N (f)
2000-1779-R	Portable Directional Antenna, 200 MHz to 500 MHz, N (f)
2000-1812-R	Portable Yagi Antenna, 450 MHz to 512 MHz, N (f), 7.1 dBi
2000-1825-R	Portable Yagi Antenna, 380 MHz to 430 MHz, N (f), 7.1 dBi
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA (m), 50Ω*1
2000-1473-R	870 MHz to 960 MHz, SMA (m), 50Ω*1
2000-1035-R	896 MHz to 941 MHz, SMA (m), 50Ω (1/2 wave)*1
2000-1030-R	1710 MHz to 1880 MHz, SMA (m), 50Ω (1/2 wave)*1
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)*1
2000-1031-R	1850 MHz to 1990 MHz, SMA (m), 50Ω (1/2 wave)*1
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA (m), 50Ω*1
2000-1032-R	2400 MHz to 2500 MHz, SMA (m), 50Ω (1/2 wave)*1
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA (m), 50Ω*1
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R,and carrying pouch)
2000-1616	20 MHz to 21000 MHz, N (f), 50Ω
2000-1487-R	Telescoping Whip Antenna, BNC*2
	GPS Antennas (Active)
2000-1652-R	Magnet Mount, SMA (m), 3 VDC to 5 VDC with 1 ft cable
2000-1528-R	Magnet Mount, SMA (m) with 5 m (16.4 ft) cable, requires 5 VDC
2000-1760-R	Mini GPS Antenna, SMA (m), 25 dB gain, 2.5 VDC to 3.7 VDC
2000-1946-R	Mag Mount Broadband Antenna Cable 1: 617 MHz to 960 MHz, 3 dBi peak gain, 1710 MHz to 3700 MHz, 4 dBi peak gain, N (m), 50Ω, 10 ft Cable 2: 3000 MHz to 6000 MHz, 5 dBi peak gain, N (m), 50Ω, 10 ft Cable 3: GPS 26 dB gain, SMA (m), 50Ω, 10 ft
	Filters
1030-114-R	806 MHz to 869 MHz, N (m) to SMA (f), 50Ω
1030-109-R	824 MHz to 849 MHz, N (m) to SMA (f), 50Ω
1030-110-R	880 MHz to 915 MHz, N (m) to SMA (f), 50Ω
1030-105-R	890 MHz to 915 MHz, N (m) to N (f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N (m) to SMA (f), 50Ω
1030-106-R	1710 MHz to 1790 MHz, N (m) to N (f), 50Ω
1030-107-R	1910 MHz to 1990 MHz, N (m) to N (f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N (m) to SMA (f), 50Ω
1030-149-R	High Pass, 150 MHz, N (m) to N (f), 50Ω
1030-150-R	High Pass, 400 MHz, N (m) to N (f), 50Ω
1030-151-R	High Pass, 700 MHz, N (m) to N (f), 50Ω
1030-152-R	Low Pass, 200 MHz, N (m) to N (f), 50Ω
1030-153-R	Low Pass, 550 MHz, N (m) to N (f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N (m) to N (f), 50Ω
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N (m) to N (f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N (m) to N (f)
42N50A-30	30 dB, 50 W, DC to 18 GHz, N (m) to N (f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N (m) to N (f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N (m) to N (f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N (m) to N (f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N (m) to N (f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N (m) to N (f)

Continued on next page

Model/Order No.	Name
	Phase-Stable Test Port Cables, Armored
15NNF50-1.5C	1.5 m, DC to 6 GHz, N (m) to N (f), 50Ω
15NN50-1.5C	1.5 m, DC to 6 GHz, N (m) to N (m), 50Ω
15NDF50-1.5C	1.5 m, DC to 6 GHz, N (m) to 7/16 DIN (f), 50Ω
15ND50-1.5C	1.5 m, DC to 6 GHz, N (m) to 7/16 DIN (m), 50Ω
15NNF50-3.0C	3.0 m, DC to 6 GHz, N (m) to N (f), 50Ω
15NN50-3.0C	3.0 m, DC to 6 GHz, N (m) to N (m), 50Ω
15NNF50-5.0C	5.0 m, DC to 6 GHz, N (m) to N (f), 50Ω
15NN50-5.0C	5.0 m, DC to 6 GHz, N (m) to N (m), 50Ω
15N43M50-1.5C	Test Port Extension Cable, 1.5 m, DC to 6 GHz, N (m) to 4.3-10 (m)
15N43F50-1.5C	Test Port Extension Cable, 1.5 m, DC to 6 GHz, N (m) to 4.3-10 (f)
15N43M50-3.0C	Test Port Extension Cable, 3 m, DC to 6 GHz, N (m) to 4.3-10 (m)
15N43F50-3.0C	Test Port Extension Cable, 3 m, DC to 6 GHz, N (m) to 4.3-10 (f)
15NF43M50-1.5C	Test Port Extension Cable, 1.5 m, DC to 6 GHz, N (f) to 4.3-10 (m)
15NF43F50-1.5C	Test Port Extension Cable, 1.5 m, DC to 6 GHz, N (f) to 4.3-10 (f)
15NF43M50-3.0C	Test Port Extension Cable, 3 m, DC to 6 GHz, N (f) to 4.3-10 (m)
15NF43F50-3.0C	Test Port Extension Cable, 3 m, DC to 6 GHz, N (f) to 4.3-10 (f)
	Adapters
1091-26-R	SMA (m) to N (m), DC to 18 GHz, 50Ω
1091-27-R	SMA (f) to N (m), DC to 18 GHz, 50Ω
1091-80-R	SMA (m) to N (f), DC to 18 GHz, 50Ω
1091-81-R	SMA (f) to N (f), DC to 18 GHz, 50Ω
1091-465-R	4.3-10 (f) to N (f), DC to 6 GHz, 50Ω
1091-467-R	4.3-10 (m) to N (f), DC to 6 GHz, 50Ω
1091-172	BNC (f) to N (m), DC to 1.3 GHz, 50Ω
510-90-R	7/16 DIN (f) to N (m), DC to 7.5 GHz, 50Ω
510-91-R	7/16 DIN (f) to N (f), DC to 7.5 GHz, 50Ω
510-92-R	7/16 DIN (m) to N (m), DC to 7.5 GHz, 50Ω
510-93-R	7/16 DIN (m) to N (f), DC to 7.5 GHz, 50Ω
510-96-R	7/16 DIN (m) to 7/16 DIN (m), DC to 7.5 GHz, 50Ω
510-97-R	7/16 DIN (f) to 7/16 DIN (f), DC to 7.5 GHz, 50Ω
513-62-R	Adapter, DC to 18 GHz, TNC (f) to N (f), 50Ω
1091-315-R	Adapter, DC to 18 GHz, TNC (m) to N (f), 50Ω
1091-324-R	Adapter, DC to 18 GHz, TNC (f) to N (m), 50Ω
1091-325-R	Adapter, DC to 18 GHz, TNC (m) to N (m), 50Ω
1091-317-R	Adapter, DC to 18 GHz, TNC (m) to SMA (f), 50Ω
1091-318-R	Adapter, DC to 18 GHz, TNC (m) to SMA (m), 50Ω
1091-323-R	Adapter, DC to 18 GHz, TNC (m) to TNC (f), 50Ω
1091-326-R	Adapter, DC to 18 GHz, TNC (m) to TNC (m), 50Ω
510-102-R	N (m) to N (m), DC to 11 GHz, 50Ω, 90 degrees right angle
	Precision Adapters
34NN50A	Precision Adapter, N (m) to N (m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N (f) to N (f), DC to 18 GHz, 50Ω
	Backpack and Transit Case
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle 56 × 45.5 × 26.5 cm (22.07" × 17.92" × 10.42")
760-261-R	Large Transit Case with Wheels and Handle 63.1 × 50 × 30 cm (24.83" × 19.69" × 11.88"), space for MA2700A, antennas, filters, instrument inside soft case, and other interference hunting accessories/tools
760-262-R	Transit Case for MA2700A, several Yagi antennas and filters
760-271-R	Transit Case for Portable Directional Antennas and Port Extender 52.4 × 42.8 × 20.6 cm (20.62" × 16.87" × 8.12") (for 2000-1777-R, 2000-1778-R, 2000-1779-R, 2000-1798-R)
760-286-R	Compact Transit Case with Wheels and Handle 55.6 × 35.5 × 22.9 cm (21.89" × 13.98" × 9.01")

Model/Order No.	Name
	Miscellaneous Accessories
MA2700A	Handheld Interference Hunter (For full specifications, refer to the MA2700A Technical Data Sheet 11410-00692)
MA25200A	High Power Tx/Rx Input Protection Module
2000-1374	External Dual Charger for Li-Ion Batteries
2000-1797-R	Screen Protector Film, 8.4 inch
66864	Rack Mount Kit, Master Platform
2000-1689	EMI Near Field Probe Kit
	Interchangeable Adaptor Phase Stable Test Port Cables, Armored W/Reinforced Grip (recommended for cable and antenna line sweep applications. It uses the same ruggedized grip as the Reinforced grip series cables. Now you can also change the adaptor interface on the grip to four different connector types)
15RCN50-1.5-R	1.5 m, DC to 6 GHz, N (m), N (f), 7/16 DIN (m), 7/16 DIN (f), 50Ω
15RCN50-3.0-R	3.0 m, DC to 6 GHz, N (m), N (f), 7/16 DIN (m), 7/16 DIN (f), 50Ω

*1: Requires 1091-27-R SMA (f) to N (m) adapter

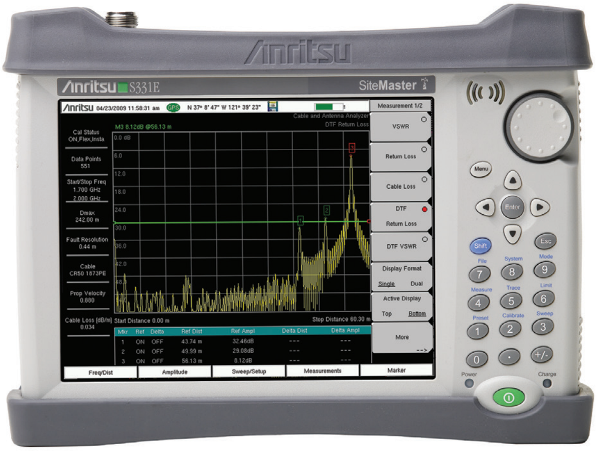
*2: Requires 1091-172-R BNC (f) to N (m) adapter

Site Master

S331E	**S332E**	**S361E**	**S362E**	
2 MHz to 4 GHz	2 MHz to 4 GHz	2 MHz to 6 GHz	2 MHz to 6 GHz	Cable & Antenna Analyzer
	9 kHz to 4 GHz		9 kHz to 6 GHz	Spectrum Analyzer

Remote Control
Ethernet OPTION | USB

Compact Handheld Cable & Antenna Analyzer with Spectrum Analyzer



The wireless communications market continues to evolve at a rapid pace. Operators and service providers have to maintain existing 2G and 3G networks while deploying 4G LTE networks. They face the additional challenge of needing to ensure their networks are competitive from a reliability, quality, and cost perspective. As a result, more is expected from the contractors and technicians who maintain their networks.

To stay competitive, these contractors and technicians must maintain more base stations than before and complete a wide variety of tasks in the shortest time possible.

Built on a trusted history of quality, expertise, and performance, the Site Master S331E/S332E/S361E/S362E compact cable and antenna analyzer series is the leading 2-port solution that provides coverage from 2 MHz to 4/6 GHz. This portable and rugged solution has a variety of configuration options that make it the preferred solution by contractors, installers, and wireless service providers. Because of the Site Master series multi-functional capabilities and options, it eliminates the need for you to carry and learn multiple instruments.

The Site Master reduces per site maintenance expense, maximizes system up-time, and breaks away from the traditional fix-after-failure maintenance mode by finding small problems before major failures occur. Radio frequency (RF) engineers and field technicians for installing and maintaining communication systems use Site Master's frequency domain reflectrometry (FDR)-based approach to improve the quality of their communication systems.

Integrated

The Site Master is a 4 GHz or 6 GHz cable and antenna analyzer that can be configured to include either a 4 GHz or 6 GHz spectrum analyzer, 2-port transmission measurement with built-in 32 V bias tee, an interference analyzer with spectrogram displays, a channel scanner, power meter, high accuracy power meter, and GPS receiver for time and location stamping. Because of its multi-functional capabilities, it eliminates the need for you to carry and learn multiple instruments.

Trusted

Anritsu builds upon its expertise in portable compact cable and antenna analyzers and spectrum analyzers. The Site Master is approved by all major operators and service providers worldwide.

Designed for Field Use

The Site Master was designed specifically for field environments.

It weighs less than 2.71 kg (6.0 lb, S331E, S361E), 3.71 kg (8.2 lb, S332E, S362E) and its field replaceable Li-Ion battery typically lasts for more than 4.5 hours (typ., S331E, S361E), 3.5 hours (typ., S332E, S362E). A new bright 8.4-inch color display provides visibility even in broad daylight. With an operating temperature range from –10°C to +55°C, the Site Master will work in the most extreme weather conditions. The analyzer is almost impervious to the bumps and bangs typically encountered by portable field equipment, and its ruggedized case and splash proof design allow you to depend on high performance anywhere, anytime.

Functions and Description

- Cable and Antenna Analyzer, 2 MHz to 4 GHz/6 GHz
- Measurements: RL, VSWR, Cable Loss, DTF, Phase
- 2-port Transmission Measurement: High/Low Power
- Sweep Speed: 1 ms/data point, typical
- Display: Single or Dual Measurement Touchscreen
- Calibration: OSL, InstaCal™, and FlexCal™
- Bias Tee: 32 V internal
- Spectrum Analyzer, 9 kHz to 4 GHz/6 GHz
- Measurements: Occupied Bandwidth, Channel Power, ACPR, C/I
- Interference Analyzer: Spectrogram, Signal Strength, RSSI, Signal ID, Interference Mapping
- Dynamic Range: >95 dB in 10 Hz RBW
- DANL: –152 dBm in 10 Hz RBW
- Phase Noise: –100 dBc/Hz max @ 10 kHz offset at 1 GHz
- Frequency Accuracy: <±50 ppb with GPS On

Capabilities and Functional Highlights

- AM/FM/PM Analyzer
- EMF Test (S332E & S362E)
- High Accuracy Power Meter
- Up to 50 GHz USB Sensors
- PIM Alert Application (S332E & S362E)
- Master Software Tools™
- Line Sweep Tools™
- easyTest Tools™
- USB & Optional Ethernet (Option 413) for data transfer and instrument control
- PIM Hunting
- Handheld Interference Hunter support (S332E & S362E)
- On-Screen Interference Mapping
- On-Screen Coverage Mapping
- GPS tagging of saved traces
- Increase throughput by automating repetitive or operator intensive tasks via Ethernet or USB. Remote programming provided via Ethernet (Option 413)
- 4.5 hour battery operation time
- Store 2000 Traces internally
- Touchscreen keyboard
- Quick Name Matrix
- <5 minute warm-up time
- E-Learning Training
- Certified Line Sweep Training

Specifications

Cable and Antenna Analyzer

Frequency	Frequency Range	2 MHz to 4 GHz (S331E, S332E), 2 MHz to 6 GHz (S361E, S362E)
	Frequency Accuracy	≤±2.5 ppm @ 25°C
	Frequency Resolution	1 kHz (RF immunity low), 100 kHz (RF immunity high)
Output Power	High	0 dBm (typ.)
	Low	2 MHz to 1.5 GHz: –40 dBm, typical >1.5 GHz to 4/6 GHz: –30 dBm, typical
Interference Immunity	On-Channel	+17 dBm @ >1.0 MHz from carrier frequency
	On-Frequency	0 dBm within ±10 kHz of the carrier frequency
Measurement Speed	Return Loss	≤1.00 msec/data point, RF immunity low (typ.)
	Distance-to-Fault	≤1.25 msec/data point, RF immunity low (typ.)
Return Loss	Measurement Range	0 to 60 dB
	Resolution	0.01 dB
VSWR	Measurement Range	1:1 to 65:1
	Resolution	0.01
Cable Loss	Measurement Range	0 to 30 dB
	Resolution	0.01 dB
Distance-to-Fault	Vertical Range Return Loss	0 to 60 dB
	Vertical Range VSWR	1:1 to 65:1
	Fault Resolution (meters)	(1.5 × 10^8 × vp)/ΔF (vp = velocity propagation constant, ΔF is F2 – F1 in Hz)
	Horizontal Range (meters)	0 to (Data Points – 1) × Fault Resolution, to a maximum of 1500 meters (4921 ft)
1-Port Phase	Measurement Range	–180° to +180°
	Resolution	0.01°
Smith Chart	Resolution	0.01 50/75Ω Selectable
Measurement Accuracy	Corrected Directivity	>42 dB, OSL calibration>38 dB, InstaCal™ calibration >38 dB, InstaCal™ Calibration to a second line

Spectrum Analyzer (S332E, S362E)

Frequency	Frequency Range	9 kHz to 4 GHz (S332E), 9 kHz to 6 GHz (S362E) (usable to 0 Hz)
	Tuning Resolution	1 Hz
	Frequency Reference	Aging: ±1.0 ppm/year Accuracy: ±1.5 ppm (25°C±25°C) + aging, <±50 ppb with GPS On
	Frequency Span	10 Hz to 4 GHz including zero span (S332E), 10 Hz to 6 GHz including zero span (S362E)
	Sweep Time	Minimum 100 ms, 10 µs to 600 seconds in zero span
	Sweep Time Accuracy	±2% in zero span
Bandwidth	Resolution Bandwidth (RBW)	10 Hz to 3 MHz in 1–3 sequence ±10% (1 MHz max in zero-span) (–3 dB bandwidth)
	Video Bandwidth (VBW)	1 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth) (auto or manually selectable)
	RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (–6 dB bandwidth)
	VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1
Spectral Purity	SSB Phase Noise @ 1 GHz	–100 dBc/Hz, –110 dBc/Hz (typ.) @ 10 kHz offset –105 dBc/Hz, –112 dBc/Hz (typ.) @ 100 kHz offset –115 dBc/Hz, –121 dBc/Hz (typ.) @ 1 MHz offset
Amplitude Ranges	Dynamic Range	>95 dB (2.4 GHz), 2/3 (TOI-DANL) in 10 Hz RBW
	Measurement Range	DANL to +26 dBm (≥50 MHz), DANL to 0 dBm (<50 MHz)
	Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed
	Reference Level Range	–150 to +30 dBm
	Attenuator Range	0 to 55 dB, 5.0 dB steps
	Maximum Continuous Input	+30 dBm
	Amplitude Units	Log Scale Modes: dBm, dBV, dBmV, dBmV, dBW, dBmW, dBmW, dBA Linear Scale Modes: nV, mV, mV, V, kV, nW, mW, mW, W, kW, nA, mA, mA, A
Amplitude Accuracy	9 kHz to 100 kHz	±2.0 dB (typ.) (Preamp Off)
	100 kHz to 4.0 GHz	±1.25 dB, ±0.5 dB (typ.)
	>4.0 GHz to 6 GHz	±1.50 dB, ±0.5 dB (typ.)

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		Preamp Off (Reference level –20 dBm)		Preamp On (Reference level –50 dBm)	
		Maximum	Typical	Maximum	Typical
Displayed Average Noise Level (DANL)	(RBW Normalized to 1 Hz, 0 dB attenuation)				
	10 MHz to 2.4 GHz	–141 dBm	–146 dBm	–157 dBm	–162 dBm
	>2.4 GHz to 4 GHz	–137 dBm	–141 dBm	–154 dBm	–159 dBm
	>4 GHz to 5 GHz	–134 dBm	–138 dBm	–150 dBm	–155 dBm
	>5 GHz to 6 GHz	–126 dBm	–131 dBm	–143 dBm	–150 dBm
	(RBW = 10 Hz, 0 dB attenuation)				
	10 MHz to 2.4 GHz	–131 dBm	–136 dBm	–147 dBm	–152 dBm
	>2.4 GHz to 4 GHz	–127 dBm	–131 dBm	–144 dBm	–149 dBm
	>4 GHz to 5 GHz	–124 dBm	–128 dBm	–140 dBm	–145 dBm
	>5 GHz to 6 GHz	–116 dBm	–121 dBm	–133 dBm	–140 dBm
Spurs	Residual Spurious	<–90 dBm (RF input terminated, 0 dB input attenuation, >10 MHz)			
	Input-Related Spurious	<–75 dBc (0 dB attenuation, –30 dBm input, span <1.7 GHz, carrier offset >4.5 MHz)			
	Exceptions (typ.)	<–70 dBc @ <2.5 GHz, with 2072.5 MHz Input <–68 dBc @ F1 – 280 MHz with F1 Input <–70 dBc @ F1 + 190.5 MHz with F1 Input <–52 dBc @ 7349 – 2F2 MHz, with F2 Input, where F2 <2437.5 MHz <–55 dBc @ 190.5 ± F1/F2 MHz, F1 <1 GHz			
Third-Order Intercept (TOI)	Preamp Off (–20 dBm tones 100 kHz apart, 10 dB attenuation)				
	800 MHz	+16 dBm			
	2400 MHz	+20 dBm			
	200 MHz to 2200 MHz	+25 dBm (typ.)			
	>2.2 GHz to 5.0 GHz	+28 dBm (typ.)			
	>5.0 GHz to 6.0 GHz	+33 dBm (typ.)			
Second Harmonic Distortion	Preamp Off, 0 dB input attenuation, –30 dBm input				
	50 MHz	–56 dBc			
	>50 MHz to 200 MHz	–60 dBc (typ.)			
	>200 MHz to 3000 MHz	–70 dBc (typ.)			
VSWR		2:1 (typ.)			

Ethernet Connectivity (Option 413)

Connector	RJ45
LAN Speed	10 Mbps
Mode	Static, DHCP
Static IP Settings	IP address Subnet Mask IP Gateway
Remote Control	Remote Access utility provided with Web Remote Control and SCPI programming
Data Upload	With Line Sweep Tools through Ethernet connection

2-Port Transmission Measurement (Option 21)

Frequency	Frequency Range	2 MHz to 4 GHz (S331E, S332E), 2 MHz to 6 GHz (S361E, S362E)
	Frequency Resolution	10 Hz
Output Power	High	0 dBm (typ.)
	Low	2 MHz to 1.5 GHz: –40 dBm, typical >1.5 GHz to 4/6 GHz: –30 dBm, typical
Dynamic Range	2 MHz to 4 GHz	80 dB, 95 dB (typ.)
	>4 GHz to 6 GHz	70 dB, 85 dB (typ.)
Application Options		Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

Bias-Tee (Option 10) (Requires Option 21 for S331E and S361E)

Setup	On/Off, Voltage, Current (Low/High)
Voltage Range	+12 V to +32 V
Current (Low/High)	250 mA/450 mA, 1 A surge for 100 ms
Resolution	0.1 V

GPS Receiver (Option 31) (Antenna sold separately)

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
GPS Time/Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
High Frequency Accuracy	Spectrum Analyzer, Interference Analyzer, CW Signal Analyzers <±50 ppb with GPS On, GPS antenna connected, 3 minutes after satellite lock in selected mode
Connector	SMA (f)

Power Meter (Option 29) (S332E, S362E)

Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #, Full Band
Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale
Average	Acquisition Fast/Med/Slow, # of Running Averages
Limits	Limit On/Off, Limit Upper/Lower
Frequency Range	10 MHz to 4 GHz (S332E), 10 MHz to 6 GHz (S362E)
Span	1 kHz to 100 MHz
Display Range	–140 to +30 dBm, ≤40 dB span
Measurement Range	–120 to +26 dBm
Offset Range	0 to +100 dB (External Gain or Loss)
VSWR	2:1 (typ.)
Maximum Continuous Input Power	+30 dBm without attenuator
Accuracy	Same as Spectrum Analyzer
Application Options	Impedance (50Ω, 75Ω, Other)

High Accuracy Power Meter (Option 19) (Requires external USB Power Sensor(s)

Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale				
Average	# of Running Averages, Max Hold				
Zero/Cal	Zero On/Off, Cal Factor (Center Frequency, Signal Standard)				
Limits	Limit On/Off, Limit Upper/Lower				
Power Sensor Model	MA24105A	MA24106A	MA24108A/18A/26A	MA24208A/18A	MA24330A/40A/50A
Description	Inline High Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor	Microwave Universal USB Power Sensor	Microwave CW USB Power Sensor
Frequency Range	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8/18/26 GHz	10 MHz to 8 GHz/18 GHz	10 MHz to 33/40/50 GHz
Connector	Type N (f), 50Ω	Type N (m), 50Ω	Type N (m), 50Ω (8 GHz/18 GHz) Type K (m), 50Ω (26 GHz)	Type N (m), 50Ω	Type K (m), 50Ω (33 GHz/40 GHz) Type V (m), 50Ω (50 GHz)
Dynamic Range	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 µW to 200 mW)	–40 to +20 dBm (0.1 µW to 100 mW)	–60 to +20 dBm (1 nW to 100 mW)	–70 to +20 dBm (0.1 nW to 100 mW)
Measurand	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power	True-RMS, Slot Power, Burst Average Power	Average Power
Measurement Uncertainty	± 0.17 dB*1	± 0.16 dB*2	± 0.18 dB*3	± 0.17 dB*4	± 0.17 dB*5
Data sheet (for complete specifications)	11410-00621	11410-00424	11410-00504	11410-00841	11410-00906

*1: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.

*2: Total RSS measurement uncertainty (0°C to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.

*3: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.

*4: Power uncertainty expressed with two sigma confidence level for CW measurement after zero operation. Includes calibration factor and linearity over temperature uncertainties, but not the effects of mismatch, zero set and drift, or noise.

*5: Includes linearity over temperature uncertainties, but not the effects of calibration factor, mismatch, zero set and drift, and noise.

Interference Analyzer (Option 25) (S332E, S362E)

Measurements	Spectrum	Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only) Carrier-to-Interference ratio (C/I)
	Spectrogram	Collect data up to 72 hours
	Signal Strength	Gives visual and aural indication of signal strength
	Received Signal Strength Indicator (RSSI)	Collect data up to one week Gives visual and aural indication of signal strength
	Signal ID (up to 12 signals)	Center Frequency Bandwidth Signal Type (FM, GSM, W-CDMA, CDMA, Wi-Fi) Closest Channel Number Number of Carriers
	Signal-to-Nose Ratio (SNR)	>10 dB
	Interference Mapping	Triangulate location of interference with on display maps
	Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other) Support for MA2700A Handheld Interference Hunter

AM/FM/PM Signal Analyzers (Option 509) (S332E, S362E only)

Measurements	RF Spectrum (AM/FM/PM)	Audio Spectrum (AM)	Audio Spectrum (FM/PM)	Audio Waveform (AM)	Audio Waveform (FM/PM)	Summary (AM)	Summary (FM/PM)
Display Type Graphic Display	Power (dBm) vs. Frequency	Depth (%) vs. Modulation Frequency	Deviation (kHz/rad) vs. Modulation Frequency	Depth (%) vs. Time	Deviation (kHz/rad) vs. Time	—	—
Numerical Displays	Carrier Power Carrier Frequency Occupied Bandwidth	AM Rate RMS Depth (Pk-PK)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Deviation (Pk-PK)/2 Deviation SINAD* THD* Distortion/Total Vrms*	AM Rate RMS Depth (Pk-PK)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Depth (Pk-PK)/2 Depth SINAD* THD* Distortion/Total Vrms*	RMS Depth (AM) Peak + Depth Peak – Depth (Pk-PK)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*	RMS Deviation (FM/PM) Peak + Depth Peak – Depth (Pk-PK)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*
Setup Parameters	Frequency	Center Freq, Span, Freq Step, Signal Standard, Channel, Channel Increment, Set Carrier Freq					
	Amplitude	Scale, Power Offset, Adjust Range					
	Setup	Demod Type (AM, FM, PM), IFBW, Auto IFBW					
	Measurements	RF Spectrum AM/FM/PM, Audio Spectrum (AM/FM/PM), Audio Waveform (AM/FM/PM), Summary (AM/FM/PM), Average					
	Marker	On/Off, Delta, Peak Search, Marker Freq to Center, Marker to Ref Lvl, Marker Table, All Markers Off					
Specifications	AM	Modulation Rate: ±1 Hz (<100 Hz), ±2% (>100 Hz) Depth: ±5% for (Modulation rates 10 Hz to 100 kHz)					
	FM	Modulation Rate: ±1 Hz (<100 Hz); ±2% (100 Hz to 100 kHz) Deviation Accuracy: ±5%					
	PM	Modulation Rate: ±1 Hz (<100 Hz); ±2% (100 Hz to 100 kHz) Deviation Accuracy: ±5% (deviation 0 to 93 Rad, rate 10 Hz to 5 kHz, IFBW must be greater than 95% occupied BW)					
	IF Bandwidth	1 kHz to 300 kHz in 1-3 sequence					
	Frequency Span	RF Spectrum: 10 kHz to 10 MHz Audio Spectrum: 2, 5, 10, 20, 70, 140 kHz					
	RBW/VBW	30					
	Span/RBW	100					
	Sweep Time	50 µs to 50 ms (Audio Waveform)					

*: Requires Sinewave modulation

Channel Scanner (Option 27) (S332E, S362E only)

Number of Channels	1 to 20 Channels
Measurements	Graph/Table, Max Hold (On/5 sec/Off), Freq/Channel, Current/Max, Single/Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Customer List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
Frequency Range	9 kHz to 4 GHz (S332E), 9 kHz to 6 GHz (S362E)
Frequency Accuracy	±10 Hz + Time base error
Measurement Range	–110 to +26 dBm
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

CW Signal Generator (Option 28) (S332E, S362E only; requires CW Signal Generator Kit, P/N 69793)

Setup Parameters	Frequency	Frequency, Signal Standard, Channel Number, Display Setup Help
	Amplitude	Power Level (Low/High), Offset (dB)
	Frequency Range	2 MHz to 2 GHz
	Frequency Reference Accuracy	±1.5 ppm (25°C±25°C) + aging, <±50 ppb with GPS On
	Output Power	High 0 dBm (typ.), Low –30 dBm (typ.) Attenuator (included in kit 69793): 0 to 90 dB in 1 dB steps

Gated Sweep (Option 90) (S332E, S362E only)

Mode	Spectrum Analyzer, Sweep
Trigger	External TTL
Setup	Gated Sweep (On/Off) Gate Polarity (Rising, Falling) Gate Delay (0 to 65 ms) (typ.) Gate Length (1 µs to 65 ms) (typ.) Zero Span Time

Electromagnetic Field Test (Option 444) (S332E, S362E only)

Measurements	Setup	Limit lines, axis dwell time, measurement time, auto-logging, measurement units, trace display
	Spectrum Analyzer	Field strength is measured
	Units	dBm/m^2, dBV/m, dBmV/m, dBuV/m, V/m, W/m^2, dBW/m^2, A/m, dBA/m, W/cm^2
	Results	Maximum, minimum, and average of all measurements conducted
	Display	Measurement status, number of measurements taken, pass/fail indicators
Frequency Range	Supported Antenna	2000-1800-R: 9 kHz to 300 MHz 2000-1792-R: 30 MHz to 3 GHz 2000-1791-R: 700 MHz to 6 GHz
Modes where EMF Measurements Available		Spectrum Analyzer

Coverage Mapping (Option 431) (S332E, S362E only) (Requires Option 31 GPS)

Measurements	Indoor Mapping	RSSI, ACPR
	Outdoor Mapping	RSSI, ACPR
Setup Parameters	Frequency	Center/Start/Stop, Span, Freq Step, Signal Standard, Channel #, Channel Increment
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
	BW	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/VBW
	Measurement Setup	ACPR, RSSI
	Point Distance/Time Setup	Repeat Type Time Distance
	Save Points Map	Save KML, JPEG, Tab Delimited
	Recall Points Map	Recall Map, Recall KML Points only, Recall KML Points with Map, Recall Default Grid

General Specifications

All specifications and characteristics apply under the following conditions, unless otherwise stated: 1) After 5 minutes of warm-up time, where the instrument is left in the ON state; 2) All specifications apply when using internal reference; 3) All specifications subject to change without notice; 4) Typical performance is the measured performance of an average unit, and is not warranted; 5) Recommended calibration cycle is 12 months. Performance Sweep Mode.

Setup Parameters	System	Status (Temperature, Battery Info, Serial Number, Firmware Version, Options Installed) Self Test, Application Self Test GPS (see Option 31)
	System Options	Name, Date and Time, Brightness, Volume Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, Russian, User defined) Reset (Factory Defaults, Master Reset, Update Firmware)
	Internal Trace/Setup Memory	2,000 traces, 2,000 Setups
	External Trace/Setup Memory	Limited by size of USB Flash drive
	Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode
Connectors	RF Out	Type N (f), 50Ω (Reflection In)
	RF Out Damage Level	+42 dBm, ± 50 VDC
	RF In	Type N (f), 50Ω
	RF In Damage Level	+30 dBm peak, ±50 VDC, Maximum Continuous Input (≥10 dB attenuation)
	GPS	SMA (f)
	External Power	5.5 mm barrel connector, 12.5 to 15 VDC, <4.0 Amps
	USB Interface (2)	Type A, Connect USB Flash Drive and Power Sensor
	USB Interface	5-pin mini-B, Connect to PC for data transfer
	Ethernet Interface	RJ45 connector for Ethernet 10BASE-T (Available with Option 413 Ethernet)
	Headset Jack	3.5 mm mini-phone plug
	External Reference In	BNC (f), 50Ω, Maximum Input +10 dBm 1, 5, 10, 13 MHz
	External Trigger/Clock Recovery	BNC (f), 50Ω, Maximum Input ±50 VDC
	RF over Fiber	SFP/SFP+ compatible socket (Available with Option 759)
Display	Type	Resistive Touchscreen
	Size	8.4″ daylight viewable color LCD
	Resolution	800 × 600
	Pixel Defects	No more than five defective pixels (99.9989% good pixels)
Battery	Type	Li-Ion
	Battery Operation	4.5 hours (typ.) (S331E, S361E) 3.5 hours (typ.) (S332E, S362E)
Regulatory Compliance	CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: 2011/65/EU, (EU) 2015/863
	Australia and New Zealand	RCM AS/NZS 4417:2012
	South Korea	KCC-REM-A21-0004

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Environmental (MIL-PRF-28800F Class 2)	Operating Temperature Range	–10°C to +55°C
	Storage Temperature Range	–51°C to +71°C
	Maximum Relative Humidity	95% RH at +30°C, non-condensing
	Vibration, Sinusoidal	5 Hz to 55 Hz
	Vibration, Random	10 Hz to 500 Hz
	Half Sine Shock	30 gn
	Altitude	4600 meters, operating and non-operating
	Explosive Atmosphere	MIL-PRF-28800F, Section 4.5.6.3 MIL-STD-810G, Method 511.5, Procedure 1
ESD	RF Port Center Pin	Withstands up to ±15 kV
Dimensions and Mass	Dimensions	273 (W) × 199 (H) × 91 (D) mm (10.7 × 7.8 × 3.6 in)
	Mass	2.71 kg (6.0 lbs, S331E, S361E), 3.71 kg (8.2 lbs, S332E, S362E)

Line Sweep Tools (for your PC)

Trace Capture	Browse to Instrument	View and copy traces from the test equipment to your PC using Windows Explorer
	Open Legacy File	Open DAT files captured with Hand Held Software Tools v6.61
	Open Current File	Open VNA or DAT file
	Capture Plots to:	The Line Sweep Tools screen, DAT files, Database, or JPEG
Traces	Trace Types	Return Loss, VSWR, DTF-RL, DTF-VSWR, Cable Loss, Smith Chart, and PIM
	Trace Formats	DAT, VNA, CSV, PNG, BMP, JPG, HTML, Data Base, and PDF
Report Generation	Report Generator	Includes GPS location along with measurements
	Report Format	Create reports in HTML or PDF format
	Report Setup	Report Title, Company, Prepared for, Location, Date and Time, Filename, Company logo
	Trace Setup	1 trace Portrait Mode, 2 Trace Portrait Mode, 1 Trace Landscape Mode
Trace Validation	Presets	7 presets allow "one click" setting of up to 6 markers and one limit line
	Marker Controls	6 regular Markers, Marker Peak, Marker valley, Marker between, and frequency entry
	Delta Markers	6 Delta markers
	Limit Line	Enable and drag or value entry. Also works with presets
	Next Trace Button	Next Trace and Previous trace arrow keys allow quick switching between traces
Tools	Cable Editor	Allows creation of custom cable parameters
	Distance to Fault	Converts a Return Loss trace to a Distance to Fault trace
	Measurement Calculator	Converts Real, Imaginary, Magnitude, Phase, RL, VSWR, Rho, and Transmit power
	Signal Standard Editor	Creates new band and channel tables
	Renaming Grid	36 user definable phrases for creation of file names, trace titles, and trace subtitles
Connectivity	Connections	USB cable, USB Memory Stick

Master Software Tools (for your PC)

Mapping (GPS Required)	Spectrum Analyzer Mode	MapInfo, MapPoint
	Mobile WiMAX OTA, LTE OTA Options	Google Earth, Google Maps, MapInfo
Folder Spectrogram (Spectrum Monitoring for Interference Analysis and Spectrum Clearing)	Folder Spectrogram – 2D View	Creates a composite file of multiple traces Peak Power, Total Power, Peak Frequency, Histogram, Average Power (Max/Min) File Filter (Violations over limit lines or deviations from averages) Playback
	Video Folder Spectrogram – 2D View	Create AVI file to export for management review/reports
	Folder Spectrogram – 3D View	Views (Set Threshold, Markers) - 3D (Rotate X, Y, Z Axis, Level Scale, Signal ID) Playback (Frequency and/or Time Domain)
List/Parameter Editors	Traces	Add, delete, and modify limit lines and markers
	Product Updates	Auto-checks Anritsu website for latest revision firmware
	Pass/Fail	Create, download, or edit Signal Analysis Pass/Fail Limits
	Languages	Add up to two languages and modify non-English language menus
Connectivity	Connections	Connect to PC using USB or Ethernet (Ethernet requires Option 413)
	Remote Operation	Operate unit remotely with MST Remote Access Tool

easyTest Tools (for your PC)

Instrument Mode		Cable & Antenna Analyzer Mode
Commands	Display Image	Allows putting a custom image on the instrument screen
	Recall Setup	Places the instrument into a known state
	Prompt	Displays instructional messages on the instrument screen
	Save	Allows automatic or manual saving of traces
Connectivity	Connections	Ethernet, USB cable or USB memory stick (Ethernet requires Option 413)

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Site Masters
S331E	2 MHz to 4 GHz Cable and Antenna Analyzer
S332E	2 MHz to 4 GHz Cable and Antenna Analyzer 9 kHz to 4 GHz Spectrum Analyzer
S361E	2 MHz to 6 GHz Cable and Antenna Analyzer
S362E	2 MHz to 6 GHz Cable and Antenna Analyzer 9 kHz to 6 GHz Spectrum Analyzer
	S331E Site Master Options
S331E-0010	Bias-Tee (requires Option 21 for S331E/S361E)
S331E-0019	High-Accuracy Power Meter (Requires External Power Sensor)
S331E-0021	2-Port Transmission Measurement
S331E-0031	GPS Receiver (Requires Antenna)
S331E-0098	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate.
S331E-0099	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate, test report, and uncertainty data.
S331E-0413	Ethernet Connectivity
	S332E Site Master Options
S332E-0010	Bias-Tee (requires Option 21 for S331E/S361E)
S332E-0019	High-Accuracy Power Meter (Requires External Power Sensor)
S332E-0021	2-Port Transmission Measurement
S332E-0025	Interference Analyzer (recommend Option 31)
S332E-0027	Channel Scanner
S332E-0028	C/W Signal Generator (Requires CW Signal Generator Kit, P/N 69793)
S332E-0029	Power Meter
S332E-0031	GPS Receiver (Requires Antenna)
S332E-0090	Gated Sweep
S332E-0098	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate.
S332E-0099	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate, test report, and uncertainty data.
S332E-0413	Ethernet Connectivity
S332E-0431	Coverage Mapping (Requires Option 31)
S332E-0444	EMF Measurements (requires Anritsu Isotropic Antenna)
S332E-0509	AM/FM/PM Analyzer
	S361E Site Master Options
S361E-0010	S362E-0010 Bias-Tee (requires Option 21 for S331E/S361E)
S361E-0019	High-Accuracy Power Meter (Requires External Power Sensor)
S361E-0021	2-Port Transmission Measurement
S361E-0031	GPS Receiver (Requires Antenna)
S361E-0098	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate.
S361E-0099	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate, test report, and uncertainty data.
S361E-0413	Ethernet Connectivity
	S362E Site Master Options
S362E-0010	S362E-0010 Bias-Tee (requires Option 21 for S331E/S361E)
S362E-0019	High-Accuracy Power Meter (Requires External Power Sensor)
S362E-0021	2-Port Transmission Measurement
S362E-0025	Interference Analyzer (recommend Option 31)
S362E-0027	Channel Scanner
S362E-0028	C/W Signal Generator (Requires CW Signal Generator Kit, P/N 69793)
S362E-0031	GPS Receiver (Requires Antenna)
S362E-0090	Gated Sweep
S362E-0098	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate.
S362E-0099	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate, test report, and uncertainty data.
S362E-0413	Ethernet Connectivity
S362E-0431	Coverage Mapping (Requires Option 31)
S362E-0444	EMF Measurements (requires Anritsu Isotropic Antenna)
S362E-0509	AM/FM/PM Analyzer

Model/Order No.	Name
	Power Sensors (For complete ordering information see the respective datasheets of each sensor)
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +3 to +51.76 dBm
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm
MA24208A	Microwave Universal USB Power Sensor, 10 MHz to 8 GHz, +20 to –60 dBm
MA24218A	Microwave Universal USB Power Sensor, 10 MHz to 18 GHz, +20 to –60 dBm
MA24330A	Microwave CW USB Power Sensor, 10 MHz to 33 GHz, +20 dBm
MA24340A	Microwave CW USB Power Sensor, 10 MHz to 40 GHz, +20 dBm
MA24350A	Microwave CW USB Power Sensor, 10 MHz to 50 GHz, +20 dBm
MA25100A	RF Power Indicator
	Manuals (soft copy at www.us.anritsu.com, website should be www.anritsu.com)
10100-00065	Product Information, Compliance, and Safety
10580-00252	Site Master User Guide
10580-00241	Cable and Antenna Analyzer Measurement Guide
10580-00242	2-Port Transmission Measurement
10580-00349	Spectrum Analyzer Measurement Guide
10580-00240	Power Meter Measurement Guide - High Accuracy Power Meter
10580-00455	EMF Measurement Guide
10580-00256	Programming Manual
	Standard Accessories (included with instrument)
2000-1654-R	Soft Carrying Case
633-75	Rechargeable Li-Ion Battery, 7500 mAh
2000-1691-R	Stylus with Coiled Tether
2000-1797-R	Screen Protector Film, 8.4 inch (2, one installed)
40-187-R	AC-DC Adapter
806-141-R	Automotive Power Adapter 12 VDC, 60 W
3-2000-1498	USB A/5-pin mini-B Cable, 10 ft/305 cm
	Optional Accessories
	Calibration Components, 50Ω
ICN50B	InstaCal™ Calibration Module, 38 dB, 2 MHz to 6.0 GHz, N (m), 50Ω
OSLN50A-8	High Performance Type N (m), DC to 8 GHz, 50Ω
OSLNF50A-8	High Performance Type N (f), DC to 8 GHz, 50Ω
2000-1618-R	Precision Open/Short/Load, 7/16 DIN (m), DC to 6.0 GHz 50Ω
2000-1619-R	Precision Open/Short/Load, 7/16 DIN (f), DC to 6.0 GHz 50Ω
2000-1914-R	Precision Open/Short/Load, 4.3-10 (f), DC to 6 GHz, 50Ω
2000-1915-R	Precision Open/Short/Load, 4.3-10 (m), DC to 6 GHz, 50Ω
22N50	Precision Open/Short, N (m), DC to 18 GHz, 50Ω
22NF50	Precision Open/Short, N (f), DC to 18 GHz, 50Ω
SM/PL-1	Precision N (m) Load, 42 dB, 6 GHz
SM/PLNF-1	Precision N (f) Load, 42 dB, 6 GHz
	Calibration Components, 75Ω
22N75	Open/Short, N (m), DC to 3 GHz, 75Ω
22NF75	Open/Short, N (f), DC to 3 GHz, 75Ω
26N75A	Precision Termination, N (m), DC to 3 GHz, 75Ω
26NF75A	Precision Termination, N (f), DC to 3 GHz, 75Ω
12N50-75B	Matching Pad, DC to 3 GHz, 50Ω to 75Ω
	Phase-Stable Test Port Cables, Armored w/Reinforced Grip (recommended for cable & antenna line sweep applications)
15RNFN50-1.5-R	1.5 m, DC to 6 GHz, N (m) - N (f), 50Ω
15RDFN50-1.5-R	1.5 m, DC to 6 GHz, N (m) - 7/16 DIN (f), 50Ω
15RDN50-1.5-R	1.5 m, DC to 6 GHz, N (m) - 7/16 DIN (m), 50Ω
15RNFN50-3.0-R	3.0 m, DC to 6 GHz, N (m) - N (f), 50Ω
15RDFN50-3.0-R	3.0 m, DC to 6 GHz, N (m) - 7/16 DIN (f), 50Ω
15RDN50-3.0-R	3.0 m, DC to 6 GHz, N (m) - 7/16 DIN (m), 50Ω
	Interchangeable Adaptor Phase Stable Test Port Cables, Armored W/Reinforced Grip (recommended for cable and antenna line sweep applications. It uses the same ruggedized grip as the Reinforced grip series cables. Now you can also change the adaptor interface on the grip to four different connector types)
15RCN50-1.5-R	1.5 m, DC to 6 GHz, N (m), N (f), 7/16 DIN (m), 7/16 DIN (f), 50Ω
15RCN50-3.0-R	3.0 m, DC to 6 GHz, N (m), N (f), 7/16 DIN (m), 7/16 DIN (f), 50Ω

Continued on next page

Model/Order No.	Name
	Phase-Stable Test Port Cables, Armored
15NNF50-1.5C	1.5 m, DC to 6 GHz, N (m) - N (f), 50Ω
15NN50-1.5C	1.5 m, DC to 6 GHz, N (m) - N (m), 50Ω
15NDF50-1.5C	1.5 m, DC to 6 GHz, N (m) - 7/16 DIN (f), 50Ω
15ND50-1.5C	1.5 m, DC to 6 GHz, N (m) - 7/16 DIN (m), 50Ω
15NNF50-3.0C	3.0 m, DC to 6 GHz, N (m) - N (f), 50Ω
15NN50-3.0C	3.0 m, DC to 6 GHz, N (m) - N (m), 50Ω
15NNF50-5.0C	5.0 m, DC to 6 GHz, N (m) - N (f), 50Ω
15NN50-5.0C	5.0 m, DC to 6 GHz, N (m) - N (m), 50Ω
15N43M50-1.5C	Test Port Extension Cable, 1.5 m, DC to 6 GHz, N (m) - 4.3-10 (m)
15N43F50-1.5C	Test Port Extension Cable, 1.5 m, DC to 6 GHz, N (m) - 4.3-10 (f)
15N43M50-3.0C	Test Port Extension Cable, 3 m, DC to 6 GHz, N (m) - 4.3-10 (m)
15N43F50-3.0C	Test Port Extension Cable, 3 m, DC to 6 GHz, N (m) - 4.3-10 (f)
	Adapters
1091-26-R	DC to 18 GHz, N (m) to SMA (m), 50Ω
1091-27-R	DC to 18 GHz, N (m) to SMA (f), 50Ω
1091-80-R	DC to 18 GHz, N (f) to SMA (m), 50Ω
1091-81-R	DC to 18 GHz, N (f) to SMA (f), 50Ω
1091-172-R	BNC (f) to N (m), DC to 1.3 GHz, 50Ω
1091-465-R	Low PIM Adapter, DC to 6 GHz, 4.3 to 10 (f) to N (f), 50Ω
1091-467-R	Low PIM Adapter, DC to 6 GHz, 4.3 to 10 (m) to N (f), 50Ω
510-90-R	DC to 7.5 GHz, 7/16 DIN (f) to N (m), 50Ω
510-91-R	DC to 7.5 GHz, 7/16 DIN (f) to N (f), 50Ω
510-92-R	DC to 7.5 GHz, 7/16 DIN (m) to N(m), 50Ω
510-93-R	DC to 7.5 GHz, 7/16 DIN (m) to N(f), 50Ω
510-96-R	DC to 7.5 GHz, 7/16 DIN (m) to 7/16 DIN (m), 50Ω
510-97-R	DC to 7.5 GHz, 7/16 DIN (f) to 7/16 DIN (f), 50Ω
1091-433-R	Low PIM Adapter, DC to 3.0 GHz, 4.1 to 9.5 (f) to 7/16 DIN (f), 50Ω
1091-434-R	Low PIM Adapter, DC to 3.0 GHz, 4.1 to 9.5 (m) to 7/16 DIN (f), 50Ω
510-102-R	DC to 11 GHz, N (m)-N (m), 90 degrees 50Ω
	Precision Adapters
34NN50A	Precision Adapter, N (m) - N (m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N (f) - N (f), DC to 18 GHz, 50Ω
	Filters
1030-114-R	806 MHz to 869 MHz, N (m) to SMA (f), 50Ω
1030-109-R	824 MHz to 849 MHz, N (m) to SMA (f), 50Ω
1030-110-R	880 MHz to 915 MHz, N (m) to SMA (f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N (m) to SMA (f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N (m) to SMA (f), 50Ω
1030-105-R	890 MHz to 915 MHz, N (m) to N (f),50Ω
1030-106-R	1710 MHz to 1790 MHz, N (m) to N (f), 50Ω
1030-107-R	1910 MHz to 1990 MHz, N (m) to N (f), 50Ω
1030-149-R	High Pass, 150 MHz, N (m) to N (f), 50Ω
1030-150-R	High Pass, 400 MHz, N (m) to N (f), 50Ω
1030-151-R	High Pass, 700 MHz, N (m) to N (f), 50Ω
1030-152-R	Low Pass, 200 MHz, N (m) to N (f), 50Ω
1030-153-R	Low Pass, 550 MHz, N (m) to N (f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N (m) to N (f), 50Ω
1030-178-R	1920 MHz to 1980 MHz, N (m) to N (f), 50Ω
1030-179-R	777 MHz to 798 MHz, N (m) to N (f), 50Ω
1030-180-R	2500 MHz to 2570 MHz, N (m) to N (f), 50Ω
2000-1684-R	791 MHz to 821 MHz, N (m) to N (f), 50Ω
2000-1734-R	Bandpass Filter, 699 MHz to 715 MHz, N (m) and N (f), 50Ω
2000-1735-R	Bandpass Filter, 776 MHz to 788 MHz, N (m) and N (f), 50Ω
2000-1736-R	Bandpass Filter, 815 MHz to 850 MHz, N (m) and N (f), 50Ω
2000-1737-R	Bandpass Filter, 1711 MHz to 1756 MHz, N (m) and N (f), 50Ω
2000-1738-R	Bandpass Filter, 1850 MHz to 1910 MHz, N (m) and N (f), 50Ω
2000-1739-R	Bandpass Filter, 880 MHz to 915 MHz, N (m) and N (f), 50Ω
2000-1740-R	Bandpass Filter, 1710 MHz to 1785 MHz, N (m) and N (f), 50Ω
2000-1741-R	Bandpass Filter, 1920 MHz to 1980 MHz, N (m) and N (f), 50Ω
2000-1742-R	Bandpass Filter, 832 MHz to 862 MHz, N (m) and N (f), 50Ω
2000-1743-R	Bandpass Filter, 2500 MHz to 2570 MHz, N (m) and N (f), 50Ω
2000-1799-R	Bandpass Filter, 2305 MHz to 2320 MHz, N (m) and N (f), 50Ω
2000-1911-R	Bandpass Filter, 703 MHz to 748 MHz, N (m) and N (f), 50Ω
2000-1912-R	Bandpass Filter, 788 MHz to 798 MHz, N (m) and N (f), 50Ω
2000-1925-R	Bandpass Filter, 663 MHz to 698 MHz, N (m) and N (f), 50Ω
2000-1926-R	Bandpass Filter, 776 MHz to 806 MHz, N (m) and N (f), 50Ω
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N (m) to N (f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N (m) to N (f)
42N50A-30	30 dB, 50 W, DC to 18 GHz, N (m) to N (f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N (m) to N (f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N (m) to N (f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N (m) to N (f), Uni-directional
1010-121-R	40 dB, 100 W, DC to 18 GHz, N (m) to N (f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N (m) to N (f)

Model/Order No.	Name
	Miscellaneous Accessories
2000-1528-R	GPS Antenna, SMA (m) with 15 ft cable
69793	CW Signal Generator Kit
2000-1374-R	External Charger for Li-Ion Batteries
633-75	7500 mAh High-capacity Battery Pack
2000-1652-R	GPS Antenna, SMA (m) with 1 ft cable
2000-1689-R	EMI Near Field Probe Kit
2000-1371-R	Ethernet Cable, 7 feet/213 cm
3-806-152	Cat 5e Crossover Patch Cable, 7 feet/213 cm
MA2700A	Handheld Interference Hunter (For full specifications, refer to the MA2700A Technical Data Sheet 11410-00692)
2000-1884-R	PIM Hunter™ Test Probe (For full specifications, refer to the 2000-1884-R Technical Data Sheet 11410-00999)
2000-1797-R	Screen Protector Film, 8.4 inch
66864	Rack Mount Kit, Master Platform
	Backpack and Transit Case
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle 56 × 45.5 × 26.5 cm (22.07" × 17.92" × 10.42")
760-261-R	Large Transit Case with Wheels and Handle 63.1 × 50 × 30 cm (24.83" × 19.69" × 11.88"), space for MA2700A, antennas, filters, instrument inside soft case, and other interference hunting accessories/tools
760-262-R	Transit Case for MA2700A, several Yagi antennas and filters
760-271-R	Transit Case for Portable Directional Antennas and Port Extender 52.4 × 42.8 × 20.6 cm (20.62" × 16.87" × 8.12") (for 2000-1777-R, 2000-1778-R, 2000-1779-R, 2000-1798-R)
760-286-R	Compact Transit Case with Wheels and Handle 55.6 × 35.5 × 22.9 cm (21.89" × 13.98" × 9.01")
	Directional Antennas
2000-1411-R	824 MHz to 896 MHz, N (f), 12.3 dBi, Yagi
2000-1412-R	885 MHz to 975 MHz, N (f), 12.6 dBi, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N (f), 12.3 dBi, Yagi
2000-1414-R	1850 MHz to 1990 MHz, N (f), 11.4 dBi, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N (f), 14.1 dBi, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N (f), 14.3 dBi, Yagi
2000-1659-R	698 MHz to 787 MHz, N (f), 10.1 dBi, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N (f), 14.3 dBi, Yagi
2000-1715-R	Directional Antenna, 698 MHz to 2500 MHz, N (f), gain of 2 dBi to 10 dBi, typical
2000-1726-R	Antenna, 2500 MHz to 2700 MHz, N (f), 14.1 dBi, Yagi
2000-1747-R	Antenna, Log Periodic, 300 MHz to 7000 MHz, N (f), 5.1 dBi, typical
2000-1748-R	Antenna, Log Periodic, 1 GHz to 18 GHz, N (f), 6 dBi, typical
2000-1777-R	Portable Directional Antenna, 9 kHz to 20 MHz, N (f)
2000-1778-R	Portable Directional Antenna, 20 MHz to 200 MHz, N (f)
2000-1779-R	Portable Directional Antenna, 200 MHz to 500 MHz, N (f)
2000-1812-R	Portable Yagi Antenna, 450 MHz to 512 MHz, N (f), 7.1 dBi
2000-1825-R	Portable Yagi Antenna, 380 MHz to 430 MHz, N (f), 7.1 dBi
	Isotropic Antennas
2000-1791-R	Isotropic Antenna, 700 MHz to 6000 MHz, N (m)
2000-1792-R	Isotropic Antenna, 30 MHz to 3000 MHz, N (m)
2000-1800-R	Isotropic Antenna, 9 kHz to 300 MHz, N (m)
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA (m), 50Ω
2000-1473-R	870 MHz to 960 MHz, SMA (m), 50Ω
2000-1035-R	896 MHz to 941 MHz, SMA (m), 50Ω (1/2 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA (m), 50Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA (m), 50Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA (m), 50Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA (m), 50Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA (m), 50Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)
	Mag Mount Broadband Antenna
2000-1616-R	20 MHz to 21000 MHz, N (f), 50Ω
2000-1645-R	694 MHz to 894 MHz 3 dBi peak gain, 1700 MHz to 2700 MHz 3 dBi peak gain, N (m), 50Ω, 10 ft
2000-1646-R	750 MHz to 1250 MHz 3 dBi peak gain, 1650 MHz to 2000 MHz 5 dBi peak gain, 2100 MHz to 2700 MHz 3 dBi peak gain, N (m), 50Ω, 10 ft
2000-1647-R	Cable 1: 698 MHz to 1200 MHz 2 dBi peak gain, 1700 MHz to 2700 MHz 5 dBi peak gain, N (m), 50Ω, 10 ft Cable 2: 3000 MHz to 6000 MHz 5 dBi peak gain, N (m), 50Ω, 10 ft Cable 3: GPS 26 dB gain, SMA (m), 50Ω, 10 ft
2000-1946-R	Cable 1: 617 MHz to 960 MHz, 3 dBi peak gain, 1710 MHz to 3700 MHz, 4 dBi peak gain, N (m), 50Ω, 10 ft Cable 2: 3000 MHz to 6000 MHz, 5 dBi peak gain, N (m), 50Ω, 10 ft Cable 3: GPS 26 dB gain, SMA (m), 50Ω, 10 ft
2000-1648-R	1700 MHz to 6000 MHz 3 dBi peak gain, N (m), 50Ω, 10 ft

Site Master™

S331L

Cable & Antenna Analyzer: 2.0 MHz to 4.0 GHz, Power Meter: 50 MHz to 4.0 GHz

Remote Control
USB

Handheld Cable & Antenna Analyzer Featuring Classic and Advanced Modes

The Site Master S331L is Anritsu's compact handheld Cable & Antenna Analyzer. The S331L was designed based on years of field experience, customer feedback, field trials, and the latest technology advances. The resulting instrument is the best value in a low cost, field optimized, reliable, rugged, easy to use, one port Cable & Antenna analyzer.

Optimized for Field Use

- Rugged and Reliable
- Instant On from Standby Mode
- Highest RF Immunity
- Built-in InstaCal™ Module
  - Fast, One-connection Calibration
- FlexCal™ Calibration
  - One Calibration for All Frequencies
- Optical connector inspection with IEC 61300-3-35 based Pass/Fail standard (Requires USB Video Inspection Probe, sold separately)
- Built-in Power Meter
- High Accuracy USB Power Meter (Requires USB Sensor, sold separately)
- Impact, Dust, and Splash Resistant
- Smallest, Lightest Site Master™

Easy to Use

- Integrated Help Function
- S331D-like Classic Mode
- S331E-like Advanced Mode
  - Additional Markers
  - Customizable Shortcuts
  - Full-screen View
- Multiple USB Ports
- 800 × 480 7″ TFT Touch Screen
  - Alphanumeric Keyboard
  - EZ Name Quick Matrix
- Backlit Keypad
- easyTest™

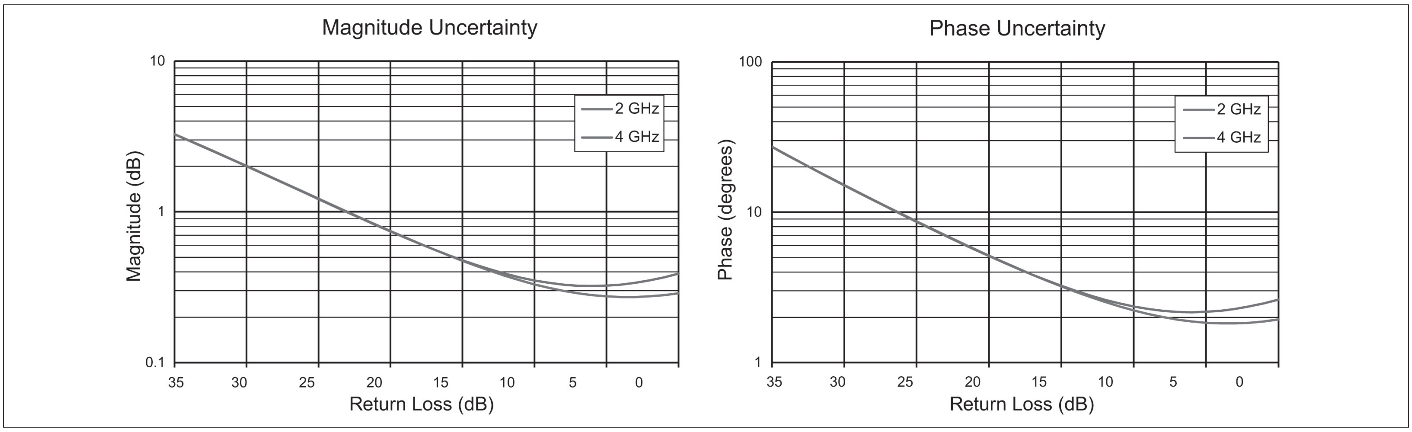
Efficient Sweep Management

- Internally Store >1000 Files
  - Sweeps, Setups, Screen Shots
- Fast Preview of Stored Sweeps
- Line Sweep Tools (LST) Software
  - Edit Sweeps, Rename, Archive
  - Generate PDF or HTML Reports
- Standard*.dat Sweep File Format
- Compatible with HHST
  - Widely Accepted by Operators
- Location Data with Compatible USB GPS Module

Cable and Antenna Analyzer Specifications

Measurements	VSWR	
	Return Loss	
	Cable Loss (One Port)	
	Distance-to-Fault (DTF) Return Loss	
	Distance-to-Fault (DTF) VSWR	
	Smith Chart 50Ω/75Ω (Advanced Mode Only)	
	1-Port Phase (Advanced Mode Only)	
	Transmission with External Sensor (Advanced Mode Only)	
Setup Parameters – Classic Mode	Measurement Display	Single Display with independent markers
	Frequency	F1/F2
	DTF	D1/D2 Units m/ft, DTF Aid, Cable Loss, Propagation Velocity, Cable type
	Windowing	Rectangular, Normal Side Lobe, Low Side Lobe, Minimum Side Lobe
	Amplitude	Top, Bottom Auto Scale, Full Scale
	Sweep	Data Points, Run/Hold, Single/Continuous, RF Immunity (High/Low), RF Power in Hold (On/Off), Trace
	Data Points	130, 259, 517, 1033, 2065
	Markers	Markers 1 to 6 (On/Off), Delta Markers 2 to 4 (Ref M1), Marker to Peak/Valley, Marker Table, Marker 5 (Peak/Valley between M1 & M2), Marker 6 (Peak/Valley between M3 & M4)
	Traces	Copy Trace To Memory, Trace Display, Trace Math [Trace – Memory, Trace + Memory, (Trace + Memory)/2]
	Limit Line	On/Off, Edit Value, Limit Alarm, Pass/Fail On/Off, Limit Preset
	Calibration	Start Calibration, Cal Info, Cal Correction (On/Off), Cal Method (OSL, InstaCal™), Cal Type (Standard, FlexCal™)
	Save/Recall	Setups, Measurements, Screen Shots
Setup Parameters – Advanced Mode	Measurement Display	Single/Dual Display with independent markers
	Frequency	Start Frequency (F1), Stop Frequency (F2)
	DTF	Start Distance (D1), Stop Distance (D2), Units m/ft, DTF Aid, Cable List, Cable Loss, Propagation Velocity
	Windowing	Rectangular, Normal Side Lobe, Low Side Lobe, Minimum Side Lobe
	Amplitude	Top, Bottom, Auto Scale, Full Scale
	Sweep	Data Points, Run/Hold, Single/Continuous, RF Immunity (High/Low), RF Power in Hold (On/Off)
	Data Points	130, 259, 517, 1033, 2065
	Markers	Markers 1 to 8 (On/Off), Delta Markers 2 to 8 (Ref M1), Marker Tracking (On/Off), Marker to Peak/Valley, Marker Table, Marker 5 & 7 (Peak/Valley between M1 & M2), Marker 6 & 8 (Peak/Valley between M3 & M4), Independent Markers for Frequency and Distance Measurements
	Traces	Copy Trace to Memory, Trace Display, Trace Math [Trace – Memory, Trace + Memory, (Trace + Memory)/2]
	Limit Line	Active Limit (Upper/Lower), Limit State (On/Off), Move Active Limit, Edit Segments (42 upper and 42 lower segments maximum), Limit Alarm, Pass/Fail On/Off, Limit Preset
	Calibration	Start Calibration, Cal Info, Cal Correction (On/Off), Cal Method (OSL, InstaCal™), Transmission, OSL + Transmission Cal Type (Standard, FlexCal™)
	Save/Recall	Setups, Measurements, Screen Shots
Frequency	Frequency Range	2 MHz to 4 GHz
	Frequency Accuracy	±5 ppm @ 23°C±3°C
	Frequency Resolution	1 kHz
Power	Output Power	–3 dBm (typ.)
Interference Immunity	On-Channel	+17 dBm outside calibrated sweep range
	On-Frequency	+13 dBm within calibrated sweep range
Measurement Speed	Return Loss	≤1.50 ms/data point, RF immunity low (typ.)
	Distance-to-Fault	≤1.75 ms/data point, RF immunity low (typ.)
Return Loss	Measurement Range Resolution	0 to 60 dB 0.01 dB
VSWR	Measurement Range	1 to 65
	Resolution	0.01
Cable Loss	Measurement Range	0 to 30 dB
	Resolution	0.01 dB
Distance-to-Fault	Vertical Range Return Loss	0 to 60 dB
	Vertical Range VSWR	1 to 65
	Fault Resolution (meters)	(1.5 × 10^8 × vp)/ΔF (vp = propagation velocity, ΔF is F2 – F1 in Hz)
	Horizontal Range (meters)	0 to (Data Points – 1) × Fault Resolution, to maximum of 1500 meters (4921 feet)
1-Port Phase (Advanced Mode Only)	Measurement Display Range	–450° to +450°
	Resolution	0.01°
Smith Chart (Advanced Mode Only)	Impedance	50Ω, 75Ω
	Resolution	0.01
Transmission Ext Sensor (Advanced Mode Only)	Measurement Display Range	–100 to +100 dB
	Resolution	0.01 dB
Measurement Accuracy (at 23°C±3°C)	Corrected Directivity	≥38 dB, InstaCal™ calibration ≥42 dB, OSL calibration (OSLN50A-8, OSLNF50A-8, OSLN50-1, OSLNF50-1)

Return Loss Measurement Uncertainty (Standard OSL calibration. OSLN50-1 Precision Open/Short/Load calibration component.)



Internal Power Meter Specifications

Frequency	Measurement Frequency (for Cal Factor)
Amplitude	Max Value, Min Value, Offset Value, Relative On/Off, Units dBm/Watts, Auto Scale, Fullscale
Calibration	Zero On/Off
Average	Running Average, Max Hold (On/Off), Run/Hold, Average Mode (Continuous/Single)
Limits	Limit On/Off, Upper Value, Lower Value
Frequency Range	50 MHz to 4 GHz
Display Range	–100 to +100 dBm
Measurement Range	–33 to +20 dBm
Offset Range	Max ±100 dB, user settable value
VSWR	1.5:1 (typ.)
Maximum Power	+27 dBm, ±45 VDC (damage level)
Connector	Type N (m), 50Ω
Accuracy	±0.7 dB (0 dBm, 1 GHz CW, @ 23°C±3°C)
Frequency Response and Linearity	Additional ±0.8 dB (±0.5 dB) (typ.)
Temperature Effect	Additional ±0.02 dB per 1°C change (typ.)

High Accuracy Power Meter (Requires external USB Power Sensor)

Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale				
Average	# of Running Averages, Max Hold				
Zero/Cal	Zero On/Off, Cal Factor (Center Frequency, Signal Standard)				
Limits	Limit On/Off, Limit Upper/Lower				
Power Sensor Model	MA24105A	MA24106A	MA24108A/18A/26A	MA24208A/18A	MA24330A/40A/50A
Description	Inline High Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor	Microwave Universal USB Power Sensor	Microwave CW USB Power Sensor
Frequency Range	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8/18/26 GHz	10 MHz to 8/18 GHz	10 MHz to 33/40/50 GHz
Connector	Type N (f), 50Ω	Type N (m), 50Ω	Type N (m), 50Ω (8 GHz/18 GHz) Type K (m), 50Ω (26 GHz)	Type N (m), 50Ω	Type K (m), 50Ω (33 GHz/40 GHz) Type V (m), 50Ω (50 GHz)
Dynamic Range	+3 to + 51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 µW to 200 mW)	–40 to +20 dBm (0.1 µW to 100 mW)	–60 to + 20 dBm (1 nW to 100 mW)	–70 to + 20 dBm (0.1 nW to 100 mW)
Measurand	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power	True-RMS, Slot Power, Burst Average Power	Average Power
Measurement Uncertainty	± 0.17 dB*1	± 0.16 dB*2	± 0.18 dB*3	± 0.17 dB*4	± 0.17 dB*5
Data sheet (for complete specifications)	11410-00621	11410-00424	11410-00504	11410-00841	11410-00906

*1: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than +20 dBm with a matched load.
Measurement results referenced to the input side of the sensor.
*2: Total RSS measurement uncertainty (0°C to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
*3: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
*4: Power uncertainty expressed with two sigma confidence level for CW measurement after zero operation. Includes calibration factor and linearity over temperature uncertainties, but not the effects of mismatch, zero set and drift, or noise.
*5: Includes linearity over temperature uncertainties, but not the effects of calibration factor, mismatch, zero set and drift, and noise.

Video Inspection Probe (requires external USB Video Inspection Probe, sold separately)

All specifications and characteristics apply to Revision 2 instruments under the following conditions, unless otherwise stated: 1) After 5 minutes of warm-up time, where the instrument has completely stabilized to the ambient temperature; 2) Internal frequency reference is used; 3) Instrument is within the recommended calibration cycle of 12 months. Cable and Antenna Analyzer measurements applicable after standard OSL calibration is performed using Anritsu calibration components; 4) Typical specifications in parentheses () describe performance that will be met by a minimum of 80% of all products. They do not include guard bands and are not warranted; 5) Typical specifications that are not in parentheses are not tested and not warranted. They are generally representative of the nominal characteristic performance; A coverage factor of k = 2 is applied to the measurement uncertainties to facilitate comparison with other industry monitors; 6) All specifications subject to change without notice.

Setup Parameters	Probe Model	G0306A or G0306B 400X USB Visual Inspection Probe
	Tip Type (included with G0306B)	SC_APC_F:, SC_PC_F:, LC_PC_F:, FC_PC_F:, 2.5APC_M:, 2.5PC_M:, 1.25PC_M:
	Test Profile (IEC 61300-3-35)	SM PC >45:, SM APC:, SM PC >25:, MM PC 62.5:, MM PC 50.0:
	Auto Analyze	On/Off
	Auto Filename	On/Off
	Auto Filename Settings	Location, File Prefix, Start Number, Include Date
Measurement Parameters	Live	View Live Image
	Captured	Capture Image for Analysis
	Analyze	Analyze Image
	Results Table	Auto/Off
	Overlay	On/Off
	Zoom Control Help	Displays instruction for image Zoom feature
Save/Recall Parameters	Save: Measurement (*.vipi), VIP Image (*.png), Screen Shot (.png) Recall: Measurement (*.vipi), VIP Image (*.png), Screen Shot (.png) File Management: Rename: Create Folder, Copy, Paste, Delete	
Report Parameters	Header Settings: Customer, Project, Operator, Notes, Include Logo Generate Report: Generates pdf report with options to include multiple *.vipi files	

General Specifications

Setup Parameters	System Info	Status, Battery
	System Setups	Date/Time, Language, Display/Audio
	Date/Time	Time and Date Settings, Time Zone Settings
	Language	English, French, German, Italian, Spanish, Russian, Portuguese, Japanese, Korean, Chinese
	Display/Audio	Brightness, Color Schemes, Screen Shot Settings, Volume
	Connectivity	GPS, Ethernet Configuration (DHCP/Static)
	Diagnostics	Self Test
	Preset	Preset, Reset, Update Firmware
	Reset	Factory Reset, Delete All User Files, Delete Custom Files, Master Reset
	File	Save, Recall, File Management
	Save	Measurement (*.dat), Setup (*.stp), Screen Shot (*.png)
	Recall	Recall, Create Folder, Copy, Paste, Delete
	File Management	Rename, Create Folder, Copy, Paste, Delete, Navigation
	Navigation	Top, Bottom, Page Up, Page Down
	Help Menu	System Info, FAQ, User Guide
	Internal Trace/Setup Memory	>1000 files (files may be traces, setups, screen shots, or any combination)
	External Trace/Setup Memory	Limited only by size of USB Flash drive
Connectors	RF Out/Reflect In	Type N, female, 50Ω, Maximum Input +42 dBm, ±50 VDC
	InstaCal™/Power Meter	Type N, male, 50Ω, Maximum Input +27 dBm, ±45 VDC (Damage Level)
	External Power	5.5 mm barrel connector, 11 to 14 VDC, <3.0 A
	USB Ports	USB 2.0 Type A (two ports)
	USB Interface	Type mini-B, Connect to PC for data transfer
Display	Type	TFT Resistive Touch Screen
	Size	7.0" daylight viewable color LCD
	Resolution	800 × 480
	Pixel Defects	No more than five defective pixels (99.9986% good pixels)
GPS Connectivity (external GPS USB module sold separately)	GPS Time/Location Indicator	Time, Latitude, Longitude and Altitude in GPS dialog (current or last known location) Time, Latitude, Longitude and Altitude with trace storage (current or last known location) Setup: Clear Data, Synchronize system time to GPS
Battery	Type	Li-Ion
	Battery Operation	>8.0 Hours (typ.) (70% brightness setting, continuous usage)
	Standby	7 days (typ.) (With fully charged battery. Actual time will vary depending on battery charge level)
CE	EMC	2014/30/EU, EN61326-1, EN61000-4-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863
RCM	Australia and New Zealand	RCM AS/NZS 4417:2012
KCC	South Korea	KCC-REM-A21-0004

Continued on next page

Environmental (MIL-PRF-28800F Class 2)	Operating Temperature Range	–10°C to +55°C
	Storage Temperature Range	–51°C to +71°C
	Maximum Relative Humidity	95% RH at +30°C, non-condensing
	Vibration, Sinusoidal	5 Hz to 55 Hz
	Vibration, Random	10 Hz to 500 Hz
	Half Sine Shock	30 g_n
	Altitude	4600 meters, operating and non-operating
	Explosive Atmosphere	MIL-PRF-28800F, Section 4.5.6.3 MIL-STD-810G, Method 511.5, Procedure 1
Dimensions and Mass		250 (W) × 177 (H) × 61 (D) mm (10.0 × 7.1 × 2.4 in) <2.0 kg (4.4 lb), including battery

Anritsu Tool Box and Line Sweep Tools (for your PC)

Line Sweep Tools (LST) is a free PC based program that increases productivity for people who deal with numerous Cable and Antenna traces every day. LST is the next generation of Anritsu's familiar Handheld Software Tools (HHST) and shares its uncomplicated user interface, giving a new face to the term "ease of use."

Cable Editor*1	Instrument Cable Lists may be retrieved from the instrument, modified as required, and uploaded back into instrument.
Distance to Fault*2 (DTF)	Easily convert Return Loss or VSWR traces to Distance to Fault traces with one button press.
Measurement Calculator	Provides quick conversion between commonly used measurement units such as VSWR, RL, and others.
Signal Standard Editor*1	Signal Standard Lists may be retrieved from the instrument, modified as required, and uploaded back into instrument.
Naming Grid	A naming grid function makes changing file names, trace titles, and trace subtitles from field values to those required by contract simple and quick. Once the naming grid is populated with user defined file name segments, a few simple button presses will then fill out the file, title, and sub-title names. Quickly applied to multiple traces, the naming grid can save time, increase efficiency and accuracy.
Presets	Presets make applying markers and a limit line to similar traces quick and easy. They only need to be set once, and recorded. After this, applying them to a similar trace requires only one button push. This speeds up trace processing and makes providing consistent marker and limit line settings easy.
Report Generator	The report generator creates a professional PDF or HTML based report. Reports may include GPS*3 location, power level*3, company logo*4, instrument and calibration status along with a display of all open traces. It also may contain additional information such as addresses and phone numbers.
Capture	Plots to Screen, Database, *.dat, *.jpg
Connect	To PC using USB, Ethernet, Serial
Download/Upload*1	Lists/measurements and live traces to PC for storage and analysis.
Supported File Types	Input: *.dat, *.vna, *.mna, *.pim, *.tm Output: *.dat, *.vna, *.pim, *.tm, *.csv, *.bmp, *.jpg, *.png

*1: Instrument type/model must match original
*2: Only *.dat and *.vna file types supported
*3: Model dependent
*4: Optionally set by user

easyTest Tools (for your PC)

Instrument Mode		Cable & Antenna Analyzer Mode
Commands	Display Image	Allows putting a custom image on the instrument screen
	Recall Setup	Places the instrument into a known state
	Prompt	Displays instructional messages on the instrument screen
	Save	Allows automatic or manual saving of traces
Connectivity	Connections	USB cable or USB memory stick

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
S331L	Cable and Antenna Analyzer (2 MHz to 4 GHz) Internal InstaCal™ (2 MHz to 4 GHz) Internal Power Meter (50 MHz to 4 GHz) High Accuracy Power Meter (Requires External USB Power Sensor, sold separately) GPS Location/System Time Sync (Requires External GPS Module 2000-1723-R, sold separately) Optical connector inspection with IEC 61300-3-35 based Pass/Fail standard (Requires USB Video Inspection Probe, sold separately)
	Calibration and Extended Warranty Options
S331L-ES510	Warranty Extension to 5 Years, Return to Anritsu
	Warranty with Z540 Calibration
S331L-ES513	Warranty Extension to 5 Years, Return to Anritsu
	Calibration Only Options
S331L-0098	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate.
S331L-0099	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate, test report, and uncertainty data.

Model/Order No.	Name
	Standard Accessories (included with instrument)
2000-1676-R	Soft Carrying Case
2000-1691-R	Stylus with Coiled Tether
2000-1687-R	Torque Multiplier N (m)
40-187-R	AC-DC Adapter
806-141-R	Automotive Power Adapter, 12 VDC, 60 W
3-2000-1498	USB A/5-pin mini-B Cable, 10 ft/305 cm
	Standard Three-Year Warranty (battery one-year warranty)
	Certificate of Calibration and Conformance
	Documentation (available at www.anritsu.com)
10100-00065	Product Information, Compliance, and Safety
11410-00616	Site Master™ S331L Technical Data Sheet
10580-00321	Site Master™ S331L User Guide
11410-00640	Site Master™ S331L Product Brochure (Includes information about additional Site Master models)
11410-00662	Site Master™ S331L Quick Fact Sheet
11410-00674	Cable and Antenna Analysis Troubleshooting Guide
10580-00253	Site Master™ S331L Maintenance Manual

Continued on next page

Model/Order No.	Name
	USB Power Sensors and Transmission Sensors (for complete ordering information, see the respective datasheets of each sensor)
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +3 to +51.76 dBm
MA24106A	RF USB Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm
MA24208A	Microwave Universal USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24218A	Microwave Universal USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24330A	Microwave CW USB Power Sensor, 10 MHz to 33 GHz, +20 dBm
MA24340A	Microwave CW USB Power Sensor, 10 MHz to 40 GHz, +20 dBm
MA24350A	Microwave CW USB Power Sensor, 10 MHz to 50 GHz, +20 dBm
SC8268	USB Transmission Sensor, K (m), 1 MHz to 40 GHz, +10 to –50 dBm
MA25100A	RF Power Indicator
	USB Extender Kit (for two port cable loss/transmission (external sensor) measurements)
2000-1717-R	USB 1.1 Passive 40 m Extender
2000-1900-R	USB 2.0 Active 100 m Extender (with Type A power cord for USA, Japan, North America, Central America and Caribbean)
2000-1901-R	USB 2.0 Active 100 m Extender (with Type C power cord for use in Europe, India, South Korea, and many countries in Middle East and Africa)
2000-1902-R	USB 2.0 Active 100 m Extender (with Type I power cord for use in Australia, New Zealand, Argentina, and the South Pacific)
2000-1903-R	USB 2.0 Active 100 m Extender (with Type G power cord for use in the UK, and several other countries in Asia, the Middle East, and Africa)
2100-28-R	Cat 5e extension cable for use with USB Extender (22.5 m)
	GPS Module
2000-1723-R	High Performance USB Mag-Mount GPS Module
	Ethernet Adapter
2000-1810-R	Portable USB to Ethernet LAN Adapter
	Video Inspection Probe
G0306B	Video Inspection Probe (400x), including the following standard connector tips:
Universal Tips	H0361A 1.25PC-M, H0360A 2.5PC-M, H0362A 2.5APC-M
Bulkhead Tips	H0363A LC-PC-F, H0364A FC-PC-F, H0375A ST-PC-F, H0366A SC-APC-F
Additional Tips Available	H0372A E2000-PC-F, H0373A FC-APC-F, H0374A MU-PC-F, H0365A SC-PC-F, H0376A 1.25APC-M
	Accessories
971-14-R	Ferrule Cleaner, 2.5 mm SC
971-15-R	Ferrule Cleaner, 1.25 mm LC
971-16	Fiber Ferrule Cleaner
	Optional Accessories
	Calibration Components, 50Ω
OSLN50A-8	Precision Open/Short/Load, N (m), 42 dB, DC to 8.0 GHz, 50Ω
OSLNF50A-8	Precision Open/Short/Load, N (f), 42 dB, DC to 8.0 GHz, 50Ω
2000-1618-R	Precision Open/Short/Load, 7/16 DIN (m), DC to 6.0 GHz 50Ω
2000-1619-R	Precision Open/Short/Load, 7/16 DIN (f), DC to 6.0 GHz 50Ω
2000-1914-R	Precision Open/Short/Load, 4.3-10 (f), DC to 6 GHz, 50Ω
2000-1915-R	Precision Open/Short/Load, 4.3-10 (m), DC to 6 GHz, 50Ω
22N50	Precision Open/Short, N (m), DC to 18 GHz, 50Ω
22NF50	Precision Open/Short, N (f), DC to 18 GHz, 50Ω
SM/PL-1	Precision, N (m) Load, 42 dB, 6 GHz
SM/PLNF-1	Precision, N (f) Load, 42 dB, 6 GHz
	Calibration Components, 75Ω
12N50-75B	Matching Pad, DC to 3 GHz, 50Ω to 75Ω
22N75	Open/Short, N (m), DC to 3 GHz, 75Ω
22NF75	Open/Short, N (f), DC to 3 GHz, 75Ω
26N75A	Precision Termination, N (m), DC to 3 GHz, 75Ω
26NF75A	Precision Termination, N (f), DC to 3 GHz, 75Ω

Model/Order No.	Name
	Adapters
510-90-R	7/16 DIN (f) to N (m), DC to 7.5 GHz, 50Ω
510-91-R	7/16 DIN (f) to N (f), DC to 7.5 GHz, 50Ω
510-92-R	7/16 DIN (m) to N (m), DC to 7.5 GHz, 50Ω
510-93-R	7/16 DIN (m) to N (f), DC to 7.5 GHz, 50Ω
510-96-R	7/16 DIN (m) to 7/16 DIN (m), DC to 7.5 GHz, 50Ω
510-97-R	7/16 DIN (f) to 7/16 DIN (f), DC to 7.5 GHz, 50Ω
510-102-R	N (m) to N (m), DC to 11 GHz, 50Ω, 90 degrees right angle
1091-26-R	SMA (m) to N (m), DC to 18 GHz, 50Ω
1091-27-R	SMA (f) to N (m), DC to 18 GHz, 50Ω
1091-80-R	SMA (m) to N (f), DC to 18 GHz, 50Ω
1091-81-R	SMA (f) to N (f), DC to 18 GHz, 50Ω
1091-172	BNC (f) to N (m), DC to 1.3 GHz, 50Ω
1091-433-R	Low PIM Adapter, 4.1-9.5 (f) to 7/16 DIN (f), DC to 3.0 GHz, 50Ω
1091-434-R	Low PIM Adapter, 4.1-9.5 (m) to 7/16 DIN (f), DC to 3.0 GHz, 50Ω
1091-435-R	Low PIM Adapter, 4.1-9.5 (f) to N (m), DC to 3.0 GHz, 50Ω
1091-436-R	Low PIM Adapter, 4.1-9.5 (m) to N (m), DC to 3.0 GHz, 50Ω
1091-440-R	Low PIM Adapter, 4.3-10 (f) to 7/16 DIN (f), DC to 3.0 GHz, 50Ω
1091-441-R	Low PIM Adapter, 4.3-10 (m) to 7/16 DIN (f), DC to 3.0 GHz, 50Ω
1091-442-R	Low PIM Adapter, 4.3-10 (f) to N (m), DC to 3.0 GHz, 50Ω
1091-443-R	Low PIM Adapter, 4.3-10 (m) to N (m), DC to 3.0 GHz, 50Ω
1091-465-R	4.3-10 (f) to N (f), DC to 6 GHz, 50Ω
1091-467-R	4.3-10 (m) to N (f), DC to 6 GHz, 50Ω
	Precision Adapters
34NN50A	Precision Adapter, N (m) to N (m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N (f) to N (f), DC to 18 GHz, 50Ω
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N (m) to N (f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N (m) to N (f)
42N50A-30	30 dB, 50 W, DC to 18 GHz, N (m) to N (f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N (m) to N (f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N (m) to N (f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N (m) to N (f), Unidirectional
1010-121-R	40 dB, 100 W, DC to 18 GHz, N (m) to N (f), Unidirectional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N (m) to N (f)
	Phase-Stable Test Port Cables, Armored w/Reinforced Grip (recommended for cable & antenna line sweep applications)
15RNFN50-1.5-R	1.5 m, DC to 6 GHz, N (m) to N (f), 50Ω
15RDFN50-1.5-R	1.5 m, DC to 6 GHz, N (m) to 7/16 DIN (f), 50Ω
15RDN50-1.5-R	1.5 m, DC to 6 GHz, N (m) to 7/16 DIN (m), 50Ω
15RNFN50-3.0-R	3.0 m, DC to 6 GHz, N (m) to N (f), 50Ω
15RDFN50-3.0-R	3.0 m, DC to 6 GHz, N (m) to 7/16 DIN (f), 50Ω
15RDN50-3.0-R	3.0 m, DC to 6 GHz, N (m) to 7/16 DIN (m), 50Ω
	Interchangeable Adapter Phase Stable Test Port Cables, Armored w/Reinforced Grip (recommended for cable and antenna line sweep applications. It uses the same ruggedized grip as the reinforced grip series cables. Now you can also change the adapter interface on the grip to four different connector types)
15RCN50-1.5-R	1.5 m, DC to 6 GHz, N (m), N (f), 7/16 DIN (m), 7/16 DIN (f), 50Ω
15RCN50-3.0-R	3.0 m, DC to 6 GHz, N (m), N (f), 7/16 DIN (m), 7/16 DIN (f), 50Ω
	Phase-Stable Test Port Cables, Armored
15NNF50-1.5C	1.5 m, DC to 6 GHz, N (m) to N (f), 50Ω
15NN50-1.5C	1.5 m, DC to 6 GHz, N (m) to N (m), 50Ω
15NDF50-1.5C	1.5 m, DC to 6 GHz, N (m) to 7/16 DIN (f), 50Ω
15ND50-1.5C	1.5 m, DC to 6 GHz, N (m) to 7/16 DIN (m), 50Ω
15NNF50-3.0C	3.0 m, DC to 6 GHz, N (m) to N (f), 50Ω
15NN50-3.0C	3.0 m, DC to 6 GHz, N (m) to N (m), 50Ω
15NNF50-5.0C	5.0 m, DC to 6 GHz, N (m) to N (f), 50Ω
15NN50-5.0C	5.0 m, DC to 6 GHz, N (m) to N (m), 50Ω
15N43M50-1.5C	Test Port Extension Cable, 1.5 m, DC to 6 GHz, N (m) to 4.3-10 (m)
15N43F50-1.5C	Test Port Extension Cable, 1.5 m, DC to 6 GHz, N (m) to 4.3-10 (f)
15N43M50-3.0C	Test Port Extension Cable, 3 m, DC to 6 GHz, N (m) to 4.3-10 (m)
15N43F50-3.0C	Test Port Extension Cable, 3 m, DC to 6 GHz, N (m) to 4.3-10 (f)
	Backpack and Transit Case
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-286-R	Compact Transit Case with Wheels and Handle 55.6 × 35.5 × 22.9 cm (21.89" × 13.98" × 9.01")

Microwave Site Master™

S820E

1 MHz to 8 GHz, 14 GHz, 20 GHz, 30 GHz, 40 GHz

Remote Control
Ethernet | USB

Cable & Antenna Analyzer Featuring Classic and Advanced Modes

With microwave frequency coverage up to 40 GHz, Site Master S820E completely redefines the standards for portable handheld analyzers, setting another new industry benchmark for performance and accuracy. The S820E is the culmination of over 50 years of microwave development, utilizing the very latest technologies to deliver accuracy and performance previously reserved only for benchtop instruments. Based on a true 4 channel receiver design, the S820E offers true VNA performance in a portable package.
Optional VNA mode provides fully reversing S-parameter measurements anywhere, anytime. Optional vector voltmeter mode (VVM) with standard A/B and B/A ratio may be used as drop-in replacement for legacy VVM products.

Cable and Antenna Analyzer Highlights

- 1-Port Measurements: RL, VSWR, Cable Loss, DTF, Phase, Smith Chart
- 2-Port Measurements: Transmission, Cable Loss
- Display: Single or Dual Measurement Touchscreen
- Calibration: Coaxial (OSL, TOSL), Waveguide (SSL, SSLT)
- Dynamic Range: 110 dB (20 MHz to 40 GHz)
- Frequency Resolution: 1 Hz (1 MHz to 40 GHz)
- Sweep Speed: 550 µs/data point
- Calibration Temperature Window: ±10°C
- Full Temperature Calibration Kits: –10°C to +55°C

Vector Network Analyzer Highlights

- Fully Reversing Error Corrected Measurements
- Measure All Four S-Parameters Simultaneously
- Flexible Trace Display Layout: 1, 2, 3, or 4, and Overlay on top
- Calibration Interpolation and Through Update
- Independent Markers and Limits Per Trace
- Fast Sweeps (<600 µs/pt) Even in 5 kHz IFBW
- Arbitrary Data Point Setting
- Port Reference Plane Extension (Distance and/or Loss)

Vector Voltmeter Highlights

- A/B & B/A Ratio Measurement Standard
- Reflection/Transmission Measurement Standard
- Reference Auto-tune reduces or eliminates need for common 10 MHz reference (for A/B & B/A Ratio measurement only)
- Vector Error Correction for Absolute Measurement (Reflection/Transmission only)
- 4 Flexible Data Display Formats
- Table Display allows 12 Measurements and 1 Reference, Simultaneously

Capabilities and Functional Highlights

- Benchtop VNA Performance
- Intuitive GUI + Classic Mode
- 2-Port Measurements Standard
- 2-Port Cable Loss
- Std High Accuracy Power Meter (Requires external USB sensor)
- USB Transmission Sensors up to 40 GHz
- Ethernet/USB Connectivity
- USB Peripheral Support
- Touchscreen Popup Keyboard
- easyTest™ Automated Scripts
- Embeddded Help (FAQ and UserGuide)
- Optical connector inspection with IEC 61300-3-35 based Pass/Fail standard (Requires USB Video Inspection Probe, sold separately)

Definitions

All specifications and characteristics apply to Revision 2 instruments under the following conditions, unless otherwise stated:

Warm-Up Time	After 10 minutes of warm-up time, where the instrument is left in the ON state.
Reference Signal	When using internal reference signal.
Typical Performance	Typical specifications that are not in parenthesis are not tested and not warranted. They are generally representative of characteristic performance. Typical specifications in parenthesis ( ) represent the mean value of measured units and do not include any guard-bands or uncertainties. They are not warranted.
Uncertainty	A coverage factor of x1 is applied to the measurement uncertainties to facilitate comparison with other industry handheld analyzers.
Calibration Cycle	Calibration is within the recommended 12 month period (residual specifications also require calibration kit calibration cycle adherence.) All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu web site: www.anritsu.com

Cable and Antenna Analyzer Specifications

Measurements	1-Port Measurements	Return Loss Distance-to-Fault (DTF) Return Loss Cable Loss VSWR Distance-to-Fault (DTF) VSWR Smith Chart 50Ω/75Ω (Advanced Mode Only) Phase (Advanced Mode Only)
	2-Port Measurements	Transmission (Advanced Mode Only) Transmission with External Sensor (Advanced Mode Only) Cable Loss (2-Port) with External Sensor (Classic Mode Only)
Setup Parameters Classic Mode	Measurement Display	Single Display with independent markers
	Frequency	F1/F2
	DTF	D1/D2, Units m/ft, DTF Aid, Cable List, Cable Loss, Propagation Velocity
	Windowing	Rectangular, Nominal Side Lobe, Low Side Lobe, Minimum Side Lobe
	Amplitude	Top, Bottom Auto Scale, Full Scale, Scale Preset
	Sweep	Data Points (130, 259, 517, 1033, 2065), Run/Hold, Sweep Type (Single/Continuous), RF Immunity (High/Low), RF Power in Hold (On/Off), Smoothing, Sweep Averaging (1 to 1000), Trace
	Marker	Markers 1 to 6 (On/Off), Delta Makers 2 to 4 (Ref Mk1), Marker to Peak/Valley, Marker Table, Marker 5 (Peak/Valley between M1 and M2), Marker 6 (Peak/Valley between M3 and M4)
	Trace	Copy Trace To Memory, Trace Display, Trace Math
	Limit	On/Off, Edit Value, Limit Alarm (On/ Off), Pass/Fail (On/Off), Limit Preset
	Calibration	Start Calibration, Calibration Info, Calibration Correction (On/ Off)
	Calibration Setup	Coax., Waveguide
	Save/Recall/File Management*1	Measurement (.dat), Setups (.stp), Screen Shots (.png), Text (.txt), CSV (.csv)
Setup Parameters Advanced Mode	Measurement Display	Single/Dual Display with independent markers
	Frequency	Start Frequency (F1), Stop Frequency (F2)
	Distance	Start Distance (D1), Stop Distance (D2), Units (meters/feet), DTF Aid
	DTF Setup	DTF Line Type (Coax/Waveguide), Cable List, Cable Loss, Propagation Velocity, Windowing (Rectangular, Nominal Side Lobe, Low Side Lobe, Minimum Side Lobe)
	Amplitude	Top, Bottom, Auto Scale, Full Scale, Scale Preset
	Sweep	Data Points (130, 259, 517, 1033, 2065), Run/Hold, Sweep Type (Single/Continuous), RF Immunity (High/Low), RF Power in Hold (On/Off), Source Power (High/Low), IFBW (10 Hz, 100 Hz, 1 kHz, 100 kHz), Smoothing, Sweep Averaging (1 to 1000)
	Markers	Markers 1 to 8 (On/Off), Delta Makers 2 to 8 (Ref Mk1), Marker to Peak/Valley, Marker Tracking (On/Off), Marker Table, Marker 5 and 7 (Peak/Valley between M1 and M2), Marker 6 and 8 (Peak/Valley between M3 and M4)
	Trace	Copy Trace to Memory, Trace Display, Trace Math
	Limit	Active Limit (Upper/Lower), Limit State (On/Off), Move Active Limit, Edit Segments (42 upper and 42 lower segments maximum), Pass./Fail (on/Off), Limit Preset
	Calibration	Start Calibration, Calibration Info, Calibration Correction (On/Off)
	Save/Recall/File Management*1	Measurement (.dat), Setups (.stp), Screen Shots (.png), Text (.txt), CSV (.csv)
Frequency	Frequency Range	1 MHz to 8 GHz, 14 GHz, 20 GHz, 30 GHz, 40 GHz (frequency option dependent)
	Frequency Accuracy	±1.0 ppm at 23°C
	Stability	±1.0 ppm from –10°C to +55°C (typ.)
	Aging	±1.0 ppm/yr (typ.)
	Frequency Resolution	1 Hz
IFBW	Advanced Mode Only	10 Hz, 100 Hz, 1 kHz, 100 kHz
Output Power	1 MHz to 8 GHz	+5 dBm (typ.) (High); –20 dBm (typ.) (Low)
	>8 GHz to 40 GHz	–3 dBm (typ.) (High); –20 dBm (typ.) (Low)
RF Immunity*2		+17 dBm (typ.)
Measurement Speed*3	Reflection/Transmission Measurements	≤550 µs/data point, RF immunity low (typ.)
	Transmission Ext. Sensor (2-port Cable Loss)	Determined by USB sensor and may vary with model used, not specified.

Continued on next page

Dynamic Range*4, *5	(High Power, 10 Hz IFBW, 10 averages Port 1 to Port 2)	
	1 MHz to 10 MHz	≥85 dB (105 dB) (typ.)
	>10 MHz to 8 GHz	≥100 dB (115 dB) (typ.)
	>8 GHz to 40 GHz	≥100 dB (110 dB) (typ.)
Receiver Compression Port 1 or Port 2	1 MHz to 40 GHz	+5 dBm (0.1 dB compression) (typ.)
High Level Noise*6	(High Power, 100 Hz IFBW, 20 MHz to 40 GHz)	
	Magnitude	±0.006 dB (±0.001 dB) (typ.) rms
	Phase	±0.090° (±0.060°) (typ.)
Temperature Stability	(10 MHz to 40 GHz, ratio measurement, ports shorted)	
	Magnitude	±0.02 dB/°C (typ.)
	Phase	±0.3 degrees/°C (typ.)
Smoothing	Range	0 to 20%
System Impedance	Port 1 or Port 2	50Ω standard, 75Ω with 50Ω to 75Ω adapter
Return Loss	Measurement Display Range	0 to 1000 dB
	Resolution	0.01 dB
VSWR	Measurement Display Range	1 to 1000
	Resolution	0.01
Cable Loss	Measurement Display Range	0 to 500 dB
	Resolution	0.01 dB
Distance-to-Fault	Vertical Range Return Loss	0 to 1000 dB
	Vertical Range VSWR	1 to 1000
	Fault Resolution (meters)	(1.5 × 10^8 × vp)/ΔF (vp = propagation velocity constant, ΔF is F2 – F1 in Hz)
	Horizontal Range (meters)	0 to (Data Points – 1) × Fault Resolution, to a maximum of 1500 m (4921 ft)
1-Port Phase	Measurement Display Range	–450° to +450°
	Resolution	0.01°
Smith Chart	Impedance	50Ω, 75Ω
	Resolution	0.01
Cable Loss 2-Port	(Classic Mode Only)	
	Measurement Display Range	–1000 to +1000 dB
	Resolution	0.01 dB
Transmission	(Advanced Mode Only)	
	Measurement Display Range	–1000 to +1000 dB
	Resolution	0.01 dB
Transmission Ext Sensor	(Advanced Mode Only)	
	Measurement Display Range	–1000 to +1000 dB
	Resolution	0.01 dB

*1: Text (.txt) and CSV (.csv) files cannot be recalled to the instrument.

*2: +13 dBm for interfering signals landing in-band.

*3: 100 kHz IFBW (typ.).

*4: Dynamic range is defined as the difference between output power and receiver noise floor.

*5: Decrease specification by 5 dB between 8 GHz and 14 GHz. Crosstalk may reduce dynamic range up to 20 dB (typ.) at lower IF bandwidths (≤10 kHz) when measuring highly reflective DUT's from 4 GHz to 8 GHz. Reflection measurements are not affected.

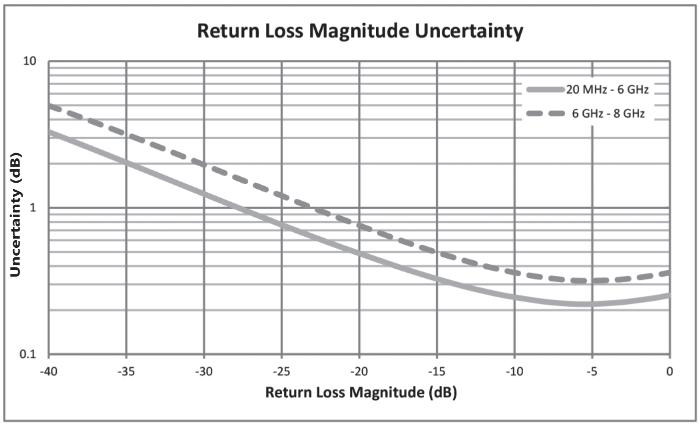
*6: High Level Noise below 20 MHz is increased by a factor of 5.0.
High Level Noise (Phase only) above 20 GHz is increased by a factor of 1.5.

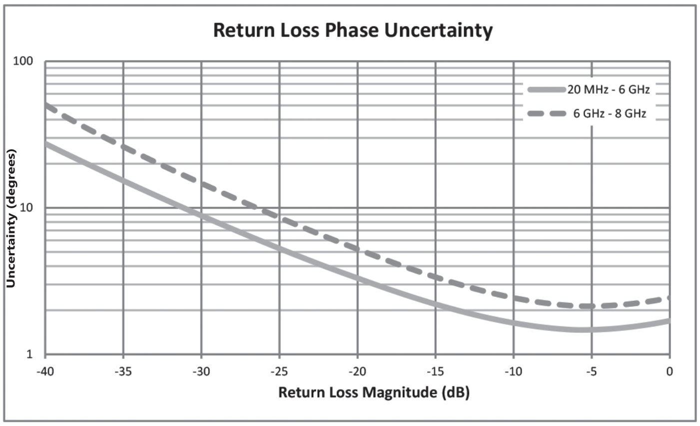
Measurement Accuracy* (OSLN50A-8 or OSLNF50A-8, TOSLN50A-8 or TOSLNF50A-8)

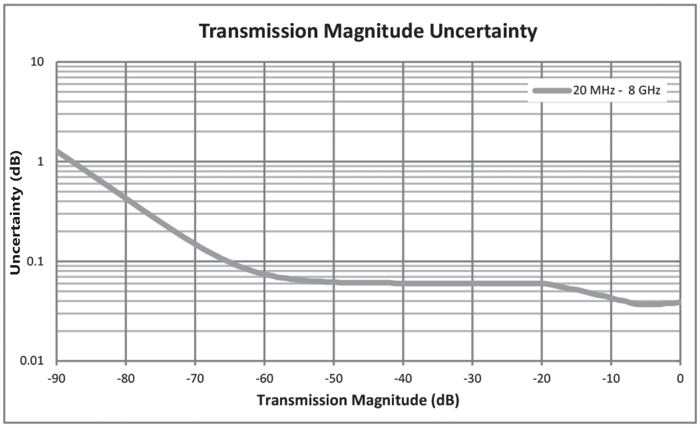
Frequency Range	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
1 MHz to 6 GHz	≥42	≥33	≥42	±0.08	±0.06
>6 GHz to 8 GHz	≥37	≥33	≥37	±0.08	±0.06

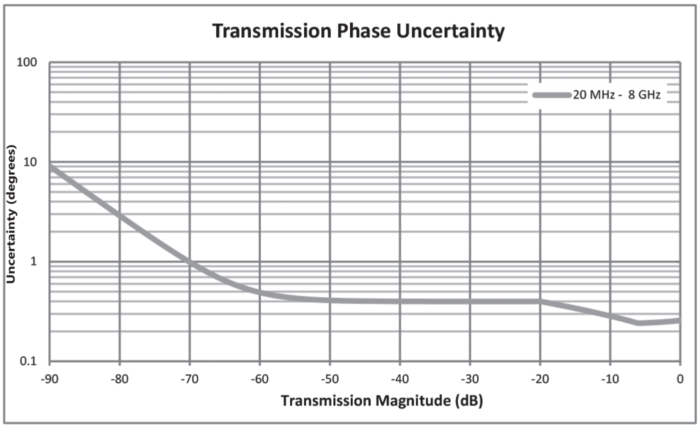
*: Full 2-Port calibration with isolation, Default Power, 10 Hz IFBW, No averaging, 10 minute warm-up. OSLN50A-8, OSLNF50A-8, TOSLN50A-8, or TOSLNF50A-8 calibration kit.
Load match specification applicable directly at corrected port only. De-rate by approximately 8 dB if using a 3670 series test port cable.
Reflection and Transmission Tracking are typical.

Corrected Measurement Uncertainty (Transmission from Port 1 to Port 2)


Return Loss Magnitude Uncertainty


Return Loss Phase Uncertainty


Transmission Magnitude Uncertainty

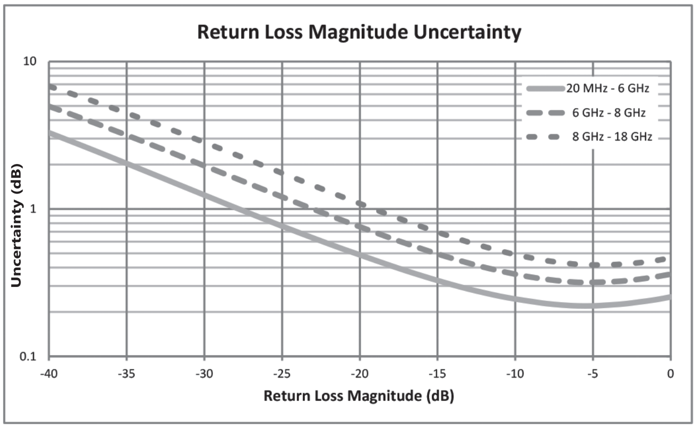

Transmission Phase Uncertainty

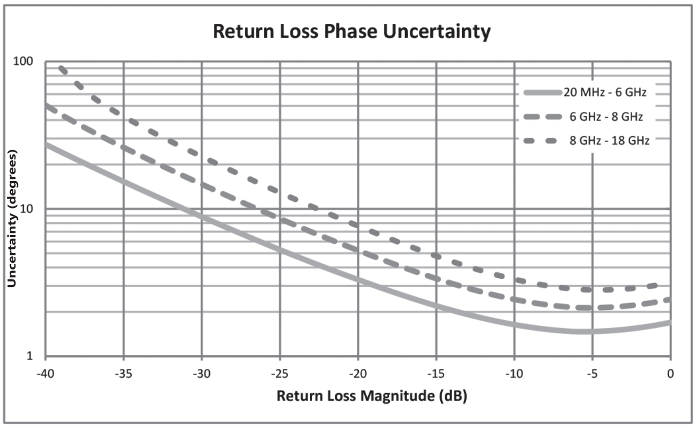
Measurement Accuracy* (OSLN50A-18 or OSLNF50A-18, TOSLN50A-18 or TOSLNF50A-18)

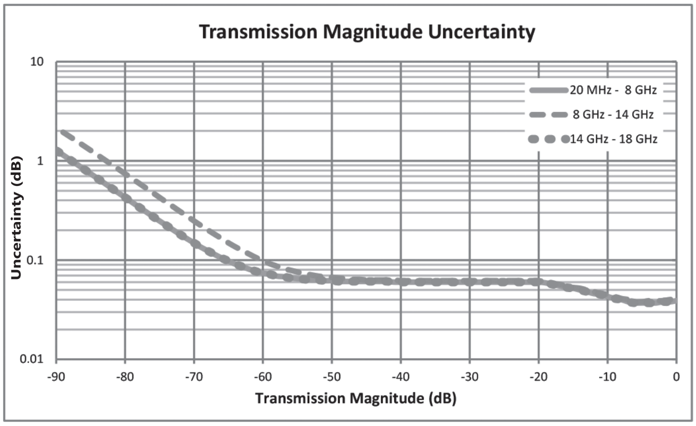
Frequency Range	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
1 MHz to 6 GHz	≥42	≥33	≥42	±0.08	±0.06
>6 GHz to 9 GHz	≥37	≥33	≥37	±0.08	±0.06
>9 GHz to 18 GHz	≥33	≥26	≥33	±0.04	±0.03

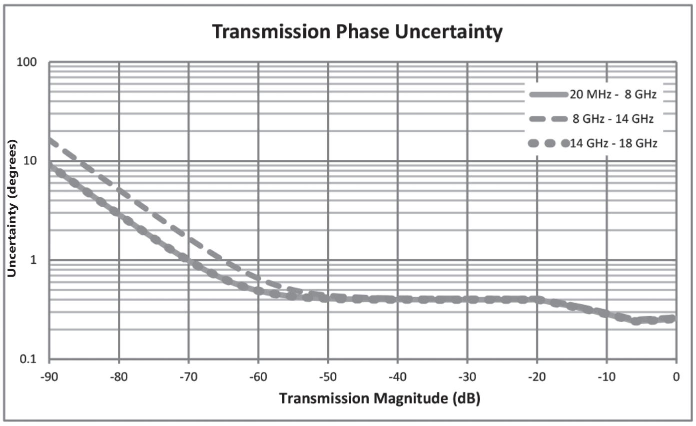
*: Full 2-Port calibration with isolation, Default Power, 10 Hz IFBW, No averaging, 10 minute warm-up. OSLN50A-18, OSLNF50A-18, TOSLN50A-18, or TOSLNF50A-18 calibration kit. Load match specification applicable directly at corrected port only. De-rate by approximately 8 dB if using a 3670 series test port cable. Reflection and Transmission Tracking are typical.

Corrected Measurement Uncertainty (Transmission from Port 1 to Port 2)


Return Loss Magnitude Uncertainty


Return Loss Phase Uncertainty


Transmission Magnitude Uncertainty

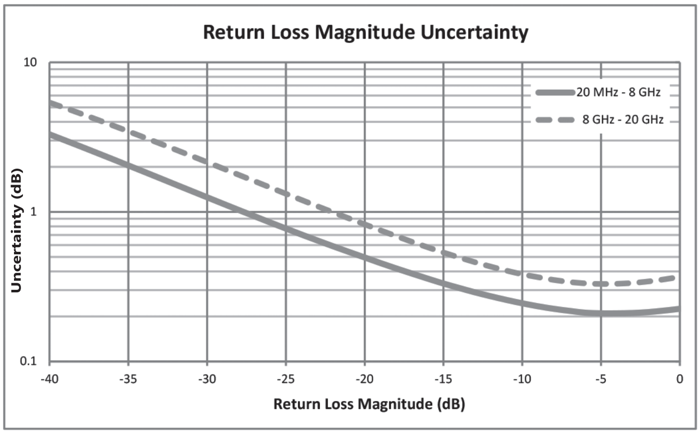

Transmission Phase Uncertainty

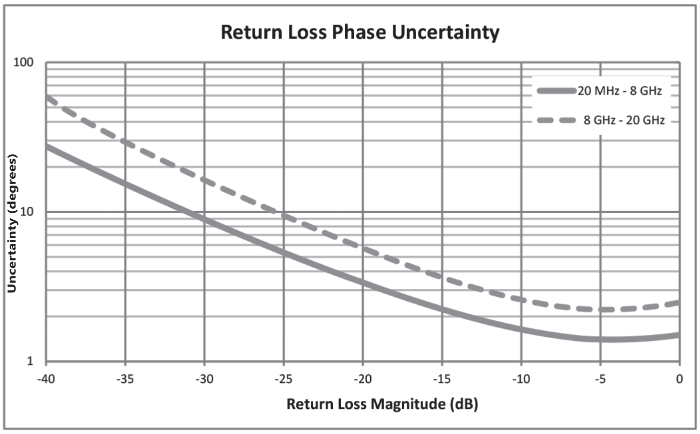
Measurement Accuracy* (TOSLK50A-20 or TOSLKF50A-20)

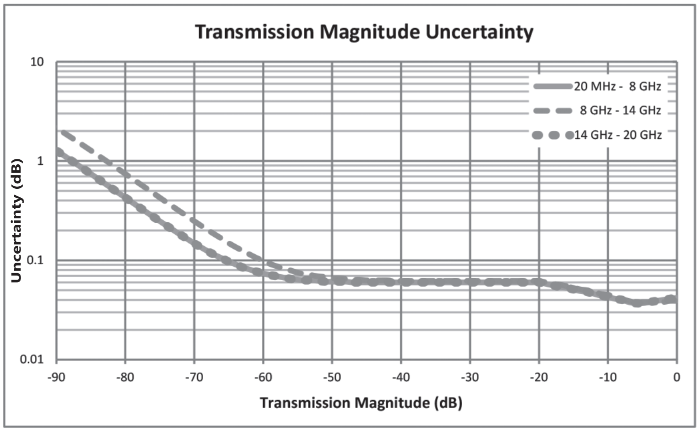
Frequency Range	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
1 MHz to 10 GHz	≥42	≥33	≥42	±0.08	±0.06
>10 GHz to 20 GHz	≥36	≥26	≥36	±0.04	±0.03

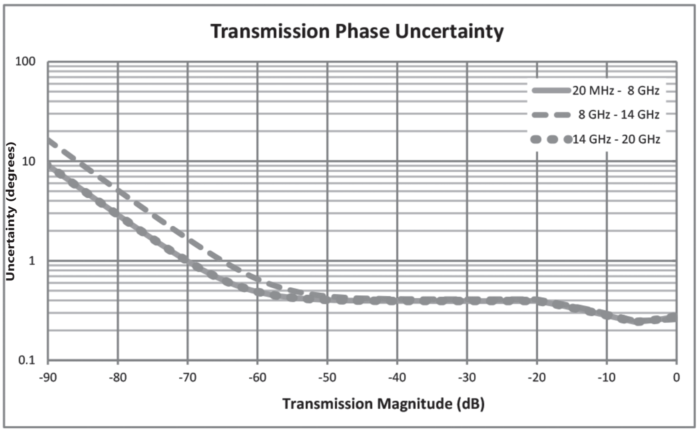
*: Full 2-Port calibration with isolation, Default Power, 10 Hz IFBW, No averaging, 10 minute warm-up. TOSLK50A-20 or TOSLKF50A-20 calibration kit.
Load match specification applicable directly at corrected port only. De-rate by approximately 8 dB if using a 3670 series test port cable.
Reflection and Transmission Tracking are typical.

Corrected Measurement Uncertainty (Transmission from Port 1 to Port 2)







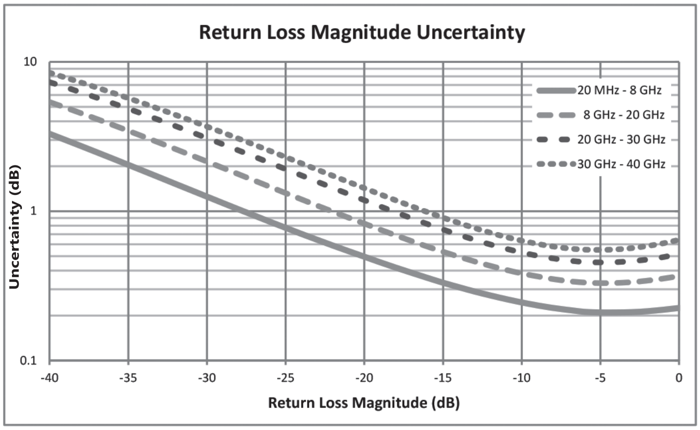


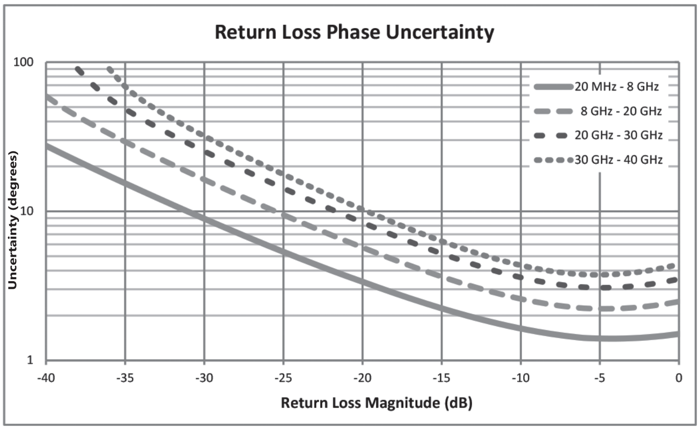
Measurement Accuracy* (TOSLK50A-40 or TOSLKF50A-40)

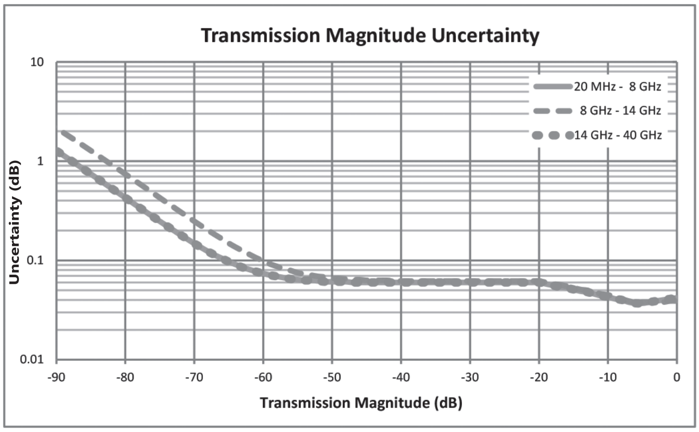
Frequency Range	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
1 MHz to 10 GHz	≥42	≥33	≥42	±0.08	±0.06
>10 GHz to 20 GHz	≥36	≥26	≥36	±0.04	±0.03
>20 GHz to 30 GHz	≥32	≥22	≥32	±0.04	±0.03
>30 GHz to 40 GHz	≥30	≥20	≥30	±0.04	±0.03

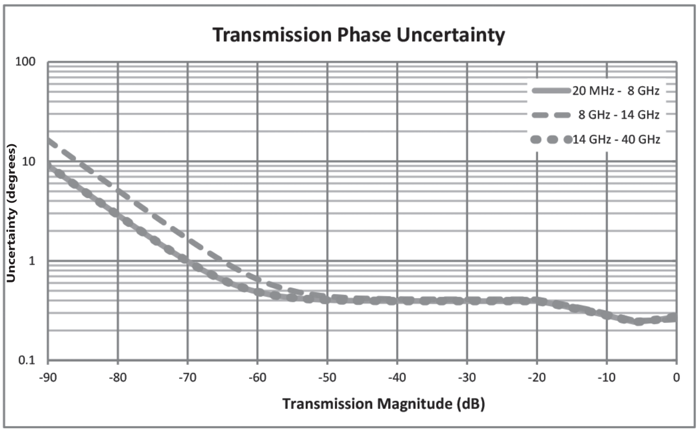
*: Full 2-Port calibration with isolation, Default Power, 10 Hz IFBW, No averaging, 10 minute warm-up. TOSLK50A-40 or TOSLKF50A-40 calibration kit.
Load match specification applicable directly at corrected port only. De-rate by approximately 8 dB if using a 3670 series test port cable.
Reflection and Transmission Tracking are typical.

Corrected Measurement Uncertainty (Transmission from Port 1 to Port 2)


Return Loss Magnitude Uncertainty

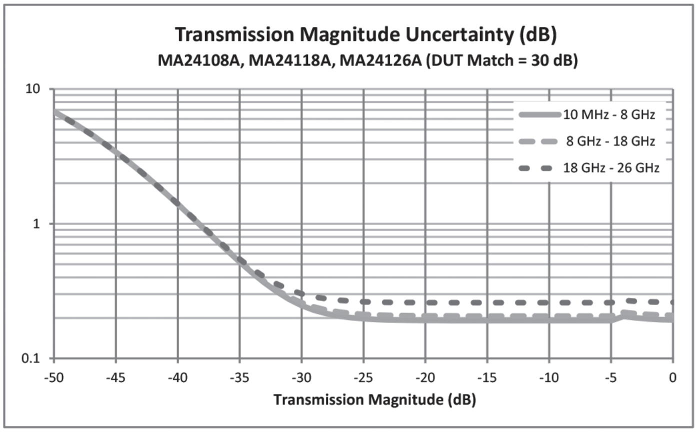

Return Loss Phase Uncertainty


Transmission Magnitude Uncertainty


Transmission Phase Uncertainty

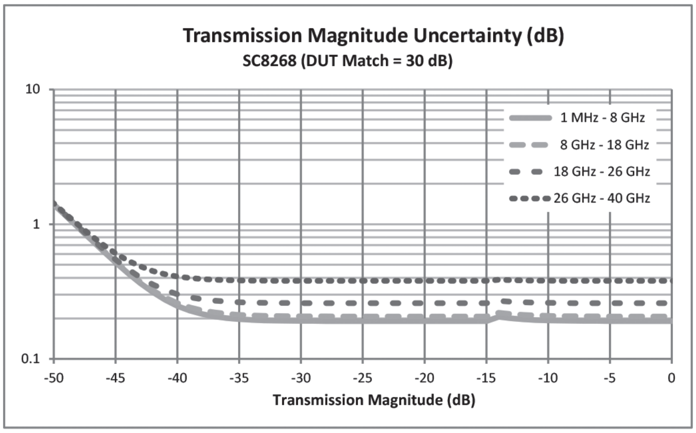
External Sensor Transmission Measurement Accuracy* (Corrected Transmission Uncertainty, Magnitude Only)

*: Sensor Transmission Calibration from Port 1 to Sensor, default power, 10 Hz bandwidth. SC8268 specifications below 10 MHz are typical.



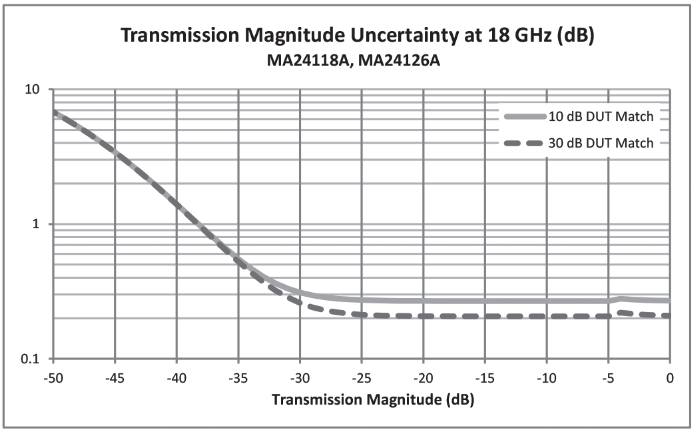
Transmission Magnitude Uncertainty (dB)

MA24108A, MA24118A, MA24126A (DUT Match = 30 dB)



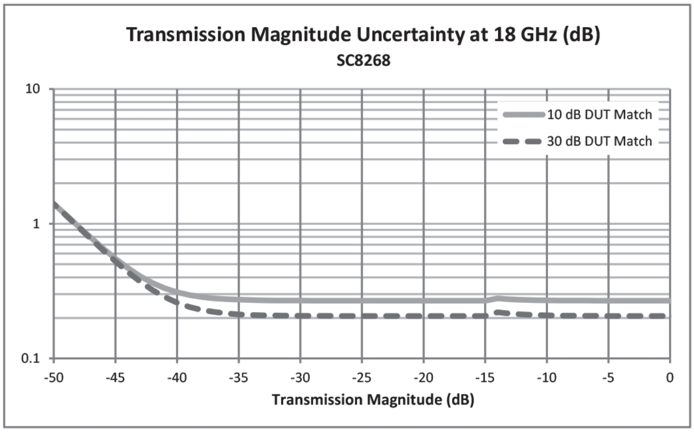
Transmission Magnitude Uncertainty (dB)

SC8268 (DUT Match = 30 dB)



Transmission Magnitude Uncertainty at 18 GHz (dB)

MA24118A, MA24126A



Transmission Magnitude Uncertainty at 18 GHz (dB)

SC8268

High Accuracy Power Meter – Standard (Requires external USB Power Sensor, sold separately)

Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale				
Average	# of Running Averages, Max Hold				
Zero/Cal	Zero On/Off, Cal Factor (Center Frequency, Signal Standard)				
Limits	Limit On/Off, Limit Upper/Lower				
Power Sensor Model	MA24105A	MA24106A	MA24108A/18A/26A	MA24208A/18A	MA24330A/40A/50A
Description	Inline High Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor	Microwave Universal USB Power Sensor	Microwave CW USB Power Sensor
Frequency Range	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8/18/26 GHz	10 MHz to 8 GHz/18 GHz	10 MHz to 33/40/50 GHz
Connector	Type N (f), 50Ω	Type N (m), 50Ω	Type N (m), 50Ω (8 GHz/18 GHz) Type K (m), 50Ω (26 GHz)	Type N (m), 50Ω	Type K (m), 50Ω (33 GHz/40 GHz) Type V (m), 50Ω (50 GHz)
Dynamic Range	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 µW to 200 mW)	–40 to +20 dBm (0.1 µW to 100 mW)	–60 to +20 dBm (1 nW to 100 mW)	–70 to +20 dBm (0.1 nW to 100 mW)
Measurand	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power	True-RMS, Slot Power, Burst Average Power	Average Power
Measurement Uncertainty	± 0.17 dB*1	± 0.16 dB*2	± 0.18 dB*3	± 0.17 dB*4	± 0.17 dB*5
Data sheet (for complete specifications)	11410-00621	11410-00424	11410-00504	11410-00841	11410-00906

*1: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than +20 dBm with a matched load.
Measurement results referenced to the input side of the sensor.

*2: Total RSS measurement uncertainty (0°C to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.

*3: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.

*4: Power uncertainty expressed with two sigma confidence level for CW measurement after zero operation. Includes calibration factor and linearity over temperature uncertainties, but not the effects of mismatch, zero set and drift, or noise.

*5: Includes linearity over temperature uncertainties, but not the effects of calibration factor, mismatch, zero set and drift, and noise.

Video Inspection Probe (Requires External USB Video Inspection Probe, sold separately)

Setup Parameters	Probe Model	G0306A or G0306B 400X USB Visual Inspection Probe
	Tip Type (included with G0306A)	SC_APC_F:, SC_PC_F:, LC_PC_F:, FC_PC_F:, 2.5APC_M:, 2.5PC_M:, 1.25PC_M:
	Test Profile (IEC 61300-3-35)	SM PC >45:, SM APC:, SM PC >25:, MM PC 62.5:, MM PC 50.0:
	Auto Analyze	On/Off
	Auto Filename	On/Off
	Auto Filename Settings	Location, File Prefix, Start Number, Include Date
Measurement Parameters	Live	View Live Image
	Captured	Capture Image for Analysis
	Analyze	Analyze Image
	Results Table	Auto/Off
	Overlay	On/Off
	Zoom Control Help	Displays instruction for image Zoom feature
Save/Recall Parameters	Save	Measurement (*.vipi), VIP Image (*.png), Screen Shot (.png)
	Recall	Measurement (*.vipi), VIP Image (*.png), Screen Shot (.png)
	File Management	Rename, Create Folder, Copy, Paste, Delete
Report Parameters	Header Settings	Customer, Project, Operator, Notes, Include Logo
	Generate Report	Generates pdf report with options to include multiple *.vipi files

Vector Network Analyzer (Option 440)

Setup Parameters	Active Trace	Tr1, Tr2, Tr3, Tr4
	Measurement (S-Parameter)	S_{11}, S_{21}, S_{12}, S_{22}
	Graph Types	Log Magnitude, SWR, Phase, Unwrapped Phase, Real, Imaginary, Group Delay, Smith Chart (Impedance), Inverted Smith Chart (Admittance), Log Mag/2 (1-Port Cable Loss), Real Impedance, Imaginary Impedance
	Domain	Frequency Domain, Distance Domain
	Number of Traces	1, 2, 3, 4
	Trace Format	Single, Dual, Tri, Quad. When used with Number of Traces, overlays are possible including a Single Format with Four trace overlays.
	Smoothing	Smoothing 0 to 20 % Independent Trace based.
	Group Delay Aperture	Aperture 0.25 to 20 % Aperture Defined as the frequency span over which the phase change is computed at a given frequency point. The aperture can be changed without recalibration.
	Group Delay Range	<180° of phase change within the aperture
	Frequency	Start Frequency (F1), Stop Frequency (F2)
	Distance	Start Distance (D1), Stop Distance (D2)
	Distance Units	Meters (m), Feet (ft)
	DTF Aid	Provides detailed DTF resolution information based on current instrument settings. Also provides helpful tips to optimize results.
	DTF Setup	DUT Line Type (Coax/WG), Cable List, Cable Loss, Propagation Velocity, Windowing
	Windowing	Rectangular, Nominal Side Lobe, Low Side Lobe, Minimum Side Lobe
	Amplitude	Resolution Per Division, Reference Value, Reference Line, Autoscale, Scale Preset
	Calibration	Start Calibration, Thru Update, Cal Info, Interpolation (On/Off), Cal Correction (On/Off)
	Cal Type	Full 2-Port, Full S_{11}, Full S_{22}, Full S_{11} & S_{22}, One-Path Two-Port (S_{11}, S_{21}), One-Path Two-Port (S_{22}, S_{12}), Response S_{11}, Response S_{22}, Response S_{11} & S_{22}, Response S_{21}, Response S_{12}, Response S_{21} & S_{12}
	Cal Line	Coax, Waveguide
	Cal Method	Short-Open-Load-Through (SOLT), Offset-Short (SSLT)
	Calibration Standards' Coefficients	Coax: K-Connector, N-Connector, 7/16, SMA, TNC, and four User defined Waveguide: WG11A, WG12, WG13, WG14, WG15, WG16, WG17, WG18, WG20, WG22, and four User Defined
	Marker	Markers 1 to 8 (On/Off), Delta Makers 2 to 8 (Ref Mk1), Marker to Peak/Valley, Marker Tracking (On/Off), 4 Marker Table, Marker 5 and 7 (Peak/Valley between M1 and M2), Marker 6 and 8 (Peak/Valley between M3 and M4)
	Limit	Active Limit (Upper/Lower), Limit State (On/Off, Single, Segmented), Move Active Limit, Edit Segments (42 upper and 42 lower segments maximum), Limit Alarm (On/Off), Pass/Fail (On/Off), Limit Preset
	Test Limits	Pass/Fail for Upper, Pass/Fail for Lower, Limit Audible Alarm
	Save[*1]	Measurement (.svna), Setup (.stp), Screen Shot (.png), S2P-Real/Imaginary (.s2p), S2P-Linear Mag/Phase (.s2p), S2P-Log Mag/Phase (.s2p), Text (.txt), CSV (.csv)
	Recall[*2]	Measurement (.svna), Setup (.stp), Screen Shot (.png)
	File Management	Rename, Create Folder, Copy, Paste, Delete
	Navigation (File Management)	Top, Bottom, Page Up, Page Down
	Frequency Sweep Type	Linear Continuous, Linear Single Sweep
	Data Points	Data Points 2 to 4001 (arbitrary setting)
	Data Averaging	Sweep-by-Sweep, 1 to 1000
	IF Bandwidth (Hz)	10, 20, 50, 100, 200, 500, 1k, 2k, 5k, 10k, 20k, 50k, 100k
	Reference Plane	Reference Plane The reference planes of a calibration (or other normalization) can be changed by entering a line length or time, and loss. Assumes flat magnitude, linear phase, and constant impedance.

Continued on next page

Setup Parameters	Auto Reference Plane Extension	Instead of manually entering a line length, this feature automatically adjusts phase shift from the current calibration (or other normalization) to compensate for external cables (or test fixtures). Assumes no loss (user can manually enter loss if known), flat magnitude, linear phase, and constant impedance.
	Trace Memory	A separate memory for each trace can be used to store measurement data for later display. The trace data can be saved and recalled.
	Trace Math	Complex trace math operations of subtraction, addition, multiplication, or division are provided.
	Dispersion Compensation	Waveguide correction that improves accuracy of distance-to-fault data by automatically compensating for different wavelengths propagating at different speeds.
	Impedance Conversion	Support for 50Ω and 75Ω Smith Charts are provided.
	Timebase Reference	Internal (default), External 10 MHz (Auto-sense, BNC female, Max +10 dBm)
	Ethernet Configuration	DHCP or Manual (Static) IP configuration, 10/100 Base-T, RJ45 jack
	Languages	English, French, German, Italian, Spanish, Russian, Portuguese, Japanese, Korean, Chinese
Frequency	Frequency Range	1 MHz to 8/14/20/30/40 GHz (Frequency option dependent)
	Frequency Accuracy	±1.0 ppm at 23°C
	Stability	±1.0 ppm from –10°C to +55°C (typ.)
	Aging	±1.0 ppm/yr (typ.)
	Frequency Resolution	1 Hz
Output Power	1 MHz to 8 GHz	+5 dBm (typ.) (High); –20 dBm (typ.) (Low)
	>8 GHz to 40 GHz	–3 dBm (typ.) (High); –20 dBm (typ.) (Low)
RF Immunity*3	RF Immunity High	+17 dBm (nom.)
Measurement Speed*4		≤ 550 µs/pt (S_{11} and S_{21}, 1001 points, 100 kHz IFBW, RF immunity low (typ.))
Dynamic Range*5, *6	(High Power, 10 Hz IFBW, 10 averages Port 1 to Port 2)	
	1 MHz to 10 MHz	≥85 dB (105 dB) (typ.)
	>10 MHz to 8 GHz	≥100 dB (115 dB) (typ.)
	>8 GHz to 40 GHz	≥100 dB (110 dB) (typ.)
Receiver Compression Port 1 or Port 2 (0.1 dB compression)	1 MHz to 40 GHz	+5 dBm (typ.)
High Level Noise*7	(High Power, 100 Hz IFBW, 20 MHz to 40 GHz)	
	Magnitude	±0.006 dB (±0.001 dB) (typ.) rms
	Phase	±0.090° (±0.060°) (typ.)
Temperature Stability	(Typical, 10 MHz to 40 GHz, ratio measurement, ports shorted)	
	Magnitude	±0.02 dB/°C
	Phase	±0.3 degrees/°C
Log Mag	Resolution Per Division	0.01 to 100 dB
	Reference Value	±1000 dB
	Reference Line	0 to 10
Log Mag/2	Resolution Per Division	0.01 to 100 dB
	Reference Value	±1000 dB
	Reference Line	0 to 10
SWR	Resolution Per Division	0.01 to 100
	Reference Value	1 to 1000
	Reference Line	0 to 10
Phase	Resolution Per Division	0.01° to 90°
	Reference Value	±1000°
	Reference Line	0 to 10
Unwrapped Phase	Resolution Per Division	0.01 degrees to 10^{13} degrees
	Reference Value	±10^{13} degrees
	Reference Line	0 to 10
Real/Imaginary	Resolution Per Division	0.01 to 260
	Reference Value	±10000
	Reference Line	0 to 10
Real/Imaginary Impedance	Resolution Per Division	0.01Ω to 100,000Ω
	Reference Value	±100,000Ω
	Reference Line	0 to 10
Group Delay	Resolution Per Division	1 fs to 100 s
	Reference Value	±100 s
	Reference Line	0 to 10
Smith Chart/ Inv Smith Chart	Reference Impedance	50Ω, 75Ω

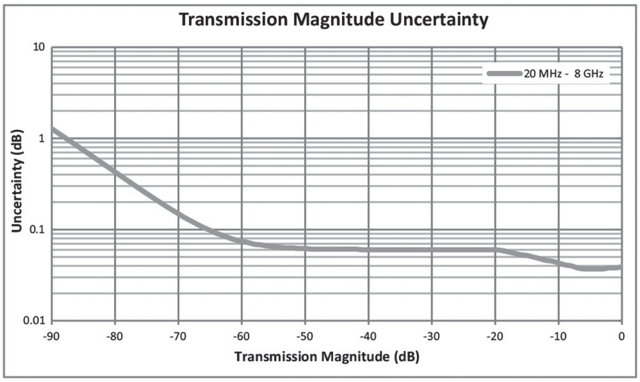
*1: SVNA (.svna) and S2P (.s2p) file formats are available in VNA Mode only.
*2: SVNA (.svna) file format recall is available in VNA Mode only.
*3: +13 dBm for interfering signals landing in-band.
*4: Single trace display, frequency domain. Excludes Group Delay, Smith, or Admittance graph types. Excludes Active Smoothing, Markers, and/or Limits.
*5: Dynamic range is defined as the difference between output power and receiver noise floor.
*6: Decrease specification by 5 dB between 8 GHz and 14 GHz. Crosstalk may reduce dynamic range up to 20 dB (typical) at lower IF bandwidths (≤ 10 kHz) when measuring highly reflective DUT's from 4 GHz to 8 GHz. Reflection measurements are not affected.
*7: High Level Noise below 20 MHz is increased by a factor of 5.0. High Level Noise (Phase only) above 20 GHz is increased by a factor of 1.5.

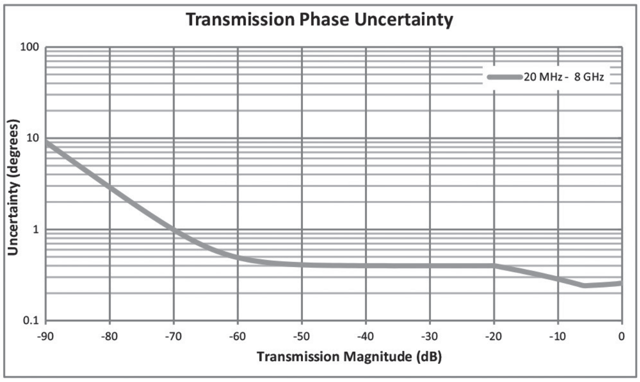
Measurement Accuracy* (OSLN50A-8 or OSLNF50A-8, TOSLN50A-8 or TOSLNF50A-8)

Frequency Range	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
1 MHz to 6 GHz	≥42	≥33	≥42	±0.08	±0.06
>6 GHz to 8 GHz	≥37	≥33	≥37	±0.08	±0.06

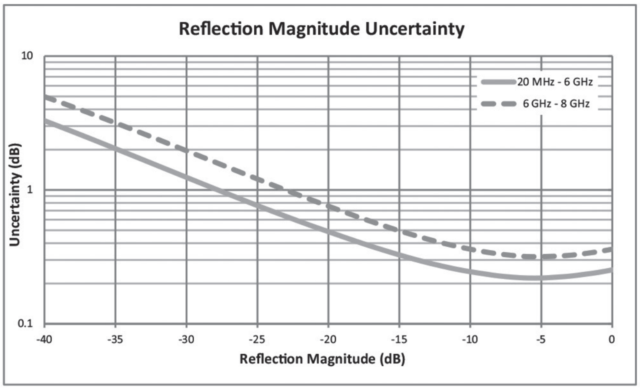
*: Full 2-Port calibration with isolation, Default Power, 10 Hz IFBW, No averaging, 10 minute warm-up. OSLN50A-8, OSLNF50A-8, TOSLN50A-8, or TOSLNF50A-8 calibration kit.
Load match specification applicable directly at corrected port only. De-rate by approximately 8 dB if using a 3670 series test port cable.
Reflection and Transmission Tracking are typical.

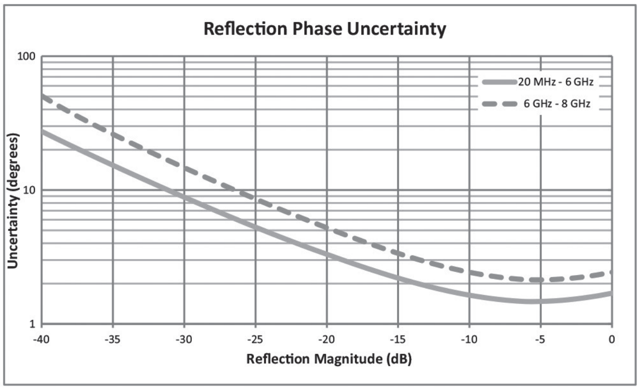
Transmission Uncertainty (S_{21}, S_{12}) (S_{11} = S_{22} = 0)





Reflection Uncertainty (S_{11}, S_{22}) (S_{21} = S_{12} = 0)



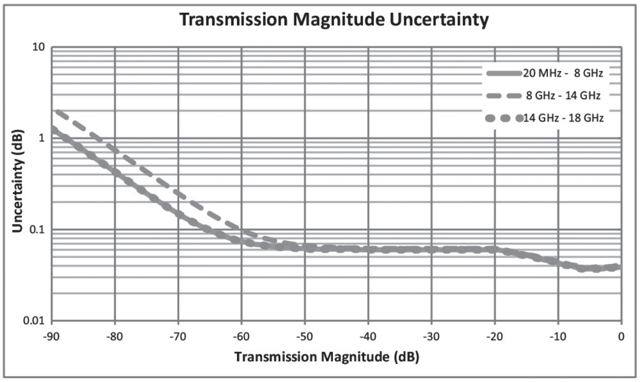


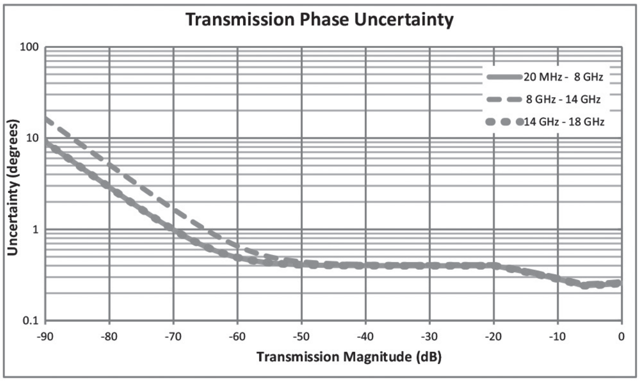
Measurement Accuracy* (OSLN50A-18 or OSLNF50A-18, TOSLN50A-18 or TOSLNF50A-18)

Frequency Range	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
1 MHz to 6 GHz	≥42	≥33	≥42	±0.08	±0.06
>6 GHz to 9 GHz	≥37	≥33	≥37	±0.08	±0.06
>9 GHz to 18 GHz	≥33	≥26	≥33	±0.04	±0.03

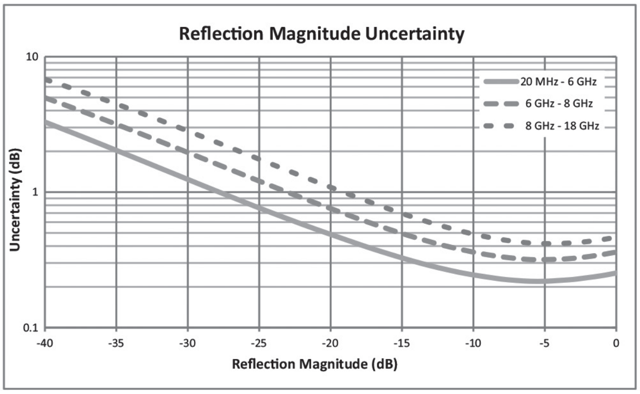
*: Full 2-Port calibration with isolation, Default Power, 10 Hz IFBW, No averaging, 10 minute warm-up. OSLN50A-18, OSLNF50A-18, TOSLN50A-18, or TOSLNF50A-18 calibration kit. Load match specification applicable directly at corrected port only. De-rate by approximately 8 dB if using a 3670 series test port cable. Reflection and Transmission Tracking are typical.

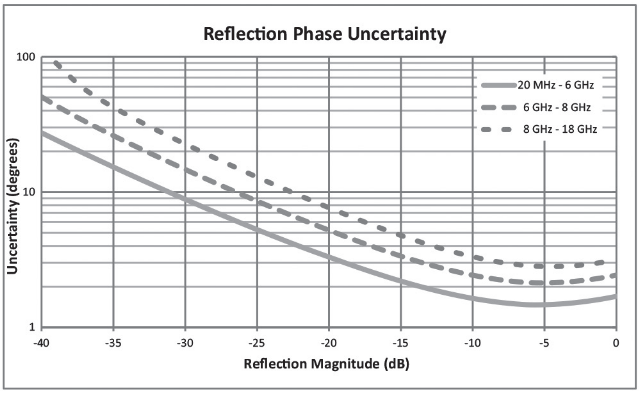
Transmission Uncertainty (S_{21}, S_{12}) (S_{11} = S_{22} = 0)


Transmission Magnitude Uncertainty


Transmission Phase Uncertainty

Reflection Uncertainty (S_{11}, S_{22}) (S_{21} = S_{12} = 0)


Reflection Magnitude Uncertainty

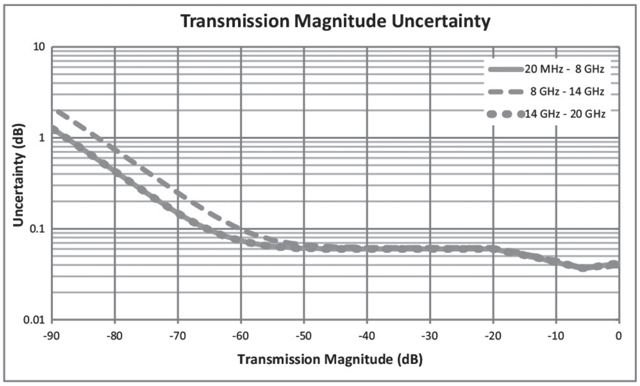

Reflection Phase Uncertainty

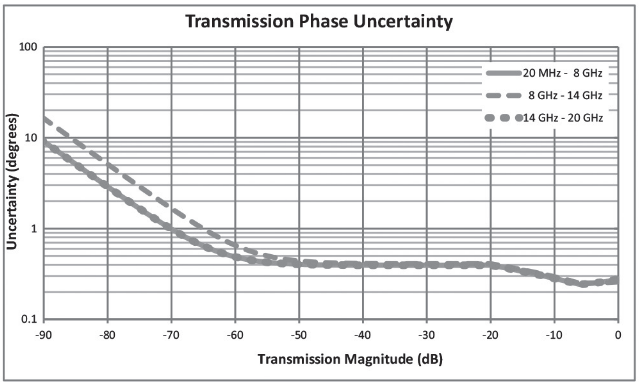
Measurement Accuracy* (TOSLK50A-20 or TOSLKF50A-20)

Frequency Range	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
1 MHz to 10 GHz	≥42	≥33	≥42	±0.08	±0.06
>10 GHz to 20 GHz	≥36	≥26	≥36	±0.04	±0.03

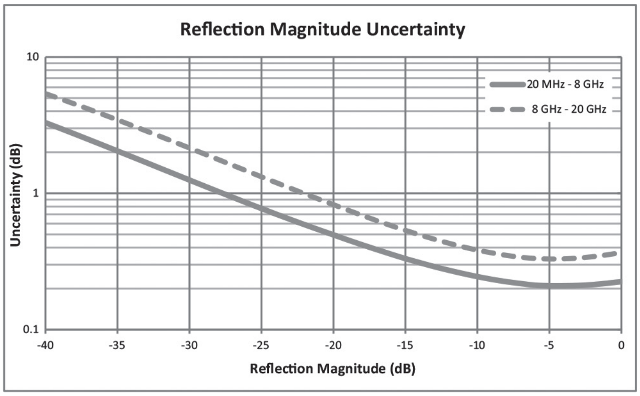
*: Full 2-Port calibration with isolation, Default Power, 10 Hz IFBW, No averaging, 10 minute warm-up. TOSLK50A-20 or TOSLKF50A-20 calibration kit.
Load match specification applicable directly at corrected port only. De-rate by approximately 8 dB if using a 3670 series test port cable.
Reflection and Transmission Tracking are typical.

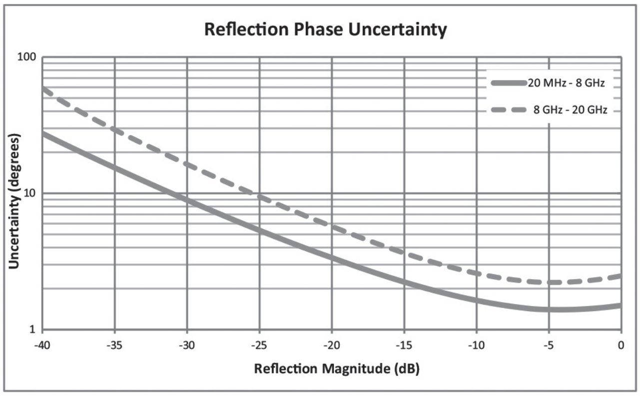
Transmission Uncertainty (S_{21}, S_{12}) (S_{11} = S_{22} = 0)


Transmission Magnitude Uncertainty


Transmission Phase Uncertainty

Reflection Uncertainty (S_{11}, S_{22}) (S_{21} = S_{12} = 0)


Reflection Magnitude Uncertainty

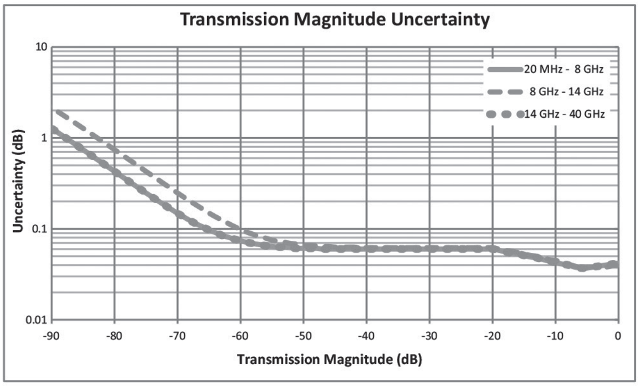

Reflection Phase Uncertainty

Measurement Accuracy* (TOSLK50A-40 or TOSLKF50A-40)

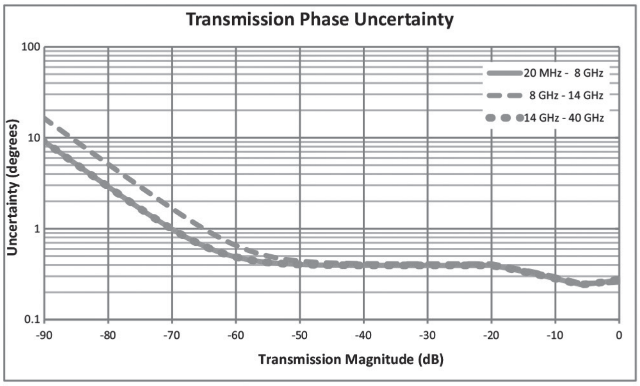
Frequency Range	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
1 MHz to 10 GHz	≥42	≥33	≥42	±0.08	±0.06
>10 GHz to 20 GHz	≥36	≥26	≥36	±0.04	±0.03
>20 GHz to 30 GHz	≥32	≥22	≥32	±0.04	±0.03
>30 GHz to 40 GHz	≥30	≥20	≥30	±0.04	±0.03

*: Full 2-Port calibration with isolation, Default Power, 10 Hz IFBW, No averaging, 10 minute warm-up. TOSLK50A-40 or TOSLKF50A-40 calibration kit.
Load match specification applicable directly at corrected port only. De-rate by approximately 8 dB if using a 3670 series test port cable.
Reflection and Transmission Tracking are typical.

Transmission Uncertainty (S_{21}, S_{12}) ($S_{11} = S_{22} = 0$)

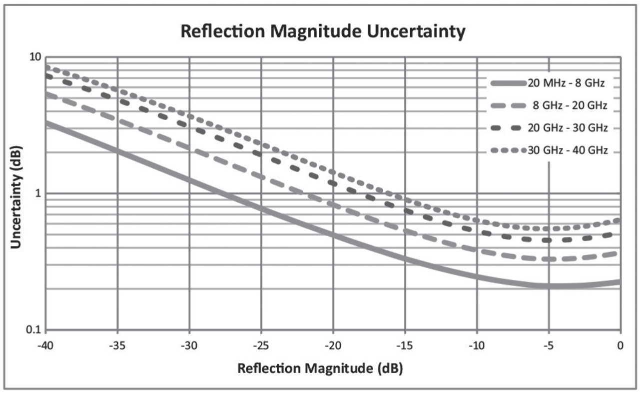


Transmission Magnitude Uncertainty

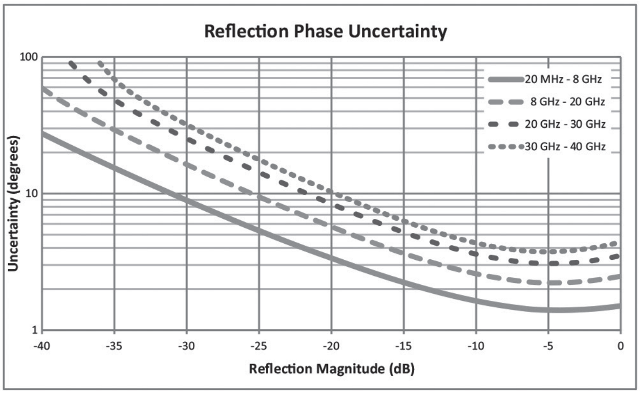


Transmission Phase Uncertainty

Reflection Uncertainty (S_{11}, S_{22}) ($S_{21} = S_{12} = 0$)



Reflection Magnitude Uncertainty



Reflection Phase Uncertainty

Vector Voltmeter (Option 441)

Setup Parameters (Measurement)	Reflection	1-port Reflection (best for cable trimming, stub tuning, magnitude and phase matching of low loss DUTs)
	Transmission	2-port Transmission (best magnitude and phase matching of splitters, high loss DUTs, glide slope, etc.)
	Ratio A/B	Magnitude & Phase Ratio of A & B receivers. Port 1 = A, Port 2 = B. Requires external CW source
	Ratio B/A	Magnitude & Phase Ratio of A & B receivers. Port 1 = A, Port 2 = B. Requires external CW source
	Measurement Format	LogMag/Phase, LinMag/Phase, SWR, Impedance
	Display Format	Single, Table (table holds up to 12 measurements plus reference)
	Save Reference	Normalize response (Measurements become relative to saved reference)
	Clear Reference	Clears normalized response (Measurements are no longer relative to saved reference)
	Clear Table	Clears all values in table
Setup Parameters (Frequency)*1	Measurement Frequency	Set CW Frequency, 1 MHz (minimum)
Setup Parameters (Amplitude)	Resolution	1 or 2 Decimal Display Resolution
	Reference Impedance	50Ω or 75Ω (Impedance Measurement Format only)
Setup Parameters (Calibration)	Start Calibration	Measure, Cal Setup
	Thru Update	Updates Thru parameters of active calibration and maintains OSL calibration parameters
	Cal Info	Display current calibration status, including temperature
	Cal Correction	On/Off
Setup Parameters (Sweep)	Run/Hold	Hold stops measurement and freezes display data
	RF Pwr In Hold	On/Off
	Source Power	High/Low
	IFBW	10 Hz, 100 Hz (default), 1 kHz, 100 kHz
	Sweep Averaging	Range 1 to 1000 rolling average
Setup Parameters (File)	Save	Measurement (.vvm), Setup (.stp), Screen Shot (.png), Text (.txt), CSV (.csv)
	Recall	Measurement (.vvm), Setup (.stp), Screen Shot (.png)
	File Management	Rename, Create Folder, Copy, Paste, Delete
	Navigation (File management)	Top, Bottom, Page Up, Page Down
Setup Parameters (System)	Timebase Reference	Internal (default), External 10 MHz (Auto-sense, BNC female, Max +10 dBm)
	Ethernet Configuration	DHCP or Manual (Static) IP configuration, 10/100 Base-T, RJ45 connector
	Languages	English, French, German, Italian, Spanish, Russian, Portuguese, Japanese, Korean, Chinese
Frequency	Frequency Range	1 MHz to 8/14/20/30/40 GHz (frequency option dependent)
	Frequency Accuracy	±1.0 ppm at 23°C
	Stability	±1.0 ppm from –10°C to +55°C (typ.)
	Aging	±1.0 ppm/yr (typ.)
	Frequency Resolution	1 Hz
Output Power*2	1 MHz to 8 GHz	+5 dBm (typ.) (High); –20 dBm (typ.) (Low)
	>8 GHz to 40 GHz	–3 dBm (typ.) (High); –20 dBm (typ.) (Low)
Reflection/ Transmission Uncertainty	1 MHz to 40 GHz	See the uncertainty curves in the Cable and Antenna Analyzer section. Applicable only when a vector error correction (calibration) is performed and active. Uncalibrated reflection/transmission uncertainty is not specified.
Receiver Compression*3 Port 1 or Port 2 (0.1 dB compression)	1 MHz to 40 GHz	+5 dBm (typ.)
Reference Level Input Range*3 (A/B and B/A)	1 MHz to 40 GHz	+5 to –60 dBm (auto ranging) (typ.)
Ratio Accuracy*4 (A/B and B/A)	1 MHz to 1 GHz	≤ ±0.2 dB typical (Relative to stored reference, DUT loss <10 dB)
	>1 GHz to 20 GHz	≤ ±0.5 dB typical (Relative to stored reference, DUT loss <10 dB)
	>20 GHz to 40 GHz	≤ ±1.0 dB typical (Relative to stored reference, DUT loss <10 dB)
Measurement Format	LogMag/Phase	Resolution: 1 or 2 decimal places Magnitude Display: dB Phase Display Range: ±180°
	LinMag/Phase	Resolution: 1 or 2 decimal places Magnitude Display: Linear Phase Display Range: ±180°
	SWR	Resolution: 1 or 2 decimal places Display: Linear SWR
	Impedance	Resolution: 1 or 2 decimal places Display: Real and Imaginary (complex impedance) Ω

*1: Reference receiver (A or B) will Auto-tune approximately ±100 kHz to lock onto external CW signal during A/B & B/A Ratio measurement.
*2: Not applicable in A/B or B/A Ratio Measurement.
*3: Recommend ≤+3 dBm for A/B or B/A Ratio Measurement.
*4: Reference signal level 0 to –20 dBm at input port.

General Specifications

Setup Parameters	System Info	Status, Battery
	System Setups	Date/Time, Language, Display/Audio, Option Configuration
	Date/Time	Day, Month, Year, Time
	Language	English, French, German, Italian, Spanish, Russian, Portuguese, Japanese, Korean, Chinese
	Display/Audio	Brightness, Color Schemes, Screen Shot Settings, Volume
	Option Configuration	Enable Options Using Key and Enable Options Using File
	Connectivity	GPS (Clear Data, Sync System Time), Ethernet Configuration (DHCP/Static)
	Diagnostics	Self Test
	Preset	Preset, Reset
	Reset	Factory Reset, Delete All User or Custom Files, Master Reset, Update Firmware
	File	Save, Recall, File Management
	File Management	Rename, Create Folder, Copy, Paste, Delete, Navigation
	Save	Measurement (*.dat, *.vipi), Setup (*.stp), Screen Shot and VIP Image (*.png), Text (*.txt), CSV (*.csv)
	Recall	Measurement (*.dat, *.vipi), Setup (*.stp), Screen Shot and VIP Image (*.png)
	Navigation	Top, Bottom, Page Up, Page Down
	Internal Trace/Setup Memory	>2000 files, files may be traces, setups, screenshots, or any combination
	External Trace/Setup Memory	Limited only by size of USB Flash drive
Connectors	Port 1 (models up to 14 GHz)	Type N (f), 50Ω, Maximum Input +23 dBm, ±50 VDC
	Port 2 (models up to 14 GHz)	Type N (f), 50Ω, Maximum Input +23 dBm, ±50 VDC
	Port 1 (models >14 GHz)	Type Ruggedized K (m), 50Ω, Maximum Input +23 dBm, ±50 VDC
	Port 2 (models >14 GHz)	Type Ruggedized K (m), 50Ω, Maximum Input +23 dBm, ±50 VDC
	External Reference In	Type BNC (f), 50Ω, 10 MHz, Maximum +10 dBm
	External Trigger In	Type BNC female, 50Ω, 3.3 V or 5 V TTL triggers on positive edge. Maximum +5 VDC
	Headset Jack	3.5 mm mini-jack
	External Power	5.5 mm barrel connector, +11 VDC to +14 VDC, ≤4.0 A
	USB Interface (2)	Type A, Connect USB Flash Drive, GPS Module, Power Sensor, other
	USB Interface	5-pin Mini-B, Connect to PC for data transfer and/or control
	Ethernet	RJ-45, Category 5, 10/100 MB/s. Connect to PC for data transfer and/or control
Display	Type	High Resolution Resistive Touchscreen
	Size	8.4 in daylight viewable color LCD
	Resolution	800 × 600 Pixel Defects No more than five defective pixels (99.9989% good pixels)
	Pixel Defects	No more than five defective pixels (99.9989% good pixels)
Battery	Type	Li-Ion
	Battery Operation	5.0 hr (typ.)
CE	EMC	2014/30/EU, EN61326-1, EN61000-4-2
	LVD	2014/35/EU, EN61010-1
	RoHS	(EU) 2015/863
RCM	Australia and New Zealand	RCM AS/NZS 4417:2012
KCC	South Korea	KCC-REM-A21-0004
Environmental MIL-PRF-28800F Class 2	Operating Temperature Range	–10°C to +55°C
	Storage Temperature Range	–51°C to +71°C
	Maximum Relative Humidity	95% RH at +30°C, non-condensing
	Vibration, Sinusoida	5 Hz to 55 Hz
	Vibration, Random	10 Hz to 500 Hz
	Half Sine Shock	30 g_n
	Altitude	4600 meters, operating and non-operating
	Explosive Atmosphere	MIL-PRF-28800F Section 4.5.6.3 MIL-STD-810G, Method 511.5, Procedure 1
Dimensions and Mass		273 (W) × 199 (H) × 91 (D) mm (10.7 × 7.8 × 3.6 in) 3.0 kg (6.6 lb), including battery

Line Sweep Tools™ (for your PC)

Trace Capture	Browse to Instrument	View and copy traces from the test equipment to your PC using Windows Explorer
	Open Legacy Files	Open DAT files captured with Handheld Software Tools v6.61
	Open Current Files	Open VNA or DAT files
	Capture Plots To	The Line Sweep Tools screen, DAT files, Database, or JPEG
Traces	Trace Types	Return Loss, VSWR, DTF-RL, DTF-VSWR, Cable Loss, Smith Chart, and PIM
	Trace Formats	DAT, VNA, CSV, PNG, BMP, JPG, HTML, Data Base, and PDF
Report Generation	Report Generator	Includes GPS location along with measurements
	Report Format	Create reports in HTML or PDF format
	Report Setup	Report Title, Company, Prepared for, Location, Date and Time, Filename, Company logo
	Trace Setup	1 Trace Portrait Mode, 2 Trace Portrait Mode, 1 Trace Landscape Mode
Trace Validation	Presets	7 presets allow “one click” setting of up to 6 markers and one limit line
	Marker Controls	6 regular Markers, Marker Peak, Marker Valley, Marker between, and frequency entry
	Delta Markers	6 Delta markers
	Limit Line	Enable and drag or value entry. Also works with presets
	Next Trace Button	Next Trace and Previous Trace arrow keys allow quick switching between traces
Tools	Cable Editor	Allows creation of custom cable parameters
	Distance to Fault	Converts a Return Loss trace to a Distance to Fault trace
	Measurement Calculator	Converts Real, Imaginary, Magnitude, Phase, RL, VSWR, Rho, and Transmit power
	Signal Standard Editor	Creates new band and channel tables
	Renaming Grid	36 user-definable phrases for creation of file names, trace titles, and trace subtitles
Connectivity	Connections	Ethernet, USB cable, and USB memory stick

easyTest Tools™ (for your PC)

Instrument Mode	Cable & Antenna Analyzer Mode	
Commands	Display Image	Allows putting a custom image on the instrument screen
	Recall Setup	Places the instrument into a known state
	Prompt	Displays instructional messages on the instrument screen
	Save	Allows automatic or manual saving of traces

Programmable Remote Control

Functionality: Instrument functionality is available via remote programming.
See the S820E Programming Manual for details.
Programming Language: Standard Commands for Programmable Instruments (SCPI)
Interfaces: USB, LAN

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Standard Configuration
S820E	Microwave Site Master
	(Requires one Frequency Option 708, 714, 720, 730, or 740)
	Three Year Warranty (One year on battery)
	Instrument Options
S820E-0440	Vector Network Analyzer (VNA)
S820E-0441	Vector Voltmeter (VVM)
S820E-0098	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate.
S820E-0099	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate, test report, and uncertainty data.
	Frequency Options
	(Select one frequency option only)
S820E-0708	1 MHz to 8 GHz, type N (f) ports
S820E-0714	1 MHz to 14 GHz, type N (f) ports
S820E-0720	1 MHz to 20 GHz, type Ruggedized K (m) ports (compatible with 3.5 mm and SMA connectors)
S820E-0730	1 MHz to 30 GHz, type Ruggedized K (m) ports (compatible with 3.5 mm and SMA connectors)
S820E-0740	1 MHz to 40 GHz, type Ruggedized K (m) ports (compatible with 3.5 mm and SMA connectors)
	USB Power Sensors
	(For complete ordering information see the respective data sheets of each sensor)
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +3 to +51.76 dBm
MA24106A	RF USB Power Sensor and 2-Port Loss/Transmission Sensor, 50 MHz to 6 GHz, +23 to –40 dBm
MA24108A	Microwave USB Power Sensor and 2-Port Loss/Transmission Sensor, 10 MHz to 8 GHz, +20 to –40 dBm
MA24118A	Microwave USB Power Sensor and 2-Port Loss/Transmission Sensor, 10 MHz to 18 GHz, +20 to –40 dBm
MA24126A	Microwave USB Power Sensor and 2-Port Loss/Transmission Sensor, 10 MHz to 26 GHz, +20 to –40 dBm
MA24208A	Microwave Universal USB Power Sensor and 2-Port Loss/Transmission Sensor, 10 MHz to 8 GHz, +20 to –60 dBm
MA24218A	Microwave Universal USB Power Sensor and 2-Port Loss/Transmission Sensor, 10 MHz to 18 GHz, +20 to –60 dBm
MA24330A	Microwave CW USB Power Sensor and 2-Port Loss/Transmission Sensor, 10 MHz to 33 GHz, +20 to –70 dBm
MA24340A	Microwave CW USB Power Sensor and 2-Port Loss/Transmission Sensor, 10 MHz to 40 GHz, +20 to –70 dBm
MA24350A	Microwave CW USB Power Sensor and 2-Port Loss/Transmission Sensor, 10 MHz to 50 GHz, +20 to –70 dBm
SC8268	USB Transmission Sensor, K (m), 1 MHz to 40 GHz, +10 to –50 dBm
MA25100A	RF Power Indicator
	USB Extender Kit
	(for use with external 2-port cable loss/transmission sensors; requires Cat 5e extension cable, sold separately)
2000-1717-R*	USB 1.1 Passive 40 m Extender
2000-1900-R	USB 2.0 active 100 meter Cat 5e Extender (with Type A power cord for USA, Japan, North America, Central America and Caribbean)
2000-1901-R	USB 2.0 active 100 meter Cat 5e Extender (with Type C power cord for use in Europe, India, South Korea, and many countries in Middle East and Africa)
2000-1902-R	USB 2.0 active 100 meter Cat 5e Extender (with Type I power cord for use in Australia, New Zealand, Argentina, and the South Pacific)
2000-1903-R	USB 2.0 active 100 meter Cat 5e Extender (with Type G power cord for use in the UK, and several other countries in Asia, the Middle East, and Africa)
2100-28-R	Cat 5e extension cable for use with USB Extender (22.5 m)
	Documentation (soft copy at www.anritsu.com)
10100-00065	Product Information, Compliance, and Safety
11410-00749	Technical Data Sheet
10580-00343	User Guide
10580-00344	Programming Manual
10580-00345	Maintenance Manual
	Standard Accessories (included with instrument)
2000-1654-R	Soft Carrying Case
71693-R	Ruggedized K (f) to N (f), 2 pcs (included only with S820E-0720)
633-75	Rechargeable Li-Ion Battery
40-187-R	AC-DC Adapter
806-141-R	Automotive Power Adapter, 12 VDC, 60 W
2000-1691-R	Stylus with Coiled Tether
2000-1797-R	Screen Protector Film (one factory installed, one spare)
3-2000-1498	USB A/5-pin Mini-B Cable, 3.05 m (10 ft)
2000-1371-R	Ethernet Cable, 2.13 m (7 ft)
	Certificate of Calibration and Conformance

Model/Order No.	Name
	Optional Accessories
	Miscellaneous Accessories
2000-1723-R	High Performance USB Mag-Mount GPS Antenna/Receiver
2000-1374-R	External Charger for Li-Ion Batteries
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle
760-286-R	Compact Transit Case with Wheels and Handle 55.6 × 35.5 × 22.9 cm (21.89" × 13.98" × 9.01")
	Full Temperature Coaxial Calibration Kits
	(–10°C to +55°C, K Type is compatible with 3.5 mm and SMA connectors see individual data sheets on www.anritsu.com)
OSLN50A-8	High Performance Type N (m), DC to 8 GHz, 50Ω
OSLNF50A-8	High Performance Type N (f), DC to 8 GHz, 50Ω
TOSLN50A-8	High Performance with Through Type N (m), DC to 8 GHz, 50Ω
TOSLNF50A-8	High Performance with Through Type N (f), DC to 8 GHz, 50Ω
OSLN50A-18	High Performance Type N (m), DC to 18 GHz, 50Ω
OSLNF50A-18	High Performance Type N (f), DC to 18 GHz, 50Ω
TOSLN50A-18	High Performance with Through Type N (m), DC to 18 GHz, 50Ω
TOSLNF50A-18	High Performance with Through Type N (f), DC to 18 GHz, 50Ω
TOSLK50A-20	High Performance with Through Type K (m), DC to 20 GHz, 50Ω
TOSLKF50A-20	High Performance with Through Type K (f), DC to 20 GHz, 50Ω
TOSLK50A-40	High Performance with Through Type K (m), DC to 40 GHz, 50Ω
TOSLKF50A-40	High Performance with Through Type K (f), DC to 40 GHz, 50Ω
	Coaxial Calibration Components, N Type 50Ω, K Type 50Ω
	(K Type is compatible with 3.5 mm and SMA connectors)
22N50	Precision Open/Short, N (m), DC to 18 GHz, 50Ω
22NF50	Precision Open/Short, N (f), DC to 18 GHz, 50Ω
28N50-2	Precision Load, N (m), DC to 18 GHz, 50Ω
28NF50-2	Precision Load, N (f), DC to 18 GHz, 50Ω
22K50	Precision Open/Short, K (m), DC to 40 GHz, 50Ω
22KF50	Precision Open/Short, K (f), DC to 40 GHz, 50Ω
28K50	Precision Load, K (m), DC to 40 GHz, 50Ω
28KF50	Precision Load, K (f), DC to 40 GHz, 50Ω
	Coaxial Calibration Components, Other 50Ω, 75Ω
2000-1618-R	Open/Short/Load, 7/16 DIN (m), DC to 6.0 GHz 50Ω
2000-1619-R	Open/Short/Load, 7/16 DIN (f), DC to 6.0 GHz 50Ω
2000-1914-R	Precision Open/Short/Load, 4.3-10 (f), DC to 6 GHz, 50Ω
2000-1915-R	Precision Open/Short/Load, 4.3-10 (m), DC to 6 GHz, 50Ω
12N50-75B	Matching Pad, DC to 3 GHz, 50Ω to 75Ω
22N75	Open/Short, N (m), DC to 3 GHz, 75Ω
22NF75	Open/Short, N (f), DC to 3 GHz, 75Ω
26N75A	Precision Termination, N (m), DC to 3 GHz, 75Ω
26NF75A	Precision Termination, N (f), DC to 3 GHz, 75Ω
1091-55-R	Open, TNC (f), DC to 18 GHz
1091-53-R	Open, TNC (m), DC to 18 GHz
1091-56-R	Short, TNC (f), DC to 18 GHz
1091-54-R	Short, TNC (m), DC to 18 GHz
1015-54-R	Termination, TNC (f), DC to 18 GHz
1015-55-R	Termination, TNC (m), DC to 18 GHz
	Video Inspection Probe
G0306B	Video Inspection Probe (400x), including the following standard connector tips:
Universal Tips	H0361A 1.25PC-M, H0360A 2.5PC-M, H0362A 2.5APC-M
Bulkhead Tips	H0363A LC-PC-F, H0364A FC-PC-F, H0375A ST-PC-F, H0366A SC-APC-F
Additional Tips	H0372A E2000-PC-F, H0373A FC-APC-F, H0374A MU-PC-F, H0365A SC-PC-F, H0376A 1.25APC-M
971-14-R	Ferrule Cleaner, 2.5 mm SC
971-15-R	Ferrule Cleaner, 1.25 mm LC
971-16	Fiber Ferrule Cleaner

Continued on next page

*: Not compatible with sensors MA24208A, MA24218A, MA24330A, MA24340A, MA24350A; must use active extenders with these sensors.

Waveguide Calibration Components, Rectangular Type 50Ω					
Frequency Range (GHz)	1/8 Offset	3/8 Offset	Termination	Coax to Waveguide Adapter	Compatible Flanges
3.95 to 5.85	23UA187-R	24UA187-R	26UA187-R	35UA187N-R	CPR187F-R, CPR187G-R, UG-1352/U-R, UG-1353/U-R, UG-1728/U-R, UG-1729/U-R, UG-148/U-R, UG-149A/U-R
5.85 to 8.20	23UA137-R	24UA137-R	26UA137-R	35UA137N-R	CPR137F-R, CPR137G-R, UG-1356/U-R, UG-1357/U-R, UG-1732/U-R, UG-1733/U-R, UG-343B/U-R, UG-344/U-R, UG-440B/U-R, UG-441/U-R
7.05 to 10.00	23UA112-R	24UA112-R	26UA112-R	35UA112N-R	CPR112F-R, CPR112G-R, UG-1358/U-R, UG-1359/U-R, UG-1734/U-R, UG-1735/U-R, UG-52B/U-R, UG-51/U-R, UG-137B/U-R, UG-138/U-R
8.20 to 12.40	23UA90-R	24UA90-R	26UA90-R	35UA90N-R	CPR90F-R, CPR90G-R, UG-1360/U-R, UG-1361/U-R, UG-1736/U-R, UG-1737/U-R, UG-40B/U-R, UG-39/U-R, UG-135/U-R, UG-136B/U-R
12.40 to 18.00	23UA62-R	24UA62-R	26UA62-R	35UA62N-R	UG-541A/U-R, UG-419/U-R, UG-1665/U-R, UG1666/U-R
17.00 to 26.50	23UA42-R	24UA42-R	26UA42-R	35UA42K-R	UG-596A/U-R, UG-595/U-R, UG-597/U-R, UG-598A/U-R
26.50 to 40.00	23UA28-R	24UA28-R	26UA28-R	35UA28K-R	UG-599/U-R
3.30 to 4.90	23UM40-R	24UM40-R	26UM40-R	35UM40N-R	PDR40-R
3.95 to 5.85	23UM48-R	24UM48-R	26UM48-R	35UM48N-R	CAR48-R, PAR48-R, UAR48-R, PDR48-R
5.85 to 8.20	23UM70-R	24UM70-R	26UM70-R	35UM70N-R	CAR70-R, PAR70-R, UAR70-R, PDR70-R
7.05 to 10.00	23UM84-R	24UM84-R	26UM84-R	35UM84N-R	CBR84-R, UBR84-R, PBR84-R, PDR84-R
8.20 to 12.40	23UM100-R	24UM100-R	26UM100-R	35UM100N-R	CBR100-R, UBR100-R, PBR100-R, PDR100-R
10.00 to 15.00	23UM120-R	24UM120-R	26UM120-R	35UM120N-R	CBR120-R, UBR120-R, PBR120-R, PDR120-R
12.40 to 18.00	23UM140-R	24UM140-R	26UM140-R	35UM140N-R	CBR140-R, UBR140-R, PBR140-R, PDR140-R
17.00 to 26.50	23UM220-R	24UM220-R	26UM220-R	35UM220K-R	CBR220-R, UBR220-R, PBR220-R, PDR220-R
26.50 to 40.00	23UM320-R	24UM320-R	26UM320-R	35UM320K-R	UBR320-R

Model/Order No.	Name
	Phase-Stable Test Port Extension Cables (Armored and Flexible)
14RKFKF50-0.6	0.6 m (24 in), DC to 40 GHz, Ruggedized K (f) to K (f), 50Ω
14RKFKF50-1.0	1.0 m (39 in), DC to 40 GHz, Ruggedized K (f) to K (f), 50Ω
14RKFK50-0.6	0.6 m (24 in), DC to 40 GHz, Ruggedized K (f) to K (m), 50Ω
14RKFK50-1.0	1.0 m (39 in), DC to 40 GHz, Ruggedized K (f) to K (m), 50Ω
14KFKF50-0.6	0.6 m (24 in), DC to 40 GHz, K (f) to K (f), 50Ω
14KFKF50-1.0	1.0 m (39 in), DC to 40 GHz, K (f) to K (f), 50Ω
14KFK50-0.6	0.6 m (24 in), DC to 40 GHz, K (f) to K (m), 50Ω
14KFK50-1.0	1.0 m (39 in), DC to 40 GHz, K (f) to K (m), 50Ω
15NN50-1.0B	1.0 m (39 in), DC to 18 GHz, N (m) to N (m), 50Ω
15NNF50-1.0B	1.0 m (39 in), DC to 18 GHz, N (m) to N (f), 50Ω
15LL50-1.0A	1.0 m (39 in), DC to 20 GHz, 3.5 mm (m) to 3.5 mm (m), 50Ω
15LLF50-1.0A	1.0 m (39 in), DC to 20 GHz, 3.5 mm (m) to 3.5 mm (f), 50Ω
15KK50-1.0A	1.0 m (39 in), DC to 26.5 GHz, K (m) to K (m), 50Ω
15KKF50-1.0A	1.0 m (39 in), DC to 26.5 GHz, K (m) to K (f), 50Ω
15N43M50-1.5C	Test Port Extension Cable, 1.5 m, DC to 6 GHz, N (m) to 4.3-10 (m)
15N43F50-1.5C	Test Port Extension Cable, 1.5 m, DC to 6 GHz, N (m) to 4.3-10 (f)
15N43M50-3.0C	Test Port Extension Cable, 3 m, DC to 6 GHz, N (m) to 4.3-10 (m)
15N43F50-3.0C	Test Port Extension Cable, 3 m, DC to 6 GHz, N (m) to 4.3-10 (f)
	Phase-Stable 18 GHz and 40 GHz Semi-Rigid Cables (Armored)
3670K50-1	0.3 m (12 in), DC to 40 GHz, K (f) to K (m), 50Ω
3670K50-2	0.6 m (24 in), DC to 40 GHz, K (f) to K (m), 50Ω
3670N50-1	0.3 m (12 in), DC to 18 GHz, N (f) to N (m), 50Ω
3670NN50-1	0.3 m (12 in), DC to 18 GHz, N (m) to N (m), 50Ω
3670N50-2	0.6 m (24 in), DC to 18 GHz, N (f) to N (m), 50Ω
3670NN50-2	0.6 m (24 in), DC to 18 GHz, N (m) to N (m), 50Ω
	Adapters
71693-R	DC to 18 GHz, Ruggedized adapter, K (f) - N (f), 50Ω
1091-26-R	DC to 18 GHz, N (m) to SMA (m), 50Ω
1091-27-R	DC to 18 GHz, N (m) to SMA (f), 50Ω
1091-80-R	DC to 18 GHz, N (f) to SMA (m), 50Ω
1091-81-R	DC to 18 GHz, N (f) to SMA (f), 50Ω
1091-172	DC to 1.3 GHz, BNC (f) to N (m), 50Ω
510-90-R	DC to 7.5 GHz, 7/16 (f) to N (m), 50Ω
510-91-R	DC to 7.5 GHz, 7/16 (f) to N (f), 50Ω
510-92-R	DC to 7.5 GHz, 7/16 (m) to N (m), 50Ω
510-93-R	DC to 7.5 GHz, 7/16 (m) to N (f), 50Ω
510-96-R	DC to 7.5 GHz, 7/16 DIN (m) to 7/16 DIN (m), 50Ω
510-97-R	DC to 7.5 GHz, 7/16 DIN (f) to 7/16 DIN (f), 50Ω
513-62	DC to 18 GHz, TNC (f) to N (f), 50Ω
1091-315	DC to 18 GHz, TNC (m) to N (f), 50Ω
1091-324	DC to 18 GHz, TNC (f) to N (m), 50Ω
1091-325	DC to 18 GHz, TNC (m) to N (m), 50Ω
1091-317	DC to 18 GHz, TNC (m) to SMA (f), 50Ω
1091-318	DC to 18 GHz, TNC (m) to SMA (m), 50Ω
1091-323	DC to 18 GHz, TNC (m) to TNC (f), 50Ω
1091-326	DC to 18 GHz, TNC (m) to TNC (m), 50Ω
1091-465-R	DC to 6 GHz, 4.3-10 (f) to N (f), 50Ω
1091-467-R	DC to 6 GHz, 4.3-10 (m) to N (f), 50Ω
510-102-R	DC to 11 GHz, N (m)-N (m), 90 degrees, 50Ω

Model/Order No.	Name
	Precision Adapters
34NN50A	Precision Adapter, N (m) to N (m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N (f) to N (f), DC to 18 GHz, 50Ω
K220B	Precision Adapter, DC to 40 GHz, K (m) to K (m), 50Ω
K222B	Precision Adapter, DC to 40 GHz, K (f) to K (f), 50Ω
K224B	Precision Adapter, DC to 40 GHz, K (m) to K (f), 50Ω
	Attenuators N Type (Up to 18 GHz)
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N (m) to N (f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N (m) to N (f)
42N50A-30	30 dB, 5 W, DC to 18 GHz, N (m) to N (f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N (m) to N (f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N (m) to N (f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N (f) to N (m), Uni-directional
1010-121-R	40 dB, 100 W, DC to 18 GHz, N (f) to N (m), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N (m) to N (f)
	Attenuators K Type (Up to 40 GHz)
41KB-3	Precision Fixed Attenuator, K (m) to K (f), 3 dB, DC to 26.5 GHz, 50Ω
41KB-6	Precision Fixed Attenuator, K (m) to K (f), 6 dB, DC to 26.5 GHz, 50Ω
41KB-10	Precision Fixed Attenuator, K (m) to K (f), 10 dB, DC to 26.5 GHz, 50Ω
41KB-20	Precision Fixed Attenuator, K (m) to K (f), 20 dB, DC to 26.5 GHz, 50Ω
41KC-3	Precision Fixed Attenuator, K (m) to K (f), 3 dB, DC to 40 GHz, 50Ω
41KC-6	Precision Fixed Attenuator, K (m) to K (f), 6 dB, DC to 40 GHz, 50Ω
41KC-10	Precision Fixed Attenuator, K (m) to K (f), 10 dB, DC to 40 GHz, 50Ω
41KC-20	Precision Fixed Attenuator, K (m) to K (f), 20 dB, DC to 40 GHz, 50Ω

S331P

Compact handheld Cable & Antenna Analyzer: 150 kHz to 4.0 GHz or 6.0 GHz

Remote Control
USB

Ultraportable Cable & Antenna Analyzer
Featuring Classic and Advanced Modes

Anritsu introduces its compact handheld Cable & Antenna Analyzer for installation and maintenance of antenna systems. It is available in two frequency ranges starting from 150 kHz and up to 4 GHz or 6 GHz.

Key Features

- FlexCal™ Calibration
  - One Calibration for All Frequencies
- Impact, Dust, and Splash Resistant
- Smallest, Lightest, and Fastest Site Master™

Easy to Use

- Factory default calibration (1-Port ReadyCal) automatically applied to OSL measurements
- S331D-like Classic Mode
- S331E-like Advanced Mode
  - Additional Markers
  - Customizable Shortcuts
  - Full-screen View
- S331L-like Graphical User Interface and Functionality
- Integrated Help Function
- EZ Name Quick Matrix
- easyTest™
- Controlled and Powered by a Windows tablet or PC using standard USB 2.0 (not included)

Efficient Sweep Management

- Internal File Storage (limited only by space on PC or Tablet)
  - Sweeps, Setups, Screen Shots
- Line Sweep Tools (LST) Software
  - Edit Sweeps, Rename, Archive
  - Generate PDF or HTML Reports
- Fast Preview of Stored Sweeps
- Standard *.dat Sweep File Format
- Compatible with HHST
  - Widely Accepted by Operators

Definitions

All specifications and characteristics apply to Revision 2 instruments under the following conditions, unless otherwise stated:

Warm-Up Time	After 10 minutes of warm-up time, where the instrument has completely stabilized to the ambient temperature.
Temperature Range	Over the 23°C±5°C temperature range.
Frequency Reference	Internal frequency reference is used.
Calibration	Instrument is within the recommended calibration cycle of 12 months. Cable and Antenna Analyzer measurements applicable after standard OSL calibration is performed using Anritsu calibration components.
Typical Performance	Typical specifications in parenthesis () describe performance that will be met by a minimum of 80% of all products. They do not include guard bands and are not warranted. Typical specifications that are not in parenthesis are not tested and not warranted. They are generally representative of the nominal characteristic performance.
Uncertainty	A coverage factor of k = 2 is applied to the measurement uncertainties to facilitate comparison with other industry monitors. All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu web site: www.anritsu.com

Cable and Antenna Analyzer Specifications

Measurements

Measurements	VSWR Return Loss Cable Loss (One Port) Distance-to-Fault (DTF) Return Loss Distance-to-Fault (DTF) VSWR Smith Chart 50Ω/75Ω (Advanced Mode Only) 1-Port Phase (Advanced Mode Only) Transmission with External Sensor (Advanced Mode Only)

Setup Parameters–Classic Mode

Measurement Display	Single Display with independent markers
Frequency	Start Frequency (F1), Stop Frequency (F2)
DTF	Start Distance (D1), Stop Distance (D2), DTF Aid, Cable Loss, Propagation Velocity, Cable type
Windowing	Rectangular, Normal Side Lobe, Low Side Lobe, Minimum Side Lobe
Amplitude	Top, Bottom Auto Scale, Full Scale
Sweep	Data Points, Run/Hold, Single/Continuous, Trace
Data Points	130, 259, 517, 1033, 2065
Markers	Markers 1 to 6 (On/Off), Delta Markers 2 to 4 (Ref M1), Marker to Peak/Valley, Marker Table, Marker 5 (Peak/Valley between M1 & M2), Marker 6 (Peak/Valley between M3 & M4), Independent Markers for Frequency and Distance Measurements
Traces	Copy Trace To Memory, Trace Display, Trace Math [Trace – Memory, Trace + Memory, (Trace + Memory)/2]
Limit Line	On/Off, Edit Value, Limit Alarm, Pass/Fail On/Off, Limit Preset
Calibration	Factory default 1-Port ReadyCal (automatically applied to all measurements) User calibration (User Cal) overrides ReadyCal Start Calibration, Cal Info, User Cal (On/Off), Cal Method: OSL Cal Types: Standard, FlexCal™
Save/Recall	Setups, Measurements, Screen Shots

Setup Parameters–Advanced Mode

Measurement Display	Single/Dual Display with independent markers
Frequency	Start Frequency (F1), Stop Frequency (F2)
DTF	Start Distance (D1), Stop Distance (D2), Units m/ft, DTF Aid, Cable List, Cable Loss, Propagation Velocity
Windowing	Rectangular, Normal Side Lobe, Low Side Lobe, Minimum Side Lobe
Amplitude	Top, Bottom, Auto Scale, Full Scale
Sweep	Data Points, Run/Hold, Single/Continuous
Data Points	130, 259, 517, 1033, 2065
Markers	Markers 1 to 8 (On/Off), Delta Markers 2 to 8 (Ref M1), Marker Tracking (On/Off), Marker to Peak/Valley, Marker Table, Marker 5 & 7 (Peak/Valley between M1 & M2), Marker 6 & 8 (Peak/Valley between M3 & M4), Independent Markers for Frequency and Distance Measurements
Traces	Copy Trace to Memory, Trace Display, Trace Math [Trace – Memory, Trace + Memory, (Trace + Memory)/2]
Limit Line	Active Limit (Upper/Lower), Limit State (On/Off), Move Active Limit, Edit Segments (42 upper and 42 lower segments maximum), Limit Alarm, Pass/Fail On/Off, Limit Preset
Calibration	Factory default 1-Port ReadyCal (automatically applied to all measurements except Transmission) User calibration (User Cal) overrides ReadyCal Start Calibration, Cal Info, User Cal (On/Off), Cal Methods: OSL, Transmission, OSL + Transmission Cal Types: Standard, FlexCal™
Save/Recall	Setups, Measurements, Screen Shots

Frequency

Frequency Ranges	500 kHz to 4 GHz (S331P-0704) 500 kHz to 6 GHz (S331P-0706) Either option can be set as low as 150 kHz
Frequency Accuracy	±2.5 ppm @ 23°C±3°C
Frequency Resolution	1 kHz

Power

Output Power	–5 dBm (typ.)

Interference Immunity

	On Channel and On Frequency +17 dBm (typ.)

Measurement Speed

	500 µs/data point (typ.)*

*: Timing dependent on external computer configuration

Return Loss

Measurement Range	0 to 60 dB
Resolution	0.01 dB

VSWR

Measurement Range	1 to 65
Resolution	0.01

Cable Loss

Measurement Range	0 to 30 dB
Resolution	0.01 dB

Distance-to-Fault

Vertical Range Return Loss	0 to 60 dB
Vertical Range VSWR	1 to 65
Fault Resolution (meters)	(1.5 × 10^8 × vp)/ΔF (vp = propagation velocity, ΔF is F2 – F1 in Hz)
Horizontal Range (meters)	0 to (Data Points – 1) × Fault Resolution, to maximum of 1500 meters (4921 ft)

1-Port Phase (Advanced Mode Only)

Measurement Display Range	–450° to +450°
Resolution	0.01°

Smith Chart (Advanced Mode Only)

Impedance	50Ω, 75Ω
Resolution	0.01

Transmission Ext Sensor (Advanced Mode Only)

Measurement Display Range	–100 to +100 dB
Resolution	0.01 dB

Measurement Accuracy (at 23°C±3°C)

Corrected Directivity	≥42 dB, OSL calibration (OSLN50A-8, OSLNF50A-8)

General Specifications

Setup Parameters

System Info	Status
System Setups	Language, Display/Audio
Language	English, French, German, Italian, Spanish, Russian, Portuguese, Japanese, Korean, Chinese
Display/Audio	Brightness, Color Schemes, Screen Shot Settings, Volume
Connectivity	USB
Diagnostics	Self Test
Preset	Preset, Reset
Reset	Factory Reset, Delete All User Files, Delete Custom Files, Master Reset
File	Save, Recall, File Management
Save	Measurement (*.dat), Setup (*.stp), Screen Shot (*.png), System and Self Test Info (*.txt)
Recall	Recall, Create Folder, Copy, Paste, Delete
File Management	Rename, Create Folder, Copy, Paste, Delete
Navigation	Top, Bottom, Page Up, Page Down
Help Menu	System Info, FAQ, User Guide
Internal Trace/Setup Memory	>1000 files for traces, setups, screen shots, or any combination (limited by PC/Tablet storage)
External Trace/Setup Memory	Limited only by size of USB Flash drive

Connectors

RF Port	Type N (m), 50Ω, Maximum input +23 dBm maximum, ±50 VDC maximum
USB Port	USB 2.0 port for connecting to an external PC controller

Regulatory Compliance

CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: 2011/65/EU, (EU) 2015/863
Australia and New Zealand	RCM AS/NZS 4417:2012
South Korea	KCC-REM-A21-0004

Environmental

Operating Temperature Range	–10°C to +55°C
Storage Temperature Range	–51°C to +71°C
Maximum Relative Humidity	95% RH at +30°C, non-condensing
Vibration, Sinusoidal	5 Hz to 55 Hz
Vibration, Random	10 Hz to 500 Hz
Altitude	4600 m (15092 ft), operating and non-operating

Dimensions and Mass

Dimensions	52 (W) × 148 (H) × 36 (D) mm (2 × 5.8 × 1.4 in)
Mass	<0.4 kg (<0.9 lb) (typ.)

Recommended External PC Configuration

Requirement	One USB 2.0 (or higher) port S331P software is compatible with Windows® 7, 8, 8.1, or 10; 32 or 64 bit operating systems. Tested with tablets running Windows 10 and Intel Atom X5-Z8300 processor.

Anritsu Tool Box and Line Sweep Tools (for your PC)

Line Sweep Tools (LST) is a free PC based program that increases productivity for people who deal with numerous Cable and Antenna traces every day. LST is the next generation of Anritsu's familiar Handheld Software Tools (HHST) and shares its uncomplicated user interface, giving a new face to the term "ease of use."

Cable Editor*1	Instrument Cable Lists may be retrieved from the instrument, modified as required, and uploaded back into instrument.
Distance to Fault*2 (DTF)	Easily convert Return Loss or VSWR traces to Distance to Fault traces with one button press.
Measurement Calculator	Provides quick conversion between commonly used measurement units such as VSWR, RL, and others.
Signal Standard Editor*1	Signal Standard Lists may be retrieved from the instrument, modified as required, and uploaded back into instrument.
Naming Grid	A naming grid function makes changing file names, trace titles, and trace subtitles from field values to those required by contract simple and quick. Once the naming grid is populated with user defined file name segments, a few simple button presses will then fill out the file, title, and sub-title names. Quickly applied to multiple traces, the naming grid can save time, increase efficiency and accuracy.
Presets	Presets make applying markers and a limit line to similar traces quick and easy. They only need to be set once, and recorded. After this, applying them to a similar trace requires only one button push. This speeds up trace processing and makes providing consistent marker and limit line settings easy.
Report Generator	The report generator creates a professional PDF or HTML based report. Reports may include GPS*3 location, power level*3, company logo*4, instrument and calibration status along with a display of all open traces. It also may contain additional information such as addresses and phone numbers.
Connection	File transfer.
Supported File Types	Input: *.dat, *.vna, *.mna, *.pim, *.tm Output: *.dat, *.vna, *.pim, *.tm, *.csv, *.bmp, *.jpg, *.png

*1: Instrument type/model must match original
*2: Only *.dat and *.vna file types supported
*3: Model dependent
*4: Optionally set by user

easyTest Tools (for your PC)

Instrument Mode

	Cable & Antenna Analyzer Mode

Commands

Display Image	Allows a custom on-screen image
Recall Setup	Places the instrument into a known state
Prompt	Displays instructional messages for the user
Save	Allows automatic or manual saving of traces

Ordering Information

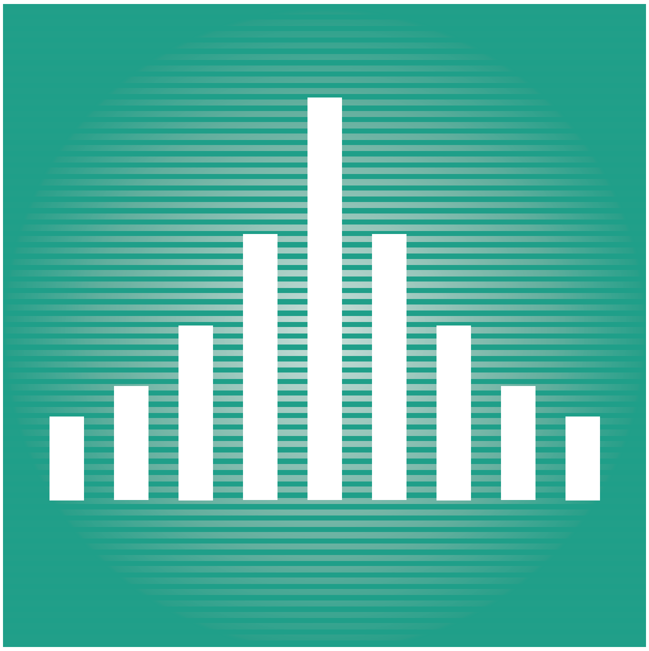
Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
S331P	Cable and Antenna Analyzer (required one frequency option)
	Frequency Options
S331P-0704	150 kHz to 4 GHz
S331P-0706	150 kHz to 6 GHz
	Calibration and Extended Warranty Options
S331P-ES510	Warranty Extension to 5 Years
S331P-ES513	Warranty Extension to 5 Years with Z540 Calibration
S331P-0098	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate.
S331P-0099	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate, test report, and uncertainty data.
	Standard Accessories (included with instrument)
2000-1864-R	Soft Carrying Case
2000-1606-R	USB-A to Micro-B with latch cable, 1.8 m (6 ft)
2000-1687-R	Torque Multiplier N (m)
	Standard Three-Year Warranty
	Certificate of Calibration and Conformance
	Reference Documents
	(Soft copies available at www.anritsu.com)
11410-00964	Site Master™ S331P Technical Data Sheet
10580-00426	Site Master™ S331P User Guide
11410-00674	Cable and Antenna Analysis Troubleshooting Guide
	Optional Accessories
	Calibration Components, 50Ω
OSLN50A-8	Precision Open/Short/Load, N (m), 42 dB, DC to 8.0 GHz, 50Ω
OSLNF50A-8	Precision Open/Short/Load, N (f), 42 dB, DC to 8.0 GHz, 50Ω
2000-1618-R	Precision Open/Short/Load, 7/16 DIN (m), DC to 6.0 GHz, 50Ω
2000-1619-R	Precision Open/Short/Load, 7/16 DIN (f), DC to 6.0 GHz, 50Ω
2000-1914-R	Precision Open/Short/Load, 4.3-10 (f), DC to 6 GHz, 50Ω
2000-1915-R	Precision Open/Short/Load, 4.3-10 (m), DC to 6 GHz, 50Ω
22N50	Open/Short, N (m), DC to 18 GHz, 50Ω
22NF50	Open/Short, N (f), DC to 18 GHz, 50Ω
SM/PL-1	Precision Load, N (m), 42 dB, DC to 6.0 GHz
SM/PLNF-1	Precision Load, N (f), 42 dB, DC to 6.0 GHz
	Calibration Components, 75Ω
12N50-75B	Matching Pad, DC to 3 GHz, 50Ω to 75Ω
22N75	Open/Short, N (m), DC to 3 GHz, 75Ω
22NF75	Open/Short, N (f), DC to 3 GHz, 75Ω
26N75A	Precision Termination, N (m), DC to 3 GHz, 75Ω
26NF75A	Precision Termination, N (f), DC to 3 GHz, 75Ω
	Adapters
510-91-R	7/16 DIN (f) to N (f), DC to 7.5 GHz, 50Ω
510-96-R	7/16 DIN (m) to 7/16 DIN (m), DC to 7.5 GHz, 50Ω
510-97-R	7/16 DIN (f) to 7/16 DIN (f), DC to 7.5 GHz, 50Ω
1091-80-R	SMA (m) to N (f), DC to 18 GHz, 50Ω
1091-81-R	SMA (f) to N (f), DC to 18 GHz, 50Ω
1091-433-R	Low PIM Adapter, 4.1/9.5 (f) to 7/16 DIN (f), DC to 3.0 GHz, 50Ω
1091-434-R	Low PIM Adapter, 4.1/9.5 (m) to 7/16 DIN (f), DC to 3.0 GHz, 50Ω
1091-435-R	Low PIM Adapter, 4.1/9.5 (f) to N (m), DC to 3.0 GHz, 50Ω
1091-436-R	Low PIM Adapter, 4.1/9.5 (m) to N (m), DC to 3.0 GHz, 50Ω
1091-440-R	Low PIM Adapter, 4.3/10 (f) to 7/16 DIN (f), DC to 3.0 GHz, 50Ω
1091-441-R	Low PIM Adapter, 4.3/10 (m) to 7/16 DIN (f), DC to 3.0 GHz, 50Ω
1091-442-R	Low PIM Adapter, 4.3/10 (f) to N (m), DC to 3.0 GHz, 50Ω
1091-443-R	Low PIM Adapter, 4.3/10 (m) to N (m), DC to 3.0 GHz, 50Ω
1091-465-R	DC to 6 GHz, 4.3-10 (f) to N (f), 50Ω
1091-467-R	DC to 6 GHz, 4.3-10 (m) to N (f), 50Ω
	Precision Adapters
34NN50A	Precision Adapter, N (m) to N (m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N (f) to N (f), DC to 18 GHz, 50Ω

Model/Order No.	Name
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N (m) to N (f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N (m) to N (f)
42N50A-30	30 dB, 50 W, DC to 18 GHz, N (m) to N (f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N (m) to N (f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N (m) to N (f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N (f) to N (m), Unidirectional
1010-121	40 dB, 100 W, DC to 18 GHz, N (f) to N (m), Unidirectional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N (m) to N (f)
	USB Extender Kit (for 2-port cable loss/transmission (external sensor) measurements)
2000-1717-R*	USB Extender, Requires Cat 5e extension cable (sold separately)
2000-1900-R	USB 2.0 Active 100 meter Extender (with Type A power cord for USA, Japan, North America, Central America and Caribbean)
2000-1901-R	USB 2.0 Active 100 meter Extender (with Type C power cord for use in Europe, India, South Korea, and many countries in Middle East and Africa)
2000-1902-R	USB 2.0 Active 100 meter Extender (with Type I power cord for use in Australia, New Zealand, Argentina, and the South Pacific)
2000-1903-R	USB 2.0 Active 100 meter Extender (with Type G power cord for use in the UK, and several other countries in Asia, the Middle East, and Africa)
2100-28-R	Cat 5e extension cable for use with USB Extender (22.5 m)
	USB Power Sensors and Transmission Sensors
	(For complete ordering information see the respective data sheets of each sensor)
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +3 to +51.76 dBm
MA24106A	RF USB Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm
MA24208A	Microwave Universal USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24218A	Microwave Universal USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24330A	Microwave CW USB Power Sensor, 10 MHz to 33 GHz, +20 dBm
MA24340A	Microwave CW USB Power Sensor, 10 MHz to 40 GHz, +20 dBm
MA24350A	Microwave CW USB Power Sensor, 10 MHz to 50 GHz, +20 dBm
SC8268	USB Transmission Sensor, K (m), 1 MHz to 40 GHz, +10 to –50 dBm
MA25100A	RF Power Indicator
	Backpack and Transit Case
67135	Anritsu Backpack (for instrument and PC)
760-283	Transit Case, USB 1 Port VNA

*: Not compatible with MA24208A, MA24218A, MA24330A, MA24340A and MA24350A sensors; must use active extenders with these sensors.



SIGNAL ANALYZERS/ SPECTRUM ANALYZERS

Selection Guide

Model	Measurement Frequency Range	Measurement Level Range (dBm @1 GHz)	Resolution Bandwidth	C/N (dBc/Hz)	RF-band Harmonic Distortion (dBc)*4	Third Order Intercept Point (TOI) (dBm)	Counter	Measure	Zone Marker	AM/FM Demodulation Mode	QP Detection	High-speed Time Domain	Gate	Tracking Generator	Remote Control	Features
MS2690A	50 Hz to 6 GHz	–155 to +30	30 Hz to 3 MHz, 50 kHz 5, 10, 20, 31.25 MHz (SPA mode) 1 Hz to 10 MHz*1 (VSA mode)	–116*2	–75	+22	✓	✓	✓	—	—	✓	✓	—	GPIB Ethernet USB	Portable
MS2692A*8	50 Hz to 26.5 GHz															
MS2850A	9 kHz to 32 GHz 9 kHz to 44.5 GHz	–151 to +30	1 Hz to 3 MHz (1–3 sequence), 500 Hz, 50 kHz, 2, 5, 10 MHz	–123*2,*3	–65	+16	✓	✓	✓	—	—	✓	✓	—	GPIB Ethernet USB	
MS2840A-040/041	9 kHz to 3.6 GHz 9 kHz to 6 GHz	–151 to +30	1 Hz to 3 MHz (1–3 sequence), 500 Hz, 50 kHz, 2, 5, 10, 20, 31.25 MHz	–123*2,*3 –133*1,*2,*3	–65	+16	✓	✓	✓	✓*1	✓*1	✓	✓	—	GPIB Ethernet USB	
MS2840A-044/046	9 kHz to 26.5 GHz 9 kHz to 44.5 GHz 26.5 GHz to 325 GHz (with external mixer)	–151 to +30	1 Hz to 3 MHz (1–3 sequence), 500 Hz, 50 kHz, 2, 5, 10 MHz, 20, 31.25 MHz (MS2840A-044)	–123*2,*3	–65	+16	✓	✓	✓	✓*1	✓*1	✓	✓	—	GPIB Ethernet USB	
MS2830A-040/041/043	9 kHz to 3.6 GHz 9 kHz to 6 GHz 9 kHz to 13.5 GHz	–151 to +30	1 Hz to 3 MHz (1–3 sequence), 500 Hz, 50 kHz, 2, 5, 10, 20*1, 31.25*1 MHz	–115*2 –133*1, *2	–65	+15	✓	✓	✓	✓*1	✓*1	✓	✓	✓ *1,*5	GPIB Ethernet USB	
MS2830A-044/045	9 kHz to 26.5 GHz 9 kHz to 43 GHz 26.5 GHz to 325 GHz (with external mixer)	–150 to +30	1 Hz to 3 MHz (1–3 sequence), 500 Hz, 50 kHz, 2, 5, 10 MHz, 20*1, 31.25*1 MHz (MS2830A-044)	–115*2	–65	+15	✓	✓	✓	—	✓*1	✓	✓	—	GPIB Ethernet USB	
MS2713E	9 kHz to 6 GHz	–157 to +26	1 Hz to 3 MHz	–100*3	–70	+33	✓	✓	—	✓	✓	✓	✓*1	✓	USB Ethernet	Handheld (<3.5 kg)
MS2720T	9 kHz to 9 GHz	–160 to +30	1 Hz to 10 MHz	–108	–75	+20	✓	✓	—	✓	✓	✓	✓*1	✓	Ethernet USB	Handheld (3.7 kg to 4.4 kg)
	9 kHz to 13 GHz	–161 to +30		–102										✓		
	9 kHz to 20 GHz													✓		
MS27100A	9 kHz to 6 GHz	–162 to +30	10 Hz to 3 MHz	–98*3	–60	+17	—	✓	—	✓*1	—	—	—	—	Ethernet	Spectrum monitoring (<1 kg)
MS27101A	9 kHz to 6 GHz	–162 to +30	10 Hz to 3 MHz	–98*3	–60	+17	—	✓	—	✓*1	—	—	—	—	Ethernet	Spectrum monitoring (2.78 kg)
MS27102A	9 kHz to 6 GHz	–162 to +20	10 Hz to 3 MHz	–98*3	–60	+17	—	✓	—	✓*1	—	—	—	—	Ethernet	Spectrum monitoring (6.87 kg)
MS27103A	9 kHz to 6 GHz	–157 to +22	10 Hz to 3 MHz	–98*3	–60	+17	—	✓	—	✓*1	—	—	—	—	Ethernet	Spectrum monitoring (3.9 kg to 4.5 kg)
MS27201A-0709	9 kHz to 9 GHz	–161 to +30	1 Hz - 10 MHz (Spectrum Analyzer Mode) Up to 40 MHz (Real-Time Spectrum Analyzer Option)	–106	–75	+20	✓	✓	—	—	✓	✓	✓*1	—	Ethernet	Rackmount
MS27201A-0720	9 kHz to 20 GHz															
MS27201A-0743	9 kHz to 43.5 GHz															
MS2760A-0032	9 kHz to 32 GHz	DANL to +10	1 Hz to 3 MHz	–75*3,*6	–60	+25*7	—	✓	—	—	—	✓	—	—	USB3.0	Spectrum monitoring (255 g)
MS2760A-0044	9 kHz to 44 GHz															
MS2760A-0050	9 kHz to 50 GHz															
MS2760A-0070	9 kHz to 70 GHz															
MS2760A-0090	9 kHz to 90 GHz															
MS2760A-0110	9 kHz to 110 GHz															
MS2760A-0145	9 kHz to 145 GHz															
MS2760A-0170	9 kHz to 170 GHz															
MS2762A-0032	6 GHz to 32 GHz	DANL to 0	1 Hz to 3 MHz	–75*3,*6	–50	+21*7	—	✓	—	—	—	✓	—	—	USB3.0	Spectrum monitoring (255 g)
MS2762A-0044	6 GHz to 44 GHz															
MS2762A-0050	6 GHz to 50 GHz															
MS2762A-0070	6 GHz to 70 GHz															
MS2762A-0090	6 GHz to 90 GHz															
MS2762A-0110	6 GHz to 110 GHz															
MS2762A-0145	6 GHz to 145 GHz															
MS2762A-0170	6 GHz to 170 GHz															
MS2090A-0709	9 kHz to 9 GHz	–161 to +30	1 Hz to 10 MHz (Spectrum Analyzer Mode) Up to 40 MHz (Real-time Spectrum Analyzer Option)	–106*2	–75	+20	✓	✓	—	✓*1	✓	✓	✓*1	—	Ethernet USB PCIe	Handheld
MS2090A-0714	9 kHz to 14 GHz															
MS2090A-0720	9 kHz to 20 GHz															
MS2090A-0726	9 kHz to 26.5 GHz															
MS2090A-0732	9 kHz to 32 GHz															
MS2090A-0743	9 kHz to 43.5 GHz															
MS2090A-0754	9 kHz to 54 GHz															

*1: Option
*2: 100 kHz offset
*3: 10 kHz offset
*4: –30 dBm
*5: Similar function by built-in SG
*6: 60 GHz
*7: 62 GHz
*8: Please note that it is only for the Conformance Test System and cannot be purchased separately.

Signal Analyzer

MS2690A

50 Hz to 6.0 GHz

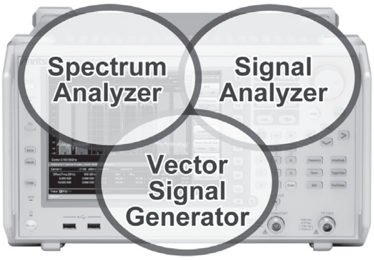
Remote Control
GPIB | Ethernet | USB

Signal Analyzer Solving Wireless Communications Issues

Excellent Eco Product

The MS2691A main unit has been discontinued.
The MS2692A main unit is only for the Conformance Test System and cannot be purchased separately.

The Signal Analyzer MS2690A/MS2691A/MS2692A (MS269xA) has the excellent general level accuracy, dynamic range and performance of a high-end spectrum analyzer.
Its easy operability and built-in functions are perfect for tests of Tx characteristics. Not only can it capture wideband signals but FFT technology supports multifunction signal analyses in both the time and frequency domains. Behavior in the time domain that cannot be handled by a sweep type spectrum analyzer can be checked in the frequency domain. A wide frequency can be analyzed using sweep type spectrum analysis functions while detailed signal analysis of a specific frequency band is supported too. Moreover, the built-in signal generator function outputs both continuous wave (CW) and modulated signals for use as a reference signal source when testing Tx characteristics of parts and as a signal source for evaluating Rx characteristics.
Wireless communications are tending toward use of higher frequencies above 3 GHz and wider bandwidths. However, general-purpose spectrum analyzers suffer from a degraded noise floor above 3 GHz due to the 3-GHz baseband, so they cannot be used to verify the true product performance. Because the MS269xA baseband can be extended up to 6 GHz it offers excellent level accuracy and modulation precision at frequencies from 50 Hz to 6 GHz. Adding the full line of versatile analysis software options eliminates the need for an external PC at wireless modulation analysis. Moreover, installing a preselector bypass option (MS2692A-067) enables use of the signal analyzer and modulation analysis functions up to 26.5 GHz (MS2692A).
Waveform creation software generates modulation signal patterns for all common wireless technologies to output signals for the vector signal generator function.
The high-performance, multi-function MS269xA Signal Analyzer supports better analysis than more expensive standalone spectrum analyzers.



Key Features

Basic Performance/Functions

- Frequency Range
  - MS2690A: 50 Hz to 6.0 GHz
  - MS2691A: 50 Hz to 13.5 GHz
  - MS2692A: 50 Hz to 26.5 GHz
- Total Level Accuracy: ±0.3 dB (typ.)
- Dynamic Range*[1]: 177 dB
  - TOI*[2]: ≥+22 dBm
  - DANL*[3]: –155 dBm/Hz
- Improved Level Linearity
- Internal Reference Oscillator
  - Pre-installed Reference Oscillator
    - Aging Rate: $\pm1 \times 10^{-8}$/day
    - Start-up Characteristics: $\pm5 \times 10^{-8}$ (5 minutes after power-on)
  - Rubidium Reference Oscillator (MS269xA-001)
    - Aging Rate: $\pm1 \times 10^{-10}$/month
    - Start-up Characteristics:
      $\pm1 \times 10^{-9}$ (7 minutes after power-on)
- Versatile Built-in Functions
  - Standard
    - Channel Power
    - Adjacent Channel Leakage Power
    - Spurious Emission*[4]
    - Frequency Counter*[4]
    - FM Deviation*[5]
    - Highest 10 Markers
    - 2-tone 3rd-order Intermodulation Distortion*[4]
    - Phase Noise
    - Occupied Bandwidth
    - Spectrum Emission Mask*[4]
    - Burst Average Power
    - AM Depth*[5]
    - Multi-marker & Marker List
    - Limit Line*[4]
    - Power Meter*[6]
  - Option
    - Noise Figure*[7]

*1: Difference between TOI and DANL as simple guide
*2: TOI (Third Order Intercept)
*3: DANL (Displayed Average Noise Level)
*4: Spectrum Analyzer functions
*5: Signal Analyzer functions
*6: Use USB Power Sensors
*7: Noise Figure Measurement Function (Requires MS269xA-017)
[Use Noise Sources (Noisecom, NC346 series)]

Signal Analyzer Functions

- Analysis Bandwidth
  Standard: 31.25 MHz max.
  (50 MHz max. sampling rate = 20 ns resolution, ADC resolution 16 bits)
  MS269xA-077: 62.5 MHz max.
  (100 MHz max. sampling rate = 10 ns resolution, ADC resolution 14 bits)
  MS269xA-078[*8, *9]: 125 MHz max.
  (200 MHz max. sampling rate = 5 ns resolution, ADC resolution 14 bits)
- Capture Function
  Saves analysis Span × Time signal to internal memory and writes to hard disk.
  Up to 100 Msamples per measurement can be saved to internal memory.
- Replay Function
  Reads saved data and replays using signal analyzer function.
- Measurement with Sub-trace Display
  Splits screen and confirms both main and sub-traces at same time to check errors.
  Main: Spectrum, Frequency vs. Time, Power vs. Time,
  Phase vs. Time, CCDF/APD, Spectrogram
  Sub: Power vs. Time, Spectrogram

Supports 125 MHz Wideband Measurements up to 26.5 GHz

Microwave Preselector Bypass	MS2692A-067[*10]
Analysis Bandwidth Extension to 125 MHz	MS2692A-078[*8]

Bypassing preselector improves RF frequency characteristics and in-band frequency characteristics. Supports modulation analysis and signal analyzer measurements for signals up to 26.5 GHz.

*8: Requires MS269xA-077
*9: Combining with WLAN 802.11ac (160 MHz) measurement software MX269028A-002 (only for MS269xA) supports modulation analysis up to 160-MHz bandwidth signals of the 802.11ac.
See measurement software catalog for more details.
*10: MS2692A-067 can be installed in MS2692A

Vector Signal Generator (MS269xA-020)

- Frequency Range: 125 MHz to 6 GHz
- Pre-installed Baseband Generator
  Vector Modulation Bandwidth: 120 MHz
  Sampling Clock: 20 kHz to 160 MHz
- Level Accuracy: ±0.5 dB
- Large-capacity Memory: 1 GB = 256 Msamples
- Internal AWGN Generator
- Internal BER Measurement Function
  Bit Rate: 100 bps to 10 Mbps
  Input Level: TTL level

Basic Performance

Excellent Total Level Accuracy: ±0.3 dB (typ.)

(Common to both Spectrum Analyzer and Signal Analyzer Functions)
With a 6-GHz basic band and level calibration over a wide frequency range, the MS269xA has excellent total level accuracy.
The Absolute Amplitude Accuracy specification described in catalogs of other spectrum analyzers ignores the important frequency characteristics, linearity, and attenuator switching errors. In contrast, the MS269xA Level Calibration technology assures excellent level accuracy over a wide frequency range from 50 Hz to 6 GHz even under measurement conditions including the above three errors. The level accuracy is assured even when the frequency and attenuator are switched.

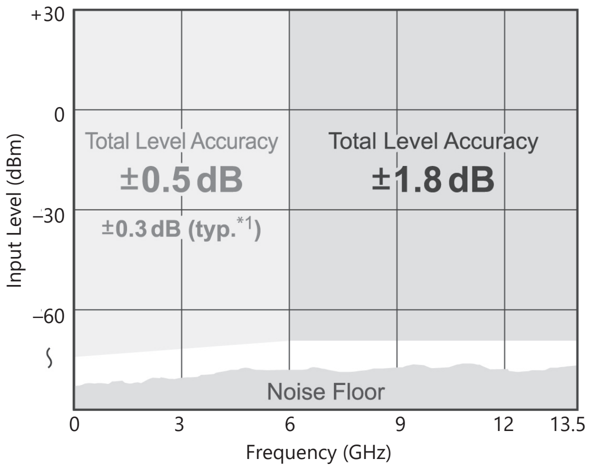
Advantage of 6 GHz Basic Band

Conventional spectrum analyzers have a degraded noise floor above 3 GHz because they use a preselector at the 3-GHz basic band, which causes lowered measurement accuracy. The MS269xA basic band of 6 GHz eliminates the degraded noise floor and improves measurement accuracy.

Advantage of MS269xA Level Accuracy Technology

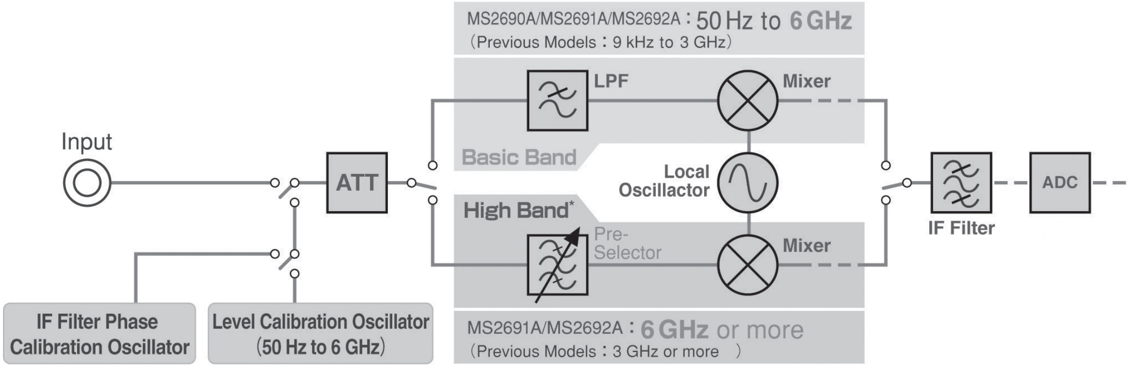
Conventional spectrum analyzers perform level calibration at just one frequency point, which causes errors when the frequency changes. The MS269xA has two built-in signal generators for level calibration over a wide frequency range from 50 Hz to 6 GHz, minimizing measurement errors in this frequency range.

The MS269xA total level accuracy includes:
- Frequency characteristics
- Linearity
- Attenuator switching error



Note: Eliminates effect of noise floor
Used only when Uncal does not occur
*1: Excluding Guard band

MS269xA Block Diagram



* MS2690A does not have a high band.

Preselector

The MS269xA has a basic band that goes to 6 GHz without a preselector. Most spectrum analyzers may use a preselector in the high band to clean-up images but it is extremely difficult to stabilize the amplitude and frequency characteristics of the preselector. This instability is the main cause of degraded level accuracy and modulation precision in measuring instruments.
Additionally, the preselector passband frequency can cause limitations at analysis bandwidths. No preselector means greater measurement accuracy.

Top Class Dynamic Range

Dynamic Range*1: 177 dB
TOI*2: ≥+22 dBm (700 MHz to 4 GHz)
DANL*3: –155 dBm/Hz (30 MHz to 2.4 GHz)

*1: Difference between TOI and DANL as simple guide.
*2: TOI (Third Order Intercept)
*3: DANL (Displayed Average Noise Level)

Dynamic range is a key specification for spectrum analyzers.
Low displayed average noise level (DANL) as well as high TOI are important too.
Low TOI may cause distortion with high-level carrier signals. Inserting an attenuator can lower the carrier level but this has the effect of lowering the level of weak spurious, making it hard to measure.

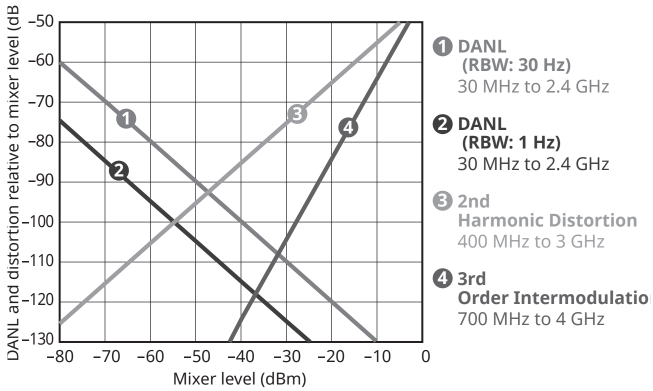
The MS269xA has an excellent dynamic range supporting true performance measurements of devices, such as base stations, requiring wideband measuring instruments.
For example, the 3GPP category-B spurious measurement specification requires a measuring instrument with severe dynamic range specifications. If the measurement is within the MS269xA dynamic range, measurement jigs such as filters and amplifiers are unnecessary and troublesome calibration is omitted, helping simplify setup and cut costs.

Microwave Preselector Bypass MS2692A-067*

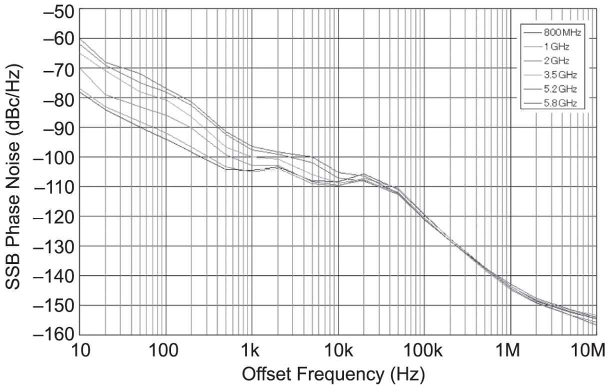
Bypasses the preselector to improve the RF frequency characteristics and the in-band frequency characteristics.
When the preselector option is set to On, the image response elimination filter is bypassed.
Therefore, this function is not appropriate for spurious measurement to receive the image response.

*: MS2692A-067 can be installed in MS2692A.

Distortion Characteristics (Spectrum Analyzer)



Example: SSB Phase Noise
(Spectrum Analyzer/Signal Analyzer Common)

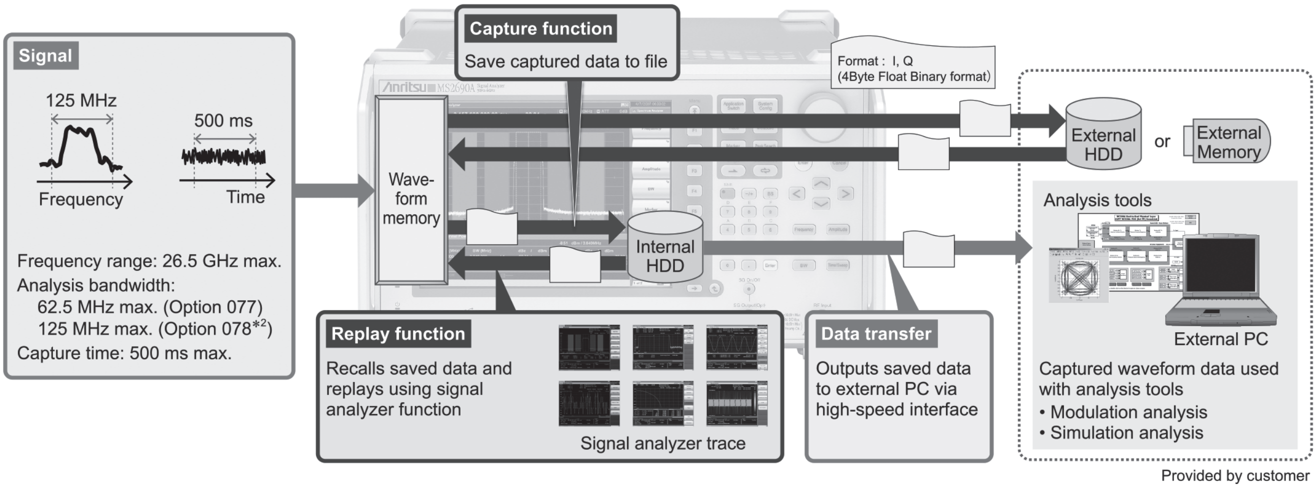


Supports 125 MHz Wideband Measurements up to 26.5 GHz

Microwave Preselector Bypass MS2692A-067*1 + Analysis Bandwidth Extension to 125 MHz MS2692A-078*2

*1: Can be installed in MS2692A.
*2: Require MS2692A-077.

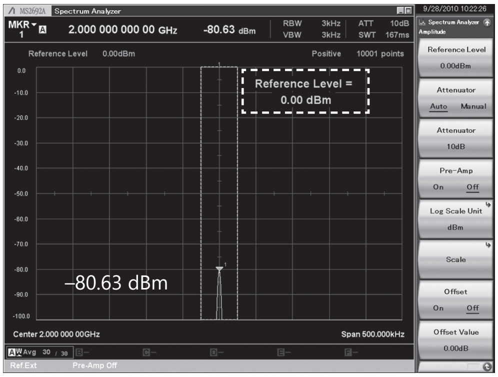
Supports wideband analysis with high frequencies for satellite communications
Microwave preselector bypass frequency range: 6 GHz to 26.5 GHz (MS2692A)
Installing the microwave preselector bypass supports signal analyzer measurement functions in the above frequency range.

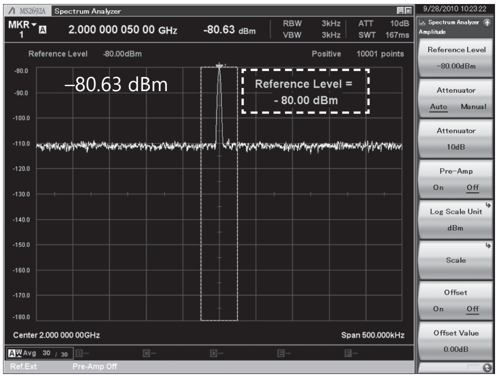


Improved Level Linearity

Conventional spectrum analyzers use an analog IF and log amp to achieve good level accuracy at points near the log scale reference level, but the accuracy degrades at points that are further away.
The MS269xA uses a digital IF instead of a log amp, which supports measurements with excellent accuracy at any point.

Example: Level Stability by Switching Reference Level

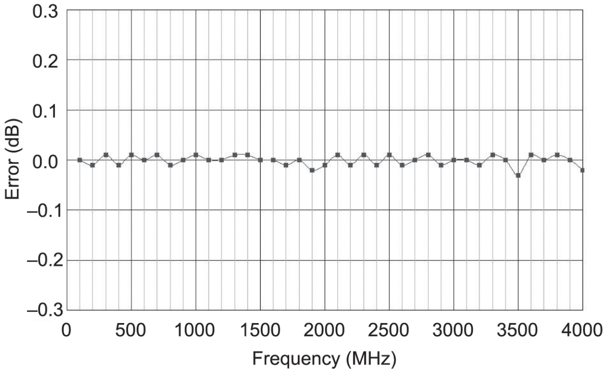




Dual Sweep Speed: Normal/Fast

When sweep time is set to [Auto], Normal (normal sweep) or Fast mode (high-speed sweep) can be set. The Fast mode sweeps six times faster than the Normal mode.

Example of Sweep Mode Switch Error: (CW –10 dBm input)
Level Error when Switching from Normal to Fast



Resolution Bandwidth (RBW)

Setting Range

- Spectrum Analyzer:
  30 Hz to 3 MHz (1-3 sequence),
  50 kHz, 5 MHz, 10 MHz, 20 MHz, 31.25 MHz*1
- Spectrum trace in signal analyzer mode:
  1 Hz to 1 MHz (1-3 sequence), 3 MHz*2, *3, 10 MHz*3

When monitoring two adjacent signals, the frequency resolution can be increased by reducing the resolution bandwidth (RBW).
This also has the effect of reducing the noise level.
Conversely, to confirm level variations of 20-MHz band signals such as LTE, set the RBW to 31.25 MHz.

*1: Instead of Gaussian filter, 31.25 MHz RBW uses filter with flat top characteristics above 31.25 MHz.
*2: With MS269xA-077 installed and bandwidth setting ≥50 MHz
*3: With MS269xA-077+078 installed and bandwidth setting ≥50 MHz

Trigger Function

Trigger sweep executes sweeping using the specified trigger condition as the start point. In particular, "SG Marker" starts analyzer measurement in synchrony with the signal output by installing MS269xA-020.
Using this function supports simple synchronized measurement even when evaluating signals with large level variation over time, such as modulation signals.

- Video trigger:
  Trigger sweeping starts in synchronization with the rise or fall of the waveform. A trigger level indicator showing the trigger level is displayed on the screen.
- Wide IF video trigger:
  An IF signal with a wide passing band of about 50 MHz is detected, and sweeping starts in synchronization with either the rise or fall of the detected signal.
- External trigger:
  Sweeping starts in synchronization with the rise or fall of the signal input via the Trigger Input connector.
- SG Marker trigger (Requires MS269xA-020):
  Sweeping starts in synchronization with the rise or fall of the marker signal output of MS269xA-020. This function supports measurement in synchronization with the output signal of MS269xA-020.

Gate Sweep

Gate sweep executes sweeping only for the length of time specified by the gate length, starting from when the trigger condition is met.
A delay time until sweeping starts after the trigger condition is met can be set using trigger delay.

- The gate source can be selected from the following
  Wide IF video trigger
  External trigger
  SG marker trigger (Requires MS269xA-020)
- Setting range and resolution for gate delay
  Setting range: 0 to 1 s
  Resolution: 20 ns
- Setting range and resolution for gate length
  Setting range: 50 µs to 1 s
  Resolution: 20 ns

Three Built-in External Interfaces

The built-in Gigabit Ethernet, USB2.0, and GPIB interfaces support remote operation.

GPIB: IEEE 488.2, Rear panel, IEEE 488 bus connector
Interface functions:
SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2
Ethernet: 10/100/1000BASE-T, Rear panel, RJ-45
USB (B): USB2.0, Rear panel, USB-B connector

Saving Measurement Results

Measurement results can be saved to internal hard disk or external USB memory. Screen dumps and trace data can be saved too.

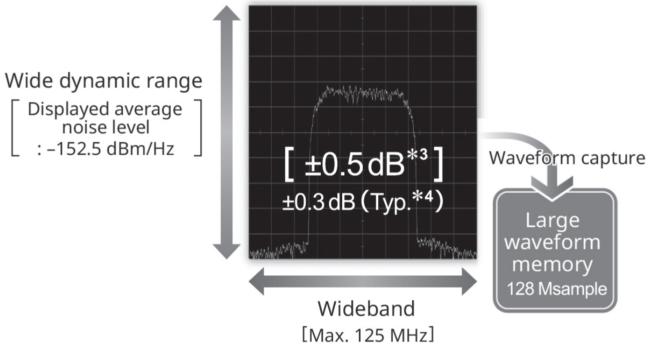
- Screen dump file type
  BMP
  PNG
- The color of the screen hard copy can be set as follows:
  Normal (same as screen display)
  Reverse
  Monochrome
  Reversed Monochrome

Signal Analyzer: Basic Performance/Functions

Wide bandwidth × High Accuracy FFT Analysis

Standard: 31.25 MHz max.
(50 MHz max. sampling rate = 20 ns resolution, ADC resolution 16 bits)
MS269xA-077: 62.5 MHz max.
(100 MHz max. sampling rate = 10 ns resolution, ADC resolution 14 bits)
MS269xA-078*1, *2: 125 MHz max.
(200 MHz max. sampling rate = 5 ns resolution, ADC resolution 14 bits)

Based on the excellent level accuracy and wide dynamic range of the MS269xA, a signal with an FFT analysis bandwidth of up to 125 MHz can be captured with a level accuracy of ±0.3 dB.



*1: Requires MS269xA-077
*2: Combining with WLAN 802.11ac (160 MHz) measurement software MX269028A-002 (only for MS269xA) supports modulation analysis up to 160-MHz bandwidth signals of the 802.11ac.
See measurement software catalog for more details.
*3: 50 Hz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal
*4: Excluding Guard band

Excellent Frequency Characteristics in Analysis Bandwidth

The Signal Analyzer Extra Band Cal function using the built-in oscillator for calibration supports analysis bandwidth calibration at the set frequency.
The excellent in-band frequency characteristics support wideband modulation analysis with less error.

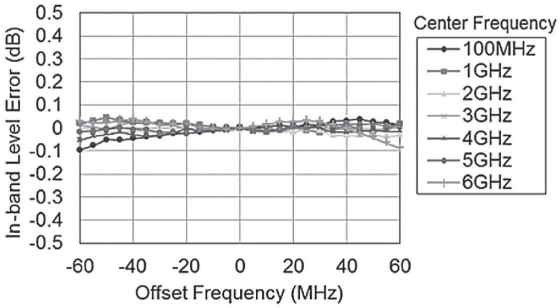
Extra Band Cal Frequency Range

Span ≤ 31.25 MHz (Standard): 30 MHz to 6 GHz

Span > 31.25 MHz (MS269xA-077/078): 100 MHz to 6 GHz

*: Setting center frequency after Extra Band Cal, requires re-execution of Extra Band Cal.

Example of frequency characteristics in analysis bandwidth after Extra band Cal (With MS269xA-078, Reference level: –10 dBm, Input attenuator: 10 dB, Preamp: Off, Span: 125 MHz)



Save Signals in Internal Memory

Max. Capture Time: 0.5 s to 2000 s
Max. Number of Samples: 100 Msamples

The "Analysis bandwidth × Analysis time" signal is held in internal memory and saved to hard disk.
Up to 100 Msamples of data can be saved to memory for one measurement. The frequency span determines the sampling rate. The following chart shows the maximum capture time per frequency span.

Span	Sampling Rate	Capture Time	Max. Sampling Data
1 kHz	2 kHz	2000 s	4M
2.5 kHz	5 kHz	2000 s	10M
5 kHz	10 kHz	2000 s	20M
10 kHz	20 kHz	2000 s	40M
25 kHz	50 kHz	2000 s	100M
50 kHz	100 kHz	1000 s	100M
100 kHz	200 kHz	500 s	100M
250 kHz	500 kHz	200 s	100M
500 kHz	1 MHz	100 s	100M
1 MHz	2 MHz	50 s	100M
2.5 MHz	5 MHz	20 s	100M
5 MHz	10 MHz	10 s	100M
10 MHz	20 MHz	5 s	100M
25 MHz	50 MHz	2 s	100M
31.25 MHz	50 MHz	2 s	100M
50 MHz*	100 MHz	500 ms	50M
62.5 MHz*	100 MHz	500 ms	50M
100 MHz*	200 MHz	500 ms	100M
125 MHz*	200 MHz	500 ms	100M

*: With MS269xA-077: 50/62.5 MHz
With MS269xA-077/078: 50/62.5/100/125 MHz

Replay Function for Comparison Evaluation

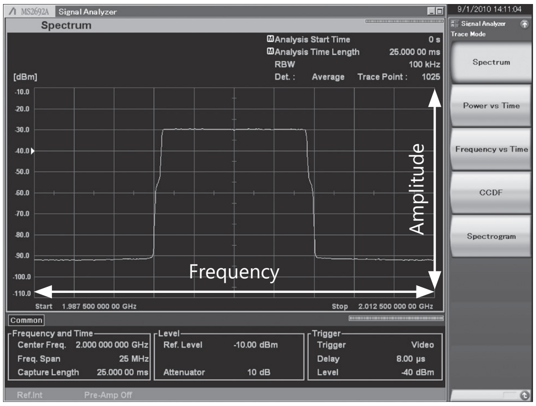
This function reads saved data and replays it using the signal analyzer measurement function.

Examples:
1. Data sharing between separate R&D and manufacturing
2. Later laboratory bench-top analysis of on-site signals
3. Save data at shipment and re-verify if problem occurs

Signal Analyzer: Trace

Spectrum

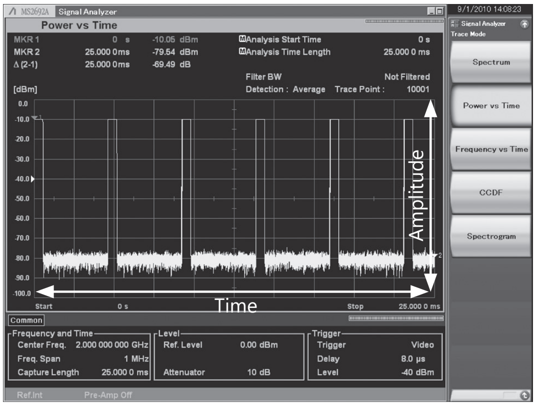
The Spectrum trace displays a graph with amplitude on the y-axis and frequency on the x-axis. The captured IQ data is FFT processed (fast Fourier transformed) and converted from the time domain to the frequency domain for display as a spectrum.



Analysis Start Time 0 s
Analysis Time Length 25.000 00 ms
RBW 100 kHz
Det. : Average Trace Point : 1025
Start 1.987 500 000 00 GHz Stop 2.012 500 000 00 GHz
Frequency and Time: Center Freq. 2.000 000 000 GHz; Freq. Span 25 MHz; Capture Length 25.000 00 ms
Level: Ref. Level -10.00 dBm; Attenuator 10 dB
Trigger: Trigger Video; Delay 8.00 μs; Level -40 dBm

Power vs. Time

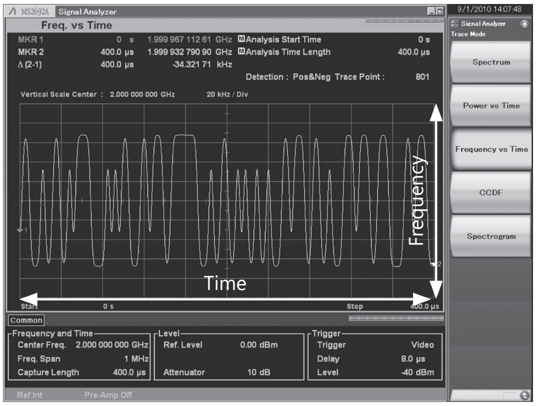
The Power vs. Time trace displays a graph with amplitude on the y-axis and time on the x-axis to confirm changes in power with time of measured signals.



MKR 1 0 s -10.05 dBm
MKR 2 25.000 0ms -79.54 dBm
Δ (2-1) 25.000 0ms -69.49 dB
Analysis Start Time 0 s
Analysis Time Length 25.000 0 ms
Filter BW Not Filtered
Detection : Average Trace Point : 10001
Start 0 s Stop 25.000 0 ms
Frequency and Time: Center Freq. 2.000 000 000 GHz; Freq. Span 1 MHz; Capture Length 25.000 0 ms
Level: Ref. Level 0.00 dBm; Attenuator 10 dB
Trigger: Trigger Video; Delay 8.0 μs; Level -40 dBm

Frequency vs. Time

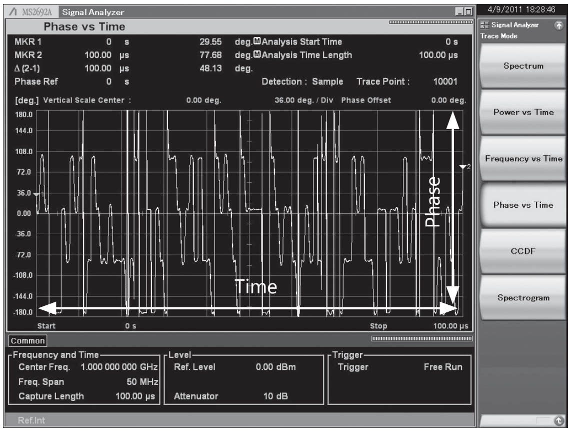
The Freq. vs. Time trace displays a graph with frequency on the y-axis and time on the x-axis to confirm time variation of the measured signal frequency.



MKR 1 0 s 1.999 967 112 61 GHz
MKR 2 400.0 μs 1.999 932 790 90 GHz
Δ (2-1) 400.0 μs -34.321 71 kHz
Analysis Start Time 0 s
Analysis Time Length 400.0 μs
Detection : Pos&Neg Trace Point : 801
Vertical Scale Center : 2.000 000 000 GHz 20 kHz / Div
Start 0 s Stop 400.0 μs
Frequency and Time: Center Freq. 2.000 000 000 GHz; Freq. Span 1 MHz; Capture Length 400.0 μs
Level: Ref. Level 0.00 dBm; Attenuator 10 dB
Trigger: Trigger Video; Delay 8.0 μs; Level -40 dBm

Phase vs. Time

The Phase vs. Time trace displays a graph with phase on the y-axis and time on the x-axis to confirm time variation of the measured signal phase.



Phase vs Time

MKR 1 0 s 29.55 deg.
MKR 2 100.00 μs 77.68 deg.
Δ (2-1) 100.00 μs 48.13 deg.
Phase Ref 0 s
Analysis Start Time 0 s
Analysis Time Length 100.00 μs
Detection : Sample Trace Point : 10001
[deg.] Vertical Scale Center : 0.00 deg. 36.00 deg. / Div Phase Offset 0.00 deg.
Start 0 s Stop 100.00 μs

Frequency and Time
Center Freq. 1.000 000 000 GHz
Freq. Span 50 MHz
Capture Length 100.00 μs

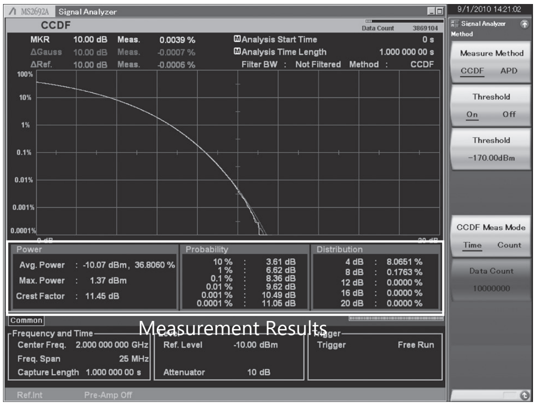
Level
Ref. Level 0.00 dBm
Attenuator 10 dB

Trigger
Trigger Free Run

CCDF*1/APD*2

The CCDF trace displays the power variation probability on the y-axis and power variation on the y-axis to confirm the CCDF and APD of measured signals.

*1: CCDF (Complementary Cumulative Distribution Function)
*2: APD (Amplitude Probability Density)



CCDF
Data Count 3869104

MKR 10.00 dB Meas. 0.0039 %
ΔGauss 10.00 dB Meas. -0.0007 %
ΔRef. 10.00 dB Meas. -0.0006 %
Analysis Start Time 0 s
Analysis Time Length 1.000 000 00 s
Filter BW : Not Filtered Method : CCDF

Power
Avg. Power : -10.07 dBm, 36.8060 %
Max. Power : 1.37 dBm
Crest Factor : 11.45 dB

Probability
10 % : 3.61 dB
1 % : 6.62 dB
0.1 % : 8.36 dB
0.01 % : 9.62 dB
0.001 % : 10.49 dB
0.0001 % : 11.05 dB

Distribution
4 dB : 8.0651 %
8 dB : 0.1763 %
12 dB : 0.0000 %
16 dB : 0.0000 %
20 dB : 0.0000 %

Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 25 MHz
Capture Length 1.000 000 00 s

Level
Ref. Level -10.00 dBm
Attenuator 10 dB

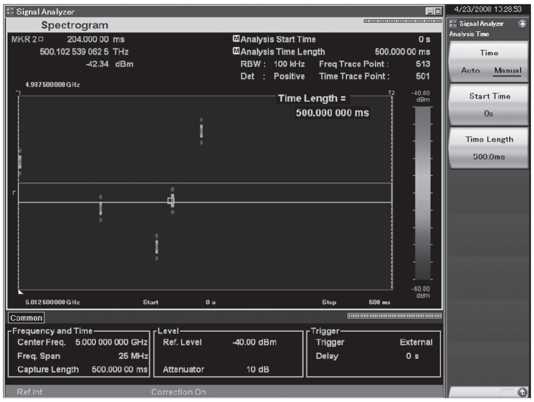
Trigger
Trigger Free Run

Measurement Results

- CCDF: The CCDF display indicates the cumulative distribution of transient power variations compared to average power.
- APD: The APD display indicates the probability distribution of transient power fluctuations compared to average power.

Spectrogram

The Spectrogram trace displays the level as color with frequency on the y-axis and time on the x-axis. The captured IQ data is FFT processed to confirm time variations in the continuous spectrum.
It is useful for monitoring frequency hopping and transient signals.



Spectrogram

MKR 2 204.000 00 ms
500.102 539 062 5 THz
-42.34 dBm
Analysis Start Time 0 s
Analysis Time Length 500.000 00 ms
RBW : 100 kHz Freq Trace Point : 513
Det : Positive Time Trace Point : 501
Start 0 s Stop 500 ms

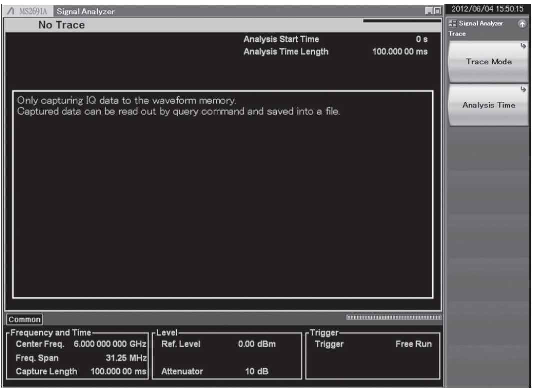
Frequency and Time
Center Freq. 5.000 000 000 GHz
Freq. Span 25 MHz
Capture Length 500.000 00 ms

Level
Ref. Level -40.00 dBm
Attenuator 10 dB

Trigger
Trigger External
Delay 0 s

No Trace

No Trace mode does not execute signal analysis. Therefore, "IQ data output" and "IQ data readout using remote commands" can be executed quickly without the need to wait for completion of analysis.



No Trace

Analysis Start Time 0 s
Analysis Time Length 100.000 00 ms

Only capturing IQ data to the waveform memory.
Captured data can be read out by query command and saved into a file.

Frequency and Time
Center Freq. 6.000 000 000 GHz
Freq. Span 31.25 MHz
Capture Length 100.000 00 ms

Level
Ref. Level 0.00 dBm
Attenuator 10 dB

Trigger
Trigger Free Run

Measurement with Sub-trace Display

This function splits the screen into top and bottom halves; simultaneous display of the sub-trace supports easy monitoring of fault locations and transient phenomena.

Main: Spectrum, Frequency vs. Time, Power vs. Time,
Phase vs. Time, CCDF/APD, Spectrogram
Sub: Power vs. Time, Spectrogram

The part of a previously captured long-term signal to be monitored can be selected on the sub-trace to display the problem part only on the main trace.

Spectrogram

MKR 1 1.001 18 ms
1.999 853 515 63 GHz
-15.78 dBm
Analysis Start Time 729.18 μs
Analysis Time Length 400.00 μs
RBW : 100 kHz Freq Trace Point : 513
Det : Positive Time Trace Point : 501
Start 729.18 μs Stop 1.129 18 ms
Start 0 s Stop 2.000 00 ms

Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 25 MHz
Capture Length 100.000 00 ms

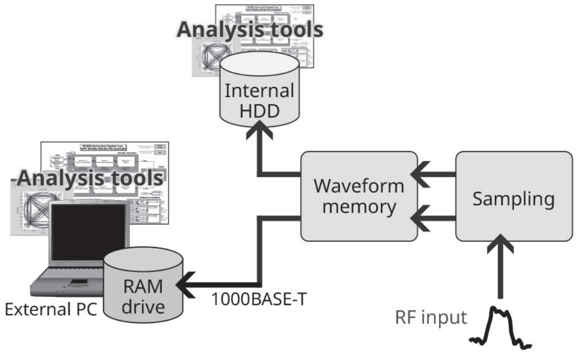
Level
Ref. Level 0.00 dBm
Attenuator 10 dB

Trigger
Trigger Video
Delay -1.000 00 ms
Level -19 dBm

Signal Analyzer: Applications

Analyze Captured Waveforms using Third-Party Tools

The MS269xA utilizes proprietary calibration technologies, enabling digitized baseband data to be used directly in third-party analysis tools without the need for correction.

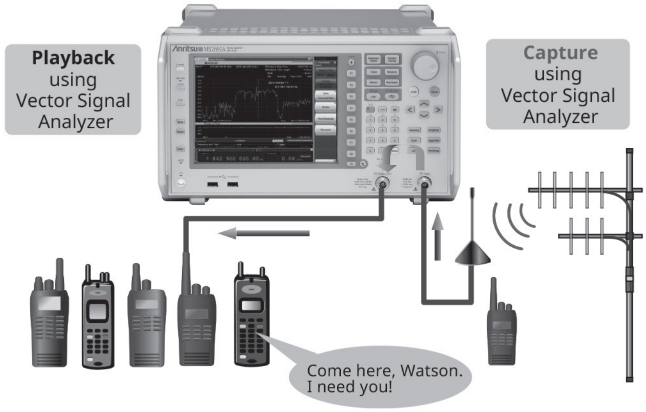


Capture & Playback Real-World Signals

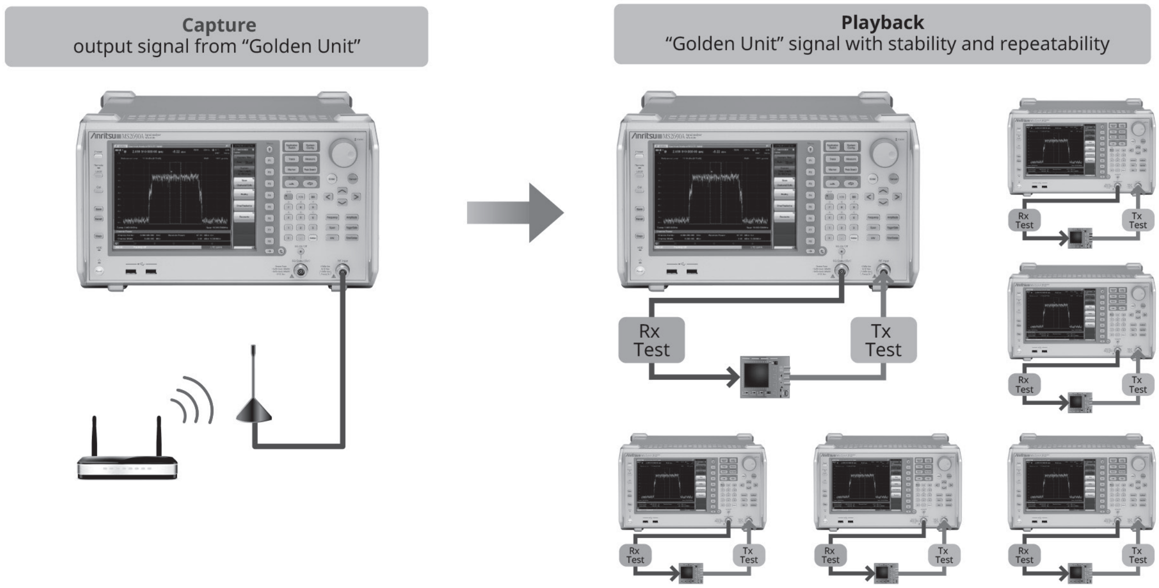
The MS269xA provides Capture & Playback functionality that enables laboratory-grade testing of transceiver systems using real world signals. Using the optional integrated Vector Signal Analyzer and Vector Signal Generator of the MS269xA, Capture & Playback allows users to conveniently capture up to 100 MHz of spectrum and play it back at any designated frequency and amplitude, making it easy to determine device performance margins.

Applications for ***Capture & Playback***

- Validation/Production Test
  Captured signals can be used to initiate a communications link and perform receiver sensitivity testing with a device under test (DUT) using signals captured from a Golden Unit.
- Device Characterization
  Actual baseband signals captured from an RFIC can be used as simulation for characterizing amplifiers and other downstream devices or modules.
- Electromagnetic Compatibility Test
  Problematic RF environments or discrete signals – such as cellular or Wi-Fi – can be captured and used to evaluate a device's susceptibility to RF interference, debug any problems found and validate the solution.



Repeatedly Test Device Performance using "Real-World" RF Environments



Use "Golden Unit" Signal for Manufacturing Test and Calibration

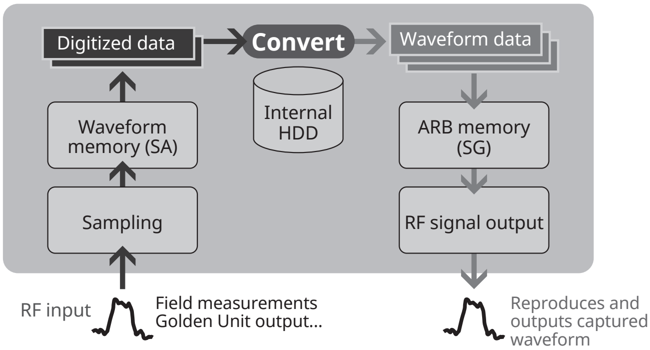
Capture & Playback Highlights

- Bandwidth and Time Limits
  Minimum 10 kHz Bandwidth (2000 s maximum duration)*
  Maximum 100 MHz Bandwidth (500 ms maximum duration)*

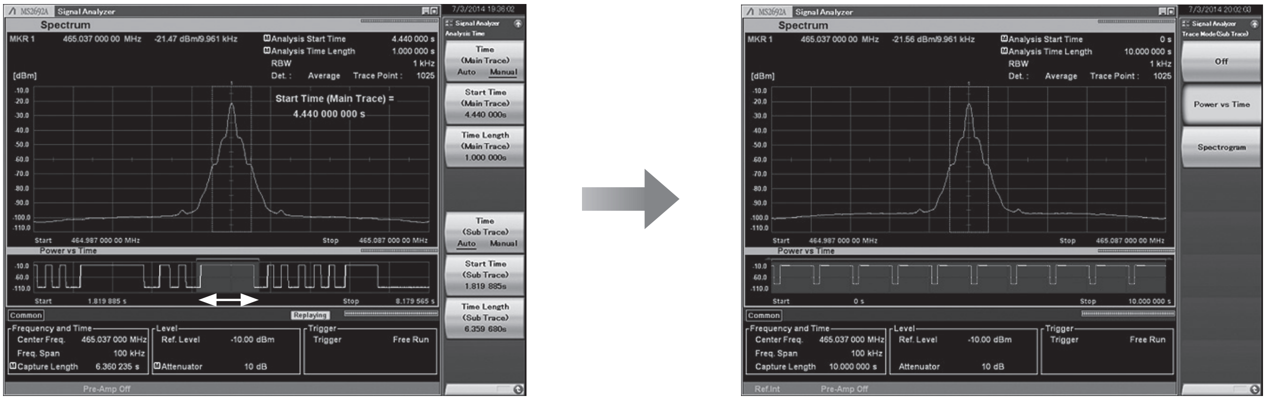
*: Maximum bandwidth depends upon vector signal analyzer options installed (Standard analysis bandwidth or MS269xA-077/078).

- Captured signal may be freely tuned to any output frequency and amplitude supported by the vector signal generator.
- Any section of the captured waveform record may be selected and played back.

  Enables user to isolate and reproduce specific signal bursts
  Enables user to change duty cycle of pulsed waveforms



Playback Block Diagram



7/3/2014 19:36:02
MKR 1 465.037 000 00 MHz -21.47 dBm/9.961 kHz
Analysis Start Time 4.440 000 s
Analysis Time Length 1.000 000 s
RBW 1 kHz
Det. : Average Trace Point : 1025
Start Time (Main Trace) = 4.440 000 000 s
Start 464.987 000 00 MHz Stop 465.087 000 00 MHz
Start 1.819 885 s Stop 8.179 565 s
Time (Main Trace) Auto Manual
Start Time (Main Trace) 4.440 000s
Time Length (Main Trace) 1.000 000s
Time (Sub Trace) Auto Manual
Start Time (Sub Trace) 1.819 885s
Time Length (Sub Trace) 6.359 680s
Frequency and Time
Center Freq. 465.037 000 MHz
Freq. Span 100 kHz
Capture Length 6.360 235 s
Level
Ref. Level -10.00 dBm
Attenuator 10 dB
Trigger
Trigger Free Run

7/3/2014 20:02:03
MKR 1 465.037 000 00 MHz -21.56 dBm/9.961 kHz
Analysis Start Time 0 s
Analysis Time Length 10.000 000 s
RBW 1 kHz
Det. : Average Trace Point : 1025
Start 464.987 000 00 MHz Stop 465.087 000 00 MHz
Start 0 s Stop 10.000 000 s
Frequency and Time
Center Freq. 465.037 000 MHz
Freq. Span 100 kHz
Capture Length 10.000 000 s
Level
Ref. Level -10.00 dBm
Attenuator 10 dB
Trigger
Trigger Free Run

Playback any Desired Section of Captured Waveform

Versatile Built-in Functions

Useful for Tx Characteristics Evaluation

The MS269xA is fully loaded with all the functions required for evaluating Tx characteristics. Tests can be performed simply and in accordance with standards using functions tailored to measurement contents.

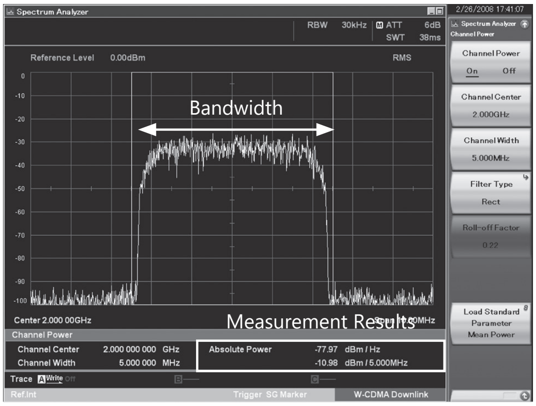
Measure Function	SPA*1	VSA*2
Channel Power	✓	✓
Occupied Bandwidth	✓	✓
Adjacent Channel Leakage Power	✓	✓
Spectrum Emission Mask	✓	
Burst Average Power	✓	✓
Spurious Emission	✓	
AM Depth		✓
FM Deviation		✓
Multi-marker & Marker List	✓	✓
Highest 10 Markers	✓	✓
Limit Line	✓	
Frequency Counter	✓	
2-tone 3rd-order Intermodulation Distortion	✓	
Annotation Display (On/Off)	✓	
Phase Noise	Independent function	
Power Meter	Independent function*3	
Noise Figure	MS269xA-017*4	

*1: SPA (Spectrum Analyzer)
*2: VSA (Vector Signal Analyzer)
*3: Use USB Power Sensors
*4: Use Noise Sources (Noisecom, NC346 series)

Channel Power

SPA VSA

This function measures channel bandwidth power. Three types of filters (Rect, Nyquist, Root Nyquist) can be selected.
Pre-installed templates for each standard support easy parameter setting.

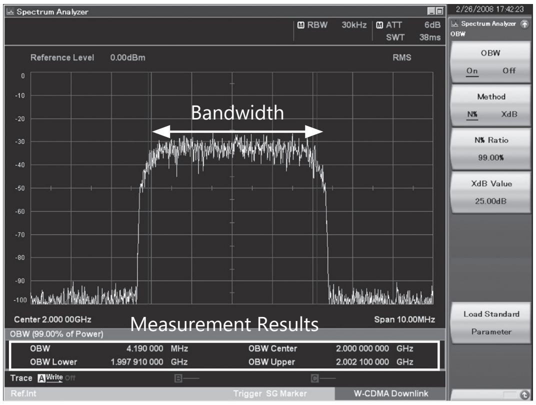

Spectrum Analyzer 2/26/2008 17:41:07
RBW 30kHz ATT 6dB SWT 38ms
Reference Level 0.00dBm RMS
Center 2.000 00GHz Span 10.00MHz
Channel Power
Channel Center 2.000 000 000 GHz
Channel Width 5.000 000 MHz
Absolute Power -77.97 dBm / Hz
-10.98 dBm / 5.000MHz
Trace A Write
Ref.Int Trigger SG Marker W-CDMA Downlink
Channel Power: On Off
Channel Center: 2.000GHz
Channel Width: 5.000MHz
Filter Type: Rect
Roll-off Factor: 0.22
Load Standard Parameter: Mean Power

Measurement Results
- Absolute power per Hz in channel band
- Total power in channel band

Occupied Bandwidth

SPA VSA

Occupied bandwidth is measured by selecting either the N% or X-dB mode. Pre-installed templates for each standard support easy parameter setting.

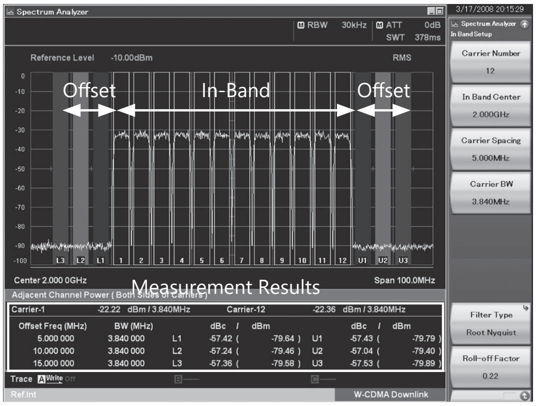

Spectrum Analyzer 2/26/2008 17:42:23
RBW 30kHz ATT 6dB SWT 38ms
Reference Level 0.00dBm RMS
Center 2.000 00GHz Span 10.00MHz
OBW (99.00% of Power)
OBW 4.190 000 MHz
OBW Center 2.000 000 000 GHz
OBW Lower 1.997 910 000 GHz
OBW Upper 2.002 100 000 GHz
Trace A Write
Ref.Int Trigger SG Marker W-CDMA Downlink
OBW: On Off
Method: N% XdB
N% Ratio: 99.00%
XdB Value: 25.00dB
Load Standard Parameter

Measurement Results
- Bandwidth for specified conditions

Adjacent Channel Leakage Power

SPA VSA

This function measures carrier adjacent channel (offset) power (In-Band). 1 to 12 carriers can be set and switched instantaneously on-screen. True ACLR performance is measured using the noise cancellation function to subtract main-frame noise from the measurement result. Pre-installed templates for each standard support easy parameter setting.


Spectrum Analyzer 3/17/2008 20:15:29
RBW 30kHz ATT 0dB SWT 378ms
Reference Level -10.00dBm RMS
Center 2.000 0GHz Span 100.0MHz
Adjacent Channel Power (Both Sides of Carriers)
Carrier-1 -22.22 dBm / 3.840MHz Carrier-12 -22.36 dBm / 3.840MHz

Offset Freq (MHz)	BW (MHz)		dBc / dBm		dBc / dBm
5.000 000	3.840 000	L1	-57.42 (-79.64)	U1	-57.43 (-79.79)
10.000 000	3.840 000	L2	-57.24 (-79.46)	U2	-57.04 (-79.40)
15.000 000	3.840 000	L3	-57.36 (-79.58)	U3	-57.53 (-79.89)

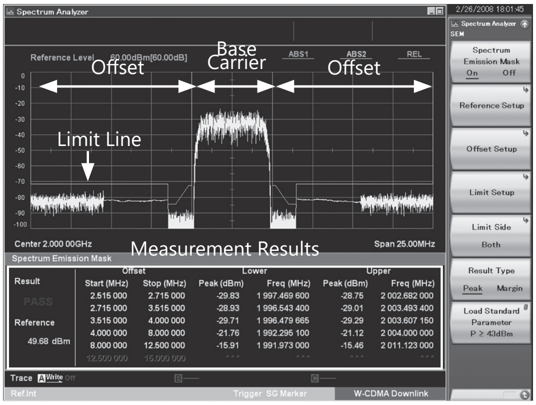
Trace A Write
Ref.Int W-CDMA Downlink
Carrier Number: 12
In Band Center: 2.000GHz
Carrier Spacing: 5.000MHz
Carrier BW: 3.840MHz
Filter Type: Root Nyquist
Roll-off Factor: 0.22

Measurement Results
- Absolute power of Offset channel
- Relative values in relation to reference power selected in ACP reference

Spectrum Emission Mask

SPA

This function splits the offset part into up to 12 segments; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment. The results are tabulated below the trace and marked PASS/FAIL. Pre-installed templates for each standard support easy parameter setting.



Reference Level 60.00dBm[60.00dB]

Center 2.000 00GHz

Span 25.00MHz

Spectrum Emission Mask

Result	Offset		Lower		Upper	
	Start (MHz)	Stop (MHz)	Peak (dBm)	Freq (MHz)	Peak (dBm)	Freq (MHz)
PASS	2.515 000	2.715 000	-29.83	1 997.469 600	-28.75	2 002.682 000
	2.715 000	3.515 000	-28.93	1 996.543 400	-29.01	2 003.493 400
Reference	3.515 000	4.000 000	-29.71	1 996.479 665	-29.29	2 003.607 150
49.68 dBm	4.000 000	8.000 000	-21.76	1 992.295 100	-21.12	2 004.000 000
	8.000 000	12.500 000	-15.91	1 991.973 000	-15.46	2 011.123 000
	12.500 000	15.000 000	***	***	***	***

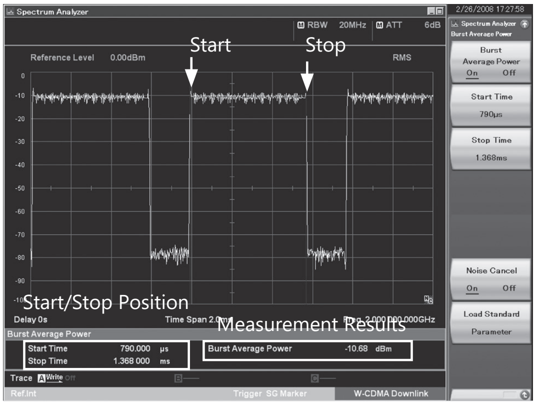
Ref.Int Trigger SG Marker W-CDMA Downlink

Measurement Results
- Peak power (or margin) at offset
- Each peak frequency

Burst Average Power

SPA VSA

The average power for the range specified by two markers is displayed in the time domain. Measurement only requires setting the measurement start and stop positions on the screen. True performance is measured using the noise cancellation function to subtract mainframe noise from the measurement result.
Pre-installed templates for each standard support easy parameter setting.



RBW 20MHz ATT 6dB

Reference Level 0.00dBm RMS

Delay 0s Time Span 2.0ms Freq. 2.000 000 000GHz

Burst Average Power

Start Time 790.000 µs
Stop Time 1.368 000 ms

Burst Average Power -10.68 dBm

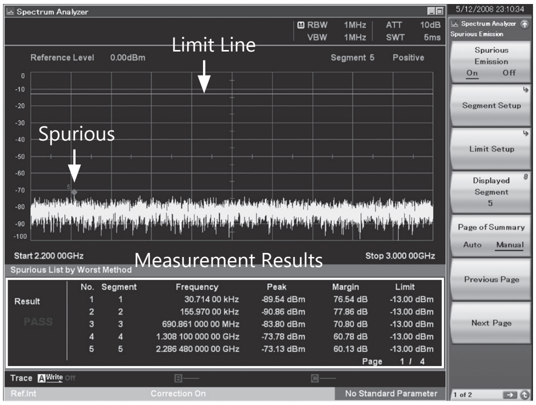
Ref.Int Trigger SG Marker W-CDMA Downlink

Measurement Results
- Average power of specified range

Spurious Emission

SPA

This function splits the frequency range into up to 20 segments for sweeping; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment. The results are tabulated below the trace and marked PASS/FAIL. And, zero-span capturing of peak power in time domain is also supported.



RBW 1MHz ATT 10dB
VBW 1MHz SWT 5ms

Reference Level 0.00dBm Segment 5 Positive

Start 2.200 00GHz Stop 3.000 00GHz

Spurious List by Worst Method

Result	No.	Segment	Frequency	Peak	Margin	Limit
	1	1	30.714 00 kHz	-89.54 dBm	76.54 dB	-13.00 dBm
PASS	2	2	155.970 00 kHz	-90.86 dBm	77.86 dB	-13.00 dBm
	3	3	690.861 000 00 MHz	-83.80 dBm	70.80 dB	-13.00 dBm
	4	4	1.308 100 000 00 GHz	-73.78 dBm	60.78 dB	-13.00 dBm
	5	5	2.286 480 000 00 GHz	-73.13 dBm	60.13 dB	-13.00 dBm

Page 1 / 4

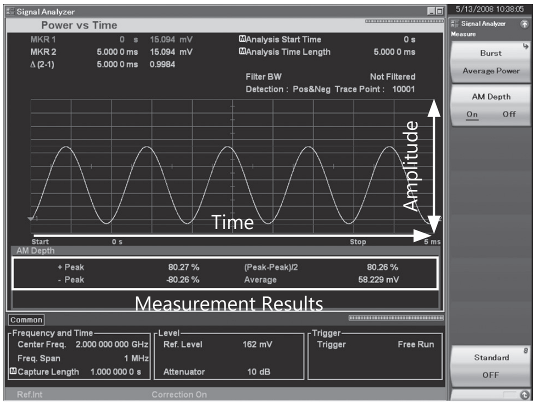
Ref.Int Correction On No Standard Parameter

Measurement Results
- Each segment peak power and margin
- Each peak frequency

AM Depth

VSA

The Power vs. Time trace measurement function is used to confirm AM depth.
It measures the measured signal AM based on trace data at the displayed marker. When marker is Off, the whole range is measured.



Power vs Time

MKR 1 0 s 15.094 mV
MKR 2 5.000 0 ms 15.094 mV
Δ (2-1) 5.000 0 ms 0.9984

Analysis Start Time 0 s
Analysis Time Length 5.000 0 ms

Filter BW Not Filtered
Detection : Pos&Neg Trace Point : 10001

AM Depth

+ Peak 80.27 % (Peak-Peak)/2 80.26 %
- Peak -80.26 % Average 58.229 mV

Common

Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 1 MHz
Capture Length 1.000 000 0 s

Level
Ref. Level 162 mV
Attenuator 10 dB

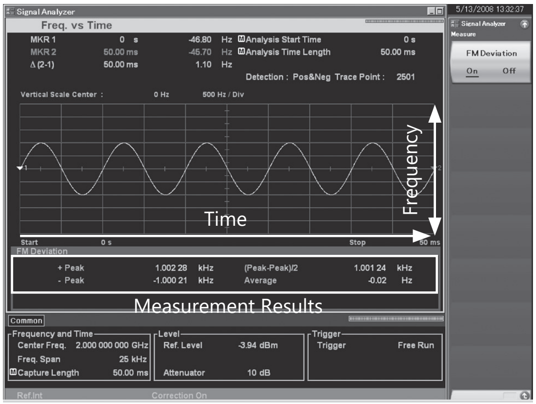
Trigger
Trigger Free Run

Ref.Int Correction On

Measurement Results
- +Peak, –Peak, (Peak-Peak)/2, Average

FM Deviation VSA

The Freq. vs. Time trace measurement is used to confirm the FM deviation. It measures the maximum and minimum frequencies from trace data in the marker range. When marker is Off, the whole range is measured.



Freq. vs Time

MKR 1	0 s	-46.80 Hz	Analysis Start Time	0 s
MKR 2	50.00 ms	-45.70 Hz	Analysis Time Length	50.00 ms
Δ (2-1)	50.00 ms	1.10 Hz		

Detection : Pos&Neg Trace Point : 2501

FM Deviation

+ Peak	1.002 28 kHz	(Peak-Peak)/2	1.001 24 kHz
- Peak	-1.000 21 kHz	Average	-0.02 Hz

Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 25 kHz
Capture Length 50.00 ms

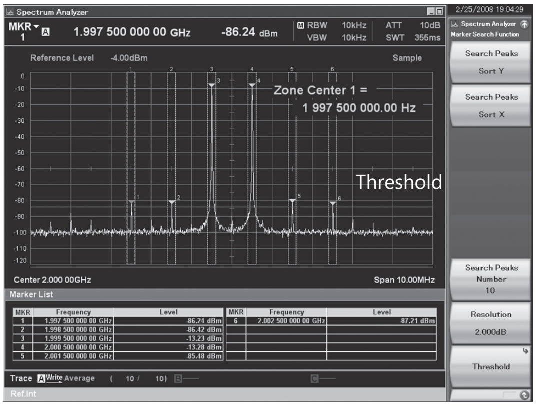
Level
Ref. Level -3.94 dBm
Attenuator 10 dB

Trigger
Trigger Free Run

Measurement Results
- +Peak, –Peak, (Peak-Peak)/2, Average

Multi-marker & Marker List SPA VSA

Up to 10 markers can be set for this function. Markers may be either a spot or a zone. Using a zone marker, the peak of a signal with an unstable variable frequency can be tracked and measured. Not only can the 10 markers be listed below the trace but the differences between markers can be calculated and displayed using the delta setting.



MKR 1 1.997 500 000 00 GHz -86.24 dBm
RBW 10kHz ATT 10dB
VBW 10kHz SWT 355ms
Reference Level -4.00dBm Sample
Center 2.000 00GHz Span 10.00MHz

Marker List

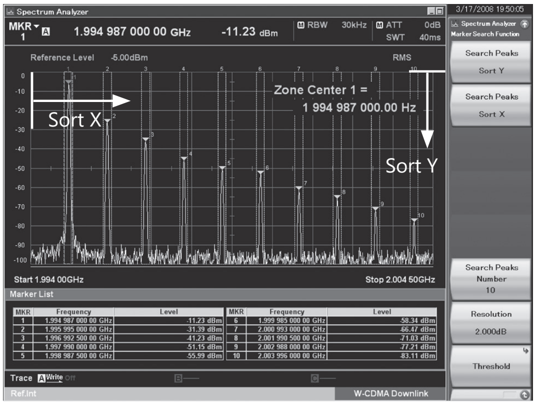
MKR	Frequency	Level	MKR	Frequency	Level
1	1.997 500 000 00 GHz	-86.24 dBm	6	2.002 500 000 00 GHz	-87.21 dBm
2	1.998 500 000 00 GHz	-86.42 dBm			
3	1.999 500 000 00 GHz	-13.23 dBm			
4	2.000 500 000 00 GHz	-13.28 dBm			
5	2.001 500 000 00 GHz	-85.48 dBm			

Trace A Write Average (10 / 10)

Measurement Results
- Marker point frequency
- Marker point power
- Absolute power per Hz in marker bandwidth
- Total power in marker bandwidth
- Difference between any markers

Highest 10 Markers SPA VSA

This function sets the threshold level and auto-detects peaks in the X (frequency) and Y (level/time) directions.



MKR 1 1.994 987 000 00 GHz -11.23 dBm
RBW 30kHz ATT 0dB
SWT 40ms
Reference Level -5.00dBm RMS
Start 1.994 00GHz Stop 2.004 50GHz

Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	1.994 987 000 00 GHz	-11.23 dBm	6	1.999 985 000 00 GHz	-58.34 dBm
2	1.995 995 000 00 GHz	-31.39 dBm	7	2.000 993 000 00 GHz	-66.47 dBm
3	1.996 992 500 00 GHz	-41.23 dBm	8	2.001 990 500 00 GHz	-71.03 dBm
4	1.997 990 000 00 GHz	-51.15 dBm	9	2.002 988 000 00 GHz	-77.21 dBm
5	1.998 987 500 00 GHz	-55.99 dBm	10	2.003 996 000 00 GHz	-83.11 dBm

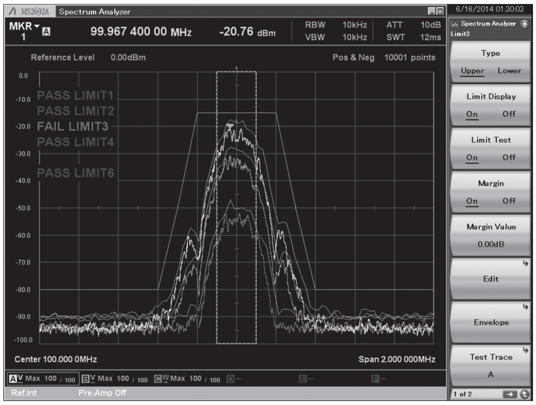
Trace A Write Off

Measurement Results
- Peak Search Y:
  Sets up to 10 markers in order of peak level
- Peak Search X:
  Sets up to 10 markers in order of frequency (time) level

Limit Lines SPA

- Setting Limit Lines
  Up to six types of Limit line can be set on the spectrum display (frequency domain).
  In addition to setting the frequency and level of crossover points manually in sequence from the low frequency, after creating the right half of a line, the left half can be created by reversing and copying the right half, to set a symmetric limit line. Additionally, a Limit line that traces the measured waveform can be created using the Limit Envelope function. A margin can be set on the Limit line in the amplitude direction.
- Evaluating using Limit Line Setting (Limit Test Function)
  When the waveform is above or below the Limit line, it is evaluated automatically as PASS or FAIL. Evaluation is also possible with an added margin. The target evaluation line can be chosen from any of six types.
- Auto-saving Waveform Data using Limit Line Setting (Save on Event Function)
  When the waveform matches the evaluation conditions (Event), it can be saved automaticaly as a csv format file. Any one of the following five Event types can be selected.

(1) Limit Fail: Saves waveform file when evaluation result is Fail
(2) Limit Pass: Saves waveform file when evaluation result is Pass
(3) Margin Fail: Saves waveform file when evaluation result including margin is Fail
(4) Margin Pass: Saves waveform file when evaluation result including margin is Pass
(5) Sweep Complete: Saves waveform file at every measurement regardless of evaluation result

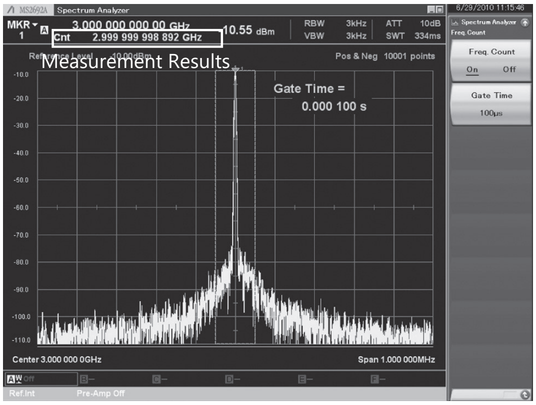


Example:
PASS/FAIL evaluation is performed by changing the input signal level.
The evaluation results for the five line types can be displayed simultaneously on one screen.

Line: Limit 1, Limit 2, Limit 3, Limit 4, Limit 5, Limit 6
Evaluation Type: Upper Limit, Lower Limit
Crossover (Point): 1 to 100
Margin: Set Margin line for each Limit 1, 2, 3, 4, 5, 6
Evaluation Result: PASS, FAIL
Result Save: Auto-save as csv format file

Frequency Counter SPA

This function of the marker functions is used to measure CW frequencies.
Gate Time sets the measurement target time.



Measurement Results
- Marker point frequency

2-tone 3rd-order Intermodulation Distortion SPA

By inputting two different frequency CW signals (desired waves), two-tone third-order intermodulation distortion is generated close to the desired waves according to non-linear characteristics of Device Under Test (DUT). Then, Third Order Intercept (TOI) is calculated from the two-tone third-order intermodulation distortion.

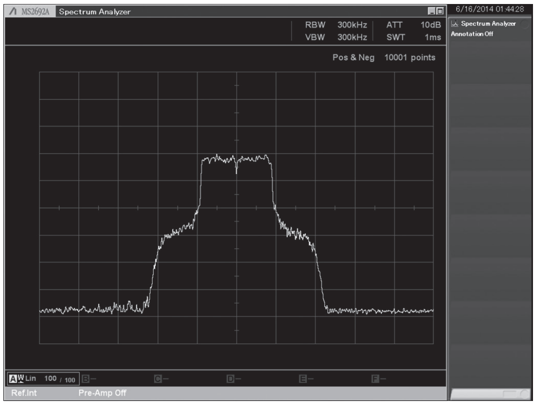
TOI (dBm) 1.69
Amplitude (dBc) -29.94

	Frequency (GHz)	Amplitude (dBm)	Amplitude (dBc)	TOI (dBm)
Lower 3rd	0.999 850 000	-43.21	-29.94	1.69
Lower Tone	0.999 949 960	-13.28		
Upper Tone	1.000 050 000	-13.27		
Upper 3rd	1.000 149 999	-43.30	-30.02	1.74

Measurement Results
- TOI: [dBm]
- Amplitude: [dBc]

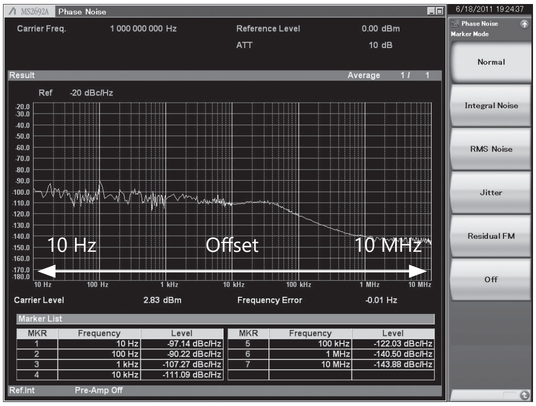
Annotation Display SPA

Screen annotations can be set to On or Off. Annotations about frequency, level, etc., are not displayed at the Off setting.



Phase Noise

This function measures phase noise in the 10 Hz to 10 MHz frequency offset range.



MS2692A Phase Noise 6/18/2011 19:24:37

Carrier Freq. 1 000 000 000 Hz
Reference Level 0.00 dBm
ATT 10 dB

Result Average 1 / 1

Ref -20 dBc/Hz

Carrier Level 2.83 dBm
Frequency Error -0.01 Hz

Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	10 Hz	-97.14 dBc/Hz	5	100 kHz	-122.03 dBc/Hz
2	100 Hz	-90.22 dBc/Hz	6	1 MHz	-140.50 dBc/Hz
3	1 kHz	-107.27 dBc/Hz	7	10 MHz	-143.88 dBc/Hz
4	10 kHz	-111.09 dBc/Hz			

Ref.Int Pre-Amp Off

Measurement Results
- Carrier level
- Error between set frequency and carrier frequency
- Marker point phase noise level

Power Meter

Power meter function can connect a USB power sensor to the MS2830A and read the measurement values.

MS2692A Power Meter 6/6/2012 12:58:15

COM5 MA24108A Freq : 1.000 000 000 GHz Range : Auto

POWER : -10.00 dBm
0.00 dB
100. μW

Measuring Not Zeroed Offset : Off , 0.00 dB Average : 80 / 1000

Measurement Results
- Power: [dBm], [W]
- Relative power: [dB]

Compatible USB power sensors

Model	Frequency Range	Dynamic Range
MA24104A*	600 MHz to 4 GHz	+3 to +51.76 dBm
MA24105A	350 MHz to 4 GHz	+3 to +51.76 dBm
MA24106A	50 MHz to 6 GHz	–40 to +23 dBm
MA24108A	10 MHz to 8 GHz	–40 to +20 dBm
MA24118A	10 MHz to 18 GHz	–40 to +20 dBm
MA24126A	10 MHz to 26 GHz	–40 to +20 dBm

*: MA24104A has been discontinued.

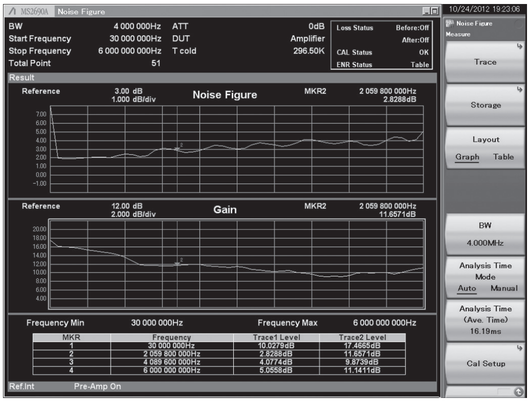
Noise Figure Measurement (MS269xA-017)

Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source*.

Frequency Mode: Fixed, List, Sweep
DUT Mode: Amplifier, Down Converter, Up Converter
Screen Layout: Graph, Table

Measurement Results Display
Graph/List/Spot

Displays measurement results for each trace (Trace1/Trace2).
Noise Figure (NF) [dB]
Noise Factor (F) [Linear]
Gain
Y-Factor: Power ratio when Noise Source is turned On/Off
T effective: Effective noise temperature
P Hot: Power measured when Noise Source is On.
P Cold: Power measured when Noise Source is Off.



MS2690A Noise Figure 10/24/2012 19:23:06

BW 4 000 000Hz ATT 0dB
Start Frequency 30 000 000Hz DUT Amplifier
Stop Frequency 6 000 000 000Hz T cold 296.50K
Total Point 51

Loss Status Before:Off After:Off
CAL Status OK
ENR Status Table

Result

Reference 3.00 dB 1.000 dB/div Noise Figure MKR2 2 059 800 000Hz 2.8288dB

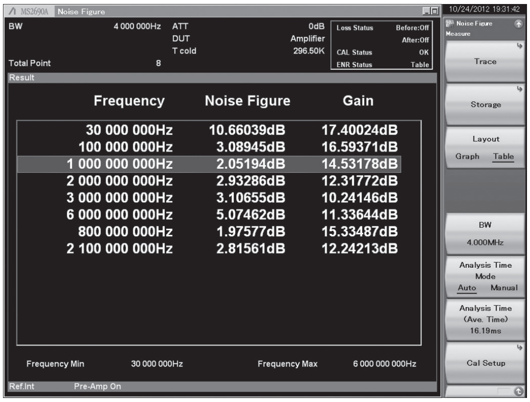
Reference 12.00 dB 2.000 dB/div Gain MKR2 2 059 800 000Hz 11.6571dB

Frequency Min 30 000 000Hz Frequency Max 6 000 000 000Hz

MKR	Frequency	Trace1 Level	Trace2 Level
1	30 000 000Hz	10.0279dB	17.4665dB
2	2 059 800 000Hz	2.8288dB	11.6571dB
3	4 089 600 000Hz	4.0774dB	9.8739dB
4	6 000 000 000Hz	5.0558dB	11.1411dB

Ref.Int Pre-Amp On

Measurement Result: Example of Graph display
(Frequency Mode: Sweep, Screen Layout: Graph)



MS2690A Noise Figure 10/24/2012 19:31:42

BW 4 000 000Hz ATT 0dB
DUT Amplifier
T cold 296.50K
Total Point 8

Loss Status Before:Off After:Off
CAL Status OK
ENR Status Table

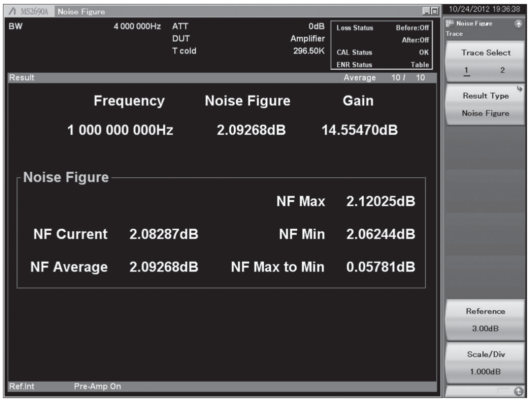
Result

Frequency	Noise Figure	Gain
30 000 000Hz	10.66039dB	17.40024dB
100 000 000Hz	3.08945dB	16.59371dB
1 000 000 000Hz	2.05194dB	14.53178dB
2 000 000 000Hz	2.93286dB	12.31772dB
3 000 000 000Hz	3.10655dB	10.24146dB
6 000 000 000Hz	5.07462dB	11.33644dB
800 000 000Hz	1.97577dB	15.33487dB
2 100 000 000Hz	2.81561dB	12.24213dB

Frequency Min 30 000 000Hz Frequency Max 6 000 000 000Hz

Ref.Int Pre-Amp On

Measurement Result: Example of List display
(Frequency Mode: List, Screen Layout: List)



MS2690A Noise Figure 10/24/2012 19:36:38

BW 4 000 000Hz ATT 0dB
DUT Amplifier
T cold 296.50K

Loss Status Before:Off After:Off
CAL Status OK
ENR Status Table

Result Average 10 / 10

Frequency	Noise Figure	Gain
1 000 000 000Hz	2.09268dB	14.55470dB

Noise Figure

NF Max 2.12025dB
NF Current 2.08287dB NF Min 2.06244dB
NF Average 2.09268dB NF Max to Min 0.05781dB

Ref.Int Pre-Amp On

Measurement Result: Example of Spot display
(Frequency Mode: Fixed)

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*: Supports noise sources from Noisecom NC346 series.
See the MS2690A/MS2691A/MS2692A catalog for more details.

Vector Signal Generator (MS269xA-020): Basic Performance

The Vector Signal Generator MS269xA-020 covers the frequency range from 125 MHz to 6 GHz; it has a wide vector modulation bandwidth of 120 MHz as well as a large built-in memory for storing 256 Msamples. Its level accuracy is at least as good as a dedicated signal generator and the ACLR performance is ideal for Tx tests of devices such as amplifiers and Rx tests of base stations.
The all-in-one analyzer and signal generator supports simple configuration of space-saving measurement systems as well as easy signal analysis matching the output timing from the signal generator option.

Frequency Range

Frequency Range: 125 MHz to 6 GHz
Resolution: 0.01 Hz step

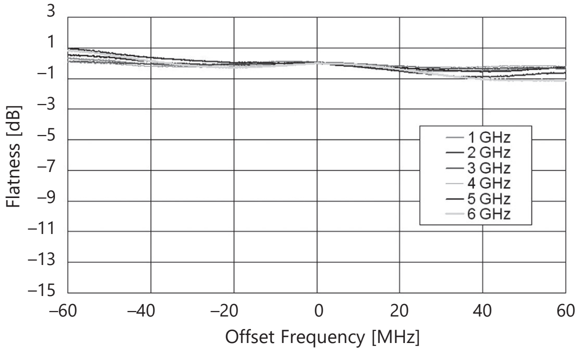
The Vector Signal Generator (MS269xA-020) frequency range is 125 MHz to 6 GHz, covering the key wireless communication range.

Internal Baseband Generator

Vector Modulation Bandwidth: 120 MHz
Sampling Clock: 20 kHz to 160 MHz

The wideband 120-MHz vector modulation bandwidth is achieved using the MS269xA-020 baseband signal generator.
The sampling clock supports up to 160 MHz.

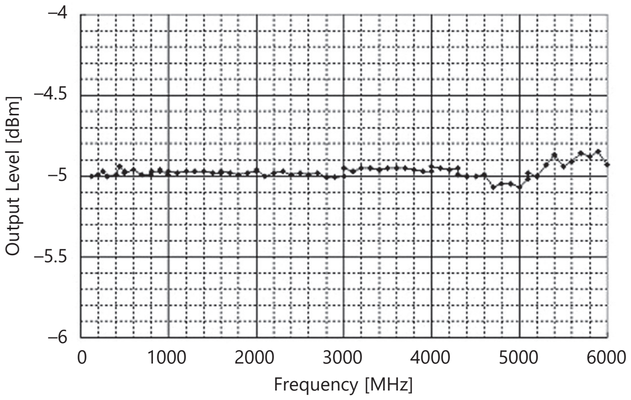
Example: Vector Modulation Bandwidth



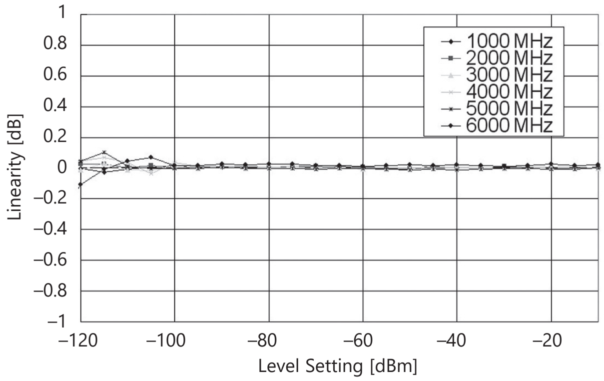
Level Accuracy ±0.5 dB

Output Level Accuracy (CW):
±0.5 dB (–120 dBm ≤ Level ≤ +5 dBm, Frequency ≤ 3 GHz)
±0.8 dB (–110 dBm ≤ Level ≤ +5 dBm, Frequency > 3 GHz)

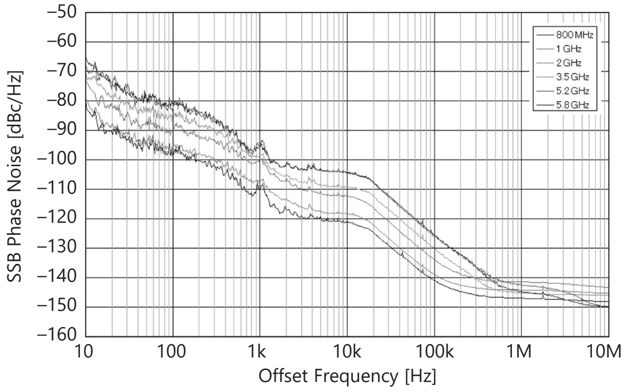
Example: Frequency Characteristics (Referenced to –5 dBm)



Example: Linearity (Referenced to –5 dBm)



Example: SSB Phase Noise



Large-capacity Memory

1 GB = 256 Msamples/channel

The MS269xA-020 arbitrary waveform memory can save 256 Msamples/channel as well as multiple waveform patterns at the same time. Waveform patterns in memory can be output instantaneously by switching without need to recall from hard disk.

Internal AWGN Generator

Absolute CN Ratio: ≤40 dB

This functions adds AWGN (Additive White Gaussian Noise) to the wanted waveform in memory. It is ideal for Tx dynamic range tests.

AWGN band set automatically to sampling clock of wanted signal.

Example: When wanted signal conditions are:
- W-CDMA
- Bandwidth = 3.84 MHz
- Over sampling = × 4

Internal BER Measurement Function

Input Bit Rate: 100 bps to 10 Mbps
Input Level: TTL Level
Input Signal: Data, Clock, Enable
Connector: Rear panel, Aux connector*

Adding the MS269xA-020 includes a built-in BER tester for measurements up to 10 Mbps. It supports Rx sensitivity tests by inputting the receiver-demodulated Data/Clock/Enable to the back of the MS269xA.

*: Requires AUX Conversion Adapter J1373A (sold separately)

Versatile Multiple Waveform Generation

Any type of waveform can be generated using the MS269xA-020. In addition to using C and simulation tools, Anritsu's IQproducer can be run on a PC to edit waveform parameters and output waveforms.

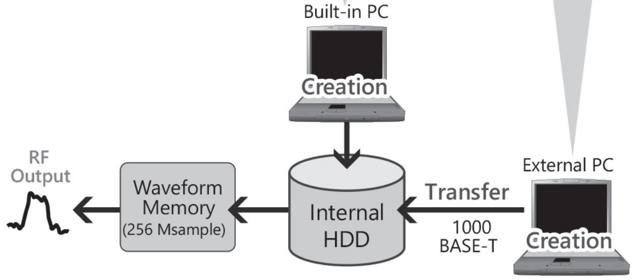
Creating Waveform Using IQproducer

IQproducer is PC software that is used to edit parameters and create any waveform pattern. It can be installed either on an external PC or in the MS269xA main frame.

- HSDPA/HSUPA IQproducer
- TDMA IQproducer
- Multi-carrier IQproducer
- LTE IQproducer
- LTE TDD IQproducer
- WLAN IQproducer
- TD-SCDMA IQproducer
- 5G NR TDD sub-6 GHz IQproducer
- 5G NR FDD sub-6 GHz IQproducer

Creating Any Waveform

IQ Data created using the MS269xA digitize function or by simulation tools or in C can be converted to a waveform pattern using the SG option and output.



Useful IQproducer Waveform Generation Software

IQproducer is application software for a PC for editing, creating and transferring waveform patterns using the MS269xA-020 arbitrary waveform generation option.
It has the following three main functions.

Parameter Editing:
Function for easily editing parameters matching each communication method
Simulation:
Function for checking generated waveform pattern before transfer to CCDF and FFT graphs
Conversion:
Function for converting ASCII format waveform patterns created by simulation software, files captured using digitizing function, and MG3700A waveform patterns, into files that can be used by MS269xA-020

Excellent Expandability Platform (Hardware)

The versatility of the MS269xA series is tailored easily to the application by installing modules in expansion slots.

Basic Function and Performance Upgrades

- Rubidium Reference Oscillator MS2690A/MS2691A/MS2692A-001
  This option is a 10 MHz reference crystal oscillator with excellent frequency stability startup characteristics of $\pm 1 \times 10^{-9}$ at 7 minutes after power-on.
  Aging Rate: $\pm 1 \times 10^{-10}$/month
  Start-up Characteristics: $\pm 1 \times 10^{-9}$ (7 minutes after power-on)
- Preselector Extended Lower Limit (3 GHz) MS2691A/MS2692A-003
  This option extends the lower limit of the preselector from 5.9 GHz to 3 GHz. It can only be installed in the MS2691A/MS2692A.
- 6 GHz Preamplifier MS2690A/MS2691A/MS2692A-008
  This option increases the sensitivity of the spectrum/signal analyzer functions and is used for examining low-level signals such as interference waveforms.
  Frequency range: 100 kHz to 6 GHz
  Gain: 14 dB (≤3 GHz)
  13 dB (3 GHz < Frequency ≤ 4 GHz)
  11 dB (4 GHz < Frequency ≤ 5 GHz)
  10 dB (5 GHz < Frequency ≤ 6 GHz)
- Microwave Preselector Bypass MS2692A-067
  Bypassing the preselector used for the microwave band improves RF frequency characteristics and in-band frequency characteristics.
  *: Cannot be installed simultaneously with MS2692A-003/008

Signal Analyzer Function and Performance Upgrade

- Analysis Bandwidth Extension to 62.5 MHz MS2690A/MS2691A/MS2692A-077
  This option expands the analysis bandwidth to 62.5 MHz.
- Analysis Bandwidth Extension to 125 MHz MS2690A/MS2691A/MS2692A-078*1, *2
  This option expands the analysis bandwidth to 125 MHz.
  *1: Requires MS269xA-077
  *2: Combining with MX269028A-002 WLAN IEEE 802.11ac (160 MHz) measurement software (only for MS269xA) supports modulation analysis up to 160-MHz bandwidth signals of the 802.11ac.
  See measurement software catalog for more details

Usage Example: Record Noise and Replay

When the Vector Signal Generator (MS269xA-020) generates a signal based on the data captured by the signal analyzer, a signal that mimics the captured signal can be output[*1].
The Capture & Playback function can also be used for capture and replay using a simple procedure.
For example, a variety of noise sources can be captured and edited using one MS269xA to evaluate the noise tolerance of a product.
In some cases, it is not possible to capture minute level fluctuations with a resolution of 20 ns[*2], depending on the noise components.
In these circumstances, a signal very close to the actual noise can be captured and replayed by setting the resolution to 5 ns[*3].
(At signal generation, the setting range of the pattern sampling rate must be within the 160 MHz upper limit of the vector signal generator sampling rate.)

*1: Capture time depends on memory capacity.
*2: Sampling rate of 50 MHz at 31.25 MHz FFT band
*3: Sampling rate of 200 MHz at 125 MHz FFT band

Expansion Functions

- Noise Figure Measurement Function MS2690A/MS2691A/MS2692A-017
  Adds noise figure measurement function.
  Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source.
- Vector Signal Generator MS2690A/MS2691A/MS2692A-020
  This option is a high-performance waveform generator covering a frequency range of 125 MHz to 6 GHz with a 120 MHz wideband vector modulation band and built-in 256 Msample waveform memory.

Future-proof Platform (Software)

Adding measurement software options to the signal analyzer assures that the modulation analysis and other functions will support all common current and future communications systems.

Measurement Software

Communications Systems	Model	Name
W-CDMA/HSPA/ HSPA Evolution	MX269011A	W-CDMA/HSPA Downlink Measurement Software
	MX269012A	W-CDMA/HSPA Uplink Measurement Software
W-CDMA/HSPA	MX269030A	W-CDMA BS Measurement Software
GSM/EDGE	MX269013A	GSM/EDGE Measurement Software
EDGE Evolution	MX269013A-001	EDGE Evolution Measurement Software
ETC/DSRC	MX269014A	ETC/DSRC Measurement Software
TD-SCDMA	MX269015A	TD-SCDMA Measurement Software
World Digital Wireless Standards	MX269017A	Vector Modulation Analysis Software
LTE/ LTE-Advanced (FDD)	MX269020A	LTE Downlink Measurement Software
	MX269020A-001	LTE-Advanced FDD Downlink Measurement Software
	MX269021A	LTE Uplink Measurement Software
	MX269021A-001	LTE-Advanced FDD Uplink Measurement Software
LTE/ LTE-Advanced (TDD)	MX269022A	LTE TDD Downlink Measurement Software
	MX269022A-001	LTE-Advanced TDD Downlink Measurement Software
	MX269023A	LTE TDD Uplink Measurement Software
	MX269023A-001	LTE-Advanced TDD Uplink Measurement Software
CDMA2000	MX269024A	CDMA2000 Forward Link Measurement Software
	MX269024A-001	All Measure Function
1xEV-DO	MX269026A	EV-DO Forward Link Measurement Software
	MX269026A-001	All Measure Function
WLAN	MX269028A	WLAN (802.11) Measurement Software (Supports IEEE 802.11n/11a/11b/11g/11j/11p)
	MX269028A-002*	802.11ac (160 MHz) Measurement Software (for MS269xA)
5G	MX269051A	5G Standard Measurement Software (Base License)
	MX269051A-011	NR TDD sub-6 GHz Downlink
	MX269051A-061	NR TDD sub-6 GHz Uplink
	MX269051A-031	NR FDD sub-6 GHz Downlink
	MX269051A-081	NR FDD sub-6 GHz Uplink

*: Only for MS269xA.
Combining with the Analysis Bandwidth Extension to 125 MHz MS269xA-078 supports modulation analysis up to 160-MHz bandwidth signals of the 802.11ac.

Adding a license for the IQproducer waveform generation software to the vector signal generator option supports easy generation of test patterns for all common communications systems worldwide.

IQproducer License for MS269xA-020 VSG

Waveforms generated by IQproducer can be downloaded to the MS269xA main frame in which the MS269xA-020 Vector Signal Generator is installed, but the following licenses (option) are required to output the signal.

• HSDPA/HSUPA IQproducer	MX269901A
• TDMA IQproducer	MX269902A
• Multi-Carrier IQproducer	MX269904A
• LTE IQproducer	MX269908A
• LTE-Advanced FDD Option	MX269908A-001[*1]
• LTE TDD IQproducer	MX269910A
• LTE-Advanced TDD Option	MX269910A-001[*2]
• WLAN IQproducer	MX269911A
• 802.11ac (80 MHz) Option	MX269911A-001[*3]
• TD-SCDMA IQproducer	MX269912A
• 5G NR TDD sub-6 GHz IQproducer	MX269913A
• 5G NR FDD sub-6 GHz IQproducer	MX269914A

*1: Requires MX269908A.
*2: Requires MX269910A.
*3: Requires MX269911A.

Waveform Patterns for MS269xA-020 VSG

Various waveforms with preset parameters matching each communication method are provided. The MS269xA-020 Vector Signal Generator option outputs RF signals.
Pre-installed reference waveforms are saved on the MS269xA hard disk for free use.

- Pre-installed Patterns
  - W-CDMA
  - HSDPA (Test Model5)
  - CDMA2000 1xEV-DO
  - CDMA2000
  - GSM/EDGE
  - Digital Broadcasting (ISDB-T/CS/BS/CATV)
  - WLAN 802.11a/b/g
  - Bluetooth

Specifications

The specification is the value after a 30-minute warm-up at a constant ambient temperature.
Typical values are only for reference and are not guaranteed specifications.

Vector Signal Analysis Function/Spectrum Analyzer Function Common

Frequency

<table>
<tr><td>Frequency Range</td><td>50 Hz to 6.0 GHz (MS2690A)
50 Hz to 13.5 GHz (MS2691A)
50 Hz to 26.5 GHz (MS2692A)</td></tr>
<tr><td>Frequency Bands</td><td>
<table>
<tr><th>Frequency Range</th><th>Band</th><th>Mixer Harmonic Order (N)</th><th></th></tr>
<tr><td>50 Hz ≤ Frequency ≤ 6.0 GHz</td><td>0</td><td>1</td><td></td></tr>
<tr><td>3.0 GHz ≤ Frequency ≤ 6.0 GHz</td><td>1 – L</td><td>1</td><td>(with MS2691A-003/MS2692A-003, MS2691A/MS2692A)</td></tr>
<tr><td>5.9 GHz ≤ Frequency ≤ 8.0 GHz</td><td>1–</td><td>1</td><td>(MS2691A/MS2692A)</td></tr>
<tr><td>7.9 GHz ≤ Frequency ≤ 13.5 GHz</td><td>1+</td><td>1</td><td>(MS2691A/MS2692A)</td></tr>
<tr><td>13.4 GHz ≤ Frequency ≤ 20.0 GHz</td><td>2–</td><td>2</td><td>(MS2692A)</td></tr>
<tr><td>19.9 GHz ≤ Frequency ≤ 26.5 GHz</td><td>2+</td><td>2</td><td>(MS2692A)</td></tr>
</table>
</td></tr>
<tr><td>Preselector Range</td><td>5.9 GHz to 13.5 GHz (Frequency band mode: Normal) (MS2691A)
5.9 GHz to 26.5 GHz (Frequency band mode: Normal) (MS2692A)
3.0 GHz to 13.5 GHz (Frequency band mode: Spurious) (MS2691A)
3.0 GHz to 26.5 GHz (Frequency band mode: Spurious) (MS2692A)</td></tr>
<tr><td>Frequency Setting Range</td><td>0 Hz to 6.0 GHz (MS2690A)
0 Hz to 13.5 GHz (MS2691A)
0 Hz to 26.5 GHz (MS2692A)
Setting resolution: 1 Hz</td></tr>
<tr><td>Internal Reference Oscillator</td><td>Start-up characteristics (23°C, referenced to frequency at 24 h after power-on):
±5 × 10^{-7} (2 minutes after power-on), ±5 × 10^{-8} (5 minutes after power-on)
Aging rate: ±1 × 10^{-7}/year, ±1 × 10^{-8}/day
Temperature characteristics: ±2 × 10^{-8} (5°C to 45°C)
With Rubidium Reference Oscillator MS269xA-001
Start-up characteristics (23°C, referenced to frequency at 24 h after power-on):
±1 × 10^{-9} (7 minutes after power-on)
Aging rate: ±1 × 10^{-10}/month
Temperature characteristics: ±1 × 10^{-9} (5°C to 45°C)</td></tr>
<tr><td>SSB Phase Noise</td><td>18°C to 28°C, 2 GHz
<table>
<tr><th>Frequency Offset</th><th>Max.</th></tr>
<tr><td>100 kHz</td><td>–116 dBc/Hz</td></tr>
<tr><td>1 MHz</td><td>–137 dBc/Hz</td></tr>
</table>
</td></tr>
</table>

Amplitude

Measurement Range	Without MS269xA-008, or Preamp: Off DANL to +30 dBm With MS269xA-008, Preamp: On DANL to +10 dBm
Max. Input Level	Without MS269xA-008, or Preamp: Off CW Average power: +30 dBm (Input attenuator: ≥10 dB) DC Voltage: 0 Vdc With MS269xA-008, Preamp: On CW Average power: +10 dBm (Input attenuator: 0 dB) DC Voltage: 0 Vdc
Input Attenuator	0 to 60 dB, 2 dB steps
Input Attenuator Switching Error	Referenced to 10 dB input attenuator Without MS269xA-008, or Preamp: Off Frequency band mode: Normal ±0.2 dB (≤6.0 GHz, 10 to 60 dB) ±0.75 dB (>6.0 GHz, 10 to 60 dB) Frequency band mode: Spurious ±0.2 dB (<3.0 GHz, 10 to 60 dB) ±0.75 dB (≥3.0 GHz, 10 to 60 dB) With MS269xA-008, Preamp: On Frequency band mode: Normal ±0.65 dB (≤6.0 GHz, 10 to 60 dB)

Reference Level

Setting Range	Log scale: –120 to +50 dBm, or Equivalent level Linear scale: 22.4 µV to 70.7 V, or Equivalent level Setting resolution: 0.01 dB, or Equivalent level
Units	Log scale: dBm, dBµV, dBmV, dBµV (emf), dBµV/m, V, W Linear scale: V
Linearity Error	Excluding the noise floor effect Without MS269xA-008, or Preamp: Off ±0.07 dB (Mixer input level: ≤–20 dBm) ±0.10 dB (Mixer input level: ≤–10 dBm) Frequency band mode: Normal, Mixer input level: ≤0 dBm ±0.15 dB (≤6.0 GHz) ±0.50 dB (>6.0 GHz) (MS2691A) ±0.60 dB (>6.0 GHz) (MS2692A) Frequency band mode: Spurious, Mixer input level: ≤0 dBm ±0.15 dB (<3.0 GHz) ±0.50 dB (≥3.0 GHz) (MS2691A) ±0.60 dB (≥3.0 GHz) (MS2692A) With MS269xA-008, Preamp: On ±0.07 dB (Preamp input level: ≤–40 dBm) ±0.10 dB (Preamp input level: ≤–30 dBm) Frequency band mode: Normal ±0.50 dB (Preamp input level: ≤–20 dBm, ≤6.0 GHz)
RF Frequency Characteristics	18°C to 28°C, After CAL, Input attenuator: 10 dB Without MS269xA-008, or Preamp: Off ±0.35 dB (9 kHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) (9 kHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious) Without MS2692A-067, or Microwave Preselector Bypass: Off, After Preselector tuning ±1.50 dB (6.0 GHz < Frequency ≤ 13.5 GHz, Frequency band mode: Normal) (3.0 GHz ≤ Frequency ≤ 13.5 GHz, Frequency band mode: Spurious) ±2.50 dB (13.5 GHz < Frequency ≤ 26.5 GHz) With MS269xA-008, Preamp: On ±0.65 dB (100 kHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) (100 kHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)
1 dB Gain Compression	Without MS269xA-008, or Preamp: Off, Mixer input level ≥+3 dBm (100 MHz ≤ Frequency < 400 MHz) ≥+7 dBm (400 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) (400 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious) ≥+3 dBm (3.0 GHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Spurious) (MS2691A) (6.0 GHz < Frequency ≤ 13.5 GHz) (MS2691A) ≥0 dBm (3.0 GHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Spurious) (MS2692A) (6.0 GHz < Frequency ≤ 26.5 GHz) (MS2692A) With MS269xA-008, Preamp: On, Preamp input level ≥–20 dBm (100 MHz ≤ Frequency < 400 MHz) ≥–15 dBm (400 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) (400 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)

Spurious Response

<table>
<tr><td>2nd Harmonic Distortion</td><td>
Without MS269xA-008, or Preamp: Off, Mixer input level: –30 dBm
<table>
<tr><th>Harmonic (dBc)</th><th>SHI (dBm)</th><th></th></tr>
<tr><td>≤–60</td><td>≥+30</td><td>(10 Hz ≤ Frequency ≤ 400 MHz)</td></tr>
<tr><td>≤–75</td><td>≥+45</td><td>(400 MHz < Frequency ≤ 3.0 GHz)</td></tr>
</table>
Without MS2692A-067, Mixer input level: –10 dBm
<table>
<tr><th>Harmonic (dBc)</th><th>SHI (dBm)</th><th></th></tr>
<tr><td>≤–90</td><td>≥+80</td><td>(>3.0 GHz, Frequency band mode: Normal)</td></tr>
<tr><td>≤–90</td><td>≥+80</td><td>(≥1.5 GHz, Frequency band mode: Spurious)</td></tr>
</table>
With MS2692A-067, Microwave Preselector Bypass: Off, Mixer input level: –10 dBm
<table>
<tr><th>Harmonic (dBc)</th><th>SHI (dBm)</th><th></th></tr>
<tr><td>≤–70</td><td>≥+60</td><td>(3 GHz < Frequency ≤ 13.25 GHz)</td></tr>
</table>
With MS269xA-008, Preamp: On, Preamp input level: –45 dBm
<table>
<tr><th>Harmonic (dBc)</th><th>SHI (dBm)</th><th></th></tr>
<tr><td>≤–50</td><td>≥+5</td><td>(10 Hz ≤ Frequency ≤ 400 MHz)</td></tr>
<tr><td>≤–55</td><td>≥+10</td><td>(400 MHz < Frequency ≤ 3.0 GHz)</td></tr>
</table>
</td></tr>
<tr><td>Residual Response</td><td>Frequency: ≥1 MHz, Input attenuator: 0 dB, 50Ω terminated
Signal Analyzer: with MS269xA-077/078, Except bandwidth setting: >31.25 MHz
≤–100 dBm</td></tr>
</table>

Connector

RF Input	Front panel, N-J, 50Ω (nom.) 18°C to 28°C, Input attenuator: ≥10 dB VSWR: ≤1.2 (nom., 40 MHz ≤ Frequency ≤ 3.0 GHz) ≤1.5 (nom., 3.0 GHz < Frequency ≤ 6.0 GHz) ≤2.0 (nom., 6.0 GHz < Frequency ≤ 26.5 GHz)
IF Output	Rear panel, BNC-J, 50Ω (nom.) Frequency: 875 MHz (Signal Analyzer, without MS269xA-077/078, or Bandwidth: ≤31.25 MHz) 900 MHz (Signal Analyzer, with MS269xA-077/078, Bandwidth: >31.25 MHz) 874.988 MHz (Spectrum Analyzer) Gain: 0 dB (nom.) (Referenced to RF input level, RF frequency: 1 GHz, Input attenuator: 0 dB) IF bandwidth: 120 MHz (nom.)
External Reference Input	Rear panel, BNC-J, 50Ω (nom.) Frequency: 10 MHz,13 MHz Operation range: ±1 ppm Input level: –15 dBm ≤ Level ≤ +20 dBm, 50Ω (AC coupling)
Reference Signal Output	Rear panel, BNC-J, 50Ω (nom.) Frequency: 10 MHz Output level: ≥0 dBm (AC coupling)
Sweep Status Output	Rear panel, BNC-J Output level: TTL level (High level at sweeping or waveform capture)
Trigger Input	Rear panel, BNC-J Input level: TTL level
Noise Source Drive	This is available when the MS269xA-017/117 is installed. Supply (+28 V) of the Noise Source Drive. Rear panel, BNC-J Output voltage: 28 ±0.5 V, Pulsed
External Reference	Control from external controller (excluding power-on) Ethernet 10/100/1000BASE-T, Rear panel, RJ-45 GPIB: IEEE 488.2, Rear panel, IEEE 488 bus connector Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2 USB (B): USB2.0, Rear panel, USB-B connector
USB	USB2.0 supporting waveform hard copy to external device, and saving main frame settings USB-A connector (Front panel: 2 ports, Rear panel: 2 ports)
Monitor Output	Rear panel, VGA compatible, mini D-Sub 15 pin
Aux	When using MS269xA-020 trigger input/output Rear panel, 68 pins (DX10BM-68S equivalent)
Display	XGA-color LCD (1024 × 768 resolution), 8.4-inch (213 mm)

General Specifications

Dimensions and Mass		340 (W) × 200 (H) × 350 (D) mm (excluding projections), ≤13.5 kg (excluding options)
Power Supply		100 VAC to 120 VAC, 200 VAC to 240 VAC (–15/+10%, 250 V max.), 50 Hz/60 Hz (±5%) ≤260 VA (excluding options), ≤440 VA (including all options, max.)
Temperature Range		Operating: +5°C to +45°C, Storage: –20°C to +60°C
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000: 2018

Spectrum Analyzer Function

Frequency

Span	Range: 0 Hz, 300 Hz to 6.0 GHz (MS2690A) 0 Hz, 300 Hz to 13.5 GHz (MS2691A) 0 Hz, 300 Hz to 26.5 GHz (MS2692A) Resolution: 2 Hz Accuracy: ±0.2% (Number of trace points: 10001)
Display Frequency Accuracy	± [Display frequency × Reference oscillator accuracy + Span frequency × Span accuracy + RBW × 0.05 + 2 × N + Span frequency/(Number of trace points – 1)] Hz N: Mixer harmonic order
Resolution Bandwidth (RBW)	Setting range: 30 Hz to 3 MHz (1-3 sequence), 50 kHz, 5, 10, 20, 31.25 MHz *31.25 MHz: Can be set when Span: 0 Hz only Selectivity (–60 dB/–3 dB): 4.5: 1 (Nom., 30 Hz to 10 MHz)
Video Bandwidth (VBW)	Setting range: 1 Hz to 10 MHz (1-3 sequence), 5 kHz, Off VBW mode: Video average, Power average

Amplitude

Displayed Average Noise Level (DANL)

18°C to 28°C, Detector: Sample, VBW: 1 Hz (Video average), Input attenuator: 0 dB

Without MS269xA-008, 6.0 GHz ≤ Frequency ≤ 26.5 GHz: without MS2692A-067

Frequency Range	Max.	Frequency Band Mode
100 kHz	–135.0 [dBm/Hz]	
1 MHz	–145.0 [dBm/Hz]	
30 MHz ≤ Frequency < 2.4 GHz	–155.0 [dBm/Hz]	
2.4 GHz ≤ Frequency < 3.0 GHz	–153.0 [dBm/Hz]	
3.0 GHz ≤ Frequency < 4.0 GHz	–153.0 [dBm/Hz]	Normal
4.0 GHz ≤ Frequency < 6.0 GHz	–152.0 [dBm/Hz]	Normal
6.0 GHz ≤ Frequency < 10.0 GHz	–151.0 [dBm/Hz]	Normal
10.0 GHz ≤ Frequency ≤ 13.5 GHz	–150.0 [dBm/Hz]	Normal
13.5 GHz < Frequency ≤ 20.0 GHz	–147.0 [dBm/Hz]	Normal
20.0 GHz < Frequency ≤ 26.5 GHz	–143.0 [dBm/Hz]	Normal

With MS269xA-008, Preamp: On

Frequency Range	Max.	Frequency Band Mode
100 kHz	–150.0 [dBm/Hz]	
1 MHz	–159.0 [dBm/Hz]	
30 MHz ≤ Frequency < 2.4 GHz	–166.0 [dBm/Hz]	
2.4 GHz ≤ Frequency < 3.0 GHz	–165.0 [dBm/Hz]	
3.0 GHz ≤ Frequency < 4.0 GHz	–164.0 [dBm/Hz]	Normal
4.0 GHz ≤ Frequency < 5.0 GHz	–161.0 [dBm/Hz]	Normal
5.0 GHz ≤ Frequency ≤ 6.0 GHz	–159.0 [dBm/Hz]	Normal

With MS269xA-008, Preamp: Off

Frequency Range	Max.	Frequency Band Mode
100 kHz	–135.0 [dBm/Hz]	
1 MHz	–145.0 [dBm/Hz]	
30 MHz ≤ Frequency < 2.4 GHz	–153.0 [dBm/Hz]	
2.4 GHz ≤ Frequency < 3.0 GHz	–152.0 [dBm/Hz]	
3.0 GHz ≤ Frequency < 4.0 GHz	–151.0 [dBm/Hz]	Normal
4.0 GHz ≤ Frequency < 5.0 GHz	–150.0 [dBm/Hz]	Normal
5.0 GHz ≤ Frequency < 6.0 GHz	–149.0 [dBm/Hz]	Normal

Total Level Accuracy*

*: The Total level accuracy is found from root sum of squares (RSS) of RF characteristics, linearity error, and input attenuator switching error.

18°C to 28°C, After CAL, Input attenuator: ≥10 dB, Auto sweep time select: Normal, RBW: ≤1 MHz, Detection: Positive, CW, Excluding the noise floor effect

Without MS269xA-008, Preamp: Off
Mixer input level: ≤0 dBm,
±0.5 dB (50 Hz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
(50 Hz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)
After preselector tuning
±1.8 dB (6.0 GHz < Frequency ≤ 13.5 GHz, Frequency band mode: Normal)
(3.0 GHz ≤ Frequency ≤ 13.5 GHz, Frequency band mode: Spurious)
±3.0 dB (13.5 GHz < Frequency ≤ 26.5 GHz)

With MS269xA-008, Preamp: On
Preamp input level: ≤–20 dBm
±1.0 dB (100 kHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
(100 kHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)

Spurious Response

2-tone 3rd-order Intermodulation Distortion

18°C to 28°C, ≥300 kHz separation

Without MS269xA-008, or Preamp: Off
With MS2692A-067, Microwave Preselector Bypass: Off
Mixer input level: –15 dBm (per waveform)
≤–60 dBc (TOI: +15 dBm) (30 MHz ≤ Frequency < 400 MHz)
≤–66 dBc (TOI: +18 dBm) (400 MHz ≤ Frequency < 700 MHz)
≤–74 dBc (TOI: +22 dBm) (700 MHz ≤ Frequency < 4.0 GHz, Frequency band mode: Normal)
(700 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)
≤–66 dBc (TOI: +18 dBm) (4.0 GHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
≤–45 dBc (TOI: +7.5 dBm) (6.0 GHz < Frequency ≤ 26.5 GHz, Frequency band mode: Normal)
(3.0 GHz ≤ Frequency ≤ 26.5 GHz, Frequency band mode: Spurious)

With MS269xA-008, Preamp: On
Preamp input level: –45 dBm (per waveform)
≤–73 dBc (TOI: –8.5 dBm) (30 MHz ≤ Frequency < 400 MHz)
≤–78 dBc (TOI: –6 dBm) (400 MHz ≤ Frequency < 700 MHz)
≤–81 dBc (TOI: –4.5 dBm) (700 MHz ≤ Frequency < 4.0 GHz, Frequency band mode: Normal)
(700 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)
≤–78 dBc (TOI: –6 dBm) (4.0 GHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)

Image Response

Without MS2692A-067
≤–70 dBc (Frequency ≤ 13.5 GHz)
≤–65 dBc (13.5 GHz < Frequency ≤ 26.5 GHz)

Sweep

Sweep Mode	Single, Continuous
Sweep Time	Setting range: 2 ms to 1000 s (Span: ≥300 Hz), 1 μs to 1000 s (Span: 0 Hz)

Waveform Display

Detector	Pos&Neg, Positive peak, Sample, Negative peak, RMS
Number of Trace Points	1001 to 30001 (Span: >500 MHz) 101 to 30001 (100 MHz < Span ≤ 500 MHz) (300 Hz ≤ Span ≤ 100 MHz, Sweep time: >10 s) 11 to 30001 (300 Hz ≤ Span ≤ 100 MHz, Sweep time: ≤10 s) (Span: 0 Hz, Sweep time: ≤10 s) 101 to 30001 (Span: 0 Hz, Sweep time: >10 s) Setting resolution: 1 Hz
Scale	Log display: 10 div/12 div, 0.1 to 20 dB/div (1-2-5 sequence) Lin display: 10 div, 1 to 10%/div (1-2-5 sequence)
Trigger Function	Trigger mode: Free run (Trig Off), Video, Wide IF, External (TTL) SG Marker (with MS269xA-020), BBIF (with MS269xA-040)
Gate Function	Gate mode: Off, Wide IF, External SG Marker (with MS269xA-020), BBIF (with MS269xA-040)

Measurement Functions

Adjacent Channel Leakage Power (ACP)		Reference: Span total, Carrier total, Both side of carrier, Carrier select Adjacent channel specification: 3 channels × 2 (Normal mode), 8 channels × 2 (Advanced mode)
Burst Average Power		In time domain, displays average power in specified time
Channel Power		Absolute value measurement: dBm, dBm/Hz
Occupied Bandwidth (OBW)		N% of power, X-dB down
Spectrum Emission Mask		Pass/Fail evaluation at Peak/Margin measurement
Spurious Emission		Pass/Fail evaluation at Worst/Peaks measurement
Frequency Counter	Accuracy	Span: ≤1 MHz, RBW: 1 kHz, S/N: ≥50 dB, Gate time: ≥100 ms, ± (Marker frequency × Frequency reference accuracy + (0.01 × N/Gate Time[s]) Hz) N: Mixer harmonic order
	Gate Time Range	100 μs to 1 s
2-tone 3rd-order Intermodulation Distortion		Measures IM3 and TOI from two-tone signal.

Vector Signal Analysis Function

Common

Trace Mode	Spectrum, Power vs. Time, Frequency vs. Time, Phase vs. Time, CCDF, Spectrogram, No trace
Bandwidth	Without MS269xA-077/078 Specified analysis bandwidth from center frequency 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz With MS269xA-077 Adds the 50 MHz, 62.5 MHz bandwidths to the standard analysis bandwidths. With MS269xA-077/078 Adds the 50, 62.5, 100, and 125 MHz bandwidths to the standard analysis bandwidths.
Sampling Rate	Auto-setting depending on RBW Without MS269xA-077/078, or Bandwidth: ≤31.25 MHz 2 kHz to 50 MHz (1-2-5 sequence) With MS269xA-077, Bandwidth: >31.25 MHz 100 MHz With MS269xA-077/078, Bandwidth: >31.25 MHz 100 MHz, 200 MHz
Capture Time	Set length of capture time Without MS269xA-077/078, or Bandwidth: ≤31.25 MHz Min. capture time length: 2 μs to 50 ms (determined depending on analysis bandwidth) Max. capture time length: 2 to 2000 s (determined depending on analysis bandwidth) Setting mode: Auto, Manual With MS269xA-077, Bandwidth: >31.25 MHz Min. capture time length: 1 μs (determined depending on analysis bandwidth) Max. capture time length: 500 ms With MS269xA-077/078, Bandwidth: >31.25 MHz Min. capture time length: 500 ns to 1 μs (determined depending on analysis bandwidth) Max. capture time length: 500 ms
Trigger	Trigger mode: Free run (Trig off), Video, Wide IF video, External (TTL) SG Marker (with MS269xA-020), BBIF (with MS269xA-040)
ADC Resolution	16 bits

Spectrum Display Function

Function Outline	Displays any time length in captured waveform data and spectrum in frequency range
Analysis Time Range	Analysis start time: Set analysis start time point from waveform data header Analysis time length: Set analysis time length Setting mode: Auto, Manual
Frequency	Set center frequency and span in frequency range of waveform data
Frequency Setting Range	Without MS269xA-077/078, or Bandwidth: ≤31.25 MHz 0 Hz to 6.0 GHz (MS2690A), 0 Hz to 13.5 GHz (MS2691A), 0 Hz to 26.5 GHz (MS2692A) With MS269xA-077, or with MS269xA-077/078, without MS2692A-067, Bandwidth: >31.25 MHz 100 MHz to 6.0 GHz With MS269xA-077, or with MS269xA-077/078, with MS2692A-067, Bandwidth: >31.25 MHz 100 MHz to 26.5 GHz
Resolution Bandwidth (RBW)	Without MS269xA-077/078, or Bandwidth: ≤31.25 MHz Setting range: 1 Hz to 1 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5: 1 (nom.) With MS269xA-077, Bandwidth: >31.25 MHz Setting range: 3 kHz to 3 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5: 1 (nom.) With MS269xA-077/078, Bandwidth: >31.25 MHz Setting range: 3 kHz to 10 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5: 1 (nom.)
Total Level Accuracy* *: The Total level accuracy is found from root sum of squares (RSS) of RF characteristics, linearity error, and input attenuator switching error.	18°C to 28°C, After CAL, Input attenuator: ≥10 dB, Center frequency, CW, RBW: Auto, Time detection: Average, Marker result: Integration or Peak (Accuracy), Excluding the noise floor effect Mixer input level: ≤0 dBm Without MS269xA-077/078, or Bandwidth: ≤31.25 MHz Without MS269xA-008, or Preamp: Off ±0.5 dB (50 Hz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) (50 Hz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious) After Preselector tuning ±1.8 dB (6.0 GHz < Frequency ≤ 13.5 GHz, Frequency band mode: Normal) (3.0 GHz ≤ Frequency ≤ 13.5 GHz, Frequency band mode: Spurious) ±3.0 dB (13.5 GHz ≤ Frequency ≤ 26.5 GHz) With MS269xA-077, or with MS269xA-077/078, Bandwidth: >31.25 MHz Without MS269xA-008, or Preamp: Off ±0.5 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) With MS269xA-077, or with MS269xA-077/078 With MS2692A-067, Microwave Preselector Bypass: On, Bandwidth: >31.25 MHz ±1.8 dB (6.0 GHz ≤ Frequency ≤ 13.5 GHz, Frequency band mode: Normal) ±3.0 dB (13.5 GHz ≤ Frequency ≤ 26.5 GHz) Preamp input level: ≤–20 dBm Without MS269xA-077/078, or Bandwidth: ≤31.25 MHz With MS269xA-008, Preamp: On ±1.0 dB (100 kHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) (100 kHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious) With MS269xA-077, or with MS269xA-077/078, Bandwidth: >31.25 MHz With MS269xA-008, Preamp: On ±1.0 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)

Continued on next page

<table>
<tr><td>Displayed Average Noise Level (DANL)</td><td>18°C to 28°C, Input attenuator: 0 dB
Without MS269xA-008, 6.0 GHz ≤ Frequency ≤ 26.5 GHz: without MS2692A-067
<table>
<tr><th>Frequency Range</th><th>Max.</th><th>Frequency Band Mode</th></tr>
<tr><td>100 kHz</td><td>–132.5 [dBm/Hz]</td><td></td></tr>
<tr><td>1 MHz</td><td>–142.5 [dBm/Hz]</td><td></td></tr>
<tr><td>30 MHz ≤ Frequency < 2.4 GHz</td><td>–152.5 [dBm/Hz]</td><td></td></tr>
<tr><td>2.4 GHz ≤ Frequency < 3.0 GHz</td><td>–150.5 [dBm/Hz]</td><td></td></tr>
<tr><td>3.0 GHz ≤ Frequency < 4.0 GHz</td><td>–150.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>4.0 GHz ≤ Frequency < 6.0 GHz</td><td>–149.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>6.0 GHz ≤ Frequency < 10.0 GHz</td><td>–148.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>10.0 GHz ≤ Frequency ≤ 13.5 GHz</td><td>–147.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>13.5 GHz < Frequency ≤ 20.0 GHz</td><td>–144.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>20.0 GHz < Frequency ≤ 26.5 GHz</td><td>–140.5 [dBm/Hz]</td><td>Normal</td></tr>
</table>
With MS269xA-008, Preamp: On
<table>
<tr><th>Frequency Range</th><th>Max.</th><th>Frequency Band Mode</th></tr>
<tr><td>100 kHz</td><td>–147.5 [dBm/Hz]</td><td></td></tr>
<tr><td>1 MHz</td><td>–156.5 [dBm/Hz]</td><td></td></tr>
<tr><td>30 MHz ≤ Frequency < 2.4 GHz</td><td>–163.5 [dBm/Hz]</td><td></td></tr>
<tr><td>2.4 GHz ≤ Frequency < 3.0 GHz</td><td>–162.5 [dBm/Hz]</td><td></td></tr>
<tr><td>3.0 GHz ≤ Frequency < 4.0 GHz</td><td>–161.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>4.0 GHz ≤ Frequency < 5.0 GHz</td><td>–158.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>5.0 GHz ≤ Frequency ≤ 6.0 GHz</td><td>–156.5 [dBm/Hz]</td><td>Normal</td></tr>
</table>
With MS269xA-008, Preamp: Off
<table>
<tr><th>Frequency Range</th><th>Max.</th><th>Frequency Band Mode</th></tr>
<tr><td>100 kHz</td><td>–132.5 [dBm/Hz]</td><td></td></tr>
<tr><td>1 MHz</td><td>–142.5 [dBm/Hz]</td><td></td></tr>
<tr><td>30 MHz ≤ Frequency < 2.4 GHz</td><td>–150.5 [dBm/Hz]</td><td></td></tr>
<tr><td>2.4 GHz ≤ Frequency < 3.0 GHz</td><td>–149.5 [dBm/Hz]</td><td></td></tr>
<tr><td>3.0 GHz ≤ Frequency < 4.0 GHz</td><td>–148.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>4.0 GHz ≤ Frequency < 5.0 GHz</td><td>–147.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>5.0 GHz ≤ Frequency < 6.0 GHz</td><td>–146.5 [dBm/Hz]</td><td>Normal</td></tr>
</table>
</td></tr>
<tr><td>Adjacent Channel Leakage Power Measurement (ACP)</td><td>Reference: Span total, Carrier total, Both sides of carriers, Carrier select
Adjacent channel specification: 3 channels × 2</td></tr>
<tr><td>Channel Power</td><td>Absolute value measurement: dBm, dBm/Hz</td></tr>
<tr><td>Occupied Bandwidth (OBW)</td><td>N% of power, × dB down</td></tr>
</table>

Power vs. Time Display Function

Function Outline	Displays variation in power of captured waveform with time
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Resolution Bandwidth	Filter type: Rect, Gaussian, Nyquist, Root nyquist, Off, (Default: Off) Roll-off ratio: 0.01 to 1 (Set for Nyquist, Root nyquist) Filter frequency offset: Set center frequency of filter in wavelength data frequency band
AM Depth (Peak to Peak Measurement)	Measures with AM depth or marker function +Peak, –Peak, (P-P)/2, Average
Burst Average Power	Measures average power of burst signal

Frequency vs. Time Display Function

Function Outline	Displays variation in frequency of input signal with time from captured waveform data
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Operation Level Range	–17 to +30 dBm (Input attenuator: ≥10 dB)
Frequency (Vertical axis)	Sets center frequency and Span in waveform data frequency range Display frequency range: 1/25, 1/10, 1/5, 1/2 of RBW Input frequency range: 10 MHz to 6 GHz
Display Frequency Accuracy	Input level: –17 to +30 dBm (Span: ≤31.25 MHz, Scale: Span/25) CW input: ± (Reference oscillator accuracy × Center frequency + Display frequency range × 0.01) Hz
FM Deviation (Peak to Peak Measurement)	Measures with FM deviation or marker function +Peak, –Peak, (P-P)/2, Average

Phase vs. Time Display Function

Function Outline	Displays phase time fluctuation of input signal from captured waveform data
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Phase (Vertical axis)	Display mode: Wrap, Unwrap Display phase range: 0.01 deg./div to 200 Gdeg./div Offset: –100 deg. to +100 Mdeg.

CCDF/APD Display Function

Function Outline	Displays CCDF and APD of waveform data captures for fixed time
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Display	Displays CCDF or APD as graph Histogram resolution: 0.01 dB Numeric display: Average power, Max power, Crest factor
Resolution Bandwidth (RBW)	Filter type: Rectangle, Off, (Default: Off) Filter frequency offset: Sets filter center frequency in waveform data frequency band

Spectrogram Display Function

Function Outline	Displays spectrogram for time period in captured waveform data
Analysis Time Range	Analysis start time: Sets position of analysis start after waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Frequency	Settable as center frequency and span frequency of waveform data
Resolution Bandwidth (RBW)	Setting range: 1 Hz to 1 MHz (1-3 sequence) Selection (–60/–3 dB): 4.5: 1 (nom.)

Digitize Function

Function Outline	Outputs captured waveform data to internal hard disk or external device
Waveform Data	Format: I, Q (32 bit Float binary format) Level: Sets 0 dBm input to $\sqrt{(I^2 + Q^2)} = 1$ Level accuracy: Same as Total level accuracy of Signal Analyzer
External Output	Output to external PC via Ethernet

Replay Function

<table>
<tr><td>Function Outline</td><td>Captured waveforms can be replayed again by using the VSA function to read saved digitize data</td></tr>
<tr><td>Measurable Waveform Data Condition</td><td>Format: I, Q (Binary format)
Combination of Span, Sampling rate, and Minimum capture sample:
<table>
<tr><th>Span</th><th>Sampling Rate</th><th>Minimum Capture Sample</th></tr>
<tr><td>1 kHz</td><td>2 kHz</td><td>74000 (37 s)</td></tr>
<tr><td>2.5 kHz</td><td>5 kHz</td><td>160000 (32 s)</td></tr>
<tr><td>5 kHz</td><td>10 kHz</td><td>310000 (31 s)</td></tr>
<tr><td>10 kHz</td><td>20 kHz</td><td>610000 (30.5 s)</td></tr>
<tr><td>25 kHz</td><td>50 kHz</td><td>730000 (14.6 s)</td></tr>
<tr><td>50 kHz</td><td>100 kHz</td><td>730000 (7.3 s)</td></tr>
<tr><td>100 kHz</td><td>200 kHz</td><td>730000 (3.65 s)</td></tr>
<tr><td>250 kHz</td><td>500 kHz</td><td>730000 (1.46 s)</td></tr>
<tr><td>500 kHz</td><td>1 MHz</td><td>730000 (730 ms)</td></tr>
<tr><td>1 MHz</td><td>2 MHz</td><td>730000 (365 ms)</td></tr>
<tr><td>2.5 MHz</td><td>5 MHz</td><td>730000 (146 ms)</td></tr>
<tr><td>5 MHz</td><td>10 MHz</td><td>730000 (73 ms)</td></tr>
<tr><td>10 MHz</td><td>20 MHz</td><td>730000 (36.5 ms)</td></tr>
<tr><td>18.6 MHz</td><td>20 MHz</td><td>730000 (36.5 ms)</td></tr>
<tr><td>20 MHz</td><td>25 MHz</td><td>730000 (29.2 ms)</td></tr>
<tr><td>25 MHz</td><td>50 MHz</td><td>730000 (14.6 ms)</td></tr>
<tr><td>31.25 MHz</td><td>50 MHz</td><td>730000 (14.6 ms)</td></tr>
<tr><td>50 MHz</td><td>100 MHz</td><td>730000 (7.3 ms)</td></tr>
<tr><td>62.5 MHz</td><td>100 MHz</td><td>730000 (7.3 ms)</td></tr>
<tr><td>100 MHz</td><td>200 MHz</td><td>730000 (3.65 ms)</td></tr>
<tr><td>125 MHz</td><td>200 MHz</td><td>730000 (3.65 ms)</td></tr>
</table>
</td></tr>
</table>

Rubidium Reference Oscillator MS2690A/MS2691A/MS2692A-001

Function Outline	Generates 10 MHz reference signal with higher frequency stability

Extension of Preselector Lower Limit to 3 GHz MS2691A/MS2692A-003

Cannot be installed simultaneously MS2692A-003 and MS2692A-067.

Function Outline	Extends lower limit of preselector to 3 GHz

6 GHz Preamplifier MS2690A/MS2691A/MS2692A-008

Cannot be installed simultaneously MS2692A-008 and MS2692A-067.

Frequency

Range	100 kHz to 6 GHz

Amplitude

<table>
<tr><td>Measurement Range</td><td>Displayed average noise level to +10 dBm</td></tr>
<tr><td>Max. Input Level</td><td>CW average power: +10 dBm (Input attenuator: 0 dB)
DC voltage: 0 Vdc</td></tr>
<tr><td>Gain</td><td>14 dB (Frequency ≤ 3.0 GHz), 13 dB (3.0 GHz < Frequency ≤ 4.0 GHz), 11 dB (4.0 GHz < Frequency ≤ 5.0 GHz), 10 dB (5.0 GHz < Frequency ≤ 6.0 GHz)</td></tr>
<tr><td>Noise Factor</td><td>7.0 dB (Frequency ≤ 3.0 GHz), 8.5 dB (3.0 GHz < Frequency ≤ 4.0 GHz), 9.5 dB (4.0 GHz < Frequency ≤ 6.0 GHz)</td></tr>
<tr><td>Displayed Average Noise Level (DANL)</td><td>Spectrum analyzer function: 18°C to 28°C, Input attenuator: 0 dB, Detector: sample, VBW: 1 Hz (Video average)
Vector signal analysis function: 18°C to 28°C, Input attenuator: 0 dB
Preamp: On
<table>
<tr><th>Frequency Range</th><th>Max. (Spectrum Analyzer function)</th><th>Max. (Vector Signal Analysis Function)</th><th>Frequency Band Mode</th></tr>
<tr><td>100 kHz</td><td>–150.0 [dBm/Hz]</td><td>–147.5 [dBm/Hz]</td><td></td></tr>
<tr><td>1 MHz</td><td>–159.0 [dBm/Hz]</td><td>–156.5 [dBm/Hz]</td><td></td></tr>
<tr><td>30 MHz ≤ Frequency < 2.4 GHz</td><td>–166.0 [dBm/Hz]</td><td>–163.5 [dBm/Hz]</td><td></td></tr>
<tr><td>2.4 GHz ≤ Frequency < 3.0 GHz</td><td>–165.0 [dBm/Hz]</td><td>–162.5 [dBm/Hz]</td><td></td></tr>
<tr><td>3.0 GHz ≤ Frequency < 4.0 GHz</td><td>–164.0 [dBm/Hz]</td><td>–161.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>4.0 GHz ≤ Frequency < 5.0 GHz</td><td>–161.0 [dBm/Hz]</td><td>–158.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>5.0 GHz ≤ Frequency ≤ 6.0 GHz</td><td>–159.0 [dBm/Hz]</td><td>–156.5 [dBm/Hz]</td><td>Normal</td></tr>
</table>
Preamp: Off
<table>
<tr><th>Frequency Range</th><th>Max. (Spectrum Analyzer function)</th><th>Max. (Vector Signal Analysis Function)</th><th>Frequency Band Mode</th></tr>
<tr><td>100 kHz</td><td>–135.0 [dBm/Hz]</td><td>–132.5 [dBm/Hz]</td><td></td></tr>
<tr><td>1 MHz</td><td>–145.0 [dBm/Hz]</td><td>–142.5 [dBm/Hz]</td><td></td></tr>
<tr><td>30 MHz ≤ Frequency < 2.4 GHz</td><td>–153.0 [dBm/Hz]</td><td>–150.5 [dBm/Hz]</td><td></td></tr>
<tr><td>2.4 GHz ≤ Frequency < 3.0 GHz</td><td>–152.0 [dBm/Hz]</td><td>–149.5 [dBm/Hz]</td><td></td></tr>
<tr><td>3.0 GHz ≤ Frequency < 4.0 GHz</td><td>–151.0 [dBm/Hz]</td><td>–148.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>4.0 GHz ≤ Frequency < 5.0 GHz</td><td>–150.0 [dBm/Hz]</td><td>–147.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>5.0 GHz ≤ Frequency < 6.0 GHz</td><td>–149.0 [dBm/Hz]</td><td>–146.5 [dBm/Hz]</td><td>Normal</td></tr>
</table></td></tr>
<tr><td>Input Attenuator Switching Error</td><td>Frequency band mode: Normal
±0.65 dB (≤6.0 GHz, 10 to 60 dB)</td></tr>
</table>

Reference Level

RF Frequency Characteristics	18°C to 28°C, After CAL, Input attenuator: 10 dB ±0.65 dB (100 kHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) (100 kHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)
Linearity Error	Excluding the noise floor effect ±0.07 dB (Preamp input level*: ≤–40 dBm) ±0.10 dB (Preamp input level*: ≤–30 dBm) Frequency band mode: Normal ±0.5 dB (Preamp input level*: ≤–20 dBm, frequency: ≤6.0 GHz)
1 dB Gain Compression	Preamp input level* ≥–20 dBm (100 MHz ≤ Frequency < 400 MHz) ≥–15 dBm (400 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) (400 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)

Spurious Response

2nd Harmonic Distortion	Preamp input level*: –45 dBm Harmonic SHI ≤–50 dBc ≥+5 dBm (10 Hz ≤ Frequency ≤ 400 MHz) ≤–55 dBc ≥+10 dBm (400 MHz < Frequency ≤ 3.0 GHz)
2-tone 3rd-order Intermodulation Distortion	18°C to 28°C, Preamp input level*: –45 dBm (per waveform), ≥300 kHz separation ≤–73 dBc (TOI: –8.5 dBm) (30 MHz ≤ Frequency < 400 MHz) ≤–78 dBc (TOI: –6 dBm) (400 MHz ≤ Frequency < 700 MHz) ≤–81 dBc (TOI: –4.5 dBm) (700 MHz ≤ Frequency < 4.0 GHz, Frequency band mode: Normal) (700 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious) ≤–78 dBc (TOI: –6 dBm) (4.0 GHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)

*: Preamp input level = RF input level – Input attenuator setting value

Noise Figure Measurement Function* MS2690A/MS2691A/MS2692A-017

Frequency

Frequency Range	MS2690A: 30 MHz to 6 GHz MS2691A: 30 MHz to 6 GHz MS2692A: 30 MHz to 6 GHz
Frequency Setting Range	MS2690A: 10 MHz to 6 GHz MS2691A: 10 MHz to 13.5 GHz MS2692A: 10 MHz to 26.5 GHz

NF Measurement

Measurement Range	Within the frequency range, Attenuator = 0 dB, Preamp = On – 20 to +40 dB
Instrument Uncertainty	Within the measurement range ENR: 4 to 7 dB ±0.02 dB ENR: 12 to 17 dB ±0.025 dB ENR: 20 to 22 dB ±0.03 dB

GAIN Measurement

Measurement Range	Within the frequency range –20 to +40 dB
Instrument Uncertainty	Within the measurement range ≤0.07

Resolution Bandwidth

Setting Range	100 kHz to 8 MHz

Connector

Noise Source	Connector: Rear panel, BNC-J Output voltage: 28 ±0.5 V, Pulsed

*: Recommending the NC346 series noise sources by Noisecom company

Vector Signal Generator MS2690A/MS2691A/MS2692A-020

Frequency

Range	125 MHz to 6 GHz
Resolution	0.01 Hz steps

Output Level

Setting Range	–140 to +10 dBm (CW), –140 to 0 dBm (Modulation)
Units	dBm, dBμV (Terminated, Open)
Resolution	0.01 dB
Level Accuracy	18°C to 28°C, CW Output level: p –120 ≤ p ≤ +5 dBm ±0.5 dB (≤3.0 GHz) –110 ≤ p ≤ +5 dBm ±0.8 dB (>3.0 GHz) –127 ≤ p < –120 dBm ±0.7 dB (≤3.0 GHz) –127 ≤ p ≤ –110 dBm ±2.5 dB (typ.) (>3.0 GHz) –136 ≤ p < –127 dBm ±1.5 dB (typ.) (≤3.0 GHz)
Linearity	18°C to 28°C, CW, Referenced to –5 dBm output Output level: p –120 ≤ p ≤ –5 dBm ±0.2 dB (typ.) (≤3.0 GHz) –110 ≤ p ≤ –5 dBm ±0.3 dB (typ.) (>3.0 GHz)
Connector	N-J connector, 50Ω [Front panel, SG Output (MS269xA-20)]
VSWR	CW: ≤–5 dBm, Modulation: ≤–15 dBm 1.3 (≤3.0 GHz) 1.9 (>3.0 GHz)
Max. Reverse Input	1 W peak (≥300 MHz), 0.25 W peak (<300 MHz)

Signal Purity

Harmonic Spurious	Output level: ≤+5 dBm, CW, Output frequency: ≥300 MHz ≤–30 dBc
Non-harmonic Spurious	Output level: ≤+5 dBm, CW, Offset: ≥15 kHz (from output frequency) <–68 dBc (125 MHz ≤ Frequency ≤ 500 MHz) <–62 dBc (500 MHz < Frequency ≤ 1.0 GHz) <–56 dBc (1.0 GHz < Frequency ≤ 2.0 GHz) <–50 dBc (2.0 GHz < Frequency ≤ 6.0 GHz)

Vector Modulation
18°C to 28°C, SG Level Auto CAL: On

Vector Accuracy	W-CDMA (DL 1code) Output level: ≤–5 dBm, Output frequency: 800 MHz to 2700 MHz ≤2% (rms)
Carrier Leak	Output frequency: ≥300 MHz ≤–40 dBc
Image Rejection	Output frequency: ≥300 MHz, Using 10 MHz max. sine wave ≤–40 dBc
ACLR	Output level: ≤–5 dBm, Using W-CDMA (Test Model 1 64DPCH) signal, 300 MHz ≤ Output frequency ≤ 2.4 GHz ≤–64 dBc/3.84 MHz (5 MHz offset), ≤–67 dBc/3.84 MHz (10 MHz offset)
CW and Level Error at Vector Modulation	AWGN signal with bandwidth of 5 MHz, Output frequency: ≥300 MHz ±0.2 dB (Output level: ≤–15 dBm) ±0.4 dB (typ., –15 dBm < Output level: ≤–5 dBm)
Spectrum Inversion	Supported

Pulse Modulation

On/Off Ratio	≥60 dB
Rising/Falling Edge Time	≤90 ns (10 to 90%)
Pulse Repetition Frequency	DC to 1 MHz (Duty 50%)
External Panel Modulation Signal Input	AUX connector (Rear panel), 600Ω, 0 to 5 V, Threshold value: approx. 1 V

Arbitrary Waveform Generator

Waveform Resolution	14 bits
Marker Output	Three signals (three signals in waveform pattern, or real-time three signals generation), TTL, Polarity inversion function
Internal Baseband Reference Clock	Range: 20 kHz to 160 MHz Resolution: 0.001 Hz
External Baseband Reference Clock	Range: 20 kHz to 40 MHz Division, Multiplier function: 1, 2, 4, 8, 16, 1/2, 1/4, 1/8, 1/16 of input signal Input connector: AUX connector (Rear panel), 0.7 Vp-p min. (AC/50Ω), or TTL
Waveform Memory	Memory: 256 Msamples
AWGN Addition Function	CN ratio absolute value: ≤40 dB

BER Measurement

Connector	AUX connector (Rear panel)
Input Level	TTL level
Input Signal	Data, Clock, Enable
Input Bit Rate	100 bps to 10 Mbps
Measured Patterns	PN9, PN11, PN15, PN20, PN23, ALL0, ALL1, 01 repeat PN9Fix, PN11Fix, PN15Fix, PN20Fix, PN23Fix, User define
Synchronization Establishing Condition	PN signal: PN stage × 2 bit error free At PNFix signal: 0 PN stage × 2 bit error free, PN signal and sync establishment, establish sync with PNFix signal at PN stage error free from PNFix signal header bit ALL0, ALL1, 01 Repeat: 10 bit error free User define: 8 to 1024 bits (variable) error free, Select header bit used at sync detection
Re-synchronization Judgment Condition	x/y y = Measured bit count: Select from 500, 5000, 50000 x = y bit error bit count: Setting range 1 to y/2
Measured Bit Count	≤2^{32} – 1 bits
Measured Error Bit Count	≤2^{31} – 1 bits
Measurement End Conditions	Measured bit count, Measured error bit count
Auto Re-synchronization Function	On/Off
Operation at Resync.	Select from Count clear, and Count keep
Measurement Mode	Single, Endless, Continuous
Display	Status, Error, Error rate, Error count, Sync loss count, Measured bit count
Polarity Inversion Function	Data, Clock, Enable polarity inversion
Clear Measurement Function	Clear measured value saved at sync during BER measurement, and select measurement from 0

Microwave Preselector Bypass MS2692A-067

Bypasses the preselector to improve the RF frequency characteristics and the in-band frequency characteristics.
When the preselector option is set to On, the image response elimination filter is bypassed.
Therefore, this function is not appropriate for spurious measurement to receive the image response.
Microwave Preselector Bypass: On (with MS2692A-067), Microwave Preselector Bypass: Off (with special directions)

Cannot install simultaneously with MS2692A-003, MS2692A-008.

Frequency

Frequency Range	6.0 GHz to 26.5 GHz

Amplitude

RF Frequency Characteristics	18°C to 28°C, After CAL, Input attenuator: 10 dB, Microwave Preselector Bypass: On ±1.0 dB (6.0 GHz ≤ Frequency ≤ 13.5 GHz) ±1.5 dB (13.5 GHz < Frequency ≤ 26.5 GHz) * With MS2692A-067, Microwave Preselector Bypass: Off, see Signal Analyzer/Spectrum Analyzer (RF Frequency Characteristics)
Displayed Average Noise Level (DANL)	18°C to 28°C, Detector: Sample, VBW: 1 Hz (Video average), Input attenuator: 0 dB Microwave Preselector Bypass: On or Off –146 dBm/Hz (6.0 GHz ≤ Frequency < 10.0 GHz) –145 dBm/Hz (10.0 GHz ≤ Frequency ≤ 13.5 GHz) –142 dBm/Hz (13.5 GHz < Frequency ≤ 20.0 GHz) –138 dBm/Hz (20.0 GHz < Frequency ≤ 26.5 GHz)
Image Responses	Microwave Preselector Bypass: Off ≤–60 dBc (6.0 GHz ≤ Frequency ≤ 26.5 GHz)

Analysis Bandwidth Extension to 62.5 MHz MS2690A/MS2691A/MS2692A-077
Analysis Bandwidth Extension to 125 MHz MS2690A/MS2691A/MS2692A-078 (Requires MS269xA-077)

Common

Bandwidth	With MS269xA-077 Adds the 50 MHz, 62.5 MHz bandwidths to the standard analysis bandwidths. With MS269xA-077/078 Adds the 50, 62.5, 100, and 125 MHz bandwidths to the standard analysis bandwidths.
Sampling Rate	Auto-setting depending on RBW With MS269xA-077, Bandwidth: >31.25 MHz 100 MHz With MS269xA-077/078, Bandwidth: >31.25 MHz 100 MHz, 200 MHz
Capture Time	Set length of capture time With MS269xA-077, Bandwidth: >31.25 MHz Min. capture time length: 1 μs (determined depending on analysis bandwidth) Max. capture time length: 500 ms With MS269xA-077/078, Bandwidth: >31.25 MHz Min. capture time length: 500 ns to 1 μs (determined depending on analysis bandwidth) Max. capture time length: 500 ms
Resolution Bandwidth (RBW)	With MS269xA-077, Bandwidth: >31.25 MHz Setting range: 3 kHz to 3 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5: 1 (nom.) With MS269xA-077/078, Bandwidth: >31.25 MHz Setting range: 3 kHz to 10 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5: 1 (nom.)
ADC Resolution	With MS269xA-077/078, Bandwidth: >31.25 MHz 14 bits
Frequency	Without MS2692A-067, Bandwidth: >31.25 MHz 100 MHz to 6.0 GHz With MS2692A-067, Bandwidth: >31.25 MHz 100 MHz to 26.5 GHz

Amplitude

<table>
<tr>
<td>Displayed Average Noise Level (DANL)</td>
<td>18°C to 28°C, Input attenuator: 0 dB
Without MS269xA-008, or Preamp: Off, Frequency band mode: Normal
<table>
<tr><th>Frequency Range</th><th>Max.</th></tr>
<tr><td>100 MHz ≤ Frequency < 2.2 GHz</td><td>–147.0 [dBm/Hz]</td></tr>
<tr><td>2.2 GHz ≤ Frequency < 4.0 GHz</td><td>–145.0 [dBm/Hz]</td></tr>
<tr><td>4.0 GHz ≤ Frequency ≤ 6.0 GHz</td><td>–143.0 [dBm/Hz]</td></tr>
</table>
With MS269xA-008, Preamp: On, Frequency band mode: Normal
<table>
<tr><th>Frequency Range</th><th>Max.</th></tr>
<tr><td>100 MHz ≤ Frequency < 2.2 GHz</td><td>–160.0 [dBm/Hz]</td></tr>
<tr><td>2.2 GHz ≤ Frequency < 4.0 GHz</td><td>–158.0 [dBm/Hz]</td></tr>
<tr><td>4.0 GHz ≤ Frequency ≤ 6.0 GHz</td><td>–154.0 [dBm/Hz]</td></tr>
</table>
With MS2692A-067, Microwave Preselector Bypass: On
<table>
<tr><th>Frequency Range</th><th>Max.</th></tr>
<tr><td>6.0 GHz < Frequency < 10.0 GHz</td><td>–140.0 [dBm/Hz]</td></tr>
<tr><td>10.0 GHz ≤ Frequency ≤ 13.5 GHz</td><td>–136.0 [dBm/Hz]</td></tr>
<tr><td>13.5 GHz < Frequency ≤ 20.0 GHz</td><td>–133.0 [dBm/Hz]</td></tr>
<tr><td>20.0 GHz < Frequency ≤ 26.5 GHz</td><td>–129.0 [dBm/Hz]</td></tr>
</table>
</td>
</tr>
<tr>
<td>Total Level Accuracy*
*: The Total level accuracy is found from root sum of squares (RSS) of RF characteristics, linearity error, and input attenuator switching error.</td>
<td>18°C to 28°C, After CAL, Input attenuator: ≥10 dB, Center frequency, CW, RBW: Auto, Time detection: Average, Marker result: Integration or Peak (Accuracy), Excluding the noise floor effect
Without MS269xA-008, or Preamp: Off, Mixer input level: ≤0 dBm, Bandwidth: >31.25 MHz
±0.5 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
With MS269xA-008, Preamp: On, Preamp input level: ≤–20 dBm, Bandwidth: >31.25 MHz
±1.0 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
With MS269xA-077, or MS269xA-077/078, Bandwidth: >31.25 MHz
With MS2692A-067, Microwave Preselector Bypass: On
±1.8 dB (6.0 GHz ≤ Frequency ≤ 13.5 GHz, Frequency band mode: Normal)
±3.0 dB (13.5 GHz ≤ Frequency ≤ 26.5 GHz)</td>
</tr>
<tr>
<td>Linearity Error</td>
<td>Excluding the noise floor effect
Without MS269xA-008, or Preamp: Off, Frequency band mode: Normal
±0.07 dB (Mixer input level: ≤–20 dBm)
±0.10 dB (Mixer input level: ≤–10 dBm)
±0.30 dB (Mixer input level: ≤0 dBm, Frequency: ≤6.0 GHz)
With MS269xA-008, Preamp: On, Frequency band mode: Normal
±0.07 dB (Mixer input level: ≤–40 dBm)
±0.10 dB (Mixer input level: ≤–30 dBm)
±0.50 dB (Mixer input level: ≤–20 dBm)
With MS2692A-067, Microwave Preselector Bypass: On
±0.60 dB (Mixer input level: ≤0 dBm, Frequency: > 6.0 GHz)</td>
</tr>
<tr>
<td>RF Frequency Characteristics</td>
<td>18°C to 28°C, After CAL, Input attenuator: 10 dB
Without MS269xA-008, or Preamp: Off
±0.35 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
With MS269xA-008, Preamp: On
±0.65 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
With MS2692A-067, Microwave Preselector Bypass: On
±1.0 dB (6.0 GHz < Frequency ≤ 13.5 GHz)
±1.5 dB (13.5 GHz < Frequency ≤ 26.5 GHz)</td>
</tr>
</table>

Note: Amplitude errors may occur in digitized IQ data at a probability of 0.0001 ppm or less. (AD converter maker nom. specifications) when the Analysis Bandwidth Extension 62.5 MHz/125 MHz option operates at the 50 MHz/62.5 MHz/100 MHz/125 MHz bandwidth setting.

Typical (typ.): Performance not warranted. Must products meet typical performance.
Nominal (nom.): Values not warranted. Included to facilitate application of product.
Example: Performance not warranted. Data actually measured by randomly selected measuring instruments.

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MS2690A	Signal Analyzer (50 Hz to 6.0 GHz)
	Standard Accessories
	Power Cord : 1 pc
P0031A	USB Memory (>1 GB USB2.0 Flash Driver) : 1 pc
Z0541A	USB Mouse : 1 pc
	Install CD-ROM (Application software, instruction manual CD-ROM) : 1 pc
	Options
MS2690A-001	Rubidium Reference Oscillator
MS2690A-008	6 GHz Preamplifier (100 kHz to 6 GHz)
MS2690A-017	Noise Figure Measurement Function
MS2690A-020	Vector Signal Generator (125 MHz to 6 GHz)
MS2690A-077	Analysis Bandwidth Extension to 62.5 MHz
MS2690A-078*2	Analysis Bandwidth Extension to 125 MHz (Requires MS2690A-077)
	Retrofit Options
MS2690A-101	Rubidium Reference Oscillator Retrofit
MS2690A-108	6 GHz Preamplifier Retrofit (100 kHz to 6 GHz)
MS2690A-117	Noise Figure Measurement Function Retrofit
MS2690A-120	Vector Signal Generator Retrofit (125 MHz to 6 GHz)
MS2690A-177*1	Analysis Bandwidth Extension to 62.5 MHz Retrofit
MS2690A-178*1, *2	Analysis Bandwidth Extension to 125 MHz Retrofit (Requires MS2690A-077/177)
MS2690A-282*4	CPU/Windows10 Upgrade Retrofit
MS2690A-283*4	CPU/WindowsXP to 10 Upgrade Retrofit
MS2691A-101	Rubidium Reference Oscillator Retrofit
MS2691A-103	Extension of Preselector Lower Limit to 3 GHz Retrofit (Extends lower limit of pre-selector to 3 GHz)
MS2691A-108	6 GHz Preamplifier Retrofit (100 kHz to 6 GHz)
MS2691A-117	Noise Figure Measurement Function Retrofit
MS2691A-120	Vector Signal Generator Retrofit (125 MHz to 6 GHz)
MS2691A-177*1	Analysis Bandwidth Extension to 62.5 MHz Retrofit
MS2691A-178*1, *2	Analysis Bandwidth Extension to 125 MHz Retrofit (Requires MS2691A-077/177)
MS2691A-282*4	CPU/Windows10 Upgrade Retrofit
MS2691A-283*4	CPU/WindowsXP to 10 Upgrade Retrofit
MS2692A-101	Rubidium Reference Oscillator Retrofit
MS2692A-103	Extension of Preselector Lower Limit to 3 GHz Retrofit (Extends lower limit of pre-selector to 3 GHz)
MS2692A-108	6 GHz Preamplifier Retrofit (100 kHz to 6 GHz)
MS2692A-117	Noise Figure Measurement Function Retrofit
MS2692A-120	Vector Signal Generator Retrofit (125 MHz to 6 GHz)
MS2692A-167*3	Microwave Preselector Bypass Retrofit
MS2692A-177*1	Analysis Bandwidth Extension to 62.5 MHz Retrofit
MS2692A-178*1, *2	Analysis Bandwidth Extension to 125 MHz Retrofit (Requires MS2692A-077/177)
MS2692A-282*4	CPU/Windows10 Upgrade Retrofit
MS2692A-283*4	CPU/WindowsXP to 10 Upgrade Retrofit
	Software Options
	CD-ROM with License and Operation manuals
MX269011A	W-CDMA/HSPA Downlink Measurement Software
MX269012A	W-CDMA/HSPA Uplink Measurement Software
MX269013A	GSM/EDGE Measurement Software
MX269013A-001	EDGE Evolution Measurement Software (Requires MX269013A)
MX269014A	ETC/DSRC Measurement Software
MX269015A	TD-SCDMA Measurement Software
MX269017A	Vector Modulation Analysis Software
MX269020A	LTE Downlink Measurement Software
MX269020A-001	LTE-Advanced FDD Downlink Measurement Software (Requires MX269020A)
MX269021A	LTE Uplink Measurement Software
MX269021A-001	LTE-Advanced FDD Uplink Measurement Software (Requires MX269021A)
MX269022A	LTE TDD Downlink Measurement Software
MX269022A-001	LTE-Advanced TDD Downlink Measurement Software (Requires MX269022A)
MX269023A	LTE TDD Uplink Measurement Software
MX269023A-001	LTE-Advanced TDD Uplink Measurement Software (Requires MX269023A)
MX269024A	CDMA2000 Forward Link Measurement Software
MX269024A-001	All Measure Function (Requires MX269024A)
MX269026A	EV-DO Forward Link Measurement Software
MX269026A-001	All Measure Function (Requires MX269026A)
MX269028A	WLAN (802.11) Measurement Software
MX269028A-002*2	802.11ac (160 MHz) Measurement Software (For MS269xA. Requires MX269028A)
MX269030A	W-CDMA BS Measurement Software
MX269051A	5G Standard Measurement Software (Base License) (Requires MX269051A-011 and/or 031/061/081)
MX269051A-011	NR TDD sub-6 GHz Downlink (Requires MX269051A)
MX269051A-061	NR TDD sub-6 GHz Uplink (Requires MX269051A)
MX269051A-031	NR FDD sub-6 GHz Downlink (Requires MX269051A)
MX269051A-081	NR FDD sub-6 GHz Uplink (Requires MX269051A)
MX269901A	HSDPA/HSUPA IQproducer
MX269902A	TDMA IQproducer
MX269904A	Multi-Carrier IQproducer
MX269908A	LTE IQproducer
MX269908A-001	LTE-Advanced FDD Option (Requires MX269908A)
MX269910A	LTE TDD IQproducer
MX269910A-001	LTE-Advanced TDD Option (Requires MX269910A)
MX269911A	WLAN IQproducer
MX269911A-001	802.11ac (80 MHz) Option (Requires MX269911A)
MX269912A	TD-SCDMA IQproducer
MX269913A	5G NR TDD sub-6 GHz IQproducer
MX269914A	5G NR FDD sub-6 GHz IQproducer
	Warranty Service
MS2690A-ES210	2 Years Extended Warranty Service
MS2690A-ES310	3 Years Extended Warranty Service
MS2690A-ES510	5 Years Extended Warranty Service
	Application Parts
	Following operation manuals provided as hard copy
W2850AE	MS2690A/MS2691A/MS2692A Operation Manual (Main frame Operation)
W2851AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Main frame Remote Control)
W2852AE	MS2690A/MS2691A/MS2692A Operation Manual (Signal Analyzer Function Operation)
W2853AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Signal Analyzer Function Remote Control)
W2854AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Spectrum Analyzer Function Operation)
W2855AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Spectrum Analyzer Function Remote Control)
W2856AE	MS2690A/MS2691A/MS2692A-020 Operation Manual (Vector Signal Generator Option Operation)
W2857AE	MS2690A/MS2691A/MS2692A-020 Operation Manual (Vector Signal Generator Option Remote Control)
W2914AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A Operation Manual (IQproducer for Vector Signal Generator Option)
W2929AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A Operation Manual (Standard Waveform Pattern for Vector Signal Generator Option)
W3117AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Phase Noise Measurement Function Operation)
W3118AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Phase Noise Measurement Function Remote control)
W3655AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A-017 Operation Manual (Noise Figure Measurement Function Operation)
W3656AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A-017 Operation Manual (Noise Figure Measurement Function Remote Control)

Continued on next page

Model/Order No.	Name
W3098AE	MX269011A Operation Manual (Operation)
W3099AE	MX269011A Operation Manual (Remote control)
W3060AE	MX269012A Operation Manual (Operation)
W3061AE	MX269012A Operation Manual (Remote control)
W3100AE	MX269013A Operation Manual (Operation)
W3101AE	MX269013A Operation Manual (Remote control)
W3031AE	MX269014A Operation Manual (Operation)
W3032AE	MX269014A Operation Manual (Remote control)
W3044AE	MX269015A Operation Manual (Operation)
W3045AE	MX269015A Operation Manual (Remote control)
W3305AE	MX269017A Operation Manual (Operation)
W3306AE	MX269017A Operation Manual (Remote control)
W3014AE	MX269020A Operation Manual (Operation)
W3064AE	MX269020A Operation Manual (Remote control)
W3015AE	MX269021A Operation Manual (Operation)
W3065AE	MX269021A Operation Manual (Remote control)
W3209AE	MX269022A Operation Manual (Operation)
W3210AE	MX269022A Operation Manual (Remote control)
W3521AE	MX269023A Operation Manual (Operation)
W3522AE	MX269023A Operation Manual (Remote Control)
W3201AE	MX269024A Operation Manual (Operation)
W3202AE	MX269024A Operation Manual (Remote control)
W3203AE	MX269026A Operation Manual (Operation)
W3204AE	MX269026A Operation Manual (Remote control)
W3528AE	MX269028A Operation Manual (Operation)
W3529AE	MX269028A Operation Manual (Remote Control)
W2860AE	MX269030A Operation Manual (Operation)
W2861AE	MX269030A Operation Manual (Remote control)
W3922AE	MX285051A/MX269051A Operation Manual
W3963AE	MX285051A-011/MX269051A-011/MX285051A-021/MX285051A-061/MX269051A-061/MX285051A-071 Operation Manual (Operation)
W3964AE	MX285051A-011/MX269051A-011/MX285051A-021/MX285051A-061/MX269051A-061/MX285051A-071 Operation Manual (Remote Control)
W4035AE	MX285051A-031/MX269051A-031/MX285051A-081/MX269051A-081 Operation Manual (Operation)
W4036AE	MX285051A-031/MX269051A-031/MX285051A-081/MX269051A-081 Operation Manual (Remote Control)
W2915AE	MX269901A Operation Manual
W2916AE	MX269902A Operation Manual
W2917AE	MX269904A Operation Manual
W3023AE	MX269908A Operation Manual
W3221AE	MX269910A Operation Manual
W3488AE	MX269911A Operation Manual
W3582AE	MX269912A Operation Manual
W3984AE	MX269913A Operation Manual
W4033AE	MX269914A Operation Manual

Model/Order No.	Name
K240B	Power Divider (K connector, DC to 26.5 GHz, 50Ω, K-J, 1 W max.)
MA1612A	Four-Port Junction Pad (5 MHz to 3 GHz, N-J)
J0576B	Coaxial Cord (N-P · 5D-2W · N-P), 1 m
J0576D	Coaxial Cord (N-P · 5D-2W · N-P), 2 m
J0127A	Coaxial Cord (BNC-P · RG58A/U · BNC-P), 1 m
J0127B	Coaxial Cord (BNC-P · RG58A/U · BNC-P), 2 m
J0127C	Coaxial Cord (BNC-P · RG58A/U · BNC-P), 0.5 m
J0322A	Coaxial Cord (SMA-P · 50Ω SUCOFLEX104 · SMA-P), 0.5 m (DC to 18 GHz)
J0322B	Coaxial Cord (SMA-P · 50Ω SUCOFLEX104 · SMA-P), 1 m (DC to 18 GHz)
J0322C	Coaxial Cord (SMA-P · 50Ω SUCOFLEX104 · SMA-P), 1.5 m (DC to 18 GHz)
J0322D	Coaxial Cord (SMA-P · 50Ω SUCOFLEX104 · SMA-P), 2 m (DC to 18 GHz)
J0805	DC Block, N type (MODEL 7003) (10 kHz to 18 GHz, N-P · N-J)
J1555A	DC Block, SMA type (MODEL 7006-1) (9 kHz to 20 GHz, SMA-P · SMA-J)
K261	DC Block (10 kHz to 40 GHz, K-P · K-J)
J0004	Coaxial Adapter (DC to 12.4 GHz, 50Ω, N-P · SMA-J)
J1398A	N-SMA Adapter (DC to 26.5 GHz, 50Ω, N-P · SMA-J)
J0911	Coaxial Cord, 1.0 M (for 40 GHz) (DC to 40 GHz, approx. 1 m) (SF102A, 11K254/K254/1.0M)
J0912	Coaxial Cord, 0.5 M (for 40 GHz) (DC to 40 GHz, approx. 0.5 m) (SF102A, 11K254/K254/0.5M)
41KC-3	Fixed Attenuator, 3 dB (DC to 40 GHz, 3 dB)
J1750A	10 dB Fixed Attenuator (DC to 18 GHz, Input Power <5 W)
J1751A	20 dB Fixed Attenuator (DC to 18 GHz, Input Power <5 W)
J1752A	30 dB Fixed Attenuator (DC to 18 GHz, Input Power <5 W)
J1753A	3 dB Fixed Attenuator (DC to 18 GHz, Input Power <5 W)
J1754A	6 dB Fixed Attenuator (DC to 18 GHz, Input Power <5 W)
J1755A	Termination (50Ω, Type N, DC to 18 GHz)
J1261A	Ethernet Cable (Shield type, straight), 1 m
J1261B	Ethernet Cable (Shield type, straight), 3 m
J1261C	Ethernet Cable (Shield type, cross), 1 m
J1261D	Ethernet Cable (Shield type, cross), 3 m
J0008	GPIB Connection Cable, 2.0 m
J1373A[*5]	AUX Conversion Adapter (AUX → BNC, for vector signal generator option)
B0597A	Rack Mount Kit (EIA)
B0589A	Carrying Case (Hard type, with casters)
MA24105A	Inline Peak Power Sensor (350 MHz to 4 GHz, with USB A to mini B cable)
MA24106A	USB Power Sensor (50 MHz to 6 GHz, with USB A to mini B cable)
MA24108A	Microwave USB Power Sensor (10 MHz to 8 GHz, with USB A to Micro-B cable)
MA24118A	Microwave USB Power Sensor (10 MHz to 18 GHz, with USB A to Micro-B cable)
MA24126A	Microwave USB Power Sensor (10 MHz to 26 GHz, with USB A to Micro-B cable)
Z1037A	Installation Kit (required when retrofitting options or installing software)

Only for Integrating into Conformance Test System

Model/Order No.	Name
	Main Frame
MS2692A	Signal Analyzer (50 Hz to 26.5 GHz)
	Standard Accessories
	Power Cord : 1 pc
P0031A	USB Memory (>1 GB USB2.0 Flash Driver) : 1 pc
Z0541A	USB Mouse : 1 pc
	Install CD-ROM (Application software, instruction manual CD-ROM) : 1 pc
	Options
MS2692A-001	Rubidium Reference Oscillator
MS2692A-003	Extension of Preselector Lower Limit to 3 GHz (Extends lower limit of preselector to 3 GHz)
MS2692A-008	6 GHz Preamplifier (100 kHz to 6 GHz)
MS2692A-017	Noise Figure Measurement Function
MS2692A-067*3	Microwave Preselector Bypass
MS2692A-077	Analysis Bandwidth Extension to 62.5 MHz
MS2692A-078*2	Analysis Bandwidth Extension to 125 MHz (Requires MS2692A-077)
	Warranty Service
MS2692A-ES210	2 Years Extended Warranty Service
MS2692A-ES310	3 Years Extended Warranty Service
MS2692A-ES510	5 Years Extended Warranty Service

*1: The MS269xA-177/178 cannot be retrofitted to the MS269xA already fitted with the MS269xA-004/104 option (discontinued).

*2: Combining the MS269xA-078 Analysis Bandwidth Extension to 125 MHz and MX269028A-002 wireless LAN IEEE 802.11ac (160 MHz) measurement software (only for MS269xA) supports modulation analysis up to 160-MHz bandwidth signals of the IEEE 802.11ac.
See measurement software catalog for more details.

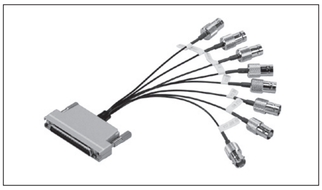
*3: Cannot be installed simultaneously with MS2692A-003/103/008/108 and MS2692A-004/104 option (discontinued).

*4: These options replaces the MS269xA CPU with Windows XP or Windows 7 and upgrades to Windows 10.
The MS269xA with Windows 7 has a sticker marked "C1" near the serial number of the main unit, and Windows 10 has a sticker marked "C2". No seal is attached to Windows XP.
Installation of Windows 10 is not supported for MS269xA units with the following options installed.

Model number	Model name
MS2690A-004/104*/204* MS2691A-004/104*/204* MS2692A-004/104*/204*	Wideband Analysis Hardware/Retrofit
MS2690A-050/150*/250* MS2691A-050/150*/250* MS2692A-050/150*/250*	HDD Digitizing Interface/Retrofit
MS2690A-065/165*/265* MS2691A-065/165*/265* MS2692A-065/165*/265*	DigRF v4 High Speed Serial Transmission Unit/ Retrofit
MS2691A-030/130*/230*	W-CDMA RNC Simulator (ATM1.5M/2M)/Retrofit
MS2691A-040/140*/240* MS2692A-040/140*/240*	Baseband Interface Unit/Retrofit

*: Retrofit option

*5: The AUX Conversion Adapter J1373A is not a standard accessory for the Vector Signal Generator Option MS269xA-020/120.



AUX Conversion Adapter J1373A

USB Power Sensor MA24106A

Carrying Case B0589A (Hard type)

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Signal Analyzer

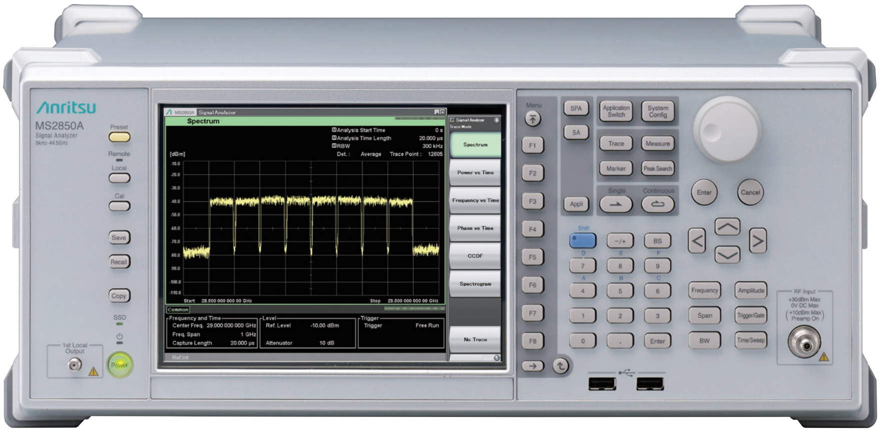
MS2850A

9 kHz to 32 GHz/ 44.5 GHz

Remote Control
GPIB | **Ethernet** | **USB**

Signal Analyzer with 1 GHz Analysis Bandwidth

Excellent Eco Product



Analysis Bandwidth up to 1 GHz Enabling 5G Mobile and Satellite Communications R&D/Manufacturing Development

The MS2850A is a spectrum analyzer/signal analyzer with a maximum analysis bandwidth of 1 GHz and a frequency range of 9 kHz to either 32 GHz or 44.5 GHz. It helps cut R&D and manufacturing costs for microwave and millimeter-wave wideband communications systems, such as 5G mobile and broadcast satellites.
Dedicated software for 5G measurements can be installed in the Signal Analyzer MS2850A, and detailed and accurate measurements are backed by the high-performance 1 GHz (max.) analysis bandwidth and high measurement dynamic range.

Features

- Analysis bandwidth:
  255 MHz (Standard), 510 MHz (Option), 1 GHz (Option)
- EVM performance:
  <1% (100 MHz bandwidth at Center Frequency: 28 GHz)
- Phase flatness performance: Center Frequency: 28 GHz, at Center Frequency ±500 MHz
  In-band Frequency Characteristics: ±1.2 dB (nom.)
  In-band Phase Linearity: 5 deg. p-p (nom.)
- Measurement applications (option):
  5G measurement, LTE/LTE-Advanced, Digital Modulation, etc.

Analysis Bandwidth 1 GHz

The 1 GHz analysis bandwidth supports wider-band microwave and millimeter-wave communications while high flatness performance facilitates multicarrier signal analysis.
With lower costs and higher measurement accuracy, the Signal Analyzer MS2850A is ideal for R&D and manufacturing of wideband next-generation communications systems, such as 5G mobile and broadcast satellites.

EVM Performance <1%

The measurement dynamic range is better than 140 dB*1 at a 1 GHz analysis bandwidth. This performance is equivalent to <1% EVM performance which is considered Peak-to-Peak of modulation waveform at measurement of a single 5G carrier (100 MHz wide)*2.
With its wide dynamic range, the MS2850A increases the reliability of next-generation, wideband communications systems.

*1: Difference between ADC Clipping level and DANL
*2: At 100 MHz bandwidth 64QAM xPDSCH

Main Frame Functions/Performance

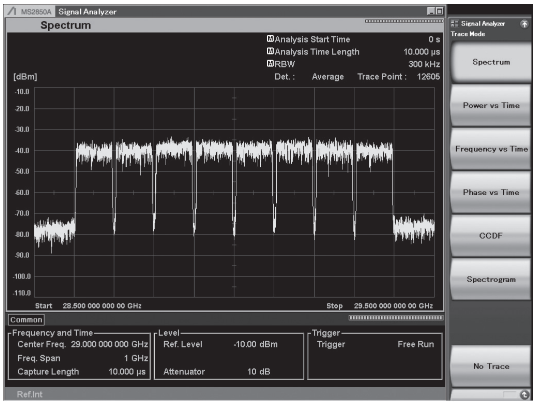
The MS2850A is a spectrum analyzer/signal analyzer with a maximum analysis bandwidth of 1 GHz and a frequency range of 9 kHz to either 32 GHz or 44.5 GHz. Its high cost-performance helps cut rising R&D and manufacturing CAPEX costs in future deployments of microwave and millimeter-wave wideband communications systems.

1 GHz Analysis Bandwidth

The 1 GHz analysis bandwidth supports wider bands for microwave and millimeter-wave communications systems, such as 5G mobile and broadcast satellites.

The signal analyzer function using FFT (Fast Fourier transform) analysis supports spectrum displays, spectrogram displays, and applications where frequency and phase change with elapsed time. In addition, frequency bands required for 5G measurements are covered and all-in-one evaluation of multicarrier signals is supported by the 5G measurement software.

Analysis Bandwidth: 255 MHz (standard)
510 MHz (option), 1 GHz (option)



Analysis Start Time 0 s
Analysis Time Length 10.000 μs
RBW 300 kHz
Det. : Average Trace Point : 12605
Start 28.500 000 000 00 GHz
Stop 29.500 000 000 00 GHz

Frequency and Time
Center Freq. 29.000 000 000 GHz
Freq. Span 1 GHz
Capture Length 10.000 μs

Level
Ref. Level -10.00 dBm
Attenuator 10 dB

Trigger
Trigger Free Run

Spectrum of eight 100 MHz bandwidth carriers
at 29 GHz center frequency

Excellent Flatness Performance

The amplitude and phase flatness performance*1 over a wide analysis bandwidth of 1 GHz exceed that of other signal analyzers*2. With this performance, the MS2850A supports high-accuracy amplitude and phase measurements for each carrier in wideband communications systems, such as 5G mobile, to play a key role in improving the quality of radio communications equipment.

Center Frequency: 28 GHz, at Center Frequency ±500 MHz
In-band Frequency Characteristics: ±1.2 dB (nom.)
In-band Phase Linearity: 5 deg. p-p (nom.)

*1: Stipulated as In-band Frequency Characteristics and In-band Phase Linearity in Anritsu specifications
*2: Anritsu test at May 2017

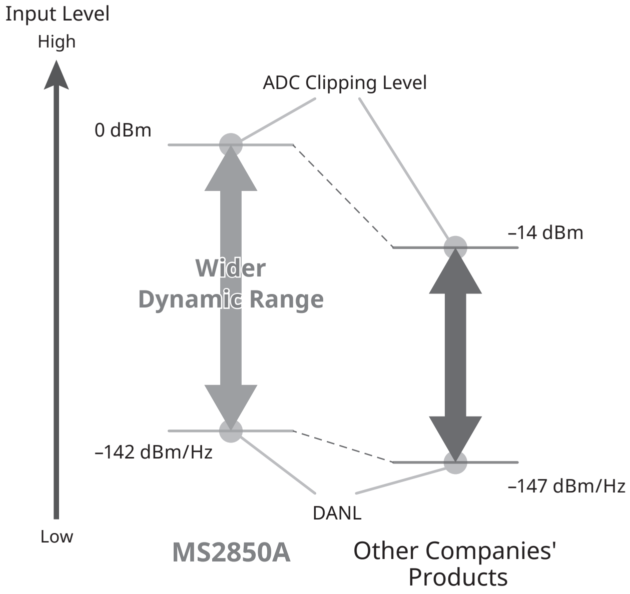
Wide Dynamic Range

High ADC*3 Clipping Level
Wide Measurement Dynamic Range at Difference from DANL*4

The MS2850A has a high ADC clipping level over an analysis bandwidth of 1 GHz. This performance can be used to obtain a wider difference from the DANL, which rises when inputting the actual signal input level and inputting a wideband signal when using an attenuator.
This wide dynamic range performance helps obtain more accurate EVM values at measurement of 5G signals. For example, in the 28 GHz band, the measured dynamic range at the difference between the ADC clipping level and DANL is better than 140 dB (ref.).

Center Frequency: 28 GHz
ADC Clipping Level: 0 dBm*5 (CW)
DANL: –142 dBm/Hz*5
Dynamic Range: 142 dB (ref.)

*3: Analog to Digital Converter
*4: Displayed Average Noise Level
*5: meas. means value measured as design stage but not guaranteed specification



The measurement dynamic range widens if the ADC clipping level is high even when the DANL is quite high.

High SFDR (Spurious Free Dynamic Range)

–70 dBc at 1 GHz Analysis Bandwidth

The MS2850A suppresses spurious generation due to ADC over the 1 GHz analysis bandwidth, assuring a wide measurement dynamic range at wideband signal analysis.

SFDR
800 MHz ≤ Frequency < 4.2 GHz: –60 dBc (nom.)
4.2 GHz ≤ Frequency ≤ 44.5 GHz: –70 dBc (nom.)

5G Measurement Software

Dedicated software for 5G measurements can be installed in the Signal Analyzer MS2850A, and detailed and accurate measurements are backed by the high-performance 1 GHz (max.) analysis bandwidth and high measurement dynamic range.

Standard		Model/Name	Channel Bandwidth (1CC)	Multi Carrier Measurement
V5G (Verizon 5GTF)		Pre-Standard CP-OFDM Downlink MX285051A-001 Pre-Standard CP-OFDM Uplink MX285051A-051	Up to 100 MHz	Support
5G NR (3GPP TS 38.211)	sub-6 GHz	NR TDD sub-6 GHz Downlink MX285051A-011 NR TDD sub-6 GHz Uplink MX285051A-061 NR FDD sub-6 GHz Downlink MX285051A-031 NR FDD sub-6 GHz Uplink MX285051A-081	Up to 100 MHz	Downlink only (Up to 2 carriers)
	mmWave	NR TDD mmWave Downlink MX285051A-021 NR TDD mmWave Uplink MX285051A-071	Up to 400 MHz	Downlink only (Up to 8 carriers)

All-in-One V5G/5G NR (sub-6 GHz/mmWave) Coverage

Adding the MS2850A software option provides support for both V5G and 5G NR (sub-6 GHz/mmWave).
The MX285051A software measures the RF characteristics of both downlink and uplink signals proposed for applications ranging from 5G demonstration tests to actual 5G NR use.

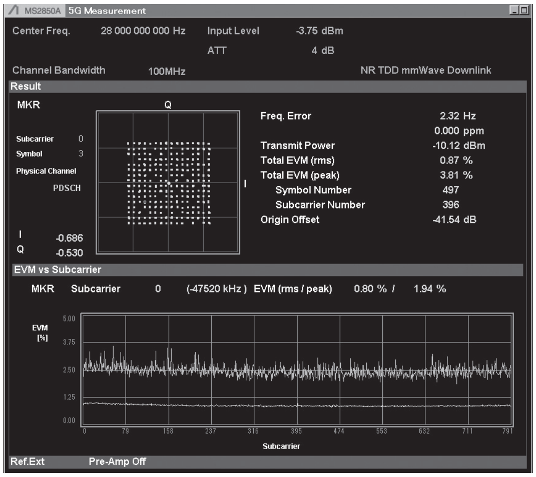
Frequency Setting Range:
100 MHz to 32 GHz (with MS2850A-047 installed)
100 MHz to 44.5 GHz (with MS2850A-046 installed)

Excellent EVM Performance for Applications Ranging from R&D to Manufacturing

The residual EVM performance in combination with the MS2850A is better than 1%*1, helping minimize the measuring instrument effect and improving the quality of 5G wireless systems at lower equipment cost

Easy Operability Improves Measurement and Test Efficiency

The one-button Auto Range function optimizes the complex built-in attenuator settings required for more accurate EVM measurement.


MS2850A 5G Measurement

Center Freq. 28 000 000 000 Hz
Input Level -3.75 dBm
ATT 4 dB
Channel Bandwidth 100MHz
NR TDD mmWave Downlink

Result

MKR
Subcarrier 0
Symbol 3
Physical Channel PDSCH
I -0.686
Q -0.530

Freq. Error 2.32 Hz
0.000 ppm
Transmit Power -10.12 dBm
Total EVM (rms) 0.87 %
Total EVM (peak) 3.81 %
Symbol Number 497
Subcarrier Number 396
Origin Offset -41.54 dB

EVM vs Subcarrier

MKR Subcarrier 0 (-47520 kHz) EVM (rms / peak) 0.80 % / 1.94 %

Ref.Ext Pre-Amp Off

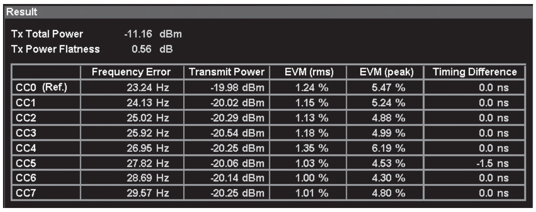
Basic Screen (EVM vs. Subcarrier)

More Efficient R&D and Manufacturing

Evaluation and manufacturing are more efficient thanks to fast collection of measurement results. Measurement speeds are about 10% faster (at 10 averaging) than the V5G software.

Multicarrier Analysis and Batch Measurement at 1 GHz*2

The 5G measurement software uses the 1 GHz analysis bandwidth of the MS2850A to support batch (all-at-once) measurement of all 5G signal carriers (8 carriers × 100 MHz wide). The characteristics of each single carrier can be evaluated quickly at the same time without needing to measure each single carrier separately.


Result

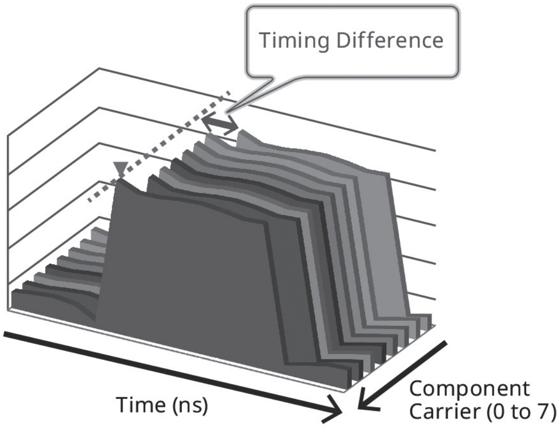
Tx Total Power -11.16 dBm
Tx Power Flatness 0.56 dB

	Frequency Error	Transmit Power	EVM (rms)	EVM (peak)	Timing Difference
CC0 (Ref.)	23.24 Hz	-19.98 dBm	1.24 %	5.47 %	0.0 ns
CC1	24.13 Hz	-20.02 dBm	1.15 %	5.24 %	0.0 ns
CC2	25.02 Hz	-20.29 dBm	1.13 %	4.88 %	0.0 ns
CC3	25.92 Hz	-20.54 dBm	1.18 %	4.99 %	0.0 ns
CC4	26.95 Hz	-20.25 dBm	1.35 %	6.19 %	0.0 ns
CC5	27.82 Hz	-20.06 dBm	1.03 %	4.53 %	-1.5 ns
CC6	28.69 Hz	-20.14 dBm	1.00 %	4.30 %	0.0 ns
CC7	29.57 Hz	-20.25 dBm	1.01 %	4.80 %	0.0 ns

Batch (All-at-Once) Carrier Measurements (Numeric Results)

Timing Difference Measurement*3

Batch (all-at-once) measurement of all carriers not only supports EVM and frequency error measurements for each carrier, but also supports timing difference measurements for each carrier.



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*1: At 100 MHz, single carrier, 28 GHz (meas.)
*2: Supported using MX285051A-001/021/051
*3: Supported using MX285051A-001/011/021/031/051

Signal Analyzer

MS2850A

The Signal Analyzer MS2850A has the analysis bandwidth and excellent flatness performance required for R&D and manufacturing of next-generation wideband communications systems. In addition to versatile basic functions for more convenient testing, it also has useful troubleshooting functions, such as Capture&Replay and sub-trace displays.

Standard Functions

Signal Analyzer (Analysis Bandwidth: 255 MHz)
Spectrum Analyzer

Option Functions

Signal Analyzer (Analysis Bandwidth: 510 MHz, 1 GHz)
Built-in Preamp
Low Second Harmonic Distortion
Phase Noise Measurement
Noise Figure (NF) Measurement
Modulation Analysis (5G, LTE, W-CDMA, etc.)

Application Parts

High Performance Waveguide Mixer (50 GHz to 90 GHz)
External Mixer (Harmonic, 26.5 GHz to 325 GHz)
USB Power Sensor

Typical Measurement Items and Functions

✓: Supported

Measurement Function/Item	Signal Analyzer	Spectrum Analyzer	Option/Application Part
Spectrum Display	✓	✓	
Power/Frequency/Phase vs. Time Display	✓		
Capture & Replay	✓		
CCDF/APD Display	✓		
Spectrogram Display	✓		
Sub-trace Display	✓		
Gate View (at Gate Sweep)		✓	
Channel Power	✓	✓	
Occupied Bandwidth	✓	✓	
Adjacent Channel Leakage Power	✓	✓	
Burst Average Power	✓	✓	
Multi-marker & List Display	✓	✓	
Highest 10 Markers	✓	✓	
Spectrum Emission Mask		✓	
Limit Line		✓	
Frequency Counter		✓	
Two-Signal Tertiary Distortion (TOI)		✓	
Power Meter*			✓
Modulation Analysis (5G, LTE, etc.)			✓
Phase Noise Measurement			✓
Noise Figure (NF) Measurement			✓
mmWave-band Spectrum Measurement using External Mixer Connection (sold separately)	✓	✓	✓

*: Connected to USB power sensor sold separately

Signal Analyzer Functions (Standard)

Analysis Bandwidth

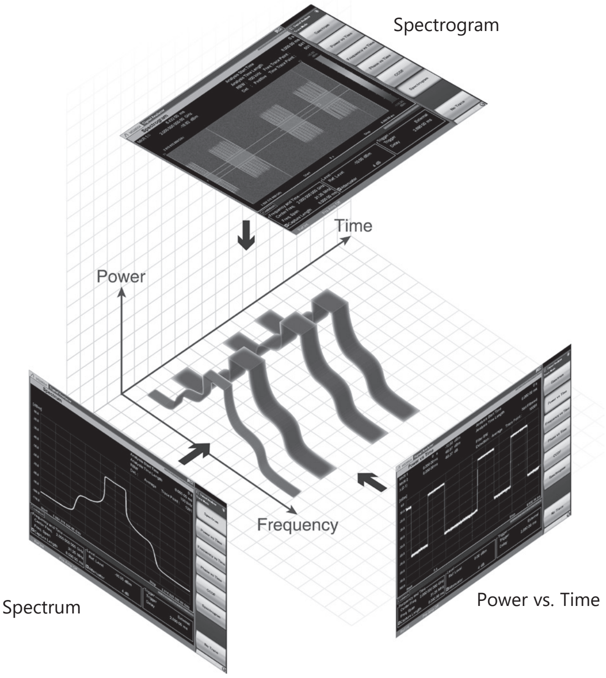
Analysis Bandwidth	Frequency Measurement Range
255 MHz (standard)	100 MHz to 32 GHz/44.5 GHz
510 MHz (option)	100 MHz to 32 GHz/44.5 GHz
1 GHz (option)	4.2 GHz to 32 GHz/44.5 GHz

Multiple Display Modes at FFT Analysis

The MS2850A has a built-in 255 MHz analysis bandwidth FFT analysis function. The measured signal is captured for display in various domains. Troubleshooting efficiency is greatly improved because phenomena such as spectrum transients that cannot be monitored by sweep-type spectrum analyzers can be observed. The analysis bandwidth can be extended optionally to 510 MHz and 1 GHz.

Display Mode

- Spectrum
- Frequency vs. Time
- CCDF/APD
- Power vs. Time
- Phase vs. Time
- Spectrogram



Excellent Phase and Amplitude Flatness Performance

The phase-array antenna performs electronic scanning to control the phase of the parallel antenna elements because the mean width of the antenna directivity will become wider than expected if the phase of each antenna element is not the same. Consequently, the signal analyzer must be able to measure phase with high accuracy. Additionally, excellent amplitude characteristics are required at evaluation of communications using wideband signals, such as 5G mobile.
The MS2850A has excellent phase and amplitude flatness over a wide analysis bandwidth of 1 GHz.

Center Frequency 28 GHz, at Center Frequency ±500 MHz

In-band Frequency Characteristics (Amplitude Flatness)	±1.2 dB (nom.)
In-band Phase Linearity (Phase Flatness)	5˚p-p (nom.)

High Dynamic Range Performance

Analysis of wideband signals of 1 GHz does not simply require a signal analyzer with a wide analysis bandwidth. Accurate signal capture and analysis requires securing good dynamic range performance.
With a high ADC clipping level*1 and low DANL, the MS2850A achieves a dynamic range of better than 140 dB*2 at a center frequency of 28 GHz. Additionally, the SFDR (Spurious Free Dynamic Range) performance is an excellent –70 dBc at an analysis bandwidth of 1 GHz. As a result, the MS2850A is ideal for accurately capturing and analyzing the true performance next-generation wideband communications systems.

Dynamic Range: 142 dB (Center Frequency 28 GHz, CW, ref.)

ADC Clipping Level*1	0 dBm*2
DANL	–142 dBm/Hz*2

SFDR:

800 MHz to 4.2 GHz	–60 dBc (nom.)
4.2 GHz to 44.5 GHz	–70 dBc (nom.)

*1: Mixer level (CW) for using ADC at full scale
*2: meas. means value measured as design stage but not guaranteed specification

Capture & Replay Function

Waveform data can be saved (captured) in the internal memory for later display and replay. The causes of problems can be resolved quickly and easily because the display mode can be switched during replay.

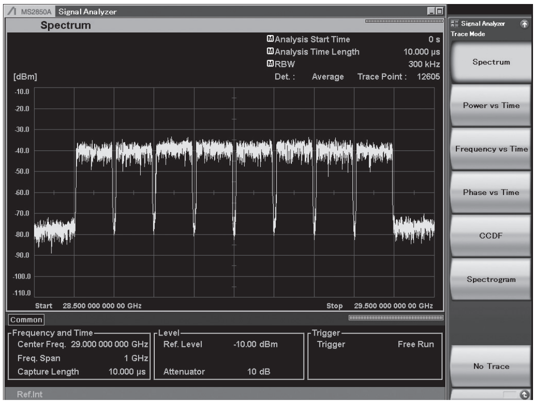
Maximum capture times for each frequency span

Span	Sampling Rate	Max. Capture Time
50 MHz	81.25 MHz	48 s
100 MHz	162.5 MHz	24 s
255 MHz	325 MHz	12 s
510 MHz	650 MHz	6 s
1000 MHz	1300 MHz	3 s

Refer to the MS2850A data sheet for details.

Spectrum Display

This function graphically displays the amplitude on the y-axis and the frequency on the x-axis. The captured IQ data are FFT- processed, and the time-domain data are converted to the frequency domain to display the spectrum. This is useful for confirming spectrum transients that cannot be monitored using spectrum analyzer functions.



MS2850A Signal Analyzer

Spectrum

Analysis Start Time 0 s
Analysis Time Length 10.000 μs
RBW 300 kHz
Det. : Average Trace Point : 12605

Start 28.500 000 000 00 GHz
Stop 29.500 000 000 00 GHz

Frequency and Time
Center Freq. 29.000 000 000 GHz
Freq. Span 1 GHz
Capture Length 10.000 μs

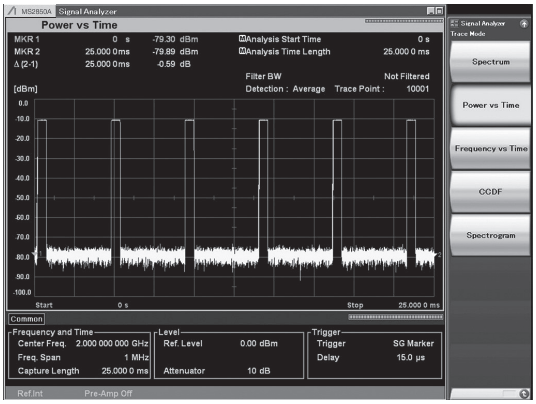
Level
Ref. Level -10.00 dBm
Attenuator 10 dB

Trigger
Trigger Free Run

Ref.Int

Power vs. Time

The Power vs. Time trace displays a graph with amplitude on the y-axis and time on the x-axis to confirm changes in power with time of measured signals.



MS2850A Signal Analyzer

Power vs Time

MKR 1 0 s -79.30 dBm
MKR 2 25.000 0ms -79.89 dBm
Δ (2-1) 25.000 0ms -0.59 dB

Analysis Start Time 0 s
Analysis Time Length 25.000 0 ms
Filter BW Not Filtered
Detection : Average Trace Point : 10001

Start 0 s
Stop 25.000 0 ms

Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 1 MHz
Capture Length 25.000 0 ms

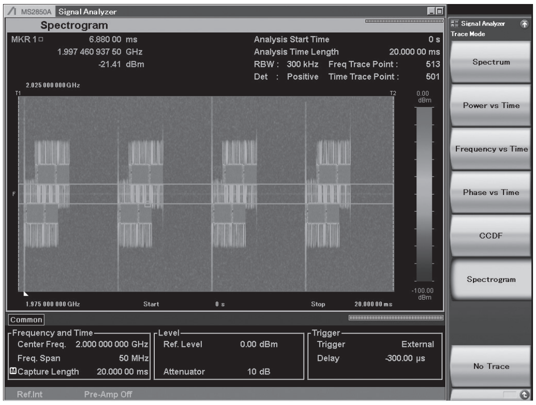
Level
Ref. Level 0.00 dBm
Attenuator 10 dB

Trigger
Trigger SG Marker
Delay 15.0 μs

Ref.Int Pre-Amp Off

Spectrogram

The Spectrogram trace displays the level as color with frequency on the y-axis and time on the x-axis. The captured IQ data is FFT processed to confirm time variations in the continuous spectrum.
It is useful for monitoring frequency hopping and transient signals.



MS2850A Signal Analyzer

Spectrogram

MKR 1 6.880 00 ms
1.997 460 937 50 GHz
-21.41 dBm

Analysis Start Time 0 s
Analysis Time Length 20.000 00 ms
RBW : 300 kHz Freq Trace Point : 513
Det : Positive Time Trace Point : 501

Start 0 s
Stop 20.000 00 ms

Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 50 MHz
Capture Length 20.000 00 ms

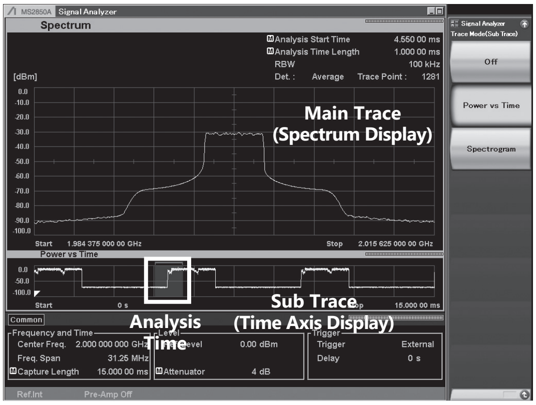
Level
Ref. Level 0.00 dBm
Attenuator 10 dB

Trigger
Trigger External
Delay -300.00 μs

Ref.Int Pre-Amp Off

Sub-trace Display

This function is useful for checking the spectrum while changing the analysis time period arbitrarily (blue display) such as when confirming burst signal rise and fall times. Simultaneous display of the time axis (sub-trace) and frequency axis (main trace) is useful for visually confirming when spectrum waveform distortion components (adjacent channel components, etc.) occur in the time domain.



MS2850A Signal Analyzer

Spectrum

Analysis Start Time 4.550 00 ms
Analysis Time Length 1.000 00 ms
RBW 100 kHz
Det. : Average Trace Point : 1281

Start 1.984 375 000 00 GHz
Stop 2.015 625 000 00 GHz

Power vs Time
Start 0 s
Stop 15.000 00 ms

Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 31.25 MHz
Capture Length 15.000 00 ms

Level
Ref. Level 0.00 dBm
Attenuator 4 dB

Trigger
Trigger External
Delay 0 s

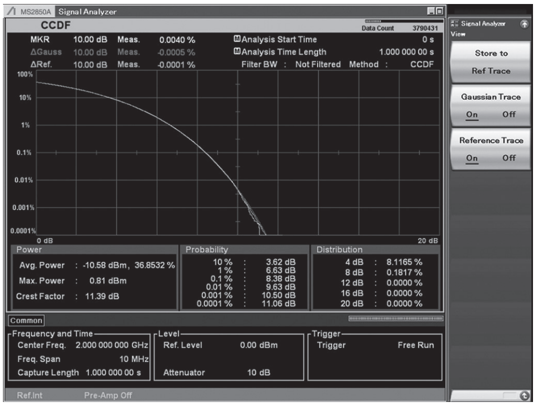
Ref.Int Pre-Amp Off

CCDF/APD

The CCDF trace displays the power variation probability on the y-axis and power variation on the y-axis to confirm the CCDF and APD of measured signals.

CCDF (Complementary Cumulative Distribution Function):
The CCDF display indicates the cumulative distribution of transient power variations compared to average power.

APD (Amplitude Probability Density):
The APD display indicates the probability distribution of transient power



MS2850A Signal Analyzer

CCDF

Data Count 3790431

MKR 10.00 dB Meas. 0.0040 %
ΔGauss 10.00 dB Meas. -0.0005 %
ΔRef. 10.00 dB Meas. -0.0001 %

Analysis Start Time 0 s
Analysis Time Length 1.000 000 00 s
Filter BW : Not Filtered Method : CCDF

Power
Avg. Power : -10.58 dBm, 36.8532 %
Max. Power : 0.81 dBm
Crest Factor : 11.39 dB

Probability
10 % : 3.62 dB
1 % : 6.63 dB
0.1 % : 8.38 dB
0.01 % : 9.63 dB
0.001 % : 10.50 dB
0.0001 % : 11.06 dB

Distribution
4 dB : 8.1165 %
8 dB : 0.1817 %
12 dB : 0.0000 %
16 dB : 0.0000 %
20 dB : 0.0000 %

Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 10 MHz
Capture Length 1.000 000 00 s

Level
Ref. Level 0.00 dBm
Attenuator 10 dB

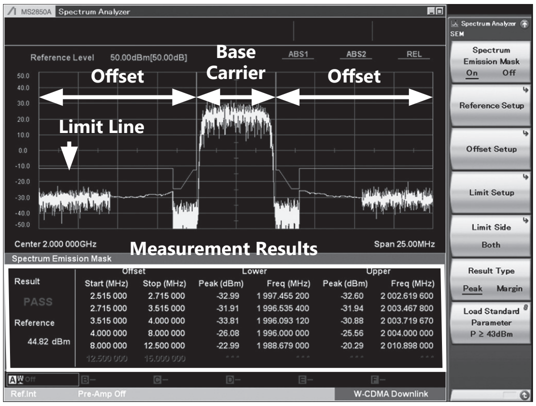
Trigger
Trigger Free Run

Ref.Int Pre-Amp Off

Versatile Built-in Functions

Spectrum Emission Mask

This function splits the offset part into up to 12 segments; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment. The results are tabulated below the trace and marked PASS/FAIL. Pre-installed templates for each standard support easy parameter setting.



Spectrum Emission Mask

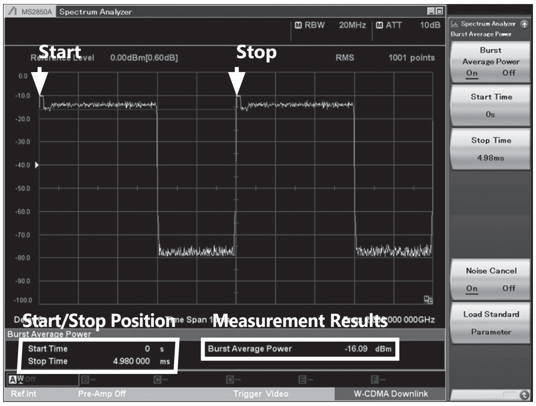
Result: PASS
Reference: 44.82 dBm

Offset		Lower		Upper	
Start (MHz)	Stop (MHz)	Peak (dBm)	Freq (MHz)	Peak (dBm)	Freq (MHz)
2.515 000	2.715 000	-32.99	1 997.455 200	-32.60	2 002.619 600
2.715 000	3.515 000	-31.91	1 996.535 400	-31.94	2 003.467 800
3.515 000	4.000 000	-33.81	1 996.093 120	-30.88	2 003.719 670
4.000 000	8.000 000	-26.08	1 996.000 000	-25.56	2 004.000 000
8.000 000	12.500 000	-22.99	1 988.679 000	-20.29	2 010.898 000
12.500 000	15.000 000	***	***	***	***

Measurement Results
- Peak power (or margin) at offset
- Each peak frequency

Burst Average Power

The average power for the range specified by two markers is displayed in the time domain. Measurement only requires setting the measurement start and stop positions on the screen. True performance is measured using the noise cancellation function to subtract main-frame noise from the measurement result.
Pre-installed templates for each standard support easy parameter setting.

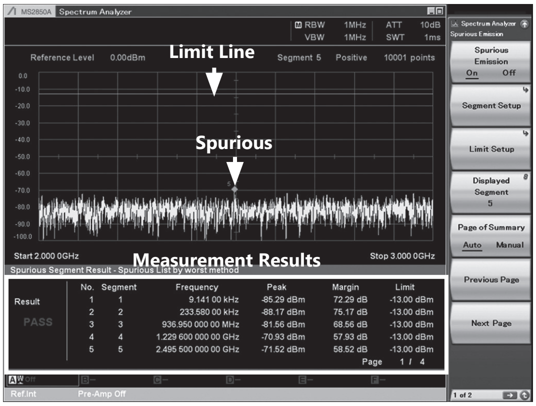


Burst Average Power

Start Time 0 s
Stop Time 4.980 000 ms
Burst Average Power -16.09 dBm

Spurious Emission

This function splits the frequency range into up to 20 segments for sweeping; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment.
The results are tabulated below the trace and marked PASS/FAIL



Spurious Segment Result - Spurious List by worst method

Result: PASS

No.	Segment	Frequency	Peak	Margin	Limit
1	1	9.141 00 kHz	-85.29 dBm	72.29 dB	-13.00 dBm
2	2	233.580 00 kHz	-88.17 dBm	75.17 dB	-13.00 dBm
3	3	936.950 000 00 MHz	-81.56 dBm	68.56 dB	-13.00 dBm
4	4	1.229 600 000 00 GHz	-70.93 dBm	57.93 dB	-13.00 dBm
5	5	2.495 500 000 00 GHz	-71.52 dBm	58.52 dB	-13.00 dBm

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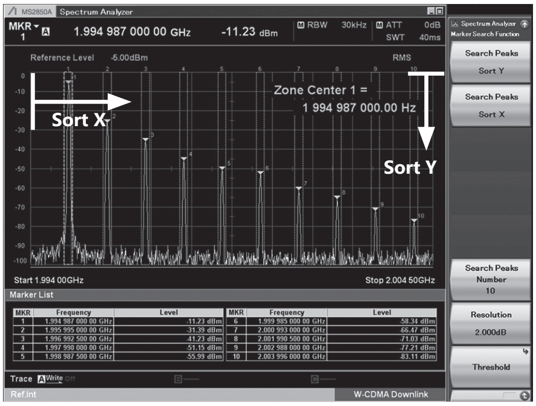
Highest 10 Markers

This function sets the threshold level and auto-detects peaks in the X (frequency) and Y (level/time) directions.

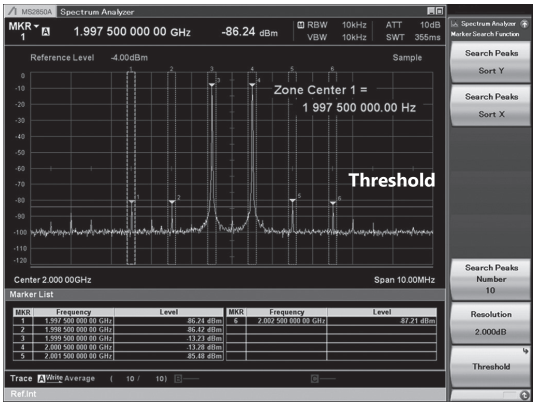


Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	1.994 987 000 00 GHz	-11.23 dBm	6	1.999 985 000 00 GHz	-58.34 dBm
2	1.995 995 000 00 GHz	-31.39 dBm	7	2.000 993 000 00 GHz	-66.47 dBm
3	1.996 992 500 00 GHz	-41.23 dBm	8	2.001 990 500 00 GHz	-71.03 dBm
4	1.997 990 000 00 GHz	-51.15 dBm	9	2.002 988 000 00 GHz	-77.21 dBm
5	1.998 987 500 00 GHz	-55.99 dBm	10	2.003 996 000 00 GHz	-83.11 dBm

Multi-marker & Marker List

Up to 10 markers can be set for this function. Markers may be either a spot or a zone. Using a zone marker, the peak of a signal with an unstable variable frequency can be tracked and measured.
Not only can the 10 markers be listed below the trace but the differences between markers can be calculated and displayed using the delta setting.

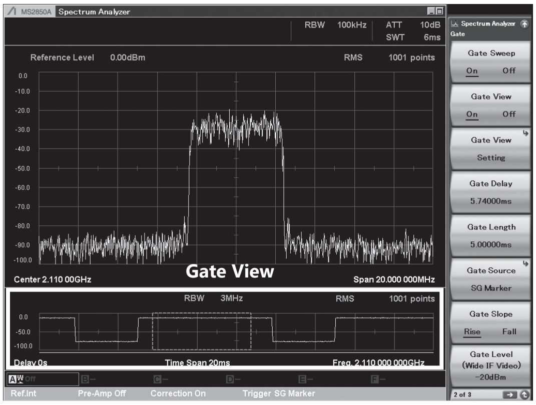


Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	1.997 500 000 00 GHz	-86.24 dBm	6	2.002 500 000 00 GHz	-87.21 dBm
2	1.998 500 000 00 GHz	-86.42 dBm			
3	1.999 500 000 00 GHz	-13.23 dBm			
4	2.000 500 000 00 GHz	-13.28 dBm			
5	2.001 500 000 00 GHz	-85.48 dBm			

Gate View

For efficient gate sweeping when sweeping only the burst- signal on period, the spectrum analyzer functions include an auxiliary screen (Gate View) to display the gate sweep section.



Hardware Standard Functions/Options/Application Parts

Microwave Preselector Bypass (Standard Function)

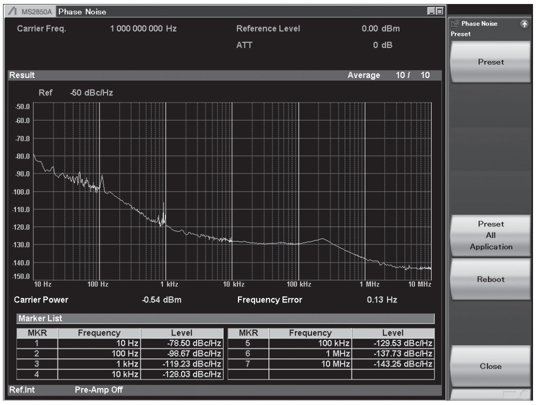
Passing the input signal through a preselector removes generated spurious at microwave and mmWave band measurements. However, in this case, the signal passband width is restricted and the flatness of the in-band frequency characteristics is degraded, both of which can adversely affect FFT analysis and modulation analysis times. As a result, adding a preselector bypass improves the in-band frequency characteristics and supports analysis up to wide bandwidths of 44.5 GHz.

2 dB Step Attenuator (Standard Function)

The built-in attenuator can be set with a resolution of 2 dB and the level of the input signal to the mixer can be adjusted with high resolution to make best use of the MS2850A dynamic range.

Phase Noise Measurement Function (MS2850A-010)

Phase noise can be measured over a frequency offset of 10 Hz to 10 MHz. The local and remote phase noise vs the carrier signal can each be measured by automatically switching to the best filter.



Carrier Freq. 1 000 000 000 Hz
Reference Level 0.00 dBm
ATT 0 dB
Result Average 10 / 10
Ref -50 dBc/Hz
Carrier Power -0.54 dBm
Frequency Error 0.13 Hz

Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	10 Hz	-78.50 dBc/Hz	5	100 kHz	-129.53 dBc/Hz
2	100 Hz	-98.67 dBc/Hz	6	1 MHz	-137.73 dBc/Hz
3	1 kHz	-119.23 dBc/Hz	7	10 MHz	-143.25 dBc/Hz
4	10 kHz	-128.03 dBc/Hz			

Ref.Int Pre-Amp Off

Measurement Screen

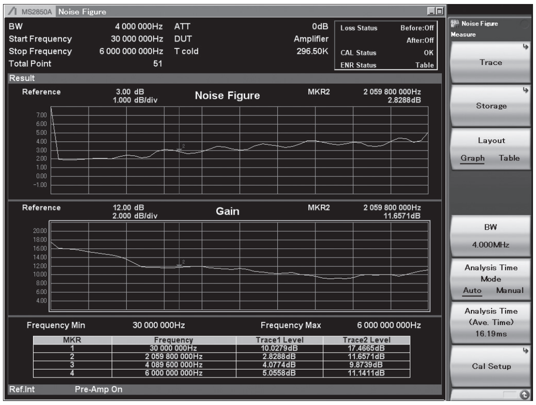
Secondary Storage Device (MS2850A-011)

This removable SSD extends the main unit internal storage capacity to save even more large digitized data files from wideband signals. Removability makes data transfer and exchange easy. The OS is not installed on this SSD and the MS2850A is shipped with the secondary SSD installed in the secondary SSD slot.

Noise Figure Measurement Function (MS2850A-017)

This option measures the noise figure according to the Y-Factor rule using a noise source. The Noisecom Inc. NC346 series of noise sources* is supported.

*: Refer to the MS2850A data sheet for details.



BW 4 000 000Hz
Start Frequency 30 000 000Hz
Stop Frequency 6 000 000 000Hz
Total Point 51
ATT 0dB
DUT Amplifier
T cold 296.50K
Loss Status Before:Off After:Off
CAL Status OK
ENR Status Table

Result

Reference 3.00 dB 1.000 dB/div MKR2 2 059 800 000Hz 2.8288dB

Reference 12.00 dB 2.000 dB/div MKR2 2 059 800 000Hz 11.6571dB

Frequency Min 30 000 000Hz
Frequency Max 6 000 000 000Hz

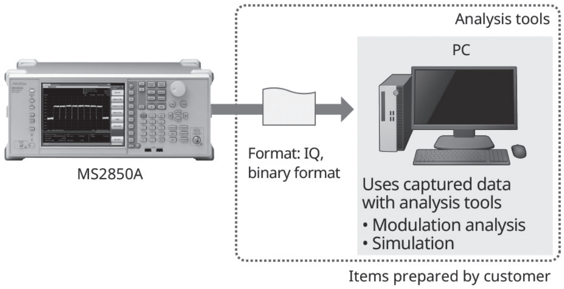
MKR	Frequency	Trace1 Level	Trace2 Level
1	30 000 000Hz	10.0279dB	17.4665dB
2	2 059 800 000Hz	2.8288dB	11.6571dB
3	4 089 600 000Hz	4.0774dB	9.8739dB
4	6 000 000 000Hz	5.0558dB	11.1411dB

Ref.Int Pre-Amp On

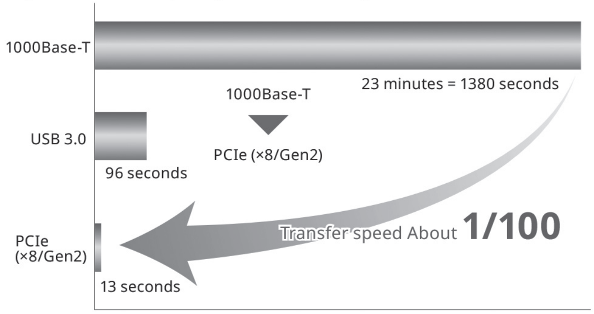
Measurement Result: Example of Graph display
(Frequency Mode: Sweep, Screen Layout: Graph)

External Interface for High Speed Data Transfer PCIe (MS2850A-053)
External Interface for High Speed Data Transfer USB3.0 (MS2850A-054)

The digitized data captured by the main unit is transferred at high speed to the PC, helping improve development efficiency and lower production costs.



IQ Data Transfer Speed (Reference Value)



Time required to transfer 32 GB* of IQ data
*: MS2850A maximum IQ data transfer size
Equivalent to about 3 seconds of digitized data at Span: 1 GHz

Noise Floor Reduction (MS2850A-051)

The Noise Floor Reduction (NFR) function increases the measurement accuracy for low-level signals. It subtracts the internal noise components (11 dB max. nominal) of the measuring instrument itself from the displayed measurement result.

Microwave Preamplifier (MS2850A-068)

With a 20 dB gain, this option improves DANL. It is useful for measuring low-level signals such as noise and interference as well as for measurements via antennas with large path losses.

Frequency Range: 100 kHz to 32 GHz (with MS2850A-047)
100 kHz to 44 .5 GHz (with MS2850A-046)

Low Second Harmonic Distortion (MS2850A-076)

Installation of this option is recommended when measuring secondary harmonics at an input frequency range of 2 GHz to 22.25 GHz. Installing this option upgrades the MS2850A secondary harmonic distortion performance.

Input Frequency	Harmonic Upper: when installed (Lower: when not installed)	SHI* Upper: when installed (Lower: when not installed)
2 GHz to 3 GHz	–80 dBc (–70 dBc)	+70 dBm (+60 dBm)
3 GHz to 22.25 GHz	–90 dBc (–70 dBc)	+80 dBm (+60 dBm)

*: SHI: Second Harmonic Intercept

USB Power Sensor (Sold Separately)

Connecting this sensor to the MS2850A supports power and absolute power measurements.

Model	Frequency Range	Dynamic Range
MA24104A*	600 MHz to 4 GHz	+3 to +51.76 dBm
MA24105A	350 MHz to 4 GHz	+3 to +51.76 dBm
MA24106A	50 MHz to 6 GHz	–40 to +23 dBm
MA24108A	10 MHz to 8 GHz	–40 to +20 dBm
MA24118A	10 MHz to 18 GHz	–40 to +20 dBm
MA24126A	10 MHz to 26 GHz	–40 to +20 dBm

*: MA24104A has been discontinued.

High Performance Waveguide Mixer/External Mixers (Harmonic Mixers)

Two types of mixer can be connected to the MS2850A series (32 GHz/44.5 GHz models) for millimeter-wave-band measurements; spectrum measurements up to 325 GHz are supported using either a High-Performance Waveguide Mixer or an external harmonic mixer.
In particular, High Performance Waveguide Mixer are ideal for analyzing the true spectrum of millimeter-wave-band transmitters due to its excellent wide dynamic range.

High Performance Waveguide Mixer MA2806A/MA2808A

Model	Name	Frequency Band	Frequency Range	Waveguide	Flange
MA2806A	High Performance Waveguide Mixer (50 to 75 GHz)	V band	50 GHz to 75 GHz	WR15	UG-385/U
MA2808A	High Performance Waveguide Mixer (60 to 90 GHz)	E band	60 GHz to 90 GHz	WR12	UG-387/U

The widest analysis bandwidth of MS2850A is 510 MHz when connecting MS2850A to MA2806A/MA2808A.

MA2808A

Features

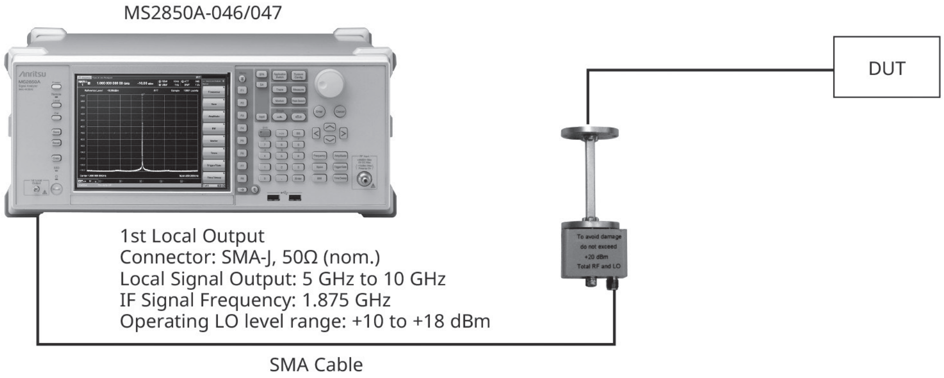
- Wide dynamic range based on excellent minimum sensitivity and P1dB performance
- Image-response-free measurement of wideband signals plus high IF frequency and PS function

For further information see MA2806A/MA2808A page.

External Mixers (Harmonic Mixers)

Connecting the MS2850A to the MA2740C/MA2750C series of External Mixers (Harmonic Mixers) supports spectrum measurements up to 325 GHz with low costs.

Model	Name	Frequency Band	Frequency Range	Waveguide	Flange	
						UG-xxx/U Equivalent
MA2741C	External Mixer	A Band	26.5 GHz to 40 GHz	WR28	MIL-DTL-3922/54-003	UG-599U
MA2742C	External Mixer	Q Band	33 GHz to 50 GHz	WR22	MIL-DTL-3922/67D-006	UG-383U
MA2743C	External Mixer	U Band	40 GHz to 60 GHz	WR19	MIL-DTL-3922/67D-007	UG-383U-M
MA2744C	External Mixer	V Band	50 GHz to 75 GHz	WR15	MIL-DTL-3922/67D-008	UG-385/U
MA2745C	External Mixer	E Band	60 GHz to 90 GHz	WR12	MIL-DTL-3922/67D-009	UG-387/U
MA2746C	External Mixer	W Band	75 GHz to 110 GHz	WR10	MIL-DTL-3922/67D-010	UG-387/U-M
MA2747C	External Mixer	F Band	90 GHz to 140 GHz	WR08	MIL-DTL-3922/67D-M08	UG-387/U-M
MA2748C	External Mixer	D Band	110 GHz to 170 GHz	WR06	MIL-DTL-3922/67D-M06	UG-387/U-M
MA2749C	External Mixer	G Band	140 GHz to 220 GHz	WR05	MIL-DTL-3922/67D-M05	UG-387/U-M
MA2750C	External Mixer	Y Band	170 GHz to 260 GHz	WR04	MIL-DTL-3922/67D-M04	UG-387/U-M
MA2751C	External Mixer	J Band	220 GHz to 325 GHz	WR03	MIL-DTL-3922/67D-M03	UG-387/U-M



1st Local Output
Connector: SMA-J, 50Ω (nom.)
Local Signal Output: 5 GHz to 10 GHz
IF Signal Frequency: 1.875 GHz
Operating LO level range: +10 to +18 dBm

Connection Setup

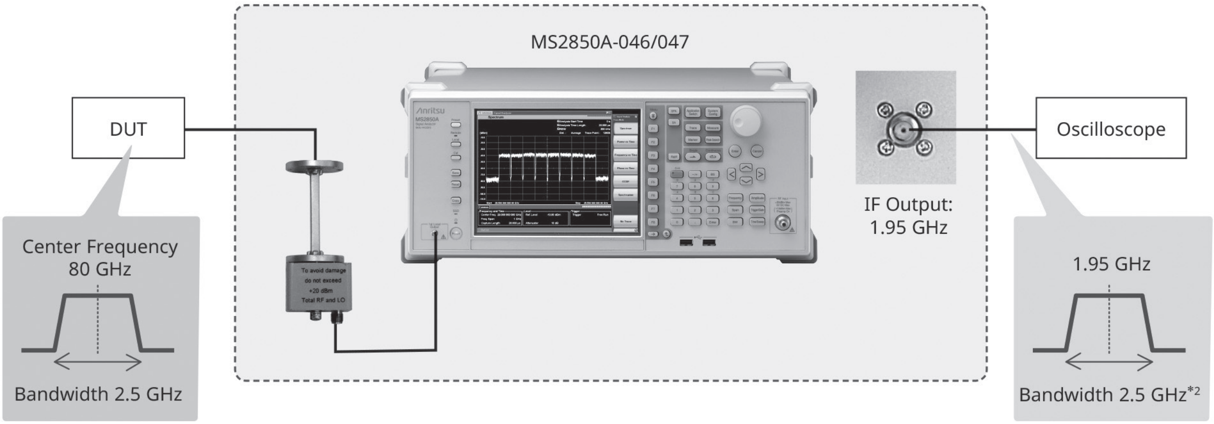
FFT Analysis in Millimeter Wave Band

The signal-analyzer functions can be used by connecting either the High-Performance Waveguide mixer or an external mixer. This helps improve troubleshooting efficiency when confirming transient phenomena, such as a degraded spectrum that cannot be captured using a sweep-type spectrum analyzer.
Additionally, MS2850A supports down converting signals up to a maximum bandwidth of 2.5 GHz through IF out port. This can be used as down converter when performing modulation analysis by digitizing with an oscilloscope, etc.

	Maximum Bandwidth set by MS2850A	Maximum Bandwidth as Down Converter
High Performance Waveguide Mixer MA2806A/MA2808A	510 MHz*1	510 MHz*1
External Mixer MA2740C/MA2750C Series	1 GHz	2.5 GHz

*1: The widest analysis bandwidth of MS2850A is 510 MHz.

Measurement image: Down convert signals with 80 GHz center frequency and 2.5 GHz*2 bandwidth to 1.95 GHz



*2: When using external mixer bands (MA2740C/MA2750C Series), or using internal micro frequency bands (Band; 3 to 9) with Microwave Preselector Bypass MS2850A-067: On

Software Options

Measurement software options are provided with modulation analysis functions supporting various communications methods.
For details refer to the MX2690xxA Series, MX2830xxA Series, MX2840xxA Series, MX2850xxA Series Measurement Software brochure.

W-CDMA/HSPA Downlink Measurement Software MX269011A

This software is for measuring the RF Tx characteristics of W-CDMA/HSDPA/HSPA Evolution base stations.

W-CDMA/HSPA Uplink Measurement Software MX269012A

This software is for measuring the RF Tx characteristics of W-CDMA/HSUPA/HSPA Evolution terminals.

GSM/EDGE Measurement Software MX269013A
EDGE Evolution Measurement Software MX269013A-001

This software is for measuring the RF Tx characteristics of GSM/EDGE (EGPRS) and EDGE Evolution (EGPRS2) base stations and terminals.

TD-SCDMA Measurement Software MX269015A

This software is for measuring the RF Tx characteristics of TD-SCDMA base stations and terminals. It supports multiple modulation methods, including ASK, FSK, QPSK, QAM, etc.

LTE Downlink Measurement Software MX269020A
LTE-Advanced FDD Downlink Measurement Software MX269020A-001
LTE TDD Downlink Measurement Software MX269022A
LTE-Advanced TDD Downlink Measurement Software MX269022A-001

This software is for measuring the RF Tx characteristics of LTE/LTE-Advanced base stations.

LTE Uplink Measurement Software MX269021A
LTE-Advanced FDD Uplink Measurement Software MX269021A-001
LTE TDD Uplink Measurement Software MX269023A
LTE-Advanced TDD Uplink Measurement Software MX269023A-001

This software is for measuring the RF Tx characteristics of LTE/LTE-Advanced terminals.

5G Standard Measurement Software (Base License) MX285051A
Pre-Standard CP-OFDM Downlink MX285051A-001
Pre-Standard CP-OFDM Uplink MX285051A-051
NR TDD sub-6 GHz Downlink MX285051A-011
NR TDD sub-6 GHz Uplink MX285051A-061
NR FDD sub-6 GHz Downlink MX285051A-031
NR FDD sub-6 GHz Uplink MX285051A-081
NR TDD mmWave Downlink MX285051A-021
NR TDD mmWave Uplink MX285051A-071

This software is for measuring the RF Tx characteristics of 5G base stations and terminals.

Vector Signal Analysis Software MX269017A
APSK Analysis MX269017A-001
Higher-Order QAM Analysis MX269017A-011

This software is for measuring the RF Tx characteristics of base stations and terminals using various digital wireless methods.

Supported Modulation Technologies
BPSK, QPSK, O-QPSK, π/4 DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 2FSK, 4FSK, 2ASK, 4ASK, H-CPM, MSK

The software options as below are required.

Option	Modulation
MX269017A-001	16APSK, 32APSK
MX269017A-011	512QAM, 1024QAM, 2048QAM

5G Standard Measurement Software (Base License) **MX285051A**
Pre-Standard CP-OFDM Downlink **MX285051A-001**
Pre-Standard CP-OFDM Uplink **MX285051A-051**

The MX285051A-001 and MX285051A-051 software packages are for measuring the RF characteristics of CP-OFDM modulation downlink and uplink signals expected to be used for 5G demonstration tests and test operations.

Single Carrier Measurement

This function analyzes a 100 MHz band carrier to display the constellation, frequency error, Tx power, modulation accuracy (EVM), etc.

Multicarrier Measurement

Combination with the Analysis Bandwidth Extension to 1 GHz MS2850A-034 option supports batch (all-at-once) analysis of up to eight 100 MHz band carriers to display the frequency error for each carrier, Tx power, EVM, timing difference, etc.

Analysis Bandwidth	Batch Analysis Carrier Count
255 MHz (standard)	2
510 MHz (option)	5
1 GHz (option)	8

Numeric Results

Name	Unit	Single Carrier Measurement	Multicarrier Measurement	Remarks
Common				
Frequency Error	Hz, ppm	✓	✓	Displays frequency error
Transmit Power	dBm	✓	✓	Displays Tx power
Total EVM (rms/peak)	%, dB	✓	✓	Displays EVM rms/peak values
Origin Offset	dB	✓		Displays Origin Offset value
Time Offset	ns	✓		Displays time offset between Frame header and trigger in ns units Displays Trigger Switch = On only when using external trigger
Timing Difference	ns		✓	Displays timing difference between reference carrier and each carrier
Symbol Clock Error	ppm	✓		Displays Symbol Clock Error
IQ Skew	ns	✓		Displays IQ Skew
IQ Imbalance	dB	✓		Displays IQ Imbalance in dB units
IQ Quadrature Error	deg.	✓		Displays IQ Quadrature Error
Tx Total Power	dBm		✓	Displays total power of all carriers
Tx Power Flatness	dB		✓	Displays maximum power difference between carriers
Downlink				
xPDSCH EVM (rms/peak)	%, dB	✓		Displays EVM rms/peak values for QPSK/16QAM/64QAM
P-SS	%, dB, dBm	✓		Displays average EVM (rms) and maximum EVM (peak) as well as average power (dBm) for each PHY channel
S-SS		✓		
E-SS		✓		
BRS		✓		
xPBCH		✓		
xPDSCH		✓		
xPDCCH		✓		
UE-RS (xPDSCH)		✓		
UE-RS (xPDSCH)		✓		
Uplink				
xPUSCH EVM (rms/peak)	%, dB	✓		Displays EVM rms/peak value for QPSK/16QAM/64QAM
xPUSCH	%, dB, dBm	✓		Displays average EVM (rms) and maximum EVM (peak) as well as average power (dBm) for each PHY channel
DM-RS (xPUSCH)		✓		

Graph Displays

Name	Single Carrier Measurement	Multicarrier Measurement
Constellation	✓	
EVM vs. Subcarrier	✓	
EVM vs. Symbol	✓	
Spectral Flatness (Amplitude/Phase)	✓	
Power vs. RB	✓	✓
EVM vs. RB	✓	✓
Summary	✓	✓

5G Standard Measurement Software (Base License)	**MX285051A**		
NR TDD sub-6 GHz Downlink	**MX285051A-011**	**NR TDD sub-6 GHz Uplink**	**MX285051A-061**
NR FDD sub-6 GHz Downlink	**MX285051A-031**	**NR FDD sub-6 GHz Uplink**	**MX285051A-081**
NR TDD mmWave Downlink	**MX285051A-021**	**NR TDD mmWave Uplink**	**MX285051A-071**

The 5G measurement software are installed in the MS2850A for developing and manufacturing 5G radio equipment.
They support analyses of both uplink and downlink signals used by the sub-6 GHz and mmWave bands in the 5G NR standards by specifying combinations of multiple component carriers (up to 400 MHz) and subcarrier spacing.

Features

All-in-one sub-6 GHz and mmWave Coverage

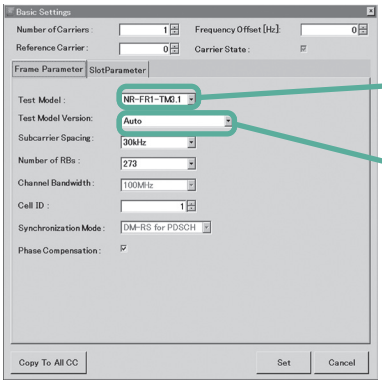
Both 5G NR sub-6 GHz and mmWave are covered by installing the MX285051A options.
Setting Frequency Ranges: 100 MHz to 32 GHz (with MS2850A-047 installed), 100 MHz to 44.5 GHz (with MS2850A-046 installed)

Supported Measurement Functions

Supported Software	Modulation Analysis	Carrier Aggregation Analysis	Power vs. Time
NR TDD sub-6 GHz Downlink MX285051A-011	✓	✓	✓
NR FDD sub-6 GHz Downlink MX285051A-031	✓	✓	—
NR TDD mmW Downlink MX285051A-021	✓	✓	✓
NR TDD sub-6 GHz Uplink MX285051A-061	✓	—	—
NR FDD sub-6 GHz Uplink MX285051A-081	✓	—	—
NR TDD mmW Uplink MX285051A-071	✓	—	—

Easy operability for higher measurement/test efficiency

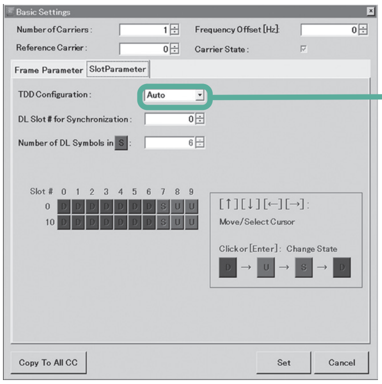
- The Phy channel can be measured simply by specifying the measured test model.



Number of Carriers: 1
Frequency Offset [Hz]: 0
Reference Carrier: 0
Carrier State: ☑
Test Model: NR-FR1-TM3.1
Test Model Version: Auto
Subcarrier Spacing: 30kHz
Number of RBs: 273
Channel Bandwidth: 100MHz
Cell ID: 1
Synchronization Mode: DM-RS for PDSCH
Phase Compensation: ☑

Easy physical channel setting by selecting test model name

Auto-detect function eliminates setting problems



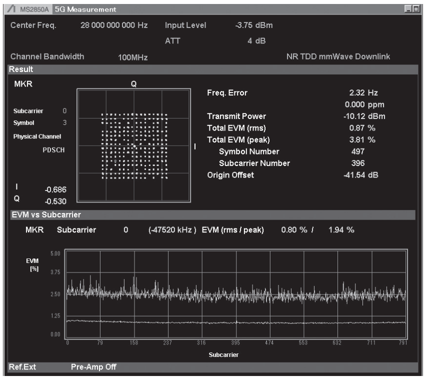
Number of Carriers: 1
Frequency Offset [Hz]: 0
Reference Carrier: 0
Carrier State: ☑
TDD Configuration: Auto
DL Slot # for Synchronization: 0
Number of DL Symbols in S: 6

[↑][↓][←][→]: Move/Select Cursor

Click or [Enter]: Change State D → U → S → D

In addition to the 3GPP-defined TDD Configuration, the TDD Configuration signal in actual use can be measured easily using the auto-detect function

- The one-button Auto Range function optimizes the complex built-in attenuator settings, required for more accurate EVM measurement.



Center Freq. 28 000 000 000 Hz
Input Level -3.75 dBm
ATT 4 dB
Channel Bandwidth 100MHz
NR TDD mmWave Downlink

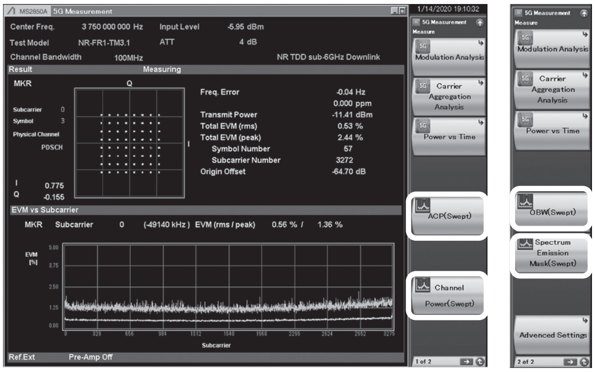
Subcarrier 0
Symbol 3
Physical Channel PDSCH
I -0.686
Q -0.530

Freq. Error 2.32 Hz
0.000 ppm
Transmit Power -10.12 dBm
Total EVM (rms) 0.87 %
Total EVM (peak) 3.81 %
Symbol Number 497
Subcarrier Number 396
Origin Offset -41.54 dB

MKR Subcarrier 0 (-47520 kHz) EVM (rms / peak) 0.80 % / 1.94 %

Ref.Ext Pre-Amp Off

- This function makes it easy to measure Channel Power, OBW, ACLR and SEM.
  The measurement software calls Signal Analyzer function and the measurement performed according to the handed over parameter settings.



Center Freq. 3 750 000 000 Hz
Input Level -5.95 dBm
Test Model NR-FR1-TM3.1
ATT 4 dB
Channel Bandwidth 100MHz
NR TDD sub-6GHz Downlink

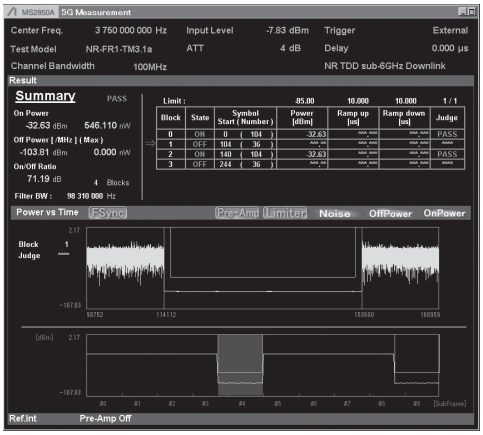
Subcarrier 0
Symbol 3
Physical Channel PDSCH
I 0.775
Q -0.155

Freq. Error -0.04 Hz
0.000 ppm
Transmit Power -11.41 dBm
Total EVM (rms) 0.53 %
Total EVM (peak) 2.44 %
Symbol Number 57
Subcarrier Number 3272
Origin Offset -64.70 dB

MKR Subcarrier 0 (-49140 kHz) EVM (rms / peak) 0.56 % / 1.36 %

Ref.Ext Pre-Amp Off

- Power vs. Time measurements are supported.
  Off power and Transient period measurements are supported in both sub-6 GHz and mmWave that are required for 3GPP TS 38.141-1/2 specified Transient On/Off Power.
  The measurement results are displayed with Power vs. Time graph.



Center Freq. 3 750 000 000 Hz
Input Level -7.83 dBm
Trigger External
Test Model NR-FR1-TM3.1a
ATT 4 dB
Delay 0.000 µs
Channel Bandwidth 100MHz
NR TDD sub-6GHz Downlink

Summary PASS
On Power -32.63 dBm 546.110 nW
Off Power [/MHz] (Max) -103.81 dBm 0.000 nW
On/Off Ratio 71.19 dB
4 Blocks
Filter BW : 98 310 000 Hz

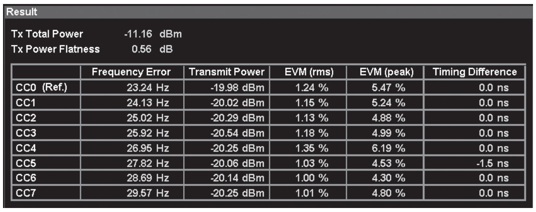
Block	State	Symbol Start (Number)	Power [dBm]	Ramp up [us]	Ramp down [us]	Judge
Limit :			-85.00	10.000	10.000	1 / 1
0	ON	0 (104)	-32.63	***.***	***.***	PASS
1	OFF	104 (36)	***.**	***.***	***.***	****
2	ON	140 (104)	-32.63	***.***	***.***	PASS
3	OFF	244 (36)	***.**	***.***	***.***	****

Block 1
Judge ****

Ref.Int Pre-Amp Off

All-at-Once Measurement and Analysis of 8 CCs max in 1-GHz Analysis Bandwidth

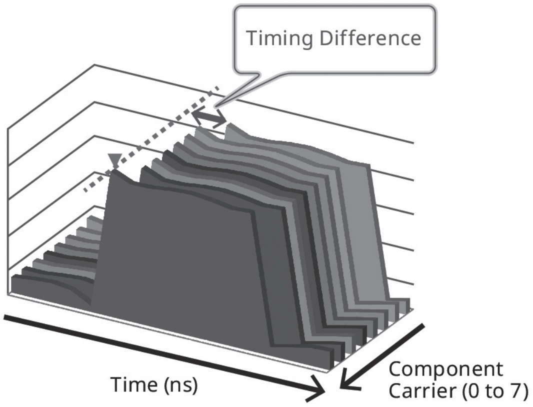
Combined use with the Analysis Bandwidth Extension to 1 GHz option (MS2850A-034) supports all-at-once measurement of up to 8 CCs (8 carriers × 100 MHz). Since this eliminates individual measurement of multiple component carriers, the characteristics of single carriers can be evaluated in shorter times. Additionally, all-at-once measurement of all carriers not only supports EVM and frequency error measurements for each carrier but also enables time difference measurements for each carrier.


Result

Tx Total Power -11.16 dBm
Tx Power Flatness 0.56 dB

	Frequency Error	Transmit Power	EVM (rms)	EVM (peak)	Timing Difference
CC0 (Ref.)	23.24 Hz	-19.98 dBm	1.24 %	5.47 %	0.0 ns
CC1	24.13 Hz	-20.02 dBm	1.15 %	5.24 %	0.0 ns
CC2	25.02 Hz	-20.29 dBm	1.13 %	4.88 %	0.0 ns
CC3	25.92 Hz	-20.54 dBm	1.18 %	4.99 %	0.0 ns
CC4	26.95 Hz	-20.25 dBm	1.35 %	6.19 %	0.0 ns
CC5	27.82 Hz	-20.06 dBm	1.03 %	4.53 %	-1.5 ns
CC6	28.69 Hz	-20.14 dBm	1.00 %	4.30 %	0.0 ns
CC7	29.57 Hz	-20.25 dBm	1.01 %	4.80 %	0.0 ns

Batch (All-at-Once) Carrier Measurements (Numeric Results)



All-at-One Multi-carrier Measurement Software

Supported Software	Analysis Bandwidth Extension Option	Channel Bandwidth	Max. Component Carrier Count
NR TDD sub-6 GHz Downlink MX285051A-011 NR FDD sub-6 GHz Downlink MX285051A-031	Not installed (Max. Analysis Bandwidth: 255 MHz) MS2850A-033 (Max. Analysis Bandwidth: 510 MHz) MS2850A-034 (Max. Analysis Bandwidth: 1 GHz)	5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz	2
NR TDD mmW Downlink MX285051A-021	Not installed (Max. Analysis Bandwidth: 255 MHz)	50 MHz	5
		100 MHz	2
		200 MHz	1
	MS2850A-033 (Max. Analysis Bandwidth: 510 MHz)	50 MHz	8
		100 MHz	5
		200 MHz	2
		400 MHz	1
	MS2850A-034 (Max. Analysis Bandwidth: 1 GHz)	50 MHz	8
		100 MHz	8
		200 MHz	4
		400 MHz	2

Numeric Results

Name	Unit	Modulation Analysis	Carrier Aggregation Analysis	Power vs. Time	Remarks
Common					
Frequency Error	Hz, ppm	✓	✓		Displays frequency error
Transmit Power	dBm	✓			Displays Tx power
Total EVM (rms/peak)	%, dB	✓	✓		Displays EVM rms/peak values
Origin Offset	dB	✓			Displays Origin Offset value
Time Offset (External Trigger)	ns	✓			Displays time offset between Frame header and trigger in ns units Displays Trigger Switch = On only when using external trigger
Timing Difference	ns		✓		Displays timing difference between reference carrier and each carrier
Symbol Clock Error	ppm	✓			Displays Symbol Clock Error
IQ Skew	ns	✓			Displays IQ Skew
IQ Imbalance	dB	✓			Displays IQ Imbalance in dB units
IQ Quad Error	deg.	✓			Displays IQ Quadrature Error
Downlink					
P-SS	%, dB, dBm	✓			Displays average EVM (rms) and maximum EVM (peak) as well as S-SS · average power (dBm) for each PHY channel
S-SS		✓			
PBCH		✓			
DM-RS (PBCH)		✓			
PDSCH		✓			
DM-RS (PDSCH)		✓			
PDCCH		✓			
DM-RS (PDCCH)		✓			
Cell ID	—	✓			Displays Cell ID
OFDM Symbol Tx Power	—	✓			Displays OSTP
On Power	dBm, W			✓	Displays average On power
Off Power	dBm, W			✓	Displays average Off power
On/Off Ratio	dB			✓	Display On/Off power ratio
Power	dBm			✓	Displays Block Tx power
Ramp up	μs			✓	Displays signal rise time (only On sections)
Ramp down	μs			✓	Displays signal fall time (only On sections)

Continued on next page

Name	Unit	Modulation Analysis	Carrier Aggregation Analysis	Power vs. Time	Remarks
Uplink					
PUSCH	%, dB, dBm	✓			Displays average EVM (rms) and maximum EVM (peak) as well as S-SS · average power (dBm) for each PHY channel
DM-RS (PUSCH)		✓			

Graph Displays

Name	Modulation Analysis	Carrier Aggregation Analysis	Power vs. Time
Constellation	✓		
EVM vs. Subcarrier	✓		
EVM vs. Symbol	✓		
Spectral Flatness (Amplitude/Phase)	✓		
Power vs. RB	✓	✓	
EVM vs. RB	✓	✓	
Summary	✓	✓	
Power vs. Time			✓

Standard		3GPP TS 38.211 (2019-06)					
Model/Name		NR TDD sub-6 GHz Downlink MX285051A-011	NR FDD sub-6 GHz Downlink MX285051A-031	NR TDD mmW Downlink MX285051A-021	NR TDD sub-6 GHz Uplink MX285051A-061	NR FDD sub-6 GHz Uplink MX285051A-081	NR TDD mmW Uplink MX285051A-071
Measurement Frequency Range		800 MHz to 5 GHz	400 MHz to 6 GHz	28 GHz	800 MHz to 5 GHz	400 MHz to 6 GHz	28 GHz
Frequency Range		100 MHz to 32 GHz (MS2850A-047) 100 MHz to 44.5 GHz (MS2850A-046)					
Test Model		NR-FR1-TM1.1, NR-FR1-TM1.2, NR-FR1-TM2, NR-FR1-TM2a, NR-FR1-TM3.1, NR-FR1-TM3.1a, NR-FR1-TM3.2, NR-FR1-TM3.3		NR-FR2-TM1.1, NR-FR2-TM2, NR-FR2-TM3.1	—		
Subcarrier Spacing (SCS)		15 kHz, 30 kHz, 60 kHz		60 kHz, 120 kHz	15 kHz, 30 kHz, 60 kHz		60 kHz, 120 kHz
Channel Bandwidth		5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz		50, 100, 200, 400 MHz	5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz		50, 100, 200, 400 MHz
Modulation		CP-OFDM QPSK, 16QAM, 64QAM, 256QAM, Auto			CP-OFDM/DFT-S-OFDM PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM, Auto		
Measurement Channel		SS-Block, PDSCH, PDCCH, PT-RS for PDSCH			PUSCH, PT-RS for PUSCH		
Component Carrier	Maximum Number of CCs	2	2	8	1	1	1
	Channel Bandwidth of each CC	to 100 MHz	to 100 MHz	50, 100 MHz	to 100 MHz	to 100 MHz	to 400 MHz

RB Number Table

The channel bandwidth is defined in accordance with SCS and RB.

		NR TDD/FDD sub-6 GHz DL/UL Channel Bandwidth [MHz] (1CC)												
		5	10	15	30	20	25	40	50	60	70	80	90	100
SCS [kHz]	15	25	52	79	160	106	133	216	270	N.A	N.A	N.A	N.A	N.A
	30	11	24	38	78	51	65	106	133	162	189	217	245	273
	60	N.A	11	18	24	31	38	51	65	79	93	107	121	135

		NR TDD mmWave DL/UL Channel Bandwidth [MHz] (1CC)			
		50	100	200	400
SCS [kHz]	60	66	132	264	N.A
	120	32	66	132	264

Channel Bandwidth

The maximum channel bandwidth is determined by the Analysis Bandwidth option.

		Maximum Analysis Bandwidth
MS2850A	Standard	255 MHz
	MS2850A-033	510 MHz
	MS2850A-034	1 GHz

5G Standard Measurement Software (Base License)	**MX285051A**
NR TDD sub-6 GHz Downlink	**MX285051A-011**
NR TDD sub-6 GHz Uplink	**MX285051A-061**

Specifications

<table>
<tr><td colspan="2">Signal Analyzer</td><td colspan="2">MS2850A</td></tr>
<tr><td colspan="2">Option</td><td>NR TDD sub-6 GHz Downlink
MX285051A-011</td><td>NR TDD sub-6 GHz Uplink
MX285051A-061</td></tr>
<tr><td rowspan="5">Electrical Characteristics</td><td>Target Signals</td><td>TS 38.211 Sub-6 GHz compliant downlink signal</td><td>TS 38.211 Sub 6-GHz compliant uplink signal</td></tr>
<tr><td>Channel Bandwidth</td><td colspan="2"><table>
<tr><th>Subcarrier Spacing</th><th>Channel Bandwidth</th></tr>
<tr><td>15 kHz</td><td>5 MHz (RB: 25), 10 MHz (RB: 52), 15 MHz (RB: 79), 20 MHz (RB: 106), 25 MHz (RB: 133), 30 MHz (RB: 160), 40 MHz (RB: 216), 50 MHz (RB: 270)</td></tr>
<tr><td>30 kHz</td><td>5 MHz (RB: 11), 10 MHz (RB: 24), 15 MHz (RB: 38), 20 MHz (RB: 51), 25 MHz (RB: 65), 30 MHz (RB: 78), 40 MHz (RB: 106), 50 MHz (RB: 133), 60 MHz (RB: 162), 70 MHz (RB: 189), 80 MHz (RB: 217), 90 MHz (RB: 245), 100 MHz (RB: 273)</td></tr>
<tr><td>60 kHz</td><td>10 MHz (RB: 11), 15 MHz (RB: 18), 20 MHz (RB: 24), 25 MHz (RB: 31), 30 MHz (RB: 38), 40 MHz (RB: 51), 50 MHz (RB: 65), 60 MHz (RB: 79), 70 MHz (RB: 93), 80 MHz (RB: 107), 90 MHz (RB: 121), 100 MHz (RB: 135)</td></tr>
</table></td></tr>
<tr><td>Capture Time</td><td colspan="2">1 to 2 Frame</td></tr>
<tr><td>Frequency Setting Range</td><td colspan="2">MS2850A-047: 100 MHz to 32 GHz
MS2850A-046: 100 MHz to 44.5 GHz</td></tr>
<tr><td>Measurement Frequency Range</td><td colspan="2">800 MHz to 5 GHz</td></tr>
<tr><td rowspan="3">Modulation/ Frequency Measurement</td><td>Measurement Level Range</td><td colspan="2">–10 to +30 dBm (Preamp Off, or Preamp not installed)
–30 to +10 dBm (Preamp On)</td></tr>
<tr><td>Carrier Frequency Measurement Accuracy</td><td>At 18°C to 28°C, After calibration, EVM = 1% (rms) signal 1 Frame at downlink signal
Only 1 carrier of 100 MHz width (Subcarrier Spacing: 30 kHz) or 50 MHz width (Subcarrier Spacing: 15 kHz) at center frequency
± (Accuracy of reference frequency × carrier frequency + 10) Hz</td><td>At 18°C to 28°C, After calibration, EVM = 1% (rms) signal 1 Frame at uplink signal
Only 1 carrier of 100 MHz width (Subcarrier Spacing: 30 kHz) or 50 MHz width (Subcarrier Spacing: 15 kHz) at center frequency
± (Accuracy of reference frequency × carrier frequency + 10) Hz</td></tr>
<tr><td>Residual Vector Error</td><td>At 18°C to 28°C, After calibration
1 Frame at downlink signal
Only 1 carrier of 100 MHz width (Subcarrier Spacing: 30 kHz) or 50 MHz width (Subcarrier Spacing: 15 kHz) at center frequency
≤1.0%</td><td>At 18°C to 28°C, After calibration
1 Frame at uplink signal
Only 1 carrier of 100 MHz width (Subcarrier Spacing: 30 kHz) or 50 MHz width (Subcarrier Spacing: 15 kHz) at center frequency
≤1.0%</td></tr>
<tr><td rowspan="2">Amplitude Measurement</td><td>Measurement Level Range</td><td colspan="2">–10 to +30 dBm (Preamp Off, or Preamp not installed)
–30 to +10 dBm (Preamp On)</td></tr>
<tr><td>Tx Power Measurement Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main frame.)</td><td colspan="2">At 18°C to 28°C, After calibration, Input attenuator ≥10 dB
Input signal within measurement level range and below value set at Input Level
Only 1 carrier at center frequency<table>
<tr><th>Frequency Range</th><th>Preamp Off, or without Preamp</th><th>Preamp On</th></tr>
<tr><td>800 MHz ≤ Frequency < 4 GHz</td><td>±0.74 dB (nom.)</td><td>±1.27 dB (nom.)</td></tr>
<tr><td>4 GHz ≤ Frequency < 4.2 GHz</td><td>±1.48 dB (nom.)</td><td>±2.11 dB (nom.)</td></tr>
<tr><td>4.2 GHz ≤ Frequency ≤ 5 GHz</td><td>±1.45 dB (nom.)</td><td>±1.94 dB (nom.)</td></tr>
</table></td></tr>
<tr><td colspan="2">Waveform Display</td><td colspan="2">Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Spectral Flatness, Power vs. RB, EVM vs. RB, Power vs. Time (NR TDD sub-6 GHz Downlink MX285051A-011)</td></tr>
<tr><td rowspan="3">Digitize Function</td><td>Function Overview</td><td colspan="2">Supports output of captured waveform data to internal storage or external storage</td></tr>
<tr><td>Waveform Data</td><td colspan="2">Format: I, Q (32 bit floating point binary format)
Level: Assumes as $\sqrt{(I^2 + Q^2)}$ = 1 for 0 dBm input
Level accuracy: Same as absolute amplitude accuracy and in-band frequency characteristics of the signal analyzer</td></tr>
<tr><td>Replay Function</td><td colspan="2">Analyzes traces of saved waveform data
Format: I, Q (32 bit floating point binary format)
Sampling Rate:<table>
<tr><th>Channel Bandwidth</th><th>Without MS2850A-033</th><th>With MS2850A-033</th></tr>
<tr><td>≤100 MHz</td><td>162.5 MHz</td><td>162.5 MHz</td></tr>
</table></td></tr>
<tr><td>Power vs. Time Measurement</td><td>Displayed Average Noise</td><td>This is calculated up to 5 GHz from the Display Average Noise Level for the signal analyzer with MS2850A-033/034 option installed at no signal input and an ambient temperature range of 18°C to 28°C when Wide Dynamic Range = On, Noise Correction = On, Pre-AMP = On.
–95 dBm/MHz (nominal)</td><td>—</td></tr>
</table>

5G Standard Measurement Software (Base License) MX285051A
NR FDD sub-6 GHz Downlink MX285051A-031
NR FDD sub-6 GHz Uplink MX285051A-081

Specifications

<table>
<tr><td colspan="2">Signal Analyzer</td><td colspan="2">MS2850A</td></tr>
<tr><td colspan="2">Option</td><td>NR FDD sub-6 GHz Downlink
MX285051A-031</td><td>NR FDD sub-6 GHz Uplink
MX285051A-081</td></tr>
<tr><td rowspan="5">Electrical Characteristics</td><td>Target Signals</td><td>TS 38.211 Sub-6 GHz compliant downlink signal</td><td>TS 38.211 Sub 6-GHz compliant uplink signal</td></tr>
<tr><td>Channel Bandwidth</td><td colspan="2"><table>
<tr><td>Subcarrier Spacing</td><td>Channel Bandwidth</td></tr>
<tr><td>15 kHz</td><td>5 MHz (RB: 25), 10 MHz (RB: 52), 15 MHz (RB: 79), 20 MHz (RB: 106), 25 MHz (RB: 133), 30 MHz (RB: 160), 40 MHz (RB: 216), 50 MHz (RB: 270)</td></tr>
<tr><td>30 kHz</td><td>5 MHz (RB: 11), 10 MHz (RB: 24), 15 MHz (RB: 38), 20 MHz (RB: 51), 25 MHz (RB: 65), 30 MHz (RB: 78), 40 MHz (RB: 106), 50 MHz (RB: 133), 60 MHz (RB: 162), 70 MHz (RB: 189), 80 MHz (RB: 217), 90 MHz (RB: 245), 100 MHz (RB: 273)</td></tr>
<tr><td>60 kHz</td><td>10 MHz (RB: 11), 15 MHz (RB: 18), 20 MHz (RB: 24), 25 MHz (RB: 31), 30 MHz (RB: 38), 40 MHz (RB: 51), 50 MHz (RB: 65), 60 MHz (RB: 79), 70 MHz (RB: 93), 80 MHz (RB: 107), 90 MHz (RB: 121), 100 MHz (RB: 135)</td></tr>
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<tr><td>Capture Time</td><td colspan="2">1 to 2 Frame</td></tr>
<tr><td>Frequency Setting Range</td><td colspan="2">MS2850A-047: 100 MHz to 32 GHz
MS2850A-046: 100 MHz to 44.5 GHz</td></tr>
<tr><td>Measurement Frequency Range</td><td colspan="2">400 MHz to 6 GHz</td></tr>
<tr><td rowspan="3">Modulation/ Frequency Measurement</td><td>Measurement Level Range</td><td colspan="2">–10 to +30 dBm (Preamp Off, or Preamp not installed)
–30 to +10 dBm (Preamp On)</td></tr>
<tr><td>Carrier Frequency Measurement Accuracy</td><td>At 18°C to 28°C, After calibration, EVM = 1% (rms) signal 1 Frame at downlink signal
Only 1 carrier of 100 MHz (Subcarrier Spacing: 30 kHz) width or 50 MHz (Subcarrier Spacing: 15 kHz) width at center frequency
However, Only 1 carrier of 25 MHz (Subcarrier Spacing: 15 kHz, 30 kHz, 60 kHz) width at 400 MHz ≤ frequency < 800 MHz
± (Accuracy of reference frequency × carrier frequency + 10) Hz</td><td>At 18°C to 28°C, After calibration, EVM = 1% (rms) signal 1 Frame at uplink signal
Only 1 carrier of 100 MHz (Subcarrier Spacing: 30 kHz) width or 50 MHz (Subcarrier Spacing: 15 kHz) width at center frequency
However, Only 1 carrier of 25 MHz (Subcarrier Spacing: 15 kHz, 30 kHz, 60 kHz) width at 400 MHz ≤ frequency < 800 MHz
± (Accuracy of reference frequency × carrier frequency + 10) Hz</td></tr>
<tr><td>Residual Vector Error</td><td>At 18°C to 28°C, After calibration, EVM = 1% (rms) signal 1 Frame at downlink signal
Only 1 carrier of 100 MHz (Subcarrier Spacing: 30 kHz) width or 50 MHz (Subcarrier Spacing: 15 kHz) width at center frequency
However, Only 1 carrier of 25 MHz (Subcarrier Spacing: 15 kHz, 30 kHz, 60 kHz) width at 400 MHz ≤ frequency < 800 MHz
≤1.0%</td><td>At 18°≤ to 28°C, After calibration, EVM = 1% (rms) signal 1 Frame at uplink signal
Only 1 carrier of 100 MHz (Subcarrier Spacing: 30 kHz) width or 50 MHz (Subcarrier Spacing: 15 kHz) width at center frequency
However, Only 1 carrier of 25 MHz (Subcarrier Spacing: 15 kHz, 30 kHz, 60 kHz) width at 400 MHz ≤ frequency < 800 MHz
≤1.0%</td></tr>
<tr><td rowspan="2">Amplitude Measurement</td><td>Measurement Level Range</td><td colspan="2">–10 to +30 dBm (Preamp Off, or Preamp not installed)
–30 to +10 dBm (Preamp On)</td></tr>
<tr><td>Tx Power Measurement Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main frame.)</td><td colspan="2">At 18°C to 28°C, After calibration, Input attenuator ≥10 dB
Input signal within measurement level range and below value set at Input Level
Only 1 carrier at center frequency<table>
<tr><td>Frequency Range</td><td>Preamp Off, or without Preamp</td><td>Preamp On</td></tr>
<tr><td>400 MHz ≤ Frequency < 800 MHz</td><td>±0.72 dB (nom.)</td><td>±1.14 dB (nom.)</td></tr>
<tr><td>800 MHz ≤ Frequency < 4 GHz</td><td>±0.74 dB (nom.)</td><td>±1.27 dB (nom.)</td></tr>
<tr><td>4 GHz ≤ Frequency < 4.2 GHz</td><td>±1.45 dB (nom.)</td><td>±2.11 dB (nom.)</td></tr>
<tr><td>4.2 GHz ≤ Frequency ≤ 6 GHz</td><td>±1.45 dB (nom.)</td><td>±1.94 dB (nom.)</td></tr>
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5G Standard Measurement Software (Base License) **MX285051A**
NR TDD mmWave Downlink **MX285051A-021**
NR TDD mmWave Uplink **MX285051A-071**

Specifications

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<tr><td colspan="2">Signal Analyzer</td><td colspan="2">MS2850A</td></tr>
<tr><td colspan="2">Option</td><td>NR TDD mmWave Downlink
MX285051A-021</td><td>NR TDD mmWave Uplink
MX285051A-071</td></tr>
<tr><td rowspan="4">Electrical Characteristics</td><td>Target Signals</td><td>TS 38.211 mmWave compliant downlink signal</td><td>TS 38.211 mmWave compliant uplink signal</td></tr>
<tr><td>Channel Bandwidth</td><td colspan="2"><table><tr><td>Subcarrier Spacing</td><td>Channel Bandwidth</td></tr><tr><td>60 kHz</td><td>50 MHz (RB: 66), 100 MHz (RB: 132), 200 MHz (RB: 264)</td></tr><tr><td>120 kHz</td><td>50 MHz (RB: 32), 100 MHz (RB: 66), 200 MHz (RB: 132), 400 MHz (RB: 264)</td></tr></table></td></tr>
<tr><td>Capture Time</td><td colspan="2">1 to 2 Frame</td></tr>
<tr><td>Frequency Setting Range</td><td colspan="2">MS2850A-047: 100 MHz to 32 GHz
MS2850A-046: 100 MHz to 44.5 GHz</td></tr>
<tr><td rowspan="3">Modulation/ Frequency Measurement</td><td>Measurement Level Range</td><td colspan="2">–15 to +30 dBm (Preamp Off, or Preamp not installed)
–30 to +10 dBm (Preamp On)</td></tr>
<tr><td>Carrier Frequency Measurement Accuracy</td><td>At 18°C to 28°C, After calibration, EVM = 2% (rms) signal 1 Frame at downlink signal
Only 1 carrier of 100 MHz width at center frequency setting of 28 GHz
± (Accuracy of reference frequency × carrier frequency + 10) Hz</td><td>At 18°C to 28°C, After calibration, EVM = 2% (rms) signal 1 Frame at uplink signal
Only 1 carrier of 100 MHz width at center frequency setting of 28 GHz
± (Accuracy of reference frequency × carrier frequency + 10) Hz</td></tr>
<tr><td>Residual Vector Error</td><td>At 18°C to 28°C, After calibration
1 Frame at downlink signal
Only 1 carrier of 100 MHz width at center frequency setting of 28 GHz
≤2.0%</td><td>At 18°C to 28°C, After calibration
1 Frame at uplink signal
Only 1 carrier of 100 MHz width at center frequency setting of 28 GHz
≤2.0%</td></tr>
<tr><td rowspan="2">Amplitude Measurement</td><td>Measurement Level Range</td><td colspan="2">–15 to +30 dBm (Preamp Off, or Preamp not installed)
–30 to +10 dBm (Preamp On)</td></tr>
<tr><td>Tx Power Measurement Accuracy
(This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main frame.)</td><td colspan="2">At 18°C to 28°C, After calibration, Input attenuator ≥10 dB
Input signal within measurement level range and below value set at Input Level
Only 1 carrier of 100 MHz width at center frequency<table><tr><td>Frequency Range</td><td>Preamp Off, or without Preamp</td><td>Preamp On</td></tr><tr><td>26.5 GHz < Frequency ≤ 40 GHz</td><td>±2.54 dB (nom.)</td><td>±3.74 dB (nom.)</td></tr></table></td></tr>
<tr><td colspan="2">Waveform Display</td><td colspan="2">Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Spectral Flatness, Power vs. RB, EVM vs. RB, Power vs. Time (NR TDD mmW Downlink MX285051A-021)</td></tr>
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<tr><td>Power vs. Time Measurement</td><td>Displayed Average Noise</td><td>This is calculated up to 5 GHz from the Display Average Noise Level for the signal analyzer with MS2850A-033/034 option installed at no signal input and an ambient temperature range of 18°C to 28°C when Wide Dynamic Range = On, Noise Correction = On, Pre-AMP = On.
–86.2 dBm/MHz (nominal)</td><td>—</td></tr>
</table>

Specifications

Refer to the MS2850A Data Sheet for detailed specifications.

• Common Signal Analyzer and Spectrum Analyzer Specifications

Frequency Range

9 kHz to 32 GHz (MS2850A-047)
9 kHz to 44.5 GHz (MS2850A-046)

Signal Analyzer Functions (at >31.25 MHz Analysis Bandwidth)
  800 MHz to 32 GHz (MS2850A-047)
  800 MHz to 44.5 GHz (MS2850A-046)

Frequency Setting Range

Spectrum Analyzer Function
  –100 MHz to 32.5 GHz (MS2850A-047)
  –100 MHz to 45 GHz (MS2850A-046)

Signal Analyzer Function
  Analysis Bandwidth ≤31.25 MHz
    0 MHz to 32 GHz (MS2850A-047)
    0 MHz to 44.5 GHz (MS2850A-046)
  31.25 < Analysis Bandwidth ≤ 510 MHz
    100 MHz to 32 GHz (MS2850A-047)
    100 MHz to 44.5 GHz (MS2850A-046)
  Analysis Bandwidth = 1 GHz
    4.2 GHz to 32 GHz (MS2850A-047)
    4.2 GHz to 44.5 GHz (MS2850A-046)

RF Input Connector (Front Panel)

K-J, 50Ω (nom.)

Aging Rate

±1 × 10^{-7}/year

Max. Input Level

CW Average Power: +30 dBm
 (Input Attenuator: ≥10 dB, Preamp: Off)

Attenuator

0 to 60 dB, 2 dB steps

Phase Noise

Spectrum Analyzer Function

Input Frequency	Frequency Offset	SSB Noise
1 GHz	10 Hz	–80 dBc/Hz (nom.)
	100 Hz	–92 dBc/Hz (nom.)
	1 kHz	–117 dBc/Hz (nom.)
	10 kHz	–123 dBc/Hz
	100 kHz	–123 dBc/Hz
	1 MHz	–135 dBc/Hz
	10 MHz	–148 dBc/Hz (nom.)

Total Level Accuracy

Preamp: None, Microwave Preselector Bypass: Off
±0.5 dB (300 kHz ≤ Frequency < 4 GHz)
±1.8 dB (4 GHz ≤ Frequency ≤ 13.8 GHz)
±3.0 dB (13.8 GHz < Frequency ≤ 40 GHz)
±3.5 dB (40 GHz < Frequency < 44.5 GHz, nom.)

Secondary Harmonic Distortion

Spectrum Analyzer Function
Signal Analyzer Function (Analysis Bandwidth: ≤31.25 MHz)
Preamp: None
Low Second Harmonic Distortion: Yes
Microwave Preselector Bypass: Off
Frequency Band Mode: Spurious

Input Frequency	Harmonic	SHI	Mixer Input Level
1 GHz	≤–65 dBc	≥+35 dBm	–30 dBm
4 GHz, 13 GHz	≤–90 dBc	≥+80 dBm	–10 dBm
20 GHz	≤–90 dBc (nom.)	≥+80 dBm (nom.)	–10 dBm

• Spectrum Analyzer Function

RBW (Resolution Bandwidth)

Setting Range:
  1 Hz to 3 MHz (1-3 sequence), 500 Hz, 50 kHz, 2 MHz, 5 MHz, 10 MHz, 20 MHz, 31.25 MHz
  (1 Hz to 10 Hz: Can not be set when Span 0 Hz
   31.25 MHz: Can be set when Span 0 Hz only)

VBW (Video Bandwidth)

Setting Range:
  1 Hz to 3 kHz (1-3 sequence), 5 kHz,
  10 kHz to 10 MHz (1-3 sequence), Off
VBW Mode: Video Average, Power Average

DANL (Display Average Noise Level)

Preamp: None
Low Second Harmonic Distortion: Yes
Microwave Preselector Bypass: On

Frequency	DANL
1 GHz	–150 dBm/Hz
4 GHz	–144 dBm/Hz
13 GHz	–146 dBm/Hz
20 GHz	–140 dBm/Hz
28 GHz	–140 dBm/Hz
39 GHz	–136 dBm/Hz
44 GHz	–130 dBm/Hz (nom.)

Two-Signal Tertiary Distortion

Preamp: None

Frequency	Two-Signal Tertiary Distortion
1 GHz	≤–62 dBc (TOI = +16 dBm)
4 GHz	≤–60 dBc (TOI = +15 dBm)
13 GHz, 20 GHz	≤–56 dBc (TOI = +13 dBm)
28 GHz, 39 GHz	≤–56 dBc (TOI = +13 dBm) (nom.)

- **Signal Analyzer Function**

Analysis Bandwidth

255 MHz (standard)
510 MHz (option)
1 GHz (option)

Display Functions (Trace Mode)

Spectrum, Power vs. Time, Frequency vs. Time, Phase vs. Time, CCDF, Spectrogram

ADC Resolution

Analysis Bandwidth ≤31.25 MHz: 16 bits
Analysis Bandwidth >31.25 MHz: 12 bits

SFDR (Spurious Free Dynamic Range)

Analysis Bandwidth >31.25 MHz

Frequency Range	SFDR
800 MHz ≤ Frequency < 4.2 GHz	–60 dBc (nom.)
4.2 GHz ≤ Frequency ≤ 44.5 GHz	–70 dBc (nom.)

RBW (Resolution Bandwidth)

Spectrum Display
Setting Range:
  Analysis Bandwidth ≤31.25 MHz: 1 Hz to 1 MHz (1-3 sequence)
  50 MHz ≤ Analysis Bandwidth ≤ 62.5 MHz:
    3 kHz to 3 MHz (1-3 sequence)
  Analysis Bandwidth ≥100 MHz: 10 kHz to 10 MHz (1-3 sequence)

DANL (Display Average Noise Level)

Analysis Bandwidth >31.25 MHz

Frequency	Preamp: None	Preamp: On
1 GHz	–141 dBm/Hz	–160 dBm/Hz
4 GHz	–138 dBm/Hz	–157 dBm/Hz
13 GHz	–140 dBm/Hz	–155 dBm/Hz
20 GHz	–135 dBm/Hz	–152 dBm/Hz
28 GHz	–135 dBm/Hz	–150 dBm/Hz
39 GHz	–132 dBm/Hz	–146 dBm/Hz
44 GHz	–125 dBm/Hz (nom.)	–138 dBm/Hz (nom.)

In-band Frequency Characteristics (Amplitude Flatness)

Analysis Bandwidth >31.25 MHz

Frequency	Frequency Offset	In-band Frequency Characteristic
13 GHz	CF ±500 MHz	±0.7 dB (nom.)
20 GHz		±1.0 dB (nom.)
28 GHz		±1.2 dB (nom.)
39 GHz, 44 GHz		±1.25 dB (nom.)

In-band Phase Linearity (Phase Flatness)

Analysis Bandwidth >31.25 MHz
Preamp: None
Offset Frequency ≤ Center Frequency ±500 MHz

Center Frequency	In-band Phase Linearity
13 GHz, 20 GHz, 28 GHz, 39 GHz	5°p-p (nom.)
44 GHz	6°p-p (nom.)

- **General Specifications**

Dimensions and Mass

426 (W) × 177 (H) × 390 (D) mm (excluding protrusions)
≤21 kg (with MS2850A-046 or 047 and other options installed)

Power

Power voltage: 100 VAC to 120 VAC/200 VAC to 240 VAC
Frequency: 50 Hz/60 Hz
Power Consumption:
  ≤500 VA (with all options installed)
  320 VA (nom.) (with MS2850A-047 or 046 and MS2850A-067/068/032/033/034 installed, but excluding other options)

CE Marking

EMC: 2014/30/EU, EN61326-1, EN61000-3-2
LVD: 2014/35/EU, EN61010-1
RoHS: 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018

UKCA Marking

EMC: S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
LVD: S.I. 2016 No.1101, EN 61010-1
RoHS: S.I. 2012 No.3032, EN IEC 63000: 2018

OS

Windows 10 (64 bits)

Windows® is a registered trademark of Microsoft Corporation in the USA and other countries.
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- **5G Measurement Software**

Refer to the MX2690xxA Series, MX2830xxA Series, MX2840xxA Series, MX2850xxA Series Measurement Software brochure for the specification details.

Typical (typ.):
  Performance not warranted. Most products meet typical performance.
Nominal (nom.):
  Values not warranted. Included to facilitate application of product.
Measured (meas.):
  Performance not warranted. Data actually measured from randomly selected measuring instruments.

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MS2850A	Signal Analyzer
	Standard Accessories
	Power Cord: 1 pc
P0031A	USB Memory (≥1 GB): 1 pc
Z0541A	USB Mouse: 1 pc
	Install DVD-ROM (Application software, instruction manual DVD-ROM): 1 pc
	Options
MS2850A-047	32 GHz Signal Analyzer
MS2850A-046	44.5 GHz Signal Analyzer
MS2850A-033	Analysis Bandwidth Extension 510 MHz
MS2850A-034	Analysis Bandwidth Extension 1 GHz
MS2850A-010	Phase Noise Measurement Function
MS2850A-017	Noise Figure Measurement Function
MS2850A-068	Microwave Preamplifier
MS2850A-072	Extended Specifications
MS2850A-076	Low Second Harmonic Distortion
MS2850A-051	Noise Floor Reduction
MS2850A-011	Secondary Storage Device
MS2850A-053	External Interface for High Speed Data Transfer PCIe
MS2850A-054	External Interface for High Speed Data Transfer USB3.0
	Retrofit Options
MS2850A-133	Analysis Bandwidth Extension 510 MHz Retrofit
MS2850A-134	Analysis Bandwidth Extension 1 GHz Retrofit
MS2850A-110	Phase Noise Measurement Function Retrofit
MS2850A-117	Noise Figure Measurement Function Retrofit
MS2850A-168	Microwave Preamplifier Retrofit
MS2850A-172	Extended Specifications Retrofit
MS2850A-176	Low Second Harmonic Distortion Retrofit
MS2850A-151	Noise Floor Reduction Retrofit
MS2850A-111	Secondary Storage Device Retrofit
MS2850A-153	External Interface for High Speed Data Transfer PCIe Retrofit
MS2850A-154	External Interface for High Speed Data Transfer USB3.0 Retrofit
MS2850A-182	CPU/Windows10 Upgrade Retrofit
MS2850A-282	CPU/Windows10 Upgrade Retrofit
	Software Options
	DVD-ROM with License and Operation manuals
MX285051A	5G Standard Measurement Software (Base License) (Requires any one of MX285051A-001/011/021/031/051/061/071/081)
MX285051A-001	Pre-Standard CP-OFDM Downlink (Requires MX285051A)
MX285051A-051	Pre-Standard CP-OFDM Uplink (Requires MX285051A)
MX285051A-011	NR TDD sub-6 GHz Downlink (Requires MX285051A)
MX285051A-061	NR TDD sub-6 GHz Uplink (Requires MX285051A)
MX285051A-031	NR FDD sub-6 GHz Downlink (Requires MX285051A)
MX285051A-081	NR FDD sub-6 GHz Uplink (Requires MX285051A)
MX285051A-021	NR TDD mmWave Downlink (Requires MX285051A)
MX285051A-071	NR TDD mmWave Uplink (Requires MX285051A)
MX269011A	W-CDMA/HSPA Downlink Measurement Software
MX269012A	W-CDMA/HSPA Uplink Measurement Software
MX269013A	GSM/EDGE Measurement Software
MX269013A-001	EDGE Evolution Measurement Software (Requires MX269013A)
MX269015A	TD-SCDMA Measurement Software
MX269017A	Vector Modulation Analysis Software
MX269017A-001	APSK Analysis (Requires MX269017A)
MX269017A-011	Higher-Order QAM Analysis (Requires MX269017A)
MX269020A	LTE Downlink Measurement Software
MX269020A-001	LTE-Advanced FDD Downlink Measurement Software (Requires MX269020A)
MX269021A	LTE Uplink Measurement Software
MX269021A-001	LTE-Advanced FDD Uplink Measurement Software (Requires MX269021A)
MX269022A	LTE TDD Downlink Measurement Software
MX269022A-001	LTE-Advanced TDD Downlink Measurement Software (Requires MX269022A)
MX269023A	LTE TDD Uplink Measurement Software
MX269023A-001	LTE-Advanced TDD Uplink Measurement Software (Requires MX269023A)
	Warranty Service
MS2850A-ES210	2 years Extended Warranty Service
MS2850A-ES310	3 years Extended Warranty Service
MS2850A-ES510	5 years Extended Warranty Service

Model/Order No.	Name
	Manuals
	Following operation manuals provided as hard copy and written in English.
W3920AE	MS2850A Operation Manual (Mainframe Operation)
W2851AE	MS2690A/MS2691A/MS2692A/MS2830A/MS2840A and MS2850A Operation Manual (Mainframe Remote Control)
W3335AE	MS2830A/MS2840A/MS2850A Operation Manual (Signal Analyzer Function Operation)
W2853AE	MS2690A/MS2691A/MS2692A/MS2830A/MS2840A and MS2850A Operation Manual (Signal Analyzer Function Remote Control)
W3336AE	MS2830A/MS2840A/MS2850A Operation Manual (Spectrum Analyzer Function Operation)
W2855AE	MS2690A/MS2691A/MS2692A/MS2830A/MS2840A and MS2850A Operation Manual (Spectrum Analyzer Function Remote Control)
W3117AE	MS2690A/MS2691A/MS2692A/MS2830A/MS2840A and MS2850A Operation Manual (Phase Noise Measurement Function Operation)
W3118AE	MS2690A/MS2691A/MS2692A/MS2830A/MS2840A and MS2850A Operation Manual (Phase Noise Measurement Function Remote Control)
W3655AE	MS2690A/MS2691A/MS2692A/MS2830A/MS2840A and MS2850A Operation Manual (Noise Figure Measurement Function Operation)
W3656AE	MS2690A/MS2691A/MS2692A/MS2830A/MS2840A and MS2850A Operation Manual (Noise Figure Measurement Function Remote control)
W3950AE	MS2850A-053/MS2850A-054 Operation Manual (External Interface for High Speed Data Transfer)
W3922AE	MX285051A/MX269051A Operation Manual
W3924AE	MX285051A-001/MX285051A-051 Operation Manual (Operation)
W3925AE	MX285051A-001/MX285051A-051 Operation Manual (Remote Control)
W3963AE	MX285051A-011/MX269051A-011/MX285051A-021/MX285051A-061/MX269051A-061/MX285051A-071 Operation Manual (Operation)
W3964AE	MX285051A-011/MX269051A-011/MX285051A-021/MX285051A-061/MX269051A-061/MX285051A-071 Operation Manual (Remote Control)
W4035AE	MX285051A-031/MX285051A-081 Operation Manual (Operation)
W4036AE	MX285051A-031/MX285051A-081 Operation Manual (Remote Control)
W3098AE	MX269011A Operation Manual (Operation)
W3099AE	MX269011A Operation Manual (Remote Control)
W3060AE	MX269012A Operation Manual (Operation)
W3061AE	MX269012A Operation Manual (Remote Control)
W3100AE	MX269013A Operation Manual (Operation)
W3101AE	MX269013A Operation Manual (Remote Control)
W3044AE	MX269015A Operation Manual (Operation)
W3045AE	MX269015A Operation Manual (Remote Control)
W3305AE	MX269017A Operation Manual (Operation)
W3306AE	MX269017A Operation Manual (Remote Control)
W3014AE	MX269020A Operation Manual (Operation)
W3064AE	MX269020A Operation Manual (Remote Control)
W3015AE	MX269021A Operation Manual (Operation)
W3065AE	MX269021A Operation Manual (Remote Control)
W3209AE	MX269022A Operation Manual (Operation)
W3210AE	MX269022A Operation Manual (Remote Control)
W3521AE	MX269023A Operation Manual (Operation)
W3522AE	MX269023A Operation Manual (Remote Control)

The following options are installed as standard and do not require separate orders when ordering the MS2850A-046/047.

Standard Software	MX269000A
Analysis Bandwidth 255 MHz	MS2850A-032
Microwave Preselector Bypass	MS2850A-067

Requires Installation Kit Z1957A when retrofitting options or installing software.

The instruction manuals are published on our website except some.

Model/Order No.	Name
	High Performance Waveguide Mixer
MA2806A	High Performance Waveguide Mixer (50 to 75 GHz)
MA2808A	High Performance Waveguide Mixer (60 to 90 GHz)
	Standard Accessories
Z1922A	MA2806A USB Memory (Saved conversion loss data, for MA2806A): 1 pc
Z1923A	MA2808A USB Memory (Saved conversion loss data, for MA2808A): 1 pc
Z1625A	AC Adapter: 1 pc Power Cord: 1 pc
J1692B	Coaxial Cord, 1 m (SMA-P · SUCOFLEX104PE · SMA-P, DC to 18 GHz, 50Ω): 1 pc
	External Mixer (Harmonic Mixer)
MA2741C	External Mixer (26.5 GHz to 40 GHz)
MA2742C	External Mixer (33 GHz to 50 GHz)
MA2743C	External Mixer (40 GHz to 60 GHz)
MA2744C	External Mixer (50 GHz to 75 GHz)
MA2745C	External Mixer (60 GHz to 90 GHz)
MA2746C	External Mixer (75 GHz to 110 GHz)
MA2747C	External Mixer (90 GHz to 140 GHz)
MA2748C	External Mixer (110 GHz to 170 GHz)
MA2749C	External Mixer (140 GHz to 220 GHz)
MA2750C	External Mixer (170 GHz to 260 GHz)
MA2751C	External Mixer (220 GHz to 325 GHz)

Model/Order No.	Name
	Application Parts
34AKNF50	Ruggedized K-to-Type N Adapter (DC to 20 GHz, 50Ω, Ruggedized K-M · N-F, SWR: 1.5 (max.), Insertion Loss: 0.4 dB (max.))
K240B	Power Divider (K connector, DC to 26.5 GHz, 50Ω, K-J, 1 W max.)
MA1612A	Four-port Junction Pad (5 MHz to 3 GHz, N-J)
J1359A	Coaxial Adaptor (K-P · K-J, SMA)
J0576B	Coaxial Cord, 1 m (N-P · 5D-2W · N-P)
J0576D	Coaxial Cord, 2 m (N-P · 5D-2W · N-P)
J0127A	Coaxial Cord, 1 m (BNC-P · RG58A/U · BNC-P)
J0127B	Coaxial Cord, 2 m (BNC-P · RG58A/U · BNC-P)
J0127C	Coaxial Cord, 0.5 m (BNC-P · RG58A/U · BNC-P)
J0322A	Coaxial Cord, 0.5 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322B	Coaxial Cord, 1 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322C	Coaxial Cord, 1.5 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322D	Coaxial Cord, 2 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0805	DC Block, N type (MODEL 7003) (10 kHz to 18 GHz, N-P · N-J)
J1555A	DC Block, SMA type (MODEL 7006-1) (9 kHz to 20 GHz, SMA-P · SMA-J)
K261	DC Block (10 kHz to 40 GHz, K-P · K-J)
J0004	Coaxial Adapter (DC to 12.4 GHz, 50Ω, N-P · SMA-J)
J1398A	N-SMA Adaptor (DC to 26.5 GHz, 50Ω, N-P · SMA-J)
J0911	Coaxial Cable, 1.0 m for 40 GHz (DC to 40 GHz, approx. 1 m, SF102A, 11K254/K254/1.0M)
J0912	Coaxial Cable, 0.5 m for 40 GHz (DC to 40 GHz, approx. 0.5 m, SF102A, 11K254/K254/0.5M)
41KC-3	Fixed Attenuator (DC to 40 GHz, 3 dB)
J1261A	Ethernet Cable (Shield type, Straight, 1 m)
J1261B	Ethernet Cable (Shield type, Straight, 3 m)
J1261C	Ethernet Cable (Shield type, Cross, 1 m)
J1261D	Ethernet Cable (Shield type, Cross, 3 m)
J0008	GPIB Cable, 2.0 m
B0635A	Rack Mount Kit (EIA)
B0657A	Rack Mount Kit (JIS)
B0636C*	Carrying Case (Hard type, with casters)
B0671A*	Front Cover for 1MW4U
MA24105A	Inline Peak Power Sensor (350 MHz to 4 GHz, with USB A to mini B cable)
MA24106A	USB Power Sensor (50 MHz to 6 GHz, with USB A to mini B cable)
MA24108A	Microwave USB Power Sensor (10 MHz to 8 GHz, with USB A to Micro-B cable)
MA24118A	Microwave USB Power Sensor (10 MHz to 18 GHz, with USB A to Micro-B cable)
MA24126A	Microwave USB Power Sensor (10 MHz to 26 GHz, with USB A to Micro-B cable)
Z0975A	Keyboard (USB)
Z1957A	Installation Kit (required when retrofitting options or installing software)
	External Interface for High Speed Data Transfer
U0088A	PCIe Host Adapter
J1749A	PCIe x8 Cable (2 m)
J1749B	PCIe x8 Cable (5 m)

*: The Carrying Case B0636C includes the Front Panel Protective Cover (B0671A).

Signal Analyzer

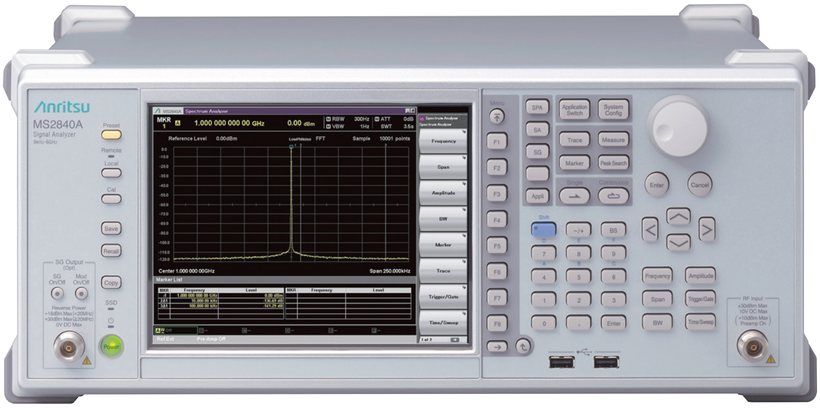
MS2840A

9 kHz to 3.6 GHz/6.0 GHz

Remote Control
GPIB | Ethernet | USB

Top-Class Close-in Phase Noise Performance at Middle-Price-Range Analyzer Cost

Excellent Eco Product



Better Than Expected Close-in Phase Noise Performance

Since 2000 most spectrum analyzers have been designed for mobile communications and the phase noise performance has been optimized for offset frequencies of several MHz. Consequently, customers requiring good close-in phase noise performance have been limited to a narrow choice of usable spectrum analyzers, causing problems. This new MS2840A series (3.6 GHz and 6 GHz models) has been designed with emphasis on offering a spectrum analyzer with excellent close-in phase noise performance at offset frequencies of just several kHz. This performance surpasses that of first-generation high-end spectrum analyzers and has sufficient margin for evaluating the close-in spurious of narrowband communications equipment in the short-wave, VHF, and UHF bands. Moreover, installing Low Phase Noise Performance MS2840A-066 option supports excellent phase noise performance surpassing that of current high-end instruments.

The high cost-performance of the MS2840A series (3.6 GHz and 6 GHz models) supporting not only development and production but also fundamental research for wireless and transmission equipment belies its mid-range price.

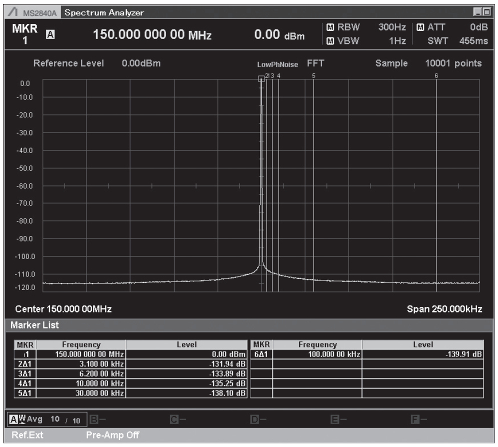
Close-in Phase Noise Performance (Spectrum Analyzer Function)

Carrier Offset	SSB Phase Noise		
	Standard	Low Phase Noise Performance MS2840A-066 Installed	
	Center Frequency: 1 GHz	Center Frequency: 1 GHz	Center Frequency: 500 MHz
10 Hz	–80 dBc/Hz (nom.)	—	—
100 Hz	–92 dBc/Hz (nom.)	–92 dBc/Hz (meas.*)	–98 dBc/Hz (nom.)
1 kHz	–117 dBc/Hz (nom.)	–125 dBc/Hz (meas.*)	–122 dBc/Hz
10 kHz	–123 dBc/Hz	–138 dBc/Hz (meas.*)	–133 dBc/Hz
100 kHz	–123 dBc/Hz	–142 dBc/Hz (meas.*)	–133 dBc/Hz
1 MHz	–135 dBc/Hz	–146 dBc/Hz (meas.*)	–148 dBc/Hz (nom.)
10 MHz	–148 dBc/Hz (nom.)	—	—

*: Value measured at design but not guaranteed specification, and value measured by Phase Noise Measurement function.

The Low Phase Noise Performance MS2840A-066 option greatly increases SSB phase noise performance for RF input signals of more than 130 MHz and less than 3.7 GHz at frequency offsets of 1 kHz to 1 MHz from the main carrier wave. Setting the span to a range of either 300 Hz to 1 MHz (spectrum analyzer function) or 1 kHz to 31.25 MHz (signal analyzer function) enables the function on Spectrum display.

Measurement Examples

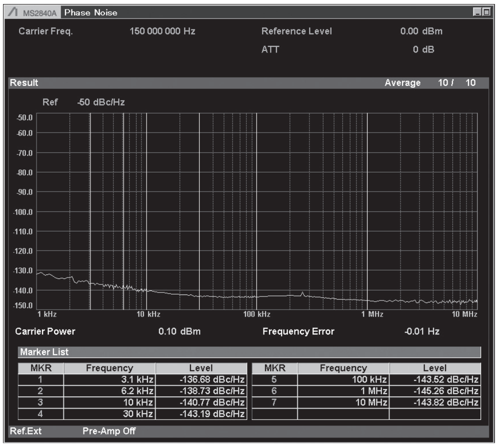


MKR 1 A 150.000 000 00 MHz 0.00 dBm
RBW 300Hz ATT 0dB
VBW 1Hz SWT 455ms
Reference Level 0.00dBm
LowPhNoise FFT Sample 10001 points
Center 150.000 00MHz
Span 250.000kHz

MKR	Frequency	Level	MKR	Frequency	Level
1	150.000 000 00 MHz	0.00 dBm	6Δ1	100.000 00 kHz	-139.91 dB
2Δ1	3.100 00 kHz	-131.94 dB			
3Δ1	6.200 00 kHz	-133.89 dB			
4Δ1	10.000 00 kHz	-135.25 dB			
5Δ1	30.000 00 kHz	-138.10 dB			

Ref.Ext Pre-Amp Off

Spectrum Display
Low Phase Noise Performance MS2840A-066 On
150 MHz Measurement Frequency, Preamp Off

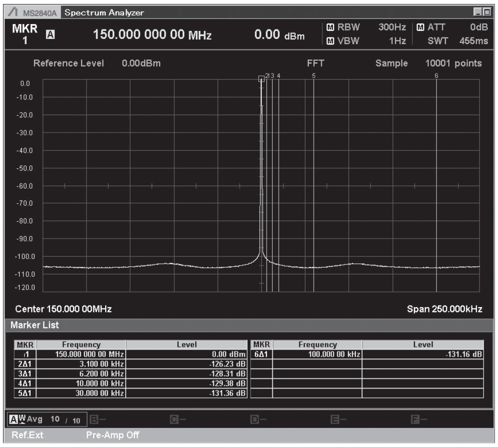


Carrier Freq. 150 000 000 Hz
Reference Level 0.00 dBm
ATT 0 dB
Average 10 / 10
Ref -50 dBc/Hz
Carrier Power 0.10 dBm
Frequency Error -0.01 Hz

MKR	Frequency	Level	MKR	Frequency	Level
1	3.1 kHz	-136.68 dBc/Hz	5	100 kHz	-143.52 dBc/Hz
2	6.2 kHz	-138.73 dBc/Hz	6	1 MHz	-145.26 dBc/Hz
3	10 kHz	-140.77 dBc/Hz	7	10 MHz	-143.82 dBc/Hz
4	30 kHz	-143.19 dBc/Hz			

Ref.Ext Pre-Amp Off

Phase Noise Measurement
Low Phase Noise Performance MS2840A-066 On
150 MHz Measurement Frequency, Preamp Off



MKR 1 A 150.000 000 00 MHz 0.00 dBm

RBW 300Hz ATT 0dB

VBW 1Hz SWT 455ms

Reference Level 0.00dBm FFT Sample 10001 points

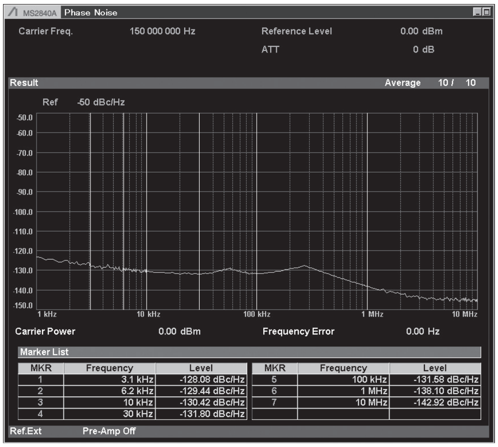
Center 150.000 00MHz Span 250.000kHz

Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	150.000 000 00 MHz	0.00 dBm	6Δ1	100.000 00 kHz	-131.16 dB
2Δ1	3.100 00 kHz	-126.23 dB			
3Δ1	6.200 00 kHz	-128.31 dB			
4Δ1	10.000 00 kHz	-129.38 dB			
5Δ1	30.000 00 kHz	-131.36 dB			

Ref.Ext Pre-Amp Off

Spectrum Display
Low Phase Noise Performance MS2840A-066 Off
150 MHz Measurement Frequency, Preamp Off



Carrier Freq. 150 000 000 Hz

Reference Level 0.00 dBm

ATT 0 dB

Result Average 10 / 10

Ref -50 dBc/Hz

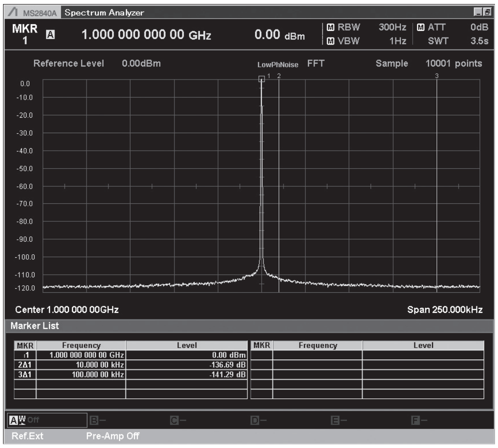
Carrier Power 0.00 dBm Frequency Error 0.00 Hz

Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	3.1 kHz	-128.08 dBc/Hz	5	100 kHz	-131.58 dBc/Hz
2	6.2 kHz	-129.44 dBc/Hz	6	1 MHz	-138.10 dBc/Hz
3	10 kHz	-130.42 dBc/Hz	7	10 MHz	-142.92 dBc/Hz
4	30 kHz	-131.80 dBc/Hz			

Ref.Ext Pre-Amp Off

Phase Noise Measurement
Low Phase Noise Performance MS2840A-066 Off
150 MHz Measurement Frequency, Preamp Off



MKR 1 A 1.000 000 000 00 GHz 0.00 dBm

RBW 300Hz ATT 0dB

VBW 1Hz SWT 3.5s

Reference Level 0.00dBm LowPhNoise FFT Sample 10001 points

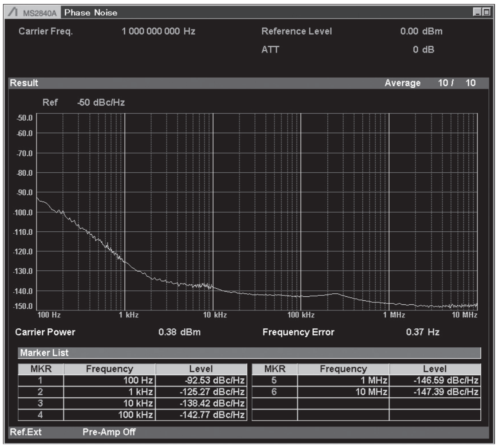
Center 1.000 000 00GHz Span 250.000kHz

Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	1.000 000 000 00 GHz	0.00 dBm			
2Δ1	10.000 00 kHz	-136.69 dB			
3Δ1	100.000 00 kHz	-141.29 dB			

Ref.Ext Pre-Amp Off

Spectrum Display
Low Phase Noise Performance MS2840A-066 On
1 GHz Measurement Frequency, Preamp Off



Carrier Freq. 1 000 000 000 Hz

Reference Level 0.00 dBm

ATT 0 dB

Result Average 10 / 10

Ref -50 dBc/Hz

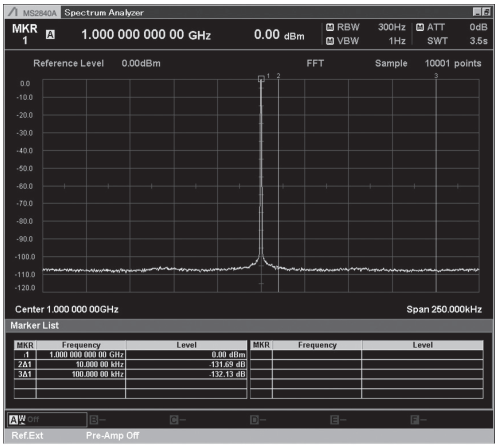
Carrier Power 0.38 dBm Frequency Error 0.37 Hz

Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	100 Hz	-92.53 dBc/Hz	5	1 MHz	-146.59 dBc/Hz
2	1 kHz	-125.27 dBc/Hz	6	10 MHz	-147.39 dBc/Hz
3	10 kHz	-138.42 dBc/Hz			
4	100 kHz	-142.77 dBc/Hz			

Ref.Ext Pre-Amp Off

Phase Noise Measurement
Low Phase Noise Performance MS2840A-066 On
1 GHz Measurement Frequency, Preamp Off



MKR 1 A 1.000 000 000 00 GHz 0.00 dBm

RBW 300Hz ATT 0dB

VBW 1Hz SWT 3.5s

Reference Level 0.00dBm FFT Sample 10001 points

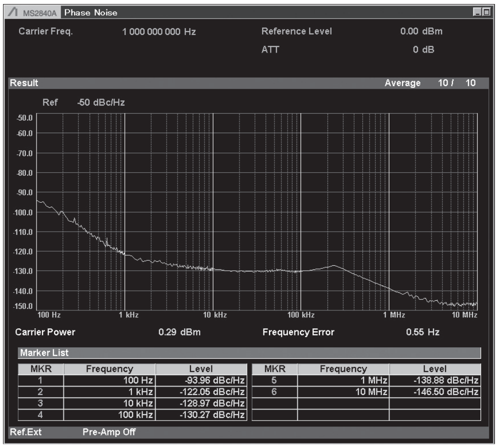
Center 1.000 000 00GHz Span 250.000kHz

Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	1.000 000 000 00 GHz	0.00 dBm			
2Δ1	10.000 00 kHz	-131.69 dB			
3Δ1	100.000 00 kHz	-132.13 dB			

Ref.Ext Pre-Amp Off

Spectrum Display
Low Phase Noise Performance MS2840A-066 Off
1 GHz Measurement Frequency, Preamp Off



Carrier Freq. 1 000 000 000 Hz

Reference Level 0.00 dBm

ATT 0 dB

Result Average 10 / 10

Ref -50 dBc/Hz

Carrier Power 0.29 dBm Frequency Error 0.55 Hz

Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	100 Hz	-93.96 dBc/Hz	5	1 MHz	-138.88 dBc/Hz
2	1 kHz	-122.05 dBc/Hz	6	10 MHz	-146.50 dBc/Hz
3	10 kHz	-128.97 dBc/Hz			
4	100 kHz	-130.27 dBc/Hz			

Ref.Ext Pre-Amp Off

Phase Noise Measurement
Low Phase Noise Performance MS2840A-066 Off
1 GHz Measurement Frequency, Preamp Off

High-Sensitivity Measurements

The MS2840A has excellent display average noise level (DANL) specifications. In particular, when the built-in preamplifier is on, it has a high sensitivity measurement performance of better than –160 dBm/Hz in the frequency range from 30 MHz to 6 GHz.

Displayed Average Noise Level (DANL)

Spectrum Analyzer Function
Preamp: None, Low Phase Noise Performance: None

Frequency	DANL
30 MHz	–153 dBm/Hz
400 MHz	–153 dBm/Hz
1 GHz	–151 dBm/Hz
3 GHz	–149 dBm/Hz
6 GHz	–146 dBm/Hz

Preamp: On, Low Phase Noise Performance : None

Frequency	DANL
30 MHz	–166 dBm/Hz
400 MHz	–166 dBm/Hz
1 GHz	–165 dBm/Hz
3 GHz	–164 dBm/Hz
6 GHz	–161 dBm/Hz

Dynamic Range

Preamp: None

Frequency	Dynamic Range	DANL/TOI
30 MHz	165 dB	Displayed Average Noise Level (DANL): –153 dBm/Hz Third Order Intercept (TOI): +12 dBm
1 GHz	167 dB	Displayed Average Noise Level (DANL): –151 dBm/Hz Third Order Intercept (TOI): +16 dBm
6 GHz	161 dB	Displayed Average Noise Level (DANL): –146 dBm/Hz Third Order Intercept (TOI): +15 dBm (nom.)

The dynamic range is assumed to be the simple difference between the TOI and DANL.

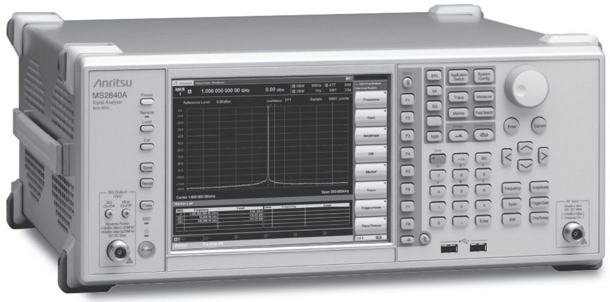
Noise Floor Reduction (MS2840A-051)

The Noise Floor Reduction (NFR) function increases the measurement accuracy for low-level signals. It subtracts the internal noise components (11 dB max. nominal) of the measuring instrument itself from the displayed measurement result.

Faster Measurement Speeds

With a built-in high-performance CPU and 8 GB of main memory supporting the 64-bit Windows 10* OS, the MS2840A is much faster than its predecessor MS2830A, offering greatly improved averaging processing times for screen displays and much faster processing when displaying the results of signal analyzer and software analysis functions.

*: Windows 10 is installed in MS2840A units ordered from September 2020.



Signal Analyzer MS2840A

The Signal Analyzer MS2840A is available as two series with two models in each series: 3.6 GHz and 6 GHz, and 26.5 GHz and 44.5 GHz; different options can be installed in each series. In addition to supporting installation of options offering various measurement functions needed both for evaluating the Tx characteristics of wireless and transmission equipment and for greatly improving phase noise performance, the 3.6 GHz/6 GHz models described in this brochure also provide all-in-one support for Rx measurements when the signal generator option is installed.

Standard Functions

Spectrum Analyzer
Signal Analyzer (31.25 MHz Analysis Bandwidth)
Power Meter (Connected to USB Power Sensor)

Options

Improved Phase Noise Performance
Signal Analyzer (extended analysis bandwidth: 62.5 MHz, 125 MHz)
Built-in Preamplifier
Phase Noise Measurement
Pre-compliance EMI Function
Noise Figure (NF) Measurement
BER Measurement
Modulation Analysis
Vector Signal Generator
Analog Signal Generator

Optional Parts

USB Power Sensor

Tx Measurement

Typical Measurement Items for Evaluating Tx Characteristics (3.6 GHz and 6 GHz models)

✓: Supported

Supported Standard Functions/Options Typical Measurement	Standard Functions			Options/Optional Parts
	Spectrum Analyzer	Signal Analyzer	Others	
Spectrum Trace	✓	✓		
Channel Power	✓	✓		
Occupied Bandwidth	✓	✓		
Adjacent Channel Leakage Power	✓	✓		
Spectrum Emission Mask	✓			
Burst Average Power	✓	✓		
Spurious Emission	✓			
AM Depth		✓		✓ Analog Measurement Software MX269018A
FM Deviation		✓		✓ Analog Measurement Software MX269018A
Multi-marker & Marker List	✓	✓		
Highest 10 Markers	✓	✓		
Limit Line	✓			
Frequency Counter	✓			
TOI	✓			
Hide Settings and Numeric Results	✓			
Power Meter Function (connected to USB Power Sensor)			✓	
Phase Noise Measurement				✓ Phase Noise Measurement Function MS2840A-010
EMI Measurement				✓ Precompliance EMI Function MS2840A-016
Vector Modulation Analysis (EVM, etc.)				✓ Vector Modulation Analysis Software MX269017A
Analog Modulation Analysis (AM/FM/ΦM) (FM Deviation, Demodulation Frequency, etc.)				✓ Analog Measurement Software MX269018A
Improved Phase Noise Performance				✓ Low Phase Noise Performance MS2840A-066

Rx Measurement

Typical Measurement Items for Evaluating Rx Characteristics (3.6 GHz and 6 GHz models)

✓: Supported

Supported Standard Functions/Options Typical Measurement	Standard Functions			Options/Optional Parts
	Spectrum Analyzer	Signal Analyzer	Others	
Vector Signal Generator				✓ Vector Signal Generator MS2840A-020/021, etc.
Analog Signal Generator				✓ Analog Signal Generator MS2840A-088, etc.
BER Measurement				✓ BER Measurement Function MS2840A-026

Others

Other Measurement Items (3.6 GHz and 6 GHz models)

✓: Supported

Supported Standard Functions/Options Typical Measurement	Standard Functions			Options/Optional Parts
	Spectrum Analyzer	Signal Analyzer	Others	
Noise Figure Measurement				✓ Noise Figure Measurement Function MS2840A-017

Tx Measurement

Versatile Standard Functions

The built-in spectrum and signal analyzer functions can be used to evaluate the Tx characteristics of wireless devices and transmitters by running easy tests, etc., in accordance with specifications.

Measure Function	Spectrum Analyzer (Standard)	Signal Analyzer (Standard)
Spectrum Trace	✓	✓
Channel Power	✓	✓
Occupied Bandwidth	✓	✓
Adjacent Channel Leakage Power	✓	✓
Spectrum Emission Mask	✓	
Burst Average Power	✓	✓
Spurious Emission	✓	
AM Depth		✓
FM Deviation		✓
Multi-marker & Marker List	✓	✓
Highest 10 Markers	✓	✓
Limit Line	✓	
Frequency Counter	✓	
TOI	✓	
Hide Settings and Numeric Results	✓	

Power Meter Function (USB Power Sensor Connection)

Connecting the optional USB Power Sensor to the MS2840A supports Power and Relative Power measurements.

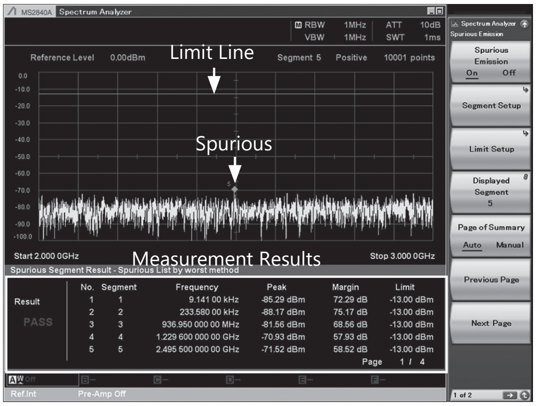
Compatible USB power sensors.

Model	Frequency Range	Dynamic Range
MA24104A*	600 MHz to 4 GHz	+3 to +51.76 dBm
MA24105A	350 MHz to 4 GHz	+3 to +51.76 dBm
MA24106A	50 MHz to 6 GHz	–40 to +23 dBm
MA24108A	10 MHz to 8 GHz	–40 to +20 dBm
MA24118A	10 MHz to 18 GHz	–40 to +20 dBm
MA24126A	10 MHz to 26 GHz	–40 to +20 dBm

*: MA24104A has been discontinued.

Spurious Emission

This function splits the frequency range into up to 20 segments for sweeping; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment.
The results are tabulated below the trace and marked PASS/FAIL.



Spurious Segment Result - Spurious List by worst method

Result PASS

No.	Segment	Frequency	Peak	Margin	Limit
1	1	9.141 00 kHz	-85.29 dBm	72.29 dB	-13.00 dBm
2	2	233.580 00 kHz	-88.17 dBm	75.17 dB	-13.00 dBm
3	3	936.950 000 00 MHz	-81.56 dBm	68.56 dB	-13.00 dBm
4	4	1.229 600 000 00 GHz	-70.93 dBm	57.93 dB	-13.00 dBm
5	5	2.495 500 000 00 GHz	-71.52 dBm	58.52 dB	-13.00 dBm

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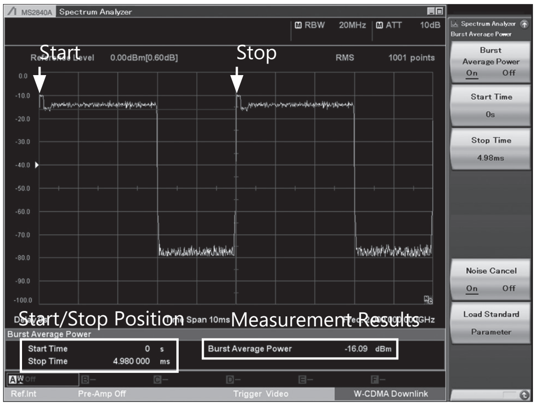
Burst Average Power

The average power for the range specified by two markers is displayed in the time domain. Measurement only requires setting the measurement start and stop positions on the screen. True performance is measured using the noise cancellation function to subtract main-frame noise from the measurement result.
Pre-installed templates for each standard support easy parameter setting.



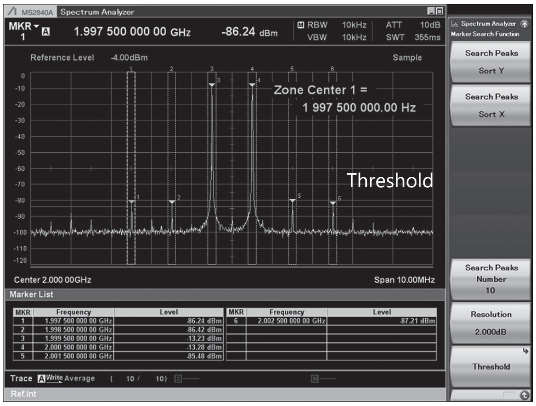
Burst Average Power

Start Time 0 s
Stop Time 4.980 000 ms

Burst Average Power -16.09 dBm

Multi-marker & Marker List

Up to 10 markers can be set for this function. Markers may be either a spot or a zone. Using a zone marker, the peak of a signal with an unstable variable frequency can be tracked and measured.
Not only can the 10 markers be listed below the trace but the differences between markers can be calculated and displayed using the delta setting.

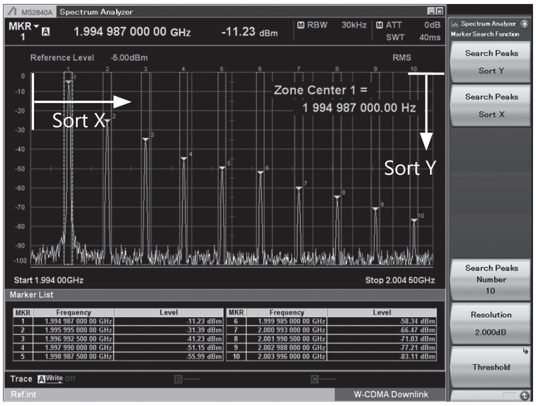


Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	1.997 500 000 00 GHz	-86.24 dBm	6	2.002 500 000 00 GHz	-87.21 dBm
2	1.998 500 000 00 GHz	-86.42 dBm			
3	1.999 500 000 00 GHz	-13.23 dBm			
4	2.000 500 000 00 GHz	-13.28 dBm			
5	2.001 500 000 00 GHz	-85.48 dBm			

Highest 10 Markers

This function sets the threshold level and auto-detects peaks in the X (frequency) and Y (level/time) directions.



Marker List

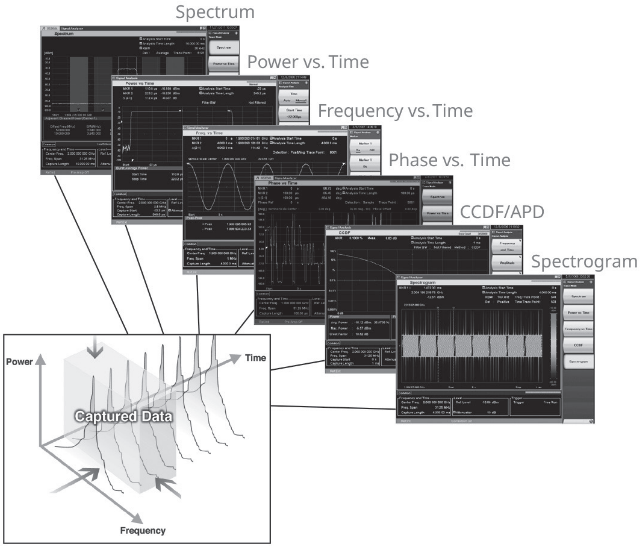
MKR	Frequency	Level	MKR	Frequency	Level
1	1.994 987 000 00 GHz	-11.23 dBm	6	1.999 985 000 00 GHz	-58.34 dBm
2	1.995 995 000 00 GHz	-31.39 dBm	7	2.000 993 000 00 GHz	-66.47 dBm
3	1.996 992 500 00 GHz	-41.23 dBm	8	2.001 990 500 00 GHz	-71.03 dBm
4	1.997 990 000 00 GHz	-51.15 dBm	9	2.002 988 000 00 GHz	-77.21 dBm
5	1.998 987 500 00 GHz	-55.99 dBm	10	2.003 996 000 00 GHz	-83.11 dBm

Tx Measurement Signal Analyzer (Standard)

The MS2840A has a built-in 31.25 MHz bandwidth Fast Fourier Transformation (FFT) analysis function supporting multi-domain analysis of captured measured signals. Since it can capture phenomena such as spectrum transients that cannot be captured by conventional sweep-type spectrum analyzers, it improves the efficiency of troubleshooting. The analysis bandwidth can be expanded to either 62.5 MHz or 125 MHz as options.

Measurement Functions

- Spectrum trace
- Frequency vs. Time
- CCDF/APD
- Power vs. Time
- Phase vs. Time
- Spectrogram



Analysis Bandwidth:

31.25 MHz (Standard)
50 MHz max. sampling rate = 20 ns resolution, ADC resolution 16 bits)
62.5 MHz (MS2840A-077)
(100 MHz max. sampling rate = 10 ns resolution, ADC resolution 14 bits)
125 MHz (MS2840A-077/078)
(200 MHz max. sampling rate = 5 ns resolution, ADC resolution 14 bits)

Max. Capture Time: 0.5 s to 2000 s

Max. Number of Samples: 100 Msamples

Note: An image response is received when setting the bandwidth to more than 31.25 MHz. This can be used when not inputting a signal frequency outside the MS2840A analysis bandwidth (125 MHz max.).
The Signal Analyzer MS2690A is recommended for other measurement purposes.

Option

Analysis Bandwidth Extension to 62.5 MHz (MS2840A-077)

Extends analysis bandwidth to 62.5 MHz.

Analysis Bandwidth Extension to 125 MHz (MS2840A-078*)

Extends analysis bandwidth to 125 MHz.

*: Requires MS2840A-077.

Capture & Replay Function

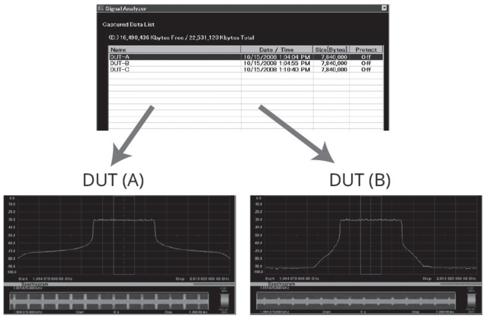
Waveform data can be saved (captured) to the internal memory.
In addition, previously saved waveform data can be loaded (replayed) to reproduce result displays whenever necessary using measurement functions.
The following chart shows the maximum capture time per frequency span.

Span	Sampling Rate	Capture Time	Max. Sampling Data
1 kHz	2 kHz	2000 s	4M
2.5 kHz	5 kHz	2000 s	10M
5 kHz	10 kHz	2000 s	20M
10 kHz	20 kHz	2000 s	40M
25 kHz	50 kHz	2000 s	100M
50 kHz	100 kHz	1000 s	100M
100 kHz	200 kHz	500 s	100M
250 kHz	500 kHz	200 s	100M
500 kHz	1 MHz	100 s	100M
1 MHz	2 MHz	50 s	100M
2.5 MHz	5 MHz	20 s	100M
5 MHz	10 MHz	10 s	100M
10 MHz	20 MHz	5 s	100M
25 MHz	50 MHz	2 s	100M
31.25 MHz	50 MHz	2 s	100M
50 MHz	100 MHz	500 ms	50M
62.5 MHz	100 MHz	500 ms	50M
100 MHz	200 MHz	500 ms	100M
125 MHz	200 MHz	500 ms	100M

Replay Usage Examples

- Sharing data between development and manufacturing sections at separate locations
- Transferring signals captured onsite for later in-house analysis
- Saving product shipping data for later warranty-claim confirmation

Captured Waveform Data: Selection Screen



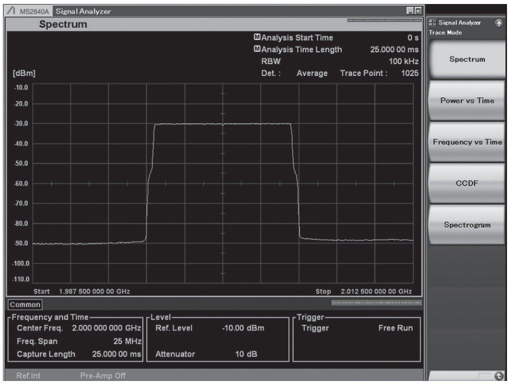
Captured Data List

(D:) 16,498,436 Kbytes Free / 22,531,128 Kbytes Total

Name	Date / Time	Size[Bytes]	Protect
DUT-A	10/15/2008 1:04:04 PM	7,840,000	Off
DUT-B	10/15/2008 1:04:55 PM	7,840,000	Off
DUT-C	10/15/2008 1:10:40 PM	7,840,000	Off

Spectrum trace

The CCDF trace displays the power variation probability on the y-axis and power variation on the y-axis to confirm the CCDF and APD of measured signals.



Analysis Start Time 0 s
Analysis Time Length 25.000 00 ms
RBW 100 kHz
Det. : Average Trace Point : 1025
Start 1.987 500 000 00 GHz Stop 2.012 500 000 00 GHz

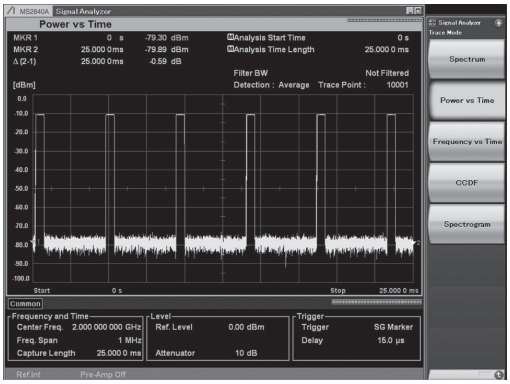
Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 25 MHz
Capture Length 25.000 00 ms

Level
Ref. Level -10.00 dBm
Attenuator 10 dB

Trigger
Trigger Free Run

Power vs. Time

The Power vs. Time trace displays a graph with amplitude on the y-axis and time on the x-axis to confirm changes in power with time of measured signals.



MKR 1 0 s -79.30 dBm
MKR 2 25.000 0ms -79.89 dBm
Δ (2-1) 25.000 0ms -0.59 dB
Analysis Start Time 0 s
Analysis Time Length 25.000 0 ms
Filter BW Not Filtered
Detection : Average Trace Point : 10001
Start 0 s Stop 25.000 0 ms

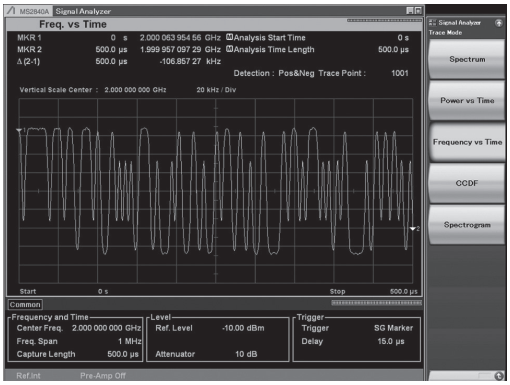
Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 1 MHz
Capture Length 25.000 0 ms

Level
Ref. Level 0.00 dBm
Attenuator 10 dB

Trigger
Trigger SG Marker
Delay 15.0 μs

Frequency vs. Time

The Frequency vs. Time trace displays a graph with frequency on the y-axis and time on the x-axis to confirm time variation of the measured signal frequency.



MKR 1 0 s 2.000 063 954 56 GHz
MKR 2 500.0 μs 1.999 957 097 29 GHz
Δ (2-1) 500.0 μs -106.857 27 kHz
Analysis Start Time 0 s
Analysis Time Length 500.0 μs
Detection : Pos&Neg Trace Point : 1001
Vertical Scale Center : 2.000 000 000 GHz 20 kHz / Div
Start 0 s Stop 500.0 μs

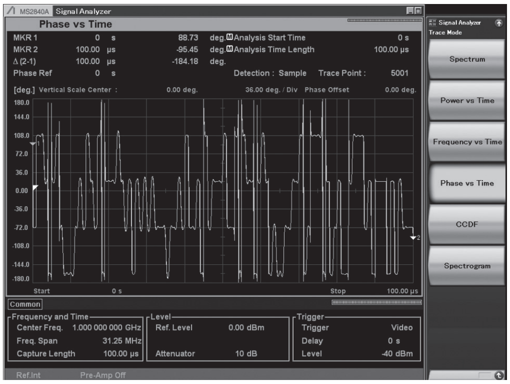
Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 1 MHz
Capture Length 500.0 μs

Level
Ref. Level -10.00 dBm
Attenuator 10 dB

Trigger
Trigger SG Marker
Delay 15.0 μs

Phase vs. Time

The Phase vs. Time trace displays a graph with phase on the y-axis and time on the x-axis to confirm time variation of the measured signal phase.



MKR 1 0 s 88.73 deg.
MKR 2 100.00 μs -95.45 deg.
Δ (2-1) 100.00 μs -184.18 deg.
Phase Ref 0 s
Analysis Start Time 0 s
Analysis Time Length 100.00 μs
Detection : Sample Trace Point : 5001
Vertical Scale Center : 0.00 deg. 36.00 deg. / Div Phase Offset 0.00 deg.
Start 0 s Stop 100.00 μs

Frequency and Time
Center Freq. 1.000 000 000 GHz
Freq. Span 31.25 MHz
Capture Length 100.00 μs

Level
Ref. Level 0.00 dBm
Attenuator 10 dB

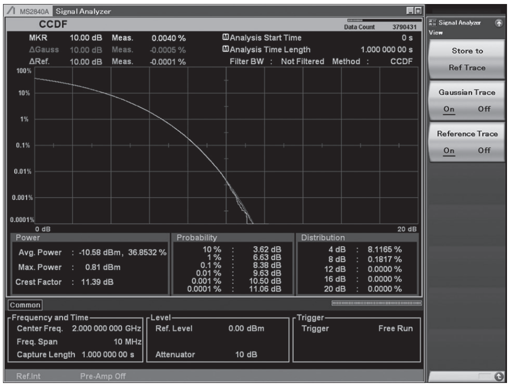
Trigger
Trigger Video
Delay 0 s
Level -40 dBm

CCDF/APD

The CCDF trace displays the power variation probability on the y-axis and power variation on the y-axis to confirm the CCDF and APD of measured signals.

CCDF (Complementary Cumulative Distribution Function):
The CCDF display indicates the cumulative distribution of transient power variations compared to average power.

APD (Amplitude Probability Density):
The APD display indicates the probability distribution of transient power.



Data Count 3790431
MKR 10.00 dB Meas. 0.0040 %
ΔGauss 10.00 dB Meas. -0.0005 %
ΔRef. 10.00 dB Meas. -0.0001 %
Analysis Start Time 0 s
Analysis Time Length 1.000 000 00 s
Filter BW : Not Filtered Method : CCDF

Power
Avg. Power : -10.58 dBm, 36.8532 %
Max. Power : 0.81 dBm
Crest Factor : 11.39 dB

Probability	
10 %	3.62 dB
1 %	6.63 dB
0.1 %	8.38 dB
0.01 %	9.63 dB
0.001 %	10.50 dB
0.0001 %	11.06 dB

Distribution	
4 dB	8.1165 %
8 dB	0.1817 %
12 dB	0.0000 %
16 dB	0.0000 %
20 dB	0.0000 %

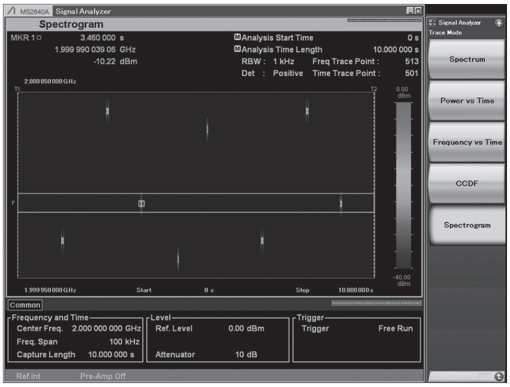
Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 10 MHz
Capture Length 1.000 000 00 s

Level
Ref. Level 0.00 dBm
Attenuator 10 dB

Trigger
Trigger Free Run

Spectrogram

The Spectrogram trace displays the level as color with frequency on the y-axis and time on the x-axis. The captured IQ data is FFT processed to confirm time variations in the continuous spectrum.
It is useful for monitoring frequency hopping and transient signals.



MKR 1 3.460 000 s
1.999 990 039 06 GHz
-10.22 dBm
Analysis Start Time 0 s
Analysis Time Length 10.000 000 s
RBW : 1 kHz Freq Trace Point : 513
Det : Positive Time Trace Point : 501
Start 0 s Stop 10.000 000 s

Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 100 kHz
Capture Length 10.000 000 s

Level
Ref. Level 0.00 dBm
Attenuator 10 dB

Trigger
Trigger Free Run

Signal Analyzer Function Applications ~ Capture & Playback Function ~

Outputs Waveforms Captured by Signal Analyzer from Built-in Vector Signal Generator

The MS2840A provides Capture & Playback functionality that enables laboratory-grade testing of transceiver systems using real world signals. Using the optional integrated Signal Analyzer and Vector Signal Generator of the MS2840A, Capture & Playback allows users to conveniently capture up to 100 MHz of spectrum and play it back at any designated frequency and amplitude, making it easy to determine device performance margins.

Applications for Capture & Playback

Validation/Production Test

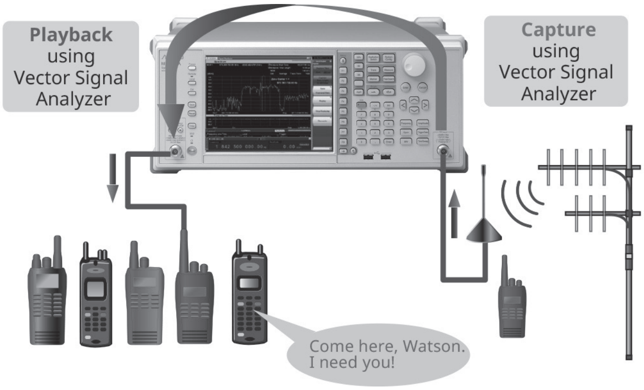
Captured signals can be used to initiate a communications link and perform receiver sensitivity testing with a device under test (DUT) using signals captured from a Golden Unit.

Device Characterization

Actual baseband signals captured from an RFIC can be used as simulation for characterizing amplifiers and other downstream devices or modules.

Electromagnetic Compatibility Test

Problematic RF environments or discrete signals can be captured and used to evaluate a device's susceptibility to RF interference, debug any problems found and validate the solution



Repeatably Test Device Performance
using "Real-World" RF Environments

Tx Measurement

Other Measurement Functions

Phase Noise Measurement Function (MS2840A-010)

The excellent close-in phase noise performance of the MS2840A supports phase noise measurement of transmitters with a frequency offset range of 10 Hz to 10 MHz and also supports when connected to the High Performance Waveguide Mixer (MA2806A, MA2808A).

Measurement Results
- Carrier level
- Error between set frequency and carrier frequency
- Marker point phase noise level

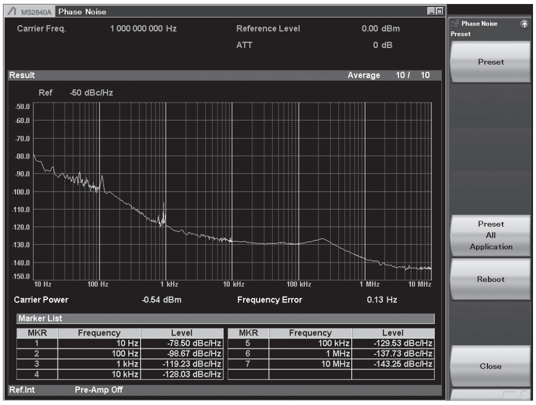
There are four measurement modes using different loop filters, which are switched to match the DUT.

Auto:
This mode switches automatically to the best loop filter for measuring the carrier signal close-in and wide-offset phase noise characteristics

Best Close-in:
This mode uses the best loop filter for measuring the carrier signal close-in phase noise characteristics.

Best Wide-offset:
This mode uses the best loop filter for measuring the carrier signal wide-offset phase noise characteristics.

Balance
This mode uses the loop filter with a good balance for measuring both close-in and wide-offset phase noise characteristics of the carrier signal.



Carrier Freq. 1 000 000 000 Hz
Reference Level 0.00 dBm
ATT 0 dB
Average 10 / 10
Carrier Power -0.54 dBm
Frequency Error 0.13 Hz

MKR	Frequency	Level	MKR	Frequency	Level
1	10 Hz	-78.50 dBc/Hz	5	100 kHz	-129.53 dBc/Hz
2	100 Hz	-98.67 dBc/Hz	6	1 MHz	-137.73 dBc/Hz
3	1 kHz	-119.23 dBc/Hz	7	10 MHz	-143.25 dBc/Hz
4	10 kHz	-128.03 dBc/Hz			

Ref.Int Pre-Amp Off

Measurement Screen

Precompliance EMI Function (MS2840A-016)

This option adds an EMI measurement detection mode and RBW to the spectrum analyzer function. Both the detection mode used for CISPR standards (Quasi-Peak, CISPR-AVG, RMS-AVG) and RBW (200 Hz (6 dB), 9 kHz (6 dB), 120 kHz (6 dB), 1 MHz (Imp)) as well as conventional settings can be selected.

Tx Measurement

Measurement Software Options

Vector Modulation Analysis Software (MX269017A)

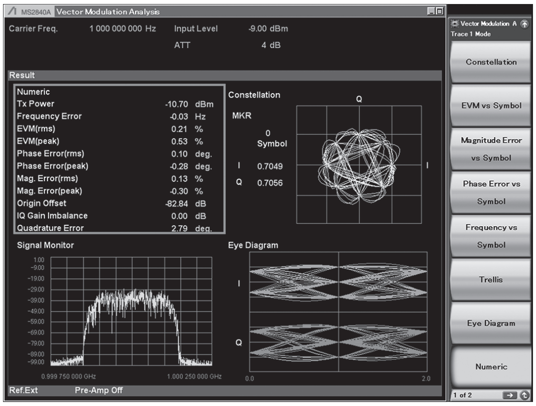
This software measures the modulation accuracy, carrier frequency, Tx power, etc., for each type of digital radio.

Supported Modulation Methods

Standard
BPSK, QPSK, O-QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 2FSK, 4FSK, 2ASK, 4ASK, H-CPM*, MSK
*: Used for APCO-P25 Phase2 Inbound measurement
APSK Analysis (MX269017A-001)
16APSK, 32APSK
Higher-Order QAM Analysis (MX269017A-011)
512QAM, 1024QAM, 2048QAM

Frequency Setting Range

100 kHz to Upper frequency limit
(300 MHz to Upper frequency limit depending on measured symbol rate and installed option)


MS2840A Vector Modulation Analysis

Carrier Freq. 1 000 000 000 Hz Input Level -9.00 dBm
ATT 4 dB

Result

Numeric		
Tx Power	-10.70	dBm
Frequency Error	-0.03	Hz
EVM(rms)	0.21	%
EVM(peak)	0.53	%
Phase Error(rms)	0.10	deg.
Phase Error(peak)	-0.28	deg.
Mag. Error(rms)	0.13	%
Mag. Error(peak)	-0.30	%
Origin Offset	-82.84	dB
IQ Gain Imbalance	0.00	dB
Quadrature Error	2.79	deg.

Constellation
MKR 0 Symbol
I 0.7049
Q 0.7056

Ref.Ext Pre-Amp Off

Measurement Screen

Analog Measurement Software (MX269018A)

When this software is installed in the MS2840A, the Tx performance (carrier frequency, Tx power, modulation rate/frequency deviation, demodulation frequency, demodulation signal distortion rate, etc.) of analog radios can be measured.

* The Audio Analyzer cannot be installed in the MS2840A.
* This software cannot be installed in the MS2830A 26.5 GHz/43 GHz models, but can be installed in the MS2840A 26.5 GHz/44.5 GHz models.

Supported Modulations

AM, FM, ΦM

Frequency Setting Range

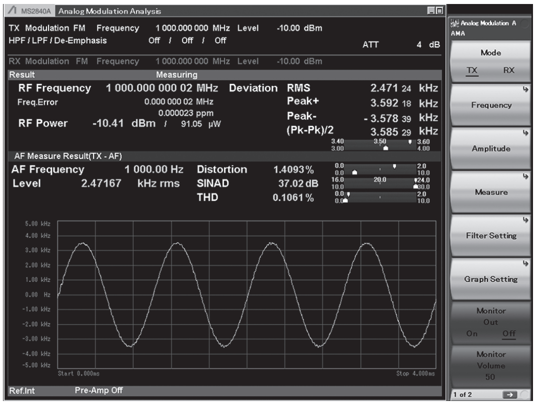
100 kHz to Upper frequency limit
(At Wide Band FM measurement: 10 MHz to Upper frequency limit)

Weighting Filter

CCITT, C-Message, CCIR 468, CCIR-ARM, A-Weighting

De-emphasis

25, 50, 75, 500, 750 µs


MS2840A Analog Modulation Analysis

TX Modulation FM Frequency 1 000.000 000 MHz Level -10.00 dBm
HPF / LPF / De-Emphasis Off / Off / Off
ATT 4 dB
RX Modulation FM Frequency 1 000.000 000 MHz Level -10.00 dBm

Result Measuring

RF Frequency 1 000.000 000 02 MHz
Freq.Error 0.000 000 02 MHz
0.000023 ppm
RF Power -10.41 dBm / 91.05 µW
Deviation RMS 2.471 24 kHz
Peak+ 3.592 18 kHz
Peak- - 3.578 39 kHz
(Pk-Pk)/2 3.585 29 kHz

AF Measure Result(TX - AF)

AF Frequency 1 000.00 Hz
Level 2.47167 kHz rms
Distortion 1.4093 %
SINAD 37.02 dB
THD 0.1061 %

Ref.Int Pre-Amp Off

Measurement Screen

Refer to the MX2690xxA Series Measurement Software brochure for details.

Tx Measurement

Other Options

Preamplifier (MS2840A-008)

This option is for the 3.6 GHz/6 GHz models (MS2840A-040/041) and the 26.5 GHz/44.5 GHz models (MS2840A-044/046).
The gain of about 20 dB improves the Displayed Average Noise Level (DANL). This preamplifier is used to measure low-level signals such as noise and interference.

Frequency Range
With MS2840A-040: 100 kHz to 3.6 GHz
With MS2840A-041: 100 kHz to 6 GHz

Noise Floor Reduction (MS2840A-051)

The Noise Floor Reduction (NFR) function increases the measurement accuracy for low-level signals. It subtracts the internal noise components (11 dB max. nominal) of the measuring instrument itself from the displayed measurement result.

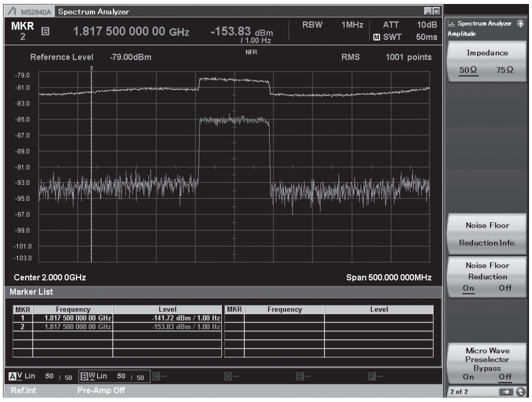
When the NFR function is used with a connected external mixer (High Performance Waveguide Mixer MA2806A/MA2808A), it measures V- and E-band millimeter waveband applications with high dynamic range.

<Main Applications>

- Spurious Emission
- Spectrum Mask
- Adjacent Channel Leakage Power (ACLR)
- Power ON/OFF ratio

Measurement times using the NFR function remain unchanged.
The NFR function eliminates the procedure of measuring the instrument noise floor each time like using the earlier noise cancelling function. If the noise floor is measured once when an ambient temperature change affects the noise floor level or when an external mixer is connected, the NFR effect can be captured by the same operation as normal measurement, unless there is a change in these conditions.

[Notes]
The NFR function is enabled only by the Spectrum Analyzer function.
The design value is nominal and is not a guaranteed specification.


MS2840A Spectrum Analyzer

MKR 2 1.817 500 000 00 GHz -153.83 dBm / 1.00 Hz
RBW 1MHz
ATT 10dB
SWT 50ms
Reference Level -79.00dBm
NFR
RMS 1001 points
Center 2.000 0GHz
Span 500.000 000MHz

Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	1.817 500 000 00 GHz	-141.72 dBm / 1.00 Hz			
2	1.817 500 000 00 GHz	-153.83 dBm / 1.00 Hz			

Ref.Int Pre-Amp Off

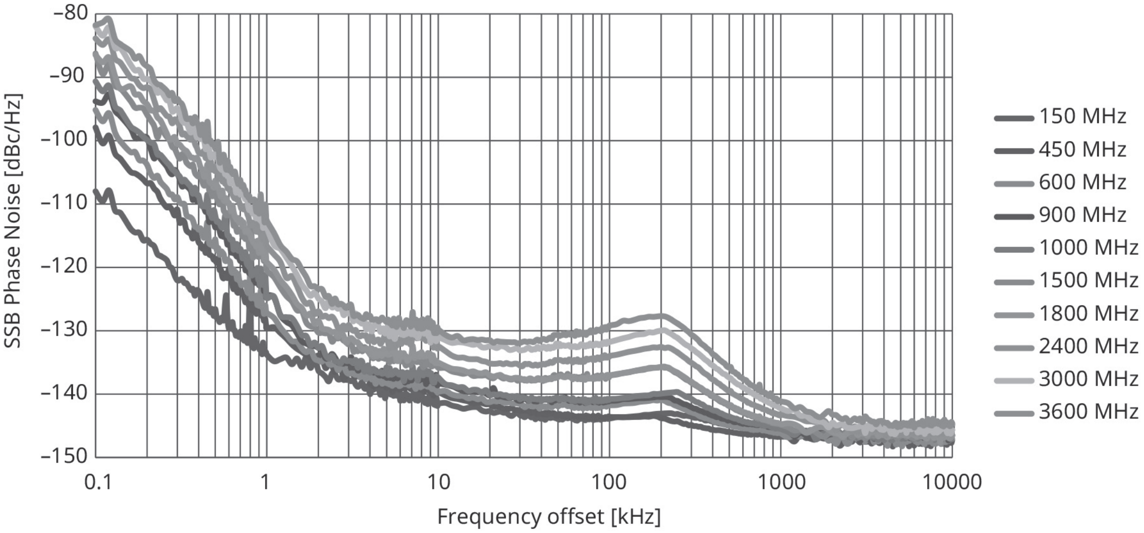
Measurement Screen

Low Phase Noise Performance (MS2840A-066)

The Low Phase Noise Performance MS2840A-066 option greatly increases SSB phase noise performance for RF input signals of more than 130 MHz and less than 3.7 GHz at frequency offsets of 1 kHz to 1 MHz from the main carrier wave. Setting the span to a range of either 300 Hz to 1 MHz (spectrum analyzer function) or 1 kHz to 31.25 MHz (signal analyzer function) enables the function on Spectrum display.

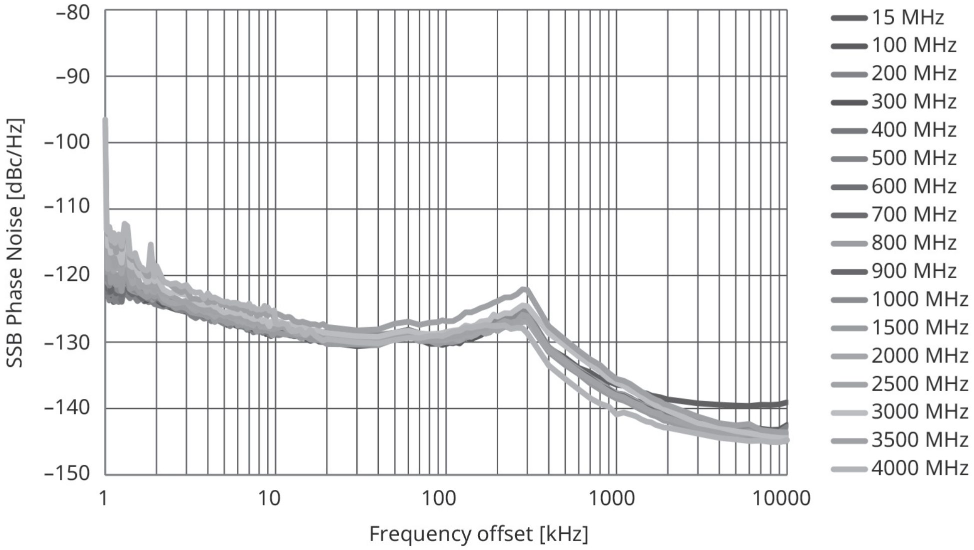
Phase Noise Performance (Spectrum Analyzer Function)

Carrier Offset	SSB Phase Noise			
	Standard	Low Phase Noise Performance MS2840A-066 Installed		
	Center Frequency: 1 GHz	Center Frequency: 1 GHz	Center Frequency: 500 MHz	Center Frequency: 150 MHz
10 Hz	–80 dBc/Hz (nom.)	—	—	—
100 Hz	–92 dBc/Hz (nom.)	–92 dBc/Hz (meas.*)	–98 dBc/Hz (nom.)	–107 dBc/Hz (meas.*)
1 kHz	–117 dBc/Hz (nom.)	–125 dBc/Hz (meas.*)	–122 dBc/Hz	–132 dBc/Hz (meas.*)
10 kHz	–123 dBc/Hz	–138 dBc/Hz (meas.*)	–133 dBc/Hz	–140 dBc/Hz (meas.*)
100 kHz	–123 dBc/Hz	–142 dBc/Hz (meas.*)	–133 dBc/Hz	–143 dBc/Hz (meas.*)
1 MHz	–135 dBc/Hz	–146 dBc/Hz (meas.*)	–148 dBc/Hz (nom.)	–145 dBc/Hz (meas.*)
10 MHz	–148 dBc/Hz (nom.)	—	—	—



Phase Noise Performance (meas.*), Low Phase Noise MS2840A-066 On

(Reference) Phase Noise Performance When MS2840A-066 Not Installed



Phase Noise Performance (meas.*), Low Phase Noise MS2840A-066 None

*: Value measured at design but not guaranteed specification, and value measured by Phase Noise Measurement function.

Rx Measurement Built-in Signal Generator

A Vector Signal Generator and Analog Signal Generator can be installed in the MS2840A series (3.6 GHz/6 GHz models). Installing Tx and Rx (Signal Generator) measurement functions in one MS2840A makes it easy to configure a simple, small-footprint measurement system.

Vector Signal Generator

Vector Signal Generator (MS2840A-020/021)

The Vector Signal Generator MS2840A-020/021 covers a frequency range from 250 kHz to 3.6 GHz/6 GHz with a wide vector modulation bandwidth of 120 MHz and two waveform memory sizes of 64 Msamples (standard) and 256 Msamples (option).
A number of waveform patterns for various communications methods are built-in as standard. In addition, the IQproducer software for editing and generating waveform patterns is also supported. Waveform pattern files can be created using common Electronic Design Automation (EDA) tools, such as MATLAB.
The vector signal generator has various applications, such as Tx tests of equipment like amplifiers, and Rx tests of wireless equipment.

Frequency Range	250 kHz to 3.6 GHz (MS2840A-020) 250 kHz to 6 GHz (MS2840A-021)
Output Level	–40 to +20 dBm (>25 MHz) (Standard) –40 to +2 dBm (≤25 MHz) (Standard) –136 to +15 dBm (>25 MHz) (with MS2840A-022 installed) –136 to –3 dBm (≤25 MHz) (with MS2840A-022 installed)
Output Level Accuracy (at CW)	±0.5 dB (typ.) (–110 dBm ≤ Level ≤ +4 dBm, 100 MHz ≤ Frequency < 375 MHz) ±0.5 dB (–110 dBm ≤ Level ≤ +4 dBm, 375 MHz ≤ Frequency ≤ 3.6 GHz)
Waveform Memory	64 Msamples (Standard), 256 Msamples (with MS2840A-027 installed)
Vector Modulation Bandwidth	120 MHz
Internal Baseband Reference Clock	20 kHz to 160 MHz
Internal Waveform Pattern (Standard)*	WLAN (IEEE 802.11a/b/g), Bluetooth, GPS, GLONASS, QZSS, etc.
IQproducer Support*	TDMA IQproducer MX269902A Multi-Carrier IQproducer MX269904A

*: Refer to the MX269xxxA series Software (Waveform Pattern MX2690xxA, IQproducer MX2699xxA) brochure for details.

Options

Low Power Extension for Vector Signal Generator (MS2840A-022)

This option extends the lower limit of the output level from the standard value of –40 dBm to –136 dBm. Note that the upper limit drops by 5 dB.

ARB Memory Upgrade 256 MSa for Vector Signal Generator (MS2840A-027)

This option extends the ARB memory size from the standard value of 64 Msamples to 256 Msamples.

AWGN (MS2840A-028)

This option adds Additive White Gaussian Noise (AWGN) to the output wanted signal. It can be used for dynamic range tests of receivers, etc.

Analog Function Extension for Vector Signal Generator (MS2840A-029)

This option adds an analog signal generator function to the Vector Signal Generator MS2840A-020/021. The analog signal generator function frequency range and output level range are the same as the Analog Signal Generator MS2840A-088. Installing this option requires the Analog Measurement Software MX269018A, Vector Signal Generator Low Power Extension MS2840A-022 and USB Audio A0086D options. It is operated using the MX269018A.

Software for Vector Signal Generator

TDMA IQproducer MX269902A*

The IQproducer MX269902A is PC application software for generating waveform patterns using TDMA parameters. The generated waveform patterns are saved in the MS2840A to output TDMA modulation baseband signals and RF signals from the vector signal generator. Various signals, such as DMR, APCO-P25, NXDN, ARIB STD-T61/T79/T86/T98/T102, ETC, DSRC, etc., can be generated.

Multi-Carrier IQproducer MX269904A*

The Multi-Carrier IQproducer MX269904A is PC application software for generating multichannel waveform patterns for modulation signals and tone signals for various communications methods. The generated waveform patterns are saved in the MS2840A to output multi-carrier signals for various communication methods from the vector signal generator option.

*: Refer to the MX269xxxA series Software (Waveform Pattern MX2690xxA, IQproducer MX2699xxA) brochure for details.

Analog Signal Generator

Analog Signal Generator (MS2840A-088)

The Analog Signal Generator MS2840A-088 covers a frequency range of 100 kHz to 3 GHz and supports output of FM, ΦM, and AM signals. When used in combination with the Analog Measurement Software MX269018A, TRx tests of analog wireless equipment can be performed by one MS2840A set. The internal modulation output function outputs both AF tone and DCS (Digital Code Squelch) code signals for Rx tests of analog wireless equipment.

*: Refer to the MX2690xxA Series Measurement Software brochure for details.

Frequency Setting Range	100 kHz to 3 GHz (MS2840A-088)
Output Setting Level	–127 to +15 dBm (>25 MHz) –127 to –3 dBm (≤25 MHz)
Output Level Accuracy (at CW)	±0.5 dB (typ.) (–110 dBm ≤ Level ≤ +4 dBm, 100 MHz ≤ Frequency < 375 MHz) ±0.5 dB (–110 dBm ≤ Level ≤ +4 dBm, 375 MHz ≤ Frequency ≤ 3.6 GHz)
Output Modulation Signal	FM, ΦM, AM
Internal Modulation Signal Source	AF tone, DCS code

Options

Vector Function Extension for Analog Signal Generator Retrofit (MS2840A-189)

This option adds a vector signal generator function to the Analog Signal Generator MS2840A-088.
The specifications of this vector signal generator are the same as the Vector Signal Generator MS2840A-020 with a frequency range of 250 kHz to 3.6 GHz; the output level is the same as the Low Power Extension for Vector Signal Generator MS2840A-022.

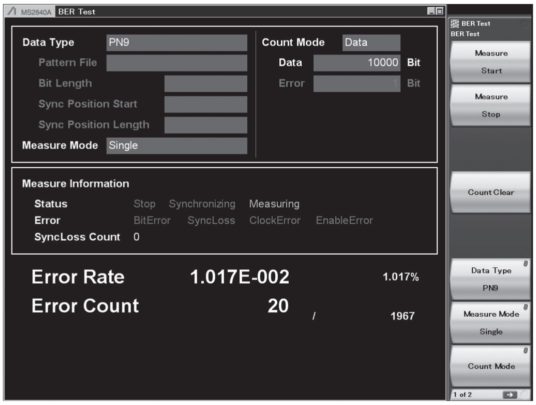
Rx Measurement

Other Measurement Functions

BER Measurement Function (MS2840A-026)

The MS2840A with the BER Measurement Function MS2840A-026 supports measurement up to 10 Mbps.
It supports Rx sensitivity tests by inputting the receiver-demodulated Data/Clock/Enable to the back of the MS2840A.

- Input Signal: Data, Clock, Enable (Polarity reversal supported)
- Input Bit Rate: 100 bps to 10 Mbps
- Input Level: TTL 3.3 V
- Connector: Rear panel, AUX connector*
  *: Can convert to BNC by connecting AUX conversion adapter (J1556A).
- Measured Patterns:
  PN9, PN11, PN15, PN20, PN23, ALL0, ALL1, Alternate (0101...),
  PN9Fix, PN11Fix, PN15Fix, PN20Fix, PN23Fix,
  UserDefine (4096 bits max.)
- Measurable Bit Count: 1000 to 4294967295 bits (2^{32} – 1 bits)
- Measurable Error Bit Count: 1 to 2147483647 bits (2^{31} – 1 bits)
- Count Mode
  Data: Measures until specified Data count
  Error: Measures until specified Error count
- Measurement Mode
  Single: Measures specified measurement bit count once
  Continuous: Repeats Single measurement
  Endless: Continues measurement to upper limit of measurement bits

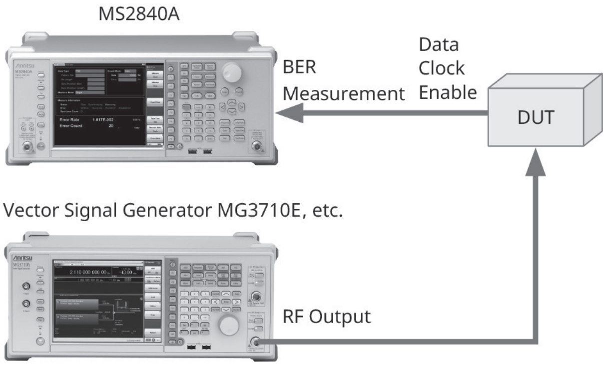


Data Type: PN9
Pattern File
Bit Length
Sync Position Start
Sync Position Length
Measure Mode: Single
Count Mode: Data
Data: 10000 Bit
Error: 1 Bit

Measure Information
Status: Stop Synchronizing Measuring
Error: BitError SyncLoss ClockError EnableError
SyncLoss Count: 0

Error Rate 1.017E-002 1.017%
Error Count 20 / 1967

BER Measurement Function Main Screen



BER Measurement Setup Example
(using external vector signal generator)

Others

Other Measurement Functions

Rubidium Reference Oscillator (MS2840A-001)

This option is a 10-MHz reference crystal oscillator with excellent frequency stability startup characteristics of ±1 × 10^{-9} at 7 minutes after power-on.
Aging Rate: ±1 × 10^{-10}/month, ±1 × 10^{-9}/year
Start-up Characteristics: ±1 × 10^{-9} (7 minutes after power-on)

High Stability Reference Oscillator (MS2840A-002)

This 10-MHz reference crystal oscillator has excellent improved frequency stability with an aging rate of ±1 × 10^{-7}/year.
Aging Rate: ±1 × 10^{-7}/year
Start-up Characteristics: ±5 × 10^{-8} (5 minutes after power-on)

2ndary SSD (MS2840A-011)

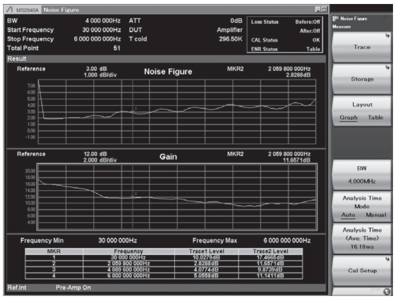
This removable SSD is for storing user data.
It has no installed OS. It is shipped mounted in the Secondary HDD/SSD slot of the MS2840A main unit.

Noise Figure Measurement Function (MS2840A-017)

Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source.
The Noisecom NC346 series* of noise sources is supported.

*: Refer to the MS2840A Data Sheet for more details.

Frequency Range (Noise sauce): 0.01 GHz to 40.0 GHz
Frequency Mode: Fixed, List, Sweep
DUT Mode: Amplifier, Down Converter, Up Converter
Screen Layout: Graph, Table
Measurement Results Display
Graph/List/Spot
Displays measurement results for each trace (Trace1/Trace2).
Noise Figure (NF) [dB]
Noise Factor (F) [Linear]
Gain
Y-Factor: Power ratio when Noise Source is turned On/Off
T effective: Effective noise temperature
P Hot: Power measured when Noise Source is On.
P Cold: Power measured when Noise Source is Off.

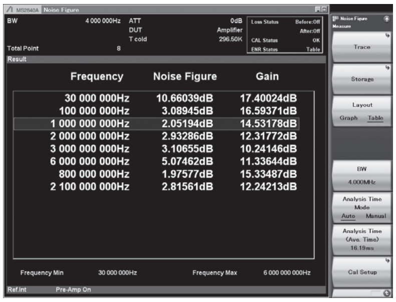


BW 4 000 000Hz
Start Frequency 30 000 000Hz
Stop Frequency 6 000 000 000Hz
Total Point 51
ATT 0dB
DUT Amplifier
T cold 296.50K
Loss Status Before:Off After:Off
CAL Status OK
ENR Status Table

Frequency Min 30 000 000Hz
Frequency Max 6 000 000 000Hz

MKR	Frequency	Trace1 Level	Trace2 Level
1	30 000 000Hz	10.0279dB	17.4665dB
2	2 059 800 000Hz	2.8288dB	11.6571dB
3	4 089 600 000Hz	4.0774dB	9.8739dB
4	6 000 000 000Hz	5.0558dB	11.1411dB

Measurement Result:
Example of Graph display
(Frequency Mode: Sweep,
Screen Layout: Graph)

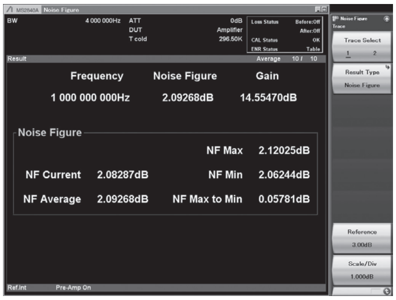


BW 4 000 000Hz
Total Point 8
ATT 0dB
DUT Amplifier
T cold 296.50K
Loss Status Before:Off After:Off
CAL Status OK
ENR Status Table

Frequency	Noise Figure	Gain
30 000 000Hz	10.66039dB	17.40024dB
100 000 000Hz	3.08945dB	16.59371dB
1 000 000 000Hz	2.05194dB	14.53178dB
2 000 000 000Hz	2.93286dB	12.31772dB
3 000 000 000Hz	3.10655dB	10.24146dB
6 000 000 000Hz	5.07462dB	11.33644dB
800 000 000Hz	1.97577dB	15.33487dB
2 100 000 000Hz	2.81561dB	12.24213dB

Frequency Min 30 000 000Hz
Frequency Max 6 000 000 000Hz

Measurement Result:
Example of List display
(Frequency Mode: List,
Screen Layout: List)



BW 4 000 000Hz
ATT 0dB
DUT Amplifier
T cold 296.50K
Loss Status Before:Off After:Off
CAL Status OK
ENR Status Table
Average 10 / 10

Frequency	Noise Figure	Gain
1 000 000 000Hz	2.09268dB	14.55470dB

Noise Figure
NF Max 2.12025dB
NF Current 2.08287dB
NF Min 2.06244dB
NF Average 2.09268dB
NF Max to Min 0.05781dB

Measurement Result:
Example of Spot display
(Frequency Mode: Fixed)

Configurations

Configuration List

Model	Name	Remarks
MS2840A	Signal Analyzer	Analysis Bandwidth 31.25 MHz installed as standard
MS2840A-040	3.6 GHz Signal Analyzer	
MS2840A-041	6 GHz Signal Analyzer	
MS2840A-001	Rubidium Reference Oscillator	Option
MS2840A-002	High Stability Reference Oscillator	Option
MS2840A-077	Analysis Bandwidth Extension to 62.5 MHz	Option
MS2840A-078	Analysis Bandwidth Extension to 125 MHz	Option, Requires MS2840A-077
MS2840A-008	Preamplifier	Option, Frequency Range: 100 kHz to 6 GHz
MS2840A-010	Phase Noise Measurement Function	Option
MS2840A-011	2ndary SSD	Option
MS2840A-016	Precompliance EMI Function	Option
MS2840A-017	Noise Figure Measurement Function	Option, Preamplifier MS2840A-008 (or 108) recommended
MS2840A-026	BER Measurement Function	Option, AUX Conversion Adapter J1566A as standard accessory
MS2840A-051	Noise Floor Reduction	Option
MS2840A-066	Low Phase Noise Performance	Option
MS2840A-020	3.6 GHz Vector Signal Generator	Option
MS2840A-021	6 GHz Vector Signal Generator	Option
MS2840A-022	Low Power Extension for Vector Signal Generator	Option
MS2840A-027	ARB Memory Upgrade 256 Msa for Vector Signal Generator	Option
MS2840A-028	AWGN	Option
MS2840A-029	Analog Function Extension for Vector Signal Generator	Option, Requires Analog Measurement Software MX269018A, USB Audio A0086D and Low Power Extension for Vector Signal Generator MS2840A-022
MS2840A-088	3.6 GHz Analog Signal Generator	Option, Requires Analog Measurement Software MX269018A and USB Audio A0086D

The following options are installed as standard and do not require separate orders when ordering the MS2840A-040/041.

Standard Software	MX269000A
Analysis Bandwidth 10 MHz	MS2840A-006
Bandwidth Extension to 31.25 MHz	MS2840A-005

Order the following combination when installing the Vector Signal Generator and Analog Signal Generator in a new order:
MS2840A-020 or 021 + MS2840A-022 + MS2840A-029

List of Retrofit Options

The following hardware options can be retrofitted. Add to the retrofit options at ordering and also order the Retrofit Kit Z1932A.
In addition, the MS2840A main unit must be returned to the Anritsu plant for remodelling when retrofitting hardware options.

Model	Name	Remarks
MS2840A-101	Rubidium Reference Oscillator Retrofit	
MS2840A-102	High Stability Reference Oscillator Retrofit	
MS2840A-177	Analysis Bandwidth Extension to 62.5 MHz Retrofit	
MS2840A-178	Analysis Bandwidth Extension to 125 MHz Retrofit	Requires Analysis Bandwidth Extension to 62.5 MHz MS2840A-077 (or 177)
MS2840A-108	Preamplifier Retrofit	Frequency Range: 100 kHz to 6 GHz
MS2840A-110	Phase Noise Measurement Function Retrofit	
MS2840A-111	2ndary SSD Retrofit	
MS2840A-116	Precompliance EMI Function Retrofit	
MS2840A-117	Noise Figure Measurement Function Retrofit	Preamplifier MS2840A-008 (or 108) recommended
MS2840A-126	BER Measurement Function Retrofit	AUX Conversion Adapter J1566A as standard accessory
MS2840A-151	Noise Floor Reduction Retrofit	Option
MS2840A-166	Low Phase Noise Performance Retrofit	
MS2840A-120	3.6 GHz Vector Signal Generator Retrofit	
MS2840A-121	6 GHz Vector Signal Generator Retrofit	
MS2840A-122	Low Power Extension for Vector Signal Generator Retrofit	
MS2840A-127	ARB Memory Upgrade 256 Msa for Vector Signal Generator Retrofit	
MS2840A-128	AWGN Retrofit	
MS2840A-129	Analog Function Extension for Vector Signal Generator Retrofit	Requires Analog Measurement Software MX269018A, USB Audio A0086D and Low Power Extension for Vector Signal Generator MS2840A-022 (or 122)
MS2840A-188	3.6 GHz Analog Signal Generator Retrofit	Requires Analog Measurement Software MX269018A and USB Audio A0086D
MS2840A-189	Vector Function Extension for Analog Signal Generator Retrofit	
MS2840A-182	CPU/Windows10 Upgrade Retrofit	

Software

The following software can be retrofitted. Add to the required software at ordering and also order the Retrofit Kit Z1932A.

Model	Name	Remarks
MX269017A	Vector Modulation Analysis Software	
MX269017A-001	APSK Analysis	Requires Vector Modulation Analysis Software MX269017A
MX269017A-011	Higher-Order QAM Analysis	Requires Vector Modulation Analysis Software MX269017A
MX269018A	Analog Measurement Software	Requires USB Audio A0086D
MX269902A	TDMA IQproducer	
MX269904A	Multi-Carrier IQproducer	

Specifications

Refer to the MS2840A Data Sheet for more details.

Frequency Range

9 kHz to 3.6 GHz (MS2840A-040)
9 kHz to 6 GHz (MS2840A-041)

Aging Rate

±1 × 10^{-6}/year (Standard)
±1 × 10^{-7}/year
(with High Stability Reference Oscillator MS2840A-002 installed)
±1 × 10^{-10}/month, ±1 × 10^{-9}/year
(with Rubidium Reference Oscillator MS2840A-001 installed)

Maximum Input Level

Average total power: +30 dBm
(Input attenuator: ≥10 dB, Preamp: Off)

Resolution Bandwidth (RBW)

Spectrum Analyzer Function
Setting Range:
1 Hz to 3 MHz (1–3 sequence), 500 Hz, 50 kHz, 2 MHz, 5 MHz, 10 MHz, 20 MHz
[At Zero SPAN: 30 Hz to 3 MHz (1–3 sequence), 50 kHz, 5 MHz, 10 MHz, 20 MHz, 31.25 MHz]
Signal Analyzer Function
Setting Range:
1 Hz to 1 MHz (1–3 sequence)

Video Bandwidth (VBW)

Spectrum Analyzer Function
Setting Range:
1 Hz to 3 kHz (1-3 sequence), 5 kHz, 10 kHz to 10 MHz (1-3 sequence), off
VBW Mode: Video Average, Power Average

SSB Phase Noise

Spectrum Analyzer Function

Carrier Offset	SSB Phase Noise	
	Standard	Low Phase Noise Performance MS2840A-066 installed
	Center Frequency: 1 GHz	Center Frequency: 500 MHz
10 Hz	–80 dBc/Hz (nom.)	—
100 Hz	–92 dBc/Hz (nom.)	–98 dBc/Hz (nom.)
1 kHz	–117 dBc/Hz (nom.)	–122 dBc/Hz
10 kHz	–123 dBc/Hz	–133 dBc/Hz
100 kHz	–123 dBc/Hz	–133 dBc/Hz
1 MHz	–135 dBc/Hz	–148 dBc/Hz (nom.)
10 MHz	–148 dBc/Hz (nom.)	—

Display Average Noise Level (DANL)

Spectrum Analyzer Function
Preamp: None, Low Phase Noise: None

Frequency	DANL
30 MHz	–153 dBm/Hz
400 MHz	–153 dBm/Hz
1 GHz	–151 dBm/Hz
3 GHz	–149 dBm/Hz
6 GHz	–146 dBm/Hz

Preamp: On, Low Phase Noise: None

Frequency	DANL
30 MHz	–166 dBm/Hz
400 MHz	–166 dBm/Hz
1 GHz	–165 dBm/Hz
3 GHz	–164 dBm/Hz
6 GHz	–161 dBm/Hz

Noise Floor Reduction: On
It subtracts the internal noise components (11 dB max. nominal) of the measuring instrument itself from the displayed measurement result.

Total Absolute Amplitude Accuracy

Preamp: None
±0.5 dB (300 kHz ≤ f < 4 GHz)
±1.8 dB (4 GHz ≤ f < 6 GHz)

The MS2840A supports level calibration over a wide range of 300 kHz to 4 GHz using its built-in level calibration oscillator.
The level accuracy standards include frequency characteristics, linearity and attenuator switching error. Consequently, the level including the above three errors can still be measured accurately even when the measurement frequency and built-in attenuator settings are changed.

2-tone 3rd-order Intermodulation Distortion

Preamp: None

Frequency	2-tone 3rd-order Intermodulation Distortion
30 GHz	≤–54 dBc (TOI = +12 dBm)
400 GHz, 1 GHz, 3 GHz	≤–62 dBc (TOI = +16 dBm)
6 GHz	≤–60 dBc (TOI = +15 dBm)

Second Harmonic Distortion

Preamp: None

Input Frequency	Harmonic Distortion	SHI	Mixer Input Level
30 GHz	≤–60 dBc	≥+30 dBm	–30 dBm
400 MHz, 1 GHz	≤–65 dBc	≥+35 dBm	–30 dBm
3 GHz	≤–80 dBc	≥+60 dBm	–20 dBm

Analysis Bandwidth (Signal Analyzer Function)

31.25 MHz (standard)
62.5 GHz (Option)
125 MHz (Option)

Built-in Signal Generator

Vector Signal Generator (MS2840A-020/021)

Frequency Range
250 kHz to 3.6 GHz (MS2840A-020)
250 kHz to 6 GHz (MS2840A-021)
Output Level
–40 to +20 dBm (>25 MHz) (Standard)
–40 to +2 dBm (≤25 MHz) (Standard)
–136 to +15 dBm (>25 MHz) (with MS2840A-022 installed)
–136 to –3 dBm (≤25 MHz) (with MS2840A-022 installed)

Analog Signal Generator (MS2840A-088)

Frequency Setting Range
100 kHz to 3 GHz
Output Setting Level
–127 to +15 dBm (>25 MHz)
–127 to –3 dBm (≤25 MHz)

Shared

Output Level Accuracy (at CW)
±0.5 dB (typ.)
(–110 dBm ≤ level ≤ +4 dBm, 100 MHz ≤ Frequency < 375 MHz)
±0.5 dB
(–110 dBm ≤ level ≤ +4 dBm, 375 MHz ≤ Frequency ≤ 3.6 GHz)

Connector

RF Input (Front panel)
N–J, 50Ω (nom.): 3.6 GHz and 6 GHz models (MS2840A-040/041)
RF Output (Front panel)
N–J, 50Ω (nom.): Built-in Signal Generator (MS2840A-020/021/088)

Dimensions and Mass

426 (W) × 177 (H) × 390 (D) mm (excluding projections)
≤14.5 kg (with either MS2840A-040 or -041 installed, and either MS2840A-020 or -021 installed, excluding other options)

Power Supply

Power voltage: 100 VAC to 120 VAC/200 VAC to 240 VAC
Frequency: 50 Hz to 60 Hz
Power consumption:
≤350 VA (including all options)
140 VA (nom.)
(with MS2840A-040 or -041 installed, excluding other options)
220 VA (nom.)
(with either MS2840A-040 or -041 installed, and either MS2840A-020 or -021 installed excluding other options)

CE Marking

EMC: 2014/30/EU, EN61326-1, EN61000-3-2
LVD: 2014/35/EU, EN61010-1
RoHS: 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018

UKCA Marking

EMC: S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
LVD: S.I. 2016 No.1101, EN 61010-1
RoHS: S.I. 2012 No.3032, EN IEC 63000: 2018

OS

Windows 10 (64 bits)

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Typical (typ.): Performance not warranted. Most products meet typical performance.
Nominal (nom.): Values not warranted. Included to facilitate application of product.
Measured (meas.): Performance not warranted. Data actually measured from randomly selected measuring instruments.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MS2840A	Signal Analyzer
	Standard Accessories
	Power Cord: 1 pc
P0031A	USB Memory (≥ 1GB): 1 pc
Z0541A	USB Mouse: 1 pc
	Install DVD-ROM (Application software, instruction manual DVD-ROM): 1 pc
	Options
MS2840A-040	3.6 GHz Signal Analyzer
MS2840A-041	6 GHz Signal Analyzer
MS2840A-001	Rubidium Reference Oscillator
MS2840A-002	High Stability Reference Oscillator
MS2840A-077	Analysis Bandwidth Extension to 62.5 MHz
MS2840A-078	Analysis Bandwidth Extension to 125 MHz (Requires MS2840A-077)
MS2840A-008	Preamplifier
MS2840A-010	Phase Noise Measurement Function
MS2840A-011	2ndary SSD
MS2840A-016	Precompliance EMI Function
MS2840A-017	Noise Figure Measurement Function
MS2840A-026	BER Measurement Function (AUX Conversion Adapter J1556A as standard accessory)
MS2840A-051	Noise Floor Reduction
MS2840A-066	Low Phase Noise Performance
MS2840A-020	3.6 GHz Vector Signal Generator
MS2840A-021	6 GHz Vector Signal Generator
MS2840A-022	Low Power Extension for Vector Signal Generator
MS2840A-027	ARB Memory Upgrade 256 MSa for Vector Signal Generator
MS2840A-028	AWGN
MS2840A-029	Analog Function Extension for Vector Signal Generator
MS2840A-088	3.6 GHz Analog Signal Generator
	Retrofit Options
MS2840A-101	Rubidium Reference Oscillator Retrofit
MS2840A-102	High Stability Reference Oscillator Retrofit
MS2840A-177	Analysis Bandwidth Extension to 62.5 MHz Retrofit
MS2840A-178	Analysis Bandwidth Extension to 125 MHz Retrofit (Requires MS2840A-077 or 177)
MS2840A-108	Preamplifier Retrofit
MS2840A-110	Phase Noise Measurement Function Retrofit
MS2840A-111	2ndary SSD Retrofit
MS2840A-116	Precompliance EMI Function Retrofit
MS2840A-117	Noise Figure Measurement Function Retrofit
MS2840A-126	BER Measurement Function Retrofit (AUX Conversion Adapter J1556A as standard accessory)
MS2840A-151	Noise Floor Reduction Retrofit
MS2840A-166	Low Phase Noise Performance Retrofit
MS2840A-120	3.6 GHz Vector Signal Generator Retrofit
MS2840A-121	6 GHz Vector Signal Generator Retrofit
MS2840A-122	Low Power Extension for Vector Signal Generator Retrofit
MS2840A-127	ARB Memory Upgrade 256 MSa for Vector Signal Generator Retrofit
MS2840A-128	AWGN Retrofit
MS2840A-129	Analog Function Extension for Vector Signal Generator Retrofit
MS2840A-188	3.6 GHz Analog Signal Generator Retrofit
MS2840A-189	Vector Function Extension for Analog Signal Generator Retrofit
MS2840A-182	CPU/Windows10 Upgrade Retrofit
MS2840A-282	CPU/Windows10 Upgrade Retrofit
	Software Options
	DVD-ROM with License and Operation manuals
MX269017A	Vector Modulation Analysis Software
MX269017A-001	APSK Analysis
MX269017A-011	Higher-Order QAM Analysis
MX269018A	Analog Measurement Software (Requires USB Audio A0086D)
MX269902A	TDMA IQproducer
MX269904A	Multi-Carrier IQproducer
	Warranty Service
MS2840A-ES210	2 years Extended Warranty Service
MS2840A-ES310	3 years Extended Warranty Service
MS2840A-ES510	5 years Extended Warranty Service

Continued on next page

Model/Order No.	Name
	Manuals Following operation manuals provided as hard copy
W3812AE	MS2840A Operation Manual (Mainframe Operation)
W2851AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Mainframe Remote Control)
W3335AE	MS2830A/MS2840A/MS2850A Operation Manual (Signal Analyzer Function Operation)
W2853AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Signal Analyzer Function Remote Control)
W3336AE	MS2830A/MS2840A/MS2850A Operation Manual (Spectrum Analyzer Function Operation)
W2855AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Spectrum Analyzer Function Remote Control)
W3117AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Phase Noise Measurement Function Operation)
W3118AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Phase Noise Measurement Function Remote Control)
W3655AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A-017 Operation Manual (Noise Figure Measurement Function Operation)
W3656AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A-017 Operation Manual (Noise Figure Measurement Function Remote control)
W3337AE	MS2830A/MS2840A-020/021 Operation Manual (Vector Signal Generator Option Operation)
W3338AE	MS2830A/MS2840A-020/021 Operation Manual (Vector Signal Generator Option Remote Control)
W2914AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A Operation Manual (IQproducer for Vector Signal Generator Option)
W2929AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A Operation Manual (Standard Waveform Pattern for Vector Signal Generator Option)
W3305AE	MX269017A Operation Manual (Operation)
W3306AE	MX269017A Operation Manual (Remote Control)
W3555AE	MX269018A Operation Manual (Operation)
W3556AE	MX269018A Operation Manual (Remote Control)
W2916AE	MX269902A Operation Manual
W2917AE	MX269904A Operation Manual

The following options are installed as standard and do not require separate orders when ordering the MS2840A-040/041.

Standard Software	MX269000A
Analysis Bandwidth 10 MHz	MS2840A-006
Bandwidth Extension to 31.25 MHz	MS2840A-005

Model/Order No.	Name
	Application Parts
34AKNF50	Ruggedized K-to-Type N Adapter (DC to 20 GHz, 50Ω, Ruggedized K-M · N-F, SWR: 1.5 (max.), Insertion Loss: 0.4 dB (max.))
K240B	Power Divider (K connector, DC to 26.5 GHz, 50Ω, K-J, 1 W max.)
MA1612A	Four-port Junction Pad (5 MHz to 3 GHz, N-J)
J1359A	Coaxial Adaptor (K-P · K-J, SMA)
J0576B	Coaxial Cord, 1 m (N-P · 5D-2W · N-P)
J0576D	Coaxial Cord, 2 m (N-P · 5D-2W · N-P)
J0127A	Coaxial Cord, 1 m (BNC-P · RG58A/U · BNC-P)
J0127B	Coaxial Cord, 2 m (BNC-P · RG58A/U · BNC-P)
J0127C	Coaxial Cord, 0.5 m (BNC-P · RG58A/U · BNC-P)
J0322A	Coaxial Cord, 0.5 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322B	Coaxial Cord, 1 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322C	Coaxial Cord, 1.5 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322D	Coaxial Cord, 2 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0805	DC Block, N type (MODEL 7003) (10 kHz to 18 GHz, N-P · N-J)
J1555A	DC Block, SMA type (MODEL 7006-1) (9 kHz to 20 GHz, SMA-P · SMA-J)
K261	DC Block (10 kHz to 40 GHz, K-P · K-J)
J0004	Coaxial Adapter (DC to 12.4 GHz, 50Ω, N-P · SMA-J)
J1398A	N-SMA Adaptor (DC to 26.5 GHz, 50Ω, N-P · SMA-J)
J0911	Coaxial Cable, 1.0 m for 40 GHz (DC to 40 GHz, approx. 1 m, SF102A, 11K254/K254/1.0M)
J0912	Coaxial Cable, 0.5 m for 40 GHz (DC to 40 GHz, approx. 0.5 m, SF102A, 11K254/K254/0.5M)
41KC-3	Fixed Attenuator (DC to 40 GHz, 3 dB)
G0392A	High Pass Filter (PassBand >90 MHz)
G0393A	High Pass Filter (PassBand >225 MHz)
G0394A	High Pass Filter (PassBand >395 MHz)
1030-151-R	Filter, Hi-Pass, 700 MHz, N (m) to N (f), 50Ω
J1750A	10 dB Fixed Attenuator (DC to 18 GHz, Input Power <5 W)
J1751A	20 dB Fixed Attenuator (DC to 18 GHz, Input Power <5 W)
J1752A	30 dB Fixed Attenuator (DC to 18 GHz, Input Power <5 W)
J1753A	3 dB Fixed Attenuator (DC to 18 GHz, Input Power <5 W)
J1754A	6 dB Fixed Attenuator (DC to 18 GHz, Input Power <5 W)
J1755A	Termination (50Ω, Type N, DC to 18 GHz)
J1261A	Ethernet Cable (Shield type, Straight, 1 m)
J1261B	Ethernet Cable (Shield type, Straight, 3 m)
J1261C	Ethernet Cable (Shield type, Cross, 1 m)
J1261D	Ethernet Cable (Shield type, Cross, 3 m)
J0008	GPIB Cable, 2.0 m
J1556A	AUX Conversion Adapter (AUX → BNC, for vector signal generator option and BER measurement function option, standard accessory with BER Measurement Function MS2840A-026)
A0086D	USB Audio (for MX269018A)
B0635A	Rack Mount Kit (EIA)
B0657A	Rack Mount Kit (JIS)
B0636C*	Carrying Case (Hard type, with casters)
B0671A*	Front Cover for 1MW4U
MA24105A	Inline Peak Power Sensor (350 MHz to 4 GHz, with USB A to mini B cable)
MA24106A	USB Power Sensor (50 MHz to 6 GHz, with USB A to mini B cable)
MA24108A	Microwave USB Power Sensor (10 MHz to 8 GHz, with USB A to Micro-B cable)
MA24118A	Microwave USB Power Sensor (10 MHz to 18 GHz, with USB A to Micro-B cable)
MA24126A	Microwave USB Power Sensor (10 MHz to 26 GHz, with USB A to Micro-B cable)
Z0975A	Keyboard (USB)
Z1932A	Installation Kit (required when retrofitting options or installing software)

*: The Carrying Case B0636C includes the Front Panel Protective Cover (B0671A).

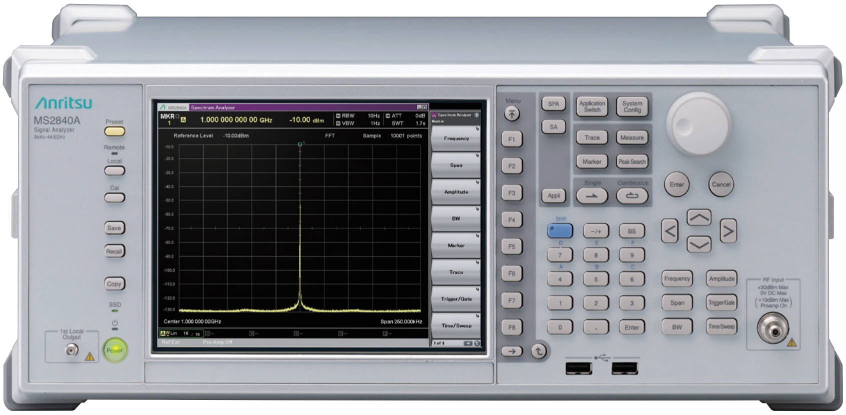
MS2840A

9 kHz to 26.5 GHz/44.5 GHz

Remote Control
GPIB | Ethernet | USB

New Choice of Microwave Models with Excellent Close-in Phase Noise Performance

Excellent Eco Product



Better Than Expected Close-in Phase Noise Performance

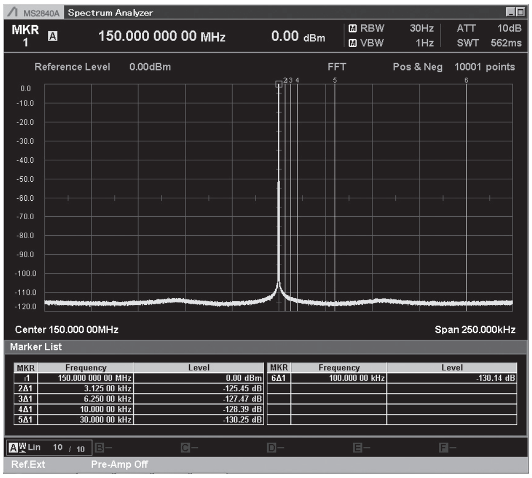
Since 2000 most spectrum analyzers have been designed for mobile communications and the phase noise performance has been optimized for offset frequencies of several MHz. Consequently, customers requiring good close-in phase noise performance have been limited to a narrow choice of usable spectrum analyzers, causing problems.
This new MS2840A series (26.5 GHz/44.5 GHz models) has been designed with emphasis on offering a spectrum analyzer with excellent close-in phase noise performance at offset frequencies of just several kHz.
This performance surpasses that of first-generation high-end spectrum analyzers and has sufficient margin for evaluating the close-in spurious of narrowband communications equipment in the short-wave, VHF, and UHF bands. Furthermore, this excellent phase noise performance proves its usefulness in the microwave and millimeter wave bands for evaluating microwave wireless equipment, aerospace equipment, weather radar, 79 GHz band automotive collision-prevention radar, and other devices requiring oscillator measurements. It supports measurements previously requiring large, expensive phase noise measuring instruments while offering excellent noise performance in a middle-price-range spectrum analyzer.

Close-in Phase Noise Performance

Specification at 1 GHz Measurement Frequency
(Spectrum Analyzer Function)

Carrier Offset	SSB Phase Noise
10 Hz	–80 dBc/Hz (nom.)
100 Hz	–92 dBc/Hz (nom.)
1 kHz	–117 dBc/Hz (nom.)
10 kHz	–123 dBc/Hz
100 kHz	–123 dBc/Hz
1 MHz	–135 dBc/Hz
10 MHz	–148 dBc/Hz (nom.)

Measurement Examples



Spectrum Analyzer

MKR 1 A 150.000 000 00 MHz 0.00 dBm
RBW 30Hz ATT 10dB
VBW 1Hz SWT 562ms

Reference Level 0.00dBm FFT Pos & Neg 10001 points

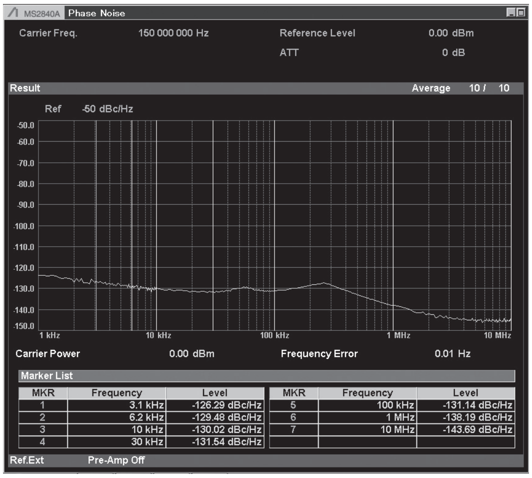
Center 150.000 00MHz Span 250.000kHz

Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	150.000 000 00 MHz	0.00 dBm	6Δ1	100.000 00 kHz	-130.14 dB
2Δ1	3.125 00 kHz	-125.45 dB			
3Δ1	6.250 00 kHz	-127.47 dB			
4Δ1	10.000 00 kHz	-128.39 dB			
5Δ1	30.000 00 kHz	-130.25 dB			

Ref.Ext Pre-Amp Off

Spectrum Display
150 MHz Measurement Frequency, Preamp Off



Phase Noise

Carrier Freq. 150 000 000 Hz
Reference Level 0.00 dBm
ATT 0 dB

Result Average 10 / 10

Ref -50 dBc/Hz

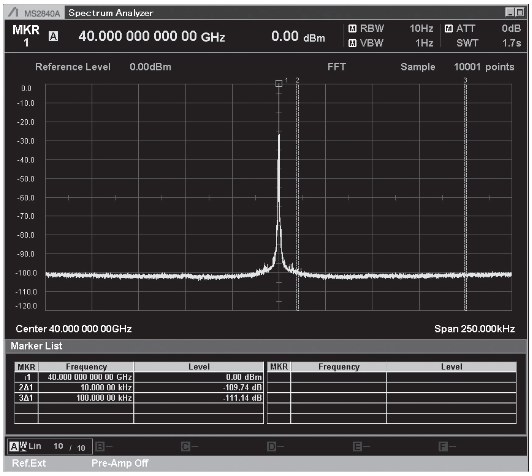
Carrier Power 0.00 dBm
Frequency Error 0.01 Hz

Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	3.1 kHz	-126.29 dBc/Hz	5	100 kHz	-131.14 dBc/Hz
2	6.2 kHz	-129.48 dBc/Hz	6	1 MHz	-138.19 dBc/Hz
3	10 kHz	-130.02 dBc/Hz	7	10 MHz	-143.69 dBc/Hz
4	30 kHz	-131.54 dBc/Hz			

Ref.Ext Pre-Amp Off

Phase Noise Measurement
150 MHz Measurement Frequency, Preamp Off



MS2840A Spectrum Analyzer

MKR 1 A 40.000 000 000 00 GHz 0.00 dBm

M RBW 10Hz M ATT 0dB

M VBW 1Hz SWT 1.7s

Reference Level 0.00dBm FFT Sample 10001 points

Center 40.000 000 00GHz Span 250.000kHz

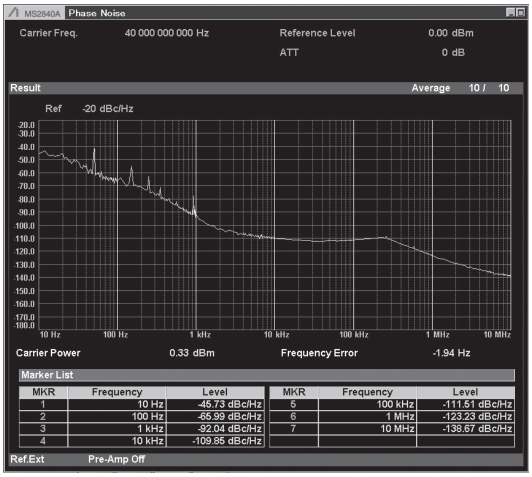
Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	40.000 000 000 00 GHz	0.00 dBm			
2Δ1	10.000 00 kHz	-109.74 dB			
3Δ1	100.000 00 kHz	-111.14 dB			

A W Lin 10 / 10

Ref.Ext Pre-Amp Off

Spectrum Display
40 GHz Measurement Frequency, Preamp Off



MS2840A Phase Noise

Carrier Freq. 40 000 000 000 Hz Reference Level 0.00 dBm

ATT 0 dB

Result Average 10 / 10

Ref -20 dBc/Hz

Carrier Power 0.33 dBm Frequency Error -1.94 Hz

Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	10 Hz	-45.73 dBc/Hz	5	100 kHz	-111.51 dBc/Hz
2	100 Hz	-65.99 dBc/Hz	6	1 MHz	-123.23 dBc/Hz
3	1 kHz	-92.04 dBc/Hz	7	10 MHz	-138.67 dBc/Hz
4	10 kHz	-109.85 dBc/Hz			

Ref.Ext Pre-Amp Off

Phase Noise Measurement
40 GHz Measurement Frequency, Preamp Off

Better Than Expected Close-in Phase Noise Performance (High-Performance Waveguide Mixer)

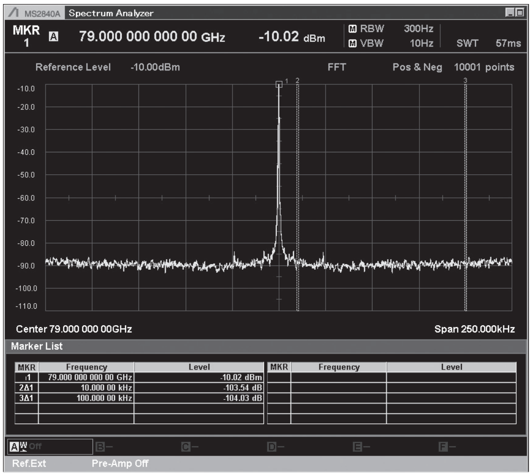
The MS2840A series (26.5 GHz/44.5 GHz models) is supported by two types of mixer: the high-performance waveguide mixers (50 GHz to 90 GHz) for measurements in the millimeter wave band, and external harmonic mixers (26.5 GHz to 325 GHz). In particular, the high-performance waveguide mixers make maximum use of the excellent phase noise performance of the MS2840A to monitor the actual spectrum floor of millimeter-wave-band transmitters and oscillators, playing a key role in evaluating their phase noise performance.

MA2808A

High-Performance Waveguide Mixers

Model	Name	Frequency Band	Frequency Range	Waveguide	Flange
MA2806A	High Performance Waveguide Mixer (50 to 75 GHz)	V band	50 GHz to 75 GHz	WR15	UG-385/U
MA2808A	High Performance Waveguide Mixer (60 to 90 GHz)	E band	60 GHz to 90 GHz	WR12	UG-387/U

Measurement Examples



MS2840A Spectrum Analyzer

MKR 1 A 79.000 000 000 00 GHz -10.02 dBm

M RBW 300Hz

M VBW 10Hz SWT 57ms

Reference Level -10.00dBm FFT Pos & Neg 10001 points

Center 79.000 000 00GHz Span 250.000kHz

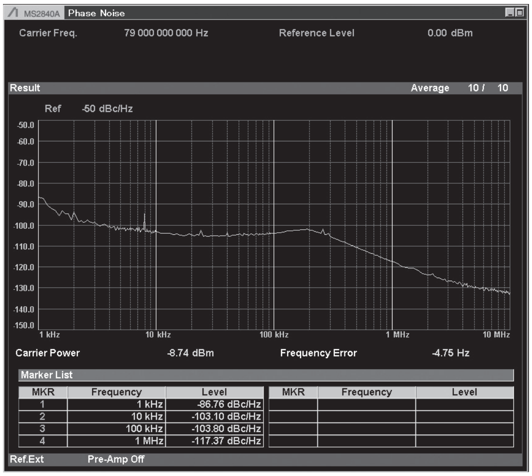
Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	79.000 000 000 00 GHz	-10.02 dBm			
2Δ1	10.000 00 kHz	-103.54 dB			
3Δ1	100.000 00 kHz	-104.03 dB			

A W Off

Ref.Ext Pre-Amp Off

Spectrum Display
79 GHz Measurement Frequency
(Using High-Performance Waveguide Mixer MA2808A)



MS2840A Phase Noise

Carrier Freq. 79 000 000 000 Hz Reference Level 0.00 dBm

Result Average 10 / 10

Ref -50 dBc/Hz

Carrier Power -8.74 dBm Frequency Error -4.75 Hz

Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	1 kHz	-86.76 dBc/Hz			
2	10 kHz	-103.10 dBc/Hz			
3	100 kHz	-103.80 dBc/Hz			
4	1 MHz	-117.37 dBc/Hz			

Ref.Ext Pre-Amp Off

Phase Noise Measurement
79 GHz Measurement Frequency
(Using High-Performance Waveguide Mixer MA2808A)

High-Sensitivity Measurements in Microwave and Millimeter Wave Bands

The MS2840A has excellent display average noise level (DANL) as well as high dynamic range performance. When the built-in preamplifier is on, the DANL supports a high sensitivity measurement performance of better than –160 dBm/Hz in the frequency range from 0.03 GHz to 34 GHz.*1 Even when connected with either of the MA2806A and MS2808A high-performance waveguide mixers
(50 GHz to 90 GHz), the MS2840A maintains a performance of –150 dBm/Hz (meas.*2) at 75 GHz, supporting high-sensitivity measurements over a wide frequency range. This performance proves its usefulness in capturing low-level signals and antenna side lobes in test systems with large coupling losses, such as free-space propagation measurements at antenna coupling.

Displayed Average Noise Level (DANL)

Spectrum Analyzer Function

Preamp: None, Microwave Preselector Bypass: None

Frequency	DANL		
	26.5 GHz Model (MS2840A-044)	44 .5 GHz Model (MS2840A-046)	
		Without MS2840A-019	With MS2840A-019
30 MHz	–153 dBm/Hz	–153 dBm/Hz	–153 dBm/Hz
400 MHz	–153 dBm/Hz	–153 dBm/Hz	–153 dBm/Hz
1 GHz	–150 dBm/Hz	–150 dBm/Hz	–150 dBm/Hz
3 GHz	–147 dBm/Hz	–147 dBm/Hz	–147 dBm/Hz
13 GHz	–151 dBm/Hz	–151 dBm/Hz	–150 dBm/Hz
20 GHz	–146 dBm/Hz	–146 dBm/Hz	–146 dBm/Hz
30 GHz	—	–146 dBm/Hz	–146 dBm/Hz
40 GHz	—	–144 dBm/Hz	–142 dBm/Hz
44 GHz	—	–140 dBm/Hz	–137 dBm/Hz

Preamp: On, Microwave Preselector Bypass: None

Frequency	DANL		
	26.5 GHz Model (MS2840A-044)	44 .5 GHz Model (MS2840A-046)	
		Without MS2840A-019	With MS2840A-019
30 MHz	–166 dBm/Hz	–166 dBm/Hz	–166 dBm/Hz
400 MHz	–166 dBm/Hz	–166 dBm/Hz	–166 dBm/Hz
1 GHz	–164 dBm/Hz	–164 dBm/Hz	–164 dBm/Hz
3 GHz	–163 dBm/Hz	–163 dBm/Hz	–163 dBm/Hz
13 GHz	–163 dBm/Hz	–163 dBm/Hz	–163 dBm/Hz
20 GHz	–157 dBm/Hz	–160 dBm/Hz	–160 dBm/Hz
30 GHz	—	–160 dBm/Hz	–159 dBm/Hz
40 GHz	—	–157 dBm/Hz	–156 dBm/Hz
44 GHz	—	–149 dBm/Hz	–149 dBm/Hz

Using High-Performance Waveguide Mixer MA2806A/MA2808A

Frequency	DANL
75 GHz	–150 dBm/Hz (meas.*2)

*1: 44.5 GHz (MS2840A-046)

*2: Value measured at design but not guaranteed specification.

Dynamic Range

Frequency	Dynamic Range	DANL/TOI
1 GHz	166 dB	Displayed Average Noise Level (DANL): –150 dBm/Hz Third Order Intercept (TOI): +16 dBm
20 GHz	159 dB	Displayed Average Noise Level (DANL): –146 dBm/Hz Third Order Intercept (TOI): +13 dBm
40 GHz	157 dB	Displayed Average Noise Level (DANL): –144 dBm/Hz Third Order Intercept (TOI): +13 dBm (nom.)

The dynamic range is assumed to be the simple difference between the TOI and DANL.

Noise Floor Reduction (MS2840A-051)

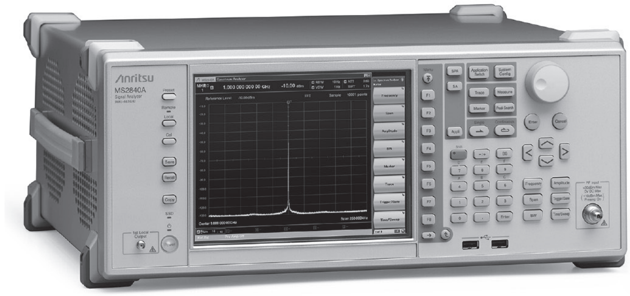
The Noise Floor Reduction (NFR) function increases the measurement accuracy for low-level signals. It subtracts the internal noise components (11 dB max. nominal) of the measuring instrument itself from the displayed measurement result.

Faster Measurement Speeds

With a built-in high-performance CPU and 8 GB of main memory supporting the 64-bit Windows 10 OS*, the MS2840A is much faster than its predecessor MS2830A, offering greatly improved averaging processing times for screen displays and much faster processing when displaying the results of signal analyzer and software analysis functions.

*: Windows 10 is installed in MS2840A units ordered from September 2020.

The Signal Analyzer MS2840A is available as two series with two models in each series: 26.5 GHz and 44.5 GHz, and 3.6 GHz and 6 GHz; different options can be installed in each series. The 26.5 GHz and 44.5 GHz models described in this brochure support various measurement functions required for evaluating the Tx characteristics of wireless and transmission devices as well as millimeter- waveband spectrum measurements using a connected mixer.



Signal Analyzer

MS2840A

Standard Functions

Spectrum Analyzer
Signal Analyzer (31.25 MHz Analysis Bandwidth)
Power Meter (Connected to USB Power Sensor)

Options

Signal Analyzer (Analysis Bandwidth Expansion: 62.5 MHz, 125 MHz)
Built-in Preamplifier
Phase Noise Measurement
Precompliance EMI Measurement
Noise Figure Measurement
BER Measurement
Modulation Analysis

Optional Parts

High Performance Waveguide Mixer (50 GHz to 90 GHz)
External Mixer (Harmonic Mixer, 26.5 GHz to 325 GHz)
USB Power Sensor

Typical Measurement Items for Evaluating Tx Characteristics (26.5 GHz and 44.5 GHz models)

✓: Supported

Supported Standard Functions/Options Typical Measurement	Standard Functions			Options/Optional Parts
	Spectrum Analyzer	Signal Analyzer	Others	
Spectrum Trace	✓	✓		
Channel Power	✓	✓		
Occupied Bandwidth	✓	✓		
Adjacent Channel Leakage Power	✓	✓		
Spectrum Emission Mask	✓			
Burst Average Power	✓	✓		
Spurious Emission	✓			
AM Depth		✓		✓ Analog Measurement Software MX269018A
FM Deviation		✓		✓ Analog Measurement Software MX269018A
Multi-marker & Marker List	✓	✓		
Highest 10 Markers	✓	✓		
Limit Line	✓			
Frequency Counter	✓			
TOI	✓			
Hide Settings and Numeric Results	✓			
Power Meter Function (connected to USB Power Sensor)			✓	
Phase Noise Measurement				✓ Phase Noise Measurement Function MS2840A-010
EMI Measurement				✓ Precompliance EMI Function MS2840A-016
Vector Modulation Analysis (EVM, etc.)				✓ Vector Modulation Analysis Software MX269017A
Analog Modulation Analysis (AM/FM/ΦM) (FM Deviation, Demodulation Frequency, etc.)				✓ Analog Measurement Software MX269018A
Millimeter-wave Band Spectrum Measurement using Connected Mixer				✓ High Performance Waveguide Mixer MA2806A/MS2808A (50 GHz to 90 GHz) ✓ External Mixer (Harmonic Mixer) MA2740C/MA2750C series (26.5 GHz to 325 GHz)

Other Measurement Items (26.5 GHz and 44.5 GHz models)

✓: Supported

Supported Standard Functions/Options Typical Measurement	Standard Functions			Options/Optional Parts
	Spectrum Analyzer	Signal Analyzer	Others	
Noise Figure Measurement				✓ Noise Figure Measurement Function MS2840A-017
BER Measurement				✓ BER Measurement Function MS2840A-026

Versatile Standard Functions

The built-in spectrum and signal analyzer functions can be used to evaluate the Tx characteristics of wireless devices and transmitters by running easy tests, etc., in accordance with specifications.

Measure Function	Spectrum Analyzer (Standard)	Signal Analyzer (Standard)
Spectrum Trace	✓	✓
Channel Power	✓	✓
Occupied Bandwidth	✓	✓
Adjacent Channel Leakage Power	✓	✓
Spectrum Emission Mask	✓	
Burst Average Power	✓	✓
Spurious Emission	✓	
AM Depth		✓
FM Deviation		✓
Multi-marker & Marker List	✓	✓
Highest 10 Markers	✓	✓
Limit Line	✓	
Frequency Counter	✓	
TOI	✓	
Hide Settings and Numeric Results	✓	

Power Meter Function (USB Power Sensor Connection)

Connecting the optional USB Power Sensor to the MS2840A supports Power and Relative Power measurements.

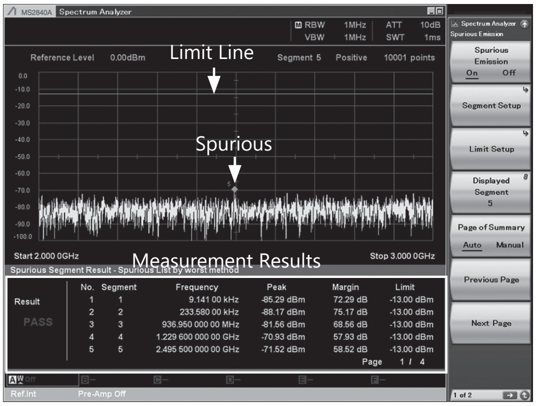
Compatible USB power sensors.

Model	Frequency Range	Dynamic Range
MA24104A*	600 MHz to 4 GHz	+3 to +51.76 dBm
MA24105A	350 MHz to 4 GHz	+3 to +51.76 dBm
MA24106A	50 MHz to 6 GHz	–40 to +23 dBm
MA24108A	10 MHz to 8 GHz	–40 to +20 dBm
MA24118A	10 MHz to 18 GHz	–40 to +20 dBm
MA24126A	10 MHz to 26 GHz	–40 to +20 dBm

*: MA24104A has been discontinued.

Spurious Emission

This function splits the frequency range into up to 20 segments for sweeping; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment.
The results are tabulated below the trace and marked PASS/FAIL.



Spurious Segment Result - Spurious List by worst method

Result

PASS

No.	Segment	Frequency	Peak	Margin	Limit
1	1	9.141 00 kHz	-85.29 dBm	72.29 dB	-13.00 dBm
2	2	233.580 00 kHz	-88.17 dBm	75.17 dB	-13.00 dBm
3	3	936.950 000 00 MHz	-81.56 dBm	68.56 dB	-13.00 dBm
4	4	1.229 600 000 00 GHz	-70.93 dBm	57.93 dB	-13.00 dBm
5	5	2.495 500 000 00 GHz	-71.52 dBm	58.52 dB	-13.00 dBm

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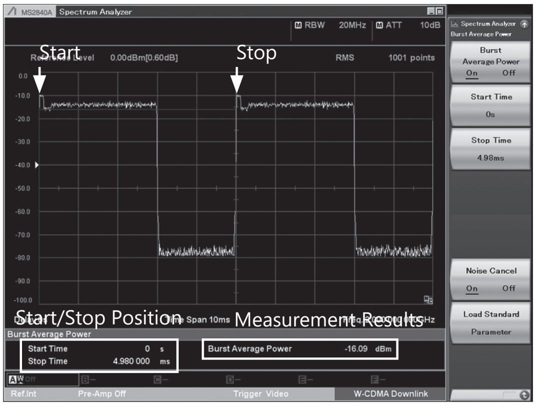
Burst Average Power

The average power for the range specified by two markers is displayed in the time domain. Measurement only requires setting the measurement start and stop positions on the screen. True performance is measured using the noise cancellation function to subtract main-frame noise from the measurement result.
Pre-installed templates for each standard support easy parameter setting.



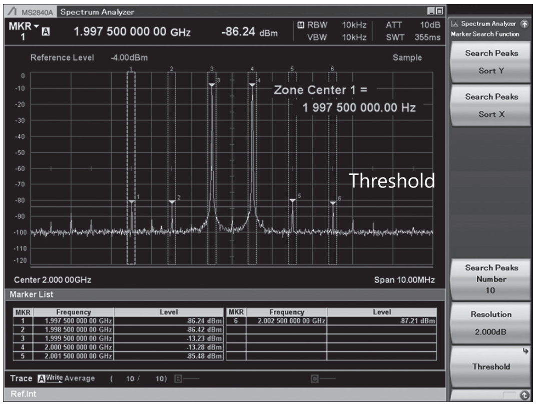
Burst Average Power

Start Time 0 s
Stop Time 4.980 000 ms

Burst Average Power -16.09 dBm

Multi-marker & Marker List

Up to 10 markers can be set for this function. Markers may be either a spot or a zone. Using a zone marker, the peak of a signal with an unstable variable frequency can be tracked and measured.
Not only can the 10 markers be listed below the trace but the differences between markers can be calculated and displayed using the delta setting.

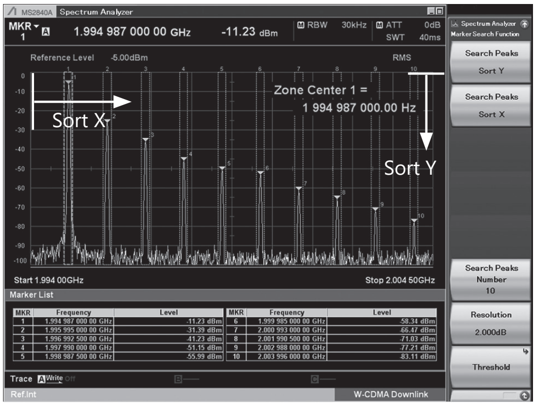


Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	1.997 500 000 00 GHz	-86.24 dBm	6	2.002 500 000 00 GHz	-87.21 dBm
2	1.998 500 000 00 GHz	-86.42 dBm			
3	1.999 500 000 00 GHz	-13.23 dBm			
4	2.000 500 000 00 GHz	-13.28 dBm			
5	2.001 500 000 00 GHz	-85.48 dBm			

Highest 10 Markers

This function sets the threshold level and auto-detects peaks in the X (frequency) and Y (level/time) directions.



Marker List

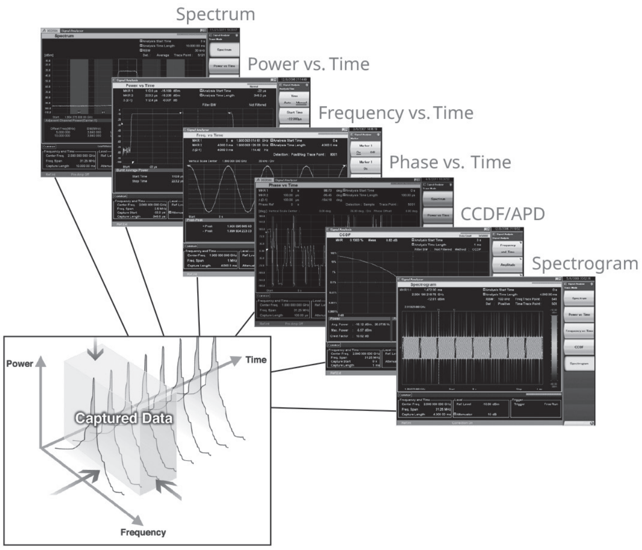
MKR	Frequency	Level	MKR	Frequency	Level
1	1.994 987 000 00 GHz	-11.23 dBm	6	1.999 985 000 00 GHz	-58.34 dBm
2	1.995 995 000 00 GHz	-31.39 dBm	7	2.000 993 000 00 GHz	-66.47 dBm
3	1.996 992 500 00 GHz	-41.23 dBm	8	2.001 990 500 00 GHz	-71.03 dBm
4	1.997 990 000 00 GHz	-51.15 dBm	9	2.002 988 000 00 GHz	-77.21 dBm
5	1.998 987 500 00 GHz	-55.99 dBm	10	2.003 996 000 00 GHz	-83.11 dBm

Signal Analyzer (Standard)

The MS2840A has a built-in 31.25 MHz bandwidth Fast Fourier Transformation (FFT) analysis function supporting multi-domain analysis of captured measured signals. Since it can capture phenomena such as spectrum transients that cannot be captured by conventional sweep-type spectrum analyzers, it improves the efficiency of troubleshooting. The analysis bandwidth can be expanded to either 62.5 MHz or 125 MHz as options.
In addition, add the Microwave Preselector Bypass (MS2840A-067) option when using the signal analyzer measurement function at a bandwidth of >31.25 MHz and a frequency of >6 GHz.

Measurement Functions

- Spectrum trace
- Frequency vs. Time
- CCDF/APD
- Power vs. Time
- Phase vs. Time
- Spectrogram



Analysis Bandwidth:
31.25 MHz (Standard)
50 MHz max. sampling rate = 20 ns resolution, ADC resolution 16 bits)
62.5 MHz (MS2840A-077)
(100 MHz max. sampling rate = 10 ns resolution, ADC resolution 14 bits)
125 MHz (MS2840A-077/078)
(200 MHz max. sampling rate = 5 ns resolution, ADC resolution 14 bits)

Max. Capture Time: 0.5 s to 2000 s

Max. Number of Samples: 100 Msamples

Note: An image response is received when setting the bandwidth to more than 31.25 MHz. This can be used when not inputting a signal frequency outside the MS2840A analysis bandwidth (125 MHz max.).

Option

Analysis Bandwidth Extension to 62.5 MHz (MS2840A-077)
Extends analysis bandwidth to 62.5 MHz.
Analysis Bandwidth Extension to 125 MHz (MS2840A-078*)
Extends analysis bandwidth to 125 MHz.

*: Requires MS2840A-077.

Capture & Replay Function

Waveform data can be saved (captured) to the internal memory.
In addition, previously saved waveform data can be loaded (replayed) to reproduce result displays whenever necessary using measurement functions.

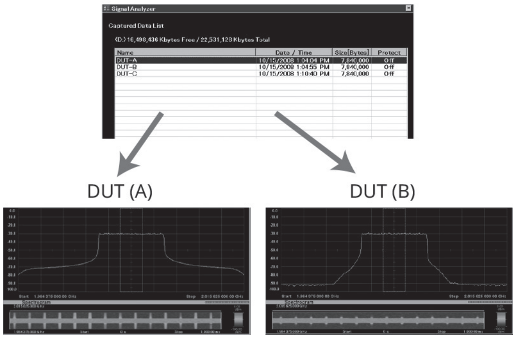
The following chart shows the maximum capture time per frequency span.

Span	Sampling Rate	Capture Time	Max. Sampling Data
1 kHz	2 kHz	2000 s	4M
2.5 kHz	5 kHz	2000 s	10M
5 kHz	10 kHz	2000 s	20M
10 kHz	20 kHz	2000 s	40M
25 kHz	50 kHz	2000 s	100M
50 kHz	100 kHz	1000 s	100M
100 kHz	200 kHz	500 s	100M
250 kHz	500 kHz	200 s	100M
500 kHz	1 MHz	100 s	100M
1 MHz	2 MHz	50 s	100M
2.5 MHz	5 MHz	20 s	100M
5 MHz	10 MHz	10 s	100M
10 MHz	20 MHz	5 s	100M
25 MHz	50 MHz	2 s	100M
31.25 MHz	50 MHz	2 s	100M
50 MHz	100 MHz	500 ms	50M
62.5 MHz	100 MHz	500 ms	50M
100 MHz	200 MHz	500 ms	100M
125 MHz	200 MHz	500 ms	100M

Replay Usage Examples

- Sharing data between development and manufacturing sections at separate locations
- Transferring signals captured onsite for later in-house analysis
- Saving product shipping data for later warranty-claim confirmation

Captured Waveform Data: Selection Screen



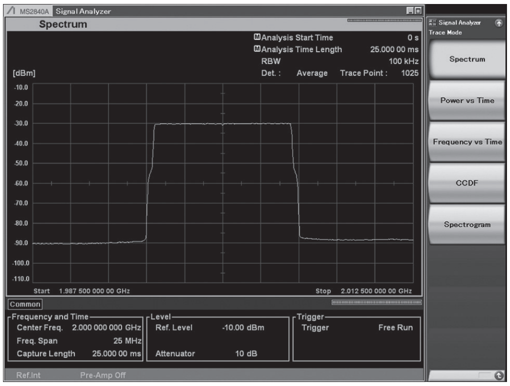
Captured Data List

(D:) 16,498,436 Kbytes Free / 22,531,128 Kbytes Total

Name	Date / Time	Size[Bytes]	Protect
DUT-A	10/15/2008 1:04:04 PM	7,840,000	Off
DUT-B	10/15/2008 1:04:55 PM	7,840,000	Off
DUT-C	10/15/2008 1:10:40 PM	7,840,000	Off

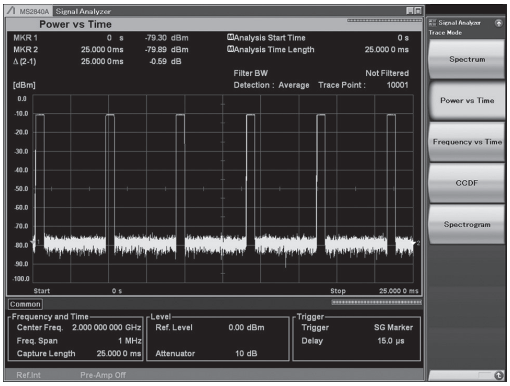
Spectrum trace

The CCDF trace displays the power variation probability on the y-axis and power variation on the y-axis to confirm the CCDF and APD of measured signals.


MS2840A Signal Analyzer
Spectrum
Analysis Start Time 0 s
Analysis Time Length 25.000 00 ms
RBW 100 kHz
Det. : Average Trace Point : 1025
Start 1.987 500 000 00 GHz Stop 2.012 500 000 00 GHz
Common
Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 25 MHz
Capture Length 25.000 00 ms
Level
Ref. Level -10.00 dBm
Attenuator 10 dB
Trigger
Trigger Free Run
Ref.Int Pre-Amp Off

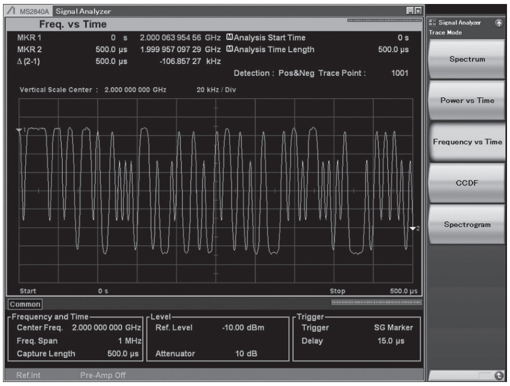
Power vs. Time

The Power vs. Time trace displays a graph with amplitude on the y-axis and time on the x-axis to confirm changes in power with time of measured signals.


MS2840A Signal Analyzer
Power vs Time
MKR 1 0 s -79.30 dBm
MKR 2 25.000 0ms -79.89 dBm
Δ (2-1) 25.000 0ms -0.59 dB
Analysis Start Time 0 s
Analysis Time Length 25.000 0 ms
Filter BW Not Filtered
Detection : Average Trace Point : 10001
Start 0 s Stop 25.000 0 ms
Common
Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 1 MHz
Capture Length 25.000 0 ms
Level
Ref. Level 0.00 dBm
Attenuator 10 dB
Trigger
Trigger SG Marker
Delay 15.0 µs
Ref.Int Pre-Amp Off

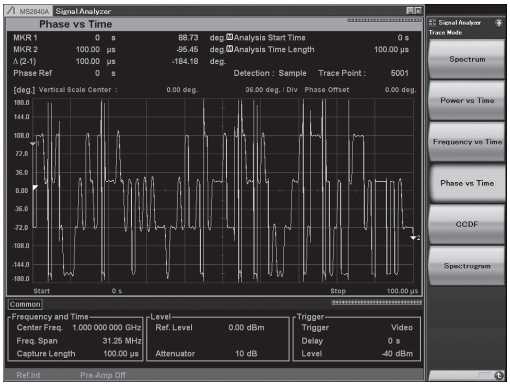
Frequency vs. Time

The Frequency vs. Time trace displays a graph with frequency on the y-axis and time on the x-axis to confirm time variation of the measured signal frequency.


MS2840A Signal Analyzer
Freq. vs Time
MKR 1 0 s 2.000 063 954 56 GHz
MKR 2 500.0 µs 1.999 957 097 29 GHz
Δ (2-1) 500.0 µs -106.857 27 kHz
Analysis Start Time 0 s
Analysis Time Length 500.0 µs
Detection : Pos&Neg Trace Point : 1001
Vertical Scale Center : 2.000 000 000 GHz 20 kHz / Div
Start 0 s Stop 500.0 µs
Common
Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 1 MHz
Capture Length 500.0 µs
Level
Ref. Level -10.00 dBm
Attenuator 10 dB
Trigger
Trigger SG Marker
Delay 15.0 µs
Ref.Int Pre-Amp Off

Phase vs. Time

The Phase vs. Time trace displays a graph with phase on the y-axis and time on the x-axis to confirm time variation of the measured signal phase.

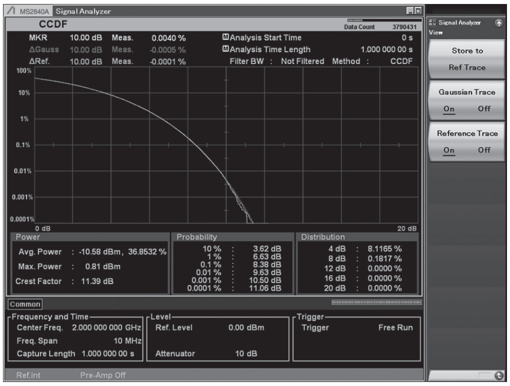

MS2840A Signal Analyzer
Phase vs Time
MKR 1 0 s 88.73 deg.
MKR 2 100.00 µs -95.45 deg.
Δ (2-1) 100.00 µs -184.18 deg.
Phase Ref 0 s
Analysis Start Time 0 s
Analysis Time Length 100.00 µs
Detection : Sample Trace Point : 5001
[deg.] Vertical Scale Center : 0.00 deg. 36.00 deg. / Div Phase Offset 0.00 deg.
Start 0 s Stop 100.00 µs
Common
Frequency and Time
Center Freq. 1.000 000 000 GHz
Freq. Span 31.25 MHz
Capture Length 100.00 µs
Level
Ref. Level 0.00 dBm
Attenuator 10 dB
Trigger
Trigger Video
Delay 0 s
Level -40 dBm
Ref.Int Pre-Amp Off

CCDF/APD

The CCDF trace displays the power variation probability on the y-axis and power variation on the y-axis to confirm the CCDF and APD of measured signals.

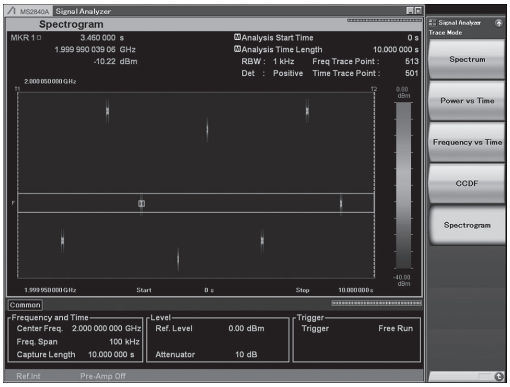
CCDF (Complementary Cumulative Distribution Function):
The CCDF display indicates the cumulative distribution of transient power variations compared to average power.

APD (Amplitude Probability Density):
The APD display indicates the probability distribution of transient power.


MS2840A Signal Analyzer
CCDF
Data Count 3790431
MKR 10.00 dB Meas. 0.0040 %
ΔGauss 10.00 dB Meas. -0.0005 %
ΔRef. 10.00 dB Meas. -0.0001 %
Analysis Start Time 0 s
Analysis Time Length 1.000 000 00 s
Filter BW : Not Filtered Method : CCDF
0 dB 20 dB
Power
Avg. Power : -10.58 dBm, 36.8532 %
Max. Power : 0.81 dBm
Crest Factor : 11.39 dB
Probability
10 % : 3.62 dB
1 % : 6.63 dB
0.1 % : 8.38 dB
0.01 % : 9.63 dB
0.001 % : 10.50 dB
0.0001 % : 11.06 dB
Distribution
4 dB : 8.1165 %
8 dB : 0.1817 %
12 dB : 0.0000 %
16 dB : 0.0000 %
20 dB : 0.0000 %
Common
Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 10 MHz
Capture Length 1.000 000 00 s
Level
Ref. Level 0.00 dBm
Attenuator 10 dB
Trigger
Trigger Free Run
Ref.Int Pre-Amp Off

Spectrogram

The Spectrogram trace displays the level as color with frequency on the y-axis and time on the x-axis. The captured IQ data is FFT processed to confirm time variations in the continuous spectrum.
It is useful for monitoring frequency hopping and transient signals.


MS2840A Signal Analyzer
Spectrogram
MKR 1 3.460 000 s
1.999 990 039 06 GHz
-10.22 dBm
Analysis Start Time 0 s
Analysis Time Length 10.000 000 s
RBW : 1 kHz Freq Trace Point : 513
Det : Positive Time Trace Point : 501
2.000 050 000 GHz
1.999 950 000 GHz Start 0 s Stop 10.000 000 s
Common
Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 100 kHz
Capture Length 10.000 000 s
Level
Ref. Level 0.00 dBm
Attenuator 10 dB
Trigger
Trigger Free Run
Ref.Int Pre-Amp Off

Other Measurement Functions

Phase Noise Measurement Function (MS2840A-010)

The excellent close-in phase noise performance of the MS2840A supports phase noise measurement of transmitters with a frequency offset range of 10 Hz to 10 MHz and also supports when connected to the High Performance Waveguide Mixer (MA2806A, MA2808A).

Measurement Results

- Carrier level
- Error between set frequency and carrier frequency
- Marker point phase noise level

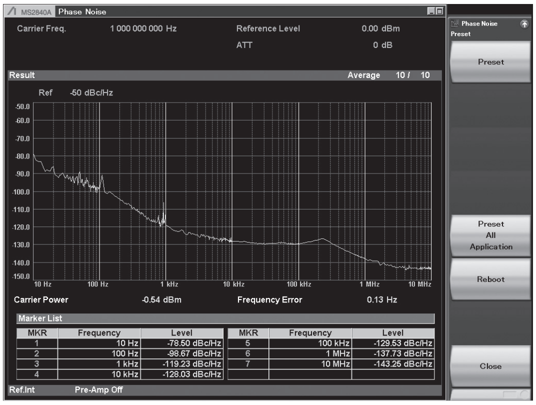
There are four measurement modes using different loop filters, which are switched to match the DUT.

Auto:
This mode switches automatically to the best loop filter for measuring the carrier signal close-in and wide-offset phase noise characteristics.

Best Close-in:
This mode uses the best loop filter for measuring the carrier signal close-in phase noise characteristics.

Best Wide-offset:
This mode uses the best loop filter for measuring the carrier signal wide-offset phase noise characteristics.

Balance:
This mode uses the loop filter with a good balance for measuring both close-in and wide-offset phase noise characteristics of the carrier signal.



Carrier Freq. 1 000 000 000 Hz
Reference Level 0.00 dBm
ATT 0 dB
Average 10 / 10
Carrier Power -0.54 dBm
Frequency Error 0.13 Hz

MKR	Frequency	Level	MKR	Frequency	Level
1	10 Hz	-78.50 dBc/Hz	5	100 kHz	-129.53 dBc/Hz
2	100 Hz	-98.67 dBc/Hz	6	1 MHz	-137.73 dBc/Hz
3	1 kHz	-119.23 dBc/Hz	7	10 MHz	-143.25 dBc/Hz
4	10 kHz	-128.03 dBc/Hz			

Measurement Screen

Precompliance EMI Function (MS2840A-016)

This option adds an EMI measurement detection mode and RBW to the spectrum analyzer function. Both the detection mode used for CISPR standards (Quasi-Peak, CISPR-AVG, RMS-AVG) and RBW (200 Hz (6 dB), 9 kHz (6 dB), 120 kHz (6 dB), 1 MHz (Imp)) as well as conventional settings can be selected.

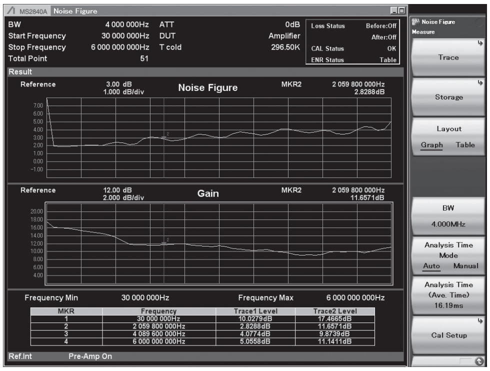
Noise Figure Measurement Function (MS2840A-017)

Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source.
The Noisecom NC346 series* of noise sources is supported.
*: Refer to the MS2840A Data Sheet for more details.

Frequency Range (Noise sauce): 0.01 GHz to 40.0 GHz
Frequency Mode: Fixed, List, Sweep
DUT Mode: Amplifier, Down Converter, Up Converter
Screen Layout: Graph, Table

Measurement Results Display
Graph/List/Spot

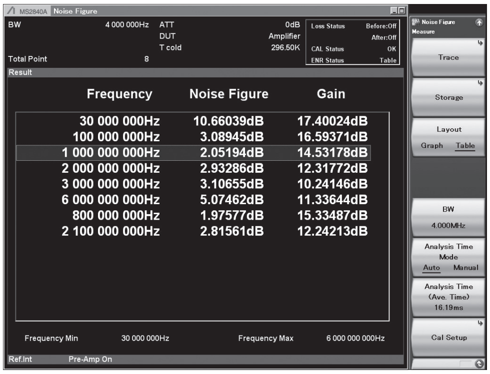
Displays measurement results for each trace (Trace1/Trace2).
Noise Figure (NF) [dB]
Noise Factor (F) [Linear]
Gain
Y-Factor: Power ratio when Noise Source is turned On/Off
T effective: Effective noise temperature
P Hot: Power measured when Noise Source is On.
P Cold: Power measured when Noise Source is Off.



BW 4 000 000Hz
Start Frequency 30 000 000Hz
Stop Frequency 6 000 000 000Hz
Total Point 51
ATT 0dB
DUT Amplifier
T cold 296.50K
Loss Status Before:Off After:Off
CAL Status OK
ENR Status Table
Reference 3.00 dB 1.000 dB/div
MKR2 2 059 800 000Hz 2.8288dB
Reference 12.00 dB 2.000 dB/div
MKR2 2 059 800 000Hz 11.6571dB
Frequency Min 30 000 000Hz
Frequency Max 6 000 000 000Hz

MKR	Frequency	Trace1 Level	Trace2 Level
1	30 000 000Hz	10.0279dB	17.4665dB
2	2 059 800 000Hz	2.8288dB	11.6571dB
3	4 089 600 000Hz	4.0774dB	9.8739dB
4	6 000 000 000Hz	5.0558dB	11.1411dB

Measurement Result: Example of Graph display
(Frequency Mode: Sweep, Screen Layout: Graph)

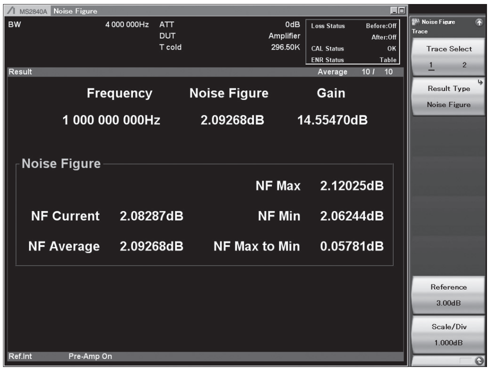


BW 4 000 000Hz
Total Point 8
ATT 0dB
DUT Amplifier
T cold 296.50K
Loss Status Before:Off After:Off
CAL Status OK
ENR Status Table

Frequency	Noise Figure	Gain
30 000 000Hz	10.66039dB	17.40024dB
100 000 000Hz	3.08945dB	16.59371dB
1 000 000 000Hz	2.05194dB	14.53178dB
2 000 000 000Hz	2.93286dB	12.31772dB
3 000 000 000Hz	3.10655dB	10.24146dB
6 000 000 000Hz	5.07462dB	11.33644dB
800 000 000Hz	1.97577dB	15.33487dB
2 100 000 000Hz	2.81561dB	12.24213dB

Frequency Min 30 000 000Hz
Frequency Max 6 000 000 000Hz

Measurement Result: Example of List display
(Frequency Mode: List, Screen Layout: List)



BW 4 000 000Hz
ATT 0dB
DUT Amplifier
T cold 296.50K
Loss Status Before:Off After:Off
CAL Status OK
ENR Status Table
Average 10 / 10

Frequency	Noise Figure	Gain
1 000 000 000Hz	2.09268dB	14.55470dB

Noise Figure
NF Max 2.12025dB
NF Current 2.08287dB
NF Min 2.06244dB
NF Average 2.09268dB
NF Max to Min 0.05781dB

Measurement Result: Example of Spot display
(Frequency Mode: Fixed)

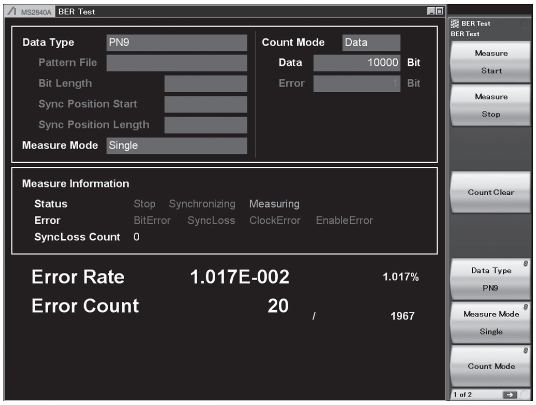
BER Measurement Function (MS2840A-026)

The MS2840A with the BER Measurement Function MS2840A-026 supports measurement up to 10 Mbps.
It supports Rx sensitivity tests by inputting the receiver-demodulated Data/Clock/Enable to the back of the MS2840A.

- Input Signal: Data, Clock, Enable (Polarity reversal supported)
- Input Bit Rate: 100 bps to 10 Mbps
- Input Level: TTL 3.3 V
- Connector: Rear panel, AUX connector*

*: Can convert to BNC by connecting AUX conversion adapter (J1556A).

- Measured Patterns:
  PN9, PN11, PN15, PN20, PN23, ALL0, ALL1, Alternate (0101…),
  PN9Fix, PN11Fix, PN15Fix, PN20Fix, PN23Fix,
  UserDefine (4096 bits max.)
- Measurable Bit Count: 1000 to 4294967295 bits (2^{32} – 1 bits)
- Measurable Error Bit Count: 1 to 2147483647 bits (2^{31} – 1 bits)
- Count Mode
  Data: Measures until specified Data count
  Error: Measures until specified Error count
- Measurement Mode
  Single: Measures specified measurement bit count once
  Continuous: Repeats Single measurement
  Endless: Continues measurement to upper limit of measurement bits



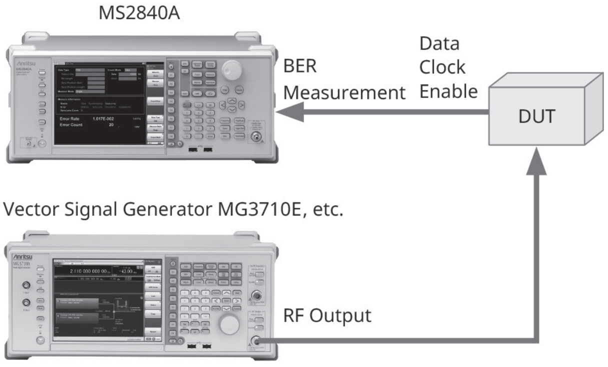
Data Type PN9
Pattern File
Bit Length
Sync Position Start
Sync Position Length
Measure Mode Single

Count Mode Data
Data 10000 Bit
Error 1 Bit

Measure Information
Status Stop Synchronizing Measuring
Error BitError SyncLoss ClockError EnableError
SyncLoss Count 0

Error Rate 1.017E-002 1.017%
Error Count 20 / 1967

BER Measurement Function Main Screen



BER Measurement Setup Example
(using external vector signal generator)

Measurement Software Options

Vector Modulation Analysis Software (MX269017A)

This software measures the modulation accuracy, carrier frequency, Tx power, etc., for each type of digital radio.

Supported Modulation Methods

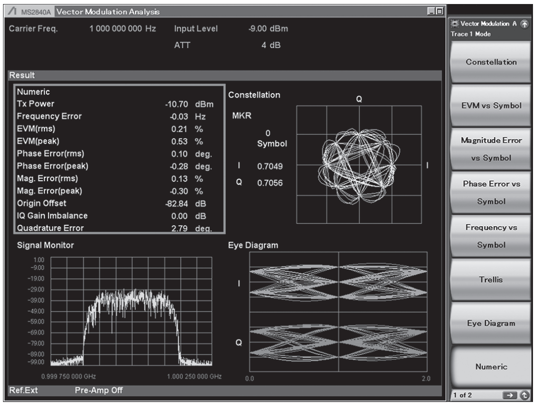
Standard
BPSK, QPSK, O-QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 2FSK, 4FSK, 2ASK, 4ASK, H-CPM*, MSK

*: Used for APCO-P25 Phase2 Inbound measurement

Option: APSK Analysis (MX269017A-001)
16APSK, 32APSK
Option: Higher-Order QAM Analysis (MX269017A-011)
512QAM, 1024QAM, 2048QAM

Frequency Setting Range

100 kHz to 44.5 GHz
(300 MHz to 6 GHz depending on measured symbol rate)



Carrier Freq. 1 000 000 000 Hz Input Level -9.00 dBm
ATT 4 dB

Result

Numeric		
Tx Power	-10.70	dBm
Frequency Error	-0.03	Hz
EVM(rms)	0.21	%
EVM(peak)	0.53	%
Phase Error(rms)	0.10	deg.
Phase Error(peak)	-0.28	deg.
Mag. Error(rms)	0.13	%
Mag. Error(peak)	-0.30	%
Origin Offset	-82.84	dB
IQ Gain Imbalance	0.00	dB
Quadrature Error	2.79	deg.

MKR
0 Symbol
I 0.7049
Q 0.7056

Ref.Ext Pre-Amp Off

Measurement Screen

Analog Measurement Software (MX269018A)

When this software is installed in the MS2840A, the Tx performance (carrier frequency, Tx power, modulation rate/frequency deviation, demodulation frequency, demodulation signal distortion rate, etc.) of analog radios can be measured.

* The Audio Analyzer and Analog Signal Generator cannot be installed in the MS2840A.
* This software cannot be installed in the MS2830A 26.5 GHz/43 GHz models, but can be installed in the MS2840A 26.5 GHz/44.5 GHz models.

Supported Modulations

AM, FM, ΦM

Frequency Range

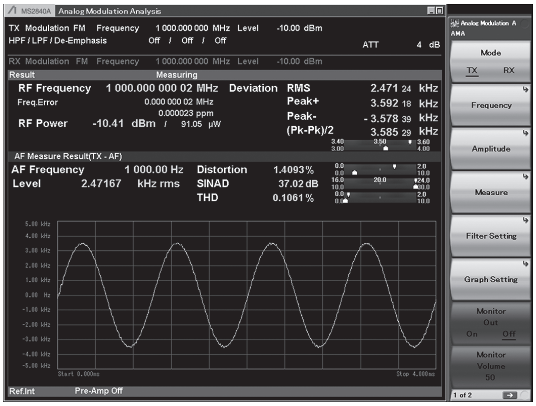
100 kHz to 2700 MHz
(At Wide Band FM measurement: 10 MHz to 2700 MHz)

Weighting Filter

CCITT, C-Message, CCIR 468, CCIR-ARM, A-Weighting

De-emphasis

25, 50, 75, 500, 750 µs



TX Modulation FM Frequency 1 000.000 000 MHz Level -10.00 dBm
HPF / LPF / De-Emphasis Off / Off / Off
ATT 4 dB
RX Modulation FM Frequency 1 000.000 000 MHz Level -10.00 dBm

Result Measuring
RF Frequency 1 000.000 000 02 MHz
Freq.Error 0.000 000 02 MHz
0.000023 ppm
RF Power -10.41 dBm / 91.05 µW
Deviation RMS 2.471 24 kHz
Peak+ 3.592 18 kHz
Peak- - 3.578 39 kHz
(Pk-Pk)/2 3.585 29 kHz

AF Measure Result(TX - AF)
AF Frequency 1 000.00 Hz
Level 2.47167 kHz rms
Distortion 1.4093 %
SINAD 37.02 dB
THD 0.1061 %

Ref.Int Pre-Amp Off

Measurement Screen

Refer to the MX2690xxA Series Measurement Software catalog for details.

Pulse Radar Measurement Function (MX284059A)

This function measures the transmission characteristics of a pulse radar device. (Transmission power, transmission frequency, pulse time, 40 dB bandwidth, spurious, occupied frequency bandwidth)

Pulse Type

Non-FM Pulse Radar/FM Pulse Radar

Measurement Frequency Range

MS2840A-044: 300 MHz to 26,500 MHz
MS2840A-046: 300 MHz to 36,000 MHz

* Spurious measurement range is from 30 MHz to the upper limit of the main unit frequency.

Pulse Width

0.5 µs to 500 µs

Pulse Repetition interval

0.05 ms to 5.0 ms (PRF = 200 Hz to 20,000 kHz)

Other Options

Rubidium Reference Oscillator (MS2840A-001)

This option is a 10-MHz reference crystal oscillator with excellent frequency stability startup characteristics of ±1 × 10^{-9} at 7 minutes after power-on.

Aging Rate: ±1 × 10^{-10}/month, ±1 × 10^{-9}/year
Start-up Characteristics: ±1 × 10^{-9} (7 minutes after power-on)

Preamplifier (MS2840A-008)

This option is for the 26.5 GHz/44.5 GHz models (MS2840A-044/046) and the 3.6 GHz/6 GHz models (MS2840A-040/041).
The gain of about 20 dB improves the Displayed Average Noise Level (DANL). This preamplifier is used to measure low-level signals such as noise and interference.

Frequency Range: 100 kHz to 6 GHz

26.5 GHz Microwave Preamplifier (MS2840A-069)

This option is for the 26.5 GHz model (MS2840A-044).
The gain of about 20 dB improves the Displayed Average Noise Level (DANL). This preamplifier is used to measure low-level signals, such as noise and interference.

Frequency Range: 100 kHz to 26.5 GHz

Microwave Preamplifier (MS2840A-068)

This option is for the 44.5 GHz model (MS2840A-046).
The gain of about 20 dB improves the Displayed Average Noise Level (DANL). This preamplifier is used to measure low-level signals, such as noise and interference.

Frequency Range: 100 kHz to 44.5 GHz

2ndary SSD (MS2840A-011)

This removable SSD is for storing user data.
It has no installed OS. It is shipped mounted in the Secondary HDD/SSD slot of the MS2840A main unit.

Microwave Preselector Bypass (MS2840A-067)

Bypassing the preselector used for the microwave band improves RF frequency characteristics and in-band frequency characteristics.
Add this option when the signal analyzer measurement function is set to a frequency band of >31.25 MHz and a frequency of >6 GHz.

2 dB Step Attenuator for Millimeter-wave (MS2840A-019)

This option is for the 44.5 GHz model (MS2840A-046).
The attenuator resolution is expanded to 2 dB (Standard resolution is 10 dB) and input level to internal mixer can be adjusted with high resolution. As a result, the radio test products using micro and millimeter wave which require wide dynamic range can be measured with a sufficient margin.

Noise Floor Reduction (MS2840A-051)

The Noise Floor Reduction (NFR) function increases the measurement accuracy for low-level signals. It subtracts the internal noise components (11 dB max. nominal) of the measuring instrument itself from the displayed measurement result.

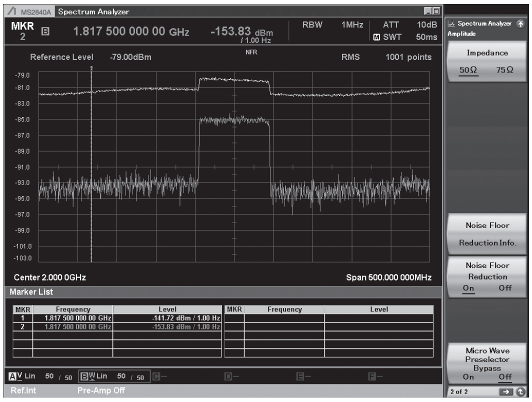
When the NFR function is used with a connected external mixer (High Performance Waveguide Mixer MA2806A/MA2808A), it measures V- and E-band millimeter waveband applications with high dynamic range.

<Main Applications>

- Spurious Emission
- Spectrum Mask
- Adjacent Channel Leakage Power (ACLR)
- Power ON/OFF ratio

Measurement times using the NFR function remain unchanged.
The NFR function eliminates the procedure of measuring the instrument noise floor each time like using the earlier noise cancelling function. If the noise floor is measured once when an ambient temperature change affects the noise floor level or when an external mixer is connected, the NFR effect can be captured by the same operation as normal measurement, unless there is a change in these conditions.

[Notes]
The NFR function is enabled only by the Spectrum Analyzer function.
The design value is nominal and is not a guaranteed specification.



MKR 2 B 1.817 500 000 00 GHz -153.83 dBm / 1.00 Hz
RBW 1MHz
ATT 10dB
SWT 50ms
Reference Level -79.00dBm
RMS 1001 points
Center 2.000 0GHz
Span 500.000 000MHz

Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	1.817 500 000 00 GHz	-141.72 dBm / 1.00 Hz			
2	1.817 500 000 00 GHz	-153.83 dBm / 1.00 Hz			

Ref.Int
Pre-Amp Off

Measurement Screen

High Performance Waveguide Mixer/External Mixers (Harmonic Mixers)

Two types of mixer can be connected to the MS2840A series (26.5 GHz/44.5 GHz models) for millimeter-wave-band measurements; spectrum measurements up to 325 GHz are supported using either a High-Performance Waveguide Mixer or an external harmonic mixer. In particular, the two High Performance Waveguide Mixer models are ideal for measuring wideband signals and the excellent phase noise performance of the MS2840A series (26.5 GHz/44.5 GHz models) plays a key role in analyzing the true spectrum of millimeter-wave-band transmitters.

High Performance Waveguide Mixer MA2806A/MA2808A

Model	Name	Frequency Band	Frequency Range	Waveguide	Flange
MA2806A	High Performance Waveguide Mixer (50 to 75 GHz)	V band	50 GHz to 75 GHz	WR15	UG-385/U
MA2808A	High Performance Waveguide Mixer (60 to 90 GHz)	E band	60 GHz to 90 GHz	WR12	UG-387/U

MA2808A

Features

- Wide dynamic range based on excellent minimum sensitivity and P1dB performance
- High phase noise performance connected to MS2840A
- Image-response-free measurement of wideband signals plus high IF frequency and PS function

For Further information see MA2806A/MA2808A page.

External Mixers (Harmonic Mixers)

The MA2740C/MA2750C series of external mixers (harmonic mixers) supports spectrum measurements up to 325 GHz with excellent cost performance.

Model	Name	Frequency Band	Frequency Range	Waveguide	Flange	
						UG-xxx/U Equivalent
MA2741C	External Mixer	A Band	26.5 GHz to 40 GHz	WR28	MIL-DTL-3922/54-003	UG-599U
MA2742C	External Mixer	Q Band	33 GHz to 50 GHz	WR22	MIL-DTL-3922/67D-006	UG-383U
MA2743C	External Mixer	U Band	40 GHz to 60 GHz	WR19	MIL-DTL-3922/67D-007	UG-383U-M
MA2744C	External Mixer	V Band	50 GHz to 75 GHz	WR15	MIL-DTL-3922/67D-008	UG-385/U
MA2745C	External Mixer	E Band	60 GHz to 90 GHz	WR12	MIL-DTL-3922/67D-009	UG-387/U
MA2746C	External Mixer	W Band	75 GHz to 110 GHz	WR10	MIL-DTL-3922/67D-010	UG-387/U-M
MA2747C	External Mixer	F Band	90 GHz to 140 GHz	WR08	MIL-DTL-3922/67D-M08	UG-387/U-M
MA2748C	External Mixer	D Band	110 GHz to 170 GHz	WR06	MIL-DTL-3922/67D-M06	UG-387/U-M
MA2749C	External Mixer	G Band	140 GHz to 220 GHz	WR05	MIL-DTL-3922/67D-M05	UG-387/U-M
MA2750C	External Mixer	Y Band	170 GHz to 260 GHz	WR04	MIL-DTL-3922/67D-M04	UG-387/U-M
MA2751C	External Mixer	J Band	220 GHz to 325 GHz	WR03	MIL-DTL-3922/67D-M03	UG-387/U-M

Configurations

Configuration List

Model	Name	Remarks
MS2840A	Signal Analyzer	Analysis Bandwidth 31.25 MHz installed as standard
MS2840A-044	26.5 GHz Signal Analyzer	
MS2840A-046	44.5 GHz Signal Analyzer	
MS2840A-001	Rubidium Reference Oscillator	Option
MS2840A-077	Analysis Bandwidth Extension to 62.5 MHz	Option
MS2840A-078	Analysis Bandwidth Extension to 125 MHz	Option, requires MS2840A-077
MS2840A-008	Preamplifier	Option, Frequency Range: 100 kHz to 6 GHz
MS2840A-069	26.5 GHz Microwave Preamplifier	Option, For MS2840A-044, Frequency Range: 100 kHz to 26.5 GHz
MS2840A-068	Microwave Preamplifier	Option, For MS2840A-046, Frequency Range: 100 kHz to 44.5 GHz
MS2840A-010	Phase Noise Measurement Function	Option
MS2840A-011	2ndary SSD	Option
MS2840A-016	Precompliance EMI Function	Option
MS2840A-017	Noise Figure Measurement Function	Option
MS2840A-019	2 dB Step Attenuator for Millimeter-wave	Option, For MS2840A-046
MS2840A-026	BER Measurement Function	Option, AUX Conversion Adapter J1556A as standard accessory
MS2840A-051	Noise Floor Reduction	Option
MS2840A-067	Microwave Preselector Bypass	Option, Add this option when the signal analyzer measurement function is set to a frequency band of >31.25 MHz and a frequency of >6 GHz.

The following options are installed as standard and do not require separate orders when ordering the MS2840A-044.

Standard Software	MX269000A
Analysis Bandwidth 10 MHz	MS2840A-006
Bandwidth Extension to 31.25 MHz	MS2840A-005

The following options are installed as standard and do not require separate orders when ordering the MS2840A-046.

Standard Software	MX269000A
Analysis Bandwidth 10 MHz	MS2840A-006
Bandwidth Extension to 31.25 MHz for Millimeter Wave	MS2840A-009

List of Retrofit Options

The following hardware options can be retrofitted. Add to the retrofit options at ordering and also order the Z1932A Retrofit Kit.
In addition, the MS2840A main unit must be returned to the Anritsu plant for remodelling when retrofitting hardware options.

Model	Name	Remarks
MS2840A-101	Rubidium Reference Oscillator Retrofit	
MS2840A-177	Analysis Bandwidth Extension to 62.5 MHz Retrofit	
MS2840A-178	Analysis Bandwidth Extension to 125 MHz Retrofit	Requires MS2840A-077 or -177
MS2840A-108	Preamplifier Retrofit	Frequency Range: 100 kHz to 6 GHz
MS2840A-169	26.5 GHz Microwave Preamplifier Retrofit	For MS2840A-044, Frequency Range: 100 kHz to 26.5 GHz
MS2840A-168	Microwave Preamplifier Retrofit	For MS2840A-046, Frequency Range: 100 kHz to 44.5 GHz
MS2840A-110	Phase Noise Measurement Function Retrofit	
MS2840A-111	2ndary SSD Retrofit	
MS2840A-116	Precompliance EMI Function Retrofit	
MS2840A-117	Noise Figure Measurement Function Retrofit	
MS2840A-119	2 dB Step Attenuator for Millimeter-wave Retrofit	Option, For MS2840A-046
MS2840A-126	BER Measurement Function Retrofit	AUX Conversion Adapter J1556A as standard accessory
MS2840A-151	Noise Floor Reduction Retrofit	Option
MS2840A-167	Microwave Preselector Bypass Retrofit	Add this option when the signal analyzer measurement function is set to a frequency band of >31.25 MHz and a frequency of >6 GHz.
MS2840A-182	CPU/Windows10 Upgrade Retrofit	

Software

The following software can be retrofitted. Add to the required software at ordering and also order the Z1932A Retrofit Kit.

Model	Name	Remarks
MX269017A	Vector Modulation Analysis Software	
MX269017A-001	APSK Analysis	Requires Vector Modulation Analysis Software MX269017A
MX269017A-011	Higher-Order QAM Analysis	Requires Vector Modulation Analysis Software MX269017A
MX269018A	Analog Measurement Software	Requires USB Audio A0086D
MX284059A	Pulse Radar Measurement Function	Unavailable to install simultaneously with MS2840A-069, MS2840A-068, MS2840A-067 (To keep a margin for spurious measurement) Requires MS2840A-019 when mounted on MS2840A-046

Mixer (External)

Model	Name	Remarks
MA2606A	High Performance Waveguide Mixer (50 to 75 GHz)	
MA2608A	High Performance Waveguide Mixer (60 to 90 GHz)	
MA2741C	External Mixer (26.5 to 40 GHz)	Harmonic Mixer
MA2742C	External Mixer (33 to 50 GHz)	Harmonic Mixer
MA2743C	External Mixer (40 to 60 GHz)	Harmonic Mixer
MA2744C	External Mixer (50 to 75 GHz)	Harmonic Mixer
MA2745C	External Mixer (60 to 90 GHz)	Harmonic Mixer
MA2746C	External Mixer (75 to 110 GHz)	Harmonic Mixer
MA2747C	External Mixer (90 to 140 GHz)	Harmonic Mixer
MA2748C	External Mixer (110 to 170 GHz)	Harmonic Mixer
MA2749C	External Mixer (140 to 220 GHz)	Harmonic Mixer
MA2750C	External Mixer (170 to 260 GHz)	Harmonic Mixer
MA2751C	External Mixer (220 to 325 GHz)	Harmonic Mixer

Specifications

Refer to the MS2840A Data Sheet for more details.

Frequency Range

9 kHz to 26 .5 GHz (MS2840A-044)
9 kHz to 44 .5 GHz (MS2840A-046)

Aging Rate

±1 × 10^{-7}/year (standard)
±1 × 10^{-10}/month, ±1 × 10^{-9}/year
(with Rubidium Reference Oscillator MS2840A-001 installed)

Maximum Input Level

Average total power: +30 dBm
(Input attenuator: ≥10 dB, Preamp: Off)

Resolution Bandwidth (RBW)

Spectrum Analyzer Function
Setting Range:
1 Hz to 3 MHz (1–3 sequence), 500 Hz, 50 kHz, 2 MHz, 5 MHz, 10 MHz, 20 MHz
[At Zero SPAN: 30 Hz to 3 MHz (1–3 sequence), 50 kHz, 5 MHz, 10 MHz, 20 MHz, 31.25 MHz]

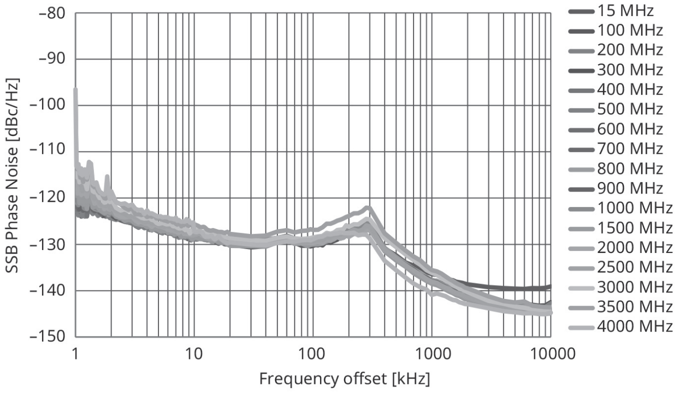
Video Bandwidth (VBW)

Spectrum Analyzer Function
Setting Range:
1 Hz to 3 kHz (1-3 sequence), 5 kHz,
10 kHz to 10 MHz (1-3 sequence), off
VBW Mode: Video Average, Power Average

SSB Phase Noise

Spectrum Analyzer Function

Input Frequency	Carrier Offset	SSB Phase Noise
1 GHz	10 Hz	–80 dBc/Hz (nom.)
	100 Hz	–92 dBc/Hz (nom.)
	1 kHz	–117 dBc/Hz (nom.)
	10 kHz	–123 dBc/Hz
	100 kHz	–123 dBc/Hz
	1 MHz	–135 dBc/Hz
	10 MHz	–148 dBc/Hz (nom.)



Phase Noise Performance (meas.)

Displayed Average Noise Level (DANL)

Spectrum Analyzer Function
Preamp: None, Microwave Preselector Bypass: None

Frequency	DANL		
	26.5 GHz Model (MS2840A-044)	44 .5 GHz Model (MS2840A-046)	
		Without MS2840A-019	With MS2840A-019
30 MHz	–153 dBm/Hz	–153 dBm/Hz	–153 dBm/Hz
400 MHz	–153 dBm/Hz	–153 dBm/Hz	–153 dBm/Hz
1 GHz	–150 dBm/Hz	–150 dBm/Hz	–150 dBm/Hz
3 GHz	–147 dBm/Hz	–147 dBm/Hz	–147 dBm/Hz
13 GHz	–151 dBm/Hz	–151 dBm/Hz	–150 dBm/Hz
20 GHz	–146 dBm/Hz	–146 dBm/Hz	–146 dBm/Hz
30 GHz	—	–146 dBm/Hz	–146 dBm/Hz
40 GHz	—	–144 dBm/Hz	–142 dBm/Hz
44 GHz	—	–140 dBm/Hz	–137 dBm/Hz

Preamp: On, Microwave Preselector Bypass: None

Frequency	DANL		
	26.5 GHz Model (MS2840A-044)	44 .5 GHz Model (MS2840A-046)	
		Without MS2840A-019	With MS2840A-019
30 MHz	–166 dBm/Hz	–166 dBm/Hz	–166 dBm/Hz
400 MHz	–166 dBm/Hz	–166 dBm/Hz	–166 dBm/Hz
1 GHz	–164 dBm/Hz	–164 dBm/Hz	–164 dBm/Hz
3 GHz	–163 dBm/Hz	–163 dBm/Hz	–163 dBm/Hz
13 GHz	–163 dBm/Hz	–163 dBm/Hz	–163 dBm/Hz
20 GHz	–157 dBm/Hz	–160 dBm/Hz	–160 dBm/Hz
30 GHz	—	–160 dBm/Hz	–159 dBm/Hz
40 GHz	—	–157 dBm/Hz	–156 dBm/Hz
44 GHz	—	–149 dBm/Hz	–149 dBm/Hz

Noise Floor Reduction: On
It subtracts the internal noise components (11 dB max. nominal) of the measuring instrument itself from the displayed measurement result.

Total Absolute Amplitude Accuracy

Preamp: None
±0.5 dB (300 kHz ≤ f < 4 GHz)
±1.8 dB (4 GHz ≤ f < 13.8 GHz)
±3.0 dB (13.8 GHz ≤ f < 40 GHz)
±3.5 dB (40 GHz ≤ f < 44.5 GHz, nom.)

The MS2840A supports level calibration over a wide range of 300 kHz to 4 GHz using its built-in level calibration oscillator.
The level accuracy standards include frequency characteristics, linearity and attenuator switching error. Consequently, the level including the above three errors can still be measured accurately even when the measurement frequency and built-in attenuator settings are changed.

2-tone 3rd-order Intermodulation Distortion

Preamp: None

Frequency	2-tone 3rd-order Intermodulation Distortion
1 GHz	≤–62 dBc (TOI = +16 dBm)
20 GHz	≤–56 dBc (TOI = +13 dBm)
40 GHz	≤–56 dBc (TOI = +13 dBm) (nom.)

Second Harmonic Distortion

Preamp: None, Microwave Preselector Bypass: None,
Frequency Band Mode: Spurious

Input Frequency	Harmonic Distortion	SHI	Mixer Input Level
400 MHz, 1 GHz	≤–65 dBc	≥+35 dBm	–30 dBm
3 GHz	≤–80 dBc	≥+70 dBm	–10 dBm
13 GHz	≤–90 dBc	≥+80 dBm	–10 dBm
20 GHz	≤–90 dBc (nom.)	≥+80 dBm (nom.)	–10 dBm

Analysis Bandwidth (Signal Analyzer Function)

31.25 MHz (Standard)
62.5 GHz (Option)
125 MHz (Option)

Connector

RF Input (Front panel)
  N–J, 50Ω (nom.): 26.5 GHz model (MS2840A-044)
  K–J, 50Ω (nom.): 44.5 GHz model (MS2840A-046)
IF Output (Rear panel)
  SMA-J, 50Ω (nom.)
  Frequency: 1.8755 GHz
  Gain: –10 dB (nom., Input attenuator: 0 dB, Input frequency: 10 GHz)
1st Local Output (Front panel)
  For High Performance Waveguide Mixer and Harmonic Mixer
  SMA-J, 50Ω (nom.)
  Frequency: 5 GHz to 10 GHz (Local signal output)
              1.8755 GHz (IF frequency)
  Local output level: ≥ +10 dBm (typ.)
  Bias current: Setting range 0.0 to 20.0 mA
                Resolution 0.1 mA

Dimensions and Mass

426 (W) × 177 (H) × 390 (D) mm (excluding projections)
≤15.3 kg (with MS2840A-044 or 046 installed, excluding other options)

Power Supply

Power voltage: 100 VAC to 120 VAC/200 VAC to 240 VAC
Frequency: 50 Hz to 60 Hz
Power consumption: ≤350 VA (including all options)
                   220 VA (nom., with MS2840A-044 or 046 installed, excluding other options)

CE Marking

EMC: 2014/30/EU, EN61326-1, EN61000-3-2
LVD: 2014/35/EU, EN61010-1
RoHS: 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018

UKCA Marking

EMC: S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
LVD: S.I. 2016 No.1101, EN 61010-1
RoHS: S.I. 2012 No.3032, EN IEC 63000: 2018

OS

Windows 10 (64 bits)

High Performance Waveguide Mixer MA2806A/MA2808A Specifications

See MA2806A/MA2808A page for detail.

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Other company names, product names, service names, etc., are trademarks or registered trademarks of their respective owners.

Typical (typ.):
  Performance not warranted. Most products meet typical performance.
Nominal (nom.):
  Values not warranted. Included to facilitate application of product.
Measured (meas.):
  Performance not warranted. Data actually measured from randomly selected measuring instruments.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MS2840A	Signal Analyzer
	Standard Accessories
	Power Cord: 1 pc
P0031A	USB Memory (≥ 1 GB): 1 pc
Z0541A	USB Mouse: 1 pc
	Install DVD-ROM (Application software, instruction manual DVD-ROM): 1 pc
	Options
MS2840A-044	26.5 GHz Signal Analyzer
MS2840A-046	44.5 GHz Signal Analyzer
MS2840A-001	Rubidium Reference Oscillator
MS2840A-077	Analysis Bandwidth Extension to 62.5 MHz
MS2840A-078	Analysis Bandwidth Extension to 125 MHz (Requires MS2840A-077)
MS2840A-008	Preamplifier
MS2840A-069	26.5 GHz Microwave Preamplifier (for MS2840A-044)
MS2840A-068	Microwave Preamplifier (for MS2840A-046)
MS2840A-010	Phase Noise Measurement Function
MS2840A-011	2ndary SSD
MS2840A-016	Precompliance EMI Function
MS2840A-017	Noise Figure Measurement Function
MS2840A-019	2 dB Step Attenuator for Millimeter-wave (for MS2840A-046)
MS2840A-051	Noise Floor Reduction
MS2840A-026	BER Measurement Function (AUX Conversion Adapter J1556A as standard accessory)
MS2840A-067	Microwave Preselector Bypass
	Retrofit Options
MS2840A-101	Rubidium Reference Oscillator Retrofit
MS2840A-177	Analysis Bandwidth Extension to 62.5 MHz Retrofit
MS2840A-178	Analysis Bandwidth Extension to 125 MHz Retrofit (Requires MS2840A-077 or 177)
MS2840A-108	Preamplifier Retrofit
MS2840A-169	26.5 GHz Microwave Preamplifier Retrofit (for MS2840A-044)
MS2840A-168	Microwave Preamplifier Retrofit (for MS2840A-046)
MS2840A-110	Phase Noise Measurement Function Retrofit
MS2840A-111	2ndary SSD Retrofit
MS2840A-116	Precompliance EMI Function Retrofit
MS2840A-117	Noise Figure Measurement Function Retrofit
MS2840A-119	2 dB Step Attenuator for Millimeter-wave Retrofit (for MS2840A-046)
MS2840A-151	Noise Floor Reduction Retrofit
MS2840A-126	BER Measurement Function Retrofit (AUX Conversion Adapter J1556A as standard accessory)
MS2840A-167	Microwave Preselector Bypass Retrofit
MS2840A-182	CPU/Windows10 Upgrade Retrofit
MS2840A-282	CPU/Windows10 Upgrade Retrofit
	Software Options
	DVD-ROM with License and Operation manuals
MX269017A	Vector Modulation Analysis Software
MX269017A-001	APSK Analysis
MX269017A-011	Higher-Order QAM Analysis
MX269018A	Analog Measurement Software (Requires USB Audio A0086D)
MX284059A	Pulse Radar Measurement Function
	Warranty Service
MS2840A-ES210	2 years Extended Warranty Service
MS2840A-ES310	3 years Extended Warranty Service
MS2840A-ES510	5 years Extended Warranty Service

Continued on next page

The following options are installed as standard and do not require separate orders when ordering the MS2840A-044.

Standard Software	MX269000A
Analysis Bandwidth 10 MHz	MS2840A-006
Bandwidth Extension to 31.25 MHz	MS2840A-005

The following options are installed as standard and do not require separate orders when ordering the MS2840A-046.

Standard Software	MX269000A
Analysis Bandwidth 10 MHz	MS2840A-006
Bandwidth Extension to 31.25 MHz for Millimeter Wave	MS2840A-009

Model/Order No.	Name
	Manuals
	Following operation manuals provided as hard copy
W3812AE	MS2840A Operation Manual (Mainframe Operation)
W2851AE	MS2690A/MS2691A/MS2692A/MS2830A and MS2840A Operation Manual (Mainframe Remote Control)
W3335AE	MS2830A/MS2840A/MS2850A Operation Manual (Signal Analyzer Function Operation)
W2853AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/ MS2850A Operation Manual (Signal Analyzer Function Remote Control)
W3336AE	MS2830A/MS2840A/MS2850A Operation Manual (Spectrum Analyzer Function Operation)
W2855AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/ MS2850A Operation Manual (Spectrum Analyzer Function Remote Control)
W3117AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/ MS2850A Operation Manual (Phase Noise Measurement Function Operation)
W3118AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/ MS2850A Operation Manual (Phase Noise Measurement Function Remote Control)
W3655AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/ MS2850A-017 Operation Manual (Noise Figure Measurement Function Operation)
W3656AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/ MS2850A-017 Operation Manual (Noise Figure Measurement Function Remote control)
W3305AE	MX269017A Operation Manual (Operation)
W3306AE	MX269017A Operation Manual (Remote Control)
W3555AE	MX269018A Operation Manual (Operation)
W3556AE	MX269018A Operation Manual (Remote Control)
W4029AE	MX284059A Operation Manual
	High Performance Waveguide Mixer
MA2806A	High Performance Waveguide Mixer (50 to 75 GHz)
MA2808A	High Performance Waveguide Mixer (60 to 90 GHz)
	Standard Accessories
Z1922A	MA2806A USB Memory (Saved conversion loss data, for MA2806A): 1 pc
Z1923A	MA2808A USB Memory (Saved conversion loss data, for MA2808A): 1 pc
Z1625A	AC Adapter: 1 pc Power Cord: 1 pc
J1692B	Coaxial Cord, 1 m (SMA-P · SUCOFLEX104PE · SMA-P, DC to 18 GHz, 50Ω): 1 pc
	External Mixer (Harmonic Mixer)
MA2741C	External Mixer (26.5 GHz to 40 GHz)
MA2742C	External Mixer (33 GHz to 50 GHz)
MA2743C	External Mixer (40 GHz to 60 GHz)
MA2744C	External Mixer (50 GHz to 75 GHz)
MA2745C	External Mixer (60 GHz to 90 GHz)
MA2746C	External Mixer (75 GHz to 110 GHz)
MA2747C	External Mixer (90 GHz to 140 GHz)
MA2748C	External Mixer (110 GHz to 170 GHz)
MA2749C	External Mixer (140 GHz to 220 GHz)
MA2750C	External Mixer (170 GHz to 260 GHz)
MA2751C	External Mixer (220 GHz to 325 GHz)

Model/Order No.	Name
	Application Parts
34AKNF50	Ruggedized K-to-Type N Adapter (DC to 20 GHz, 50Ω, Ruggedized K-M · N-F, SWR: 1.5 (max.), Insertion Loss: 0.4 dB (max.))
K240B	Power Divider (K connector, DC to 26.5 GHz, 50Ω, K-J, 1 W max.)
MA1612A	Four-port Junction Pad (5 MHz to 3 GHz, N-J)
J1359A	Coaxial Adaptor (K-P · K-J, SMA)
J0576B	Coaxial Cord, 1 m (N-P · 5D-2W · N-P)
J0576D	Coaxial Cord, 2 m (N-P · 5D-2W · N-P)
J0127A	Coaxial Cord, 1 m (BNC-P · RG58A/U · BNC-P)
J0127B	Coaxial Cord, 2 m (BNC-P · RG58A/U · BNC-P)
J0127C	Coaxial Cord, 0.5 m (BNC-P · RG58A/U · BNC-P)
J0322A	Coaxial Cord, 0.5 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322B	Coaxial Cord, 1 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322C	Coaxial Cord, 1.5 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322D	Coaxial Cord, 2 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0805	DC Block, N type (MODEL 7003) (10 kHz to 18 GHz, N-P · N-J)
J1555A	DC Block, SMA type (MODEL 7006-1) (9 kHz to 20 GHz, SMA-P · SMA-J)
K261	DC Block (10 kHz to 40 GHz, K-P · K-J)
J0004	Coaxial Adapter (DC to 12.4 GHz, 50Ω, N-P · SMA-J)
J1398A	N-SMA Adaptor (DC to 26.5 GHz, 50Ω, N-P · SMA-J)
J0911	Coaxial Cable, 1.0 m for 40 GHz (DC to 40 GHz, approx. 1 m, SF102A, 11K254/K254/1.0M)
J0912	Coaxial Cable, 0.5 m for 40 GHz (DC to 40 GHz, approx. 0.5 m, SF102A, 11K254/K254/0.5M)
41KC-3	Fixed Attenuator (DC to 40 GHz, 3 dB)
J1261A	Ethernet Cable (Shield type, Straight, 1 m)
J1261B	Ethernet Cable (Shield type, Straight, 3 m)
J1261C	Ethernet Cable (Shield type, Cross, 1 m)
J1261D	Ethernet Cable (Shield type, Cross, 3 m)
J0008	GPIB Cable, 2.0 m
J1556A	AUX Conversion Adapter (AUX → BNC, for vector signal generator option and BER measurement function option, standard accessory with BER Measurement Function MS2840A-026)
A0086D	USB Audio (for MX269018A)
B0635A	Rack Mount Kit (EIA)
B0657A	Rack Mount Kit (JIS)
B0636C*	Carrying Case (Hard type, with casters)
B0671A*	Front Cover for 1MW4U
MA24105A	Inline Peak Power Sensor (350 MHz to 4 GHz, with USB A to mini B cable)
MA24106A	USB Power Sensor (50 MHz to 6 GHz, with USB A to mini B cable)
MA24108A	Microwave USB Power Sensor (10 MHz to 8 GHz, with USB A to Micro-B cable)
MA24118A	Microwave USB Power Sensor (10 MHz to 18 GHz, with USB A to Micro-B cable)
MA24126A	Microwave USB Power Sensor (10 MHz to 26 GHz, with USB A to Micro-B cable)
Z0975A	Keyboard (USB)
Z1932A	Installation Kit (required when retrofitting options or installing software)

*: The Carrying Case B0636C includes the Front Panel Protective Cover (B0671A).

Signal Analyzer

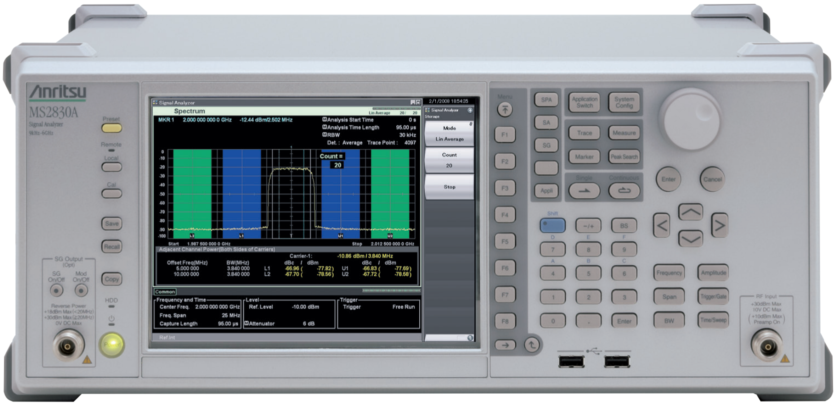
MS2830A

9 kHz to 3.6 GHz/6.0 GHz/13.5 GHz

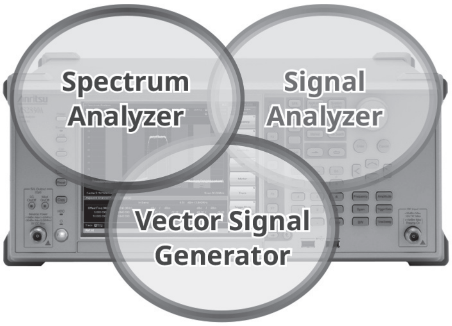
Remote Control
GPIB | **Ethernet** | **USB**

[High Speed + High Performance] × [Low Cost] + Eco-friendly

Excellent Eco Product



The MS2830A is a high-speed, high-performance, cost-effective Spectrum Analyzer/Signal Analyzer.
Not only can it capture wideband signals but FFT technology supports multifunction signal analyses in both the time and frequency domains. Behavior in the time domain that cannot be handled by a sweep type spectrum analyzer can be checked in the frequency domain. A wide frequency can be analyzed using sweep type spectrum analysis functions while detailed signal analysis of a specific frequency band is supported too.
Moreover, the built-in signal generator function outputs both continuous wave (CW) and modulated signals for use as a reference signal source when testing Tx characteristics of parts and as a signal source for evaluating Rx characteristics.



Key Features

Basic Performance/Functions

- Frequency Range
  MS2830A-040: 9 kHz to 3.6 GHz
  MS2830A-041: 9 kHz to 6.0 GHz
  MS2830A-043: 9 kHz to 13.5 GHz
- Total Level Accuracy: ±0.3 dB (typ.)
- Dynamic Range[*1]: 168 dB
  TOI[*2]: ≥+15 dBm
  DANL[*3]: –153 dBm/Hz
- Improved Level Linearity
- Internal Reference Oscillator
  Pre-installed Reference Oscillator
    Aging Rate: ±1 × 10^{-6}/year, ±1 × 10^{-7}/day
    Start-up Characteristics: ±5 × 10^{-7} (5 minutes after power-on)
  Rubidium Reference Oscillator (MS2830A-001)
    Aging Rate: ±1 × 10^{-10}/month
    Start-up Characteristics: ±1 × 10^{-9} (7 minutes after power-on)
  High Stability Reference Oscillator (MS2830A-002)
    Aging Rate: ±1 × 10^{-7}/year, ±1 × 10^{-8}/day
    Start-up Characteristics: ±5 × 10^{-8} (5 minutes after power-on)
- Versatile Built-in Functions
  Channel Power
  Occupied Bandwidth
  Adjacent Channel Leakage Power
  Spectrum Emission Mask[*4]
  Spurious Emission[*4]
  Burst Average Power
  Frequency Counter[*4]
  AM Depth[*5]
  FM Deviation[*5]
  Multi-marker & Marker List
  Highest 10 Markers
  Limit Line[*4]
  2-tone 3rd-order Intermodulation Distortion[*4]
  Annotation Display (On/Off)
  Power Meter[*6]
  Phase Noise[*7]
  Noise Figure[*8]
- Low-power-consumption
  MS2830A-040: 110 VA (nom.)
  MS2830A-041: 110 VA (nom.)
  MS2830A-043: 130 VA (nom.)

*1: Difference between TOI and DANL as simple guide
*2: TOI (Third Order Intercept)
*3: DANL (Displayed Average Noise Level)
*4: Spectrum Analyzer functions
*5: Signal Analyzer functions (Requires MS2830A-005/006/077/078)
*6: Power Meter Function (Use USB Power Sensors)
*7: Phase Noise Measurement Function (Requires MS2830A-010)
*8: Noise Figure Measurement Function (Requires MS2830A-017)
[Use Noise Sources (Noisecom, NC346 series)]

Signal Analyzer Functions (MS2830A-005/006/077/078)

- Analysis Bandwidth
  - MS2830A-006: 10 MHz max.
    (20 MHz max. sampling rate = 50 ns resolution, ADC resolution 16 bits)
  - MS2830A-005[*9]: 31.25 MHz max
    (50 MHz max. sampling rate = 20 ns resolution, ADC resolution 16 bits)
  - MS2830A-077[*10]: 62.5 MHz max.
    (100 MHz max. sampling rate = 10 ns resolution, ADC resolution 14 bits)
  - MS2830A-078[*11]: 125 MHz max
    (200 MHz max. sampling rate = 5 ns resolution, ADC resolution 14 bits)

Note: An image response is received when setting the bandwidth to more than 31.25 MHz. This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.). The Signal Analyzer MS2690A is recommended for other measurement purposes.

*9: Requires MS2830A-006
*10: Requires MS2830A-005 and MS2830A-006
*11: Requires MS2830A-005, MS2830A-006 and MS2830A-077

- Capture Function
  Saves analysis Span × Time signal to internal memory and writes to hard disk.
  Up to 100 Msamples per measurement can be saved to internal memory.
- Replay Function
  Reads saved data and replays using signal analyzer function.
- Measurement with Sub-trace Display
  Splits screen and confirms both main and sub-traces at same time to check errors.
  Main: Spectrum, Frequency vs. Time, Power vs. Time,
  Phase vs. Time, CCDF/APD, Spectrogram
  Sub: Power vs. Time, Spectrogram

Vector Signal Generator (MS2830A-020/021)

- Frequency Range
  MS2830A-020: 250 kHz to 3.6 GHz
  MS2830A-021: 250 kHz to 6 GHz
- Pre-installed Baseband Generator
  Vector Modulation Bandwidth: 120 MHz
  Sampling Clock: 20 kHz to 160 MHz
- Level Accuracy: ±0.5 dB (typ.)
- Large-capacity Memory
  256 MB = 64 Msamples
  1 GB = 256 Msamples (MS2830A-027)
- Internal AWGN Generator (MS2830A-028)

BER Measurement Function (MS2830A-026)

This option measures BER using Data/Clock/Enable demodulated at the DUT.

Input Bit Rate: 100 bps to 10 Mbps
Input Level: TTL Level

Basic Performance

Excellent Total Level Accuracy: ±0.3 dB (typ.)

(Common to both Spectrum Analyzer and Signal Analyzer Performances)

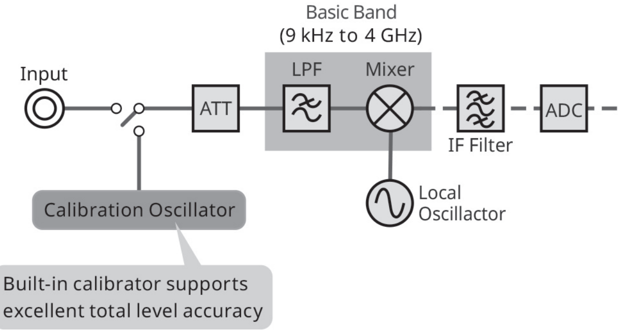
With a level calibration over a wide frequency range, the MS2830A has excellent total level accuracy.
The Absolute Amplitude Accuracy specification described in catalogs of other spectrum analyzers ignores the important frequency characteristics, linearity, and attenuator switching errors.
In contrast, the MS2830A Level Calibration technology assures excellent level accuracy over a wide frequency range from 300 kHz to 4 GHz even under measurement conditions including the above three errors. The level accuracy is assured even when the frequency and attenuator are switched.

The MS2830A total level accuracy includes:
- Frequency characteristics
- Linearity
- Attenuator switching error

Advantage of MS2830A Level Accuracy Technology

Conventional spectrum analyzers perform level calibration at just one frequency point, which causes errors when the frequency changes.
The MS2830A has a built-in calibration oscillator for level calibration over a wide frequency range from 300 kHz to 4 GHz, minimizing measurement errors in this frequency range.

MS2830A Block Diagram



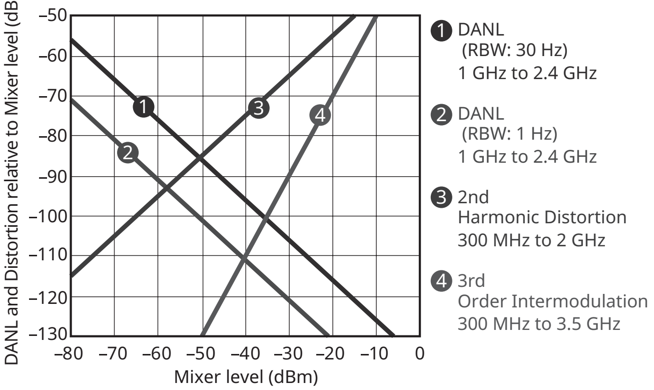
Wide Dynamic Range

Dynamic Range[*1]: 168 dB
TOI[*2]: ≥+15 dBm (300 MHz to 3.5 GHz)
DANL[*3]: –153 dBm/Hz (30 MHz to 1 GHz)

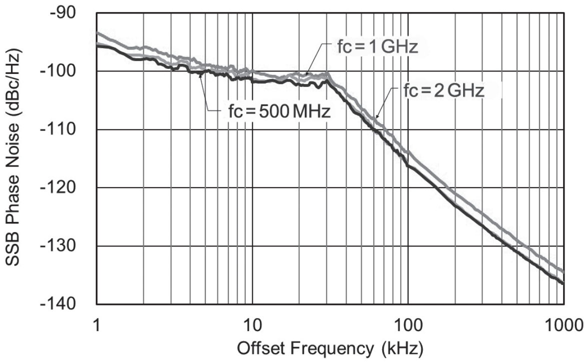
*1: Difference between TOI and DANL as simple guide.
*2: TOI (Third Order Intercept)
*3: DANL (Displayed Average Noise Level)

Dynamic range is a key specification for spectrum analyzers. Low displayed average noise level (DANL) as well as high TOI are important too.
Low TOI may cause distortion with high-level carrier signals. Inserting an attenuator can lower the carrier level but this has the effect of lowering the level of weak spurious, making it hard to measure.
The MS2830A has an excellent dynamic range supporting true performance measurements of devices, such as base stations, requiring wideband measuring instruments.

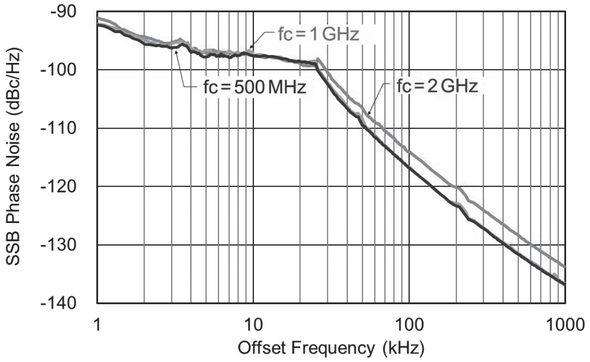
Distortion Characteristics (Spectrum Analyzer)
MS2830A-040/041/043



Example: SSB Phase Noise
(Spectrum Analyzer/Signal Analyzer Common)



(Applies for instruments with serial number ≥ 6201349078)

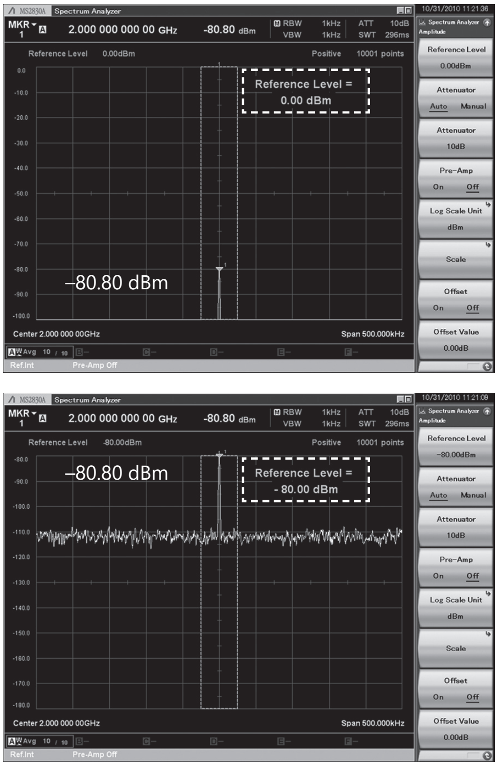


(Applies for instruments with serial number < 6201349078)

Improved Level Linearity

Conventional spectrum analyzers use an analog IF and log amp to achieve good level accuracy at points near the log scale reference level, but the accuracy degrades at points that are further away.
The MS2830A uses a digital IF instead of a log amp, which supports measurements with excellent accuracy at any point.

Example: Level Stability by Switching Reference Level

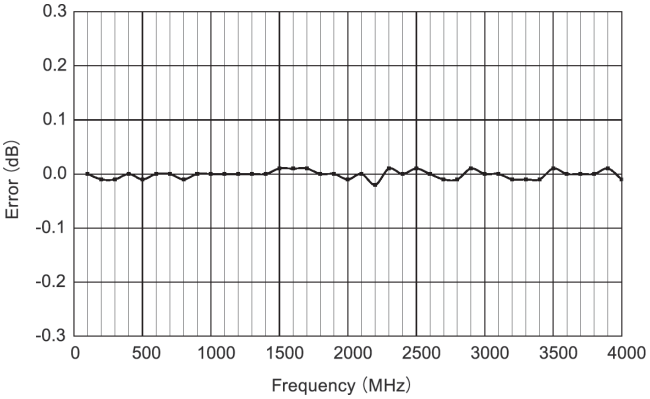

MS2830A Spectrum Analyzer 10/31/2010 11:21:36
MKR 1 2.000 000 000 00 GHz -80.80 dBm RBW 1kHz VBW 1kHz ATT 10dB SWT 296ms
Reference Level 0.00dBm Positive 10001 points
Reference Level = 0.00 dBm
–80.80 dBm
Center 2.000 000 00GHz Span 500.000kHz
Reference Level 0.00dBm
Attenuator Auto Manual
Attenuator 10dB
Offset Value 0.00dB
Ref.Int Pre-Amp Off

MS2830A Spectrum Analyzer 10/31/2010 11:21:09
MKR 1 2.000 000 000 00 GHz -80.80 dBm RBW 1kHz VBW 1kHz ATT 10dB SWT 296ms
Reference Level -80.00dBm Positive 10001 points
Reference Level = - 80.00 dBm
–80.80 dBm
Center 2.000 000 00GHz Span 500.000kHz
Reference Level −80.00dBm
Attenuator Auto Manual
Attenuator 10dB
Offset Value 0.00dB
Ref.Int Pre-Amp Off

Dual Sweep Speed: Normal/Fast

When sweep time is set to [Auto], Normal (normal sweep) or Fast mode (high-speed sweep) can be set. The Fast mode sweeps six times faster than the Normal mode.

Example of Sweep Mode Switch Error: (CW –10 dBm input)
Level Error when Switching from Normal to Fast



Low Consumption Power, Excellent Eco Product

The MS2830A meets Anritsu "Excellent eco products" standard for environment-friendly products. It cuts consumed power by 50% compared to conventional models.

Power Consumption:
≤350 VA (including all options)
110 VA (nom., with MS2830A-040, 3.6 GHz*1)
110 VA (nom., with MS2830A-041, 6 GHz*1)
130 VA (nom., with MS2830A-043, 13.5 GHz*1)

*1: One of the MS2830A-040, 041 or 043. Excludes other options.

Resolution Bandwidth (RBW)

Setting Range

- Spectrum Analyzer:
  1 Hz to 3 MHz (1-3 sequence),
  500 Hz, 50 kHz, 2 MHz, 5 MHz, 10 MHz, 20 MHz*2, 31.25 MHz*2, *3,
  200 Hz (6 dB)*4, 9 kHz (6 dB)*4, 120 kHz (6 dB)*4, 1 MHz (Impulse)*4
- Spectrum trace in signal analyzer mode:
  1 Hz to 1 MHz (1-3 sequence)*5
  1 Hz to 3 MHz (1-3 sequence)*6
  1 Hz to 10 MHz (1-3 sequence)*7

When monitoring two adjacent signals, the frequency resolution can be increased by reducing the resolution bandwidth (RBW).
This also has the effect of reducing the noise level.
Conversely, to confirm level variations of 20-MHz band signals such as LTE, set the RBW to 31.25 MHz.

*2: Can be set when with MS2830A-005.
*3: Instead of Gaussian filter, 31.25 MHz RBW uses filter with flat top characteristics above 31.25 MHz.
*4: When MS2830A-016 installed.
*5: Without MS2830A-077/078, or Bandwidth: ≤31.25 MHz.
*6: With MS2830A-077, Bandwidth: >31.25 MHz.
*7: With MS2830A-078, Bandwidth: >31.25 MHz.

Gate Sweep

Gate sweep executes sweeping only for the length of time specified by the gate length, starting from when the trigger condition is met.
A delay time until sweeping starts after the trigger condition is met can be set using trigger delay.

- The gate source can be selected from the following
  Wide IF video trigger
  External trigger
  Frame trigger
  SG marker trigger (Requires MS2830A-020/021)
- Setting range and resolution for gate delay
  Setting range: 0 to 1 s
  Resolution: 20 ns
- Setting range and resolution for gate length
  Setting range: 50 µs to 1 s
  Resolution: 20 ns

Trigger Function

Trigger sweep executes sweeping using the specified trigger condition as the start point. In particular, "SG Marker" starts analyzer measurement in synchrony with the signal output by installing MS2830A-020/021. Using this function supports simple synchronized measurement even when evaluating signals with large level variation over time, such as modulation signals.

- Video trigger:
  Trigger sweeping starts in synchronization with the rise or fall of the waveform. A trigger level indicator showing the trigger level is displayed on the screen.
- Wide IF video trigger:
  An IF signal with a wide passing band of about 5 MHz is detected, and sweeping starts in synchronization with either the rise or fall of the detected signal.
- External trigger:
  Sweeping starts in synchronization with the rise or fall of the signal input via the Trigger Input connector.
- Frame trigger:
  An equipment-internal trigger signal is used to generate a trigger and start the sweep. The generation period (Period) and offset time (Offset) for the trigger signal can be set. It is also possible to re-synchronize the trigger signal with either the Wide IF Video signal or an external trigger.
- SG Marker trigger (Requires MS2830A-020/021):
  Sweeping starts in synchronization with the rise or fall of the marker signal output of MS2830A-020/021. This function supports measurement in synchronization with the output signal of MS2830A-020/021.

Three Built-in External Interfaces

The built-in Gigabit Ethernet, USB2.0, and GPIB interfaces support remote operation.

GPIB: IEEE 488.2, Rear panel, IEEE 488 bus connector
Interface functions:
SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2
Ethernet: 10/100/1000BASE-T, Rear panel, RJ-45
USB (B): USB2.0, Rear panel, USB-B connector

Saving Measurement Results

Measurement results can be saved to internal hard disk or external USB memory. Screen dumps and trace data can be saved too.

- Screen dump file type
  BMP
  PNG
- The color of the screen hard copy can be set as follows:
  Normal (same as screen display)
  Reverse
  Monochrome
  Reversed Monochrome

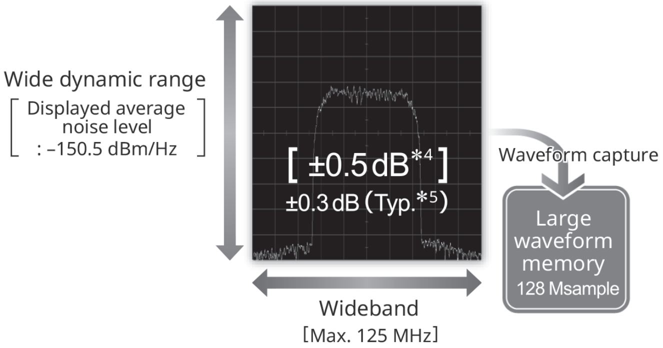
Signal Analyzer: Basic Performance/Functions

Wide bandwidth × High Accuracy FFT Analysis

MS2830A-006: 10 MHz max.
(20 MHz max. sampling rate = 50 ns resolution, ADC resolution 16 bits)
MS2830A-005*1: 31.25 MHz max.
(50 MHz max. sampling rate = 20 ns resolution, ADC resolution 16 bits)
MS2830A-077*2: 62.5 MHz max.
(100 MHz max. sampling rate = 10 ns resolution, ADC resolution 14 bits)
MS2830A-078*3: 125 MHz max.
(200 MHz max. sampling rate = 5 ns resolution, ADC resolution 14 bits)

Note: An image response is received when setting the bandwidth to more than 31.25 MHz. This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.).
The Signal Analyzer MS2690A is recommended for other measurement purposes.

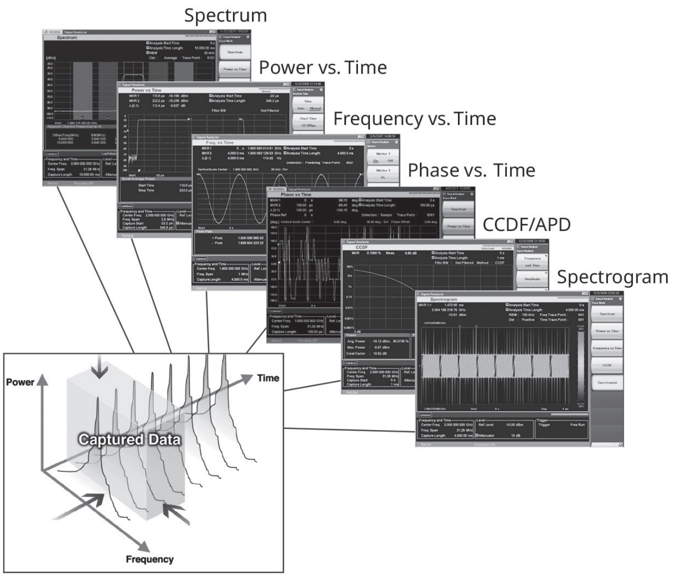
Based on the excellent level accuracy and wide dynamic range of the MS2830A, a signal with an FFT analysis bandwidth of up to 125 MHz can be captured with a level accuracy of ±0.3 dB.



*1: Requires MS2830A-006.
*2: Requires MS2830A-005 and MS2830A-006.
*3: Requires MS2830A-005, MS2830A-006 and MS2830A-077.
*4: 300 kHz ≤ f < 4 GHz, Frequency band mode Normal.
*5: Excluding Guard band.

Vector Signal Analysis (VSA) Function

Seamless signal capture and VSA analysis in multiple domains make it easy to evaluate burst-signal responses and capture degraded spectrum transients, etc., which cannot be checked by conventional sweep spectrum analyzers. This greatly improves design verification and troubleshooting efficiency.



Save Signals in Internal Memory

Max. Capture Time: 0.5 s to 2000 s
Max. Number of Samples: 100 Msamples

The "Analysis bandwidth × Analysis time" signal is held in internal memory and saved to hard disk.
Up to 100 Msamples of data can be saved to memory for one measurement. The frequency span determines the sampling rate.
The following chart shows the maximum capture time per frequency span.

Span*	Sampling Rate	Capture Time	Max. Sampling Data
1 kHz	2 kHz	2000 s	4M
2.5 kHz	5 kHz	2000 s	10M
5 kHz	10 kHz	2000 s	20M
10 kHz	20 kHz	2000 s	40M
25 kHz	50 kHz	2000 s	100M
50 kHz	100 kHz	1000 s	100M
100 kHz	200 kHz	500 s	100M
250 kHz	500 kHz	200 s	100M
500 kHz	1 MHz	100 s	100M
1 MHz	2 MHz	50 s	100M
2.5 MHz	5 MHz	20 s	100M
5 MHz	10 MHz	10 s	100M
10 MHz	20 MHz	5 s	100M
25 MHz	50 MHz	2 s	100M
31.25 MHz	50 MHz	2 s	100M
50 MHz	100 MHz	500 ms	50M
62.5 MHz	100 MHz	500 ms	50M
100 MHz	200 MHz	500 ms	100M
125 MHz	200 MHz	500 ms	100M

*: With MS2830A-006: 1 kHz to 10 MHz
With MS2830A-005/006: 1 kHz to 31.25 MHz
With MS2830A-005/006/077: 1 kHz to 62.5 MHz
With MS2830A-005/006/077/078: 1 kHz to 125 MHz

Replay Function for Comparison Evaluation

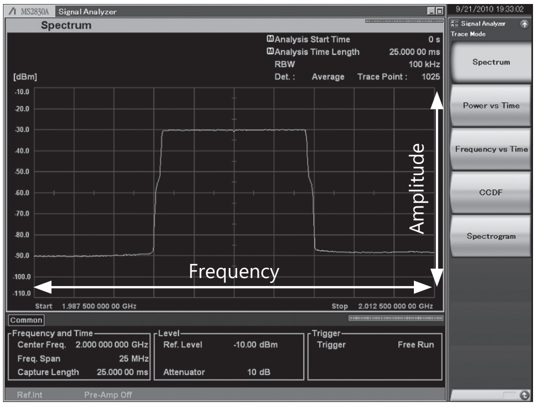
This function reads saved data and replays it using the signal analyzer measurement function.

Examples:
1. Data sharing between separate R&D and manufacturing
2. Later laboratory bench-top analysis of on-site signals
3. Save data at shipment and re-verify if problem occurs

Signal Analyzer: Trace

Spectrum

The Spectrum trace displays a graph with amplitude on the y-axis and frequency on the x-axis. The captured IQ data is FFT processed (fast Fourier transformed) and converted from the time domain to the frequency domain for display as a spectrum.



Analysis Start Time 0 s
Analysis Time Length 25.000 00 ms
RBW 100 kHz
Det. : Average Trace Point : 1025
Start 1.987 500 000 00 GHz
Stop 2.012 500 000 00 GHz

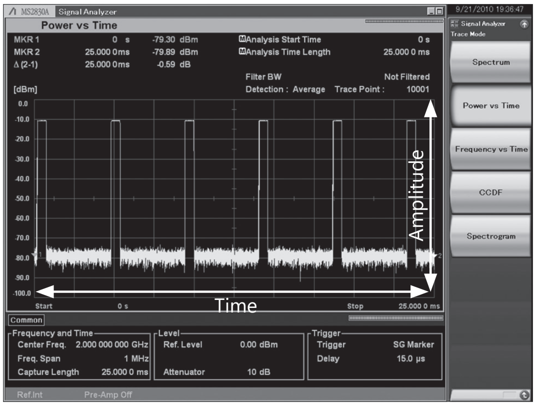
Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 25 MHz
Capture Length 25.000 00 ms

Level
Ref. Level -10.00 dBm
Attenuator 10 dB

Trigger
Trigger Free Run

Power vs. Time

The Power vs. Time trace displays a graph with amplitude on the y-axis and time on the x-axis to confirm changes in power with time of measured signals.



MS2830A Signal Analyzer 9/21/2010 19:36:47

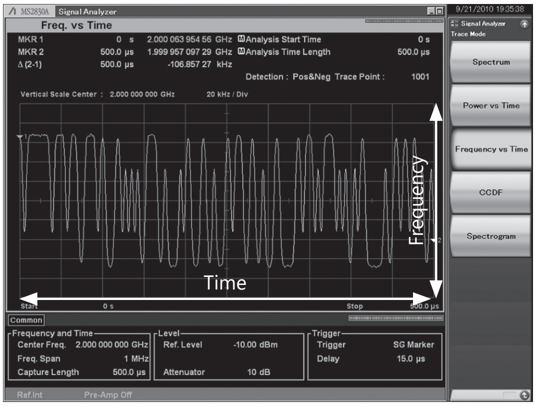
Power vs Time

MKR 1 0 s -79.30 dBm
MKR 2 25.000 0ms -79.89 dBm
Δ (2-1) 25.000 0ms -0.59 dB
Analysis Start Time 0 s
Analysis Time Length 25.000 0 ms
Filter BW Not Filtered
Detection : Average Trace Point : 10001
Start 0 s Stop 25.000 0 ms

Common
Frequency and Time: Center Freq. 2.000 000 000 GHz; Freq. Span 1 MHz; Capture Length 25.000 0 ms
Level: Ref. Level 0.00 dBm; Attenuator 10 dB
Trigger: Trigger SG Marker; Delay 15.0 μs
Ref.Int Pre-Amp Off

Frequency vs. Time

The Frequency vs. Time trace displays a graph with frequency on the y-axis and time on the x-axis to confirm time variation of the measured signal frequency.



MS2830A Signal Analyzer 9/21/2010 19:35:38

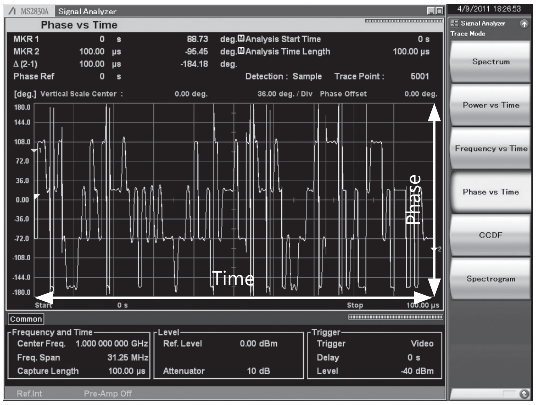
Freq. vs Time

MKR 1 0 s 2.000 063 954 56 GHz
MKR 2 500.0 μs 1.999 957 097 29 GHz
Δ (2-1) 500.0 μs -106.857 27 kHz
Analysis Start Time 0 s
Analysis Time Length 500.0 μs
Detection : Pos&Neg Trace Point : 1001
Vertical Scale Center : 2.000 000 000 GHz 20 kHz / Div
Start 0 s Stop 500.0 μs

Common
Frequency and Time: Center Freq. 2.000 000 000 GHz; Freq. Span 1 MHz; Capture Length 500.0 μs
Level: Ref. Level -10.00 dBm; Attenuator 10 dB
Trigger: Trigger SG Marker; Delay 15.0 μs
Ref.Int Pre-Amp Off

Phase vs. Time

The Phase vs. Time trace displays a graph with phase on the y-axis and time on the x-axis to confirm time variation of the measured signal phase.



MS2830A Signal Analyzer 4/9/2011 18:26:53

Phase vs Time

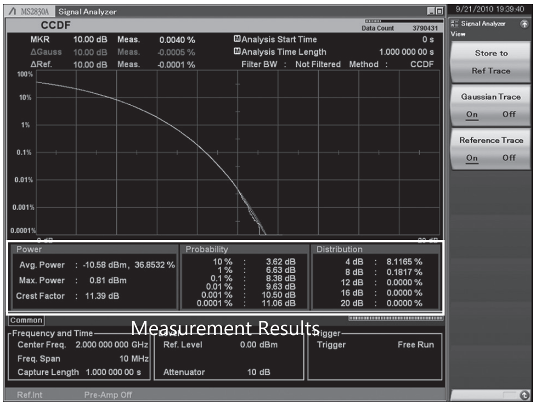
MKR 1 0 s 88.73 deg.
MKR 2 100.00 μs -95.45 deg.
Δ (2-1) 100.00 μs -184.18 deg.
Phase Ref 0 s
Analysis Start Time 0 s
Analysis Time Length 100.00 μs
Detection : Sample Trace Point : 5001
[deg.] Vertical Scale Center : 0.00 deg. 36.00 deg. / Div Phase Offset 0.00 deg.
Start 0 s Stop 100.00 μs

Common
Frequency and Time: Center Freq. 1.000 000 000 GHz; Freq. Span 31.25 MHz; Capture Length 100.00 μs
Level: Ref. Level 0.00 dBm; Attenuator 10 dB
Trigger: Trigger Video; Delay 0 s; Level -40 dBm
Ref.Int Pre-Amp Off

CCDF[*1]/APD[*2]

The CCDF trace displays the power variation probability on the y-axis and power variation on the y-axis to confirm the CCDF and APD of measured signals.

*1: CCDF (Complementary Cumulative Distribution Function)
*2: APD (Amplitude Probability Density)



MS2830A Signal Analyzer 9/21/2010 19:39:40

CCDF

Data Count 3790431
MKR 10.00 dB Meas. 0.0040 %
ΔGauss 10.00 dB Meas. -0.0005 %
ΔRef. 10.00 dB Meas. -0.0001 %
Analysis Start Time 0 s
Analysis Time Length 1.000 000 00 s
Filter BW : Not Filtered Method : CCDF

Power
Avg. Power : -10.58 dBm, 36.8532 %
Max. Power : 0.81 dBm
Crest Factor : 11.39 dB

Probability	
10 %	3.62 dB
1 %	6.63 dB
0.1 %	8.38 dB
0.01 %	9.63 dB
0.001 %	10.50 dB
0.0001 %	11.06 dB

Distribution	
4 dB	8.1165 %
8 dB	0.1817 %
12 dB	0.0000 %
16 dB	0.0000 %
20 dB	0.0000 %

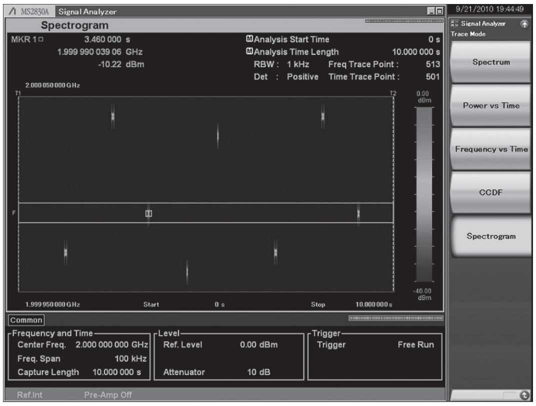
Common
Frequency and Time: Center Freq. 2.000 000 000 GHz; Freq. Span 10 MHz; Capture Length 1.000 000 00 s
Level: Ref. Level 0.00 dBm; Attenuator 10 dB
Trigger: Trigger Free Run
Ref.Int Pre-Amp Off

Measurement Results

- CCDF: The CCDF display indicates the cumulative distribution of transient power variations compared to average power.
- APD: The APD display indicates the probability distribution of transient power fluctuations compared to average power.

Spectrogram

The Spectrogram trace displays the level as color with frequency on the y-axis and time on the x-axis. The captured IQ data is FFT processed to confirm time variations in the continuous spectrum.
It is useful for monitoring frequency hopping and transient signals.



MS2830A Signal Analyzer 9/21/2010 19:44:49

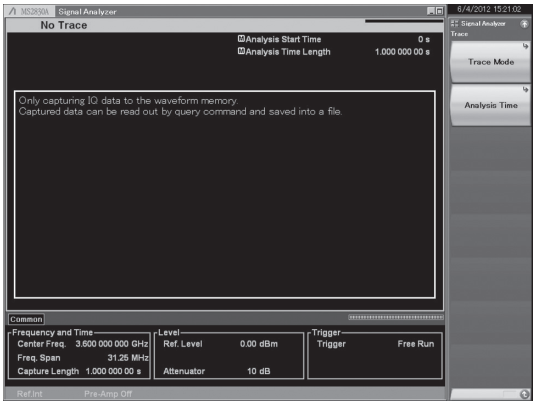
Spectrogram

MKR 1 3.460 000 s
1.999 990 039 06 GHz
-10.22 dBm
Analysis Start Time 0 s
Analysis Time Length 10.000 000 s
RBW : 1 kHz Freq Trace Point : 513
Det : Positive Time Trace Point : 501
Start 0 s Stop 10.000 000 s

Common
Frequency and Time: Center Freq. 2.000 000 000 GHz; Freq. Span 100 kHz; Capture Length 10.000 000 s
Level: Ref. Level 0.00 dBm; Attenuator 10 dB
Trigger: Trigger Free Run
Ref.Int Pre-Amp Off

No Trace

No Trace mode does not execute signal analysis. Therefore, “IQ data output” and “IQ data readout using remote commands” can be executed quickly without the need to wait for completion of analysis.



6/4/2012 15:21:02

Analysis Start Time 0 s
Analysis Time Length 1.000 000 00 s

Only capturing IQ data to the waveform memory.
Captured data can be read out by query command and saved into a file.

Frequency and Time
Center Freq. 3.600 000 000 GHz
Freq. Span 31.25 MHz
Capture Length 1.000 000 00 s

Level
Ref. Level 0.00 dBm
Attenuator 10 dB

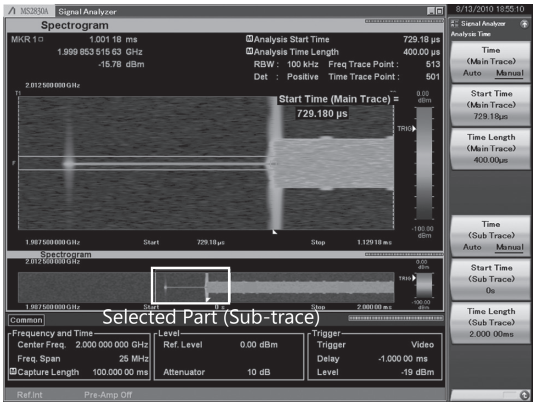
Trigger
Trigger Free Run

Measurement with Sub-trace Display

This function splits the screen into top and bottom halves; simultaneous display of the sub-trace supports easy monitoring of fault locations and transient phenomena.

Main: Spectrum, Frequency vs. Time, Power vs. Time,
Phase vs. Time, CCDF/APD, Spectrogram
Sub: Power vs. Time, Spectrogram

The part of a previously captured long-term signal to be monitored can be selected on the sub-trace to display the problem part only on the main trace.



8/13/2010 18:55:10

MKR 1 1.001 18 ms
1.999 853 515 63 GHz
-15.78 dBm

Analysis Start Time 729.18 µs
Analysis Time Length 400.00 µs
RBW : 100 kHz Freq Trace Point : 513
Det : Positive Time Trace Point : 501

Start Time (Main Trace) = 729.180 µs

Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 25 MHz
Capture Length 100.000 00 ms

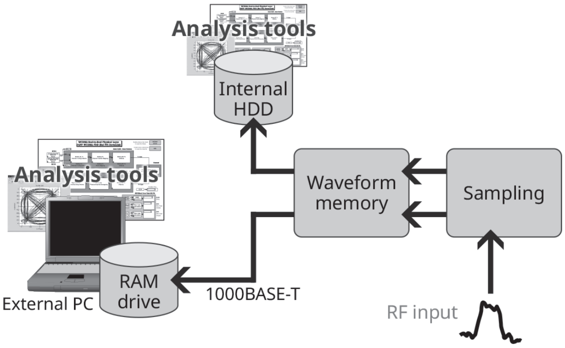
Level
Ref. Level 0.00 dBm
Attenuator 10 dB

Trigger
Trigger Video
Delay -1.000 00 ms
Level -19 dBm

Signal Analyzer: Applications

Analyze Captured Waveforms using Third-Party Tools

The MS2830A utilizes proprietary calibration technologies, enabling digitized baseband data to be used directly in third-party analysis tools without the need for correction.

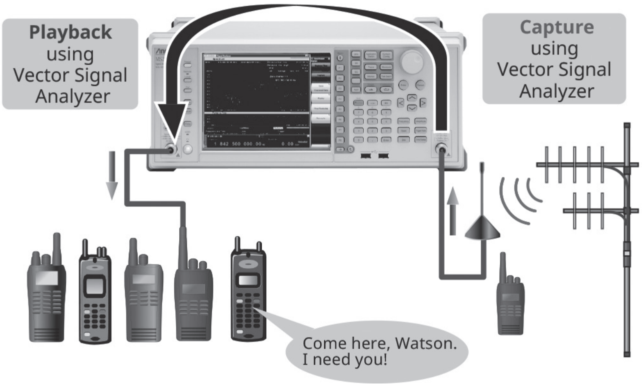


Capture & Playback Real-World Signals

The MS2830A provides *Capture & Playback* functionality that enables laboratory-grade testing of transceiver systems using real world signals. Using the optional integrated Vector Signal Analyzer and Vector Signal Generator of the MS2830A, *Capture & Playback* allows users to conveniently capture up to 100 MHz of spectrum and play it back at any designated frequency and amplitude, making it easy to determine device performance margins.

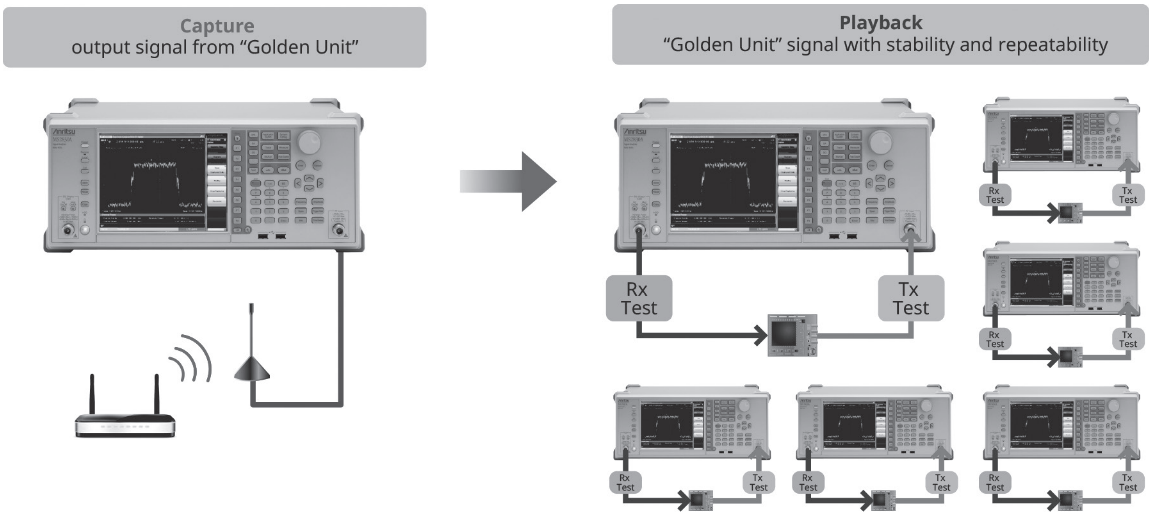
Applications for *Capture & Playback*

- Validation/Production Test
  Captured signals can be used to initiate a communications link and perform receiver sensitivity testing with a device under test (DUT) using signals captured from a Golden Unit.
- Device Characterization
  Actual baseband signals captured from an RFIC can be used as simulation for characterizing amplifiers and other downstream devices or modules.
- Electromagnetic Compatibility Test
  Problematic RF environments or discrete signals – such as cellular or Wi-Fi – can be captured and used to evaluate a device’s susceptibility to RF interference, debug any problems found and validate the solution.



Repeatably Test Device Performance using “Real-World” RF Environments

Wi-Fi® is a registered trademark of Wi-Fi Alliance.



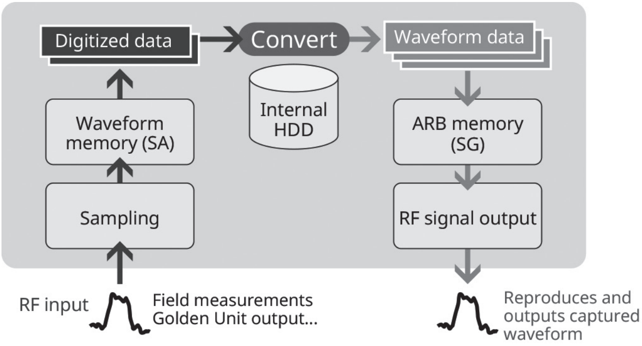
Use "Golden Unit" Signal for Manufacturing Test and Calibration

Capture & Playback Highlights

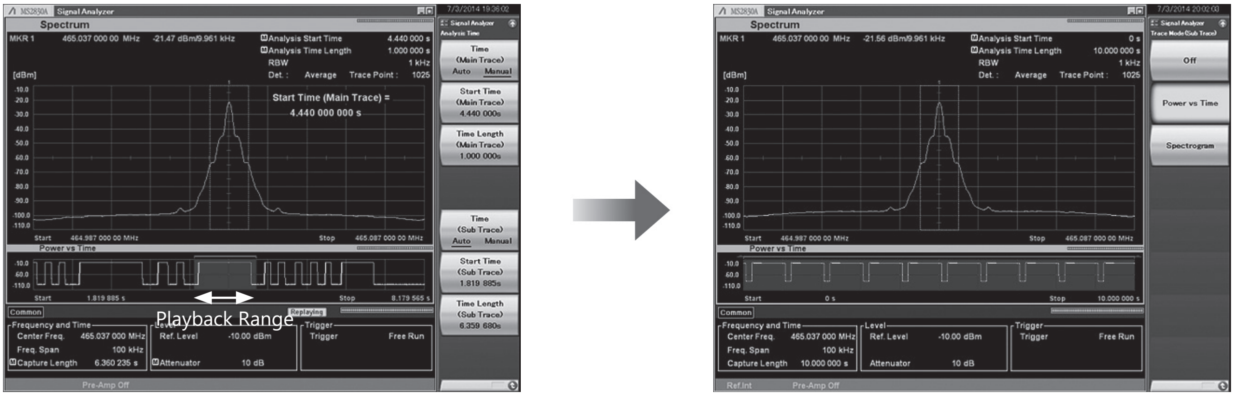
- Bandwidth and Time Limits
  Minimum 10 kHz Bandwidth (2000 s maximum duration)*
  Maximum 100 MHz Bandwidth (500 ms maximum duration)*

  *: Maximum bandwidth depends upon vector signal analyzer options installed (MS2830A-006/005/077/078). Maximum playback duration depends upon whether vector signal generator memory upgrade (MS2830A-027) is installed.
- Captured signal may be freely tuned to any output frequency and amplitude supported by the vector signal generator.
- Any section of the captured waveform record may be selected and played back.

  Enables user to isolate and reproduce specific signal bursts
  Enables user to change duty cycle of pulsed waveforms



Playback Block Diagram



MS2830A Signal Analyzer
7/3/2014 19:36:02
Spectrum
MKR 1 465.037 000 00 MHz -21.47 dBm/9.961 kHz
Analysis Start Time 4.440 000 s
Analysis Time Length 1.000 000 s
RBW 1 kHz
Det. : Average Trace Point : 1025
[dBm]
Start Time (Main Trace) = 4.440 000 000 s
Start 464.987 000 00 MHz Stop 465.087 000 00 MHz
Power vs Time
Start 1.819 885 s Stop 8.179 565 s
Common
Replaying
Frequency and Time
Center Freq. 465.037 000 MHz
Freq. Span 100 kHz
Capture Length 6.360 235 s
Level
Ref. Level -10.00 dBm
Attenuator 10 dB
Trigger
Trigger Free Run
Pre-Amp Off
Signal Analyzer
Analysis Time
Time (Main Trace) Auto Manual
Start Time (Main Trace) 4.440 000s
Time Length (Main Trace) 1.000 000s
Time (Sub Trace) Auto Manual
Start Time (Sub Trace) 1.819 885s
Time Length (Sub Trace) 6.359 680s

MS2830A Signal Analyzer
7/3/2014 20:02:03
Spectrum
MKR 1 465.037 000 00 MHz -21.56 dBm/9.961 kHz
Analysis Start Time 0 s
Analysis Time Length 10.000 000 s
RBW 1 kHz
Det. : Average Trace Point : 1025
[dBm]
Start 464.987 000 00 MHz Stop 465.087 000 00 MHz
Power vs Time
Start 0 s Stop 10.000 000 s
Common
Frequency and Time
Center Freq. 465.037 000 MHz
Freq. Span 100 kHz
Capture Length 10.000 000 s
Level
Ref. Level -10.00 dBm
Attenuator 10 dB
Trigger
Trigger Free Run
Ref.Int Pre-Amp Off
Signal Analyzer
Trace Mode (Sub Trace)
Off
Power vs Time
Spectrogram

Playback any Desired Section of Captured Waveform

Versatile Built-in Functions

Useful for Tx Characteristics Evaluation

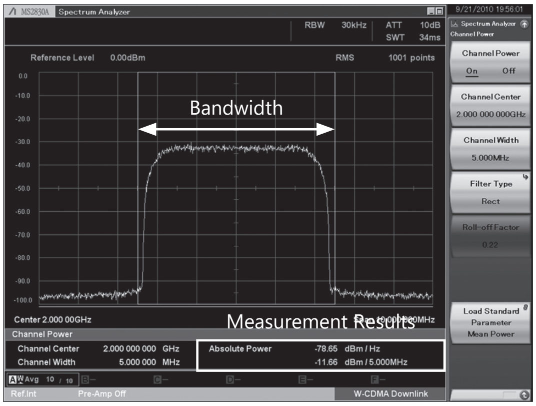
The MS2830A is fully loaded with all the functions required for evaluating Tx characteristics. Tests can be performed simply and in accordance with standards using functions tailored to measurement contents.

Measure Function	SPA*1	VSA*2
Channel Power	✓	✓
Occupied Bandwidth	✓	✓
Adjacent Channel Leakage Power	✓	✓
Spectrum Emission Mask	✓	
Burst Average Power	✓	✓
Spurious Emission	✓	
AM Depth		✓
FM Deviation		✓
Multi-marker & Marker List	✓	✓
Highest 10 Markers	✓	✓
Limit Line	✓	
Frequency Counter	✓	
2-tone 3rd-order Intermodulation Distortion	✓	
Annotation Display (On/Off)	✓	
Power Meter	Independent function*3	
Phase Noise	MS2830A-010	
Noise Figure	MS2830A-017*4	

*1: SPA (Spectrum Analyzer)
*2: VSA (Vector Signal Analyzer), Requires MS2830A-005/006/077/078
*3: Use USB Power Sensors
*4: Use Noise Sources (Noisecom, NC346 series)

Channel Power SPA VSA

This function measures channel bandwidth power. Three types of filters (Rect, Nyquist, Root Nyquist) can be selected.
Pre-installed templates for each standard support easy parameter setting.

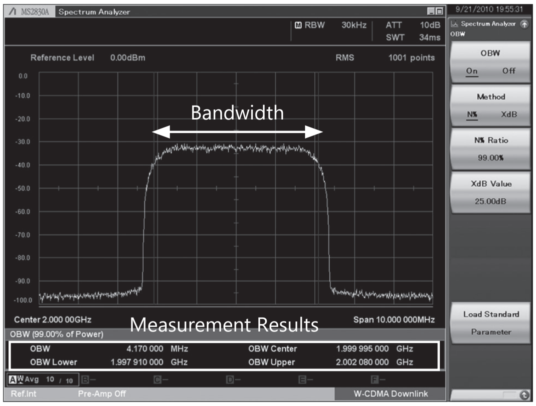


Channel Power
Channel Center 2.000 000 000 GHz
Channel Width 5.000 000 MHz
Absolute Power -78.65 dBm / Hz
-11.66 dBm / 5.000MHz

Measurement Results
- Absolute power per Hz in channel band
- Total power in channel band

Occupied Bandwidth SPA VSA

Occupied bandwidth is measured by selecting either the N% or X-dB mode.
Pre-installed templates for each standard support easy parameter setting.

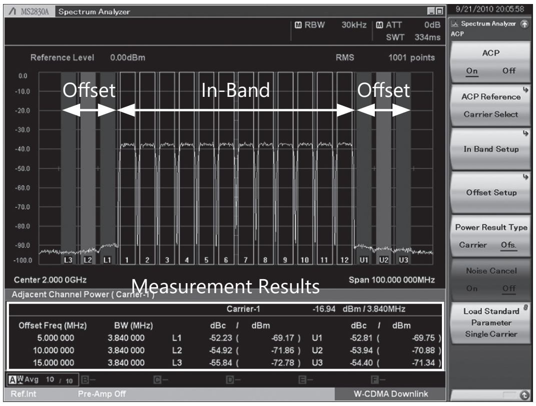


OBW (99.00% of Power)
OBW 4.170 000 MHz
OBW Center 1.999 995 000 GHz
OBW Lower 1.997 910 000 GHz
OBW Upper 2.002 080 000 GHz

Measurement Results
- Bandwidth for specified conditions

Adjacent Channel Leakage Power SPA VSA

This function measures carrier adjacent channel (offset) power (In-Band). 1 to 12 carriers can be set and switched instantaneously on-screen.
True ACLR performance is measured using the noise cancellation function to subtract main-frame noise from the measurement result.
Pre-installed templates for each standard support easy parameter setting.



Adjacent Channel Power (Carrier-1)
Carrier-1 -16.94 dBm / 3.840MHz

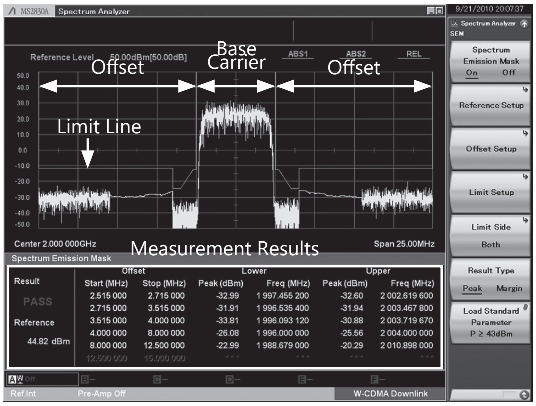
Offset Freq (MHz)	BW (MHz)		dBc / dBm		dBc / dBm
5.000 000	3.840 000	L1	-52.23 (-69.17)	U1	-52.81 (-69.75)
10.000 000	3.840 000	L2	-54.92 (-71.86)	U2	-53.94 (-70.88)
15.000 000	3.840 000	L3	-55.84 (-72.78)	U3	-54.40 (-71.34)

Measurement Results
- Absolute power of Offset channel
- Relative values in relation to reference power selected in ACP reference

Spectrum Emission Mask

SPA

This function splits the offset part into up to 12 segments; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment. The results are tabulated below the trace and marked PASS/FAIL. Pre-installed templates for each standard support easy parameter setting.



Spectrum Emission Mask

Result	Offset		Lower		Upper	
	Start (MHz)	Stop (MHz)	Peak (dBm)	Freq (MHz)	Peak (dBm)	Freq (MHz)
PASS	2.515 000	2.715 000	-32.99	1 997.455 200	-32.60	2 002.619 600
	2.715 000	3.515 000	-31.91	1 996.535 400	-31.94	2 003.467 800
Reference	3.515 000	4.000 000	-33.81	1 996.093 120	-30.88	2 003.719 670
44.82 dBm	4.000 000	8.000 000	-26.08	1 996.000 000	-25.56	2 004.000 000
	8.000 000	12.500 000	-22.99	1 988.679 000	-20.29	2 010.898 000
	12.500 000	15.000 000	***	***	***	***

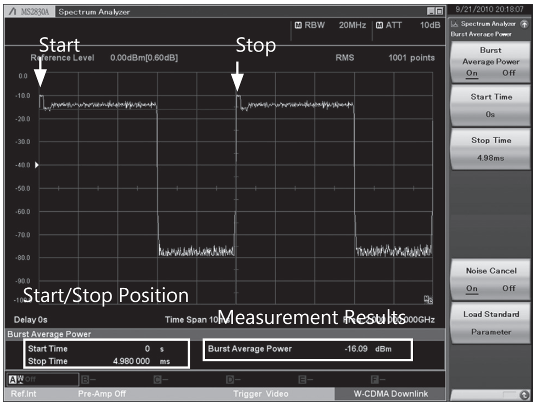
Measurement Results
- Peak power (or margin) at offset
- Each peak frequency

Burst Average Power

SPA VSA

The average power for the range specified by two markers is displayed in the time domain. Measurement only requires setting the measurement start and stop positions on the screen. True performance is measured using the noise cancellation function to subtract mainframe noise from the measurement result.

Pre-installed templates for each standard support easy parameter setting.



Burst Average Power

Start Time 0 s
Stop Time 4.980 000 ms

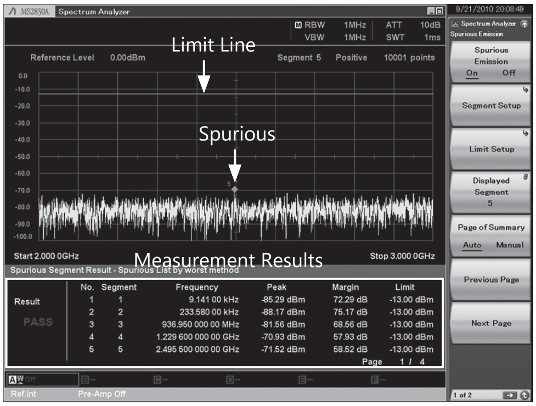
Burst Average Power -16.09 dBm

Measurement Results
- Average power of specified range

Spurious Emission

SPA

This function splits the frequency range into up to 20 segments for sweeping; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment. The results are tabulated below the trace and marked PASS/FAIL. And, zero-span capturing of peak power in time domain is also supported.



Spurious Segment Result - Spurious List by worst method

Result	No.	Segment	Frequency	Peak	Margin	Limit
PASS	1	1	9.141 00 kHz	-85.29 dBm	72.29 dB	-13.00 dBm
	2	2	233.580 00 kHz	-88.17 dBm	75.17 dB	-13.00 dBm
	3	3	936.950 000 00 MHz	-81.56 dBm	68.56 dB	-13.00 dBm
	4	4	1.229 600 000 00 GHz	-70.93 dBm	57.93 dB	-13.00 dBm
	5	5	2.495 500 000 00 GHz	-71.52 dBm	58.52 dB	-13.00 dBm

Page 1 / 4

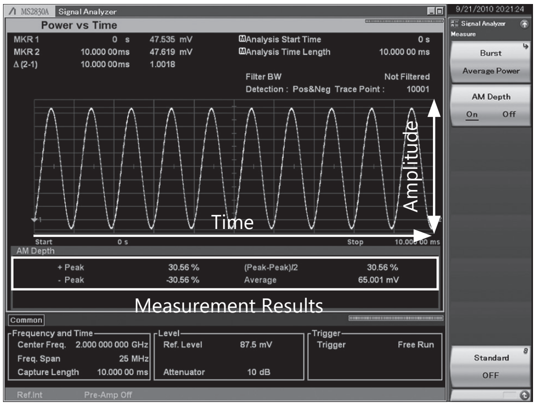
Measurement Results
- Each segment peak power and margin
- Each peak frequency

AM Depth

VSA

The Power vs. Time trace measurement function is used to confirm AM depth.

It measures the measured signal AM based on trace data at the displayed marker. When marker is Off, the whole range is measured.



MKR 1 0 s 47.535 mV
MKR 2 10.000 00ms 47.619 mV
Δ (2-1) 10.000 00ms 1.0018

Analysis Start Time 0 s
Analysis Time Length 10.000 00 ms
Filter BW Not Filtered
Detection : Pos&Neg Trace Point : 10001

AM Depth

+ Peak	30.56 %	(Peak-Peak)/2	30.56 %
- Peak	-30.56 %	Average	65.001 mV

Common

Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 25 MHz
Capture Length 10.000 00 ms

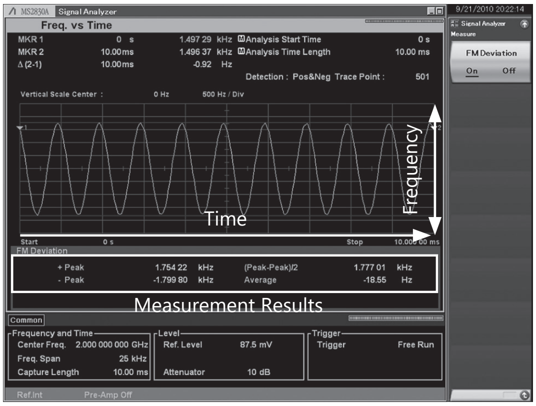
Level
Ref. Level 87.5 mV
Attenuator 10 dB

Trigger
Trigger Free Run

Measurement Results
- +Peak, –Peak, (Peak-Peak)/2, Average

FM Deviation VSA

The Frequency vs. Time trace measurement is used to confirm the FM deviation. It measures the maximum and minimum frequencies from trace data in the marker range. When marker is Off, the whole range is measured.



Freq. vs Time

MKR 1 0 s 1.497 29 kHz
MKR 2 10.00ms 1.496 37 kHz
Δ (2-1) 10.00ms -0.92 Hz
Analysis Start Time 0 s
Analysis Time Length 10.00 ms
Detection : Pos&Neg Trace Point : 501
Vertical Scale Center : 0 Hz 500 Hz / Div
Start 0 s Stop 10.000 00 ms

FM Deviation

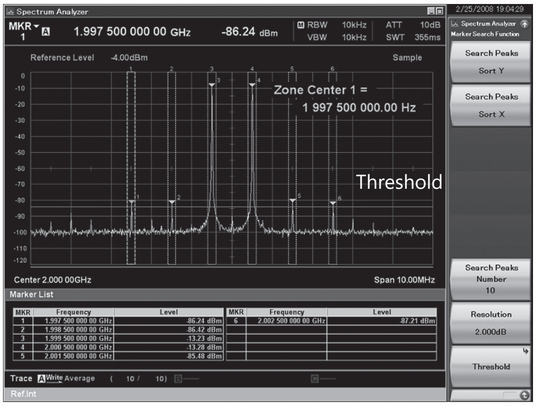
+ Peak 1.754 22 kHz (Peak-Peak)/2 1.777 01 kHz
- Peak -1.799 80 kHz Average -18.55 Hz

Frequency and Time: Center Freq. 2.000 000 000 GHz; Freq. Span 25 kHz; Capture Length 10.00 ms
Level: Ref. Level 87.5 mV; Attenuator 10 dB
Trigger: Trigger Free Run
Ref.Int Pre-Amp Off

Measurement Results
- +Peak, –Peak, (Peak-Peak)/2, Average

Multi-marker & Marker List SPA VSA

Up to 10 markers can be set for this function. Markers may be either a spot or a zone. Using a zone marker, the peak of a signal with an unstable variable frequency can be tracked and measured. Not only can the 10 markers be listed below the trace but the differences between markers can be calculated and displayed using the delta setting.



MKR 1 1.997 500 000 00 GHz -86.24 dBm
RBW 10kHz VBW 10kHz ATT 10dB SWT 355ms
Reference Level -4.00dBm Sample
Center 2.000 00GHz Span 10.00MHz

Marker List

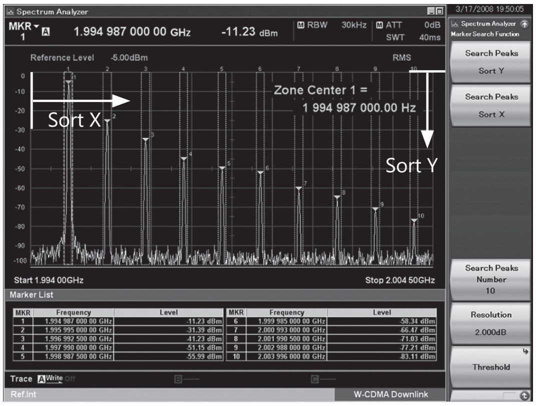
MKR	Frequency	Level	MKR	Frequency	Level
1	1.997 500 000 00 GHz	-86.24 dBm	6	2.002 500 000 00 GHz	-87.21 dBm
2	1.998 500 000 00 GHz	-86.42 dBm			
3	1.999 500 000 00 GHz	-13.23 dBm			
4	2.000 500 000 00 GHz	-13.28 dBm			
5	2.001 500 000 00 GHz	-85.48 dBm			

Trace A Write Average (10 / 10)
Ref.Int

Measurement Results
- Marker point frequency
- Marker point power
- Absolute power per Hz in marker bandwidth
- Total power in marker bandwidth
- Difference between any markers

Highest 10 Markers SPA VSA

This function sets the threshold level and auto-detects peaks in the X (frequency) and Y (level/time) directions.



MKR 1 1.994 987 000 00 GHz -11.23 dBm
RBW 30kHz ATT 0dB SWT 40ms
Reference Level -5.00dBm RMS
Start 1.994 00GHz Stop 2.004 50GHz

Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	1.994 987 000 00 GHz	-11.23 dBm	6	1.999 985 000 00 GHz	-58.34 dBm
2	1.995 995 000 00 GHz	-31.39 dBm	7	2.000 993 000 00 GHz	-66.47 dBm
3	1.996 992 500 00 GHz	-41.23 dBm	8	2.001 990 500 00 GHz	-71.03 dBm
4	1.997 990 000 00 GHz	-51.15 dBm	9	2.002 988 000 00 GHz	-77.21 dBm
5	1.998 987 500 00 GHz	-55.99 dBm	10	2.003 996 000 00 GHz	-83.11 dBm

Trace A Write Off
Ref.Int W-CDMA Downlink

Measurement Results
- Peak Search Y:
  Sets up to 10 markers in order of peak level
- Peak Search X:
  Sets up to 10 markers in order of frequency (time) level

Limit Lines SPA

- Setting Limit Lines

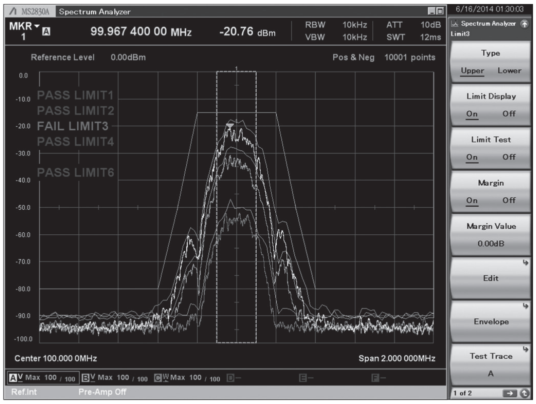
  Up to six types of Limit line can be set on the spectrum display (frequency domain).

  In addition to setting the frequency and level of crossover points manually in sequence from the low frequency, after creating the right half of a line, the left half can be created by reversing and copying the right half, to set a symmetric limit line. Additionally, a Limit line that traces the measured waveform can be created using the Limit Envelope function. A margin can be set on the Limit line in the amplitude direction.
- Evaluating using Limit Line Setting (Limit Test Function)

  When the waveform is above or below the Limit line, it is evaluated automatically as PASS or FAIL. Evaluation is also possible with an added margin. The target evaluation line can be chosen from any of six types.
- Auto-saving Waveform Data using Limit Line Setting (Save on Event Function)

  When the waveform matches the evaluation conditions (Event), it can be saved automaticaly as a csv format file. Any one of the following five Event types can be selected.

  (1) Limit Fail: Saves waveform file when evaluation result is Fail
  (2) Limit Pass: Saves waveform file when evaluation result is Pass
  (3) Margin Fail: Saves waveform file when evaluation result including margin is Fail
  (4) Margin Pass: Saves waveform file when evaluation result including margin is Pass
  (5) Sweep Complete: Saves waveform file at every measurement regardless of evaluation result



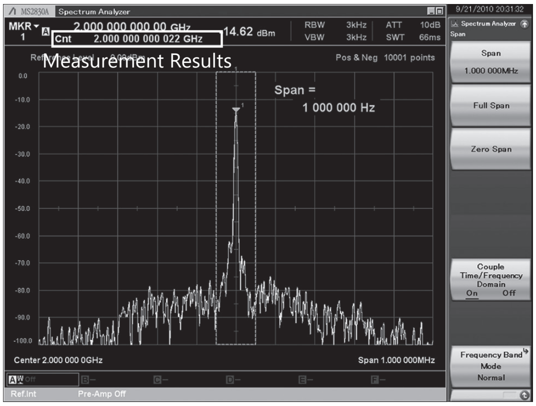
Example:

PASS/FAIL evaluation is performed by changing the input signal level. The evaluation results for the five line types can be displayed simultaneously on one screen.

Line: Limit 1, Limit 2, Limit 3, Limit 4, Limit 5, Limit 6
Evaluation Type: Upper Limit, Lower Limit
Crossover (Point): 1 to 100
Margin: Set Margin line for each Limit 1, 2, 3, 4, 5, 6
Evaluation Result: PASS, FAIL
Result Save: Auto-save as csv format file

Frequency Counter SPA

This function of the marker functions is used to measure CW frequencies. Gate Time sets the measurement target time.



Measurement Results
- Marker point frequency

2-tone 3rd-order Intermodulation Distortion SPA

By inputting two different frequency CW signals (desired waves), two-tone third-order intermodulation distortion is generated close to the desired waves according to non-linear characteristics of Device Under Test (DUT). Then, Third Order Intercept (TOI) is calculated from the two-tone third-order intermodulation distortion.

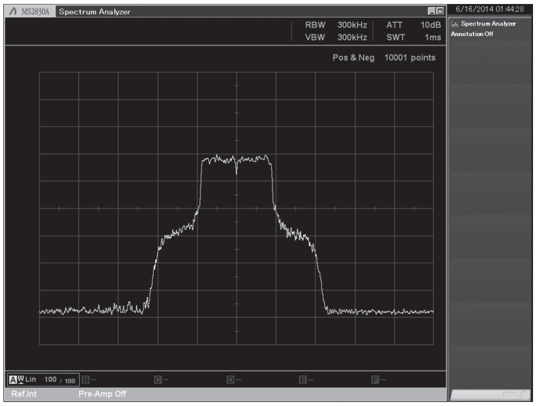
TOI

TOI (dBm)		Frequency (GHz)	Amplitude (dBm)	Amplitude (dBc)	TOI (dBm)
1.69	Lower 3rd	0.999 850 000	-43.21	-29.94	1.69
	Lower Tone	0.999 949 960	-13.28		
Amplitude (dBc)	Upper Tone	1.000 050 000	-13.27		
-29.94	Upper 3rd	1.000 149 999	-43.30	-30.02	1.74

Measurement Results
- TOI: [dBm]
- Amplitude: [dBc]

Annotation Display SPA

Screen annotations can be set to On or Off. Annotations about frequency, level, etc., are not displayed at the Off setting.



Power Meter

Power meter function can connect a USB power sensor to the MS2830A and read the measurement values.

COM5 | MA24108A | Freq : 1.000 000 000 GHz | Range : Auto

POWER : -10.00 dBm
0.00 dB
100. μW

Measuring | Not Zeroed | Offset : Off , 0.00 dB | Average : 80 / 1000

Measurement Results
- Power: [dBm], [W]
- Relative power: [dB]

Compatible USB power sensors

Model	Frequency Range	Dynamic Range
MA24104A*	600 MHz to 4 GHz	+3 to +51.76 dBm
MA24105A	350 MHz to 4 GHz	+3 to +51.76 dBm
MA24106A	50 MHz to 6 GHz	–40 to +23 dBm
MA24108A	10 MHz to 8 GHz	–40 to +20 dBm
MA24118A	10 MHz to 18 GHz	–40 to +20 dBm
MA24126A	10 MHz to 26 GHz	–40 to +20 dBm

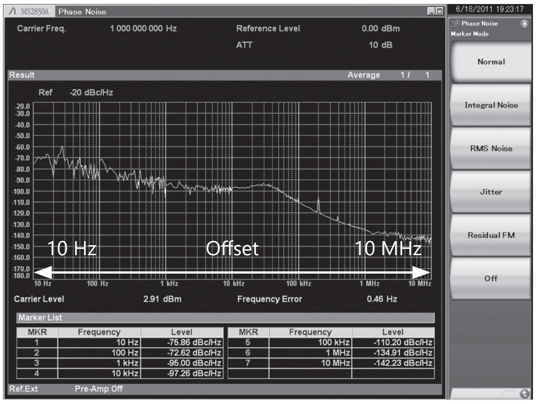
*: MA24104A has been discontinued.

Installing the PowerXpert™

Installing the PowerXpert™ PC application software for the Anritsu USB Power Sensor in the MS2830A supports various measurement functions offered by PowerXpert™, as well as use of other USB power sensors by the MS2830A.
PowerXpert™ for the MS2830A can be downloaded from the MS2830A and MS2830A Microwave product pages at the Anritsu website. When using the PowerXpert™ software with a PC, download the latest version from the USB Power Sensor product page at the Anritsu website.

Phase Noise (MS2830A-010)

This function measures phase noise in the 10 Hz to 10 MHz frequency offset range.



Carrier Freq. 1 000 000 000 Hz
Reference Level 0.00 dBm
ATT 10 dB
Average 1 / 1
Carrier Level 2.91 dBm
Frequency Error 0.46 Hz

Marker List

MKR	Frequency	Level	MKR	Frequency	Level
1	10 Hz	-75.86 dBc/Hz	5	100 kHz	-110.20 dBc/Hz
2	100 Hz	-72.62 dBc/Hz	6	1 MHz	-134.91 dBc/Hz
3	1 kHz	-95.00 dBc/Hz	7	10 MHz	-142.23 dBc/Hz
4	10 kHz	-97.26 dBc/Hz			

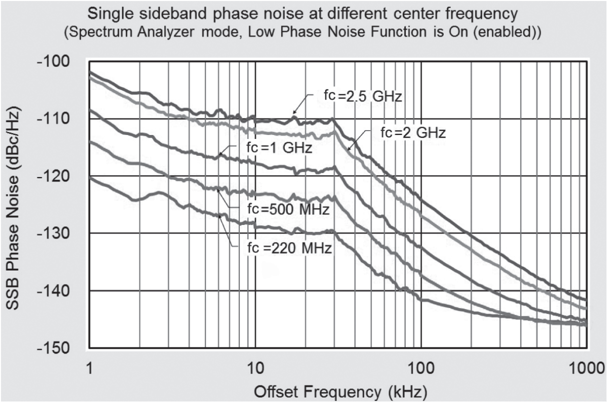
Measurement Results
- Carrier level
- Error between set frequency and carrier frequency
- Marker point phase noise level

Basic Performance Upgrade:
Low Phase Noise Performance (MS2830A-066)

The MS2830A with MS2830A-066 supports significantly improved phase noise performance, especially at carrier offsets of 1 kHz to 100 kHz.

Spectrum analyzer phase noise performance affects ACLR/MASK measurements at narrowband communications (Channel bandwidth: <100 kHz).

Add MS2830A-066 when required by the specifications.

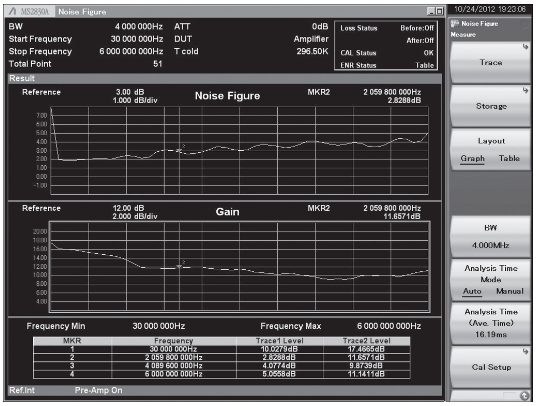

Single sideband phase noise at different center frequency
(Spectrum Analyzer mode, Low Phase Noise Function is On (enabled))

Noise Figure Measurement (MS2830A-017)

Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source*.

Frequency Mode: Fixed, List, Sweep
DUT Mode: Amplifier, Down Converter, Up Converter
Screen Layout: Graph, Table

Measurement Results Display
Graph, List, Spot
Displays measurement results for each trace (Trace1/Trace2).
Noise Figure (NF) [dB]
Noise Factor (F) [Linear]
Gain
Y-Factor: Power ratio when Noise Source is turned On/Off
T effective: Effective noise temperature
P Hot: Power measured when Noise Source is On.
P Cold: Power measured when Noise Source is Off.



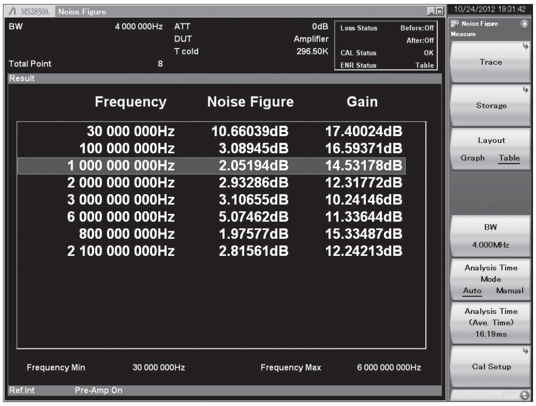
BW 4 000 000Hz
Start Frequency 30 000 000Hz
Stop Frequency 6 000 000 000Hz
Total Point 51
ATT 0dB
DUT Amplifier
T cold 296.50K
Loss Status Before:Off After:Off
CAL Status OK
ENR Status Table

Noise Figure: Reference 3.00 dB, 1.000 dB/div; MKR2 2 059 800 000Hz 2.8288dB
Gain: Reference 12.00 dB, 2.000 dB/div; MKR2 2 059 800 000Hz 11.6571dB

Frequency Min 30 000 000Hz
Frequency Max 6 000 000 000Hz

MKR	Frequency	Trace1 Level	Trace2 Level
1	30 000 000Hz	10.0279dB	17.4665dB
2	2 059 800 000Hz	2.8288dB	11.6571dB
3	4 089 600 000Hz	4.0774dB	9.8739dB
4	6 000 000 000Hz	5.0558dB	11.1411dB

Measurement Result: Example of Graph display
(Frequency Mode: Sweep, Screen Layout: Graph)



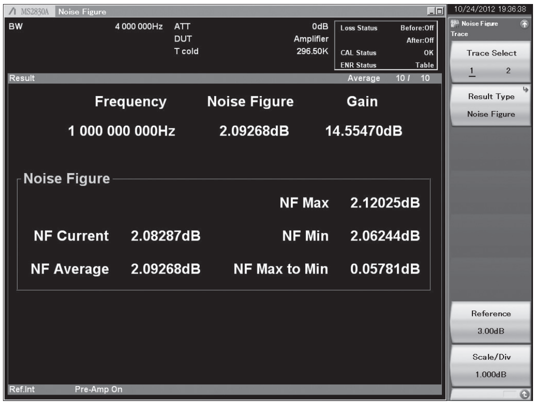
BW 4 000 000Hz
ATT 0dB
DUT Amplifier
T cold 296.50K
Total Point 8
Loss Status Before:Off
After:Off
CAL Status OK
ENR Status Table

Result

Frequency	Noise Figure	Gain
30 000 000Hz	10.66039dB	17.40024dB
100 000 000Hz	3.08945dB	16.59371dB
1 000 000 000Hz	2.05194dB	14.53178dB
2 000 000 000Hz	2.93286dB	12.31772dB
3 000 000 000Hz	3.10655dB	10.24146dB
6 000 000 000Hz	5.07462dB	11.33644dB
800 000 000Hz	1.97577dB	15.33487dB
2 100 000 000Hz	2.81561dB	12.24213dB

Frequency Min 30 000 000Hz
Frequency Max 6 000 000 000Hz
Ref.Int Pre-Amp On

Measurement Result: Example of List display
(Frequency Mode: List, Screen Layout: List)



BW 4 000 000Hz
ATT 0dB
DUT Amplifier
T cold 296.50K
Loss Status Before:Off
After:Off
CAL Status OK
ENR Status Table

Result
Average 10 / 10

Frequency	Noise Figure	Gain
1 000 000 000Hz	2.09268dB	14.55470dB

Noise Figure

NF Max 2.12025dB
NF Current 2.08287dB
NF Min 2.06244dB
NF Average 2.09268dB
NF Max to Min 0.05781dB

Ref.Int Pre-Amp On

Measurement Result: Example of Spot display
(Frequency Mode: Fixed)

*: Supports noise sources from Noisecom NC346 series.
See the MS2830A catalog for more details.

Vector Signal Generator (MS2830A-020/021): Basic Performance

The Vector Signal Generator MS2830A-020/021 covers the frequency range from 250 kHz to 3.6 GHz/6.0 GHz; it has a wide vector modulation bandwidth of 120 MHz as well as a large built-in memory for storing 64 Msamples/256 Msamples (with MS2830A-027).
Its level accuracy is at least as good as a dedicated signal generator and the ACLR performance is ideal for Tx tests of devices such as amplifiers and Rx tests of base stations. The all-in-one analyzer and signal generator supports simple configuration of space-saving measurement systems as well as easy signal analysis matching the output timing from the signal generator option.

Frequency Range

Frequency Range: 250 kHz to 3.6 GHz (MS2830A-020)
250 kHz to 6 GHz (MS2830A-021)
Resolution: 0.01 Hz step

The Vector Signal Generator option (MS2830A-020/021) frequency range is 250 kHz to 3.6 GHz/6.0 GHz, covering the key wireless communication range.

Output Level Range

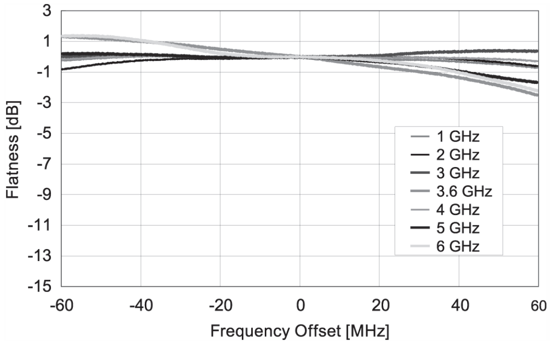
Output Level Range:
–40 to +20 dBm (without MS2830A-022, >25 MHz)
–136 to +15 dBm (with MS2830A-022, >25 MHz)
Resolution: 0.01 dB step

Internal Baseband Generator

Vector Modulation Bandwidth: 120 MHz
Sampling Clock: 20 kHz to 160 MHz

The wideband 120-MHz vector modulation bandwidth is achieved using the MS2830A-020/021 baseband signal generator.
The sampling clock supports up to 160 MHz.

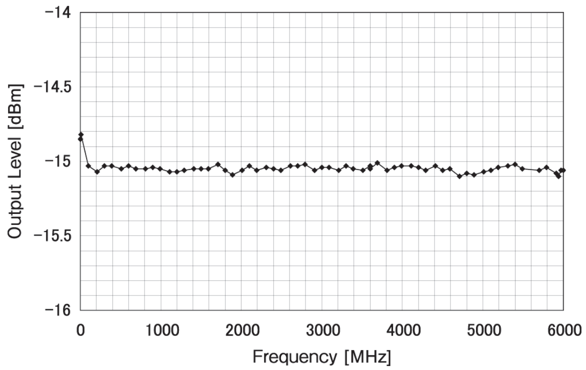
Example: Vector Modulation Bandwidth



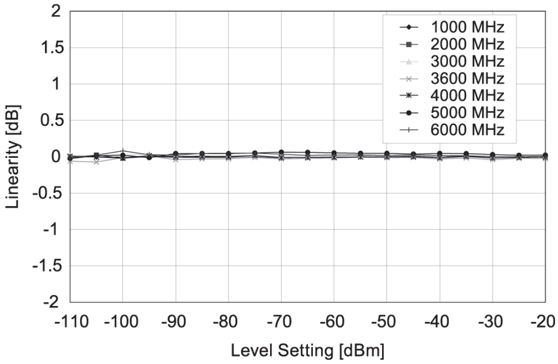
Level Accuracy ±0.5 dB

Output Level Accuracy (CW):
±0.5 dB (typ.)
(–110 dBm ≤ Level ≤ +4 dBm, 100 MHz ≤ Frequency ≤ 3.6 GHz)

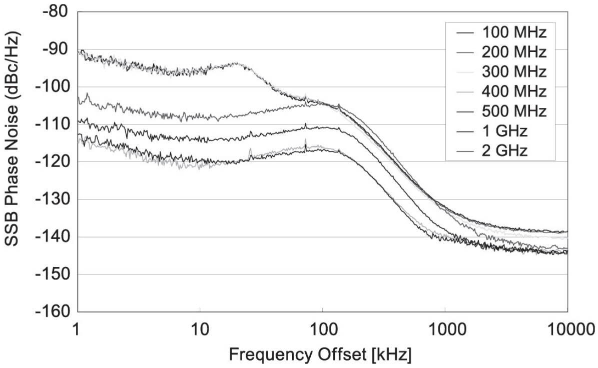
Example: Frequency Characteristics (Referenced to –15 dBm)



Example: Linearity (Referenced to –15 dBm)



Example: SSB Phase Noise



Large-capacity Memory (MS2830A-027)

256 MB = 64 Msamples/channel (without MS2830A-027)
1 GB = 256 Msamples/channel (with MS2830A-027)

The MS2830A-020/021 arbitrary waveform memory can save Max. 256 Msamples/channel as well as multiple waveform patterns at the same time. Waveform patterns in memory can be output instantaneously by switching without need to recall from hard disk.

Internal AWGN Generator (MS2830A-028)

Absolute CN Ratio: ≤40 dB

This functions adds AWGN (Additive White Gaussian Noise) to the wanted waveform in memory. It is ideal for Tx dynamic range tests.

AWGN band set automatically to sampling clock of wanted signal.

Example: When wanted signal conditions are:

- W-CDMA
- Bandwidth = 3.84 MHz
- Over sampling = × 4

Versatile Multiple Waveform Generation

Any type of waveform can be generated using the MS2830A-020/021 Signal Generator option. In addition to using C and simulation tools, Anritsu's IQproducer can be run on a PC to edit waveform parameters and output waveforms.

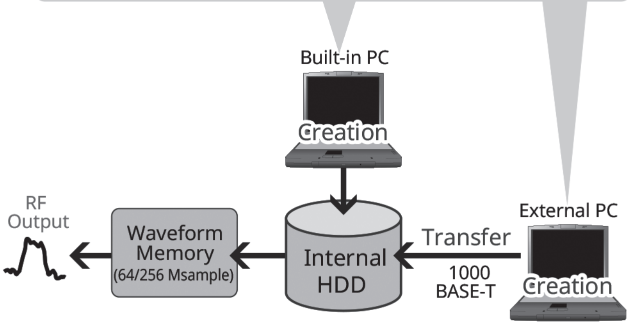
Creating Waveform Using IQproducer

IQproducer is PC software that is used to edit parameters and create any waveform pattern. It can be installed either on an external PC or in the MS2830A main frame.

- HSDPA/HSUPA IQproducer
- TDMA IQproducer
- Multi-carrier IQproducer
- LTE IQproducer
- LTE TDD IQproducer
- WLAN IQproducer
- TD-SCDMA IQproducer

Creating Any Waveform

IQ Data created using the MS2830A digitize function or by simulation tools or in C can be converted to a waveform pattern using the SG option and output.



Useful IQproducer Waveform Generation Software

IQproducer is application software for a PC for editing, creating and transferring waveform patterns using the MS2830A-020/021 arbitrary waveform generation option.
It has the following three main functions.

Parameter Editing:
Function for easily editing parameters matching each communication method

Simulation:
Function for checking generated waveform pattern before transfer to CCDF and FFT graphs

Conversion:
Function for converting ASCII format waveform patterns created by simulation software, files captured using digitizing function, and MG3700A/MS269xA-020 waveform patterns, into files that can be used by MS2830A-020/021

BER Measurement Function (MS2830A-026): Basic Performance

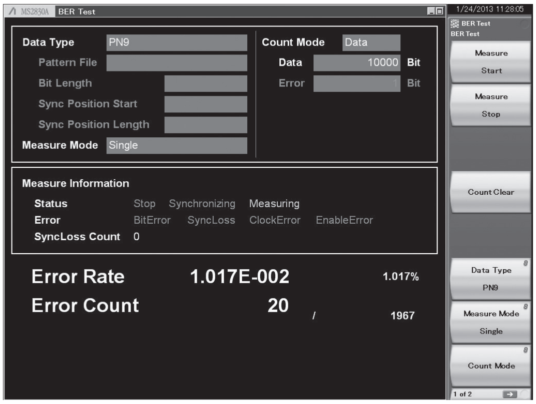
Convenient Built-in BER Measurement Function for Rx Evaluations

The MS2830A with the BER Measurement Function MS2830A-026 supports measurement up to 10 Mbps.
It supports Rx sensitivity tests by inputting the receiver-demodulated Data/Clock/Enable to the back of the MS2830A.

- Input Signal: Data, Clock, Enable (Polarity reversal supported)
- Input Bit Rate: 100 bps to 10 Mbps
- Input Level: TTL 3.3 V
- Connector: Rear panel, AUX connector*

*: Can convert to BNC by connecting AUX conversion adapter (J1556A).

- Measured Patterns:
  PN9, PN11, PN15, PN20, PN23, ALL0, ALL1, Alternate (0101...), PN9Fix, PN11Fix, PN15Fix, PN20Fix, PN23Fix, UserDefine (4096 bits Max.)
- Measurable Bit Count: 1000 to 4294967295 bits (2^{32} – 1 bits)
- Measurable Error Bit Count: 1 to 2147483647 bits (2^{31} – 1 bits)
- Count Mode
  Data: Measures until specified Data count
  Error: Measures until specified Error count
- Measurement Mode
  Single: Measures specified measurement bit count once
  Continuous: Repeats Single measurement
  Endless: Continues measurement to upper limit of measurement bits

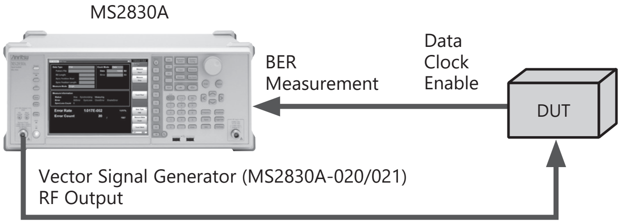


Data Type: PN9
Pattern File
Bit Length
Sync Position Start
Sync Position Length
Measure Mode: Single
Count Mode: Data
Data: 10000 Bit
Error: 1 Bit

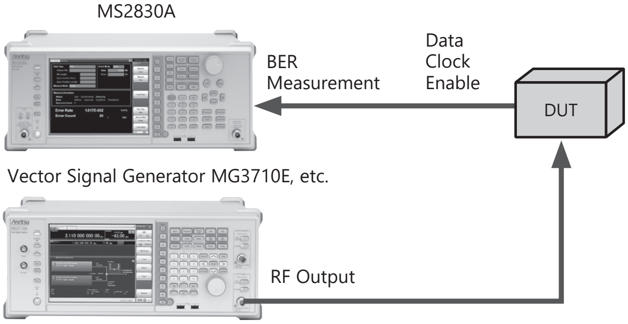
Measure Information
Status: Stop Synchronizing Measuring
Error: BitError SyncLoss ClockError EnableError
SyncLoss Count: 0

Error Rate 1.017E-002 1.017%
Error Count 20 / 1967

BER Measurement Function Main Screen



BER Measurement Setup Example (with MS2830A-020/021 installed)



BER Measurement Setup Example
(using external vector signal generator)

Excellent Expandability Platform (Hardware)

The versatility of the MS2830A series is tailored easily to the application by installing modules in expansion slots.

Basic Function and Performance Upgrades

- Rubidium Reference Oscillator/Retrofit MS2830A-001/101
  This option is a 10 MHz reference crystal oscillator with excellent frequency stability startup characteristics of ±1 × 10^{-9} at 7 minutes after power-on.
  Aging Rate: ±1 × 10^{-10}/month
  Start-up Characteristics: ±1 × 10^{-9} (7 minutes after power-on)
- High Stability Reference Oscillator/Retrofit MS2830A-002/102
  The 10 MHz reference oscillator improving frequency stability up to aging rate: ±1 × 10^{-8}/day
  Aging Rate: ±1 × 10^{-8}/day
  Start-up Characteristics: ±5 × 10^{-8} (5 minutes after power-on)
- Preamplifier/Retrofit MS2830A-008/108
  This option increases the sensitivity of the spectrum/signal analyzer functions and is used for examining low-level signals such as interference waveforms.
- Precompliance EMI Function/Retrofit MS2830A-016/116
  This option adds an EMI measurement detection mode and RBW to the spectrum analyzer function. Both the detection mode used for CISPR standards (Quasi-Peak, CISPR-AVG, RMS-AVG) and RBW (200 Hz (6 dB), 9 kHz (6 dB), 120 kHz (6 dB), 1 MHz (Imp)) as well as conventional settings can be selected.
- Low Phase Noise Performance MS2830A-066
  Phase noise performance is increasingly important at carrier offsets of 1 kHz to 100 kHz.
  Spectrum analyzer phase noise performance affects ACLR/MASK measurements at narrowband communications.
  (Channel bandwidth: <100 kHz)
  Add MS2830A-066 when required by the specifications.
  Frequency Range: 9 kHz to 3.7 GHz
  (Frequency band mode: * Normal)
  9 kHz to 3.5 GHz
  (Frequency band mode: * Spurious)

  *: Requires MS2830A-041/043 for setting.

  Span: 300 Hz to 1 MHz (Spectrum Analyzer)
  1 kHz to 31.25 MHz (Signal Analyzer)

  MS2830A-066 cannot be retrofitted
  MS2830A-066 sometimes cannot be installed depending on options.

Model	Case 1	Case 2	Case 3
MS2830A-020/021	Yes	Yes	No
MS2830A-043	Yes	No	Yes
MS2830A-066	No	Yes	Yes

Signal Analyzer Function and Performance Upgrade

- Analysis Bandwidth Extension to 31.25 MHz/Retrofit MS2830A-005/105

  Extends analysis bandwidth to 31.25 MHz.

  *: Requires MS2830A-006.
- Analysis Bandwidth 10 MHz/Retrofit MS2830A-006/106

  This option supports the VSA and digitize functions.
- Analysis Bandwidth Extension to 62.5 MHz MS2830A-077

  Extends analysis bandwidth to 62.5 MHz.

  *: Retrofit not supported.
  *: Requires MS2830A-005 and MS2830A-006.
- Analysis Bandwidth Extension to 125 MHz MS2830A-078

  Extends analysis bandwidth to 125 MHz.

  *: Retrofit not supported.
  *: Requires MS2830A-005, MS2830A-006 and MS2830A-077.

  Note: An image response is received when setting the bandwidth to more than 31.25 MHz. This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.). The Signal Analyzer MS2690A is recommended for other measurement purposes.

Expansion Functions

- Phase Noise Measurement Function/Retrofit MS2830A-010/110

  Phase Noise Measurements

  Frequency Range: 10 MHz to main-frame upper limit frequency
  Offset Frequency Range: 10 Hz to 10 MHz
- 2ndary HDD/Retrofit MS2830A-011/111

  This removable 2ndary HDD is installed in the HDD Option Slot of the MS2830A main frame to expand the user data storage space.
  It does not have the Windows OS installed. The MS2830A ships with it installed. Only one expansion HDD can be installed in the MS2830A.
  It is useful when taking the instrument for calibration but the security of saved user data, such as measurement results, must be protected.
- 2ndary HDD Retrofit MS2830A-311

  This removable 2ndary HDD is installed in the HDD Option Slot of the MS2830A main frame to expand the user data storage space.
  It does not have the Windows OS installed.
  It is useful when taking the instrument for calibration but the security of saved user data, such as measurement results, must be protected.
- Noise Figure Measurement Function/Retrofit MS2830A-017/117

  Adds noise figure measurement function.
  Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source.
- Audio Analyzer/Retrofit MS2830A-018/118

  Adds AF signal Input/Output function. Measurement operation performed using Analog Measurement Software MX269018A.

  *: Requires MX269018A
- BER Measurement Function/Retrofit MS2830A-026/126

  Adds BER measurement function.
  It supports Rx sensitivity tests by inputting the receiver-demodulated Data/Clock/Enable to the back of the MS2830A.

  Input Bit Rate: 100 bps to 10 Mbps
  Input Level: TTL
  Connector: Rear panel, AUX connector*

  *: Can convert to BNC by connecting AUX Conversion Adapter (J1556A).
- 3.6 GHz Vector Signal Generator/Retrofit MS2830A-020/120

  Cover frequency ranging from 250 kHz to 3.6 GHz with 120 MHz wideband vector modulation bandwidth
- 6 GHz Vector Signal Generator/Retrofit MS2830A-021/121

  Cover frequency ranging from 250 kHz to 6 GHz with 120 MHz wideband vector modulation bandwidth
- Low Power Extension for Vector Signal Generator/Retrofit MS2830A-022/122

  Extends lower limit of output level from –40 to –136 dBm
  (Note: 5-dB drop in upper output level)
- ARB Memory Upgrade 256 Msa for Vector Signal Generator/Retrofit MS2830A-027/127

  Extends ARB memory capacity from 64 Msample to 256 Msample
- AWGN/Retrofit MS2830A-028/128

  AWGN generator function
- Analog Function Extension for Vector Signal Generator MS2830A-029

  Adds analog signal generation function using Analog Measurement Software MX269018A to Vector Signal Generator option (MS2830A-020/021). Can calibrate lower limit frequency up to 100 kHz (MS2830A-020/021 lower limit frequency is 250 kHz)

  *: Requires MX269018A, MS2830A-020 or 021, and MS2830A-022
- 3.6 GHz Analog Signal Generator/Retrofit MS2830A-088/188

  Outputs analog signals and includes low power expansion (equivalent to MS2830A-022). Measurement operation performed using Analog Measurement Software MX269018A.
  Can calibrate lower limit frequency up to 100 kHz (MS2830A-020/021 lower limit frequency is 250 kHz)

  *: Requires MX269018A
  *: Vector modulation signal output not supported (added by MS2830A-189)
- Vector Function Extension for Analog Signal Generator Retrofit MS2830A-189

  Installs license required for vector signal generation in existing Analog Signal Generator (MS2830A-088/188).
  Use following options when ordering new Analog Signal Generator + Vector Signal Generator:
  - MS2830A-020 or 021 + MS2830A-022 + MS2830A-029 + MX269018A + MS2830A-066 + A0086D
- Internal Signal Generator Control Function/User-Installable MS2830A-052/352

  The transmission characteristics of amplifiers, filters etc., can be measured using linked operation between the Spectrum Analyzer function and the Vector Signal Generator option (MS2830A-020/120 or 021/121) or the Analog Signal Generator option (MS2830A-088/188).

  *: Requires any of MS2830A-020/120, 021/121, or 088/188.

Future-proof Platform (Software)

Adding measurement software options to the signal analyzer assures that the modulation analysis and other functions will support all common current and future communications systems.

Measurement Software

Communications Systems	Model	Name	Addition to Main frame (✓: Can be installed, No: Cannot be installed)		Analysis Bandwidth Extension Option (✓: Required, ✓+: Function expansion, Space (no symbol): No specification)			
			Opt. 040/041/043	Opt. 044/045	Opt. 006	Opt. 005/009	Opt. 077	Opt. 078
LTE/LTE-Advanced (FDD)	MX269020A	LTE Downlink Measurement Software	✓	✓	✓	✓		
	MX269020A-001	LTE-Advanced FDD Downlink Measurement Software	✓	✓	✓	✓	✓+	✓+
	MX269021A	LTE Uplink Measurement Software	✓	✓	✓	✓		
	MX269021A-001	LTE-Advanced FDD Uplink Measurement Software	✓	✓	✓	✓	✓+	✓+
LTE/LTE-Advanced (TDD)	MX269022A	LTE TDD Downlink Measurement Software	✓	✓	✓	✓		
	MX269022A-001	LTE-Advanced TDD Downlink Measurement Software	✓	✓	✓	✓	✓+	✓+
	MX269023A	LTE TDD Uplink Measurement Software	✓	✓	✓	✓		
	MX269023A-001	LTE-Advanced TDD Uplink Measurement Software	✓	✓	✓	✓	✓+	✓+
W-CDMA/HSPA/ HSPA Evolution	MX269011A	W-CDMA/HSPA Downlink Measurement Software	✓	✓	✓			
	MX269012A	W-CDMA/HSPA Uplink Measurement Software	✓	✓	✓			
W-CDMA/HSPA (Downlink)	MX269030A	W-CDMA BS Measurement Software	✓	✓	✓			
TD-SCDMA	MX269015A	TD-SCDMA Measurement Software	✓	✓	✓			
CDMA2000	MX269024A	CDMA2000 Forward Link Measurement Software	✓	✓	✓			
	MX269024A-001	All Measure Function	✓	✓	✓			
1xEV-DO	MX269026A	EV-DO Forward Link Measurement Software	✓	✓	✓			
	MX269026A-001	All Measure Function	✓	✓	✓			
GSM/EDGE	MX269013A	GSM/EDGE Measurement Software	✓	✓	✓			
EDGE Evolution	MX269013A-001	EDGE Evolution Measurement Software	✓	✓	✓			
World Digital Wireless Standards	MX269017A	Vector Modulation Analysis Software	✓	✓	✓	✓+	✓+	✓+
Analog (FM/ΦM/AM)	MX269018A	Analog Measurement Software	✓	No				
WLAN IEEE 802.11a/b/g/n/j/p	MX269028A	WLAN (802.11) Measurement Software (Supports IEEE 802.11n/11a/11b/11g/11j/11p)	✓	✓	✓	✓		
WLAN IEEE 802.11ac (80 MHz)	MX269028A-001	802.11ac (80 MHz) Measurement Software	✓	✓	✓	✓	✓	✓

See each software catalog for more details.

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IQproducer™ is a trademark of Anritsu Corporation.

Adding a license for the IQproducer waveform generation software to the vector signal generator option supports easy generation of test patterns for all common communications systems worldwide.

IQproducer License for MS2830A-020/021 VSG

Following licenses (option) are required to download waveform pattern created with IQproducer to the MS2830A with vector signal generator option and output signals.

• HSDPA/HSUPA IQproducer	MX269901A	• LTE TDD IQproducer	MX269910A
• TDMA IQproducer	MX269902A	• LTE-Advanced TDD Option	MX269910A-001*2
• Multi-carrier IQproducer	MX269904A	• WLAN IQproducer	MX269911A
• LTE IQproducer	MX269908A	• 802.11ac (80 MHz) Option	MX269911A-001*3
• LTE-Advanced FDD Option	MX269908A-001*1	• TD-SCDMA IQproducer	MX269912A

*1: Requires MX269908A
*2: Requires MX269910A
*3: Requires MX269911A

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Waveform patterns for MS2830A-020/021 VSG

Various waveforms with preset parameters matching each communication method are provided. The MS2830A-020/021 Vector Signal Generator option outputs RF signals.
Pre-installed reference waveforms are saved on the MS2830A hard disk for free use.

- Pre-installed patterns
  W-CDMA
  HSDPA (Test Model5)
  CDMA2000 1xEV-DO
  CDMA2000
  GSM/EDGE
  Digital Broadcasting (ISDB-T/CS/BS/CATV)
  WLAN 802.11a/b/g
  Bluetooth

Excellent-Expandability Platform (Analog Radio Equipment Measurement)

Supports Key TRx Performance Tests (FM/ΦM/AM) Required by Analog Equipment

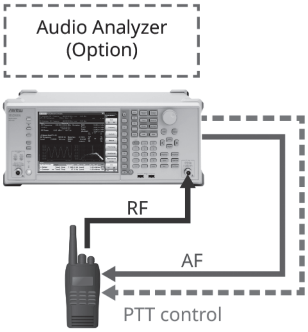
Combining the MS2830A-088 (or 029) 3.6 GHz Analog Signal Generator, Audio Analyzer MS2830A-018 and Analog Measurement Software MX269018A options in the all-in-one MS2830A main frame supports the simultaneous RF and AF signals required for implementing key TRx tests of analog radio equipment.

At Tx tests, the AF signal output from the Audio Analyzer is input to the radio equipment and the RF signal output from the radio is measured. As well as simultaneously outputting an AF signal with up to three tones, tone + DCS, white noise (ITU-T G.227), and DTMF signals can also be output. Furthermore, at RF signal measurement, the Tx frequency, power, modulation, demodulated AF signal frequency, level, and distortion can be displayed simultaneously on time vs. level and frequency vs. level graphs.

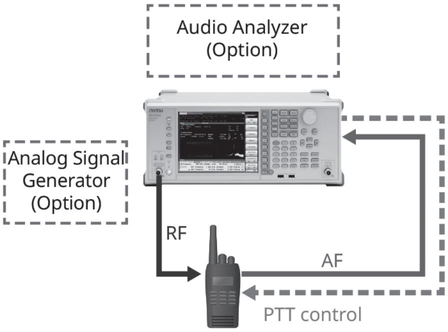
The DCS Code is also displayed at frequency modulation. By using the spectrum analyzer display it is also possible to measure the spurious and occupied bandwidth (OBW) while outputting an AF signal such as white noise (ITU-T G.227) from the Audio Analyzer.

The Audio Analyzer option has a Push To Talk (PTT) connector for On/Off control of the radio equipment PTT.

At Rx tests, the RF signal output from the Analog Signal Generator is input to the radio equipment and the AF signal from the radio is measured using the Audio Analyzer. As well as outputting up to three AF tones simultaneously from the internal modulation signal source of the Analog Signal Generator, both DCS (FM only) and Wave audio format files can be output as signals. At AF signal measurement using the Audio Analyzer, the frequency, level and distortion (SINAD measurement, etc.) can be displayed simultaneously on time vs. level and frequency vs. level graphs.

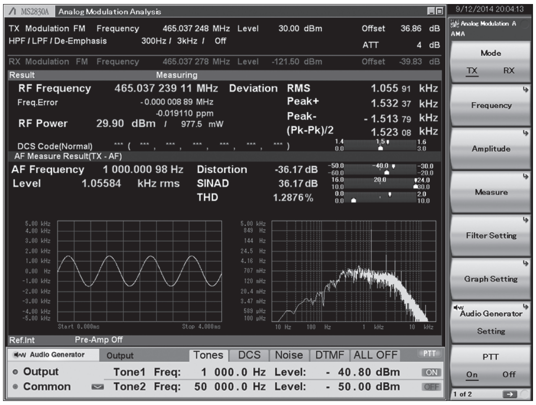


Tx Characteristics Test Setup



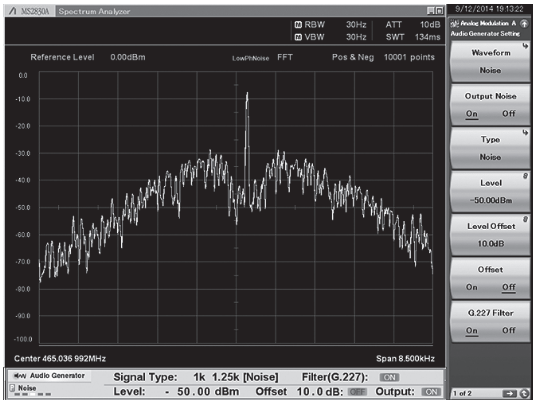
Rx Sensitivity Test Setup

- Tx Tests
  Key Measurement Test Items (FM Radio Equipment)
    Tx Power, Tx Frequency, FM Deviation, Microphone input sensitivity, Modulation frequency characteristics, Distortion, S/N, Tone frequency, Occupied bandwidth (OBW)/Spurious emission or Unwanted emission strength (White noise (ITU-T G.227) output supported)



TX Modulation FM Frequency 465.037 248 MHz Level 30.00 dBm Offset 36.86 dB
HPF / LPF / De-Emphasis 300Hz / 3kHz / Off ATT 4 dB
RX Modulation FM Frequency 465.037 278 MHz Level -121.50 dBm Offset -39.83 dB
Result Measuring
RF Frequency 465.037 239 11 MHz Deviation RMS 1.055 91 kHz
Freq.Error - 0.000 008 89 MHz Peak+ 1.532 37 kHz
-0.019110 ppm Peak- - 1.513 79 kHz
RF Power 29.90 dBm / 977.5 mW (Pk-Pk)/2 1.523 08 kHz
DCS Code(Normal) *** (*** , *** , *** , *** , *** , ***)
AF Measure Result(TX - AF)
AF Frequency 1 000.000 98 Hz Distortion -36.17 dB
Level 1.05584 kHz rms SINAD 36.17 dB
THD 1.2876 %
Ref.Int Pre-Amp Off
Audio Generator Output Tones DCS Noise DTMF ALL OFF PTT
Output Tone1 Freq: 1 000.0 Hz Level: - 40.80 dBm ON
Common Tone2 Freq: 50 000.0 Hz Level: - 50.00 dBm OFF

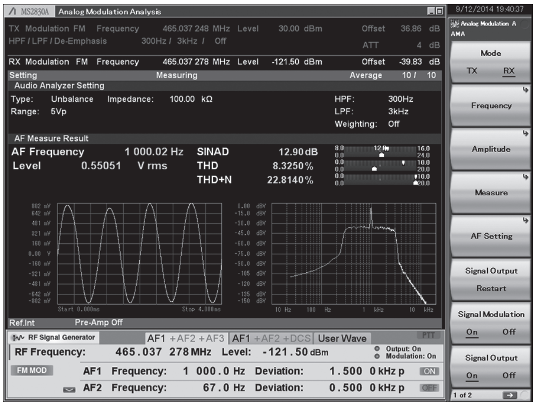
Example of AF Signal Output (bottom) and FM Signal (top) Measurement



RBW 30Hz ATT 10dB
VBW 30Hz SWT 134ms
Reference Level 0.00dBm LowPhNoise FFT Pos & Neg 10001 points
Center 465.036 992MHz Span 8.500kHz
Audio Generator Noise
Signal Type: 1k 1.25k [Noise] Filter(G.227): ON
Level: - 50.00 dBm Offset 10.0 dB: OFF Output: ON

Example of White Noise (ITU-T G.227) Output (bottom) and Spectrum Analyzer (top)

- Rx Tests
  Key Measurement Test Items (FM Radio Equipment)
    Receiving sensitivity (SINAD and NQ method), Bandwidth, AF level, Demodulation frequency characteristics, Distortion, S/N, Squelch sensitivity



TX Modulation FM Frequency 465.037 248 MHz Level 30.00 dBm Offset 36.86 dB
HPF / LPF / De-Emphasis 300Hz / 3kHz / Off ATT 4 dB
RX Modulation FM Frequency 465.037 278 MHz Level -121.50 dBm Offset -39.83 dB
Setting Measuring Average 10 / 10
Audio Analyzer Setting
Type: Unbalance Impedance: 100.00 kΩ HPF: 300Hz
Range: 5Vp LPF: 3kHz
Weighting: Off
AF Measure Result
AF Frequency 1 000.02 Hz SINAD 12.90 dB
Level 0.55051 V rms THD 8.3250 %
THD+N 22.8140 %
Ref.Int Pre-Amp Off
RF Signal Generator AF1 +AF2 +AF3 AF1 +AF2 +DCS User Wave PTT
RF Frequency: 465.037 278 MHz Level: -121.50 dBm Output: On Modulation: On
FM MOD
AF1 Frequency: 1 000.0 Hz Deviation: 1.500 0 kHz p ON
AF2 Frequency: 67.0 Hz Deviation: 0.500 0 kHz p OFF

Example of FM Signal Output (bottom) and AF Signal (top) Measurement

Excellent-Expandability Platform (Digital LMR/PMR Measurement)

Digital Radio (π/4DQPSK, 4FSK, etc.)

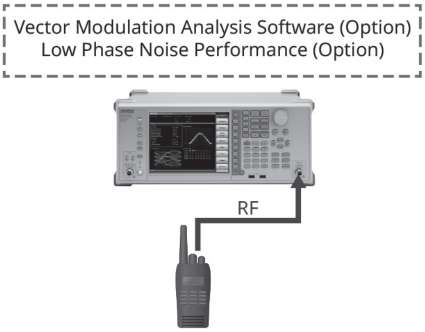
Combining the Vector Modulation Analysis Software MX269017A with the Low Phase Noise Performance MS2830A-066, 3.6 GHz Vector Signal Generator MS2830A-020, and BER Measurement Function MS2830A-026 supports all-in-one measurement of key TRx characteristics of narrow-band digital radio.

As Tx test items, it covers Tx frequency and power measurement of the RF signal output from the radio, as well as the π/4DQPSK, QPSK, and 16QAM modulation accuracy (EVM), the zero offset, 4FSK modulation accuracy (FSK Error), and frequency shift at each symbol rate. It has the parameters supporting easy settings for the standards and technologies.

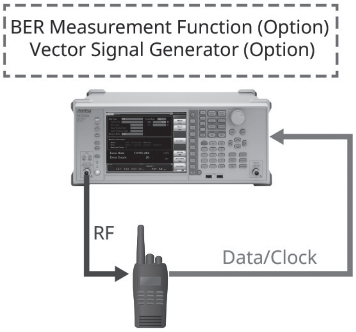
- APCO P25,NXDN,TETRA,DMR,dPMR,etc.
- ARIB STD-T61,T79,T86,T98,T102,T115,T116,B54,etc.

Adding the Low Phase Noise MS2830A-066 option uses a unique circuit technology to improve the MS2830A close-in phase noise by about 20 dB. As well as supporting the severe close-in spurious measurement standards, this platform also has sufficient margins for measuring adjacent channel leakage power.

Rx tests measure the bit error rate (BER) by inputting an RF signal output from a vector signal generator to the radio and then inputting the demodulated Data and Clock from the radio to the MS2830A.

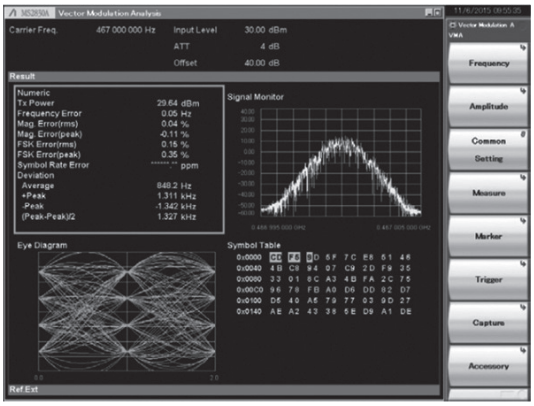


Tx Characteristics Test Setup



Rx Sensitivity Test Setup

- Tx Tests
  - Key Tx Test Items
    - Tx Power, Tx Frequency, Modulation Accuracy, Zero Offset, Frequency Shift, Occupied Bandwidth, Adjacent Channel Leakage Power, Spurious Emissions, and Unwanted Emissions



MS2830A Vector Modulation Analysis 11/6/2015 09:55:35

Carrier Freq. 467 000 000 Hz
Input Level 30.00 dBm
ATT 4 dB
Offset 40.00 dB

Result

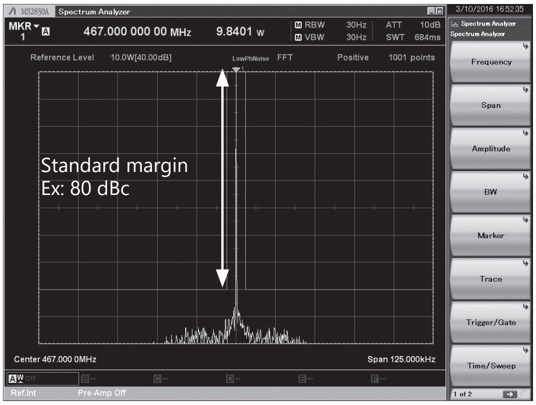
Numeric
Tx Power 29.64 dBm
Frequency Error 0.05 Hz
Mag. Error(rms) 0.04 %
Mag. Error(peak) -0.11 %
FSK Error(rms) 0.15 %
FSK Error(peak) 0.35 %
Symbol Rate Error ******.** ppm
Deviation
Average 848.2 Hz
+Peak 1.311 kHz
-Peak -1.342 kHz
(Peak-Peak)/2 1.327 kHz

Symbol Table

```
0x0000  CD F6 9D 6F 7C E8 61 46
0x0040  4B C8 94 07 C9 2D F9 35
0x0080  33 01 8C A3 4B FA 2C 75
0x00C0  96 78 FB A0 D6 DD 82 D7
0x0100  D5 40 A5 79 77 03 9D 27
0x0140  AE A2 43 38 5E D9 A1 DE
```

Ref.Ext

4FSK Modulation Analysis Measurement Example



MS2830A Spectrum Analyzer 3/10/2016 16:52:35

MKR 1 A 467.000 000 00 MHz 9.8401 W
RBW 30Hz ATT 10dB
VBW 30Hz SWT 684ms
Reference Level 10.0W[40.00dB] LowPhNoise FFT Positive 1001 points
Center 467.000 0MHz Span 125.000kHz
Ref.Int Pre-Amp Off

Spurious Emissions (out-of-band) Measurement Example

- Rx Tests
  - Key Test Items
    - Rx Sensitivity (BER)

BER Test 1/24/2013 11:28:05

Data Type PN9
Pattern File
Bit Length
Sync Position Start
Sync Position Length
Measure Mode Single
Count Mode Data
Data 10000 Bit
Error Bit

Measure Information
Status Stop Synchronizing Measuring
Error BitError SyncLoss ClockError EnableError
SyncLoss Count 0

Error Rate 1.017E-002 1.017%
Error Count 20 / 1967

PN9
Frequency 467 000 000.00 Hz
Amplitude -121.50 dBm

BER Measurement Function (top) and Vector Signal Generator (bottom) Measurement Examples

Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature.
The specifications are defined under the following conditions unless otherwise specified.
Auto sweep time select: Normal, Auto sweep type rules: Sweep only, Switching speed mode: Normal mode,
Attenuator mode: Mechanical Attenuator Only
The specifications of the Signal Analyzer function are values at the center frequency if not specified.
Nominal values indicate expected performance or describe product performance. That is not covered by the product warranty.

Signal Analyzer/Spectrum Analyzer

Frequency

<table>
<tr><td>Frequency Range</td><td>9 kHz to 3.6 GHz [MS2830A-040]
9 kHz to 6 GHz [MS2830A-041]
9 kHz to 13.5 GHz [MS2830A-043]</td></tr>
<tr><td>Frequency Bands</td><td><table>
<tr><th>Frequency Range</th><th>Band</th><th>Mixer Harmonics Order (N)</th></tr>
<tr><td>9 kHz to 4 GHz</td><td>0</td><td>1</td></tr>
<tr><td>3.5 GHz to 4.4 GHz</td><td>1</td><td>1/2</td></tr>
<tr><td>4.3 GHz to 6.1 GHz</td><td>1</td><td>1</td></tr>
<tr><td>5.9 GHz to 10.575 GHz</td><td>2</td><td>1</td></tr>
<tr><td>10.425 GHz to 13.6 GHz</td><td>2</td><td>2</td></tr>
</table></td></tr>
<tr><td>Frequency Setting Range</td><td>–100 MHz to 3.7 GHz [MS2830A-040]
–100 MHz to 6.1 GHz [MS2830A-041]
–100 MHz to 13.6 GHz [MS2830A-043]
Setting resolution: 1 Hz</td></tr>
<tr><td>Pre-Selector Range</td><td><table>
<tr><th>MS2830A-041</th><th>MS2830A-043</th><th></th></tr>
<tr><td>4 GHz to 6 GHz</td><td>4 GHz to 13.5 GHz</td><td>(Frequency band mode: Normal)</td></tr>
<tr><td>3.5 GHz to 6 GHz</td><td>3.5 GHz to 13.5 GHz</td><td>(Frequency band mode: Spurious)</td></tr>
</table></td></tr>
<tr><td>Internal Reference Oscillator</td><td>Without MS2830A-001/002
Aging rate: $\pm1 \times 10^{-6}$/year, $\pm1 \times 10^{-7}$/day
Temperature stability: $\pm2.5 \times 10^{-6}$ (5°C to 45°C)
With MS2830A-001
23°C , Referenced to frequency at 24-hour after power-on
Start-up characteristics: $\pm1 \times 10^{-9}$ (7 minutes after power-on)
Aging rate: $\pm1 \times 10^{-10}$/month
Temperature stability: $\pm1 \times 10^{-9}$ (5°C to 45°C)
With MS2830A-002
23°C , Referenced to frequency at 24-hour after power-on
Start-up characteristics: $\pm5 \times 10^{-7}$ (2 minutes after power-on)
$\pm5 \times 10^{-8}$ (5 minutes after power-on)
Aging rate: $\pm1 \times 10^{-7}$/year, $\pm1 \times 10^{-8}$/day
Temperature stability: $\pm2 \times 10^{-8}$ (5°C to 45°C)</td></tr>
<tr><td>SSB Phase Noise</td><td>18°C to 28°C , 500 MHz, Spectrum Analyzer, Switching speed mode: Normal
–115 dBc/Hz (100 kHz offset)
–133 dBc/Hz (1 MHz offset)</td></tr>
</table>

Amplitude

Level Measurement Range	Without MS2830A-008, or Preamp: Off DANL to +30 dBm With MS2830A-008, Preamp: On DANL to +10 dBm
Maximum Input Level	Without MS2830A-008, or Preamp: Off Average total power: +30 dBm (Input attenuator: ≥10 dB) +20 dBm (Input attenuator: 0 dB) DC voltage: ±10 Vdc With MS2830A-008, Preamp: On Average total power: +10 dBm (Input attenuator: 0 dB) DC voltage: ±10 Vdc
Input Attenuator Range	0 to 60 dB, 2 dB steps
Input Attenuator Switching Uncertainty	18°C to 28°C , Referenced to 10 dB Without MS2830A-008, or Preamp: Off Frequency band mode: Normal ±0.2 dB (<4 GHz, 10 to 60 dB) ±0.75 dB (≥4 GHz, 10 to 60 dB) Frequency band mode: Spurious ±0.2 dB (<3.5 GHz, 10 to 60 dB) ±0.75 dB (≥3.5 GHz, 10 to 60 dB)

Reference Level

Setting Range	Log scale: –120 to +50 dBm, or Equivalent level Linear scale: 22.4 µV to 70.7 V, or Equivalent level Setting resolution: 0.01 dB, or Equivalent level
Scale Units	Log scale: dBm, dBµV, dBmV, dBµV (emf), dBµV/m, V, W Linear scale: V
Linearity Error	Excluding the noise floor effect Without MS2830A-008, or Preamp: Off ±0.07 dB (Mixer input level: ≤–20 dBm) ±0.10 dB (Mixer input level: ≤–10 dBm) With MS2830A-008, Preamp: On ±0.07 dB (Preamp input level: ≤–40 dBm) ±0.10 dB (Preamp input level: ≤–30 dBm)
RF Frequency Characteristics	18°C to 28°C , After CAL, Input attenuator: 10 dB Without MS2830A-008, or Preamp: Off ±1.0 dB (9 kHz ≤ f < 300 kHz) ±0.35 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.5 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 6 GHz, Frequency band mode: Spurious) ±1.5 dB (6 GHz < f) With MS2830A-008, Preamp: On ±0.65 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 6 GHz, Frequency band mode: Spurious)
1 dB Gain Compression	Without MS2830A-008, or Preamp: Off, At mixer input level ≥+3 dBm (300 MHz ≤ f ≤ 6 GHz) ≥–1 dBm (6 GHz < f ≤ 13.5 GHz) With MS2830A-008, Preamp: On, At preamp input level ≥–15 dBm (300 MHz ≤ f ≤ 6 GHz)

Spurious Responses

<table>
<tr><td>Second Harmonic Distortion</td><td>
Without MS2830A-008, or Preamp: Off
Mixer input level: –30 dBm
<table>
<tr><th>Harmonic Distortion</th><th>SHI</th><th></th></tr>
<tr><td>≤–60 dBc</td><td>≥+30 dBm</td><td>(10 MHz ≤ f ≤ 300 MHz)</td></tr>
<tr><td>≤–65 dBc</td><td>≥+35 dBm</td><td>(300 MHz < f ≤ 2 GHz)</td></tr>
</table>
Mixer input level: –10 dBm
<table>
<tr><th>Harmonic Distortion</th><th>SHI</th><th></th></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(2 GHz < f ≤ 3 GHz, Frequency band mode: Normal)</td></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(1.75 GHz ≤ f ≤ 3 GHz, Frequency band mode: Spurious)</td></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(3 GHz < f ≤ 6.75 GHz)</td></tr>
</table>
With MS2830A-008, Preamp: On
Preamp input level: –45 dBm
<table>
<tr><th>Harmonic Distortion</th><th>SHI</th><th></th></tr>
<tr><td>≤–50 dBc</td><td>≥+5 dBm</td><td>(10 MHz ≤ f ≤ 300 MHz)</td></tr>
<tr><td>≤–55 dBc</td><td>≥+10 dBm</td><td>(300 MHz < f ≤ 3 GHz)</td></tr>
</table>
SHI: Second Harmonic Intercept
</td></tr>
<tr><td>Residual Responses</td><td>Frequency: ≥1 MHz, Input attenuator: 0 dB, 50Ω terminated
With MS2830A-077/078, except bandwidth setting: >31.25 MHz
≤–100 dBm (up to 1 GHz)
≤–90 dBm (typ., 1 GHz to 6 GHz)
≤–90 dBm (nom., 6 GHz to 13.5 GHz)</td></tr>
</table>

Connector

RF Input	Connector: N-J (Front panel), 50Ω (nom.) 18°C to 28°C , Input attenuator: ≥10 dB VSWR (nom.): ≤1.2 (40 MHz ≤ f ≤ 3 GHz) ≤1.5 (3 GHz < f ≤ 6 GHz) ≤1.6 (6 GHz < f ≤ 13.5 GHz)
External Reference Input	Connector: BNC-J (Rear panel), 50Ω (nom.) Frequency: 5, 10, 13 MHz Operating range: ±1 ppm Input level: –15 to +20 dBm, 50Ω (AC coupling)
Reference Signal Output	Connector: BNC-J (Rear panel), 50Ω (nom.) Frequency: 10 MHz Output level: ≥0 dBm (AC coupling)
Sweep Status Output	Connector: BNC-J (Rear panel) Output level: TTL level (High level at sweeping or waveform capture)
SA Trigger Input	Connector: BNC-J (Rear panel) Output level: TTL level
Noise Source Drive	This is available when the MS2830A-017/117 is installed. Supply (+28 V) of the Noise Source Drive. Rear Panel, BNC-J Output Voltage: 28 ±0.5 V, Pulsed
External Controller	Control from external controller (excluding power-on/off)
Ethernet (10/100/1000BASE-T)	Connector: RJ-45 (Rear panel)
GPIB	IEEE488 bus connector (IEEE 488.2, Rear panel) Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2
USB (B)	USB-B connector (USB2.0, Rear panel)
USB	USB-A connector (USB2.0, Front panel: 2 ports, Rear panel: 2 ports)
Monitor Output	Mini D-Sub 15 pin (Compatible with VGA, Rear panel)
Aux	50 pin (Correspond to DX10A-50S, Rear panel), Using extended input/output
Display	XGA-color LCD (Resolution: 1024 × 768), 8.4 inches (Diagonal: 213 mm)

General

Dimensions and Mass		426 (W) × 177 (H) × 390 (D) mm (excluding of surface projection) ≤14.5 kg (with MS2830A-040/041, and MS2830A-020/021, excluding other options) ≤13.5 kg (with MS2830A-043, excluding other options)
Power Supply		Power voltage: 100 VAC to 120 VAC / 200 VAC to 240 VAC (–15/+10%, except 250 V max.) Frequency: 50 Hz/60 Hz Power consumption: ≤350 VA (including all options) 110 VA (nom., with MS2830A-040/041, excluding other options) 130 VA (nom., with MS2830A-043, excluding other options) 170 VA (nom., with MS2830A-040/041, MS2830A-020/021, and MS2830A-022, excluding other options) 190 VA (nom., with MS2830A-043, MS2830A-020/021, and MS2830A-022, excluding other options)
Temperature Range		Operating: +5°C to +45°C Storage: –20°C to +60°C
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000: 2018
Vibration		MIL-STD-810D
Shock		MIL-T-28800E

Spectrum Analyzer

Frequency

Span	Range: 0 Hz, 300 Hz to 3.6 GHz [MS2830A-040] 0 Hz, 300 Hz to 6 GHz [MS2830A-041] 0 Hz, 300 Hz to 13.5 GHz [MS2830A-043] Resolution: 2 Hz Accuracy: ±0.2% (Sweep points: 10001)
Frequency Readout Accuracy	± (Display frequency × Frequency reference accuracy + Span frequency × Span accuracy + RBW × 0.05 + 2 × N + Span frequency/(Sweep points – 1)) Hz N: Mixer harmonic order
Resolution Bandwidth (RBW)	Setting range: 1 Hz to 3 MHz (1-3 sequence), 500 Hz, 50 kHz, 2 MHz, 5 MHz, 10 MHz, 20 MHz, 31.25 MHz 1 Hz to 10 Hz: Can not be set when Span: 0 Hz 31.25 MHz: Can be set when Span: 0 Hz only 20 MHz, 31.25 MHz: Can be set when with MS2830A-005 200 Hz (6 dB), 9 kHz (6 dB), 120 kHz (6 dB), 1 MHz (Impulse) (with MS2830A-016) Selectivity (–60 dB/–3 dB): 4.5: 1 (nom., 1 Hz to 10 MHz)
Video Bandwidth (VBW)	1 Hz to 3 kHz (1-3 sequence), 5 kHz, 10 kHz to 10 MHz (1-3 sequence), Off VBW mode: Video average, Power average

Amplitude

Displayed Average Noise Level (DANL)	18°C to 28°C , Detector: Sample, VBW: 1 Hz (Video average), Input attenuator: 0 dB Without MS2830A-062/066, without MS2830A-008, or Preamp: Off –120 dBm/Hz (9 kHz ≤ f < 100 kHz, nom.) –134 dBm/Hz (100 kHz) –134 dBm/Hz (100 kHz < f < 1 MHz, nom.) –144 dBm/Hz (1 MHz) –144 dBm/Hz (1 MHz < f < 10 MHz, nom.) –150 dBm/Hz (10 MHz ≤ f < 30 MHz, nom.) –153 dBm/Hz (30 MHz ≤ f < 1 GHz) –151 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –149 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –146 dBm/Hz (3.5 GHz < f ≤ 6 GHz) [MS2830A-041/043] –142 dBm/Hz (6 GHz < f ≤ 13.5 GHz) [MS2830A-043] Without MS2830A-062/066, with MS2830A-008, Preamp: On –147 dBm/Hz (100 kHz, nom.) –156 dBm/Hz (1 MHz) –163 dBm/Hz (30 MHz ≤ f < 1 GHz) –162 dBm/Hz (1 GHz ≤ f < 2 GHz) –160 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –157 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Normal) [MS2830A-041/043] –157 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Spurious) [MS2830A-041/043] –157 dBm/Hz (4 GHz < f ≤ 6 GHz) [MS2830A-041/043] With MS2830A-062/066 and inactive, without MS2830A-008, or Preamp: Off –120 dBm/Hz (9 kHz ≤ f < 100 kHz, nom.) –133 dBm/Hz (100 kHz) –133 dBm/Hz (100 kHz < f < 1 MHz, nom.) –143 dBm/Hz (1 MHz) –143 dBm/Hz (1 MHz < f < 10 MHz, nom.) –149 dBm/Hz (10 MHz ≤ f < 30 MHz, nom.) –152 dBm/Hz (30 MHz ≤ f < 1 GHz) –150 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –147 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –144 dBm/Hz (3.5 GHz < f ≤ 6 GHz) [MS2830A-041/043] –142 dBm/Hz (6 GHz < f ≤ 13.5 GHz) [MS2830A-043] With MS2830A-062/066 and active, without MS2830A-008, or Preamp: Off –133 dBm/Hz (100 kHz) –143 dBm/Hz (1 MHz) –152 dBm/Hz (30 MHz ≤ f < 1 GHz) –150 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –147 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –144 dBm/Hz (3.5 GHz < f ≤ 6 GHz) [MS2830A-041/043] –142 dBm/Hz (6 GHz < f ≤ 13.5 GHz) [MS2830A-041/043] With MS2830A-062/066, with MS2830A-008, Preamp: On –146 dBm/Hz (100 kHz, nom.) –155 dBm/Hz (1 MHz) –162 dBm/Hz (30 MHz ≤ f < 1 GHz) –161 dBm/Hz (1 GHz ≤ f < 2 GHz) –158 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –154 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Normal) [MS2830A-041/043] –154 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Spurious) [MS2830A-041/043] –154 dBm/Hz (4 GHz < f ≤ 6 GHz) [MS2830A-041/043]
Total Absolute Amplitude Accuracy* *: Total absolute amplitude accuracy is found from root sum of squares (RSS) of RF frequency characteristics, Linearity error, and Input attenuator switching uncertainty.	18°C to 28°C , After CAL, Auto sweep time select: Normal, 30 Hz ≤ RBW ≤ 1 MHz, Detector: Positive, CW Excluding the noise floor effect, and FFT runtime (Display: On) Without MS2830A-008, or Preamp: Off Input attenuator: ≥10 dB, Mixer input level: ≤–10 dBm ±0.5 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 6 GHz, Frequency band mode: Spurious) ±1.8 dB (6 GHz < f ≤ 13.5 GHz) With MS2830A-008, Preamp: On Input attenuator: 10 dB, Preamp input level: –30 dBm ±1.0 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 6 GHz, Frequency band mode: Spurious)

Spurious Responses

2-tone 3rd-order Intermodulation Distortion	18°C to 28°C , ≥300 kHz separation Without MS2830A-008, or Preamp: Off Mixer input level: –15 dBm (1 wave) ≤–54 dBc, TOI = +12 dBm (30 MHz ≤ f < 300 MHz) ≤–60 dBc, TOI = +15 dBm (300 MHz ≤ f < 3.5 GHz) ≤–58 dBc, TOI = +14 dBm (3.5 GHz ≤ f ≤ 6 GHz) ≤–50 dBc, TOI = +10 dBm (6 GHz < f ≤ 13.5 GHz) With MS2830A-008, Preamp: On Preamp input level: –45 dBm (1 wave) ≤–73 dBc, TOI = –8.5 dBm (30 MHz ≤ f < 300 MHz) ≤–78 dBc, TOI = –6 dBm (300 MHz ≤ f ≤ 700 MHz) ≤–81 dBc, TOI = –4.5 dBm (700 MHz ≤ f < 4 GHz, Frequency band mode: Normal) (700 MHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ≤–78 dBc, TOI = –6 dBm (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 6 GHz, Frequency band mode: Spurious) TOI: Third-order intermodulation distortion
Image Responses	Frequency band mode: Normal ≤–70 dBc (10 MHz ≤ f < 4 GHz) ≤–55 dBc (4 GHz ≤ f ≤ 6 GHz) ≤–60 dBc (6 GHz < f ≤ 13.5 GHz)

Sweep

Sweep Mode	Continuous, Single
Sweep Time	Setting range: 1 ms to 1000 s (Span: ≥300 Hz) 1 μs to 1000 s (Span: 0 Hz)

Waveform Display

<table>
<tr><td>Detector</td><td>Positive & Negative, Positive peak, Sample, Negative peak, RMS
Quasi-Peak, CISPR-AVG, RMS-AVG (with MS2830A-016)</td></tr>
<tr><td>Sweep (trace) Point</td><td>
<table>
<tr><td>SPAN</td><td></td></tr>
<tr><td>500 MHz < SPAN ≤ 13.5 GHz</td><td>1001 to 30001</td></tr>
<tr><td>100 MHz < SPAN ≤ 500 MHz</td><td>101 to 30001</td></tr>
<tr><td>300 Hz ≤ SPAN ≤ 100 MHz and Sweep Time > 10 s</td><td>101 to 30001</td></tr>
<tr><td>300 Hz ≤ SPAN ≤ 100 MHz and Sweep Time ≤ 10 s</td><td>11 to 30001</td></tr>
<tr><td>0 Hz and Sweep Time > 10 s</td><td>101 to 30001</td></tr>
<tr><td>0 Hz and Sweep Time ≤ 10 s</td><td>11 to 30001</td></tr>
</table>
Setting resolution: 1 point</td></tr>
<tr><td>Scale</td><td>Log scale: 10 div/12 div, 0.1 to 20 dB/div (1-2-5 sequence)
Linear scale: 10 div, 1 to 10%/div (1-2-5 sequence)</td></tr>
<tr><td>Trigger</td><td>Free run (Trigger off), Video, Wide IF video, External, Frame
SG Marker (with MS2830A-020/021)</td></tr>
<tr><td>Gate</td><td>Off, Wide IF video, External, Frame
SG Marker (with MS2830A-020/021)</td></tr>
</table>

Measure Function

<table>
<tr><td colspan="2">Adjust Channel Power (ACP)</td><td>Reference: Span total, Carrier total, Both sides of carriers, Carrier select
Adjust channel specifications: 3 channels × 2 (Normal mode), 8 channels × 2 (Advanced mode)</td></tr>
<tr><td colspan="2">Burst Average Power</td><td>Displayed average power of specified interval at time domain</td></tr>
<tr><td colspan="2">Channel Power</td><td>Measurement of absolute values: dBm, dBm/Hz</td></tr>
<tr><td colspan="2">Occupied Bandwidth (OBW)</td><td>N% of power, X-dB down</td></tr>
<tr><td colspan="2">Spectrum Emission Mask (SEM)</td><td>Decision to Pass/Fail at Peak/Margin measurement</td></tr>
<tr><td colspan="2">Spurious Emission</td><td>Decision to Pass/Fail at Worst/Peaks measurement</td></tr>
<tr><td rowspan="2">Frequency Counter</td><td>Accuracy</td><td>Span: ≤1 MHz, RBW: 1 kHz, S/N: ≥50 dB, Gate time: ≥100 ms
± (Marker frequency × Frequency reference accuracy + (0.1 × N / Gate time [s] Hz)
N: Mixer harmonic order</td></tr>
<tr><td>Gate Time Setting</td><td>100 μs to 1 s</td></tr>
<tr><td colspan="2">2-tone 3rd-order Intermodulation Distortion</td><td>Measures IM3 and TOI from two-tone signal.</td></tr>
</table>

Signal Analyzer

Display waveform data, such as Spectrum, Power vs. Time captured at specific time

General

Trace Mode	Spectrum, Power vs. Time, Frequency vs. Time, Phase vs. Time, CCDF, Spectrogram, No trace
Analysis Bandwidth	Sets capture analysis bandwidth from center frequency 1 kHz to 10 MHz (1-2.5-5 sequence) (with MS2830A-006) 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz (with MS2830A-005) 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz, 50 MHz, 62.5 MHz (with MS2830A-077) 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz, 50 MHz, 62.5 MHz, 100 MHz, 125 MHz (with MS2830A-078)
Sampling Rate	Auto setting by conditions of analysis bandwidth 2 kHz to 20 MHz (1-2-5 sequence) (with MS2830A-006) 2 kHz to 50 MHz (1-2-5 sequence) (with MS2830A-005) 2 kHz to 100 MHz (1-2-5 sequence) (with MS2830A-077) 2 kHz to 200 MHz (1-2-5 sequence) (with MS2830A-078)
Capture Time	Without MS2830A-077/078, or ≤31.25 MHz bandwidth Setting capture time length Minimum capture time length: 2 µs to 50 ms (Determined according to analysis bandwidth) Maximum capture time length: 2 s to 2000 s (Determined according to analysis bandwidth) Setting mode: Auto, Manual With MS2830A-077, >31.25 MHz bandwidth Setting capture time length Minimum capture time length: 1 µs Maximum capture time length: 500 ms Setting mode: Auto, Manual With MS2830A-078, >31.25 MHz bandwidth Setting capture time length Minimum capture time length: 500 ns to 1 µs (Determined according to analysis bandwidth) Maximum capture time length: 500 ms Setting mode: Auto, Manual
Trigger	Free run (Trigger off), Video, Wide IF video, Frame, External (TTL) SG Marker (with MS2830A-020/021)
ADC Resolution	Without MS2830A-077/078, or ≤31.25 MHz bandwidth 16 bits

Spectrum Displayed Function

Function Outline	Displayed spectrum of any time length and frequency range within captured waveform data
Analysis Time Length	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Frequency	Can be set Center frequency and Span at frequency range in waveform data
Frequency Setting	Without MS2830A-077/078, or ≤31.25 MHz bandwidth 0 MHz to 3.6 GHz [MS2830A-040] 0 MHz to 6 GHz [MS2830A-041] 0 MHz to 13.5 GHz [MS2830A-043] With MS2830A-077/078, >31.25 MHz bandwidth 300 MHz to 3.6 GHz [MS2830A-040] 300 MHz to 6 GHz [MS2830A-041] 300 MHz to 13.5 GHz [MS2830A-043]
Resolution Bandwidth (RBW)	Without MS2830A-077/078, or ≤31.25 MHz bandwidth Setting range: 1 Hz to 1 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5: 1 (nom.) With MS2830A-077, >31.25 MHz bandwidth Setting range: 3 kHz to 3 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5: 1 (nom.) With MS2830A-078, >31.25 MHz bandwidth Setting range: 3 kHz to 10 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5: 1 (nom.)
Total Absolute Amplitude Accuracy* *: Total absolute amplitude accuracy is found from root sum of squares (RSS) of RF frequency characteristics, Linearity error, and Input attenuator switching uncertainty.	18°C to 28°C , After CAL, Input attenuator: ≥10 dB, RBW: Auto, Time detection: Average, Marker result: Integration or Peak (Accuracy), Center frequency, CW Excluding the noise floor effect Without MS2830A-008, or Preamp: Off Input attenuator: ≥10 dB, Mixer input level: ≤–10 dBm ±0.5 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 6 GHz, Frequency band mode: Spurious) ±1.8 dB (6 GHz < f ≤ 13.5 GHz) With MS2830A-008, Preamp: On Input attenuator: 10 dB, Preamp input level: ≤–30 dBm ±1.0 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 6 GHz, Frequency band mode: Spurious)

Continued on next page

In-band Frequency Characteristics	18°C to 28°C , Referenced to level at center frequency, Center frequency: ±10 MHz Without MS2830A-077/078, or ≤31.25 MHz bandwidth ±0.31 dB (30 MHz ≤ f ≤ 4 GHz, Frequency band mode: Normal) (30 MHz ≤ f < 3.5 GHz, Frequency band mode: Spurious)
Displayed Average Noise Level (DANL)	18°C to 28°C , Time Detection: Average, Input attenuator: 0 dB Without MS2830A-062/066, without MS2830A-008, or Preamp: Off –131.5 dBm/Hz (100 kHz) –141.5 dBm/Hz (1 MHz) –150.5 dBm/Hz (30 MHz ≤ f < 1 GHz) –148.5 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –146.5 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –143.5 dBm/Hz (3.5 GHz < f ≤ 6 GHz) [MS2830A-041/043] –139.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz) [MS2830A-043] Without MS2830A-062/066, with MS2830A-008, Preamp: On –144.5 dBm/Hz (100 kHz, nom.) –153.5 dBm/Hz (1 MHz) –160.5 dBm/Hz (30 MHz ≤ f < 1 GHz) –159.5 dBm/Hz (1 GHz ≤ f < 2 GHz) –157.5 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –154.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Normal) [MS2830A-041/043] –154.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Spurious) [MS2830A-041/043] –154.5 dBm/Hz (4 GHz < f ≤ 6 GHz) [MS2830A-041/043] With MS2830A-062/066, without MS2830A-008, or Preamp: Off –130.5 dBm/Hz (100 kHz) –140.0 dBm/Hz (1 MHz) –149.5 dBm/Hz (30 MHz ≤ f < 1 GHz) –147.0 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –144.5 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –141.5 dBm/Hz (3.5 GHz < f ≤ 6 GHz) [MS2830A-041/043] –139.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz) [MS2830A-043] With MS2830A-062/066, with MS2830A-008, Preamp: On –143.5 dBm/Hz (100 kHz, nom.) –152.5 dBm/Hz (1 MHz) –159.5 dBm/Hz (30 MHz ≤ f < 1 GHz) –158.5 dBm/Hz (1 GHz ≤ f < 2 GHz) –155.5 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –151.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Normal) [MS2830A-041/043] –151.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Spurious) [MS2830A-041/043] –151.5 dBm/Hz (4 GHz < f ≤ 6 GHz) [MS2830A-041/043] With MS2830A-077, 078: See MS2830A-077, 078 specifications.
Adjacent Channel Power (ACP)	Reference: Span total, Carrier total, Both sides of carriers, Carrier select Adjacent channel specifications: 3 channels × 2
Channel Power	Measurement of absolute values: dBm, dBm/Hz
Occupied Bandwidth (OBW)	N% of Power, X-dB Down

Power vs. Time Displayed Function

Function Outline	Displayed time changes of power for captured waveform data
Analysis Time Range	Analysis start time: Sets analysis start time position from beginning of waveform data Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Resolution Bandwidth	Filter type: Rect, Gaussian, Nyquist, Root nyquist, Off (Default: Off) Roll-off ratio: 0.01 to 1 (Set for Nyquist, Root nyquist) Filter frequency offset: Set center frequency of filter in wavelength data frequency band
AM Depth (Peak to Peak Measurement)	Measures with AM depth or marker function +Peak, –Peak, (P-P)/2, Average
Burst Average Power	Measures average power of burst signal

Frequency vs. Time Displayed Function

Function Outline	Displayed frequency time fluctuations of input signal from captured waveform data
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Operating Level Range	–17 to +30 dBm (Input attenuator: ≥10 dB)
Frequency (Vertical axis)	Can be set Center frequency and Span at frequency range in waveform data Displayed frequency range: Selectable 1/25, 1/10, 1/5, 1/2 of analysis bandwidth Input frequency range: 10 MHz to 6 GHz
Frequency Readout Accuracy	Input level: –17 to +30 dBm, Span: ≤31.25 MHz, Scale: Span/25, CW input ± (Reference oscillator accuracy × Center frequency + Displayed frequency range × 0.01) Hz
FM Deviation (Peak to Peak Measurement)	Measures FM deviation or marker function +Peak, –Peak, (P-P)/2, Average
FMCW Measurement	Display items: FM Error Peak, FM Error RMS, Chirp Deviation, Chirp Rate, Chirp Length The measurement range can be set by automatic detection or marker.

Phase vs. Time Displayed Function

Function Outline	Displayed phase time fluctuation of input signal from captured waveform data
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Phase (Vertical Axis)	Display mode: Wrap, Unwrap Displayed phase range: 0.01 deg./div to 200 Gdeg./div Offset: –100 deg. to +100 Mdeg.

CCDF/APD Displayed Function

Function Outline	Displayed CCDF and APD of waveform date within a given length of time
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Display	Displayed CCDF or APD as graphs Histogram resolution: 0.01 dB Value: Average power, Max. power, Crest factor
Resolution Bandwidth	Filter type: Rectangle, Off (Default: Off) Filter frequency offset: Sets filter center frequency in frequency band of waveform data

Spectrogram Displayed Function

Function Outline	Displayed spectrogram for arbitrary time length in captured waveform data
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Frequency	Can be set Center frequency and Span at frequency range in waveform data
Resolution Bandwidth (RBW)	Setting range: 1 Hz to 1 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5: 1 (nom.)

Digitize Function

Function Outline	Captured waveform data saved to internal HDD or output to external devices
Waveform Data	Format: I, Q (each 32 bit, Float binary type) Level: 0 dBm input is $\sqrt{(I^2 + Q^2)} = 1$ Level accuracy: Same as signal analyzer absolute amplitude accuracy
External Output	Can be output to external PC via Ethernet

Replay Function

<table>
<tr><td>Function Outline</td><td>Captured waveforms can be replayed again by using the VSA function to read saved digitize data</td></tr>
<tr><td>Conditions for Measurable Waveform Data</td><td>Format: I, Q (binary format)
Combination of span, sampling rate, and minimum capture sample
<table>
<tr><th>Span</th><th>Sampling Rate</th><th>Minimum Capture Sample</th></tr>
<tr><td>1 kHz</td><td>2 kHz</td><td>74000 (37 s)</td></tr>
<tr><td>2.5 kHz</td><td>5 kHz</td><td>160000 (32 s)</td></tr>
<tr><td>5 kHz</td><td>10 kHz</td><td>310000 (31 s)</td></tr>
<tr><td>10 kHz</td><td>20 kHz</td><td>610000 (30.5 s)</td></tr>
<tr><td>25 kHz</td><td>50 kHz</td><td>730000 (14.6 s)</td></tr>
<tr><td>50 kHz</td><td>100 kHz</td><td>730000 (7.3 s)</td></tr>
<tr><td>100 kHz</td><td>200 kHz</td><td>730000 (3.65 s)</td></tr>
<tr><td>250 kHz</td><td>500 kHz</td><td>730000 (1.46 s)</td></tr>
<tr><td>500 kHz</td><td>1 MHz</td><td>730000 (730 ms)</td></tr>
<tr><td>1 MHz</td><td>2 MHz</td><td>730000 (365 ms)</td></tr>
<tr><td>2.5 MHz</td><td>5 MHz</td><td>730000 (146 ms)</td></tr>
<tr><td>5 MHz</td><td>10 MHz</td><td>730000 (73 ms)</td></tr>
<tr><td>10 MHz</td><td>20 MHz</td><td>730000 (36.5 ms)</td></tr>
<tr><td>18.6 MHz</td><td>20 MHz</td><td>730000 (36.5 ms)</td></tr>
<tr><td>20 MHz</td><td>25 MHz</td><td>730000 (29.2 ms)</td></tr>
<tr><td>25 MHz</td><td>50 MHz</td><td>730000 (14.6 ms)</td></tr>
<tr><td>31.25 MHz</td><td>50 MHz</td><td>730000 (14.6 ms)</td></tr>
<tr><td>50 MHz</td><td>100 MHz</td><td>730000 (7.3 ms)</td></tr>
<tr><td>62.5 MHz</td><td>100 MHz</td><td>730000 (7.3 ms)</td></tr>
<tr><td>100 MHz</td><td>200 MHz</td><td>730000 (3.65 ms)</td></tr>
<tr><td>125 MHz</td><td>200 MHz</td><td>730000 (3.65 ms)</td></tr>
</table></td></tr>
</table>

Noise Figure Measurement Function MS2830A-017*1

Frequency

Frequency Range	MS2830A-040: 30 MHz to 3.6 GHz MS2830A-041: 30 MHz to 6 GHz MS2830A-043: 30 MHz to 13.5 GHz
Frequency Setting Range	MS2830A-040: 10 MHz to 3.6 GHz MS2830A-041: 10 MHz to 6 GHz MS2830A-043: 10 MHz to 13.5 GHz

NF Measurement
Within the measurement range,
Attenuator = 0 dB*2

Measurement Range	–20 to +40 dB
Instrument Uncertainty	ENR: 4 to 7 dB ±0.02 dB ENR: 12 to 17 dB ±0.025 dB ENR: 20 to 22 dB ±0.03 dB

Gain Measurement

Measurement Range	Within the frequency range –20 to +40 dB
Instrument Uncertainty	Within the measurement range ≤0.07

Resolution Bandwidth

Setting Range	100 kHz to 8 MHz

Connector

Noise Source	Connector: Rear panel, BNC-J Output voltage: 28 ±0.5 V, Pulsed

*1: Recommending the NC346 Series noise sources by Noisecom company
*2: Recommend to use Pre Amp

Audio Analyzer MS2830A-018

The Audio Analyzer is used in combination with the Analog Measurement Software MX269018A.

Audio Analyzer Function
The specifications for single tone measurement

Measurement Function	Amplitude, Frequency, THD, THD + N, SINAD
Connector	Balanced: 1/4-inch phone jack (3-pole, Φ6.3 mm) Unbalanced: BNC-J
Impedance	Balanced: 200kΩ (AC coupled, nom.) Unbalanced: 100kΩ (AC coupled, nom.)
Frequency Measurement Range	20 Hz to 50 kHz
Level Measurement Range	1 mV rms to 25 V rms (30 V rms max.)
Input Range Setting	50 mV peak, 500 mV peak, 5 V peak, 50 V peak
Level Accuracy	18°C to 28°C ±0.4 dB (20 Hz ≤ f ≤ 25 kHz) ±3.0 dB (25 kHz < f ≤50 kHz)
THD + N (Total Harmonic Distortion + Noise)	At 1 kHz, 1.4 V rms, Band: 20 Hz to 20 kHz, Range: 5 Vp-p, 18°C to 28°C <–60 dB <–80 dB (nom.)
Audio Filter	LPF: Off, 3, 15, 20, 30, 50 kHz HPF: Off, 20, 50, 100, 300, 400 Hz, 30 kHz BPF (Weighting filter): Off, CCITT, C-Message, CCIR468, CCIR-ARM, A-Weighting

Audio Generator Function
The specifications for all single-tone measurements except White Noise (through ITU-T G.227 filter)

<table>
<tr><td>Connector Type</td><td>Balanced: 1/4-inch phone jack (3-pole, Φ6.3 mm)
Unbalanced: BNC-J</td></tr>
<tr><td>Impedance</td><td>Balanced: 100Ω/600Ω (AC coupled, nom.)
Unbalanced: 50Ω/600Ω (AC coupled, nom.)</td></tr>
<tr><td>Output Waveform</td><td>Single tone
Multi tone: Tone × 3, DCS, White noise (ITU-T G.227), DTMF</td></tr>
<tr><td>Guaranteed Frequency Range</td><td>20 Hz to 25 kHz</td></tr>
<tr><td>Frequency Setting Range</td><td>10 Hz to 50 kHz</td></tr>
<tr><td>Frequency Resolution</td><td>0.01 Hz</td></tr>
<tr><td>Output Level Range</td><td>Using sub supply/audio revision 2*1
Single tone
<table>
<tr><td rowspan="2">Open circuit voltage
(≥100kΩ termination)</td><td>Balanced</td><td>Off, 1 mV rms to 12.4 V rms</td></tr>
<tr><td>Unbalanced</td><td>Off, 1 mV rms to 6.2 V rms</td></tr>
<tr><td rowspan="2">600Ω termination*</td><td>Balanced</td><td>Off, –63 dBm (equivalent to 0.5 mV rms) to +18 dBm (equivalent to 6.2 V rms)</td></tr>
<tr><td>Unbalanced</td><td>Off, –63 dBm (equivalent to 0.5 mV rms) to +12 dBm (equivalent to 3.1 V rms)</td></tr>
</table>
White noise (through ITU-T G.227 filter)
<table>
<tr><td rowspan="2">Open circuit voltage
(≥100kΩ termination)</td><td>Balanced</td><td>Off, 1.545 mV rms to 3.083 V rms (nom.)</td></tr>
<tr><td>Unbalanced</td><td>Off, 1.545 mV rms to 1.545 V rms (nom.)</td></tr>
<tr><td rowspan="2">600Ω termination*</td><td>Balanced</td><td>Off, –60 dBm (equivalent to 0.774 mV rms) to +6 dBm (equivalent to 1.545 V rms) (nom.)</td></tr>
<tr><td>Unbalanced</td><td>Off, –60 dBm (equivalent to 0.774 mV rms) to 0 dBm (equivalent to 0.774 V rms) (nom.)</td></tr>
</table>
*: Output Impedance = 600Ω , and Output Impedance Reference = 600Ω</td></tr>
<tr><td>Output Level Resolution</td><td>Single tone: 1 mV (350 mV rms < Output level ≤ 6.2 V rms)
100 µV (35 mV rms < Output level ≤ 350 mV rms)
10 µV (Output Level ≤ 35 mV rms)
White noise (through ITU-T G.227 filter): 0.01 dB (nom.)</td></tr>
<tr><td>Level Accuracy</td><td>Single tone: ±0.3 dB (1 kHz, 100kΩ termination, 18°C to 28°C)
White noise (through ITU-T G.227 filter): ±3 dB</td></tr>
<tr><td>Maximum Output Currency</td><td>100 mA (nom., no short circuit)</td></tr>
<tr><td>THD + N
(Total Harmonic Distortion + Noise)</td><td>At 1 kHz, 0.7 V rms, Band: 20 Hz to 25 kHz, 100kΩ termination, 18°C to 28°C
< –60 dB
< –80 dB (nom.)</td></tr>
</table>

Other Functions

Demodulation Output (FM only)*2	Connector: BNC-J Level: –10 dBm ±2 dB (Frequency deviation = 3.5 kHz, 600Ω) Impedance: 600Ω Sound Monitor: Internal speaker or 3.5 mm phone jack (2-pole, monaural)
Others	Crosstalk: Crosstalk from Audio Generator to Audio Analyzer >80 dB Push To Talk (PTT) control Connector: Banana jack (Φ4.0 mm, 30 V max., 500 mA max.) General Input/Output (Audio function) Connector: D-Sub 15 pin (jack) Function: Open collector × 1 (5 V, 100 mA max.), TTL Output × 2, TTL Input × 2

*1: Sub Supply/Audio Revision is the MS2830A-018/118 printed-circuit board version.
<Sub Supply/Audio Revision Confirmation Method>
(1) MS2830A units with Sub Supply/Audio Revision 2 have a sticker marked 'A1' next to the main-frame serial number.
(2) The MS2830A Sub Supply/Audio Revision can be confirmed as follows:
Press [System Config] → [F5] System Information → [F4] Board Revision View to list the Board Revisions; check the displayed Sub Supply/Audio Revision number. (It may be either 1 or 2.)

*2: For Tx test of analog wireless equipment. Wide FM measurements not supported.

3.6 GHz Vector Signal Generator MS2830A-020
6 GHz Vector Signal Generator MS2830A-021

*: Use the MS2830A-021 for frequencies higher than 3.6 GHz.
Available to use for signal source of Internal Signal Generator Control Function MS2830A-052.

The specifications of the MS2830A-020/021 are defined under the following conditions unless otherwise specified.

CW	Pulse modulation: Off
Modulation	After CAL Waveform pattern RMS value: At RMSw (linear value) and each combination less than following ranges: RMSnom = 20 • log (RMSw/4628) [16-bit data] RMSnom = 20 • log (RMSw/2314) [15-bit data] RMSnom = 20 • log (RMSw/1157) [14-bit data] –3.00 dB ≤ RMSnom ≤ +3.00 dB Pulse modulation: Off

Frequency

Range	250 kHz to 3.6 GHz [MS2830A-020] 250 kHz to 6 GHz [MS2830A-021]
Resolution	0.01 Hz steps

Above specifications also apply under MS2830A-052 working.

Output Level

<table>
<tr><td>Setting Range</td><td>Without MS2830A-022
–40 to +20 dBm (>25 MHz), –40 to +2 dBm (≤25 MHz)
With MS2830A-022
–136 to +15 dBm (>25 MHz), –136 to –3 dBm (≤25 MHz)</td></tr>
<tr><td>Units</td><td>dBm, dBμV (terminated, open)</td></tr>
<tr><td>Resolution</td><td>0.01 dB</td></tr>
<tr><td>Output Level Accuracy</td><td>18°C to 28°C, CW
Without MS2830A-022
<table>
<tr><th></th><th>Output Level [p] (dBm)</th></tr>
<tr><td>±0.5 dB (typ., ≤25 MHz)</td><td>–40 ≤ p ≤ +2</td></tr>
<tr><td>±0.5 dB (typ., 25 MHz < f ≤ 375 MHz)</td><td>–40 ≤ p ≤ +9</td></tr>
<tr><td>±0.5 dB (375 MHz ≤ f ≤ 3.6 GHz)</td><td>–40 ≤ p ≤ +9</td></tr>
<tr><td>±0.8 dB (>3.6 GHz)</td><td>–40 ≤ p ≤ +4</td></tr>
</table>
With MS2830A-022
<table>
<tr><th></th><th>Output Level [p] (dBm)</th></tr>
<tr><td>±1.0 dB (typ., ≤25 MHz)</td><td>–110 ≤ p ≤ –3</td></tr>
<tr><td>±1.0 dB (typ., 25 MHz < f < 100 MHz)</td><td>–110 ≤ p ≤ +4</td></tr>
<tr><td>±0.5 dB (typ., 100 MHz ≤ f < 375 GHz)</td><td>–110 ≤ p ≤ +4</td></tr>
<tr><td>±0.5 dB (375 MHz ≤ f ≤ 3.6 GHz)</td><td>–110 ≤ p ≤ +4</td></tr>
<tr><td>±0.8 dB (>3.6 GHz)</td><td>–110 ≤ p ≤ –1</td></tr>
<tr><td>±1.0 dB (100 MHz ≤ f ≤ 3.6 GHz)</td><td>–120 ≤ p < –110</td></tr>
<tr><td>±1.0 dB (typ., 100 MHz ≤ f ≤ 3.6 GHz)</td><td>–127 ≤ p < –120</td></tr>
<tr><td>±2.5 dB (typ., >3.6 GHz)</td><td>–127 ≤ p < –110</td></tr>
</table></td></tr>
<tr><td>Output Level Linearity</td><td>18°C to 28°C , CW
Without MS2830A-022, Referenced to –10 dBm output
<table>
<tr><th></th><th>Output Level [p] (dBm)</th></tr>
<tr><td>±0.2 dB (typ., ≤3.6 GHz)</td><td>–40 ≤ p ≤ –10</td></tr>
<tr><td>±0.3 dB (typ., >3.6 GHz)</td><td>–40 ≤ p ≤ –10</td></tr>
</table>
With MS2830A-022, Referenced to –15 dBm output
<table>
<tr><th></th><th>Output Level [p] (dBm)</th></tr>
<tr><td>±0.2 dB (typ., ≤3.6 GHz)</td><td>–110 ≤ p ≤ –15</td></tr>
<tr><td>±0.3 dB (typ., >3.6 GHz)</td><td>–110 ≤ p ≤ –15</td></tr>
</table></td></tr>
</table>

Above specifications also apply under MS2830A-052 working.

Output Connector

Connector	N-J connector, 50Ω (Front panel, SG output)
VSWR	18°C to 28°C Without MS2830A-022, Output level ≤–10 dBm 1.5 (≤3.6 GHz), 2.0 (>3.6 GHz) With MS2830A-022, Output level: ≤–15 dBm 1.3 (≤3.6 GHz), 1.9 (>3.6 GHz)
Max. Reverse Input	0 Vdc (max.) Without MS2830A-022 +12 dBm (<20 MHz), +24 dBm (≥20 MHz) With MS2830A-022 +18 dBm (<20 MHz), +30 dBm (≥20 MHz)

Above specifications also apply under MS2830A-052 working.

Signal Purity

Harmonic Spurious	Output level: ≤0 dBm (without MS2830A-022), ≤–5 dBm (with MS2830A-022), CW <–30 dBc (≥1 MHz)
Non-Harmonic Spurious	Offset from output frequency: ≥15 kHz Output level: ≤0 dBm (without MS2830A-022), ≤–5 dBm (with MS2830A-022), CW <–46 dBc (100 MHz ≤ f ≤ 3 GHz) <–40 dBc (3 GHz < f ≤ 6 GHz)

Above specifications also apply under MS2830A-052 working.

Vector Modulation

<table>
<tr><td>Vector Accuracy</td><td>18°C to 28°C , Output level: ≤0 dBm (without MS2830A-022), ≤–5 dBm (with MS2830A-022)
W-CDMA (DL 1 code), Output frequency: 800 MHz to 2.7 GHz
LTE-DL (20 MHz), Output frequency: 600 MHz to 2.7 GHz
≤1.4% (rms)</td></tr>
<tr><td>Carrier Leak</td><td>18°C to 28°C , RMS: 0 dB
≤–40 dBc (375 MHz ≤ f ≤ 2.4 GHz)</td></tr>
<tr><td>Image Rejection</td><td>18°C to 28°C , use sine wave <10 MHz
≤–40 dBc</td></tr>
<tr><td>ACLR</td><td>18°C to 28°C , W-CDMA (Test Model 1 64DPCH)
Output level: ≤0 dBm (without MS2830A-022), ≤–5 dBm (with MS2830A-022)
<table>
<tr><th></th><th>5 MHz Offset</th><th>10 MHz Offset</th></tr>
<tr><td>375 MHz ≤ f ≤ 2.4 GHz</td><td>≤–64 dBc/3.84 MHz</td><td>≤–67 dBc/3.84 MHz</td></tr>
<tr><td>2.4 GHz < f ≤ 3.6 GHz</td><td>≤–59 dBc/3.84 MHz</td><td>≤–63 dBc/3.84 MHz</td></tr>
<tr><td>3.6 GHz < f ≤ 6 GHz</td><td>≤–56 dBc/3.84 MHz</td><td>≤–60 dBc/3.84 MHz</td></tr>
</table></td></tr>
<tr><td>CW and Level Error at Vector Modulation</td><td>18°C to 28°C , Bandwidth: 5 MHz (AWGN), Output frequency: ≥100 MHz
Output level: ≤0 dBm (without MS2830A-022), ≤–5 dBm (with MS2830A-022)
±0.2 dB</td></tr>
</table>

Pulse Modulation

On/Off Ratio	>60 dB (≤3 GHz) >40 dB (3 GHz < f ≤ 6 GHz)
Rising/Falling Edge Time	≤90 ns (10% to 90%)
Pulse Repetition Frequency	DC to 1 MHz (Duty: 50%)
External Panel Modulation Signal Input	Aux connector (Rear panel), TTL H: Signal On, L: Signal Off

Arbitrary Waveform Generator

Waveform Resolution	14/15/16 bits
Marker Output	14 bits: Three signals in waveform pattern, or real-time three-signal generation 15 bits: One signal in waveform pattern, or real-time three-signal generation 16 bits: Real-time three-signal generation Switching positive and negative logic pulse outputs
Internal Baseband Reference Clock	Range: 20 kHz to 160 MHz Resolution: 0.001 Hz
External Baseband Reference Clock	Range: 20 kHz to 40 MHz Division, multiplier function: Internally generate 1, 2, 4, 8, 16, 1/2, 1/4, 1/8 and 1/16 times input signals and use as DAC sampling clock Input connector: Aux connector (Rear panel) Input level ≥0.7 Vp-p, 50Ω (AC coupling)
Waveform Memory	Memory: 64 Msamples (without MS2830A-027) 256 Msamples (with MS2830A-027) File (package) open count: Max. package count: 100 Max. patterns per package: 1000 However, 4096 patterns in total and 128 samples minimum per pattern SG Trigger input: Synchronize with trigger signals and start waveform pattern output. Switch start trigger/frame trigger Start trigger: To start waveform output Frame trigger: To output signals at burst timing To output data for burst length at frame trigger timing and wait for next frame trigger.
Input Connector	Function switch: Common start/frame trigger connector. Switch to use. Connector: BNC-J connector (Rear panel) Input level: TTL Logic: Select rise/fall polarity

AWGN Addition Function

CN Ratio Absolute Value	≤40 dB (with MS2830A-028)

BER Measurement Function MS2830A-026

Connector	AUX connector (Rear panel)* *: Can convert to BNC by connecting AUX Conversion Adapter (J1556A).
Input Level	TTL level
Input Signal	Data, Clock, Enable
Input Bit Rate	100 bps to 10 Mbps
Measured Patterns	PN9, PN11, PN15, PN20, PN23, ALL0, ALL1, Alternate (0101 ...) PN9Fix, PN11Fix, PN15Fix, PN20Fix, PN23Fix, User define (4096 bits max.)
Synchronization Establishing Condition	PN signal: PN stage × 2 bit error free At PNFix signal: PN stage × 2 bit error free, PN signal and sync establishment, establish sync with PNFix signal at PN stage error free from PNFix signal header bit ALL0, ALL1, Alternate (0101 ...): 10 bit error free User define: 8 to 1024 bits (variable) error free Select header bit used at sync detection
Re-synchronization Judgment Condition	x/y (Resynchronization at detection of x-bit error in y bits) y ... Measured bit count: Select from 500 bits, 5000 bits, 50000 bits x ... Number of error bits in y bits: Setting range 1 to y/2
Measured Bit Count	≤2^{32} – 1 bits
Measured Error Bit Count	≤2^{31} – 1 bits
Measurement End Conditions	Measured bit count, Measured error bit count
Auto Re-synchronization Function	Can be toggled on and off
Operation at Resync.	Select from Count clear, and Count keep
Measurement Mode	Single, Endless, Continuous
Display	Status, Error, Error rate, Error count, SyncLoss count, Measured bit count
Polarity Inversion Function	Supports polarity reversal for Data, Clock, Enable
Clear Measurement Function	At BER measurement, hold sync status, clears measured value and measures from 0

Low Phase Noise Performance MS2830A-066

Signal Analyzer/Spectrum Analyzer

Frequency Range	9 kHz to 3.7 GHz 9 kHz to 3.5 GHz (Frequency band mode: Spurious)
Span	300 Hz to 1 MHz (Spectrum Analyzer) 1 kHz to 31.25 MHz (Signal Analyzer)
SSB Phase Noise	18°C to 28°C 500 MHz, Spectrum Analyzer, Switching speed mode: Normal –115 dBc/Hz (100 kHz offset) –133 dBc/Hz (1 MHz offset) With MS2830A-066, MS2830A-066: On Center frequency: 500 MHz, Span: ≤1 MHz (Spectrum Analyzer) –109 dBc/Hz (1 kHz offset) –118 dBc/Hz (10 kHz offset) –133 dBc/Hz (100 kHz offset) –148 dBc/Hz (1 MHz offset, nom.) Center frequency: 220 MHz, Span: ≤500 kHz (Spectrum Analyzer) –122 dBc/Hz (25 kHz offset)

Spectrum Analyzer

Displayed Average Noise Level (DANL)	18°C to 28°C , Detector: Sample, VBW: 1 Hz (Video average), Input attenuator: 0 dB With MS2830A-066 installed and inactive, without MS2830A-008, or Preamp: Off –120 dBm/Hz (9 kHz ≤ f < 100 kHz, nom.) –133 dBm/Hz (100 kHz) –133 dBm/Hz (100 kHz < f < 1 MHz, nom.) –143 dBm/Hz (1 MHz) –143 dBm/Hz (1 MHz < f < 10 MHz, nom.) –149 dBm/Hz (10 MHz ≤ f < 30 MHz, nom.) –152 dBm/Hz (30 MHz ≤ f < 1 GHz) –150 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –147 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –144 dBm/Hz (3.5 GHz < f ≤ 6 GHz) [MS2830A-041/043] –142 dBm/Hz (6 GHz < f ≤ 13.5 GHz) [MS2830A-043] With MS2830A-066 installed and active, without MS2830A-008, or Preamp: Off –133 dBm/Hz (100 kHz) –143 dBm/Hz (1 MHz) –152 dBm/Hz (30 MHz ≤ f < 1 GHz) –150 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –147 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –144 dBm/Hz (3.5 GHz < f ≤ 6 GHz) [MS2830A-041/043] –142 dBm/Hz (6 GHz < f ≤ 13.5 GHz) [MS2830A-043] With MS2830A-066, with MS2830A-008, Preamp: On –146 dBm/Hz (100 kHz, nom.) –155 dBm/Hz (1 MHz) –162 dBm/Hz (30 MHz ≤ f < 1 GHz) –161 dBm/Hz (1 GHz ≤ f < 2 GHz) –158 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –154 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Normal) [MS2830A-041/043] –154 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Spurious) [MS2830A-041/043] –154 dBm/Hz (4 GHz < f ≤ 6 GHz) [MS2830A-041/043]
Image Responses	With MS2830A-066 MS2830A-066: On, Center frequency: ≤3.6 GHz, Span: ≤1 MHz (Spectrum Analyzer) Image responses (Input signal + 150 MHz): ≤–10 dBc (110 MHz ≤ f < 3.6 GHz)
Multiple Responses	With MS2830A-066 MS2830A-066: On, Center frequency: ≤3.6 GHz, Span: ≤1 MHz (Spectrum Analyzer), Mixer input level: –15 dBm ≤10 dBc (nom.)

Signal Analyzer

Displayed Average Noise Level (DANL)	18°C to 28°C , Input attenuator: 0 dB With MS2830A-066, without MS2830A-008, or Preamp: Off –130.5 dBm/Hz (100 kHz) –140.5 dBm/Hz (1 MHz) –149.5 dBm/Hz (30 MHz ≤ f < 1 GHz) –147.5 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –144.5 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –141.5 dBm/Hz (3.5 GHz < f ≤ 6 GHz) [MS2830A-041/043] –139.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz) [MS2830A-043] With MS2830A-066, MS2830A-008, Preamp: On –143.5 dBm/Hz (100 kHz, nom.) –152.5 dBm/Hz (1 MHz) –159.5 dBm/Hz (30 MHz ≤ f < 1 GHz) –158.5 dBm/Hz (1 GHz ≤ f < 2 GHz) –155.5 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –151.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Normal) [MS2830A-041/043] –151.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Spurious) [MS2830A-041/043] –151.5 dBm/Hz (4 GHz < f ≤ 6 GHz) [MS2830A-041/043]

Analysis Bandwidth Extension to 62.5 MHz MS2830A-077 (Requires MS2830A-005 and MS2830A-006)
Analysis Bandwidth Extension to 125 MHz MS2830A-078 (Requires MS2830A-005, MS2830A-006 and MS2830A-077)

An image response is received when setting the bandwidth to more than 31.25 MHz. This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.). The Signal Analyzer MS2690A is recommended for other measurement purposes.

General

Analysis Bandwidth	Sets capture analysis bandwidth from center frequency 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz, 50 MHz, 62.5 MHz (with MS2830A-077) 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz, 50 MHz, 62.5 MHz, 100 MHz, 125 MHz (with MS2830A-078)
Sampling Rate	Auto setting by conditions of analysis bandwidth 2 kHz to 100 MHz (1-2-5 sequence) (with MS2830A-077) 2 kHz to 200 MHz (1-2-5 sequence) (with MS2830A-078)
Capture Time	With MS2830A-077, >31.25 MHz bandwidth Setting capture time length Minimum capture time length: 1 µs Maximum capture time length: 500 ms Setting mode: Auto, Manual With MS2830A-078, >31.25 MHz bandwidth Setting capture time length Minimum capture time length: 500 ns to 1 µs (Determined according to analysis bandwidth) Maximum capture time length: 500 ms Setting mode: Auto, Manual
ADC Resolution	With MS2830A-077/078, >31.25 MHz bandwidth 14 bits

Frequency

Frequency Setting	With MS2830A-077/078, >31.25 MHz bandwidth 300 MHz to 3.6 GHz [MS2830A-040] 300 MHz to 6 GHz [MS2830A-041] 300 MHz to 13.5 GHz [MS2830A-043]
Resolution Bandwidth (RBW)	With MS2830A-077, >31.25 MHz bandwidth Setting range: 1 Hz to 3 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5: 1 (nom.) With MS2830A-078, >31.25 MHz bandwidth Setting range: 1 Hz to 10 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5: 1 (nom.)

Amplitude

Displayed Average Noise Level (DANL)	18°C to 28°C , Time Detection: Average, Input attenuator: 0 dB With MS2830A-077, or 078, > 31.25 MHz bandwidth Without MS2830A-066, MS2830A-008, or with MS2830A-008, Preamp: Off –146.5 dBm/Hz (300 MHz ≤ f < 1 GHz) –144.5 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –142.5 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –139.5 dBm/Hz (3.5 GHz < f ≤ 6 GHz) [MS2830A-041/043] –135.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz) [MS2830A-043] Without MS2830A-066, with MS2830A-008, Preamp: On –156.5 dBm/Hz (300 MHz ≤ f < 1 GHz) –155.5 dBm/Hz (1 GHz ≤ f < 2 GHz) –153.5 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –150.5 dBm/Hz (3.5 GHz < f ≤ 6 GHz) [MS2830A-041/043] With MS2830A-066, without MS2830A-008, or Preamp: Off –143.5 dBm/Hz (300 MHz ≤ f < 1 GHz) –141.5 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –138.5 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –135.5 dBm/Hz (3.5 GHz < f ≤ 6 GHz) [MS2830A-041/043] –135.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz) [MS2830A-043] With MS2830A-066, MS2830A-008, Preamp: On –153.5 dBm/Hz (300 MHz ≤ f < 1 GHz) –152.5 dBm/Hz (1 GHz ≤ f < 2 GHz) –149.5 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –145.5 dBm/Hz (3.5 GHz < f ≤ 6 GHz) [MS2830A-041/043]
Image Response	With MS2830A-077/078, >31.25 MHz bandwidth Image response (Occurs at frequency 200 MHz away): 0 dBc (nom., 300 MHz < f ≤ 13.5 GHz)
Linearity Error	Excluding the noise floor effect Without MS2830A-008, or Preamp: Off ±0.07 dB (Mixer input level: ≤–20 dBm) ±0.10 dB (Mixer input level: ≤–10 dBm) With MS2830A-008, Preamp: On ±0.07 dB (Preamp input level: ≤–40 dBm) ±0.10 dB (Preamp input level: ≤–30 dBm)
RF Frequency Characteristics	18°C to 28°C, After CAL, Input attenuator: 10 dB, Frequency band mode: Normal Without MS2830A-008, or Preamp: Off ±0.35 dB (300 MHz ≤ f < 4 GHz) ±1.5 dB (4 GHz ≤ f ≤ 6 GHz) ±1.5 dB (6 GHz < f) With MS2830A-008, Preamp: On ±0.65 dB (300 MHz ≤ f < 4 GHz) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz)

Internal Signal Generator Control Function MS2830A-052 (Requires any of MS2830A-020, 021, or 088)

This option measures the DUT transmission characteristics using linked operation between the Spectrum Analyzer functions and the installed signal generator. For the performance, refer to specifications for the Spectrum Analyzer function and the installed vector signal generator or analog signal generator.

3.6 GHz Analog Signal Generator MS2830A-088
Analog Function Extension for Vector Signal Generator MS2830A-029

The Analog Signal Generator and Analog Function Extension for Vector Signal Generator are used in combination with the Analog Measurement Software MX269018A.
And these are available to use for signal source of Internal Signal Generator Control Function MS2830A-052.
The following specifications are added to or changed from the specifications of the "Vector Signal Generator MS2830A-020/021" and "Low Power Extension for Vector Signal Generator MS2830A-022" installed.

Frequency

Frequency Setting Range	With FM, φM, AM modulation signal 100 kHz to 3000 MHz With Internal Signal Generator Control Function (MS2830A-052) 100 kHz to 3.6 GHz (With MS2830A-088 or MS2830A-020 + 029) 100 kHz to 6 GHz (With MS2830A-021 + 029)
Frequency Setting Resolution	1 Hz

Output Level

<table>
<tr><td>Output Setting Level</td><td>With FM, φM, AM modulation signal
–136 to +15 dBm (Rx frequency: > 25 MHz)
–136 to –3 dBm (Rx frequency: ≤ 25 MHz)
With Internal Signal Generator Control Function MS2830A-052
–136 to +15 dBm (> 25 MHz), –136 to –3 dBm (≤ 25 MHz)</td></tr>
<tr><td>Output Level Accuracy</td><td>18°C to 28°C, CW
MS2830A-029/088
<table>
<tr><td></td><td>Output Level [p] (dBm)</td></tr>
<tr><td>±3.0 dB (typ., 100 kHz ≤ f < 250 kHz)</td><td>–110 ≤ p ≤ –3</td></tr>
</table>
Refer to the MS2830A-020/021 Vector Signal Generator section (with MS2830A-022) for the output level accuracy for other frequency ranges.</td></tr>
</table>

Arbitrary Signal Generator

Available when the MS2830A-020, 021 or 189 (Vector Signal Generator) is installed.

Typical (typ.): Performance not warranted. Must products meet typical performance.
Nominal (nom.): Values not warranted. Included to facilitate application of product.
Example: Performance not warranted. Data actually measured by randomly selected measuring instruments.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MS2830A	Signal Analyzer
	Standard Accessories
	Power Cord: 1 pc
P0031A	USB Memory (≥256 MB, USB2.0 Flash Driver): 1 pc
Z0541A	USB Mouse: 1 pc
	Install CD-ROM (Application software, instruction manual CD-ROM): 1 pc
	Options
MS2830A-040	3.6 GHz Signal Analyzer
MS2830A-041	6 GHz Signal Analyzer
MS2830A-043	13.5 GHz Signal Analyzer
MS2830A-001	Rubidium Reference Oscillator
MS2830A-002	High Stability Reference Oscillator
MS2830A-005[*1]	Analysis Bandwidth Extension to 31.25 MHz (Requires MS2830A-006)
MS2830A-006	Analysis Bandwidth 10 MHz
MS2830A-008	Preamplifier
MS2830A-010	Phase Noise Measurement Function
MS2830A-011	2ndary HDD
MS2830A-016	Precompliance EMI Function
MS2830A-017	Noise Figure Measurement Function
MS2830A-018	Audio Analyzer
MS2830A-026[*2]	BER Measurement Function (AUX Conversion Adapter J1556A as standard accessory)
MS2830A-066[*3]	Low Phase Noise Performance
MS2830A-077[*4]	Analysis Bandwidth Extension to 62.5 MHz
MS2830A-078[*5]	Analysis Bandwidth Extension to 125 MHz
MS2830A-311	2ndary HDD Retrofit
MS2830A-052[*6]	Internal Signal Generator Control Function
MS2830A-020	3.6 GHz Vector Signal Generator
MS2830A-021	6 GHz Vector Signal Generator
MS2830A-022	Low Power Extension for Vector Signal Generator
MS2830A-027	ARB Memory Upgrade 256 Msa for Vector Signal Generator
MS2830A-028	AWGN
MS2830A-029[*7]	Analog Function Extension for Vector Signal Generator
MS2830A-088	3.6 GHz Analog Signal Generator
	Retrofit Options
MS2830A-101	Rubidium Reference Oscillator Retrofit
MS2830A-102	High Stability Reference Oscillator Retrofit
MS2830A-105[*1]	Analysis Bandwidth Extension to 31.25 MHz Retrofit (Requires MS2830A-006)
MS2830A-106	Analysis Bandwidth 10 MHz Retrofit
MS2830A-108	Preamplifier Retrofit
MS2830A-110	Phase Noise Measurement Function Retrofit
MS2830A-111	2ndary HDD Retrofit
MS2830A-116	Precompliance EMI Function Retrofit
MS2830A-117	Noise Figure Measurement Function Retrofit
MS2830A-118	Audio Analyzer Retrofit
MS2830A-126[*2]	BER Measurement Function Retrofit (AUX Conversion Adapter J1556A as standard accessory)
MS2830A-352[*6]	Internal Signal Generator Control Function User-Installable
MS2830A-120	3.6 GHz Vector Signal Generator Retrofit
MS2830A-121	6 GHz Vector Signal Generator Retrofit
MS2830A-122	Low Power Extension for Vector Signal Generator Retrofit
MS2830A-127	ARB Memory Upgrade 256 Msa for Vector Signal Generator Retrofit
MS2830A-128	AWGN Retrofit
MS2830A-188	3.6 GHz Analog Signal Generator Retrofit
MS2830A-189	Vector Function Extension for Analog Signal Generator Retrofit
MS2830A-152[*6]	Internal Signal Generator Control Function Retrofit
MS2830A-182[*8]	CPU/Windows10 Upgrade Retrofit
MS2830A-282[*8]	CPU/Windows10 Upgrade Retrofit

Model/Order No.	Name
	Software Options
	CD-ROM with License and Operation manuals
MX269011A	W-CDMA/HSPA Downlink Measurement Software
MX269012A	W-CDMA/HSPA Uplink Measurement Software
MX269013A	GSM/EDGE Measurement Software
MX269013A-001	EDGE Evolution Measurement Software (Requires MX269013A)
MX269015A	TD-SCDMA Measurement Software
MX269017A	Vector Modulation Analysis Software
MX269018A	Analog Measurement Software (For MS2830A. Requires MS2830A-066 and A0086D)
MX269020A	LTE Downlink Measurement Software
MX269020A-001	LTE-Advanced FDD Downlink Measurement Software (Requires MX269020A)
MX269021A	LTE Uplink Measurement Software
MX269021A-001	LTE-Advanced FDD Uplink Measurement Software (Requires MX269021A)
MX269022A	LTE TDD Downlink Measurement Software
MX269022A-001	LTE-Advanced TDD Downlink Measurement Software (Requires MX269022A)
MX269023A	LTE TDD Uplink Measurement Software
MX269023A-001	LTE-Advanced TDD Uplink Measurement Software (Requires MX269023A)
MX269024A	CDMA2000 Forward Link Measurement Software
MX269024A-001	All Measure Function (Requires MX269024A)
MX269026A	EV-DO Forward Link Measurement Software
MX269026A-001	All Measure Function (Requires MX269026A)
MX269028A	WLAN (802.11) Measurement Software
MX269028A-001	802.11ac (80 MHz) Measurement Software (For MS2830A. Requires MX269028A.)
MX269030A	W-CDMA BS Measurement Software
MX269901A	HSDPA/HSUPA IQproducer
MX269902A	TDMA IQproducer
MX269904A	Multi-Carrier IQproducer
MX269908A	LTE IQproducer
MX269908A-001	LTE-Advanced FDD Option (Requires MX269908A)
MX269910A	LTE TDD IQproducer
MX269910A-001	LTE-Advanced TDD Option (Requires MX269910A)
MX269911A	WLAN IQproducer
MX269911A-001	802.11ac (80 MHz) Option (Requires MX269911A)
MX269912A	TD-SCDMA IQproducer
	Warranty Service
MS2830A-ES210	2 years Extended Warranty Service
MS2830A-ES310	3 years Extended Warranty Service
MS2830A-ES510	5 years Extended Warranty Service

Continued on next page

*1: Requires MS2830A-006/106.

*2: The AUX Conversion Adapter J1556A is a standard accessory supplied with MS2830A-026/126.

*3: Retrofit not supported.
MS2830A-066 sometimes cannot be installed depending on options.

Model	Case 1	Case 2	Case 3
MS2830A-020/021	Yes	Yes	No
MS2830A-043	Yes	No	Yes
MS2830A-066	No	Yes	Yes

*4: Retrofit not supported. Requires MS2830A-005 and MS2830A-006.

*5: Retrofit not supported. Requires MS2830A-005, MS2830A-006 and MS2830A-077.

*6: Requires any of MS2830A-020/120, 021/121, or 088/188.
For details, refer to the Options Configuration Guide: Hardware item.

*7: Please contact our sales representative when requesting retrofitting.

*8: Replace the CPU board and upgrade the OS to Windows 10.
Due to OS license restrictions, this option is not applicable to MS2830A units in which Option MS2830A-313 Removable HDD (sales discontinued) is installed.

Model/Order No.	Name
	Application Parts
	Following operation manuals provided as hard copy
W3334AE	MS2830A Operation Manual (Mainframe Operation)
W2851AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Mainframe Remote Control)
W3335AE	MS2830A/MS2840A/MS2850A Operation Manual (Signal Analyzer Function Operation)
W2853AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Signal Analyzer Function Remote Control)
W3336AE	MS2830A/MS2840A/MS2850A Operation Manual (Spectrum Analyzer Function Operation)
W2855AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Spectrum Analyzer Function Remote Control)
W3117AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Phase Noise Measurement Function Operation)
W3118AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Phase Noise Measurement Function Remote Control)
W3655AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A-017 Operation Manual (Noise Figure Measurement Function Operation)
W3656AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A-017 Operation Manual (Noise Figure Measurement Function Remote control)
W3337AE	MS2830A/MS2840A-020/021 Operation Manual (Vector Signal Generator Option Operation)
W3338AE	MS2830A/MS2840A-020/021 Operation Manual (Vector Signal Generator Option Remote Control)
W2914AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A Operation Manual (IQproducer for Vector Signal Generator Option)
W2929AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A Operation Manual (Standard Waveform Pattern for Vector Signal Generator Option)
W2919AE	MX269010A Operation Manual (Operation)
W2954AE	MX269010A Operation Manual (Remote Control)
W3098AE	MX269011A Operation Manual (Operation)
W3099AE	MX269011A Operation Manual (Remote Control)
W3060AE	MX269012A Operation Manual (Operation)
W3061AE	MX269012A Operation Manual (Remote Control)
W3100AE	MX269013A Operation Manual (Operation)
W3101AE	MX269013A Operation Manual (Remote Control)
W3044AE	MX269015A Operation Manual (Operation)
W3045AE	MX269015A Operation Manual (Remote Control)
W3305AE	MX269017A Operation Manual (Operation)
W3306AE	MX269017A Operation Manual (Remote Control)
W3555AE	MX269018A Operation Manual (Operation)
W3556AE	MX269018A Operation Manual (Remote Control)
W3014AE	MX269020A Operation Manual (Operation)
W3064AE	MX269020A Operation Manual (Remote Control)
W3015AE	MX269021A Operation Manual (Operation)
W3065AE	MX269021A Operation Manual (Remote Control)
W3209AE	MX269022A Operation Manual (Operation)
W3210AE	MX269022A Operation Manual (Remote Control)
W3521AE	MX269023A Operation Manual (Operation)
W3522AE	MX269023A Operation Manual (Remote Control)
W3201AE	MX269024A Operation Manual (Operation)
W3202AE	MX269024A Operation Manual (Remote Control)
W3203AE	MX269026A Operation Manual (Operation)
W3204AE	MX269026A Operation Manual (Remote Control)
W3528AE	MX269028A Operation Manual (Operation)
W3529AE	MX269028A Operation Manual (Remote Control)
W2860AE	MX269030A Operation Manual (Operation)
W2861AE	MX269030A Operation Manual (Remote Control)
W2915AE	MX269901A Operation Manual
W2916AE	MX269902A Operation Manual
W2917AE	MX269904A Operation Manual
W3023AE	MX269908A Operation Manual
W3221AE	MX269910A Operation Manual
W3488AE	MX269911A Operation Manual
W3582AE	MX269912A Operation Manual

Model/Order No.	Name
K240B	Power Divider (K connector, DC to 26.5 GHz, 50Ω, K-J, 1 W max.)
MA1612A	Four-port Junction Pad (5 MHz to 3 GHz, N-J)
J1640A	Resistive Power Tap (DC to 3000 MHz, Maximum Allowable Power: 16 W)
J0576B	Coaxial Cord, 1 m (N-P · 5D-2W · N-P)
J0576D	Coaxial Cord, 2 m (N-P · 5D-2W · N-P)
J0127A	Coaxial Cord, 1 m (BNC-P · RG58A/U · BNC-P)
J0127B	Coaxial Cord, 2 m (BNC-P · RG58A/U · BNC-P)
J0127C	Coaxial Cord, 0.5 m (BNC-P · RG58A/U · BNC-P)
J0322A	Coaxial Cord, 0.5 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322B	Coaxial Cord, 1 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322C	Coaxial Cord, 1.5 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322D	Coaxial Cord, 2 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0805	DC Block, N type (MODEL 7003) (10 kHz to 18 GHz, N-P · N-J)
J1555A	DC Block, SMA type (MODEL 7006-1) (9 kHz to 20 GHz, SMA-P · SMA-J)
K261	DC Block (10 kHz to 40 GHz, K-P · K-J)
J0004	Coaxial Adapter (DC to 12.4 GHz, 50Ω, N-P · SMA-J)
J1398A	N-SMA Adaptor (DC to 26.5 GHz, 50Ω, N-P · SMA-J)
34AKNF50	Ruggedized K-to-Type N Adapter (DC to 20 GHz, 50Ω, Ruggedized K-M · N-F, SWR: 1.5 (max.), Insertion Loss: 0.4 dB (max.))
J1359A	Coaxial Adaptor (K-P · K-J, SMA)
J0911	Coaxial Cable, 1.0 m for 40 GHz (DC to 40 GHz, approx. 1 m, SF102A, 11K254/K254/1.0M)
J0912	Coaxial Cable, 0.5 m for 40 GHz (DC to 40 GHz, approx. 0.5 m, SF102A, 11K254/K254/0.5M)
G0392A	High Pass Filter (PassBand >90 MHz)
G0393A	High Pass Filter (PassBand >225 MHz)
G0394A	High Pass Filter (PassBand >395 MHz)
1030-151-R	Filter, Hi-Pass, 700 MHz, N (m) to N (f), 50Ω
41KC-3	Fixed Attenuator (DC to 40 GHz, 3 dB)
J0063	30DB FIXED ATTENUATOR (DC to 12.4 GHz, N-type, Maximum Allowable Power: 10 W)
J0078*11	HIGH POWER ATTENUATOR (20 dB, DC to 18 GHz, N-type, Maximum Allowable Power: 10 W)
J0395	FIXED ATTENUATOR FOR HIGH POWER (30 dB) (DC to 9 GHz, N-type, Maximum Allowable Power: 30 W)
B0472*11	FIXED ATTENUATOR FOR HIGH-POWER (30 dB, DC to 18 GHz, Maximum Allowable Power: 100 W)
J1750A	10 dB Fixed Attenuator (DC to 18 GHz, Input Power <5 W)
J1751A	20 dB Fixed Attenuator (DC to 18 GHz, Input Power <5 W)
J1752A	30 dB Fixed Attenuator (DC to 18 GHz, Input Power <5 W)
J1753A	3 dB Fixed Attenuator (DC to 18 GHz, Input Power <5 W)
J1754A	6 dB Fixed Attenuator (DC to 18 GHz, Input Power <5 W)
J1755A	Termination (50Ω, Type N, DC to 18 GHz)
J1261A	Ethernet Cable (Shield type, Straight, 1 m)
J1261B	Ethernet Cable (Shield type, Straight, 3 m)
J1261C	Ethernet Cable (Shield type, Cross, 1 m)
J1261D	Ethernet Cable (Shield type, Cross, 3 m)
J0008	GPIB Cable, 2.0 m
J1556A*9	AUX Conversion Adapter (AUX → BNC, for vector signal generator option and BER measurement function option)
A0086D	USB Audio (for MX269018A)
B0635A	Rack Mount Kit (EIA)
B0657A	Rack Mount Kit (JIS)
B0636C*10	Carrying Case (Hard type, with casters)
B0671A*10	Front Cover for 1MW4U
MA24105A	Inline Peak Power Sensor (350 MHz to 4 GHz, with USB A to mini B cable)
MA24106A	USB Power Sensor (50 MHz to 6 GHz, with USB A to mini B cable)
MA24108A	Microwave USB Power Sensor (10 MHz to 8 GHz, with USB A to Micro-B cable)
MA24118A	Microwave USB Power Sensor (10 MHz to 18 GHz, with USB A to Micro-B cable)
MA24126A	Microwave USB Power Sensor (10 MHz to 26 GHz, with USB A to Micro-B cable)
Z0975A	Keyboard (USB)
Z1345A	Installation Kit (required when retrofitting options or installing software)

*9: The AUX Conversion Adapter J1556A is not a standard accessory for the Vector Signal Generator Option MS2830A-020/120/021/121.
The AUX Conversion Adapter J1556A is a standard accessory supplied with BER Measurement Function MS2830A-026/126.

*10: The Carrying Case B0636C includes a Front Panel Protective Cover (B0671A).

*11: RoHS non-compliant product
Cannot be shipped to the EU, UK and EFTA.

Signal Analyzer

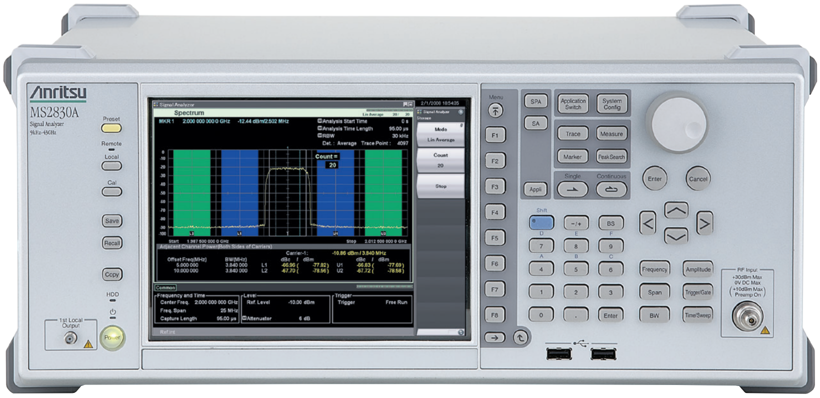
MS2830A Microwave

9 kHz to 26.5 GHz/43 GHz (26.5 GHz to 325 GHz)

Remote Control
GPIB | Ethernet | USB

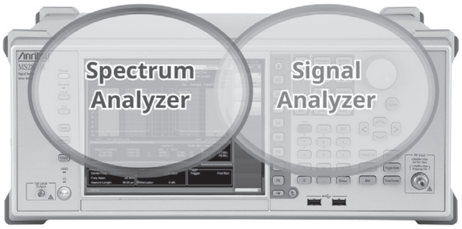
[High Speed + High Performance] × [Low Cost] + Eco-friendly

Excellent Eco Product



The Signal Analyzer MS2830A-044/045 includes a spectrum analyzer function with upper frequency limits of 26.5 GHz and 43 GHz. Combining it with the High Performance Waveguide Mixer MA2806A/MA2808A or the External Mixer MA2740C/MA2750C series supports measurements up to 325 GHz. It supports measurements of Tx characteristics, including adjacent channel leakage power, spectrum mask, and frequency counter, as well as spurious measurements requiring a wide dynamic range.
Installing the bandwidth analysis option up to 125 MHz adds signal analyzer functions for checking phenomena that are hard to check using a spectrum analyzer, such as frequency vs. time, phase vs. time, spectrogram, and CCDF. In addition, optional measurement software supports modulation analysis. Moreover, installing a preselector bypass option enables use of the signal analyzer and modulation analysis functions up to 26.5 GHz/43 GHz (MS2830A-044/045). Finally, it can be customized to support a range of application-specific measurements.

- Installing a microwave-band preamp supports measurement of weaker signals.
- Using the 1st local signal output as an external mixer supports measurement of high-frequency signals up to 325 GHz.
- Using the 1st IF signal output as a down converter supports analysis in combination with external equipment.



Key Features

Basic Performance/Functions

- Frequency Range
  MS2830A-044: 9 kHz to 26.5 GHz
  MS2830A-045: 9 kHz to 43 GHz
- Measures up to 325 GHz using High Performance Waveguide Mixer and External Mixer
  Frequency Range:
    26.5 GHz to 325 GHz (External Mixer)
    50 GHz to 90 GHz (High Performance Waveguide Mixer)
  Built-in connector to connect High Performance Waveguide Mixer and External Mixer (MS2830A-044/045)
    Connector: SMA-J, 50Ω
    Local Signal Output: 5 GHz to 10 GHz
    IF Signal Frequency: 1.875 GHz
- Excellent Dynamic Range[*1]:
  159 dB (at 25 GHz)
    TOI[*2]: ≥+13 dBm, DANL[*3]: –146 dBm/Hz
  157 dB (at 40 GHz)
    TOI: ≥+13 dBm (nom.), DANL: –144 dBm/Hz
- Preamp up to 43 GHz
  → MS2830A-068/168: Microwave Preamplifier
  DANL[*3]: –156 dBm/Hz (at 25 GHz)[*4], –150 dBm/Hz (at 40 GHz)[*4]
- Total Level Accuracy:
  ±0.5 dB (300 kHz ≤ f < 4 GHz), ±3.0 dB (13.8 GHz < f ≤ 40 GHz)
- Used as Wideband Down Converter
  Built-in IF Output Function (MS2830A-044/045)
    Connector: SMA-J, 50Ω
    IF Output Frequency: 1.875 GHz
    IF Output Bandwidth: 1 GHz (3 dB Bandwidth, nom.)[*5]
    Gain: –10 dB (nom.)
- Improved Level Linearity
- Reference Oscillator
  Pre-installed Reference Oscillator
    Aging Rate: ±1 × 10^{-7}/year, ±1 × 10^{-8}/day
    Start-up Characteristics: ±5 × 10^{-8} (5 minutes after power-on)
  Rubidium Reference Oscillator (MS2830A-001)
    Aging Rate: ±1 × 10^{-10}/month
    Start-up Characteristics: ±1 × 10^{-9} (7 minutes after power-on)

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*1: Difference between TOI and DANL as simple guide
*2: TOI (Third Order Intercept)
*3: DANL (Displayed Average Noise Level)
*4: Spectrum Analyzer functions
*5: When using external mixer bands, or using internal micro frequency bands (Band; 3 to 9) with Microwave Preselector Bypass option: On

- Versatile Built-in Functions
  - Channel Power
  - Adjacent Channel Leakage Power
  - Spurious Emission*1
  - Frequency Counter*1
  - FM Deviation*2
  - Highest 10 Markers
  - Occupied Bandwidth
  - Spectrum Emission Mask*1
  - Burst Average Power
  - AM Depth*2
  - Multi-marker & Marker List
  - Limit Line*1
  - 2-tone 3rd-order Intermodulation Distortion*1
  - Annotation Display (On/Off)
  - Phase Noise*4
  - Power Meter*3
  - Noise Figure*5
- Low-power Consumption
  MS2830A-044/045: 190 VA (nom.)

Signal Analyzer Functions

- Analysis Bandwidth
  MS2830A-006: 10 MHz max.
  (20 MHz max. sampling rate = 50 ns resolution, ADC resolution 16 bits)
  MS2830A-005*6, Option 009*7: 31.25 MHz max.
  (50 MHz max. sampling rate = 20 ns resolution, ADC resolution 16 bits)
  MS2830A-077*8: 62.5 MHz max.
  (100 MHz max. sampling rate = 10 ns resolution, ADC resolution 14 bits)
  MS2830A-078*9: 125 MHz max.
  (200 MHz max. sampling rate = 5 ns resolution, ADC resolution 14 bits)

Note: An image response is received when setting the bandwidth to more than 31.25 MHz. This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.).
The Signal Analyzer MS2690A is recommended for other measurement purposes.

- Capture Function
  Saves analysis Span × Time signal to internal memory and writes to hard disk. Up to 100 Msamples per measurement saved to internal memory.
  Example: Span 1 MHz: Max. capture time 50 s
  Span 10 MHz: Max. capture time 5 s
  Span 100 MHz: Max. capture time 0.5 s
- Replay Function
  Reads saved data and replays using signal analyzer function.
  Example:
  1. Data sharing between R&D and manufacturing
  2. Later laboratory bench-top analysis of on-site signals
- Measurement with Sub-trace Display
  Split screen displaying both main and sub-traces at same time to check errors
  Main: Spectrum, Frequency vs. Time, Power vs. Time, Phase vs. Time, CCDF/APD, Spectrogram
  Sub: Power vs. Time, Spectrogram
- Supports 125 MHz Wideband Measurements up to 43 GHz
  → MS2830A-067: Microwave Preselector Bypass
  → MS2830A-078*9:Analysis Bandwidth Extension to 125 MHz
  Bypassing preselector improves RF frequency characteristics and in-band frequency characteristics. Supports modulation analysis and signal analyzer measurements for signals up to 43 GHz.

BER Measurement Function (MS2830A-026)

This option measures BER using Data/Clock/Enable demodulated at the DUT.

Input Bit Rate: 100 bps to 10 Mbps
Input Level: TTL Level

*1: Spectrum Analyzer Functions
*2: Signal Analyzer functions (requires MS2830A-005/006/009/077/078)
*3: Power Meter Function (use USB power sensors)
*4: Phase Noise Measurement Function (requires MS2830A-010)
*5: Noise Figure Measurement function (Requires MS2830A-017)
[Use Noise Sources (Noisecom, NC346 series)]
*6: MS2830A-005 can be installed in MS2830A-044. Requires MS2830A-006.
*7: MS2830A-009 can be installed in MS2830A-045. Requires MS2830A-006.
*8: Requires MS2830A-006 and MS2830A-005 (for MS2830A-044).
Requires MS2830A-006 and MS2830A-009 (for MS2830A-045).
*9: Requires MS2830A-006, MS2830A-005 and MS2830A-077 (for MS2830A-044).
Requires MS2830A-006, MS2830A-009 and MS2830A-077 (for MS2830A-045).

Basic Performance

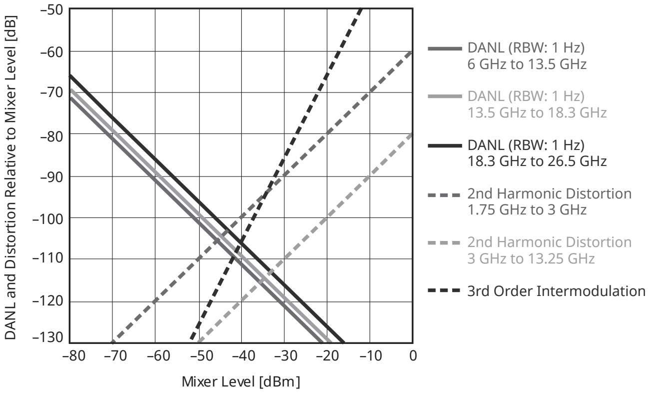
Dynamic Range*10

159 dB (at 25 GHz)
TOI*11: ≥+13 dBm (6 GHz < f ≤ 26.5 GHz)
DANL*12: –146 dBm/Hz (18.3 GHz < f ≤ 34 GHz)
157 dB (at 40 GHz)
TOI: ≥+13 dBm (nom., 26.5 GHz < f ≤ 40 GHz)
DANL: –144 dBm/Hz (34 GHz < f ≤ 40 GHz)

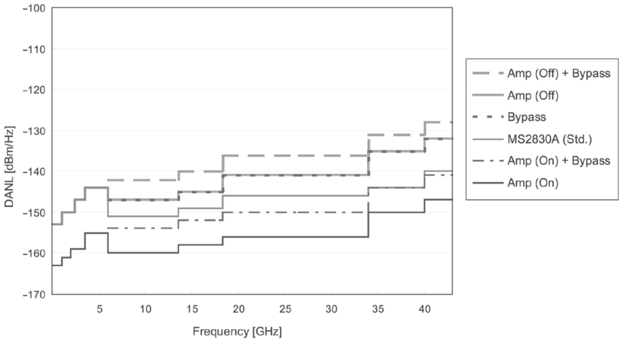
*10: Difference between TOI and DANL as simple guide
*11: TOI (Third Order Intercept)
*12: DANL (Displayed Average Noise Level)

Dynamic range is a key specification for spectrum analyzers. Low displayed average noise level (DANL) as well as high TOI are important too. Low TOI may cause distortion with high-level carrier signals. Inserting an attenuator can lower the carrier level but this has the effect of lowering the level of weak spurious, making it hard to measure.
The MS2830A has an excellent dynamic range supporting true performance measurements of devices, such as base stations, requiring wideband measuring instruments.

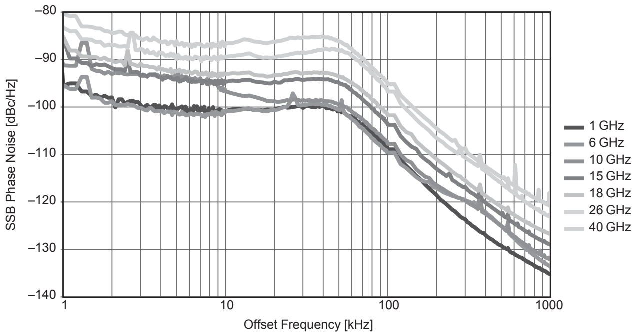
Distortion Characteristics (Spectrum Analyzer)



DANL (MS2830A-045)
Amp (Preamplifier: MS2830A-068), Bypass (Preselector Bypass: MS2830A-067/009)



Example: SSB Phase Noise (Spectrum Analyzer/Signal Analyzer Common)



Total Level Accuracy

±0.5 dB (300 kHz ≤ f <4 GHz)
±1.8 dB (4 GHz ≤ f ≤ 13.8 GHz)
±3.0 dB (13.8 GHz < f ≤ 40 GHz)

The absolute level accuracy in most spectrum analyzer catalogs does not include frequency characteristics, linearity, and attenuator switching error.
However, the MS2830A Total Level Accuracy in the catalog includes the above three errors.
Even when changing the frequency and attenuator, stable measurement is assured in the specified error range.

The MS2830A total level accuracy includes:
- Frequency characteristics
- Linearity
- Attenuator switching error

Preamp up to 43 GHz (Microwave Preamplifier MS2830A-068)

DANL: −156 dBm/Hz (at 25 GHz)
−150 dBm/Hz (at 40 GHz)

Installing the Microwave Preamplifier (MS2830A-068) amplifies signals before the mixer to improve the spectrum analyzer and signal analyzer sensitivity. This is recommended when measuring low-level signals, such as noise and interference signals.

Frequency range: 100 kHz to 26.5 GHz (MS2830A-044)
100 kHz to 43 GHz (MS2830A-045)

*: Simultaneous installation with MS2830A-008 not supported

Measures Up To 325 GHz using High Performance Waveguide Mixer and External Mixer

High Performance Waveguide Mixer MA2806A and MA2808A Targeting Spectrum Analysis for Wider-Band Millimeter-Wave Wireless Transmitters

The High Performance Waveguide Mixer MA2806A and MA2808A are new mixers for connection to the Signal Analyzer MS2830A with frequency option 044 or option 045. It has the good features of both a harmonic mixer and a down converter and is ideal for spectrum analysis of millimeter-wave (50 GHz to 90 GHz-band) wireless transmitters now being used for future wider-band applications, such as wireless backhaul, automotive radar, etc.

Model	Name	Frequency Band	Frequency Range	Waveguide Flange	Waveguide Size
MA2806A	High Performance Waveguide Mixer (50 to 75 GHz)	V band	50 GHz to 75 GHz	UG-385/U	WR15
MA2808A	High Performance Waveguide Mixer (60 to 90 GHz)	E band	60 GHz to 90 GHz	UG-387/U	WR12

Specifications in back of this catalog

MA2808A

Features

- Wide dynamic range based on excellent minimum sensitivity and P1dB performance
- Image-response-free measurement of wideband signals plus high IF frequency and PS function

For Further information see MA2806A/MA2808A page.

Minimum Recommended Configuration

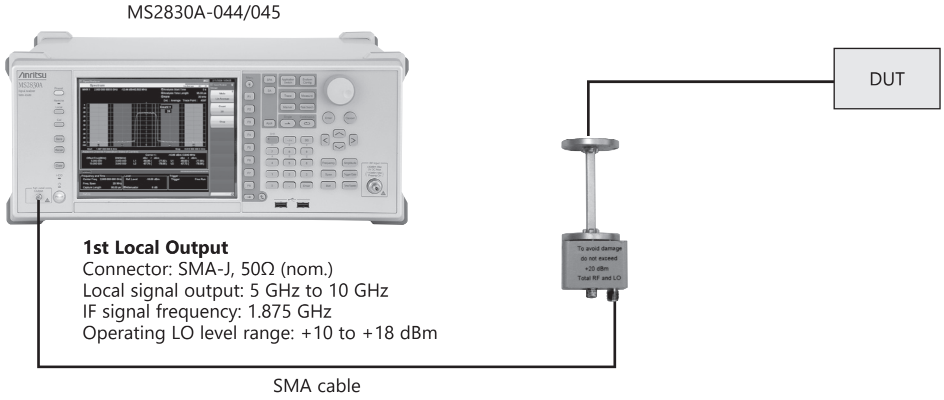
Model No.	Name	Notes
MS2830A	Signal Analyzer	Main unit
MS2830A-044	26.5 GHz Signal Analyzer	Select upper frequency Select one of MS2830A-044 or MS2830A-045 options
MS2830A-045	43 GHz Signal Analyzer	
MA2806A	High Performance Waveguide Mixer (50 to 75 GHz)	Select mixer model Select one of MA2806A or MA2808A
MA2808A	High Performance Waveguide Mixer (60 to 90 GHz)	

External Mixers (MA2740C/MA2750C Series)

The MA2740C/MA2750C series of External Mixers (Harmonic Mixers) supports spectrum measurements up to 325 GHz with high sensitivity and fewer LO harmonic order because these mixers output 1st local signals from 5 GHz to 10 GHz.

Model	Name	Frequency Band	Frequency Range	LO Harmonic Order	Mixing Mode	Conversion Loss* (dB)	Waveguide Flange		Wave Guide Size
								UG-xxx/U Equivalent	
MA2741C	External Mixer	A Band	26.5 GHz to 40 GHz	4	+	23	MIL-DTL-3922/54-003	UG-599U	WR28
MA2742C	External Mixer	Q Band	33 GHz to 50 GHz	5	+	26	MIL-DTL-3922/67D-006	UG-383U	WR22
MA2743C	External Mixer	U Band	40 GHz to 60 GHz	6	+	28	MIL-DTL-3922/67D-007	UG-383U-M	WR19
MA2744C	External Mixer	V Band	50 GHz to 75 GHz	8	+	32	MIL-DTL-3922/67D-008	UG-385/U	WR15
MA2745C	External Mixer	E Band	60 GHz to 90 GHz	9	+	36	MIL-DTL-3922/67D-009	UG-387/U	WR12
MA2746C	External Mixer	W Band	75 GHz to 110 GHz	11	+	39	MIL-DTL-3922/67D-010	UG-387/U-M	WR10
MA2747C	External Mixer	F Band	90 GHz to 140 GHz	14	+	40	MIL-DTL-3922/67D-M08	UG-387/U-M	WR08
MA2748C	External Mixer	D Band	110 GHz to 170 GHz	17	+	45	MIL-DTL-3922/67D-M06	UG-387/U-M	WR06
MA2749C	External Mixer	G Band	140 GHz to 220 GHz	22	+	50	MIL-DTL-3922/67D-M05	UG-387/U-M	WR05
MA2750C	External Mixer	Y Band	170 GHz to 260 GHz	26	+	65	MIL-DTL-3922/67D-M04	UG-387/U-M	WR04
MA2751C	External Mixer	J Band	220 GHz to 325 GHz	33	+	70	MIL-DTL-3922/67D-M03	UG-387/U-M	WR03

*: The Conversion loss is a typical value near the center frequency of each band but is not a guaranteed specification.



1st Local Output
Connector: SMA-J, 50Ω (nom.)
Local signal output: 5 GHz to 10 GHz
IF signal frequency: 1.875 GHz
Operating LO level range: +10 to +18 dBm

Connection Setup

Used as Wideband Down Converter: IF Output Frequency 1.875 GHz

Since IF Out supports a high frequency of 1.875 GHz, 1 GHz* wideband signals can be down converted. This can be used for down converting when performing modulation analysis by digitizing with an oscilloscope, etc.

Measurement image: Down convert signals with 80 GHz center frequency and 1 GHz* bandwidth to 1.875 GHz

*: When using external mixer bands (MA2740C/MA2750C Series), or using internal micro frequency bands (Band; 3 to 9) with Microwave Preselector Bypass option: On

Supports 125 MHz Wideband Measurements up to 43 GHz

Microwave Preselector Bypass MS2830A-067 + Analysis Bandwidth Extension to 125 MHz MS2830A-078*

*: Requires MS2830A-006, MS2830A-005 and MS2830A-077 (for MS2830A-044).
Requires MS2830A-006, MS2830A-009 and MS2830A-077 (for MS2830A-045).

Supports wideband analysis with high frequencies

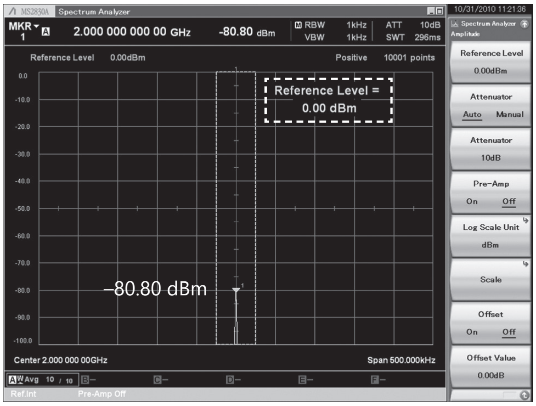
Frequency range: 4 GHz to 26.5 GHz (MS2830A-044, Frequency band mode: Normal)
4 GHz to 43 GHz (MS2830A-045, Frequency band mode: Normal)

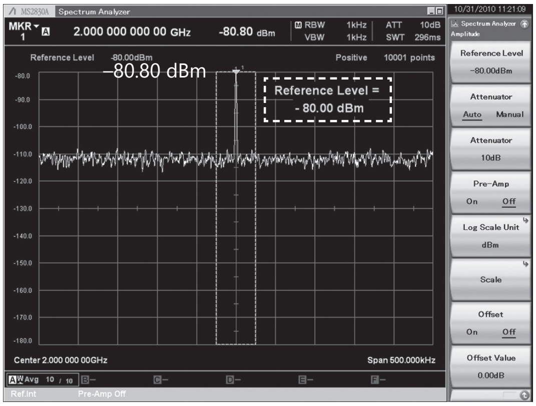
Installing the Microwave Preselector Bypass supports signal analyzer measurement functions in the above frequency range.
Adding the measurement software permits modulation analysis and is very useful for designing and inspecting high-frequency devices.

Improved Level Linearity

Conventional spectrum analyzers use an analog IF and log amp to achieve good level accuracy at points near the log scale reference level, but the accuracy degrades at points that are further away.
The MS2830A uses a digital IF instead of a log amp, which supports measurements with excellent accuracy at any point.

Example: Level Stability by Switching Reference Level

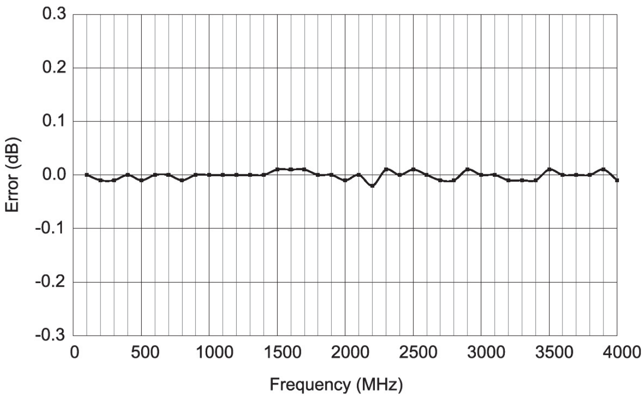




Dual Sweep Speed: Normal/Fast

When sweep time is set to [Auto], Normal (normal sweep) or Fast mode (high-speed sweep) can be set. The Fast mode sweeps six times faster than the Normal mode.

Example of Sweep Mode Switch Error: (CW –10 dBm input)
Level Error when Switching from Normal to Fast



Low Consumption Power, Excellent Eco Product

The MS2830A meets Anritsu "Excellent eco products" standard for environment-friendly products. It cuts consumed power by 50% compared to conventional models.

Power Consumption:
≤350 VA (including all options)
190 VA (nom., MS2830A-044 only, 26.5 GHz*1)
190 VA (nom., MS2830A-045 only, 43 GHz*1)
*1: Excluding other options

Resolution Bandwidth (RBW)

Setting Range

- Spectrum Analyzer:
  1 Hz to 3 MHz (1-3 sequence),
  500 Hz, 50 kHz, 2 MHz, 5 MHz, 10 MHz, 20 MHz*2, 31.25 MHz*2, *3,
  200 Hz (6 dB)*4, 9 kHz (6 dB)*4, 120 kHz (6 dB)*4, 1 MHz (Impulse)*4
- Spectrum trace in signal analyzer mode:
  1 Hz to 1 MHz (1-3 sequence)*5
  1 Hz to 3 MHz (1-3 sequence)*6
  1 Hz to 10 MHz (1-3 sequence)*7

When monitoring two adjacent signals, the frequency resolution can be increased by reducing the resolution bandwidth (RBW).
This also has the effect of reducing the noise level.
Conversely, to confirm level variations of 20-MHz band signals such as LTE, set the RBW to 31.25 MHz.

*2: Can be set when with MS2830A-005 or MS2830A-009.
*3: Instead of Gaussian filter, 31.25 MHz RBW uses filter with flat top characteristics above 31.25 MHz.
*4: When MS2830A-016 installed.
*5: Without MS2830A-077/078, or Bandwidth: ≤31.25 MHz
*6: With MS2830A-077, Bandwidth: >31.25 MHz
*7: With MS2830A-078, Bandwidth: >31.25 MHz

Gate Sweep

Gate sweep executes sweeping only for the length of time specified by the gate length, starting from when the trigger condition is met.
A delay time until sweeping starts after the trigger condition is met can be set using trigger delay.

- The gate source can be selected from the following
  Wide IF video trigger
  External trigger
  Frame trigger
- Setting range and resolution for gate delay
  Setting range: 0 to 1 s
  Resolution: 20 ns
- Setting range and resolution for gate length
  Setting range: 50 μs to 1 s
  Resolution: 20 ns

Trigger Function

Trigger sweep executes sweeping using the specified trigger condition as the start point.

- Video trigger:
  Trigger sweeping starts in synchronization with the rise or fall of the waveform. A trigger level indicator showing the trigger level is displayed on the screen.
- Wide IF video trigger:
  An IF signal with a wide passing band of about 5 MHz is detected, and sweeping starts in synchronization with either the rise or fall of the detected signal.
- External trigger:
  Sweeping starts in synchronization with the rise or fall of the signal input via the Trigger Input connector.
- Frame trigger:
  An equipment-internal trigger signal is used to generate a trigger and start the sweep. The generation period (Period) and offset time (Offset) for the trigger signal can be set. It is also possible to resynchronize the trigger signal with either the Wide IF Video signal or an external trigger.

Three Built-in External Interfaces

The built-in Gigabit Ethernet, USB2.0, and GPIB interfaces support remote operation.

GPIB: IEEE 488.2, Rear panel, IEEE 488 bus connector
Interface functions:
SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2
Ethernet: 10/100/1000BASE-T, Rear panel, RJ-45
USB (B): USB2.0, Rear panel, USB-B connector

Saving Measurement Results

Measurement results can be saved to internal hard disk or external USB memory. Screen dumps and trace data can be saved too.

- Screen dump file type
  - BMP
  - PNG
- The color of the screen hard copy can be set as follows:
  - Normal (same as screen display)
  - Reverse
  - Monochrome
  - Reversed Monochrome

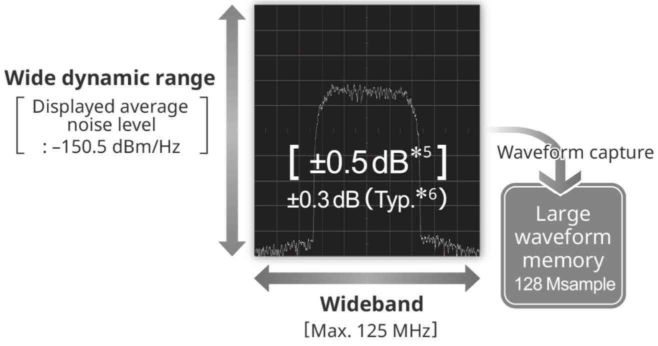
Signal Analyzer: Basic Performance/Functions

Wide Bandwidth × High Accuracy FFT Analysis

Analysis Bandwidth
MS2830A-006: 10 MHz max.
(20 MHz max. sampling rate = 50 ns resolution, ADC resolution 16 bits)
MS2830A-005*1, MS2830A-009*2: 31.25 MHz max.
(50 MHz max. sampling rate = 20 ns resolution, ADC resolution 16 bits)
MS2830A-077*3: 62.5 MHz max.
(100 MHz max. sampling rate = 10 ns resolution, ADC resolution 14 bits)
MS2830A-078*4: 125 MHz max.
(200 MHz max. sampling rate = 5 ns resolution, ADC resolution 14 bits)

Note: An image response is received when setting the bandwidth to more than 31.25 MHz. This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.). The Signal Analyzer MS2690A is recommended for other measurement purposes.

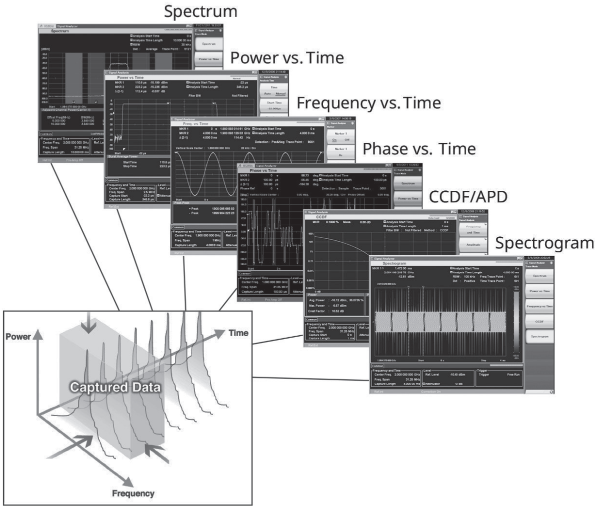
Based on the excellent level accuracy and wide dynamic range of the MS2830A, a signal with an FFT analysis bandwidth of up to 125 MHz can be captured with a level accuracy of ±0.3 dB.



*1: MS2830A-005 can be installed in MS2830A-044. Requires MS2830A-006.
*2: MS2830A-009 can be installed in MS2830A-045. Requires MS2830A-006.
*3: Requires MS2830A-006 and MS2830A-005 (for MS2830A-044).
Requires MS2830A-006 and MS2830A-009 (for MS2830A-045).
*4: Requires MS2830A-006, MS2830A-005 and MS2830A-077 (for MS2830A-044).
Requires MS2830A-006, MS2830A-009 and MS2830A-077 (for MS2830A-045).
*5: 300 kHz ≤ f < 4 GHz, Frequency band mode Normal.
*6: Excluding Guard band

Vector Signal Analysis (VSA) Function

Seamless signal capture and VSA analysis in multiple domains make it easy to evaluate burst-signal responses and capture degraded spectrum transients, etc., which cannot be checked by conventional sweep spectrum analyzers. This greatly improves design verification and troubleshooting efficiency.



Save Signals in Internal Memory

Max. Capture Time: 0.5 s to 2000 s
Max. Number of Samples: 100 Msamples

The "Analysis bandwidth × Analysis time" signal is held in internal memory and saved to hard disk.
Up to 100 Msamples of data can be saved to memory for one measurement. The frequency span determines the sampling rate.
The following chart shows the maximum capture time per frequency span.

Span*	Sampling Rate	Capture Time	Max. Sampling Data
1 kHz	2 kHz	2000 s	4M
2.5 kHz	5 kHz	2000 s	10M
5 kHz	10 kHz	2000 s	20M
10 kHz	20 kHz	2000 s	40M
25 kHz	50 kHz	2000 s	100M
50 kHz	100 kHz	1000 s	100M
100 kHz	200 kHz	500 s	100M
250 kHz	500 kHz	200 s	100M
500 kHz	1 MHz	100 s	100M
1 MHz	2 MHz	50 s	100M
2.5 MHz	5 MHz	20 s	100M
5 MHz	10 MHz	10 s	100M
10 MHz	20 MHz	5 s	100M
25 MHz	50 MHz	2 s	100M
31.25 MHz	50 MHz	2 s	100M
50 MHz	100 MHz	500 ms	50M
62.5 MHz	100 MHz	500 ms	50M
100 MHz	200 MHz	500 ms	100M
125 MHz	200 MHz	500 ms	100M

*: With MS2830A-006: 1 kHz to 10 MHz
With MS2830A-005/006 (for MS2830A-044) or
MS2830A-006/009 (for MS2830A-045): 1 kHz to 31.25 MHz
With MS2830A-005/006/077 (for MS2830A-044) or
MS2830A-006/009/077 (for MS2830A-045): 1 kHz to 62.5 MHz
With MS2830A-005/006/077/078 (for MS2830A-044) or
MS2830A-006/009/077/078 (for MS2830A-045): 1 kHz to 125 MHz

Replay Function for Comparison Evaluation

This function reads saved data and replays it using the signal analyzer measurement function.

Examples:
1. Data sharing between separate R&D and manufacturing
2. Later laboratory bench-top analysis of on-site signals
3. Save data at shipment and re-verify if problem occurs

Signal Analyzer: Trace

Spectrum

The Spectrum trace displays a graph with amplitude on the y-axis and frequency on the x-axis. The captured IQ data is FFT processed (fast Fourier transformed) and converted from the time domain to the frequency domain for display as a spectrum.

Power vs. Time

The Power vs. Time trace displays a graph with amplitude on the y-axis and time on the x-axis to confirm changes in power with time of measured signals.

Frequency vs. Time

The Frequency vs. Time trace displays a graph with frequency on the y-axis and time on the x-axis to confirm time variation of the measured signal frequency.

Phase vs. Time

The Phase vs. Time trace displays a graph with phase on the y-axis and time on the x-axis to confirm time variation of the measured signal phase.

CCDF*1/APD*2

The CCDF trace displays the power variation probability on the y-axis and power variation on the y-axis to confirm the CCDF and APD of measured signals.

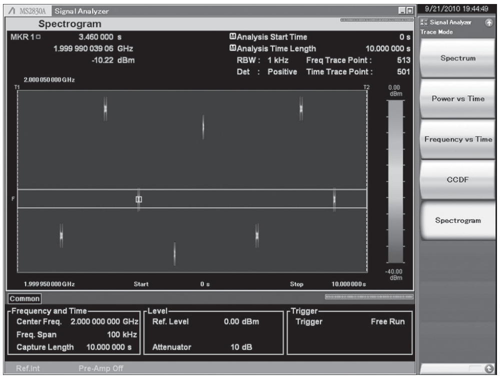
*1: CCDF (Complementary Cumulative Distribution Function)
*2: APD (Amplitude Probability Density)

Measurement Results

- CCDF: The CCDF display indicates the cumulative distribution of transient power variations compared to average power.
- APD: The APD display indicates the probability distribution of transient power fluctuations compared to average power.

Spectrogram

The Spectrogram trace displays the level as color with frequency on the y-axis and time on the x-axis. The captured IQ data is FFT processed to confirm time variations in the continuous spectrum.
It is useful for monitoring frequency hopping and transient signals.



MKR 1 3.460 000 s
1.999 990 039 06 GHz
-10.22 dBm
Analysis Start Time 0 s
Analysis Time Length 10.000 000 s
RBW : 1 kHz Freq Trace Point : 513
Det : Positive Time Trace Point : 501

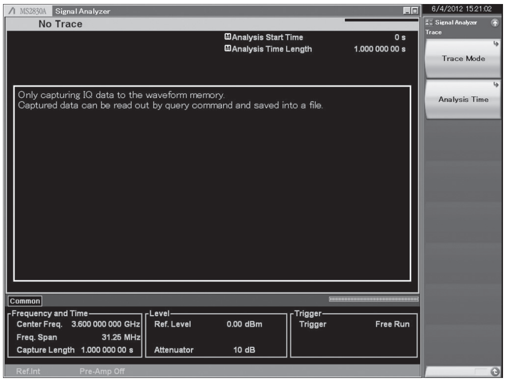
Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 100 kHz
Capture Length 10.000 000 s

Level
Ref. Level 0.00 dBm
Attenuator 10 dB

Trigger
Trigger Free Run

No Trace

No Trace mode does not execute signal analysis. Therefore, “IQ data output” and “IQ data readout using remote commands” can be executed quickly without the need to wait for completion of analysis.



Analysis Start Time 0 s
Analysis Time Length 1.000 000 00 s

Only capturing IQ data to the waveform memory.
Captured data can be read out by query command and saved into a file.

Frequency and Time
Center Freq. 3.600 000 000 GHz
Freq. Span 31.25 MHz
Capture Length 1.000 000 00 s

Level
Ref. Level 0.00 dBm
Attenuator 10 dB

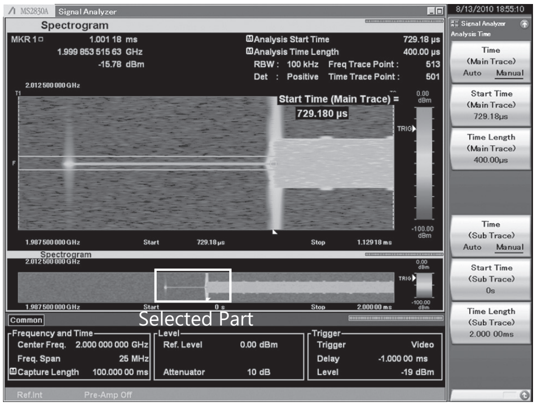
Trigger
Trigger Free Run

Measurement with Sub-trace Display

This function splits the screen into top and bottom halves; simultaneous display of the sub-trace supports easy monitoring of fault locations and transient phenomena.

Main: Spectrum, Frequency vs. Time, Power vs. Time,
Phase vs. Time, CCDF/APD, Spectrogram
Sub: Power vs. Time, Spectrogram

The part of a previously captured long-term signal to be monitored can be selected on the sub-trace to display the problem part only on the main trace.



MKR 1 1.001 18 ms
1.999 853 515 63 GHz
-15.78 dBm
Analysis Start Time 729.18 μs
Analysis Time Length 400.00 μs
RBW : 100 kHz Freq Trace Point : 513
Det : Positive Time Trace Point : 501

Start Time (Main Trace) =
729.180 μs

Frequency and Time
Center Freq. 2.000 000 000 GHz
Freq. Span 25 MHz
Capture Length 100.000 00 ms

Level
Ref. Level 0.00 dBm
Attenuator 10 dB

Trigger
Trigger Video
Delay -1.000 00 ms
Level -19 dBm

Versatile Built-in Functions

Useful for Tx Characteristics Evaluation

The MS2830A is fully loaded with all the functions required for evaluating Tx characteristics. Tests can be performed simply and in accordance with standards using functions tailored to measurement contents.

Measure Function	SPA*1	VSA*2
Channel Power	✓	✓
Occupied Bandwidth	✓	✓
Adjacent Channel Leakage Power	✓	✓
Spectrum Emission Mask	✓	
Burst Average Power	✓	✓
Spurious Emission	✓	
AM Depth		✓
FM Deviation		✓
Multi-marker & Marker List	✓	✓
Highest 10 Markers	✓	✓
Limit Line	✓	
Frequency Counter	✓	
2-tone 3rd-order Intermodulation Distortion	✓	
Annotation Display (On/Off)	✓	
Power Meter	Independent function*3	
Phase Noise	MS2830A-010	
Noise Figure	MS2830A-017*4	

*1: SPA (Spectrum Analyzer)
*2: VSA (Vector Signal Analyzer), requires MS2830A-005/006/009/077/078
*3: Use USB Power Sensors
*4: Use Noise Sources (Noisecom, NC346 series)

Channel Power SPA VSA

This function measures channel bandwidth power. Three types of filters (Rect, Nyquist, Root Nyquist) can be selected.
Pre-installed templates for each standard support easy parameter setting.

Measurement Results

- Absolute power per Hz in channel band
- Total power in channel band

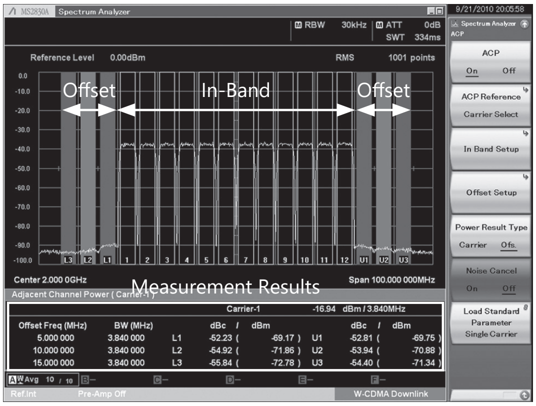
Occupied Bandwidth SPA VSA

Occupied bandwidth is measured by selecting either the N% or X-dB mode.
Pre-installed templates for each standard support easy parameter setting.

Measurement Results
- Bandwidth for specified conditions

Adjacent Channel Leakage Power SPA VSA

This function measures carrier adjacent channel (offset) power (In-Band). 1 to 12 carriers can be set and switched instantaneously on-screen. True ACLR performance is measured using the noise cancellation function to subtract main-frame noise from the measurement result. Pre-installed templates for each standard support easy parameter setting.



Adjacent Channel Power (Carrier-1)

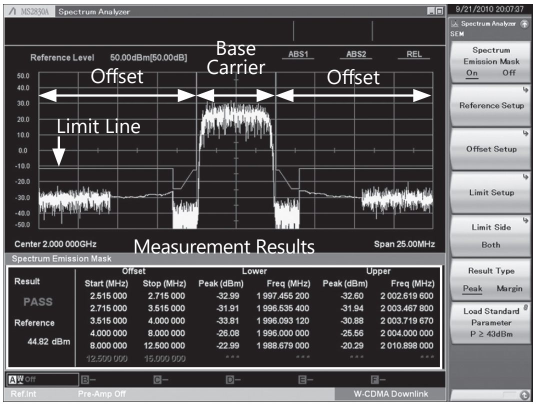
Carrier-1 -16.94 dBm / 3.840MHz

Offset Freq (MHz)	BW (MHz)		dBc / dBm			dBc / dBm	
5.000 000	3.840 000	L1	-52.23 (	-69.17)	U1	-52.81 (	-69.75)
10.000 000	3.840 000	L2	-54.92 (	-71.86)	U2	-53.94 (	-70.88)
15.000 000	3.840 000	L3	-55.84 (	-72.78)	U3	-54.40 (	-71.34)

Measurement Results
- Absolute power of Offset channel
- Relative values in relation to reference power selected in ACP reference

Spectrum Emission Mask SPA

This function splits the offset part into up to 12 segments; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment. The results are tabulated below the trace and marked PASS/FAIL. Pre-installed templates for each standard support easy parameter setting.



Spectrum Emission Mask

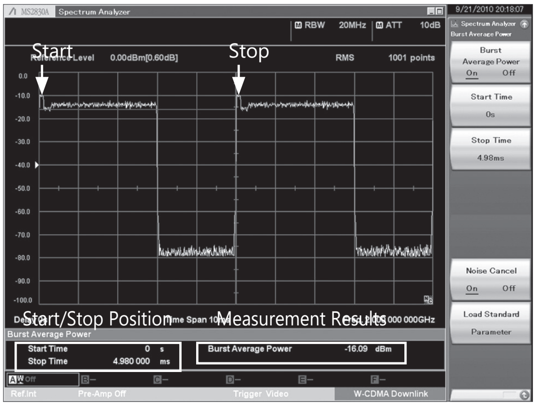
Result: PASS
Reference: 44.82 dBm

Offset		Lower		Upper	
Start (MHz)	Stop (MHz)	Peak (dBm)	Freq (MHz)	Peak (dBm)	Freq (MHz)
2.515 000	2.715 000	-32.99	1 997.455 200	-32.60	2 002.619 600
2.715 000	3.515 000	-31.91	1 996.535 400	-31.94	2 003.467 800
3.515 000	4.000 000	-33.81	1 996.093 120	-30.88	2 003.719 670
4.000 000	8.000 000	-26.08	1 996.000 000	-25.56	2 004.000 000
8.000 000	12.500 000	-22.99	1 988.679 000	-20.29	2 010.898 000
12.500 000	15.000 000	***	***	***	***

Measurement Results
- Peak power (or margin) at offset
- Each peak frequency

Burst Average Power SPA VSA

The average power for the range specified by two markers is displayed in the time domain. Measurement only requires setting the measurement start and stop positions on the screen. True performance is measured using the noise cancellation function to subtract main-frame noise from the measurement result.
Pre-installed templates for each standard support easy parameter setting.



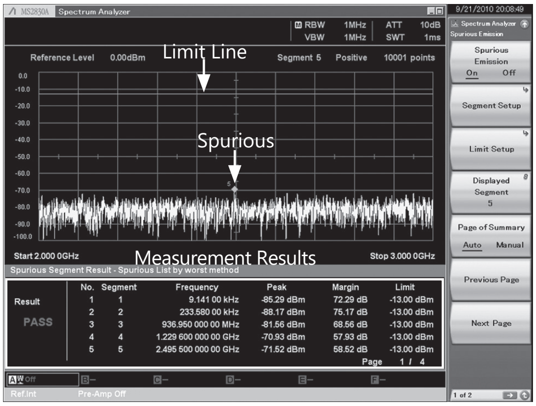
Burst Average Power

Start Time	0	s
Stop Time	4.980 000	ms
Burst Average Power	-16.09	dBm

Measurement Results
- Average power of specified range

Spurious Emission SPA

This function splits the frequency range into up to 20 segments for sweeping; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment. The results are tabulated below the trace and marked PASS/FAIL.
And, zero-span capturing of peak power in time domain is also supported.



Spurious Segment Result - Spurious List by worst method

Result: PASS

No.	Segment	Frequency	Peak	Margin	Limit
1	1	9.141 00 kHz	-85.29 dBm	72.29 dB	-13.00 dBm
2	2	233.580 00 kHz	-88.17 dBm	75.17 dB	-13.00 dBm
3	3	936.950 000 00 MHz	-81.56 dBm	68.56 dB	-13.00 dBm
4	4	1.229 600 000 00 GHz	-70.93 dBm	57.93 dB	-13.00 dBm
5	5	2.495 500 000 00 GHz	-71.52 dBm	58.52 dB	-13.00 dBm

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Measurement Results
- Each segment peak power and margin
- Each peak frequency

AM Depth VSA

The Power vs. Time trace measurement function is used to confirm AM depth.
It measures the measured signal AM based on trace data at the displayed marker. When marker is Off, the whole range is measured.

Measurement Results
- +Peak, –Peak, (Peak-Peak)/2, Average

FM Deviation VSA

The Freq. vs. Time trace measurement is used to confirm the FM deviation. It measures the maximum and minimum frequencies from trace data in the marker range. When marker is Off, the whole range is measured.

Measurement Results
- +Peak, –Peak, (Peak-Peak)/2, Average

Multi-marker & Marker List SPA VSA

Up to 10 markers can be set for this function. Markers may be either a spot or a zone. Using a zone marker, the peak of a signal with an unstable variable frequency can be tracked and measured. Not only can the 10 markers be listed below the trace but the differences between markers can be calculated and displayed using the delta setting.

Measurement Results
- Marker point frequency
- Marker point power
- Absolute power per Hz in marker bandwidth
- Total power in marker bandwidth
- Difference between any markers

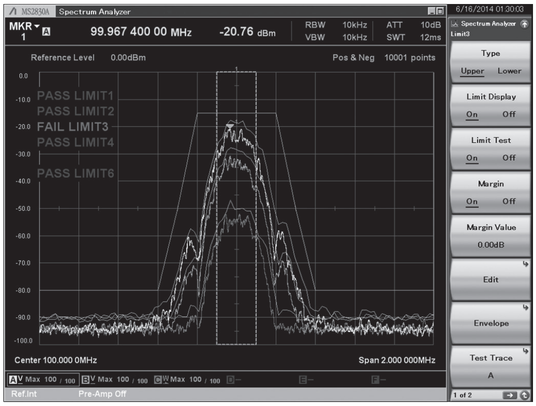
Highest 10 Markers SPA VSA

This function sets the threshold level and auto-detects peaks in the X (frequency) and Y (level/time) directions.

Measurement Results
- Peak Search Y: Sets up to 10 markers in order of peak level
- Peak Search X: Sets up to 10 markers in order of frequency (time) level

Limit Line SPA

- Setting Limit Lines
  Up to six types of Limit line can be set on the spectrum display (frequency domain).
  In addition to setting the frequency and level of crossover points manually in sequence from the low frequency, after creating the right half of a line, the left half can be created by reversing and copying the right half, to set a symmetric limit line. Additionally, a Limit line that traces the measured waveform can be created using the Limit Envelope function. A margin can be set on the Limit line in the amplitude direction.
- Evaluating using Limit Line Setting (Limit Test Function)
  When the waveform is above or below the Limit line, it is evaluated automatically as PASS or FAIL. Evaluation is also possible with an added margin. The target evaluation line can be chosen from any of six types.
- Auto-saving Waveform Data using Limit Line Setting (Save on Event Function)
  When the waveform matches the evaluation conditions (Event), it can be saved automaticaly as a csv format file. Any one of the following five Event types can be selected.
  (1) Limit Fail: Saves waveform file when evaluation result is Fail
  (2) Limit Pass: Saves waveform file when evaluation result is Pass
  (3) Margin Fail: Saves waveform file when evaluation result including margin is Fail
  (4) Margin Pass: Saves waveform file when evaluation result including margin is Pass
  (5) Sweep Complete: Saves waveform file at every measurement regardless of evaluation result


MS2830A Spectrum Analyzer
6/16/2014 01:30:03
MKR 1 A 99.967 400 00 MHz -20.76 dBm
RBW 10kHz VBW 10kHz ATT 10dB SWT 12ms
Reference Level 0.00dBm
Pos & Neg 10001 points
Center 100.000 0MHz
Span 2.000 000MHz
A V Max 100 / 100 B V Max 100 / 100 C W Max 100 / 100
Ref.Int Pre-Amp Off
Spectrum Analyzer Limit3
Type: Upper
Limit Display: On
Limit Test: On
Margin: On
Margin Value 0.00dB
Test Trace A

Example:
PASS/FAIL evaluation is performed by changing the input signal level. The evaluation results for the five line types can be displayed simultaneously on one screen.

Line: Limit 1, Limit 2, Limit 3, Limit 4, Limit 5, Limit 6
Evaluation Type: Upper Limit, Lower Limit
Crossover (Point): 1 to 100
Margin: Set Margin line for each Limit 1, 2, 3, 4, 5, 6
Evaluation Result: PASS, FAIL
Result Save: Auto-save as csv format file

Frequency Counter SPA

This function of the marker functions is used to measure CW frequencies.
Gate Time sets the measurement target time.

Measurement Results
- Marker point frequency

2-tone 3rd-order Intermodulation Distortion SPA

By inputting two different frequency CW signals (desired waves), two-tone third-order intermodulation distortion is generated close to the desired waves according to non-linear characteristics of Device Under Test (DUT). Then, Third Order Intercept (TOI) is calculated from the two-tone third-order intermodulation distortion.


MS2830A Spectrum Analyzer
5/30/2012 10:27:40
RBW 3kHz VBW 3kHz ATT 10dB SWT 27ms
Reference Level 0.00dBm
Pos & Neg 10001 points
Center 0.999 999 98GHz
Span 400.160kHz
Spectrum Analyzer TOI
TOI: On
Tone Frequency: Manual
Lower Tone Frequency 999.949 960MHz
Upper Tone Frequency 1.000 050 000GHz
IM3 Frequency Search: On
A W Off
Ref.Int Pre-Amp Off

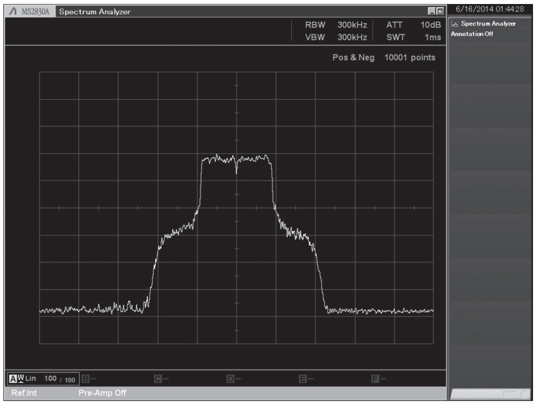
TOI

TOI (dBm)		Frequency (GHz)	Amplitude (dBm)	Amplitude (dBc)	TOI (dBm)
1.69	Lower 3rd	0.999 850 000	-43.21	-29.94	1.69
	Lower Tone	0.999 949 960	-13.28		
Amplitude (dBc)	Upper Tone	1.000 050 000	-13.27		
-29.94	Upper 3rd	1.000 149 999	-43.30	-30.02	1.74

Measurement Results
- TOI: [dBm]
- Amplitude: [dBc]

Annotation Display SPA

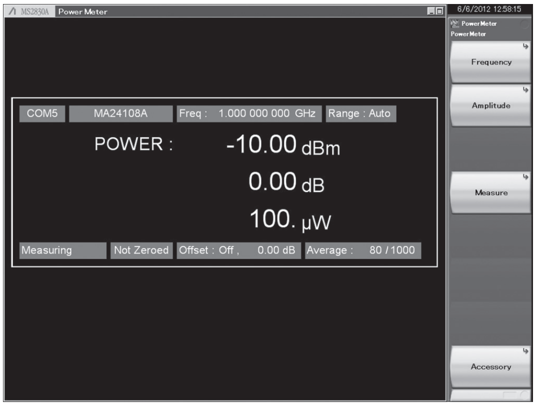
Screen annotations can be set to On or Off. Annotations about frequency, level, etc., are not displayed at the Off setting.



RBW 300kHz ATT 10dB
VBW 300kHz SWT 1ms
Pos & Neg 10001 points

Power Meter

Power meter function can connect a USB power sensor to the MS2830A and read the measurement values.



COM5 MA24108A Freq : 1.000 000 000 GHz Range : Auto

POWER : -10.00 dBm
0.00 dB
100. µW

Measuring Not Zeroed Offset : Off , 0.00 dB Average : 80 / 1000

Measurement Results
- Power: [dBm], [W]
- Relative power: [dB]

Compatible USB power sensors

Model	Frequency Range	Dynamic Range
MA24104A*	600 MHz to 4 GHz	+3 to +51.76 dBm
MA24105A	350 MHz to 4 GHz	+3 to +51.76 dBm
MA24106A	50 MHz to 6 GHz	–40 to +23 dBm
MA24108A	10 MHz to 8 GHz	–40 to +20 dBm
MA24118A	10 MHz to 18 GHz	–40 to +20 dBm
MA24126A	10 MHz to 26 GHz	–40 to +20 dBm

*: MA24104A has been discontinued.

Installing the PowerXpert™

Installing the PowerXpert™ PC application software for the Anritsu USB Power Sensor in the MS2830A supports various measurement functions offered by PowerXpert™, as well as use of other USB power sensors by the MS2830A.

PowerXpert™ for the MS2830A can be downloaded from the MS2830A and MS2830A Microwave product pages at the Anritsu website. When using the PowerXpert™ software with a PC, download the latest version from the USB Power Sensor product page at the Anritsu website.

Phase Noise (MS2830A-010)

This function measures phase noise in the 10 Hz to 10 MHz frequency offset range.

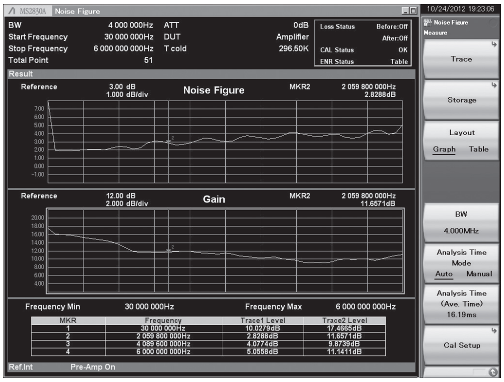
Measurement Results
- Carrier level
- Error between set frequency and carrier frequency
- Marker point phase noise level

Noise Figure Measurement (MS2830A-017)

Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source*.

Frequency Mode: Fixed, List, Sweep
DUT Mode: Amplifier, Down Converter, Up Converter
Screen Layout: Graph, Table

Measurement Results Display
Graph, List, Spot
Displays measurement results for each trace (Trace1/Trace2).
Noise Figure (NF) [dB]
Noise Factor (F) [Linear]
Gain
Y-Factor: Power ratio when Noise Source is turned ON/OFF
T effective: Effective noise temperature
P Hot: Power measured when Noise Source is On.
P Cold: Power measured when Noise Source is Off.



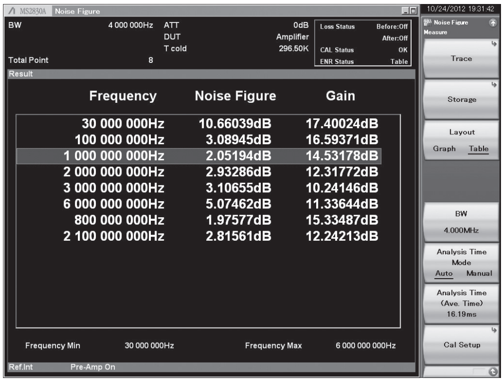
BW 4 000 000Hz ATT 0dB
Start Frequency 30 000 000Hz DUT Amplifier
Stop Frequency 6 000 000 000Hz T cold 296.50K
Total Point 51
Loss Status Before:Off After:Off
CAL Status OK
ENR Status Table

Result
Reference 3.00 dB 1.000 dB/div Noise Figure MKR2 2 059 800 000Hz 2.8288dB
Reference 12.00 dB 2.000 dB/div Gain MKR2 2 059 800 000Hz 11.6571dB

Frequency Min 30 000 000Hz Frequency Max 6 000 000 000Hz

MKR	Frequency	Trace1 Level	Trace2 Level
1	30 000 000Hz	10.0279dB	17.4665dB
2	2 059 800 000Hz	2.8288dB	11.6571dB
3	4 089 600 000Hz	4.0774dB	9.8739dB
4	6 000 000 000Hz	5.0558dB	11.1411dB

Measurement Result: Example of Graph display
(Frequency Mode: Sweep, Screen Layout: Graph)



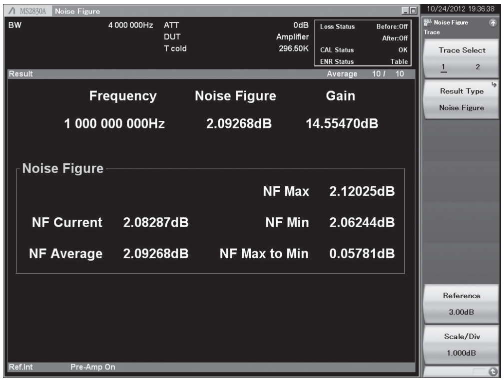
BW 4 000 000Hz ATT 0dB
DUT Amplifier
T cold 296.50K
Total Point 8
Loss Status Before:Off After:Off
CAL Status OK
ENR Status Table

Result

Frequency	Noise Figure	Gain
30 000 000Hz	10.66039dB	17.40024dB
100 000 000Hz	3.08945dB	16.59371dB
1 000 000 000Hz	2.05194dB	14.53178dB
2 000 000 000Hz	2.93286dB	12.31772dB
3 000 000 000Hz	3.10655dB	10.24146dB
6 000 000 000Hz	5.07462dB	11.33644dB
800 000 000Hz	1.97577dB	15.33487dB
2 100 000 000Hz	2.81561dB	12.24213dB

Frequency Min 30 000 000Hz Frequency Max 6 000 000 000Hz

Measurement Result: Example of List display
(Frequency Mode: List, Screen Layout: List)



BW 4 000 000Hz ATT 0dB
DUT Amplifier
T cold 296.50K
Loss Status Before:Off After:Off
CAL Status OK
ENR Status Table

Result Average 10 / 10

Frequency	Noise Figure	Gain
1 000 000 000Hz	2.09268dB	14.55470dB

Noise Figure
NF Max 2.12025dB
NF Current 2.08287dB NF Min 2.06244dB
NF Average 2.09268dB NF Max to Min 0.05781dB

Measurement Result: Example of Spot display
(Frequency Mode: Fixed)

*: Supports noise sources from Noisecom NC346 series.
See the MS2830A catalog for more details.

BER Measurement Function (MS2830A-026): Basic Performance

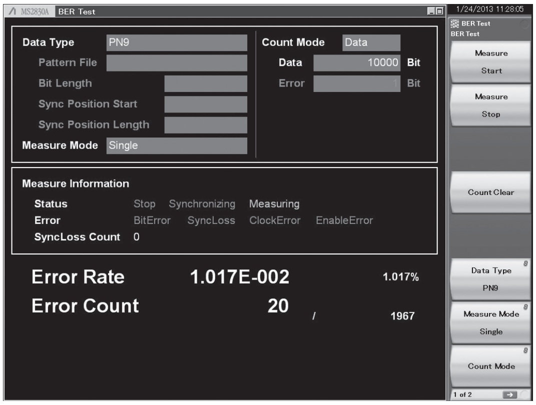
Convenient Built-in BER Measurement Function for Rx Evaluations

The MS2830A with the BER Measurement Function MS2830A-026 supports measurement up to 10 Mbps.
It supports Rx sensitivity tests by inputting the receiver-demodulated Data/Clock/Enable to the back of the MS2830A.

- Input Signal: Data, Clock, Enable (Polarity reversal supported)
- Input Bit Rate: 100 bps to 10 Mbps
- Input Level: TTL 3.3 V
- Connector: Rear panel, AUX connector*

*: Can convert to BNC by connecting AUX conversion adapter (J1556A).

- Measured Patterns:
  PN9, PN11, PN15, PN20, PN23, ALL0, ALL1, Alternate (0101…),
  PN9Fix, PN11Fix, PN15Fix, PN20Fix, PN23Fix,
  UserDefine (4096 bits Max.)
- Measurable Bit Count: 1000 to 4294967295 bits (2^{32} – 1 bits)
- Measurable Error Bit Count: 1 to 2147483647 bits (2^{31} – 1 bits)
- Count Mode
  Data: Measures until specified Data count
  Error: Measures until specified Error count
- Measurement Mode
  Single: Measures specified measurement bit count once
  Continuous: Repeats Single measurement
  Endless: Continues measurement to upper limit of measurement bits



MS2830A BER Test 1/24/2013 11:28:05

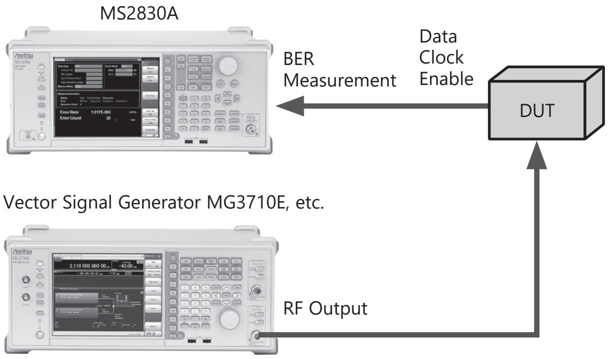
Data Type: PN9
Pattern File:
Bit Length:
Sync Position Start:
Sync Position Length:
Measure Mode: Single

Count Mode: Data
Data: 10000 Bit
Error: 1 Bit

Measure Information
Status: Stop Synchronizing Measuring
Error: BitError SyncLoss ClockError EnableError
SyncLoss Count: 0

Error Rate 1.017E-002 1.017%
Error Count 20 / 1967

BER Measurement Function Main Screen



BER Measurement Setup Example
(using external vector signal generator)

Excellent Expandability Platform (Hardware)

The versatility of the MS2830A series is tailored easily to the application by installing modules in expansion slots.

Basic Performance and Function Improvement

- Rubidium Reference Oscillator/Retrofit MS2830A-001/101
  This option is a 10 MHz reference crystal oscillator with excellent frequency stability startup characteristics of ±1 × 10^{-9} at 7 minutes after power-on.
  Aging Rate: ±1 × 10^{-10}/month
  Start-up Characteristics: ±1 × 10^{-9} (7 minutes after power-on)
- Preamplifier/Retrofit MS2830A-008/108
  This option is used to measure low-level signals, such as noise and interference signals.
  Frequency Range: 100 kHz to 6 GHz
  *: Cannot be installed simultaneously with MS2830A-068/168
- Precompliance EMI Function/Retrofit MS2830A-016/116
  This option adds an EMI measurement detection mode and RBW to the spectrum analyzer function. Both the detection mode used for CISPR standards (Quasi-Peak, CISPR-AVG, RMS-AVG) and RBW (200 Hz (6 dB), 9 kHz (6 dB), 120 kHz (6 dB), 1 MHz (Imp)) as well as conventional settings can be selected.
- Microwave Preselector Bypass/Retrofit MS2830A-067/167
  Bypassing the preselector used for the microwave band improves RF frequency characteristics and in-band frequency characteristics.
  *: Add MS2830A-067 when using the signal analyzer measurement functions at bandwidth: >31.25 MHz and frequency: >6 GHz.
- Microwave Preamplifier/Retrofit MS2830A-068/168
  This option is used to measure low-level signals, such as noise and interference signals.
  Frequency Range: 100 kHz to 26.5 GHz (MS2830A-044)
  100 kHz to 43 GHz (MS2830A-045)
  *: Cannot be installed simultaneously with MS2830A-008/108

Signal Analyzer Function and Performance Improvement

- Analysis Bandwidth Extension to 31.25 MHz/Retrofit MS2830A-005/105
  This option extends the analysis bandwidth to 31.25 MHz.
  *: Requires MS2830A-006/106
  Not supported by MS2830A-045 (43 GHz Signal Analyzer) - use MS2830A-009
- Analysis Bandwidth 10 MHz/Retrofit MS2830A-006/106
  This option supports the VSA and digitize functions.
- Bandwidth Extension to 31.25 MHz for Millimeter-wave/Retrofit MS2830A-009/109
  This option extends the MS2830A-045 (43 GHz Signal Analyzer) analysis bandwidth to 31.25 MHz.
  *: Requires MS2830A-006/106
  Dedicated option for MS2830A-045 (43 GHz Signal Analyzer)
- Analysis Bandwidth Extension to 62.5 MHz MS2830A-077
  This option extends the analysis bandwidth to 62.5 MHz.
  *: Retrofit not supported.
  Requires MS2830A-006 and MS2830A-005 (for MS2830A-044).
  Requires MS2830A-006 and MS2830A-009 (for MS2830A-045).
- Analysis Bandwidth Extension to 125 MHz MS2830A-078
  This option extends the analysis bandwidth to 125 MHz.
  *: Retrofit not supported.
  Requires MS2830A-006, MS2830A-005 and MS2830A-077 (for MS2830A-044).
  Requires MS2830A-006, MS2830A-009 and MS2830A-077 (for MS2830A-045).
  Note: An image response is received when setting the bandwidth to more than 31.25 MHz. This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.). The Signal Analyzer MS2690A is recommended for other measurement purposes.

Expansion Functions

- Phase Noise Measurement Function/Retrofit MS2830A-010/110
  Adds phase noise measurements.
  Frequency Range: 10 MHz to main-frame upper limit frequency
  Offset Frequency Range: 10 Hz to 10 MHz
- 2ndary HDD/Retrofit MS2830A-011/111
  This removable 2ndary HDD is installed in the HDD Option Slot of the MS2830A main frame to expand the user data storage space.
  It does not have the Windows OS installed. The MS2830A ships with it installed. Only one expansion HDD can be installed in the MS2830A.
  It is useful when taking the instrument for calibration but the security of saved user data, such as measurement results, must be protected.
- 2ndary HDD Retrofit MS2830A-311
  This removable 2ndary HDD is installed in the HDD Option Slot of the MS2830A main frame to expand the user data storage space.
  It does not have the Windows OS installed.
  It is useful when taking the instrument for calibration but the security of saved user data, such as measurement results, must be protected.

- Noise Figure Measurement Function/Retrofit MS2830A-017/117
  Adds noise figure measurement function.
  Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source.
- BER Measurement Function/Retrofit MS2830A-026/126
  Adds BER measurement function.
  It supports Rx sensitivity tests by inputting the receiver-demodulated Data/Clock/Enable to the back of the MS2830A.
  Input Bit Rate: 100 bps to 10 Mbps

Future-proof Platform (Software)

Adding measurement software options to the signal analyzer assures that the modulation analysis and other functions will support all common current and future communications systems.

Measurement Software

Communications Systems	Model	Name	Addition to Main frame (✓: Can be installed, No: Cannot be installed)		Analysis Bandwidth Extension Option (✓: Required, ✓+: Function expansion, Space (no symbol): No specification)			
			Opt. 040/041/043	Opt. 044/045	Opt. 006	Opt. 005/009	Opt. 077	Opt. 078
LTE/LTE-Advanced (FDD)	MX269020A	LTE Downlink Measurement Software	✓	✓	✓	✓		
	MX269020A-001	LTE-Advanced FDD Downlink Measurement Software	✓	✓	✓	✓	✓+	✓+
	MX269021A	LTE Uplink Measurement Software	✓	✓	✓	✓		
	MX269021A-001	LTE-Advanced FDD Uplink Measurement Software	✓	✓	✓	✓	✓+	✓+
LTE/LTE-Advanced (TDD)	MX269022A	LTE TDD Downlink Measurement Software	✓	✓	✓	✓		
	MX269022A-001	LTE-Advanced TDD Downlink Measurement Software	✓	✓	✓	✓	✓+	✓+
	MX269023A	LTE TDD Uplink Measurement Software	✓	✓	✓	✓		
	MX269023A-001	LTE-Advanced TDD Uplink Measurement Software	✓	✓	✓	✓	✓+	✓+
W-CDMA/HSPA/ HSPA Evolution	MX269011A	W-CDMA/HSPA Downlink Measurement Software	✓	✓	✓			
	MX269012A	W-CDMA/HSPA Uplink Measurement Software	✓	✓	✓			
W-CDMA/HSPA (Downlink)	MX269030A	W-CDMA BS Measurement Software	✓	✓	✓			
TD-SCDMA	MX269015A	TD-SCDMA Measurement Software	✓	✓	✓			
CDMA2000	MX269024A	CDMA2000 Forward Link Measurement Software	✓	✓	✓			
	MX269024A-001	All Measure Function	✓	✓	✓			
1xEV-DO	MX269026A	EV-DO Forward Link Measurement Software	✓	✓	✓			
	MX269026A-001	All Measure Function	✓	✓	✓			
GSM/EDGE	MX269013A	GSM/EDGE Measurement Software	✓	✓	✓			
EDGE Evolution	MX269013A-001	EDGE Evolution Measurement Software	✓	✓	✓			
World Digital Wireless Standards	MX269017A	Vector Modulation Analysis Software	✓	✓	✓	✓+	✓+	✓+
Analog Wireless	MX269018A	Analog Measurement Software	✓	No				
WLAN IEEE 802.11a/b/g/n/j/p	MX269028A	WLAN (802.11) Measurement Software (Supports IEEE 802.11n/11a/11b/11g/11j/11p)	✓	✓	✓	✓		
WLAN IEEE 802.11ac (80 MHz)	MX269028A-001	802.11ac (80 MHz) Measurement Software	✓	✓	✓	✓	✓	✓

See each software catalog for more details.

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Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature.
The specifications are defined under the following conditions unless otherwise specified.
Auto sweep time select: Normal, Auto sweep type rules: Sweep only, Switching speed mode: Normal mode
The specifications of the Signal Analyzer function are values at the center frequency if not specified. Nominal values indicate expected performance or describe product performance. That is not covered by the product warranty.
Specifications above 26.5 GHz: MS2830A-045 only.

Signal Analyzer/Spectrum Analyzer

Frequency

<table>
<tr><td>Frequency Range</td><td>9 kHz to 26.5 GHz [MS2830A-044], 9 kHz to 43 GHz [MS2830A-045]</td></tr>
<tr><td>Frequency Bands</td><td>
<table>
<tr><th>Frequency Range</th><th>Band</th><th>Mixer Harmonics Order (N)</th></tr>
<tr><td>9 kHz to 4 GHz</td><td>0</td><td>1</td></tr>
<tr><td>3.5 GHz to 4.4 GHz</td><td>1</td><td>1/2</td></tr>
<tr><td>4.3 GHz to 6 GHz</td><td>1</td><td>1</td></tr>
<tr><td>3.9 GHz to 8 GHz</td><td>3</td><td>1</td></tr>
<tr><td>7.9 GHz to 10.575 GHz</td><td>4</td><td>1</td></tr>
<tr><td>10.475 GHz to 12.2 GHz</td><td>5</td><td>2</td></tr>
<tr><td>12.1 GHz to 18.4 GHz</td><td>6</td><td>2</td></tr>
<tr><td>18.3 GHz to 26.6 GHz</td><td>7</td><td>4</td></tr>
<tr><td>26.5 GHz to 41.9 GHz</td><td>8</td><td>4</td></tr>
<tr><td>41.8 GHz to 43 GHz</td><td>9</td><td>8</td></tr>
</table>
</td></tr>
<tr><td>Frequency Setting Range</td><td>–100 MHz to 26.6 GHz [MS2830A-044]
–100 MHz to 43.1 GHz [MS2830A-045]
Setting resolution: 1 Hz</td></tr>
<tr><td>Pre-selector Range</td><td>
<table>
<tr><th>MS2830A-044</th><th>MS2830A-045</th><th></th></tr>
<tr><td>4 GHz to 26.5 GHz</td><td>4 GHz to 43 GHz</td><td>(Frequency band mode: Normal)</td></tr>
<tr><td>3.5 GHz to 26.5 GHz</td><td>3.5 GHz to 43 GHz</td><td>(Frequency band mode: Spurious)</td></tr>
</table>
</td></tr>
<tr><td>Internal Reference Oscillator</td><td>With MS2830A-044/045
23°C, Referenced to frequency at 24-hour after power-on
Start-up characteristics: $\pm5 \times 10^{-7}$ (2 minutes after power-on), $\pm5 \times 10^{-8}$ (5 minutes after power-on)
Aging rate: $\pm1 \times 10^{-7}$/year
Temperature stability: $\pm2 \times 10^{-8}$ (5°C to 45°C)
With MS2830A-001
23°C, Referenced to frequency at 24-hour after power-on
Start-up characteristics: $\pm1 \times 10^{-9}$ (7 minutes after power-on)
Aging rate: $\pm1 \times 10^{-10}$/month
Temperature stability: $\pm1 \times 10^{-9}$ (5°C to 45°C)</td></tr>
<tr><td>SSB Phase Noise</td><td>18°C to 28°C, 500 MHz, Spectrum Analyzer mode, Switching speed mode: Normal
–115 dBc/Hz (100 kHz offset)
–133 dBc/Hz (1 MHz offset)</td></tr>
</table>

Amplitude

Level Measurement Range	Without MS2830A-008/068, or Preamp: Off DANL to +30 dBm With MS2830A-008/068, Preamp: On DANL to +10 dBm
Maximum Input Level	Without MS2830A-008/068, or Preamp: Off Average total power: +30 dBm (Input attenuator: ≥10 dB) DC voltage: ±0 Vdc With MS2830A-008/068, Preamp: On Average total power: +10 dBm (Input attenuator: 0 dB) DC voltage: ±0 Vdc
Input Attenuator Range	With MS2830A-044 0 to 60 dB, 2 dB steps With MS2830A-045 0 to 60 dB, 10 dB steps (ATT mode: Mechanical ATT only, or E-ATT combined mode, Stop frequency: ≥6 GHz) 0 to 10 dB, 10 dB steps/10 to 40 dB, 2 dB steps/40 to 60 dB, 10 dB steps (Attenuator mode: E-ATT combined mode, Stop frequency: <6 GHz)
Input Attenuator Switching Uncertainty	18°C to 28°C, Referenced to 10 dB, ATT mode: Mechanical ATT only Without MS2830A-008/068, or Preamp: Off ±0.2 dB (10 to 60 dB) (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±0.75 dB (10 to 60 dB) (4 GHz ≤ f ≤ 13.8 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 13.8 GHz, Frequency band mode: Spurious) ±0.8 dB (10 to 60 dB) (13.8 GHz < f ≤ 26.5 GHz) ±1.0 dB (10 to 60 dB) (26.5 GHz < f ≤ 40 GHz) ±1.0 dB (10 to 60 dB) (typ., 40 GHz < f ≤ 43 GHz)

Reference Level

Setting Range	Log scale: –120 to +50 dBm, or Equivalent level (Signal Analyzer function) –130 to +50 dBm, or Equivalent level (Spectrum Analyzer function) Linear scale: 22.4 µV to 70.7 V, or Equivalent level (Signal Analyzer function) 70.7 nV to 70.7 V, or Equivalent level (Spectrum Analyzer function) Setting resolution: 0.01 dB, or Equivalent level
Scale Units	Log scale: dBm, dBµV, dBmV, dBµV (emf), dBµV/m, V, W Linear scale: V
Linearity Error	Excluding the noise floor effect, Input level: ≤–10 dB (f: <30 MHz) ±0.07 dB (Mixer input level: ≤–20 dBm) ±0.10 dB (Mixer input level: ≤–10 dBm)
RF Frequency Characteristics	18°C to 28°C, After Cal, Input attenuator: 10 dB Without MS2830A-008/068, or Preamp: Off Without MS2830A-067, or Microwave Preselector Bypass: Off, After preselector auto tune ±1.0 dB (9 kHz ≤ f < 300 kHz) ±0.35 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.5 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 6 GHz, Frequency band mode: Spurious) ±1.5 dB (6 GHz < f ≤ 13.8 GHz) ±2.5 dB (13.8 GHz < f ≤ 26.5 GHz) ±2.5 dB (26.5 GHz < f ≤ 40 GHz) ±2.5 dB (typ., 40 GHz < f ≤ 43 GHz) With MS2830A-008, Preamp: On ±0.65 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 4 GHz, Frequency band mode: Spurious) With MS2830A-068, or Preamp: On Without MS2830A-067, or Microwave Preselector Bypass: Off, After preselector auto tune ±0.65 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 13.8 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 13.8 GHz, Frequency band mode: Spurious) ±2.5 dB (13.8 GHz < f ≤ 26.5 GHz) ±3.5 dB (26.5 GHz < f ≤ 40 GHz) ±3.5 dB (nom., 40 GHz < f ≤ 43 GHz)
1 dB Gain Compression	Without MS2830A-008/068, or Preamp: Off, At mixer input level ≥+3 dBm (300 MHz ≤ f ≤ 4 GHz) ≥–1 dBm (4 GHz < f ≤ 13.5 GHz) ≥–1 dBm (13.5 GHz < f ≤ 26.5 GHz) ≥–1 dBm (nom., 26.5 GHz < f ≤ 40 GHz) With MS2830A-068, Preamp: On, At preamp input level ≥–15 dBm (300 MHz ≤ f ≤ 4 GHz) ≥–21 dBm (4 GHz < f ≤ 13.5 GHz) ≥–21 dBm (13.5 GHz < f ≤ 26.5 GHz) ≥–21 dBm (nom., 26.5 GHz < f ≤ 40 GHz)

Spurious Responses

<table>
<tr><td>Second Harmonic Distortion</td><td>Without MS2830A-008/068, without MS2830A-067
Mixer input level: –30 dBm
<table>
<tr><th>Harmonic Distortion</th><th>SHI</th><th></th></tr>
<tr><td>≤–60 dBc</td><td>≥+30 dBm</td><td>(10 MHz ≤ f ≤ 300 MHz)</td></tr>
<tr><td>≤–65 dBc</td><td>≥+35 dBm</td><td>(300 MHz < f ≤ 1 GHz)</td></tr>
<tr><td>≤–65 dBc</td><td>≥+35 dBm</td><td>(1 GHz < f ≤ 2 GHz, Frequency band mode: Normal)</td></tr>
<tr><td>≤–65 dBc</td><td>≥+35 dBm</td><td>(1 GHz < f < 1.75 GHz, Frequency band mode: Spurious)</td></tr>
</table>
Mixer input level: –10 dBm
<table>
<tr><th>Harmonic Distortion</th><th>SHI</th><th></th></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(2 GHz < f ≤ 3 GHz, Frequency band mode: Normal)</td></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(1.75 GHz ≤ f ≤ 3 GHz, Frequency band mode: Spurious)</td></tr>
<tr><td>≤–90 dBc</td><td>≥+80 dBm</td><td>(3 GHz < f ≤ 13.25 GHz)</td></tr>
<tr><td>≤–90 dBc</td><td>≥+80 dBm</td><td>(13.25 GHz < f ≤ 21.5 GHz, nom.)</td></tr>
</table>
With MS2830A-068, Preamp: Off, or with MS2830A-067, Microwave Preselector Bypass: Off
Mixer input level: –30 dBm
<table>
<tr><th>Harmonic Distortion</th><th>SHI</th><th></th></tr>
<tr><td>≤–60 dBc</td><td>≥+30 dBm</td><td>(10 MHz ≤ f ≤ 300 MHz)</td></tr>
<tr><td>≤–65 dBc</td><td>≥+35 dBm</td><td>(300 MHz < f ≤ 1 GHz)</td></tr>
<tr><td>≤–65 dBc</td><td>≥+35 dBm</td><td>(1 GHz < f ≤ 2 GHz, Frequency band mode: Normal)</td></tr>
<tr><td>≤–65 dBc</td><td>≥+35 dBm</td><td>(1 GHz < f < 1.75 GHz, Frequency band mode: Spurious)</td></tr>
</table>
Mixer input level: –10 dBm
<table>
<tr><th>Harmonic Distortion</th><th>SHI</th><th></th></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(2 GHz < f ≤ 3 GHz, Frequency band mode: Normal)</td></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(1.75 GHz ≤ f ≤ 3 GHz, Frequency band mode: Spurious)</td></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(2 GHz < f ≤ 3 GHz, Frequency band mode: Spurious)</td></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(3 GHz < f ≤ 13.25 GHz)</td></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(13.25 GHz < f ≤ 21.5 GHz, nom.)</td></tr>
</table>
With MS2830A-008/068, Preamp: On, with MS2830A-067, Microwave Preselector Bypass: Off
Preamp input level: –45 dBm
<table>
<tr><th>Harmonic Distortion</th><th>SHI</th><th></th></tr>
<tr><td>≤–50 dBc</td><td>≥+5 dBm</td><td>(10 MHz ≤ f ≤ 300 MHz)</td></tr>
<tr><td>≤–55 dBc</td><td>≥+10 dBm</td><td>(300 MHz < f ≤ 2 GHz)</td></tr>
<tr><td>≤–45 dBc</td><td>≥0 dBm</td><td>(2 GHz < f ≤ 13.25 GHz)</td></tr>
<tr><td>≤–40 dBc</td><td>≥–5 dBm</td><td>(13.25 GHz < f < 21.5 GHz, nom.)</td></tr>
</table>
SHI: Second harmonic intercept</td></tr>
<tr><td>Residual Responses</td><td>Frequency: ≥1 MHz, Input attenuator: 0 dB, 50Ω terminated
With MS2830A-077/078, except bandwidth setting: >31.25 GHz
≤–100 dBm (up to 1 GHz)
≤–90 dBm (typ., 1 GHz to 6 GHz)
≤–90 dBm (nom., 6 GHz to 13.5 GHz)
≤–90 dBm (nom., 13.25 GHz to 26.5 GHz)
≤–80 dBm (nom., 26.5 GHz to 40 GHz)</td></tr>
</table>

Spectrum Analyzer

Frequency

Span	Range: 0 Hz, 300 Hz to 26.5 GHz [MS2830A-044] 0 Hz, 300 Hz to 43 GHz [MS2830A-045] Resolution: 2 Hz Accuracy: ±0.2% (Sweep points: 10001)
Frequency Readout Accuracy	± (Display frequency × Frequency reference accuracy + Span frequency × Span accuracy + RBW × 0.05 + 2 × N + Span frequency/(Sweep points–1)) Hz N: Mixer harmonic order
Resolution Bandwidth (RBW)	Setting range: 1 Hz to 3 MHz (1-3 sequence), 500 Hz, 50 kHz, 2 MHz, 5 MHz, 10 MHz, 20 MHz, 31.25 MHz 1 Hz to 10 Hz: Can not be set when span: 0 Hz 31.25 MHz: Can be set when span: 0 Hz only 20 MHz, 31.25 MHz: Can be set when with MS2830A-005 or MS2830A-009 Selectivity (–60 dB/–3 dB): 4.5: 1 (nom., 1 Hz to 10 MHz)
Resolution Bandwidth (CISPR RBW)	With MS2830A-016 Setting range: 200 Hz (6 dB), 9 kHz (6 dB), 120 kHz (6 dB), 1 MHz (Impulse)
Video Bandwidth (VBW)	1 Hz to 3 kHz (1-3 sequence), 5 kHz, 10 kHz to 10 MHz (1-3 sequence), Off VBW mode: Video average, Power average

Amplitude

Displayed Average Noise Level (DANL)	18°C to 28°C, Detector: Sample, VBW: 1 Hz (Video average), Input attenuator: 0 dB Without MS2830A-067/068, Frequency band mode: Normal –120 dBm/Hz (9 kHz ≤ f < 100 kHz, nom.) –134 dBm/Hz (100 kHz) –134 dBm/Hz (100 kHz < f < 1 MHz, nom.) –144 dBm/Hz (1 MHz) –144 dBm/Hz (1 MHz < f < 10 MHz, nom.) –150 dBm/Hz (10 MHz ≤ f < 30 MHz, nom.) –153 dBm/Hz (30 MHz ≤ f < 1 GHz) –150 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –147 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –144 dBm/Hz (3.5 GHz < f ≤ 4 GHz) –144 dBm/Hz (4 GHz < f ≤ 6 GHz) –151 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –149 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –146 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –146 dBm/Hz (26.5 GHz < f ≤ 34 GHz) [MS2830A-045] –144 dBm/Hz (34 GHz < f ≤ 40 GHz) [MS2830A-045] –140 dBm/Hz (40 GHz < f ≤ 43 GHz) [MS2830A-045] Without MS2830A-067, with MS2830A-068, Preamp: Off, Frequency band mode: Normal –120 dBm/Hz (9 kHz ≤ f < 100 kHz, nom.) –134 dBm/Hz (100 kHz) –134 dBm/Hz (100 kHz < f < 1 MHz, nom.) –144 dBm/Hz (1 MHz) –144 dBm/Hz (1 MHz < f < 10 MHz, nom.) –150 dBm/Hz (10 MHz ≤ f < 30 MHz, nom.) –153 dBm/Hz (30 MHz ≤ f < 1 GHz) –150 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –147 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –144 dBm/Hz (3.5 GHz < f ≤ 4 GHz) –144 dBm/Hz (4 GHz < f ≤ 6 GHz) –147 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –145 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –141 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –141 dBm/Hz (26.5 GHz < f ≤ 34 GHz) [MS2830A-045] –135 dBm/Hz (34 GHz < f ≤ 40 GHz) [MS2830A-045] –132 dBm/Hz (40 GHz < f ≤ 43 GHz) [MS2830A-045] Without MS2830A-067, or Microwave Preselector Bypass: Off With MS2830A-068, Preamp: On, Frequency band mode: Normal –147 dBm/Hz (100 kHz, nom.) –156 dBm/Hz (1 MHz) –163 dBm/Hz (30 MHz ≤ f < 1 GHz) –161 dBm/Hz (1 GHz ≤ f < 2 GHz) –159 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –155 dBm/Hz (3.5 GHz < f ≤ 4 GHz) –155 dBm/Hz (4 GHz < f ≤ 6 GHz) –160 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –158 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –156 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –156 dBm/Hz (26.5 GHz < f ≤ 34 GHz) [MS2830A-045] –150 dBm/Hz (34 GHz < f ≤ 40 GHz) [MS2830A-045] –147 dBm/Hz (40 GHz < f ≤ 43 GHz) [MS2830A-045] With MS2830A-067: See Microwave Preselector Bypass (Displayed average noise level)
Total Absolute Amplitude Accuracy* *: Total absolute amplitude accuracy is found from root sum of squares (RSS) of RF frequency characteristics, Linearity error, and Input attenuator switching uncertainty.	18°C to 28°C, After Cal, Auto sweep time select: Normal, 30 Hz ≤ RBW ≤ 1 MHz, Detector: Positive, CW, Excluding the noise floor effect, and FFT runtime (Display: On) Without MS2830A-068, or Preamp: Off Input attenuator: ≥10 dB, Input level: ≤–10 dBm (f: <30 MHz), Mixer input level: ≤–10 dBm (f: ≥30 MHz) ±0.5 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 4 GHz, Frequency band mode: Spurious) ±1.8 dB (6 GHz < f ≤ 13.8 GHz, Frequency band mode: Normal) (4 GHz < f ≤ 13.8 GHz, Frequency band mode: Spurious) ±3.0 dB (13.8 GHz < f ≤ 26.5 GHz) ±3.0 dB (26.5 GHz < f ≤ 40 GHz) ±3.5 dB (nom., 40 GHz < f ≤ 43 GHz) With MS2830A-068, Preamp: On Input attenuator: 10 dB, Preamp input level: ≤–30 dBm ±1.0 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 4 GHz, Frequency band mode: Spurious) ±2.0 dB (6 GHz < f ≤ 13.8 GHz, Frequency band mode: Normal) (4 GHz < f ≤ 13.8 GHz, Frequency band mode: Spurious) ±3.0 dB (13.8 GHz < f ≤ 26.5 GHz) ±4.0 dB (26.5 GHz < f ≤ 40 GHz) ±4.0 dB (nom., 40 GHz < f ≤ 43 GHz)

Spurious Responses

2-tone 3rd-order Intermodulation Distortion	18°C to 28°C, ≥300 kHz separation Without MS2830A-068, or Preamp: Off, Mixer input level: –15 dBm (1 wave) ≤–54 dBc, TOI = +12 dBm (30 MHz ≤ f < 300 MHz) ≤–60 dBc, TOI = +15 dBm (300 MHz ≤ f < 3.5 GHz) ≤–58 dBc, TOI = +14 dBm (3.5 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) ≤–56 dBc, TOI = +13 dBm (6 GHz < f ≤ 13.5 GHz) ≤–56 dBc, TOI = +13 dBm (13.5 GHz < f ≤ 26.5 GHz) ≤–56 dBc, TOI = +13 dBm (nom., 26.5 GHz < f ≤ 40 GHz) With MS2830A-068, Preamp: On Without MS2830A-067, Microwave Preselector Bypass: Off, Preamp input level: –45 dBm (1 wave) ≤–73 dBc, TOI = –8.5 dBm (30 MHz ≤ f < 300 MHz) ≤–78 dBc, TOI = –6 dBm (300 MHz ≤ f ≤ 700 MHz) ≤–81 dBc, TOI = –4.5 dBm (700 MHz < f < 4 GHz, Frequency band mode: Normal) (700 MHz < f < 3.5 GHz, Frequency band mode: Spurious) ≤–78 dBc, TOI = –6 dBm (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 4 GHz, Frequency band mode: Spurious) ≤–70 dBc, TOI = –10 dBm (6 GHz < f ≤ 13.5 GHz, Frequency band mode: Normal) (4 GHz < f ≤ 13.5 GHz, Frequency band mode: Spurious) ≤–70 dBc, TOI = –10 dBm (13.5 GHz < f ≤ 26.5 GHz) ≤–70 dBc, TOI = –10 dBm (nom., 26.5 GHz < f ≤ 40 GHz) TOI: Third-order intermodulation distortion
Image Responses	ATT mode: Mechanical-ATT only, Frequency band mode: Normal Without MS2830A-067 ≤–70 dBc (10 MHz ≤ f < 4 GHz) ≤–55 dBc (4 GHz ≤ f ≤ 6 GHz) ≤–70 dBc (6 GHz < f ≤ 13.5 GHz) ≤–70 dBc (13.5 GHz < f ≤ 26.5 GHz) With MS2830A-067: See Microwave Preselector Bypass (Image responses)

Sweep

Sweep Mode	Continuous, Single
Sweep Time	Setting range: 1 ms to 1000 s (Span: ≥300 Hz) 1 µs to 1000 s (Span: 0 Hz)

Waveform Display

<table>
<tr><td>Detector</td><td>Positive & Negative, Positive peak, Sample, Negative peak, RMS</td></tr>
<tr><td>CISPR Detector</td><td>Quasi-Peak, CISPR-AVG, RMS-AVG (with MS2830A-016)</td></tr>
<tr><td>Sweep (Trace) Point</td><td><table>
<tr><td>SPAN</td><td></td></tr>
<tr><td>> 30 GHz</td><td>5001 to 30001</td></tr>
<tr><td>500 MHz < SPAN ≤ 30 GHz</td><td>1001 to 30001</td></tr>
<tr><td>100 MHz < SPAN ≤ 500 MHz</td><td>101 to 30001</td></tr>
<tr><td>300 Hz ≤ SPAN ≤ 100 MHz and Sweep Time > 10 s</td><td>101 to 30001</td></tr>
<tr><td>300 Hz ≤ SPAN ≤ 100 MHz and Sweep Time ≤ 10 s</td><td>11 to 30001</td></tr>
<tr><td>SPAN = 0 Hz and Sweep Time > 10 s</td><td>101 to 30001</td></tr>
<tr><td>SPAN = 0 Hz and Sweep Time ≤ 10 s</td><td>11 to 30001</td></tr>
</table>Setting resolution: 1 point</td></tr>
<tr><td>Scale</td><td>Log scale: 10 div/12 div, 0.1 to 20 dB/div (1-2-5 sequence)
Linear scale: 10 div, 1 to 10%/div (1-2-5 sequence)</td></tr>
<tr><td>Trigger</td><td>Free run (Trigger off), Video, Wide IF video, External, Frame</td></tr>
<tr><td>Gate</td><td>Off, Wide IF video, External, Frame</td></tr>
</table>

Measure Function

Adjust Channel Power (ACP)		Reference: Span total, Carrier total, Both sides of carriers, Carrier select Adjust channel specifications: 3 channels × 2 (Normal mode), 8 channels × 2 (Advanced mode)
Burst Average Power		Displayed average power of specified interval at time domain
Channel Power		Measurement of absolute values: dBm, dBm/Hz
Occupied Bandwidth (OBW)		N% of power, X-dB down
Spectrum Emission Mask (SEM)		Decision to Pass/Fail at Peak/Margin measurement
Spurious Emission		Decision to Pass/Fail at Worst/Peaks measurement
Frequency Counter	Accuracy	Span: ≤1 MHz, RBW: 1 kHz, S/N: ≥50 dB, Gate time: ≥100 ms ± (Marker frequency × Frequency reference accuracy + (0.1 × N / Gate time [s] Hz) N: Mixer harmonic order
	Gate Time Setting	100 µs to 1 s
2-tone 3rd-order Intermodulation Distortion		Measures IM3 and TOI from two-tone signal

Signal Analyzer

Display waveform data, such as Spectrum, Power vs. Time captured at specific time

General

Trace Mode	Spectrum, Power vs. Time, Frequency vs. Time, Phase vs. Time, CCDF, Spectrogram, No trace
Analysis Bandwidth	Sets capture analysis bandwidth from center frequency 1 kHz to 10 MHz (1-2.5-5 sequence) (with MS2830A-006) 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz (with MS2830A-005, or with MS2830A-009) 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz, 50 MHz, 62.5 MHz (with MS2830A-077) 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz, 50 MHz, 62.5 MHz, 100 MHz, 125 MHz (with MS2830A-078) ∗MS2830A-005 is not available when MS2830A-045 is installed.
Sampling Rate	Auto setting by conditions of analysis bandwidth 2 kHz to 20 MHz (1-2-5 sequence) (with MS2830A-006) 2 kHz to 50 MHz (1-2-5 sequence) (with MS2830A-005, or with MS2830A-009) 2 kHz to 100 MHz (1-2-5 sequence) (with MS2830A-077) 2 kHz to 200 MHz (1-2-5 sequence) (with MS2830A-078)
Capture Time	Without MS2830A-077/078, or ≤31.25 MHz bandwidth Setting capture time length Minimum capture time length: 2 µs to 50 ms (Determined according to analysis bandwidth) Maximum capture time length: 2 s to 2000 s (Determined according to analysis bandwidth) Setting mode: Auto, Manual With MS2830A-077, >31.25 MHz bandwidth Setting capture time length Minimum capture time length: 1 µs Maximum capture time length: 500 ms Setting mode: Auto, Manual With MS2830A-078, >31.25 MHz bandwidth Setting capture time length Minimum capture time length: 500 ns to 1 µs (Determined according to analysis bandwidth) Maximum capture time length: 500 ms Setting mode: Auto, Manual
Trigger	Free run (Trigger off), Video, Wide IF video, Frame, External
ADC Resolution	Without MS2830A-077/078, or ≤31.25 MHz bandwidth 16 bits

Spectrum Displayed Function

Function Outline	Displayed spectrum of any time length and frequency range within captured waveform data
Analysis Time Length	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Frequency	Can be set center frequency and span at frequency range in waveform data
Frequency Setting	Without MS2830A-077/078, or ≤31.25 MHz bandwidth 0 MHz to 26.5 GHz [MS2830A-044] 0 MHz to 43 GHz [MS2830A-045] With MS2830A-077/078, without MS2830A-067, >31.25 MHz bandwidth 300 MHz to 6 GHz [MS2830A-044] 300 MHz to 6 GHz [MS2830A-045] With MS2830A-077/078, MS2830A-067, >31.25 MHz bandwidth 300 MHz to 26.5 GHz [MS2830A-044] 300 MHz to 43 GHz [MS2830A-045]
Resolution Bandwidth (RBW)	Without MS2830A-077/078, or ≤31.25 MHz bandwidth Setting range: 1 Hz to 1 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5: 1 (nom.) With MS2830A-077, >31.25 MHz bandwidth Setting range: 3 kHz to 3 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5: 1 (nom.) With MS2830A-078, >31.25 MHz bandwidth Setting range: 3 kHz to 10 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5: 1 (nom.)

Continued on next page

Total Absolute Amplitude Accuracy* *: Total absolute amplitude accuracy is found from root sum of squares (RSS) of RF frequency characteristics, Linearity error, and Input attenuator switching uncertainty.	18°C to 28°C, After Cal, Input attenuator: ≥10 dB, RBW: Auto, Time detection: Average, Marker result: Integration or Peak (Accuracy), Center frequency, CW, Excluding the noise floor effect Without MS2830A-068, or Preamp: Off Input attenuator: ≥10 dB, Input level: ≤–10 dBm (f: <30 MHz), Mixer input level: ≤–10 dBm (f: ≥30 MHz) ±0.5 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 4 GHz, Frequency band mode: Spurious) ±1.8 dB (6 GHz < f ≤ 13.8 GHz, Frequency band mode: Normal) (4 GHz < f ≤ 13.8 GHz, Frequency band mode: Spurious) ±3.0 dB (13.8 GHz < f ≤ 26.5 GHz) ±3.0 dB (26.5 GHz < f ≤ 40 GHz) ±3.5 dB (nom., 40 GHz < f ≤ 43 GHz) With MS2830A-068, Preamp: On Input attenuator: 10 dB, Preamp Input level: ≤–30 dBm ±1.0 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 4 GHz, Frequency band mode: Spurious) ±2.0 dB (6 GHz < f ≤ 13.8 GHz, Frequency band mode: Normal) (4 GHz < f ≤ 13.8 GHz, Frequency band mode: Spurious) ±3.0 dB (13.8 GHz < f ≤ 26.5 GHz) ±4.0 dB (26.5 GHz < f ≤ 40 GHz) ±4.0 dB (nom., 40 GHz < f ≤ 43 GHz)
In-band Frequency Characteristics	18°C to 28°C, Referenced to level at center frequency, Center frequency: ±10 MHz Without MS2830A-077/078, or ≤31.25 MHz bandwidth ±0.31 dB (30 MHz ≤ f ≤ 4 GHz, Frequency band mode: Normal) (30 MHz ≤ f < 3.5 GHz, Frequency band mode: Spurious)
Displayed Average Noise Level (DANL)	18°C to 28°C, Time Detection: Average, Input attenuator: 0 dB Without MS2830A-067/068, Frequency band mode: Normal –131.5 dBm/Hz (100 kHz) –141.5 dBm/Hz (1 MHz) –150.5 dBm/Hz (30 MHz ≤ f < 1 GHz) –147.5 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –144.5 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –141.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz) –141.5 dBm/Hz (4 GHz < f ≤ 6 GHz) –148.5 dBm/Hz (6 GHz ≤ f ≤ 13.5 GHz) –146.5 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –143.5 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –143.5 dBm/Hz (26.5 GHz < f ≤ 34 GHz) –141.5 dBm/Hz (34 GHz < f ≤ 40 GHz) –137.5 dBm/Hz (40 GHz < f ≤ 43 GHz) Without MS2830A-067, with MS2830A-068, Preamp: Off, Frequency band mode: Normal –131.5 dBm/Hz (100 kHz) –141.5 dBm/Hz (1 MHz) –150.5 dBm/Hz (30 MHz ≤ f < 1 GHz) –147.5 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –144.5 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –141.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz) –141.5 dBm/Hz (4 GHz < f ≤ 6 GHz) –144.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –142.5 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –138.5 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –138.5 dBm/Hz (26.5 GHz < f ≤ 34 GHz) –132.5 dBm/Hz (34 GHz < f ≤ 40 GHz) –129.5 dBm/Hz (40 GHz < f ≤ 43 GHz) Without MS2830A-067, with MS2830A-068, Preamp: On, Frequency band mode: Normal –144.5 dBm/Hz (nom., 100 kHz) –153.5 dBm/Hz (1 MHz) –160.5 dBm/Hz (30 MHz ≤ f < 1 GHz) –158.5 dBm/Hz (1 GHz ≤ f < 2 GHz) –156.5 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –152.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz) –152.5 dBm/Hz (4 GHz < f ≤ 6 GHz) –157.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –155.5 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –153.5 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –153.5 dBm/Hz (26.5 GHz < f ≤ 34 GHz) –147.5 dBm/Hz (34 GHz < f ≤ 40 GHz) –144.5 dBm/Hz (40 GHz < f ≤ 43 GHz) With MS2830A-067: See Microwave Preselector Bypass (Displayed average noise level)
Adjacent Channel Power (ACP)	Reference: Span total, Carrier total, Both sides of carriers, Carrier select Adjacent channel specifications: 3 channels × 2
Channel Power	Measurement of absolute values: dBm, dBm/Hz
Occupied Bandwidth (OBW)	N% of power, X-dB down

Power vs. Time Displayed Function

Function Outline	Displayed time changes of power for captured waveform data
Analysis Time Range	Analysis start time: Sets analysis start time position from beginning of waveform data Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Resolution Bandwidth	Filter type: Rect, Gaussian, Nyquist, Root nyquist, Off (Default: Off) Roll-off ratio: 0.01 to 1 (Set for Nyquist, Root nyquist) Filter frequency offset: Set center frequency of filter in wavelength data frequency band
AM Depth (Peak to Peak Measurement)	Measures with AM depth or marker function +Peak, –Peak, (P-P)/2, Average
Burst Average Power	Measures average power of burst signal

Frequency vs. Time Displayed Function

Function Outline	Displayed frequency time fluctuations of input signal from captured waveform data
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Operating Level Range	–17 to +30 dBm (Input attenuator: ≥10 dB)
Frequency (Vertical Axis)	Can be set center frequency and span at frequency range in waveform data Displayed frequency range: Selectable 1/25, 1/10, 1/5, 1/2 of analysis bandwidth Input frequency range: 10 MHz to 6 GHz
Frequency Readout Accuracy	Input level: –17 to +30 dBm, Span: ≤31.25 MHz, Scale: Span/25, CW input ± (Reference oscillator accuracy × Center frequency + Displayed frequency range × 0.01) Hz
FM Deviation (Peak to Peak Measurement)	Measures FM deviation or marker function +Peak, –Peak, (P-P)/2, Average
FMCW Measurement	Display items: FM Error Peak, FM Error RMS, Chirp Deviation, Chirp Rate, Chirp Length The measurement range can be set by automatic detection or marker.

Phase vs. Time Displayed Function

Function Outline	Displayed phase time fluctuation of input signal from captured waveform data
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Phase (Vertical Axis)	Display mode: Wrap, Unwrap Displayed phase range: 0.01 deg./div to 200 Gdeg./div Offset: –100 deg. to +100 Mdeg.

CCDF/APD Displayed Function

Function Outline	Displayed CCDF and APD of waveform date within a given length of time
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Display	Displayed CCDF or APD as graphs Histogram resolution: 0.01 dB Value: Average power, Max. power, Crest factor
Resolution Bandwidth	Filter type: Rectangle, Off (Default: Off) Filter frequency offset: Sets filter center frequency in frequency band of waveform data

Spectrogram Displayed Function

Function Outline	Displayed spectrogram for arbitrary time length in captured waveform data
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Frequency	Can be set center frequency and span at frequency range in waveform data
Resolution Bandwidth (RBW)	Setting range: 1 Hz to 1 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5: 1 (nom.)

Digitize Function

Function Outline	Captured waveform data saved to internal HDD or output to external devices
Waveform Data	Format: I, Q (each 32 bit, Float binary type) Level: 0 dBm input is $\sqrt{(I^2 + Q^2)} = 1$ Level accuracy: Same as signal analyzer absolute amplitude accuracy
External Output	Can be output to external PC via Ethernet

Replay Function

<table>
<tr><td>Function Outline</td><td>Captured waveforms can be replayed again by using the VSA function to read saved digitize data</td></tr>
<tr><td>Conditions for Measurable Waveform Data</td><td>Format: I, Q (binary format)
Combination of span, sampling rate, and Minimum capture sample
<table>
<tr><th>Span</th><th>Sampling Rate</th><th>Minimum Capture Sample</th></tr>
<tr><td>1 kHz</td><td>2 kHz</td><td>74000 (37 s)</td></tr>
<tr><td>2.5 kHz</td><td>5 kHz</td><td>160000 (32 s)</td></tr>
<tr><td>5 kHz</td><td>10 kHz</td><td>310000 (31 s)</td></tr>
<tr><td>10 kHz</td><td>20 kHz</td><td>610000 (30.5 s)</td></tr>
<tr><td>25 kHz</td><td>50 kHz</td><td>730000 (14.6 s)</td></tr>
<tr><td>50 kHz</td><td>100 kHz</td><td>730000 (7.3 s)</td></tr>
<tr><td>100 kHz</td><td>200 kHz</td><td>730000 (3.65 s)</td></tr>
<tr><td>250 kHz</td><td>500 kHz</td><td>730000 (1.46 s)</td></tr>
<tr><td>500 kHz</td><td>1 MHz</td><td>730000 (730 ms)</td></tr>
<tr><td>1 MHz</td><td>2 MHz</td><td>730000 (365 ms)</td></tr>
<tr><td>2.5 MHz</td><td>5 MHz</td><td>730000 (146 ms)</td></tr>
<tr><td>5 MHz</td><td>10 MHz</td><td>730000 (73 ms)</td></tr>
<tr><td>10 MHz</td><td>20 MHz</td><td>730000 (36.5 ms)</td></tr>
<tr><td>18.6 MHz</td><td>20 MHz</td><td>730000 (36.5 ms)</td></tr>
<tr><td>20 MHz</td><td>25 MHz</td><td>730000 (29.2 ms)</td></tr>
<tr><td>25 MHz</td><td>50 MHz</td><td>730000 (14.6 ms)</td></tr>
<tr><td>31.25 MHz</td><td>50 MHz</td><td>730000 (14.6 ms)</td></tr>
<tr><td>50 MHz</td><td>100 MHz</td><td>730000 (7.3 ms)</td></tr>
<tr><td>62.5 MHz</td><td>100 MHz</td><td>730000 (7.3 ms)</td></tr>
<tr><td>100 MHz</td><td>200 MHz</td><td>730000 (3.65 ms)</td></tr>
<tr><td>125 MHz</td><td>200 MHz</td><td>730000 (3.65 ms)</td></tr>
</table></td></tr>
</table>

Connector

RF Input	18°C to 28°C, Input attenuator: ≥10 dB With MS2830A-044 Connector: N-J (Front panel), 50Ω (nom.) VSWR: ≤1.2 (nom., 40 MHz ≤ f ≤ 3 GHz) ≤1.5 (nom., 3 GHz < f ≤ 6 GHz) ≤1.6 (nom., 6 GHz < f ≤ 13.5 GHz) ≤1.9 (nom., 13.5 GHz < f ≤ 26.5 GHz) With MS2830A-045 Connector: K-J (Front panel), 50Ω (nom.) VSWR: ≤1.2 (nom., 40 MHz ≤ f ≤ 3 GHz) ≤1.3 (nom., 3 GHz < f ≤ 6 GHz) ≤1.3 (nom., 6 GHz < f ≤ 13.5 GHz) ≤1.4 (nom., 13.5 GHz < f ≤ 26.5 GHz) ≤1.6 (nom., 26.5 GHz < f ≤ 40 GHz) ≤1.6 (Reference data, 40 GHz < f ≤ 43 GHz, V-K converter mounted and included)
External Reference Input	Connector: BNC-J (Rear panel), 50Ω (nom.) Frequency: 5, 10, 13 MHz Operating range: ±1 ppm Input level: –15 to +20 dBm, 50Ω (AC coupling)
Reference Signal Output	Connector: BNC-J (Rear panel), 50Ω (nom.) Frequency: 10 MHz Output level: ≥0 dBm (AC coupling)
Sweep Status Output	Connector: BNC-J (Rear panel) Output level: TTL level (High level at sweeping or waveform capture)
SA Trigger Input	Connector: BNC-J (Rear panel) Output level: TTL level
Noise Source Drive	This is available when the MS2830A-017/117 is installed. Supply (+28 V) of the noise source drive. Rear panel, BNC-J Output voltage: 28 ±0.5 V, Pulsed
External Controller	Control from external controller (excluding power-on/off)
Ethernet (10/100/1000BASE-T)	Connector: RJ-45 (Rear panel)
GPIB	IEEE 488 bus connector (IEEE 488.2, Rear panel) Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2
USB (B)	USB-B connector (USB2.0, Rear panel)
USB	USB-A connector (USB2.0, Front panel: 2 ports, Rear panel: 2 ports)
Monitor Output	Mini D-Sub 15 pin (Compatible with VGA, Rear panel)
AUX	50-pin (Correspond to DX10A-50S, Rear panel), Using extended input/output
IF Output*	Connector: SMA-J (Rear panel), 50Ω (nom.) Frequency: 1.875 GHz Gain: –10 dB (nom., Input attenuator: 0 dB, Input frequency: 10 GHz)
1st Local Output*	Connector: SMA-J (Front panel), 50Ω (nom.) Frequency: 5 GHz to 10 GHz (Local signal output), 1.875 GHz (IF frequency) Gain: –10 dB (nom., Input attenuator: 0 dB, Input frequency: 10 GHz)

*: With MS2830A-044/045 only

Display

Display	XGA-color LCD (Resolution: 1024 × 768), 8.4 inches (Diagonal: 213 mm)

General

Dimensions and Mass		426 (W) × 177 (H) × 390 (D) mm (excluding projections) ≤15 kg (excluding other options)
Power Supply		Power voltage: 100 VAC to 120 VAC/200 VAC to 240 VAC Frequency: 50 Hz/60 Hz Power consumption: 190 VA (nom., excluding other options)
Temperature Range		Operating: +5°C to +45°C, Storage: –20°C to +60°C
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000: 2018

External Mixer Function (26.5 GHz to 325 GHz)

<table>
<tr>
<td>External Mixer*</td>
<td>
Frequency
Frequency range: 26.5 GHz to 325 GHz
Frequency bands:
<table>
<tr><th>Model</th><th>Band</th><th>Frequency Range</th><th>Mixer Harmonics Order (N)</th></tr>
<tr><td>MA2741C</td><td>A</td><td>26.5 GHz to 40 GHz</td><td>4+</td></tr>
<tr><td>MA2742C</td><td>Q</td><td>33 GHz to 50 GHz</td><td>5+</td></tr>
<tr><td>MA2743C</td><td>U</td><td>40 GHz to 60 GHz</td><td>6+</td></tr>
<tr><td>MA2744C</td><td>V</td><td>50 GHz to 75 GHz</td><td>8+</td></tr>
<tr><td>MA2745C</td><td>E</td><td>60 GHz to 90 GHz</td><td>9+</td></tr>
<tr><td>MA2746C</td><td>W</td><td>75 GHz to 110 GHz</td><td>11+</td></tr>
<tr><td>MA2747C</td><td>F</td><td>90 GHz to 140 GHz</td><td>14+</td></tr>
<tr><td>MA2748C</td><td>D</td><td>110 GHz to 170 GHz</td><td>17+</td></tr>
<tr><td>MA2749C</td><td>G</td><td>140 GHz to 220 GHz</td><td>22+</td></tr>
<tr><td>MA2750C</td><td>Y</td><td>170 GHz to 260 GHz</td><td>26+</td></tr>
<tr><td>MA2751C</td><td>J</td><td>220 GHz to 325 GHz</td><td>33+</td></tr>
</table>
Amplitude
Mixer conversion loss
Setting range: 0 to 99.9 dB
Maximum input level, Average noise level, Frequency response: Depends on external mixer
Input/Output
Applicable mixer: 2-port mixer only
Local frequency: 5 GHz to 10 GHz
IF frequency: 1.875 GHz
</td>
</tr>
</table>

*: With MS2830A-044/045 only

Rubidium Reference Oscillator MS2830A-001

Generates 10 MHz reference signal with higher frequency stability.

Frequency

Internal Reference Oscillator	See Signal Analyzer/Spectrum Analyzer (Internal reference oscillator)

Analysis Bandwidth 10 MHz MS2830A-006

This option adds a function to analyze 10 MHz bandwidth.

Analysis Bandwidth Extension to 31.25 MHz MS2830A-005

This option adds a function to analyze 31.25 MHz bandwidth. (Requires MS2830A-006)
MS2830A-005 is not available when MS2830A-045 is installed.

Bandwidth Extension to 31.25 MHz for Millimeter-wave MS2830A-009

This option adds a function to analyze 31.25 MHz bandwidth (Requires MS2830A-006).
MS2830A-009 is available when MS2830A-045 is installed.
Cannot be set the RBW to more than 10 MHz in Spectrum Analyzer function.

Preamplifier MS2830A-008

This option amplifies signal prior to mixer to enhance sensitivity.
Cannot install simultaneously with MS2830A-068.

Frequency

Frequency Range	100 kHz to 6 GHz

Amplitude

Level Measurement Range	See Signal Analyzer/Spectrum Analyzer (Level measurement range)
Maximum Input Level	See Signal Analyzer/Spectrum Analyzer (Maximum input level)
Displayed Average Noise Level (DANL)	See Spectrum Analyzer, Signal Analyzer (Displayed average noise level (DANL))
RF Frequency Characteristics	See Signal Analyzer/Spectrum Analyzer (RF frequency characteristics)
Input Attenuator Switching Uncertainty	See Signal Analyzer/Spectrum Analyzer (Input attenuator switching uncertainty)
Linearity Error	See Signal Analyzer/Spectrum Analyzer (Linearity error)
Second Harmonic Distortion	See Signal Analyzer/Spectrum Analyzer (Second harmonic distortion)
1 dB Gain Compression	See Signal Analyzer/Spectrum Analyzer (1 dB gain compression)
2-tone 3rd-order Intermodulation Distortion	See Spectrum Analyzer (2-tone 3rd-order intermodulation distortion)

Phase Noise Measurement Function MS2830A-010

Displays the phase noise characteristics on a logarithmic scale

Frequency

Frequency Range	10 MHz to Upper frequency limit
Offset Frequency Range	10 Hz to 10 MHz
Marker Mode	Normal, Integral noise, RMS noise, Jitter, Residual FM

2ndary HDD MS2830A-011

This option adds a Removable HDD for storing user data.

Precompliance EMI Function MS2830A-016

Adds the detection mode and the resolution bandwidth for EMI measurement to the Spectrum Analyzer function.

Resolution Bandwidth (RBW)	Setting range: 200 Hz (6 dB), 9 kHz (6 dB), 120 kHz (6 dB), 1 MHz (Impulse)
Detector	Quasi-Peak, CISPR-AVG, RMS-AVG

Noise Figure Measurement Function MS2830A-017*1

Frequency

Frequency Range	MS2830A-044: 30 MHz to 26.5 GHz MS2830A-045: 30 MHz to 40 GHz
Frequency Setting Range	MS2830A-044: 10 MHz to 26.5 GHz MS2830A-045: 10 MHz to 43 GHz

NF Measurement
Within the measurement range,
Attenuator = 0 dB*2

Measurement Range	–20 to +40 dB
Instrument Uncertainty	ENR: 4 to 7 dB ±0.02 dB ENR: 12 to 17 dB ±0.025 dB ENR: 20 to 22 dB ±0.03 dB

Gain Measurement

Measurement Range	Within the frequency range –20 to +40 dB
Instrument Uncertainty	Within the measurement range ≤0.07

Resolution Bandwidth

Setting Range	100 kHz to 8 MHz

Connector

Noise Source	Connector: Rear panel, BNC-J Output voltage: 28 ±0.5 V, Pulsed

*1: Recommending the NC346 series noise sources by Noisecom company
*2: Recommend to use Pre Amp

BER Measurement Function MS2830A-026

Connector	AUX connector (Rear panel)* *: Can convert to BNC by connecting AUX Conversion Adapter (J1556A).
Input Level	TTL level
Input Signal	Data, Clock, Enable
Input Bit Rate	100 bps to 10 Mbps
Measured Patterns	PN9, PN11, PN15, PN20, PN23, ALL0, ALL1, Alternate (0101 ...) PN9Fix, PN11Fix, PN15Fix, PN20Fix, PN23Fix, User define (4096 bits max.)
Synchronization Establishing Condition	PN signal: PN stage × 2 bit error free At PNFix signal: PN stage × 2 bit error free, PN signal and sync establishment, establish sync with PNFix signal at PN stage error free from PNFix signal header bit ALL0, ALL1, Alternate (0101 ...): 10 bit error free User define: 8 to 1024 bits (variable) error free Select header bit used at sync detection
Re-synchronization Judgment Condition	x/y (Resynchronization at detection of x-bit error in y bits) y ... Measured bit count: Select from 500 bits, 5000 bits, 50000 bits x ... Number of error bits in y bits: Setting range 1 to y/2
Measured Bit Count	$\leq 2^{32} - 1$ bits
Measured Error Bit Count	$\leq 2^{31} - 1$ bits
Measurement End Conditions	Measured bit count, Measured error bit count
Auto Re-synchronization Function	Can be toggled on and off
Operation at Resync.	Select from Count clear, and Count keep
Measurement Mode	Single, Endless, Continuous
Display	Status, Error, Error rate, Error count, SyncLoss count, Measured bit count
Polarity Inversion Function	Supports polarity reversal for Data, Clock, Enable
Clear Measurement Function	At BER measurement, hold sync status, clears measured value and measures from 0

Microwave Preamplifier MS2830A-068

This option amplifies signal prior to mixer to enhance sensitivity.
Cannot install simultaneously with MS2830A-008.
When MS2830A-168 is added to MS2830A (with MS2830A-008), only MS2830A-168 becomes available.

Frequency

Frequency Range	100 kHz to 26.5 GHz [MS2830A-044] 100 kHz to 43 GHz [MS2830A-045]

Amplitude

Level Measurement Range	See Signal Analyzer/Spectrum Analyzer (Level measurement range)
Maximum Input Level	See Signal Analyzer/Spectrum Analyzer (Maximum input level)
Displayed Average Noise Level (DANL)	See Spectrum Analyzer, Signal Analyzer (Displayed average noise level (DANL))
RF Frequency Characteristics	See Signal Analyzer/Spectrum Analyzer (RF frequency characteristics)
Input Attenuator Switching Uncertainty	See Signal Analyzer/Spectrum Analyzer (Input attenuator switching uncertainty)
Linearity Error	See Signal Analyzer/Spectrum Analyzer (Linearity error)
Second Harmonic Distortion	See Signal Analyzer/Spectrum Analyzer (Second harmonic distortion)
1 dB Gain Compression	See Signal Analyzer/Spectrum Analyzer (1 dB gain compression)
2-tone 3rd-order Intermodulation Distortion	See Spectrum Analyzer (2-tone 3rd-order intermodulation distortion)

Microwave Preselector Bypass MS2830A-067

Bypasses the preselector to improve the RF frequency characteristics and the in-band frequency characteristics.
Add MS2830A-067 when using the signal analyzer measurement functions at bandwidth: >31.25 MHz and frequency: >6 GHz.
When the preselector option is set to On, the image response elimination filter is bypassed.
Therefore, this function is not appropriate for spurious measurement to receive the image response.
Microwave Preselector Bypass: On (with MS2830A-067), Microwave Preselector Bypass: Off (with special directions)

Frequency

Frequency Range	4 GHz to 26.5 GHz [MS2830A-044] 4 GHz to 43 GHz [MS2830A-045]

Amplitude

Frequency Characteristics	18°C to 28°C, After Cal, Input attenuator: 10 dB, Microwave Preselector Bypass: On Without MS2830A-068, Preamp: Off ±1.0 dB (6 GHz ≤ f ≤ 13.8 GHz, Frequency band mode: Normal) (4 GHz ≤ f ≤ 13.8 GHz, Frequency band mode: Spurious) ±1.5 dB (13.8 GHz < f ≤ 26.5 GHz) ±2.0 dB (26.5 GHz < f ≤ 40 GHz) ±2.0 dB (typ., 40 GHz < f ≤ 43 GHz) With MS2830A-068, Preamp: On ±1.8 dB (6 GHz ≤ f ≤ 13.8 GHz, Frequency band mode: Normal) (4 GHz ≤ f ≤ 13.8 GHz, Frequency band mode: Spurious) ±2.5 dB (13.8 GHz < f ≤ 26.5 GHz) ±3.0 dB (26.5 GHz < f ≤ 40 GHz) ±3.0 dB (nom., 40 GHz < f ≤ 43 GHz) * With MS2830A-067, Microwave Preselector Bypass: Off, see Signal Analyzer/Spectrum Analyzer (RF frequency characteristics)
Displayed Average Noise Level (DANL)	18°C to 28°C, Detector: Sample, VBW: 1 Hz (Video average), Input attenuator: 0 dB, Frequency band mode: Normal Without MS2830A-068, Microwave Preselector Bypass: On, Off –120 dBm/Hz (9 kHz ≤ f < 100 kHz, nom.) –134 dBm/Hz (100 kHz) –134 dBm/Hz (100 kHz < f < 1 MHz, nom.) –144 dBm/Hz (1 MHz) –144 dBm/Hz (1 MHz < f < 10 MHz, nom.) –150 dBm/Hz (10 MHz ≤ f < 30 MHz, nom.) –153 dBm/Hz (30 MHz ≤ f < 1 GHz) –150 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –147 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –144 dBm/Hz (3.5 GHz < f ≤ 4 GHz) –144 dBm/Hz (4 GHz < f ≤ 6 GHz) –147 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –145 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –141 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –141 dBm/Hz (26.5 GHz < f ≤ 34 GHz) –135 dBm/Hz (34 GHz < f ≤ 40 GHz) –132 dBm/Hz (40 GHz < f ≤ 43 GHz) With MS2830A-068, Preamp: Off, Microwave Preselector Bypass: On, Off –120 dBm/Hz (9 kHz ≤ f < 100 kHz, nom.) –134 dBm/Hz (100 kHz) –134 dBm/Hz (100 kHz < f < 1 MHz, nom.) –144 dBm/Hz (1 MHz) –144 dBm/Hz (1 MHz < f < 10 MHz, nom.) –150 dBm/Hz (10 MHz ≤ f < 30 MHz, nom.) –153 dBm/Hz (30 MHz ≤ f < 1 GHz) –150 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –147 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –144 dBm/Hz (3.5 GHz < f ≤ 4 GHz) –144 dBm/Hz (4 GHz < f ≤ 6 GHz) –142 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –140 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –136 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –136 dBm/Hz (26.5 GHz < f ≤ 34 GHz) –131 dBm/Hz (34 GHz < f ≤ 40 GHz) –128 dBm/Hz (40 GHz < f ≤ 43 GHz) With MS2830A-068, Preamp: On, Microwave Preselector Bypass: On –147 dBm/Hz (100 kHz, nom.) –156 dBm/Hz (1 MHz) –163 dBm/Hz (30 MHz ≤ f < 1 GHz) –161 dBm/Hz (1 GHz ≤ f < 2 GHz) –159 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –155 dBm/Hz (3.5 GHz < f ≤ 4 GHz) –155 dBm/Hz (4 GHz < f ≤ 6 GHz) –154 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –152 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –150 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –150 dBm/Hz (26.5 GHz < f ≤ 34 GHz) –144 dBm/Hz (34 GHz < f ≤ 40 GHz) –141 dBm/Hz (40 GHz < f ≤ 43 GHz)
Image Responses	With MS2830A-067, Microwave Preselector Bypass: Off ≤–60 dBc (6 GHz < f ≤ 13.5 GHz) ≤–60 dBc (13.5 GHz < f ≤ 26.5 GHz) With MS2830A-067, Microwave Preselector Bypass: On Generated at the frequency at the distance of 1.875 GHz × 2 0 dBc (nom., 4 GHz ≤ f ≤ 26.5 GHz) 0 dBc (nom., 26.5 GHz < f ≤ 43 GHz)

Analysis Bandwidth Extension to 62.5 MHz MS2830A-077

This option adds a function to analyze 62.5 MHz bandwidth.

MS2830A-044: Requires MS2830A-006 and MS2830A-005
MS2830A-045: Requires MS2830A-006 and MS2830A-009

Analysis Bandwidth Extension to 125 MHz MS2830A-078

This option adds a function to analyze 125 MHz bandwidth.

MS2830A-044: Requires MS2830A-006, MS2830A-005 and MS2830A-077
MS2830A-045: Requires MS2830A-006, MS2830A-009 and MS2830A-077

An image response is received when setting the bandwidth to more than 31.25 MHz.
This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.).
The Signal Analyzer MS2690A is recommended for other measurement purposes.

General

Analysis Bandwidth	See Signal Analyzer (Analysis bandwidth)
Sampling Rate	See Signal Analyzer (Sampling rate)
Capture Time	See Signal Analyzer (Capture time)
ADC Resolution	With MS2830A-077/078, >31.25 MHz bandwidth 14 bits

Frequency

Frequency Setting	See Signal Analyzer/Spectrum display function (Frequency setting)
Resolution Bandwidth (RBW)	See Signal Analyzer/Spectrum display function (Resolution bandwidth (RBW))

Amplitude

Displayed Average Noise Level (DANL)	18°C to 28°C, Time Detection: Average, Input attenuator: 0 dB With MS2830A-077 or 078, >31.25 MHz bandwidth Without MS2830A-008/068, or with MS2830A-008/068, Preamp: Off –146.5 dBm/Hz (300 MHz ≤ f < 1 GHz), –143.5 dBm/Hz (1 GHz ≤ f < 2.4 GHz), –140.5 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz), –137.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz), –137.5 dBm/Hz (4 GHz < f ≤ 6 GHz) With MS2830A-008/068, Preamp: ON –156.5 dBm/Hz (300 MHz ≤ f < 1 GHz), –154.5 dBm/Hz (1 GHz ≤ f < 2 GHz), –152.5 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz), –148.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz), –148.5 dBm/Hz (4 GHz < f ≤ 6 GHz) 18°C to 28°C, Input attenuator: 0 dB With MS2830A-077 or 078, with MS2830A-067, >31.25 MHz bandwidth Without MS2830A-068 –137.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz), –135.5 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz), –131.5 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –131.5 dBm/Hz (26.5 GHz < f ≤ 34 GHz), –125.5 dBm/Hz (34 GHz < f ≤ 40 GHz), –122.5 dBm/Hz (40 GHz < f ≤ 43 GHz) [MS2830A-045] With MS2830A-068, Preamp: Off –132.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz), –130.5 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz), –126.5 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –126.5 dBm/Hz (26.5 GHz < f ≤ 34 GHz), –121.5 dBm/Hz (34 GHz < f ≤ 40 GHz), –118.5 dBm/Hz (40 GHz < f ≤ 43 GHz) [MS2830A-045] With MS2830A-068, Preamp: On –147.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz), –145.5 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz), –143.5 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –143.5 dBm/Hz (26.5 GHz < f ≤ 34 GHz), –137.5 dBm/Hz (34 GHz < f ≤ 40 GHz), –134.5 dBm/Hz (40 GHz < f ≤ 43 GHz) [MS2830A-045]
Image Response	With MS2830A-077/078, >31.25 MHz bandwidth Image response (occurs at frequency 200 MHz away): 0 dBc (nom., 300 MHz < f ≤ 43 GHz) With MS2830A-077/078, MS2830A-067, >31.25 MHz bandwidth Image response (occurs at frequency 1.875 GHz × 2 away): 0 dBc (nom., 6 GHz < f ≤ 43 GHz)
RF Frequency Characteristics	18°C to 28°C, After Cal, Input attenuator: 10 dB, Frequency band mode: Normal, >31.25 MHz bandwidth Without MS2830A-008/068, or Preamp: Off ±0.35 dB (300 MHz ≤ f < 4 GHz), ±1.5 dB (4 GHz ≤ f ≤ 6 GHz) With MS2830A-008, Preamp: On ±0.65 dB (300 MHz ≤ f < 4 GHz), ±1.8 dB (4 GHz ≤ f ≤ 6 GHz) Without MS2830A-068, or Preamp: Off With MS2830A-067, Microwave Preselector Bypass: On ±1.0 dB (6 GHz ≤ f ≤ 13.8 GHz), ±1.5 dB (13.8 GHz < f ≤ 26.5 GHz), ±2.0 dB (26.5 GHz < f ≤ 40 GHz), ±2.0 dB (typ., 40 GHz < f ≤ 43 GHz) With MS2830A-068, or Preamp: On With MS2830A-067, Microwave Preselector Bypass: On ±1.8 dB (6 GHz ≤ f ≤ 13.8 GHz), ±2.5 dB (13.8 GHz < f ≤ 26.5 GHz), ±3.0 dB (26.5 GHz < f ≤ 40 GHz), ±3.0 dB (nom., 40 GHz < f ≤ 43 GHz)
Linearity Error	See Signal Analyzer/Spectrum Analyzer (Linearity error)

High Performance Waveguide Mixer (50 to 75 GHz) MA2806A
High Performance Waveguide Mixer (60 to 90 GHz) MA2808A

See MA2806A/MA2808A page for detail.

Typical (typ.): Performance not warranted. Most products meet typical performance.
Nominal (nom.): Values not warranted. Included to facilitate application of product.
Example: Performance not warranted. Data actually measured by randomly selected measuring instruments.

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MS2830A	Signal Analyzer
	Standard Accessories
	Power Cord: 1 pc
P0031A	USB Memory (≥256 MB, USB2.0 Flash Driver): 1 pc
Z0541A	USB Mouse: 1 pc
	Install CD-ROM (Application software, instruction manual CD-ROM): 1 pc
	Options
MS2830A-044	26.5 GHz Signal Analyzer
MS2830A-045	43 GHz Signal Analyzer
MS2830A-001	Rubidium Reference Oscillator
MS2830A-005*1	Analysis Bandwidth Extension to 31.25 MHz
MS2830A-006	Analysis Bandwidth 10 MHz
MS2830A-008	Preamplifier
MS2830A-009*2	Bandwidth Extension to 31.25 MHz for Millimeter-wave
MS2830A-010	Phase Noise Measurement Function
MS2830A-011	2ndary HDD
MS2830A-016	Precompliance EMI Function
MS2830A-017	Noise Figure Measurement
MS2830A-026*3	BER Measurement Function (AUX Conversion Adapter J1556A as standard accessory)
MS2830A-067	Microwave Preselector Bypass
MS2830A-068	Microwave Preamplifier
MS2830A-077*4	Analysis Bandwidth Extension to 62.5 MHz
MS2830A-078*5	Analysis Bandwidth Extension to 125 MHz
MS2830A-311	2ndary HDD Retrofit
	Retrofit Options
MS2830A-101	Rubidium Reference Oscillator Retrofit
MS2830A-105*1	Analysis Bandwidth Extension to 31.25 MHz Retrofit
MS2830A-106	Analysis Bandwidth 10 MHz Retrofit
MS2830A-108	Preamplifier Retrofit
MS2830A-109*2	Bandwidth Extension to 31.25 MHz for Millimeter-wave Retrofit
MS2830A-110	Phase Noise Measurement Function Retrofit
MS2830A-111	2ndary HDD Retrofit
MS2830A-116	Precompliance EMI Function Retrofit
MS2830A-117	Nose Figure Measurement Retrofit
MS2830A-126*3	BER Measurement Function Retrofit (AUX Conversion Adapter J1556A as standard accessory)
MS2830A-167	Microwave Preselector Bypass Retrofit
MS2830A-168	Microwave Preamplifier Retrofit
MS2830A-182*6	CPU/Windows10 Upgrade Retrofit
MS2830A-282*6	CPU/Windows10 Upgrade Retrofit
	Software Options
	CD-ROM with License and Operation manuals
MX269011A	W-CDMA/HSPA Downlink Measurement Software
MX269012A	W-CDMA/HSPA Uplink Measurement Software
MX269013A	GSM/EDGE Measurement Software
MX269013A-001	EDGE Evolution Measurement Software (Requires MX269013A)
MX269015A	TD-SCDMA Measurement Software
MX269017A	Vector Modulation Analysis Software
MX269020A	LTE Downlink Measurement Software
MX269020A-001	LTE-Advanced FDD Downlink Measurement Software (Requires MX269020A)
MX269021A	LTE Uplink Measurement Software
MX269021A-001	LTE-Advanced FDD Uplink Measurement Software (Requires MX269021A)
MX269022A	LTE TDD Downlink Measurement Software
MX269022A-001	LTE-Advanced TDD Downlink Measurement Software (Requires MX269022A)
MX269023A	LTE TDD Uplink Measurement Software
MX269023A-001	LTE-Advanced TDD Uplink Measurement Software (Requires MX269023A)
MX269024A	CDMA2000 Forward Link Measurement Software
MX269024A-001	All Measure Function (Requires MX269024A)
MX269026A	EV-DO Forward Link Measurement Software
MX269026A-001	All Measure Function (Requires MX269026A)
MX269028A	WLAN (802.11) Measurement Software
MX269028A-001	802.11ac (80 MHz) Measurement Software (Requires MX269028A)
MX269030A	W-CDMA BS Measurement Software
	Warranty Service
MS2830A-ES210	2 years Extended Warranty Service
MS2830A-ES310	3 years Extended Warranty Service
MS2830A-ES510	5 years Extended Warranty Service

Model/Order No.	Name
	Application Parts
	Following operation manuals provided as hard copy
W3334AE	MS2830A Operation Manual (Mainframe Operation)
W2851AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Mainframe Remote Control)
W3335AE	MS2830A/MS2840A/MS2850A Operation Manual (Signal Analyzer Function Operation)
W2853AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Signal Analyzer Function Remote Control)
W3336AE	MS2830A/MS2840A/MS2850A Operation Manual (Spectrum Analyzer Function Operation)
W2855AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Spectrum Analyzer Function Remote Control)
W3117AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Phase Noise Measurement Function Operation)
W3118AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A Operation Manual (Phase Noise Measurement Function Remote Control)
W3655AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A-017 Operation Manual (Noise Figure Measurement Function Operation)
W3656AE	MS2690A/MS2691A/MS2692A and MS2830A/MS2840A/MS2850A-017 Operation Manual (Noise Figure Measurement Function Remote Control)
W3098AE	MX269011A Operation Manual (Operation)
W3099AE	MX269011A Operation Manual (Remote Control)
W3060AE	MX269012A Operation Manual (Operation)
W3061AE	MX269012A Operation Manual (Remote Control)
W3100AE	MX269013A Operation Manual (Operation)
W3101AE	MX269013A Operation Manual (Remote Control)
W3044AE	MX269015A Operation Manual (Operation)
W3045AE	MX269015A Operation Manual (Remote Control)
W3305AE	MX269017A Operation Manual (Operation)
W3306AE	MX269017A Operation Manual (Remote Control)
W3014AE	MX269020A Operation Manual (Operation)
W3064AE	MX269020A Operation Manual (Remote Control)
W3015AE	MX269021A Operation Manual (Operation)
W3065AE	MX269021A Operation Manual (Remote Control)
W3209AE	MX269022A Operation Manual (Operation)
W3210AE	MX269022A Operation Manual (Remote Control)
W3521AE	MX269023A Operation Manual (Operation)
W3522AE	MX269023A Operation Manual (Remote Control)
W3201AE	MX269024A Operation Manual (Operation)
W3202AE	MX269024A Operation Manual (Remote Control)
W3203AE	MX269026A Operation Manual (Operation)
W3204AE	MX269026A Operation Manual (Remote Control)
W3528AE	MX269028A Operation Manual (Operation)
W3529AE	MX269028A Operation Manual (Remote Control)
W2860AE	MX269030A Operation Manual (Operation)
W2861AE	MX269030A Operation Manual (Remote Control)

*1: MS2830A-005/105 is available when MS2830A-044 is installed.
Requires MS2830A-006/106.

*2: MS2830A-009/109 is available when MS2830A-045 is installed.
Requires MS2830A-006/106

*3: The Aux Conversion Adapter J1556A is a standard accessory supplied with MS2830A-026/126.

*4: Retrofit not supported.
Requires MS2830A-006 and MS2830A-005 (for MS2830A-044).
Requires MS2830A-006 and MS2830A-009 (for MS2830A-045).

*5: Retrofit not supported.
Requires MS2830A-006, MS2830A-005 and MS2830A-077 (for MS2830A-044).
Requires MS2830A-006, MS2830A-009 and MS2830A-077 (for MS2830A-045).

*6: Replace the CPU board and upgrade the OS to Windows 10.
Due to OS license restrictions, this option is not applicable to MS2830A units in which Option MS2830A-313 Removable HDD (sales discontinued) is installed.

Model/Order No	Name
	High Performance Waveguide Mixer
MA2806A	High Performance Waveguide Mixer (50 to 75 GHz)
MA2808A	High Performance Waveguide Mixer (60 to 90 GHz)
	Standard Accessories
Z1922A	MA2806A USB Memory (Saved conversion loss data, for MA2806A): 1 pc
Z1923A	MA2808A USB Memory (Saved conversion loss data, for MA2808A): 1 pc
Z1625A	AC Adapter: 1 pc
	Power Cord: 1 pc
J1692B	Coaxial Cord, 1 m (SMA-P · SUCOFLEX104PE · SMA-P, DC to 18 GHz, 50Ω): 1 pc
	External Mixer
MA2741C	External Mixer (26.5 GHz to 40 GHz)
MA2742C	External Mixer (33 GHz to 50 GHz)
MA2743C	External Mixer (40 GHz to 60 GHz)
MA2744C	External Mixer (50 GHz to 75 GHz)
MA2745C	External Mixer (60 GHz to 90 GHz)
MA2746C	External Mixer (75 GHz to 110 GHz)
MA2747C	External Mixer (90 GHz to 140 GHz)
MA2748C	External Mixer (110 GHz to 170 GHz)
MA2749C	External Mixer (140 GHz to 220 GHz)
MA2750C	External Mixer (170 GHz to 260 GHz)
MA2751C	External Mixer (220 GHz to 325 GHz)

Model/Order No	Name
K240B	Power Divider (K connector, DC to 26.5 GHz, 50Ω, K-J, 1 W max.)
MA1612A	Four-port Junction Pad (5 MHz to 3 GHz, N-J)
J0576B	Coaxial Cord, 1 m (N-P · 5D-2W · N-P)
J0576D	Coaxial Cord, 2 m (N-P · 5D-2W · N-P)
J0127A	Coaxial Cord, 1 m (BNC-P · RG58A/U · BNC-P)
J0127B	Coaxial Cord, 2 m (BNC-P · RG58A/U · BNC-P)
J0127C	Coaxial Cord, 0.5 m (BNC-P · RG58A/U · BNC-P)
J0322A	Coaxial Cord, 0.5 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322B	Coaxial Cord, 1 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322C	Coaxial Cord, 1.5 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322D	Coaxial Cord, 2 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0805	DC Block, N type (MODEL 7003) (10 kHz to 18 GHz, N-P · N-J)
J1555A	DC Block, SMA type (MODEL 7006-1) (9 kHz to 20 GHz, SMA-P · SMA-J)
K261	DC Block (10 kHz to 40 GHz, K-P · K-J)
J0004	Coaxial Adapter (DC to 12.4 GHz, 50Ω, N-P · SMA-J)
J1398A	N-SMA Adaptor (DC to 26.5 GHz, 50Ω, N-P · SMA-J)
34AKNF50	Ruggedized K-to-Type N Adapter (DC to 20 GHz, 50Ω, Ruggedized K-M · N-F, SWR: 1.5 (max.), Insertion Loss: 0.4 dB (max.))
J1359A	Coaxial Adaptor (K-P · K-J, SMA)
J0911	Coaxial Cable, 1.0 m for 40 GHz (DC to 40 GHz, approx. 1 m, SF102A, 11K254/K254/1.0M)
J0912	Coaxial Cable, 0.5 m for 40 GHz (DC to 40 GHz, approx. 0.5 m, SF102A, 11K254/K254/0.5M)
41KC-3	Fixed Attenuator (DC to 40 GHz, 3 dB)
J1261A	Ethernet Cable (Shield type, Straight, 1 m)
J1261B	Ethernet Cable (Shield type, Straight, 3 m)
J1261C	Ethernet Cable (Shield type, Cross, 1 m)
J1261D	Ethernet Cable (Shield type, Cross, 3 m)
J0008	GPIB Cable, 2.0 m
J1556A[*7]	AUX Conversion Adapter (AUX → BNC, for vector signal generator option and BER measurement function option)
B0635A	Rack Mount Kit (EIA)
B0657A	Rack Mount Kit (JIS)
B0636C[*8]	Carrying Case (Hard type, with casters)
B0671A[*8]	Front Cover for 1MW4U
MA24105A	Inline Peak Power Sensor (350 MHz to 4 GHz, with USB A to mini B cable)
MA24106A	USB Power Sensor (50 MHz to 6 GHz, with USB A to mini B Cable)
MA24108A	Microwave USB Power Sensor (10 MHz to 8 GHz, with USB A to Micro-B Cable)
MA24118A	Microwave USB Power Sensor (10 MHz to 18 GHz, with USB A to Micro-B Cable)
MA24126A	Microwave USB Power Sensor (10 MHz to 26 GHz, with USB A to Micro-B Cable)
Z0975A	Keyboard (USB)
Z1345A	Installation Kit (required when retrofitting options or installing software)

*7: The AUX Conversion Adapter J1556A is not a standard accessory for the Vector Signal Generator Option MS2830A-020/120/021/121.
The AUX Conversion Adapter J1556A is a standard accessory supplied with BER Measurement Function MS2830A-026/126.

*8: The Carrying Case B0636C includes a Front Panel Protective Cover (B0671A).

High Performance Waveguide Mixer

MA2806A/MA2808A

50 GHz to 75 GHz/60 GHz to 90 GHz

Wide Dynamic Range Based on Excellent Minimum Sensitivity and P1dB Performance

MA2806A

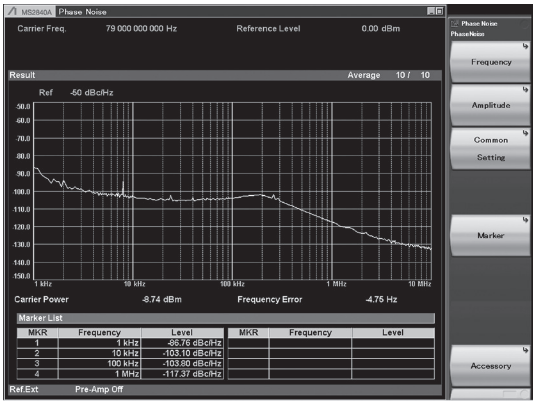
MA2808A

The High Performance Waveguide Mixer MA2806A and MA2808A have a dedicated multiplier, amplifier, bandpass filter, etc., supporting an excellent conversion loss of at least 10 dB better than conventional harmonic mixers, as well as P1dB performance exceeding 0 dBm. When used in combination with the Signal Analyzer MS2850A/MS2840A series (26.5 GHz/44.5 GHz models)/MS2830A series (26.5 GHz/43 GHz models) the display average noise performance level is excellent at –150 dBm/Hz (meas.)*1 at 75 GHz.
Due to this wide dynamic range, the MA2806A and MA2808A support evaluation of the true spurious performance of wider-band, millimeter-wave wireless transmitters as well as various types of millimeter-wave equipment, such as automotive radar, wireless backhaul and gigabit wireless LAN (IEEE 802.11ad/WiGig) etc., that cannot be evaluated accurately using conventional harmonic-mixer and downconverter methods.

Moreover, by using the high IF frequency*2 of the MS2850A/MS2840A series (26.5 GHz/44.5 GHz models)/MS2830A series (26.5 GHz/43 GHz models), spectrum mask measurements can be made over a wide measurement span with no impact from image-response effects. Spectrum mask measurements require measurement over a wider measurement span than the bandwidth of the signal to be measured. For example, when using the MA2806A and MA2808A to measure a signal with a bandwidth of 1 GHz, no image response occurs in a wide measurement span covering 6.5 GHz. Moreover, no image response occurs in a measurement span of 5.5 GHz for a signal with a bandwidth of 2 GHz. Additionally, use of the newly developed PS function supports image-response-free measurements over a measurement span of up to 7.502 GHz, irrespective of the measured signal bandwidth.

Additionally, connecting these mixers to the MS2850A/MS2840A series (26.5 GHz/44.5 GHz models)/MS2830A series (26.5 GHz/43 GHz models) supports measurements using its excellent high phase noise performance of –100 dBc/Hz (10 kHz offset frequency, meas.)*1 in the 79 GHz band for evaluating the intrinsic phase noise performance of millimeter- waveband devices, such as automotive radar.
Connection to the MS2850A/MS2840A series (26.5 GHz/44.5 GHz models)/MS2830A series (26.5 GHz/43 GHz models) is as easy as simply connecting a cable to the IF port. Conversion loss data saved in a USB memory stick is loaded into the Signal Analyzer for reflection in the measured values.

*1: Example when connected with MS2840A. Value measured at design but not guaranteed specification.
*2: 1.8755 GHz (MS2850A/MS2840A), 1.875 GHz (MS2830A)



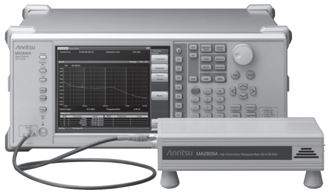
Carrier Freq. 79 000 000 000 Hz
Reference Level 0.00 dBm
Result
Average 10 / 10
Carrier Power -8.74 dBm
Frequency Error -4.75 Hz

Marker List

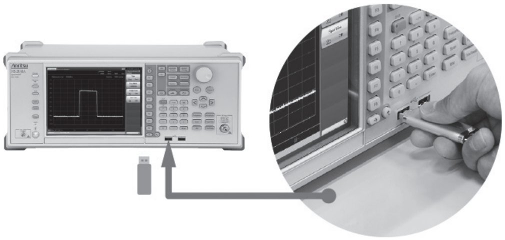
MKR	Frequency	Level	MKR	Frequency	Level
1	1 kHz	-86.76 dBc/Hz			
2	10 kHz	-103.10 dBc/Hz			
3	100 kHz	-103.80 dBc/Hz			
4	1 MHz	-117.37 dBc/Hz			

Ref.Ext
Pre-Amp Off

Phase Noise measurement with MS2840A using High Performance Waveguide Mixer MA2808A (Measurement frequency: 79 GHz)

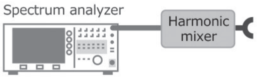
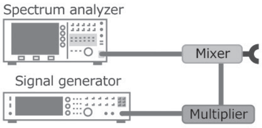


Simple Connection



Save mixer conversion loss data to USB memory

Measurement Method Performance Comparison

Measurement Method	Product Selection Points				
	Min. Sensitivity	Image Response	P1dB	System Config	Mixer Conversion Loss Calibration
Anritsu Solution  	✓ Good	✓ Far	✓ High	✓ Simple	✓ No Need
Harmonic Mixer  	*1 — Bad	*2 — Very Close	✓ High	✓ Simple	*4 ✓ No Need
Down Converter  	✓ Good	✓✓ Very Far	*3 — Low	— Complex	*5 — Need

*1: High noise floor level and narrow dynamic range due to high mixer conversion order
*2: Low IF frequency depending on spectrum analyzer causes occurrence of image response generated in measurement range
*3: Narrow dynamic range due to mixer P1dB performance of only –10 to –5 dBm
*4: Different calibration procedure depending on spectrum analyzer used
*5: Requires mixer conversion loss data for measurement range because any IF frequency can be set

Specifications

Electrical Characteristics

Frequency Range		MA2806A: 50 GHz to 75 GHz MA2808A: 60 GHz to 90 GHz
LO Amplitude Range		>+10 dBm
Multiplication factor		MA2806A: 8 MA2808A: 12
Conversion Loss		<15 dB (typ.)*
1 dB Gain Compression (P1dB)		>0 dBm (typ.)*
LO Leakage		<–30 dBm (nom.)
RF Input VSWR		≤1.5 (nom.)
IF/LO Port VSWR	1.875 GHz (IF)	≤2.0 (nom.)
	5 GHz to 10 GHz (LO)	MA2806A: ≤2.4 (nom.) MA2808A: ≤2.0 (nom.)
Max. Input Level (CW)		+10 dBm

*: At assured performance temperature range

Interface

RF	MA2806A: Waveguide (WR15, UG-385/U) MA2808A: Waveguide (WR12, UG-387/U)
IF/LO	SMA-J

General

Power Supply		100 VAC to 120 VAC/200 VAC to 240 VAC, 50 Hz/60 Hz, 40 VA
Dimensions and Mass		134 (W) × 51 (H) × 229 (D) mm (excluding projections), <2 kg
Temperature Range		Assured performance range: +18°C to +28°C Operating: +5°C to +45°C (no condensation) Storage: –20°C to +60°C (no condensation)
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000: 2018

Typical (typ.): Performance not warranted. Most products meet typical performance.
Nominal (nom.): Values not warranted. Included to facilitate application of product.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
	Main frame	
MA2806A	High Performance Waveguide Mixer (50 GHz to 75 GHz)	
MA2808A	High Performance Waveguide Mixer (60 GHz to 90 GHz)	
	Standard accessories	
Z1922A	MA2806A USB Memory (Saved conversion loss data):	1 pc
Z1923A	MA2808A USB Memory (Saved conversion loss data):	1 pc
Z1625A	AC Adapter:	1 pc
	Power Cord:	1 pc
J1692B	Coaxial Cord, 1 m (SMA-P · SUCOFLEX104PE · SMA-P, DC to 18 GHz, 50Ω):	1 pc

Field Master™

MS2070A

9 kHz to 3 GHz

Handheld RF Spectrum Analyzer

NEW

The Field Master™ MS2070A from Anritsu offers an unrivalled combination of performance and features for standard spectrum analysis to 3 GHz. It builds on Anritsu's experience of developing handheld instruments that delivers in both field and laboratory environments. The large 10-inch high resolution multi-touch screen presents results and instrument configuration in a clear and easy to use style. At under 4 kg weight, with the integrated battery typically providing three hours of operation all in a convenient soft carry case, it is ideal for measurements in the field. Key applications include HF, VHF, UHF transmitter measurements, interference hunting, EMI/EMC pre-compliance testing and PIM hunting.

Key Features

- Spectrum analyzer: 9 kHz to 3 GHz
- Interference analyzer with interference mapping and eCompass handle
- Spectrogram display for detection and recording of interfering signals
- Smart measurements including channel power and occupied bandwidth
- USB power sensor support for precise transmitter power measurements
- AM/FM demodulation with audio output for signal identification

Field Master™

MS2080A

9 kHz to 4 GHz

Handheld RF Spectrum Analyzer

NEW

The Field Master™ MS2080A is a spectrum analyzer that integrates RF field technician's most commonly used instruments into a single package. That means less to carry and a single user interface to learn, making time in the field more productive. Integrating a high performance spectrum analyzer with RTSA, interference analyzer tools, LTE/5GNR transmitter analysis and cable and antenna line sweep measurements the MS2080A addresses the full complement of the RF field technicians requirements. Designed to withstand the knocks and blows inevitable when working at remote transmitter sites. Weighing less than 4 kg, the Field Master MS2080A is small, compact, and easy to carry. An optional shoulder harness attaches to the supplied soft case to ease long-term use outdoors, especially with over six hours of continuous operation when adding the extended power pack. An environmental rating of IP52 in the soft case protects the instrument from dust and water, ensuring it is always ready to make the measurements you need in the location you need them.

Key Features

- Spectrum analyzer: 9 kHz to 4 GHz
- Fast sweep speeds of 45 GHz per second
- Real Time Spectrum Analyzer (RTSA) with 40 MHz bandwidth
- Cable and antenna analyzer with addition of S331P Site Master
- LTE FDD/TDD analyzer with modulation quality
- 5G NR FR1 analyzer including support for DSS
- Interference analyzer with interference mapping and eCompass handle
- USB power sensor support for precise transmitter power measurements
- AM/FM demodulation with audio output for signal identification

Field Master Pro™ Spectrum Analyzer

MS2090A

9 kHz to 9/14/20/26.5/32/43.5/54 GHz

Ruggedized for the Field. High Level of Performance

The Field Master Pro MS2090A, real-time spectrum analyzer, delivers performance never previously available in a compact, handheld instrument. With continuous frequency coverage from 9 kHz to 54 GHz, the Field Master Pro MS2090A is specifically designed to meet the test challenges of a full range of other wireless technologies in use today, including: 5G, LTE, wireless backhaul, aerospace/defense, satellite systems, and radar.
The Field Master Pro MS2090A delivers the highest levels of RF performance available in a handheld, touchscreen spectrum analyzer, with a displayed average noise level (DANL) of –164 dBm and Third Order Intercept (TOI) of +20 dBm (typ). This makes measurements such as spectrum clearing, radio alignment, harmonic, and distortion even more accurate than previously possible. For modulation measurements on digital systems, 100 MHz modulation bandwidth coupled with best-in-class phase noise performance maximizes measurement precision, while ±0.5 dB typical amplitude accuracy provides confidence when testing transmitter power and spurious.
Ruggedized for field use, all versions provide a comprehensive range of features to speed and simplify measurement, as well as enhance usability. RTSA spans of 22 MHz (standard) to 110 MHz (optional) provide capability for cellular interference monitoring to full ISM band signal analysis. In addition to being a full span swept tuned spectrum analyzer, all versions include a spectrogram display that helps monitor the RF spectrum for intermittent or interfering signals. Integrated channel power and occupied bandwidth measurements simplify the measuring and characterizing of common radio transmission. Cable and Antenna line sweep measurements are supported with the addition of the S331P Site Master. IQ data capture of 5G frames enables the capture and saving of IQ data for off-line processing on a PC using standard data analysis tools.

Key Features

- 9 kHz to 9/14/20/26.5/32/43.5/54 GHz
- DANL: –164 dBm (with preamp)
- TOI: +20 dBm (typ)
- Analysis bandwidth: 100 MHz
- Amp range: DANL to +30 dBm
- Phase noise at 1 GHz: –110 dBc/Hz @ 100 kHz offset (typ)
- Demodulation: 5GNR, LTE FDD/TDD RF, and modulation quality plus SSB signal analysis
- Resolution bandwidth (RBW): 1 Hz to 10 MHz
- RTSA bandwidth: 22, 55, 110 MHz (option dependent)
- Amplitude accuracy: <14 GHz ±1.3 dB (±0.5 dB, typ)
- Zero span with 60 ns minimum span

Standard Features

Smart Measurements

Field Strength	Measures field strength (dBm/m^2, dBW/m^2, dBV/m, dBmV/m, dBµV/m, V/m, W/m^2, W/cm^2, A/m) with antenna gain vs. frequency plot
Channel Power	Measures the total power and power spectral density within a specified bandwidth
Occupied Bandwidth	Measures 99 to 1% power channel of a signal
Adjacent Channel Power	Measures channel power of the adjacent channel
Spectral Emission Mask	Standards based limits for wireless emissions

Setup Parameters

Frequency	Center/Start/Stop, Frequency Step, Frequency Offset
Span	Span, Full Span, Last Span, Zero Span
Amplitude	Reference Level (Manual/Auto and Offset), Scale/Division, Y-Axis Unit (dBm, dBW, dBV, dBmV, dBµV, dBA, V, W, A), Preamp (On/Off), Attenuation (Auto/Manual), Attenuation Level, Field Strength, Gestures
Bandwidth	RBW/VBW (Auto/Manual), VBW Type (Linear/Logarithmic), RBW: VBW Ratio, SPAN: RBW Ratio
Sweep	Single/Continuous, Restart, Sweep Once, Sweep to N, Auto/Manual Time, Gated Sweep

Sweep Functions

Sweep	Single/Continuous, Restart, Sweep Once, Sweep to N, Sweep Time
Sweep Time	60 ns to 3600 s in zero span
Sweep Time Accuracy	±2% in zero span
Sweep Points	1001

Trace Functions

Traces	Up to Six Traces
Trace Type	Clear/Write, Min Hold, Max Hold, Average, Rolling Max Hold, Rolling Min Hold, Rolling Average
Trace Mode	Active, Hold/View, Blank
Detector Type per Trace	Peak, Negative, Sample

Spectrogram

Number of Lines	142
Trace Time/Position Cursor	Up to Six Cursors (display historical trace data by trace position or time)
Cursor State	Active, Hold/View, Blank
Color Setup	Set Color Top/Bottom Range, Reference Hue, Preset Setup

Marker Functions

Markers	Up to 12 Markers
Marker Measurements	Amplitude, Frequency (swept spectrum display)
Marker Mode	Normal, Delta, Fixed
Delta Marker	Relative to any Normal or Fixed Marker
Marker Function	None, Noise, Frequency Counter (1 Hz, 100 mHz, 10 mHz, 1 mHz resolutions), Quasi-Peak (per CISPR 16-1-1)
Marker Trace	Assign Marker to any Trace
Peak Search	Peak Search, Next Peak, Next Peak Left, Next Peak Right, Next Point Left, Next Point Right
Peak Search Setup	Peak Threshold, Peak Excursion
Marker →	Mkr → Center, Mkr → Ref Level
Marker Table	Up to 12 Markers Showing Marker Mode, Function, Trace, Frequency, Amplitude, Delta Frequency & Offset

Limit Line Functions

Limit Setup	Upper/Lower, Limit On/Off, Limit Alarm On/Off, Set Default Limit Line, Absolute/Relative
Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
Limit Line Move	Center, X-Offset (Hz), Left, Right, Y-Offset, Up, Down, To Marker 1, Marker 1 Offset (dB)
Limit Line Envelope	Select Envelope (Upper/Lower), Set Envelope, Envelope Points (2-41), Amplitude Offset, Shape (Square/Slope)

General Specifications

Setup Menu

Date and Time	Date and Time settings (Automatic, Manual), Time Zone settings, Time synced to Internet/GPS
Languages	English, Spanish, Chinese-simplified, Japanese, French, Korean
Display	Brightness adjustment, Auto screen dimming shutoff timer (on/off), Color schemes (Default, Light, Black on White, Night Vision), Shortcuts (Hide Shortcuts On/Off)
Screenshot	Capture Region (Graphs Only, Entire Application), Color (Printable, Standard), Annotations (Header, Footer) File naming (Automatic Timestamp, Manual), Directory
Option	Installed Options, Available Options, Install Options from web, Enable options using file (USB), Save Config
GPS	GPS Receiver (Option 31)
Ethernet	Ethernet (IP4 & IP6 formats), Type (DHCP, Static, IP)
WLAN (Wi-Fi)	2 × 2 MIMO, 802.11 a/b/g/n/ac, On/Off, Auto detect wireless networks
Diagnostics	Self Test, Service Tools, exportable event and system error logs

File Menu

Save/Recall	Measurement Setup, Screenshot Image (.PNG), Export Measurement data (Text, CSV), Location
File Management	Save, Copy, Paste, Delete, Create New Folder, Set File Name and File Type, Rename

Connectors

RF In	MS2090A-0709, -0714, -0720: Type N (f), 50Ω MS2090A-0726, -0732, -0743: Ruggedized Type K (m), 50Ω MS2090A-0754: Ruggedized Type V (m), 50Ω
GPS	SMA (f), 50Ω
External Power	5.5 mm barrel connector, 14 V to 16 VDC, 5.0 A max
Ethernet Interface	RJ45 connector for Ethernet 10/100/1000 Mbps (connect to PC or LAN for remote access) and IQ streaming
USB Interface	Two USB 3 Type A (supports file transfer and IQ capture/streaming) One USB 3 Type C (USB-TMC) (Compatible with external USB memory device that have an integrated keypad and are FIPS compliant using AES 256-bit encryption.)
Headset Jack	3.5 mm 3-wire headset jack
External Reference In	SMA (f), 50Ω, maximum input +10 dBm
External Reference Out	SMB (f), 50Ω, 10 MHz
External Trigger	SMB (f), 50Ω, TTL-compatible levels, maximum input +5 VDC
IF Out	SMB (f), 50Ω (Zero Span IF Output (Option 89))
DC Bias Voltage	SMB (f), Setup: On/Off, Voltage, Trip Reset Voltage Range: +1 V to +34 V, Resolution: 0.1 V Max Current: 1 A, Max Power: 15 W

Display and Keyboard

Display	10.1 inch capacitive touchscreen, 1280 × 800 resolution
Shortcuts	Maximum of 5 user-configurable shortcuts
Screen Strength	IK08 (protected against a 5 joule impact)
Keyboard	Common alphanumeric/symbolic keys and customizable EZ keyboard
Touch Gestures	Pinch to zoom × (span), Drag in × (center frequency, markers, limit line points)
Toolbar	System menu, application menu, + shortcuts icon, camera icon, USB eject icon, software update icon, local host icon, lock status (touchscreen), notification icon, Wi-Fi status, GPS status, battery status, time and date

Battery

Type	Li-Ion
Battery Operation	Two hour operation, typical
Charging Temperature Limit	0°C to +45°C, relative humidity ≤80%

EU Standards (CE Marking)

CE	EMC: 2014/30/EU, EN61326-1, EN61000-3-2 LVD: 2014/35/EU, EN61010-1 RoHS: 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
RCM	Australia and New Zealand: RCM AS/NZS 4417:2012
KCC	South Korea: KCC-REM-A21-0004

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No	Name
	Main Frame
MS2090A	Field Master Pro (Requires Option 709, 714, 720, 726, 732, 743, or 754)
	Options
MS2090A-0709	Frequency Range 9 kHz to 9 GHz
MS2090A-0714	Frequency Range 9 kHz to 14 GHz
MS2090A-0720	Frequency Range 9 kHz to 20 GHz
MS2090A-0726	Frequency Range 9 kHz to 26.5 GHz
MS2090A-0732	Frequency Range 9 kHz to 32 GHz
MS2090A-0743	Frequency Range 9 kHz to 43.5 GHz
MS2090A-0754	Frequency Range 9 kHz to 54 GHz
MS2090A-0024	Interference Finder (requires directional antenna, sold separately)
MS2090A-0006	Remove Wi-Fi
MS2090A-0019*	High Accuracy Power Meter (requires compatible USB power sensor, sold separately)
MS2090A-0031*	GPS Receiver (requires GPS antenna, sold separately)
MS2090A-0089*	Zero Span IF Output
MS2090A-0090*	Gated Sweep
MS2090A-0103*	55 MHz Analysis Bandwidth
MS2090A-0104*	110 MHz Analysis Bandwidth
MS2090A-0124*	IQ Waveform Capture
MS2090A-0125*	IQ Waveform Streaming (requires Option 124, MA25424A recommended)
MS2090A-0126*	IQ Waveform Capture (non-export controlled)
MS2090A-0127*	IQ Waveform Streaming (non-export controlled, requires Option 126, MA25424A recommended)
MS2090A-0128*	Vector Modulation Analysis Software enabled
MS2090A-0199*	Real-Time Spectrum Analyzer
MS2090A-0331*	Cable and Antenna Analyzer (requires Site Master S331P analyzer, sold separately)
MS2090A-0421*	Pulse Analyzer
MS2090A-0431*	Coverage Mapping (requires GPS Option 31)
MS2090A-0444*	EMF Measurement (requires a compatible Anritsu isotropic antenna)
MS2090A-0445*	EMF Meter Enabled (requires 2000-1985-R isotropic EMF probe)
MS2090A-0883*	LTE FDD Summary Measurements (requires GPS option MS2090A-0031)
MS2090A-0888*	5GNR Downlink Measurements (requires GPS option MS2090A-0031)
MS2090A-0400*	Vision Monitor Enabled
MS2090A-0407*	Vision High-Speed Port Scanner Enabled
MS2090A-xxxx-0097	Accredited Calibration to ISO17025 and ANSI/NCSL Z540-1 (xxxx is the frequency option number)
MS2090A-xxxx-0098	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1 (xxxx is the frequency option number)
MS2090A-xxxx-0099	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1 plus test data (xxxx is the frequency option number)
	Standard Accessories (included with instrument)
2000-1371-R	Ethernet Cable, 2 m
2000-1931-R	Stylus
3-2000-1928	Shoulder Strap
633-75	Li-Ion Rechargeable Battery
40-204-R	AC/DC Power Supply (Field Master Series)
2000-1859-R	USB Cable, USB 3.0 Type-A to Type-C, 1 m
2000-2054-R	SMA (m) to BNC (f) Adapter (qty 3)
806-442-R	SMA (m) to BNC (m) cable, 1 m
	Certificate of Calibration and Conformance

* Timed-Limited Options Options marked with an asterisk are offered as a 90-day time limited option by ordering as a -9xxx series option. For example, MS2090A-9888 is the 90-day time limited option for 5GNR FDD/TDD Measurements. The option start time begins when the user first activates the option.

Spectrum Master™ High Performance Handheld Spectrum Analyzer

MS2720T

9 kHz to 9 GHz, 13 GHz, 20 GHz

Remote Control
Ethernet | **USB**

High Performance Handheld Spectrum Analyzer

Anritsu's Spectrum Master MS2720T represents the highest performance handheld spectrum analyzers available as Anritsu pushes the envelope closer to benchtop quality. This generation introduces a touch screen, full-band tracking generators to 20 GHz, and best-in-class performance for dynamic range, DANL, phase noise, and sweep speed.

Spectrum and Interference Analyzer Highlights

- Measure: Occupied Bandwidth, Channel Power, ACPR, C/I, Field Strength, Spectral Emissions
- Measure Interference: Spectrogram, Signal Strength, RSSI
- Dynamic Range: >106 dB in 1 Hz RBW
- DANL: –164 dBm in 1 Hz RBW
- Phase Noise: –112 dBc/Hz @ 10 kHz offset at 1 GHz
- Resolution Bandwidth (RBW): 1 Hz to 10 MHz
- PIM Hunting
- Full-band Tracking Generators: 9, 13, 20 GHz
- Full-band Preamplifiers standard
- Channel Scanner: scan up to 20 channels at once
- Burst Detect™ Sweep Mode: Sweep 1000x in 15 MHz span
- Coverage Mapping: plot RSSI on on-screen map
- Interference Mapping: on-screen mapping with triangulation
- Operation to +55°C: full performance on AC or battery

Capabilities and Functional Highlights

Wireless Measurements

- GSM/GPRS/EDGE
- W-CDMA/HSPA+
- TD-SCDMA/HSPA+
- PIM Alert Application
- LTE/LTE-A FDD/TDD
- NB-IoT
- CDMA/EV-DO
- WiMAX Fixed/Mobile
- EMF Test
- Zero-span IF Output
- I/Q Waveform Capture
- Gated Sweep
- AM/FM/PM Demodulator
- High Accuracy Power Meter up to 26 GHz USB Sensors
- Three Hour Battery

Spectrum Analyzer

All specifications and characteristics apply to Revision 3 instruments under the following conditions, unless otherwise stated. After 5 minutes of warm-up time, where the instrument is left in the ON state. Sweep Mode set to Performance. When using the internal reference signal.

Measurements	Smart Measurements	Field Strength (dBm/m^2, dBV/m, dBmV/m, dBµV/m, V/m, Watt/m^2, dBW/m^2, A/m, dBA/m, or Watt/cm^2) Occupied Bandwidth (measures 99% to 1% power channel of a signal, or N dB from center of signal) Channel Power (measures the total power in a specified bandwidth) ACPR (adjacent channel power ratio) Emission Mask (recall limit lines as emission mask) Spurious Emissions (measures up to 32 segments with independent setups and limits) C/I (carrier-to-interference ratio) AM/FM/SSB Demodulation (AM, wide/narrow FM, upper/lower SSB), (audio only) PIM Alert Application (available for download) PIM Hunting
Setup Parameters	Frequency	Center/Start/Stop, Span, Frequency Step, Frequency Offset, Signal Standard, Channel #, Channel Increment
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Units (dBm, dBV, dBmV, dBµV, Volt, Watt, dBW, A, dBA), Pre-Amp On/Off, Detection (Peak, RMS/Avg, Negative Peak, Sample, Quasi-Peak)
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
	Bandwidth	RBW, Auto RBW, VBW, Auto VBW, VBW/Avg Type (Linear, Log), RBW/VBW Ratio, Span/RBW Ratio
	Impedance	50Ω, 75Ω; external pad required for 75Ω operation
Sweep Functions	Sweep	Single/Continuous, Sweep Time, Gated Sweep (see Option 0090)
	Sweep Mode	Fast (up to 100x faster than Performance), Performance, No FFT, Burst Detect (1000x Fast in 15 MHz span)
	Triggers	Free Run, External, Video, IF Power, Force Trigger Once
	Trigger Parameters	Delay, Level, Slope, Hysteresis, Holdoff (availability varies with trigger)
Trace Functions	Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations
	Trace A Operations	Normal, Max Hold, Min Hold, Average, # of Averages, (always the live trace)
	Trace B Operations	A → B, B ↔ C, Max Hold, Min Hold
	Trace C Operations	A → C, B ↔ C, Max Hold, Min Hold, A – B → C, B – A → C, Relative Reference (dB), Scale
Marker Functions	Markers	Markers 1-6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off/Large), All Markers Off
	Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker
	Marker Auto-Position	Peak Search, Next Peak (Right/Left), Peak Threshold %, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level
	Marker Table	1-6 markers frequency and amplitude, plus delta markers frequency offset and amplitude
Limit Line Functions	Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, Default Limit
	Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
	Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
	Limit Line Envelope	Create Envelope, Update Amplitude, Number of Points (2-41), Offset, Shape Square/Slope
	Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall
	Available Spans	>0 Hz
	Save on Event	When Limit Crossed
Frequency	Frequency Range	(usable to 0 Hz)
	MS2720T-0709	9 kHz to 9 GHz
	MS2720T-0713	9 kHz to 13 GHz
	MS2720T-0720	9 kHz to 20 GHz
	Tuning Resolution	1 Hz
	Frequency Reference	Aging: ±1.0 × 10^{-6} per 10 years Accuracy: ±0.3 × 10^{-6} (25°C±25°C) plus aging (see Options 1 and 31 for improved frequency reference aging and accuracy)
	Auto-sensing External Frequency Reference	1, 1.2288, 1.544, 2.048, 2.4576, 4.8, 4.9152, 5, 9.8304, 10, 13, 19.6608 MHz
	Sweep Time	7 µs to 3600 s in zero span
	Sweep Time Accuracy	±2% in zero span
Bandwidth	Resolution Bandwidth (RBW)	1 Hz to 10 MHz in 1–3 sequence ±10% (–3 dB bandwidth)
	Video Bandwidth (VBW)	1 Hz to 10 MHz in 1–3 sequence (–3 dB bandwidth)
	RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (–6 dB bandwidth)
	VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1
	VBW/Average Type	Linear/Log

Continued on next page

Spectrum Analyzer (continued)

Spectral Purity – SSB Phase Noise	Offset from 1 GHz	9 GHz Instrument		13 GHz to 20 GHz Instruments	
		Maximum	Typical	Maximum	Typical
	10 kHz	–108 dBc/Hz	–112 dBc/Hz	–102 dBc/Hz	–106 dBc/Hz
	100 kHz	–110 dBc/Hz	–115 dBc/Hz	–106 dBc/Hz	–110 dBc/Hz
	1 MHz	–118 dBc/Hz	–123 dBc/Hz	–111 dBc/Hz	–116 dBc/Hz
	10 MHz	–129 dBc/Hz	–133 dBc/Hz	–123 dBc/Hz	–129 dBc/Hz
	Offset from 300 MHz	9 GHz Instrument			
		Maximum	Typical		
	1 kHz	–107 dBc/Hz	–111 dBc/Hz		
	10 kHz	–112 dBc/Hz	–114 dBc/Hz		
	62.5 kHz	–113 dBc/Hz	–115 dBc/Hz		
	100 kHz	–114 dBc/Hz	–117 dBc/Hz		
	1 MHz	–120 dBc/Hz	–122 dBc/Hz		
	10 MHz	–128 dBc/Hz	–131 dBc/Hz		
Amplitude Ranges	Dynamic Range	>106 dB minimum at 2.4 GHz, 2/3 (TOI-DANL) in 1 Hz RBW			
	Measurement Range	DANL to +30 dBm			
	Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed			
	Reference Level Range	–150 to +30 dBm			
	Attenuator Resolution	0 to 65 dB, 5.0 dB steps			
	Reference Level Offset	99.9 dB External Loss to 99.9 dB External Gain			
	Amplitude Units	Log Scale Modes: dBW, dBm, dBµW, dBV, dBmV, dBµV, dBA, dBmA, dBµA Linear Scale Modes: fV, nV, µV, mV, V, pW, nW, µW, mW, W, pA, nA, uA, mA, A			
	Maximum Continuous Input	+30 dBm Peak (typ.), ±50 VDC (≥10 dB Attenuation) +23 dBm Peak (typ.), ±50 VDC (<10 dB Attenuation) +13 dBm Peak (typ.), ±50 VDC (Preamp = ON Option 713, 720; no extra limit for Option 709)			
Amplitude Accuracy (excluding effects of VSWR, noise, and spurs)		+20°C to +30°C (after 30 minute warm-up)		–10°C to +55°C (after 60 minute warm-up)	
	9 GHz Instrument	Maximum	Typical	Maximum	Typical
	9 kHz to 100 kHz*1	±2.3 dB	±0.5 dB	±2.3 dB	±0.5 dB
	100 kHz to 7 GHz	±1.3 dB	±0.5 dB	±2.3 dB	±0.5 dB
	>7 GHz to 9 GHz	±1.8 dB	±0.5 dB	±2.8 dB	±0.5 dB
	13 GHz, 20 GHz Instruments				
	100 kHz to 13 GHz	±1.3 dB	±0.5 dB	±2.3 dB	±0.5 dB
	>13 GHz to 18 GHz	±2.3 dB	±0.5 dB	±3.3 dB	±0.5 dB
	>18 GHz to 20 GHz	—	±1.0 dB	—	±1.0 dB
Displayed Average Noise Level (DANL) (RMS detection, VBW/Avg type = Log, Ref Level = –20 dBm for Preamp Off and –50 dBm for Preamp On, Auto Attenuator On Performance Sweep Mode)		Preamp = Off		Preamp = On	
	9 GHz Instrument	Maximum	Typical	Maximum	Typical
	10 MHz to 3 GHz	–146 dBm	–149 dBm	–160 dBm	–163 dBm
	>3 GHz to 8 GHz	–140 dBm	–143 dBm	–152 dBm	–155 dBm
	>8 GHz to 9 GHz	—	–138 dBm	—	–155 dBm
	20 GHz Instrument >13 GHz to 20 GHz	–136 dBm	–142 dBm	–155 dBm	–161 dBm
Spurs (0 dB input attenuation)		(RF input terminated, 0 dB input attenuation)			
	Residual Spurs (RF input terminated)	Preamp = Off		Preamp = On	
	<13 GHz	–90 dBm (max.)		–100 dBm (max.)	
	13 GHz to 20 GHz	–85 dBm (max.)		–100 dBm (max.)	
	Input-Related Spurious (–30 dBm input)	Maximum*2 –60 dBc		Typical –70 dBc	

*1: Values below 100 kHz are with the preamplifier turned off.
*2: Instrument centered on single signal, span <1.7 GHz

Spectrum Analyzer (continued)

Third-Order Intercept (TOI) (–20 dBm tones 100 kHz apart, 0 dB Attenuation, Preamp OFF, Reference Level –20 dBm)	2.4 GHz	+14 dBm (min.)
	50 MHz to 20 GHz	+20 dBm (typ.)
P1dB	<4 GHz	+5 dBm (nom.)
	4 GHz to 20 GHz	+12 dBm (nom.)
Second Harmonic Distortion	(0 dB input attenuation, –30 dBm input)	
	50 MHz	–68 dBc (max.)
	<4 GHz	–60 dBc (typ.)
	>4 GHz	–75 dBc (typ.)
VSWR (≥10 dB input attenuation)	9 GHz Instruments	
	<4 GHz	1.5:1 (typ.)
	4 GHz to 8 GHz	1.8:1 (typ.)

High Accuracy Power Meter (Option 19) (Requires external USB Power Sensor)

Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale				
Average	# of Running Averages, Max Hold				
Zero/Cal	Zero On/Off, Cal Factor (Center Frequency, Signal Standard)				
Limits	Limit On/Off, Limit Upper/Lower				
Power Sensor Model	MA24105A	MA24106A	MA24108A/18A/26A	MA24208A/18A	MA24330A/40A/50A
Description	Inline High Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor	Microwave Universal USB Power Sensor	Microwave CW USB Power Sensor
Frequency Range	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8/18/26 GHz	10 MHz to 8/18 GHz	10 MHz to 33/40/50 GHz
Connector	Type N (f), 50Ω	Type N (m), 50Ω	Type N (m), 50Ω (8 GHz/18 GHz) Type K (m), 50Ω (26 GHz)	Type N (m), 50Ω	Type K (m), 50Ω (33 GHz/40 GHz) Type V (m), 50Ω (50 GHz)
Dynamic Range	+3 to + 51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 µW to 200 mW)	–40 to +20 dBm (0.1 µW to 100 mW)	–60 to +20 dBm (1 nW to 100 mW)	–70 to +20 dBm (0.1 nW to 100 mW)
Measurand	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power	True-RMS, Slot Power, Burst Average Power	Average Power
Measurement Uncertainty	± 0.17 dB*1	± 0.16 dB*2	± 0.18 dB*3	± 0.17 dB*4	± 0.17 dB*5
Data sheet (for complete specifications)	11410-00621	11410-00424	11410-00504	11410-00841	11410-00906

*1: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than +20 dBm with a matched load.
Measurement results referenced to the input side of the sensor.

*2: Total RSS measurement uncertainty (0º to 50ºC) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.

*3: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.

*4: Power uncertainty expressed with two sigma confidence level for CW measurement after zero operation. Includes calibration factor and linearity over temperature uncertainties, but not the effects of mismatch, zero set and drift, or noise.

*5: Includes linearity over temperature uncertainties, but not the effects of calibration factor, mismatch, zero set and drift, and noise.

Tracking Generator (Options 809, 813 and 820)

<table>
<tr><td rowspan="8">Setup Parameters</td><td>Frequency</td><td colspan="4">Center/Start/Stop, Span, Frequency Step, Frequency Offset, Signal Standard, Channel #, Channel Increment</td></tr>
<tr><td>Amplitude</td><td colspan="4">Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Units, Pre-Amp, Detection</td></tr>
<tr><td>Span</td><td colspan="4">Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span</td></tr>
<tr><td>Bandwidth</td><td colspan="4">RBW, Auto RBW, VBW, Auto VBW, VBW/Average Type (Linear/Log), RBW/VBW Ratio, Span/RBW Ratio</td></tr>
<tr><td>Generator</td><td colspan="4">On/Off, Output Power, Mode (CW/Tracking), Settings, Transmission Measurement</td></tr>
<tr><td>Tracking Generator Settings</td><td colspan="4">External Gain/Loss, Power Statistics (On/Off)</td></tr>
<tr><td>Transmission Measurement Settings</td><td colspan="4">Normalize (Off/On), Scale, Reference Position and Amplitude, Transmission Statistics and Offset</td></tr>
<tr><td>Maximum Continuous Input</td><td colspan="4">+23 dBm, ±50 VDC</td></tr>
<tr><td rowspan="4">Frequency</td><td>MS2720T-0809</td><td colspan="4">100 kHz to 9 GHz</td></tr>
<tr><td>MS2720T-0813</td><td colspan="4">100 kHz to 13 GHz</td></tr>
<tr><td>MS2720T-0820</td><td colspan="4">100 kHz to 20 GHz</td></tr>
<tr><td>Frequency Accuracy</td><td colspan="4">Aging: ±1.0 × 10^{-6} per 10 years
Accuracy: ±0.3 × 10^{-6} (25°C±25°C) plus aging</td></tr>
<tr><td rowspan="5">Output Power</td><td>100 kHz to 20 GHz</td><td colspan="4">–40 to 0 dBm</td></tr>
<tr><td>Step Size</td><td colspan="4">0.1 dB (nom.)</td></tr>
<tr><td>Dynamic Range</td><td colspan="4"></td></tr>
<tr><td>9 GHz Instrument</td><td colspan="4">>110 dB (typ.) 100 kHz to 7 GHz
>100 dB (typ.) >7 GHz to 9 GHz</td></tr>
<tr><td>13 GHz and 20 GHz Instruments</td><td colspan="4">>100 dB (typ.) 100 kHz to 12 GHz
>80 dB (typ.) >12 GHz to 20 GHz</td></tr>
<tr><td rowspan="2">Level Accuracy
(At least 30 minute warm-up after 1 hour non-operating at 15°C to 35°C ambient, excludes load VSWR effects)</td><td>Frequency Range</td><td colspan="2">20°C to 30°C
(after 30 minute warm-up)</td><td colspan="2">0°C to 50°C
(after 60 minute warm-up)</td></tr>
<tr><td>100 kHz to 9 GHz
>9 GHz to 13 GHz
>13 GHz to 18 GHz</td><td>Maximum
±1.5 dB
±1.6 dB
±2.0 dB</td><td>Typical
±0.5 dB
±1.0 dB
±1.0 dB</td><td>Maximum
±2.0 dB
±2.1 dB
±2.5 dB</td><td>Typical
±1.0 dB
±1.5 dB
±1.5 dB</td></tr>
<tr><td rowspan="2">VSWR</td><td>100 kHz to 5 GHz</td><td colspan="4">2:1 (typ.)</td></tr>
<tr><td>>5 GHz to 20 GHz</td><td colspan="4">4:1 (typ.)</td></tr>
</table>

Interference Analyzer (Option 25)

Measurements	Spectrum	Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power Ratio (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only) Carrier-to-Interference ratio (C/I)
	Spectrogram	Collect data up to 72 hours
	Signal Strength	Gives visual and aural indication of signal strength
	Received Signal Strength Indicator (RSSI)	Collect data up to 168 hours (one week)
	Interference Mapping	Draw multiple bearings of signal strength from GPS location on on-screen map Pan and Zoom on-screen maps Support for Anritsu MA2700A Handheld Interference Hunter
	Impedance	50Ω, 75Ω; external pad required for 75Ω operation

Channel Scanner (Option 27)

General	Number of Channels	1 to 20 Channels (Power Levels)
	Measurements	Graph/Table, Max Hold (On/5 s/Off), Frequency/Channel, Current/Maximum, Dual Color
	Scanner	Scan Channels, Scan Frequencies, Scan Custom List, Scan Script Master™
	Amplitude	Reference Level, Scale
	Custom Scan	Number of Channels, Signal Standard & Channel, Frequency, Bandwidth
	Frequency Range	9 kHz to 9, 13, 20, 32, or 43 GHz
	Frequency Accuracy	±10 Hz + time base error
	Measurement Range	–110 to +30 dBm
	Impedance	50Ω, 75Ω; external pad required for 75Ω operation

Coverage Mapping (Option 431)

Measurements	Indoor Mapping: RSSI, ACPR	
	Outdoor Mapping: RSSI, ACPR	
Setup Parameters	Mode	Spectrum Analyzer
	Frequency	Center, Span (ACPR only), Freq Step, Signal Standard, Channel #, Channel Increment
	Amplitude	Reference Level (RL), Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
	Span	RSSI Mode: Zero Span ACPR Mode: Span, Span Up/Down (1-2-5), Full Span, Last Span
	BW	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW Ratio, Span/VBW Ratio
	Measurement Setup	RSSI: Mapping color thresholds ACPR: Main Ch BW, Adj Ch BW, Ch Spacing, Adjacent Ch dB Offset, Thresholds for Good and Poor main channel levels
	Mapping Colors	RSSI: Dark Green (Excellent), Light Green (Very Good), Yellow (Good), Orange (Fair), Dark Red (Poor) ACPR: Dark Green (Good), Yellow (between Good and Poor), Dark Red (Poor)
	Point Distance/Time Setup	Repeat Type: Time (100 ms to 16 s), Distance (1 m to 10,000 m) Distance Units: m, ft
	Save Points Map	Save KML, JPEG, Tab Delimited
	Recall Points Map	Recall Map, Recall KML Points only, Recall KML Points with Map, Recall Default Grid
	Map Types	Outdoor (GPS embedded), Indoor (non-GPS embedded). Import maps using the Anritsu easyMap Tools. Zoomable (.azm) maps are usable, but cannot be zoomed.

Electromagnetic Field Test (Option 444)

Measurements	Setup	Limit lines, axis dwell time, measurement time, auto-logging, measurement units, trace display
	Spectrum Analyzer	Field strength is measured
	LTE OTA, TD-LTE OTA	P-SS, S-SS, and RS are measured and displayed based on each Cell ID received
	W-CDMA OTA	P-CPICH signals are measured and displayed for each Scrambling Code measured
	Units	Spectrum Analyzer: dBm/m^2, dBV/m, dBmV/m, dBuV/m, V/m, W/m^2, dBW/m^2, A/m, dBA/m, W/cm^2 LTE OTA, TD-LTE OTA, W-CDMA OTA: dBm/m^2, V/m, W/m^2
	Results	Maximum, minimum, and average of all measurements conducted
	Display	Measurement status, number of measurements taken, pass/fail indicators
Frequency Range	Supported Antenna	2000-1800-R: 9 kHz to 300 MHz 2000-1792-R: 30 MHz to 3 GHz 2000-1791-R: 700 MHz to 6 GHz
Modes where EMF Measurements available	Spectrum Analyzer LTE (both FDD and TDD Modes, Option 883) W-CDMA (Option 881)	

GPS Receiver (Option 31)

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
Anritsu Antennas	2000-1528-R GPS antenna requires +5 VDC 2000-1652-R GPS antenna requires +3.3 VDC or +5 VDC 2000-1760-R GPS antenna requires +2.5 VDC to +3.7 VDC
GPS Time/Location Indicator	UTC Time, Latitude, Longitude, and Altitude on display (UTC Time and Altitude on GPS Info display) UTC Time, Latitude, Longitude, and Altitude with trace storage
High Frequency Accuracy	$<\pm 2.5 \times 10^{-8}$ with GPS On, 3 minutes after satellite lock in selected mode (GPS Antenna connected) $<\pm 5.0 \times 10^{-8}$ for 3 days after GPS lock, 0°C to 50°C ambient temperature (GPS Antenna disconnected)
Connector	SMA (f)

Gated Sweep (Option 90)

Mode	Spectrum Analyzer, Sweep
Trigger	External TTL, IF Level
IF Trigger Level	–80 dBm to +25 dBm (typ.)
Setup	Gated Sweep (On/Off) Gate Polarity (Rising, Falling) Gate Delay (0 ms to 10 ms) (typ.) Gate Length (1 µs to 65 ms) (typ.) Gate View Settings: Zero Span Time , Zero Span RBW, Zero Span VBW

Zero Span IF Output (Option 89)

Mode	Spectrum Analyzer/Span/Zero Span
Center Frequency	140 MHz (nom.) (varies up to ±10 kHz nominal with center frequency and IF bandwidth)
Output Level	–25 dBm typical for signals at below reference levels, with Auto Attenuation. Maximum –10 dBm (typ.).
Reference Level	–57 to +30 dBm (Preamp Off) –87 to –40 dBm (Preamp On)
IF Bandwidths	Up to 30 MHz (3 dB bandwidth)
Connector	BNC (f)

I/Q Waveform Capture (Option 24)

Mode	Spectrum Analyzer
Capture Mode	Single or Continuous
Trigger	Free Run, External (Rising/Falling), Delay
Maximum Capture Length	800 ms
Maximum Sample Rate	40 MHz
Maximum Signal Bandwidth	32 MHz

Secure Data (Option 7)

Set at Factory	Save measurement files on external USB flash drive only Internal memory is permanently disabled

AM/FM/PM Signal Analyzer (Option 509)

Measurements							
Display Type	RF Spectrum (AM/FM/PM)	Audio Spectrum (AM)	Audio Spectrum (FM/PM)	Audio Waveform (AM)	Audio Waveform (FM/PM)	Summary (AM)	Summary (FM/PM)
Graphic Display	Power (dBm) vs. Frequency	Depth (%) vs. Modulation Frequency	Deviation (kHz/rad) vs. Modulation Frequency	Depth (%) vs. Time	Deviation (kHz/rad) vs. Time	None	None
Numerical Displays	Carrier Power Carrier Frequency Occupied Bandwidth	AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Deviation (Pk-Pk)/2 Deviation SINAD* THD* Distortion/Total Vrms*	AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Deviation (Pk-Pk)/2 Deviation SINAD* THD* Distortion/Total Vrms*	RMS Depth Peak + Depth Peak – Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*	RMS Deviation Peak + Deviation Peak – Deviation (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth FM/PM Rate SINAD* THD* Distortion/Total Vrms*

*: Requires sine wave modulation

Setup Parameters	Frequency	Center Freq, Span, Freq Step, Signal Standard, Channel, Channel Increment, Set (measured) Carrier Freq to Center
	Amplitude Setup	Scale, Power Offset, Adjust Range
	Measurements	RF Spectrum, Audio Spectrum (demodulated), Audio Waveform (demodulated), Summary, Coverage Mapping (Option 431 required), Audio Demod (AM/FM only)
	Measurement Setup	All Measurements: Demod Type (AM, FM, PM), IFBW, Auto IFBW, Squelch Units, Distortion Measurements (Sinewave or Broadcast) RF Spectrum: OBW Method, OBW %, OBW dBC Audio Spectrum: Span, Scale, Squelch Power Audio Waveform: Sweep Time, Scale, Squelch Power Summary: Average count, Squelch Power Coverage Mapping: Measurement (SINAD, Carrier Power, Multiple), Thresholds, Point Distance/Time Audio Demod: Demod Type (AM, USB, LSB, Wideband FM, Narrowband FM), Volume, Squelch
	Mapping Colors	Dark Green (Excellent), Light Green (Very Good), Orange (Good), Yellow (Fair), Dark Red (Poor)
	Marker	Six markers with Delta for each, Peak Search, Marker Freq to Center, Marker to Ref Lvl, Marker Table
RF and Modulation Measurements	AM	Modulation Rate: ±1 Hz (<100 Hz), ±2% (>100 Hz) Depth: ±5% for (Modulation rates 10 Hz to 100 kHz)
	FM	Modulation Rate: ±1 Hz (<100 Hz); ±2% (100 Hz to 100 kHz) Deviation Accuracy: ±5% (100 Hz to 100 kHz)*
	PM	Modulation Rate: ±1 Hz (<100 Hz); ±2% (100 Hz to 100 kHz) Deviation Accuracy: ±5% (deviation 0 to 93 Rad, rate 10 Hz to 5 kHz)*
	IF Bandwidth	1 kHz to 300 kHz in 1-3 sequence
	Frequency Span	RF Spectrum: 10 kHz to 10 MHz Audio Spectrum: 2 kHz, 5 kHz, 10 kHz, 20 kHz, 70 kHz, 140 kHz
	RBW/VBW	30
	Span/RBW	100
	Sweep Time	50 µs to 50 ms (Audio Waveform)

*: IFBW must be greater than 95% occupied BW

GSM/GPRS/EDGE Measurements (Option 880)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC) Multi-channel Spectrum Power vs. Time (Frame/Slot) Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC)	Phase Error EVM Origin Offset C/I Modulation Type Magnitude Error BSIC (NCC, BCC)	There are no additional OTA Measurements RF and Demodulation Measurements can be made OTA	View Pass/Fail Limits GSM, EDGE Available Measurements Channel Power Occupied Bandwidth Burst Power Average Burst power Frequency Error Phase Error EVM Origin Offset C/I Magnitude Error Script Master™

Setup Parameters	GSM/EDGE Select	Auto, GSM, EDGE
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (JPEG - save only), to Internal/External Memory
	Measurement Summary Screen	Overall Measurements
RF Measurements	Frequency Error	±10 Hz + time base error, 99% confidence level
	Occupied Bandwidth	Bandwidth within which lies 99% of the power transmitted on a single channel
	Burst Power Error	±1.5 dB, ±1 dB (typ.), (–50 to +20 dBm)
Demodulation Measurements	GMSK Modulation Quality (RMS Phase)	
	Measurement Accuracy	±1°
	Residual Error (GSMK)	1°
	8PSK Modulation Quality (EVM)	
	Measurement Accuracy	±1.5%
	Residual Error (8PSK)	2.5%

W-CDMA/HSPA+ Measurements (Option 881)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Band Spectrum Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Emission Mask Single carrier ACLR Multi-carrier ACLR RF Summary	Code Domain Power Graph P-CPICH Power Channel Power Noise Floor EVM Carrier Feed Through Peak Code Domain Error Carrier Frequency Frequency Error Control Channel Power Abs/Rel/Delta Power CPICH, P-CCPCH S-CCPCH, PICH P-SCH, S-SCH HSPA+ Power vs. Time Constellation Code Domain Power Table Code, Status EVM, Modulation Type Power, Code Utilization Power Amplifier Capacity Codogram Modulation Summary	Scrambling Code Scanner (Six) Scrambling Codes CPICH E_c/I_o E_c Pilot Dominance OTA Total Power Multipath Scanner (Six) Six Multipaths Tau Distance RSCP Relative Power Multipath Power	View Pass/Fail Limits All, RF, Demod Available Measurements Max Output Power Frequency Error EVM CPICH Occupied Bandwidth Spectral Mask ACLR PCDE P-CCPCH S-CCPCH Code Spread 3 PICH Code 128 Test Models 1 (16), (32), (64) 2 3 (16), (32) 4 (+CPICH), (–CIPCH) 5 (2 HS), (4 HS), (8 HS)

Setup Parameters	Scrambling Code, Threshold	Auto, Manual
	User Selectable	Scrambling Code, S-CCPCH Spread, S-CCPCH Code, PICH Code, Threshold, Max Amp Power, CPICH Power, Frequency Error Average
	Maximum Spreading Factor	256, 512
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
	Marker	Six Markers, Table On/Off
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (JPEG - save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements
RF Measurements	RF Channel Power Accuracy	±1.25 dB, ±0.7 dB (typ.), (temperature range 15°C to 35°C)
	Occupied Bandwidth Accuracy	±100 kHz
	Adjacent Channel Leakage Ratio (ACLR)	–54 dB/–59 dB ±0.8 dB @ 5 MHz/10 MHz offset (typ.), 824 MHz to 894 MHz, 1710 MHz to 2170 MHz –54 dB/–57 dB ±1.0 dB @ 5 MHz/10 MHz offset (typ.), 2300 MHz to 2700 MHz
Demodulation Measurements	W-CDMA Modulations	QPSK, QPSK-DTX (Codecs: AMR 4.75, 5.9, 7.4, 12.2 kbps, DTX 7.4, 12.2 kbps)
	HSPA+ Modulations	QPSK, 16 QAM, 64 QAM
	Frequency Error	±10 Hz + time base error, 99% confidence level
	EVM Accuracy	±2.5%, 6% ≤EVM ≤25%
	Residual EVM	2.5% (typ.)
	Code Domain Power	±0.5 dB for code channel power > –25 dB, 16, 32, 64 DCPH (test model 1), 16, 32 DCPH (test model 2, 3)
	CPICH (dBm) Accuracy	±0.8 dB (typ.)
Over-the-Air (OTA) Measurements	Scrambling Code Scanner	Six strongest Scrambling Codes
	Multipath Scanner	Multipath power of six signals relative to strongest pilot

TD-SCDMA/HSPA+ Measurements (Option 882)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Left Channel Power Left Channel Occ B/W Right Channel Power Right Channel Occ B/W Power vs. Time Six Slot Powers Channel Power (RRC) DL-UL Delta Power UpPTS Power DwPTS Power On/Off Ratio Slot Peak-to-Average Power Spectral Emission RF Summary	Code Domain Power/Error (QPSK/8PSK/16 QAM/64 QAM) Slot Power DwPTS Power Noise Floor Frequency Error Tau Scrambling Code EVM Peak EVM Peak Code Domain Error CDP Marker Modulation Summary	Code Scan (32) Scrambling Code Group Tau E_c/I_o DwPTS Power Pilot Dominance Tau Scan (Six) Sync-DL# Tau E_c/I_o DwPTS Power Pilot Dominance Record Run/Hold	View Pass/Fail Limits All, RF, Demod Available Measurements Occupied Bandwidth Channel Power Channel Power RCC On/Off Ratio Peak-to-Average Ratio Frequency Error EVM Peak EVM Peak Code Domain Error Tau Noise Floor

Setup Parameters	Slot Selection	Auto, 0-6
	Trigger	Trigger Type (No Trigger/GPS/External), External Trigger (Rising/Falling), Tau Offset
	SYNC-DL Code	Auto, 0-31
	Scrambling/Midamble Code	Auto, 0-127
	Maximum Users	Auto, 2, 4, 6, 8, 10, 12, 14, 16
	Measurement Speed	Fast, Normal, Slow
	User Selectable	Uplink Switch Point, Number of Carriers (1, 3), Tau Offset
	Demodulation Type	Auto, QPSK, 8PSK, 16 QAM, 64 QAM
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
	Sweep	Hold/Run, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (JPEG - save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
RF Measurements	RF Channel Power Accuracy (RRC)	±1.5 dB, ±1.0 dB (typ.), (slot power –40 to +10 dBm)
	Frequency Error	±10 Hz + time base error, in the presence of a downlink slot
Demodulation Measurements	Supported Modulation	QPSK, 8PSK, 16 QAM, 64 QAM
	Residual EVM (rms)	3% (typ.), P-CCPH Slot Power >–50 dBm
	PN Offset	Within 1 × 64 chips
	Pilot Power Accuracy	±1.0 dB (typ.)
	Timing Error (Tau) for Dominant SYNC-DL	±0.2 µs (external trigger)
	Spreading Factor	1, 16
Over-the-Air (OTA) Measurements	Code Scanner	32 Sync Codes and associated Scrambling Code Groups
	Tau Scanner	Six strongest Sync Codes
	Auto Save	Yes
	GPS Tagging and Logging	Yes

LTE/LTE-A FDD/TDD Measurements (Option 883 and 886)

LTE FDD Measurements			
RF	Modulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth ACLR Spectral Emission Mask Category A or B (Opt 1) RF Summary	Power vs. Resource Block (RB) RB Power (PDSCH) Active RBs, Utilization% Channel Power, Cell ID OSTP, Frame EVM by modulation Constellation QPSK, 16 QAM, 64 QAM 256 QAM Demod (Option 886) Modulation Results Ref Signal Power (RS) Sync Signal Power (SS) EVM – rms, peak, max hold Frequency Error – Hz, ppm Carrier Frequency Cell ID Control Channel Power Bar Graph or Table View RS, P-SS, S-SS PBCH, PCFICH, PHICH, PDCCH Total Power (Table View) EVM per Control Channel Tx Time Alignment Modulation Summary Includes EVM by modulation Antenna Icons Detects active antennas (1 or 2)	Scanner Cell ID (Group, Sector) S-SS, RSRP, RSRQ, SINR Dominance Modulation Results – On/Off Auto Save – On/Off Tx Test Scanner RS Power of MIMO antennas (2×2, 4×4) Cell ID, Average Power Delta Power (Max-Min) Graph of Antenna Power Modulation Results – On/Off Mapping On-screen S-SS, RSRP, RSRQ, or SINR Scanner Modulation Results – Off Carrier Aggregation Up to 5 component carriers (CC1 to CC5) CP, MIMO status, RS & SS Power, EVM, Frequency Error, Time Alignment Error, Cell ID	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth ACLR Frequency Error Carrier Frequency Dominance EVM peak, rms Frame EVM, rms Frame EVM by mod type RS, SS Power RS EVM P-SS, S-SS, Power, EVM PBCH, PCFICH, PHICH, PDCCH Power, EVM Cell, Group, Sector ID OSTP Tx Time Alignment

Setup Parameters	Frequency	E-UTRA Bands 1 - 14, 17 - 21, 23 - 32, 66A (tunable 10 MHz to 4.0 GHz) Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Bandwidth (MHz)	1.4, 3, 5, 10, 15, 20
	Span (MHz)	Auto, 1.4, 3, 5, 10, 15, 20, 30
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous
	EVM Mode	Auto, PBCH only, Max Hold
	Cyclic Prefix (CP)	Auto, Normal, Extended
	Sync Type	Normal (SS), RS/Cell ID
	Save/Recall	Setup, Measurement, Screen Shot (JPEG - save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements
LTE/LTE-A FDD RF Measurements	RF Channel Power Accuracy	±1.5 dB, ±1.0 dB (typ.), (RF input –50 to +10 dBm)
LTE/LTE-A FDD Modulation Measurements	RS Power Accuracy	±1.0 dB (typ.), (RF input –50 to +10 dBm)
	Frequency Error	±10 Hz + time base error, 99% confidence level
	Residual EVM (rms)	2.0% (typ.) (E-UTRA Test Model 3.1, RF Input –50 to +10 dBm)
LTE/LTE-A FDD Over-the-Air (OTA) Measurements	Scanner	Six strongest signals if present Auto Save – Sync Signal power and Modulation Results with GPS information
	Tx Test	Scanner – Three strongest signals if present RS Power – Strongest signal
	Mapping	Map On-screen S-SS, RSRP, RSRQ, or SINR of Cell ID with strongest signal Scanner – three strongest signals if present Save and Export Mapping data: KML, MTD (tab delimited)
	Carrier Aggregation	Up to 5 component carriers specified (CC1 to CC5) Automatic detection of CP and MIMO status for each active CC RS Power & RS Delta Power, SS Power, EVM (peak and rms), Freq Error (Hz & ppm), TAE, Cell ID

LTE/LTE-A FDD/TDD Measurements (Option 883 and 886) (continued)

LTE/LTE-A TDD Measurements			
RF	Modulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Frame View Sub-Frame View Total Frame Power DwPTS Power Transmit Off Power Cell ID Timing Error ACLR Spectral Emission Mask Category A or B (Opt 1) RF Summary	Power vs. Resource Block (RB) RB Power (PDSCH) Active RBs, Utilization% Channel Power, Cell ID OSTP, Frame EVM by modulation Constellation QPSK, 16 QAM, 64 QAM 256 QAM Demod (Option 886) Modulation Results Ref Signal Power (RS) Sync Signal Power (SS) EVM – rms, peak, max hold Frequency Error – Hz, ppm Carrier Frequency Cell ID Control Channel Power Bar Graph or Table View RS, P-SS, S-SS PBCH, PCFICH, PHICH, PDCCH Total Power (Table View) EVM per Control Channel Tx Time Alignment Modulation Summary Includes EVM by modulation Antenna Icons Detects active antennas (1/2)	Scanner Cell ID (Group, Sector) S-SS, RSRP, RSRQ, SINR Dominance Modulation Results – On/Off Tx Test Scanner RS Power of MIMO antennas Cell ID, Average Power Delta Power (Max-Min) Graph of Antenna Power Modulation Results – On/Off Mapping On-screen S-SS, RSRP, RSRQ, or SINR Scanner Modulation Results – Off Carrier Aggregation Up to 5 component carriers (CC1 to CC5) CP, MIMO status, RS & SS Power, EVM, Frequency Error, Time Alignment Error, Cell ID	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth ACLR Frequency Error Carrier Frequency Dominance EVM peak, rms Frame EVM, rms Frame EVM by mod type RS, SS Power RS EVM P-SS, S-SS, Power, EVM PBCH, PCFICH, PHICH, PDCCH Power, EVM Cell, Group, Sector ID OSTP Tx Time Alignment Frame Power DWPTS Power Transmit Off Power Timing Error

Setup Parameters	Frequency	E-UTRA bands 33 - 44 (tunable 10 MHz to 4.0 GHz) Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Bandwidth (MHz)	1.4, 3, 5, 10, 15, 20
	Span (MHz)	Auto, 1.4, 3, 5, 10, 15, 20, 30
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous, Trigger Sweep
	EVM Mode	Auto, PBCH only, Max Hold
	Cyclic Prefix (CP)	Auto, Normal, Extended
	Trigger	No Trigger/Ext Trigger, Rising/Falling
	Uplink/Downlink Configuration	0 to 6
	Save/Recall	Setup, Measurement, Screen Shot (JPEG - save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements
LTE/LTE-A TDD RF Measurements	RF Channel Power Accuracy	±1.5 dB, ±1.0 dB (typ.), (RF input –30 to +10 dBm)
LTE/LTE-A TDD Modulation Measurements	RS Power Accuracy	±1.0 dB (typ.), (RF input –50 to +10 dBm)
	Frequency Error	±10 Hz + time base error, 99% confidence level
	Residual EVM (rms)	2.0% (typ.) (E-UTRA Test Model 3.1, RF Input –30 to +10 dBm)
LTE/LTE-A TDD Over-the-Air (OTA) Measurements	Scanner	Six strongest signals if present Auto Save – Sync Signal power and Modulation Results with GPS information
	Tx Test	Scanner – Three strongest signals if present RS Power – Strongest signal
	Mapping	Map On-screen S-SS, RSRP, RSRQ, or SINR of Cell ID with strongest signal Scanner – three strongest signals if present Save and Export Mapping data: *.kml, *.mtd (tab delimited)
	Carrier Aggregation	Up to 5 component carriers specified (CC1 to CC5) Automatic detection of CP and MIMO status for each active CC RS Power & RS Delta Power, SS Power, EVM (peak and rms), Freq Error (Hz & ppm), TAE, Cell ID

CDMA/EV-DO Measurements (Option 884)

CDMA Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Emission Mask Single Carrier ACPR Multi-carrier ACPR RF Summary	Code Domain Power Graph Pilot Power Channel Power Noise Floor Rho Carrier Feed Through Tau RMS Phase Error Frequency Error Abs/Rel/ Power Pilot Page Sync Q Page Code Domain Power Table Code Status Power Multiple Codes Code Utilization Modulation Summary	Pilot Scanner (Nine) PN E_c/I_o Tau Pilot Power Channel Power Pilot Dominance Multipath Scanner (Six) E_c/I_o Tau Channel Power Multipath Power Limit Test – 10 Tests Averaged Rho Adjusted Rho Multipath Pilot Dominance Pilot Power Pass/Fail Status	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Mask Test Frequency Error Channel Frequency Pilot Power Noise Floor Rho Carrier Feed Through Tau RMS Phase Error Code Utilization Measured PN Pilot Dominance Multipath Power

CDMA Setup Parameters	PN Setup	PN Trigger (No Trigger, GPS, External), PN Search Type (Auto, Manual), PN Offset
	Walsh Codes	64, 128
	Measurement Speed	Fast, Normal, Slow
	External Trigger Polarity	Rising, Falling
	Number of Carriers	1 to 5
	Carrier Bandwidth (MHz)	1.23, 1.24, 1.25
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (JPEG - save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
CDMA RF Measurements	RF Channel Power Accuracy	±1.5 dB, ±1.0 dB (typ.), (RF input –50 to +20 dBm)
CDMA Demodulation Measurements	Frequency Error	±10 Hz + time base error, 99% confidence level (in slow mode)
	Rho Accuracy	±0.005, for Rho >0.9
	Residual Rho	>0.995 (typ.), >0.99 (max.), (RF input –50 to +20 dBm)
	PN Offset	1 × 64 chips
	Pilot Power Accuracy	±1.0 dB (typ.), relative to channel power
	Tau	±0.5 µs (typ.), ±1.0 µs (max.)
CDMA Over-the-Air (OTA) Measurements	Pilot Scanner	Nine strongest pilots
	Multipath Scanner	Multipath power of six signals relative to strongest pilot
	Limit Test	Average of ten tests compared to limit

CDMA/EV-DO Measurements (Option 884) (continued)

EV-DO Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Power vs. Time Pilot & MAC Power Channel Power Frequency Error Idle Activity On/Off Ratio Spectral Emission Mask Single Carrier ACPR Multi-carrier ACPR RF Summary	MAC Code Domain Power Graph Pilot & MAC Power Channel Power Frequency Error Rho Pilot Rho Overall Data Modulation Noise Floor MAC Code Domain Power Table Code Status Power Code Utilization Data Code Domain Power Active Data Power Data Modulation Rho Pilot Rho Overall Maximum Data CDP Minimum Data CDP Modulation Summary	Pilot Scanner (Nine) PN E_c/I_o Tau Pilot Power Channel Power Pilot Dominance Mulitpath Scanner (Six) E_c/I_o Tau Channel Power Multipath Power	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth Peak-to-Average Power Carrier Frequency Frequency Error Spectral Mask Noise Floor Pilot Power RMS Phase Error Tau Code Utilization Measured PN Pilot Dominance Mulitpath Power

Setup Parameters	PN Setup	PN Trigger (No Trigger, GPS, External), PN Search Type (Auto, Manual), PN Offset
	Walsh Codes	64, 128
	Measurement	Speed Fast, Normal, Slow
	External Trigger Polarity	Rising, Falling
	Slot Type	Auto, Active, Idle
	Number of Carriers	1 to 5
	Carrier Bandwidth (MHz)	1.23, 1.24, 1.25
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/W)
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shots (JPEG - save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements
EV-DO RF Measurements	RF Channel Power Accuracy	±1.5 dB; ±1.0 dB (typ.) (RF input –50 to +20 dBm)
EV-DO Demodulation Measurements	EV-DO Compatibility	Rev 0 and Rev A
	Frequency Error	±10 Hz + time base error, 99% confidence level
	Rho Accuracy	±0.01, for Rho >0.9
	Residual Rho	>0.995 (typ.), >0.99 (max.) (RF input –50 to +20 dBm)
	PN Offset	Within 1 × 64 chips
	Pilot Power Accuracy	±1.0 dB (typ.), relative to channel power
	Tau	±0.5 µs (typ.), ±1.0 µs (max.)
EV-DO Over-the-Air (OTA) Measurements	Pilot Scanner	Nine strongest pilots
	Multipath Scanner	Multipath power of six signals relative to strongest pilot

WiMAX Fixed/Mobile Measurements (Option 885)

WiMAX Fixed Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Channel Power Preamble Power Data Burst Power Crest Factor ACPR RF Summary	Constellation RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error Carrier Frequency Base Station ID Spectral Flatness Adjacent Subcarrier Flatness EVM vs. Subcarrier/Symbol RCE EVM Frequency Error Carrier Frequency Base Station ID Sector ID (Mobile) Modulation Summary	There are no additional OTA Measurements RF and Demodulation Measurements can be made OTA	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth Burst Power Preamble Power Crest Factor Frequency Error Carrier Frequency EVM RCE Base Station ID

Setup Parameters	Bandwidth (MHz)	1.25, 1.50, 2.50, 3.50, 5.00, 5.50, 6.00, 7.00, 10.00
	Cyclic Prefix Ratio (CP)	1/4, 1/8, 1/16, 1/32
	Span (MHz)	5, 10, 15, 20
	Frame Length (ms)	2.5, 5.0, 10.0
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (JPEG - save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements
WiMAX Fixed RF Measurements (temperature range 15°C to 35°C)	RF Channel Power Accuracy	±1.5 dB; ±1.0 dB (typ.), (RF input –50 to +20 dBm)
WiMAX Fixed Demodulation Measurements (temperature range 15°C to 35°C)	Frequency Error	7 × 10^{-8} + time base error, 99% confidence level
	Residual EVM (rms)	3% (typ.), 3.5% (max.) (RF Input –50 to +20 dBm)

WiMAX* Fixed/Mobile Measurements (Option 885) (continued)

WiMAX Mobile[5] Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Channel Power Preamble Power Downlink Burst Power Uplink Burst Power ACPR Spectral Emission Mask RF Summary	Constellation RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error CINR Base Station ID Sector ID Spectral Flatness Adjacent Subcarrier Flatness EVM vs. Subcarrier/Symbol RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error CINR Base Station ID Sector ID DL-MAP (Tree View) Modulation Summary	Channel Power Monitor Preamble Scanner (Six) Preamble Relative Power Cell ID Sector ID PCINR Dominant Preamble Base Station ID Auto Save - On/Off	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth Downlink Burst Power Uplink Burst Power Preamble Power Crest Factor Frequency Error Carrier Frequency EVM RCE Sector ID

Setup Parameters	Zone Type	PUSC
	DL-MAP Auto Decoding	Convolutional Coding (CC), Convolutional Turbo Coding (CTC)
	Bandwidths (MHz)	3.50, 5.00, 7.00, 8.75, 10.00
	Cyclic Prefix Ratio (CP)	1/8
	Span (MHz)	5, 10, 20, 30
	Frame Lengths (ms)	5, 10
	Demodulation	Auto, Manual, FCH
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (JPEG - save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements
WiMAX Mobile RF Measurements (temperature range 15°C to 35°C)	RF Channel Power Accuracy	±1.5 dB; ±1.0 dB (typ.), (RF input –50 to +20 dBm)
WiMAX Mobile Demodulation Measurements (temperature range 15°C to 35°C)	Frequency Error	2×10^{-8} plus time base error, 99% confidence level
	Residual EVM (rms)	2.5% (typ.), 3.0% (max.) (RF Input –50 to +20 dBm)
WiMAX Mobile Over-the-Air (OTA) Measurements	Channel Power Monitor	Over time (one week), measurement time interval 1 s to 60 s
	Preamble Scanner	Six strongest Preambles
	Auto Save	Yes
	GPS Tagging and Logging	Yes

*: Mobile WiMAX conforms to IEEE Std. 802.16e-2005, WiMAX Forum® Air Interface – Mobile System Profile – Release 1.0 Certified, System Profiles according to WMF-T24-001-R010v07

NB-IoT Analyzer (Option 887) (requires Option 9)

Measurements	NB-IoT Mode	Guard Band, Standalone
RF Measurements	Summary Screen	Carrier Frequency, Channel Power, Occupied Bandwidth, NPSS Power, NSSS Power, NPBCH Power, NPDCCH or NPDSCH Power, Cell ID, RSRP, RSRQ, SINR, Spectral Emission Mask Pass/Fail
	Channel Spectrum	Spans supported: 1.4, 3, 5, 10, 15, 20, 30 MHz
	Spectral Emission Mask	Mask Type: NB-IoT Fixed Summary Table Off/On (Mask Segment; Start, Stop, Peak Frequencies; Power; Power Margin; RBW; Status)
	Save/Recall	Measurement (.iot), Setup (.stp), Screen Shots (.jpg) to Internal or External Memory

easyTest Tools™ (for your PC)

Instrument Modes	Spectrum Analyzer	
	Interference Analyzer	
	Channel Scanner	
	AM/FM/PM Analyzer	
Commands	Display Image	Allows putting a custom image on the instrument screen
	Recall Setup	Places the instrument into a known state; auto-advance to next command available
	Prompt	Displays instructional messages on the instrument screen; timed advance to next command available; instrument users can be allowed or disallowed from making setup adjustments
	Save	Allows automatic or manual saving of traces; auto-advance to next command available

easyMap Tools™ (create instrument-compatible maps on your PC)

Outdoor Maps	On-Line Sources	Google Maps, Cloud Made Open-Source Maps
	Pan & Zoom Mode	AZM map file format allows pan and zoom on-instrument
	Legacy Mode	MAP format is compatible with older firmware
	Geo-Referenced	Works with instrument based GPS
	Map Conversion	Convert scanned maps to geo-referenced
Indoor Maps	Sources	Scanned images in JPG, JPEG, JPE, JFIF, GIF, TIF, TIFF, PNG
General	Color Filter	Grayscale, High Contrast
	Coverage	Worldwide
	Zoom Levels	16 total zoom levels, 7 available in any one map
	Map Size	Less than 1 MB to over 1 GB

Master Software Tools (for your PC)

Measurement Viewing	Display	Modify display settings, including scale
	Spectrum Traces	Add, delete, and modify limit lines and markers. Overlay traces.
	Spectrum Analyzer Measurements	Field Strength, Occupied Bandwidth, Channel Power, ACPR, Emission Mask, C/I*1
	Interference Analyzer Measurements	Spectrograms, Signal Strength Meter, RSSI*2
	Non-Spectrum Measurements	Hi Accuracy Power Meter, Channel Scanner, GSM, W-CDMA/HSPA, LTE, TD-LTE, TD-SCDMA, CDMA, EV-DO, Fixed WiMAX, Mobile WiMAX, Screen captures (JPEGs)
Database Management	Full Trace Retrieval	Retrieve all traces from instrument into one PC directory (limited to approximately 15,000 files)
	Trace Catalog	Index all traces in selected folder & subfolder on PC into one catalog
	Trace Rename Utility	Rename measurement traces
	Group Edit	Titles, subtitles, plot scaling, markers and limit lines, simultaneously on similar files
Data Analysis	Trace Math and Smoothing	Compare multiple traces
	Measurement Calculator	Translate into other units
Report Generation	Report Generator	Includes GPS, power level, and with measurements
	Edit Graph	Change scale, limit lines, and markers
	Report Format	Create reports in HTML
	Export Measurements	Export measurements or entire folders to *.jpg or *.csv format
	Notes	Annotate measurements
Mapping (GPS Required)	Spectrum Analyzer Mode	MapInfo
	LTE Mode	Google Earth, Google Maps
Spectrogram (Spectrum Monitoring for Interference Analysis and Spectrum Clearing)	Source	Recorded Spectrogram or multiple spectrum traces
	Folder Spectrogram	2D View creates a composite file of multiple traces
	Available Displays	Spectrogram, Peak Power vs. Time, Variation in Total Power vs. Time, Peak Frequency vs. Time, Number of Traces Saved vs. Time (useful with Save on Limit Exceeded), Maximum/Average/Minimum Power vs. Time File Filter (Violations over limit lines or deviations from averages) Playback
	Display Functions per Trace	Markers, GPS location altitude and time (when recorded), instrument time Filename per trace for Folder Spectrogram
	Export to Video	Create AVI file of 2D Spectrogram for management review/reports
	Export to 3D Spectrogram	Views (Set Threshold, Markers) - 3D (Rotate X, Y, Z Axis, Level Scale, Signal ID) - 2D (Frequency or Time Domain, Signal ID) - Top Down Playback (Frequency and/or Time Domain)
List/Parameter Editors	Antennas, Cables, Signal Standards	Modify instrument's Antenna, Cable, and Signal Standard List
	Pass/Fail	Create, download, or edit Signal Analysis Pass/Fail Limits
	Script Master	Create Script Master files for GSM/W-CDMA or Channel Scanner
	Languages	Modify non-English language menus
	Mobile WiMAX	DL-MAP Parameters
Connectivity	Connections	Connect to PC using USB, LAN, or Direct Ethernet connection
	Network Search	Find all Anritsu handheld instruments on local network
	Download	Download measurements and live traces to PC for storage and analysis
	Upload	Upload measurements from PC to instrument
	Remote Access Tool	Remote control and monitoring of instrument (via Ethernet port) over the Internet
	Export	Measurements can be saved in various formats, depending on the measurement type, including JPEG, CSV, and Anritsu DAT format
	Printing	Print individual or all measurement screens

*1: Spurious Emissions results viewable in a browser
*2: Coverage Mapping and Interference Mapping files viewable in spreadsheet, Google Earth, or Google Maps

Web Remote Control

Control	Full instrument control through a browser – all instrument functions except power switch and rotary knob
Connections	RJ45 Ethernet jack Third party Wi-Fi router
Protocol	HTTP/TCP/IP
Physical Layer	Cat 5 Cable, Wi-Fi router compatible
Software Required	HTML 5 Compliant Browser – Newer versions of Chrome, Firefox, Internet Explorer and others
Operating System	iOS, Windows, Linux, Android operating systems that can host the HTML 5 Compliant browser
Remote Hardware	PCs, Tablets, and Smart Phones with Ethernet or Wi-Fi connections and a HTML 5 Compliant browser

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Download	Individual instrument files downloaded via browser Multiple instrument files and directories zipped and downloaded via browser Screen capture capability
Display Modes	Normal: All modes & displays supported Fast: Spectrum traces update faster (up to 5 updates per second)
Password	The instrument can be password protected Passwords may be used to manage who is controlling the instrument
Users/Instruments	One user/device can view and control many instruments

Programmable Remote Control

Functionality	Many instrument functions are programmable. See the Programming Manual for details.
Programming Language	Standard Commands for Programmable Instruments (SCPI)
Interfaces	USB, LAN
Available Drivers	LabView. Visit NI.com for driver.

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MS2720T	Spectrum Master (Requires Option 709, 713, or 720)
	Frequency Options
MS2720T-0709	Frequency Range 9 kHz to 9 GHz
MS2720T-0713	Frequency Range 9 kHz to 13 GHz
MS2720T-0720	Frequency Range 9 kHz to 20 GHz
	Tracking Generator Options
MS2720T-0809	9 GHz Tracking Generator (Requires Option 709)
MS2720T-0813	13 GHz Tracking Generator (Requires Option 713)
MS2720T-0820	20 GHz Tracking Generator(Requires Option 720)
	Spectrum Analyzer Options
MS2720T-0025	Interference Analyzer (Option 31 is recommended)
MS2720T-0027	Channel Scanner
MS2720T-0431	Coverage Mapping (Requires Option 31 for full functionality)
MS2720T-0444	EMF Measurements (Requires Anritsu Isotropic Antenna)
MS2720T-0509	AM/FM/PM Measurements (Option 431 required for full functionality)
MS2720T-0024	I/Q Waveform Capture (Requires Option 9)
MS2720T-0089	Zero-Span IF Output
MS2720T-0090	Gated Sweep
	Power Meter Option
MS2720T-0019	High Accuracy Power Meter (Requires USB Power Sensor, sold separately)
	Wireless Measurement Options
MS2720T-0009	Demodulation Hardware
MS2720T-0880	GSM/GPRS/EDGE Measurements (Requires Option 9)
MS2720T-0881	W-CDMA/HSPA+ Measurements (Requires Option 9, Option 31 recommended)
MS2720T-0882	TD-SCDMA/HSPA+ Measurements (Requires Option 9, Option 31 required for full functionality)
MS2720T-0883	LTE/LTE-A FDD/TDD Measurements (Requires Option 9, Option 31 required for full functionality)
MS2720T-0884	CDMA/EV-DO Measurements (Requires Option 9, Option 31 required for full functionality)
MS2720T-0885	WiMAX Fixed/Mobile Measurements (Requires Option 9, Option 31 required for full functionality)
MS2720T-0886	LTE 256-QAM Demodulation (Requires Option 883)
MS2720T-0887	NB-IoT Measurement (requires Option 9)
	Power Sensors (for complete ordering information see the respective datasheets of each sensor)
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +3 to +51.76 dBm
MA24106A	RF USB Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm
MA24208A	Microwave Universal USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24218A	Microwave Universal USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24330A	Microwave CW USB Power Sensor, 10 MHz to 33 GHz, +20 dBm
MA24340A	Microwave CW USB Power Sensor, 10 MHz to 40 GHz, +20 dBm
MA24350A	Microwave CW USB Power Sensor, 10 MHz to 50 GHz, +20 dBm
MA25100A	RF Power Indicator

Model/Order No.	Name
	Manuals (soft copy at www.anritsu.com)
10100-00065	Product Information, Compliance, and Safety
10580-00340	Spectrum Master User Guide
10580-00349	Spectrum Analyzer Measurement Guide
10580-00339	Tracking Generator Measurement Guide
10580-00240	Power Meter Measurement Guide
10580-00234	3GPP Signal Analyzer Measurement Guide
10580-00235	3GPP2 Signal Analyzer Measurement Guide
10580-00236	WiMAX Signal Analyzer Measurement Guide
10580-00341	Spectrum Master Programming Manual
10580-00342	Spectrum Master Maintenance Manual
10580-00455	EMF Measurement Guide
	Troubleshooting Guides
11410-00551	Spectrum Analyzers
11410-00472	Interference
11410-00566	LTE eNodeB
11410-00615	TD-LTE eNodeB
11410-00466	GSM/GPRS/EDGE Base Stations
11410-00463	W-CDMA/HSPA+ Base Stations
11410-00465	TD-SCDMA/HSPA+ Base Stations
11410-00467	cdmaOne/CDMA2000 1X Base Stations
11410-00468	CDMA2000 1xEV-DO Base Stations
11410-00470	Fixed WiMAX Base Stations
11410-00469	Mobile WiMAX Base Stations
	Standard Accessories (included with instrument)
2000-1371-R	Ethernet Cable, 213 cm (7 ft)
2000-1685-R	Soft Carrying Case
2000-1691-R	Stylus with Coiled Tether
2000-1797-R	Touchscreen Protective Film, 8.4 in (one factory-installed, one spare)
633-75	High Capacity Li-Ion Battery
40-187-R	AC-DC Power Supply
806-141-R	Automotive Power Adapter, 12 VDC, 60 W
3-2000-1498	USB A-mini B Cable, 10 ft/305 cm
	Certificate of Calibration and Conformance
	Optional Accessories
	GPS Antennas
2000-1528-R	GPS Antenna, SMA (m) with 5 m (15 ft) cable, requires 5 VDC
2000-1652-R	GPS Antenna, SMA (m) with 0.3 m (1 ft) cable, requires 3.3 VDC or 5 VDC
2000-1760-R	GPS Antenna, SMA (m), 25 dB gain, 2.5 VDC to 3.7 VDC
	Directional Antennas
2000-1411-R	824 MHz to 896 MHz, N (f), 12.3 dBi, Yagi
2000-1412-R	885 MHz to 975 MHz, N (f), 12.6 dBi, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N (f), 12.3 dBi, Yagi
2000-1414-R	1850 MHz to 1990 MHz, N (f), 11.4 dBi, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N (f), 14.1 dBi, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N (f), 14.3 dBi, Yagi
2000-1659-R	698 MHz to 787 MHz, N (f), 10.1 dBi, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N (f), 14.3 dBi, Yagi
2000-1715-R	Directional Antenna, 698 MHz to 2500 MHz, N (f), gain of 2 to 10 dBi, typical
2000-1726-R	Antenna, 2500 MHz to 2700 MHz N (f), 14.1 dBi, Yagi
2000-1747-R	Antenna, Log Periodic, 300 MHz to 7000 MHz, N (f), 5.1 dBi (typ.)
2000-1748-R	Antenna, Log Periodic, 1 GHz to 18 GHz, N (f), 6 dBi (typ.)
2000-1777-R	Portable Directional Antenna, 9 kHz to 20 MHz, N (f)
2000-1778-R	Portable Directional Antenna, 20 MHz to 200 MHz, N (f)
2000-1779-R	Portable Directional Antenna, 200 MHz to 500 MHz, N (f)
2000-1812-R	Portable Yagi Antenna, 450 MHz to 512 MHz, N (f), 7.1 dBi
2000-1825-R	Portable Yagi Antenna, 380 MHz to 430 MHz, N (f), 7.1 dBi

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Model/Order No.	Name
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA (m), 50Ω
2000-1473-R	870 MHz to 960 MHz, SMA (m), 50Ω
2000-1035-R	896 MHz to 941 MHz, SMA (m), 50Ω (1/2 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA (m), 50Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA (m), 50Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA (m), 50Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA (m), 50Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA (m), 50Ω
2000-1751-R	698 MHz to 960 MHz, 1710 MHz to 2100 MHz, 2500 MHz to 2700 MHz, SMA (m), 2 dB (typ.), 50Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)
	Isotropic Antenna
2000-1791-R	700 MHz to 6000 MHz, N (m)
2000-1792-R	30 MHz to 3000 MHz, N (m)
2000-1800-R	9 kHz to 300 MHz, N (m)
	Mag Mount Broadband Antenna
2000-1616-R	20 MHz to 21000 MHz, N (f), 50Ω
2000-1645-R	694 MHz to 894 MHz, 3 dBi peak gain, 1700 MHz to 2700 MHz, 3 dBi peak gain, N (m), 50Ω, 10 ft
2000-1646-R	750 MHz to 1250 MHz, 3 dBi peak gain, 1650 MHz to 2700 MHz, 5 dBi peak gain
2000-1647-R	Cable 1: 698 MHz to 1200 MHz, 2 dBi peak gain, 1700 MHz to 2700 MHz, 5 dBi peak gain, N (m), 50Ω, 10 ft Cable 2: 3000 MHz to 6000 MHz, 5 dBi peak gain, N (m), 50Ω, 10 ft Cable 3: GPS 26 dB gain, SMA (m), 50Ω, 10 ft
2000-1946-R	Cable 1: 617 MHz to 960 MHz, 3 dBi peak gain, 1710 MHz to 3700 MHz, 4 dBi peak gain, N (m), 50Ω, 10 ft Cable 2: 3000 MHz to 6000 MHz, 5 dBi peak gain, N (m), 50Ω, 10 ft Cable 3: GPS 26 dB gain, SMA (m), 50Ω, 10 ft
2000-1648-R	1700 MHz to 6000 MHz, 3 dBi peak gain, N (m), 50Ω, 10 ft
	Bandpass Filters
1030-114-R	806 MHz to 869 MHz, N (m) to SMA (f), 50Ω
1030-109-R	824 MHz to 849 MHz, N (m) to SMA (f), 50Ω
1030-110-R	880 MHz to 915 MHz, N (m) to SMA (f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N (m) to SMA (f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N (m) to SMA (f), 50Ω
1030-105-R	890 MHz to 915 MHz, N (m) to SMA (f), 50Ω
1030-106-R	1710 MHz to 1790 MHz, N (m) to SMA (f), 50Ω
1030-107-R	1910 MHz to 1990 MHz, N (m) to SMA (f), 50Ω
1030-149-R	High Pass, 150 MHz, N (m) to N (f), 50Ω
1030-150-R	High Pass, 400 MHz, N (m) to N (f), 50Ω
1030-151-R	High Pass, 700 MHz, N (m) to N (f), 50Ω
1030-152-R	Low Pass, 200 MHz, N (m) to N (f), 50Ω
1030-153-R	Low Pass, 550 MHz, N (m) to N (f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N (m) to N (f), 50Ω
1030-178-R	1920 MHz to 1980 MHz, N (m) to N (f), 50Ω
1030-179-R	777 MHz to 798 MHz, N (m) to N (f), 50Ω
1030-180-R	2500 MHz to 2570 MHz, N (m) to N (f), 50Ω
2000-1684-R	791 MHz to 821 MHz, N (m) to N (f), 50Ω
2000-1734-R	Bandpass Filter, 699 MHz to 715 MHz, N(m) and N(f), 50Ω
2000-1735-R	Bandpass Filter, 776 MHz to 788 MHz, N (m) and N(f), 50Ω
2000-1736-R	Bandpass Filter, 815 MHz to 850 MHz, N (m) and N(f), 50Ω
2000-1737-R	Bandpass Filter, 1711 MHz to 1756 MHz, N (m) and N(f), 50Ω
2000-1738-R	Bandpass Filter, 1850 MHz to 1910 MHz, N (m) and N(f), 50Ω
2000-1739-R	Bandpass Filter, 880 MHz to 915 MHz, N (m) and N(f), 50Ω
2000-1740-R	Bandpass Filter, 1710 MHz to 1785 MHz, N (m) and N(f), 50Ω
2000-1741-R	Bandpass Filter, 1920 MHz to 1980 MHz, N (m) and N(f), 50Ω
2000-1742-R	Bandpass Filter, 832 MHz to 862 MHz, N (m) and N(f), 50Ω
2000-1743-R	Bandpass Filter, 2500 MHz to 2570 MHz, N (m) and N(f), 50Ω
2000-1799-R	Bandpass Filter, 2305 MHz to 2320 MHz, N (m) and N(f), 50Ω

Model/Order No.	Name
	Adapters
1091-26-R	SMA (m) to N (m), DC to 18 GHz, 50Ω
1091-27-R	SMA (f) to N (m), DC to 18 GHz, 50Ω
1091-80-R	SMA (m) to N (f), DC to 18 GHz, 50Ω
1091-81-R	SMA (f) to N (f), DC to 18 GHz, 50Ω
1091-172-R	BNC (f) to N (m), DC to 1.3 GHz, 50Ω
1091-417-R	N (m) to QMA (f), DC to 6 GHz, 50Ω
1091-418-R	N (m) to QMA (m), DC to 18 GHz, 50Ω
510-90-R	7/16 DIN (f) to N (m), DC to 7.5 GHz, 50Ω
510-91-R	7/16 DIN (f) to N (f), DC to 7.5 GHz, 50Ω
510-92-R	7/16 DIN (m) to N (m), DC to 7.5 GHz, 50Ω
510-93-R	7/16 DIN (m) to N (f), DC to 7.5 GHz, 50Ω
510-96-R	7/16 DIN (m) to 7/16 DIN (m), DC to 7.5 GHz, 50Ω
510-97-R	7/16 DIN (f) to 7/16 DIN (f), DC to 7.5 GHz, 50Ω
510-102-R	N (m) to N (m), DC to 11 GHz, 50Ω, 90 degrees right angle
71693-R	Ruggedized K (f) to Type N (f)
	Precision Adapters
34NN50A	N (m) to N (m), DC to 18 GHz, 50Ω
34NFNF50	N (f) to N (f), DC to 18 GHz, 50Ω
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N (m) to N (f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N (m) to N (f)
42N50A-30	30 dB, 50 W, DC to 18 GHz, N (m) to N (f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N (m) to N (f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N (m) to N (f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N (m) to N (f), Uni-directional
1010-121-R	40 dB, 100 W, DC to 18 GHz, N (m) to N (f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N (m) to N (f)
	Miscellaneous Accessories
2000-1374	External Dual Charger for Li-Ion Batteries
633-75	Rechargeable Li-Ion Battery, 7500 mAh
2000-1689-R	EMI Near Field Probe Kit
2000-1797-R	Touchscreen Protective Film, 8.4 in.
MA2700A	Handheld Interference Hunter (for full specifications, refer to the MA2700A Technical Data Sheet, 11410-00692)
2000-1691-R	Stylus with Coiled Tether
2000-1798-R	Port Extender, DC to 6 GHz, N (m) to N (f)
MA25401A	Atomic Clock, External, 10 MHz Frequency Reference (see 11410-01134 for details)
	Backpack and Transit Case
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle, 56 × 45.5 × 26.5 cm (22.07" × 17.92" × 10.42")
760-261-R	Transit Case, space for MA2700A, antennas, filters, instrument inside softcase, and other interference hunting accessories/tools
760-262-R	Transit Case for MA2700A, several Yagi antennas and filters
760-271-R	Transit Case for Portable Directional Antennas and Port Extender, 52.4 × 42.8 × 20.6 cm (20.62" × 16.87" × 8.12") (for 2000-1777-R, 2000-1778-R, 2000-1779-R, 2000-1798-R)
760-286-R	Compact Transit Case with Wheels and Handle 55.6 cm × 35.5 cm x 22.9 cm (21.89" × 13.98" × 9.01")

Spectrum Master™ Ultraportable Spectrum Analyzer

MS2760A/MS2762A

9 kHz to 32 GHz/44 GHz/50 GHz/70 GHz/90 GHz/110 GHz/145 GHz/170 GHz (MS2760A)
6 GHz to 32 GHz/44 GHz/50 GHz/70 GHz/90 GHz/110 GHz/145 GHz/170 GHz (MS2762A)

Pocket-sized, Big Performance

Excellent Eco Product

Utilizing Anritsu's patented nonlinear transmission line (NLTL) technology, the Spectrum Master MS2760A and MS2762A ultraportable spectrum analyzer products deliver the best-in-class price/performance ratio unmatched by traditional benchtop instruments. This enables you to more efficiently advance your technology development and reduce your time to market. The MS276xA series are pocket-sized, yet big on performance with leading dynamic range, sweep speed, and amplitude accuracy. The ultraportable size of these instruments enables a direct connection to almost any DUT, eliminating the need for lossy, expensive cables.

The 145 GHz and 170 GHz models are the world's first handheld millimeter-wave (mmWave) spectrum analyzers to provide broadband, continuous coverage from 9 kHz to 170 GHz. These are the world's first and only broadband spectrum analyzers that break through the 110 GHz barrier and enable research and development in the entire D band spectrum.

They are perfect for advanced mmWave applications like radio astronomy, automotive radar, antenna beam pattern testing, and more. The MS2760A and MS2762A are USB-powered and controlled from a Windows-based PC, laptop, or tablet, making them uniquely flexible for use in the lab, on the manufacturing floor, or even in the field.

Key Features

- Measure: Channel Power, Adjacent Channel Power, Occupied Bandwidth
- Spectrum and Spectrogram Displays
- External 10 MHz Frequency Reference
- External TTL Trigger Input
- Resolution Bandwidth (RBW): 1 Hz to 3 MHz
- Phase Noise: –116 dBc/Hz @ 1 GHz, typical (MS2760A)
- Up to Six Spectrum Traces and Spectrogram Cursors, Three Trace Detectors, 12 Markers
- Dynamic Range: >108 dB, typical at 70 GHz (MS2762A)
- DANL: as low as –142 dBm (MS2762A, 6 GHz to 40 GHz typical)

Specifications

Smart Measurements	Channel Power	Measures the total power in a specified bandwidth
	Occupied Bandwidth	Measures 99 to 1% power channel of a signal
	Adjacent Channel Power	Measures channel power of the adjacent channel
Setup Parameters	Frequency	Center/Start/Stop, Frequency Step, Frequency Offset
	Span	Span, Span Up/Down, Full Span, Last Span, Zero Span
	Bandwidth	RBW, Auto RBW, VBW, Auto VBW, VBW/RBW, Span/RBW, VBW Log/Lin Averaging
	Amplitude	Reference Level, Scale/Division, Units, Ref Level Offset, IF Gain (On/Off), Image Reject (Normal/Low Only/High
Sweep Functions	Sweep	Single/Continuous, Restart, Sweep Once, Sweep to N, Points, Minimum Capture Time
	Zero Span Sweep Time	0.02 ms to 60 s
	Sweep (Trace) Points	Settable range from 10 to 10,001 points; the default is 501 points
	Minimum Capture Time	0 s to 10 s
	Sweep Time Accuracy	±2% in Zero Span
Trace Functions	Traces	Up to six traces
	Trace Type	Clear/Write, Trace Average, Max Hold, Min Hold, Rolling Average, Rolling Max Hold, Rolling Min Hold
	Trace Mode	Active, Hold/View, Blank
	Detector Type per Trace	Peak, RMS/Avg, Negative
Spectrogram	Trace Time Cursor	Up to six Time Cursors to recall historical trace data by trace number or time
	Color Setup	Set Color Top/Bottom Range, Set Color Reference Hue

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Marker Functions	Markers	Up to 12 Markers
	Marker Mode	Normal, Delta, Fixed
	Delta Marker	Relative to any Normal or Fixed Marker
	Marker Function	None, Noise
	Marker Trace	Assign Marker to any Trace
	Peak Search	Peak Search, Next Peak, Next Peak Left, Next Peak Right, Next Point Left, Next Point Right
	Peak Search Setup	Peak Threshold, Peak Excursion
	Marker →	Mkr → Center, Mkr → Ref Level
Limit Line Functions	Limit Setup	Upper/Lower, Limit On/Off, Limit Alarm On/Off, Set Default Limit Line, Absolute/Relative
	Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
	Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
	Limit Line Envelope	Create Envelope, Update Envelope, Points (41 max.), Offset, Shape Square/Slope
Frequency	Model Number	Frequency Range (usable to 0 Hz)
	MS2760A-0032	9 kHz to 32 GHz
	MS2760A-0044	9 kHz to 44 GHz
	MS2760A-0050	9 kHz to 50 GHz
	MS2760A-0070	9 kHz to 70 GHz
	MS2760A-0090	9 kHz to 90 GHz
	MS2760A-0110	9 kHz to 110 GHz
	MS2760A-0145	9 kHz to 145 GHz
	MS2760A-0170	9 kHz to 170 GHz
	Tuning Resolution	1 Hz
	Internal 10 MHz Frequency Reference	Aging: ±1.0 ppm/year Accuracy: ±0.2 ppm (25°C±25°C) + aging
	Frequency Span	10 Hz to maximum frequency range of instrument
Bandwidth	Resolution Bandwidth (RBW)	1 Hz to 3 MHz (Span ≥10 Hz) Zero Span 5 kHz to 20 MHz
	Video Bandwidth (VBW)	1 Hz to 3 MHz (Span ≥10 Hz) Zero Span 5 kHz to 20 MHz
	VBW/Average Type	Linear/Log
	RBW Filters	Flat Top, Nuttall
	Shape Factor	<5:1 typical
Amplitude Ranges	Dynamic Range	>103 dB (typ.) at 70 GHz, 2/3 (TOI – DANL) in 1 Hz RBW
	Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed
	Measurement Range	DANL to +10 dBm
	Reference Level Range	–120 to +30 dBm
	Amplitude Units	dBm
	Maximum Safe Level Input	+30 dBm CW, ±10 VDC
External Trigger	Source	External, Free Run, Video, Periodic (0 s to 5 s)
	Delay	0 ms to 1670 ms; –60 s (up to sweep time) in zero span and video or external trigger
	Holdoff	0 ms to 5000 ms
	Slope	Rising, Falling, Both
	Hysteresis	0 to 200 dB

Spurs

Residual Spurs	Maximum (dBm)	Typical (dBm)
10 MHz to 70 GHz	–85	–95
>70 MHz to 90 GHz	–84	–95
>90 MHz to 110 GHz	–81	–95
>110 GHz to 145 GHz	–68	–85
>145 GHz to 170 GHz	–67	–85

Input-related Spurious (–10 dBm CW input)
28 MHz: –50 dBc (70 MHz input signal)
35 MHz: –50 dBc (133 MHz input signal)
770 MHz: –35 dBc (3430 MHz, 4970 MHz, 7630 MHz input signal)
910 MHz: –35 dBc (4970 MHz, 6790 MHz input signal)
All other input frequencies: <–60 dBc
Zero Span: No image rejection is applied to the sweep while in zero span, therefore spurious impact may be different.

Amplitude Accuracy
(–10 dBm CW signal)

	20°C to 30°C (after 30 minute warm-up)		0°C to 50°C (after 60 minute warm-up)	
Frequency Range	Maximum (dB)	Typical (dB)	Maximum (dB)	Typical (dB)
9 kHz to 644 MHz	±1.3	±0.5	±2.0	±0.5
>644 MHz to 40 GHz	±1.8	±0.5	±3.0	±1.0
>40 GHz to 70 GHz	±2.0	±0.5	±3.0	±1.0
>70 GHz to 90 GHz	±2.2	±0.5	±3.0	±1.0
>90 GHz to 110 GHz	±2.5	±0.5	±3.0	±1.0
>110 GHz to 145 GHz	±3.5	±0.5	±4.0	±1.5
>145 GHz to 170 GHz	±3.5	±0.5	±4.0	±1.5

Continued on next page

Displayed Average Noise Level (DANL)
(RMS detection, VBW/Avg type = Log, IF Gain On),
1 Hz RBW

Frequency Range	Maximum (dB)	Typical (dB)
10 MHz to 644 MHz	–131	–134
>644 MHz to 4 GHz	–136	–140
>4 GHz to 40 GHz	–131	–134
>40 GHz to 70 GHz	–128	–132
>70 GHz to 90 GHz	–127	–130
>90 GHz to 110 GHz	–123	–127
>110 GHz to 145 GHz	–112	–120
>145 GHz to 170 GHz	–111	–115

Spectral Purity – SSB Phase Noise
(dBc/Hz, 20°C to 30°C)

Offset	1 GHz (typ.)	6 GHz (max.)	6 GHz (typ.)	30 GHz (max.)	30 GHz (typ.)	60 GHz (max.)	60 GHz (typ.)
1 kHz	–100	–80	–88	–66	–74	–60	–69
10 kHz	–110	–95	–104	–81	–88	–75	–84
100 kHz	–116	–95	–104	–81	–88	–75	–84

Spectral Purity –
SSB Phase Noise
(dBc/Hz, 20°C to
30°C)

Spectral Purity – SSB Phase Noise (dBc/Hz, 20°C to 30°C)	Third-Order Intercept (TOI) (IF Gain Off, typical, 0 dBm tones 1 MHz apart, 0 dBm reference level)	2 GHz (+35 dBm) 18 GHz (+35 dBm) 62 GHz (+25 dBm)
	Second Harmonic Distortion (at 1 GHz input)	0 dBm Input (–50 dBc max.) –20 dBm Input (–60 dBc max.)

Input Match (typ.)

	K Connector		V Connector		W Connector	
Frequency Range	VSWR	Return Loss	VSWR	Return Loss	VSWR	Return Loss
9 kHz to 12.4 GHz	1.29:1	18 dB	1.29:1	18 dB	1.29:1	18 dB
>12.4 GHz to 26.5 GHz	1.67:1	12 dB	1.43:1	15 dB	1.67:1	12 dB
>26.5 GHz to 40 GHz	1.67:1	12 dB	1.58:1	13 dB	1.67:1	12 dB
>40 GHz to 50 GHz	1.67:1	12 dB	1.67:1	12 dB	1.67:1	12 dB
>50 GHz to 70 GHz	—	—	2.10:1	9 dB	2.10:1	9 dB
>70 GHz to 110 GHz	—	—	—	—	2.10:1	9 dB
>110 GHz to 145 GHz	—	—	—	—	3.56:1	5 dB
>145 GHz to 170 GHz	—	—	—	—	4.42:1	4 dB

General

Setup Parameters	System Information	Connected To, Manufacturer, Model Number, Serial Number, Server Version, Client Version, Frequency
	Settings Display	Color Theme (Default/Light)
	Settings Screenshot	Capture Region (Entire Application/Graphs Only), Color (Standard/Printable), Annotations (Footer/Header), Directory, File Naming (Automatic Timestamp/Manual)
	File	Quick Save, Save As, Recall, Save On Event, Browse Files
	Save On Event	Limit Crossed (Off/Single/Continuous), Sweep End (Off/Single/Continuous), Interval, Clear All Events
Connectors	RF In	32 GHz and 44 GHz Instruments: K Connector (2.92 mm), male 50Ω 50 GHz and 70 GHz Instruments: V Connector (1.85 mm), male 50Ω 90 GHz and 110 GHz Instruments: W Connector (1.0 mm), male 50Ω 145 GHz and 170 GHz Instruments: 0.8 mm Connector (0.8 mm), male 50Ω
	USB Interface	USB 3.0, Type C Connector
	External Reference In	MCX (f), 50Ω, 10 MHz
	External Trigger In	MCX (f), 50Ω, TTL Levels
Computer Requirement	Display Resolution	16:9/16:10 Aspect Ratio (>1280 × 720/1280 × 800)
	Operating System	Windows® 7, 8.1, 10; 64-bit
	Recommended Minimum Configuration	Quad Core i7 fourth generation or higher CPU, 16 GB RAM, 128 GB Data Storage, USB 3.0
Regulatory Compliance (not including Windows Tablet/ Laptop/PC)	CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: 2011/65/EU, (EU) 2015/863
	Australia and New Zealand	RCM AS/NZS 4417:2012
	South Korea	KCC-REM-A21-0004
Environmental MIL-PRF-28800F Class 3 (not including Windows Tablet/ Laptop/PC)	Operating Temperature Range	0°C to +50°C
	Storage Temperature Range	–40°C to +71°C
	Maximum Relative Humidity	95% RH at +30°C, non-condensing
	Vibration, Sinusoidal	5 Hz to 55 Hz
	Vibration, Random	10 Hz to 500 Hz
	Half Sine Shock	30 g_n
	Altitude	4600 meters, operating and non-operating
	Explosive Atmosphere	MIL-PRF-28800F Section 4.5.6.3 MIL-STD-810G, Method 511.5, Procedure 1
Warranty	Duration	Standard three-year warranty
Dimensions and Mass (not including Windows Tablet/Laptop/PC)		84 (W) × 155 (H) × 27 (D) mm (6.1 × 3.3 × 1.1 in) 255 g (9.0 oz)

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Models and Options
MS2760A-0032	Spectrum Master, Ultraportable Spectrum Analyzer, 9 kHz to 32 GHz
MS2760A-0044	Spectrum Master, Ultraportable Spectrum Analyzer, 9 kHz to 44 GHz
MS2760A-0050	Spectrum Master, Ultraportable Spectrum Analyzer, 9 kHz to 50 GHz
MS2760A-0070	Spectrum Master, Ultraportable Spectrum Analyzer, 9 kHz to 70 GHz
MS2760A-0090	Spectrum Master, Ultraportable Spectrum Analyzer, 9 kHz to 90 GHz
MS2760A-0110	Spectrum Master, Ultraportable Spectrum Analyzer, 9 kHz to 110 GHz
MS2760A-0145	Spectrum Master, Ultraportable Spectrum Analyzer, 9 kHz to 145 GHz
MS2760A-0170	Spectrum Master, Ultraportable Spectrum Analyzer, 9 kHz to 170 GHz
MS2762A-0032	Spectrum Master, Ultraportable Spectrum Analyzer, 6 GHz to 32 GHz
MS2762A-0044	Spectrum Master, Ultraportable Spectrum Analyzer, 6 GHz to 44 GHz
MS2762A-0050	Spectrum Master, Ultraportable Spectrum Analyzer, 6 GHz to 50 GHz
MS2762A-0070	Spectrum Master, Ultraportable Spectrum Analyzer, 6 GHz to 70 GHz
MS2762A-0090	Spectrum Master, Ultraportable Spectrum Analyzer, 6 GHz to 90 GHz
MS2762A-0110	Spectrum Master, Ultraportable Spectrum Analyzer, 6 GHz to 110 GHz
MS2762A-0145	Spectrum Master, Ultraportable Spectrum Analyzer, 6 GHz to 145 GHz
MS2762A-0170	Spectrum Master, Ultraportable Spectrum Analyzer, 6 GHz to 170 GHz

Model/Order No.	Name
	Option Number
MS2760A-0032-0098 MS2760A-0044-0098 MS2760A-0050-0098 MS2760A-0070-0098 MS2760A-0090-0098 MS2760A-0110-0098 MS2760A-0145-0098 MS2760A-0170-0098 MS2762A-0032-0098 MS2762A-0044-0098 MS2762A-0050-0098 MS2762A-0070-0098 MS2762A-0090-0098 MS2762A-0110-0098 MS2762A-0145-0098 MS2762A-0170-0098	Standard Calibration (ISO/IEC 17025 and ANSI/NCSL Z540-1)
MS2760A-0032-0099 MS2760A-0044-0099 MS2760A-0050-0099 MS2760A-0070-0099 MS2760A-0090-0099 MS2760A-0110-0099 MS2760A-0145-0099 MS2760A-0170-0099 MS2762A-0032-0099 MS2762A-0044-0099 MS2762A-0050-0099 MS2760A-0070-0099 MS2762A-0090-0099 MS2762A-0110-0099 MS2762A-0145-0099 MS2762A-0170-0099	Premium Calibration (ISO/IEC 17025 and ANSI/NCSL Z540-1 plus test data)
	Standard Accessories (Included with instrument)
2300-1859-R	USB 3.0 Type C to Type A Cable, 1 m
2300-1605-R	BNC (m) to MCX (m) Cable (qty 2)
	Certificate of Calibration and Conformance
	Manuals (available at www.anritsu.com)
10580-00427	User Guide

Spectrum Master

MS2713E

9 kHz to 6 GHz

Remote Control
USB

Compact Handheld Spectrum Analyzer

The wireless communications market is rapidly growing as the telecommunications sectors continue to evolve. Whether you are installing, troubleshooting, or solving problems for public safety providers, or wireless service providers, Anritsu has a solution.
Anritsu's Spectrum Master has been designed for technicians, installers, field radio frequency (RF) engineers, and contractors who struggle with both keeping track of the growing number of interfering signals and assessing signal quality on a wide range of increasingly complex signals.
Easy-to-use, integrated and high performing, the Spectrum Master helps users address those challenges and more.
Its feature-rich and compact design helps users comply to regulatory requirements, manage and maximize efficiency, improve system up-time, and increase revenue – all in a rugged and field-proven device designed to withstand even the most punishing conditions.
Anritsu's Spectrum Master series is ideal for spectrum monitoring, interference analysis, RF and microwave measurements, field strength measurements, transmitter spectrum analysis, electromagnetic field strength, signal strength mapping, and overall field analysis of cellular 2G/3G/4G, Wi-Fi, and broadcast signals.

Designed for Field Use

The Spectrum Master was designed specifically for field environments. Weighing less than 3.45 kg, it is small and compact and easy to carry. Its field replaceable Li-Ion battery typically lasts for more than 3 hours, and a bright 8.4-inch color display provides visibility even in broad daylight. With an operating temperature range from –10°C to +55°C, a rugged case and splash proof design, the Spectrum Master works in the most extreme weather conditions with guaranteed performance anywhere and anytime.

Integrated Solution

The Spectrum Master is a multifunctional instrument that eliminates the need for you to carry and learn multiple instruments. It can be configured to across a broad range of parameters, including a 6 GHz spectrum analyzer, an interference analyzer, tracking generator, channel scanner, power meter, high accuracy power meter, and GPS receiver for time/location stamping and accuracy enhancements.

Easy-to-Use

The Spectrum Master uses intuitive spectrum analyzer menus.
A touchscreen keypad combination provides you with an intuitive menu-driven interface designed to give a familiar menu structure with quick access to popular measurements.

Key Features

- 9 kHz to 6 GHz
- Interference Analyzer:
  Spectrogram, Signal Strength, RSSI, Signal ID, Interference Mapping
- DANL: –162 dBm in 1 Hz RBW
- Dynamic Range:
  >102 dB in 1 Hz RBW
- Phase Noise:
  –100 dBc/Hz max @ 10 kHz offset at 1 GHz
- Frequency Accuracy:
  <±50 ppb with GPS On

Functions and Description

- LTE/LTE-A FDD/TDD; MIMO (2×2, 4×4)
- Narrow-Band Internet of Things (NB-IoT)
- CDMA, EV-DO
- GSM/EDGE
- W-CDMA/HSPA+
- TD-SCDMA/HSPA+
- Fixed, Mobile WiMAX
- EMF Test
- ISDB-T, ISDB-T SFN
- PIM Alert Application
- PIM Hunting
- DVB-T/H, DVB-T/H SFN
- Gated Sweep
- Tracking Generator
- Internal Preamplifier standard
- Internal Bias-Tee
- Internal Power Meter
- High Accuracy Power Meter
- Up to 50 GHz Power Sensors
- GPS tagging of saved traces

Specifications

Spectrum Analyzer

Frequency	Frequency Range	9 kHz to 6 GHz (tunable to 0 Hz)
	Tuning Resolution	1 Hz
	Frequency Reference	Aging: ±1.0 ppm/year Accuracy: ±1.5 ppm (25°C±25°C) + aging, <±50 ppb with GPS On
	Frequency Span	10 Hz to 6 GHz including zero span
	Sweep Time	Minimum 100 ms, 7 µs to 3600 seconds in zero span
	Sweep Time Accuracy	±2% in zero span
Bandwidth	Resolution Bandwidth (RBW)	1 Hz to 3 MHz in 1–3 sequence ±10% (1 MHz max in zero span) (–3 dB bandwidth)
	Video Bandwidth (VBW)	1 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth) (auto or manually selectable)
	RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (–6 dB bandwidth)
	VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1
Spectral Purity	SSB Phase Noise @ 1 GHz	–100 dBc/Hz, –110 dBc/Hz (typ., 10 kHz offset) –105 dBc/Hz, –112 dBc/Hz (typ., 100 kHz offset) –115 dBc/Hz, –121 dBc/Hz (typ., 1 MHz offset)
Amplitude Ranges	Dynamic Range	>102 dB (2.4 GHz), 2/3 (TOI-DANL) in 1 Hz RBW
	Measurement Range	DANL to +26 dBm (≥50 MHz) DANL to 0 dBm (<50 MHz)
	Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed
	Reference Level Range	–150 to +30 dBm
	Attenuator Range	0 to 55 dB, 5 dB steps
	Maximum Continuous Input	+30 dBm
	Amplitude Units	Log Scale Modes: dBm, dBV, dBmV, dBµV, dBW, dBµW, dBA, dBmA, dBµA Linear Scale Modes: nV, µV, mV, V, nW, µW, mW, W, kW, nA, µA, mA, A
Amplitude Accuracy	9 kHz to 100 kHz	±2.0 dB (typ.) (Preamp Off)
	100 kHz to 4.0 GHz	±1.25 dB, ±0.5 dB (typ.)
	>4.0 GHz to 6 GHz	±1.50 dB, ±0.5 dB (typ.)
Displayed Average Noise Level (DANL)	RBW= 1 Hz, 0 dB attenuation	

	Preamp Off (Reference level –20 dBm)		Preamp On (Reference level –50 dBm)	
	Maximum	Typical	Maximum	Typical
10 MHz to 2.4 GHz	–141 dBm	–146 dBm	–157 dBm	–162 dBm
>2.4 GHz to 4 GHz	–137 dBm	–141 dBm	–154 dBm	–159 dBm
>4 GHz to 5 GHz	–134 dBm	–138 dBm	–150 dBm	–155 dBm
>5 GHz to 6 GHz	–126 dBm	–131 dBm	–143 dBm	–150 dBm

Spurs	Residual Spurious	<–90 dBm (RF input terminated, 0 dB input attenuation, >10 MHz)
	Input-Related Spurious	<–75 dBc (0 dB attenuation, –30 dBm input, span <1.7 GHz, carrier offset >4.5 MHz)
	Exceptions (typ.)	<–70 dBc @ <2.5 GHz, with 2072.5 MHz Input <–68 dBc @ F1 – 280 MHz with F1 Input <–70 dBc @ F1 + 190.5 MHz with F1 Input <–52 dBc @ 7349 – (2F2) MHz, with F2 Input, where F2 <2437.5 MHz <–55 dBc @ 190.5 ± (F1/2) MHz, F1 <1 GHz
Third-Order Intercept (TOI)		Preamp Off (–20 dBm tones 100 kHz apart, 10 dB attenuation)
	800 MHz	+16 dBm
	2400 MHz	+20 dBm
	200 MHz to 2200 MHz	+25 dBm (typ.)
	>2.2 GHz to 5.0 GHz	+28 dBm (typ.)
	>5.0 GHz to 6.0 GHz	+33 dBm (typ.)
Second Harmonic Distortion		Preamp Off, 0 dB input attenuation, –30 dBm input
	50 MHz	–56 dBc
	>50 MHz to 200 MHz	–60 dBc (typ.)
	>200 MHz to 3000 MHz	–70 dBc (typ.)
VSWR		2:1 (typ.)

Tracking Generator (Option 20)

Frequency Range	500 kHz to 6 GHz
Output Power Range	–50 to 0 dBm
Step Size	0.1 dB (nom.)
Output Flatness	±1 dB max, ±0.3 dB (typ.) (Using field calibration, relative to spectrum analyzer input with ≥3 dB attenuator)
Zero Span Behavior	CW output
Output Connector	Type N (f), 50Ω
Damage Level	+23 dBm ±50 V DC (limited dv/dt)

Bias-Tee (Option 10)

Setup	On/Off, Voltage, Current (Low/High)
Voltage Range	+12 V to +32 V
Current (Low/High)	250 mA/450 mA, 1 A surge for 100 ms
Resolution	0.1 V

GPS Receiver (Option 31) (Antenna sold separately)

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
GPS Time/Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
High Frequency Accuracy	Spectrum Analyzer, Interference Analyzer, CW Signal Analyzer <±50 ppb with GPS On, GPS antenna connected, 3 minutes after satellite lock in selected mode
Connector	SMA (f)

Power Meter (Option 29)

Frequency Range	10 MHz to 6 GHz
Span	1 kHz to 100 MHz
Display Range	–140 to +30 dBm, ≤40 dB span
Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale
Average	Acquisition Fast/Med/Slow, # of Running Averages
Limits	Limit On/Off, Limit Upper/Lower
Measurement Range	–120 to +26 dBm
Offset Range	0 to +100 dB (External Gain or Loss)
VSWR	2:1 (typ.)
Maximum Power	+30 dBm without attenuator
Accuracy	Same as Spectrum Analyzer
Application Options	Impedance (50Ω, 75Ω, Other)

High Accuracy Power Meter (Option 19) (Requires external USB Power Sensor)

Power Sensor Model	MA24105A	MA24106A*5	MA24108A/18A/26A	MA24208A/18A	MA24330A/40A/50A
Description	Inline High Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor	Microwave Universal USB Power Sensor	Microwave CW USB Power Sensor
Frequency Range	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8 GHz 10 MHz to 18 GHz 10 MHz to 26 GHz	10 MHz to 8 GHz 10 MHz to 18 GHz	10 MHz to 33 GHz 10 MHz to 40 GHz 10 MHz to 50 GHz
Connector	Type N (f), 50Ω	Type N (m), 50Ω	Type N (m), 50Ω (8 GHz/18 GHz) Type K (m), 50Ω (26 GHz)	Type N (m), 50Ω	Type K (m), 50Ω (33 GHz/40 GHz) Type V (m), 50Ω (50 GHz)
Dynamic Range	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 µW to 200 mW)	–40 to +20 dBm (0.1 µW to 100 mW)	–60 to +20 dBm (1 nW to 100 mW)	–70 to +20 dBm (0.1 nW to 100 mW)
Measurand	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power	True-RMS, Slot Power, Burst Average Power	Average Power
Measurement Uncertainty	±0.17 dB*1	±0.16 dB*2	±0.18 dB*3	±0.17 dB*4	± 0.17 dB*5
Datasheet (for complete specifications)	11410-00621	11410-00424	11410-00504	11410-00841	11410-00906

*1: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.
*2: Total RSS measurement uncertainty (0°C to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
*3: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
*4: Power uncertainty expressed with two sigma confidence level for CW measurement after zero operation. Includes calibration factor and linearity over temperature uncertainties, but not the effects of mismatch, zero set and drift, or noise.
*5: Includes linearity over temperature uncertainties, but not the effects of calibration factor, mismatch, zero set and drift, and noise.

Interference Analyzer (Option 25)

Spectrum	Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power Ratio (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB - audio out only) Carrier-to-Interference ratio (C/I)
Spectrogram	Collect data up to 72 hours
Signal Strength	Gives visual and aural indication of signal strength
Received Signal Strength Indicator (RSSI)	Collect data up to one week
Signal ID	Up to 12 signals Center Frequency Bandwidth Signal Type (FM, GSM, W-CDMA, CDMA, Wi-Fi) Closest Channel Number Number of Carriers Signal-to-Noise Ratio (SNR) >10 dB
Interference Mapping	Draw multiple bearings of signal strength from GPS location on on-screen map Pan and Zoom on-screen maps Support for MA2700A Handheld Interference Hunter (see Optional Accessories)
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

Channel Scanner (Option 27)

Number of Channels	1 to 20 Channels
Measurements	Graph/Table, Max Hold (On/5 sec/Off), Freq/Channel, Current/Max, Single/Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Customer List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
Frequency Range	9 kHz to 6 GHz
Frequency Accuracy	±10 Hz + Time base error
Measurement Range	–110 to +26 dBm
Application Options	Bias-Tee (On/Off)

Gated Sweep (Option 90)

Mode	Spectrum Analyzer, Sweep
Trigger	External TTL
Setup	Gated Sweep (On/Off) Gate Polarity (Rising, Falling) Gate Delay (0 to 65 ms) (typ.) Gate Length (1 µs to 65 ms) (typ.) Zero Span Time

Coverage Mapping (Option 431) (Requires Option 31)

Measurements	Indoor Mapping RSSI ACPR	Outdoor Mapping RSSI ACPR
Setup Parameters	Frequency	Center/Start/Stop, Span, Freq. Step, Signal Standard, Channel #, Channel Increment
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
	BW	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/VBW
	Measurement Setup	ACPR, RSSI
	Point Distance/ Time Setup	Repeat Type Time Distance
	Save Points Map	Save KML, JPEG, Tab Delimited
	Recall Points Map	Recall Map, Recall KML Points only, Recall KML Points with Map, Recall Default Grid

Electromagnetic Field Measurements (Option 444)

Measurements	Setup	Limit lines, axis dwell time, measurement time, auto-logging, measurement units, trace display
	Spectrum Analyzer	Field strength is measured
	LTE OTA, TD-LTE OTA	P-SS, S-SS, and RS are measured and displayed based on each Cell ID received
	W-CDMA OTA	P-CPICH signals are measured and displayed for each Scrambling Code measured
	Units	Spectrum Analyzer: dBm/m^2, dBV/m, dBmV/m, dBuV/m, V/m, W/m^2, dBW/m^2, A/m, dBA/m, W/cm^2 LTE OTA, TD-LTE OTA: dBm/m^2, V/m, W/m^2 W-CDMA OTA: dBm/m^2, V/m, W/m^2, % of Limit (V/m), % of Limit (W/m^2)
	Results	Maximum, minimum, and average of all measurements conducted
	Display	Measurement status, number of measurements taken, pass/fail indicators
Frequency Range	Supported Antenna	2000-1800-R: 9 kHz to 300 MHz 2000-1792-R: 30 MHz to 3 GHz 2000-1791-R: 700 MHz to 6 GHz
EMF Measurement Modes	Spectrum Analyzer LTE OTA (Option 883) TD-LTE OTA (Option 883) W-CDMA OTA (Option 881)	

General Specifications

All specifications and characteristics apply under the following conditions, unless otherwise stated: 1) After 5 minutes of warm-up time, where the instrument is left in the ON state; 2) All specifications apply when using internal reference; 3) All specifications subject to change without notice; 4) Typical performance is the measured performance of an average unit; 5) Recommended calibration cycle is 12 months.

System Parameters	System	Status (Temperature, Battery Info, Serial Number, Firmware Version, Options Installed) Self Test, Application Self Test GPS (see Option 31)
	System Options	Name, Date and Time, Brightness, Volume Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, Russian, Portuguese) Reset (Factory Defaults, Master Reset, Update Firmware)
	Internal Trace/Setup Memory	2,000 Traces, 2,000 Setups
	External Trace/Setup Memory	Limited by size of USB Flash drive
	Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode
File Management	File Types	Vary with measurement mode
	File	Save, Recall, Copy, Delete
	Save	Setups, Measurements, Screen Shots (JPEG)
	Recall	Setups, Measurements
	Copy	Selected file or files to internal/external memory (USB)
	Delete	Selected file or files from internal/external memory (USB)
	File Sort Method	By Name/Date/Type, Ascend/Descend
Connectors	RF Out	Type N (f), 50Ω
	RF Out Damage Level	23 dBm, ±50 VDC
	RF In	Type N (f), 50Ω
	RF In Damage Level	+33 dBm peak, ±50 VDC, Maximum Continuous Input (≥10 dB attenuation)
	GPS	SMA (f)
	External Power	5.5 mm barrel connector, 11.0 to 14.5 VDC, <4.0 Amps
	USB Interface (2)	Type A, Connect USB Flash Drive and Power Sensor
	USB Interface	5-pin mini-B, Connect to PC for data transfer
	Ethernet Interface	RJ45 connector for Ethernet 10-Base T (available with Ethernet Option 413)
	Headset Jack	3.5 mm mini-phone plug
	External Reference In	BNC (f), 50Ω, Maximum Input +10 dBm, 1, 5, 10, 13 MHz
	External Trigger	BNC (f), 50Ω, Maximum Input ±5 VDC
	RF over Fiber	SFP/SFP+ compatible socket (available with Option 759)
Display	Type	Resistive Touchscreen
	Size	8.4-inch daylight viewable color LCD
	Resolution	800 × 600
	Pixel Defects	No more than five defective pixels (99.9989% good pixels)
Battery	Type	Li-Ion
	Battery Operation	3.0 hours (typ.)
	Battery Charging Limits	0°C to +45°C, Relative Humidity ≤80%
CE	EMC	2014/30/EU, CISPR 11/EN 55011, IEC/EN 61000-4-2/3/4/5/6/8/11
	LVD	2014/35/EU, EN61010-1
	RoHS	(EU) 2015/863
RCM	Australia and New Zealand	RCM: AS/NZS 4417:2012
KCC	South Korea	KCC: REM-A21-0004
Environmental	Operating and Storage Temperature Range	–10°C to +55°C (Operating), –51°C to +71°C (Storage)
	Maximum Humidity	95% RH at 30°C, non-condensing
	Vibration, Sinusoidal	5 Hz to 55 Hz
	Vibration, Random	10 Hz to 500 Hz
	Half Sine Shock	30 g_n
	Altitude	4600 meters, operating and non-operating
	Explosive Atmosphere	MIL-PRF-28800F Section 4.5.6.3 MIL-STD-810G, Method 511.5, Procedure 1
Dimensions and Mass		273 (W) × 199 (H) × 91 (D) mm, (10.7 × 7.8 × 3.6 in), 3.45 kg, (7.6 lbs)

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MS2713E	Spectrum Analyzer (9 kHz to 6 GHz)
	Options
MS2713E-0010	Bias-Tee
MS2713E-0009	20 MHz BW Demod
MS2713E-0031	GPS Receiver (Requires GPS antenna)
MS2713E-0019	High-Accuracy Power Meter (Requires External Power Sensor)
MS2713E-0029	Power Meter
MS2713E-0025	Interference Analyzer (Option 31 recommended)
MS2713E-0027	Channel Scanner
MS2713E-0431	Coverage Mapping (Requires Option 31)
MS2713E-0444	EMF Measurements (Requires Anritsu Isotropic Antenna)
MS2713E-0090	Gated Sweep
MS2713E-0020	Tracking Generator
MS2713E-0509	AM/FM/PM Analyzer
MS2713E-0880	GSM/GPRS/EDGE Measurements (Requires Option 9)
MS2713E-0881	W-CDMA/HSPA+ Measurements (Requires Option 9; Option 31 recommended)
MS2713E-0882	TD-SCDMA/HSPA+ Measurements (Requires Option 9; requires Option 31 for full functionality)
MS2713E-0883	LTE/LTE-A FDD/TDD Measurements (Requires Option 9; requires Option 31 for full functionality)
MS2713E-0884	CDMA/EV-DO Measurements (Requires Option 9; requires Option 31 for full functionality)
MS2713E-0885	WiMAX Fixed/Mobile Measurements (Requires Option 9; requires Option 31 for full functionality)
MS2713E-0886	LTE 256QAM Demodulation (Requires Option 883)
MS2713E-0887	NB-IoT Measurements (Requires Option 9)
MS2713E-0030	ISDB-T Digital Video Measurements (Requires Option 9)
MS2713E-0032	ISDB-T SFN Measurements (Requires Option 9)
MS2713E-0079	ISDB-T BER Measurements (Requires Options 9 and 30. Cannot be ordered with Option 759)
MS2713E-0064	DVB-T/H Digital Video Measurements (Requires Option 9)
MS2713E-0078	DVB-T/H SFN Measurements (Requires Option 9)
MS2713E-0057	DVB-T/H BER Measurements (Requires Option 64. Cannot be ordered with Option 759)
MS2713E-0098	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate.
MS2713E-0099	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate, test report, and uncertainty data.
	Power Sensors (for complete ordering information, see the respective data sheets of each sensor)
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +3 to +51.76 dBm
MA24106A	RF USB Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm
MA24208A	Microwave Universal USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24218A	Microwave Universal USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24330A	Microwave CW USB Power Sensor, 10 MHz to 33 GHz, +20 dBm
MA24340A	Microwave CW USB Power Sensor, 10 MHz to 40 GHz, +20 dBm
MA24350A	Microwave CW USB Power Sensor, 10 MHz to 50 GHz, +20 dBm
MA25100A	RF Power Indicator
	Manuals (soft copy at www.anritsu.com)
10100-00065	Product Information Compliance and Safety
10580-00251	Spectrum Master User Guide
10580-00349	Spectrum Analyzer Measurement Guide
10580-00234	3GPP Signal Analyzer Measurement Guide
10580-00235	3GPP2 Signal Analyzer Measurement Guide
10580-00236	WiMAX Signal Analyzer Measurement Guide
10580-00237	Digital TV Measurement Guide
10580-00240	Power Meter Measurement Guide
10580-00455	EMF Measurement Guide
10580-00256	Programming Manual
	Standard Accessories (included with instrument)
2000-1371-R	Ethernet Cable, 7 ft (213 cm)
2000-1654-R	Soft Carrying Case
2000-1691-R	Stylus with Coiled Tether
2000-1797-R	Touchscreen Protective Film, 8.4 in
633-75	Rechargeable Li-Ion Battery, 7500 mAh
40-187-R	AC-DC Adapter
806-141-R	Automotive Power Adapter, 12 VDC, 60 W
3-2000-1498	USB 2.0 A/Mini-B (5-pin) Cable, 10 ft (305 cm)

Model/Order No.	Name
	Optional Accessories
	Directional Antennas
2000-1411-R	824 MHz to 896 MHz, N (f), 12.3 dBi, Yagi
2000-1412-R	885 MHz to 975 MHz, N (f), 12.6 dBi, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N (f), 12.3 dBi, Yagi
2000-1414-R	1850 MHz to 1990 MHz, N (f), 11.4 dBi, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N (f), 14.1 dBi, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N (f), 14.3 dBi, Yagi
2000-1659-R	698 MHz to 787 MHz, N (f), 10.1 dBi, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N (f), 14.3 dBi, Yagi
2000-1715-R	698 MHz to 2500 MHz, N (f), gain of 2 dBi to 10 dBi (typ.)
2000-1726-R	Antenna, 2500 MHz to 2700 MHz N (f), 14.1 dBi, Yagi
2000-1747-R	Antenna, Log Periodic, 300 MHz to 7000 MHz, N (f), 5.1 dBi (typ.)
2000-1748-R	Antenna, Log Periodic, 1 GHz to 18 GHz, N (f), 6 dBi (typ.)
2000-1777-R	Portable Directional Antenna, 9 kHz to 20 MHz, N (f)
2000-1778-R	Portable Directional Antenna, 20 MHz to 200 MHz, N (f)
2000-1779-R	Portable Directional Antenna, 200 MHz to 500 MHz, N (f)
2000-1812-R	Portable Yagi Antenna, 450 MHz to 512 MHz, N (f), 7.1 dBi
2000-1825-R	Portable Yagi Antenna, 380 MHz to 430 MHz, N (f), 7.1 dBi
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA (m), 50Ω
2000-1473-R	870 MHz to 960 MHz, SMA (m), 50Ω
2000-1035-R	896 MHz to 941 MHz, SMA (m), 50Ω (1/2 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA (m), 50Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA (m), 50Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA (m), 50Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA (m), 50Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA (m), 50Ω
2000-1751-R	Dipole, 698 MHz to 960 MHz, 1710 MHz to 2100 MHz, 2500 MHz to 2700 MHz, SMA (m), 2 dB (typ.), 50Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)
	Isotropic Antennas
2000-1791-R	700 MHz to 6000 MHz, N (m)
2000-1792-R	30 MHz to 3000 MHz, N (m)
2000-1800-R	9 kHz to 300 MHz, N (m)
	Filters
1030-114-R	806 MHz to 869 MHz, N (m) to SMA (f), 50Ω
1030-109-R	824 MHz to 849 MHz, N (m) to SMA (f), 50Ω
1030-110-R	880 MHz to 915 MHz, N (m) to SMA (f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N (m) to SMA (f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N (m) to SMA (f), 50Ω
1030-105-R	890 MHz to 915 MHz, N (m) to SMA (f), 50Ω
1030-106-R	1710 MHz to 1790 MHz, N (m) to SMA (f), 50Ω
1030-107-R	1910 MHz to 1990 MHz, N (m) to SMA (f), 50Ω
1030-149-R	High Pass, 150 MHz, N (m) to N (f), 50Ω
1030-150-R	High Pass, 400 MHz, N (m) to N (f), 50Ω
1030-151-R	High Pass, 700 MHz, N (m) to N (f), 50Ω
1030-152-R	Low Pass, 200 MHz, N (m) to N (f), 50Ω
1030-153-R	Low Pass, 550 MHz, N (m) to N (f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N (m) to N (f), 50Ω
1030-178-R	1920 MHz to 1980 MHz, N (m) to N (f), 50Ω
1030-179-R	777 MHz to 798 MHz, N (m) to N (f), 50Ω
1030-180-R	2500 MHz to 2570 MHz, N (m) to N (f), 50Ω
2000-1684-R	791 MHz to 821 MHz, N (m) to N (f), 50Ω
2000-1734-R	Bandpass Filter, 699 MHz to 715 MHz, N (m) to N (f), 50Ω
2000-1735-R	Bandpass Filter, 776 MHz to 788 MHz, N (m) to N (f), 50Ω
2000-1736-R	Bandpass Filter, 815 MHz to 850 MHz, N (m) to N (f), 50Ω
2000-1737-R	Bandpass Filter, 1711 MHz to 1756 MHz, N (m) to N (f), 50Ω
2000-1738-R	Bandpass Filter, 1850 MHz to 1910 MHz, N (m) to N (f), 50Ω
2000-1739-R	Bandpass Filter, 880 MHz to 915 MHz, N (m) to N (f), 50Ω
2000-1740-R	Bandpass Filter, 1710 MHz to 1785 MHz, N (m) to N (f), 50Ω
2000-1741-R	Bandpass Filter, 1920 MHz to 1980 MHz, N (m) to N (f), 50Ω
2000-1742-R	Bandpass Filter, 832 MHz to 862 MHz, N (m) to N (f), 50Ω
2000-1743-R	Bandpass Filter, 2500 MHz to 2570 MHz, N (m) to N (f), 50Ω
2000-1799-R	Bandpass Filter, 2305 MHz to 2320 MHz, N (m) to N (f), 50Ω
2000-1911-R	Bandpass Filter, 703 MHz to 748 MHz, N (m) and N (f), 50Ω
2000-1912-R	Bandpass Filter, 788 MHz to 798 MHz, N (m) and N (f), 50Ω
2000-1925-R	Bandpass Filter, 663 MHz to 698 MHz, N (m) and N (f), 50Ω
2000-1926-R	Bandpass Filter, 776 MHz to 806 MHz, N (m) and N (f), 50Ω

Continued on next page

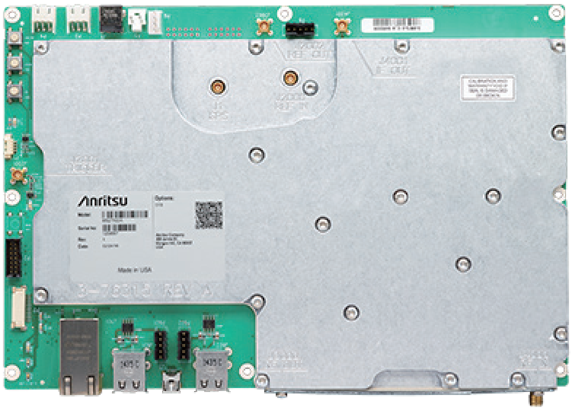
Model/Order No.	Name
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N (m) - N (f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N (m) - N (f)
42N50A-30	30 dB, 50 W, DC to 18 GHz, N (m) - N (f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N (m) - N (f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N (m) - N (f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N (m) - N (f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N (m) - N (f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N (m) - N (f)
	Adapters
1091-417-R	N (m) to QMA (f), DC to 6 GHz, 50Ω
1091-418-R	N (m) to QMA (m), DC to 18 GHz, 50Ω
1091-26-R	SMA (m) to N (m), DC to 18 GHz, 50Ω
1091-27-R	SMA (f) to N (m), DC to 18 GHz, 50Ω
1091-80-R	SMA (m) to N (f), DC to 18 GHz, 50Ω
1091-81-R	SMA (f) to N (f), DC to 18 GHz, 50Ω
1091-172-R	BNC (f) to N (m), DC to 1.3 GHz, 50Ω
510-90-R	7/16 DIN (f) to N (m), DC to 7.5 GHz, 50Ω
510-91-R	7/16 DIN (f) to N (f), DC to 7.5 GHz, 50Ω
510-92-R	7/16 DIN (m) to N (m), DC to 7.5 GHz, 50Ω
510-93-R	7/16 DIN (m) to N (f), DC to 7.5 GHz, 50Ω
510-96-R	7/16 DIN (m) to 7/16 DIN (m), DC to 7.5 GHz, 50Ω
510-97-R	7/16 DIN (f) to 7/16 DIN (f), DC to 7.5 GHz, 50Ω
510-102-R	N (m) to N (m), DC to 11 GHz, 50Ω, 90 degrees right angle
	Precision Adapters
34NN50A	N (m) to N (m), DC to 18 GHz, 50Ω
34NFNF50	N (f) to N (f), DC to 18 GHz, 50Ω
	Backpack and Transit Case
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle, 56 × 45.5 × 26.5 cm (22.07" × 17.92" × 10.42")
760-261-R	Large Transit Case with Wheels and Handle, 63.1 × 50 × 30 cm (24.83" × 19.69" × 11.88"), space for MA2700A, antennas, filters, instrument inside soft case, and other interference hunting accessories/tools
760-262-R	Transit Case for MA2700A, several Yagi antennas and filters
760-271-R	Transit Case for Portable Directional Antennas and Port Extender, 52.4 × 42.8 × 20.6 cm (20.62" × 16.87" × 8.12") (for 2000-1777-R, 2000-1778-R, 2000-1779-R, 2000-1798-R)
760-286-R	Compact Transit Case with Wheels and Handle, 55.6 × 35.5 × 22.9 cm (21.89" × 13.98" × 9.01")
	Miscellaneous Accessories
2000-1374-R	External Dual Charger for Li-Ion Batteries
633-75	Rechargeable Li-Ion Battery, 7500 mAh
66864	Rack Mount Kit, Master Platform
2000-1689	EMI Near Field Probe Kit
2000-1797-R	Touchscreen Protective Film, 8.4 in.
MA2700A	Handheld Interference Hunter (for full specifications, refer to the MA2700A Technical Data Sheet, 11410-00692)
2000-1884-R	PIM Hunter™ Test Probe (For full specifications, refer to the 2000-1884-R Technical Data Sheet 11410-00999)
2000-1691-R	Stylus with Coiled Tether
2000-1798-R	Port Extender, DC to 6 GHz, N (m) to N (f)

Remote RF Signal Monitoring

MS27100A

9 kHz to 6 GHz

High Performance Real-Time Monitoring of the Radio Spectrum



The Anritsu platform of spectrum monitors provide high performance real-time monitoring of the radio spectrum. Designed to be stable over time under continuous operation, the MS27100A spectrum monitor module provides superior sweep speeds, high dynamic range, and low spurious levels for fast and accurate measurements. Applications include monitoring for interference, white space analysis, unlicensed transmission discovery, and signal coverage. The MS27100A spectrum monitor module is available as a single RF input port instrument with wired Ethernet for remote interface and USB ports for connecting accessories. The MS27100A spectrum monitor module can also be expanded to four RF input ports with an optional multiplexer accessory.

Key Features

- Sweep rates up to 24 GHz/s
- Integrated web server to view, control, and conduct measurements via a web browser (Chrome or Firefox)
- Remote firmware updates
- Watchdog timer to insure long-term stability for remotely deployed monitors
- Low spurious signals for accurate signal discovery
- 20 MHz IF bandwidth
- Low power consumption < 11 watts
- Integrated GPS receiver for monitoring location and time synchronization applications
- Gigabit Ethernet available for high speed communications
- Measurements: occupied bandwidth, channel power
- Interference analysis: spectrogram and signal strength
- Dynamic range: >106 dB normalized to 1 Hz BW
- DANL: <–150 dBm referenced to 1 Hz BW, preamp On
- Phase noise: –98 dBc/Hz @ 10 kHz offset at 1 GHz
- Frequency accuracy: <±1.5 ppm, <±50 ppb with GPS High Accuracy Mode
- IQ block mode and streaming with time stamping for TDOA applications
- Remote control via SCPI commands
- Vision™ software optional for automated spectrum measurements, setting alarms, and geo-locating signal sources
- AeroShield drone detection and tracking

Definitions

All specifications and characteristics apply under the following conditions, unless otherwise stated:

Warm-Up Time	After 10 minutes of warm-up time, where the instrument is left in the on state.
Temperature Range	Over the 23°C±5°C temperature range.
Typical Performance	Typical specifications in parenthesis () describe performance that will be met by a minimum of 80% of all products. They do not include guard bands and are not warranted. Typical specifications that are not in parenthesis are not tested and not warranted. They are generally representative of the nominal characteristic performance.
Uncertainty	A coverage factor of k = 2 is applied to the measurement uncertainties to facilitate comparison with other industry monitors.
Specifications Subject to Change	All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu web site: www.anritsu.com

Remote Spectrum Monitor

Frequency

Frequency Range	9 kHz to 6 GHz (tunable to 0 Hz)
Tuning Resolution	1 Hz
Frequency Reference Accuracy	±1.5 ppm (25°C±25°C) ±1.0 ppm/year aging <±50 ppb with GPS on
Frequency Span	10 Hz to 6 GHz

Sweep Speed Typical (full span FFT mode)

10 kHz RBW	5 GHz/s
30 kHz RBW	12 GHz/s
3 MHz RBW	24 GHz/s

Bandwidth

Resolution Bandwidth (RBW)	10 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth)
Video Bandwidth (VBW)	10 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth) (auto or manually selectable)

Spectral Purity

SSB Phase Noise @ 1 GHz	(–98 dBc/Hz) @ 10 kHz offset (–98 dBc/Hz) @ 100 kHz offset

Amplitude Range

<table>
<tr><td>Dynamic Range</td><td>>106 dB (2.4 GHz), 2/3 (TOI-DANL) in 1 Hz RBW</td></tr>
<tr><td>Measurement Range</td><td>DANL to Maximum Continuous Input</td></tr>
<tr><td>Reference Level Range</td><td>–150 to +30 dBm</td></tr>
<tr><td>Attenuator Range</td><td>0 to 50 dB in 5 dB steps</td></tr>
<tr><td>Maximum Continuous Input</td><td>
<table>
<tr><th></th><th>without Option 406
(RF Input to MS27100A)</th><th>with Option 406
(RF Input to multiplexer)</th></tr>
<tr><td>100 MHz to 6 GHz, ≥ 10 dB attenuation</td><td>+30 dBm*1, ±50 VDC</td><td>+20 dBm*2, ±50 VDC</td></tr>
<tr><td>300 kHz to 6 GHz, < 10 dB attenuation</td><td>+10 dBm*1, ±50 VDC</td><td>+10 dBm*2, ±50 VDC</td></tr>
<tr><td>9 kHz to 6 GHz, preamp on</td><td>–10 dBm, ±50 VDC</td><td>–10 dBm, ±50 VDC</td></tr>
</table>
*1: For lower frequencies, derate maximum continuous input by 6 dB per decade
*2: For lower frequencies, derate maximum continuous input by 4 dB per decade
</td></tr>
<tr><td>Amplitude Units</td><td>Log Scale Modes: dBm, dBμV</td></tr>
</table>

Amplitude Accuracy

Attenuation ≤40 dB, preamp off for frequencies less than 100 kHz

9 kHz to 100 kHz	± 2.5 dB
>100 kHz to 6 GHz	± 1.5 dB

Displayed Average Noise Level (DANL)

RBW normalized to 1 Hz, 0 dB attenuation

	Preamp Off, Reference Level –20 dBm		Preamp On, Reference Level –50 dBm	
	Max (dBm)	Typical (dBm)	Max (dBm)	Typical (dBm)
10 MHz to 3.3 GHz	–145	–150	–162	–165
>3.3 GHz to 4.1 GHz	–140	–145	–159	–162
>4.1 GHz to 5 GHz	–138	–143	–156	–160
>5 GHz to 6 GHz	–128	–136	–146	–154

Spurious (typ.)

Residual Spurious	(<–80 dBm) RF input terminated, 0 dB input attenuation, preamp off, >10 MHz (<–95 dBm) RF input terminated, 0 dB input attenuation, preamp on, >10 MHz (<–88 dBm) RF input terminated, 0 dB input attenuation, preamp on, 16 MHz to 18 MHz
Input-Related Spurious	<–60 dBc, 0 dB attenuation, –30 dBm input, carrier offset >5 MHz
Exceptions	<–60 dBc, input = 4140 MHz

Second Harmonic Distortion

Typical; 0 dB attenuation, –30 dBm input

50 MHz	(–50 dBc)
>50 MHz to 200 MHz	<–60 dBc
>200 MHz to 3000 MHz	<–60 dBc

Third-Order Intercept (TOI)

Typical; preamp off, –20 dBm tones 100 kHz apart, 0 dB attenuation, reference level –20 dBm

800 MHz	(+7 dBm)
2400 MHz	(+17 dBm)
200 MHz to 2200 MHz	+10 dBm
>2.2 GHz to 5.0 GHz	+8 dBm
>5.0 GHz to 6.0 GHz	+14 dBm
VSWR	<2.5:1 (typ.)

Signal Processing

Data Types	I/Q time series: 8, 10, 16 or 24 bit resolution Spectrum trace: 100 to 4000 points
Data Transfer Modes	I/Q time series or spectrum trace in streaming or block mode
I/Q Data Streaming Rate	Gapless on 100BASE-T network, Up to 2.6 MHz signal bandwidth
I/Q Data Time Stamp Resolution	8.7 ns

I/Q Recording Time Typical

Output Data Rate		I/Q Bit Resolution			
Signal Bandwidth	MSPS	24 bits	16 bits	10 bits	8 bits
20 MHz	76.25/3	1.3 s	2.5 s	3.8 s	5 s
13.3 MHz	76.25/4	1.7 s	3.4 s	5 s	6.7 s
6.67 MHz	76.25/8	3.4 s	6.7 s	10.1 s	13.4 s
2.67 MHz	76.25/20	8.4 s	16.8 s	25.2 s	33.6 s
1.33 MHz	76.25/40	16.8 s	33.6 s	50.4 s	1.12 min
667 kHz	76.25/80	33.6 s	1.12 min	1.68 min	2.24 min
267 kHz	76.25/200	1.4 min	2.8 min	4.2 min	5.6 min
133 kHz	76.25/400	2.8 min	5.6 min	8.39 min	11.19 min
66.7 kHz	76.25/800	5.6 min	11.19 min	16.79 min	22.38 min
26.7 kHz	76.25/2000	13.99 min	27.98 min	41.97 min	55.96 min
13.3 kHz	76.25/4000	27.98 min	55.96 min	1.4 h	1.87 h
6.67 kHz	76.25/8000	55.96 min	1.87 h	2.8 h	3.73 h
2.67 kHz	76.25/20000	2.33 h	4.66 h	6.99 h	9.33 h
1.33 kHz	76.25/40000	4.66 h	9.33 h	13.99 h	18.65 h

General Specifications

Setup Parameters

Setup System	Temperature, Serial Number, Firmware Version, Options Installed, Self-Test, Application Self Test, GPS
System Options	Name, Date and Time, Reset (Factory Defaults, Master Reset, Update Firmware)
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy
Internal Trace/Setup Memory	4 GB internal memory available for storing files
Mode Switching	Automatically stores/recalls most recently used setup parameters in the mode

Warranty

Instrument	Standard three-year warranty

Environmental

Operating Temperature Range	0°C to +50°C
Storage Temperature Range	–40°C to +71°C
Maximum Humidity	95% RH (non-condensing) at 30°C
Vibration, Sinusoidal	5 Hz to 55 Hz
Vibration, Random	10 Hz to 500 Hz
Half Sine Shock	30 g_n
Altitude	4600 meters, operating and non-operating
Explosive Atmosphere	MIL-PRF-28800F Section 4.5.6.3 MIL-STD-810G, Method 511.5, Procedure 1

ESD

RF Input Pin	Withstands up to ±4 kV

Dimension and Mass

Dimensions	244 (W) × 165.36 (H) × 27.75 (D) mm
Mass	0.93 kg (2.05 lb) without packaging

EU Standards (CE Marking)

EMC	2014/30/EU, EN61326-1, EN61000-4-2
LVD	2014/35/EU, EN61010-1
RoHS	2011/65/EU, (EU) 2015/863

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Standard Hardware
MS27100A	Spectrum Monitor Module with 1 RF IN Port (requires one frequency option)
	Hardware Options
MS27100A-0406	Enables USB Interface to 6-port RF multiplexer (requires 2000-1894-R)
MS27100A-0706	9 kHz to 6 GHz Frequency Range
	Standard Accessories (includes with instrument)
40-187-R	AC-DC Adapter
	Optional Accessories
2000-1849-R	6-Port Multiplexer Module (requires software Option 406 above)
3-67367	USB-A to HC5 5-pin header cable, 30 cm (included with 2000-1894-R)

Remote Spectrum Monitor

MS27101A/MS27102A/MS27103A/MS27201A

9 kHz to 6 GHz 9 kHz to 43.5 GHz

For Remote RF Signal Monitoring

NEW (MS27201A)

Excellent Eco Product

MS27101A
1/2 Rack model

MS27103A
Multi-port model

MS27102A
Operates outodoor model

MS27201A

Anritsu offers three models of remote spectrum monitoring products, designed to both mitigate interference problems and identify illegal or unlicensed signal activity. The Remote Spectrum Monitor MS27101A is housed in a ½ rack enclosure with 1U height, designed exclusively for indoor applications. The Remote Spectrum Monitor MS27102A is an IP67 rated device which operates outdoors, with the ability to be mounted on poles or walls (using the included mounting bracket). The Remote Spectrum Monitor MS27103A is a multi-port spectrum monitor (12 RF In ports or optionally 24 RF In ports) which is ideal for cellular, DAS, and other applications requiring the use of multiple antennas.

The MS27102A is a full featured platform for monitoring and recording signals in user specified frequencies. Capable of sweep rates up to 24 GHz/s, this probe allows for the capture of many types of signals. This includes periodic or transient transmissions as well as short "bursty" signals. The 20 MHz instantaneous FFT bandwidth is available on the MS27102A provides the ability for wideband, real-time captures of signal activity for subsequent post-processing.

The MS27103A is designed to identify and locate interfering signals. This serves to optimize the user experience which is a key goal for network operators. This translates into customer loyalty, reduced customer churn, and superior brand.

The MS27201A Spectrum Monitor is designed to facilitate wide-area spectrum monitoring up to 43.5 GHz. This provides the MS27201A the ability to cover all standard LMR, cellar, satellite, and electronic defense bands.

Remote Spectrum Monitor Highlights

- Sweep rates up to 24 GHz/s
- Integrated web server to view, control, and conduct measurements via a web browser (Chrome or Firefox)
- Remote firmware updates
- Watchdog timer to insure long-term stability for remotely deployed monitors
- Low spurious signals for accurate signal discovery
- 20 MHz IF bandwidth
- Integrated web server to view, control and conduct measurements via web browser
- Watchdog timer to insure long-term stability for remotely deployed monitors
- Low spur levels for accurate signal discovery
- 20 MHz instantaneous FFT bandwidth
- Available in 2/4/6 port (RF in) options

Definitions

All specifications and characteristics apply under the following conditions, unless otherwise stated:

Warm-Up	After 10 minutes of warm-up time, where the instrument is left in the on state.
Temperature Range	Over the 23°C±5°C temperature range.
Typical Performance	Typical specifications in parenthesis () describe performance that will be met by a minimum of 80% of all products. They do not include guard bands and are not warranted. Typical specifications that are not in parenthesis are not tested and not warranted. They are generally representative of the nominal characteristic performance.
Uncertainty	A coverage factor of k = 2 is applied to the measurement uncertainties to facilitate comparison with other industry monitors.
Specifications Subject to Change	All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu web site: www.anritsu.com

Remote Spectrum Monitor

- **MS27101A, MS27102A, MS27103A**

Frequency

Frequency Range	9 kHz to 6 GHz (tunable to 0 Hz)
Tuning Resolution	1 Hz
Frequency Reference Accuracy	±1.5 ppm (25°C±25°C) ±1.0 ppm/year aging <±50 ppb with GPS on
Frequency Span	10 Hz to 6 GHz

Sweep Speed Typical (full span FFT mode)

10 kHz RBW	5 GHz/s
30 kHz RBW	12 GHz/s
3 MHz RBW	24 GHz/s

Bandwidth

Resolution Bandwidth (RBW)	10 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth)
Video Bandwidth (VBW)	10 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth) (auto or manually selectable)

Spectral Purity

SSB Phase Noise @ 1 GHz	(–98 dBc/Hz) @ 10 kHz offset (–98 dBc/Hz) @ 100 kHz offset

Amplitude Range

Dynamic Range	>106 dB (2.4 GHz), 2/3 (TOI-DANL) in 1 Hz RBW
Measurement Range	DANL to Maximum Continuous Input
Reference Level Range	–150 to +30 dBm
Attenuator Range	0 to 50 dB in 5 dB steps
Maximum Continuous Input	100 MHz to 6 GHz, ≥ 10 dB attenuation +30 dBm*, ±50 VDC 300 kHz to 6 GHz, < 10 dB attenuation +10 dBm*, ±50 VDC 9 kHz to 6 GHz, preamp on –10 dBm, ±50 VDC *: For lower frequencies, derate maximum continuous input by 6 dB per decade
Amplitude Units	Log Scale Modes: dBm, dBµV

Amplitude Accuracy

Attenuation ≤40 dB, preamp off for frequencies less than 100 kHz

9 kHz to 6.0 GHz	±2.5 dB (MS27101A and MS27102A)
9 kHz to 5.0 GHz	±2.5 dB Port 1 (dB), ±3.0 dB Port 2 to 12 dB (typ.), ±3.0 dB Port 13 to 24 dB (typ.) (Option 424 installed, MS27103A)
>5 GHz to 6.0 GHz	±3.0 dB Port 1 (dB), ±3.5 dB Port 2 to 12 dB (typ.), ±3.5 dB Port 13 to 24 dB (typ.) (Option 424 installed, MS27103A)

Displayed Average Noise Level (DANL)

RBW normalized to 1 Hz, 0 dB attenuation (MS27101A, MS27102A)

	Preamp Off, Reference Level –20 dBm		Preamp On, Reference Level –50 dBm	
	Max (dBm)	Typical (dBm)	Max (dBm)	Typical (dBm)
10 MHz to 3.3 GHz	–145	–150	–162	–165
>3.3 GHz to 4.1 GHz	–140	–145	–159	–162
>4.1 GHz to 5 GHz	–138	–143	–156	–160
>5 GHz to 6 GHz	–128	–136	–146	–154

RBW normalized to 1 Hz, 0 dB attenuation (Port 1 is specified. All other ports are typical and within 1 dBm of the specified values) (MS27103A)

	Preamp Off, Reference Level –20 dBm		Preamp On, Reference Level –50 dBm	
	Max (dBm)	Typical (dBm)	Max (dBm)	Typical (dBm)
10 MHz to 3.3 GHz	–140	–145	–157	–160
>3.3 GHz to 4.1 GHz	–133	–138	–152	–155
>4.1 GHz to 5 GHz	–130	–135	–148	–152
>5 GHz to 6 GHz	–115	–123	–133	–141

Spurious (typ.)

Residual Spurious (MS27101A and MS27102A)	(< –80 dBm) RF input terminated, 0 dB input attenuation, preamp off, > 10 MHz (< –95 dBm) RF input terminated, 0 dB input attenuation, preamp on, > 10 MHz (< –88 dBm) RF input terminated, 0 dB input attenuation, preamp on, 16 MHz to 18 MHz
Residual Spurious (MS27103A)	RF input terminated, 0 dB input attenuation, preamp Off (<–80 dBm), 10 MHz to 4.5 GHz (<–70 dBm), >4.5 GHz to 6.0 GHz RF input terminated, 0 dB input attenuation, preamp On (<–95 dBm), 10 MHz to 5.0 GHz (<–85 dBm), >5.0 GHz to 6.0 GHz (<–88 dBm), >16 MHz to 18 MHz
Input-Related Spurious (All)	<–60 dBc, 0 dB attenuation, –30 dBm input, carrier offset >5 MHz

Second Harmonic Distortion

Typical; 0 dB attenuation, –30 dBm input

50 MHz	(–50 dBc)
>50 MHz to 200 MHz	<–60 dBc
>200 MHz to 3000 MHz	<–60 dBc

Third-Order Intercept (TOI)

Typical; preamp off, –20 dBm tones 100 kHz apart, 0 dB attenuation, reference level –20 dBm

800 MHz	(+7 dBm)
2400 MHz	(+17 dBm)
200 MHz to 2200 MHz	+10 dBm
>2.2 GHz to 5.0 GHz	+8 dBm
>5.0 GHz to 6.0 GHz	+14 dBm
VSWR	<2.5:1 (typ.)

Signal Processing

Data Types	I/Q time series: 8, 10, 16, or 24 bit resolution Spectrum trace: 100 to 4000 points
Data Transfer Modes	I/Q time series or spectrum trace in streaming or block mode
I/Q Data Streaming Rate	Gapless on 100BASE-T network, Up to 2.6 MHz signal bandwidth
I/Q Data Time Stamp Resolution	8.7 ns

I/Q Recording Time Typical

Output Data Rate		I/Q Bit Resolution			
Signal Bandwidth	MSPS	24 bits	16 bits	10 bits	8 bits
20 MHz	76.25/3	1.3 s	2.5 s	3.8 s	5 s
13.3 MHz	76.25/4	1.7 s	3.4 s	5 s	6.7 s
6.67 MHz	76.25/8	3.4 s	6.7 s	10.1 s	13.4 s
2.67 MHz	76.25/20	8.4 s	16.8 s	25.2 s	33.6 s
1.33 MHz	76.25/40	16.8 s	33.6 s	50.4 s	1.12 min
667 kHz	76.25/80	33.6 s	1.12 min	1.68 min	2.24 min
267 kHz	76.25/200	1.4 min	2.8 min	4.2 min	5.6 min
133 kHz	76.25/400	2.8 min	5.6 min	8.39 min	11.19 min
66.7 kHz	76.25/800	5.6 min	11.19 min	16.79 min	22.38 min
26.7 kHz	76.25/2000	13.99 min	27.98 min	41.97 min	55.96 min
13.3 kHz	76.25/4000	27.98 min	55.96 min	1.4 h	1.87 h
6.67 kHz	76.25/8000	55.96 min	1.87 h	2.8 h	3.73 h
2.67 kHz	76.25/20000	2.33 h	4.66 h	6.99 h	9.33 h
1.33 kHz	76.25/40000	4.66 h	9.33 h	13.99 h	18.65 h

Antenna Port Isolation (MS27102A/MS27103A) Typical

≤3 GHz	>40 dB
>3 GHz	>30 dB

• MS27201A Standard Spectrum Analyzer Features

Smart Measurements

Field Strength	Measures field strength in dBm/m^2 or dBW/m^2
Channel Power	Measures the total power in a specified bandwidth
Occupied Bandwidth	Measures 99 % to 1 % power channel of a signal
Adjacent Channel Power	Measures channel power of the adjacent channel
Spectral Emission Mask	Standards based limits for wireless emissions

Setup Parameters

Frequency	Center/Start/Stop, Frequency Step, Frequency Offset
Span	Span (Manual/Increment 1, 2, 5), Full Span, Last Span, Zero Span
Amplitude	Reference Level (Manual/Auto and Offset), Scale/Division, Y-Axis Unit (dBm, dBW, dBµV), Pre Amp, Attenuation (Auto/Manual)
Bandwidth	RBW/VBW (Auto/Manual), VBW Type (Linear/Logarithmic), RBW: VBW Ratio, SPAN: RBW Ratio

Sweep Functions

Sweep	Single/Continuous, Restart, Sweep Once, Sweep to N
Sweep Points	10 to 10,001 (1001 in zero span)
Sweep Time	60 ns to 3600 s in zero span
Sweep Time Accuracy	±2 % in zero span

Trace Functions

Traces	Up to Six Traces
Trace Type	Clear/Write, Average (2 to 1000), Max Hold, Min Hold, Rolling Average, Rolling Max Hold, Rolling Min Hold
Trace Mode	Active, Hold/View, Blank
Detector Type per Trace	Peak, RMS/Avg, Negative
Trace Record	Record live samples with manual tagging to internal or external storage
Trace Playback	Play recorded samples from internal or external storage; set playback interval
CSV Logging	Record live or playback traces in CSV format for post processing

Trigger Functions (zero span only)

Sources	Free Run, Video, External 1, External 2, Periodic
Settings	Level, Delay, Holdoff, Slope, Hysteresis

Spectrogram

Number of Lines	142
Trace Time/Position Cursor	Up to Six Cursors (display historical trace data by trace position or time)
Color Setup	Set Color Top/Bottom Range, Set Color Reference Hue

Marker Functions

Markers	Up to 12 Markers
Marker Measurements	Power, Frequency, Time (Spectrogram)
Marker Mode	Normal, Delta, Fixed
Delta Marker	Relative to any Normal or Fixed Marker
Marker Function	None, Noise, Counter Marker (1 Hz, 100 MHz, 10 MHz, 1 MHz resolutions), Quasi-Peak (per CISPR 16-1-1)
Marker Trace	Assign Marker to any Trace
Peak Search	Peak Search, Next Peak, Next Peak Left, Next Peak Right, Next Point Left, Next Point Right
Peak Search Setup	Peak Threshold, Peak Excursion
Marker →	Mkr → Center, Mkr → Ref Level
Marker Table	Up to 12 Markers Showing Marker Mode, Function, Trace, Frequency, Amplitude, Delta Frequency & Offset

Limit Line Functions

Limit Setup	Upper/Lower, Limit On/Off, Limit Alarm On/Off, Set Default Limit Line, Absolute/Relative, Mirror On/Off, Default Limit
Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
Limit Line Envelope	Create Envelope, Update Envelope, Points (41 max), Offset, Shape Square/Slope

• MS27201A Spectrum Analyzer Performance

Frequency (usable to 0 Hz)

MS27201A-0709	9 kHz to 9 GHz (Option 709)
MS27201A-0720	9 kHz to 20 GHz (Option 720)
MS27201A-0743	9 kHz to 43.5 GHz (Option 743)
Tuning Resolution	1 Hz
Span	10 Hz to max frequency
Frequency Reference	Internal, GPS, External
Internal Frequency Reference	Aging: ± 1.0 x 10^{-6} per 10 years Accuracy: ± 0.3 x 10^{-6} (25°C ±25°C) plus aging (see "GPS Receiver (Option 31)" for improved accuracy)
External Frequency Reference	10 MHz, 0 to +10 dBm

Bandwidth

Analysis Bandwidth	20 MHz (standard) or 110 MHz (Option 104)
Resolution Bandwidth (RBW)	1 Hz to 10 MHz (in RTSA, minimum RBW varies by span, max is 40 MHz)
Video Bandwidth (VBW)	0.1 Hz to 10 MHz
CISPR Bandwidth	Resolution bandwidth when using Quasi-Peak marker function: 200 Hz, 9 kHz, and 120 kHz
VBW/Average Type	Linear/Log

Spectral Purity – SSB Phase Noise

Offset from 1 GHz GHz	Maximum	Typical
10 kHz	–102 dBc/Hz	–106 dBc/Hz
100 kHz	–106 dBc/Hz	–110 dBc/Hz
1 MHz	–111 dBc/Hz	–116 dBc/Hz
10 MHz	–123 dBc/Hz	–129 dBc/Hz

Spurs (0 dB input attenuation)

Residual Spurs (RF input terminated)	Preamp = Off	Preamp = On
<14 GHz	–90 dBm, maximum	–100 dBm, maximum
14 to 20 GHz	–85 dBm, maximum	–100 dBm, maximum
>20 to 32 GHz	–80 dBm, maximum	–100 dBm, maximum
>32 to 43.5 GHz	–80 dBm, maximum	–95 dBm, maximum
Input-Related Spurious (–30 dBm input)	–60 dBc (Maximum)* –70 dBc (Typical)	

*: Instrument centered on single signal, span <1.7 GHz, 0 dB input attenuation.

Amplitude Ranges

Dynamic Range	>106 dB minimum at 2.4 GHz, 2/3 (TOI-DANL) in 1 Hz RBW
Measurement Range	DANL to +30 dBm
Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed
Reference Level Range	–150 to +30 dBm
Attenuator Resolution	0 to 65 dB, 5 dB steps
Reference Level Offset	99.9 dB external loss to 99.9 dB external gain
Amplitude Units	dBm, dBm/m^2, dBW/m^2
Maximum Continuous Input	+30 dBm peak typical, ±50 VDC (≥10 dB attenuation) +23 dBm peak typical, ±50 VDC (<10 dB attenuation) +10 dBm peak typical, ±50 VDC (preamp = On)

Amplitude Accuracy

10 dB attenuation, –50 dBm ≤ input signal ≤ –10 dBm, 1 kHz RBW, auto-coupled, excluding effects of VSWR, noise, and spurs

	+20°C to +30°C (after 30 minute warm-up)		–10°C to +55°C (after 60 minute warm-up)	
9 GHz and 20 GHz Instruments	Maximum	Typical	Maximum	Typical
9 kHz to 14 GHz	±1.3 dB	±0.5 dB	±2.0 dB	±0.5 dB
>14 GHz to 18 GHz	±1.3 dB	±0.5 dB	±2.0 dB	±0.5 dB
>18 GHz to 20 GHz	–	±1.0 dB	–	±1.0 dB
43.5 GHz Instruments	Maximum	Typical	Maximum	Typical
9 kHz to 14 GHz	±1.3 dB	±0.5 dB	±2.0 dB	±0.5 dB
>14 GHz to 20 GHz	±1.3 dB	±0.5 dB	±2.0 dB	±0.5 dB
>20 GHz to 43.5 GHz	±1.8 dB	±0.5 dB	±2.5 dB	±0.5 dB

Displayed Average Noise Level (DANL)

RMS detection, VBW/Avg type = Log, reference level = –20 dBm for preamp Off and –50 dBm for preamp On, auto attenuation On

	Preamp = Off		Preamp = On	
9 GHz to 20 GHz Instruments	Maximum	Typical	Maximum	Typical
10 MHz to 4 GHz	–145 dBm	–148 dBm	–161 dBm	–164 dBm
>4 GHz to 9 GHz	–142 dBm	–145 dBm	–159 dBm	–162 dBm
>9 GHz to 14 GHz	–136 dBm	–139 dBm	–156 dBm	–159 dBm
>14 GHz to 20 GHz	–138 dBm	–144 dBm	–156 dBm	–161 dBm
43.5 GHz Instruments	Maximum	Typical	Maximum	Typical
10 MHz to 4 GHz	–145 dBm	–148 dBm	–161 dBm	–164 dBm
>4 GHz to 9 GHz	–142 dBm	–145 dBm	–159 dBm	–162 dBm
>9 GHz to 14 GHz	–136 dBm	–139 dBm	–156 dBm	–159 dBm
>14 GHz to 20 GHz	–138 dBm	–142 dBm	–156 dBm	–159 dBm
>20 GHz to 32 GHz	–135 dBm	–140 dBm	–154 dBm	–159 dBm
>32 GHz to 43.5 GHz	–135 dBm	–140 dBm	–152 dBm	–154 dBm

Third-Order Intercept (TOI)

–20 dBm tones 2 MHz apart, 0 dB input attenuation, preamp OFF, reference level –20 dBm

2.4 GHz	+14 dBm minimum
50 MHz to 20 GHz	+20 dBm typical
>20 GHz to 32 GHz	+15 dBm typical
>32 GHz to 43.5 GHz	+20 dBm typical

P1dB (nominal)

<4 GHz	+5 dBm
4 GHz to 20 GHz	+12 dBm
>20 GHz to 32 GHz	+7 dBm
>32 GHz to 43.5 GHz	+12 dBm

Second Harmonic Distortion

0 dB input attenuation, –30 dBm input

50 MHz	–64 dBc maximum
≤4 GHz	–72 dBc typical
>4 GHz	–75 dBc typical

VSWR

≥10 dB input attenuation

≤20 GHz	1.5:1 typical
>20 GHz to 43.5 GHz	2.0:1 typical

GPS Receiver (Option 31)

Supported Satellite Systems	GNSS (includes GPS, GLONASS, Galileo)
Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
Anritsu Antennas	2000-1528-R GPS antenna (requires +5 VDC) 2000-1652-R GPS antenna (requires +3.3 VDC or +5 VDC) 2000-1760-R GPS antenna (requires +2.5 VDC to +3.7 VDC)
GPS Time/Location Indicator	UTC Time, Latitude, Longitude, and Altitude on display (UTC Time and Altitude on GPS Info display)
High Frequency Accuracy	<±2.5 × 10^{-8} with GPS On, 3 minutes after satellite lock in selected mode (GPS antenna connected) <±5.0 × 10^{-8} 24 hour holdover accuracy, 0°C to 50°C ambient temperature (GPS antenna disconnected)
Connector	SMA (f), 50Ω

Zero Span IF Output (Option 89)

Mode	Spectrum Analyzer/Zero Span only
Center Frequency	325 MHz (nominal, FFT capture BW ≤32 MHz) 300 MHz (nominal, FFT capture BW >32 MHz, requires Option 103 or 104)
Output Level	–4 dBm (nominal, –20 dBm input level, 0 dB input attenuation, preamp Off, 10 MHz input frequency) Spectrum is inverted in certain input RF bands.
Reference Level	–57 dBm to +30 dBm (Preamp Off) –87 dBm to –40 dBm (Preamp On)
IF Bandwidth	≤32 MHz; ≤110 MHz with Option 103 or 104
Rise Time	<20 ns
Connector	SMA (f), 50Ω

Gated Sweep (Option 90)

Gate Source	GPS
Frame Time	1 s, 20 ms, 10 ms
Gate Delay	up to 200 ms
Gate Length	1 µs up to 200 ms
Power vs. Time, Display Length	100 µs to 200 ms

IQ Waveform Capture (Option 124/126)

Option 126 is non-export controlled and limits depth to 8 or 10 bits when bandwidth is 110 MHz

<table>
<tr><td>IQ Capture</td><td>Mode: Spectrum Analyzer
Capture Mode: Single or Continuous
Trigger: Free Run, External (Rising/Falling), Interval, Level
Trigger Settings: Delay
Maximum Sample Rate*: 200 MHz
Maximum Signal Bandwidth*: 110 MHz
Bit Resolution: 8, 10, 16, or 32-bit
Total Capture Memory: 2 GB</td></tr>
<tr><td>IQ Capture Time</td><td>
<table>
<tr><th rowspan="2">Signal Bandwidth (MHz)</th><th rowspan="2">IQ Sample Rate (MSPS)</th><th colspan="4">IQ Bit Resolution</th><th colspan="2">Mode*</th></tr>
<tr><th>32 bit</th><th>16 bit</th><th>10 bit</th><th>8 bit</th><th>SPA</th><th>RTSA</th></tr>
<tr><td>110</td><td>200</td><td>1.34 s</td><td>2.68 s</td><td>4.29 s</td><td>5.37 s</td><td>x</td><td>x</td></tr>
<tr><td>100</td><td>122.88</td><td>2.18 s</td><td>4.37 s</td><td>6.99 s</td><td>8.74 s</td><td>x</td><td></td></tr>
<tr><td>80</td><td>100</td><td>2.68 s</td><td>5.37 s</td><td>8.59 s</td><td>10.74 s</td><td>x</td><td>x</td></tr>
<tr><td>74</td><td>92.16</td><td>2.91 s</td><td>5.83 s</td><td>9.32 s</td><td>11.65 s</td><td>x</td><td></td></tr>
<tr><td>50</td><td>61.44</td><td>4.37 s</td><td>8.74 s</td><td>13.98 s</td><td>17.48 s</td><td>x</td><td></td></tr>
<tr><td>40</td><td>50</td><td>5.37 s</td><td>10.74 s</td><td>17.18 s</td><td>21.47 s</td><td>x</td><td>x</td></tr>
<tr><td>36</td><td>46.08</td><td>5.83 s</td><td>11.65 s</td><td>18.64 s</td><td>23.3 s</td><td>x</td><td></td></tr>
<tr><td>25</td><td>30.72</td><td>8.74 s</td><td>17.48 s</td><td>27.96 s</td><td>34.95 s</td><td>x</td><td></td></tr>
<tr><td>20</td><td>25</td><td>10.74 s</td><td>21.47 s</td><td>34.36 s</td><td>42.95 s</td><td>x</td><td>x</td></tr>
<tr><td>18</td><td>23.04</td><td>11.65 s</td><td>23.30 s</td><td>37.28 s</td><td>46.6 s</td><td>x</td><td></td></tr>
<tr><td>12</td><td>15.36</td><td>17.48 s</td><td>34.95 s</td><td>55.92 s</td><td>1.17 min</td><td>x</td><td></td></tr>
<tr><td>10</td><td>12.5</td><td>21.47 s</td><td>42.95 s</td><td>1.15 min</td><td>1.43 min</td><td>x</td><td>x</td></tr>
<tr><td>6</td><td>7.68</td><td>34.95 s</td><td>1.17 min</td><td>1.86 min</td><td>2.33 min</td><td>x</td><td></td></tr>
<tr><td>5</td><td>6.25</td><td>42.95 s</td><td>1.43 min</td><td>2.29 min</td><td>2.86 min</td><td>x</td><td>x</td></tr>
<tr><td>3</td><td>3.84</td><td>1.17 min</td><td>2.33 min</td><td>3.73 min</td><td>4.66 min</td><td>x</td><td></td></tr>
<tr><td>2.5</td><td>3.125</td><td>1.43 min</td><td>2.86 min</td><td>4.58 min</td><td>5.73 min</td><td>x</td><td>x</td></tr>
<tr><td>1.5</td><td>1.92</td><td>2.33 min</td><td>4.66 min</td><td>7.46 min</td><td>9.32 min</td><td>x</td><td></td></tr>
<tr><td>1.25</td><td>1.5625</td><td>2.86 min</td><td>5.73 min</td><td>9.16 min</td><td>11.45 min</td><td>x</td><td>x</td></tr>
<tr><td>0.28</td><td>0.36</td><td>12.43 min</td><td>24.86 min</td><td>39.77 min</td><td>49.71 min</td><td>x</td><td></td></tr>
<tr><td>0.036</td><td>0.045</td><td>99.42 min</td><td>198.84 min</td><td>318.15 min</td><td>397.68 min</td><td>x</td><td></td></tr>
</table>
</td></tr>
</table>

*: Option Dependent: Standard Analysis Bandwidth up to 20 MHz, Option 103 up to 50 MHz, Option 104 up to 110 MHz.

IQ Waveform Streaming (Option 125/127)

Requires Option 124 or 126: Option 127 is non-export controlled and limits streams to 100 MHz BW or less.

Bit Resolution	8, 10, 16, or 32-bit
Ethernet Port	Maximum gapless bandwidth depends on network transfer speed
USB Port	Requires USB 3.0 solid state drive. Device formatted as external file system (ext4) maximum gapless streaming bandwidth: 8 bit: 100 MHz bandwidth, 122.88 MSPS sample rate 10 bit: 80 MHz BW, 100 MSPS sample rate 16 bit: 50 MHz BW, 61.44 MSPS 32 bit: 25 MHz BW, 30.72 MSPS Device formatted as extensible file allocation table file system (exFAT) maximum gapless streaming bandwidth: 8 bit: 50 MHz bandwidth, 61.44 MSPS sample rate 10 bit: 36 MHz BW, 46.08 MSPS sample rate 16 bit: 25 MHz BW, 30.72 MSPS 32 bit: 12 MHz BW, 15.36 MSPS

LTE FDD/TDD Signal Analyzer (Option 883)

General	Frequency Range: 10 MHz to 43.5 GHz (option dependent) Channel Bandwidth (MHz): 1.4, 3, 5, 10, 15, 20 Amplitude: Auto Range, Reference Level, Scale/Division, Reference Level Offset Input Signal Range: –76 to +10 dBm (≤20 GHz) –72 to +10 dBm (>20 GHz) Sweep: Single/Continuous MIMO Antenna Setup: Auto, Antenna 1, 2, 3, or 4
LTE Demodulation Summary	PCI Summary Measurements: Physical Cell ID, Sector ID, Cell Group, Frequency Error, Time Offset, Cyclic Prefix, Status of Primary Synchronization Signal (PSS), MIMO Time Alignment Error, Resource Block Power Signal Power Measurements (dBm): Physical Broadcast Channel Power (PBCH), Sync Signal (SS), Reference Signal (RS), OFDM Symbol Transmit Power (OSTP) Error Vector Magnitude Measurements (%): Physical Broadcast Channel (QPSK), Physical Downlink Shared Channel (QPSK), PDSCH (16-QAM/64-QAM/256-QAM) Demod Summary View: PCI, Sector ID, Cell Group, Frequency Error, Time Offset, Cyclic Prefix, Sync Status, Power (PBCH, SS, RS), EVM (PBCH(QPSK), PDSCH (QPSK, 16-QAM, 64-QAM, 256-QAM) Time Alignment Error (TAE) View: PCI, Sector ID, Cell Group, Frequency Error, Time Offset, Cyclic Prefix, Sync Status, TAE between each antenna pair, Power (RS, SS), EVM (RMS, PEAK) Resource Block View: PCI, Sector ID, Cell Group, Frequency Error, Time Offset, Cyclic Prefix, Sync Status, RB (number of active RBs, Utilization, OSTP), EVM (QPSK, 16-QAM, 64-QAM, 256-QAM) Setup Parameters: Antenna (Auto/1/2/3/4), Cyclic Prefix (Auto/Normal/Extended), Duplex Type (FDD/TDD), UL/DL Config (TDD only), CFI (Auto/CFI1/CFI2/CFI3) RS Power Accuracy: ± 1.0 dB typical (RF input –50 dBm to +10 dBm) Frequency Error: ± 10 Hz + time base error (99 % confidence level) Residual EVM (rms): 2.0 % typical (E-UTRA Test Model 3.1, RF Input –50 dBm to +10 dBm)
LTE Multi PCI	Measurements: Multiple Physical Cell IDs, Secondary Sync Signal Power (S-SS), Reference Signal Received Power (RSRP), Reference Signal Received Quality (RSRQ), Signal to Interference and Noise Ratio (SINR), Average Error Vector Magnitude (EVM), Peak EVM, Frequency Error (Hz and PPM), Dominance Graph Displays: PCI, SINR, RSRP, RSRQ, SS Power Setup Parameters: Cyclic Prefix (Auto/Normal/Extended), Duplex Type (FDD/TDD), UL/DL Config (TDD only), CFI (Auto/CFI1/CFI2/CFI3)
Channel Power	Measurements: Total Channel Power, Total Power Spectral Density (PSD), Limit Test (Power and PSD) Setup Parameters: Integration Bandwidth, PSD Units (Hz/MHz), Power Limit (dBm), PSD Limit (dBm/Hz) RF Channel Power Accuracy: ±1 dB typical (–50 to +10 dBm)
Channel Spectrum	Measurements: Occupied Bandwidth (OBW), Total Power, Occupied Bandwidth, Limit Test (OBW) Setup Parameters: OBW Power (%/dB), OBW Limit (Hz), Method (%/x dB)
Carrier Aggregation	PCI Measurements: Physical-layer Cell ID (PCI), RS Power, EVM (% rms), Frequency Error (Hz) Setup Parameters: Carrier Count (up to eight), Antenna (Auto/1/2/3/4), Cyclic Prefix (Auto/Normal/Extended), Duplex Type (FDD/TDD)
Control Channel	PCI Summary Measurements: Physical Cell ID, Sector ID, Cell Group, Frequency Error, Time Offset, Cyclic Prefix, Status of Primary Synchronization Signal (PSS) Power Measurements: Reference Signal (RS), P-Primary Synchronization Signal (P-SS), Secondary Synchronization Signal (S-SS), Physical Broadcast Channel (PBCH), Physical Control Format Indicator Channel (PCFICH), Physical Hybrid Automatic Repeat Request Indicator Channel (PDCCH), Physical Downlink Control Channel (PDCCH), Total Power per Resource Element and Power (dBm/watts), EVM (%) Setup Parameters: Antenna (Auto/1/2/3/4), Cyclic Prefix (Auto/Normal/Extended), Duplex Type (FDD/TDD), UL/DL Config (TDD only), NG (1/6, 1/2, 1, 2)
Constellation	Measurements: Constellation Display of PBCH or PDSCH Setup Parameters: Antenna (Auto/1/2/3/4), Cyclic Prefix (Auto/Normal/Extended), Duplex Type (FDD/TDD), UL/DL Config (TDD only), CFI (Auto/CFI1/CFI2/CFI3), Modulation (PBCH/PDSCH), Data Format (All/QPSK/16-QAM/64-QAM/256-QAM)
Frame Power	Measurements: Power vs. Time Display, Power of Frame, Sub-Frame, Slot (0 and 1), Uplink and Downlink Pilot Time Slots (DwPTS and UpPTS), Transmit Off Power Setup Parameters: Analysis (Frame/Subframe/Slot), SSF Config (Auto/0-9), Sub-Frame (0-9), Slot (1/2) Antenna (Auto/1/2/3/4), Cyclic Prefix (Auto/Normal/Extended), Duplex Type (FDD/TDD), UL/DL Config (TDD only), NG (1/6, 1/2, 1, 2)

5GNR FDD/TDD Signal Analyzer (Option 888)

General	Frequency Range: 10 MHz to 43.5 GHz (option dependent) Band Configuration: Manual or selectable Band #, Absolute Radio Frequency Channel Number (ARFCN), Global Synchronization Raster Channel (GSCN), Channel Bandwidth (5 MHz to 100 MHz in steps of 5 MHz), SSB Offset, Subcarrier Spacing (15, 30, 120, 240 kHz), Mapping Pattern (Auto, P1, P2), Auto SSB Detect Auto SSB Detect: Searches 3GPP defined GSCN raster Amplitude: Auto Range, Reference Level, Scale/Division, Reference Level Offset, Attenuation Level (Auto/Manual), Preamp Input Signal Range: –76 dBm to +10 dBm (≤20 GHz) –72 dBm to +10 dBm (>20 GHz) Sweep: Single/Continuous, Sweep Once
5GNR Demod Summary	Multi-Beam Measurements: Physical-layer Cell ID, Beam Index, Sector ID, Cell Group, Frequency Error, Time Offset, SS-RSRP (dBm), SS-RSRQ (dB), SS-SINR (dB), Sync and Demod Status Indicators, Beam Power (dBm) Single-Beam Measurements: Physical Cell ID, Sector ID, Cell Group, Frequency Error, Time Offset, SS-RSRP (dBm), SS-RSRQ (dB), SS-SINR (dB), Sync and Demod Status Indicators, Block Measurements (PSS, SSS, PBCH, PBCH-DMRS), Average EVM, Peak EVM (@ subcarrier/symbol), Beam Power (dBm) Views: Multi Beam (up to 64), Single Beam Setup Parameters: SINR Threshold (dB), Duplex Type (FDD/TDD) RSRP Accuracy: ±1.0 dB typical Residual EVM (rms): 2.0% typical Frequency Error: <±2.0E-8 + time base error, typical
5GNR Multi PCI	Measurements: Multiple Physical-layer Cell IDs, Beam Index, SS-RSRP (dBm), SS-RSRQ (dB), SS-SINR (dB), SS-EVM (%) Beam Power (dBm) Views: Multi PCI Beam Scanner (up to 64 beams), Table Setup Parameters: SINR Threshold (dB), Duplex Type (FDD/TDD)
5GNR RF EIRP	Measurements: EIRP (Active, Horizontal/Vertical, Sum), Upper/Lower Limit Test Views: Normal (RF spectrum), Quick View (summary) Setup Parameters: Save (Horizontal/Vertical), Reset Sum, RX Antenna Gain, Distance to Antenna, Units (Meters/Feet), Upper/Lower Limit Test, RX Cable Loss
5GNR RF Occupied Bandwidth	Measurements: Occupied Bandwidth, Total Power, x dB Bandwidth, Tx Frequency Error, Limit Test View: Normal (RF Spectrum) Setup Parameters: Method: OBW Power (% and X dB), OBW Limit Test
5GNR RF Channel Power	Measurements: Total Channel Power, Total PSD, Limit Test View: Normal (RF Spectrum) Setup Parameters: Integration Bandwidth, PSD Units, Power and PSD Limit Tests RF Channel Power Accuracy: ±1 dB typical (–76 to +10 dBm)
5GNR Carrier Aggregation	Component Carriers: Up to Eight Component Carriers PCI Measurements: Sync status (PSS), Physical-layer Cell ID (PCI), RSRP Max, EVM (% rms), Frequency Error (Hz), Time Offset Setup Parameters: Carrier Count (up to 8), Duplex Type (FDD/TDD)
5GNR Constellation	Measurements: Constellation Display of PBCH Setup Parameters: Modulation (QPSK), Data Format (PBCH), Beam Select, Reference Points

General Specifications

- **MS27101A, MS27102A, MS27103A**

Setup Parameters

Setup System	Temperature, Serial Number, Firmware Version, Options Installed, Self-Test, Application Self Test, GPS
System Options	Name, Date and Time, Reset (Factory Defaults, Master Reset, Update Firmware)
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy
Internal Trace/Setup Memory	4 GB internal memory available for storing files
Mode Switching	Automatically stores/recalls most recently used setup parameters in the mode

Connectors

RF In	One type N, female port, 50Ω (MS27101A, MS27102A) 12 SMA (f) ports, 50Ω (MS27103A) 24 SMA (f) ports, 50Ω (optional) (MS27103A)
External Power	11 W, 5.5 mm barrel connector, 11 VDC to 14 VDC (MS27101A) 11 W, 11 V to 24 V, 3-pin IP67 power connector (MS27102A) 11 W, ±20 VDC to ±70 VDC (110/220 VAC optional) (MS27103A)
External Reference In	10 MHz, +10 dBm max, +5 VDC max, BNC (f) (MS27101A, MS27103A)
Ethernet	1 RJ45 connector (MS27101A) 1 RJ45 connector for Gbit LAN (ruggedized and weatherproof) (MS27102A) One RJ45 connector for Gbit LAN, 2nd port optional for daisy chain (MS27103A)
USB	2 Type A interface connectors (MS27101A) 2 USB Type A connectors (MS27103A)
GPS	SMA (f)

EU Standards (CE Marking)

CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2
	LVD: 2014/35/EU, EN61010-1
	RoHS: 2011/65/EU, (EU) 2015/863
Australia and New Zealand	RCM AS/NZS 4417:2012
Korea	KCC-REM-A21-0004

Warranty

Instrument	Standard three-year warranty

Environmental

Operating Temperature Range	0°C to +50°C (MS27101A, MS27103A) –40°C to +55°C (MS27102A)
Storage Temperature Range	–40°C to +71°C (MS27101A, MS27103A) –51°C to +71°C (MS27102A)
Maximum Relative Humidity	95% RH at 30°C, non-condensing
Vibration, Sinusoidal	5 Hz to 55 Hz
Vibration, Random	10 Hz to 500 Hz
Half Sine Shock	30 g_n
Altitude	4600 meters, operating and non-operating

ESD

RF Input Pin	Withstands up to ±4 kV

Dimension and Mass

Dimensions	216 (W) × 45 (H) × 368 (D) mm (8.5 × 1.75 × 14.5 in) (MS27101A) 310 (W) × 102 (H) × 310 (D) mm (12.2 × 4.0 × 12.2 in) (MS27102A) 480 (W) × 90 (H) × 300 (D) mm (18.9 × 3.5 × 11.8 in) (MS27103A)
Mass	2.78 kg (6.2 lb) (MS27101A) 6.87 kg (15.2 lb) (MS27102A) 12-port: 3.9 kg (8.9 lb) (MS27103A) 24-port: 4.5 kg (9.9 lb) (MS27103A)

General Specifications

- **MS27201A**

Setup Parameters

Date and Time	Date and Time settings, Time Zone settings, Time synced to Internet/GPS
Languages	English
Screen Shot Settings	Image capture size, Image header/footer
Option Configuration	Enable options using file (USB)
GPS	See "GPS Receiver (Option 31)"
Ethernet	Ethernet (IP4 & IP6 formats), Type (DHCP, factory set to static IP address 10.0.0.2)
Reset	Factory Reset, Delete All User Files, Delete System Files, Master Reset, Diagnostics
Diagnostics	Self Test, Service Tools, exportable event and system error logs
Save/Recall	Measurement Setup, Screenshot Image (.PNG), Export Measurement data (Text, CSV), Location
File Management	Save, Copy, Paste, Delete, Create New Folder, Set File Name and File Type, Rename

Connectors

RF In	MS27201A-0709, -0720: Type N (f), 50Ω MS27201A-0743: Ruggedized Type K (m), 50Ω
GPS	SMA (f), 50Ω
External Power	5.5 mm barrel connector, 13.5 to 17.5 VDC, 5.0 A max.
Ethernet Interface	RJ45 connector for Ethernet 10/100/1000 Mbps (connect to PC or LAN for remote access)
USB Interface	USB 3 Type A ×2
External Reference In	SMA (f), 50Ω, maximum input +10 dBm
External Reference Out	SMA (f), 50Ω, 10 MHz
External Trigger	SMA (f), 50Ω, TTL-compatible levels, maximum input +5 VDC
IF Out	SMA (f), 50Ω
DC Bias Voltage	SMA (f), Setup: On/Off, Voltage, Trip Reset Voltage Range: +1 V to +34 V, Resolution: 0.1 V Max Current: 1 A, Max Power: 15 W

Regulatory Compliance

European Union	EMC 2014/30/EU, EN 61326-1:2013, CISPR 11/EN 55011, IEC/EN 61000-4-3/4/5/6/8/11 Low Voltage Directive 2014/35/EU Safety EN 61010-1:2010 RoHS Directive 2011/65/EU
Australia and New Zealand	RCM AS/NZS 4417:2012
South Korea	KCC-REM-A21-0004
Canada	ICES-3(A)/NMB-3(A)
United States	FCC ID: SQG-60SIPT

Environmental

MIL-PRF-28800F Class 2

Operating Temperature Range	–10°C to +55°C
Storage Temperature Range	–51°C to +71°C
Maximum Relative Humidity	95% RH at 30°C, non-condensing
Vibration, Sinusoidal	5 Hz to 55 Hz
Vibration, Random	10 Hz to 500 Hz
Half Sine Shock	30 g_n
Altitude	4600 meters, operating and non-operating
Explosive Atmosphere	MIL-PRF-28800F Section 4.5.6.3 MIL-STD-810G, Method 511.5, Procedure 1

Warranty

Duration	Standard three-year warranty

Dimension and Mass

Dimensions	426 (W) × 85 (H) × 282 (D) mm (16.8 × 3.3 × 11.1 in)
Mass	MS27201A-0709, -0714, -0720: 5.06 kg (11.15 lb) MS27201A-0743, -0754: 5.4 kg (11.9 lb)

Programmable Remote Control

Functionality	Full instrument programming control (except power on/off) via Ethernet connectivity. See the Programming Manual for details.
Programming Language	Standard Commands for Programmable Instruments (SCPI)
Interfaces	Ethernet

IQ Data Converter MA25424A

IQ Streaming	Shipping Contents: MA25424A Module PCIe OCuLink I/O Data Cable USB 3.0 Type A to Type C Cable Mode: Spectrum Analyzer Input Ports: Data In (PCIe), USB (for power) Output Port: IEEE 1284-C, 50 pin Data Throughput: 200 MSPS @ 16 bit max Power Consumption: 3.33 W (USB 3.0)
Warranty	Duration: Standard three-year warranty
Dimensions and Mass	Dimensions: 128.3 (W) × 88.86 (H) × 33.43 (D) mm Mass: 377 g (including cables)

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

MS27101A, MS27102A, MS27103A

Model/Order No.	Name
	Standard Hardware
MS27101A	Spectrum Monitor with 1 RF IN Port (Requires one frequency option)
MS27102A	Spectrum Monitor with 1 RF IN Port (Requires one frequency option)
MS27103A	Spectrum Monitor with 12 SMA (f) Input Ports (Requires one frequency option)
	Hardware Options
MS27101A-0706	9 kHz to 6 GHz Frequency Range
MS27101A-0001	Rack Mount Kit
MA8100A	NEON Signal Mapper (MS27101A)
MS27102A-0402	2 RF IN Ports
MS27102A-0404	4 RF IN Ports
MS27102A-0406	6 RF IN Ports
MS27102A-0706	9 kHz to 6 GHz Frequency Range
MS27103A-0706	9 kHz to 6 GHz Frequency Range
MS27103A-0424	Expands Input Ports to 24 SMA (f)
MS27103A-0110	110-220 VAC Power Supply
MS27103A-0412	Two Ethernet Ports
	Software Options
MS27101A-0400	Vision Monitor Enabled
MS27101A-0401	Vision Locate Enabled (Requires Option 400 above)
MS27101A-0407	Vision High-Speed Port Scanner Enabled
MS27101A-0486	Vision Coverage Mapping (Requires Option 407)
MS27102A-0400	Vision Monitor Enabled
MS27102A-0401	Vision Locate Enabled (Requires Option 400 above)
MS27102A-0407	Vision High-Speed Port Scanner Enabled
MS27102A-0486	Vision Coverage Mapping (Requires Option 407)
MS27103A-0400	Vision Monitor Enabled
MS27103A-0401	Vision Locate Enabled (Requires Option 400 above)
MS27103A-0407	Vision High-Speed Port Scanner Enabled
MS27103A-0486	Vision Coverage Mapping (Requires Option 407)
	Standard Accessories (includes with instrument)
40-187-R	AC-DC Adapter (MS27101A, MS27102A)
2100-32-R	Power Adapter (MS27102A)
2000-1371-R	Ethernet Cable, 2.13 m (7 ft) (MS27102A, MS27103A)
2000-1528-R	GPS Antenna, SMA (m) with 5 m (15 ft) cable, 3 dBi gain, requires 5 VDC (MS27102A, MS27103A)
	Optional Accessories
760-288-R	Transit Case (MS27101A)
760-285-R	Large Transit Case with Wheels and Handle (MS27102A)
760-287-R	Large Transit Case with Wheels and Handle (MS27103A)

MS27201A

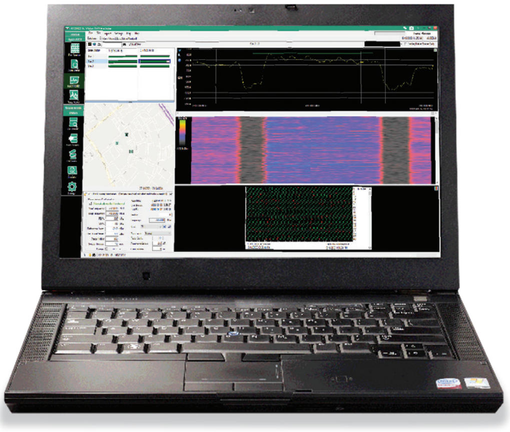
Model/Order No.	Name
	Standard Hardware
MS27201A	Remote Spectrum Monitor (Requires Option 709, 720, or 743)
	Options
MS27201A-0709	Frequency Range 9 kHz to 9 GHz
MS27201A-0720	Frequency Range 9 kHz to 20 GHz
MS27201A-0743	Frequency Range 9 kHz to 43.5 GHz
MS27201A-0031	GPS Receiver (requires GPS antenna, sold separately)
MS27201A-0883	LTE FDD/TDD Measurements (requires GPS option MS27201A-0031)
MS27201A-0888	5GNR FDD/TDD Measurements (requires GPS option MS27201A-0031)
MS27201A-0089	Zero Span IF Output
MS27201A-0090	Gated Sweep
MS27201A-0104	110 MHz Analysis Bandwidth
MS27201A-0124	IQ Waveform Capture
MS27201A-0125	IQ Waveform Streaming (requires Option 124, MA25424A recommended)
MS27201A-0126	IQ Waveform Capture (non-export controlled)
MS27201A-0127	IQ Waveform Streaming (non-export controlled, requires Option 126, MA25424A recommended)
MS27201A-0128	Vector Signal Analysis enabled (requires option 124 or 126)
MS27201A-0400	Vision Monitor Enabled
MS27201A-0407	Vision High-Speed Port Scanner Enabled
MS27201A-xxxx-0098	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1 (xxxx is the frequency option number)
MS27201A-xxxx-0099	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1 plus test data (xxxx is the frequency option number)
	Supported Software
MX280005A	Vector Signal Analysis PC software
MX280001A	Remote Spectrum Monitor Vision Software
MS27201A	Remote Spectrum Monitor PC Software

Spectrum Monitoring Systems

MX280001A Vision™ Software

Remote Control
GPIB | **Ethernet**

Automate the Process of Collecting Measurement Data



Spectrum monitoring systems facilitate the identification and removal of interference signals that degrade network capacity. By monitoring spectrum on a continual basis, problem signals can be identified as they occur in real-time. Patterns of unwanted signal activity can also be examined, providing an efficient way to characterize and locate the source of the interference problem.

In addition to interference detection, spectrum monitoring is also used to characterize spectrum occupancy. Government regulators and operators are often interested in determining the usage rate for various frequency bands. Monitoring these frequencies provides the information needed to optimize spectrum for maximum utilization. Spectrum can be re-purposed for other applications or multiplexed with other signals using cognitive radio techniques.

Spectrum monitoring also serves to enforce compliance with government regulations. Police, fire fighters, air traffic control, and emergency services must all have access to communications free of impediments and distortion. Compliance with spectrum regulations is often enforced by spectrum monitoring.

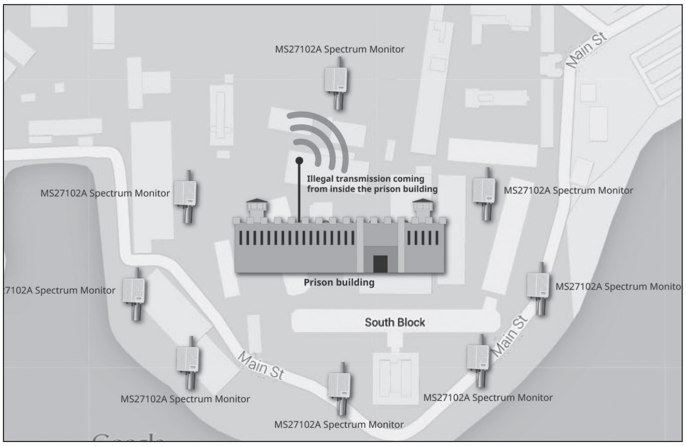


Figure 1: Monitoring for Illegal Transmissions from Prison Facility

Vision™ Software Overview (MX280001A)

The Vision™ software platform works with Anritsu's spectrum monitoring hardware to automate the process of collecting measurement data, providing useful information about network health, and use of the spectrum. Using multiple hardware probes covering a wide geographical area, Vision presents a comprehensive picture of spectral activity to assist users in monitoring the spectrum for unusual activity. Figure 2 shows a typical signal monitoring system with Anritsu spectrum monitors positioned for maximum coverage.

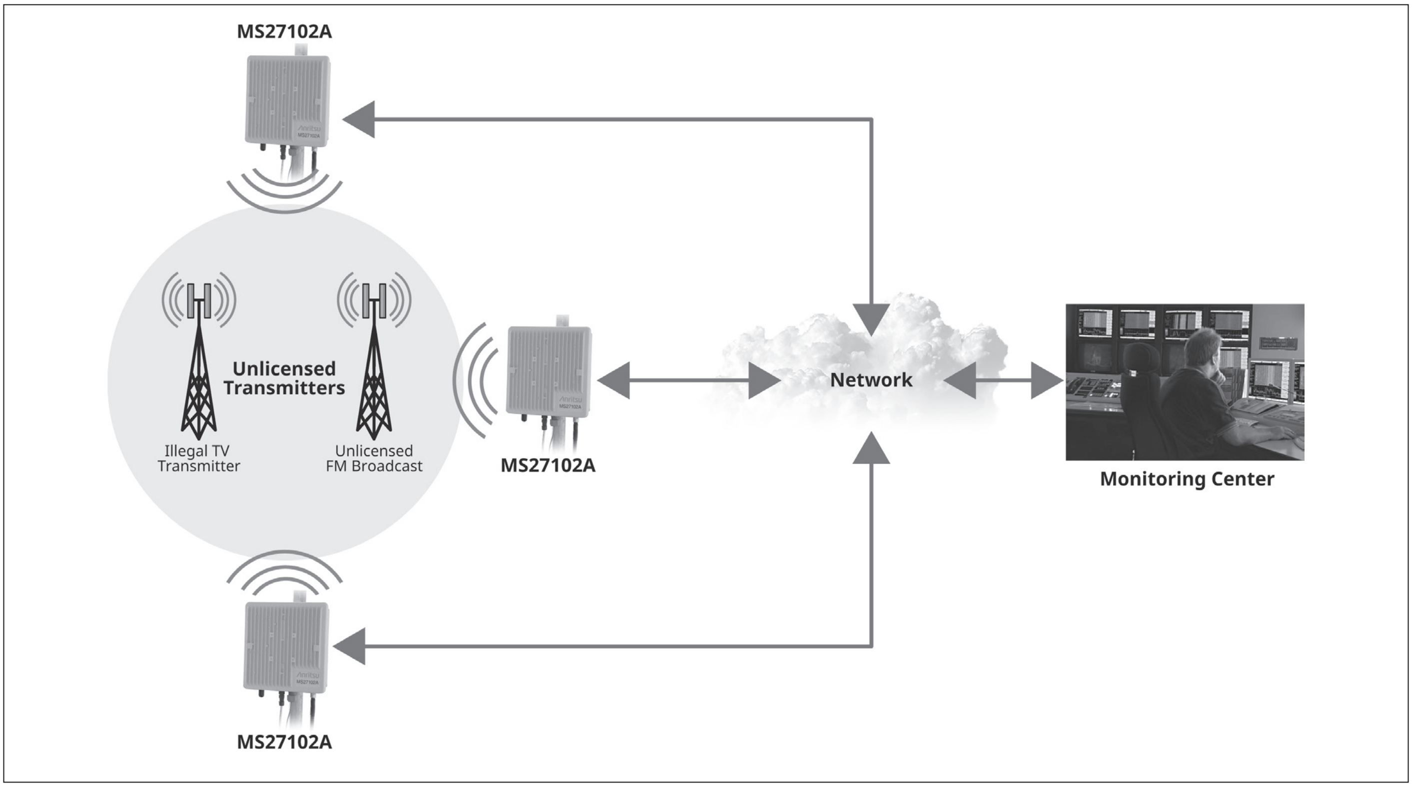


Figure 2: Spectrum Monitoring System

Vision software facilitates a variety of applications used for spectrum monitoring systems. One important application includes determining the presence of interferers in a network which can degrade communications services. Cellular operators in particular are vulnerable to such interference that manifests itself in slower data rates and dropped calls. In most cases, network performance is compromised on the uplink frequency bands (communication from the mobile unit to the base station). However, network quality of service can also be impacted by interference on the downlink channels. This type of interference can be prevalent at the cell periphery where the power levels of the interference signals approximate those transmitted by the base station itself.

Another important application for Vision software is the detection of illegal or unlicensed broadcast signals. Illegal broadcasters may set up AM/FM, cellular or other types of transmissions which must be identified and ultimately located. By using spectrum monitors, unlicensed broadcasts can be tracked, processed, and stored in a database for further examination and potential use in legal proceedings. See figures 3 and 4 for important spectrum monitoring applications.

Figure 3: Stadium Monitoring

Figure 4: Airport Frequency Monitoring

Other Applications Include the Following:

- Inform spectrum policy – accumulate historical spectrum data to determine percent time of occupancy
- Monitor jails/prisons for unauthorized transmissions
- Monitor borders, airports, nuclear facilities, and other sensitive areas
- Railroads – monitor spectrum for potential interference of positive train control (PTC) signals
- Satellite reception interference detection
- Interference monitoring at large venues such as stadiums, malls, etc.
- White space monitoring
- Indoor monitoring (board rooms, embassies, and other sensitive facilities). See Figure 5.

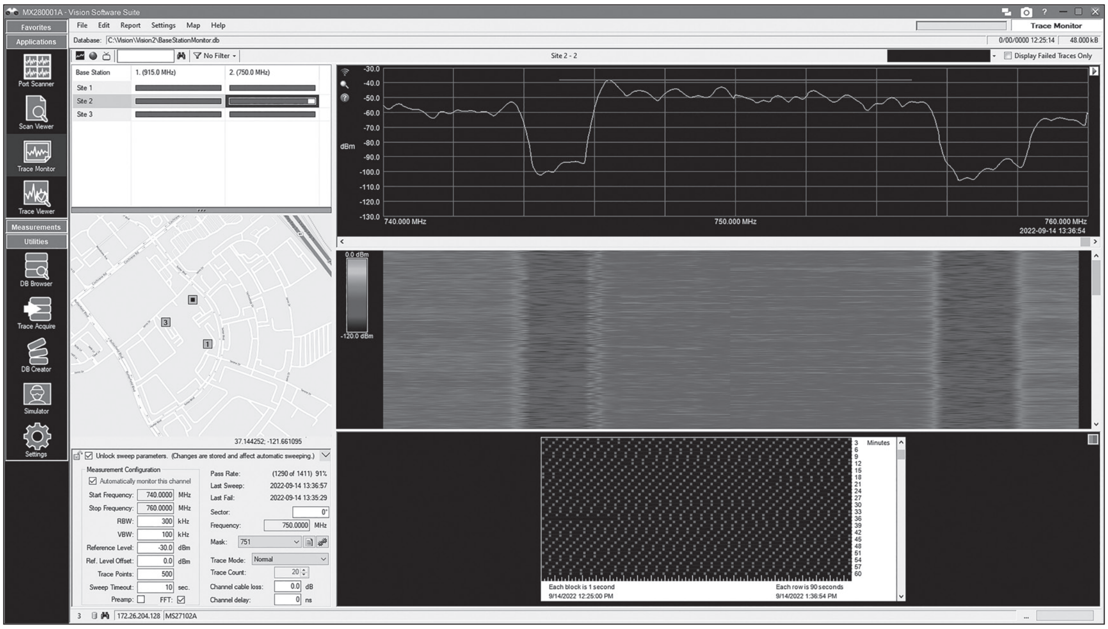
Figure 5: Indoor Transmissions Detection

Vision Software – How it Works

Vision is an optional software program which runs on a PC using the Windows operating system (Windows 7, 8, 10, or 11). This software provides control and automation capabilities when used with Anritsu's spectrum monitor hardware. Vision is composed of two components responsible for monitoring and geo-locating interference signals, called Vision Monitor and Vision Locate respectively. Each performs a wide range of spectrum monitoring and control applications designed to mitigate interference problems and detect unusual signal activity. A summary of each vision software product is presented below.

Vision Monitor (Option 400)

The Vision Monitor program is the visible user interface for monitoring remote spectrum activity. It provides a listing of all hardware monitors in the system along with a graphic overview of system health. A screenshot of the main user interface for Vision Monitor is shown in figure 6.



Database: C:\Vision\Vision2\BaseStationMonitor.db

0/00/0000 12:25:14 | 48.000 kB

37.144252; -121.661095

☑ Unlock sweep parameters. (Changes are stored and affect automatic sweeping.)

Measurement Configuration

☑ Automatically monitor this channel

Start Frequency: 740.0000 MHz

Stop Frequency: 760.0000 MHz

RBW: 300 kHz

VBW: 100 kHz

Reference Level: -30.0 dBm

Ref. Level Offset: 0.0 dBm

Trace Points: 500

Sweep Timeout: 10 sec.

Preamp: ☐ FFT: ☑

Pass Rate: (1290 of 1411) 91%

Last Sweep: 2022-09-14 13:36:57

Last Fail: 2022-09-14 13:35:29

Sector: 0°

Frequency: 750.0000 MHz

Mask: 751

Trace Mode: Normal

Trace Count: 20

Channel cable loss: 0.0 dB

Channel delay: 0 ns

Each block is 1 second
9/14/2022 12:25:00 PM

Each row is 90 seconds
9/14/2022 1:36:54 PM

3 | 172.26.204.128 | MS27102A

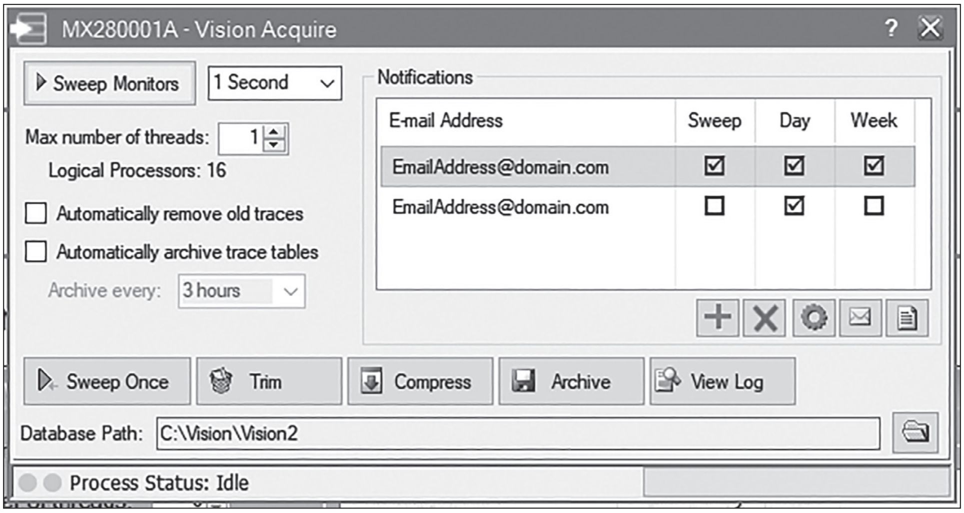
Figure 6: Vision Monitor Screen

Shown here is a listing of the deployed monitors, with the ability to view both "real-time" and historic measurement trace and spectrogram data.

Vision Monitor performs a wide range of spectrum monitoring duties. These functions include:

- Measurement acquisition
- Data storage
- Threshold setting/alarm generation
- Reporting

Users can set up the Vision program to take automatic measurements for all spectrum monitors. The measurements are in turn uploaded into a database for further review. The database is updated with new data, while old information is periodically purged according to user settings. Functions are also available for archiving, copying, and compressing the database. See Figure 7 for illustration.



Sweep interval: 1 Second

Max number of threads: 1

Logical Processors: 16

☐ Automatically remove old traces

☐ Automatically archive trace tables

Archive every: 3 hours

E-mail Address	Sweep	Day	Week
EmailAddress@domain.com	☑	☑	☑
EmailAddress@domain.com	☐	☑	☐

Database Path: C:\Vision\Vision2

Process Status: Idle

Figure 7: Vision Monitor Measurement and Database Control

With Vision Monitor, users can set up limit lines for triggering alarms, view spectrum history, and change measurement parameters of individual or groups of spectrum monitor probes. The program makes heavy use of intuitive graphics to indicate the presence of interference or other signals of interest. Additionally, searches both in real-time and over history can be made to indicate patterns of interference. In some cases, interference may only occur at certain times of the day or certain days of the week. It is important to be able to capture the signal, identify the pattern, and subsequently hunt for the signal location at the appropriate times. In addition to trace data, spectrograms can be viewed to indicate changes in frequency over time for suspicious signals. For each remote monitor, Vision Monitor is capable of collecting data from as many as 24 input RF ports. This can be ideal for cellular systems with multiple sectors and multiple frequencies per sector. Figure 8 shows a screen shot of the user interface with multiple monitors overlaid on a map. Using this map, alarm threshold violations can be easily seen with color changes on the probe indicating a frequency threshold violation at that site. If needed, automated email alerts can be sent to any email address provided. These alerts can be emailed in real-time or sent as summary reports on a daily or weekly basis. These reports are a great tool for provide a snap shot of the network's health and provide time-stamped indications of when a suspicious signal might be present.

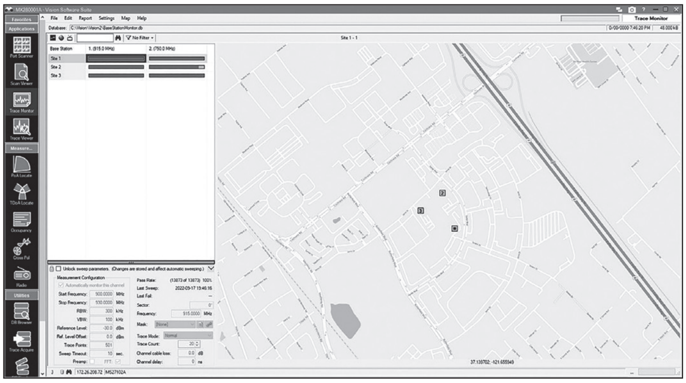


Figure 8: Monitor Positions Overlaid on Map

Vision Locate (Option 401)

Vision Locate is an optional program used with Vision Monitor. Once an interferer or suspected illegal signal is identified, a geo-location algorithm is employed to fix the approximate position of the signal. This enables the user to narrow down the signal location, minimizing the time and expense for pin-pointing its position. A sample map is shown in Figure 9 showing the suspected interference position. In this window, the probe locations are indicated by the red squares. The interference position is identified by the concentric circles.

For interference that may have occurred in the past, users can also use historical data for positioning the signal of interest (SOI). A search can be done for alarm violations that occurred at any of the spectrum monitor probes in the network. Using three probes in the vicinity, the interference position can be geo-located. Power-of-Arrival (POA) algorithms are used to position the interference signal. Three or more probes must be in the vicinity to detect the SOI in order to correctly triangulate the position. See figure 9 for example for geo-location positioning on the map.

Figure 9: Geo-Location of Interference Position

Remote Spectrum Monitoring Hardware

Anritsu offers several spectrum monitoring systems designed for both indoor and outdoor environments. The Remote Spectrum Monitor MS27101A addresses the need for an accurate remote solution for white space monitoring, harm claim threshold detection, in-building interference monitoring, positive train control (PTC) system protection and locating illegal/unlicensed signal sources or similar interference. Housed in a half-rack size enclosure, the MS27101A is ideal for spectrum monitoring where a small footprint is required. The Remote Spectrum Monitor MS27102A is an outdoor IP67-rated probe that can be positioned on towers, rooftops, or poles. It is ideally used to monitor for both interference and unusual signal activity. The Remote Spectrum Monitor MS27103A, which maintains 12 or optionally 24 RF inputs, is designed specifically for cellular system or in applications requiring multiple RF inputs. The MS27103A is also ideal for monitoring for interference in DAS environments. Both platforms are designed for stability, sweep speed and low spurious signals.

Anritsu's latest offering is the Remote Spectrum Monitor MS27201A. With frequency options up to 43.5 GHz in a 2U rack-mount form factor, this is our most advanced spectrum monitoring instrument capable of LTE and 5G measurement options and 40 MHz RTSA.

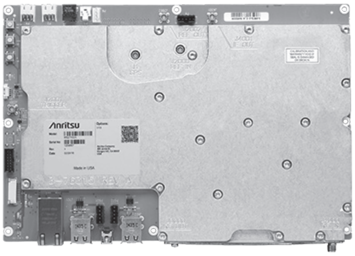
Key features for each hardware platform include the following:

- 9 kHz to 6 GHz
- Sweep speed up to 24 GHz/s
- Integrated web server to view, control and conduct measurements via a web browser (both Chrome and FireFox supported)
- Remote firmware update capable
- Watchdog timer to insure long-term stability for remotely deployed monitors
- IP67 rated for outdoor deployments
- Linux operating system
- Low spurious signals for accurate signal discovery
- 20 MHz instantaneous FFT bandwidth
- Low power consumption < 11 watts (input voltage 11 to 24 VDC)
- Integrated GPS receiver for monitoring location and time synchronization applications
- Gigabit Ethernet available for high speed transmissions
- Interference analysis: spectrogram and signal strength
- Dynamic range: > 106 dB normalized to 1 Hz BW
- DANL: <–150 dBm referenced to 1 Hz BW, preamp On
- Phase noise: –99 dBc/Hz @ 10 kHz offset at 1 GHz
- IQ block mode and streaming with time stamping for TDOA applications

Remote Spectrum Monitor MS27103A
(24-Port RF Input option shown)

Remote Spectrum Monitor MS27101A

Remote Spectrum Monitor MS27102A



Remote Spectrum Monitor MS27100A

Summary

In order to minimize expense while preserving network integrity, a highly automated process is required. Vision software provides an efficient user-friendly method for monitoring frequencies, alerting the user when unusual signal activity is present. By identifying patterns of interference and recording spectrum history and geo-locating the position of target signals, Vision software is the perfect solution for interference mitigation needs.

Ordering Information

The Vision software application can be downloaded from the Anritsu website. In order to use Vision, an Anritsu spectrum monitor must be purchased and enabled with the option. Note that in order to use Vision Locate for geo-location, Vision Monitor must also be purch

Model/Order No.	Name
MS27100A-0400	Vision Monitor enabled on MS27100A
MS27100A-0401	Vision Locate enabled on MS27100A (Requires Option 400)
MS27101A-0400	Vision Monitor enabled on MS27101A
MS27101A-0401	Vision Locate enabled on MS27101A (Requires Option 400)
MS27102A-0400	Vision Monitor enabled on MS27102A
MS27102A-0401	Vision Locate enabled on MS27102A (Requires Option 400)
MS27103A-0400	Vision Monitor enabled on MS27103A
MS27103A-0401	Vision Locate enabled on MS27103A (Requires Option 400)
MS27201A-0400	Vision Monitor Enabled

VECTOR NETWORK ANALYZERS

Selection Guide

Group	Model	Frequency Band	Measurement Function									
			S-Parameter	Power Sweep Mode	Receiver Offset Mode (Option)	Multiple-source Control (Option)	Time Domain (Option)	Mixer Measurement (Option)	Pulse (Option)	Internal Second Source (Option)	Spectrum Analyzer	Distance-to-Fault (DTF)
VectorStar	MS4642B	70 kHz to 20 GHz	✓	✓	✓	✓	✓	✓	✓	✓		
	MS4644B	10 MHz to 40 GHz*1	✓	✓	✓	✓	✓	✓	✓	✓		
	MS4647B	10 MHz to 70 GHz*1	✓	✓	✓	✓	✓	✓	✓	✓		
	ME7838AX	70 kHz to 110 GHz/125 GHz (1.1 THz)	✓	✓	✓	✓	✓	✓	✓	✓		
	ME7838A4X	70 kHz to 110/125/145 GHz (1.1 THz)	✓	✓	✓	✓	✓	✓	✓	✓		
	ME7838D	70 kHz to 145 GHz (1.1 THz)	✓	✓	✓	✓	✓	✓	✓	✓		
	ME7838D4	70 kHz to 140 GHz/150 GHz (1.1 THz)	✓	✓			✓		✓			
	ME7838EX	70 kHz to 110 GHz (1.1 THz)	✓	✓	✓	✓	✓	✓	✓	✓		
	ME7838E4X	70 kHz to 110 GHz (1.1 THz)	✓	✓			✓		✓			
	ME7838G	70 kHz to 220 GHz										
	ME7838G4	70 kHz to 220 GHz										
	ME7848A	10 MHz to 110 GHz										
ShockLine	MS46121B	150 kHz to 6 GHz	✓				✓					
	MS46122B	1 MHz to 8 GHz 1 MHz to 20 GHz 1 MHz to 43.5 GHz	✓				✓					
	MS46131A	1 MHz to 43.5 GHz	✓				✓					
	MS46322B	1 MHz to 8 GHz 1 MHz to 20 GHz 1 MHz to 43.5 GHz	✓				✓					
	MS46522B	50 kHz to 8.2/20/43.5 GHz, E-band	✓	✓		✓	✓					
	MS46524B	50 kHz to 8.5/20/43.5 GHz	✓	✓		✓	✓					
	ME7868A	1 MHz to 43.5 GHz	✓				✓					
VNA Master	MS2036C	5 kHz to 6 GHz 9 kHz to 9 GHz	✓				✓				✓	✓
	MS2024B	500 kHz to 4 GHz	✓*2									✓
	MS2025B	500 kHz to 6 GHz	✓*2									✓
	MS2034B	500 kHz to 4 GHz 9 kHz to 4 GHz	✓*2								✓	✓
	MS2035B	500 kHz to 6 GHz 9 kHz to 6 GHz	✓*2								✓	✓

*1: Requires Option 070 (70 kHz Frequency Extension)
*2: S_{11}/S_{21} measurement by 1 path 2 ports calibration can be performed.

Selection Guide (Frequency Range)

Group	Model	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	2 MHz	5 MHz	10 MHz	20 MHz	50 MHz	100 MHz	200 MHz	500 MHz	1 GHz	2 GHz	5 GHz	10 GHz	20 GHz	50 GHz	100 GHz	500 GHz	750 GHz	1 THz	Remarks
VectorStar	MS4642B				■	■	■	■	■	■	■	■	■	■	■	■	■	■	▒	▒	▒	▒	▒		70 kHz to 20 GHz
	MS4644B								■	■	■	■	■	■	■	■	■	■	■	▒	▒	▒	▒		10 MHz to 40 GHz*1
	MS4647B								■	■	■	■	■	■	■	■	■	■	■	■	▒	▒	▒		10 MHz to 70 GHz*1
	ME7838AX				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▒	▒	▒		70 kHz to 110 GHz/125 GHz (1.1 THz)
	ME7838A4X				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▒	▒	▒		70 kHz to 110/125/145 GHz (1.1 THz)
	ME7838D				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▒	▒		70 kHz to 145 GHz (1.1 THz)
	ME7838D4				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▒	▒		70 kHz to 145/150 GHz (1.1 THz)
	ME7838EX				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▒	▒	▒		70 kHz to 110 GHz (1.1 THz)
	ME7838E4X				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	▒	▒	▒		70 kHz to 110 GHz (1.1 THz)
	ME7838G				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				70 kHz to 220 GHz
	ME7838G4				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				70 kHz to 220 GHz
	ME7848A								■	■	■	■	■	■	■	■	■	■	■	■					10 MHz to 110 GHz
ShockLine	MS46121B				■	■	■	■	■	■	■	■	■	■	■	■	■								150 kHz to 6 GHz
	MS46122B					■	■	■	■	■	■	■	■	■	■	■	■	■	■						1 MHz to 8 GHz/20 GHz/ 43.5 GHz
	MS46131A					■	■	■	■	■	■	■	■	■	■	■	■	■	■						1 MHz to 43.5 GHz
	MS46322B					■	■	■	■	■	■	■	■	■	■	■	■	■	■						1 MHz to 8 GHz/20 GHz/ 43.5 GHz
	MS46522B				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■					50 kHz to 8.5 GHz/20 GHz/ 43.5 GHz, 55 GHz to 92 GHz*3
	MS46524B				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						50 kHz to 8.5 GHz/20 GHz/ 43.5 GHz
	ME7868A					■	■	■	■	■	■	■	■	■	■	■	■	■	■						1 MHz to 43.5 GHz

*1: Requires Option 070 (70 kHz Frequency Extension)
*2: Requires Option 2 (2 MHz Frequency Extension)
*3: Requires Option 082 or 083

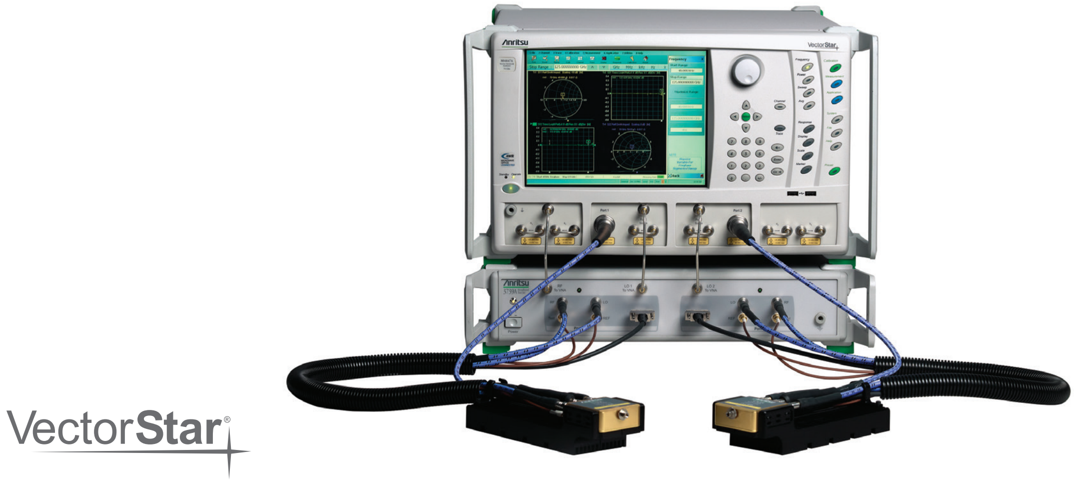
VectorStar™ Broadband Vector Network Analyzers

ME7838AX/EX/D/G Series

Broadband 70 kHz to 110, 125, 145, and 220 GHz, Coaxial and Millimeter Waveguide VNA Systems up to 1.1 THz

Remote Control
GPIB | **Ethernet**

High Performance, Broadband Network Analysis Solutions



The VectorStar ME7838 Broadband series system provides high performance in a compact mmWave module with industry-best calibration stability. While other broadband systems continue to provide raw performance with negative directivity in critical frequency bands, the ME7838 series is the only broadband system with positive raw directivity in these bands. The result is better calibration stability and better measurement stability with significantly longer time between calibrations for accurate measurements and improved productivity. The VectorStar ME7838 VNA series delivers 100 dB dynamic range at 220 GHz for high-sensitivity measurements across 70 kHz to 110, 125, 145, and 220 GHz (up to 1.1 THz with mmWave modules) with excellent measurement stability. This stable broadband performance means you can make high-accuracy measurements all day, with the confidence that your calibration remains rock solid! Spend less time calibrating and more time measuring.

Broadband/Millimeter-Wave System Options

- MS4640B-002 – Time Domain
- MS4640B-021 – Universal Fixture Extraction
- MS464xB-031 – Dual Source Architecture
- MS464xB-032 – Internal RF Combiner
- MS4640B-035 – IF Digitizer
- MS4640B-036 – Extended IF Digitizer Memory
- MS4640B-041 – Noise Figure
- MS4640B-042 – PulseView™
- MS4640B-043 – DifferentialView™
- MS4640B-044 – IMDView™
- MS4640B-046 – Fast CW
- MS4640B-047 – Eye Diagram
- MS4640B-048 – Differential Noise Figure
- MS4640B-049 – Broadband and Banded Spectrum Analyzer Option
- MS464xB-051 – External VNA Direct Access Loops
- MS464xB-061 – Active Measurement Suite, with 2 Attenuators
- MS464xB-062 – Active Measurement Suite, with 4 Attenuators
- SC8215 and SC7287 – Kelvin Bias Tees

Definitions

All specifications and characteristics apply under the following conditions, unless otherwise stated:

Warm-Up Time	After 90 minutes of warm-up time, where the instrument is left in the ON state.
Temperature Range	Over the 25°C±5°C temperature range.
Error-Corrected Specifications	For error-corrected specifications, over 23°C±3°C, with <1°C variation from calibration temperature. For error-corrected specifications are warranted and include guard bands, unless otherwise stated.
Typical Performance	"Typical" specifications describe expected, but not warranted, performance based on sample testing. Typical performance indicates the measured performance of an average unit and do not guarantee the performance of any individual product. "Typical" specifications do not account for measurement uncertainty and are shown in parenthesis, such as (–102 dB), or noted as Typical.
User Cables/Adapters	Specifications do not include effects of any user cables adapters, fixtures, or other structures attached to the instrument.
Discrete Spurious Responses	Specifications may exclude discrete spurious responses.
Internal Reference Signal	All specifications apply with internal 10 MHz Crystal Oscillator Reference Signal.
Characteristic Performance	Characteristic performance indicates a performance designed-in and verified during the design phase. It does include guard-bands and is not covered by the product warranty.
Below 300 kHz	All uncertainties below 300 kHz are typical.
Recommended Calibration Cycle	12 months
Interpolation Mode	All specifications are with Interpolation Mode Off.
Specifications Subject to Change	All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu web site at www.anritsu.com.

Specifications for Broadband Configuration

ME7838AX/EX Broadband System 70 kHz to 110/125 GHz, ME7838D Broadband System 70 kHz to 145 GHz (150 GHz), ME7838G Broadband System 70 kHz to 220 GHz

System and Receiver Dynamic Range, Noise Floor

System dynamic range is measured as the difference between maximum port power and the RMS noise floor in a 10 Hz bandwidth and no averaging (ports terminated).
Noise floor is calculated as the difference between maximum rated port power and system dynamic range.
Receiver Dynamic Range is calculated as the difference between the receiver compression level and the noise floor at Ports 1 or 2.
Normalizing measurement made with a through line connection, with its effects compensated for. The cables between the VNA and the 3743A modules are assumed to be the 806-206-R 1.85 mm cable (61 cm, 24 in long) or the 806-209-R 1.85 mm cable (91.5 cm, 36 in long).
All values are typical.

Frequency Range (GHz)	System Dynamic Range (dB)*1				Receiver Dynamic Range (dB)*1				Nose Floor (dBm)*1			
	ME7838D	ME7838D Option 62	ME7838G	ME7838G Option 62	ME7838D	ME7838D Option 62	ME7838G	ME7838G Option 62	ME7838D	ME7838D Option 62	ME7838G	ME7838G Option 62
70 kHz to 300 kHz	93	90	93	90	89	86	89	88	–83	–82	–83	–82
>0.3 MHz to 2 MHz	103	100	103	100	103	102	103	104	–93	–92	–93	–92
>2 MHz to 10 MHz	115	112	115	112	115	114	115	114	–105	–102	–105	–102
>0.01 to 2.5 GHz	120	116	120	116	121	122	121	122	–110	–109	–110	–109
>2.5 to 24	110	105	110	105	121	121	121	122	–110	–108	–110	–109
>24 to 54	110	107	110	107	125	125	126	126	–115	–115	–116	–116
>54 to 60	110	110	112	112	124	124	126	126	–114	–114	–116	–116
>60 to 65					123	123						
>60 to 67	110	110	109	109	123	123	122	122	–113	–113	–112	–112
>65 to 80												
>67 to 80	108	108	109	109	121	121	122	122	–111	–111	–112	–112
>80 to 85	106	106	106	106	123	123	123	123	–113	–113	–113	–113
>85 to 90	106	106	106	106	122	122	122	122	–112	–112	–112	–112
>90 to 95	106	106	106	106	121	121	122	122	–111	–111	–112	–112
>95 to 100												
>95 to 105	106	106	106	106	121	121	122	122	–111	–111	–112	–112
>100 to 110												
>105 to 110	109	109	106	106	125	125	122	122	–115	–115	–112	–112
>110 to 120	108	108	109	109	118	118	123	123	–111	–111	–116	–116
>120 to 125	104	104	109	109	116	116	123	123	–109	–109	–116	–116
>125 to 140	92	92	100	100	109	109	122	122	–102	–102	–115	–115
>140 to 145	94	94			107	107			–100	–100		
>140 to 150			100	100			122	122			–115	–115
>150 to 160			97	97			119	119			–112	–112
>160 to 180			102	102			122	122			–115	–115
>180 to 200			103	103			123	123			–116	–116
>200 to 220			100	100			122	122			–115	–115

Frequency Range (GHz)	System Dynamic Range (dB)*1				Receiver Dynamic Range (dB)*1			
	ME7838AX	ME7838AX Option 61 or 62	ME7838EX	ME7838EX Option 61 or 62	ME7838AX	ME7838AX Option 61 or 62	ME7838EX	ME7838EX Option 61 or 62
70 kHz to 300 kHz	95	95	95	95	91	95	91	94
>0.3 MHz to 2 MHz	107	107	107	107	107	107	107	112
>2 MHz to 10 MHz	130	130	130	130	128	130	128	132
>0.01 to 2.5 GHz	119	117	119	117	120	117	120	122
>2.5 to 10	117	113	117	113	124	113	124	124
>10 to 24	109	113	109	113	121	113	121	128
>24 to 40	107	103	107	103	119	103	119	117
>40 to 54	107	103	107	103	124	103	124	124
>54 to 60	107	107	107	107	119	107	119	119
>60 to 65	107	107	107	107	119	107	119	119
>65 to 70					122		122	122
>65 to 80	106	106	106	106		106		
>70 to 80					120.5		120.5	120.5
>80 to 90	104	104	104	104	120.5	104	120.5	120.5
>90 to 100	104	104	104	104	116.5	104	116.5	116.5
>100 to 110	104	104	104	104	120.5	104	120.5	120.5
>110 to 115	103	103			120	103		
>115 to 120	97	97			105	97		
>120 to 125	97	97			105	97		

*1: Excludes localized spurious responses and crosstalk

Test Port Power, Receiver Compression*[1]

Port power control is provided by the base VNA for frequencies below 54 GHz, and by the 3743AX mmWave module for frequencies greater than 54 GHz. Receiver compression point is defined as the port power level beyond which the response may be compressed more than 0.2 dB relative to normalization level. 10 Hz IF bandwidth used to remove trace noise effects. All typical.

Frequency Range (GHz)	Port Power							
	Max. Power ME7838AX	Max. Power ME7838AX Option 61 or 62	Max. Power ME7838EX	Max. Power ME7838EX Option 61 or 62	Max. Power ME7838D	Max. Power ME7838D Option 62*[2]	Max. Power ME7838G	Max. Power ME7838G Option 62*[2]
70 kHz to 300 kHz	10	7	10	7	10	8	10	8
>0.3 MHz to 2 MHz	10	7	10	7	10	8	10	8
>2 MHz to 10 MHz	12	10	12	10	10	10	10	10
>0.01 to 2.5	10	8	10	8	10	7	10	7
>2.5 to 10	4	2	4	2				
>2.5 to 24					0	–3	0	–4
>10 to 24	–1	–2	–1	–2				
>24 to 40	–2	–4	–2	–4				
>24 to 54					–5	–8	–6	–9
>40 to 54	–7	–11	–7	–11				
>54 to 60	–2	–2	–2	–2	–4	–4	–4	–4
>60 to 65	–2	–2	–2	–2				
>60 to 67					–3	–3	–3	–3
>65 to 70	–6	–6	–6	–6				
>65 to 80								
>67 to 80					–3	–3	–3	–3
>70 to 80	–4.5	–4.5	–4.5	–4.5				
>80 to 85	–6.5	–6.5	–6.5	–6.5	–7	–7	–7	–7
>85 to 90	–6.5	–6.5	–6.5	–6.5	–6	–6	–6	–6
>90 to 95	–2.5	–2.5	–2.5	–2.5	–5	–5	–6	–6
>95 to 100	–2.5	–2.5	–2.5	–2.5				
>95 to 105					–5	–5	–6	–6
>100 to 110	–6.5	–6.5	–6.5	6.5				
>105 to 110					–6	–6	–6	–6
>110 to 115	–7	–7						
>110 to 120					–3	–3	–7	–7
>115 to 120	–3	–3						
>120 to 125	–3	–3			–5	–5	–7	–7
>125 to 140					–10	–10	–15	–15
>140 to 145					–6	–6		
>140 to 150							–15	–15
>150 to 160							–15	–15
>160 to 180							–13	–13
>180 to 200							–13	–13
>200 to 220							–15	–15
>220 to 226							–18	–18

Frequency Range (GHz)	Receiver Compression							
	Compression ME7838AX	Compression ME7838AX Option 61 or 62	Compression ME7838EX	Compression ME7838EX Option 61 or 62	Compression ME7838D	Compression ME7838D Option 62	Compression ME7838G	Compression ME7838G Option 62
70 kHz to 300 kHz	6	6	6	6	6	6	6	6
>0.3 MHz to 2 MHz	10	12	10	12	10	12	10	12
>2 MHz to 10 MHz	10	12	10	12	10	12	10	12
>0.01 to 2.5	11	13	11	13	11	13	11	13
>2.5 to 24	11	13	11	13	11	13	11	13
>24 to 40	10	10	10	10				
>24 to 54					10	10	10	10
>40 to 54	10	10	10	10				
>54 to 60	10	10	10	10	10	10	10	10
>60 to 65	10	10	10	10				
>60 to 67					10	10	10	10
>65 to 80	10	10	10	10				
>67 to 80					10	10	10	10
>80 to 85					10	10	10	10
>80 to 90	10	10	10	10				
>85 to 90					10	10	10	10
>90 to 95					10	10	10	10
>90 to 100	10	10	10	10				
>95 to 100								
>95 to 105					10	10	10	10
>100 to 110	10	10	10	10				
>105 to 110					10	10	10	10
>110 to 115	10	10						
>110 to 120					7	7	7	7
>115 to 120	5	5						
>120 to 125	5	5			7	7	7	7
>125 to 140					7	7	7	7
>140 to 145					7	7		
>140 to 150							7	7
>150 to 160							7	7
>160 to 180							7	7
>180 to 200							7	7
>200 to 220							7	7
>220 to 226							5	5

*1: Using the 806-206-R 1.85 mm (61 cm, 24 in long), and 806-209-R 1.85 mm (91.5 cm, 36 in long) (only ME7838G) test port cables between the VNA and the 3743AX mmWave modules.

*2: Use this column also for Options 51 and 61 although the performance between 10 MHz and 54 GHz will characteristically be better by 1 dB or more for Option 51, and will characteristically be better by 1 dB or more for Option 61 (with port 1 driving and port 2 receiving).

Power Range, Accuracy, Linearity, and Resolution

Accuracy is defined at –10 dBm or max. rated power, whichever is lower. Linearity is defined as the incremental error between the accuracy test power level and 5 dB below. Typical.

Frequency Range (GHz)	Power Range (dB)		Accuracy (dB)	Linearity (dB)	Resolution (dB)
	ME7838AX	ME7838AX Option 61 or 62			
70 kHz to 300 kHz	10 to –25	7 to –85	±0.3	±0.2	0.01
>0.3 MHz to 2 MHz	10 to –25	7 to –85	±0.3	±0.2	0.01
>2 MHz to 10 MHz	12 to –25	10 to –85	±0.3	±0.2	0.01
>0.1 to 2.5	10 to –25	8 to –85	±0.4	±0.3	0.01
>2.5 to 10	4 to –25	2 to –85	±0.5	±0.3	0.01
>10 to 24	–1 to –25	–2 to –85	±0.5	±0.3	0.01
>24 to 40	–2 to –30	–4 to –90	±0.9	±0.3	0.01
>40 to 54	–7 to –30	–11 to –90	±0.9	±0.3	0.01
>54 to 60	–2 to –55	–2 to –55	±1.3	±0.5	0.01
>60 to 65	–2 to –55	–2 to –55	±1.3	±0.5	0.01
>65 to 70	–6 to –55	–6 to –55	±1.3	±0.5	0.01
>70 to 80	–4.5 to –55	–4.5 to –55	±1.3	±0.5	0.01
>80 to 90	–6.5 to –55	–6.5 to –55	±1.7	±0.6	0.01
>90 to 100	–2.5 to –55	–2.5 to –55	±2.3	±0.6	0.01
>100 to 110	–6.5 to –55	–6.5 to –55	±2.3	±1.0	0.01
>110 to 115	–7 to –50	–7 to –50	±2.3	±2.0	0.01
>115 to 120	–3 to –40	–3 to –40	±2.3	±2.0	0.01
>120 to 125	–3 to –40	–3 to –40	±3.0	±2.0	0.01

Frequency Range (GHz)	Power Range (dBm)		Accuracy (dB)	Linearity (dB)	Resolution (dB)
	ME7838EX	ME7838EX Option 61 or 62			
70 kHz to 300 kHz	10 to –25	7 to –85	±0.3	±0.2	0.01
>0.3 MHz to 2 MHz	10 to –25	7 to –85	±0.3	±0.2	0.01
>2 MHz to 10 MHz	12 to –25	10 to –85	±0.3	±0.2	0.01
>0.01 to 2.5	10 to –25	8 to –85	±0.4	±0.3	0.01
>2.5 to 10	4 to –25	2 to –85	±0.5	±0.3	0.01
>10 to 24	–1 to –25	–2 to –85	±0.5	±0.3	0.01
>24 to 40	–2 to –30	–4 to –90	±0.9	±0.3	0.01
>40 to 54	–7 to –30	–11 to –90	±0.9	±0.3	0.01
>54 to 60	–2 to –55	–2 to –55	±1.3	±0.5	0.01
>60 to 65	–2 to –55	–2 to –55	±1.3	±0.5	0.01
>65 to 70	–6 to –55	–6 to –55	±1.3	±0.5	0.01
>70 to 80	–4.5 to –55	–4.5 to –55	±1.3	±0.5	0.01
>80 to 90	–6.5 to –55	–6.5 to –55	±1.7	±0.6	0.01
>90 to 100	–2.5 to –55	–2.5 to –55	±2.3	±0.6	0.01
>100 to 110	–6.5 to –55	–6.5 to –55	±2.3	±1.0	0.01

Frequency Range (GHz)	Power Range (dBm)		Accuracy (dB)	Linearity (dB)	Resolution (dB)
	ME7838D	ME7838D Option 62			
70 kHz to 300 kHz	–25 to 10	–85 to 8	±1.5	±1.5	0.01
>0.3 MHz to 2 MHz	–25 to 10	–85 to 8	±1.5	±1.5	0.01
>2 MHz to 10 MHz	–25 to 10	–85 to 10	±1.5	±1.5	0.01
>0.01 to 2.5	–25 to 10	–85 to 8	±1.0	±1.0	0.01
>2.5 to 24	–25 to 0	–85 to –3	±1.0	±1.0	0.01
>24 to 54	–30 to –5	–90 to –8	±1.5	±1.0	0.01
>54 to 60	–55 to –4	–55 to –4	±2.0	±1.5	0.01
>60 to 67	–55 to –3	–55 to –3	±2.0	±1.5	0.01
>67 to 80	–55 to –3	–55 to –3	±2.0	±1.5	0.01
>80 to 85	–55 to –7	–55 to –7	±2.0	±1.5	0.01
>85 to 90	–55 to –6	–55 to –6	±2.0	±1.5	0.01
>90 to 95	–55 to –5	–55 to –5	±2.0	±1.5	0.01
>90 to 105	–55 to –5	–55 to –5	±3.0	±2.0	0.01
>105 to 110	–55 to –6	–55 to –6	±3.0	±2.0	0.01
>110 to 120	–55 to –3	–55 to –3	±4.0	±3.0	0.01
>120 to 125	–55 to –5	–55 to –5	±4.0	±3.0	0.01
>125 to 140	–50 to –10	–50 to –10	±5.0	±4.0	0.01
>140 to 145	–50 to –6	–50 to –6	±5.0	±4.0	0.01

Frequency Range (GHz)	Power Range (dBm)		Accuracy (dB)	Linearity (dB)	Resolution (dB)
	ME7838G	ME7838G Option 62			
70 kHz to 300 kHz	–25 to 10	–85 to 8	±1.5	±1.5	0.01
>0.3 MHz to 2 MHz	–25 to 10	–85 to 8	±1.5	±1.5	0.01
>2 MHz to 10 MHz	–25 to 10	–85 to 10	±1.5	±1.5	0.01
>0.01 to 2.5	–25 to 10	–85 to 7	±1.5	±1.0	0.01
>2.5 to 24	–25 to 0	–85 to –4	±1.5	±1.0	0.01
>24 to 54	–30 to –6	–90 to –9	±1.5	±1.0	0.01
>54 to 60	–55 to –4	–55 to –4	±2.0	±1.5	0.01
>60 to 67	–55 to –3	–55 to –3	±2.0	±1.5	0.01
>67 to 80	–55 to –3	–55 to –3	±2.0	±1.5	0.01
>80 to 85	–55 to –7	–55 to –7	±2.0	±1.5	0.01
>85 to 90	–55 to –6	–55 to –6	±2.0	±1.5	0.01
>90 to 95	–55 to –6	–55 to –6	±2.0	±1.5	0.01
>90 to 105	–55 to –6	–55 to –6	±3.0	±2.0	0.01
>105 to 110	–55 to –6	–55 to –6	±3.0	±2.0	0.01
>110 to 120	–55 to –7	–55 to –7	±4.0	±3.0	0.01
>120 to 125	–55 to –7	–55 to –7	±4.0	±3.0	0.01
>125 to 140	–50 to –15	–50 to –15	±4.0	±4.0	0.01
>140 to 150	–50 to –15	–50 to –15	±4.0	±4.0	0.01
>150 to 160	–50 to –15	–50 to –15	±4.0	±4.0	0.01
>160 to 180	–50 to –13	–50 to –13	±4.0	±4.0	0.01
>180 to 200	–50 to –13	–50 to –13	±4.0	±4.0	0.01
>200 to 220	–50 to –15	–50 to –15	±4.0	±4.0	0.01
>220 to 226	–50 to –18	–50 to –18	±5.0	±4.0	0.01

High Level Noise

Noise measured at 1 kHz IF bandwidth, at maximum power or compression limit (whichever is less), with through transmission. RMS. Typical.

Frequency Range (GHz)	ME7838AX		ME7838EX		ME7838D	
	Magnitude (dB)	Phase (deg.)	Magnitude (dB)	Phase (deg.)	Magnitude (dB)	Phase (deg.)
70 kHz to 300 kHz						
70 kHz to 500 kHz	0.040	0.3	0.040	0.3	<0.04	<0.4
>0.3 MHz to 2 MHz						
>0.5 MHz to 2 MHz	0.006	0.03	0.006	0.03	<0.005	<0.05
>2 MHz to 10 MHz	0.0045	0.03	0.0045	0.03	<0.005	<0.05
>0.01 to 2.5	0.0045	0.03	0.0045	0.03	<0.005	<0.05
>2.5 to 10	0.005	0.035	0.005	0.035		
>2.5 to 24					<0.006	<0.06
>10 to 24	0.005	0.045	0.005	0.045		
>24 to 54	0.005	0.06	0.005	0.06	<0.005	<0.06
>54 to 80	0.0045	0.075	0.0045	0.075	<0.005	<0.06
>80 to 110	0.006	0.105	0.006	0.105	<0.008	<0.09
>110 to 120	0.007	0.115			<0.008	<0.09
>120 to 125	0.0075	0.13			<0.011	<0.11
>125 to 140					<0.016	<0.16
>140 to 145					<0.016	<0.16

Frequency Range (GHz)	ME7838G 1 kHz IF bandwidth		ME7838G 100 Hz IF bandwidth	
	Magnitude (dB)	Phase (deg.)	Magnitude (dB)	Phase (deg.)
70 kHz to 300 kHz	<0.04	<0.4	<0.02	<0.2
>0.5 MHz to 2 MHz	<0.005	<0.05	<0.003	<0.03
>2 MHz to 10 MHz	<0.005	<0.05	<0.003	<0.03
>0.01 to 2.5	<0.005	<0.05	<0.003	<0.03
>2.5 to 24	<0.006	<0.06	<0.003	<0.03
>24 to 54	<0.007	<0.08	<0.005	<0.05
>54 to 80	<0.007	<0.09	<0.005	<0.06
>80 to 110	<0.008	<0.09	<0.005	<0.06
>110 to 120	<0.008	<0.09	<0.006	<0.06
>120 to 125	<0.011	<0.11	<0.006	<0.07
>125 to 140	<0.015	<0.15	<0.006	<0.07
>140 to 150	<0.015	<0.15	<0.006	<0.07
>150 to 160	<0.020	<0.20	<0.001	<0.01
>160 to 180	<0.025	<0.25	<0.009	<0.09
>180 to 200	<0.025	<0.25	<0.009	<0.09
>200 to 220	<0.070	<0.50	<0.004	<0.03
>220 to 226	<0.020	<0.80	<0.005	<0.05

Stability

Rationed measurement at max. leveled power and with nominally a full coaxial reflect or a stable coaxial thru over the normal specified temperature range. (23°C±3°C Typical)

Frequency Range (GHz)	ME7838AX		ME7838EX		ME7838D	
	Magnitude (dB/°C)	Phase (deg./°C)	Magnitude (dB/°C)	Phase (deg./°C)	Magnitude (dB/°C)	Phase (deg./°C)
70 kHz to 300 kHz	<0.015	<0.1	0.015	0.1	<0.015	<0.1
>0.3 MHz to 2 MHz	<0.015	<0.05	0.015	0.05	<0.015	<0.05
>2 MHz to 10 MHz	<0.01	<0.05	0.01	0.05	<0.01	<0.05
>0.01 to 2.5	<0.01	<0.05	0.01	0.05	<0.01	<0.05
>2.5 to 30	<0.01	<0.09	0.01	0.09	<0.01	<0.09
>30 to 54	<0.01	<0.07	0.301	0.07	<0.01	<0.07
>54 to 80	<0.015	<0.1	0.015	0.1	<0.015	<0.1
>80 to 110	<0.015	<0.15	0.015	0.15	<0.015	<0.15
>110 to 120	<0.02	<0.2			<0.02	<0.2
>120 to 125	<0.04	<0.25			<0.025	<0.2
>125 to 140					<0.03	<0.35
>140 to 145					<0.04	<0.5

Frequency Range (GHz)	ME7838G	
	Magnitude (dB/°C)	Phase (deg./°C)
70 kHz to 300 kHz	<0.015	<0.1
>0.3 MHz to 2 MHz	<0.015	<0.05
>2 MHz to 10 MHz	<0.01	<0.05
>0.01 to 2.5	<0.01	<0.05
>2.5 to 30	<0.01	<0.09
>30 to 54	<0.01	<0.07
>54 to 80	<0.015	<0.1
>80 to 110	<0.015	<0.15
>110 to 120	<0.02	<0.2
>120 to 125	<0.025	<0.2
>125 to 140	<0.025	<0.3
>140 to 150	<0.025	<0.5
>150 to 160	<0.04	<0.5
>160 to 180	<0.04	<0.5
>180 to 200	<0.04	<0.5
>200 to 220	<0.04	<0.5
>220 to 226	<0.06	<0.7

Frequency Resolution, Accuracy and Stability - ME7838AX/ME7838EX/ME7838D/ME7838G

Resolution	Accuracy	Stability
1 Hz	$\pm 5 \times 10^{-7}$ Hz/Hz (at time of calibration)	$<5 \times 10^{-9}$/°C over 0°C to 50°C temperature $<1 \times 10^{-9}$/day aging, instrument on

Uncorrected (Raw) Port Characteristics

Typical performance with either ME7838AX or ME7838AX with Option 62, ME7838EX or ME7838EX with Option 62.

Frequency Range (GHz)	Directivity (dB)	Port Match (dB)
≤10 MHz	10*	8
>0.01 to 2.5	9*	10
>2.5 to 30	5*	12
>30 to 40	5*	5
>40 to 54	10	5
>54 to 80	10	10
>80 to 110	5	7
>110 to 120 (ME7838AX or ME7838AX with Option 62, only)	5	7
>120 to 125 (ME7838AX or ME7838AX with Option 62, only)	5	7

*: Raw directivity is degraded below 300 kHz, 2.2 GHz to 2.5 GHz and in narrow bands within 10 GHz to 34 GHz

Typical performance with either ME7838D or ME7838D with Option 62.

Frequency Range (GHz)	Directivity (dB)	Port Match (dB)
70 kHz to 10 MHz	10*	8
>0.01 to <2.5	9*	10
2.5 to 30	5*	11
>30 to 40	9*	11
>40 to 54	9*	11
>54 to 80	9	10
>80 to 110	5	7
>110 to 120	5	7
>120 to 125	5	7
>125 to 140	5	7
>140 to 145	5	6

*: Raw directivity is degraded below 300 kHz, 2.2 GHz to 2.5 GHz and in narrow bands within 10 GHz to 34 GHz

Typical performance with either ME7838G or ME7838G with Option 62.

Frequency Range (GHz)	Port Match (dB)
70 kHz to 10 MHz	8
>0.01 to <2.5	10
2.5 to 30*	11
>30 to 40*	11
>40 to 54	11
>54 to 80	10
>80 to 110	7
>110 to 120	7
>120 to 125	7
>125 to 140	7
>140 to 150	5
>150 to 160	5
>160 to 180	5
>180 to 200	5
>200 to 220	5

*: Port match is degraded in narrow bands between 20 GHz and 40 GHz.

Corrected System Performance and Uncertainties

With 12-term concatenated SOLT and Triple Offset Short Calibration (SSST), using the 3656C W1 Calibration Kit. Typical. (ME7838AX and ME7838EX only.)

Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
70 kHz to 10 MHz	40	40	38	±0.10	±0.10
>0.01 to 2.5	40	40	38	±0.05	±0.05
>2.5 to 20	40	40	38	±0.05	±0.05
>20 to 40	36	38	33	±0.05	±0.07
>40 to 67	30	36	27	±0.05	±0.07
>67 to 90	30	34	30	±0.07	±0.07
>90 to 110	30	34	28	±0.07	±0.07
>110 to 120	30	30	28	±0.10	±0.10
>120 to 125	28	30	26	±0.12	±0.12

With 12-term concatenated SOLT and Triple Offset Short Calibration (SSST), using the 3659 0.8 mm Calibration Kit. Typical for ME7838D.

Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
70 kHz to 10 MHz	36	36	36	±0.1	±0.1
>0.01 to 2.5	38	41	38	±0.05	±0.05
>2.5 to 20	40	41	40	±0.05	±0.05
>20 to 67	35	41	35	±0.05	±0.07
>67 to 80	35	38	35	±0.05	±0.07
>80 to 95	35	40	35	±0.05	±0.07
>95 to 110	34	37	34	±0.05	±0.07
>110 to 125	30	34	30	±0.07	±0.09
>125 to 140	28	28	28	±0.09	±0.11
>140 to 145	26	28	26	±0.11	±0.13

With 12-term concatenated SOLT and Triple Offset Short Calibration (SSST), using the 3659 0.8 mm Calibration Kit. Typical for ME7838G.

Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
70 kHz to 10 MHz	36	36	36	±0.1	±0.1
>0.01 to <2.5	38	41	38	±0.05	±0.05
2.5 to 20	40	41	40	±0.05	±0.05
>20 to 67	35	41	35	±0.05	±0.07
>67 to 80	35	38	35	±0.05	±0.07
>80 to 95	35	40	35	±0.05	±0.07
>95 to 110	34	37	34	±0.05	±0.07
>110 to 125	30	34	30	±0.07	±0.09
>125 to 140	28	28	28	±0.09	±0.11
>140 to 145	26	28	26	±0.11	±0.13

Measurement Time

Measurement times include sweep time, retrace time, and band-switching time. Typical.

Measurement Time (ms)

Full Band, 70 kHz to 110 GHz (ME7838AX/EX), 70 kHz to 145 GHz (ME7838D), 70 kHz to 220 GHz (ME7838G), Display ON, and ALC ON.

Calibration	IFBW	401 Points				1,601 Points			
		ME7838AX	ME7838EX	ME7838D	ME7838G	ME7838AX	ME7838EX	ME7838D	ME7838G
1-port calibration	1 MHz	230	210	80	280	290	270	100	280
	30 kHz	270	250	90	290	340	320	160	290
	10 kHz	285	265	110	310	450	430	240	310
	1 kHz	550	530	470	650	1700	1680	1600	650
	10 Hz	48,000	48,000	47,000	39,000	160,000	160,000	160,000	39,000
2-port calibration*	1 MHz	460	420	160	560	580	540	200	560
	30 kHz	540	500	180	580	680	640	320	580
	10 kHz	570	530	220	620	900	860	480	620
	1 kHz	1100	1060	940	1300	3400	3360	3200	1300
	10 Hz	96,000	96,000	94,000	78,000	320,000	320,000	320,000	78,000

Calibration	IFBW	10,001 Points				25,000 Points			
		ME7838AX	ME7838EX	ME7838D	ME7838G	ME7838AX	ME7838EX	ME7838D	ME7838G
1-port calibration	1 MHz	800	780	350	800	1400	1380	700	2000
	30 kHz	1200	1180	600	1250	3000	2980	1500	2500
	10 kHz	1950	1930	1100	1800	4400	4380	2600	3600
	1 kHz	11,000	11,000	10,000	10,000	27,000	27,000	25,000	25,000
	10 Hz	1,000,000	1,000,000	1,000,000	950,000	2,500,000	1,000,000	2,500,000	2,400,000
2-port calibration*	1 MHz	1600	1560	700	1600	2800	2760	1400	4000
	30 kHz	2400	2360	1200	2500	6000	5960	3000	5000
	10 kHz	3900	3860	2200	3600	8800	8760	5200	7200
	1 kHz	22,000	22,000	20,000	20,000	54,000	54,000	50,000	50,000
	10 Hz	2,000,000	2,000,000	2,000,000	1,900,000	5,000,000	5,000,000	5,000,000	4,800,000

*: Times for only those parameters in the calibration. Times are double for 1-2 calibrations and 3-4 calibrations. (ME7838AX only)

Measurement Time (ms) vs. System Dynamic Range (dB)

Full Band, Display ON, and ALC ON.

Calibration		401 Points Measurement Time	Achieved System Dynamic Range (Option 062 at 54 GHz)	IFBW and Averaging Used
Uncorrected or 1-port calibration	ME7838AX, ME7838EX	285	77	10 kHz/no avg.
		550	87	1 kHz/no avg.
	ME7838D	110	77	10 kHz/no avg.
		470	87	1 kHz/no avg.
	ME7838G	310	80	10 kHz/no avg.
		650	90	1 kHz/no avg.
2-port calibration*	ME7838AX, ME7838EX	570	77	10 kHz/no avg.
		1100	87	1 kHz/no avg.
	ME7838D	220	77	10 kHz/no avg.
		940	87	1 kHz/no avg.
	ME7838G	620	80	10 kHz/no avg.
		1300	90	1 kHz/no avg.

*: 2-port calibration (excluding 1-2 and 3-4). (ME7838AX only)

Waveguide Band Specifications

Port Power, Noise Floor, Dynamic Range – 3744A-EE/3744A-EW mmWave Modules for ME7838AX, ME7838EX, ME7838D, and ME7838G

System dynamic range is defined as the ratio of the source power to the noise floor. Maximum Receiver Power is defined as the 0.2 dB compression point of the receiver at the waveguide port. Receiver dynamic range is defined as the ratio of maximum receive power to the noise floor. Noise Floor measurements are RMS, are made with no average in a 10 Hz IF bandwidth, and include an isolation calibration.
All figures are typical.

3744A-EE Extended-E Band (WR-12) Waveguide

Frequency Range (GHz)	Source Power (dBm)	Max. Receive Power (0.2 dB comp. pt.) (dBm)	Noise Floor (dBm)	System Dynamic Range (dB)	Receiver Dynamic Range (dB)
56 to 60	–2	11	–111	109	122
>60 to 65	0	11	–106	106	117
>65 to 80	–3	11	–109	106	120
>80 to 85	–4	11	–112	108	123
>85 to 90	–4	11	–110	106	121
>90 to 94*	0	12	–109 (ME7838AX) –105 (ME7838EX/D)	109 (ME7838AX) 105 (ME7838EX/D)	117

*: Operational to 95 GHz.

3744A-EW Extended-W Band (WR-10) Waveguide

Frequency Range (GHz)	Source Power (dBm)	Max. Receive Power (0.2 dB comp. pt.) (dBm)	Noise Floor (dBm)	System Dynamic Range (dB)	Receiver Dynamic Range (dB)
65 to 67	0	11	–106	106	117
>67 to 80	–3	11	–109	106	120
>80 to 85	–4	11	–112	108	123
>85 to 90	–4	11	–110	106	121
>90 to 100	0	12	–109 (ME7838AX) –105 (ME7838EX/D)	109 (ME7838AX) 105 (ME7838EX/D)	121 117 (ME7838EX/D)
>100 to 110	–5	12	–110	105	122

Power Range, Accuracy, Linearity, and Resolution

Accuracy is defined at –10 dBm or max rated power, whichever is lower. Linearity is defined as the incremental error between the accuracy test power level and 5 dB below. Typical.

Frequency Range (GHz)	Range (dBm)		Accuracy (dB)	Linearity (dB)	Resolution (dB)
	ME7838AX	ME7838AX Option 62			
54 to 60	–55 to –2	–55 to –2	±2.0	±1.5	0.01
>60 to 65	–55 to 0	–55 to 0	±2.0	±1.5	0.01
>65 to 80	–55 to–3	–55 to –3	±2.0	±1.5	0.01
>80 to 85	–55 to –4	–55 to –4	±2.0	±1.5	0.01
>85 to 90	–55 to –4	–55 to –4	±2.0	±1.5	0.01
>90 to 100	–55 to 0	–55 to 0	±3.0	±2.0	0.01
>100 to 110	–50 to –5	–50 to –5	±3.0	±2.0	0.01
>110 to 120*	–40 to –12	–40 to –12	±4.0	±3.0	0.01
>120 to 125*	–40 to –15	–40 to –15	±4.0	±3.0	0.01

*: 110 GHz to 125 GHz frequency range is available as operational.

Frequency Range (GHz)	Range (dBm)		Accuracy (dB)	Linearity (dB)	Resolution (dB)
	ME7838EX/ME7838D	ME7838EX Option 62/ ME7838D Option 62			
54 to 60	–55 to –2	–55 to –2	±2.0	±1.5	0.01
>60 to 65	–55 to 0	–55 to 0	±2.0	±1.5	0.01
>65 to 80	–55 to –3	–55 to –3	±2.0	±1.5	0.01
>80 to 85	–55 to –4	–55 to –4	±2.0	±1.5	0.01
>85 to 90	–55 to –4	–55 to –4	±2.0	±1.5	0.01
>90 to 100	–55 to 0	–55 to 0	±3.0	±2.0	0.01
>100 to 110	–50 to –5	–50 to –5	±3.0	±2.0	0.01
>110 to 120* (ME7838D only)	–40 to –12	–40 to –12	±4.0	±3.0	0.01
>120 to 125* (ME7838D only)	–40 to –15	–40 to –15	±4.0	±3.0	0.01

*: 110 GHz to 125 GHz frequency range is available as operational.

Alternatively, the V, E, and W bands can be supported using external millimeter-wave modules such as the 3740/41A series modules available from Anritsu. For further description and specifications please refer to the VectorStar ME7838-series technical data sheet for your system available at www.anritsu.com.

Waveguide Bands from 50 GHz to 1.1 THz

VectorStar ME7838AX, ME7838EX, ME7838D, ME7838G Millimeter-Wave System with VDI Modules

This section provides the specifications for the VectorStar MS4640B series microwave Vector Network Analyzers (VNAs) when configured with the Virginia Diodes, Inc. millimeter-wave (mmWave) frequency extension modules. The following frequency bands are supported:

Waveguide Band	WR15	WR10	WR8.0	WR6.5	WR5.1	WR4.3	WR3.4	WR2.8	WR2.2	WR1.5	WR1.0*
Frequency Range (GHz)	50 to 75	75 to 110	90 to 140	110 to 170	140 to 220	170 to 260	220 to 330	260 to 400	330 to 500	500 to 750	750 to 1100

*: Contact Anritsu

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

ME7838AX Broadband System, 70 kHz to 125 GHz; ME7838EX Broadband System, 70 kHz to 110 GHz; ME7838D Broadband System, 70 kHz to 145 GHz

Action	Part Number and Description	Additional Information
Order the base VectorStar model with the listed components and options:	MS4647B, 70 kHz to 70 GHz VNA MS4640B-007, receiver offset MS4640B-070, 70 kHz frequency coverage 3739C, Broadband Test Set with 36 inch interface cables 3743AX/EX, Millimeter-Wave Module, 2 each M25300A, Millimeter-Wave Module, 2 each (ME7838D) ME7838AX/EX/D-SS020, On-site system assembly and verification	
Include one of the following:	MS4647B-080, MS4647B with ME7838AX system option MS4647B-086, MS4647B with ME7838EX system option MS4647B-080, MS4647B with ME7838D system option	MS4647B-084 is ordered when Option 31 is included MS4647B-088 is ordered when Option 31 is included (ME7838EX) MS4647B-084 is ordered when Option 31 is included (ME7838D)
	MS4647B-081, MS4647B with ME7838AX system option and Option 51 or 61 or 62 MS4647B-087, MS4647B with ME7838EX system option and Option 51, or 61, or 62 MS4647B-081, MS4647B with ME7838D system option and Option 51 or 61 or 62.	MS4647B-085 is ordered when Option 31 is included MS4647B-089 is ordered when Option 31 is included (ME7838EX)
Include one of the following:	806-206-R, 1.85 mm coaxial VNA RF cables, 24", M-F, 2 each	
	806-209-R, 1.85 mm coaxial VNA RF cables, 36", M-F, 2 each	
Add options if desired:	Option 51, 61, or 62: MS4647B-051 – External VNA Loops MS4647B-061 – Active Measurement Suite, 2 Attenuators MS4647B-062 – Active Measurement Suite, 4 Attenuators	
	MS4640B-070 – for 70 kHz operation in base VNA (ME7838EX) MS4640B-002 – Time domain MS464xB-031 – Dual Source Architecture MS4640B-035 – IF Digitizer MS4640B-041 – Noise Figure MS4640B-042 – PulseView™ MS4640B-043 – DifferentialView™ MS4640B-048 – Differential Noise Figure	MS464xB-031 requires Option 84 or 85 instead of Option 80 or 81 (ME7838AX and ME7838D only). MS464xB-031 requires Option 88 or 89 (ME7838EX). For other available options, see "ME7838AX/EX/D Broadband/ Millimeter-Wave System Options"
Calibration Options	ME7838AX/EX/D-098 - Standard Calibration, ISO 17025 compliant, without data ME7838AX/EX/D-099 - Premium Calibration, ISO 17025 compliant, with data	
Accessories	MS4640B-001, MS4640B rack mount 3739C-001, 3739C rack mount	

ME7838G Broadband System, 70 kHz to 220 GHz

Action	Part Number and Description	Additional Information
Order the base VectorStar model with the listed options:	MS4647B, 70 kHz to 70 GHz VNA MS4640B-007, receiver offset MS4640B-070, 70 kHz frequency coverage 3739C, Broadband Test Set with 36 inch interface cables MA25400A, Millimeter-Wave Module, 2 each ME7838G-SS020, On-site system assembly and verification	
Include one of the following:	MS4647B-080, MS4647B with ME7838G system option	MS4647B-084 is ordered when Option 31 is included.
	MS4647B-081, MS4647B with ME7838G system option and Option 51 or 61 or 62	MS4647B-085 is ordered when Option 31 is included.
Include the following:	806-209-R, 1.85 mm phase stable VNA RF cables, 36", M-F, 2 each	
Add options if desired:	Option 51, or 61, or 62: MS4647B-051 – External VNA Loops MS4647B-061 – Active Measurement Suite, 2 Attenuators MS4647B-062 – Active Measurement Suite, 4 Attenuators	
	MS4640B-002 – for Time Domain MS4640B-021 – UFX, Universal Fixture Extraction MS464xB-031 – Dual Source Architecture MS4640B-035 – IF Digitizer MS4640B-041 – Noise Figure MS4640B-042 – PulseView™ MS4640B-043 – DifferentialView™	MS464xB-031 requires Option 84 or 85. For other available options, see "ME7838G Broadband/Millimeter-Wave System Options"
Calibration Options	ME7838G-098 - Standard Calibration, ISO 17025 compliant, without data ME7838G-099 - Premium Calibration, ISO 17025 compliant, with data	
Accessories	MS4640B-001, MS4640B rack mount 3739C-001, 3739C rack mount	

ME7838AX, and ME7838D Waveguide-Band System to 110 GHz – 3744A-EE or 3744A-EW mmWave Modules

Configurator for ME7838AX, and ME7838D Millimeter-Wave System using 3744A-EE or 3744A-EW mmWave Modules:

Action	Part Number and Description	Additional Information
Choose and order one of the two base VectorStar models with options listed:	MS4644B VNA, 10 MHz to 40 GHz MS4640B-007 MS4644B-082 or MS4644B-083 or -084 or -085	MS4644B-083 is ordered when Option 51, 61, or 62 are included. MS4644B-084 is ordered when Option 31 is included and Option 51, 61, or 62 are excluded. MS4644B-085 is ordered when Option 31 and Option 51, 61, or 62 are included.
	MS4647B VNA, 10 MHz to 70 GHz MS4647B-007 MS4647B-080 or MS4647B-081 or -084 or -085	MS4647B-081 is ordered when Option 51, 61, or 62 are included. MS4647B-084 is ordered when Option 31 is included and Option 51, 61, or 62 are excluded. MS4647B-085 is ordered when Option 31 and Option 51, 61, or 62 are included.
Order Test Set	3739C mmWave Test Set	
Choose and order Extended-E or Extended-W Band Modules:	3744A-EE, 56 GHz to 94 GHz Extended E Band module, 2 each	
	3744A-EW, 65 GHz to 110 GHz Extended W Band module, 2 each	
Add options if desired:	Option 51, 61, or 62: MS464xB-051 – External VNA Loops MS464xB-061 – Active Measurement Suite, 2 Attenuators MS464xB-062 – Active Measurement Suite, 4 Attenuators	
	MS4640B-070 – for 70 kHz operation in base VNA MS4640B-002 – for Time Domain MS464xB-031 – Dual Source Architecture MS4640B-035 – IF Digitizer MS4640B-041 – Noise Figure MS4640B-042 – PulseView™ MS4640B-043 – DifferentialView™ MS4640B-048 – Differential Noise Figure	MS464xB-031 requires Option 84 or 85 instead of Option 80 or 81. For other available options, see “ME7838AX/D Broadband/Millimeter-Wave System Options”
	MS4640B-001, MS4640B Rack Mount 3739C-001, 3739C Rack Mount	
	ME7838AX Waveguide-Band System with VDI Modules	
Accessories	35WR12WF-EE – Precision Waveguide to Coax Adapter Kit, 56 GHz to 94 GHz, WR-12 to W1 (f)	
	35WR10WF-EW – Precision Waveguide to Coax Adapter Kit, 65 GHz to 110 GHz, WR-10 to W1 (f)	

ME7838EX Waveguide-Band System to 110 GHz – 3744E-EE or 3744E-EW mmWave Modules

Configuration for ME7838EX Millimeter-Wave System using 3744E-EE or 3744E-EW mmWave Modules:

Action	Part Number and Description	Additional Information
Choose and order one of the two base VectorStar models with options listed:	MS4644B VNA, 10 MHz to 40 GHz MS4644B-007 MS4644B-086 or -087 or -088 or -089	MS4644B-087 is ordered when Option 51, 61, or 62 is included. MS4644B-088 is ordered when Option 31 is included and Option 51, or 61, or 62 is excluded. MS4644B-089 is ordered when Option 31 and Option 51, 61, or 62 is included.
	MS4647B VNA, 10 MHz to 70 GHz MS4647B-007 MS4647B-086 or -087 or -088 or -089	MS4647B-087 is ordered when Options 51, 61, or 62 are included. MS4647B-088 is ordered when Option 31 is included and Option 51, 61, or 62 is excluded. MS4647B-089 is ordered when Option 31 and Option 51, 61, or 62 is included.
Order Test Set	3739C mmWave Test Set	
Choose and order Extended-E or Extended-W Band Modules:	3744A-EE, 56 GHz to 94 GHz Extended E Band module, 2 each	
	3744A-EW, 65 GHz to 110 GHz Extended W Band module, 2 each	
Add options if desired:	Option 51, or 61, or 62: MS464xB-051 – External VNA Loops MS464xB-061 – Active Measurement Suite, 2 Attenuators MS464xB-062 – Active Measurement Suite, 4 Attenuators	
	MS4640B-070 – for 70 kHz operation in base VNA MS4640B-002 – for Time Domain MS464xB-031 – Dual Source Architecture MS4640B-035 – IF Digitizer MS4640B-041 – Noise Figure MS4640B-042 – PulseView™ MS4640B-043 – DifferentialView™ MS4640B-048 – Differential Noise Figure	MS464xB-031 requires Option 88 or 89. For other available options, see “ME7838EX Broadband/Millimeter-Wave System Options”
	MS4640B-001, MS4640B Rack Mount 3739C-001, 3739C Rack Mount	
Accessories	35WR12WF-EE – Precision Waveguide to Coax Adapter Kit, 56 GHz to 94 GHz, WR-12 to W1 (f)	
	35WR10WF-EW – Precision Waveguide to Coax Adapter Kit, 65 GHz to 110 GHz, WR-10 to W1 (f)	

ME7838G Waveguide-Band System to 110 GHz - 3744A-EE or 3744A-EW mmWave Modules

Configurator for ME7838G Millimeter-Wave System using 3744A-EE or 3744A-EW mmWave Modules:

Action	Part Number and Description	Additional Information
Choose and order one of the two base VectorStar models with options listed:	MS4644B VNA, 10 MHz to 40 GHz MS4640B-007 MS4644B-082 or -083 or -084 or -085	MS4644B-083 is ordered when Options 51, 61, or 62 are included. MS4644B-084 is ordered when Option 31 is included and Options 51, 61, or 62 are excluded. MS4644B-085 is ordered when Option 31 is included and Options 51, 61, or 62 are included
	MS4647B VNA, 10 MHz to 70 GHz MS4640B-007 MS4647B-080 or -081 or -084 or -085	MS4647B-081 is ordered when Options 51, 61, or 62 are included MS4647B-084 is ordered when Option 31 is included and Options 51, 61, or 62 are excluded. MS4647B-085 is ordered when Option 31 is included and Options 51, 61, or 62 are included.
Order Test Set	3739C mmWave Test Set	
Choose and order Extended-E or Extended-W Band Modules:	3744A-EE, 56 GHz to 94 GHz Extended E Band module, 2 each	
	3744A-EW, 65 GHz to 110 GHz Extended W Band module, 2 each	
Add options if desired:	Option 51, or 61, or 62: MS464xB-051 – External VNA Loops MS464xB-061 – Active Measurement Suite, 2 Attenuators MS464xB-062 – Active Measurement Suite, 4 Attenuators	
	MS4640B-070 – for 70 kHz operation in base VNA MS4640B-002 – for Time Domain MS464xB-031 – Dual Source Architecture MS4640B-035 – IF Digitizer MS4640B-041 – Noise Figure MS4640B-042 – PulseView™ MS4640B-043 – DifferentialView™	MS464xB-031 requires Option 84 or 85. For other available options, see "ME7838G Broadband/Millimeter-Wave System Options"
	MS4640B-001, MS4640B Rack Mount 3739C-001, 3739C Rack Mount	
Accessories	35WR12WF-EE – Precision Waveguide to Coax Adapter Kit, 56 GHz to 94 GHz, WR-12 to W1 (f)	
	35WR10WF-EW – Precision Waveguide to Coax Adapter Kit, 65 GHz to 110 GHz, WR-10 to W1 (f)	

ME7838AX, ME7838EX, and ME7838D Waveguide-Band System – VDI mmWave Modules

ME7838AX, ME7838EX, and ME7838D Waveguide-band System using VDI Millimeter-Wave modules:

Action	Part Number and Description	Additional Information
Choose and order one of the three base VectorStar models with options listed:	MS4642B VNA, 70 kHz to 20 GHz MS4642B-061 or MS4642B-062 MS4642B-083 (ME7838AX and ME7838D only) MS4642B-087 or MS4642B-089 (ME7838EX only)	MS4642B-061 includes Active Device Measurements, with 2 Step Attenuators MS4642B-062 includes Active Device Measurements, with 4 Step Attenuators MS4642B-085 is ordered when Option 31 is included. (ME7838AX and ME7838D only)
	MS4644B VNA, 10 MHz to 40 GHz MS4640B-007 Receiver Offset MS4644B-082 or MS4644B-083 or -084 (ME7838AX and ME7838D only) MS4644B-086 or -087 or -088 or -089 (ME7838EX only)	MS4644B-083 (ME7838AX and ME7838D only) MS4644B-087 (ME7838EX) is ordered when Option 51, 61, or 62 are included. MS4644B-084 (ME7838AX and ME7838D only) MS4644B-088 (ME7838EX) is ordered when Option 31 is included and Option 51, 61, or 62 are excluded. MS4644B-085 (ME7838AX and ME7838D only) MS4644B-089 (ME7838EX only) is ordered when Option 31 and Option 51, 61, or 62 are included.
	MS4647B VNA, 10 MHz to 70 GHz MS4647B-007 Receiver Offset MS4647B-080 or MS4647B-081 or -085 (ME7838AX and ME7838D only) MS4644B-086 or -087 or -088 or -089 (ME7838EX only)	MS4647B-081 (ME7838AX and ME7838D only) MS4647B-087 (ME7838EX only) is ordered when Option 51, 61, or 62 are included. MS4647B-084 (ME7838AX and ME7838D only) MS4647B-088 (ME7838EX and ME7838D only) is ordered when Option 31 is included and Option 51, 61, or 62 are excluded. MS4647B-085 (ME7838AX and ME7838D only) MS4644B-089 (ME7838EX) is ordered when Option 31 and Option 51, 61, or 62 are included.
Order:	3739C mmWave Test Set	
	SM6537 Interface Cables (2) for VDI mmWave Modules	Does not include DC cable. DC supply is provided by mmWave module power supply.
Choose and order one of the two appropriate millimeter-wave module combinations:	2 each TxRx transmission and reflection millimeter-Wave Modules	Choose appropriate VDI modules. Contact Anritsu Company for ordering information.
	1 each TxRx transmission and reflection module, and 1 each Tx transmission only module	
Add options if desired:	Option 51, or 61, or 62: MS464xB-051 – External VNA Loops MS464xB-061 – Active Measurement Suite, 2 Attenuators MS464xB-062 – Active Measurement Suite, 4 Attenuators	
	MS4640B-070 – for 70 kHz operation in base VNA MS4640B-002 – for Time Domain MS464xB-031 – Dual Source Architecture MS4640B-035 – IF Digitizer MS4640B-041 – Noise Figure MS4640B-042 – PulseView™ MS4640B-043 – DifferentialView™ MS4640B-048 – Differential Noise Figure	MS464xB-031 requires Option 84 or Option 85 (ME7838AX and ME7838D only) Option 88 or 89 (ME7838EX only) For other available options, see "ME7838AX Broadband/Millimeter-Wave System Options"

ME7838G Waveguide-Band System - VDI mmWave Modules

ME7838G Waveguide-band System using VDI Millimeter-Wave modules:

Action	Part Number and Description	Additional Information
Choose and order one of the three base VectorStar models with options listed:	MS4642B VNA, 10 MHz to 20 GHz MS4640B-007 Receiver Offset MS4642B-061 or MS4642B-062 MS4642B-083 or -085	MS4642B-061 includes Active Device Measurements, with 2 Step Attenuators MS4642B-062 includes Active Device Measurements, with 4 Step Attenuators MS4642B-085 is ordered when Option 31 is included.
	MS4644B VNA, 10 MHz to 40 GHz MS4640B-007 Receiver Offset MS4644B-082 or -083 or -084 or -085	MS4644B-083 is ordered when Options 51, 61, or 62 are included. MS4644B-084 is ordered when Option 31 is included and Options 51, 61, or 62 are excluded. MS4644B-085 is ordered when Option 31 is included and Options 51, 61, or 62 are included.
	MS4647B VNA, 10 MHz to 70 GHz MS4640B-007 Receiver Offset MS4647B-080 or -081 or -084 or -085	MS4647B-081 is ordered when Options 51, 61, or 62 are included. MS4647B-084 is ordered when Option 31 is included and Options 51, 61, or 62 are excluded. MS4647B-085 is ordered when Option 31 is included and Options 51, 61, or 62 are included.
Order:	3739C mmWave Test Set	
	SM6537 Interface Cables (2) for VDI mmWave Modules	Does not include DC cable. DC supply is provided by mmWave module power supply.
Choose and order one of the two appropriate millimeter-wave module combinations:	2 each TxRx transmission and reflection millimeter-wave modules	Choose appropriate VDI modules. Contact Anritsu Company for ordering information.
	1 each TxRx transmission and reflection module, and 1 each Tx transmission only module	
Add options if desired:	Option 51, or 61, or 62: MS464xB-051 – External VNA Loops MS464xB-061 – Active Measurement Suite, 2 Attenuators MS464xB-062 – Active Measurement Suite, 4 Attenuators	
	MS4640B-070 – for 70 kHz operation in base VNA MS4640B-002 – for Time Domain MS464xB-031 – Dual Source Architecture MS4640B-035 – IF Digitizer MS4640B-041 – Noise Figure MS4640B-042 – PulseView™ MS4640B-043 – DifferentialView™	MS464xB-031 requires Option 84 or Option 85 For other available options, see "ME7838G Broadband/Millimeter-Wave System Options"

Model/Order No.	Name
	Calibration/Verification Kits
3656C	W1 (1 mm) Calibration/Verification Kit
3656C-3	W1 (1 mm) Calibration/Verification Kit, With .s1p Characterization Files
3656C-5	W1 (1 mm) Calibration Kit (ME7838AX only)
3656C-6	W1 (1 mm) Calibration Kit, With .s1p Characterization Files (ME7838AX only)
3655V	WR-15 Waveguide Calibration Kit, Without Sliding Loads
3655V-1	WR-15 Waveguide Calibration Kit, With Sliding Loads
3655E	WR-12 Waveguide Calibration Kit, Without Sliding Loads
3655E-1	WR-12 Waveguide Calibration Kit, With Sliding Loads
3655W	WR-10 Waveguide Calibration Kit, Without Sliding Loads
3655W-1	WR-10 Waveguide Calibration Kit, With Sliding Loads
3650A	SMA/3.5 mm Calibration Kit, Without Sliding Loads
3650A-1	SMA/3.5 mm Calibration Kit, With Sliding Loads
3652A	K Calibration Kit, With Pin Depth Gauge
3652A-1	K Calibration Kit, With Sliding Loads (ME7838G only)
3652A-2	K Calibration Kit, With No Pin Depth Gauge
3652A-3	K Calibration Kit, With Pin Depth Gauge and .s1p Characterization Files
3652A-4	K Calibration Kit, With .s1p Characterization Files
3654D	V Calibration Kit, With Pin Depth Gauge
3654D-1	V Calibration Kit, With Pin Depth Gauge and Sliding Loads (ME7838G only)
3654D-2	V Calibration Kit, With No Pin Depth Gauge
3654D-3	V Calibration Kit, With Pin Depth Gauge and .s1p Characterization Files
3654D-4	V Calibration Kit, With .s1p Characterization Files
3657	V Multi-Line Calibration Kit, Without Shorts
3657-1	V Multi-Line Calibration Kit, With Shorts
3659	0.8 mm Calibration/Verification Kit (ME7838D and ME7838G only)
	External Power Meters/Sensors
ML243xA	CW Power Meter, Single Input or Dual Input Recommended Power Sensors: SC7770, MA247xD, MA244xD, MA248xD, MA2400xA
ML248xB	Wideband Power Meter, Single Input or Dual Input Recommended Power Sensors: MA249xA, MA2411B
ML249xA	Pulse Power Meter, Single Input or Dual Input Recommended Power Sensors: MA249xA, MA2411B
MA24106A	USB Power Sensor, 50 MHz to 6 GHz
MA24108A	USB Power Sensor, 10 MHz to 8 GHz
MA24118A	USB Power Sensor, 10 MHz to 18 GHz
MA24126A	USB Power Sensor, 10 MHz to 26 GHz
MA24330A	USB Power Sensor, 10 MHz to 33 GHz
MA24340A	USB Power Sensor, 10 MHz to 40 GHz
MA24350A	USB Power Sensor, 10 MHz to 50 GHz
MA24507A	Power Master™ Frequency Selectable mmWave Power Analyzer, 9 kHz to 70 GHz
MA24510A	Power Master™ Frequency Selectable mmWave Power Analyzer, 9 kHz to 110 GHz Note that usage of the MA24507A or MA24510A Power Master™ sensor requires connection to two USB ports to supply needed current draw.
	Test Port Cables, Flexible, High Performance
3671W1-50-1	W1 (m) to W1 (f), 1 each, 10.0 cm (3.9 in)
3671W1-50-2	W1 (m) to W1 (f), 1 each, 13.0 cm (5.1 in)
3671W1-50-3	W1 (m) to W1 (f), 1 each, 16.0 cm (6.3 in)
3671KFS50-60	K (f) to 3.5 mm (m) cable, 60 cm (one cable)
3671KFK50-60	K (f) to K (m) cable, 60 cm (one cable)
3671KFK50-100	K (f) to K (m) cable, 1 each, 100 cm (one cable)
3671KFKF50-60	K (f) to K (f) cable, 1 each, 60 cm (once cable)
3671VFV50-60	V (f) to V (m) cable, 1 each, 60 cm (one cable)
3671VFV50-100	V (f) to V (m) cable, 1 each, 100 cm (one cable)
3671KFSF50-60	K (f) to 3.5 mm (f) cable, 1 each, 60 cm (one cable)
3671VFVF50-60	V (f) to V (f) cable, 1 each, 60 cm (one cable)
3671VFVF50-100	V (f) to V (m) cable, 1 each, 60 cm (one cable) (ME7838D and ME7838G only)
3670.850-1	0.8 mm (m) to 0.8 mm (f), 1 each, 10.0 cm (3.9 in) (ME7838D and ME7838G only)
3670.850-2	0.8 mm (m) to 0.8 mm (f), 1 each, 16.0 cm (6.3 in) (ME7838D and ME7838G only)
3670W50-1	DC to 110 GHz, W1(m) to W1(f), 10.0 cm (ME7838D only)
3670W50-2	DC to 110 GHz, W1(m) to W1(f), 16.0 cm (ME7838D only)

Model/Order No.	Name
	Adapters and More
0.8-105F	0.8 mm (f) Sparkplug Launcher Connector, DC to 145 GHz (ME7838D and ME7838G only)
0.8-105M	0.8 mm (m) Sparkplug Launcher Connector, DC to 145 GHz (ME7838D and ME7838G only)
34WV50	W1 (m) to V (m) Adapter, W1 (1 mm) to V, Coaxial
34WVF50	W1 (m) to V (f) Adapter, W1 (1 mm) to V, Coaxial
34WFV50	W1 (f) to V (m) Adapter, W1 (1 mm) to V, Coaxial
34WFVF50	W1 (f) to V (f) Adapter, W1 (1 mm) to V, Coaxial
33WW50A	W1 (m) to W1 (m) Adapter, W1 (1 mm) in-series, Coaxial
33WWF50A	W1 (m) to W1 (f) Adapter, W1 (1 mm) in-series, Coaxial
33WFWF50A	W1 (f) to W1 (f) Adapter, W1 (1 mm) in-series, Coaxial
33WG50	MA25400A Flange Interface to 1 mm (male) Adapter (ME7838G only)
33.8WG50	MA25400A Flange Interface to 0.8 mm (male) Adapter (ME7838G only)
35WR5G	MA25400A Flange Interface to WR5 Waveguide Adapter (ME7838G only)
35WR10W	WR10 to W1 (m) Adapter, W1 (1 mm) to WR10 Waveguide
35WR10WF	WR10 to W1 (f) Adapter, W1 (1 mm) to WR10 Waveguide
SC7260	WR12 to W1 (m) Adapter, W1 (1 mm) to WR12 Waveguide
SC7442	WR12 to W1 (f) Adapter, W1 (1 mm) to WR12 Waveguide
35WR15V	WR15 to V (m) Adapter, V (1.85 mm) to WR15 Waveguide
35WR15VF	WR15 to V (f) Adapter, V (1.85 mm) to WR15 Waveguide
For More Information	Refer to our Precision RF & Microwave Components Catalog for descriptions of adapters and other components.
	Miscellaneous Components
41W-3	Attenuator, DC to 110 GHz, 0.2 W, 3 dB, W1 (m) to W1 (f), 50Ω
41W-6	Attenuator, DC to 110 GHz, 0.2 W, 6 dB, W1 (m) to W1 (f), 50Ω
41W-10	Attenuator, DC to 110 GHz, 0.2 W, 10 dB, W1 (m) to W1 (f), 50Ω
W240A	Precision Power Divider, DC to 110 GHz, W1 (f) input, W1 (f) outputs, 3 resistor, 50Ω
W241A	Precision Power Splitter, DC to 110 GHz, W1 (m) input, W1 (f) outputs, 2 resistor, 50Ω
MN25110A	Precision Directional Coupler, 20 GHz to 110 GHz, W1 (f) input, W1 (f) output, W1 (f) coupled port, 50Ω (ME7838D only)
W255MF	Precision Ultra Wide Band Bias Tee, 50 kHz to 110 GHz, W1(m) input, W1 (f) output, SMC (m) bias (ME7838D only)
W255FM	Precision Ultra Wide Band Bias Tee, 50 kHz to 110 GHz, W1 (f) input, W1 (m) output, SMC (m) bias (ME7838D only)
W265	Precision Ultra Wide Band DC Block, 50 kHz to 110 GHz (ME7838D only)
W252MF	Precision Ultra Wide Band Bias Tee, 100 MHz to 110 GHz, W1 (m) input, W1 (f) output, SMC (m) bias (ME7838D only)
W252FM	Precision Ultra Wide Band Bias Tee, 100 MHz to 110 GHz, W1 (f) input, W1 (m) output, SMC (m) bias (ME7838D only)
33GG50	MA25400 Flange Interface 50 mm Thru Line (male-male)
	Accessories
SC8215	Kelvin Bias Tee, low frequency limit: 70 kHz, Max Voltage: 16 VDC, Max Current: 100 mA
SC7287	Kelvin Bias Tee, low frequency limit: 100 kHz, Max Voltage: 50 VDC, Max Current: 500 mA
SC8218	Triax (m) to SMC (f) Cable, (Inner-shield floating at SMC end), 1.5 m (60 in) long two (2) needed per Kelvin Bias Tee
SM6494	System floor console. Includes larger size writing table
2100-1-R	GPIB cable, 1 m (39 in) long
2100-2-R	GPIB cable, 2 m (79 in) long
2100-4-R	GPIB cable, 4 m (157 in) long
806-206-R	Flexible Coaxial Cable, DC to 70 GHz, 24 in (61 cm), V (m) - V (f), 50Ω (ME7838AX and ME7838D and ME7838G only)
806-209-R	Flexible Coaxial Stable Cable, DC to 70 GHz, 36in (91.5 cm), V (m) - V (f), 50Ω (ME7838AX and ME7838D and ME7838G only)
806-396-R	Flexible Phase Stable Coaxial Cable, DC to 70 GHz, 36 in (91.5 cm), V (m) to V (f), 50Ω (ME7838G only)
01-201	Torque Wrench (for tightening male devices), 8 mm (5/16 in), 0.9 N·m (8 lbf·in) for SMA, 3.5 mm, 2.4 mm, K, and V connectors
01-202	Universal Test Port Connector Wrench
01-203	Torque Wrench (for tightening the VNA test ports to female devices) 20.6 mm (13/16 in), 0.9 N·m (8 lbf·in)
01-204	Anritsu Stainless Steel Connector Wrench, circular, open-ended for SMA, 3.5 mm, 2.4 mm, K and V connectors
01-504	Torque wrench (for tightening male devices) 6 mm, 0.45 N-m (4 lbf-in) for 1.0 mm and 0.8 mm connectors
01-524	Low profile Torque Wrench (for tightening male devices), 6 mm, 0.45 N-m (lbf-in), 126 mm long for 1.0 mm and 0.8 mm connectors
01-529-R	Torque Wrench, 4 mm (5/32 in), 0.17 N·m (1.5 lbf·in) (for tightening the test and reference IF connectors on the mmWave modules)
	Additional Accessories
	DC-220 GHz probes available from MPI Corporation:
2000-1972-R	T220A-GSG050, 220 GHz Probe, 50 µm pitch (ME7838G only)
2000-1973-R	T220A-GSG075, 220 GHz Probe, 75 µm pitch (ME7838G only)
2000-1974-R	T220A-GSG100, 220 GHz Probe, 100 µm pitch (ME7838G only)

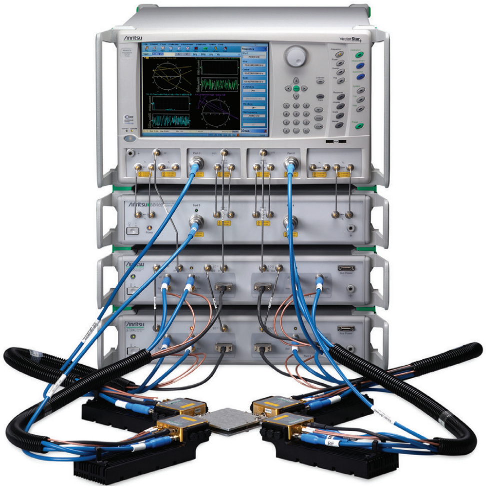
VectorStar™ Broadband Vector Network Analyzers

ME7838A4X/E4X/D4/G4 4-Port Broadband Vector Network Analyzers

4-Port Broadband VNA System, 70 kHz to 110/125 GHz (ME7838A4X/E4X), to 145 (150) GHz (ME7838D4), to 220 GHz (ME7838G4)
4-Port Millimeter Waveguide VNA System, 50 GHz to 1.1 THz

Remote Control
GPIB | **Ethernet**

High Performance, Broadband Network Analysis Solutions



Broadband VNA System 70 kHz to 110/125, 145/220 GHz

The VectorStar ME7838A4X/E4X/D4/G4 broadband systems provide high-performance 4-port measurements utilizing compact mmWave modules with industry-best calibration stability. While other broadband systems continue to provide raw performance with negative directivity in critical frequency bands, the ME7838 series, which includes the 4-port systems, is the only broadband system with positive raw directivity in all bands. The result is better calibration and measurement stability with significantly longer time between calibrations for accurate measurements and improved productivity. The ME7838D4 takes high-performance 4-port broadband measurements to a new level by incorporating the Anritsu MA25400A mmWave module. The MA25400A module combines Anritsu developed Nonlinear Transmission Line (NLTL) technology in a small, compact high-performance mmWave module with a MPI TITAN T220 probe for on-wafer measurements to 220 GHz.
All VectorStar broadband systems include an RF VNA architecture using bridges instead of couplers to extend frequencies down to the RF bands (operational to 40 kHz) for near-DC analysis with excellent dynamic range.

VectorStar 4 Port Broadband VNA ME7838E4X/A4X/D4/G4

The VectorStar ME7838E4X, ME7838A4X, ME7838D4, and ME7838G4 series offer the widest available 4-port single sweep measurements from 70 kHz to 110, 125, 145, and 220 GHz with mmWave bands up to 1.1 THz.

Broadband/Millimeter-Wave System Features

- The ME7838E4X 4-port system sweeps from 70 kHz to 110 GHz
- The ME7838A4X 4-port system sweeps from 70 kHz to 125 GHz
- The ME7838D4 4-port system sweeps from 70 kHz to 145 GHz
- The ME7838G4 4-port system sweeps from 70 kHz to 220 GHz
- All systems may be configured to include banded millimeter-wave modules up to 1.1 THz
- Industry-best calibration and measurement stability: 0.1 dB vs 0.6 dB over 24 hrs
- All systems also supports the 3744x-Rx receiver for noise figure measurements to 125 GHz
- Compact, lightweight mmWave modules offer low cost installation with industry-best performance

Definitions

All specifications and characteristics apply under the following conditions, unless otherwise stated:

Warm-Up Time	After 90 minutes of warm-up time, where the instrument is left in the ON state.
Temperature Range	Over the 25°C±5°C temperature range.
Error Corrected Specifications	For error-corrected specifications, over 23°C±3°C, with <1°C variation from calibration temperature. For error-corrected specifications are warranted and include guard bands, unless otherwise stated.
Typical Performance	"Typical" specifications describe expected, but not warranted, performance based on sample testing. Typical performance indicates the measured performance of an average unit and do not guarantee the performance of any individual product. "Typical" specifications do not account for measurement uncertainty and are shown in parenthesis, such as (–102 dB), or noted as Typical.
User Cables/Adapters	Specifications do not include effects of any user cables attached to the instrument.
Discrete Spurious Responses	Specifications may exclude discrete spurious responses.
Internal Reference Signal	All specifications apply with internal 10 MHz Crystal Oscillator Reference Signal.
Characteristic Performance	Characteristic performance indicates a performance designed-in and verified during the design phase. It does include guard-bands and is not covered by the product warranty.
Below 300 kHz	All uncertainties below 300 kHz are typical.
Recommended Calibration Cycle	12 months
Interpolation Mode	All specifications are with Interpolation Mode Off.
Specifications Subject to Change	All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu web site at www.anritsu.com.

Specifications for Broadband Configuration

System and Receiver Dynamic Range, Noise Floor

(Excludes localized spurious responses and crosstalk)

System Dynamic Range	System dynamic range is measured as the difference between maximum port power and the RMS noise floor in a 10 Hz bandwidth and no averaging (ports terminated).
Noise Floor	Noise floor is calculated as the difference between maximum rated port power and system dynamic range.
Receiver Dynamic Range	Receiver Dynamic Range is calculated as the difference between the receiver compression level and the noise floor at the appropriate port.
Normalizing Measurement	Normalizing measurement made with a through line connection, with its effects compensated for. The cables between the VNA and the 3743AX modules (ME7838A4X and ME7838E4X only) MA25400A modules (ME7838D4 only) are assumed to be the 806-206 1.85 mm cable (61 cm, 24 in long) or the 806-209 1.85 mm cable (91 cm, 36 in long). All figures are typical.

Frequency Range	System Dynamic Range (dB)				Receiver Dynamic Range (dB)*1				Noise Floor (dBm)*1			
	ME7838D4 Option 51 *1, *2	ME7838D4 Options 31/51 *1, *2	ME7838G4 Option 51 *1, *3	ME7838G4 Options 31/51 *1, *3	ME7838D4 Option 51	ME7838D4 Option 62	ME7838G4 Option 51*1	ME7838G4 Option 62*1	ME7838D4 Option 51	ME7838D4 Option 62	ME7838G4 Option 51	ME7838G4 Option 62
70 to 300 kHz	76	78	76	78	78	79	78	79	–72	–73	–72	–73
>0.3 to 2 MHz	86	88	86	88	94	94	92	93	–82	–81	–82	–81
>2 to 10 MHz	100	102	100	102	106	105	104	104	–94	–92	–94	–92
>0.01 to 2.5 GHz	111	115	111	115	115	115	114	114	–103	–101	–103	–101
>2.5 to 24 GHz	96	97	96	97	114	114	113	113	–102	–100	–102	–100
>24 to 54 GHz	90	91	90	91	114	113	115	113	–104	–103	–105	–103
>54 to 60 GHz	110	110	112	112	124	124	126	126	–114	–114	–116	–116
>60 to 65 GHz												
>60 to 67 GHz	110	110	109	109	123	123	122	122	–113	–113	–112	–112
>65 to 80 GHz												
>67 to 80 GHz	108	108	109	109	121	121	122	122	–111	–111	–112	–112
>80 to 85 GHz	106	106	106	106	123	123	123	123	–113	–113	–113	–113
>85 to 90 GHz	106	106	106	106	122	122	122	122	–112	–112	–112	–112
>90 to 95 GHz	106	106	106	106	121	121	122	122	–111	–111	–112	–112
>95 to 100 GHz												
>95 to 105 GHz	106	106	106	106	121	121	122	122	–111	–111	–112	–112
>100 to 110 GHz												
>105 to 110 GHz	109	109	106	106	125	125	122	122	–115	–115	–112	–112
>110 to 120 GHz*2	108	108	109	109	118	118	123	123	–111	–111	–116	–116
>120 to 125 GHz*2	104	104	109	109	116	116	123	123	–109	–109	–116	–116
>125 to 140 GHz	92	92	100	100	109	109	122	122	–102	–102	–115	–115
>140 to 145 GHz	94	94			107	107			–100	–100		
>140 to 150 GHz			100	100			122	122			–115	–115
>145 to 150 GHz*4	94	94			107	107			–100	–100		
>150 to 160 GHz			97	97			119	119			–112	–112
>160 to 180 GHz			102	102			122	122			–115	–115
>180 to 200 GHz			103	103			123	123			–116	–116
>200 to 220 GHz			98	98			120	120			–113	–113
>220 to 226 GHz			85	85			108	108			–103	–103

*1: Excludes localized spurious responses and crosstalk.

*2: 110 GHz to 125 GHz frequency range is available as operational.

*3: Table represents dynamic range with Ports 1 and/or 3 driving.
With Port 2 driving, dynamic range may be up to 4 dB (ME7838D4) 7 dB (ME7838G4) lower in the 2.5-54 GHz band.
With Port 4 driving, dynamic range may be up to 3 dB higher in the 24 (2.5 ME7838G4)-54 GHz band.

*4: 145 GHz to 150 GHz available as operational.

Frequency Range	System Dynamic Range (dB)*1, *2								Receiver Dynamic Range (dB)*1							
	ME7838A4X Option 51	ME7838A4X Options 61/62	ME7838A4X Options 31/51	ME7838A4X Options 31/61/62	ME7838E4X Option 51	ME7838E4X Options 61/62	ME7838E4X Options 31/51	ME7838E4X Options 31/61/62	ME7838A4X Option 51	ME7838A4X Options 61/62	ME7838A4X Options 31/51	ME7838A4X Options 31/61/62	ME7838E4X Option 51	ME7838E4X Options 61/62	ME7838E4X Options 31/51	ME7838E4X Options 31/61/62
70 to 300 kHz	82	82	84	84	82	82	84	84	82	83	82	82	82	83	82	82
>0.3 to 2 MHz	92	92	94	94	92	92	94	94	98	100	98	99	98	100	98	99
>2 to 10 MHz	100	100	102	102	100	100	102	102	107	108	106	107	107	108	106	107
>0.01 to 2.5 GHz	108	108	111	110	108	108	111	110	115	117	115	117	115	117	115	117
>2.5 to 10 GHz	107	104	110	104	107	104	110	104	122	122	124	121	122	122	124	121
>10 to 24 GHz	98	92	102	95	98	92	102	95	117	115	120	116	117	115	120	116
>24 to 40 GHz	95	90	100	95	95	90	100	95	115	112	119	115	115	112	119	115
>40 to 54 GHz	94	87	99	93	94	87	99	93	121	117	122	118	121	117	122	118
>54 to 60 GHz	107	107	107	107	107	107	107	107	119	119	119	119	119	119	119	119
>60 to 65 GHz	107	107	107	107	107	107	107	107	119	119	119	119	119	119	119	119
>65 to 70 GHz									122	122	122	122	122	122	122	122
>65 to 80 GHz	106	106	106	106	106	106	106	106								
>70 to 80 GHz									120.5	120.5	120.5	120.5	120.5	120.5	120.5	120.5
>80 to 90 GHz	104	104	104	104	104	104	104	104	1205	120.5	120.5	120.5	120.5	120.5	120.5	120.5
>90 to 100 GHz	104	104	104	104	104	104	104	104	116.5	116.5	116.5	116.5	116.5	116.5	116.5	116.5
>100 to 110 GHz	104	104	104	104	104	104	104	104	120.5	120.5	120.5	120.5	120.5	120.5	120.5	120.5
>110 to 115 GHz	103	103	103	103					120	120	120	120				
>115 to 120 GHz	95	95	95	95					103	103	103	103				
>120 to 125 GHz	95	95	95	95					103	103	103	103				

*1: Option 51 is the minimum required option for 4-port baseband VNAs.

*2: Table represents dynamic range with Ports 1 and/or 3 driving. With Port 2 driving, dynamic range may be up to 7 dB lower in the 2.5-54 GHz bands. With Port 4 driving, dynamic range may be up to 3 dB higher in the 2.5-54 GHz bands.

Test Port Power

Port power control is provided by the base VNA for frequencies below 54 GHz, and by the 3743AX mmWave module for frequencies greater than 54 GHz. Port Power and Power Range tables represent powers available at Ports 1 and 3. Max Power may be up to 4 dB lower on Port 2 in the 24-54 GHz band (only for option 31 systems). Max Power may be up to 3 dB higher on Port 4 in the 24-54 GHz band. All typical.

Frequency Range	Port Power*1				Port Power*1 W/MS4647B Option 31 Dual Source Architecture			
	Max Power ME7838D4 Option 51	Max Power ME7838D4 Option 62	Max Power ME7838G4 Option 51	Max Power ME7838G4 Option 62*2	Max Power ME7838D4 Options 31/51	Max Power ME7838D4 Options 31/62	Max Power ME7838G4 Options 31/51	Max Power ME7838G4 Options 31/62
70 to 300 kHz	4	6	4	3	6	8	6	5
>0.3 to 2 MHz	4	6	4	3	6	8	6	5
>2 to 10 MHz	6	6	6	5	8	8	8	6
>0.01 to 2.5 GHz	8	6	8	7	12	10	12	9
>2.5 to 24 GHz	–6	–8	–6	–8	–5	–7	–5	–7
>24 to 54 GHz	–14	–16	–15	–18	–13	–15	–14	–17
>54 to 60 GHz	–4	–4	–4	–4	–4	–4	–4	–4
>60 to 65 GHz								
>60 to 67 GHz	–3	–3	–3	–3	–3	–3	–3	–3
>65 to 80 GHz								
>67 to 80 GHz	–3	–3	–3	–3	–3	–3	–3	–3
>80 to 85 GHz	–7	–7	–7	–7	–7	–7	–7	–7
>85 to 90 GHz	–6	–6	–6	–6	–6	–6	–6	–6
>90 to 95 GHz	–5	–5	–6	–6	–5	–5	–6	–6
>95 to 100 GHz								
>95 to 105 GHz	–5	–5	–6	–6	–5	–5	–6	–6
>100 to 110 GHz								
>105 to 110 GHz	–6	–6	–6	–6	–6	–6	–6	–6
>110 to 120 GHz*3	–3	–3	–7	–7	–3	–3	–7	–7
>120 to 125 GHz*3	–5	–5	–7	–7	–5	–5	–7	–7
>125 to 140 GHz	–10	–10	–15	–15	–10	–10	–15	–15
>140 to 145 GHz	–6	–6			–6	–6		
>140 to 150 GHz			–15	–15			–15	–15
>145 to 150 GHz*3	–6	–6			–6	–6		
>150 to 160 GHz			–15	–15			–15	–15
>160 to 180 GHz			–13	–13			–13	–13
>180 to 200 GHz			–13	–13			–13	–13
>200 to 220 GHz			–15	–15			–15	–15
>220 to 226 GHz			–18	–18			–18	–18

*1: Using the 806–206 1.85 mm (61 cm, 24 in long) test port cables between the VNA and the MA25400A mmWave modules.

*2: Use this column also for Options 51 and 61 although the performance between 10 MHz and 54 GHz will characteristically be better by 1 dB or more for Option 51, and will characteristically be better by 1 dB or more for Option 61 (with port 1 driving and port 2 receiving).

*3: 145 GHz to 150 GHz (ME7838D4) available as operational.

Frequency Range	Port Power*1				Port Power*1 W/MS4647B Option 31 Dual Source Architecture			
	Max Power ME7838A4X Option 51	Max Power ME7838A4X Options 61 or 62	Max Power ME7838E4X Option 51	Max Power ME7838E4X Options 61 or 62	Max Power ME7838A4X Options 31/51	Max Power ME7838A4X Options 31/61 or 62	Max Power ME7838E4X Options 31/51	Max Power ME7838E4X Options 31/61 or 62
70 to 300 kHz	6	5	6	5	8	8	8	8
>0.3 to 2 MHz	6	5	6	5	8	8	8	8
>2 to 10 MHz	5	5	5	5	8	8	8	8
>0.01 to 2.5 GHz	5	5	5	5	8	7	8	7
>2.5 to 10 GHz	–3	–4	–3	–4	–2	–3	–2	–3
>10 to 24 GHz	–7	–9	–7	–9	–6	–7	–6	–7
>24 to 40 GHz	–10	–12	–10	–12	–9	–10	–9	–10
>40 to 54 GHz	–17	–20	–17	–20	–13	–15	–13	–15
>54 to 60 GHz	–2	–2	–2	–2	–2	–2	–2	–2
>60 to 65 GHz	–2	–2	–2	–2	–2	–2	–2	–2
>65 to 70 GHz	–6	–6	–6	–6	–6	–6	–6	–6
>70 to 80 GHz	–4.5	–4.5	–4.5	–4.5	–4.5	–4.5	–4.5	–4.5
>80 to 90 GHz	–6.5	–6.5	–6.5	–6.5	–6.5	–6.5	–6.5	–6.5
>90 to 100 GHz	–2.5	–2.5	–2.5	–2.5	–2.5	–2.5	–2.5	–2.5
>100 to 110 GHz	–6.5	–6.5	–6.5	–6.5	–6.5	–6.5	–6.5	–6.5
>110 to 115 GHz	–7	–7			–7	–7		
>115 to 120 GHz	–3	–3			–3	–3		
>120 to 125 GHz	–3	–3			–3	–3		

*1: Using the 806–206-R 1.85 mm (61 cm, 24 in long) test port cables between the VNA and the 3743AX mmWave modules.

Power Range, Accuracy, Linearity and Resolution

Accuracy is defined at –10 dBm or max rated power, whichever is lower. Linearity is defined as the incremental error between the accuracy test power level and 5 dB below. Typical.

Frequency Range	Range (dB)				Accuracy*1 (dB)	Resolution (dB)
	ME7838A4X Option 51	ME7838A4X Option 61 or 62	ME7838A4X Option 31/51	ME7838A4X Option 31/61 or 62		
70 kHz to 300 kHz	6 to –25	5 to –85	8 to –25	8 to –85	±0.3	0.01
>0.3 MHz to 2 MHz	6 to –25	5 to –85	8 to –25	8 to –85	±0.3	0.01
>2 MHz to 10 MHz	5 to –25	5 to –85	8 to –25	8 to –85	±0.3	0.01
>0.01 GHz to 2.5 GHz	5 to –25	5 to –85	8 to –25	7 to –85	±0.4	0.01
>2.5 GHz to 10 GHz					±0.5	0.01
>2.5 GHz to 24 GHz	–3 to –25	–4 to –85	–2 to –25	–3 to –85		
>10 GHz to 24 GHz	–7 to –25	–9 to –85	–6 to –25	–7 to –85	±0.5	0.01
>24 GHz to 40 GHz	–10 to –30	–12 to –90	–9 to –30	–10 to –90	±0.9	0.01
>40 GHz to 54 GHz	–17 to –30	–20 to –90	–13 to –30	–15 to –90	±0.9	0.01
>54 GHz to 60 GHz	–2 to –55	–2 to –55	–2 to –55	–2 to –55	±1.3	0.01
>60 GHz to 65 GHz	–2 to –55	–2 to –55	–2 to –55	–2 to –55	±1.3	0.01
>65 GHz to 70 GHz	–6 to –55	–6 to –55	–6 to –55	–6 to –55		
>65 GHz to 80 GHz					±1.3	0.01
>70 GHz to 80 GHz	–4.5 to –55	–4.5 to –55	–4.5 to –55	–4.5 to –55		
>80 GHz to 90 GHz	–6.5 to –55	–6.5 to –55	–6.5 to –55	–6.5 to –55	±1.7	0.01
>90 GHz to 100 GHz	–2.5 to –55	–2.5 to –55	–2.5 to –55	–2.5 to –55	±2.3	0.01
>100 GHz to 110 GHz	–6.5 to –55	–6.5 to –55	–6.5 to –55	–6.5 to –55	±2.3	0.01
>110 GHz to 115 GHz	–7 to –55	–7 to –55	–7 to –55	–7 to –55	±2.3	0.01
>115 GHz to 120 GHz	–3 to –40	–3 to –40	–3 to –40	–3 to –40	±2.3	0.01
>120 GHz to 125 GHz	–3 to –40	–3 to –40	–3 to –40	–3 to –40	±3.0	0.01

Frequency Range	Range (dB)				Accuracy*1 (dB)	Resolution (dB)
	ME7838E4X Option 51	ME7838E4X Option 61 or 62	ME7838E4X Option 31/51	ME7838E4X Option 31/61 or 62		
70 kHz to 300 kHz	6 to –25	5 to –85	8 to –25	8 to –85	±0.3	0.01
>0.3 MHz to 2 MHz	6 to –25	5 to –85	8 to –25	8 to –85	±0.3	0.01
>2 MHz to 10 MHz	5 to –25	5 to –85	8 to –25	8 to –85	±0.3	0.01
>0.01 GHz to 2.5 GHz	5 to –25	5 to –85	8 to –25	7 to –85	±0.4	0.01
>2.5 GHz to 10 GHz	–3 to –25	–4 to –85	–2 to –25	–3 to –85	±0.5	0.01
>10 GHz to 24 GHz	–7 to –25	–9 to –85	–6 to –25	–7 to –85	±0.5	0.01
>24 GHz to 40 GHz	–10 to –30	–12 to –90	–9 to –30	–10 to –90	±0.9	0.01
>40 GHz to 54 GHz	–17 to –30	–20 to –90	–13 to –30	–15 to –90	±0.9	0.01
>54 GHz to 60 GHz	–2 to –55	–2 to –55	–2 to –55	–2 to –55	±1.3	0.01
>60 GHz to 65 GHz	–2 to –55	–2 to –55	–2 to –55	–2 to –55	±1.3	0.01
>65 GHz to 70 GHz	–6 to –55	–6 to –55	–6 to –55	–6 to –55		
>65 GHz to 80 GHz					±1.3	0.01
>70 GHz to 80 GHz	–4.5 to –55	–4.5 to –55	–4.5 to –55	–4.5 to –55		
>80 GHz to 90 GHz	–6.5 to –55	–6.5 to –55	–6.5 to –55	–6.5 to –55	±1.7	0.01
>90 GHz to 100 GHz	–2.5 to –55	–2.5 to –55	–2.5 to –55	–2.5 to –55	±2.3	0.01
>100 GHz to 110 GHz	–6.5 to –55	–6.5 to –55	–6.5 to –55	–6.5 to –55	±2.3	0.01

Frequency Range	Power Range (dBm)		Accuracy (dB)*	Linearity (dB)	Resolution (dB)
	ME7838D4 Option 51	ME7838D4 Option 62			
70 kHz to 300 kHz	4 to –25	6 to –85	±1.5	±1.5	0.01
>0.3 MHz to 2 MHz	4 to –25	6 to –85	±1.5	±1.5	0.01
>2 MHz to 10 MHz	6 to –25	6 to –85	±1.5	±1.5	0.01
>0.01 GHz to 2.5 GHz	8 to –25	6 to –85	±1.0	±1.0	0.01
>2.5 GHz to 24 GHz	–6 to –25	–8 to –85	±1.0	±1.0	0.01
>24 GHz to 54 GHz	–14 to –30	–16 to –90	±1.5	±1.0	0.01
>54 GHz to 60 GHz	–4 to –55	–4 to –55	±2.0	±1.5	0.01
>60 GHz to 67 GHz	–3 to –55	–3 to –55	±2.0	±1.5	0.01
>67 GHz to 80 GHz	–3 to –55	–3 to –55	±2.0	±1.5	0.01
>80 GHz to 85 GHz	–7 to –55	–7 to –55	±2.0	±1.5	0.01
>85 GHz to 90 GHz	–6 to –55	–6 to –55	±2.0	±1.5	0.01
>90 GHz to 95 GHz	–5 to –55	–5 to –55	±2.0	±1.5	0.01
>95 GHz to 105 GHz	–5 to –55	–5 to –55	±3.0	±2.0	0.01
>105 GHz to 110 GHz	–6 to –55	–6 to –55	±3.0	±2.0	0.01
>110 GHz to 120 GHz	–3 to –55	–3 to –55	±4.0	±3.0	0.01
>120 GHz to 125 GHz	–5 to –55	–5 to –55	±4.0	±3.0	0.01
>125 GHz to 140 GHz	–10 to –50	–10 to –50	±5.0	±4.0	0.01
>140 GHz to 145 GHz	–6 to –50	–6 to –50	±5.0	±4.0	0.01

*: Accuracy does not include effects of the MN4697B test set (affects <54 GHz).

Frequency Range	Power Range (dBm)		Accuracy (dB)	Linearity (dB)	Resolution (dB)
	ME7838G4 Option 51	ME7838G4 Option 62			
70 kHz to 300 kHz	–25 to 4	–85 to 3	±1.5	±1.5	0.01
>0.3 MHz to 2 MHz	–25 to 4	–85 to 3	±1.5	±1.5	0.01
>2 MHz to 10 MHz	–25 to 6	–85 to 5	±1.5	±1.5	0.01
>0.01 GHz to 2.5 GHz	–25 to 8	–85 to 7	±1.5	±1.0	0.01
>2.5 GHz to 24 GHz	–25 to –6	–85 to –8	±1.5	±1.0	0.01
>24 GHz to 54 GHz	–30 to –15	–90 to –18	±1.5	±1.0	0.01
>54 GHz to 60 GHz	–55 to –4	–55 to –4	±2.0	±1.5	0.01
>60 GHz to 67 GHz	–55 to –3	–55 to –3	±2.0	±1.5	0.01
>67 GHz to 80 GHz	–55 to –3	–55 to –3	±2.0	±1.5	0.01
>80 GHz to 85 GHz	–55 to –7	–55 to –7	±2.0	±1.5	0.01
>85 GHz to 90 GHz	–55 to –6	–55 to –6	±2.0	±1.5	0.01
>90 GHz to 95 GHz	–55 to –6	–55 to –6	±2.0	±1.5	0.01
>95 GHz to 105 GHz	–55 to –6	–55 to –6	±3.0	±2.0	0.01
>105 GHz to 110 GHz	–55 to –6	–55 to –6	±3.0	±2.0	0.01
>110 GHz to 120 GHz	–55 to –7	–55 to –7	±4.0	±3.0	0.01
>120 GHz to 125 GHz	–55 to –7	–55 to –7	±4.0	±3.0	0.01
>125 GHz to 140 GHz	–50 to –15	–50 to –15	±4.0	±4.0	0.01
>140 GHz to 150 GHz	–50 to –15	–50 to –15	±4.0	±4.0	0.01
>150 GHz to 160 GHz	–50 to –15	–50 to –15	±4.0	±4.0	0.01
>160 GHz to 180 GHz	–50 to –13	–50 to –13	±4.0	±4.0	0.01
>180 GHz to 200 GHz	–50 to –13	–50 to –13	±4.0	±4.0	0.01
>200 GHz to 220 GHz	–50 to –15	–50 to –15	±4.0	±4.0	0.01
>220 GHz to 226 GHz	–50 to –18	–50 to –18	±5.0	±4.0	0.01

Receiver Compression*1

Receiver compression point is defined as the port power level beyond which the response may be compressed more than 0.2 dB relative to normalization level. 10 Hz IF bandwidth used to remove trace noise effects. All typical.

Frequency	ME7838A4X Option 51	ME7838A4X Option 61/62	ME7838D4 Option 51	ME7838D4 Option 62	ME7838G4 Option 51	ME7838G4 Option 62
70 kHz to 300 kHz	6	6	6	6	6	6
>0.3 MHz to 10 MHz	12	13	12	13	10	12
>0.01 GHz to 24 GHz	12	14	12	14	11	13
>24 GHz to 110 GHz*2			10	10	10	10
>24 GHz to 115 GHz	10	10				
>110 GHz to 125 GHz*2			7	7	7	7
>115 GHz to 125 GHz	5	5				
>125 GHz to 145 GHz			7	7	7	7
>145 GHz to 220 GHz					7	7
>220 GHz to 226 GHz					5	5

*1: Using the 806–206-R 1.85 mm (61 cm, 24 in long) (91.5 cm, 36 in long, ME7838G4 only) test port cables between the VNA and the 3743AX mmWave modules.
*2: 110 GHz to 125 GHz frequency range is available as operational (ME7838A4X only).

Frequency	ME7838E4X Option 51	ME7838E4X Option 61/62
70 kHz to 300 kHz	6	6
>0.3 MHz to 10 MHz	12	13
>0.01 GHz to 24 GHz	12	14
>24 GHz to 110 GHz	10	10

*1: Using the 806–206 1.85 mm (61 cm, 24 in long) test port cables between the VNA and the 3743EX mmWave modules.

High Level Noise

Noise measured at 1 kHz IF bandwidth, at maximum power or compression limit (whichever is less), with through transmission. RMS. Typical.

Frequency Range	System Dynamic Range (dB)							
	Magnitude (dB)				Phase (deg.)			
	ME7838A4X	ME7838E4X	ME7838D4	ME7838G4	ME7838A4X	ME7838E4X	ME7838D4	ME7838G4
70 kHz to 500 kHz	<0.04	<0.04	<0.04	<0.04	<0.3	<0.3	<0.4	<0.4
>0.5 MHz to 2 MHz	<0.009	<0.009	<0.006	<0.006	<0.05	<0.05	<0.06	<0.06
>2 MHz to 10 MHz	<0.0055	<0.0055	<0.006	<0.006	<0.045	<0.045	<0.06	<0.06
>0.01 GHz to 10 GHz	<0.0055	<0.0055			<0.055	<0.055		
>0.01 GHz to 24 GHz			<0.006	<0.006			<0.06	<0.06
>10 GHz to 24 GHz	<0.0055	<0.0055			<0.0065	<0.065		
>24 GHz to 54 GHz	<0.0055	<0.0055	<0.005	<0.005	<0.0065	<0.065	<0.06	<0.06
>54 GHz to 80 GHz	<0.0045	<0.0045	<0.005	<0.005	<0.075	<0.075	<0.06	<0.06
>80 GHz to 110 GHz	<0.006	<0.006	<0.008	<0.008	<0.105	<0.105	<0.09	<0.09
>110 GHz to 120 GHz*	<0.007		<0.008	<0.008	<0.115		<0.09	<0.09
>120 GHz to 125 GHz*	<0.0075		<0.011	<0.011	<0.13		<0.11	<0.11
>125 GHz to 140 GHz			<0.016	<0.016			<0.16	<0.16
>140 GHz to 145 GHz			<0.016	<0.016			<0.16	<0.16

*: 110 GHz to 125 GHz frequency range is available as operational (ME7838A4X only).

Frequency Range	1 kHz IF bandwidth		100 Hz IF bandwidth	
	ME7838G4 Magnitude (dB)	ME7838G4 Phase (deg.)	ME7838G4 Magnitude (dB)	ME7838G4 Phase (deg.)
70 kHz to 500 kHz	<0.04	<0.4	<0.02	<0.2
>0.5 MHz to 2 MHz	<0.006	<0.06	<0.004	<0.04
>2 MHz to 10 MHz	<0.006	<0.06	<0.004	<0.04
>0.01 GHz to 2.5 GHz	<0.006	<0.06	<0.004	<0.04
>2.5 GHz to 24 GHz	<0.007	<0.07	<0.004	<0.04
>24 GHz to 54 GHz	<0.009	<0.09	<0.007	<0.07
>54 GHz to 80 GHz	<0.008	<0.09	<0.006	<0.06
>80 GHz to 110 GHz	<0.008	<0.09	<0.006	<0.06
>110 GHz to 120 GHz	<0.008	<0.09	<0.006	<0.06
>120 GHz to 125 GHz	<0.011	<0.11	<0.006	<0.07
>125 GHz to 140 GHz	<0.017	<0.17	<0.006	<0.07
>140 GHz to 150 GHz	<0.017	<0.17	<0.006	<0.07
>150 GHz to 160 GHz	<0.022	<0.22	<0.01	<0.1
>160 GHz to 180 GHz	<0.030	<0.25	<0.009	<0.09
>180 GHz to 200 GHz	<0.030	<0.25	<0.009	<0.09
>200 GHz to 220 GHz	<0.07	<0.5	<0.04	<0.3
>220 GHz to 226 GHz	<0.2	<0.8	<0.05	<0.5

Stability

Rationed measurement at maximum leveled power with nominally a full reflect or a stable thru over the normal specified temperature range. Typical.

Frequency Range	Magnitude (dB/°C)			Phase (deg./°C)		
	ME7838A4X	ME7838D4	ME7838G4	ME7838A4X	ME7838D4	ME7838G4
70 kHz to 300 kHz	<0.015	<0.015	<0.015	<0.15	<0.15	<0.15
>0.3 MHz to 2 MHz	<0.015	<0.015	<0.015	<0.1	<0.1	<0.1
>2 MHz to 10 MHz	<0.02	<0.02	<0.02	<0.1	<0.1	<0.1
>0.01 GHz to 2.5 GHz	<0.02	<0.02	<0.02	<0.08	<0.05	<0.05
>2.5 GHz to 30 GHz	<0.02	<0.02	<0.02	<0.09	<0.09	<0.1
>30 GHz to 54 GHz	<0.02	<0.01	<0.02	<0.1	<0.07	<0.07
>54 GHz to 80 GHz	<0.015	<0.015	<0.015	<0.1	<0.1	<0.1
>80 GHz to 110 GHz	<0.015	<0.015	<0.015	<0.15	<0.15	<0.15
>110 GHz to 120 GHz*	<0.02	<0.02	<0.02	<0.2	<0.2	<0.2
>120 GHz to 125 GHz*	<0.04	<0.025	<0.025	<0.25	<0.2	<0.2
>125 GHz to 140 GHz		<0.03	<0.025		<0.35	<0.3
>140 GHz to 145 GHz		<0.04			<0.5	
>140 GHz to 150 GHz			<0.025			<0.5
>150 GHz to 160 GHz			<0.04			<0.5
>160 GHz to 180 GHz			<0.04			<0.5
>180 GHz to 200 GHz			<0.04			<0.5
>200 GHz to 220 GHz			<0.04			<0.5
>220 GHz to 226 GHz			<0.06			<0.7

*: 110 GHz to 125 GHz frequency range is available as operational (ME7838A4X only).

Frequency Resolution, Accuracy and Stability

Resolution	Accuracy	Stability
1 Hz	±5 × 10^{-7} Hz/Hz (at time of calibration)	<5 × 10^{-9}/°C over 0°C to 50°C temperature <1 × 10^{-9}/day aging, instrument on

Uncorrected (Raw) Port Characteristics

Typical performance

Frequency Range	System Dynamic Range (dB)						
	ME7838A4X Directivity (dB)	ME7838A4X Port Match (dB)	ME7838E4X Directivity (dB)	ME7838E4X Port Match (dB)	ME7838D4 Directivity (dB)	ME7838D4 Port Match (dB)	ME7838G4 Port Match (dB)
70 kHz to 0.01 MHz	10^{*1}	8	10^{*1}	8	10^{*1}	8	8
>0.1 MHz to <2.5 MHz	9^{*1}	10	9^{*1}	10	9^{*1}	10	10
>2.5 MHz to 30 MHz^{*2}	5^{*1}	12	5^{*1}	12	5^{*1}	12	10
>30 GHz to 40 GHz^{*2}	5^{*1}	5	5^{*1}	5	5^{*1}	10	10
>40 GHz to 54 GHz	10	5	10	5	9	10	10
>54 GHz to 80 GHz	10	10	10	10	9	10	10
>80 GHz to 110 GHz^{*3}	5	7	5	7	5	7	7
>110 GHz to 120 GHz^{*3}	5	7			5	7	7
>120 GHz to 125 GHz	5	7			5	7	7
>125 GHz to 140 GHz							7
>140 GHz to 145 GHz					5	6	
>140 GHz to 220 GHz							5

*1: Raw directivity is degraded below 300 kHz, 2.2 GHz to 2.5 GHz and in narrow bands within 10 GHz to 34 GHz.
*2: Port match is degraded in narrow bands between 20 and 40 GHz.
*3: 110 GHz to 125 GHz frequency range is available as operational (ME7838A4X only).

Corrected System Performance and Uncertainties – SOLT/SSST

With 12-term concatenated SOLT and Triple Offset Short Calibration (SSST), using the 3656B W1 Calibration Kit. Typical.

Frequency Range	ME7838A4X Directivity (dB)	ME7838A4X Source Match (dB)	ME7838A4X Load Match (dB)	ME7838A4X Reflection Tracking (dB)	ME7838A4X Transmission Tracking (dB)
70 kHz to 10 MHz	40	40	38	±0.10	±0.10
>0.01 GHz to <2.5 GHz	40	40	38	±0.05	±0.05
2.5 GHz to 20 GHz	40	40	38	±0.05	±0.05
>20 GHz to 40 GHz	36	38	33	±0.05	±0.07
>40 GHz to 67 GHz	30	36	27	±0.05	±0.07
>67 GHz to 90 GHz	30	34	28	±0.07	±0.07
>90 GHz to 110 GHz	30	34	28	±0.07	±0.07
>110 GHz to 120 GHz	30	30	28	±0.10	±0.10
>120 GHz to 125 GHz	28	30	26	±0.12	±0.12

Frequency Range	ME7838E4X Directivity (dB)	ME7838E4X Source Match (dB)	ME7838E4X Load Match (dB)	ME7838E4X Reflection Tracking (dB)	ME7838E4X Tracking (dB)
70 kHz to 10 MHz	40	40	38	±0.10	±0.10
>0.01 GHz to 2.5 GHz	40	40	38	±0.05	±0.05
>2.5 GHz to 20 GHz	40	40	38	±0.05	±0.05
>20 GHz to 40 GHz	36	38	33	±0.05	±0.07
>40 GHz to 67 GHz	30	37	27	±0.05	±0.07
>67 GHz to 90 GHz	30	34	30	±0.07	±0.07

Frequency Range	ME7838D4 Directivity (dB)	ME7838D4 Source Match (dB)	ME7838D4 Load Match (dB)	ME7838D4 Reflection Tracking (dB)	ME7838D4 Tracking (dB)
70 kHz to 10 MHz	36	36	36	±0.10	±0.10
>0.01 MHz to <2.5 MHz	38	41	38	±0.05	±0.05
2.5 MHz to 20 MHz	40	41	40	±0.05	±0.05
>20 GHz to 67 GHz	35	41	35	±0.05	±0.07
>67 GHz to 80 GHz	35	38	35	±0.05	±0.07
>80 GHz to 95 GHz	35	40	35	±0.05	±0.07
>95 GHz to 110 GHz	34	37	34	±0.05	±0.07
>110 GHz to 125 GHz	30	34	30	±0.07	±0.09
>125 GHz to 140 GHz	28	28	28	±0.09	±0.11
>140 GHz to 145 GHz	26	28	26	±0.11	±0.13

Frequency Range	ME7838G4 Directivity (dB)	ME7838G4 Source Match (dB)	ME7838G4 Load Match (dB)	ME7838G4 Reflection Tracking (dB)	ME7838G4 Tracking (dB)
70 kHz to 10 MHz	36	36	36	±0.10	±0.10
>0.01 MHz to <2.5 MHz	38	41	38	±0.05	±0.05
2.5 MHz to 20 MHz	40	41	40	±0.05	±0.05
>20 GHz to 67 GHz	35	41	35	±0.05	±0.07
>67 GHz to 80 GHz	35	38	35	±0.05	±0.07
>80 GHz to 95 GHz	35	40	35	±0.05	±0.07
>95 GHz to 110 GHz	34	37	34	±0.05	±0.07
>110 GHz to 125 GHz	30	34	30	±0.07	±0.09
>125 GHz to 140 GHz	28	28	28	±0.09	±0.11
>140 GHz to 145 GHz	26	28	26	±0.11	±0.13

Warranty

The ME7838A4X/ME7838E4X/ME7838D4/ME7838G4 4-Port BB/mmWave VNA and related accessories offer a 3 year warranty from the date of shipment (excluding OML and VDI modules). Please contact your local service center for additional warranty coverage.

Ordering Information

The ME7838A4X 4-Port Broadband/Millimeter-Wave VNA System provides single sweep coverage from 70 kHz to 110 GHz and consists of the following standard components and optional accessories, which are described in the sections below:

ME7838A4X/ME7838E4X 4-Port Broadband System, 70 kHz to 110 (125) GHz, ME7838D4 4-Port Broadband System, 70 kHz to 145 GHz, ME7838G4 Broadband System, 70 kHz to 220 GHz

Action	Part Number and Description	Additional Information
Order the base VectorStar model with the listed components and options:	MS4647B, 70 kHz to 70 GHz VNA MS4640B-007, receiver offset MS4640B-070, 70 kHz frequency coverage MN4697C, 4-Port Test Set 3739C, Broadband Test Set with 36 inch interface cables 3736B Broadband/Millimeter-Wave Test Set 3743AX, 3743EX, Millimeter-Wave Module, 4 each 806-209-R, 1.85 mm phase stable VNA RF cables, 36 in, (m-f) 4 each (ME7838A4X, ME7838E4X, ME7838D4, ME7838G4)-SS020, On-site system assembly and verification	
Include the following:	MS4647B-081, MS4647B with ME7838A4X, ME7838E4X, ME7838G4 system option and Option 51, 61, or 62: MS4647B-087, MS4647B with ME7838E4X system option and Option 51, 61, or 62 (only ME7838E4X): MS4647B-051 – External VNA Loops MS4647B-061 – Active Measurement Suite, 2 Attenuators MS4647B-062 – Active Measurement Suite, 4 Attenuators	MS4647B-085 is ordered when Option 31 is included (ME7838A4X, ME7838D4, and ME7838G4) MS4647B-089 is ordered when Option 31 is included (ME7838E4X)
Add options if desired	MS4640B-070 – for 70 kHz operation in base VNA MS4640B-002 – for Time Domain MS464xB-031 – Dual Source Architecture MS4640B-035 – IF Digitizer MS4640B-041 – Noise Figure MS4640B-042 – PulseView™ MS4640B-043 – DifferentialView™ MS4640B-044 - IMDView™ (ME7838E4X) MS4640B-048 – Differential Noise Figure (ME7838A4X, ME7838E4X, and ME7838D4)	MS464xB-031 requires Option 85 (ME7838A4X, ME7838D4, and ME7838G4) MS464xB-031 requires Option 89 (ME7838E4X) For other available options, see "ME7838A4X, ME7838E4X, ME7838D4, ME7838AG4 Broadband/Millimeter-Wave System Options"
Calibration Options	ME7838A4X-098 - Standard Calibration, ISO 17025 compliant, without data (ME7838A4X, ME7838E4X, and ME7838G4) ME7838A4X-099 - Premium Calibration, ISO 17025 compliant, with data (ME7838A4X, ME7838E4X, and ME7838G4)	

ME7838A4X/ME7838E4X/ME7838D4/ME7838G4 4-Port Waveguide-Band System to 110 GHz – 3744A-EE or 3744A-EW mmWave Modules

Configurator for ME7838A4X/ME7838E4X/ME7838D4/ME7838G4 Millimeter-Wave System using 3744A-EE or 3744A-EW mmWave Modules:

Action	Part Number and Description	Additional Information
Choose and order one of the two base VectorStar models with options listed:	MS4644B VNA, 10 MHz to 40 GHz MS4640B-007 MS4644B-083 or MS4644B-085 MS4644B-087 or MS4644B-089 (only ME7838E4X)	MS4644B-085 is ordered when Option 31 and Option 51 is included MS4644B-089 is ordered when Option 31 and Option 51 is included (ME7838E4X and ME7838G4)
	MS4647B VNA, 10 MHz to 70 GHz MS4647B-007 MS4647B-081 or MS4647B-085 (ME7838A4X, ME7838D4, and ME7838G4) MS4647B-087 or MS4647B-089 (ME7838E4X)	MS4647B-085 is ordered when Option 31 and Option 51 is included MS4644B-089 is ordered when Option 31 and Option 51 is included (ME7838E4X and ME7838G4)
Order:	MN4697C, 4-Port Test Set 3736B Broadband/Millimeter-Wave Test Set 3739C Broadband/Millimeter-Wave Test Set	
Choose and order Extended-E or Extended-W Band Modules:	3744A-EE, 56 GHz to 94 GHz Extended E Band module, 4 each	If you order the 3744A-EE, then you can get the EW adapter kit to allow conversion of the moduleto both bands.
	3744A-EW, 65 GHz to 110 GHz Extended W Band module, 4 each	
Order one of the following:	Option 51, 61, or 62: MS4647B-051 – External VNA Loops MS4647B-061 – Active Measurement Suite, 2 Attenuators MS4647B-062 – Active Measurement Suite, 4 Attenuators	ME7838A4X, ME783E4X, ME7838D4 requires Option 51, or 61, or 62
Add options if desired:	MS4640B-070 – for 70 kHz operation in base VNA MS4640B-002 – for Time Domain MS464xB-031 – Dual Source Architecture MS4640B-035 – IF Digitizer MS4640B-041 – Noise Figure MS4640B-042 – PulseView™ MS4640B-043 – DifferentialView™ MS4640B-048 – Differential Noise Figure	MS464xB-031 requires Option 85 (ME7838A4X, ME7838D4, and ME7838G4) MS464xB-031 requires Option 89 (ME7838E4X) For other available options, see "ME7838A4X, ME7838E4X, ME7838D4, ME7838G4 Broadband/Millimeter-Wave System Options"
Accessories	35WR12WF-EE – Precision Waveguide to Coax Adapter Kit, 56 GHz to 94 GHz, WR-12 to W1 (f)	
	35WR10WF-EW – Precision Waveguide to Coax Adapter Kit, 65 GHz to 110 GHz, WR-10 to W1 (f)	

ME7838A4X 4-Port Waveguide-Band System – VDI mmWave Modules

ME7838A4X, ME7838E4X, ME7838D4, ME7838G4 4-Port Waveguide-Band System using OML or VDI Millimeter-Wave modules:

Action	Part Number and Description	Additional Information
Choose and order one of the three base VectorStar models with options listed:	MS4642B VNA, 70 kHz to 20 GHz MS4642B-051 (ME7838G4) MS4642B-061 or MS4642B-062 MS4642B-083 (ME7838A4X, and ME7838D4) MS4642B-085 (ME7838G4) MS4642B-087 (ME7838E4X)	MS4642B-061 includes Active Device Measurements, with 2 Step Attenuators MS4642B-062 includes Active Device Measurements, with 4 Step Attenuators MS4642B-085 is ordered when Option 31 is included (ME7838A4X, ME7838D4, and ME7838G4) MS4644B-089 is ordered when Option 31 is included (ME7838E4X)
	MS4644B VNA, 10 MHz to 40 GHz MS4640B-007 Receiver Offset MS4644B-083 MS4644B-085 (ME7838G4) MS4644B-087 (ME7838E4X)	MS4644B-085 is ordered when Option 31 is included (ME7838A4X, ME7838D4, and ME7838G4) MS4644B-089 is ordered when Option 31 is included (ME7838E4X)
	MS4647B VNA, 10 MHz to 70 GHz (ME7838A4X, ME7838D4, and ME7838G4) MS4640B-007 Receiver Offset (ME7838A4X, ME7838D4, and ME7838G4) MS4647B-081 (ME7838A4X, ME7838D4 and ME7838G4) MS4647B-085 (ME7838G4)	MS4647B-085 is ordered when Option 31 is included (ME7838A4X, ME7838D4, and ME7838G4)
Order:	MN469xC, 4-port Test Set 3739C Broadband/Millimeter-Wave Test Set 3736B Broadband/Millimeter-Wave Test Set	
	SM6537 Interface Cables (4) for OML/VDI mmWave Modules	Does not include DC cable. DC supply is provided by mmWave module power supply
Choose and order one of the two appropriate millimeter-wave module combinations:	4 each TxRx transmission and reflection millimeter-wave modules	Choose appropriate OML or VDI modules Contact Anritsu Company for ordering information
For MS4644B or MS4647B, order:	Option 51, 61, or 62: MS4647B-051 – External VNA Loops MS4647B-061 – Active Measurement Suite, 2 Attenuators MS4647B-062 – Active Measurement Suite, 4 Attenuators	ME7838A4X, ME7838E4X, and ME7838D4 requires Option 51, 61, or 62
Add options if desired:	MS4640B-070 – for 70 kHz operation in base VNA MS4640B-002 – for Time Domain MS464xB-031 – Dual Source Architecture MS4640B-035 – IF Digitizer MS4640B-041 – Noise Figure MS4640B-042 – PulseView™ MS4640B-043 – DifferentialView™ MS4640B-048 – Differential Noise Figure	MS464xB-031 requires Option 85 (ME7838A4X and ME7838D4) MS464xB-031 requires Option 84 or Option 85 (ME7838G4) MS464xB-031 requires Option 89 (ME7838E4X) For other available options, see "ME7838A4X, ME7838E4X, ME7838D4, ME7838G4, Broadband/Millimeter-Wave System Options"

Model/Order No.	Name
	Calibration/Verification Kits
3659	0.8 mm Calibration/Verification Kit (ME7838D4, ME7838G4)
3656C	W1 (1 mm) Calibration/Verification Kit
3656C-3	W1 (1 mm) Calibration/Verification Kit, With .s1p Characterization Files
3656C-5	W1 (1 mm) Calibration Kit (ME7838A4X, ME7838E4X)
3656C-6	W1 (1 mm) Calibration Kit, With .s1p Characterization Files (ME7838A4X, ME7838E4X)
3655V	WR-15 Waveguide Calibration Kit, Without Sliding Loads
3655V-1	WR-15 Waveguide Calibration Kit, With Sliding Loads
3655E	WR-12 Waveguide Calibration Kit, Without Sliding Loads
3655E-1	WR-12 Waveguide Calibration Kit, With Sliding Loads
3655W	WR-10 Waveguide Calibration Kit, Without Sliding Loads
3655W-1	WR-10 Waveguide Calibration Kit, With Sliding Loads
3650A	SMA/3.5 mm Calibration Kit, Without Sliding Loads
3650A-1	SMA/3.5 mm Calibration Kit, With Sliding Loads
3652A	K Calibration Kit, With Pin Depth Gauge
3652A-1	K Calibration Kit, With Sliding Loads (ME7838G4)
3652A-2	K Calibration Kit, With No Pin Depth Gauge
3652A-3	K Calibration Kit, With Pin Depth Gauge and .s1p Characterization Files
3652A-4	K Calibration Kit, With .s1p Characterization Files
3654D	V Calibration Kit, With Pin Depth Gauge
3654D-1	V Calibration Kit, With Pin Depth Gauge and Sliding Loads (ME7838G4)
3654D-2	V Calibration Kit, With No Pin Depth Gauge
3654D-3	V Calibration Kit, With Pin Depth Gauge and .s1p Characterization Files
3654D-4	V Calibration Kit, With .s1p Characterization Files
3657	V Multi-Line Calibration Kit, Without Shorts
3657-1	V Multi-Line Calibration Kit, With Shorts
	External Power Meters/Sensors
ML243xA	CW Power Meter, Single Input or Dual Input Recommended Power Sensors: SC7770, MA247xD, MA244xD, MA248xD, MA2400xA
ML248xB	Wideband Power Meter, Single Input or Dual Input Recommended Power Sensors: MA249xA, MA2411B
ML249xA	Pulse Power Meter, Single Input or Dual Input Recommended Power Sensors: MA249xA, MA2411B
MA24106A	USB Power Sensor, 50 MHz to 6 GHz
MA24108A	USB Power Sensor, 10 MHz to 8 GHz
MA24118A	USB Power Sensor, 10 MHz to 18 GHz
MA24126A	USB Power Sensor, 10 MHz to 26 GHz
MA24330A	USB Power Sensor, 10 MHz to 33 GHz
MA24340A	USB Power Sensor, 10 MHz to 40 GHz
MA24350A	USB Power Sensor, 10 MHz to 50 GHz
MA24507A	Power Master™ Frequency Selectable mmWave Power Analyzer, 9 kHz to 70 GHz
MA24510A	Power Master™ Frequency Selectable mmWave Power Analyzer, 9 kHz to 110 GHz Note that usage of the MA24507A or MA24510A Power Master™ sensor requires connection to two USB ports to supply needed current draw.
	Test Port Cables, Flexible, High Performance
3671W1-50-1	W1 (m) to W1 (f), 1 each, 10.0 cm (3.9 in)
3671W1-50-2	W1 (m) to W1 (f), 1 each, 13.0 cm (5.1 in)
3671W1-50-3	W1 (m) to W1 (f), 1 each, 16.0 cm (6.3 in)
3671KFS50-60	K (f) to 3.5 mm (m) cable, 60 cm (one cable)
3671KFK50-60	K (f) to K (m) cable, 60 cm (one cable)
3671KFK50-100	K (f) to K (m) cable, 1 each, 100 cm (one cable)
3671KFKF50-60	K (f) to K (f) cable, 1 each, 60 cm (once cable)
3671VFV50-60	V (f) to V (m) cable, 1 each, 60 cm (one cable)
3671VFV50-100	V (f) to V (m) cable, 1 each, 100 cm (one cable)
3671KFSF50-60	K (f) to 3.5 mm (f) cable, 1 each, 60 cm (one cable)
3671VFVF50-60	V (f) to V (f) cable, 1 each, 60 cm (one cable)
3671VFV50-100	V (f) to V (m) cable, 1 each, 60 cm (one cable) (ME7838D4, ME7838G4)
3670.850-1	0.8 mm (m) to 0.8 mm (f), 1 each, 10.0 cm (3.9 in) (ME7838D4, ME7838G4)
3670.850-2	0.8 mm (m) to 0.8 mm (f), 1 each, 16.0 cm (6.3 in) (ME7838D4, ME7838G4)

Model/Order No.	Name
	Adapters and More
0.8-105F	0.8 mm (f) Sparkplug Launcher Connector, DC to 145 GHz (ME7838D4, ME7838G4)
0.8-105M	0.8 mm (m) Sparkplug Launcher Connector, DC to 145 GHz (ME7838D4, ME7838G4)
34WV50	W1 (m) to V (m) Adapter, W1 (1 mm) to V, Coaxial
34WVF50	W1 (m) to V (f) Adapter, W1 (1 mm) to V, Coaxial
34WFV50	W1 (f) to V (m) Adapter, W1 (1 mm) to V, Coaxial
34WFVF50	W1 (f) to V (f) Adapter, W1 (1 mm) to V, Coaxial
33WW50A	W1 (m) to W1 (m) Adapter, W1 (1 mm) in-series, Coaxial
33WWF50A	W1 (m) to W1 (f) Adapter, W1 (1 mm) in-series, Coaxial
33WFWF50A	W1 (f) to W1 (f) Adapter, W1 (1 mm) in-series, Coaxial
33WG50	MA25400A Flange Interface to 1 mm (male) Adapter (ME7838G4)
33.8WG50	MA25400A Flange Interface to 0.8 mm (male) Adapter (ME7838G4)
35WR5G	MA25400A Flange Interface to WR5 Waveguide Adapter (ME7838G4)
35WR10W	WR10 to W1 (m) Adapter, W1 (1 mm) to WR10 Waveguide
35WR10WF	WR10 to W1 (f) Adapter, W1 (1 mm) to WR10 Waveguide
SC7260	WR12 to W1 (m) Adapter, W1 (1 mm) to WR12 Waveguide
SC7442	WR12 to W1 (f) Adapter, W1 (1 mm) to WR12 Waveguide
35WR15V	WR15 to V (m) Adapter, V (1.85 mm) to WR15 Waveguide
35WR15VF	WR15 to V (f) Adapter, V (1.85 mm) to WR15 Waveguide
For More Information	Refer to our Precision RF & Microwave Components Catalog for descriptions of adapters and other components.
	Accessories
SC8215	Kelvin Bias Tee, low frequency limit: 70 kHz, Max Voltage: 16 VDC, Max Current: 100 mA
SC7287	Kelvin Bias Tee, low frequency limit: 100 kHz, Max Voltage 50 VDC, Max Current: 500 mA
SC8218	Triax (m) to SMC (f) Cable, (Inner-shield floating at SMC end), 1.5 m (60 in) long two (2) needed per Kelvin Bias Tee
SM6494	System floor console. Includes larger size writing table
2100-1-R	GPIB cable, 1 m (39 in) long
2100-2-R	GPIB cable, 2 m (79 in) long
2100-4-R	GPIB cable, 4 m (157 in) long
806-206-R	Flexible Coaxial Cable, DC to 70 GHz, 24 in (61 cm), V(m) – V(f), 50Ω
806-209-R	Flexible Coaxial Cable, DC to 70 GHz, 36 in (91.5 cm), V(m) – V(f), 50Ω
806-396-R	Flexible Phase Stable Coaxial Cable, DC to 70 GHz, 36 in (91.5 cm), V(m) – V(f), 50Ω (ME7838G4)
01-201	Torque Wrench (for tightening male devices), 8 mm (5/16 in), 0.9 N·m (8 lbf·in) for SMA, 3.5 mm, 2.4 mm, K, and V connectors
01-202	Universal Test Port Connector Wrench
01-203	Torque Wrench (for tightening the VNA test ports to female devices) 20.6 mm (13/16 in), 0.9 N·m (8 lbf·in)
01-204	Anritsu Stainless Steel Connector Wrench, circular, open-ended for SMA, 3.5 mm, 2.4 mm, K and V connectors
01-504	Torque wrench (for tightening male devices) 6 mm, 0.45 N-m (4 lbf-in) for 1.0 mm and 0.8 mm connectors
01-524	Low profile Torque Wrench (for tightening male devices), 6 mm, 0.45 N-m (4 lbf-in), 126 mm long for 1.0 mm and 0.8 mm connectors
01-529-R	Torque wrench, 4 mm (5/32 in), 0.17 N·m (1.5 lbf·in) (for tightening the test and reference IF connectors on the mmWave modules)
	Miscellaneous Components
41W-3	Attenuator, DC to 110 GHz, 0.2 W, 3 dB, W1 (m) to W1 (f), 50Ω
41W-6	Attenuator, DC to 110 GHz, 0.2 W, 6 dB, W1 (m) to W1 (f), 50Ω
41W-10	Attenuator, DC to 110 GHz, 0.2 W, 10 dB, W1 (m) to W1 (f), 50Ω
W240A	Precision Power Divider, DC to 110 GHz, W1 (f) input, W1 (f) outputs, 3 resistor, 50Ω
W241A	Precision Power Splitter, DC to 110 GHz, W1 (m) input, W1 (f) outputs, 2 resistor, 50Ω
MN25110A	Precision Directional Coupler, 20 GHz to 110 GHz, W1 (f) input, W1 (f) output, W1 (f) coupled port, 50Ω
33GG50	MA25400 Flange Interface 50 mm Thru Line (m - m) (ME7838G4)

Contact Anritsu regarding rack mount options www.anritsu.com.

VectorStar™ Opto-Electronic Network Analyzer

ME7848A

Remote Control
GPIB | Ethernet | USB

Specified, Traceable Measurements of O/E, E/O, and O/O Devices Operating at 850/1310/1550 nm Wavelengths at 40/70/110 GHz

The VectorStar Opto-Electronic Network Analyzer (ONA) ME7848A system includes the VectorStar VNA combined with a traceable calibration optical-to-electrical (O/E) detector module and an electrical-to-optical (E/O) converter. The ME7848A ONA with the E/O converter and O/E calibration module detector enables the measurement of domain-transfer devices such as optical modulators, modulated lasers, optical transmitters, photodiodes, photo-receivers, and transceivers.
The ONA system facilitates the measurement of E/O and O/E transfer function in terms of bandwidth, flatness, and phase linearity (group delay). The ME7848A-01xx systems have all of the potential functionality of the -02xx systems but do not include an E/O converter. Three system options provide the ability to measure optical devices at the 850, 1310, and 1550 nm wavelengths. System modularity offers the ability to add detectors and/or converters with different wavelengths to expand system capabilities without the need for additional VNAs.
The O/E Calibration Module MN4765B is the base and when combined with appropriate options can be used with the Anritsu VNAs to perform accurate, flexible, and cost-effective characterization of optoelectronic devices. Option 40 offers optoelectronic measurements of devices from 70 kHz to 40 GHz in the 850 nm range. The 1550 and 1310 nm wavelengths are supported with the Option 70 and 71 respectively. The built-in de-embedding software (accessed through the VNA's measurement menu) provides full on screen direction, thus, simplifying calibration and speeding measurement throughput.
The E/O Converter MN4775A offer wavelength support of 850 nm at 40 GHz and 1310 and 1550 nm with frequency response to 70 GHz or 110 GHz.
Each converter incorporates a telecommunication grade lithium niobate (LiNbO3) modulator this is stabilized by an automatic bias controller and a tunable or fixed-wavelength laser source (all specifications assume this bias controller is in quadrature mode). The converter also includes a tunable or fixed-wavelength laser source. The 1310 nm and 1550 nm versions also have loopback access for operation using an external laser.

Key Features and Benefits

- **Fast and accurate optoelectronic measurements** — when calibrated using the MN4765B O/E module, enables error-corrected transfer function, group delay, and return loss measurements of E/O and O/E components and subsystems.
- **MN4765B O/E calibration module** — this photodiode reference standard detector is thermally stabilized to minimize drift over temperature. Available 40/70/110 GHz.
- **MN4775A E/O converter** — excellent converter stability ensures characteristics remain consistent during measurement of O/E DUT detectors and receivers.
- **National Institute of Standards and Technology (NIST) derived characterization** — Magnitude and phase characterization of the O/E calibration module is obtained using a primary standard characterized by NIST and held in the Anritsu calibration lab.
- **Internal biasing** — Accurate bias voltage to the photodiode is maintained internally.
- **Excellent stability and repeatability** — use of full 12-term calibration with de-embedding results in stable and repeatable measurements of optoelectronic devices using the VectorStar VNA.
- **Modularity and upgradeability** — easily modify ME7838A ONA to a different wavelength by adding the appropriate MN4775A E/O converter and MN4765B O/E calibration detector. The ME7838A-100 series can be upgraded to a 200 series by including the appropriate MN4775A E/O converter.
- **Measurement flexibility** — easily switch between electrical and O/E measurements. Only one 12-term calibration is required, which can be applied to E/E, E/O, and O/E set-ups. This makes it flexible and easy to use for all high-speed device measurements.

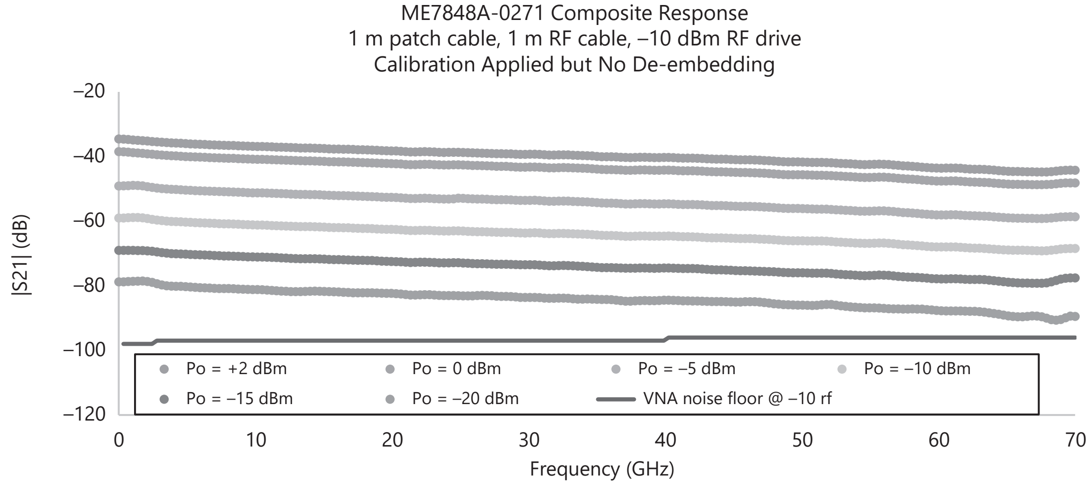
Basic Specifications of ME7848A Systems*1

	ME7848A-0240	ME7848A-0271	ME7848A-0270
RF Frequency Range*2	70 kHz to 40 GHz	70 kHz to 70 GHz	70 kHz to 70 GHz
RF Connector Type	K (2.92 mm)	V (1.85 mm)	V (1.85 mm)
Optical Source Input Connector Type (polarization-maintaining fiber recommended)	FC/PC	FC/PC	FC/PC
Optical Output and Modulated Input Connector Type	FC/APC	FC/APC	FC/APC
Receiver Wavelength Range	800 nm to 1700 nm	1300 nm to 1330 nm	1480 nm to 1620 nm
Receiver DC Responsivity	>0.2 A/W (850 ±20 nm)	>0.45 A/W (1319 ±10 nm)	>0.7 A/W (1550 ±20 nm)
Maximum Linear Optical Power to Receiver (<0.5 dB variance in frequency response shape)	2 dBm	6 dBm	6 dBm
Maximum Safe Optical Power (average) to Receiver	6 dBm	10 dBm	10 dBm
Optical Return Loss (modulation output and detection ports)	>24 dB	>24 dB	>24 dB
Average Optical Power Uncertainty (transmit)	± 0.5 dB	± 0.5 dB	± 0.5 dB
Optical Modulation Sensitivity (RF V_π at 1 GHz, typical)	2.3 V pk-pk	5.5 V pk-pk	5.5 V pk-pk
Transmit Wavelength	850 nm	1310 nm	15270 nm to 1565 nm
Average Output Power Range (typical)	–17 to –1*3 dBm	–17 to +2 dBm	–15 to +5 dBm
Output Power Stability (over 4 hours and 3°C temperature range)	±0.1 dB	±0.1 dB	±0.1 dB
Optical Modulation Path Loss (quadrature bias, typical)	8 dB	10 dB	8 dB
0.1 dB Compression Point of RF Receiver (at port)*2 (characteristic)	>+5 dBm for 70 kHz to 300 kHz >+11 dBm above 300 kHz	>+5 dBm for 70 kHz to 300 kHz >+11 dBm above 300 kHz	>+5 dBm for 70 kHz to 300 kHz >+11 dBm above 300 kHz
0.1 dB Compression Point of RF Receiver (at reversed port)*2 (characteristic)	>–15 dBm 70 kHz to 300 kHz >–10 dBm 300 kHz to 2.5 GHz >–5 dBm above 2.5 GHz	>–15 dBm 70 kHz to 300 kHz >–10 dBm 300 kHz to 2.5 GHz >–5 dBm above 2.5 GHz	>–15 dBm 70 kHz to 300 kHz >–10 dBm 300 kHz to 2.5 GHz >–5 dBm above 2.5 GHz
Modulation Port Return Loss (raw)*2	>10 dB for <20 GHz >7.5 dB for 20 GHz to 40 GHz	>10 dB for <20 GHz >7.5 dB for 20 GHz to <50 GHz >3 dB for 50 GHz to 70 GHz	>10 dB for <20 GHz >7.5 dB for 20 GHz to <50 GHz >3 dB for 50 GHz to 70 GHz
Detection Port Return Loss (raw)*2	>10 dB for <18 GHz >3 dB for 18 GHz to 40 GHz	>8 dB for <50 GHz >5 dB for 50 GHz to 70 GHz	> 8 dB for <50 GHz > 5 dB for 50 GHz to 70 GHz

*1: All system specifications are based on the modulator being biased in quadrature mode.
*2: These line entries assume the presence of VNA option 070 (70 kHz lower frequency limit). Without option 070, the minimum frequency is 10 MHz.
*3: Recommended operation at –3 dBm and below for optimal modulator performance.

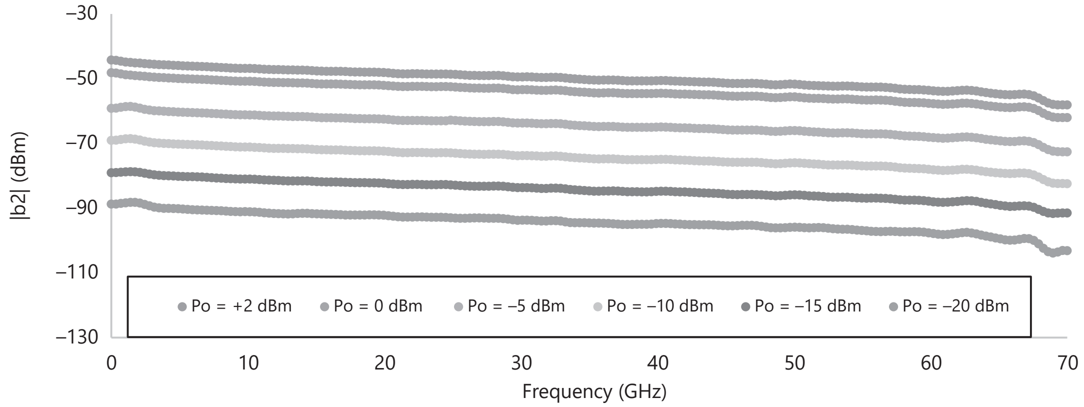
Example Plots

Example plots of the response dependence on optical power are shown below for the ME7848A-0271 (1310 nm) system. Transmission (|S21|) is shown first with an RF drive of –10 dBm (default power for the 70 GHz systems) and 10 Hz IF bandwidth. This measurement is of the integral E/O and O/E modules (and internal laser) connected by a 1 m patch cable and with a 1 m RF cable from the VNA to the E/O input. The O/E output is connected directly to port 2 of the VNA in its normal (not reversed) configuration. A full 2-port calibration is applied but no de-embedding has been performed (of either the O/E or E/O components). The specified VNA noise floor for this bandwidth and power level is also shown.
Higher RF power levels are possible (native and with external amplification) as long as compression limits are observed. When user E/O and O/E devices are inserted, the responses may go up or down from these plots depending on the relative responsivities. In an O/O measurement, optical loss will shift the curves lower. The ME7848A-0270 system will have curves nominally 4 dB higher (higher detector responsivity) and higher optical powers are generally available in those systems. ME7848A-0240 systems will have curves generally 6-7 dB lower (lower responsivities) to 40 GHz.



The absolute O/E output power is plotted below for the same setup. This measurement is achieved by first performing an RF power calibration and a receiver calibration at port 2 (for the b2 receiver).

ME7848A-0271 Composite Detector Output Power
1 m patch cable, 1 m RF cable, –10 dBm RF drive



Specifications

Noise Floor for O/E Measurements

Expressed in terms of dBm (RMS) in a 10 Hz IFBW. Based on maximum nominal optical power from modulator (+5 dBm for -0270, +2 dBm for -0271, or –3 dBm for -0240) and derived from de-embedding the absolute E/O response. Interconnecting fiber loss (1 m) neglected. 1 m VNA cable loss is included. 'Normal' refers to the conventional VNA coupler configuration. 'Reversed' refers to the use of the loop access to reverse the orientation of the port 2 test couplers (requires changing front and rear panel access loop configuration). The table below assumes the presence of VNA option 070 (70 kHz operation); otherwise the minimum frequency is 10 MHz.

Frequency Range (GHz)	ME7848A-0240 (dBm)				ME7848A-0271 (dBm)				ME7848A-0270 (dBm)			
	051 Normal	051 Reversed	062 Normal	062 Reversed	051 Normal	051 Reversed	062 Normal	062 Reversed	051 Normal	051 Reversed	062 Normal	062 Reversed
70 kHz to 300 kHz	–54	–64	–54	–64	–66	–76	–66	–76	–66	–76	–66	–76
>300 kHz to 2 MHz	–59	–69	–59	–69	–71	–81	–71	–81	–71	–81	–71	–81
>2 MHz to 10 MHz	–64	–74	–64	–74	–76	–86	–76	–86	–76	–86	–76	–86
>0.01 to <2.5	–72	–79	–72	–79	–86	–93	–86	–93	–86	–93	–86	–93
2.5 to 5	–75	–82	–75	–82	–87	–94	–87	–94	–87	–94	–87	–94
>5 to 20	–74	–81	–74	–81	–84	–91	–84	–91	–84	–91	–84	–91
>20 to 38/40*	–64	–81	–63	–65	–80	–82	–80	–81	–80	–82	–79	–81
>38 to 50	—	—	—	—	–75	–77	–74	–75	–75	–76	–74	–75
>50 to 65	—	—	—	—	–71	–69	–71	–69	–71	–69	–69	–67
>65 to 67	—	—	—	—	–68	–65	–65	–62	–68	–65	–65	–62
>67 to 70	—	—	—	—	–64	–61	–60	–58	–64	–61	–60	–58

*: 38 GHz applies for -027x systems; 40 GHz applies for -0240 system.

Frequency Response Repeatability for E/O, O/O Measurements

Typical and in dB terms, 10 Hz IFBW at various composite response levels (P1-P4) at the receiving VNA port (assumed normal (not reversed)), excludes fiber connector effects. The composite response is affected by the optical power level and the E/O responsivity. Assumes nominal 90 minute warm-up time and ignores DUT bias system stability effects. The corresponding low frequency E/O $V_{\pi,rf}$ values below are based on default RF power, +5 dBm optical power (-0270) or +2 dBm optical power (-0271), or –3 dBm optical power (-0240), and Anritsu O/E module specified low frequency responsivities. At higher frequencies, values scale with the roll-off. The table below assumes the presence of VNA option 070 (70 kHz operation); otherwise the minimum frequency is 10 MHz.

P1 received level	–30 dBm (at low freq, $V_{\pi,rf}$ of 0.6 V, 0.4 V, or 1.1 V for -0240, -0271, or -0270, respectively)
P2 received level	–40 dBm (at low freq, $V_{\pi,rf}$ of 1.8 V, 1.1 V, or 3.5 V for -0240, -0271, or -0270, respectively)
P3 received level	–50 dBm (at low freq, $V_{\pi,rf}$ of 6 V, 3.6 V, or 11 V for -0240, -0271, or -0270, respectively)
P4 received level	–60 dBm (at low freq, $V_{\pi,rf}$ of 18 V, 11 V, or 35 V for -0240, -0271, or -0270, respectively)

Frequency Range (GHz)	ME7848A-0240 (dBm)				ME7848A-0271 (dBm)				ME7848A-0270 (dBm)			
	P1	P2	P3	P4	P1	P2	P3	P4	P1	P2	P3	P4
70 kHz to 300 kHz	±0.07	±0.1	±0.15	±0.2	±0.07	±0.1	±0.15	±0.2	±0.07	±0.1	±0.15	±0.2
>300 kHz to 2 MHz	±0.05	±0.07	±0.1	±0.15	±0.05	±0.07	±0.1	±0.15	±0.05	±0.07	±0.1	±0.15
>2 MHz to 10 MHz	±0.05	±0.05	±0.05	±0.07	±0.05	±0.05	±0.05	±0.05	±0.03	±0.03	±0.03	±0.03
>0.01 to < 2.5	±0.05	±0.05	±0.05	±0.07	±0.05	±0.05	±0.05	±0.05	±0.03	±0.03	±0.03	±0.03
2.5 to 5	±0.03	±0.05	±0.05	±0.05	±0.05	±0.05	±0.05	±0.05	±0.03	±0.03	±0.03	±0.03
>5 to 20	±0.03	±0.05	±0.05	±0.05	±0.05	±0.05	±0.05	±0.05	±0.03	±0.03	±0.03	±0.03
>20 to 38/40*	±0.05	±0.07	±0.07	±0.09	±0.05	±0.05	±0.05	±0.05	±0.03	±0.05	±0.05	±0.05
>38 to 50	—	—	—	—	±0.05	±0.05	±0.05	±0.05	±0.03	±0.05	±0.05	±0.05
>50 to 65	—	—	—	—	±0.05	±0.05	±0.05	±0.05	±0.05	±0.05	±0.05	±0.05
>65 to 67	—	—	—	—	±0.05	±0.05	±0.05	±0.07	±0.05	±0.05	±0.05	±0.05
>67 to 70	—	—	—	—	±0.07	±0.07	±0.07	±0.1	±0.07	±0.07	±0.07	±0.07

*: 38 GHz applies for -027x systems; 40 GHz applies for -0240 system.

Noise Floor for O/O Measurements

Expressed in terms of dBm (RMS) in a 10 Hz IFBW. Based on maximum nominal optical power from modulator (+5 dBm for -0270, +2 dBm for -0271, or –3 dBm for -0240) and derived from de-embedding both the absolute E/O and O/E responses. Interconnecting fiber loss (1 m) neglected. 1 m VNA cable loss is included. 'Normal' refers to the conventional VNA coupler configuration. 'Reversed' refers to the use of the loop access to reverse the orientation of the port 2 test couplers (requires changing front and rear panel access loop configuration). The table below assumes the presence of VNA option 070 (70 kHz operation); otherwise the minimum frequency is 10 MHz.

Frequency Range (GHz)	ME7848A-0240 (dBm)				ME7848A-0271 (dBm)				ME7848A-0270 (dBm)			
	051 Normal	051 Reversed	062 Normal	062 Reversed	051 Normal	051 Reversed	062 Normal	062 Reversed	051 Normal	051 Reversed	062 Normal	062 Reversed
70 kHz to 300 kHz	–32	–42	–32	–42	–49	–59	–49	–59	–56	–66	–56	–66
>300 kHz to 2 MHz	–37	–47	–37	–47	–54	–64	–54	–64	–61	–71	–61	–71
>2 MHz to 10 MHz	–42	–52	–42	–52	–59	–69	–59	–69	–66	–76	–66	–76
>0.01 to <2.5	–50	–57	–50	–57	–69	–76	–69	–76	–76	–83	–76	–83
2.5 to 5	–52	–59	–52	–59	–69	–76	–69	–76	–76	–83	–76	–83
>5 to 20	–47	–54	–47	–54	–65	–72	–65	–72	–72	–79	–72	–78
>20 to 38/40*	–32	–34	–32	–33	–62	–64	–62	–63	–69	–71	–69	–70
>38 to 50	—	—	—	—	–54	–55	–53	–54	–61	–62	–60	–61
>50 to 65	—	—	—	—	–49	–47	–47	–45	–56	–53	–53	–52
>65 to 67	—	—	—	—	–46	–43	–43	–40	–53	–50	–50	–47
>67 to 70	—	—	—	—	–41	–37	–38	–34	–48	–45	–44	–42

*: 38 GHz applies for -027x systems; 40 GHz applies for -0240 system.

Definitions

Specifications (and related definitions) and stated values are based on certain conditions:

Warm-Up Time	After 90 minutes of warm-up time, where the instruments are left in their ON state.
Temperature Range	Over the 25°C±5°C temperature range.
Error-Corrected Specifications	For error-corrected specifications, over 23°C±3°C with <1°C variation from calibration temperature
User Cables/Adapters	Specifications and typical values do not include effects of any user cables, adapters, fixtures, or other structures attached to the instrument unless noted.
Discrete Spurious Response	Specifications may exclude discrete spurious responses.
Internal Reference Signal	All specifications apply when the internal 10 MHz reference is used.
Interpolation Mode	All specification are with interpolation mode OFF.
Typical Performance	"Typical" specifications describe expected, but not warranted, performance based on analysis of a statistically significant set of samples. Typical performance indicates measured performance of an average unit and does not guarantee the performance of an individual unit and is show in parenthesis (e.g., (-102 dB)) or noted as Typical.
Characteristic Performance	Characteristic performance indicates a level of performance that is designed in and verified during the design phase. These values are not covered by the product warranty.
Below 300 kHz	All uncertainties below 300 kHz are typical.
Other Information	Recommended calibration cycle 12 months on components (or system as a whole for -02xx cases). Uncertainties are dependent on calibration kit residual performance, so the calibration kit calibration cycle should be adhered to as well.
Specifications Subject to Change	All specifications are subject to change without notice. For the most current data sheet, please visit the Anritsu website at www.anritsu.com.

Standard Capabilities

Operating Frequency	ME7848A-0240 (uses the MS4644B VNA)	10 MHz to 40.5 GHz
	ME7848A-027x (uses the MS4647B VNA)	10 MHz to 70 GHz
	MS4640B-070	Optional for MS4640B series VNAs. Provides 40 kHz to 10 MHz Coverage Extension. Provides a lower limit specified to 70 kHz, which is allowed to extend to 40 kHz.
Measurement Parameters	2-Port Measurements	S_{11}, S_{21}, S_{22}, S_{12}, and any user-defined combination of a_1, a_2, b_1, b_2, and 1.
	4-Port Measurements	Refer to the separate VectorStar MN469xC Series Multiport VNA Measurement System Technical Data Sheet 11410-00777, available at http://www.anritsu.com/en-US/test-measurement/products/ms4640b-series
	Domains	Frequency Domain, Power Domain, CW Draw, and Time (Distance) Domain
Sweeps	Frequency Sweep Types	Linear, Log, CW, or Segmented
	Power Sweep Types	Linear, constant power sweeps, or constant power slope (dB/GHz) over frequency sweep
Display Graphs	Single Rectilinear Graph Types	Log Magnitude, Phase, Group Delay, Linear Magnitude, Real, Imaginary, Inductance, Capacitance, SWR, Power Out, Impedance, and Power In
	Dual Rectilinear Graph Types	Log Magnitude and Phase, Linear Magnitude and Phase, and Real and Imaginary
	Circular Graph Types	Smith Chart (Impedance), Smith Chart (Admittance), Linear Polar, and Log Polar
Measurements Data Points	25,000 Data Points	2 to 25,000 points in up to 16 channels
	100,000 Data Points	2 to 100,000 points in single channel
	Limit Lines	Single or segmented. 2 limit lines per trace. 50 segments per limit line. Single Limit Readouts: Uses interpolation to determine the intersection frequency. Test Limits: Both single and segmented limits can be used for PASS/FAIL testing.
Averaging	Point-by-Point	Point-by-point (default), max. Averaging = IF Bandwidth/1 Hz
	Sweep-by-Sweep	Sweep-by-sweep (no limit)
	IF Bandwidth	1, 2, 3, 5, 7, 10, 20, 30, 50, 70, 100, 200, 300, 500, 700 Hz; 1, 2, 3, 5, 7, 10, 20, 30, 50, 70, 100, 200, 300, 500, 700 kHz; 1 MHz

Continued on next page

Reference Plane	Line Length or Time Delay	The reference planes of a calibration or other normalization can be changed by entering a line length or time delay.
	Dielectric Constants	Dielectric constants may be entered for different media so the length entry can be physically meaningful.
	Dispersion Modeling	Dispersion modeling is used in the cases of microstrip and waveguide to take into account frequency dependent phase velocities.
	Attenuation	Attenuation (with frequency slope) and constant phase offsets can be entered to better describe any reference plane distortions. The frequency dependence exponent is changeable.
	Auto Modes	Automatic reference plane finding tools are available for phase alone or phase + magnitude. These routines do a fitting process on phase or phase and magnitude to estimate the reference plane location and enter correcting values.
	De-embedding	For more complete reference plane manipulation, the full de-embedding system can also be used.
Measurement Frequency Range	Frequency Range Change	Frequency range of the measurement can be narrowed within the calibration range without recalibration.
	CW Mode	CW mode permits single frequency measurements also without recalibration.
	Interpolation Not Activated	If interpolation is not activated, the subset frequency range is forced to use calibration frequency points.
	Interpolation Activated	If interpolation is activated, any frequency range that is a subset of the calibration frequency range can be used, but there may be some added interpolation error.
Group Delay	Group Delay Aperture	Defined as the frequency span over which the phase change is computed at a given frequency point.
	Aperture	The aperture can be changed without recalibration.
	Minimum Aperture	The minimum aperture is the frequency range divided by the number of points in calibration and can be increased to 20% of the frequency range.
	Group Delay Range	<180° of phase change within the aperture
Channels, Display, and Traces	Channels and Traces	16 channels, each with up to 16 traces
	Display	Color touch screen LCD, 26.4 cm (10.4") diagonal
	Display Colors	Unlimited colors for data traces, memory, text, markers, graticules and limit lines.
	Trace Memory and Math	A separate memory for each trace can be used to store measurement data for later display or subtraction, addition, multiplication or division with current measurement data. The trace data can be saved and recalled.
	Inter-trace Math	Any two traces within a channel can also be combined (via addition, subtraction, multiplication or division) and displayed on another trace. An equation editor mode is also available that allows the combination of trace data, trace memory and S-parameter data in more complex equations. Over 30 built-in functions are available. Simple editing tools and the ability to save/recall equations are also provided.

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Opto-Electronic Network Analyzer ME7848A
	The ME7848A series systems are available to meet different frequency range requirements.
ME7848A-0240	40 GHz, 850 nm system
ME7848A-0270	70 GHz, 1550 nm system
ME7848A-0271	70 GHz, 1310 nm system
ME7848A-0140	40 GHz, 850 nm system (VNA and O/E module only)
ME7848A-0170	70 GHz, 1550 nm system (VNA and O/E module only)
ME7848A-0171	70 GHz, 1310 nm system (VNA and O/E module only)
	Included Accessories
	Each system comes with a set of included accessories.
Online Help	The instrument is equipped with context-sensitive help built from the VectorStar Operation Manual, User Interface Reference Manual, Programming Manual, Programming Manual Supplement, and Calibration and Measurement Guide.
Peripherals	Optical USB Mouse
Power	Power Cord
2000-1957-R	Accessory Kit, 40 GHz (-0x40 systems) 2 one meter F-M K RF cables 1 one meter FC/PC-FC/APC fiber patch cord 2 semi-rigid K cables to allow VNA coupler reversal for increasing for-ward dynamic range 1 F-F K adapter Optical connector cleaning accessories (for both fiber ends and fer-rule-based connectors)
2000-1958-R	Accessory Kit, 70 GHz (-0x7x systems) 2 one meter F-M V RF cables 1 one meter FC/PC-FC/APC fiber patch cord 2 semi-rigid V cables to allow VNA coupler reversal for increasing for-ward dynamic range 1 F-F V adapter Optical connector cleaning accessories (for both fiber ends and fer-rule-based connectors)
2000-2119-R	Accessory kit (110 GHz systems) 2 (13 cm) F-M W RF cables 1 one meter FC/PC-FC/APC fiber patch cord 1 F-F W adapter Optical cleaning accessories (for both fiber ends and ferrule-based connectors)

Model/Order No.	Name
	ME7848A Available Options
ME7848A-0002	Time Domain Measurements
ME7848A-0007	Receiver Offset
ME7848A-0021	Universal Fixture Extraction
ME7848A-0031	Dual Source Architecture
ME7848A-0032	Internal RF Combiner
ME7848A-0035	IF Digitizer
ME7848A-0036	Extended IF Digitizer Memory
ME7848A-0041	Noise Figure
ME7848A-0042	PulseView™
ME7848A-0043	DifferentialView™
ME7848A-0044	IMDView™
ME7848A-0046	Fast CW
ME7848A-0047	Eye Diagram
ME7848A-0048	Differential Noise Figure
ME7848A-0051	Direct Access Loops
ME7848A-0053	External ALC
ME7848A-0061	Active Measurements Suite
ME7848A-0062	Active Measurements Suite
ME7848A-0070	70 kHz Low End Frequency Extension
	MN4765B Configuration Option
MN4765B-0040	70 kHz to 40 GHz range, with 850 wavelength coverage
MN4765B-0042	70 kHz to 40 GHz range, with 850 nm and 1060 nm wavelength coverage
MN4765B-0043	70 kHz to 40 GHz range, with 850/1060/1310/1550 nm wavelength coverage
MN4765B-0070	70 kHz to 70 GHz range, with 1550 nm wavelength coverage
MN4765B-0071	70 kHz to 70 GHz range, with 1310 nm wavelength coverage
MN4765B-0072	70 kHz to 70 GHz range, with 1310 nm and 1550 nm wavelength coverage
MN4765B-0110	70 kHz to 110 GHz range, with 1550 nm wavelength coverage
MN4765B-0111	70 kHz to 110 GHz range, with 1310 nm wavelength coverage
MN4765B-0112	70 kHz to 110 GHz range, with 1310 nm and 1550 nm wavelength coverage
MN4765B-0098	Standard Calibration – Includes Certificate of Calibration
MN4765B-0099	Premium Calibration – Includes Certificate of Calibration and Test Data
	MN4775A Configuration Options
MN4775A-0040	40 GHz modulation bandwidth and internal 850 nm laser
MN4775A-0070	70 GHz modulation bandwidth and internal C-band laser set to 1550 nm
MN4775A-0071	70 GHz modulation bandwidth and internal 1310 nm fixed laser
MN4775A-0110	110 GHz modulation bandwidth and internal C-Band laser set to 1550 nm
MN4775A-0111	110 GHz modulation bandwidth and internal 1310 nm fixed laser

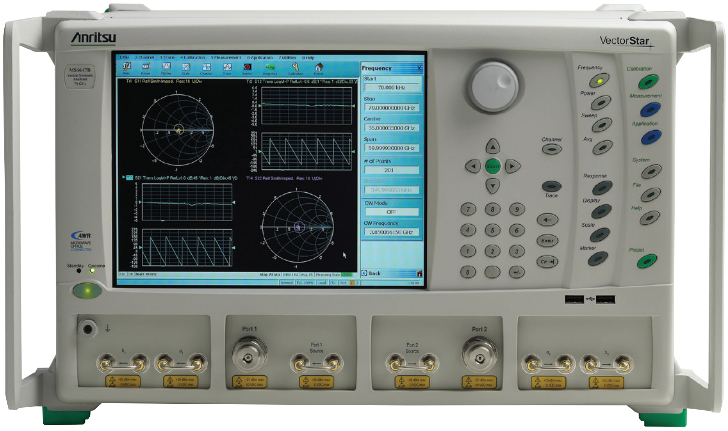
VectorStar™ Microwave Vector Network Analyzers

MS4640B Series

70 kHz to 20 GHz, 40 GHz, 70 GHz

Remote Control
Ethernet | USB

High Performance, Broadband Network Analysis Solutions



The VectorStar™ family is Anritsu's Premium VNA line, providing the highest overall performance on a modern platform. The MS4640B VectorStar VNA offers the broadest coverage in a single instrument, 70 kHz to 70 GHz. The additional two decades at the low end are even more impressive than the guaranteed 70 GHz coverage on the high end.
PulseView™, when combined with the innovative IF digitizing option, offers industry-leading 2.5 ns pulse resolution and 100 dB dynamic range with no compromises or trade-offs due to varying duty cycles. PulseView provides real time display of pulse measurements while dynamically modifying pulse parameters for immediate design validation.
DifferentialView™, when combined with the dual internal source option, offers real time display analysis of differential devices, drivers, and components while actively modifying phase and magnitude relationships of the internal dual sources.
The noise figure option is based on a cold source technique for improved noise figure measurement accuracy. VectorStar is the only VNA platform capable of measuring noise figure from 70 kHz to 125 GHz and available with an optimized noise receiver for measurements from 30 GHz to 125 GHz.
IMDView, when combined with the dual source option and internal switch and combiner, VectorStar provides the only VNA platform with a choice of all 3 most common IMD configuraitons: IMD software only, IMD software with internal 2nd source, and IMD software with internal 2nd source and switch with combiner. The internal switch and combiner provides the ability to perform single connection IMD measurements. Using the multiple channel capabilities of VectorStar allows automatic switching from S-parameter measurements, power sweep gain compression measurements, spectrum view of intermodulation products, and frequency sweeping of intermodulation products for complete active device characterization.
The IMD measurements are also supported in the broadband systems up to 220 GHz and mmWave bands up to 1.1 THz.
For broadband applications, the ME7838 Series offers superior performance and coverage spanning a range from 70 kHz to 110/125/145/220 GHz in a single coaxial test port. The Anritsu developed Non-linear Transmission Line mmWave module is compact while providing high performance up to 0 GHz.
The Anritsu MS4640B Vector Network Analyzer offers a new level of performance for device modeling engineers struggling to accurately and reliably characterize their devices, for R&D engineers pushing the last fraction of a dB out of their state-of-the-art designs, and for the manufacturing engineer trying to maximize throughput without sacrificing accuracy. Backed by a 3-year warranty and the most responsive sales support team, the MS4640B is the VNA of choice for the discerning engineer.

Key Features

- Broadest frequency span from a single coaxial test port covering 70 kHz to 70 GHz in a single instrument and 70 kHz to 110/125/145/220 GHz in the broadband configuration
- Highest performance pulse measurements – PulseView™ offers 2.5 ns pulse resolution with 100 dB dynamic range
- 4-port single-ended or balanced measurements using DifferentialView™ analysis
- Superior Dynamic Range – up to 142 dB
- High available power – up to +14 dBm
- Best test port characteristic performance – up to 50 dB in Directivity, Source Match and Load Match
- Most convenient automatic calibration system with best accuracy
- Best time domain analysis

Instrument Models and Operating Frequencies

- MS4642B – (Optional 70 kHz) 10 MHz to 20 GHz
- MS4644B – (Optional 70 kHz) 10 MHz to 40 GHz
- MS4647B – (Optional 70 kHz) 10 MHz to 70 GHz
- Extended Operating Frequency Details Inside

Principal Options

- MS4640B-002 – Time Domain
- MS4640B-007 – Receiver Offset
- MS4640B-021 – Universal Fixture Extraction
- MS4640B-031 – Dual Source Architecture
- MS4640B-032 – Internal RF Combiner
- MS4640B-035 – IF Digitizer
- MS4640B-036 – Extended IF Digitizer Memory
- MS4640B-041 – Noise Figure
- MS4640B-042 – PulseView™
- MS4640B-043 – DifferentialView™
- MS4640B-044 – IMDView™
- MS4640B-046 – Fast CW
- MS4640B-047 – Eye Diagram
- MS4640B-048 – Differential Noise Figure
- MS4640B-05x – Direct Access Loops
- MS4640B-053 – External ALC
- MS4640B-06x – Active Measurements Suite
- MS4640B-070 – 70 kHz Low-End Frequency Extension
- MS4640B-08x – Broadband/Millimeter-Wave Interface

A detailed color brochure available on the Anritsu web site provides descriptions and examples of the VectorStar family's features and benefits. The web site also provides detailed information on 110/125/145/220 GHz Broadband Coaxial, Banded Waveguide, and Multiport solutions based on the MS4640B VNA.

Definitions

All specifications and characteristics apply under the following conditions, unless otherwise stated:	
Warm-Up Time	After 90 minutes of warm-up time, where the instrument is left in the ON state.
Temperature Range	Over the 25°C±5°C temperature range.
Error-Corrected Specifications	For error-corrected specifications, over 23°C±3°C, with <1°C variation from calibration temperature. For error-corrected specifications are warranted and include guard-bands, unless otherwise stated.
Frequency Bands in Tables	When a frequency is listed in two rows of the same table, the specification for the common frequency is taken from the lower frequency band, except when the band edge is less than 5 GHz.
User Cables	Specifications do not include effects of any user cables, adapters, or fixtures attached to the instrument.
Discrete Spurious Responses	Specifications may exclude discrete spurious responses.
Internal Reference Signal	All specifications apply with internal 10 MHz Crystal Oscillator Reference Signal.
Interpolation Mode	All specifications are with Interpolation Mode Off.
Standard	Refers to instruments without Option 51, 61, or 62.
Typical Performance	Typical performance indicates the measured performance of an average unit. It does not include guard-bands and is not covered by the product warranty. Typical specifications are shown in parentheses, such as (–102 dB), or noted as typical.
Characteristic Performance	Characteristic performance indicates a performance designed-in and verified during the design phase. It does include guard-bands and is not covered by the product warranty.
Nominal Performance	Nominal performance indicates a performance designed in and observed during the design phase. It does not include guard bands, is not production tested, and is not covered by the product warranty.
Below 300 kHz	All uncertainties below 300 kHz are typical.
Recommended Calibration Cycle	12 months (Residual specifications also require calibration kit calibration cycle adherence.)
Specifications Subject to Change	All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu web site: www.anritsu.com

System Dynamic Range

System dynamic range is calculated as the difference between the maximum rated source power and the specified noise floor at the specified reference plane. Option 31 System Dynamic Range is listed in alternating tables. Note that Option 32 System Dynamic Range differs by the delta in max power.

MS4642B 20 GHz Model, System Dynamic Range (dB)		
	at Ports 1 or 2	at b_1 or b_2
Frequency Range	Option 61* or 62	Option 61* or 62
0.07 MHz to 0.3 MHz	81	112
>0.3 MHz to 2 MHz	98	124
>2 MHz to 10 MHz	111	132
>0.01 GHz to 2.5 GHz	114	135
>2.5 GHz to 20 GHz	115	130
With Option 31		
0.07 MHz to 0.3 MHz	83	114
>0.3 MHz to 2 MHz	100	126
>2 MHz to 10 MHz	113	134
>0.01 GHz to 2.5 GHz	116	137
>2.5 GHz to 20 GHz	116	131

*: The option 61 dynamic range reported in this column corresponds to S_{21}. For S_{12}, add 2 dB.

MS4644B 40 GHz Model, System Dynamic Range (dB)					
	at Ports 1 or 2			at b_1 or b_2	
Frequency Range	Standard	Option 51	Option 61* or 62	Option 51	Option 61* or 62
0.07 MHz to 0.3 MHz	85	83	81	114	112
>0.3 MHz to 2 MHz	102	100	98	126	124
>2 MHz to 10 MHz	115	113	111	134	132
>0.01 GHz to 2.5 GHz	122	119	114	140	135
>2.5 GHz to 40 GHz	119	115	110	130	125
With Option 31					
0.07 MHz to 0.3 MHz	87	85	83	116	114
>0.3 MHz to 2 MHz	104	102	100	128	126
>2 MHz to 10 MHz	117	115	113	136	134
>0.01 GHz to 2.5 GHz	129	121	116	142	137
>2.5 GHz to 40 GHz	122	118	113	133	128

*: The Option 61 Dynamic Range reported in this column applies for S_{21} measurements. For S_{12} Dynamic Range, use the figures from the Option 51 column.

MS4647B 70 GHz Model, System Dynamic Range (dB)					
	at Ports 1 or 2			at b_1 or b_2	
Frequency Range	Standard	Option 51	Option 61* or 62	Option 51	Option 61* or 62
0.07 MHz to 0.3 MHz	85	83	81	114	112
>0.3 MHz to 2 MHz	102	100	98	126	124
>2 MHz to 10 MHz	115	113	111	134	132
>0.01 GHz to 2.5 GHz	122	119	114	140	135
>2.5 GHz to 5 GHz	116	112	106	127	121
>5 GHz to 20 GHz	115	111	105	126	120
>20 GHz to 38 GHz	116	111	105	126	120
>38 GHz to 50 GHz	115	109	104	124	119
>50 GHz to 65 GHz	110	104	99	119	115
>65 GHz to 67 GHz	108	103	95	117	111
>67 GHz to 70 GHz	107	100	90	110	106
With Option 31					
0.07 MHz to 0.3 MHz	87	85	83	116	114
>0.3 MHz to 2 MHz	104	102	100	128	126
>2 MHz to 10 MHz	117	115	113	136	134
>0.01 GHz to 2.5 GHz	124	121	116	142	137
>2.5 GHz to 5 GHz	118	114	108	129	123
>5 GHz to 20 GHz	118	114	108	129	123
>20 GHz to 38 GHz	118	113	107	128	122
>38 GHz to 50 GHz	117	111	106	126	121
>50 GHz to 65 GHz	117	111	106	126	122
>65 GHz to 67 GHz	116	111	103	125	119
>67 GHz to 70 GHz	114	107	97	120	113

*: The Option 61 Dynamic Range reported in this column applies for S_{21} measurements. For S_{12} Dynamic Range, use the figures from the Option 51 column.

Receiver Dynamic Range

Calculated as the difference between the maximum receiver input level for 0.1 dB compression and the specified noise floor at the specified reference plane. Characteristic Performance.

All Models, Receiver Dynamic Range (dB)					
	at Ports 1 or 2			at b_1 or b_2	
Frequency Range	Standard[*1]	Option 51[*1]	Option 61[*2, *3, *4] or 62	Option 51[*1]	Option 61[*3, *4] or 62
0.07 MHz to 0.3 MHz	80	79	78	90	89
>0.3 MHz to 2 MHz	102	102	102	107	107
>2 MHz to 10 MHz	115	115	115	115	115
>0.01 GHz to 2.5 GHz	120	119	116	119	116
>2.5 GHz to 5 GHz	120	118	115	117	114
>5 GHz to 20 GHz	120	118	115	118	115
>20 GHz to 40 GHz[*5]	120	118	115	118	116
>38 GHz to 50 GHz	120	118	117	117	117
>50 GHz to 65 GHz	117	115	115	113	114
>65 GHz to 67 GHz	115	113	111	110	109
>67 GHz to 70 GHz	113	110	109	107	108

*1: Not applicable to MS4642B.
*2: The Option 61 dynamic range reported in this column applies for S_{21} measurements. For S_{12} dynamic range, use the figures from the Option 51 column.
*3: Option 8 or 9 for MS4642B.
*4: The Option 8 dynamic range reported in this column corresponds to S_{21}. For S_{12}, add 2 dB.
*5: 20 GHz to 38 GHz for MS4647B.

Receiver Compression

Port power level beyond which the response may be compressed more than 0.1 dB relative to the normalization level. 10 Hz IF bandwidth used to remove any high level noise effects. Match not included. Performance is characteristic. In pulse modes (Option 42), compression is measured with 1 kHz IF bandwidth and the compression level is 0.3 dB below 1 GHz.

All Models, Compression Levels (dBm)						
	0.1 dB Compression Levels in dBm relative to the Normalization Level*1					
	at Ports 1 or 2			at a_x loops	at b_x loops	
Frequency Range	Standard*2	Option 51*2	Option 61*3, *4, *5 or 62	Option 51, 061*5, or 62	Option 51*2	Option 61*3, *4, *5 or 62
0.07 MHz to 0.3 MHz	+5	+5	+5	–15	–15	–15
>0.3 MHz to 10 MHz	+10	+11	+12	–10	–10	–9
>0.01 GHz to 2.5 GHz	+10	+11	+12	–10	–10	–9
>2.5 GHz to 5 GHz	+10	+11	+12	–5	–5	–4
>5 GHz to 20 GHz	+10	+11	+12	–4	–4	–3
>20 GHz to 40 GHz*6	+10	+11	+12	–4	–4	–2
>38 GHz to 50 GHz	+10	+12	+14	–4	–4	–1
>50 GHz to 65 GHz	+10	+12	+14	–5	–5	–2
>65 GHz to 67 GHz	+10	+13	+15	–5	–5	–2
>67 GHz to 70 GHz	+10	+13	+15	–5	–5	–1

*1: 0.3 dB for <0.3 MHz.
*2: Not applicable to MS4642B.
*3: The Option 61 compression level reported in this column applies to Port 2 or b_2. For Port 1 or b_1 compression level, use the figures from the appropriate Port X or bx Option 51 column.
*4: Option 8 or 9 for MS4642B.
*5: For Option 8, the value in this column corresponds to that for port 2 or b_2. For port 1 or b_1, subtract 1 dB.
*6: 20 GHz to 38 GHz for MS4647B.

During intermodulation measurements it is useful to know the linearity of the receiver. In addition to considering the receiver compression point, it is helpful to understand the third order Intercept Point (IP3) of the receiver. IP3 can therefore be used as a figure of merit to describe the range and quality of IMD measurements. The nominal IP3 performance provided is valid with or without the Option 32 combiner and represents the receiver performance at the input of the test port. Minimal degradation of IP3 at different tone spacings. For the approximate IP3 of the receiver at the sampler input, deduct ~13 dB from the numbers below. The spec values below were derived by using –10 dBm/tone power incident at the receive port, a tone spacing of 3 MHz (reducing to frequency/10 for frequencies under 30 MHz) and an IF bandwidth of no more than 10 Hz.

All Models, Third Order Intercept Point (IP3, dBm)	
Frequency Range	At Ports 2 (nom.)
0.07 MHz to 0.3 MHz	+20
>0.3 MHz to 1 GHz	+25
>1 GHz to 20/40/70 GHz (max. frequency of the models)	+35

High Level Noise

Measured at 1 kHz IF bandwidth, at default power, with either full reflects or through transmission. RMS. Characteristic performance on MS4647B with either Option 51, 61, or 62. High level noise magnitude may be degraded to 20 dBm RMS (typ.) at particular frequencies due to receiver residuals.

Frequency Range	Magnitude (dB)	Phase (degree)
70 kHz to 500 kHz	<0.04	<0.4
>500 kHz to 2.5 GHz	<0.0045	<0.05
>2.5 GHz to 5 GHz	<0.0045	<0.05
>5 GHz to 20 GHz	<0.0045	<0.05
>20 GHz to 40 GHz	<0.006	<0.06
>40 GHz to 67 GHz	<0.006	<0.08
>67 GHz to 70 GHz	<0.008 (<0.006)	<0.08

Noise Floor

Measured at 10 Hz IF Bandwidth with no averaging, and at –10 dBm port power. RMS, no leakage correction applied. Measurement made with a through line connection, with its effects compensated for Performance at a_x and b_x loops is characteristic.

	At Ports 1 or 2			At a_x Loops	At b_x Loops	
Frequency Range	Standard*1	Option 51*1	Option 61*2, *3, *4 or 62	Option 51, 61*3, or 62	Option 51*1	Option 61*2, *3, *4 or 62
0.07 MHz to 0.3 MHz	–75	–74	–73	–105	–105	–104
>0.3 MHz to 2 MHz	–92	–91	–90	–117	–117	–116
>2 MHz to 10 MHz	–105	–104	–103	–125	–125	–124
>0.01 GHz to 2.5 GHz	–110	–108	–104	–129	–129	–125
>2.5 GHz to 40 GHz*5	–110	–107	–103	–121	–122	–118
>38 GHz to 50 GHz	–110	–106	–103	–121	–121	–118
>50 GHz to 65 GHz	–110	–106	–103	–121	–121	–119
>65 GHz to 67 GHz	–110	–106	–100	–120	–120	–116
>67 GHz to 70 GHz	–110	–106	–100	–115	–119	–116

*1: Not applicable to MS4642B.
*2: The Option 61 noise floor reported in this column applies to Port 2 or b_2. For Port 1 or b_1 noise floor, use the figures from the appropriate Portx or bx Option 51 column.
*3: Option 8 or 9 for MS4642B.
*4: For Option 8, the value in this column applies to port 2 or b_2. For port 1 or b_1, the appropriate value is 1 dB more negative.
*5: 2.5 GHz to 38 GHz for MS4647B.

Power Range

Maximum Rated Power to minimum level. The difference reflects the ALC range for standard models or with Option 51, and the ALC + Attenuator Range for models with Options 61 or 62. Maximum Rated Power is typical from 2.4 GHz to 2.7 GHz.

MS4642B, 20 GHz Model, Power Range (dBm)	
Frequency Range	Option 61* or 62
70 kHz to 0.01 GHz	+8 to –95
>0.01 GHz to 2.5 GHz	+10 to –95
>2.5 GHz to 20 GHz	+11 to –90
With Option 31	
70 kHz to 0.01 GHz	+10 to –95
>0.01 GHz to 2.5 GHz	+12 to –95
>2.5 GHz to 20 GHz	+12 to –90

*: For Option 61, the power range reported in this column applies to Port 1. For Port 2, add 1 dB to the maximum (minimum unchanged).

MS4644B, 40 GHz Model, Power Range (dBm)			
Frequency Range	Standard	Option 51	Option 61*1 or 62
70 kHz to 0.01 GHz	+10 to –25	+9 to –25	+8 to –95
>0.01 GHz to 2.5 GHz	+12 to –25	+11 to –25	+10 to –95
>2.5 GHz to 20 GHz	+9 to –20	+8 to –20	+7 to –90
>20 GHz to 40 GHz	+9 to –25	+8 to –25	+7 to –95
With Option 31*2			
70 kHz to 0.01 GHz	+12 to –25	+11 to –25	+10 to –95
>0.01 GHz to 2.5 GHz	+14 to –25	+13 to –25	+12 to –95
>2.5 GHz to 20 GHz	+12 to –20	+11 to –20	+10 to –90
>20 GHz to 40 GHz	+12 to –25	+11 to –25	+10 to –95

*1: The Option 61 power range reported in this column applies to Port 1. For Port 2, use the figures from the Option 51 column.
*2: With Option 8x, Test Port 2 maximum power is equivalent to the non-option 31 range (typ.).

MS4647B, 70 GHz Model, Power Range (dBm)			
Frequency Range	Standard	Option 51	Option 61*1 or 62
70 kHz to 0.01 GHz	+10 to –25	+9 to –25	+8 to –85
>0.01 GHz to 2.5 GHz	+12 to –25	+11 to –25	+10 to –85
>2.5 GHz to 5 GHz	+6 to –20	+5 to –20	+3 to –80
>5 GHz to 20 GHz	+5 to –20	+4 to –20	+2 to –80
>20 GHz to 38 GHz	+6 to –25	+4 to –25	+2 to –85
>38 GHz to 50 GHz*2	+5 to –25	+3 to –25	+1 to –85
>50 GHz to 65 GHz	0 to –25	–2 to –25	–4 to –85
>65 GHz to 67 GHz	–2 to –25	–3 to –25	–5 to –85
>67 GHz to 70 GHz	–3 to –25	–6 to –25	–10 to –85
With Option 31*3			
70 kHz to 0.01 GHz	+12 to –25	+11 to –25	+10 to –85
>0.01 GHz to 2.5 GHz	+14 to –25	+13 to –25	+12 to –85
>2.5 GHz to 5 GHz	+8 to –20	+7 to –20	+5 to –80
>5 GHz to 20 GHz	+8 to –20	+7 to –20	+5 to –80
>20 GHz to 38 GHz	+8 to –25	+6 to –25	+4 to –85
>38 GHz to 50 GHz	+7 to –25	+5 to –25	+3 to –85
>50 GHz to 65 GHz	+7 to –25	+5 to –25	+3 to –85
>65 GHz to 67 GHz	+6 to –25	+4 to –25	+2 to –85
>67 GHz to 70 GHz	+4 to –25	+1 to –25	–3 to –85

*1: The Option 61 power range reported in this column applies to Port 1. For Port 2, use the figures from the Option 51 column.
*2: Rated power is typical 49 GHz to 50 GHz.
*3: With Option 8x, Test Port 2 maximum power is equivalent to the non-option 31 range (typ.). 38 GHz to 50 GHz range may degrade by up to 3 dB.

Output Default Power

Instrument default power. For maximum rated power, refer to "Power Range" above.

Model	Standard (No Options)	Option 51, 61 or 62*1
MS4642B, 20 GHz	NA	+5 dBm
MS4644B, 40 GHz	+5 dBm	+5 dBm
MS4647B, 70 GHz	–3 dBm*2	–10 dBm

*1: Measured at default power.
*2: Measured between default and 5 dB below default port power.

Power Accuracy, Linearity and Resolution

Frequency Range	Accuracy*1 (dB)	Linearity*2 (dB)	Resolution (dB)
70 kHz to 0.01 GHz	±1.5	±1.5	0.01
>0.01 GHz to 40 GHz	±1.5	±1.0	0.01
>40 GHz to 67 GHz	±3.0	±1.0	0.01
>67 GHz to 70 GHz	±4.0 (±3.0)	±2.0 (±1.0)	0.01

*1: Measured at default power.
*2: Measured between default and 5 dB below default port power.

Measurement Stability

Ratio measurement, with ports shorted. Characteristic.

Frequency Range	Magnitude (dB/°C)	Phase (degree/°C)
70 kHz to 0.01 GHz	<0.04	<0.4
>0.01 GHz to 20 GHz	<0.02	<0.2
>20 GHz to 40 GHz	<0.03	<0.5
>40 GHz to 67 GHz	<0.03	<0.7
>67 GHz to 70 GHz	<0.04	<0.8

Frequency Resolution, Accuracy, and Stability

Resolution	Accuracy	Stability
1 Hz	±5 × 10^{-7} Hz/Hz (at time of calibration)	<5 × 10^{-9}/°C over 0°C to 50°C temperature <1 × 10^{-9}/day aging, instrument on

Phase Noise, Harmonics, and Non-Harmonics (Spurious)

Measured at default power. Phase Noise values are typical. Non-Harmonics are characteristic performance.

Frequency Range	SSB Phase Noise (dBc/Hz) at 1 kHz Offset	SSB Phase Noise (dBc/Hz) at 10 kHz Offset	SSB Phase Noise (dBc/Hz) at 100 kHz Offset	Harmonics (dBc) (second and third)	Non-Harmonic Spurious (dBc) at > 1 kHz Offsets
70 kHz to 0.01 GHz	–86	–83	–88*1	–20	–20
>0.01 GHz to 2.5 GHz	–90	–92	–96	–20	–30
>2.5 GHz to 5 GHz	–93	–94	–95	–20*2	–30
>5 GHz to 10 GHz	–86	–90	–90	–20	–30
>10 GHz to 20 GHz	–81	–84	–84	–20	–30
>20 GHz to 26.5 GHz	–78	–81	–81	–20	–30
>26.5 GHz to 40 GHz	–72	–76	–78	–20*2	–30
>40 GHz to 50 GHz	–70	–75	–75	–20	–30
>50 GHz to 70 GHz	–69	–71	–71	–20	–30

*1: Only applies for source frequencies >300 kHz.
*2: Typical from 2.5 GHz to 2.7 GHz on MS4642B systems and from 20.0 GHz to 21.0 GHz on MS4647B systems.

Uncorrected (Raw) Port Characteristics

Characteristic performance with Options 31, 51, 61, or 62.

Frequency Range	Directivity (dB)	Port Match*1 (dB)
70 kHz to 0.01 GHz	>10*2	>8
>0.01 GHz to 2.5 GHz	>9*2	>10
>2.5 GHz to 5 GHz	>20	>10
>5 GHz to 20 GHz	>17	>9
>20 GHz to 40 GHz	>14	>7
>40 GHz to 65 GHz	>11	>7
>65 GHz to 67 GHz	>11	>7
>67 GHz to 70 GHz	>5 (>10)	>7

*1: Port Match is defined as the worst of source and load match.
*2: Raw Directivity degraded to 4 dB (typ.) below 300 kHz and in a 300 MHz window below 2.5 GHz.

Power Range with Option 32

Maximum Rated Power to minimum level. Option 32 System Dynamic range differs by the delta in max power.

SOURCE1 to PORT1 POWER RANGE (dBm)

Frequency Range	Standard	Option 51	Option 61 or 62
MS4642B, 20 GHz with Option 31 and Option 32			
70 kHz to 0.01 GHz	—	—	+8 to –95
>0.01 GHz to 2.5 GHz	—	—	+10 to –95
>2.5 GHz to 20 GHz	—	—	+10 to –90
MS4644B, 40 GHz with Option 31 and Option 32			
70 kHz to 0.01 GHz	+10 to –25	+9 to –25	+8 to –95
>0.01 GHz to 2.5 GHz	+12 to –25	+11 to –25	+10 to –95
>2.5 GHz to 20 GHz	+10 to –20	+9 to –20	+8 to –90
>20 GHz to 40 GHz	+10 to –25	+9 to –25	+8 to –95
MS4647B, 70 GHz with Option 31 and Option 32			
70 kHz to 0.01 GHz	+10 to –25	+9 to –25	+8 to –85
>0.01 GHz to 2.5 GHz	+12 to –25	+11 to –25	+10 to –85
>2.5 GHz to 5 GHz	+6 to –20	+5 to –20	+3 to –80
>5 GHz to 20 GHz	+6 to –20	+5 to –20	+3 to –80
>20 GHz to 38 GHz	+6 to –25	+4 to –25	+2 to –85
>38 GHz to 50 GHz	+5 to –25	+3 to –25	+1 to –85
>50 GHz to 65 GHz	+5 to –25	+3 to –25	+1 to –85
>65 GHz to 67 GHz	+3 to –25	+1 to –25	–1 to –85
>67 GHz to 70 GHz	+2 to –25	–1 to –25	–5 to –85

SOURCE2 to PORT2 POWER RANGE (dBm)

Frequency Range	Standard	Option 51	Option 61 or 62
MS4642B, 20 GHz with Option 31 and Option 32			
70 kHz to 0.01 GHz	—	—	+6 to –95
>0.01 GHz to 2.5 GHz	—	—	+8 to –95
>2.5 GHz to 20 GHz	—	—	+9 to –90
MS4644B, 40 GHz with Option 31 and Option 32			
70 kHz to 0.01 GHz	+8 to –25	+7 to –25	+6 to –95
>0.01 GHz to 2.5 GHz	+10 to –25	+9 to –25	+8 to –95
>2.5 GHz to 20 GHz	+7 to –20	+6 to –20	+5 to –90
>20 GHz to 40 GHz	+7 to –25	+6 to –25	+5 to –95
MS4647B, 70 GHz with Option 31 and Option 32			
70 kHz to 0.01 GHz	+8 to –25	+7 to –25	+6 to –85
>0.01 GHz to 2.5 GHz	+10 to –25	+9 to –25	+8 to –85
>2.5 GHz to 5 GHz	+4 to –20	+3 to –20	+1 to –80
>5 GHz to 20 GHz	+3 to –20	+2 to –20	0 to –80
>20 GHz to 38 GHz	+4 to –25	+2 to –25	0 to –85
>38 GHz to 50 GHz*	+3 to –25	+1 to –25	–1 to –85
>50 GHz to 65 GHz	–2 to –25	–4 to –25	–6 to –85
>65 GHz to 67 GHz	–4 to –25	–5 to –25	–7 to –85
>67 GHz to 70 GHz	–5 to –25	–8 to –25	–12 to –85

*: Rated power is typical 49 GHz to 50 GHz.

SOURCE2 to PORT1 POWER RANGE (dBm, typical performance)

Frequency Range	Standard	Option 51 or 61	Option 62
MS4642B, 20 GHz with Option 31 and Option 32			
70 kHz to 0.01 GHz	—	—	–22 to –95
>0.01 to 2.5 GHz	—	—	–15 to –95
>2.5 to 20 GHz	—	—	–11 to –95
MS4644B, 40 GHz with Option 31 and Option 32			
70 kHz to 0.01 GHz	–20 to –25	–21 to –25	–22 to –95
>0.01 GHz to 2.5 GHz	–13 to –25	–14 to –25	–15 to –95
>2.5 GHz to 20 GHz	–9 to –25	–10 to –25	–11 to –95
>20 GHz to 40 GHz	–8 to –25	–9 to –25	–10 to –95
MS4647B, 70 GHz with Option 31 and Option 32			
70 kHz to 0.01 GHz	–20 to –25	–21 to –25	–22 to –85
>0.01 GHz to 2.5 GHz	–13 to –25	–14 to –25	–15 to –85
>2.5 GHz to 5 GHz	–12 to –25	–13 to –25	–15 to –85
>5 GHz to 20 GHz	–11 to –25	–12 to –25	–14 to –85
>20 GHz to 38 GHz	–11 to –25	–13 to –25	–15 to –85
>38 GHz to 50 GHz	–12 to –25	–14 to –25	–16 to –85
>50 GHz to 65 GHz	–16 to –25	–18 to –25	–20 to –85
>65 GHz to 67 GHz	–17 to –25	–18 to –25	–20 to –85
>67 GHz to 70 GHz	–20 to –25	–23 to –25	–27 to –85

MS4642B 20 GHz VNA System Performance

MS4642B – 12-Term SOLT – Sliding Load – 3652A-1 K Calibration Kit

MS4642B 20 GHz Model, with 12-term SOLT with Sliding Load Calibration, using the 3652A-1 K Calibration Kit.

Frequency Range	Directivity	Source Match	Load Match*1	Reflection Tracking	Transmission Tracking
70 kHz to 0.01 GHz	>38 dB	>36 dB	>38 dB	±0.02 dB	±0.05 dB
>0.01 GHz to 2.5 GHz	>42 dB	>41 dB	>42 dB	±0.005 dB	±0.03 dB
>2.5 GHz to 20 GHz	>43 dB	>39 dB	>43 dB	±0.006 dB	±0.07 dB

MS4642B – 12-Term SOLT – 3652A or 3652A-1 K Calibration Kit

MS4642B 20 GHz Model, with 12-term SOLT Calibration, using 3652A K or 3652A-1 K Cal Kit.

Frequency Range	Directivity	Source Match	Load Match*1	Reflection Tracking	Transmission Tracking
70 kHz to 0.01 GHz	>38 dB	>36 dB	>38 dB	±0.02 dB	±0.05 dB
>0.01 GHz to 2.5 GHz	>37 dB	>41 dB	>37 dB	±0.005 dB	±0.03 dB
>2.5 GHz to 20 GHz	>34 dB	>39 dB	>35 dB	±0.006 dB	±0.07 dB

MS4642B with .s1p Calibration and 3652A-3 or 3652A-4 K Calibration Kit

MS4642B 20 GHz Model, with.s1p Calibration, using the 3652A-3 or 3652A-4 K Calibration Kit.

Frequency Range	Directivity	Source Match	Load Match*1	Reflection Tracking	Transmission Tracking
70 kHz to 0.01 GHz	>47 dB	>45 dB	>46 dB	±0.02 dB	±0.05 dB
>0.01 GHz to 2.5 GHz	>47 dB	>45 dB	>46 dB	±0.005 dB	±0.03 dB
>2.5 GHz to 20 GHz	>46 dB	>45 dB	>46 dB	±0.006 dB	±0.07 dB

MS4642B – 12-Term SOLT – Sliding Load – 3650A-1 3.5 mm Calibration Kit

MS4642B 20 GHz Model, with 12-term SOLT Calibration with Sliding Load Calibration, using the 3650A-1 3.5 mm Cal Kit.

Frequency Range	Directivity	Source Match	Load Match*1	Reflection Tracking	Transmission Tracking
70 kHz to 0.01 GHz	>40 dB	>37 dB	>40 dB	±0.02 dB	±0.05 dB
>0.01 GHz to 2.5 GHz	>42 dB	>41 dB	>42 dB	±0.005 dB	±0.03 dB
>2.5 GHz to 10 GHz	>43 dB	>39 dB	>43 dB	±0.005 dB	±0.03 dB
>10 GHz to 20 GHz	>43 dB	>39 dB	>43 dB	±0.006 dB	±0.07 dB

MS4642B – 12-Term SOLT – 3650A or 3650A-1 3.5 mm Calibration Kit

MS4642B 20 GHz Model, with 12-term SOLT Calibration, using the 3650A or 3650A-1 3.5 mm Cal Kit.

Frequency Range	Directivity	Source Match	Load Match*1	Reflection Tracking	Transmission Tracking
70 kHz to 0.01 GHz	>40 dB	>37 dB	>40 dB	±0.02 dB	±0.05 dB
>0.01 GHz to 2.5 GHz	>42 dB	>40 dB	>42 dB	±0.005 dB	±0.03 dB
>2.5 GHz to 10 GHz	>40 dB	>34 dB	>40 dB	±0.005 dB	±0.03 dB
>10 GHz to 20 GHz	>30 dB	>34 dB	>30 dB	±0.006 dB	±0.07 dB

MS4642B – 12-Term – 36585K K AutoCal™

MS4642B 20 GHz Model, with 12-term Calibration, using the 36585K K Automatic Calibrator (AutoCal)

Frequency Range	Directivity	Source Match	Load Match*1	Reflection Tracking	Transmission Tracking
70 kHz to 0.01 GHz*2	>40 dB	>40 dB	>43 dB	±0.10 dB	±0.10 dB
>0.01 GHz to 2.5 GHz	>43 dB	>47 dB	>43 dB	±0.05 dB	±0.03 dB
>2.5 GHz to 20 GHz	>50 dB	>47 dB	>50 dB	±0.09 dB	±0.03 dB

*1: Since Residual Load Match is limited by Residual Directivity and the user test port cable, it can only be specified as Residual Directivity. For practical considerations, derate it by approximately 8 dB for a 3670 series test port cable, to compensate for effects such as match, repeatability, bend radius, and similar parameters.

*2: Typical performance below 2 MHz.

MS4644B 40 GHz VNA System Performance

MS4644B – 12-Term SOLT – Sliding Load – 3652A-1 K Calibration Kit

MS4644B 40 GHz Model, with 12-term SOLT with Sliding Load Calibration, using the 3652A-1 K Calibration Kit.

Frequency Range	Directivity	Source Match	Load Match*1	Reflection Tracking	Transmission Tracking
70 kHz to 0.01 GHz	>38 dB	>36 dB	>38 dB	±0.02 dB	±0.05 dB
>0.01 GHz to 2.5 GHz	>42 dB	>41 dB	>42 dB	±0.005 dB	±0.03 dB
>2.5 GHz to 20 GHz	>43 dB	>39 dB	>43 dB	±0.006 dB	±0.07 dB
>20 GHz to 40 GHz	>40 dB	>34 dB	>40 dB	±0.006 dB	±0.08 dB

MS4644B – 12-Term SOLT – 3652A or 3652A-1 K Calibration Kit

MS4644B 40 GHz Model, with 12-term SOLT Calibration, using the 3652A or 3652A-1 K Calibration Kit.

Frequency Range	Directivity	Source Match	Load Match*1	Reflection Tracking	Transmission Tracking
70 kHz to 0.01 GHz	>38 dB	>36 dB	>38 dB	±0.02 dB	±0.05 dB
>0.01 GHz to 2.5 GHz	>37 dB	>41 dB	>37 dB	±0.005 dB	±0.03 dB
>2.5 GHz to 20 GHz	>34 dB	>39 dB	>35 dB	±0.006 dB	±0.07 dB
>20 GHz to 40 GHz	>32 dB	>34 dB	>32 dB	±0.006 dB	±0.08 dB

MS4644B with .s1p Calibration and 3652A-3 or 3652A-4 K Calibration Kit

MS4644B 40 GHz Model, with .s1p Calibration , using the 3652A-3 or 3652A-4 K Calibration Kit.

Frequency Range	Directivity	Source Match	Load Match*1	Reflection Tracking	Transmission Tracking
70 kHz to 0.01 GHz	>47 dB	>45 dB	>46 dB	±0.02 dB	±0.05 dB
>0.01 GHz to 2.5 GHz	>47 dB	>45 dB	>46 dB	±0.005 dB	±0.03 dB
>2.5 GHz to 20 GHz	>46 dB	>45 dB	>46 dB	±0.006 dB	±0.07 dB
>20 GHz to 40 GHz	>42 dB	>38 dB	>42 dB	±0.006 dB	±0.07 dB

MS4644B – 12-Term – 36585K K AutoCal

MS4644B 40 GHz Model, with 12-term Calibration, using the 36585K K AutoCal.

Frequency Range	Directivity	Source Match	Load Match*1	Reflection Tracking	Transmission Tracking
70 kHz to 0.01 GHz*2	>40 dB	>40 dB	>43 dB	±0.10 dB	±0.10 dB
>0.01 GHz to 2.5 GHz	>43 dB	>47 dB	>43 dB	±0.05 dB	±0.03 dB
>2.5 GHz to 20 GHz	>50 dB	>47 dB	>50 dB	±0.09 dB	±0.03 dB
>20 GHz to 40 GHz	>48 dB	>47 dB	>48 dB	±0.14 dB	±0.07 dB

*1: Since Residual Load Match is limited by Residual Directivity and the user test port cable, it can only be specified as Residual Directivity. For practical considerations, derate it by approximately 8 dB for a 3670 Series test port cable, to compensate for effects such as match, repeatability, bend radius, and similar parameters.

*2: Typical performance below 2 MHz.

MS4647B 70 GHz VNA System Performance

MS4647B VNA – 12-Term SOLT Sliding Load – 3654D-1 V Calibration Kit

Frequency Range	Directivity	Source Match	Load Match*	Reflection Tracking	Transmission Tracking
70 kHz to 0.01 GHz	>38 dB	>36 dB	>38 dB	±0.02 dB	±0.05 dB
>0.01 GHz to 2.5 GHz	>41 dB	>39 dB	>41 dB	±0.02 dB	±0.05 dB
>2.5 GHz to 20 GHz	>41 dB	>37 dB	>41 dB	±0.02 dB	±0.07 dB
>20 GHz to 40 GHz	>37 dB	>32 dB	>37 dB	±0.02 dB	±0.08 dB
>40 GHz to 65 GHz	>35 dB	>28 dB	>35 dB	±0.08 dB	±0.12 dB
>65 GHz to 67 GHz	>35 dB	>28 dB	>35 dB	±0.15 dB	±0.15 dB
>67 GHz to 70 GHz	>30 dB	>26 dB	>30 dB	±0.30 dB	±0.15 dB

*: Since Residual Load Match is limited by Residual Directivity and the user test port cable, it can only be specified as Residual Directivity. For practical considerations, derate it by approximately 8 dB for a 3670 series test port cable, to compensate for effects such as match, repeatability, bend radius, and similar parameters.

MS4647B VNA – 12-Term SOLT – 3654D or 3654D-1 V Calibration Kit

Frequency Range	Directivity	Source Match	Load Match*	Reflection Tracking	Transmission Tracking
70 kHz to 0.01 GHz	>38 dB	>36 dB	>38 dB	±0.02 dB	±0.05 dB
>0.01 GHz to 2.5 GHz	>40 dB	>39 dB	>40 dB	±0.02 dB	±0.05 dB
>2.5 GHz to 20 GHz	>40 dB	>37 dB	>40 dB	±0.02 dB	±0.07 dB
>20 GHz to 40 GHz	>35 dB	>32 dB	>35 dB	±0.02 dB	±0.08 dB
>40 GHz to 65 GHz	>32 dB	>28 dB	>32 dB	±0.08 dB	±0.12 dB
>65 GHz to 67 GHz	>32 dB	>28 dB	>32 dB	±0.15 dB	±0.15 dB
>67 GHz to 70 GHz	>28 dB	>26 dB	>28 dB	±0.30 dB	±0.15 dB

*: Since Residual Load Match is limited by Residual Directivity and the user test port cable, it can only be specified as Residual Directivity. For practical considerations, derate it by approximately 8 dB for a 3670 series test port cable, to compensate for effects such as match, repeatability, bend radius, and similar parameters.

MS4647B VNA with .s1p Calibration and 3654D-3 or 3654D-4 Calibration Kit

Frequency Range[*1]	Directivity	Source Match	Load Match[*2]	Reflection Tracking	Transmission Tracking
70 kHz to 0.01 GHz	>47 dB	>47 dB	>46 dB	±0.02 dB	±0.05 dB
>0.01 GHz to 2.5 GHz	>47 dB	>47 dB	>46 dB	±0.01 dB	±0.05 dB
>2.5 GHz to 20 GHz	>46 dB	>42 dB	>46 dB	±0.01 dB	±0.07 dB
>20 GHz to 35 GHz	>44 dB	>42 dB	>44 dB	±0.01 dB	±0.07 dB
>35 GHz to 40 GHz	>44 dB	>41 dB	>44 dB	±0.03 dB	±0.08 dB
>40 GHz to 50 GHz	>42 dB	>37 dB	>42 dB	±0.05 dB	±0.1 dB
>50 GHz to 65 GHz	>42 dB	>34 dB	>42 dB	±0.06 dB	±0.1 dB
>65 GHz to 67 GHz	>40 dB	>34 dB	>40 dB	±0.1 dB	±0.12 dB
>67 GHz to 70 GHz	>37 dB	>34 dB	>37 dB	±0.15 dB	±0.12 dB

*1: The performance levels for the s1p calibration processes are contingent on the pin depth of the connector at the reference plane (and of any DUT connector) meeting Anritsu specifications.
*2: Since Residual Load Match is limited by Residual Directivity and the user test port cable, it can only be specified as Residual Directivity. For practical considerations, derate it by approximately 8 dB for a 3670 series test port cable, to compensate for effects such as match, repeatability, bend radius, and similar parameters.

MS4647B VNA – LRL – 3657-1 V Multi-Line Calibration Kit

MS4647B 70 GHz VNA, with an LRL Calibration, using the 3657-1 V Multi-Line Calibration Kit, with symmetric reflects.

Frequency Range	Directivity	Source Match	Load Match[*1]	Reflection Tracking	Transmission Tracking
0.24 GHz[*2] to 2.5 GHz	>50 dB	>50 dB	>50 dB	±0.005 dB	±0.02 dB
>2.5 GHz to 20 GHz	>50 dB	>50 dB	>50 dB	±0.005 dB	±0.02 dB
>20 GHz to 40 GHz	>50 dB	>50 dB	>50 dB	±0.005 dB	±0.02 dB
>40 GHz to 65 GHz	>45 dB	>50 dB	>45 dB	±0.015 dB	±0.02 dB
>65 GHz to 67 GHz	>45 dB	>50 dB	>45 dB	±0.03 dB	±0.04 dB
>67 GHz to 70 GHz	>45 dB	>45 dB	>45 dB	±0.10 dB	±0.08 dB

*1: Since Residual Load Match is limited by Residual Directivity and the user test port cable, it can only be specified as Residual Directivity. For practical considerations, derate it by approximately 8 dB for a 3670 series test port cable, to compensate for effects such as match, repeatability, bend radius, and similar parameters.
*2: Limited to about 240 MHz, due to the longest line delta of 34.84 mm in the 3657 Series Multi-Line Calibration Kit.

MS4647B VNA – 12-Term – 36585V V AutoCal

MS4647B 70 GHz VNA, with 12-term Calibration, using the 36585V V AutoCal.

Frequency Range	Directivity	Source Match	Load Match[*1]	Reflection Tracking	Transmission Tracking
70 kHz to 0.01 GHz[*2]	>40 dB	>40 dB	>40 dB	±0.10 dB	±0.10 dB
>0.01 GHz to 2.5 GHz	>43 dB	>47 dB	>43 dB	±0.05 dB	±0.03 dB
>2.5 GHz to 20 GHz	>50 dB	>47 dB	>50 dB	±0.09 dB	±0.03 dB
>20 GHz to 40 GHz	>48 dB	>47 dB	>48 dB	±0.14 dB	±0.07 dB
>40 GHz to 65 GHz	>43 dB	>45 dB	>43 dB	±0.17 dB[*3]	±0.10 dB
>65 GHz to 67 GHz	>43 dB	>45 dB	>43 dB	±0.17 dB	±0.10 dB
>67 GHz to 70 GHz	>42 dB	>40 dB	>42 dB	±0.30 dB	±0.12 dB

*1: Since Residual Load Match is limited by Residual Directivity and the user test port cable, it can only be specified as Residual Directivity. For practical considerations, derate it by approximately 8 dB for a 3670 series test port cable, to compensate for effects such as match, repeatability, bend radius, and similar parameters.
*2: Limited to about 240 MHz, due to the longest line delta of 34.84 mm in the 3657 Series Multi-Line Calibration Kit.
*3: ±0.25 dB from 51 GHz to 55 GHz.

Measurement Times

Measurement times include sweep time, and band-switching time, in single channel mode. Typical.
~30 µs/point is achieved in true swept mode, with 100,000 points, with ALC turned on for level accuracy, with display turned-on for tuning purposes, with locking turned-on for frequency accuracy and repeatability, with correction turned on to meet published residual specifications, and over the full span of the product with all band-switch points to fully characterize a device.

Measurement Time (ms), SYNTHESIZED Sweep, Display ON and ALC ON

Calibration	Sweep Width	IFBW	Measurement Time (ms)			
			401 Points	1,601 Points	25,000 Points	100,000 Points
Uncorrected or 1-port calibration	Narrow (≤1 GHz span without band-switch points)	1 MHz	20	60	890	3,300
		30 kHz	30	110	1,600	6,100
		1 kHz	380	1,600	25,000	100,000
	Wide (70 GHz span)	1 MHz	50	90	1,000	3,400
		30 kHz	60	140	1,700	6,200
		1 kHz	420	1,670	25,000	100,000
2-port calibration (per sweep)	Narrow (≤1 GHz span without band-switch points)	1 MHz	20	60	890	3,300
		30 kHz	30	110	1,600	6,100
		1 kHz	400	1,610	25,000	100,000
	Wide (70 GHz span)	1 MHz	50	90	1,000	3,400
		30 kHz	60	140	1,700	6,200
		1 kHz	420	1,670	25,000	100,000

Measurement Time (ms) vs. Noise Floor (dBm), SYNTHESIZED Sweep, Display ON and ALC ON

Calibration	Full Band Sweep	Measurement Time 1,601 Points	Achieved Noise Floor at Maximum Frequency (dBm)	IFBW (kHz)
2-port calibration (per sweep)	MS4642B	110	–85	100
		210	–95	10
	MS4644B	115	–80	100
		210	–90	10
	MS4647B	120	–75	100
		210	–85	10

Standard Capabilities

Operating Frequency	MS4642B	40 kHz to 20.2 GHz
	MS4644B	10 MHz to 40.5 GHz
	MS4647B	10 MHz to 70 GHz
	MS4640B-070	Optional for all MS4640B Series VNAs. Provides 40 kHz to 10 MHz Coverage Extension. Provides a lower limit specified to 70 kHz, which is allowed to extend to 40 kHz.
Measurement Parameters	2-Port Measurements	S_{11}, S_{21}, S_{22}, S_{12}, and any user-defined combination of a_1, a_2, b_1, b_2, and 1.
	4-Port Measurements	Refer to the separate VectorStar MN469xC Series Multiport VNA Measurement System Technical Data Sheet – 11410-00777, available at https://www.anritsu.com/en-us/test-measurement/products/ms4640b-series
	Domains	Frequency Domain, Power Domain, CW Draw, and Time (Distance) Domain
Sweeps	Frequency Sweep Types	Linear, Log, CW, or Segmented
	Power Sweep Types	Linear, constant power sweeps, or constant power slope (dB/GHz) over frequency sweep
Display Graphs	Single Rectilinear Graph Types	Log Magnitude, Phase, Group Delay, Linear Magnitude, Real, Imaginary, SWR, Power Out, Impedance, and Power In
	Dual Rectilinear Graph Types	Log Magnitude and Phase, Linear Magnitude and Phase, and Real and Imaginary
	Circular Graph Types	Smith Chart (Impedance), Smith Chart (Admittance), Linear Polar, and Log Polar
Measurements Data Points	25,000 Data Points	2 to 25,000 points in up to 16 channels
	100,000 Data Points	2 to 100,000 points in single channel
Limit Lines	Limit Lines	Single or segmented. 2 limit lines per trace. 50 segments per limit line.
	Single Limit Readouts	Uses interpolation to determine the intersection frequency.
	Test Limits	Both single and segmented limits can be used for PASS/FAIL testing.
Averaging	Point-by-Point	Point-by-point (default), max Averaging = IF Bandwidth/1 Hz
	Sweep-by-Sweep	Sweep-by-sweep (no limit)
IF Bandwidth	1, 2, 3, 5, 7, 10, 20, 30, 50, 70, 100, 200, 300, 500, 700 Hz, 1, 2, 3, 5, 7, 10, 20, 30, 50, 70, 100, 200, 300, 500, 700 kHz; 1 MHz	
Reference Plane	Line Length or Time Delay	The reference planes of a calibration or other normalization can be changed by entering a line length or time delay.
	Dielectric Constants	Dielectric constants may be entered for different media so the length entry can be physically meaningful.
	Dispersion Modeling	Dispersion modeling is used in the cases of microstrip and waveguide to take into account frequency dependent phase velocities.
	Attenuation	Attenuations (with frequency slope) and constant phase offsets can be entered to better describe any reference plane distortions.
	Auto Modes	Automatic reference plane finding tools are available for phase alone or phase + magnitude. These routines do a fitting process on phase or phase and magnitude to estimate the reference plane location and enter correcting values
	De-embedding	For more complete reference plane manipulation, the full de-embedding system can also be used.
Measurement Frequency Range	Frequency Range Change	Frequency range of the measurement can be narrowed within the calibration range without recalibration.
	CW Mode	CW mode permits single frequency measurements also without recalibration.
	Interpolation Not Activated	If interpolation is not activated, the subset frequency range is forced to use calibration frequency points.
	Interpolation Activated	If interpolation is activated, any frequency range that is a subset of the calibration frequency range can be used, but there may be some added interpolation error.

Continued on next page

Group Delay	Group Delay Aperture	Defined as the frequency span over which the phase change is computed at a given frequency point.
	Aperture	The aperture can be changed without recalibration.
	Minimum Aperture	The minimum aperture is the frequency range divided by the number of points in calibration and can be increased to 20% of the frequency range.
	Group Delay Range	<180° of phase change within the aperture
Channels, Display, and Traces	Channels and Traces	16 channels, each with up to 16 traces
	Display	Color touch screen LCD, 26.4 cm (10.4") diagonal
	Display Colors	Unlimited colors for data traces, memory, text, markers, graticules and limit lines.
	Trace Memory and Math	A separate memory for each trace can be used to store measurement data for later display or subtraction, addition, multiplication or division with current measurement data. The trace data can be saved and recalled.
	Inter-trace Math	Any two traces within a channel can also be combined (via addition, subtraction, multiplication or division) and displayed on another trace. An equation editor mode is also available that allows the combination of trace data, trace memory and S-parameter data in more complex equations. Over 30 built-in functions are available. Simple editing tools and the ability to save/recall equations are also provided.
Scale Resolution Minimum per division, varies with graph type.	Log Magnitude	0.001 dB
	Linear Magnitude	1 *pu*
	Phase	0.01°
	Group Delay	0.001 ps
	Time	0.001 ps
	Distance	0.1 µm
	SWR	1 *pu*
	Power	0.01 dB
Markers	Markers	12 markers per trace (× 16 traces × 16 channels, for a total of 3,072)
	Marker Coupling	Coupled or decoupled within a channel
	Marker Data	Data displayed in graph area or in table form
	Reference Marker	Additional marker per trace for reference
	Marker Statistics	Mean, maximum, minimum, standard deviation Per trace or over a marker region.
	Marker Search and Tracking	Search and/or track for minimum, maximum, peak, or target value.
Other	Filter Parameters	Display bandwidth (user-selectable loss value), corner and center frequencies, loss, Q, and shape factors.
	Blank Frequency Information	Blanking function removes all references to frequencies on the display. Frequency references can only be restored through a system preset or GPIB command.

Calibration and Correction Capabilities

Calibration Methods	Short-Open-Load-Through (SOLT) with Fixed or Sliding Load and supporting .s1p-defined cal kits Offset-Short-Offset-Short-Load-Through (SSLT) with Fixed or Sliding Load Triple-Offset-Short-Through (SSST) Short-Open-Load-Reciprocal (SOLR) or Unknown Through Method (SSLR, SSSR) Line-Reflect-Line (LRL)/Line-Reflect-Match (LRM) – (up to 5 bands supported) Thru-Reflect-Line (TRL)-(up to 5 bands supported) Advanced-LRM (A-LRM™) for improved on-wafer calibrations AutoCal Thru Update available Secondary match correction available for improved low insertion loss measurements
Correction Models	2-Port (Forward, Reverse, or both directions) 1-Port (S_{11}, S_{22}, or both) Transmission Frequency Response (Forward, Reverse, or both directions) Reflection Frequency Response (S_{11}, S_{22}, or both)
Merged Calibration	Merge multiple calibrations over bands of frequency points and with different algorithms
Coefficients for Calibration Standards	Use the Anritsu calibration kit USB Memory Device to load kit coefficients and characterization files. Enter manual coefficients into user-defined locations. Complex load models are available. Full .s1p definitions of calibration standards can be loaded.
Reference Impedance	Modify the reference impedance from 50Ω to any impedance greater than 0Ω.
Interpolation	Allows interpolation between calibration frequency points. Accuracy will be reduced at non-calibration frequencies and that degradation is dependent on the frequency step size in the initial calibration and the electrical length of the user's setup.
Adapter Removal Calibration	Characterizes and "removes" an adapter that is used during calibration that will not be used for subsequent device measurements; for accurate measurement of non-insertable devices.
Dispersion Compensation	Selectable as Coaxial, other non-dispersive (e.g., for coplanar waveguide), Waveguide, or Microstrip.

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Power	Power Meter Correction	Different power meter calibrations are available to enhance power accuracy at the desired reference plane. The source power will match the target calibration power, as read by the power meter, to within ~0.1 dB for short periods of time (determined by thermal drift of the system and the power meter). The absolute accuracy of the calibrated power will be dependent on the power meter and sensor used.
	Flat Power Calibrations	A flat power calibration (when in frequency sweep mode) is available at a user-selectable power level, if it is within the power adjustment range of the internal source. The flat power correction is applied to other power levels.
	Linear Power Calibrations	A linear power calibration is performed over a range of power levels for use in power sweep mode and is performed at a specified frequency or frequency range.
	External Power Meter	Both calibrations are performed using an external power meter (Anritsu ML2438A, ML248xB, ML249xA, Agilent 437, or equivalent) over the Dedicated GPIB port, or a USB power sensor (Anritsu MA24106A, MA24108A, MA24118A, MA24208A, MA24218A, MA24330A, MA24340A, MA24350A, MA24507A, or MA24510A) connected to a USB port. Note: Usage of the MA24500A or MA24510A sensor requires connection to two USB ports to supply needed current draw.
Embedding/ De-embedding	The MS4640B is equipped with an Embedding/De-embedding system.	
	De-embedding	De-embedding is generally used for removal of test fixture contributions, modeled networks and other networks described by S-parameters (s2p files) from measurements.
	Embedding	Similarly, the Embedding function can be used to simulate matching circuits for optimizing amplifier designs or simply adding effects of a known structure to a measurement.
	Multiple Networks	Multiple networks can be embedded/de-embedded and changing the port and network orientations is handled easily.
	Extraction Utility	An extraction utility is part of this package that allows the easier computation of deembedding files based on some additional calibration steps and measurements.
Impedance Conversion	Allows entry of different reference impedances (complex values) for different ports	
Mixer Setup	Mixer setup provides assistance to configure common mixer measurements including a simple, yet accurate, calibration methodology.	
	Mixer Setup – Single Channel	The prime objective of the guided Mixer Setup Single Channel is to help configure the frequency plan of the measurement using easy-to-understand diagrams. Mixers using harmonics of the LO are supported as are mm-wave configurations (see ME7838x documentation).
	Mixer Setup – Multiple Channel	The Mixer Setup Multiple Channels helps configure measurement channels to handle any of a suite of possible mixer measurements and to list the required calibration steps.
	Mixer Calibration	Both of these tools are coupled with the mixer calibration menu system that enables both scalar and vector-corrected measurements. The user can be directed to power calibrations that are automatically set up based on the mixer configuration.
	Dual Source Mixer	Allows easier external mixer setups and can take advantage of the flexibility of having two independent internal sources within the VNA.

Remote Operability

VectorStar supports several remote operability options.

Communication Type	Data Format	Performance	Description
Via GPIB	Using IEEE 488.2	1 MB/s Data Transfer Speed	Use SCPI or previous generation Lightning VNA commands. Also compatible with a fundamental set of HP/Agilent 8510x VNA commands.
Via LAN	Using VXI-11 Protocol	2.5 MB/s Data Transfer Speed	
Via USB	Using USBTMC Protocol	5.5 MB/s Data Transfer Speed	
Drivers for GPIB, LAN, or USB	National Instruments LabVIEW and LabWindows/CVI drivers are available for download from both the Anritsu and National Instruments web sites. .NET/COM driver for Windows™ Applications such as Visual Studio 6 thru VS 2005, VB6, C#, C++, C, Visual C, HP Vee, and more are available for download from the Anritsu web site. These drivers require VISA runtime, not provided by Anritsu. NI VISA version 3.2 or higher is recommended for .NET and USB support.		
Triggering	Internal, External, GPIB Single point, Single Sweep, and Single Channel. All Channels are hand-shaking for optimum tandem sweeps (check rear panel connections).		

Throughput Time

Throughput Time (ms), Synthesized Sweep, Display ON and ALC ON, single 20 GHz sweep, 30 kHz IFBW, including trigger and data transfer time.

Communication Type	Data Format	Measurement Time		
		401 points	1,601 points	100,000 points
GPIB (IEEE-488.2)	32- or 64-bit Floating	380	410	6,400
	ASCII	290	370	7,400
LAN (VXI-11)	32- or 64-bit Floating	280	320	6,300
	ASCII	290	350	7,400
USB (USBTMC class)	32- or 64-bit Floating	280	310	6,000
	ASCII	290	350	6,800

Optional Capabilities

Time Domain Measurements — Option 2	Displays all S-parameters and overlays with Frequency Domain, Low-pass Mode with added harmonics frequency list flexibility, Band-pass Mode, Phasor Impulse Mode, Windowing, Gating (pass-band or reject-band), and Frequency with Time Gate. Low-pass mode requires a harmonically related frequency list (step size = start frequency). A harmonic sweep tool is available to help with this setup. In low-pass mode, the impulse or step response can be displayed (the latter for a TDR-like presentation). When applying gating, the impedance levels at gate edges can be changed to simplify de-embedding operations.	
Receiver Offset — Option 7	Independent Source/Receive Functions	Allows for independent source and receive functions for Mixer, Harmonics, IMD and other measurements, where the source and receive frequencies are offset.
	Multiple Source Control Mode	To independently control the frequencies of up to four external sources, in addition to the internal source, and the receiver, in a synchronized manner.
	NxN Frequency-Translated Devices	Provides calibration and measurements capability for NxN Frequency-translated devices. For accurate and absolute magnitude and phase measurements of match, gain/loss, and group delay of devices such as mixers and converters.
Universal Fixture Extraction — Option 21	Description	Provides a suite of additional network extraction techniques for different de-embedding problems, particularly those when only partial interface information is available at the DUT plane. These are often useful for on-wafer and fixtured environments with more complex DUT interfaces where traditional standards may not be available. In most cases, .s1p definition/model of reflect standards is allowed and generally automatic fixture length detection is available. In addition, a sequential extraction (peeling) of isolated fixture defects is possible and allows one to generate sNp files for portions of the fixture for design analysis.
Dual Source Architecture — Option 31	Description	Adds a second internal source to the VNA structure and removes the transfer switch. This architecture results in higher test port power and improved dynamic range. Combined with Option 7 Receiver Offset, allows two sources and the receiver to be active at the same time and at independent frequencies. When both sources are active and at the same frequency, a relative phase shift can be set between them. When combined with Option 43 DifferentialView™, adds the ability to perform true mode stimulus measurements of differential devices. The dual source mixer capability allows the flexibility of two independent sources within the VNA to allow external mixer measurements.
	Required Options	None, except with the dual source mixer applications which require Option 7.
	System Compatible Options	Option 2 Time Domain Option 7 Receiver Offset Option 21 Universal Fixture Extraction Option 32 Internal RF Combiner Option 35 IF Digitizer Option 36 Extended IF Digitizer Memory Option 41 Noise Figure Option 42 PulseView™ Option 43 DifferentialView™ Option 44 IMDView™ Option 46 Fast CW Option 47 Eye Diagram Option 48 Differential Noise Figure Option 51 Direct Access Loops Option 53 External ALC Option 53 External ALC Options 61/62 Active Measurements Suite Option 70 70 kHz Low Frequency Extension Options 84/85 Broadband/Banded/Millimeter-Wave Extension Options 88/89 Broadband/Banded/Millimeter-Wave Extension. Maximum frequency available is 110 GHz
	Incompatible	Options 80/81 Broadband/Millimeter-Wave Options 82/83 Banded Millimeter-Wave Extension Options 86/87 Broadband/Millimeter-Wave. Maximum frequency available is 110 GHz.
Internal RF Combiner — Option 32	Description	Adds an internal combiner to combine Source 2 of the Dual Source Architecture option (Option 31) with Source 1 and routes to Port 1 of the VectorStar front panel. When combined with IMDView Option 44 the configuration provides optimized intermodulation distortion (IMD) measurements. The Frequency Offset (Option 7) and Dual Source (Option 31) must be ordered with the combiner option. If IMDView Option 44 is not included, switching of the combiner is activated using the Multiple Source Control menus supplied with the frequency offset option.
	Required Options	Option 7 Receiver Offset and Option 31 Dual Source Architecture
	System Compatible Options	Option 2 Time Domain Option 21 Universal Fixture Extraction Option 35 IF Digitizer Option 36 Extended IF Digitizer Memory Option 41 Noise Figure Option 42 PulseView™ Option 43 DifferentialView™ Option 44 IMDView™ Option 46 Fast CW Option 47 Eye Diagram Option 48 Differential Noise Figure Option 51 Direct Access Loops Option 53 External ALC Option 61/62 Active Measurements Suite Option 70 70 kHz Low Frequency Extension Options 84/85 Broadband/Banded/Millimeter-Wave Extension Options 88/89 Broadband/Banded/Millimeter-Wave Extension. Maximum frequency available is 110 GHz
	Incompatible Options	Options 80/81 Broadband/Millimeter-Wave Options 82/83 Banded/Millimeter-Wave Extension Options 86/87 Broadband/Millimeter-Wave. Maximum frequency available is 110 GHz

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IF Digitizer — Option 35	Description	When combined with Option 42 PulseView™, adds the capability to generate and measure pulsed signals. Four internal signal generators are included enabling singlet, doublet, triplet, quadruplet, and/or burst signal generation. Pulse measurements include pulse profile, point-inpulse, and pulse-to-pulse capability.
	Required Options	None
	System Compatible Options	All
	Incompatible Options	None
	Multiport Systems	Compatible with the MN469xC Series Multiport System on any model VNA. Fast CW (non-pulsed) Captures up to 400 million data points per measurement channel with variable acquisition rates from 80 MHz to 400 MHz. This capability enables long time records (0.5 s to 2.5 s, depending on acquisition rate) stored in files retrievable via USB or a local area network.
	Additional Information	For detailed pulse measurement theory, description, and operational information, see the VectorStar MS464xB Series VNA Calibration and Measurement Guide, 10410-00318.
Extended IF Digitizer Memory — Option 36	Description	Provides additional memory for the IF digitizer option to allow for longer record lengths. This option increases the maximum record length from 0.5 seconds to 2.5 seconds at the maximum sampling rate (minimum time resolution) with proportionate increases in record length increases at other sampling rates.
	Required Options	Option 35 IF Digitizer
	System Compatible Options	All
	Incompatible Options	None
Noise Figure — Option 41	Description	Adds the capability to measure degradation of the signal-to-noise ratio caused by components in a signal chain. The Noise Figure measurement is based on a cold source technique for improved accuracy. Various levels of match and fixture correction are available for additional enhancement. Mixer noise figure measurements are supported. Compatible with mmWave measurements in the ME7838X family with the use of receiver-only modules (e.g., 3744A-Rx).
	Required Options	Option 51, Option 61, or Option 62
	System Compatible Options	Option 2 Time Domain Option 7 Receiver Offset Option 21 Universal Fixture Extraction Option 31 Dual Source Architecture Option 32 Internal RF Combiner Option 35 IF Digitizer Option 36 Extended IF Digitizer Memory Option 42 PulseView™ Option 43 DifferentialView™ Option 44 IMDView™ Option 46 Fast CW Option 47 Eye Diagram Option 53 External ALC Option 70 70 kHz Low Frequency Extension Options 81/87 Broadband/Millimeter-Wave Option 83 Millimeter-Wave Extension Options 85/89 Broadband/Banded/Millimeter-Wave Extension
	Incompatible Options	Option 48 Differential Noise Figure Options 80/86 Broadband/Millimeter-Wave Option 82 Banded Millimeter-Wave Extension Option 84 Broadband/Banded/Millimeter-Wave Extension Option 86 Broadband/Millimeter-Wave Option 88 Broadband/Banded/Millimeter-Wave Extension
	Multiport System	MN469xC Series Multiport System on any model VNA; Noise Figure is only available when configured as a 2-Port VNA.
	Additional Information	For detailed Noise Figure measurement theory, description, and operational information, see the VectorStar MS464xB Series VNA Calibration and Measurement Guide, 10410-00318.

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PulseView™ — Option 42	Description	When combined with Option 35 IF Digitizer, adds the capability to generate and measure pulsed signals. Four internal signal generators are included enabling singlet, doublet, triplet, quadruplet, and/or burst signal generation. Pulse measurements include pulse profile, point-in-pulse, and pulse-to-pulse capability. Allows pulsed leveling of source power at an external point (e.g., after a preamplifier).
	Required Options	Option 35 IF Digitizer
	System Compatible Options	All
	Incompatible Options	None
	Multiport Systems	Compatible with the MN469xC Series Multiport System on any model VNA
	Additional Information	For detailed pulse generation and measurement capability theory, description, and operation information, see the VectorStar MS464xB Series VNA Calibration and Measurement Guide - 10410-00318.
	Pulse Measurements	Pulse profile (PP), point-in-pulse (PIP), pulse-to-pulse (P2P), continuous pulse profiling (Cprof), and continuous point-in-pulse (CPIP)
	Minimum Profile Width	2.5 ns (5 ns minimum for continuous profiling)
	Minimum PIP Measurement Width	2.5 ns (5 ns minimum for continuous point-in-pulse)
	P2P Measurement Width	Minimum 5 ns
	Record Length	0.5 s
	Pulse Repetition Frequency (PRF)	4 Hz to 67 MHz in Pulse mode; PRFs slower than 4 Hz can be measured in standard Transmission/ Reflection mode with triggering.
	Duty Cycle (DC) Dynamic Range Reduction (characteristic)	
	1% DC	0 dB
	0.1% DC	0 dB
	0.01% DC	0 dB
	Pulse Generation	Four (4) internal pulse generators: PG1-PG4.
	Pulse Formats	Singlet, doublet, triplet, quadruplet, and burst
	Pulse Repetition Frequency (PRF) Range	4 Hz to 67 MHz
	Maximum Pulse Width	0.25 s
	Minimum Pulse Width	5 ns
	RF Modulation	Requires a SM6628, SM6629, SM6630, or SM6631 Pulse Modulator Test Set (see next section)
RF Modulation (Pulse Modulator Test Sets for use with Option 42 PulseView™)	Description	Pulse Modulator Test Sets are available to pulse the RF stimulus and/or provide receiver gating (modulation). Receiver gating generally required only for higher power antenna and related applications where undesired pulses could saturate the VNA receiver. The Test Set frequency range is limited to that of the VNA with which it is used. Test Sets include necessary cabling and installation documentation.
	Required Options	Option 35 IF Digitizer Option 42 PulseView™ Option 51 Direct Access Loops or Options 61/62 Active Measurements Suite
	Requires one of the following compatible Pulse Modulator Test Sets	SM6628, 70 kHz to 40 GHz. Provides the MS4642B and MS4644B VNA with source modulation. SM6629, 70 kHz to 40 GHz. Provides the MS4642B and MS4644B VNA with source and receiver modulation. SM6630, 70 kHz to 70 GHz. Provides the MS4647B VNA with source modulation. SM6631, 70 kHz to 70 GHz. Provides the MS4647B VNA with source and receiver modulation.
	Polarity	Low (<1 V) = RF ON High (3.3 V ±10%) = RF OFF
	Pulse Rise/Fall Time (typ.)	5 ns (10 to 90%)
	Insertion Loss (typ.)	<10 dB, to 20 GHz <12 dB, 20 GHz to 40 GHz <15 dB, 40 GHz to 60 GHz <20 dB, 60 GHz to 70 GHz
	On/Off Ratio (typ.)	>100 dB, to 20 GHz >95 dB, 20 GHz to 60 GHz >90 dB, 60 GHz to 70 GHz
	Max Input Power	+20 dBm max, 0 VDC max
	Latency (typ.)	35 ns
DifferentialView™ — Option 43	Description	When combined with Option 31 Dual Source Architecture, provides dual source control and calibrations required for stimulating and measuring differential devices. Allows true differential and common mode device drives. Corrects mismatch introduced error of the DUT to VNA interface via real and time calibration. This mode supports balanced in/out or combined balanced and single source drive configurations. In addition, it provides the ability to control amplitude and phase offsets of the drive conditions as well as swept phase offset for custom characterization.
	Required Options	Option 31 Dual Source Architecture
	Compatible Options	All
	Incompatible Options	None
	Multiport Systems	Requires an MN469xC Series Multiport System for full differential characterization of a multiport device.

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IMDView™ — Option 44	Description	When combined with Options 31, 32, and 7, IMDView provides user interface for setting up and performing IMD measurements. Interface configures and controls source routing, power and receiver calibrations, for baseband or mmWave VectorStar systems. Frequency Offset Option 7 required. If Options 31 and/or 32 are not included, the IMDView software will control external sources and perform power calibrations of external combiners.
	Required Options	Option 7 Receiver Offset
	System Compatible Options	Option 2 Time Domain Option 7 Receiver Offset Option 21 Universal Fixture Extraction Option 31 Dual Source Architecture Option 32 Internal RF Combiner Option 35 IF Digitizer Option 36 Extended IF Digitizer Memory Option 42 PulseView™ Option 43 DifferentialView™ Option 46 Fast CW Option 47 Eye Diagram Option 51 Direct Access Loops Option 53 External ALC Options 61/62 Active Measurements Suite Option 70 70 kHz Low Frequency Extension Options 84/85 Broadband/Banded/Millimeter-Wave Extension Options 88/89 Broadband/Banded/Millimeter-Wave Extension. Maximum frequency available is 110 GHz Options 80/81 Broadband/Millimeter-Wave Options 82/83 Banded/Millimeter-Wave Extension Options 86/87 Broadband/Millimeter-Wave. Maximum frequency available is 110 GHz Option 88 Broadband/Banded/Millimeter-Wave Extension
	Multiport System	Compatible with the MN469xC Series Multiport System on any model VNA; IMDView measurements can only be performed when the system is configured as a 2-Port VNA.
	Additional Information	For detailed IMD measurement theory, description and operational information, see the VectorStar MS464xB Series VNA Calibration and Measurement Guide - 10410-00318.
Fast CW — Option 46	Description: Standard Mode Fast CW	If Option 35 is not installed then Standard Mode Fast CW operations are available in T/R mode via remote commands. Standard Option CW supports both continuous data streaming and buffered data collection maximum data rates of ~200,000 measurements/second. The maximum buffer size is up to 60 million measurements with transfer blocks of up to 5 million measurements. Fast transfers are available for both streaming and buffered modes. Data extraction at corrected and final formatted layers is permitted.
	Description: Advanced Fast CW	With Options 35 and 46 installed, Advanced Fast CW becomes available that allows data rates of up to 100,000,000 measurements/second on all receivers at once and buffers of up to 800,000,000 measurements deep (with Option 36). Advanced Fast CW is available in the user interface as well as remotely and has on-board synchronization choices and data reduction functionality.
	Required Options	Option 35 IF Digitizer (required for Advanced Fast CW only)
	System Compatible Options	All
	Incompatible Options	None
Eye Diagram — Option 47	Description	Adds the capability to calculate an eye diagram representation of what the currently measured trace data would do to a digital data stream (that can be configured by the user). This is particularly valuable in seeing the data stream signal integrity issues that could occur with a given transmission path and can help with building up subsystem simulation results. Since the eye diagram computation is per-trace, one can configure a single channel having frequency domain, time domain impulse response, TDR-like and eye diagram traces simultaneously and all responding to the same live data.
	Required Options	Option 2 Time Domain
	System Compatible Options	All
	Incompatible Options	None
	Additional Information	For detailed Eye Diagram measurement theory, description and operational information, see the VectorStar MS4640B Series VNA Calibration and Measurement Guide - 10410-00318.

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Differential Noise Figure — Option 48	Description	Includes all the functionality of Option 41 and allows measurement of differential and common-mode noise properties with the cold source method. Three operating modes (uncorrelated, correlated, and combiner-based) are available for measurement efficiency and accuracy optimization. Full treatment of output port correlation is available for 3- and 4-port DUTs. Mixer noise figure measurements are supported. Various levels of vector correction are available, as is full fixture/probe embedding and de-embedding. Compatible with mm-wave measurements in the ME7838X family with the use of receiver-only modules (e.g., 3744A-Rx).
	Required Options	Option 51 or Option 61 or Option 62
	System Compatible Options	Option 2 Time Domain Option 7 Receiver Offset Option 21 Universal Fixture Extraction Option 31 Dual Source Architecture Option 32 Internal RF Combiner Option 35 IF Digitizer Option 36 Extended IF Digitizer Memory Option 42 PulseView™ Option 43 DifferentialView™ Option 44 IMDView™ Option 46 Fast CW Option 47 Eye Diagram Option 53 External ALC Option 70 70 kHz Low Frequency Extension Option 81 Broadband/Millimeter-Wave Option 83 Millimeter-Wave Extension Option 85 Broadband/Banded/Millimeter-Wave Extension Option 87 Broadband/Millimeter-Wave Option 89 Broadband/Banded/Millimeter-Wave Extension
	Incompatible Options	Option 41 Noise Figure Option 80 Broadband/Millimeter-Wave Option 82 Banded Millimeter-Wave Extension Option 84 Broadband/Banded/Millimeter-Wave Extension Option 86 Broadband/Millimeter-Wave Option 88 Broadband/Banded/Millimeter-Wave Extension
	Multiport System	MN469xC Series Multiport System on any model VNA; Differential Noise Figure measurements can be performed when the system is configured as a 2-Port VNA or a 4-Port VNA.
	Additional Information	For detailed Differential Noise Figure measurement theory, description, and operational information, see the VectorStar MS4640B Series VNA Calibration and Measurement Guide, 10410-00318.
Direct Access Loops — Option 51	Access Loops Per Port	Adds three (3) Access loops per port for Source, Test, and Receive Paths. Note: Direct access loops are not available for VNAs equipped with Option 61 or 62, which include access loops.
	Front Panel Loops	≥2.5 GHz Frequency Coverage loops, located at front panel.
	Rear Panel Loops	<2.5 GHz Frequency Coverage loops, located at rear panel.
External ALC — Option 53	External ALC access allows leveling of source power at an external point (e.g., after a preamplifier). The connector is also installed with Option 8x for use with the modular broadband and mm-wave functions (when in a 3739 mode, the broadband/mm-wave functionality takes precedence).	
	Required Options	Option 61 or 62
	System Compatible Options	All
	Incompatible Options	None
Active Measurements Suite — Options 61/62	Adds Step Attenuators, Bias Tees, Direct Access Loops, and Gain Compression and Efficiency Measurement Capabilities.	
	MS4642B Attenuators	70 dB, 10 dB/step
	MS4644B Attenuators	70 dB, 10 dB/step
	MS4647B Attenuators	60 dB, 10 dB/step
	Option 61	Two (2) attenuators: One in Source 1 path, and one in Receive 2 path.
	Option 62	Four (4) attenuators: One in each Source path and in each Receive path.
	Bias Tees	0.5 A max., 40 VDC max. 3 kHz BW (nominal), looking into a High Impedance 10MΩ to Ground for DUT Static Discharge Protection located at rear panel.
	Access Loops	Includes Option 51 loops, listed above. (Option 51, 61, and 62 are mutually exclusive)
	Gain Compression	Swept Power Gain Compression at a CW frequency Px dB over Swept Frequency, up to 401 points.
70 kHz Low End Frequency Extension — Option 70	Extends the VNA standard 10 MHz low-end start frequency to 70 kHz, providing 70 kHz to 20, 40, or 70 GHz coverage models. The low-end is allowed to extend to 40 kHz.	
Broadband/Banded/ Millimeter-Wave Systems	For details on the MS464xB-08x series of options, see the: VectorStar ME7838A Modular Broadband/Millimeter-Wave Technical Data Sheet – 11410-00593 (For 70 kHz to 125 GHz) VectorStar ME7838D Modular Broadband/Millimeter-Wave Technical Data Sheet – 11410-00778 (For 70 kHz to 145 GHz) VectorStar ME7838E Modular Broadband/Millimeter-Wave Technical Data Sheet – 11410-00767 (For 70 kHz to 110 GHz) VectorStar ME7838G Modular Broadband/Millimeter-Wave Technical Data Sheet – 11410-01060 (For 70 kHz to 220 GHz) VectorStar ME7838A4 4-Port Modular Broadband/Millimeter-Wave Technical Data Sheet – 11410-00704 (For 70 kHz to 125 GHz) VectorStar ME7838D4 4-Port Modular Broadband/Millimeter-Wave Technical Data Sheet – 11410-01099 (For 70 kHz to 145 GHz) VectorStar ME7838E4 4-Port Modular Broadband/Millimeter-Wave Technical Data Sheet – 11410-01100 (For 70 kHz to 110 GHz)	

CPU, OS, Memory, and Security Features

CPU	Intel Core™ i5	
O/S	The Microsoft® Windows® 7 operating system on the MS4640B Series VNA is configured for optimum performance when the instrument leaves the factory.	
Display	26.4 cm (10.4”) Color XGA Touch-Screen Display	
Storage	Serial-ATA (SATA) Solid State Drive (SSD), for OS, Programs, and Data. (>30 GB)	
Security Features	Display Blanking	For security, VectorStar™ software can obscure frequency and power levels on the system display for security.
	Removable Internal Drive	Rear Panel accessible Solid State Drive (SSD) is quickly removable and easy to secure.
	Option 4 Spare SSD	A bootable SSD module is available as a spare for VectorStar units used in multiple or compartmentalized locations. The VectorStar’s operating system and software are preinstalled on each Option 4 SSD.
	Virus Protection, Best Practices	If the VNA is attached to a network, best practices recommend installing anti-virus software.

Front Panel Connections

Test Ports 1 and 2	Type	Universal Test Port Connectors, easily exchangeable in case of damage.
	MS4642B and MS4644B	K (m)
	MS4647B	V (m)
	Damage Input Levels	+27 dBm maximum, 40 VDC maximum
Direct Access Loops (optional)	Type	For Source, Test and Receive paths, 3 per port, for ≥2.5 GHz frequency coverage.
	MS4642B and MS4644B	K (f)
	MS4647B	V (f)
	Damage Input Levels	+20 dBm maximum, 0 VDC maximum (+27 dBm maximum on source loop ports)
USB Ports	Four type A USB 2.0 Ports (two each on the front and rear panel) for peripherals such as keyboard, mouse, memory stick, hardware key, and similar devices.	
Chassis Grounding Port	Banana (f)	
Ports to Millimeter-Wave Test Set (optional)	Connector Type	K (f) (LO1, and LO2 for RF; One with single source; Two with Option 31 Dual Source)

Rear Panel Connections

AC Power Input	AC Input connector, with On/Off switch, and fuses 350 VA maximum, 90 VAC to 264 VAC, 47 Hz to 63 Hz (power factor controlled)	
USB, PS/2, and LAN	USB Control Port	Type B USB 2.0 port for controlling the instrument externally, for remote operation
	USB Ports	Two Type A USB 2.0 Ports for peripherals such as keyboard, mouse, memory stick, hardware key, etc. (Two more USB ports at the front panel)
	Keyboard and Mouse Ports	Dedicated PS/2 ports.
	LAN Port	10/100BASE-T Ethernet
GPIB Ports	GPIB Port (Talker/Listener)	Type D-24, female, IEEE 488.2 compatible, for controlling the instrument externally, for remote operation.
	GPIB Port (Dedicated Controller)	Type D-24, female, for the control of external instruments such as power meters, external test sets, and similar devices.
External I/O Port	Type	25-pin D-Sub, female, User-defined I/O for custom external test set interface, to synchronize with different sweep states, such as Start, Stop, Driven Port, and similar parameters.
	Pin 1	Limit Pass/Fail
	Pins 2, 3, 15, 16	TTL In
	Pins 4, 13 14, 21	GND
	Pins 5-12, 17-20, 22	TTL Out
	Pins 23-25	Reserved
Serial Port	9-pin D-Sub, male, compatible with RS-232, provides control for AutoCal modules and similar devices.	
VGA Port	15-pin mini D-Sub, for simultaneously projecting the instrument’s screen display onto an external VGA monitor, with 1024 × 768 minimum resolution.	
Bias Inputs	Optional	Requires Active Measurement Suite, Option 61 or 62
	Bias Inputs	BNC (f), one per port
	Bias Fuses	0.5 A, 250 V, one per port
Direct Access Loops	Required Options	Options 51, 61, or 62
	Connector Type	SMA (f)
	Description	For Source, Test, and Receive paths, 3 per port, for <2.5 GHz frequency coverage
	Damage Input Levels	+20 dBm maximum, 0 VDC maximum (+27 dBm maximum on source loop ports)
IF Inputs/Outputs	a_1, a_2, b_1, b_2, IF Inputs/Outputs	
	Connector Type	SMA (f)
	Inputs	Inputs used with external converters such as millimeter-wave modules, or for antenna testing.
	Outputs	Outputs used with external IF digitizers and processors
	Nominal Inputs	5 MHz to 200 MHz (mode dependent), 0 dBm for full scale
	Nominal Outputs	0.2 MHz to 200 MHz (mode dependent), +10 dBm maximum
10 MHz In	Signal presence is auto-sensing (better than 1000 ppm frequency accuracy is recommended).	
	Connector Type	BNC (f)
	Signal	–10 to +3 dBm, 50Ω (nom.)

Continued on next page

10 MHz Out	Derived from the internal reference, unless an external 10 MHz reference input is applied.	
	Connector Type	BNC (f)
	Signal	0 ±5 dBm sinusoidal, 50Ω (nom.)
Analog In 1 and 2	Two independent inputs for measurements simultaneous with the RF measurements, for current sensing, efficiency computation, power detection, and similar parameters.	
	Connector Type	BNC (f)
	Range	–10 V to +10 V with automatic offset and gain calibrations
	Accuracy	2 mV + 2% for |V| <5 V; 2% for |V| >5 V
	Nominal Input Impedance	60kΩ
Ext In ALC 1 and ALC 2	For external automatic level control of the internal signal source generators. The input assumes 0 V represents no RF power and a larger negative value represents increasing RF power. The maximum range is 0 to –1.3 V.	
	Optional	ALC 1 is available with Options 80/81, 82/83, 86/87. ALC 1 and ALC 2 are both available with Options 31 and 84/85, 88/89.
	Connector Type	BNC (f)
Ext Analog Out	For external attenuator control, external switch control, analog triggering assistance, measurement system integration, and other purposes.	
	Connector Type	BNC (f)
	Normal Operating Modes	Sawtooth synch sweep, TTL indication of driving port, open loop level controller
	Range	–10 V to +10 V; low impedance drive
	Accuracy	20 mV + 2% (Load: >5kΩ)
Ext Trigger	Connector Type	BNC (f)
	Voltage Input	0 to 3.3 V input (5 V tolerant) Low threshold = 0.8 V High threshold = 2 V
	Impedance	High impedance (>100kΩ)
	Pulse Width	100 ns minimum input pulse width
	Edge Trigger	Programmable edge trigger
Lock Status	Connector Type	BNC (f)
	Voltage Input	0 to 3.3 V input (5 V tolerant) Low threshold = 0.8 V High threshold = 2 V
	Impedance	High impedance (>100kΩ)
	Pulse Width	100 ns minimum input pulse width
	Edge Trigger	Positive-edge trigger
Ready for Trigger	Connector Type	BNC (f)
	Voltage Input	0 to 3.3 V latched output
	Impedance	Low impedance (approximately 50Ω)
	Voltage	$V_{\text{(output high)}}$ = 2 V min @ –12 mA $V_{\text{(output low)}}$ = 0.8 V max @ +12 mA
Trigger Out	Connector Type	BNC (f)
	Voltage Output	0 to 3.3 V pulse output 1 µs positive pulse
	Voltage	$V_{\text{(output high)}}$ = 2 V min @ –12 mA $V_{\text{(output low)}}$ = 0.8 V max @ +12 mA
	Impedance	Low impedance (approximately 50Ω)
Pulse Generator Outputs	All values listed are nominal.	
	Optional	Requires Options 35 and 42 PulseView™
	Connector Type	SMA (f)
	Pulse Generator Outputs	P GEN 1, P GEN 2, P GEN 3, and P GEN 4
	Voltage	High: 3.3 V ±10% Low: <1 V
	Drive Impedance	Low impedance (approximately 50Ω)
	Load Impedance	50Ω or higher impedance
Pulse Synch Input	All values listed are nominal.	
	Optional	Requires Options 35 and 42 PulseView™
	Connector Type	SMA (f)
	Voltage Input	High threshold: 2.2 V Low threshold: 1 V
	Signal	5.5 VDC damage level
	Latency	55 ns delay from received synch to T0 (typ.)
	Impedance	High impedance input
Pulse Synch Output	All values listed are nominal.	
	Optional	Requires Options 35 and 42 PulseView™
	Connector Type	SMA (f)
	Voltage Output	High: 3.3 V ±10% Low: <1 V
	Signal	5.5 VDC damage level
	Latency	<5 ns delay from T0 to providing an external synch (typ.)
	Drive Impedance	Low impedance (approximately 50Ω)
	Load Impedance	50Ω or higher impedance

Mechanical and Environmental

Dimensions	Dimensions listed are for the instrument without rack mount option (MS4640B-001) attached.	
	Width	426 mm body 457 mm between feet outer edges 487 mm between front panel handle outer edges
	Height	267 mm body (6U) 286 mm between feet outer edges
	Depth	502 mm body 591 mm between handle and foot outer edges
Mass	<30 kg (<66 lb), Typical weight for a fully-loaded MS4647B VNA	
Environmental – Operating	Specification	Conforms to MIL-PRF-28800F (class 3)
	Temperature Range	0°C to +50°C without error codes Except for 'unleveled' error messages that may occur at the extreme edges of the temperature range.
	Relative Humidity	5 to 90% at +30°C, Non-condensing
	Altitude	4,600 m (15,000 ft)
Environmental – Non-Operating	Temperature Range	–40°C to +71°C
	Relative Humidity	0 to 95% at +30°C, Non-condensing
	Altitude	4,600 m (15,000 ft)
CE	EMC	2014/30/EU, EN61326-1, EN61000-4-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863
RCM	Australia and New Zealand	RCM AS/NZS 4417:2012
KCC	South Korea	KCC-REM-A21-0004
Warranty	Instrument and Built-In Options	3 years from the date of shipment (standard warranty)
	Calibration Kits	Typically 1 year from the date of shipment
	Test Port Cables	Typically 1 year from the date of shipment
	Additional Warranty Options	Additional warranty available

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Instrument Models
MS4642B	Vector Network Analyzer 10 MHz to 20 GHz
MS4644B	Vector Network Analyzer 10 MHz to 40 GHz
MS4647B	Vector Network Analyzer 10 MHz to 70 GHz
	Included Accessories Each VNA comes with a set of included accessories: Online Help – The instrument is equipped with context-sensitive help built from the VectorStar Operation Manual, User Interface Reference Manual, Programming Manual, Programming Manual Supplement, and Calibration and Measurement Guide. Peripherals – Optical USB Mouse Power – Power Cord
	Main VNA Options
MS4640B-001	Rack Mount, adds handles and removes feet for shelf-mounting into a 19" universal rack
MS4640B-002	Time Domain
MS4640B-004	Additional Serial-ATA (SATA) Solid State Drive (SSD) with OS and VectorStar Application Software
MS4640B-007	Receiver Offset
MS4640B-021	Universal Fixture Extraction
MS464xB-031	Dual Source Architecture
MS464xB-032	Internal RF Combiner, requires Option 31
MS4640B-035	IF Digitizer
MS464xB-036	Extended IF Digitizer Memory
MS4640B-041	Noise Figure, requires Option 51, 61, or 62
MS4640B-042	PulseView™, requires Option 35
MS4640B-043	DifferentialView™
MS4640B-044	IMDView™
MS4640B-046	Fast CW software, requires Option 35
MS4640B-047	Eye Diagram requires Option 2
MS4640B-048	Differential Noise Figure, requires Option 51 or Option 61 or Option 62
MS464xB-051	Direct Access Loops, see description below
MS464xB-053	External ALC
MS464xB-061/062	Active Measurement Suite options, see description below
MS4640B-070	70 kHz Low-End Frequency Extension

Model/Order No.	Name
	Direct Access Loop Options Note: Direct access loops are not available for VNAs equipped with Options 61 or 62, which include loops.
MS4644B-051	Direct Access Loops for MS4644B, not available with Options 61 or 62
MS4647B-051	Direct Access Loops for MS4647B, not available with Options 61 or 62
	Active Measurement Suite Options
MS4642B-061	Active Device Measurements, For MS4642B, with 2 Step Attenuators
MS4642B-062	Active Device Measurements, For MS4642B, with 4 Step Attenuators
MS4644B-061	Active Measurements Suite, For MS4644B, with 2 Step Attenuators
MS4644B-062	Active Measurements Suite, For MS4644B, with 4 Step Attenuators
MS4647B-061	Active Measurements Suite, For MS4647B, with 2 Step Attenuators
MS4647B-062	Active Measurements Suite, For MS4647B, with 4 Step Attenuators
	Pulse Modulator Test Set Note: Pulse Modulator Test Set options require the VNA to be equipped with Options 35, 42, and Option 51, 61, or 62)
SM6628	Pulse Modulator Test Set, 70 kHz to 40 GHz, for source modulation with an MS4642B or MS4644B
SM6629	Pulse Modulator Test Set, 70 kHz to 40 GHz, for source and receiver modulation with an MS4642B or MS4644B
SM6630	Pulse Modulator Test Set, 70 kHz to 70 GHz, for source modulation with an MS4647B
SM6631	Pulse Modulator Test Set, 70 kHz to 70 GHz, for source and receiver modulation with an MS4647B

Continued on next page

Model/Order No.	Name
	Multiport VNA Options
	The multiport VNA option provides four test ports for all VectorStar MS4640B Series VNAs with the MN4690C Series Multiport Test Sets. The option provides the Test Set, necessary cabling, and installation documentation. The Test Set frequency range is limited to that of the attached VNA.
MN4694C	70 kHz to 40 GHz, Use the MN4694C Test Set with MS4642B and MS4644B VNAs
MN4697C	70 kHz to 70 GHz, Use the MN4697C Test Set with MS4647B VNA
Documentation	For detailed MN469xC specifications, refer to the VectorStar MN469xC Series Multiport VNA Technical Data Sheet – 11410-00777
	Broadband/Banded/Millimeter-Wave Systems
	For details on the MS464xB-08x series of options, see the:
	VectorStar ME7838A Modular Broadband/Millimeter-Wave Technical Data Sheet – 11410-00593 (For 70 kHz to 125 GHz)
	VectorStar ME7838D Modular Broadband/Millimeter-Wave Technical Data Sheet – 11410-00778 (For 70 kHz to 145 GHz)
	VectorStar ME7838E Modular Broadband/Millimeter-Wave Technical Data Sheet – 11410-00767 (For 70 kHz to 110 GHz)
	VectorStar ME7838G Modular Broadband/Millimeter-Wave Technical Data Sheet – 11410-01060 (For 70 kHz to 220 GHz)
	VectorStar ME7838A4 4-Port Modular Broadband/Millimeter-Wave Technical Data Sheet – 11410-00704 (For 70 kHz to 125 GHz)
	VectorStar ME7838D4 4-Port Modular Broadband/Millimeter-Wave Technical Data Sheet – 11410-01099 (For 70 kHz to 145 GHz)
	VectorStar ME7838E4 4-Port Modular Broadband/Millimeter-Wave Technical Data Sheet – 11410-01100 (For 70 kHz to 110 GHz)
	Calibration Options
MS4640B-097	Accredited Calibration, With Data
MS4640B-098	Z540/Guide 25 Calibration, No Data
MS4640B-099	Premium Calibration, With Data
	Precision Automatic Calibrator Modules (Precision AutoCal)
36585K-2M	K Precision AutoCal Module, 70 kHz to 40 GHz, K (m) to K (m)
36585K-2F	K Precision AutoCal Module, 70 kHz to 40 GHz, K (f) to K (f)
36585K-2MF	K Precision AutoCal Module, 70 kHz to 40 GHz, K (m) to K (f)
36585V-2M	V Precision AutoCal Module, 70 kHz to 70 GHz, V (m) to V (m)
36585V-2F	V Precision AutoCal Module, 70 kHz to 70 GHz, V (f) to V (f)
36585V-2MF	V Precision AutoCal Module, 70 kHz to 70 GHz, V (m) to V (f)
	Mechanical Calibration Kits
3650A	SMA/3.5 mm Calibration Kit, Without Sliding Loads
3650A-1	SMA/3.5 mm Calibration Kit, With Sliding Loads
3652A	K Calibration Kit, Without Sliding Loads
3652A-2	K Calibration Kit, Without additional options
3652A-3	K Calibration Kit, With Pin Depth Gauge and .s1p Characterization Files
3652A-4	K Calibration Kit, With .s1p Characterization Files
3654D	V Calibration Kit, Without Sliding Loads
3654D-2	V Calibration Kit Without additional options
3654D-3	V Calibration Kit, With Pin Depth Gauge and .s1p Characterization Files
3654D-4	V Calibration Kit, With .s1p Characterization Files
3657	V Multi-Line Calibration Kit, Without Shorts
3657-1	V Multi-Line Calibration Kit, With Shorts
	Verification Kits
3666-1	SMA/3.5 mm Verification Kit
3668-1	K Verification Kit
3669B-1	V Verification Kit
	Test Port Cables, Ruggedized Semi-Rigid
3670K50-1	Test Port Cable, K (f) to K (m), 1 each, 30.5 cm (12 in)
3670K50-2	Test Port Cable, K (f) to K (m), 1 each, 61.0 cm (24 in)
3670V50A-1	Test Port Cable, V (f) to V (m), 1 each, 30.5 cm (12 in), rated to 70 GHz
3670V50A-2	Test Port Cable, V (f) to V (m), 1 each, 61.0 cm (24 in), rated to 70 GHz

Model/Order No.	Name
	Test Port Cables, Flexible, Ruggedized-Style Female Connectors, Phase Stable
	Ruggedized style female connectors for VNA test ports.
3671KFS50-60	K (f) to 3.5 mm (m), 1 each 63.5 cm (25 in)*
3671KFK50-60	K (f) to K (m), 1 each, 63.5 cm (25 in)*
3671KFK50-100	K (f) to K (m), 1 each, 96.5 cm (38 in)
3671KFKF50-60	K (f) to K (m), 1 each, 63.5 cm (25 in)
3671KFK50-60	K (f) to K m), 1 each 63.5 cm (25 in)*
3671VFV50-60	V (f) to V (m), 1 each, 63.5 cm (25 in), rated to 70 GHz*
3671VFV50-100	V (f) to V (m), 1 each 96.5 cm (38 in), rated to 70 GHz
	Test Port Converters
	To change or replace VNA test ports.
34YK50C	Universal Test Port Connector to K (m), Installation requires wrench 01-202 (not included)
34YV50C	Universal Test Port Connector to V (m), Installation requires wrench 01-202 (not included)
34YS50A	Universal Test Port Connector to 3.5 mm (m), Installation requires wrench 01-202 (not included)
34YQ50A	Universal Test Port Connector to 2.4 mm (m), Installation requires wrench 01-202 (not included)
	Universal Test Fixture (UTF)
3680-20	UTF, DC to 20 GHz
3680K	UTF, DC to 40 GHz
3680V	UTF, DC to 60 GHz
36801K	UTF Right Angle Launcher, DC to 30 GHz
36801V	UTF Right Angle Launcher, DC to 50 GHz
36803	Bias Probe
36804B-10M	Microstrip Calibration/Verification Kit, 10 mil, DC to 50 GHz
36804B-15M	Microstrip Calibration/Verification Kit, 15 mil, DC to 30 GHz
36804B-25M	Microstrip Calibration/Verification Kit, 25 mil, DC to 15 GHz
	Precision Fixed Attenuators, Adapters (In and Out of Series, Waveguide to Coaxial), and More
	Refer to our extensive Precision RF & Microwave Components Catalog – 11410-00235
	GPIB Cables
2100-5	GPIB Cable, 0.5 m long
2100-1	GPIB Cable, 1 m long
2100-2	GPIB Cable, 2 m long
2100-4	GPIB Cable, 4 m long
	Transit Case
760-246-R	Transit Case, for all MS4640B Series VNAs, Hard plastic with wheels, 85 × 70 × 45 cm
	Tools
01-201	Torque End Wrench, 5/16 in, 0.9 N·m (8 lbf·in), For tightening male devices, For SMA, 3.5 mm, 2.4 mm, K, and V connectors.
01-202	Torque End Wrench, 1/2 in, 60 lbf ·in, For servicing the universal test port, For the removal or installation of a test port.
01-203	Torque End Wrench, 20.6 mm (13/16 in), 0.9 N·m (8 lbf·in), For tightening the VNA test ports to female devices.
01-204	End Wrench, 5/16 in, Universal, Circular, Open-ended, For SMA, 3.5 mm, 2.4 mm, K and V connectors.
01-504	Torque End Wrench, 6 mm, 0.45 N·m (4 lbf·in), For tightening 1 mm connectors.
01-505	6 mm × 7 mm Open End Wrench, Backing wrench for 6 mm torque wrench above for W1 connectors.
01-511	Torque End Wrench, 4 mm (5/32 in), 0.22 N·m (2 lbf·in), For tightening the SSMC TEST and REF connectors on 3743A Modules.
	Documentation
	User Documentation at www.anritsu.com. Printed manuals in 3-ring binders are available for a nominal charge.
10410-00317	MS4640B Series VNA Operation Manual (OM)
10410-00318	MS4640B Series VNA Calibration and Measurement Guide (MG)
10410-00319	MS4640B Series VNA User Interface Reference Manual (UIRM)
10410-00320	MS4640B Series VNA Maintenance Manual (MM)
10410-00322	MS4640B Series VNA Programming Manual (PM), for IEEE 488.2, System, and SCPI Commands
10410-00323	MS4640B Series VNA Programming Manual Supplement (PMS), for Lightning 37xxxx and HP8510 Emulation
10410-00774	MN4775A E/O Converter Operations Manual
11410-01144	MN4775A E/O Converter Technical Data Sheet
10410-00777	ME7848A Opto-electronic Network Analyzer Quick Start Guide
10410-00778	ME7848A Opto-electronic Network Analyzer Maintenance Manual
11410-01145	ME7848A Opto-electronic Network Analyzer Technical Data Sheet

*: Due to length, two (2) cables are required for each system

ShockLine™ Family

MS46121B, MS46122B, MS46131A, MS46322B, MS46522B, MS46524B, ME7868A

Frequency coverage from 50 kHz to 43.5 GHz, with banded E-band 55 GHz to 92 GHz (ME7868A: 1 MHz to 43.5 GHz)

Bringing Simplicity and Value to High-Performance RF and Microwave VNA Measurements

The ShockLine family of vector network analyzers (VNAs) achieve a new level of capability, flexibility, and value for RF and microwave network analysis applications. ShockLine VNAs deliver excellent performance for measurements from 50 kHz up to 43.5 GHz and banded E-band measurements from 55 GHz to 92 GHz. These instruments are ideal for testing passive and many active components with general purpose VNA requirements.

The ShockLine family employs advanced Anritsu technology and design expertise to attain outstanding dynamic range, calibration and measurement stability, and speed performance in efficiently packaged, compact, and robust VNA instruments.

ShockLine VNAs provide S-parameter, time domain, and signal integrity measurement capabilities in 1-, 2-, and 4-port configurations.

Instrument Models and Operating Frequencies

- MS46121B, 1-Port USB VNA,
  40 MHz to 4 GHz, 150 kHz to 6 GHz N (m) connector
- MS46122B, 2-Port USB VNA,
  1 MHz to 8/20/43.5 GHz N (f) and K (m) connectors
- MS46131A, 1-Port USB VNA,
  1 MHz to 43.5 GHz
- MS46322B, 2-Port Economy VNA,
  1 MHz to 8/20/43.5 GHz N (f) and K (m) connectors
- MS46522B, 2-Port Performance VNA,
  50 kHz to 8.5/20/43.5 GHz N (f), K (m) connectors,
  E-band WR12 waveguide
- MS46524B, 4-Port Performance VNA,
  50 kHz to 8.5/20/43.5 GHz N (f) and K (m) connectors
- ME7868A, 2-Port USB VNA,
  1 MHz to 43.5 GHz

Definitions

All specifications and characteristics apply under the following conditions, unless otherwise stated:

Warm-Up Time	After 30 minutes of warm-up time, where the instrument is left in the ON state.
Temperature Range	Specifications apply over the 25°C±5°C temperature range.
Error-Corrected Specifications	Specifications are valid over 23°C±3°C, with <1°C variation from calibration temperature.
Frequency Bands in Tables	When a frequency is listed in two rows of the same table, the specification for the common frequency is taken from the lower frequency band.
User Cables	Specifications do not include effects of any user cables attached to the instrument.
Discrete Spurious Responses	Specifications may exclude discrete spurious responses.
Internal Reference Signal	All specifications apply with internal 10 MHz Crystal Oscillator Reference Signal.
Interpolation Mode	All specifications are with Interpolation Mode Off.
Standard	Refers to instruments without Options.
Typical Performance	Typical performance indicates the measured performance of an average unit. It does not include guard-bands and is not covered by the product warranty.
Characteristic Performance	Characteristic performance indicates a performance designed-in and verified during the design phase. It does include guard-bands and is not covered by the product warranty.
Recommended Calibration Cycle	12 months (Residual specifications also require calibration kit calibration cycle adherence.)
Specifications Subject to Change	All specifications are typical unless otherwise noted and are subject to change without notice.

High Level Noise

Measured at 100 Hz IF bandwidth and at default power level, RMS. Performance is characteristic.

Product	Frequency Range	Magnitude (dB)	Phase Noise (deg RMS)
MS46121B	150 kHz to 6 GHz	0.02	0.2
MS46122B MS46322B	1 MHz to <20 MHz 20 MHz to 20 GHz >20 GHz to 40 GHz >40 GHz to 43.5 GHz	0.03 (0.005, typ.) 0.006 (0.001, typ.) 0.006 (0.001, typ.) 0.009 (0.001, typ.)	<0.2 (<0.035 typ.) <0.1 (<0.05 typ.) <0.15 (<0.05 typ.) <0.18 (<0.05 typ.)
MS46522B MS46524B	50 kHz to 300 kHz >300 kHz to 1 GHz >1 GHz to 25 GHz >25 GHz to 43.5 GHz	0.02 (0.01, typ.) 0.004 (0.003, typ.) 0.004 (0.002, typ.) 0.004 (0.002, typ.)	0.15 (0.08, typ.) 0.04 (0.02, typ.) 0.05 (0.02, typ.) 0.05 (0.04, typ.)

	Magnitude (dB)			Phase (deg)		
	MS46131A-010	MS46131A-020/043	ME7868A	MS46131A-010	MS46131A-020/043	ME7868A
1 MHz to 4 GHz			0.007 (0.0015 typ.)			0.21 (0.02 typ.)
1 MHz to 6 GHz		0.009 (0.003 typ.)			0.12 (0.03 typ.)	
1 MHz to 8 GHz	0.009 (0.003 typ.)			0.12 (0.03 typ.)		
>4 GHz to 8 GHz			0.011 (0.003 typ.)			0.41 (0.08 typ.)
>6 GHz to 8 GHz		0.022 (0.01 typ.)			0.15 (0.08 typ.)	
>8 GHz to 20 GHz			0.006 (0.0015 typ.)			0.41 (0.08 typ.)
>8 GHz to 40 GHz		0.006 (0.001 typ.)			0.1 (0.02 typ.)	
>20 GHz to 43.5 GHz			0.011 (0.0025 typ.)			0.56 (0.25 typ.)
>40 GHz to 43.5 GHz		0.009 (0.002 typ.)			0.12 (0.03 typ.)	

Measurement Stability

Ratio measurement, with ports shorted. Typical.

Product		Frequency Range	Magnitude (dB/°C)	Phase (deg./°C)
MS46121B		150 kHz to 1 MHz >1 MHz to 4 GHz >4 GHz to 6 GHz	0.1 0.01 0.05	0.1 0.1 0.2
MS46122B MS46322B		10 MHz to 43.5 GHz	0.02	0.3
MS46522B MS46524B		50 kHz to 8.5 GHz >8.5 GHz to 40 GHz >40 GHz to 43.5 GHz	0.02 0.01 0.02	0.5 1.0 1.5
MS46131A/ ME7868A	1-Port	1 MHz to 43.5 GHz	0.02	0.3
	2-Port	1 MHz to 8 GHz	0.015	0.3
		>8 GHz to 20 GHz	0.015	0.5
		>20 GHz to 43.5 GHz	0.02	0.8

Frequency Resolution, Accuracy and Stability

Product	Resolution	Accuracy	Stability	Aging
MS46121B	1 Hz*1	±0.5 ppm (at time of calibration)	±1.0 ppm from –10°C to +55°C	±1.0 ppm/year
MS46122B MS46322B	1 Hz	±1.0 ppm (at time of calibration)	±1.0 ppm from –10°C to +55°C (typ.)	±1.0 ppm/year (typ.)
MS46522B MS46524B	1 Hz	±0.1 ppm (at time of calibration)	±0.1 ppm/+10°C to +50°C	±0.02 ppm/24 hours ±0.2 ppm/1 month ±1.0 ppm/1 year ±2.0 ppm/3 years
MS46131A/ME7868A	1 Hz	+1.0 ppm (at time of calibration)	±1.0 ppm from –10°C to +55°C (typ.)	±1.0 ppm/year (typ.)

*1: Frequency resolution is 10 kHz when using an external reference.

Uncorrected (Raw) Port Characteristics

User and System Correction Off.

Product	Frequency Range	Directivity (dB)	Port Match (dB)
MS46121B	150 kHz to 6 GHz	10 dB*2	10 dB*3
MS46122B MS46322B	1 MHz to 43.5 GHz	>8 dB	>8 dB
MS46522B MS46524B	50 kHz to 1 GHz >1 GHz to 4 GHz >4 GHz to 8.5 GHz >8.5 GHz to 43.5 GHz	>21 >21 >15 >15	>17 >17 >15 >15
MS46131A/ME7868A	1 MHz to 6 GHz >6 GHz to 8 GHz >8 GHz to 43.5 GHz	>6 >5 >10	>6 >6 >10

*2: Raw directivity specification degrades by 2 dB above 4 GHz.
*3: Raw port match specification degrades by 5 dB above 4 GHz.

VNA System Performance

Error-Corrected Specifications

With 12-term SOLT calibration using TOSLN50A-XX or TOSLNF50A-XX N- or K-type connector manual calibration kits or the MN25208A SmartCal™ automatic calibration kit.

MS46121B Frequency Range	Directivity (dB)	Source Match (dB)	Reflection Tracking (dB)
150 kHz to 4 GHz	42	35	±0.1
>4 GHz to 6 GHz	42	35	±0.2

MS46122B and MS46322B Frequency Range	Directivity (dB)	Source Match (dB)	Load Match[*4] (dB)	Reflection Tracking[*4] (dB)	Transmission Tracking[*4] (dB)
1 MHz to 6 GHz	≥42	≥33	≥42	±0.15	±0.06
>6 GHz to 8 GHz	≥37	≥33	≥37	±0.15	±0.06

MS46522B and MS46524B Frequency Range	Directivity (dB)	Source Match (dB)	Load Match[*4] (dB)	Reflection Tracking[*4] (dB)	Transmission Tracking[*4] (dB)
50 kHz to 50 MHz	>40	>35	>38	±0.15	±0.09
>50 MHz to 6 GHz	>40	>35	>38	±0.08	±0.05
>6 GHz to 8 GHz	≥36	>35	≥34	±0.08	±0.05
>8 GHz to 8.5 GHz	>36	>35	>34	±0.10	±0.08

With calibration using TOSLK50A-XX or TOSLKF50A-XX N or K type connector calibration kits.

Frequency Range		Directivity (dB)	Source Match (dB)	Load Match[*4] (dB)	Reflection Tracking[*4] (dB)	Transmission Tracking[*4] (dB)
MS46131A-010/ ME7868A	1 MHz to 6 GHz	≥42	≥33	≥41	±0.15	±0.06
	>6 GHz to 8 GHz	≥37	≥33	≥36	±0.15	±0.06
MS46131A-020	1 MHz to 10 GHz	≥42	≥33	>41	±0.15	±0.06
	>10 GHz to 20 GHz	≥36	≥26	>35	±0.15	±0.06
MS46131A-043	1 MHz to 10 GHz	≥42	≥33	>41	±0.15	±0.06
	>10 GHz to 20 GHz	≥36	≥26	>35	±0.15	±0.06
	>20 GHz to 30 GHz	≥32	≥22	>31	±0.15	±0.06
	>30 GHz to 40 GHz	≥30	≥20	>29	±0.15	±0.06
	>40 GHz to 43.5 GHz	≥28	≥20	>27	±0.2	±0.16

*4: Characteristic performance.

** there are many variations of the Error-Corrected Specification. We also have data with various SmartCals and Precision AutoCals.
Please let me know if you would like other data.

Standard Capabilities

Operating Frequencies

Product	Operating Frequency
MS46121B-006	150 kHz to 6 GHz
MS46122B-010 MS46122B-020 MS46122B-043	1 MHz to 8 GHz 1 MHz to 20 GHz 1 MHz to 43.5 GHz
MS46322B-010 MS46322B-020 MS46322B-043	1 MHz to 8 GHz 1 MHz to 20 GHz 1 MHz to 43.5 GHz
MS46522B-010 MS46522B-020 MS46522B-043 MS46522B-082 MS46522B-083	50 kHz to 8.5 GHz 50 kHz to 20 GHz 50 kHz to 43.5 GHz 55 GHz to 92 GHz, one meter tethers 55 GHz to 92 GHz, five meter tethers
MS46524B-010 MS46524B-020 MS46524B-043	50 kHz to 8.5 GHz 50 kHz to 20 GHz 50 kHz to 43.5 GHz
MS46131A/ME7868A-010 MS46131A/ME7868A-020 MS46131A/ME7868A-043	1 MHz to 8 GHz 1 MHz to 20 GHz 1 MHz to 43.5 GHz

Sweeps

Frequency Sweep Types	Linear, Log, CW (MS46131A/ME7868A only) or Segmented

Display Graphs

Single Rectilinear Graph Types	Log Magnitude, Phase, Linear Magnitude, Real, Imaginary, SWR, Impedance and Group Delay (MS46131A/ME7868A only)
Dual Rectilinear Graph Types	Log Mag and Phase, Linear Mag and Phase, Real and Imaginary
Circular Graph Types	Smith Chart (Impedance), Polar

Measurements Data Points

Product	Measurement Data Points
MS46121B MS46522B MS46524B	Maximum Data Point 2 to 20,001 points
MS46122B MS46322B MS46131A/ME7686A	Maximum Data Point 2 to 16,001 points

Limit Lines

Limit Lines	Single or segmented. 2 limit lines per trace. 50 segments per trace.
Single Limit Readouts	Uses interpolation to determine the intersection frequency.
Test Limits	Both single and segmented limits can be used for PASS/FAIL testing.

Ripple Limit Lines

Limit Lines	Single or segmented. 2 limit lines per trace. 50 segments per trace.
Ripple Value	Absolute Value or Margin
Test Limits	Both single and segmented limits can be used for PASS/FAIL testing.

Averaging

Product	Averaging
MS46121B MS46522B MS46524B	Point-by-point (default), maximum number of averages = 4096 Sweep-by-sweep, maximum number of averages = 4096
MS46122B MS46322B MS46131A/ME7868A	Point-by-point (default), maximum number of averages = 200 Sweep-by-sweep, maximum number of averages = 4096

IF Bandwidth

MS46121B	10, 20, 30, 50, 70, 100, 200, 300, 500, 700 Hz 1, 2, 3, 5, 7, 10, 20, 30, 50, 100 kHz
MS46122B MS46322B MS46131A ME7868A	10, 20, 50, 70, 100, 200, 300, 500, 700 Hz 1, 2, 3, 5, 7, 10, 20, 30, 50, 70, 100, 200, 300 kHz
MS46522B MS46524B	10, 20, 30, 50, 70, 100, 200, 300, 500, 700 Hz 1, 2, 3, 5, 7, 10, 20, 30, 70, 100, 200, 300, 500 kHz

Scale Resolution

	Minimum per division, varies with graph type.
Log Magnitude	0.001 dB
Linear Magnitude	10 µU
Phase	0.01°
Time	0.0001 ps
Distance	0.1 µm
SWR	10 µU
Power	0.01 dB

Markers

Markers	12 markers + 1 reference marker
Marker Coupling	Coupled or decoupled
Marker Overlay	Display markers on active trace only or on all traces when multiple trace responses are present on the same trace.
Marker Data	Data displayed in graph area or in table form
Reference Marker	Additional marker per trace for reference
Marker Statistics	Mean, maximum, minimum, standard deviation Per trace or over a marker region
Marker Search and Tracking	Search and/or track for minimum, maximum, peak, or target value. Multiple marker search ranges per trace are available.

Other

Filter Parameters	Display bandwidth (user-selectable loss value), corner and center frequencies, loss, Q and shape factors.
S-Parameter Conversion	Z Reflection Impedance Z Transmission Impedance Y Reflection Admittance Y Transmission Admittance 1/S

Calibration and Correction Capabilities

Calibration Methods

Product	Calibration Methods
MS46121B	Open Short Load (OSL) Offset Short (SSL) Triple Offset Short (SSS) SmartCal™, AutoCal™
MS46122B MS46322B MS46131A/ME7868A	Short-Open-Load-Through (SOLT) Offset-Short-Offset-Short-Load-Through (SSLT) Triple-Offset-Short-Through (SSST) Short-Open-Load-Reciprocal (SOLR) Line-Reflect-Line (LRL) / Line-Reflect-Match (LRM) SmartCal™ AutoCal™ Thru Update available Secondary match correction available for improved low insertion loss measurements
MS46522B MS46524B	Short-Open-Load-Through (SOLT) Short-Open-Load-Reciprocal (SOLR) Offset-Short-Offset-Short-Load-Through (SSLT) Triple-Offset-Short-Through (SSST) Line-Reflect-Line (LRL) / Line-Reflect-Match (LRM) Source Calibration Receiver Calibration SmartCal™, AutoCal™ Thru Update available Secondary match correction available for improved low insertion loss measurements

Coefficients for Calibration Standards

Use the Anritsu calibration kit USB memory device to load kit coefficients and characterization files. Enter coefficients into user-defined locations. Use complex load models.

Interpolation

Allows interpolation between calibration frequency points.

Dispersion Compensation

Selectable as Coaxial, other non-dispersive (e.g., for coplanar waveguide), Waveguide, or Microstrip

Embedding/De-embedding

The MS46121B, MS46131A/ME7868A are equipped with an Embedding/De-embedding system.

De-embedding	De-embedding is generally used for removal of test fixture contributions, modeled networks, and other networks described by S-parameters (s2p files) from measurements.
Embedding	Similarly, the Embedding function can be used to simulate matching circuits for optimizing amplifier designs or simply adding effects of a known structure to a measurement.
Multiple Networks	Multiple networks can be embedded/de-embedded and changing the port and network orientations is handled easily.
Extraction Utility	An extraction utility is part of this package that allows easier computation of de-embedding files based on additional calibration steps and measurements.

Regulatory Compliance

CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: (EU) 2015/863
Australia and New Zealand	RCM AS/NZS 4417:2012
South Korea	KCC-REM-A21-0004

Environmental

MS46121B MS46131A, ME7868A, MIL-PRF-28800F Class 2

Operating Temperature Range	–10°C to +55°C
Storage Temperature Range	–51°C to +71°C
Maximum Relative Humidity	95% RH at 30°C, non-condensing
Vibration, Sinusoidal	5 Hz to 55 Hz
Vibration, Random	10 Hz to 500 Hz
Half Sine Shock	30 gn
Altitude	4600 meters, operating and non-operating

MS46122B, MS46322B, MIL-PRF-28800F Class 3

Operating Temperature Range	0°C to +50°C
Storage Temperature Range	–40°C to +71°C
Maximum Relative Humidity	95% RH at 30°C, non-condensing
Altitude	4600 meters, operating and non-operating

MS46522B, MS46524B, MIL-PRF-28800F Class 3

Operating Temperature Range	0°C to +50°C
Storage Temperature Range	–40°C to +71°C
Maximum Relative Humidity	95% RH at +30°C, non-condensing
Vibration, Sinusoidal	5 Hz to 55 Hz
Vibration, Random	10 Hz to 500 Hz
Half Sine Shock	30 gn
Altitude	4600 meters, operating and non-operating

Warranty

Instrument and Built-In Options	Three (3) years from the date of shipment (standard warranty)
Calibration Kits	Typically 1 year from the date of shipment
Test Port Cables	Typically 1 year from the date of shipment
Warranty Options	Additional warranty available

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
MS46121B	**Instrument Models** ShockLine 1-Port USB VNA MS46121B-006, 150 kHz to 6 GHz, type N (m) port - Base Model Required Option (Select one frequency option only)
MS46122B	2-Port ShockLine Economy VNA – Base Model Select one Frequency Option Only. MS46122B-010, 1 MHz to 8 GHz, type N (f) ports – Required Option MS46122B-020, 1 MHz to 20 GHz, Ruggedized type K (m) ports (compatible with 3.5 mm and SMA connectors) MS46122B-043, 1 MHz to 43.5 GHz, Ruggedized type Extended-K™ (m) ports (compatible with standard K (2.92 mm), 3.5 mm, and SMA connectors)
MS46131A	1-Port Modular VNA MS46131A-010, 1 MHz to 8 GHz, type N (f) port MS46131A-020, 1 MHz to 20 GHz, Ruggedized type K (m) port (compatible with 3.5 mm and SMA connectors) MS46131A-043, 1 MHz to 43.5 GHz, Ruggedized type Extended-K™ (m) port (compatible with standard K (2.92 mm), 3.5 mm, and SMA connectors)
MS46322B	2-Port ShockLine™ Economy VNA (base model) Requires One Frequency Option. MS46322B-010 1 MHz to 8 GHz, type N (f) ports MS46322B-020 1 MHz to 20 GHz, type Ruggedized K (m) ports (compatible with 3.5 mm and SMA connectors) MS46322B-043 1 MHz to 43.5 GHz, type Ruggedized Extended-K™ (m) ports (compatible with standard K (2.92 mm), 3.5 mm and SMA connectors)
MS46522B	ShockLine 2-Port Vector Network Analyzer (base model) Requires One Frequency Option. MS46522B-010 50 kHz to 8.5 GHz, type N (f) ports MS46522B-020 50 kHz to 20 GHz, type K (m) Ruggedized ports (compatible with 3.5 mm and SMA connectors) MS46522B-043 50 kHz to 43.5 GHz, type Extended-K™ (m) Ruggedized ports (compatible with standard K (2.92 mm), 3.5 mm, and SMA connectors) MS46522B-082 55 GHz to 92 GHz, WR12 waveguide flange, one meter tethers MS46522B-083 55 GHz to 92 GHz, WR12 waveguide flange, five meter tethers
MS46524B	ShockLine 4-Port Vector Network Analyzer (base model) Requires One Frequency Option. MS46524B-010 50 kHz to 8.5 GHz, type N (f) ports MS46524B-020 50 kHz to 20 GHz, type K (m) Ruggedized ports (compatible with 3.5 mm and SMA connectors) MS46524B-043 50 kHz to 43.5 GHz, type Extended-K™ (m) Ruggedized ports (compatible with standard K (2.92 mm), 3.5 mm, and SMA connectors)
ME7868A	
2 meter	ME7868A-010-2: 2-port Modular ME7868A Vector Network Analyzer, 1 MHz to 8 GHz ME7868A-020-2: 2-port Modular ME7868A Vector Network Analyzer, 1 MHz to 20 GHz ME7868A-043-2: 2-port Modular ME7868A Vector Network Analyzer, 1 MHz to 43.5 GHz
5 meter	ME7868A-010-5: 2-port Modular ME7868A Vector Network Analyzer, 1 MHz to 8 GHz ME7868A-020-5: 2-port Modular ME7868A Vector Network Analyzer, 1 MHz to 20 GHz ME7868A-043-5: 2-port Modular ME7868A Vector Network Analyzer, 1 MHz to 43.5 GHz
25 meter*	ME7868A-010-25: 2-port Modular ME7868A Vector Network Analyzer, 1 MHz to 8 GHz ME7868A-020-25: 2-port Modular ME7868A Vector Network Analyzer, 1 MHz to 20 GHz ME7868A-043-25: 2-port Modular ME7868A Vector Network Analyzer, 1 MHz to 43.5 GHz
USB Cable	**Included Accessories** Getting Started with Anritsu Flier, provides access to all ShockLine web content and services.

*: All 25 meter configurations come with additional components to enable long distance usage. These items include two MN25131A multi-function extenders, USB monitor, keyboard, mouse, headset, and additional cabling to allow for communication and control from either side of the 25 meter setup.

Model/Order No.	Name
	Main/Calibration VNA Options
MS46121B-002	Low Pass Time Domain
MS46121B-021	Scalar Transmission Measurement
MS46122B-002	Time Domain with Time Gating
MS46122B-024	Universal Fixture Extraction
MS46122B-097	Accredited Calibration, with data
MS46122B-098	Standard Calibration, ISO 17025 compliant, without data
MS46122B-099	Premium Calibration, ISO 17025 compliant, with data
MS46131A-002	Time Domain with Time Gating
MS46131A-012	PhaseLync option
MS46131A-098	Standard Calibration, ISO 17025 compliant, without data
MS46131A-099	Premium Calibration, ISO 17025 compliant, with data
MS46322B-001	Rack Mount, adds handles and removes feet for shelf-mounting into a 19 inch universal rack
MS46322B-002	Time Domain with Time Gating
MS46322B-024	Universal Fixture Extraction
MS46522B-001	Rack Mount, adds handles and removes feet for shelf-mounting into a 19 inch universal rack
MS46522B-002	Time Domain with Time Gating
MS46522B-022	Advanced Time Domain
MS46522B-024	Universal Fixture Extraction
MS46522B-061	Bias Tee (Only available with Option 10)
MS46524B-001	Rack Mount, adds handles and removes feet for shelf-mounting into a 19 inch universal rack
MS46524B-002	Time Domain with Time Gating
MS46524B-022	Advanced Time Domain
MS46524B-024	Universal Fixture Extraction
MS46524B-061	Bias Tee (Only available with Option 10)
	Precision Automatic Calibrator Module
MN25208A	2-port USB SmartCal Module, 300 kHz to 8.5 GHz (available with connector Options -001 N (f), -002 K (f), -003 3.5 mm (f))
MN25408A	4-port USB SmartCal Module, 300 kHz to 8.5 GHz (available with connector Options -001 N (f), -002 K (f), -003 3.5 mm (f))
MN25218A*	2-port USB SmartCal Module, 300 kHz to 20 GHz (available with connector Option -002 K (f))
MN25418A	4-port USB SmartCal Module, 300 kHz to 20 GHz (available with connector Option -002 K (f))
36585K-2M	K Connector Precision AutoCal Module, 70 kHz to 40 GHz, K (m) to K (m)
36585K-2F	K Connector Precision AutoCal Module, 70 kHz to 40 GHz, K (f) to K (f)
36585K-2MF	K Connector Precision AutoCal Module, 70 kHz to 40 GHz, K (m) to K (f)
2000-1809-R	Serial to USB Adapter (required for use with 36585 AutoCal module if control PC does not have a serial port)

Continued on next page

Model/Order No.	Name
	RF Cables and Adapters
N120-6 RF	Cables, Semi-Rigid, N (m) to N (m), 1 each, 0.01 GHz to 18 GHz, 50Ω, 15 cm (5.9 in) (MS46322B, MS46522B, and MS46524B only)
NS120MF-6 RF	Cables, Semi-Rigid, N (f) to N (f), 1 each, 0.01 GHz to 18 GHz, 50Ω,15 cm (5.9 in) (MS46322B, MS46522B, and MS46524B only)
1091-26-R	Adapter, SMA (m) to N (m), DC to 18 GHz, 50Ω
1091-27-R	Adapter, SMA (f) to N (m), DC to 18 GHz, 50Ω
1091-80-R	Adapter, SMA (m) to N (f), DC to 18 GHz, 50Ω
1091-81-R	Adapter, SMA (f) to N (f), DC to 18 GHz, 50Ω
71693-R	Ruggedized adapter, K (f) to N (f), DC to 18 GHz, 50Ω
33KK50C	Calibration Grade Adapter, DC to 43.5 GHz, K (m) to K (m), 50Ω (MS46122B, MS46322B, MS46522B, and MS46524B only)
33KKF50C	Calibration Grade Adapter, DC to 43.5 GHz, K (m) to K (f), 50Ω (MS46122B, MS46322B, MS46522B, and MS46524B only)
33KFKF50C	Calibration Grade Adapter, DC to 43.5 GHz, K (f) to K (f), 50Ω (MS46122B, MS46322B, MS46522B, and MS46524B only)
34NK50	Precision Adapter, N (m) to K (m), DC to 18 GHz, 50Ω
34NKF50	Precision Adapter, N (m) to K (f), DC to 18 GHz, 50Ω
34NFK50	Precision Adapter, N (f) to K (m), DC to 18 GHz, 50Ω
34NFKF50	Precision Adapter, N (f) to K (f), DC to 18 GHz, 50Ω
34VFK50A	Precision Adapter, DC to 43.5 GHz, V (f) - K (m), 50Ω (MS46122B, MS46322B, MS46522B, and MS46524B only)
34VFKF50A	Precision Adapter, DC to 43.5 GHz, V (f) - K (f), 50Ω (MS46122B, MS46322B, MS46522B, and MS46524B only)
34VK50A	Precision Adapter, DC to 43.5 GHz, V (m) - K (m), 50Ω (MS46122B, MS46322B, MS46522B, and MS46524B only)
34VKF50A	Precision Adapter, DC to 43.5 GHz, V (m) - K (f), 50Ω (MS46122B, MS46322B, MS46522B, and MS46524B only)
K220B	Precision Adapter, K (m) to K (m), DC to 40 GHz, 50Ω
K222B	Precision Adapter, K (f) to K (f), DC to 40 GHz, 50Ω
K224B	Precision Adapter, K (m) to K (f), DC to 40 GHz, 50Ω
SC7260	WR12 to W1 (m) Adapter, W1 (1 mm) to WR12 Waveguide (MS46522B and MS46524B only)
SC7442	WR12 to W1 (f) Adapter, W1 (1 mm) to WR12 Waveguide (MS46522B and MS46524B only)
35WR12WF-EE	Precision Waveguide to Coax Adapter Kit, 56 GHz to 94 GHz, WR-12 to 1.0 mm (f) (MS46522B and MS46524B only)
	Test Port Cables, Flexible, Ruggedized, Phase Stable
15NNF50-1.0B	1.0 m (39"), DC to 18 GHz, Test Port Cable, Flexible, Phase Stable, N (f) to N (m), 50Ω
15NNF50-1.5B	1.5 m (59"), DC to 18 GHz, Test Port Cable, Flexible, Phase Stable, N (f) to N (m), 50Ω
15NN50-1.0B	1.0 m (39"), DC to 18 GHz, Test Port Cable, Flexible, Phase Stable, N (m) to N (m), 50Ω
15LL50-1.0A	1.0 m (39"), DC to 20 GHz, Test Port Cable, Armored, Phase Stable, 3.5 mm (m) to 3.5 mm (m), 50Ω
15LLF50-1.0A	1.0 m (39"), DC to 20 GHz, Test Port Cable, Armored, Phase Stable, 3.5 mm (m) to 3.5 mm (f), 50Ω
15KK50-1.0A	1.0 m (39"), DC to 20 GHz, Test Port Cable, Armored, Phase Stable, K (m) to K (m), 50Ω
15KKF50-1.0A	1.0 m (39"), DC to 20 GHz, Test Port Cable, Armored, Phase Stable, K (m) to K (f), 50Ω
	Tools
01-200	Calibrated Torque End Wrench, GPC-7 and Type N
01-201	Torque End Wrench, 5/16 in, 0.9 N·m (8 lbf·in) For tightening male devices, for SMA, 3.5 mm, 2.4 mm, K and V connectors
01-203	Torque End Wrench, 13/16 in, 0.9 N.m (8 lbf.in) For tightening ruggedized SMA, 2.4 mm, K and V connectors (MS46121B, MS46122B and MS46322B only)
01-204	End Wrench, 5/16 in, Universal, Circular, Open-ended, For SMA, 3.5 mm, 2.4 mm, K and V connectors
More Information	Refer to our Precision RF & Microwave Components Catalog for descriptions of adapters and other components.

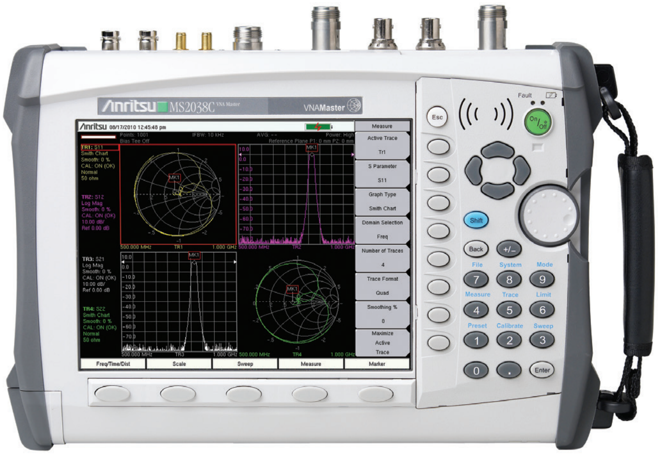
Model/Order No.	Name
	Documentation
User Documentation	Soft copies of the manuals as Adobe Acrobat PDF files are available for download from the instrument model web page at www.anritsu.com. For more information and product support, please contact ShockLineVNA.support@Anritsu.com.
10100-00067	Product information, compliance, and safety
10410-00344	MS46121A/B Series VNA User Guide (MS46121B only)
10410-00337	MS46121A/B, MS46122A/B, and MS46322A/B Series VNA User Interface Reference Manual
10410-00340	MS46122A/B Series VNA Operation Manual (MS46122B only)
10410-00335	MS46322A/B Series VNA Operation Manual (MS46322B only)
10410-00336	MS46322A/B Series VNA Calibration and Measurement Guide (MS46322B only)
10410-00743	MS46522B/524B VNA Operation Manual (MS46522B and MS46524B only)
10410-00744	MS46522B/524B VNA User Interface Reference Manual (MS46522B and MS46524B only)
10410-00746	ShockLine Series VNA Programming Manual, for IEEE 488.2 and SCPI Commands (MS46122B, MS46322B, MS46522B, and MS46524B only)
10410-00753	MS46522B/524B VNA Calibration and Measurement Guide (MS46522B and MS46524B only)
10410-00780	MS46131A Series VNA Operation Manual
10410-00782	ME7868A Quick Start Guide

MS2036C

5 kHz to 6 GHz / 9 kHz to 9 GHz

Remote Control
Ethernet | **USB**

The Ultimate Handheld Vector Network + Spectrum Analyzer for Cable, Antenna and Signal Analysis Anytime, Anywhere



High Performance Handheld S-Parameters

The VNA Master MS2036C is a Handheld Vector Network Analyzer with frequency coverage from 5 kHz to 6 GHz PLUS a Spectrum Analyzer covering 9 kHz to 9 GHz all rolled into a single measurement powerhouse for the harsh RF and physical environments of field test. Whether it is for spectrum monitoring, broadcast proofing, interference analysis, RF and microwave measurements, regulatory compliance, or 3G/4G and wireless data network measurements, this VNA/Spectrum Analyzer combination is the ideal instrument for making fast and reliable measurements in the field.

The Anritsu VNA Master MS2036C is a high performing, handheld solution for 2-port, 2-path measurements, anytime, anywhere. It specifically addresses complex cable and antenna measurement needs in the field with accurate, vector corrected 2-port magnitude, phase, and Distance-To-Fault measurements. The VNA Master MS2036C covers a frequency band from 5 kHz to 6 GHz, which contains a wide variety of radio frequency communications systems.

The Anritsu VNA Master MS2036C is high performing, handheld solution for 2-port, 2-path measurements, anytime, anywhere. It specifically addresses complex coaxial or waveguide measurement needs in the field with accurate, vector corrected 2-port magnitude, phase, and standard Distance-To-Fault measurements (requires firmware V1.16 or higher). The VNA Master MS2036C covers a frequency band from 5 kHz to 6 GHz, which contains a wide variety of radio frequency communications systems.

Performance and Functional Highlights

VNA Master MS2036C (5 kHz to 6 GHz)

- True 2-Path 2-Port Vector Network Analyzer
- Ultimate accuracy with 12-term error correction algorithm
- User-defined Quad Display for viewing all 4 S-parameters

Spectrum Analyzer (9 kHz to 9 GHz)

- Detectors: Peak, Negative, Sample, Quasi-peak, and true RMS
- Markers: 6, each with a Delta Marker, or 1 Reference with 6 Deltas
- Built-in pre-selector for eliminating spurious in displays
- PIM Hunting
- Standard three-year warranty (battery one-year warranty)

VNA Master Functional Specifications

Definitions

- All specifications and characteristics apply to Revision 2 instruments under the following conditions, unless otherwise stated:
- Warm-up time — After 15 minutes of warm-up time in VNA mode, where the instrument is left in the ON state.
- Temperature range is 23°C±5°C.
- Reference Signal — When using internal reference signal.
- Spectrum Analyzer — After 5 minutes of warm-up time, where the instrument is left in the ON state and Sweep Mode set to Performance.
- Typical Performance — Typical specifications that are not in parenthesis are not tested and not warranted. They are generally representative of characteristic performance. Typical specifications in parenthesis ( ) represent the mean value of measured units and do not include any guard-bands or uncertainties. They are not warranted.
- Uncertainty — A coverage factor of x1 is applied to the "VNA" or "corrected system" measurement uncertainties to facilitate comparison with other industry handheld analyzers.
- Calibration Cycle — Calibration is within the recommended 12 month period (residual specifications also require calibration kit calibration cycle adherence.)

All specifications subject to change without notice.
For the most current data sheet, please visit the Anritsu website:
www.anritsu.com

Frequency

Frequency Range	5 kHz to 6 GHz
Frequency Accuracy	±1.5 ppm
Frequency Resolution	1 Hz to 375 MHz, 10 Hz to 6 GHz

Test Port Power (All values are Typical)

VNA Master supports selection of either High (default) or Low test port power. Changing power after calibration can degrade the calibrated performance. Typical power by bands is shown in the following table.

Frequency Range	High Port Power	Low Port Power
5 kHz to 3 GHz	+3 dBm	–25 dBm
>3 GHz to 6 GHz	–3 dBm	–25 dBm

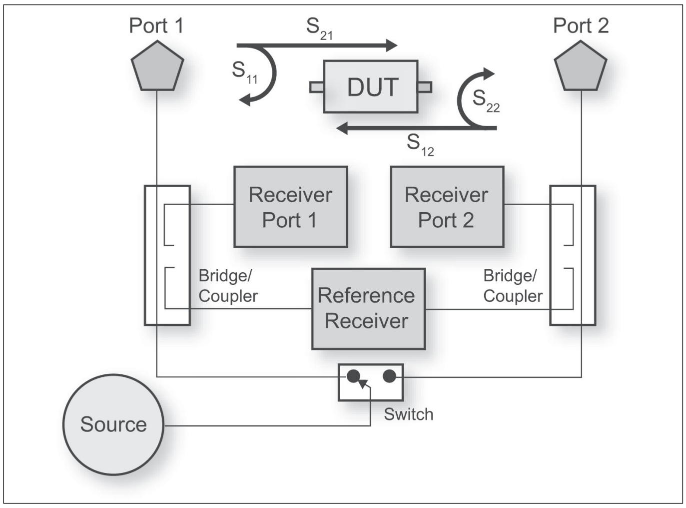
Transmission Dynamic Range

The transmission dynamic range (the difference between test port power and noise floor) using 10 Hz IF Bandwidth and High Port Power is shown in the following table.

Frequency Range	Dynamic Range
5 kHz to 2 MHz	85 dB
>2 MHz to 3 GHz	100 dB
>3 GHz to 6 GHz	90 dB

Block Diagram

As shown in the following block diagram, the VNA Master has a 2-port, 2-path architecture that automatically measures four S-parameters with a single connection.



The above illustration is a simplified block diagram of VNA Master's 2-port, 2-path architecture.

Sweep Speed

The typical sweep speed in µs/point for IF Bandwidth of 100 kHz, 1001 data points, and single display is shown for the following frequencies. The three receiver architecture will simultaneously collect S_{21} and S_{11} (or S_{12} and S_{22}) in a single sweep.

Frequency Range	Typical Sweep Speed
5 kHz to 6 GHz	350 µs/point

High-Level Noise

S_{11} or S_{22}, Short, Power = High, IFBW = 200 Hz (typ.)

Frequency Range	Magnitude	Phase
5 kHz to 6 GHz	0.004 dB (rms)	0.040 deg

Noise Floor

10 Hz IFBW

Frequency Range	Noise Floor
5 kHz to 2 MHz	–85 dBm (typ.)
>2 MHz to 3 GHz	–100 dBm (typ.)
>3 GHz to 6 GHz	–96 dBm (typ.)

Temperature Stability

S_{11} or S_{22}, Short, 23°C±5°C (typ.)

Frequency Range	Magnitude	Phase
5 kHz to 6 GHz	0.018 dB/°C	0.160 deg/°C

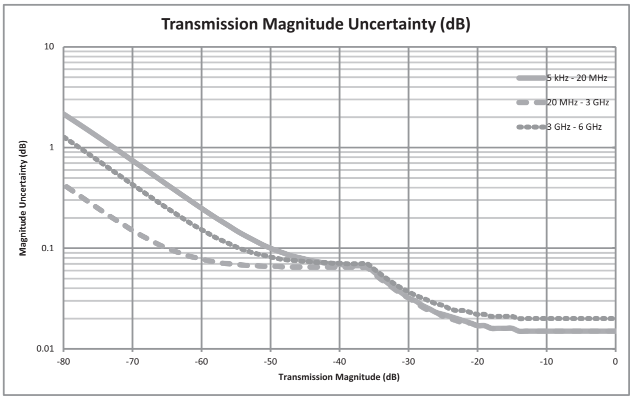
Corrected System Performance and Uncertainties — High Port Power

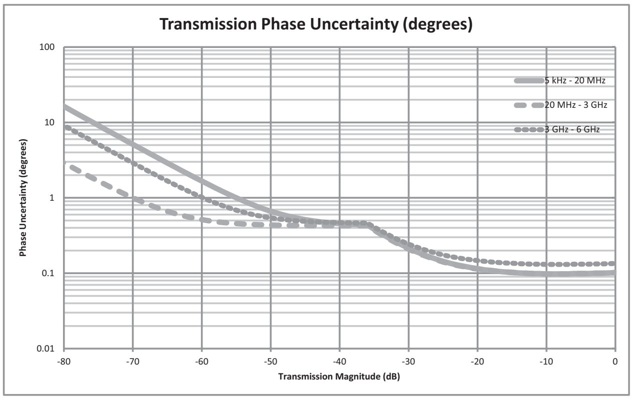
Measurement Accuracy (OSLN50A-18 or TOSLN50A-18)

Full 2-Port calibration, Default Power, 10 Hz IFBW, No averaging, 10 minute warm-up. OSLN50A-18 or TOSLN50A-18 calibration kit.
Load match specification applicable directly at corrected port only. De-rate by approximately 8 dB if using a 3670 series test port cable.
Reflection and Transmission Tracking are typical.

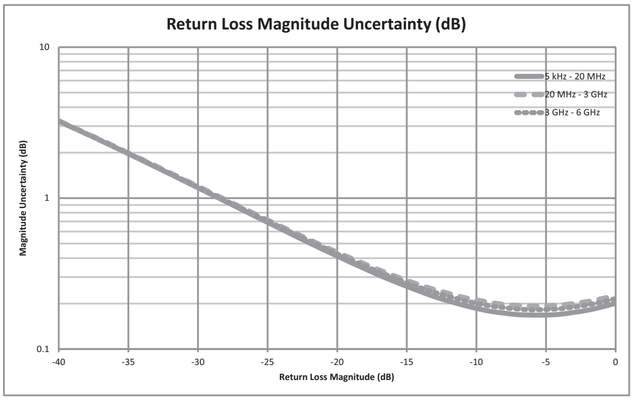
Frequency Range	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
5 kHz to 20 MHz	≥42	≥30	≥42	±0.02	±0.01
>20 MHz to 3 GHz	≥42	≥30	≥42	±0.07	±0.01
>3 GHz to 6 GHz	≥42	≥30	≥42	±0.05	±0.02

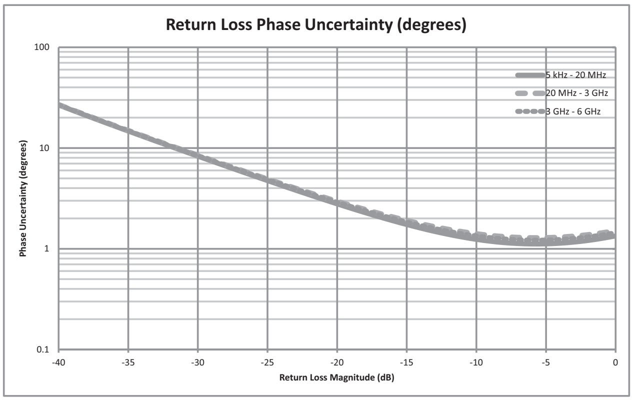
Transmission Uncertainty (S_{21}, S_{12})*


Transmission Magnitude Uncertainty (dB)


Transmission Phase Uncertainty (degrees)

Reflection Uncertainty (S_{11}, S_{22})*


Return Loss Magnitude Uncertainty (dB)

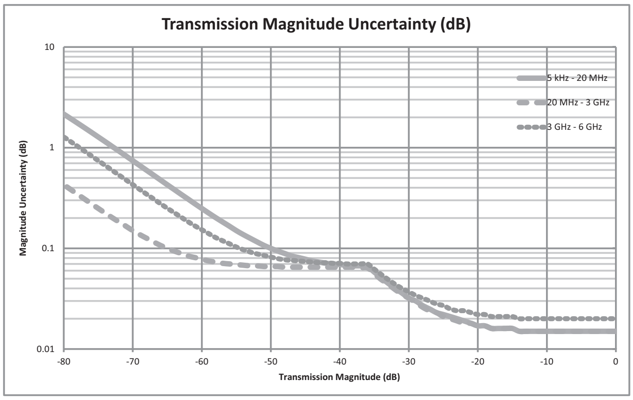

Return Loss Phase Uncertainty (degrees)

Measurement Accuracy (OSLNF50A-18 or TOSLNF50A-18)

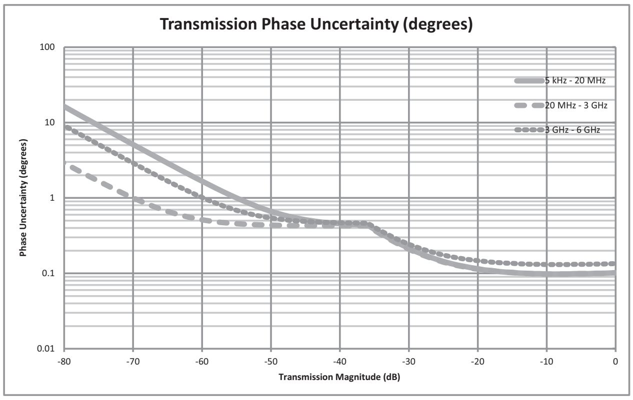
Full 2-Port calibration, Default Power, 10 Hz IFBW, No averaging, 10 minute warm-up. OSLNF50A-18 or TOSLNF50A-18 calibration kit. Load match specification applicable directly at corrected port only. De-rate by approximately 8 dB if using a 3670 series test port cable. Reflection and Transmission Tracking are typical.

Frequency Range	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
5 kHz to 20 MHz	≥42	≥30	≥42	±0.02	±0.01
>20 MHz to 3 GHz	≥42	≥30	≥42	±0.07	±0.01
>3 GHz to 6 GHz	≥42	≥30	≥42	±0.05	±0.02

Transmission Uncertainty (S_{21}, S_{12})*

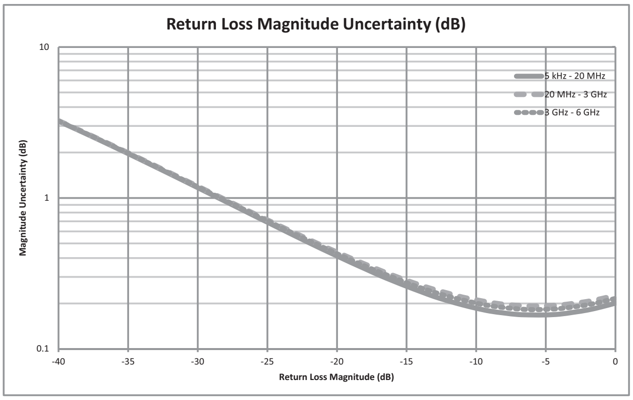


Transmission Magnitude Uncertainty (dB)

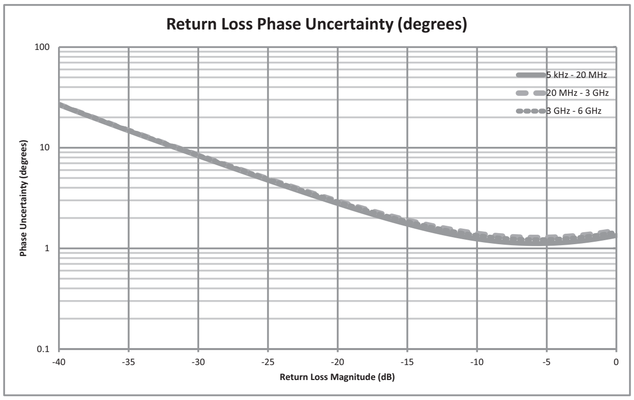


Transmission Phase Uncertainty (degrees)

Reflection Uncertainty (S_{11}, S_{22})*



Return Loss Magnitude Uncertainty (dB)



Return Loss Phase Uncertainty (degrees)

VNA Functional Specifications

Measurement Parameters	S_{11}, S_{21}, S_{22}, S_{12}, (optionally: S_{d1d1}, S_{c1c1}, S_{d1c1}, S_{c1d1})
Number of Traces	Four: TR1, TR2, TR3, TR4
Trace Format	Single, Dual, Tri, Quad, with Trace overlay capabilities
Graph Types	Log Magnitude, SWR, Phase, Real, Imaginary, Group Delay, Smith Chart, Inverted Smith Chart (Admittance), Log Mag/2 (1-Port Cable Loss), Linear Polar, Log Polar, Real Impedance, Imaginary Impedance
Domains	Frequency Domain, Distance Domain, Time Domain with gating (Time Domain optional)
Frequency	Start Frequency, Stop Frequency, Center Frequency, Span
Distance	Start Distance, Stop Distance
Time	Start Time, Stop Time
Frequency Sweep Type: Linear	Single Sweep, Continuous
Data Points	2 to 4001 (arbitrary setting); data points can be reduced without recalibration.
Limit Lines	Upper, Lower, 10-segmented Upper, 10-segmented Lower
Test Limits	Pass/Fail for Upper, Pass/Fail for Lower, Limit Audible Alarm
Data Averaging	Sweep-by-sweep
Smoothing	0 to 20%
IF Bandwidth	10, 20, 50, 100, 200, 500 Hz, 1, 2, 5, 10, 20, 50, 100 kHz
Reference Plane	The reference planes of a calibration (or other normalization) can be changed by entering a line length. Assumes no loss, flat magnitude, linear phase,and constant impedance.
Auto Reference Plane Extension	Instead of manually entering a line length, this feature automatically adjusts phase shift from the current calibration (or other normalization) to compensate for external cables (or test fixtures). Assumes no loss, flat magnitude, linear phase, and constant impedance.
Group Delay Aperture	Defined as the frequency span over which the phase change is computed at a given frequency point. The aperture can be changed without recalibration. The minimum aperture is the frequency range divided by the number of points in calibration and can be increased to 20% of the frequency range.
Trace Memory	A separate memory for each trace can be used to store measurement data for later display. The trace data can be saved and recalled.
Trace Math	Complex trace math operations of subtraction, addition, multiplication, or division are provided.
Number of Markers	Twelve, arbitrary assignments to any trace
Marker Types	Reference, Delta
Marker Readout Styles	Log Mag, Cable Loss (Log Mag/2), Log Mag and Phase, Phase, Real and Imaginary, SWR, Impedance, Admittance, Normalized Impedance, Normalized Admittance, Polar Impedance, Group Delay, Linear Mag, Linear Mag and Phase
Marker Search	Peak Search, Valley Search, Find Marker Value
Correction Models	Full 2-Port, Full S_{11}, Full S_{22}, Full S_{11} & S_{22}, Response S_{21}, Response S_{12}, Response S_{21} & S_{12}, Response S_{11}, Response S_{22}, Response S_{11} & S_{22}, One-Path Two-Port (S_{11}, S_{21}), One-Path Two-Port (S_{22}, S_{12})
Calibration Types	Flex, Standard
Calibration Methods	Short-Open-Load-Through (SOLT), Offset-Short (SSLT), and Triple-Offset-Short (SSST), Short-Open-Load-Reciprocal (SOLR), Double-Offset-Short-Load-Reciprocal (SSLR), Triple-Offset-Short-Reciprocal (SSSR)
Calibration Standard Coefficients	Coax: N-Connector, K-Connector, 7/16, TNC, SMA, and four User Defined coax types Waveguide: WG11A, WG12, WG13, WG14, WG15, WG16, WG17, WG18, WG20, and four User Defined rectangular waveguide types
Cal Correction Toggle	On/Off
Interpolation	On/Off
Dispersion Compensation	Waveguide correction that improves accuracy of distance-to-fault data by compensating for different wavelengths propagating at different speeds.
Impedance Conversion	Support for 50Ω and 75Ω are provided.
Units	Meters, Feet
Bias Tee Settings	Internal, External, Off
Timebase Reference	Internal, External
File Storage Types	Measurement (.mna), Setup (.stp, with or without CAL), S2P (Real/Imag), S2P (Lin Mag/Phase), S2P (Log Mag/Phase), Text (VNA Only), CSV (VNA Only), JPEG
Ethernet Configuration	DHCP or Manual (Static) IP configuration, 10/100 Base-T, RJ45 jack
Languages	English, French, German, Spanish, Chinese, Japanese, Korean, Italian, Russian, Portuguese

Measurement Options Specifications

Distance Domain (formerly Option 501, now standard with firmware revision v1.16 or higher)

Distance Domain Analysis is a powerful field test tool to analyze cables for faults, including minor discontinuities that may occur due to a loose connection, corrosion, or other aging effects. By using Frequency Domain Reflectometry (FDR), the VNA Master exploits a user-specified band of full power operational frequencies (instead of DC pulses from TDR approaches) to more precisely identify cable discontinuities. The VNA Master converts S-parameters from frequency domain into distance domain on the horizontal display axis, using a mathematical computation called Inverse Fourier Transform. Connect a reflection at the opposite end of the cable, and the discontinuities appear versus distance to reveal any potential maintenance issues. When access to both ends of the cable is convenient, a similar distance domain analysis is available on transmission measurements. Distance Domain will improve your productivity with displays of the cable in terms of discontinuities versus distance. This readout can then be compared against previous measurements (from stored data) to determine whether any degradations have occurred since installation (or the last maintenance activity). More importantly, you will know precisely where to go to fix the problem and so minimize or prevent downtime of the system.

Round-Trip (reflection) Fault Resolution (meters)	(0.5 × c × Vp)/ΔF; (c is speed of light = 299,792,458 m/s, ΔF is F2 – F1 in Hz)
One-Way (transmission) Fault Resolution (meters)	(c × Vp)/ΔF; (c is speed of light = 299,792,458 m/s, ΔF is F2 – F1 in Hz)
Horizontal Range (meters)	0 to (data points – 1) × Fault Resolution to a maximum of 3000 m (9843 ft.)
Windowing	Rectangular, Nominal Side Lobe (NSL), Low Side Lobe (LSL), and Minimum Side Lobe (MSL)

Time Domain (Option 2) (includes Distance Domain)

The VNA Master can display the S-parameter measurements in the time or distance domain using lowpass or bandpass processing analysis modes. The broadband frequency coverage coupled with 4001 data points means you can measure discontinuities both near and far with unprecedented clarity for a handheld tool. With this option, you can simultaneously view S-parameters in frequency, time, and distance domain to quickly identify faults in the field. Advanced features available with this option include step response, phasor impulse, gating, and frequency gated in time. The option includes computational routines that further enhance the Distance Domain results by compensating for cable loss, relative velocity of propagation, and dispersion compensation in waveguide. See the Distance Domain Specifications above.

Option Comparison Table (Distance Domain and Time Domain)

Measurement	Distance Domain (formerly Option 501)	Option 2 Time Domain
Distance-to-Fault	×	×
Distance Domain Display	×	×
Windowing	×	×
Distance of Waveguide		×
Time Domain Display		×
One Way vs. Round Trip Reflection		×
Phasor Impulse		×
Impulse Response		×
Step Response		×
Low Pass vs. Bandpass		×
Frequency Gated by Time		×
Frequency Gated by Distance		×

Secure Data Operation (Option 7)

For highly secure data handling requirements, this software option prevents the storing of measurement setup or data information onto any internal file storage location. Instead, setup and measurement information is stored ONLY to the external USB memory location.

A simple factory preset prepares the VNA Master for transportation while the USB memory remains behind in the secure environment.

The VNA Master cannot be switched between secure and non-secure operation by the user once configured for secure data operation.

With this option enabled, the user can also choose to blank the frequency values displayed on the screen.

Balanced/Differential S-Parameters, 1-port (Option 77)

As an alternative to a sampling oscilloscope, verifying the performance and identifying discontinuities in high-data-rate differential cables is now possible with the VNA Master. After a full two-port calibration, connect your differential cable directly to the two test ports and reveal the S_{d1d1} performance, which is essentially differential return loss, or any of the other differential S-Parameters, S_{c1c1}, S_{d1c1}, or S_{c1d1}. With optional time domain, you can convert frequency sweeps to distance. This capability is especially valuable for applications in high data rate cables where balanced data formats are used to isolate noise and interference.

Bias Tee (Option 10)

For tower mounted amplifier tests, the MS203xC series with optional internal bias tees can supply both DC and RF signals on the center conductor of the cable during measurements. For frequency sweeps in excess of 2 MHz, the VNA Master can supply internal voltage control from +12 V to +32 V in 0.1 V steps up to 450 mA.

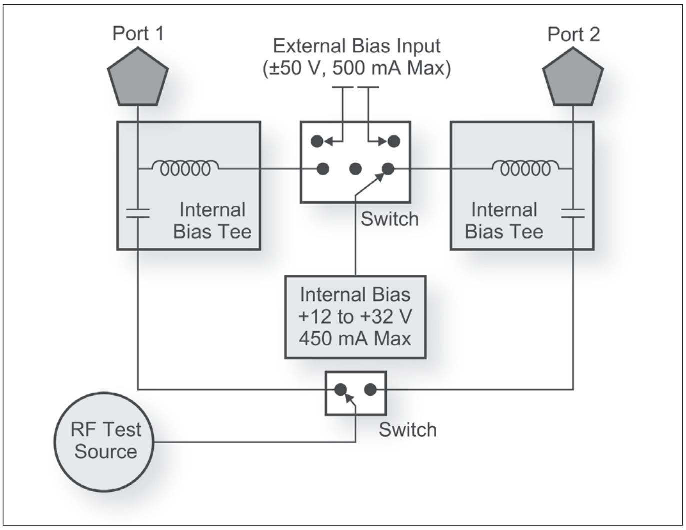
To extend battery life, an external power supply can substitute for the internal supply by using the included external bias ports.

Both test ports can be configured to supply voltage via this integrated bias tees option. Bias can be directed to VNA Port 1 or Port 2.

The VNA Master offers optional integrated bias tee for supplying DC plus RF to the DUT as shown in the simplified block diagram.

Connectivity is also provided for external supply (instead of internal) to preserve battery consumption.

Frequency Range	2 MHz to 6 GHz
Internal Voltage/Current	+12 V to +32 V at 450 mA steady rate
Internal Resolution	0.1 V
External Voltage/Current	±50 V at 500 mA steady rate
Bias Tee Selections	Internal, External, Off



Vector Voltmeter (Option 15)

A phased array system relies on phase matched cables for nominal performance. For this class of application, the VNA Master offers this special software mode to simplify phase matching cables at a single frequency. The similarity between the popular vector voltmeter and this software mode ensures minimal training is required to phase match cables. Operation is as simple as configuring the display for absolute or relative measurements.

The easy-to-read large fonts show either reflection or transmission measurements using impedance, magnitude, or VSWR readouts. For instrument landing system (ILS) or VHF Omni-directional Range (VOR) applications, a table view improves operator efficiency when phase matching up to twelve cables. The MS203xC solution is superior because the signal source is included internally, precluding the need for an external signal generator.

CW Frequency Range	5 kHz to 6 GHz
Measurement Display	CW, Table (Twelve Entries, Plus Reference)
Measurement Types	Return Loss, Insertion
Measurement Format	dB/VSWR/Impedance

Spectrum Analyzer Performance Specifications

Measurements	Field Strength	dBm/m², dBV/m, dBmV/m, dBµV/m, V/m, Watt/m², dBW/m², A/m, dBA/m, or Watt/cm²
	Occupied Bandwidth	Measures 99 % to 1 % power channel of a signal, or N dB from center of signal
	Channel Power	Measures the total power in a specified bandwidth
	ACPR	Adjacent channel power ratio
	Emission Mask	Recall limit lines as emission mask
	Spurious Emissions	Measures up to 32 segments with independent setups and limits
	C/I	Carrier-to-interference ratio
	AM/FM/SSB Demodulation	AM, wide/narrow FM, upper/lower SSB (audio only)
	PIM Hunting	
Setup Parameters	Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #, Channel Increment
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Units (dBm, dBV, dBmV, dBµV, Volt, Watt, dBW, A, dBA), Pre-Amp On/Off, Detection (Peak, RMS/Avg, Negative Peak, Sample, Quasi-Peak)
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
	Bandwidth	RBW, Auto RBW, VBW, Auto VBW, VBW/Avg Type (Linear, Log), RBW/VBW Ratio, Span/RBW Ratio
	Impedance	50Ω, 75Ω; external pad required for 75Ω operation
Sweep Functions	Sweep	Single/Continuous, Sweep Time
	Sweep Mode	Fast (up to 100x faster than Performance), Performance, No FFT, Burst Detect (1000x Fast in 15 MHz span)
	Triggers	Free Run, External, Video, IF Power, Force Trigger Once
	Trigger Parameters	Delay, Level, Slope, Hysteresis, Holdoff (availability varies with trigger)
Trace Functions	Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations
	Trace A Operations	Normal, Max Hold, Min Hold, Average, # of Averages, (always the live trace)
	Trace B Operations	A → B, B ↔ C, Max Hold, Min Hold
	Trace C Operations	A → C, B ↔ C, Max Hold, Min Hold, A – B → C, B – A → C, Relative Reference (dB), Scale
Marker Functions	Markers	Markers 1-6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off/Large), All Markers Off
	Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker
	Marker Auto-Position	Peak Search, Next Peak (Right/Left), Peak Threshold %, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level
	Marker Table	1-6 markers frequency and amplitude plus delta markers frequency offset and amplitude
Limit Line Functions	Available Spans	>0 Hz
	Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, Default Limit
	Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
	Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
	Limit Line Envelope	Create Envelope, Update Amplitude, Number of Points (2 to 41), Offset, Shape Square/Slope
	Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall
	Save on Event	When Limit Crossed
Frequency	Frequency Range	(usable to 0 Hz) 9 kHz to 9 GHz
	Tuning Resolution	1 Hz
	Frequency Reference	Aging: ± 1.0 × 10^{-6} per year for 10 years Accuracy: ± 0.3 × 10^{-6} (25°C ±25°C) plus aging (see Option 31 for improved frequency reference aging and accuracy)
	External Frequency Reference	1, 1.2288, 1.544, 2.048, 2.4576, 4.8, 4.9152, 5, 9.8304, 10, 13, 19.6608 MHz (auto-sensing)
	Sweep Time	7 µs to 3600 seconds in zero span
	Sweep Time Accuracy	±2% in zero span
Bandwidth	Resolution Bandwidth (RBW)	1 Hz to 10 MHz in 1–3 sequence ±10% (–3 dB bandwidth)
	Video Bandwidth (VBW)	1 Hz to 10 MHz in 1–3 sequence (–3 dB bandwidth)
	RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (–6 dB bandwidth)
	VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1
	VBW/Average	Type Linear/Log
Spectral Purity – SSB Phase Noise		Offset from 1 GHz

	Maximum	Typical
10 kHz	–102 dBc/Hz	–106 dBc/Hz
100 kHz	–106 dBc/Hz	–110 dBc/Hz
1 MHz	–111 dBc/Hz	–116 dBc/Hz
10 MHz	–123 dBc/Hz	–129 dBc/Hz

Amplitude Ranges	Dynamic Range	>106 dB @ 2.4 GHz, 2/3 (TOI-DANL) in 1 Hz RBW
	Measurement Range	DANL to +30 dBm
	Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed
	Reference Level Range	–150 to +30 dBm
	Reference Level Offset	99.9 dB External Loss to 99.9 dB External Gain
	Attenuator Resolution	0 to 65 dB, 5.0 dB steps
	Amplitude Units	Log Scale Modes: dBW, dBm, dBµW, dBV, dBmV, dBµV, dBA, dBmA, dBµA Linear Scale Modes: fV, nV, µV, mV, V, fW, pW, nW, µW, mW, W, pA, nA, µA, mA, A
	Maximum Continuous Input (typ.)	+30 dBm Peak, ±50 VDC (≥10 dB Attn) +23 dBm Peak, ±50 VDC (<10 dB Attn) +13 dBm Peak, ±50 VDC (Preamp On)

Continued on next page

Amplitude Accuracy
(excluding effects of VSWR, noise and spurs)

Frequency Range	+20°C to +30°C (after 30 minute warm-up)		−10°C to +55°C (after 60 minute warm-up)	
	Maximum	Typical	Maximum	Typical
9 kHz to 100 kHz*	±2.3 dB	±0.5 dB	±2.3 dB	±0.5 dB
>100 kHz to 9 GHz	±1.3 dB	±0.5 dB	±2.3 dB	±0.5 dB

*: Values below 100 kHz are with the preamplifier turned off.

Displayed Average Noise Level (DANL)
(RMS detection, VBW/Avg type = Log., Ref Level = –20 dBm for preamp Off and –50 dBm for preamp On, Auto Attenuation, Performance Sweep Mode)

Frequency Range	Preamp = Off		Preamp = On	
	Maximum	Typical	Maximum	Typical
10 MHz to 4 GHz	–145 dBm	–148 dBm	–161 dBm	–164 dBm
>4 GHz to 9 GHz	–142 dBm	–145 dBm	–159 dBm	–162 dBm

Spurs (0 dB input attenuation)	Residual Spurs (RF input terminated)	Preamp Off: –90 dBm (≤9 GHz) Preamp On: –100 dBm (≤9 GHz)
	Input-Related Spurious (–30 dBm input)	Preamp Off: –60 dBc (Instrument centered on single signal, span <1.7 GHz) Preamp On: –70 dBc (typ.)
Third-Order Intercept (TOI)		(–20 dBm tones 100 kHz apart, –20 dBm Ref level, 0 dB input attenuation, preamp Off) 2.4 GHz: +14 dBm minimum 50 MHz to 20 GHz: 20 dBm (typ.)
P1dB		<4 GHz: +5 dBm (nom.) 4 GHz to 20 GHz: +12 dBm (nom.)
Second Harmonic Distortion (0 dB input attenuation, –30 dBm input)		50 MHz: –54 dBc (max.) <4 GHz: –60 dBc (typ.) ≥4 GHz: –75 dBc (typ.)
VSWR (≥10 dB input attenuation)		≤20 GHz: 1:5:1 (typ.)

High Accuracy Power Meter (Option 19)

Requires external USB power sensor.

Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale
Average	# of Running Averages, Max Hold
Zero/Cal	Zero On/Off, Cal Factor (Center Frequency, Signal Standard)
Limits	Limit On/Off, Limit Upper/Lower

Power Sensors (Ordered separately):

Power Sensor Model	MA24105A	MA24106A	MA24108A/18A/26A	MA24208A/18A	MA24330A/40A/50A
Description	Inline High Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor	Microwave Universal USB Power Sensor	Microwave CW USB Power Sensor
Frequency Range	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8/18/26 GHz	10 MHz to 8 GHz/18 GHz	10 MHz to 33/40/50 GHz
Connector	Type N (f), 50Ω	Type N (m), 50Ω	Type N (m), 50Ω (8 GHz/18 GHz) Type K (m), 50Ω (26 GHz)	Type N (m), 50Ω	Type K (m), 50Ω (33 GHz/40 GHz) Type V (m), 50Ω (50 GHz)
Dynamic Range	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 µW to 200 mW)	–40 to +20 dBm (0.1 µW to 100 mW)	–60 to +20 dBm (1 nW to 100 mW)	–70 to +20 dBm (0.1 nW to 100 mW)
Measurand	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power	True-RMS, Slot Power, Burst Average Power	Average Power
Measurement Uncertainty	± 0.17 dB*1	± 0.16 dB*2	± 0.18 dB*3	± 0.17 dB*4	± 0.17 dB*5
Data sheet (for complete specifications)	11410-00621	11410-00424	11410-00504	11410-00841	11410-00906

*1: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.

*2: Total RSS measurement uncertainty (0°C to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.

*3: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.

*4: Power uncertainty expressed with two sigma confidence level for CW measurement after zero operation. Includes calibration factor and linearity over temperature uncertainties, but not the effects of mismatch, zero set and drift, or noise.

*5: Includes linearity over temperature uncertainties, but not the effects of calibration factor, mismatch, zero set and drift, and noise.

Interference Analyzer (Option 25)

Spectrum	Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only) Carrier-to-Interference ratio (C/I)
Spectrogram	Collect data up to 3 days
Signal Strength	Gives visual and aural indication of signal strength
Received Signal Strength Indicator (RSSI)	Collect data up to 168 hours (one week)
Interference Mapping	Draw multiple bearings of signal strength from GPS location on on-screen map Pan and Zoom on-screen maps Support for Anritsu MA2700A Handheld Interference Hunter
Impedance	50Ω, 75Ω; external pad required for 75Ω operation

Channel Scanner (Option 27)

Number of Channels	1 to 20 Channels (Power Levels)
Measurements	Graph/Table, Max Hold (On/5 sec/Off), Frequency/Channel, Current/Maximum, Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Custom List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Number of Channels, Signal Standard & Channel, Frequency, Bandwidth
Frequency Range	9 kHz to 9 GHz
Frequency Accuracy	±10 Hz + frequency reference error
Measurement Range	–110 to +30 dBm
Impedance	50Ω, 75Ω; external pad required for 75Ω operation

GPS Receiver (Option 31)

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info Note: 2000-1528-R GPS antenna requires +5 VDC 2000-1652-R GPS antenna requires +3.3 VDC or +5 VDC 2000-1760-R GPS antenna requires +2.5 VDC to +3.7 VDC
GPS Time/ Location Indicator	UTC Time, Latitude, Longitude, and Altitude on display (UTC Time and Altitude on GPS Info display) UTC Time, Latitude, Longitude, and Altitude with trace storage
High Frequency Accuracy	$< \pm 2.5 \times 10^{-8}$ Hz/Hz with GPS On, 3 minutes after satellite lock in selected mode (GPS Antenna connected) $< \pm 5.0 \times 10^{-8}$ Hz/Hz for 3 days after GPS lock, 0°C to 50°C (GPS Antenna disconnected)
Connector	SMA (f)

Coverage Mapping (Option 431)

Measurements	Indoor Mapping	RSSI, ACPR
	Outdoor Mapping	RSSI, ACPR
Setup Parameters	Mode	Spectrum Analyzer
	Frequency	Center, Span (ACPR only), Freq Step, Signal Standard, Channel #, Channel Increment
	Amplitude	Reference Level (RL), Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
	Span	RSSI Mode: Zero Span ACPR Mode: Span, Span Up/Down (1-2-5), Full Span, Last Span
	BW	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW Ratio, Span/RBW Ratio
	Measurement Setup	RSSI: Mapping color thresholds
	Mapping Colors	ACPR: Main Ch BW, Adj Ch BW, Ch Spacing, Adjacent Ch dB Offset, Thresholds for Good and Poor main channel levels RSSI: Dark Green (Excellent), Light Green (Very Good), Yellow (Good), Orange (Fair), Dark Red (Poor) ACPR: Dark Green (Good), Yellow (between Good and Poor), Dark Red (Poor)
	Point Distance or Time Setup	Repeat Type: Time (100 ms to 16 s), Distance (1 m to 10,000 m) Distance Units: m, ft
	Save Points Map	Save KML, JPEG, Tab Delimited
	Recall Points Map	Recall Map, Recall KML Points only, Recall KML Points with Map, Recall Default Grid
	Map Types	Outdoor (GPS embedded), Indoor (non-GPS embedded). Import maps using the Anritsu easyMap Tools. Zoomable (.azm) maps are usable, but cannot be zoomed.

AM/FM/PM Signal Analyzer (Option 509)

Measurements							
Display Type	RF Spectrum AM/FM/PM	Audio Spectrum (AM)	Audio Spectrum (FM/PM)	Audio Waveform (AM)	Audio Waveform (FM/PM)	Summary (AM)	Summary (FM/PM)
Graphic Display	Power (dBm) vs. Frequency	Depth (%) vs. Modulation Frequency	Deviation (kHz/rad) vs. Modulation Frequency	Depth (%) vs. Time	Deviation (kHz/rad) vs. Time	None	None
Numerical Displays	Carrier Power Carrier Frequency Occupied Bandwidth	AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Deviation (Pk-Pk)/2 Deviation SINAD* THD* Distortion/Total Vrms*	AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	RMS Depth Peak + Depth Peak – Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*	RMS Deviation Peak + Deviation Peak – Deviation (Pk-Pk)/2 Deviation Carrier Power Carrier Frequency Occupied Bandwidth FM/PM Rate SINAD* THD* Distortion/Total Vrms*

*: Requires sine wave modulation

Setup Parameters	Frequency	Center Freq, Span, Freq Step, Signal Standard, Channel, Channel Increment, Set (measured) Carrier Freq to Center
	Amplitude Setup	Scale, Power Offset, Adjust Range
	Measurements	RF Spectrum, Audio Spectrum (demodulated), Audio Waveform (demodulated), Summary, Coverage Mapping (Option 431 required), Audio Demod (AM/FM only)
	Measurement Setup	All Measurements: Demod Type (AM, FM, PM), IFBW, Auto IFBW, Squelch Units, Distortion Measurements (Sinewave or Broadcast) RF Spectrum: OBW Method, OBW %, OBW dBC Audio Spectrum: Span, Scale, Squelch Power Audio Waveform: Sweep Time, Scale, Squelch Power Summary: Average count, Squelch Power Coverage Mapping: Measurement (SINAD, Carrier Power, Multiple), Thresholds, Point Distance/Time Audio Demod: Demod Type (AM, USB, LSB, Widband FM, Narrowband FM), Volume, Squelch
	Mapping Colors	Dark Green (Excellent), Light Green (Very Good), Orange (Good), Yellow (Fair), Dark Red (Poor)
	Marker	Six markers with Delta for each, Peak Search, Marker Freq to Center, Marker to Ref Lvl, Marker Table
RF and Modulation Measurements	AM	Modulation Rate: ±1 Hz (<100 Hz), ±2% (>100 Hz) Depth: ±5% for (Modulation rates 10 Hz to 100 kHz)
	FM	Modulation Rate: ±1 Hz (<100 Hz); ±2% (100 Hz to 100 kHz) Deviation Accuracy: ±5% (100 Hz to 100 kHz)*
	PM	Modulation Rate: ±1 Hz (<100 Hz); ±2% (100 Hz to 100 kHz) Deviation Accuracy: ±5% (deviation 0 to 93 Rad, rate 10 Hz to 5 kHz)*
	IF Bandwidth	1 kHz to 300 kHz in 1-3 sequence
	Frequency Span	RF Spectrum: 10 kHz to 10 MHz Audio Spectrum: 2, 5, 10, 20, 70, 140 kHz
	RBW/VBW	30
	Span/RBW	100
	Sweep Time	50 µs to 50 ms (Audio Waveform) IFBW must be greater than 95% occupied BW

*: IFBW must be greater than 95% occupied BW

General Specifications

Setup Parameters	System	Status (Temperature, Battery Info, S/N, Firmware Ver, IP Address, Options Installed) Self Test, Application Self Test, GPS (see Option 31)
	System Options	Name, Date and Time, Ethernet Configuration, Brightness, Volume Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, Russian, Portuguese) Reset (Factory Defaults, Master Reset, Update Firmware)
	File	Save, Recall, Delete, Directory Management
	Save/Recall	Setups, Measurements, Screen Shots Jpeg (save only)
	Delete	Selected File, All Measurements, All Mode Files, All Content
	Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy
	Internal Trace/Setup Memory	Store more than 4000 traces and setups in memory
	External Trace/Setup Memory	Limited by size of USB Flash drive
	Mode Switching	Auto-Stores/Recalls most recently used setup parameters for the mode
Connectors	Maximum Input (Damage Level)	Vector Network Analyzer Input: +23 dBm, ±50 VDC (all models) Spectrum Analyzer Input: +30 dBm, ±50 VDC
	VNA Connectors	Type N (f)
	Spectrum Analyzer Connectors	Type N (f)
	Bias Tee	Type BNC (f) (enabled with Option 10) (× 2)
	Ext Ref	Type BNC (f), 10 MHz, ±10 dBm
	Ethernet	RJ45, 10/100 Mbps, Connect to PC or LAN for Remote Access
	GPS	SMA (f) (available with Option 31 GPS)
	External Power	5.5 mm barrel connector, 12 to 14.5 VDC, <5.0 A
	LAN Connection	RJ48C, 10/100 Mbps, Connect to PC or LAN for Remote Access
	USB Interface (2)	Type A, Connect Flash Drive and Power Sensor
	USB Interface	5-pin mini-B, Connect to PC for data transfer
	Headset Jack	3.5 mm 3-wire headset jack
	External Trigger	BNC (f), TTL 3.3 V or 5 V triggers on positive edge, Maximum Input +5 VDC
	10 MHz Out	SMA (f), 50Ω
Display	Size	8.4 in, daylight viewable color LCD
	Resolution	800 × 600
	Pixel Defects	No more than five defective pixels (99.9989% good pixels)
Power	Field Replaceable Li-Ion Battery	40 W when powered by factory 7500 mAh Li-Ion battery (part number: 633-75)
	AC/DC Power Adapter	55 W when powered by supplied universal 110 V/220 V AC/DC adaptor while charging battery
	Life Time Charging Cycles	>300 (80% of initial capacity)
	Battery Operation	3.0 hours, (typ.)
	Battery Charging Limits	0°C to +45°C, Relative Humidity ≤80%, non-condensing
Regulatory Compliance	CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD 2014/35/EU, EN61010-1 RoHS: (EU) 2015/863
	Australia and New Zealand	RCM AS/NZS 4417:2012
	South Korea	KCC-REM-A21-0004
Environmental	MIL-PRF-28800F, Class 2	
	Operating Temperature Range	–10°C to +55°C
	Storage Temperature Range	–51°C to +71°C
	Maximum Relative Humidity	95% RH at +30°C, non-condensing
	Vibration, Sinusoidal	5 Hz to 55 Hz
	Vibration, Random	10 Hz to 500 Hz
	Half Sine Shock	30 gn
	Altitude	4600 meters, operating and non-operating
	Explosive Atmosphere	MIL-PRF-28800F Section 4.5.6.3 MIL-STD-810G, Method 511.5, Procedure 1
Dimensions and Mass	Dimensions	Width: 315 mm (12.4 in) Height: 211 mm (8.3 in) Depth: 97 mm (3.8 in)
	Mass, Including Battery	4.8 kg (10.5 lb)
Warranty		Standard three-year warranty (one year warranty on battery)

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	VNA Master™ 2-Port, 1-Path VNA + Spectrum Analyzer
MS2036C	VNA: 5 kHz to 6 GHz, S/A: 9 kHz to 9 GHz
	MS2036C VNA Master, + Spectrum Analyzer Options
MS2036C-0002	Time Domain (includes Distance Domain capabilities)
MS2036C-0007	Secure Data Operation
MS2036C-0010	Built-in Bias-Tee
MS2036C-0015	Vector Voltmeter
MS2036C-0019	High Accuracy Power Meter (requires external USB sensor)
MS2036C-0025	Interference Analysis, 9 kHz to 9 GHz[*1]
MS2036C-0027	Channel Scanner, 9 kHz to 9 GHz[*1]
MS2036C-0031	GPS Receiver (requires GPS antenna, 2000-1528-R, 2000-1652-R, or 2000-1760-R)
MS2036C-0077	Balanced/Differential S-Parameters, 1-port
MS2036C-0431	Coverage Mapping[*2]
MS2036C-0098	Standard Calibration (ISO 17025 and Z540.1)
MS2036C-0099	Premium Calibration (ISO 17025 and Z540.1 plus test data)
MS2036C-0509	AM/FM/PM Analyzer[*3]
	Standard Accessories
2000-1686-R	Soft Carrying Case
40-187-R	AC-DC Adapter
806-141-R	Automotive Power Adapter, 12 VDC, 60 W
3-2000-1498	USB A/5-pin Mini-B Cable, 3.05 m (10 ft)
2000-1371-R	Ethernet Cable, 2.13 m (7 ft)
	Certificate of Calibration and Conformance
	Optional Accessories
	GPS Antennas (active)
2000-1528-R	Magnet Mount, SMA (m), 3 VDC to 5 VDC with 4.6 m (15 ft) extension cable
2000-1652-R	Magnet Mount, SMA (m), 3 VDC to 5 VDC with 1 ft cable
2000-1760-R	Mini GPS Antenna, SMA (m), 25 dB gain, 2.5 VDC to 3.7 VDC
	Power Sensor
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +3 to +51.76 dBm
MA24106A	RF USB Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm
MA24208A	Microwave Universal USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24218A	Microwave Universal USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24330A	Microwave CW USB Power Sensor, 10 MHz to 33 GHz, +20 dBm
MA24340A	Microwave CW USB Power Sensor, 10 MHz to 40 GHz, +20 dBm
MA24350A	Microwave CW USB Power Sensor, 10 MHz to 50 GHz, +20 dBm
MA25100A	RF Power Indicator
	Directional Antennas
2000-1411-R	824 MHz to 896 MHz, N (f), 12.3 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N (f), 12.6 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N (f), 12.3 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N (f), 11.4 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N (f), 14.1 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N (f), 14.3 dBd, Yagi
2000-1659-R	698 MHz to 787 MHz, N (f), 10.1 dBi, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N (f), 14.3 dBi, Yagi
2000-1715-R	698 MHz to 2500 MHz, N (f), gain of 2 dBi to 10 dBi, typical
2000-1726-R	Antenna, 2500 MHz to 2700 MHz, N (f), 14.1 dBi, Yagi
2000-1747-R	Antenna, Log Periodic, 300 MHz to 7000 MHz, N (f), 5.1 dBi, typical
2000-1748-R	Antenna, Log Periodic, 1 GHz to 18 GHz, N (f), 6 dBi, typical
2000-1777-R	Portable Directional Antenna, 9 kHz to 20 MHz, N (f)
2000-1778-R	Portable Directional Antenna, 20 MHz to 200 MHz, N (f)
2000-1779-R	Portable Directional Antenna, 200 MHz to 500 MHz, N (f)
2000-1812-R	Portable Yagi Antenna, 450 MHz to 512 MHz, N (f), 7.1 dBi
2000-1825-R	Portable Yagi Antenna, 380 MHz to 430 MHz, N (f), 7.1 dBi

[*1]: Option 31 (GPS) is recommended.
[*2]: Requires Option 31 (GPS) for full functionality.
[*3]: Requires Option 431 (Coverage Mapping) for full functionality.

Model/Order No.	Name
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA (m), 50Ω
2000-1473-R	870 MHz to 960 MHz, SMA (m), 50Ω
2000-1035-R	896 MHz to 941 MHz, SMA (m), 50Ω (1/2 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA (m), 50Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA (m), 50Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA (m), 50Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA (m), 50Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA (m), 50Ω
2000-1751-R	698 MHz to 960 MHz, 1710 MHz to 2100 MHz, 2500 MHz to 2700 MHz, SMA (m), 2 dB typical, 50Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)
2000-1487-R	VHF/UHF, Telescopic Whip antenna, straight or 90°, BNC (m), 50Ω
	Bandpass Filters
1030-114-R	806 MHz to 869 MHz, N (m) to SMA (f), 50Ω
1030-109-R	824 MHz to 849 MHz, N (m) to SMA (f), 50Ω
1030-110-R	880 MHz to 915 MHz, N (m) to SMA (f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N (m) to SMA (f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N (m) to SMA (f), 50Ω
1030-105-R	890 MHz to 915 MHz, N (m) to N (f), 50Ω
1030-106-R	1710 MHz to 1790 MHz, N (m) to N (f), 50Ω
1030-107-R	1910 MHz to 1990 MHz, N (m) to N (f), 50Ω
1030-149-R	High Pass, 150 MHz, N (m) to N (f), 50Ω
1030-150-R	High Pass, 400 MHz, N (m) to N (f), 50Ω
1030-151-R	High Pass, 700 MHz, N (m) to N (f), 50Ω
1030-152-R	Low Pass, 200 MHz, N (m) to N (f), 50Ω
1030-153-R	Low Pass, 550 MHz, N (m) to N (f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N (m) to N (f), 50Ω
1030-178-R	1920 MHz to 1980 MHz, N (m) to N (f), 50Ω
1030-179-R	777 MHz to 798 MHz, N (m) to N (f), 50Ω
1030-180-R	2500 MHz to 2570 MHz, N (m) to N (f), 50Ω
2000-1684-R	791 MHz to 821 MHz, N (m) to N (f), 50Ω
2000-1734-R	699 MHz to 715 MHz, N (m) and N (f), 50Ω
2000-1735-R	776 MHz to 788 MHz, N (m) and N (f), 50Ω
2000-1736-R	815 MHz to 850 MHz, N (m) and N (f), 50Ω
2000-1737-R	1711 MHz to 1756 MHz, N (m) and N (f), 50Ω
2000-1738-R	1850 MHz to 1910 MHz, N (m) and N (f), 50Ω
2000-1739-R	880 MHz to 915 MHz, N (m) and N (f), 50Ω
2000-1740-R	1710 MHz to 1785 MHz, N (m) and N (f), 50Ω
2000-1741-R	1920 MHz to 1980 MHz, N (m) and N (f), 50Ω
2000-1742-R	832 MHz to 862 MHz, N (m) and N (f), 50Ω
2000-1743-R	2500 MHz to 2570 MHz, N (m) and N (f), 50Ω
2000-1799-R	2305 MHz to 2320 MHz, N (m) and N (f), 50Ω
2000-1911-R	703 MHz to 748 MHz, N (m) and N (f), 50Ω
2000-1912-R	788 MHz to 798 MHz, N (m) and N (f), 50Ω
2000-1925-R	663 MHz to 698 MHz, N (m) and N (f), 50Ω
2000-1926-R	776 MHz to 806 MHz, N (m) and N (f), 50Ω
	Attenuators N Type (up to 18 GHz)
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N (m) to N (f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N (m) to N (f)
42N50A-30	30 dB, 5 W, DC to 18 GHz, N (m) to N (f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N (m) to N (f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N (m) to N (f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N (m) to N (f), Uni-directional
1010-121-R	40 dB, 100 W, DC to 18 GHz, N (m) to N (f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N (m) to N (f)
	Related Literature, Application Notes
10100-00065	Product Information, Compliance, and Safety
10580-00349	Spectrum Analyzer Measurement Guide
10580-00240	Power Meter Measurement Guide
10580-00289	VNA Measurement Guide
10580-00305	VNA Master User Guide
10580-00306	VNA Master Programming Manual
10580-00307	VNA Master Maintenance Manual
11410-00387	Primer on Vector Network Analysis
11410-00424	USB Power Sensor MA24106A
11410-00472	Measuring Interference
11410-00504	Microwave USB Power Sensor MA241x8A
11410-00531	Practical Tips on Making "Vector Voltmeter (VVM)" Phase Measurements using VNA Master (Option 15)
11410-00545	VNA Master + Spectrum Analyzer Brochure
11410-00549	VNA Master + Spectrum Analyzer Technical Data Sheet
11410-00700	Evaluation of RF Network Testing

Continued on next page

Model/Order No.	Name
	Adapters
1091-26-R	SMA (m) to N (m), DC to 18 GHz, 50Ω
1091-27-R	SMA (f) to N (m), DC to 18 GHz, 50Ω
1091-80-R	SMA (m) to N (f), DC to 18 GHz, 50Ω
1091-81-R	SMA (f) to N (f), DC to 18 GHz, 50Ω
1091-172-R	BNC (f) to N (m), DC to 1.3 GHz, 50Ω
1091-465-R	DC to 6 GHz, 4.3-10(f) to N(f), 50Ω
1091-467-R	DC to 6 GHz, 4.3-10(m) to N(f), 50Ω
510-90-R	7/16 DIN (f) to N (m), DC to 7.5 GHz, 50Ω
510-91-R	7/16 DIN (f) to N (f), DC to 7.5 GHz, 50Ω
510-92-R	7/16 DIN (m) to N (m), DC to 7.5 GHz, 50Ω
510-93-R	7/16 DIN (m) to N (f), DC to 7.5 GHz, 50Ω
510-96-R	7/16 DIN (m) to 7/16 DIN (m), DC to 7.5 GHz, 50Ω
510-97-R	7/16 DIN (f) to 7/16 DIN (f), DC to 7.5 GHz, 50Ω
513-62-R	TNC (f) to N (f), DC to 18 GHz, 50Ω
1091-315-R	TNC (m) to N (f), DC to 18 GHz, 50Ω
1091-324-R	TNC (f) to N (m), DC to 18 GHz, 50Ω
1091-325-R	TNC (m) to N (m), DC to 18 GHz, 50Ω
1091-317-R	TNC (m) to SMA (f), DC to 18 GHz, 50Ω
1091-318-R	TNC (m) to SMA (m), DC to 18 GHz, 50Ω
1091-323-R	TNC (m) to TNC (f), DC to 18 GHz, 50Ω
1091-326-R	TNC (m) to TNC (m), DC to 18 GHz, 50Ω
34RKNF50	Ruggedized K (m) to N (f), DC to 18 GHz, 50Ω
510-102-R	N (m) to N (m), DC to 11 GHz, 50Ω, 90 degrees right angle
	Precision Adapters
34NN50A	N (m) to N (m), DC to 18 GHz, 50Ω
34NFNF50	N (f) to N (f), DC to 18 GHz, 50Ω
34NK50	DC to 18 GHz, N (m) to K (m), 50Ω
34NFKF50	DC to 18 GHz, N (m) to K (f), 50Ω
K220B	DC to 40 GHz, K (m) to K (m), 50Ω
K222B	DC to 40 GHz, K (f) to K (f), 50Ω
K224B	DC to 40 GHz, K (m) to K (f), 50Ω

Model/Order No.	Name
	NEON® MA8100A Signal Mapper
MA8100A-001	NEON Signal Mapper with Anritsu Integration and Tracking Unit. Includes 1 year NEON Software License with 1 year of maintenance and support and 1 year of Cloud Service.
MA8100A-003	NEON Signal Mapper with Anritsu Integration and Tracking Unit. Includes 3 year NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service.
MA8100A-005	NEON Signal Mapper with Anritsu Integration and Tracking Unit. Includes 5 year NEON Software License with 5 years of maintenance and support and 5 years of Cloud Service.
MA8100A-100	NEON Signal Mapper with Anritsu Integration and Tracking Unit. Includes Perpetual NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service.
2300-606	Perpetual NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service. Part number can also be used to order a perpetual license after a limited term license has expired.
2300-612	Renewal of 1 year NEON Software License with 1 year of maintenance and support and 1 year of Cloud Service.
2300-613	Renewal of 3 year NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service.
2300-614	Renewal of 5 year NEON Software License with 5 years of maintenance and support and 5 years of Cloud Service.

Waveguide Calibration Components and WG/Coaxial Adapters, Rectangular Type 50Ω

Recommended waveguide calibration procedure requires two offset shorts and a precise load. The waveguide/coax adapter, shown attached to test port #1, adapts the VNA Master test ports to the waveguide under test.

Frequency Range (GHz)	1/8 Offset	3/8 Offset	Termination	Coax to Waveguide Adapter	Compatible Flanges
3.95 to 5.85	23UA187-R	24UA187-R	26UA187-R	35UA187N-R	CPR187F-R, CPR187G-R, UG-1352/U-R, UG-1353/U-R, UG-1728/U-R, UG-1729/U-R, UG-148/U-R, UG-149A/U-R
5.85 to 8.20	23UA137-R	24UA137-R	26UA137-R	35UA137N-R	CPR137F-R, CPR137G-R, UG-1356/U-R, UG-1357/U-R, UG-1732/U-R, UG-1733/U-R, UG-343B/U-R, UG-344/U-R, UG-440B/U-R, UG-441/U-R
7.05 to 10.00	23UA112-R	24UA112-R	26UA112-R	35UA112N-R	CPR112F-R, CPR112G-R, UG-1358/U-R, UG-1359/U-R, UG-1734/U-R, UG-1735/U-R, UG-52B/U-R, UG-51/U-R, UG-137B/U-R, UG-138/U-R
8.20 to 12.40	23UA90-R	24UA90-R	26UA90-R	35UA90N-R	CPR90F-R, CPR90G-R, UG-1360/U-R, UG-1361/U-R, UG-1736/U-R, UG-1737/U-R, UG-40B/U-R, UG-39/U-R, UG-135/U-R, UG-136B/U-R
12.40 to 18.00	23UA62-R	24UA62-R	26UA62-R	35UA62N-R	UG-541A/U-R, UG-419/U-R, UG-1665/U-R, UG1666/U-R
17.00 to 26.50	23UA42-R	24UA42-R	26UA42-R	35UA42K-R	UG-596A/U-R, UG-595/U-R, UG-597/U-R, UG-598A/U-R
26.50 to 40.00	23UA28-R	24UA28-R	26UA28-R	35UA28K-R	UG-599/U-R
3.30 to 4.90	23UM40-R	24UM40-R	26UM40-R	35UM40N-R	PDR40-R
3.95 to 5.85	23UM48-R	24UM48-R	26UM48-R	35UM48N-R	CAR48-R, PAR48-R, UAR48-R, PDR48-R
5.85 to 8.20	23UM70-R	24UM70-R	26UM70-R	35UM70N-R	CAR70-R, PAR70-R, UAR 70-R, PDR70-R
7.05 to 10.00	23UM84-R	24UM84-R	26UM84-R	35UM84N-R	CBR84-R, UBR84-R, PBR84-R, PDR84-R
8.20 to 12.40	23UM100-R	24UM100-R	26UM100-R	35UM100N-R	CBR100-R, UBR100-R, PBR100-R, PDR100-R
10.00 to 15.00	23UM120-R	24UM120-R	26UM120-R	35UM120N-R	CBR120-R, UBR120-R, PBR120-R, PDR120-R
12.40 to 18.00	23UM140-R	24UM140-R	26UM140-R	35UM140N-R	CBR140-R, UBR140-R, PBR140-R, PDR140-R
17.00 to 26.50	23UM220-R	24UM220-R	26UM220-R	35UM220K-R	CBR220-R, UBR220-R, PBR220-R, PDR220-R

*: For Coaxial/Waveguide Adapter part numbers, N designates Type N and K designates K-Connector

VNA Master™ Handheld Vector Network Analyzer + Spectrum Analyzer

MS202xB VNAs/MS203xB VNAs + Spectrum Analyzers

VNA: 500 kHz to 6 GHz/Spectrum Analyzer: 9 kHz to 6 GHz

Affordable Handheld Vector Network + Spectrum Analyzer for Cable, Antenna, and Signal Analysis Anytime, Anywhere

Anritsu proudly offers the VNA Master + Spectrum Analyzer MS202xB/MS203xB, the industry's most affordable and compact handheld solution to address cable, antenna, component, and signal analysis needs in the field. All VNA Master MS202xB/3xB models offer benchtop accuracy and high performance S-parameter measurements in portable form. With frequency coverage from 500 kHz up to 4 GHz or 6 GHz in a truly handheld, battery-operated, rugged, multi-function instrument, the VNA Master also provides a field-friendly touchscreen user interface. VNA Master MS2034B/35B models include a powerful spectrum analyzer which multiplies user convenience by combining both a VNA and a separate spectrum analyzer into a single measurement powerhouse for the harsh RF and physical environments of field test. Whether it is for spectrum monitoring, broadcast proofing, interference analysis, RF and microwave measurements, regulatory compliance, 3G/4G, Land Mobile Radio, or wireless data network measurements, this VNA/Spectrum Analyzer combination is the ideal instrument for making fast and reliable measurements in the field.

Vector Network Analyzer Performance and Functional Highlights (All Models)

- Broadband coverage of 500 kHz to 4 GHz/6 GHz
- 1-path, 2-port Vector Network Analyzer
- Intuitive Graphical User Interface (GUI) with convenient Touch Screen
- VNA-quality error correction for directivity and source match
- 2-port Transmission Measurements: High/Default/Low Power
- Outstanding calibration stability, minimal drift error
- Calibration Interpolation feature adds flexibility
- User-defined overlays for viewing multiple S-Parameters
- Arbitrary data points up to 4001
- IF Bandwidth selections of 10 Hz to 100 kHz
- 100 dB Transmission Dynamic Range
- 850 µs/data point sweep speed
- Greater than 3 hour battery life
- USB and (Optional) Ethernet for data transfer and instrument control
- User-selectable menu options: Choose either VNA or Field Mode for simplified Cable & Antenna analysis
- Field upgradable firmware
- Internal Flash Memory: 2 GB — Store more than 4000 traces and setups in memory
- Portable: 3.5 kg (7.6 lb)
- Full Speed USB Memory support
- Automate repetitive tasks via optional Ethernet and USB
- High resolution daylight-viewable TFT color display
- "Glove Friendly" Resistive Touchscreen Display
- Distance Domain (Standard with firmware V1.20 and above)
- Internal Bias Tee Option
- Vector Voltmeter Option, ideal for cable phase matching
- High Accuracy Power Meter Option
- GPS Receiver Option
- Polar Format Impedance Display
- Complies with MIL-PRF-28800F Class 2.
- Certified for use in Explosive Atmosphere per MIL-PRF-28800F and MIL-STD-810G

Spectrum Analyzer Performance and Functional (MS203xB Models Only)

- Measure: Occupied Bandwidth, Channel Power, ACPR, C/I
- Interference Analyzer: Spectrogram, Signal Strength, RSSI, Signal ID
- Dynamic Range: >95 dB in 10 Hz RBW
- DANL: –162 dBm in 1 Hz RBW (normalized)
- Phase Noise: –100 dBc/Hz max @ 10 kHz offset at 1 GHz
- Frequency Accuracy: < ±50 ppb 3 minutes after GPS lock
- Traces: Normal, Max Hold, Min Hold, Average, # of Averages
- Detectors: Peak, Negative, Sample, Quasi-peak, and RMS
- Markers: 6, each with a Delta Marker, or
  1 Reference Marker with 6 Delta Markers
- Trace Save-on-Event: crossing limit line or sweep complete
- PIM Hunting
- Limit Lines: up to 41 segments with one-button envelope creation
- AM/FM/SSB Audio-only Demodulation
- Optional AM/FM/PM Demodulation Analyzer
- Store thousands of traces internally
- Channel Scanner Option
- GPS tagging of stored traces
- Internal Preamplifier standard
- High Accuracy Power Meter Option
- Coverage Mapping Option

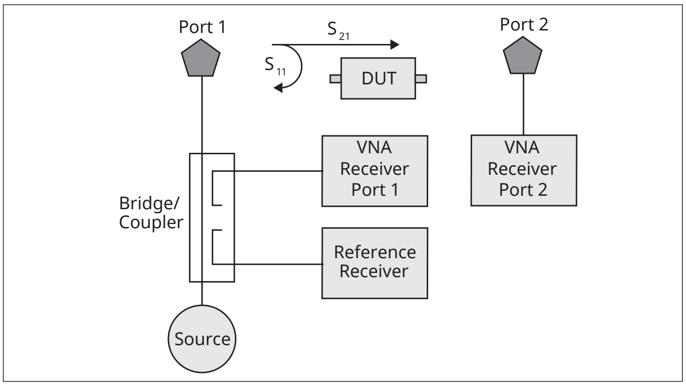
Definitions

All specifications and characteristics apply under the following conditions, unless otherwise noted:

Specifications	All specifications and characteristics apply under the following conditions, unless otherwise stated:
Temperature Range	Over the 23°C±5°C temperature range.
Warm-Up Time	After 10 minutes of warm-up time in VNA mode, where the instrument is left in the ON state.
Reference Signal	When using internal reference signal.
Typical Performance	Typical specifications that are not in parenthesis are not tested and not warranted. They are generally representative of characteristic performance. Typical specifications in parenthesis () represent the mean value of measured units and do not include any guard-bands or uncertainties. They are not warranted.
Uncertainty	A coverage factor of x1 is applied to the measurement uncertainties to facilitate comparison with other industry handheld analyzers.
Time Base Error	Input Frequency × Frequency Reference Error
Calibration Cycle	Calibration is within the recommended 12 month period (residual specifications also require calibration kit calibration cycle adherence.) All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu web site: www.anritsu.com

Block Diagram

As shown in the following block diagram, the VNA Master has a 2-port, 1-path architecture that automatically measures 2 S-parameters with error-correction precision inherent to VNA operation. The above illustration is a simplified block diagram of the VNA Master 2-port, 1-path architecture. The magnitude AND phase information gained from Vector Network data enables the VNA Master to provide improved field measurements with greater accuracy.



Frequency Range	MS2024/34B: 500 kHz to 4 GHz MS2025/35B: 500 kHz to 6 GHz Frequency Accuracy: 2.5 ppm Frequency Resolution: 1 Hz
Test Port Power (typ.)	VNA Master supports selection of High, Default, or Low test port power. Changing power after calibration can degrade the calibrated performance. Typical power by bands:
Transmission Dynamic Range	The transmission dynamic range (the difference between test port power and noise floor) using 10 Hz IF Bandwidth and High Port Power: 2 MHz to ≤4 GHz: 100 dB 4 GHz to ≤6 GHz: 90 dB
Sweep Speed (typ.)	Sweep speed in µs/point for IF Bandwidth of 100 kHz, 1001 data points, and single display. The two-receiver architecture will simultaneously collect S_{21} and S_{11} in a single sweep. 500 kHz to 6 GHz : 850 µs/point
Noise Floor	
Temperature Stability	(S_{11} or S_{21}, Short, 23°C±5°C)
Interference Immunity	On-Channel: +17 dBm at >1.0 MHz from carrier frequency On-Frequency: 0 dBm within ±10 kHz of the carrier frequency

Test Port Power (typ.):

Frequency Range	High Port Power (dBm)	Default Port Power (dBm)	Low Port Power (dBm)
500 kHz to <3 GHz	+3	–5	–25
3 GHz to 6 GHz	0	–5	–25

Noise Floor:

Frequency Range	Noise Floor (typ.)
500 kHz to 3 GHz	–100 dBm
3 GHz to 4 GHz	–103 dBm
4 GHz to 6 GHz	–93 dBm

Temperature Stability:

Frequency Range	Magnitude (typ.)	Phase (typ.)
500 kHz to 6 GHz	0.020 dB/°C	0.200 deg/°C

VNA Functional Specifications

Measurements	Measurement Parameters	S_{11}, S_{21}
	Number of Traces	Four: TR1, TR2, TR3, TR4
	Trace Format	Single, Dual, Tri, Quad. When used with Number of Traces, overlays are possible including a Single Format with Four trace overlays.
	Graph Types	Log Magnitude, SWR, Phase, Real, Imaginary, Group Delay, Smith Chart, Log Mag/2 (1-Port Cable Loss), Linear Polar, Log Polar, Real Impedance, Imaginary Impedance
	Domains	Frequency Domain, Distance Domain
	Frequency	Start Frequency, Stop Frequency, Center Frequency, Span
	Distance	Start Distance, Stop Distance
	Frequency Sweep Type: Linear	Single Sweep, Continuous
	Data Points	2 to 4001 (arbitrary setting); data points can be reduced without recalibration.
	Limit Lines	Upper, Lower, 10 segmented Upper, 10 segmented Lower
	Test Limits	Pass/Fail for Upper, Pass/Fail for Lower, Limit Audible Alarm
	Data Averaging	Sweep-by-sweep
	Smoothing	0 to 20%
	IF Bandwidth	10, 20, 50, 100, 200, 500, 1 k, 2 k, 5 k, 10 k, 20 k, 50 k, 100 k (Hz)
	Reference Plane	The reference planes of a calibration (or other normalization) can be changed by entering a line length. Assumes no loss, flat magnitude, linear phase, and constant impedance.
	Auto Reference Plane Extension	Instead of manually entering a line length, this feature automatically adjusts phase shift from the current calibration (or other normalization) to compensate for external cables (or test fixtures). Assumes no loss, flat magnitude, linear phase, and constant impedance.
	Frequency Range	Frequency range of the measurement can be narrowed (reduces number of data points) within the calibration range without recalibration. When Interpolation is On, narrowed frequency range will retain original number of data points.
	Group Delay Aperture	Defined as the frequency span over which the phase change is computed at a given frequency point. The aperture can be changed without recalibration. The minimum aperture is the frequency range divided by the number of points in calibration and can be increased to 20% of the frequency range.
	Group Delay Range	<180° of phase change within the aperture
	Trace Memory	A separate memory for each trace can be used to store measurement data for later display. The trace data can be saved and recalled.
	Trace Math	Complex trace math operations of subtraction, addition, multiplication, or division are provided.
	Number of Markers	12, arbitrary assignments to any trace
	Marker Types	Reference, Delta
	Marker Readout Styles	Log Mag, Cable Loss (Log Mag/2), Log Mag and Phase, Phase, Real and Imaginary, SWR, Impedance, Admittance, Normalized Impedance, Normalized Admittance, Polar Impedance, and Group Delay
	Marker Search	Peak Search, Valley Search, Find Marker Value
	Calibration Type	Full S_{11}, 1-Path, 2-Port (S_{11} and S_{21}), Response S_{11}, Response S_{21}
	Calibration Methods	Short-Open-Load-Through (SOLT)
	Calibration Standards' Coefficients	Coax: N-Connector, K-Connector, 7/16, TNC, SMA, and four User Defined
	Cal Correction Toggle	On/Off
	Interpolation	On/Off (Interpolation may be activated before or after calibration)
	Impedance Conversion (Smith Chart)	Support for 50Ω and 75Ω are provided.
	Units	Meters, Feet
	Bias Tee Settings	Internal, Off
	Timebase Reference	Internal
	File Storage Types	Measurement, Setup (with CAL), Setup (without CAL), S2P (Real/Imag), S2P (Lin Mag/Phase), S2P (Log Mag/Phase), JPEG
	Ethernet Configuration	DHCP or Manual (Static); IP, Gateway, Subnet entries
	Languages	English, French, German, Spanish, Chinese, Japanese, Korean, Italian, Russian plus one User Defined

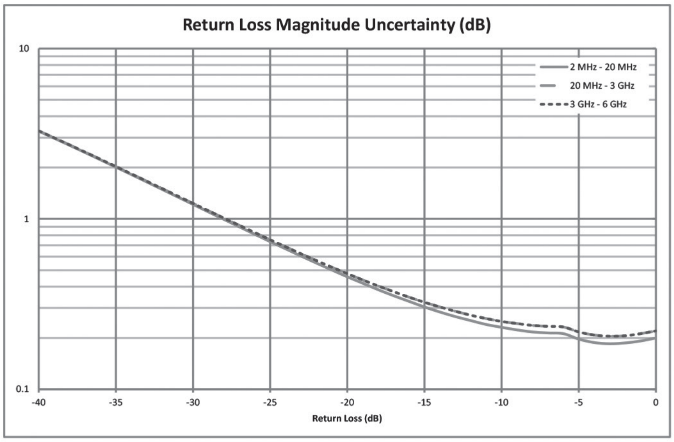
Corrected System Performance and Uncertainties — High Port Power, N-Type

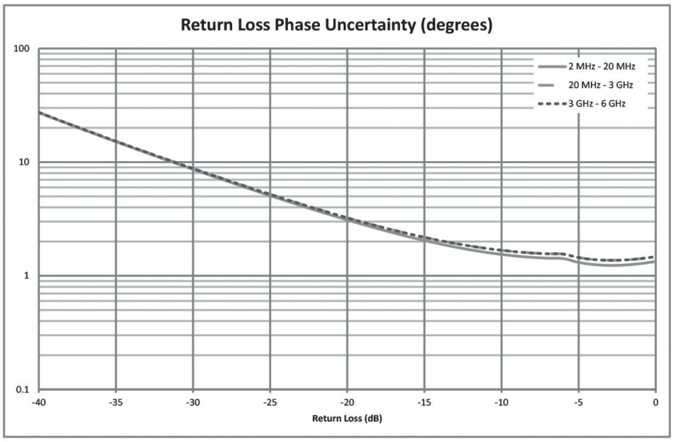
Measurement Accuracy OSLN50A-8 or OSLNF50A-8, TOSLN50A-8 or TOSLNF50A-8.

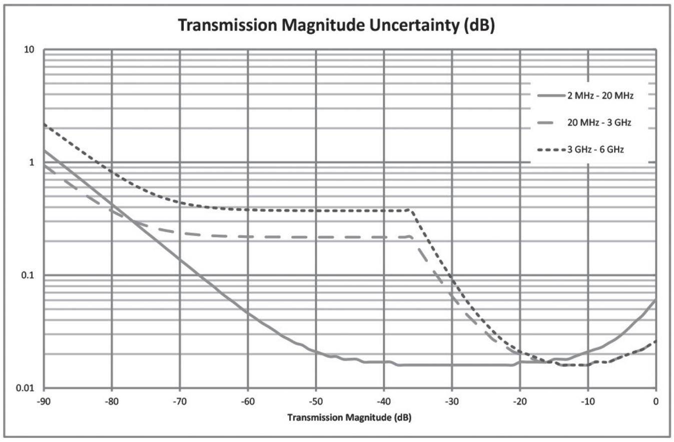
Full 1-path, 2-port forward path calibration with isolation, high power, 10 Hz IFBW, no averaging, 10 minute warm-up. OSLN50A-8, OSLNF50A-8, TOSLN50A-8, or TOSLNF50A-8 calibration kit. Reflection and Transmission Tracking are typical.

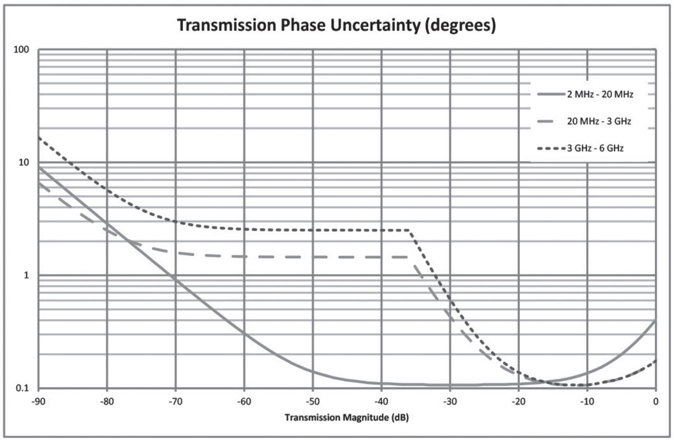
Frequency Range	Directivity (dB)	Source Match (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
<20 MHz	≥42	≥30	±0.01	±0.01
20 MHz to <3 GHz	≥42	≥30	±0.05	±0.01
3 GHz to 6 GHz	≥42	≥30	±0.05	±0.01

Corrected Measurement Uncertainty (Transmission from Port 1 to Port 2)


Return Loss Magnitude Uncertainty (dB)


Return Loss Phase Uncertainty (degrees)


Transmission Magnitude Uncertainty (dB)


Transmission Phase Uncertainty (degrees)

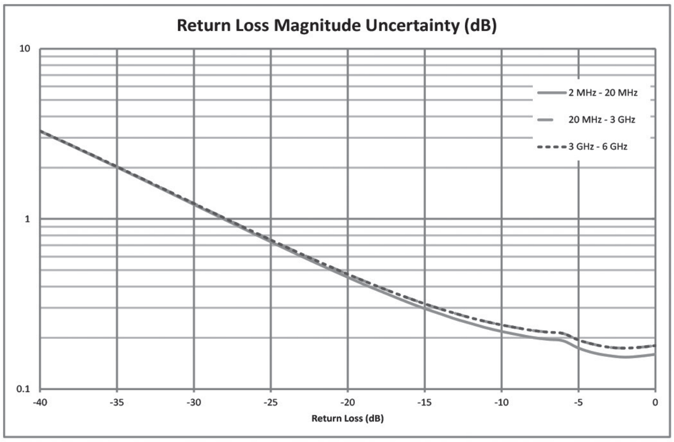
Corrected System Performance and Uncertainties — High Port Power, K-Type

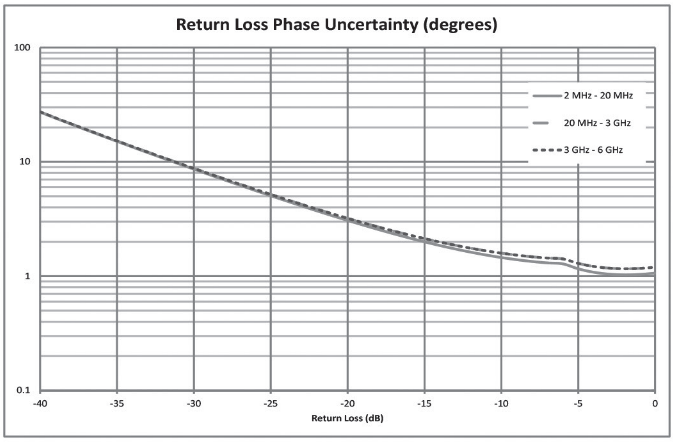
Measurement Accuracy TOSLK50A-20 or TOSLKF50A-20. Compatible with 3.5 mm and SMA connectors.

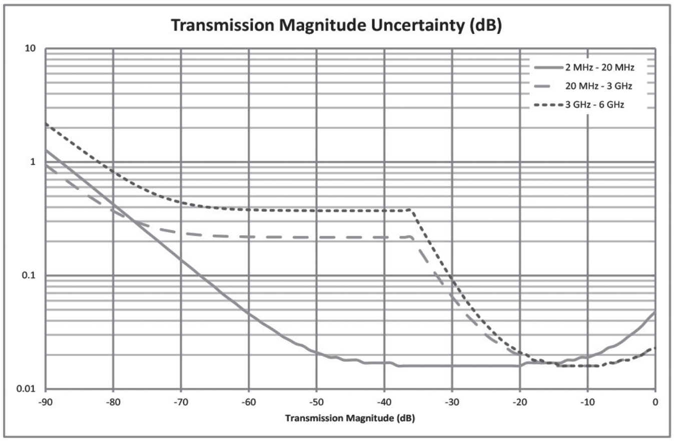
Full 1-path, 2-port forward path calibration with isolation, high power, 10 Hz IFBW, no averaging, 10 minute warm-up.
TOSLK50A-20, TOSLKF50A-20 calibration kit. Reflection and Transmission Tracking are typical.

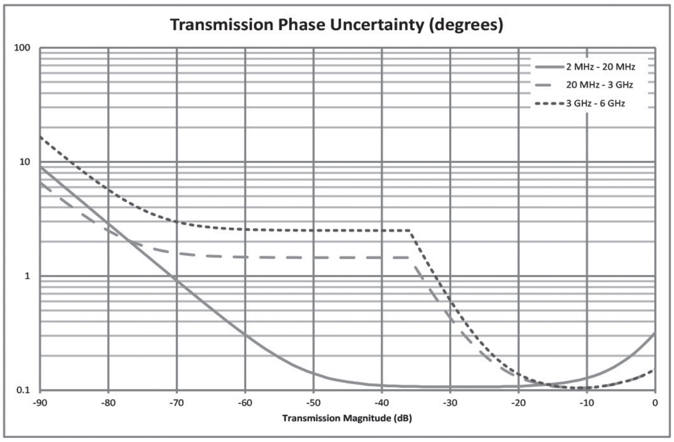
Frequency Range	Directivity (dB)	Source Match (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
<20 MHz	≥42	≥33	±0.01	±0.01
20 MHz to <3 GHz	≥42	≥33	±0.05	±0.01
3 GHz to 6 GHz	≥42	≥33	±0.05	±0.01

Corrected Measurement Uncertainty (Transmission from Port 1 to Port 2)


Return Loss Magnitude Uncertainty (dB)


Return Loss Phase Uncertainty (degrees)


Transmission Magnitude Uncertainty (dB)


Transmission Phase Uncertainty (degrees)

Spectrum Analyzer Performance Specifications (Models MS203xB only)

<table>
<tr><td rowspan="6">Frequency</td><td>Frequency Range</td><td>MS2034B: 9 kHz to 4 GHz, (tunable to 0 Hz)
MS2035B: 9 kHz to 6 GHz, (tunable to 0 Hz)</td></tr>
<tr><td>Frequency Span</td><td>MS2034B: 10 Hz to 4 GHz including zero span
MS2035B: 10 Hz to 6 GHz including zero span</td></tr>
<tr><td>Tuning Resolution</td><td>1 Hz</td></tr>
<tr><td>Frequency Reference</td><td>Aging: ±1.0 ppm/year
Accuracy: ±1.5 ppm (25°C±25°C) + aging, <±50 ppb with GPS On</td></tr>
<tr><td>Sweep Time</td><td>Minimum 100 ms, 7 µs to 600 seconds in zero span</td></tr>
<tr><td>Sweep Time Accuracy</td><td>±2% in zero span</td></tr>
<tr><td rowspan="4">Bandwidth</td><td>Resolution Bandwidth (RBW)</td><td>10 Hz to 3 MHz in 1–3 sequence ±10% (1 MHz max in zero-span) (–3 dB bandwidth)</td></tr>
<tr><td>Video Bandwidth (VBW)</td><td>1 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth) (auto or manually selectable)</td></tr>
<tr><td>RBW with Quasi-Peak Detection</td><td>200 Hz, 9 kHz, 120 kHz (–6 dB bandwidth)</td></tr>
<tr><td>VBW with Quasi-Peak Detection</td><td>Auto VBW is On, RBW/VBW = 1</td></tr>
<tr><td>Spectral Purity</td><td>SSB Phase Noise @ 1 GHz</td><td>–100 dBc/Hz, –110 dBc/Hz (typ.) @ 10 kHz offset
–105 dBc/Hz, –112 dBc/Hz (typ.) @ 100 kHz offset
–115 dBc/Hz, –121 dBc/Hz (typ.) @ 1 MHz offset</td></tr>
<tr><td rowspan="8">Amplitude</td><td>Dynamic Range</td><td>>102 dB (2.4 GHz), 2/3 (TOI-DANL) in 1 Hz RBW</td></tr>
<tr><td>Measurement Range</td><td>DANL to +26 dBm (≥ 50 MHz)
DANL to 0 dBm (<50 MHz)</td></tr>
<tr><td>Maximum Continuous Input</td><td>+30 dBm Peak</td></tr>
<tr><td>Display Range</td><td>1 to 15 dB/div in 1 dB steps, ten divisions displayed</td></tr>
<tr><td>Reference Level Range</td><td>–150 to +30 dBm</td></tr>
<tr><td>Attenuator Resolution</td><td>0 to 55 dB, 5.0 dB steps</td></tr>
<tr><td>Amplitude Units</td><td>Log Scale Modes: dBW, dBm, dBµW, dBV, dBmV, dBµV, dBA, dBmA, dBµA</td></tr>
<tr><td>Linear Scale Modes</td><td>nV, mV, mV, V, kV, nW, mW, mW, W, kW, nA, mA, mA, A</td></tr>
<tr><td colspan="2">Displayed Average Noise Level (DANL)</td><td>(RBW Normalized to 1 Hz, 0 dB attenuation)
<table>
<tr><td rowspan="2"></td><td colspan="2">Preamp Off
(Reference level –20 dBm)</td><td colspan="2">Preamp On
(Reference level –50 dBm)</td></tr>
<tr><td>Maximum</td><td>Typical</td><td>Maximum</td><td>Typical</td></tr>
<tr><td>10 MHz to 2.4 GHz</td><td>–141 dBm</td><td>–146 dBm</td><td>–157 dBm</td><td>–162 dBm</td></tr>
<tr><td>>2.4 GHz to 4 GHz</td><td>–137 dBm</td><td>–141 dBm</td><td>–154 dBm</td><td>–159 dBm</td></tr>
<tr><td>>4 GHz to 5 GHz</td><td>–134 dBm</td><td>–138 dBm</td><td>–150 dBm</td><td>–155 dBm</td></tr>
<tr><td>>5 GHz to 6 GHz</td><td>–126 dBm</td><td>–131 dBm</td><td>–143 dBm</td><td>–150 dBm</td></tr>
</table></td></tr>
<tr><td rowspan="3">Spurs</td><td>Residual Spurious</td><td><–90 dBm (RF input terminated, 0 dB input attenuation, >10 MHz)</td></tr>
<tr><td>Input-Related Spurious</td><td><–75 dBc (0 dB attenuation, –30 dBm input, span <1.7 GHz, carrier offset >4.5 MHz)</td></tr>
<tr><td>Exceptions (typ.)</td><td><–70 dBc @ <2.5 GHz with 2072.5 MHz Input
<–68 dBc @ F1 – 280 MHz with F1 Input
<–70 dBc @ F1 + 190.5 MHz with F1 Input
<–52 dBc @ 7349 – 2F2 MHz, with F2 Input, where F2 <2437.5 MHz
<–55 dBc @ 190.5 ± (F1/2) MHz, F1 <1 GHz</td></tr>
<tr><td rowspan="5">Second Harmonic Distortion</td><td colspan="2">Preamp Off, 0 dB input attenuation, –30 dBm input</td></tr>
<tr><td>50 MHz</td><td>–56 dBc</td></tr>
<tr><td>>50 MHz to 200 MHz</td><td>–60 dBc (typ.)</td></tr>
<tr><td>>200 MHz to 3000 MHz</td><td>–70 dBc (typ.)</td></tr>
<tr><td>VSWR</td><td>2:1 (typ.)</td></tr>
<tr><td rowspan="6">Third-Order Intercept (TOI)</td><td colspan="2">Preamp Off, –20 dBm tones 100 kHz apart, 10 dB attenuation</td></tr>
<tr><td>800 MHz</td><td>+16 dBm</td></tr>
<tr><td>2400 MHz</td><td>+20 dBm</td></tr>
<tr><td>200 MHz to 2200 MHz</td><td>+25 dBm (typ.)</td></tr>
<tr><td>>2.2 GHz to 5.0 GHz</td><td>+28 dBm (typ.)</td></tr>
<tr><td>>5.0 GHz to 6.0 GHz</td><td>+33 dBm (typ.)</td></tr>
</table>

Spectrum Analyzer Functional Specifications (Models MS203xB only)

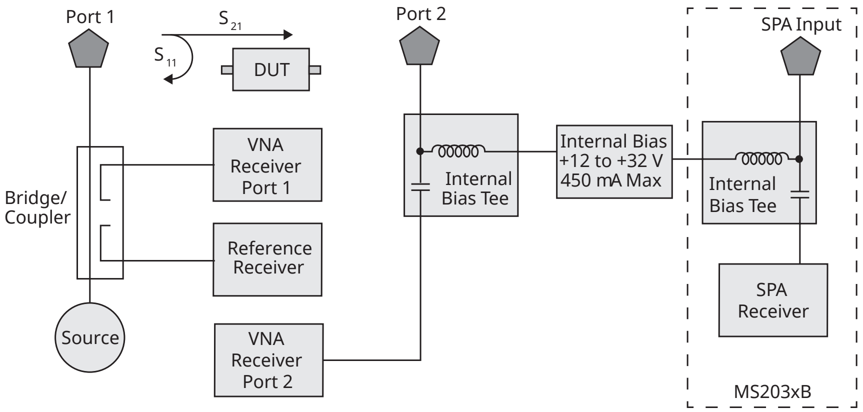
Measurements	Smart Measurements	Field Strength (uses antenna calibration tables to measure dBm/m², dBmV/m, dBV/m, dBµV/m, Volt/m, Watt/m², dBW/m², A/m, dBA/m and Watt/cm²) Occupied Bandwidth (measures 99 to 1% power channel of a signal) Channel Power (measures the total power in a specified bandwidth) ACPR (Adjacent Channel Power Ratio) AM/FM/SSB Demodulation (Wide/Narrow FM, AM, Upper/Lower SSB), (audio out only) C/I (carrier-to-interference ratio) Emission Mask Coverage Mapping (requires Option 431 and Option 31) PIM Alert Application (available for download) PIM Hunting
Setup Parameters	Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #, Channel Increment
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
	Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/RBW
	File	Save, Recall, Delete, Directory Management
	Save/Recall	Setups, Measurements, Limit Lines, Screen Shots JPEG (save only), Save-on-Event
	Save-on-Event	Crossing Limit Line, Sweep Complete, Save-then-Stop, Clear All
	Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)
Sweep Functions	Sweep	Single/Continuous, Sweep Mode (Fast, Performance, No FFT), Reset, Detection, Minimum Sweep Time, Trigger Type, Gated Sweep (see Option 90)
	Detection	Peak, RMS, Negative, Sample, Quasi-peak
	Triggers	Free Run, External, Video, Change Position, Manual
Trace Functions	Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations
	Trace A	Operations Normal, Max Hold, Min Hold, Average, # of Averages, (always the live trace)
	Trace B	Operations A → B, B ↔ C, Max Hold, Min Hold
	Trace C	Operations A → C, B ↔ C, Max Hold, Min Hold, A – B → C, B – A → C, Relative Reference (dB), Scale
Marker Functions	Markers	Markers 1–6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off), All Markers Off
	Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker
	Marker Auto-Position	Peak Search, Next Peak (Right/Left), Peak Threshold%, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level
	Marker Table	1–6 markers frequency and amplitude plus delta markers frequency offset and amplitude
Limit Line Functions	Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, Default Limit
	Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
	Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
	Limit Line Envelope	Create Envelope, Update Amplitude, Number of Points (41 max), Offset, Shape Square/Slope
	Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall

Bias Tee (Option 10)

Bias Tee Measurements
For tower mounted amplifier tests, the MS202xB/MS203xB series with optional internal bias tees can supply both DC and RF signals on the center conductor of the cable during measurements. For frequency sweeps in excess of 2 MHz, the VNA Master can supply internal voltage control from +12 V to +32 V in 0.1 V steps up to 450 mA. Bias can be directed to VNA Port 2 or to the Spectrum Analyzer Input Port (MS203xB).

Frequency Range	MS20x4B: 2 MHz to 4 GHz MS20x5B: 2 MHz to 6 GHz
Internal Voltage/Current	+12 V to +32 V at 450 mA (1 A surge for 100 ms)
Internal Resolution	0.1 V
Bias Tee Selections	Internal, Off

The Compact VNA Master offers optional integrated bias tee for supplying DC plus RF to the DUT as shown in this simplified block diagram.



Vector Voltmeter (Option 15)

A phased array system relies on phase matched cables for nominal performance. For this class of application, the VNA Master offers this special software mode to simplify phase matching cables at a single frequency. The similarity between the popular vector voltmeter and this software mode ensures minimal training is required to phase match cables. Operation is as simple as configuring the display for absolute or relative measurements. The easy-to-read large fonts show either reflection or transmission measurements using impedance, magnitude, or VSWR readouts. For instrument landing system (ILS) or VHF Omnidirectional Range (VOR) applications, a table view improves operator efficiency when phase matching up to twelve cables. The MS202xB/MS203xB solution is superior because the signal source is included internally, precluding the need for an external signal generator.

VVM Specifications	CW Frequency Range	500 kHz to 4 GHz/6 GHz
	Source Power	High, Default, Low
	IFBW	10 Hz to 100 kHz in 1-2-5 sequence
	Measurement Display	CW, Table (twelve entries, plus reference)
	Measurement Types	Return Loss, Insertion
	Measurement Format	dB/VSWR/Impedance

High Accuracy Power Meter (Option 19) (Requires external USB power sensor)

Conduct precise measurements of CW and digitally modulated transmitters in the field using this VNA Master software mode with a separately purchased Anritsu USB power sensor. After specifying the center frequency and zeroing the sensor to ensure accuracy at low power levels, the software offers intuitive operation for absolute and relative readouts in dBm or Watts.

Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale
Average	# of Running Averages, Max Hold
Zero/Cal	Zero On/Off, Cal Factor (Center Frequency, Signal Standard)
Limits	Limit On/Off, Limit Upper/Lower

Power Sensor Model	MA24105A	MA24106A	MA24108A/18A/26A	MA24208A/18A	MA24330A/40A/50A
Description	Inline High Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor	Microwave Universal USB Power Sensor	Microwave CW USB Power Sensor
Frequency Range	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8/18/26 GHz	10 MHz to 8 GHz/18 GHz	10 MHz to 33/40/50 GHz
Connector	Type N (f), 50Ω	Type N (m), 50Ω	Type N (m), 50Ω (8 GHz/18 GHz) Type K (m), 50Ω (26 GHz)	Type N (m), 50Ω	Type K (m), 50Ω (33 GHz/40 GHz) Type V (m), 50Ω (50 GHz)
Dynamic Range	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 µW to 200 mW)	–40 to +20 dBm (0.1 µW to 100 mW)	–60 to +20 dBm (1 nW to 100 mW)	–70 to +20 dBm (0.1 nW to 100 mW)
Measurand	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power	True-RMS, Slot Power, Burst Average Power	Average Power
Measurement Uncertainty	± 0.17 dB*1	± 0.16 dB*2	± 0.18 dB*3	± 0.17 dB*4	± 0.17 dB*5
Data sheet (for complete specifications)	11410-00621	11410-00424	11410-00504	11410-00841	11410-00906

*1: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.
*2: Total RSS measurement uncertainty (0°C to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
*3: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
*4: Power uncertainty expressed with two sigma confidence level for CW measurement after zero operation. Includes calibration factor and linearity over temperature uncertainties, but not the effects of mismatch, zero set and drift, or noise.
*5: Includes linearity over temperature uncertainties, but not the effects of calibration factor, mismatch, zero set and drift, and noise.

Interference Analyzer (Option 25) (Models MS203xB only, GPS Option 31 recommended)

Measurements	Spectrum	Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB – audio out only) Carrier-to-Interference ratio (C/I)
	Spectrogram	Collect data up to 72 Hours
	Signal Strength	Gives visual and aural indication of signal strength
	Received Signal Strength Indicator (RSSI)	Collect data up to 168 Hours
	Signal ID	Up to 12 signals Center Frequency Bandwidth Signal Type: FM, GSM, W-CDMA, CDMA, Wi-Fi Closest Channel Number Number of Carriers
	Signal-to-Nose Ratio (SNR)	>10 dB
	Interference Mapping	Triangulate location of interference with on-display maps
	Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

Channel Scanner (Option 27) (Models MS203xB only, GPS Option 31 recommended)

General	Number of Channels	1 to 20 Channels
	Measurements	Graph/Table, Max Hold (On/5 s/Off), Freq/Channel, Current/Max, Single/Dual Color
	Scanner	Scan Channels, Scan Frequencies, Scan Customer List, Scan Script Master™
	Amplitude	Reference Level, Scale
	Custom Scan	Scan Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
	Frequency Range	9 kHz to 4 GHz (MS2034B), 9 kHz to 6 GHz (MS2035B)
	Frequency Accuracy	±10 Hz + Time base error
	Measurement Range	–110 to +26 dBm
	Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

GPS (Option 31) (requires external GPS antenna, sold separately)

Built-in GPS provides location information (latitude, longitude, altitude) and Universal Time (UT) information for storage along with trace data so that you can later verify that measurements were taken at the right location. The GPS option requires a separately ordered Anritsu GPS antenna. Frequency accuracy is enhanced for the Spectrum Analyzer (on MS203xB models) when GPS is active and has achieved satellite lock.

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
GPS Time/Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
High Frequency Accuracy	Spectrum Analyzer, Interference Analyzer, CW Signal Analyzers <±50 ppb with GPS On, GPS antenna connected, 3 minutes after satellite lock in selected mode
Connector	SMA, Female

Ethernet Connectivity (Formerly Option 411)

Connector	RJ45
LAN Speed	10 Mbps
Mode	Static, DHCP
Static IP settings	IP address Subnet Mask IP Gateway
Remote Control	Fully remote programmable via SCPI commands and/or remote access utility provided with Master Software Tools
Data Upload	With Line Sweep Tools or Master Software Tools through a LAN connection

Distance Domain (Formerly Option 501, now standard with firmware v1.20 or greater)

Distance-to-Fault Analysis (standard with firmware v1.20 and above) is a powerful field test tool to analyze cables for faults, including minor discontinuities that may occur due to a loose connection, corrosion, or other aging effects. By using Frequency Domain Reflectometry (FDR), the Compact VNA Master exploits a user-specified band of full power operational frequencies (instead of DC pulses from TDR approaches) to more precisely identify discontinuities. The Compact VNA Master converts S-parameters from frequency domain into distance domain on the horizontal display axis, using a mathematical computation called Inverse Fourier Transform. Connect a reflection at the opposite end of the cable, and the discontinuities appear versus distance to reveal any potential maintenance issues. When access to both ends of the cable is convenient, a similar distance domain analysis is available on transmission measurements.

Distance Domain, will improve your productivity with displays of the cable in terms of discontinuities versus distance. This readout can then be compared against previous measurements (from stored data) to determine whether any degradations have occurred since installation (or the last maintenance activity). More importantly, you will know precisely where to go to fix the problem and so minimize or prevent downtime of the system.

Coverage Mapping (Option 431) (Models MS203xB only. Requires GPS)

Measurements	Indoor Mapping	RSSI and ACPR
	Outdoor Mapping	RSSI and ACPR
Setup Parameters	Frequency	Center/Start/Stop, Span, Freq Step, Signal Standard, Channel #, Channel Increment
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
	BW	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/VBW
	Measurement Setup	ACPR, RSSI
	Point Distance/Time Setup	Repeat Type Time Distance
	Save Points Map	Save KML, JPEG, Tab Delimited
	Recall Points Map	Recall Map, Recall KML Points only, Recall KML Points with Map, Recall Default Grid

AM/FM/PM Demodulation Analyzer (Option 509) (Models MS203xB only)

Measurements							
Display Type	RF Spectrum AM/FM/PM	Audio Spectrum (AM)	Audio Spectrum (FM/PM)	Audio Waveform (AM)	Audio Waveform (FM/PM)	Summary (AM)	Summary (FM/PM)
Graphic Display	Power (dBm) vs. Frequency	Depth (%) vs. Modulation Frequency	Deviation (kHz/rad) vs. Modulation Frequency	Depth (%) vs. Time	Deviation (kHz/rad) vs. Time	None	None
Numerical Displays	Carrier Power Carrier Frequency Occupied Bandwidth	AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Deviation (Pk-Pk)/2 Deviation SINAD* THD* istortion/Total Vrms*	AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	RMS Depth (AM) Peak + Depth Peak – Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*	RMS Deviation (FM/PM) Peak + Depth Peak – Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*

*: Requires Sinewave modulation

Setup Parameters	Frequency	Center Freq, Span, Freq Step, Signal Standard, Channel, Channel Increment, Set Carrier Freq
	Amplitude	Scale, Power Offset, Adjust Range
	Setup	Demod Type (AM, FM, PM), IFBW, Auto IFBW
	Measurements	RF Spectrum AM/FM/PM, Audio Spectrum (AM/FM/PM), Audio Waveform (AM/FM/PM), Summary (AM/FM/PM), Average
	Marker	On/Off, Delta, Peak Search, Marker Freq to Center, Marker to Ref Lvl, Marker Table, All Markers Off
Specifications	AM	Modulation Rate: ±1 Hz (<100 Hz), ±2% (>100 Hz) Depth: ±5% for (Modulation rates 10 Hz to 100 kHz)
	FM	Modulation Rate: ±1 Hz (<100 Hz); ±2% (100 Hz to 100 kHz) Deviation Accuracy: ±5% (100 Hz to 100 kHz)*
	PM	Modulation Rate: ±1 Hz (<100 Hz); ±2% (100 Hz to 100 kHz) Deviation Accuracy: ±5% (deviation 0 to 93 rad, rate 10 Hz to 5 kHz)*
	IF bandwidth	1 kHz to 300 kHz in 1-3 sequence
	Frequency Span	RF Spectrum: 10 kHz to 10 MHz Audio Spectrum: 2 kHz, 5 kHz, 10 kHz, 20 kHz, 70 kHz, 140 kHz
	RBW/VBW	30
	Span/RBW	100
	Sweep time	50 µs to 50 ms (Audio Waveform)

*: IFBW must be greater than 95% occupied BW

Line Sweep Tools (for your PC)

Trace Capture	Browse to Instrument	View and copy traces from the test equipment to your PC using Windows Explorer
	Open Legacy Files	Open DAT files captured with Hand Held Software Tools v6.61
	Open Current Files	Open VNA or DAT files
	Capture plots To	The Line Sweep Tools screen, DAT files, Database, or JPEG
Traces	Trace Types	Return Loss, VSWR, DTF-RL, DTF-VSWR, Cable Loss, Smith and Smith Chart
	Trace Formats	DAT, VNA, CSV, PNG, BMP, JPG, HTML, Data Base, and PDF
Report Generation	Report Generator	Includes GPS location along with measurements
	Report Format	Create reports in HTML or PDF format
	Report Setup	Report Title, Company, Prepared for, Location, Date and Time, Filename, Company logo
	Trace Setup	1 trace Portrait Mode, 2 Trace Portrait Mode, 1 Trace Landscape Mode
Trace Validation	Presets	7 presets allow “one click” setting of up to 6 markers and one limit line
	Marker Controls	6 regular Markers, Marker Peak, Marker valley, Marker between, and frequency entry
	Delta Markers	6 Delta markers
	Limit Line	Enable and drag or value entry. Also works with presets
	Next Trace Button	Next Trace and Previous trace arrow keys allow quick switching between traces
Tools	Cable Editor	Allows creation of custom cable parameters
	Distance to Fault	Converts a Return Loss trace to a Distance to Fault trace
	Measurement Calculator	Converts Real, Imaginary, Magnitude, Phase, RL, VSWR, Rho, and Transmit power
	Signal Standard Editor	Creates new band and channel tables
	Renaming Grid	36 user definable phrases for creation of file names, trace titles, and trace subtitles
Connectivity	Connections	Ethernet, USB cable, USB Memory Stick (Ethernet requires Option 411)

Master Software Tools (for your PC)

Mapping (GPS Required)	Spectrum Analyzer Mode	MapInfo, MapPoint
	Mobile WiMAX OTA, LTE OTA Options	Google Earth, Google Maps, MapInfo
Spectrogram	(Spectrum Monitoring for Interference Analysis and Spectrum Clearing)	
	Source	Recorded Spectrogram or multiple spectrum traces
	Folder Spectrogram	2D View creates a composite file of multiple traces
	Available Displays	Spectrogram, Peak Power vs. Time, Variation in Total Power vs. Time, Peak Frequency vs. Time, Number of Traces Saved vs. Time (useful with Save on Limit Exceeded), Maximum/Average/Minimum Power vs. Time File Filter (Violations over limit lines or deviations from averages) Playback
	Display Functions per Trace	Markers, GPS location altitude and time (when recorded), instrument time Filename per trace for Folder Spectrogram
	Export to Video	Create AVI file of 2D Spectrogram for management review/reports
	Export to 3D Spectrogram	Views (Set Threshold, Markers) - 3D (Rotate X, Y, Z Axis, Level Scale, Signal ID) - 2D (Frequency or Time Domain, Signal ID) - Top Down Playback (Frequency and/or Time Domain)
List/Parameter Editors	Antennas, Cables, Signal Standards	Modify instrument's Antenna, Cable, and Signal Standard List
	Pass/Fail	Create, download, or edit Signal Analysis Pass/Fail Limits
	Script Master	Create Script Master files for GSM/WCDMA or Channel Scanner
	Languages	Modify non-English language menus
	Mobile WiMAX	DL-MAP Parameters
Connectivity	Connections	Connect to PC using USB, LAN, or Direct Ethernet connection (LAN and Ethernet require Option 411)
	Network Search	Find all Anritsu handheld instruments on local network
	Download	Download measurements and live traces to PC for storage and analysis
	Upload	Upload measurements and other files from PC to instrument
	Export	Measurements can be saved in various formats, depending on the measurement type, including JPEG, CSV, and Anritsu DAT format
	Printing	Print individual or all measurement screens

General Specifications

Maximum Input		(Damage Level)
	VNA Port 1 or 2	+23 dBm, ±50 VDC
	Spectrum Analyzer Port	+30 dBm peak, ±50 VDC, Maximum Continuous Input, ≥10 dB attenuation (Models MS203xB, spectrum analyzer input port only)
System Parameters and File Management	System	Status (Temperature, Battery Info, Serial Number, Firmware Version, Options Installed) Self Test, Application Self Test GPS (see Option 31)
	System Options	Name, Date and Time, Ethernet Configuration, Brightness, Volume, Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, Russian, Portuguese), Reset (Factory Defaults, Master Reset, Update Firmware)
	File	Save, Recall, Copy, Delete, Directory Management
	Save/Recall	Setups, Measurements, Screen Shots JPEG (save only), Limit Lines
	Copy	Setups, Measurements, Screen Shots JPEG
	Delete	Selected File, All Measurements, All Mode Files, All Content
	Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
	Internal Trace/Setup Memory	2000 traces, 2000 setups
	External Trace/Setup Memory	Limited by size of USB Flash drive
Connectors	VNA Port 1 or 2	Type N (f), 50Ω
	Spectrum Analyzer Port	Type N (f), 50Ω (MS203xB only)
	GPS	SMA (f)
	External Power	5.5 mm barrel connector, 12.5 VDC to 15 VDC, <4.0 Amps
	USB Interface (2)	Type A, Connect Flash Drive and Power Sensor
	USB Interface	5-pin mini-B, Connect to PC for data transfer
	Headset Jack	3.5 mm barrel connector
	External Reference In	BNC (f), Maximum Input ±5 VDC 1, 5, 10, 13 MHz
	External Trigger/Clock Recovery	BNC (f), Maximum Input ±5 VDC
	Ethernet	RJ45 connector for Ethernet 10/100-BaseT
Display	Type	Resistive Touch Screen
	Size	8.4 in, daylight viewable color LCD
	Resolution	800 × 600
	Pixel Defects	No more than five defective pixels (99.9989% good pixels)

Continued on next page

Power	Field replaceable Battery	Li-Ion, 633-75, 7500 mAh
	DC Power	40 W on battery power only Universal 110 V/220 V AC/DC Adapter 55 W running off AC/DC adaptor while charging battery
	Life time charging cycles	>300 (80% of initial capacity)
	Battery Operation	3.6 hours (typ.)
	Battery Charging Limits	0°C to +45°C, Relative Humidity ≤80%
CE	EMC	2014/30/EU, EN61326-1, EN61000-4-2
	LVD	2014/35/EU, EN61010-1
	RoHS	(EU) 2015/863
RCM	Australia and New Zealand	RCM AS/NZS 4417:2012
KCC	South Korea	KCC-REM-A21-0004
Environmental (MS202xB/3xB) MIL-PRF-28800F, Class 2	Operating Temperature Range	–10°C to +55°C
	Storage Temperature Range	–51°C to +71°C
	Maximum Relative Humidity	95% RH at +30°C, non-condensing
	Vibration, Sinusoidal	5 Hz to 55 Hz
	Vibration, Random	10 Hz to 500 Hz
	Half Sine Shock	30 g_n
	Altitude	4600 meters, operating and non-operating
	Explosive Atmosphere	MIL-PRF-28800F Section 4.5.6.3 MIL-STD-810G, Method 511.5, Procedure 1
Dimensions and Mass	Dimensions	273 (W) × 199 (H) × 91 (D) mm [10.7 (W) × 7.8 (H) × 3.6 (D) in]
	Mass, Including Battery	3.5 kg (7.6 lb)
Warranty	Duration	Standard three-year warranty (battery one-year warranty)

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Instrument Options

VNA Master Handheld Vector Network Analyzer + Spectrum Analyzer

Includes standard three-year warranty and Certificate of Calibration and Conformance.

MS2024B	MS2025B	MS2034B	MS2035B	Description
500 kHz to 4 GHz	500 kHz to 6 GHz	500 kHz to 4 GHz	500 kHz to 6 GHz	Vector Network Analyzer
—	—	9 kHz to 4 GHz	9 kHz to 6 GHz	Spectrum Analyzer
MS2024B-0010	MS2025B-0010	MS2034B-0010	MS2035B-0010	Built-in Bias-Tee, +12 V to +32 V variable
MS2024B-0015	MS2025B-0015	MS2034B-0015	MS2035B-0015	Vector Voltmeter
MS2024B-0019	MS2025B-0019	MS2034B-0019	MS2035B-0019	High Accuracy Power Meter (requires external USB sensor, sold separately)
—	—	MS2034B-0025	MS2035B-0025	Interference Analyzer*1
—	—	MS2034B-0027	MS2035B-0027	Channel Scanner*1
MS2024B-0031	MS2025B-0031	MS2034B-0031	MS2035B-0031	GPS Receiver*2
MS2024B-0098	MS2025B-0098	MS2034B-0098	MS2035B-0098	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate.
MS2024B-0099	MS2025B-0099	MS2034B-0099	MS2035B-0099	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate, test report, and uncertainty data.
—	—	MS2034B-0431	MS2035B-0431	Coverage Mapping*3
—	—	MS2034B-0509	MS2035B-0509	AM/FM/PM Demodulation Analyzer

*1: GPS Option 31 recommended.
*2: Requires external GPS antenna (sold separately).
*3: Requires GPS Option 31.

Model/Order No.	Name
	Standard Accessories (Included with instrument)
2000-1654-R	Soft Carrying Case
2000-1691-R	Stylus with Coiled Tether
2000-1797-R	Screen Protector Film (x2, one factory installed, one spare)
2000-1371-R	Ethernet Cable, 2.1 m (7 ft)
633-75	Rechargeable Li-Ion Battery, 7500 mAh
40-187-R	AC-DC Adapter
806-141-R	Automotive Power Adapter, 12 VDC, 60 W
3-2000-1498	USB A/5-pin mini-B Cable, 10 ft/305 cm
	- Certificate of Calibration and Conformance
	Optional Accessories
	Miscellaneous Accessories
MA2700A	Handheld Interference Hunter (For full specifications, refer to the Technical Data Sheet 11410-00692)
2000-1371-R	Ethernet Cable, 2.13 m (7 ft)
3-806-152	Cat 5e Crossover Patch Cable, 2.13 m (7 ft)
633-75	Rechargeable Li-Ion Battery, 7500 mAh
2000-1374	External Dual Charger for Li-Ion Batteries
2000-1689-R	EMI Near Field Probe Kit
66864	Rack Mount Kit

Model/Order No.	Name
	Backpack and Transit Case
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Transit Case with Wheels and Handle 56 × 45.5 × 26.5 cm (22.07 × 17.92 × 10.42")
760-261-R	Large Transit Case with Wheels and Handle 63.1 × 50 × 30 cm (24.83 × 19.69 × 11.88"), space for MA2700A, antennas, filters, instrument inside soft case, and other interference hunting accessories/tools
760-262-R	Transit Case for MA2700A, several Yagi antennas and filters
760-271-R	Transit Case for Portable Directional Antennas and Port Extender 52.4 × 42.8 × 20.6 cm (20.62 × 16.87 × 8.12") (for 2000-1777-R, 2000-1778-R, 2000-1779-R, 2000-1798-R)
760-286-R	Compact Transit Case with Wheels and Handle 55.6 × 35.5 × 22.9 cm (21.89" × 13.98" × 9.01")
	GPS Antennas (Active)
2000-1652-R	Magnet Mount, SMA (m), 3 VDC to 5 VDC with 1 ft cable
2000-1528-R	Magnet Mount, SMA (m), 3 VDC to 5 VDC with 4.6 m (15 ft) extension cable
2000-1760-R	Mini GPS Antenna, SMA (m), 25 dB gain, 2.5 VDC to 3.7 VDC

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Model/Order No.	Name
	Power Sensors
	(For complete ordering information see the respective datasheets of each sensor)
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +3 to +51.76 dBm
MA24106A	RF USB Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm
MA24208A	Microwave Universal USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24218A	Microwave Universal USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24330A	Microwave CW USB Power Sensor, 10 MHz to 33 GHz, +20 dBm
MA24340A	Microwave CW USB Power Sensor, 10 MHz to 40 GHz, +20 dBm
MA24350A	Microwave CW USB Power Sensor, 10 MHz to 50 GHz, +20 dBm
MA25100A	RF Power Indicator
	Full Temperature N-Type Coaxial Calibration Kits –10°C to +55°C
	(see individual data sheets on www.anritsu.com)
OSLN50A-8	High Performance Type N (m), DC to 8 GHz, 50Ω
OSLNF50A-8	High Performance Type N (f), DC to 8 GHz, 50Ω
TOSLN50A-8	High Performance with Through, Type N (m), DC to 8 GHz, 50Ω
TOSLNF50A-8	High Performance with Through, Type N (f), DC to 8 GHz, 50Ω
OSLN50A-18	High Performance Type N (m), DC to 18 GHz, 50Ω
OSLNF50A-18	High Performance Type N (f), DC to 18 GHz, 50Ω
TOSLN50A-18	High Performance with Through Type N (m), DC to 18 GHz, 50Ω
TOSLNF50A-18	High Performance with Through Type N (f), DC to 18 GHz, 50Ω
TOSLK50A-20	High Performance with Through Type K (m), DC to 20 GHz, 50Ω
TOSLKF50A-20	High Performance with Through Type K (f), DC to 20 GHz, 50Ω
TOSLK50A-40	High Performance with Through Type K (m), DC to 40 GHz, 50Ω
TOSLKF50A-40	High Performance with Through Type K (f), DC to 40 GHz, 50Ω
	Coaxial Calibration Components, other 50Ω, 75Ω
2000-1618-R	Open/Short/Load, 7/16 DIN (m), DC to 6.0 GHz 50Ω
2000-1619-R	Open/Short/Load, 7/16 DIN (f), DC to 6.0 GHz 50Ω
2000-1914-R	Precision Open/Short/Load, 4.3-10 (f), DC to 6 GHz, 50Ω
2000-1915-R	Precision Open/Short/Load, 4.3-10 (m), DC to 6 GHz, 50Ω
12N50-75B	Matching Pad, DC to 3 GHz, 50Ω to 75Ω
22N75	Open/Short, N (m), DC to 3 GHz, 75Ω
22NF75	Open/Short, N (f), DC to 3 GHz, 75Ω
26N75A	Precision Termination, N (m), DC to 3 GHz, 75Ω
26NF75A	Precision Termination, N (f), DC to 3 GHz, 75Ω
SM/PL-1	Precision N (m) Load, 42 dB, 6 GHz
SM/PLNF-1	Precision N (f) Load, 42 dB, 6 GHz
1091-55-R	Open, TNC (f), DC to 18 GHz
1091-53-R	Open, TNC (m), DC to 18 GHz
1091-56-R	Short, TNC (f), DC to 18 GHz
1091-54-R	Short, TNC (m), DC to 18 GHz
1015-54-R	Termination, TNC (f), DC to 18 GHz
1015-55-R	Termination, TNC (m), DC to 18 GHz
	Phase-Stable Test Port Cables, Armored
15NNF50-1.5C	1.5 m, DC to 6 GHz, N (m) to N (f), 50Ω
15NN50-1.5C	1.5 m, DC to 6 GHz, N (m) to N (m), 50Ω
15NDF50-1.5C	1.5 m, DC to 6 GHz, N (m) to 7/16 DIN (f), 50Ω
15ND50-1.5C	1.5 m, DC to 6 GHz, N (m) to 7/16 DIN (m), 50Ω
15NNF50-3.0C	3.0 m, DC to 6 GHz, N (m) to N (f), 50Ω
15NN50-3.0C	3.0 m, DC to 6 GHz, N (m) to N (m), 50Ω
15NNF50-5.0C	5.0 m, DC to 6 GHz, N (m) to N (f), 50Ω
15NN50-5.0C	5.0 m, DC to 6 GHz, N (m) to N (m), 50Ω
15N43M50-1.5C	Test Port Extension Cable, 1.5 m, DC to 6 GHz, N (m) to 4.3-10 (m)
15N43F50-1.5C	Test Port Extension Cable, 1.5 m, DC to 6 GHz, N (m) to 4.3-10 (f)
15N43M50-3.0C	Test Port Extension Cable, 3 m, DC to 6 GHz, N (m) to 4.3-10 (m)
15N43F50-3.0C	Test Port Extension Cable, 3 m, DC to 6 GHz, N (m) to 4.3-10 (f)

Model/Order No.	Name
	Directional Antennas
2000-1411-R	824 MHz to 896 MHz, N (f), 12.3 dBi, Yagi
2000-1412-R	885 MHz to 975 MHz, N (f), 12.6 dBi, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N (f), 12.3 dBi, Yagi
2000-1414-R	1850 MHz to 1990 MHz, N (f), 11.4 dBi, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N (f), 14.1 dBi, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N (f), 14.3 dBi, Yagi
2000-1659-R	698 MHz to 787 MHz, N (f), 10.1 dBi, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N (f), 14.3 dBi, Yagi
2000-1715-R	698 MHz to 2500 MHz, N (f), gain of 2 dBi to 10 dBi, typical
2000-1726-R	Antenna, 2500 MHz to 2700 MHz, N (f), 14.1 dBi, Yagi
2000-1747-R	Antenna, Log Periodic, 300 MHz to 7000 MHz, N (f), 5.1 dBi, typical
2000-1748-R	Antenna, Log Periodic, 1 GHz to 18 GHz, N (f), 6 dBi, typical
2000-1777-R	Portable Directional Antenna, 9 kHz to 20 MHz, N (f)
2000-1778-R	Portable Directional Antenna, 20 MHz to 200 MHz, N (f)
2000-1779-R	Portable Directional Antenna, 200 MHz to 500 MHz, N (f)
2000-1812-R	Portable Yagi Antenna, 450 MHz to 512 MHz, N (f), 7.1 dBi
2000-1825-R	Portable Yagi Antenna, 380 MHz to 430 MHz, N (f), 7.1 dBi
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA (m), 50Ω
2000-1473-R	870 MHz to 960 MHz, SMA (m), 50Ω
2000-1035-R	896 MHz to 941 MHz, SMA (m), 50Ω (1/2 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA (m), 50Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA (m), 50Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA (m), 50Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA (m), 50Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA (m), 50Ω
2000-1751-R	698 MHz to 960 MHz, 1710 MHz to 2100 MHz, 2500 MHz to 2700 MHz, SMA (m), 2 dB (typ.), 50Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)
2000-1487-R	VHF/UHF, Telescopic Whip antenna, straight or 90°, BNC (m), 50Ω
	Bandpass Filters
1030-114-R	806 MHz to 869 MHz, N (m) to SMA (f), 50Ω
1030-109-R	824 MHz to 849 MHz, N (m) to SMA (f), 50Ω
1030-110-R	880 MHz to 915 MHz, N (m) to SMA (f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N (m) to SMA (f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N (m) to SMA (f), 50Ω
1030-105-R	890 MHz to 915 MHz, N (m) to N (f), 50Ω
1030-106-R	1710 MHz to 1790 MHz, N (m) to N (f), 50Ω
1030-107-R	1910 MHz to 1990 MHz, N (m) to N (f), 50Ω
1030-149-R	High Pass, 150 MHz, N (m) to N (f), 50Ω
1030-150-R	High Pass, 400 MHz, N (m) to N (f), 50Ω
1030-151-R	High Pass, 700 MHz, N (m) to N (f), 50Ω
1030-152-R	Low Pass, 200 MHz, N (m) to N (f), 50Ω
1030-153-R	Low Pass, 550 MHz, N (m) to N (f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N (m) to N (f), 50Ω
1030-178-R	1920 MHz to 1980 MHz, N (m) to N (f), 50Ω
1030-179-R	777 MHz to 798 MHz, N (m) to N (f), 50Ω
1030-180-R	2500 MHz to 2570 MHz, N (m) to N (f), 50Ω
2000-1684-R	791 MHz to 821 MHz, N (m) to N (f), 50Ω
2000-1734-R	699 MHz to 715 MHz, N (m) and N (f), 50Ω
2000-1735-R	776 MHz to 788 MHz, N (m) and N (f), 50Ω
2000-1736-R	815 MHz to 850 MHz, N (m) and N (f), 50Ω
2000-1737-R	1711 MHz to 1756 MHz, N (m) and N (f), 50Ω
2000-1738-R	1850 MHz to 1910 MHz, N (m) and N (f), 50Ω
2000-1739-R	880 MHz to 915 MHz, N (m) and N (f), 50Ω
2000-1740-R	1710 MHz to 1785 MHz, N (m) and N (f), 50Ω
2000-1741-R	1920 MHz to 1980 MHz, N (m) and N (f), 50Ω
2000-1742-R	832 MHz to 862 MHz, N (m) and N (f), 50Ω
2000-1743-R	2500 MHz to 2570 MHz, N (m) and N (f), 50Ω
2000-1799-R	2305 MHz to 2320 MHz, N (m) and N (f), 50Ω
2000-1911-R	703 MHz to 748 MHz, N (m) and N (f), 50Ω
2000-1912-R	788 MHz to 798 MHz, N (m) and N (f), 50Ω
2000-1925-R	663 MHz to 698 MHz, N (m) and N (f), 50Ω
2000-1926-R	776 MHz to 806 MHz, N (m) and N (f), 50Ω

Continued on next page

Model/Order No.	Name
	Miscellaneous Adapters
1091-26-R	SMA (m) to N (m), DC to 18 GHz, 50Ω
1091-27-R	SMA (f) to N (m), DC to 18 GHz, 50Ω
1091-80-R	SMA (m) to N (f), DC to 18 GHz, 50Ω
1091-81-R	SMA (f) to N (f), DC to 18 GHz, 50Ω
1091-172-R	BNC (f) to N (m), DC to 1.3 GHz, 50Ω
1091-465-R	Adapter, DC to 6 GHz, 4.3-10 (f) to N (f), 50Ω
1091-467-R	Adapter, DC to 6 GHz, 4.3-10(m) to N (f), 50Ω
510-90-R	7/16 DIN (f) to N (m), DC to 7.5 GHz, 50Ω
510-91-R	7/16 DIN (f) to N (f), DC to 7.5 GHz, 50Ω
510-92-R	7/16 DIN (m) to N (m), DC to 7.5 GHz, 50Ω
510-93-R	7/16 DIN (m) to N (f), DC to 7.5 GHz, 50Ω
510-96-R	7/16 DIN (m) to 7/16 DIN (m), DC to 7.5 GHz, 50Ω
510-97-R	7/16 DIN (f) to 7/16 DIN (f), DC to 7.5 GHz, 50Ω
513-62-R	TNC (f) to N (f), DC to 18 GHz, 50Ω
1091-315-R	Adapter, DC to 18 GHz, TNC (f) to N (f), 50Ω
1091-324-R	Adapter, DC to 18 GHz, TNC (m) to N (f), 50Ω
1091-325-R	Adapter, DC to 18 GHz, TNC (f) to N (m), 50Ω
1091-317-R	Adapter, DC to 18 GHz, TNC (m) to N (m), 50Ω
1091-318-R	Adapter, DC to 18 GHz, TNC (m) to SMA (f), 50Ω
1091-323-R	Adapter, DC to 18 GHz, TNC (m) to SMA (m), 50Ω Adapter, DC to 18 GHz, TNC (m) to TNC (f), 50Ω
1091-326-R	Adapter, DC to 18 GHz, TNC (m) to TNC (m), 50Ω
510-102-R	N (m) to N (m), DC to 11 GHz, 50Ω, 90 degrees right angle
34RKNF50	Ruggedized K (m) to N (f), DC to 18 GHz, 50Ω
	Precision Adapters
34NN50A	Precision Adapter, N (m) to N (m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N (f) to N (f), DC to 18 GHz, 50Ω
34NK50	Precision Adapter, DC to 18 GHz, N (m) to K (m), 50Ω
34NFKF50	Precision Adapter, DC to 18 GHz, N (m) to K (f), 50Ω
K220B	Precision Adapter, DC to 40 GHz, K (m) to K (m), 50Ω
K222B	Precision Adapter, DC to 40 GHz, K (f) to K (f), 50Ω
K224B	Precision Adapter, DC to 40 GHz, K (m) to K (f), 50Ω
	Attenuators N Type (up to 18 GHz)
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N (m) to N (f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N (m) to N (f)
42N50A-30	30 dB, 50 W, DC to 18 GHz, N (m) to N (f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N (m) to N (f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N (m) to N (f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N (f) to N (m), Uni-directional
1010-121-R	40 dB, 100 W, DC to 18 GHz, N (f) to N (m), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N (m) to N (f)
	Attenuators K Type (up to 40 GHz)
41KB-3	Precision Fixed Attenuator, K (m) to K (f), 3 dB, DC to 26.5 GHz, 50Ω
41KB-6	Precision Fixed Attenuator, K (m) to K (f), 6 dB, DC to 26.5 GHz, 50Ω
41KB-10	Precision Fixed Attenuator, K (m) to K (f), 10 dB, DC to 26.5 GHz, 50Ω
41KB-20	Precision Fixed Attenuator, K (m) to K (f), 20 dB, DC to 26.5 GHz, 50Ω
41KC-3	Precision Fixed Attenuator, K (m) to K (f), 3 dB, DC to 40 GHz, 50Ω
41KC-6	Precision Fixed Attenuator, K (m) to K (f), 6 dB, DC to 40 GHz, 50Ω
41KC-10	Precision Fixed Attenuator, K (m) to K (f), 10 dB, DC to 40 GHz, 50Ω
41KC-20	Precision Fixed Attenuator, K (m) to K (f), 20 dB, DC to 40 GHz, 50Ω

VNA

Calibration Kits

For Performing Precise Calibrations of Vector Network Analyzers

3652A

The Anritsu Calibration Kits contain all the precision components and tools required to calibrate your VNA or VNMS for 12-term error-corrected measurements in the connector style of your choice. Components are included for calibrating male and female test ports as required. The kits support calibration with opens, shorts, an broadband loads.
The following kits are for use with 27xxx Lightning VNAs, MS464xB VectorStar, ShockLine Series VNAs, and MS20xxx VNA Master.
For more information about included components with each calibration kit, please refer to the respective referenced VNA's technical data sheet.

3650A Series SMA/3.5 mm Calibration Kit

3650A Cal Kit contains:

- 28S50-2 Termination 3.5 mm (male)
- 28SF50-2 Termination 3.5 mm (female)
- 24S50 Open 3.5 mm (male)
- 24SF50 Open 3.5 mm (female)
- 23S50 Short 3.5 mm (male)
- 23SF50 Short 3.5 mm (female)
- 33SS50 Adapter, 3.5 mm (male) to 3.5 mm (male)
- 33SFSF50 Adapter, 3.5 mm (female) to 3.5 mm (female)
- 33SSF50 Adapter, 3.5 mm (male) to 3.5 mm (female)
- 01-201 Torque Wrench
- 01-204 Wrench, Universal
- 01-222 Pin Depth Gauge
- 01-223 Adapter (female) for Pin Gauge
- 01-210 Reference Flat
- A18311 Connector Thumb Wheel

3650A-1 Cal Kit adds:

- 17S50 Sliding Termination 3.5 mm (male)
- 17SF50 Sliding Termination 3.5 mm (female)
- 01-211 Flush Short (male)
- 01-212 Flush Short (female)

3651B GPC-7 Calibration Kit

- 3651B-1 Sliding Terminations

3652A K Connector® Calibration Kit consisting of:

- 28K50A Broadband Male Termination (2)
- 28KF50A Broadband Female termination (2)
- 33KKF50C Male-Female Adapter (2)
- 24K50 Male Open
- 24KF50 Female Open
- 23K50 Male Short
- 23KF50 Female Short
- 01-201 Torque Wrench
- 01-210 Reference Flat
- 01-222 Pin Depth Gauge
- 01-223 Pin Depth Gauge
- Connector thumb wheel (4)
- Calibration coefficients memory stick

3652-1 adds the following:

- 17K50 Sliding Termination K, (male)
- 17KF50 Sliding Termination K, (female)
- 01-211 Flush Short, (male)
- 01-212 Flush Short, (female)

3652A-2 removes the following:

- 01-222 Pin Depth Gauge
- 01-223 Pin Depth Gauge
- 01-210 Reference Flat

3652A-3 adds the following:

- .s1p Database Calibration

3652A-4 adds the following:

- .s1p Datatbase Calibration

3652A-4 removes the following:

- 01-222 Pin Depth Gauge
- 01-223 Pin Depth Gauge
- 01-210 Reference Flat

3653A Type N Calibration Kit

- 23NF50 Female Short
- 23N50 Male Short
- 24NF50 Female Open
- 24N50 Male Open
- 28N50-2 Broadband Male Termination (2)
- 28NF50-2 Broadband Female Termination (2)
- 34AN50-2 Male Adapter (2)
- 34ANF50-2 Female Adapter (2)
- 01-213 Reference Gauge
- 01-224 Pin Depth Gauge
- Calibration coefficients diskette
- Calibration coefficients memory stick

3654D V Connector™ Calibration Kit

- 23V50C-5.1 Male Short 5.1 mm
- 23VF50C-5.1 Female Short 5.1 mm
- 24V50C Male Open
- 24VF50C Female Open
- 28V50D Male Broadband Termination (2)
- 28VF50D Female Broadband Termination (2)
- 33VV50C Male-Male Adapter*
- 33VFVF50C Female-Female Adapter (2)*
- 33VVF50C Male-Female Adapter (2)*
- Connector thumb wheel (4)
- 01-201 Torque Wrench
- 01-210 Reference Flat
- 01-322 Pin Depth Gauge
- 01-323 Female Adapter for pin gauge
- 01-204 Adapter Wrench
- 01-312 Male Flush Short
- 01-311 Female Flush Short
- Calibration coefficients memory stick

Option 2 removes the following:

- 01-322 Pin Depth Gage
- 01-323 Pin Depth Gage

Option 3 adds the following:

- .s1p Database calibration

Option 4 adds the following:

- .s1p Database calibration

Option 4 removes the following:

- 01-322 Pin Depth Gage
- 01-323 Pin Depth Gage

3655 Series Waveguide Calibration Kit

The 3655 Series Calibration Kit contains all of the precision components and tools required to calibrate your VNA for 12-term error-corrected measurements of test devices with the appropriate waveguide designation. Components are included for calibrating both module ports. The kit supports calibration with offset shorts and broadband loads. Option 1 adds a sliding termination.

Consisting of:

- 3-1091-302 Short, Flush (2)
- 3-1091-223 SHORT, OFFSET, 3/8WAVE
- 3-1091-222 SHORT, OFFSET, 1/8WAVE
- 3-B27394-3 Terminations, Fixed (2)
- Test Port Sections (2)

Option 1 adds the following:

- Sliding Termination

3656B W1 Calibration/Verification Kit

- 23W50-1 Male Offset Short (2.02 mm)
- 23W50-2 Male Offset Short (2.65 mm)
- 23W50-3 Male Offset Short (3.180 mm)
- 24W50 Male Open (1.510 mm)
- 28W50 Male Broadband Termination
- 23WF50-1 Female Offset Short 1 (2.02 mm)
- 23WF50-2 Female Offset Short 2 (2.65 mm)
- 23WF50-3 Female Offset Short 3 (3.180 mm)
- 28WF50 Female Broadband Termination
- 24WF50 Female Open (1.930 mm)
- 33WSC50 Fixed Male SC Connector
- 33WFSC50 Fixed Female SC Connector
- Interchangeable Sliders, SC Connectors
- Locking Keys, SC Connectors
- 01-402 Interchange Adapter Fixed Male
- 33WWF50 Male-Female Adapter
- 33WW50 Male-Male Adapter
- 33WFWF50 Female-Female Adapter
- 01-504 6 mm Torque Wrench
- 01-505 6-7 mm End Wrench
- 18WWF50-1B Stepped Impedance Thruline (Verification Device)
- 18WWF50-1 50Ω Matched Thruline (Verification Device)
- Calibration coefficients memory stick
- .s1p Database Calibration

3656C W1 (1 mm) Calibration/Verification Kit

- 28W50 Male Broadband Termination
- 28WF50 Female Broadband Termination
- 24W50 Male Open
- 24WF50 Female Open (1.930 mm)
- 23W50-1 Male Offset Short 1 (2.02 mm)
- 23WF50-1 Female Offset Short 1 (2.02 mm)
- 23W50-2 Male Offset Short 2 (2.65 mm)
- 23WF50-2 Female Offset Short 2 (2.65 mm)
- 23W50-3 Male Offset Short 3 (3.180 mm)
- 23WF50-3 Female Offset Short 3 (3.180 mm)
- 33WW50A Male-Male Adapter
- 33WWF50A Male-Female Adapter
- 33WFWF50A Female-Female Adapter
- 33WSC50 Fixed Male SC Connector
- 33WFSC50 Fixed Female SC Connector
- 60939 (M) • 60943 (F) Interchangeable Slider, SC Connectors
- 61265 Locking Keys, SC Connectors
- 01-402 Pin Exchange Tool
- 18WWF50A-1B (3656C/3656C-3 only) Stepped Impedance Mismatch Thru Line Verification Device inside plastic box
- 18WWF50A-1 (3656C/3656C-3 only) 50Ω Matched Thru Line Verification Device inside plastic box
- 01-505 6×7 mm End Wrench
- 01-504 6 mm Torque Wrench

VNA

Verification Kits

For Confirming Accuracy of Vector Network Analyzers

3669B

The Anritsu Verification Kits contain precision components with characteristics that are traceable to NIST. Used primarily by the metrology laboratory, these components provide the most dependable means of determining the system accuracy of your VNA. A USB memory device containing factory measured test data for all components is supplied for comparison with customer-measured data.

3666-1 SMA/3.5 mm Verification Kit consisting of:
- 19S50-7, 7.5 cm airline
- 19S50-7B, 7.5 cm stepped impedance airline (Beatty standard)
- 42S-50, 50 dB offset attenuator
- 42S-20, 20 dB offset attenuator
- USB memory device

3668-1 K Connector™ Verification Kit consisting of:
- 19K50-7, 7.5 cm airline
- 42K-50, 50 dB offset attenuator
- 42K-20, 20 dB offset attenuator
- 19K50-7B, 7.5 cm stepped impedance airline (Beatty standard)
- USB memory device

3669B-1 V Connector™ Verification Kit consisting of:
- 42V-50, 50 dB offset attenuator
- 42V-20, 20 dB offset attenuator
- 19V50-5, 5 cm airline
- 19V50-5B, 5 cm stepped impedance airline (Beatty standard)
- USB memory device

The following kits are for use with 37XXX Lightning VNAs.

3663 Type N Verification Kit consisting of:
- 42N-50, 50 dB Attenuator
- 18N50-10, 10 cm Airline
- 42N20, 20 dB Attenuator
- 18N50-10B, 10 cm Stepped Impedance Airline (Beatty standard)
- Verification kit disks

3666 SMA/3.5 mm Verification Kit consisting of:
- 19S50-7, 7.5 cm Airline
- 19S50-7B, 7.5 cm Stepped Impedance Airline (Beatty standard)
- 42S-50, 50 dB Attenuator
- 42S-20, 20 dB Attenuator
- Verification kit disks

3667 GPC-7 Verification Kit consisting of:
- 42A-50, 50 dB Attenuator
- 18A50-10, 10 cm Airline
- 42A-20, 20 dB Attenuator
- 18A50-10B, 10 cm Stepped Impedance Airline (Beatty standard)
- Verification kit disks

3668 K Connector® Verification Kit consisting of:
- 19K50-7, 7.5 cm Airline
- 42K-50, 50 dB Attenuator
- 42K-20, 20 dB Attenuator
- 19K50-7B, 7.5 cm Stepped Impedance Airline (Beatty standard)
- Verification kit disks

3669B V Connector® Verification Kit consisting of:
- 42V-40, 40 dB Attenuator
- 42V-20, 20 dB Attenuator
- 19V50-5, 5 cm Airline
- 19V50-5B, 5 cm Stepped Impedance Airline (Beatty standard)
- Verification kit disks

W1 (1.0 mm) Verification Components are included in W1 Calibration and Verification Kit (3656B).

See previous section for details.

W1 (1.0 mm) Verification Components are included in W1 Calibration and Verification Kit (3656C).

See previous section for details.

EU Standards (CE Marking)

(EU) 2015/863

O/E Calibration Module

MN4765B

70 kHz to 110 GHz range, with 1310 nm and 1550 nm wavelength coverage

Fast and Accurate Optoelectronic Measurements

The O/E Calibration Module MN4765B is a characterized, unamplified photodiode module. It is used as an optical receiver with the VectorStar™ VNAs MS4640B Series VNA and MS4652xB Series VNA to perform highly accurate and stable optoelectronic measurements of both modulators (E/O) and photoreceivers (O/E). Model MN4765B is the base calibration module part number only. Customers are required to also order an option to configure the bandwidth and wavelength coverage. These options consist of an InGaAs photodiode that converts modulated optical signals to electrical signals, and includes additional circuitry for temperature and bias stability. Available configuration options are:

- MN4765B-0040 (Option 40) Configured for 70 kHz to 40 GHz range, with 850 wavelength coverage
- MN4765B-0042 (Option 42) Configured for 70 kHz to 40 GHz range, with 850 nm and 1060 nm wavelength coverage
- MN4765B-0043 (Option 43) Configured with 70 kHz to 40 GHz range, with 850/1060/1310/1550 nm wavelength coverage
- MN4765B-0070 (Option 70) Configured for 70 kHz to 70 GHz range, with 1550 nm wavelength coverage
- MN4765B-0071 (Option 71) Configured for 70 kHz to 70 GHz range, with 1310 nm wavelength coverage
- MN4765B-0072 (Option 72) Configured for 70 kHz to 70 GHz range, with 1310 and 1550 nm wavelength coverage
- MN4765B-0110 (Option 110) Configured for 70 kHz to 110 GHz range, with 1550 nm wavelength coverage
- MN4765B-0111 (Option 111) Configured for 70 kHz to 110 GHz range, with 1310 nm wavelength coverage
- MN4765B-0112 (Option 112) Configured for 70 kHz to 110 GHz range, with 1310 nm and 1550 nm wavelength coverage

Calibration Options

MN4765B-0098 (Option 98) Standard Calibration

Standard Calibrations provide a Certificate of Calibration which certifies that the product has been calibrated in compliance with a quality system registered to ISO 9001:2000, and in compliance with ISO/IEC 17025-2005 and ANSI/NCSL Z540-1-1994 (R2002). It lists the measurement standards used in the calibration of the new equipment, the test procedure and its revision, as well as the environmental conditions.

MN4765B-0099 (Option 99) Premium Calibration

Premium calibration includes everything provided with a Standard Calibration plus Test Data showing actual measured values.

The test data provided varies by product complexity.

Key Features

Fast and Accurate Optoelectronic Measurements

The VectorStar and Shockline VNA Series, when calibrated using the MN4765B module, enable error-corrected Transfer Function, Group Delay, and Return Loss measurements of E/O, O/E and O/O components and subsystems.

National Institute of Standards and Technology Derived Characterization

Magnitude and phase characterization is obtained using a primary standard characterized by NIST or other National Metrology Institutes and held in the Anritsu Calibration Lab. The magnitude and phase data is provided on a USB drive with the module.

Temperature Stable

The MN4765B is thermally stabilized to eliminate drift in photodiode performance over temperature.

Internal Biasing

Accurate bias voltage to the photodiode is maintained internally.
An external, multi-country, AC adapter is included for easy operation.

High Linearity

Linear operating range to +6 dBm (+2 dBm for MN4765B-004x) for transfer function measurement uncertainties of:

<0.5 dB at 40 GHz
(Typical specifications for MN4765B-0043 at 1550 nm or 1310 nm)
<1 dB at 40 GHz (Typical specifications for MN4765B-004x at 850 nm)
<2 dB at 40 GHz
(Typical specifications for MN4765B-0042 and MN4765B-0043 at 1060 nm)
<0.45 dB at 50 GHz and <0.7 dB at 70 GHz
(Typical specifications for MN4765B-0070 and MN4765B-0072 at 1550 nm)
<0.35 dB at 40 GHz and <1 dB at 70GHz
(Typical specifications for MN4765B-0071 and MN4765B-0072 at 1310 nm)
<0.5 dB at 70 GHz and <0.75 dB at 110 GHz
(Typical specifications for MN4765B-0110 and MN4765B-0112 at 1550 nm)
<0.6 dB at 70 GHz and <0.9 dB at 110 GHz
(Typical specifications for MN4765B-0111 and MN4765B-0112 at 1310 nm)

High Responsivity

>0.2 A/W for MN4765B-0040 at 850 nm (Typical specification)
>0.2 A/W for MN4765B-0042 at 850 nm and >0.6 A/W at 1060 nm (Typical specification)
>0.2 A/W for MN4765B-0043 at 850 nm, >0.6 A/W at 1060 nm, >0.7 A/W at 1310 nm and >0.8 A/W at 1550 nm (Typical specification)
>0.7 A/W for MN4765B-0070 (Typical specification)
>0.45 A/W for MN4765B-0071 (Typical specification)
>0.45 A/W for MN4765B-0072 at 1310 nm (Typical specification)
>0.65 A/W for MN4765B-0072 at 1550 nm (Typical specification)
>0.5 A/W for MN4765B-0110 and MN4765B-0112 at 1550 nm (Typical specification)
>0.4 A/W for MN4765B-0111 and MN4765B-0112 at 1310 nm (Typical specification)

Typical Specifications*[1]

MN4765B-0040	Frequency Range	70 kHz to 40 GHz
	Operating Wavelength Range	800 nm to 900 nm
	Characterized Wavelength	850 nm ±20 nm
	Linear Optical Input Power	<2 dBm
	Maximum Optical Input PTD-SCDMA Simulation Softwareower	7 dBm
	Electrical Return Loss	<–10 dB at <18GHz <–3 dB from 18 GHz to 40 GHz
	Optical Return Loss	<–20 dB
	DC Responsivity	>0.2 A/W (850 nm ±20 nm)
	RF OUT Connector	K male (2.92 mm)
MN4765B-0042	Frequency Range	70 kHz to 40 GHz
	Operating Wavelength Range	800 nm to 1100 nm
	Characterized Wavelength	850 nm ±20 nm, 1060 nm ±20 nm
	Linear Optical Input Power	<2 dBm
	Maximum Optical Input Power	7 dBm
	Electrical Return Loss	<–10 dB at <18 GHz < –3 dB from 18 GHz to 40 GHz
	Optical Return Loss	<–20 dB
	DC Responsivity	>0.2 A/W (850 nm ±20 nm), > 0.6 A/W (1060 nm ±20 nm)
	RF OUT Connector	K male (2.92 mm)
MN4765B-0043	Frequency Range	70 kHz to 40 GHz
	Operating Wavelength Range	800 nm to 1700 nm
	Characterized Wavelength	850 nm ±20 nm, 1060 nm ±20 nm, 1319 nm ±20 nm, and 1550 nm ±20 nm
	Linear Optical Input Power	<2 dBm
	Maximum Optical Input Power	7 dBm
	Electrical Return Loss	<–10 dB at <18 GHz <–3 dB from 18 GHz to 40 GHz
	Optical Return Loss	<–20 dB
	DC Responsivity	>0.2 A/W (850 nm ±20 nm), >0.6 A/W (1060 nm ±20 nm), >0.7 A/W (1310 nm ±20 nm), and >0.8 A/W (1550 nm ±20 nm)
	RF OUT Connector	K male (2.92 mm)
MN4765B-0070	Frequency Range	70 kHz to 70 GHz
	Operating Wavelength Range	1480 nm to 1620 nm
	Characterized Wavelength	1550 nm ±20 nm
	Linear Optical Input Power	<6 dBm
	Maximum Optical Input Power	10 dBm
	Electrical Return Loss	<–8 dB at <50 GHz <–5 dB from 50 GHz to 70 GHz
	Optical Return Loss	<–24 dB
	DC Responsivity	>0.7 A/W (1550 nm ±20 nm)
	RF OUT Connector	V male (1.85 mm)
MN4765B-0071	Frequency Range	70 kHz to 70 GHz
	Operating Wavelength Range	1300 nm to 1330 nm
	Characterized Wavelength	1319 nm ±10 nm
	Linear Optical Input Power	<6 dBm
	Maximum Optical Input Power	10 dBm
	Electrical Return Loss	<–8 dB at <50 GHz <–5 dB from 50 GHz to 70 GHz
	Optical Return Loss	<–24 dB
	DC Responsivity	>0.45 A/W (1319 nm ±10 nm)
	RF OUT Connector	V male (1.85 mm)
MN4765B-0072	Frequency Range	70 kHz to 70 GHz
	Operating Wavelength Range	1300 nm to 1330 nm and 1530 nm to 1620 nm
	Characterized Wavelength	1319 nm ±10 nm and 1550 nm ±20 nm
	Linear Optical Input Power	<6 dBm
	Maximum Optical Input Power	10 dBm
	Electrical Return Loss	<–8 dB at <50 GHz <–5 dB from 50 GHz to 70 GHz
	Optical Return Loss	<–24 dB
	DC Responsivity	>0.45 A/W (1319 nm ±10 nm) and >0.65 A/W (1550 nm ±20 nm)
	RF OUT Connector	V male (1.85 mm)

Continued on next page

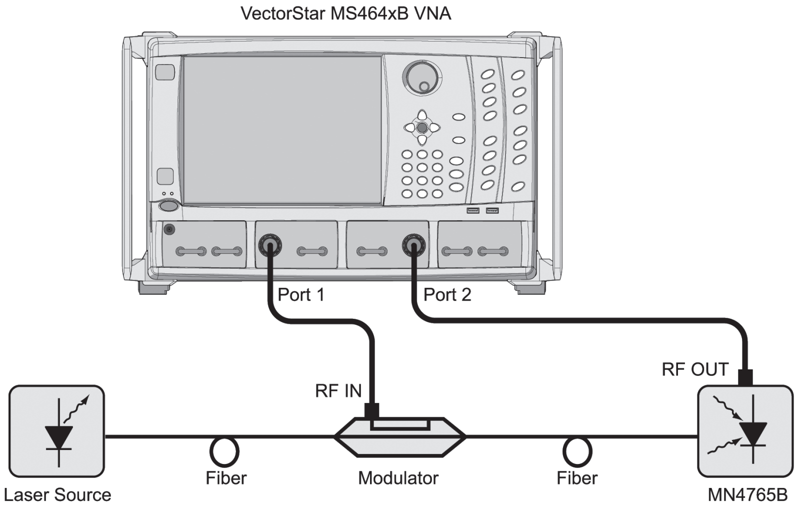
MN4765B-0110	Frequency Range	70 kHz to 110 GHz
	Operating Wavelength Range	1480 nm to 1620 nm
	Characterized Wavelength	1550 nm ±20 nm
	Linear Optical Input Power	<6 dBm
	Maximum Optical Input Power	10 dBm
	Electrical Return Loss	<–6 dB at <50 GHz <–4 dB from 50 GHz to 110 GHz
	Optical Return Loss	<–24 dB
	DC Responsivity	>0.5 A/W (1550 nm ±20 nm)
	RF OUT Connector	W male (1.0 mm)
MN4765B-0111	Frequency Range	70 kHz to 110 GHz
	Operating Wavelength Range	1300 nm to 1330 nm
	Characterized Wavelength	1319 ±10 nm
	Linear Optical Input Power	<6 dBm
	Maximum Optical Input Power	10 dBm
	Electrical Return Loss	<–6 dB at <50 GHz <–4 dB from 50 GHz to 110 GHz
	Optical Return Loss	<–24 dB
	DC Responsivity	>0.4 A/W (1319 ±10 nm) and >0.5 A/W (1550 ±20 nm)
	RF OUT Connector	W male (1.0 mm)
MN4765B-0112	Frequency Range	70 kHz to 110 GHz
	Operating Wavelength Range	1300 nm to 1330 nm and 1480 nm to 1620 nm
	Characterized Wavelength	1319 ±10 nm and 1550 ±20 nm
	Linear Optical Input Power	<6 dBm
	Maximum Optical Input Power	10 dBm
	Electrical Return Loss	<–6 dB at <50 GHz <–4 dB from 50 GHz to 110 GHz
	Optical Return Loss	<–24 dB
	DC Responsivity	>0.4 A/W (1319 ±10 nm) and > 0.5 A/W (1550 ±20 nm)
	RF OUT Connector	W male (1.0 mm)
General Specifications	Optical IN	FC/APC
	AC Adapter	100 V to 240 V (50 Hz to 60 Hz) input, +12 VDC output
	Power LED	On when the AC adapter is plugged in and the internal photodiode is properly biased
	Operate LED	On when the module's internal temperature has stabilized at an optimum temperature for accurate calibrations and measurements
	Dimensions	51 (W) × 33 (H) × 127 (D) mm (2.0 (W) × 1.3 (H) × 5.0 (D) in)
Environmental Specifications	Calibrated temperature	23°C±3°C
	Operating Temperature	+18°C to +28°C
	Storage Temperature	–20°C to +70°C (–15°C to +60°C for -004x)
	Relative Humidity	5 to 95%
	CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: 2011/65/EU, (EU) 2015/863

*1: Typical specifications represent the measured performance of an average unit. They do not include guard-bands and are not covered by the product warranty.

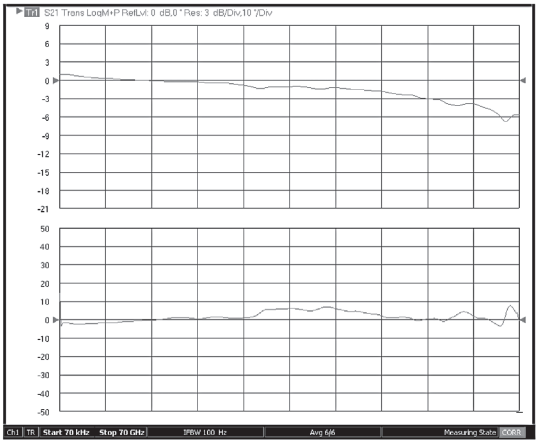
MN4765B Example Measurement Setup and Module Frequency Response

Full frequency use of the Option 70/71/72 module requires a MS4647B 70 GHz VNA although lower frequency VNAs can be used for their portion of the MN4765B-0070/-0071/-0072 frequency range and for all of the MN4765B-0040/0042/0043 frequency range. Full use of the frequency range of the Option 110 /111/112 module requires a ME7838x broadband system. Below is an example of the general E/O or O/E measurement setup. Frequency response traces for the different options are shown on the following pages.

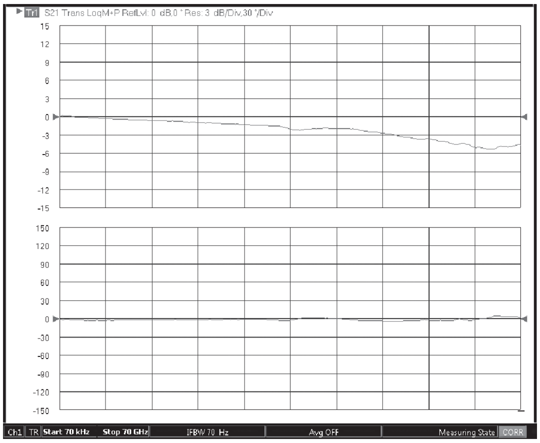
Note Frequency response of individual modules will vary in shape but will have same stability and general immunity from the noise floor.



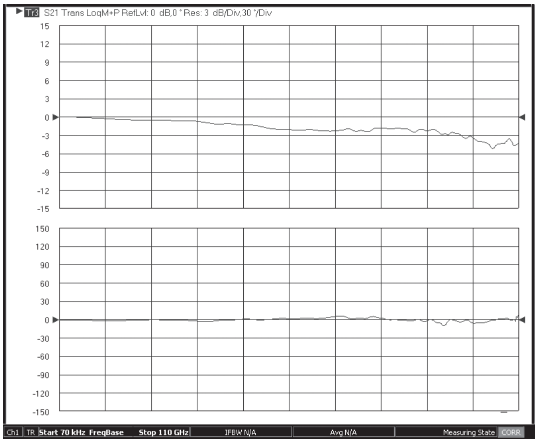
MN4765B Frequency Response Measurement Setup (Refer to Application Note 11410-00798)



Example of Frequency Response –
Option 70, 1550 nm (MN4765B-0070)



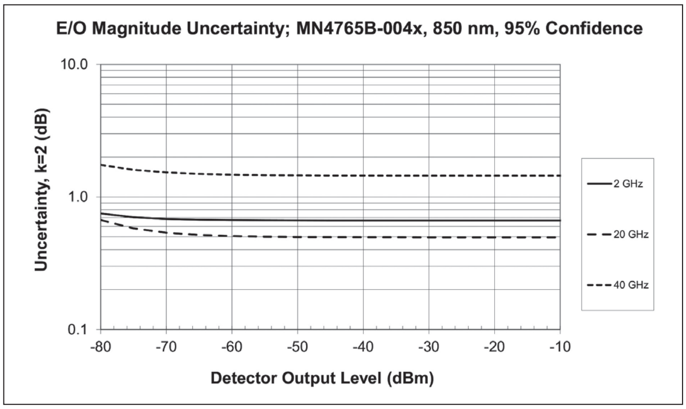
Example of Frequency Response –
Option 71 or Option 72 at 1310 nm (MN4765B-0071/0072)

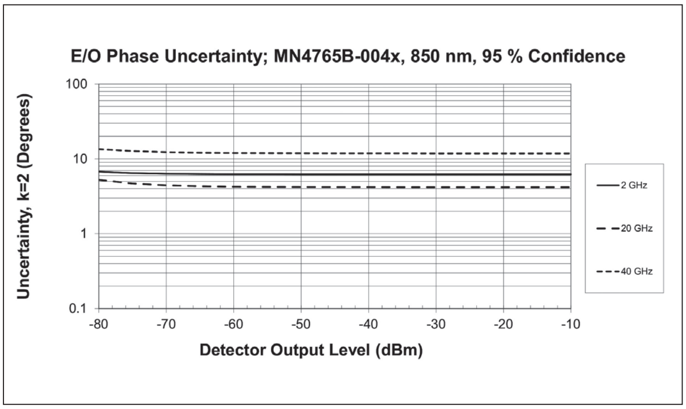


Example of Frequency Response –
Option 110, 1550 nm (MN4765B-0110)

Measurement Uncertainties for Option 40, Option 42, or Option 43 (850 nm)

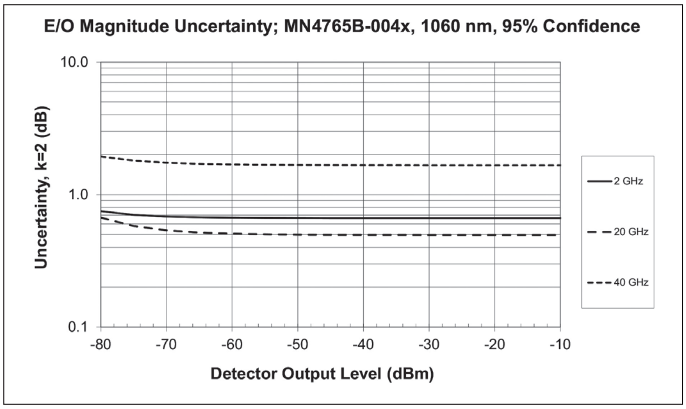
Uncertainty curves apply for temperatures of 23°C±3°C (and measurements within 1 degree of calibration temperature) and are based on a coverage factor of 2 for a 95% confidence interval. Analysis based on a 9 µm fiber connecting devices.
See the section: "Notes on Multimode Operation" for information on use with large core diameters.

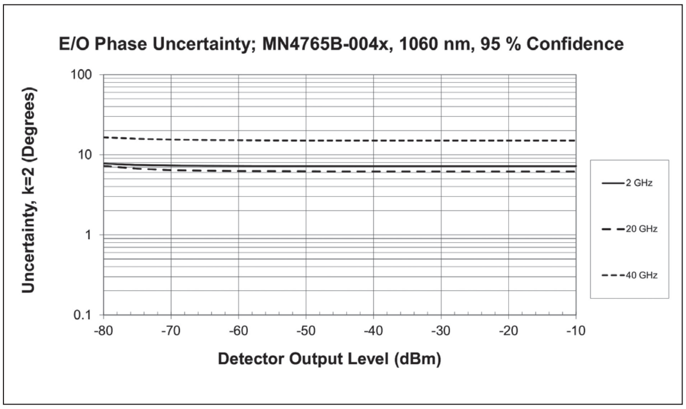




Measurement Uncertainties for Option 42, or Option 43 (1060 nm)

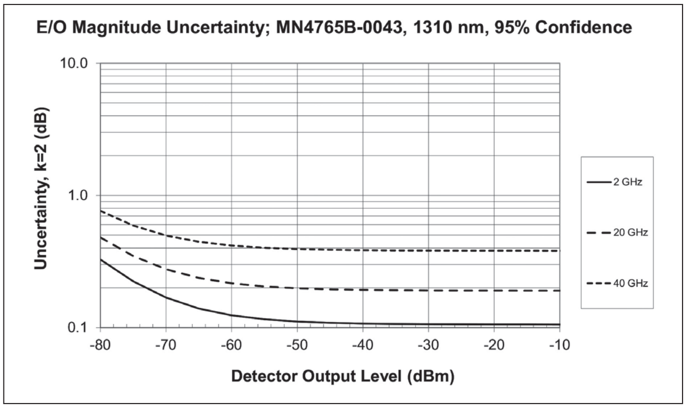
Uncertainty curves apply for temperatures of 23°C±3°C (and measurements within 1 degree of calibration temperature) and are based on a coverage factor of 2 for a 95% confidence interval. Derived from interpolation and wavelength dependence information. Analysis based on a 9 µm fiber connecting devices. See the section: "Notes on Multimode Operation" for information on use with large core diameters.

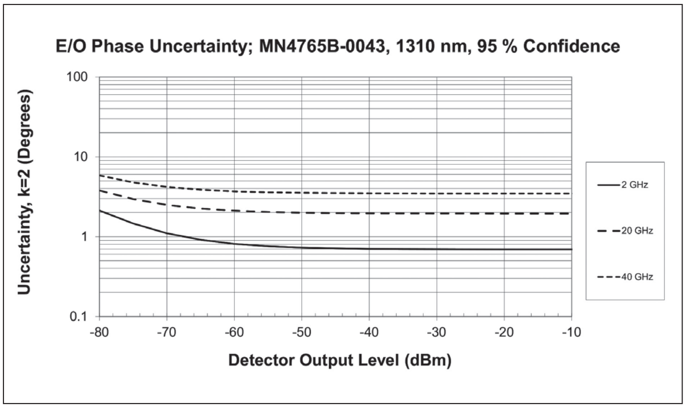




Measurement Uncertainties for Option 43 (1310 nm)

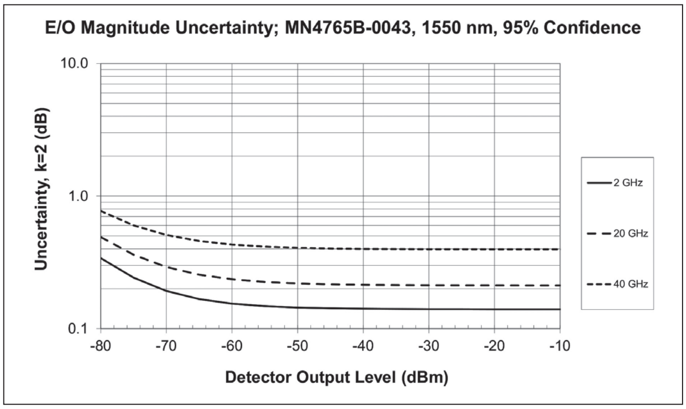
Uncertainty curves apply for temperatures of 23°C±3°C (and measurements within 1 degree of calibration temperature) and are based on a coverage factor of 2 for a 95% confidence interval.

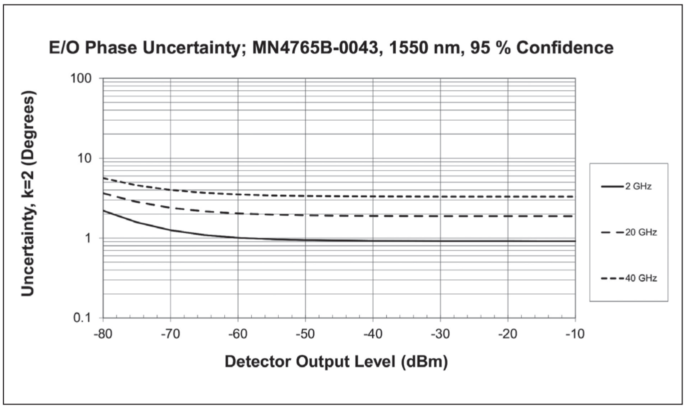




Measurement Uncertainties for Option 43 (1550 nm)

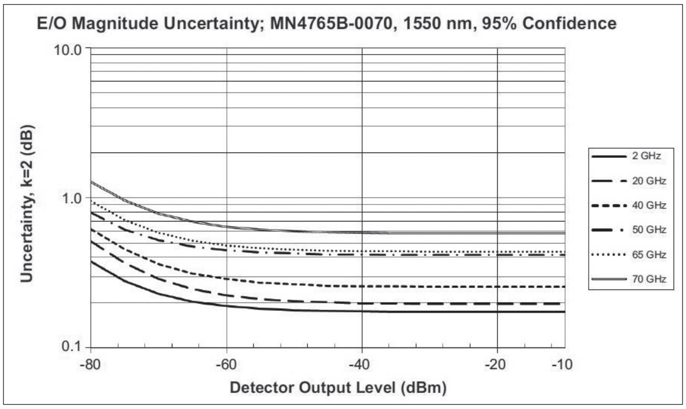
Uncertainty curves apply for temperatures of 23°C±3°C (and measurements within 1 degree of calibration temperature) and are based on a coverage factor of 2 for a 95% confidence interval.

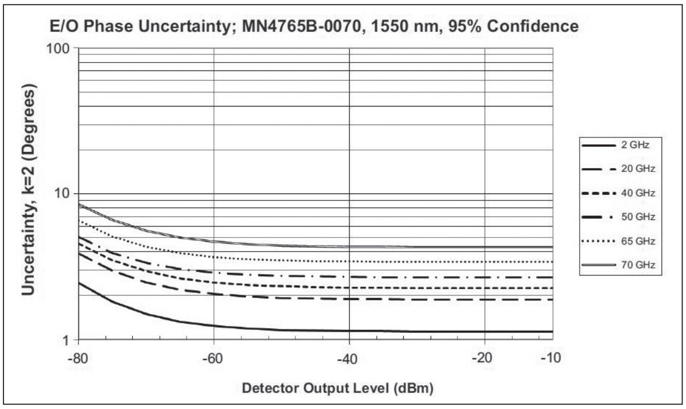




Measurement Uncertainties for Option 70 or Option 72 (at 1550 nm)

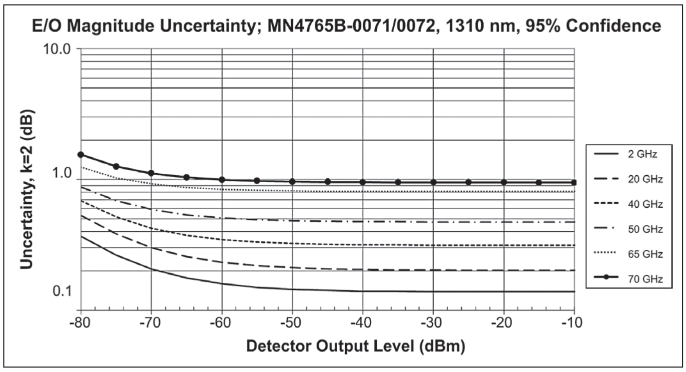
Uncertainty curves apply for temperatures of 23°C±3°C (and measurements within 1 degree of calibration temperature) and are based on a coverage factor of 2 for a 95% confidence interval.

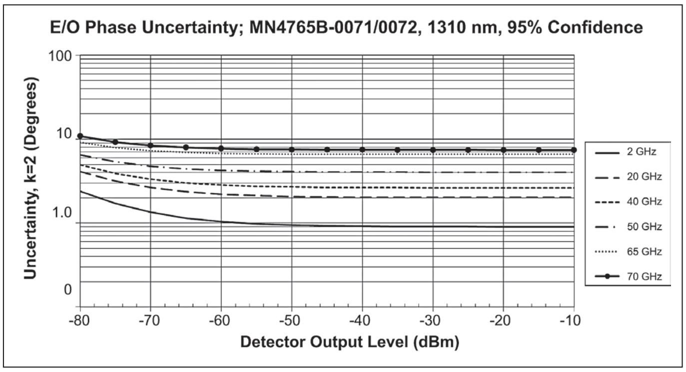




Measurement Uncertainties for Option 71 or Option 72 (at 1310 nm)

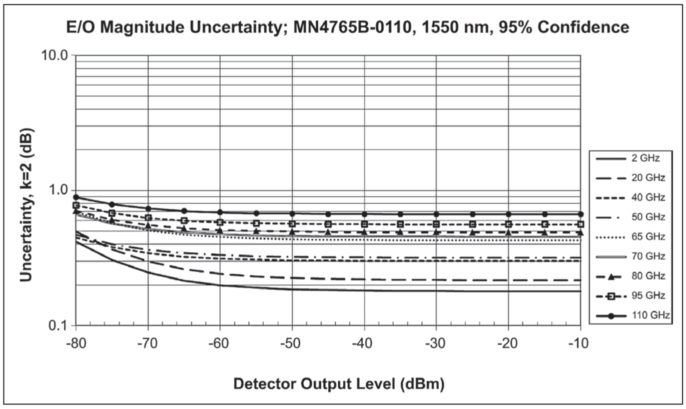
Uncertainty curves apply for temperatures of 23°C±3°C (and measurements within 1 degree of calibration temperature) and are based on a coverage factor of 2 for a 95% confidence interval. Magnitude uncertainty values above 40 GHz and phase uncertainty values are based on a 1550-1310 nm transfer model.

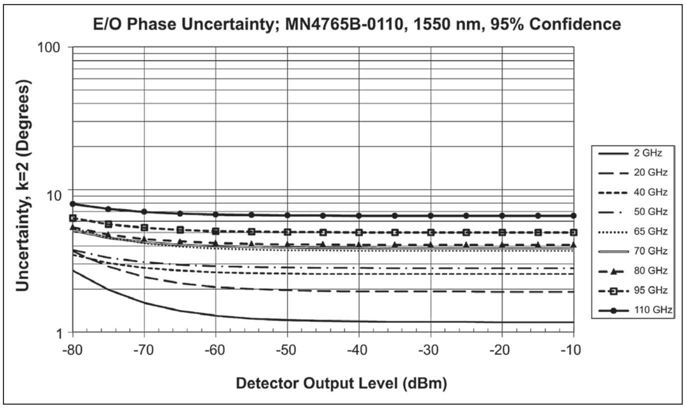




Measurement Uncertainties for Option 110 or Option 112 (at 1550 nm)

Uncertainty curves apply for temperatures of 23°C±3°C (and measurements within 1 degree of calibration temperature) and are based on a coverage factor of 2 for a 95% confidence interval.





Find Drivers, Utilities, Software Updates, and other Helpful Tools at the VectorStar Users Site visit:
https://www.anritsu.com/en-us/test-measurement/products/users-site

Training at Anritsu

Anritsu has designed courses to help you stay up to date with technologies important to your job.
For available training courses, visit: www.anritsu.com/training

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Options
MN4765B-0040	Configured for 70 kHz to 40 GHz range, with 850 nm wavelength coverage.
MN4765B-0042	Configured for 70 kHz to 40 GHz range, with 800 nm wavelength coverage.
MN4765B-0043	Configured for 70 kHz to 40 GHz range, with 800 nm wavelength coverage.
MN4765B-0070	Configured for 70 kHz to 70 GHz range, with 1550 nm wavelength coverage.
MN4765B-0071	Configured for 70 kHz to 70 GHz range, with 1310 nm wavelength coverage.
MN4765B-0072	Configured for 70 kHz to 70 GHz range, with 1310 nm and 1550 nm wavelength coverage.
MN4765B-0110	Configured for 70 kHz to 110 GHz range, with 1550 nm wavelength coverage.
MN4765B-0111	Configured for 70 kHz to 110 GHz range, with 1310 nm wavelength coverage
MN4765B-0112	Configured for 70 kHz to 110 GHz range, with 1310 nm and 1550 nm wavelength coverage

ShockLine™ 2-Port and 4-Port SmartCal Calibration Units

MN252x8A SmartCal™ and MN254x8A SmartCal™

MN25208A: 300 kHz to 8.5 GHz, 2-Port Auto Calibration Module, MN25218A: 300 kHz to 20 GHz, 2-Port Auto Calibration Module
MN25408A: 300 kHz to 8.5 GHz, 4-Port Auto Calibration Module, MN25418A: 300 kHz to 20 GHz, 4-Port Auto Calibration Module

Remote Control
USB

Low Cost USB Automatic Calibration Units

The MN252x8A and MN254x8A SmartCal's are a series of 2-port and 4-port automatic calibration units covering a frequency range from 300 kHz to 20 GHz.

The MN252x8A and MN254x8A deliver automatic, fast and error-free calibrations for any ShockLine VNA. The SmartCals automatically powers on via an USB connection and loads calibration kit coefficients from on-board memory into the ShockLine software. The SmartCals are ready to use immediately after detection by the VNA because it doesn't require warm-up. The SmartCal's improve productivity by providing easier and faster single connection calibrations. Port auto sense and port mapping feature reduce errors and make multi-port calibrations easier.

The MN252x8A and MN254x8A, along with easyTest, can also be used in guided graphical test procedures to further simplify complex calibrations.

MN252x8A and MN254x8A SmartCal™ Highlights

- Auto load of calibration kit coefficients speeds up setups and reduces calibration error.
- Auto sense determines the number of VNA ports connected preventing poor connections and calibration.
- VNA to SmartCal Port mapping increases flexibility and simplifies multiport calibrations.
- ShockLine software auto detects SmartCal providing simple and easy calibrations.
- No internal heater eliminates warm up time speeding calibration time.
- USB power and control provides the convenience of a one plug interface without an external power supply.
- Single connection calibrations reduce wear and tear on connectors and cables over manual calibrations.
- Supports all ShockLine VNAs with 1-, 2-, 4-port calibration available.
- SCPI command set allows for easy integration into automated test environments.
- Automatic and fast calibrations at a low price.
- Small size provides easier use when moving between VNAs.
- Supports ShockLine Vector Network Analyzer A and B models.

VNA System Performance

Error-Corrected Specifications

With 12-term SOLT calibration using TOSLN50A-XX or TOSLNF50A-XX N- or K-type connector manual calibration kits or the MN25208A SmartCal™ automatic calibration kit.

MS46121B Frequency Range	Directivity (dB)	Source Match (dB)	Reflection Tracking (dB)
150 kHz to 4 GHz	42	35	±0.1
>4 GHz to 6 GHz	42	35	±0.2

MS46122B and MS46322B Frequency Range	Directivity (dB)	Source Match (dB)	Load Match*4 (dB)	Reflection Tracking*4 (dB)	Transmission Tracking*4 (dB)
1 MHz to 6 GHz	≥42	≥33	≥42	±0.15	±0.06
>6 GHz to 8 GHz	≥37	≥33	≥37	±0.15	±0.06

MS46522B and MS46524B Frequency Range	Directivity (dB)	Source Match (dB)	Load Match*4 (dB)	Reflection Tracking*4 (dB)	Transmission Tracking*4 (dB)
50 kHz to 50 MHz	>40	>35	>38	±0.15	±0.09
>50 MHz to 6 GHz	>40	>35	>38	±0.08	±0.05
>6 GHz to 8 GHz	≥36	>35	≥34	±0.08	±0.05
>8 GHz to 8.5 GHz	≥36	>35	≥34	±0.10	±0.08

With calibration using TOSLK50A-XX or TOSLKF50A-XX N or K type connector calibration kits.

Frequency Range		Directivity (dB)	Source Match (dB)	Load Match*4 (dB)	Reflection Tracking*4 (dB)	Transmission Tracking*4 (dB)
MS46131A-010/ ME7868A	1 MHz to 6 GHz	>42	>33	>41	±0.15	±0.06
	>6 GHz to 8 GHz	>37	>33	>36	±0.15	±0.06
MS46131A-020	1 MHz to 10 GHz	>42	>33	>41	±0.15	±0.06
	>10 GHz to 20 GHz	>36	>26	>35	±0.15	±0.06
MS46131A-043	1 MHz to 10 GHz	>42	>33	>41	±0.15	±0.06
	>10 GHz to 20 GHz	>36	>26	>35	±0.15	±0.06
	>20 GHz to 30 GHz	>32	>22	>31	±0.15	±0.06
	>30 GHz to 40 GHz	>30	>20	>29	±0.15	±0.06
	>40 GHz to 43.5 GHz	>28	>20	>27	±0.2	±0.16

*4: Characteristic performance.

** there are many variations of the Error-Corrected Specification. We also have data with various SmartCals and Precision AutoCals. Please let me know if you would like other data.

K (f) connector
(other connector
options available)

N (F) Connector
(other connector
options available)

Two Color LED
Reports Functional
Status of Smartcal

USB micro-B Port
for PC Connectivity

Two Color LED
Reports Functional
Status of Smartcal

USB micro-B Port
for PC Connectivity

EU Standards (CE Marking)

EMC: 2014/30/EU, EN61326-1, EN61000-4-2
LVD: 2014/35/EU, EN61010-1
RoHS: (EU) 2015/863

MN252x8A SmartCal – Automatic Calibration Unit

Product Options

Analyzer Performance

Option Number	Description
MN25208A-001	Option 1, N (f) - N (f) Connectors
MN25208A-002	Option 2, K (f) - K (f) Connectors
MN25208A-003	Option 3, 3.5 mm (f) - 3.5 mm (f) Connectors

Included Accessories

Part Number	Description
2000-1606-R	1.8 m USB A/Micro-B latch cable

Recommended Accessories

Part Number	Description
01-200	Torque Wrench, 3/4 in. 0.9 N*m (8 lbf*in), Type N
01-201	Torque Wrench, 5/16 in, 0.9 N*m (8 lbf*in)
34NN50A	Precision Adapter, DC to 18 GHz, N (m) - N (m), 50Ω
33NNF50B	Calibration Grade Adapter, DC to 18 GHz, N (m) - N (f), 50Ω
33SS50	Calibration Grade Adapter, DC to 26.5 GHz, 3.5 mm (m) - 3.5 mm (m), 50Ω
K220B	Precision Adapter, DC to 40 GHz, K (m) - K (m), 50Ω

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
MN25208A	**SmartCal** 2-port USB SmartCal Module, 300 kHz to 8.5 GHz (available with connector Options -001 N (f), -002 K (f), -003 3.5 mm (f))
MN25218A	2-port USB SmartCal Module, 300 kHz to 20 GHz (available with connector Option -002 K (f))
MN25408A	4-port USB SmartCal Module, 300 kHz to 8.5 GHz (available with connector Options -001 N (f), -002 K (f), -003 3.5 mm (f))
MN25418A	4-port USB SmartCal Module, 300 kHz to 20 GHz (available with connector Option -002 K (f))

SIGNAL GENERATORS

Synthesizer Selection Guide (Measurement Function)

Group	Model	Functions																											Remarks
		Frequency Extensions				Level Extensions							Modulation						Others										
		8 MHz to 2 GHz	8 MHz to 2.2 GHz	0.1 Hz to 10 MHz	mmWave (50 GHz to 500 GHz) signal source	110 dB step attenuator (<20 GHz)	110 dB step attenuator (<40 GHz)	90 dB step attenuator (>40 GHz)	23 dBm high power (<20 GHz, Without Option 4 or 5)	19 dBm high power (<40 GHz, Without Option 4 or 5)	13 dBm high power (<50 GHz, Without Option 4 or 5)	9 dBm high power (<67 GHz, Without Option 4 or 5)	AM modulation (external)	FM/ΦM modulation (external)	Pulse modulation (external, <40 GHz)	Pulse modulation (external, >40 GHz)	For AM/FM/ΦM modulation (Internal signal source)	For pulse modulation (Internal signal source)	Low phase noise	Premium phase noise	Analog sweep	High stability time base	User-defined modulation waveform software	Rear panel RF output (<40 GHz)	Rear panel RF output (>40 GHz)	Delete front panel	Rack mount kit	Ultra-stable phase tracking	
Main frame	MG3695C	✓	✓	✓	*			✓			✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	2 GHz to 50 GHz
	MG3697C	✓	✓	✓	*			✓				✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	2 GHz to 67 GHz (setting range: 2 GHz to 70 GHz)
Options	1A																										✓		Either selection Option 1A comes with slides. Option 1B does not include slides.
	1B																										✓		
	2C							✓																					Choose corresponding to main frame frequency range
	3																		✓										Ultra and premium versions available. Consult the TDS for more information. Not available with Option 3X.
	3X																			✓									Not available with Option 3.
	4		✓																										Starts at 10 MHz. Not available with Option 5.
	5	✓																											Not available with Option 4.
	6																				✓								When used with Option 4, analog sweep capability is limited to ≥500 MHz
	9V																								✓				
	10																						✓						Requires Option 27 or 28
	12													✓															For internal modulation capability, requires addition of a LF Generator, Option 27
	14												✓																
	16																					✓							
	17																									✓			Only available with Options 1A or 1B
	26B															✓													Choose corresponding to main frame frequency range. For MG3690C and internal modulation capability, requires addition of Option 27
	27																✓	✓											For MG3690C, provides modulation waveforms for internal AM (with Option 14), FM (with Option 12), ΦM (with Option 12) and Pulse (with Option 26). Not available without Option 12, 14, or 26
	28B												✓	✓		✓	✓	✓											Choose corresponding to main frame frequency range
	36																											✓	Requires Option 3 or 3X.
	CE																												

*: The maximum of frequency required for frequency extension to mmWave is 20 GHz.

Synthesizer Selection Guide (Measurement Function)

Group	Model	Functions													Remarks
		Level		Modulation			Phase Noise			Freq. Stability		Others			
		Step Attenuator	High Power Output	AM/FM/PM Modulation Int/Ext	Pulse Modulation Int/Ext	Front Panel Modulation I/O Access	Low Phase Noise	Ultra Low Phase Noise	Premium Phase Noise	Ultra Stability Time Base	GNSS Atomic Clock Receiver	Rear Panel RF output	Rack Mount Kit	Removable SDIO memory	
Main frame	MG36221A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9 kHz to 20 GHz
	MG36241A	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	9 kHz to 43.5 GHz
Options	Option 0001												✓		
	Option 0002	✓													
	Option 0003						✓								
	Option 0009											✓			
	Option 0011												✓		
	Option 0012			✓											
	Option 0013							✓							
	Option 0015		✓												
	Option 0023								✓						
	Option 0026				✓										
	Option 0027			✓	✓	✓									
	Option 0029					✓									
	Option 0056									✓					
	Option 0066										✓				

Model	Frequency Range	Output Level Range	Harmonics	Non-harmonics	SSB Phase Noise (CW 1 GHz, 20 kHz offset)	Amplitude Modulation	Frequency Modulation	Pulse Modulation	Sine-wave	Triangular-wave	Square-wave	Sawtooth-wave	Mass
MG3740A (MG3740A-032/062)	100 kHz to 2.7 GHz	–110 to +17 dBm [Standard] –144 to +25 dBm [Option]	<–30 dBc	<–68 dBc (187.5 MHz < f ≤ 750 MHz)	–131 dBc/Hz (typ.)	✓	✓	✓	✓	Option	Option	Option	≤13.7 kg
MG3740A (MG3740A-034/064)	100 kHz to 4 GHz												
MG3740A (MG3740A-036/066)	100 kHz to 6 GHz												

Synthesizer Selection Guide (Frequency Range)

Group	Model	Frequency Range																						Remarks
		1 MHz	2 MHz	5 MHz	10 MHz	20 MHz	50 MHz	100 MHz	200 MHz	500 MHz	1 GHz	2 GHz	5 GHz	10 GHz	20 GHz	50 GHz	100 GHz	200 GHz	300 GHz	500 GHz	800 GHz	1 THz	2 THz	
Main frame	MG3695C											■	■	■	■									2 GHz to 50 GHz
	MG3697C											■	■	■	■	■								2 GHz to 67 GHz
Options	4			■	■	■	■	■	■	■	■	■												8 MHz to 2.2 GHz
	5			■	■	■	■	■	■	■	■													8 MHz to 2 GHz
	2000-2087-R															■								50 GHz to 75 GHz
	2000-2088-R															■								60 GHz to 90 GHz
	2000-2089-R															■	■							75 GHz to 110 GHz
	2000-2090-R															■	■							90 GHz to 140 GHz
	2000-2091-R																■							110 GHz to 170 GHz
	2000-2092-R																■	■						140 GHz to 220 GHz
	2000-2093-R																■	■						170 GHz to 260 GHz
	2000-2094-R																	■	■					220 GHz to 325 GHz
	2000-2095-R																	■	■					260 GHz to 400 GHz
	2000-2096-R																		■					330 GHz to 500 GHz
	2000-2097-R																			■				500 GHz to 750 GHz
	2000-2098-R																			■	■	■		750 GHz to 1100 GHz

Group	Model	Frequency Range																Remarks
		1 kHz	10 kHz	100 kHz	1 MHz	100 MHz	1 GHz	10 GHz	20 GHz	40 GHz	70 GHz	100 GHz	200 GHz	400 GHz	600 GHz	800 GHz	1.1 THz	
Main frame	MG36221A	■	■	■	■	■	■	■										9 kHz to 20 GHz
	MG36241A	■	■	■	■	■	■	■	■	■								9 kHz to 43.5 GHz
	2000-2087-R									■	■							50 GHz to 75 GHz
	2000-2088-R									■	■							60 GHz to 90 GHz
	2000-2089-R										■	■						75 GHz to 110 GHz
	2000-2090-R										■	■						90 GHz to 140 GHz
	2000-2091-R											■						110 GHz to 170 GHz
	2000-2092-R											■	■					140 GHz to 220 GHz
	2000-2093-R											■	■					170 GHz to 260 GHz
	2000-2094-R												■					220 GHz to 325 GHz
	2000-2095-R												■					260 GHz to 400 GHz
	2000-2096-R												■	■				330 GHz to 500 GHz
	2000-2097-R													■	■			500 GHz to 750 GHz
	2000-2098-R														■	■		750 GHz to 1100 GHz

Model	Frequency Range																		Remarks
	0.1 Hz	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz	20 MHz	30 MHz	50 MHz	100 MHz	1 GHz	2 GHz	3 GHz	5 GHz	10 GHz	
MG3740A (MG3740A-032/062)							■	■	■	■	■	■	■	■	■				100 kHz to 2.7 GHz
MG3740A (MG3740A-034/064)							■	■	■	■	■	■	■	■	■	■			100 kHz to 4 GHz
MG3740A (MG3740A-036/066)							■	■	■	■	■	■	■	■	■	■	■		100 kHz to 6 GHz

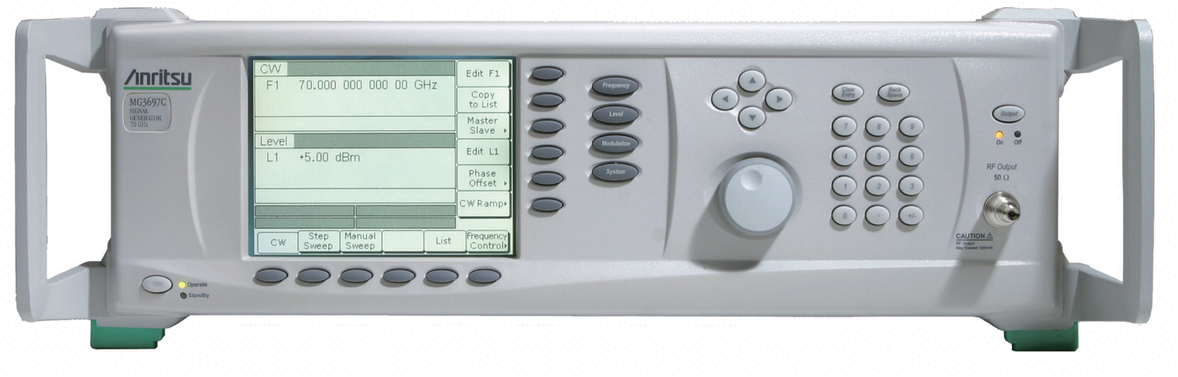
RF/Microwave Signal Generator

MG3690C Series

0.1 Hz to 70 GHz/1.1 THz

Remote Control
GPIB | **LAN**

The Ideal Microwave Signal Generator



Value Without Compromise

The MG3690C series of RF/Microwave signal generators cover the audio, HF, VHF, UFH, RF, and microwave frequencies and provide coverage from 0.1 Hz to 70 GHz with a single coaxial output (up to 1.1 THz with external multipliers). With excellent phase noise, fast switching speeds, and a full suite of analog modulation capabilities (including high-performance pulse modulation), the MG3690C series is an optimal signal source solution for the design and testing of components and systems for a wide variety of industries - wireless communications, aerospace and defense, and consumer and computer electronics.

Key Features

Basic CW generators configurable to full-featured signal generators.

- Broad frequency coverage in a single output: 0.1 Hz to 70 GHz
  - Two Models, 2 to 50 and 67 GHz (operational to 70 GHz)
  - 8 MHz Coverage Optional (Analog or Digital Down-Conversion)
  - 0.1 Hz Coverage Optional
- mmW Coverage up to 500 GHz, in Waveguide
- Ultra-Low SSB Phase Noise Option
- –109 dBc/Hz (typ.) at 1 kHz Offset, 10 GHz Carrier
- Excellent Harmonics and Spurious Response
- CW and Step Sweep Modes; Analog Sweep Optional
- <5 ms Switching Time (typ.) for <100 MHz steps
- 0.01 Hz standard Frequency Resolution
- Phase Offset Capability
- AM, FM/ΦM Modulations Optional
  - Internal LF Generator Optional
- Pulse Modulation Optional
  - 100 ns Leveled Width, ≥1 GHz
  - Internal Pulse Generator Optional
- Intuitive, Menu-driven Front Panel
- Proven Reliability with 3 Year Standard Warranty
- Completely Configurable and Upgradable

High-Performance Signal Generators

The ultimate in full-function signal generation, including comprehensive, high-performance modulation for signal simulation applications. Additional features in these units include:

- Internal pulse generator with swept delay capability for moving target simulation
- Flexible pulse triggering including free-run, delayed, gated, and composite
- 0 to 90% AM, log or linear over DC to 100 kHz rates
- Four FM modes for up to 10 MHz deviation at 8 MHz rates or 100 MHz deviation at 100 Hz rates
- Phase modulation (ΦM) up to 400 radians deviation at 1 MHz rates
- Internal AM, FM, and ΦM generators, each with 7 modulating waveforms
- Optional user-defined complex modulation

Automatic Test Equipment

The MG3690C is an ideal signal generator for an ATE system. It packs the highest performance in a 13.3 cm (3u) package with a 450 mm depth that minimizes rack space. High output power assures adequate signal strength to the device under test, even after ATE switching and cabling losses. Accurately leveled output power to –105 dBm in 0.01 dB steps facilitates receiver sensitivity measurements. Fast 5 ms switching time maximizes system throughput. Internal list mode frees the A.T.E. controller to perform measurement analysis tasks. Free application drivers, including the IVI-COM driver and National Instruments LabView® drivers, save you time and money in code generation and maintenance. For additional cost savings, Option 17 eliminates the complete front panel, including circuitry.

Interchangeable Virtual Instruments Standard

The IVI Foundation defines a standard instrument driver model that enables instrument interchangeability and interoperability without software changes. Anritsu's IVI-driver supported synthesizer minimizes instrument development and maintenance cost through the use of IVI-standard interfaces as well as instrument-specific interfaces for unique instrument features. The IVI standard provides a single driver that supports the common application development environments such as Visual Basic, Visual C++, and Labview.

Anritsu Corporation leads the way with IVI technology, having released the first COM-based IVI driver supporting the Signal Generator instrument class, and includes the driver with every MG3690C series synthesizer. As an active member of the IVI Foundation, Anritsu supports the Foundation's drive toward instrument driver standardization as a powerful means of delivering interchangeable ATE instrumentation solutions.

Specifications

For detailed and most up-to-date specifications, please refer to the MG3690C data sheet, p/n 11410-00515. The latest version of this data sheet is available for down-loading in pdf format from the MG3690C product page on the Anritsu website www.anritsu.com.

CW Mode	Accuracy	Same as internal or external 10 MHz time base
	Internal Time Base Stability	With aging: <2 × 10^{-9}/day (<5 × 10^{-10}/day with Option 16) With temperature: <2 × 10^{-8}/°C over 0°C to 55°C (<2 × 10^{-10}/°C with Option 16)
	Resolution	0.01 Hz
	Internal Time Base Calibration	The internal time base can be calibrated via the System Cal menu to match an external reference (10 MHz ±50 Hz).
	External 10 MHz Reference Input	Accepts external 10 MHz ±50 Hz (typ.), 0 to +20 dBm time base signal Automatically disconnects the internal high-stability time-base option (if installed) Rear panel BNC (50Ω impedance) Selectable bandwidth for best phase noise immunity or best phase tracking performance
	10 MHz Reference Output	1 V_{p-p} into 50Ω, AC coupled; rear panel BNC (50Ω impedance)
	Phase Offset	Adjustable in 0.1° steps
	Electronic Frequency Control (EFC)	–4 V to +4 V input range 0.2 ppm/V (typ.) sensitivity (0.08 ppm/V (typ.) for Option 3x) ≤250 Hz modulation bandwidth Rear panel BNC (high impedance)
Phase-Locked Step Sweep Mode	Sweep Width	Independently selected, 0.01 Hz to full range; every frequency step in sweep range is phase-locked
	Accuracy	Same as internal or external 10 MHz time base
	Resolution (Minimum Step Size)	0.01 Hz
	Linear/Log Sweep	User-selectable linear or log sweep; in log sweep, step size logarithmically increases with frequency
	Steps	User-selectable number of steps or the step size
	Number of Steps	Variable from 1 to 10,000
	Step Size	0.01 Hz to the full frequency range of the instrument If the step size does not divide into the selected frequency range, the last step is truncated
	Dwell Time Per Step	Variable from 1 ms to 99 s
	Fixed Rate Sweep	Variable from 30 ms to 99 s
Alternate Sweep Mode		Sweeps alternately in step sweep between any two sweep ranges. Each sweep range may be associated with a power level.
Analog Sweep Mode (Option 6)	Sweep Width	Independently selected from 1 MHz to full frequency range For units with Option 4 (Digital Down Converter), the start frequency during analog sweep is limited to ≥2.2 GHz for stop frequencies >20 GHz. For stop frequencies ≤20 GHz, the start frequency is limited to ≥500 MHz. A range error will be displayed if any of these analog sweep start/stop limits are exceeded.
	Accuracy	The lesser of ±30 MHz or ±2 MHz +0.25% of sweep width for sweep speeds of ≤50 MHz/ms (typ.).
	Sweep Time Range	30 ms to 99 s
Manual Sweep Mode		Provides stepped, phase-locked adjustment of frequency between sweep limits. User-selectable number of steps or step size.
List Sweep Mode		Under GPIB or Ethernet control, or via the front panel, up to 4 tables with 2000 non-sequential frequency/power sets can be stored and then addressed as a phase-locked step sweep. One table of 2000 points is stored in non-volatile memory. All other tables are stored in volatile memory.
Programmable Frequency Agility		Under GPIB or Ethernet control, up to 3202 non-sequential frequency/power sets can be stored and then addressed as a phase-locked step sweep. Data is stored in volatile memory.
Markers	Up to 20 independent, settable markers (F0 to F9 and M0 to M9)	
	Video Markers	+5 V or –5 V marker output, selectable from system menus; AUX I/O connector, rear panel
	Marker Accuracy	Same as sweep frequency accuracy
	Intensity Markers	Produces an intensity dot on analog display traces, obtained by a momentary dwell in RF sweep, in analog sweeps of <1 second.
	Marker Resolution	Analog Sweep: 1 MHz or Sweep Width/4096, whichever is greater Step Sweep: 0.01 Hz
Sweep Triggering	Sweep triggering is provided for Analog Frequency Sweep, Step Frequency Sweep, List Frequency Sweep, and CW Power Sweep.	
	Auto	Triggers sweep automatically
	External	Triggers a sweep on the low-to-high transition of an external TTL signal; AUX I/O connector, rear panel
	Single	Triggers, aborts, and resets a single sweep; reset sweep may be selected to be at the top or bottom of the sweep

Continued on next page

General	Stored Setups	Stores front panel settings and nine additional front-panel setups in a non-volatile RAM. A system menu allows for saving and recalling instrument setups. Whenever the instrument is turned on, control settings come on at the same functions and values existing as when it was last turned off.
	Memory Sequencing Input	Accepts a TTL low-level signal to sequence through ten stored setups AUX I/O connector, rear panel
	Self-Test	Instrument self-test is performed when Self-Test soft-key is selected. If an error is detected, an error message is displayed in a window on the LCD identifying the probable cause and remedy.
	Secure Mode	Disables all frequency and power level state displays. Stored setups saved in secure mode remain secured when recalled. Mode selectable from a system menu and via GPIB or Ethernet.
	Parameter Entry	Instrument-controlled parameters can be entered in three ways: keypad, rotary data knob, or the touch pads of the cursor-control key. Controlled parameters are frequency, power level, sweep time, dwell time, and number of steps. Keypad entries are terminated by pressing the appropriate soft key. Edits are terminated by exiting the edit menu
	Reset	Returns all instrument parameters to predefined default states or values. Any pending GPIB or Ethernet I/O is aborted. Selectable from the system menu.
	Primary/Secondary Operation	Allows two output signals to be swept with a user-selected frequency offset. One instrument controls the other via AUX I/O and SERIAL I/O connections. Requires a Primary/Secondary Interface Cable Set (Part No. ND36329).
	User Level Flatness Correction	Allows user to calibrate out path loss due to external switching and cables via entered power table from a GPIB power meter or calculated data. When user level correction is activated, entered power levels are delivered at the point where calibration was performed. Supported power meters are Anritsu ML2437A, ML2438A, ML2480A/B, ML2490A, and ML4803A and HP 437B, 438A, and 70100A. Five user tables are available with up to 801 points/table.
	Warm Up Time	From Standby: 30 minutes From Cold Start (0°C): 120 hours to achieve specified frequency stability with aging Instruments disconnected from AC line power for more than 72 hours require 30 days to return to specified frequency stability with aging
	Power	85 VAC to 264 VAC, 48 Hz to 440 Hz, 250 VA (max.)
	Standby	With AC line power connected, unit is placed in standby when front panel power switch is released from the OPERATE position
	Dimensions	429 (W) × 133 (H) × 450 (D) mm
	Mass	18 kg (max.)
Remote Operation	All instrument functions, settings, and operating modes (except for power on/standby) are controllable using commands sent from an external computer via Ethernet (VXI-11 over TCP/IP) or GPIB (IEEE-488 interface bus). Note: For users who wish to use a USB control interface, the following adapter available from National Instruments is recommended: USB: NI GPIB-USB-MS	
	Ethernet Port	10/100 Base-T
	Ethernet Address	DHCP with Auto-IP 169.254.90.55 (default) or static 192.168.0.254
	GPIB Address	Selectable from a system menu
	GPIB Commands	Native, SCPI
	IEEE-488 Interface Function Subset	Source Handshake: SH1 Acceptor Handshake: AH1 Talker: T6 Listener: L4 Service Request: SR1 Remote/Local: RL1 Parallel Poll: PP1 Device Clear: DC1 Device Trigger: DT1 Controller Capability: C0, C1, C2, C3, C28 Tri-State Driver: E2
	GPIB Status Annunciators	When the instrument is operating in Remote, the GPIB status annunciators (listed below) will appear in a window on the front panel LCD
	Remote	Operating on the GPIB or via Ethernet, all instrument front panel keys are ignored (except for the SYSTEM key and the RETURN TO LOCAL soft key)
	LLO (Local Lockout)	Disables the RETURN TO LOCAL soft key. Instrument can be placed in local mode only via Ethernet or GPIB, or by cycling line power
	Emulations	The instrument responds to the published GPIB commands and responses of the Anritsu Models 6600, 6700, and 6XX00-series signal sources. When emulating another signal source, the instrument will be limited to the capabilities, mnemonics, and parameter resolutions of the emulated instrument.
Environmental (MIL0PRF-28800F, class3)	Temperature Range	0°C to +50°C (Operating), –40°C to +75°C (Storage)
	Relative Humidity	5 to 95% at +40°C (non-condensing)
	Altitude	4,600 m, 43.9 cm Hg
	Vibration	Random, 5 Hz to 500 Hz, 0.015 to 0.0039 g^2/Hz PSD; Sinusoidal, 5 Hz to 55 Hz, 0.33 mm displacement
	CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1
	RCM	Australia and New Zealand RCM AS/NZS 4417:2012
	KCC	South Korea KCC-REM-A21-0004
Regulatory Compliance	European Union	EMC 2014/30/EU, EN 61326:2013, CISPR 11/EN 55011, IEC/EN 61000-4-2/3/4/5/6/8/11 Low Voltage Directive 2014/35/EU Safety EN 61010-1:2010 RoHS directive 2011/65/EU applies to instruments with CE marking and noted as Rev. 2 or above on the rear panel
	Australia and New Zealand	RCM AS/NZS 4417:2012
	South Korea	KCC-REM-A21-0004

Signal Purity

All specifications apply at the lesser of +10 dBm output or maximum specified leveled output power unless otherwise noted.

Harmonic and Harmonic-Related

Frequency Range	Standard
10 MHz to ≤100 MHz (Option 4)	<–40 dBc
>100 MHz to ≤2.2 GHz (Option 4)	<–50 dBc
10 MHz to ≤50 MHz (Option 5)	<–30 dBc
>50 MHz to <2 GHz (Option 5)	<–40 dBc
2 GHz (>2.2 GHz w/Option 4) to ≤20 GHz	<–60 dBc
>20 GHz to ≤40 GHz	<–40 dBc
>40 GHz to ≤50 GHz (MG3695C)	<–40 dBc
>40 GHz to ≤67 GHz (MG3697C)	<–25 dBc

Non-Harmonic

Frequency Range	Standard
10 MHz to ≤2.2 GHz (Option 4)	<–60 dBc
10 MHz to ≤2 GHz (Option 5)	<–40 dBc
>2 GHz (2.2 GHz w/Option 4) to ≤67 GHz	<–60 dBc

Power Line and Fan Rotation Spurious Emissions (dBc)

Frequency Range	Offset from Carrier		
	300 Hz	300 Hz to 1 kHz	>1 kHz to 3 kHz
≥10 MHz to ≤500 MHz (Option 4)	<–68	<–72	<–72
>500 MHz to ≤1050 MHz (Option 4)	<–62	<–72	<–72
>1050 MHz to ≤2200 MHz (Option 4)	<–56	<–66	<–66
0.01 GHz to ≤8.4 GHz	<–50	<–60	<–60
>8.4 GHz to ≤20 GHz	<–46	<–56	<–60
>20 GHz to ≤40 GHz	<–40	<–50	<–54
>40 GHz to ≤67 GHz	<–34	<–44	<–48

Residual FM (CW and Step Sweep modes, 50 Hz to 15 kHz BW, typ.)

Note: Residual FM is not applicable with FM locked mode.

Frequency Range	Residual FM (Hz RMS)	
	Option 3/3X	Standard
≤8.4 GHz	<40	<120
>8.4 GHz to ≤20 GHz	<40	<220
>20 GHz to ≤40 GHz	<80	<440
>40 GHz to ≤67 GHz	<160	<880

Residual FM (Analog Sweep and Unlocked FM modes, 50 Hz to 15 kHz BW, typ.)

Note: Residual FM is not applicable with FM locked mode.

Frequency Range	Residual FM (kHz RMS)	
	Unlocked Narrow FM mode	Unlocked Wide FM mode or Analog Sweep (typ.)
0.01 GHz to ≤20 GHz	<10	<25
>20 GHz to ≤40 GHz	<20	<50
>40 GHz to ≤67 GHz	<40	<100

AM Noise Floor

Typically <–145 dBm/Hz at 0 dBm output and offsets >5 MHz from carrier.

Single-Sideband Phase Noise

Phase noise is specified and guaranteed only with internal reference. In External Reference mode, the phase noise of the external supplied reference, and the selected external reference bandwidth, will dictate the instrument phase noise performance. Phase noise measured at +10 dBm <5 GHz and +6 dBm >5 GHz.

Single-Sideband Phase Noise (dBc/Hz): (Typ.)

Frequency Range	Offset from Carrier					
	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
10 MHz to 15.625 MHz (Option 4)	–102 (–113)	–128 (–133)	–142 (–149)	–145 (–152)	–145 (–153)	–145 (–153)
>15.625 MHz to 31.25 MHz (Option 4)	–97 (–109)	–125 (–130)	–142 (–147)	–144 (–149)	–144 (–153)	–145 (–155)
>31.25 MHz to 62.5 MHz (Option 4)	–92 (–104)	–122 (–128)	–140 (–146)	–142 (–146)	–143 (–150)	–145 (–155)
>62.5 MHz to 125 MHz (Option 4)	–87 (–98)	–114 (–118)	–133 (–139)	–130 (–140)	–130 (–143)	–145 (–155)
>125 MHz to 250 MHz (Option 4)	–82 (–93)	–108 (–113)	–126 (–134)	–124 (–134)	–124 (–138)	–145 (–153)
>250 MHz to 500 MHz (Option 4)	–75 (–87)	–102 (–109)	–120 (–128)	–118 (–127)	–118 (–130)	–143 (–149)
>500 MHz to 1050 MHz (Option 4)	–70 (–80)	–94 (–100)	–115 (–123)	–115 (–122)	–116 (–126)	–138 (–144)
>1050 MHz to 2200 MHz (Option 4)	–65 (–74)	–86 (–96)	–113 (–117)	–111 (–116)	–114 (–120)	–133 (–139)
10 MHz to <2000 MHz (Option 5)	–62 (–72)	–85 (–95)	–100 (–104)	–102 (–106)	–102 (–106)	–111 (–114)
2 GHz to 6 GHz	–54 (–64)	–81 (–88)	–102 (–109)	–103 (–110)	–106 (–114)	–128 (–133)
>6 GHz to 10 GHz	–52 (–62)	–75 (–85)	–98 (–106)	–104 (–109)	–106 (–113)	–126 (–132)
>10 GHz to 20 GHz	–45 (–55)	–69 (–78)	–92 (–101)	–98 (–103)	–98 (–106)	–124 (–131)
>20 GHz to 40 GHz	–38 (–48)	–62 (–72)	–86 (–94)	–92 (–100)	–92 (–100)	–118 (–124)
>40 GHz to 67 GHz	–32 (–42)	–56 (–66)	–80 (–88)	–87 (–94)	–82 (–91)	–112 (–118)

Single-Sideband Phase Noise (dBc/Hz) - Option 3: (Typ.)

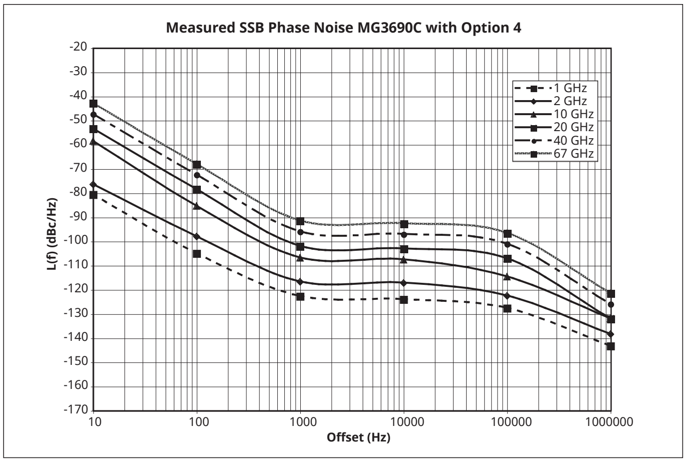
Frequency Range	Offset from Carrier					
	10 Hz	100 Hz	1 kHz*	10 kHz*	100 kHz	1 MHz
10 MHz to 15.625 MHz (Option 4)	–102 (–120)	–128 (–140)	–142 (–150)	–145 (–152)	–148 (–153)	–148 (–152)
>15.625 MHz to 31.25 MHz (Option 4)	–97 (–108)	–125 (–128)	–142 (–149)	–145 (–153)	–148 (–153)	–148 (–155)
>31.25 MHz to 62.5 MHz (Option 4)	–92 (–109)	–122 (–131)	–140 (–146)	–145 (–153)	–148 (–153)	–148 (–156)
>62.5 MHz to 125 MHz (Option 4)	–87 (–98)	–114 (–118)	–134 (–139)	–142 (–147)	–143 (–148)	–148 (–155)
>125 MHz to 250 MHz (Option 4)	–82 (–93)	–108 (–113)	–129 (–134)	–138 (–143)	–137 (–142)	–148 (–153)
>250 MHz to 500 MHz (Option 4)	–77 (–91)	–102 (–114)	–124 (–130)	–132 (–137)	–128 (–137)	–144 (–153)
>500 MHz to 1050 MHz (Option 4)	–72 (–83)	–98 (–103)	–119 (–123)	–126 (–132)	–122 (–132)	–139 (–150)
>1050 MHz to 2200 MHz (Option 4)	–66 (–77)	–92 (–101)	–113 (–119)	–121 (–126)	–117 (–125)	–135 (–146)
10 MHz to <2000 MHz (Option 5)	–64 (–72)	–85 (–95)	–100 (–104)	–102 (–106)	–102 (–106)	–111 (–114)
2 GHz to 6 GHz	–54 (–77)	–82 (–93)	–106 (–111)	–115 (–119)	–112 (–119)	–136 (–140)
>6 GHz to 10 GHz	–52 (–73)	–75 (–88)	–102 (–109)	–113 (–119)	–115 (–120)	–134 (–140)
>10 GHz to 20 GHz	–52 (–66)	–69 (–82)	–100 (–105)	–109 (–115)	–109 (–115)	–130 (–137)
>20 GHz to 40 GHz	–45 (–59)	–63 (–75)	–94 (–98)	–104 (–108)	–103 (–109)	–122 (–131)
>40 GHz to 67 GHz	–40 (–51)	–58 (–68)	–89 (–91)	–97 (–103)	–97 (–103)	–118 (–125)

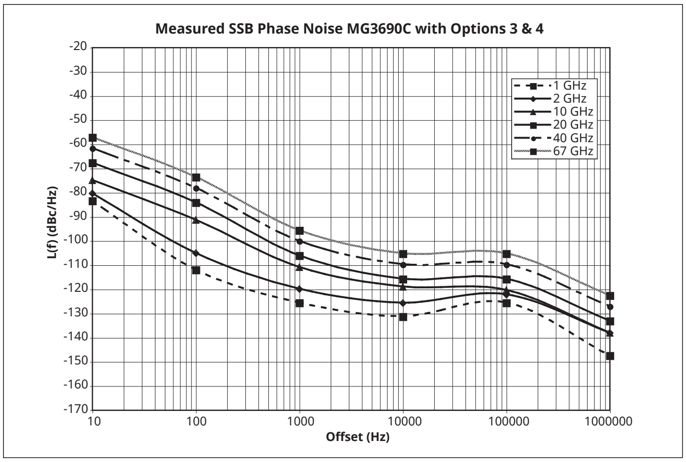
Single-Sideband Phase Noise (dBc/Hz) - Option 3X: (Typ.)

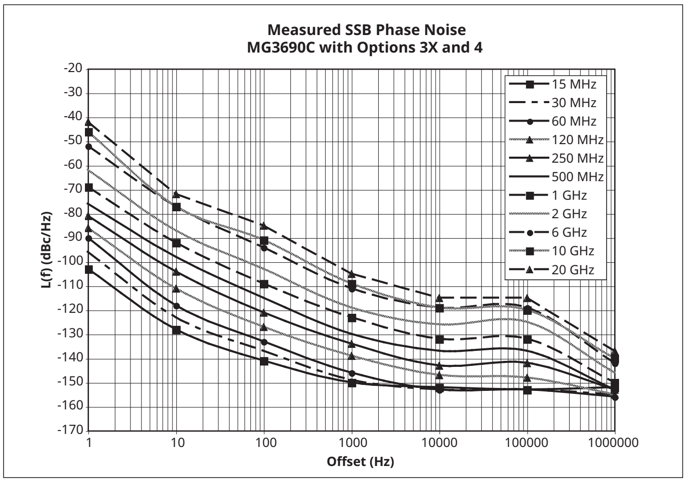
Frequency Range	Offset from Carrier						
	1 Hz	10 Hz	100 Hz	1 kHz*	10 kHz*	100 kHz	1 MHz
10 MHz to 15.625 MHz (Option 4)	–94 (–103)	–118 (–128)	–136 (–141)	–142 (–150)	–145 (–152)	–148 (–153)	–148 (–152)
>15.625 MHz to 31.25 MHz (Option 4)	–88 (–96)	–113 (–123)	–130 (–137)	–142 (–149)	–145 (–153)	–148 (–153)	–148 (–155)
>31.25 MHz to 62.5 MHz (Option 4)	–83 (–90)	–109 (–118)	–125 (–133)	–140 (–146)	–145 (–153)	–148 (–153)	–148 (–156)
>62.5 MHz to 125 MHz (Option 4)	–77 (–86)	–103 (–111)	–119 (–127)	–134 (–139)	–142 (–147)	–143 (–148)	–148 (–155)
>125 MHz to 250 MHz (Option 4)	–71 (–81)	–97 (–104)	–113 (–121)	–129 (–134)	–138 (–143)	–137 (–142)	–148 (–153)
>250 MHz to 500 MHz (Option 4)	–67 (–76)	–91 (–98)	–107 (–115)	–124 (–130)	–132 (–137)	–128 (–137)	–144 (–153)
>500 MHz to 1050 MHz (Option 4)	–60 (–69)	–84 (–92)	–101 (–109)	–119 (–123)	–126 (–132)	–122 (–132)	–139 (–150)
>1050 MHz to 2200 MHz (Option 4)	–53 (–62)	–77 (–87)	–95 (–103)	–113 (–119)	–121 (–126)	–117 (–125)	–135 (–146)
10 MHz to <2000 MHz (Option 5)	–38 (–45)	–68 (–78)	–85 (–95)	–100 (–104)	–102 (–106)	–102 (–106)	–111 (–114)
2 GHz to 6 GHz	–46 (–52)	–70 (–77)	–86 (–94)	–106 (–111)	–115 (–119)	–112 (–119)	–136 (–140)
>6 GHz to 10 GHz	–38 (–46)	–68 (–77)	–83 (–91)	–102 (–109)	–113 (–119)	–115 (–120)	–134 (–140)
>10 GHz to 20 GHz	–35 (–42)	–64 (–72)	–80 (–85)	–100 (–105)	–109 (–115)	–109 (–115)	–130 (–137)
>20 GHz to 40 GHz	–29 (–36)	–58 (–65)	–74 (–79)	–94 (–98)	–104 (–108)	–103 (–109)	–122 (–131)
>40 GHz to 67 GHz	–23 (–30)	–53 (–59)	–69 (–73)	–89 (–91)	–97 (–103)	–97 (–103)	–118 (–125)

*: When fitted with Option 36 and when multiple units are connected for purposes of Ultra-Stable Phase Tracking, phase noise may be degraded by up to 4 dB at 1 kHz and 10 kHz offsets.

Typical MG3690C single sideband phase noise at 10 GHz carrier.







RF Output

Power level specifications apply at 25°C±10°C.

Maximum Leveled Output Power

Model Number	Configuration	Frequency Range (GHz)	Output Power (dBm)	Output Power with Step Attenuator (dBm)
MG3695C	w/opt 4 or 5	<2*1	+12	+10
	STD	≥2*2 to ≤20	+10	+8
	STD	>20 to ≤40	+6	+3
	STD	>40 to ≤50	+3	+0
MG3697C	w/opt 4 or 5	<2*1	+12	+10
	STD	≥2*2 to ≤20	+10	+8
	STD	>20 to ≤40	+6	+3
	STD	>40 to ≤67	+3	+0*3

*1: ≤2.2 GHz with Option 4
*2: >2.2 GHz with Option 4
*3: Typical 60 GHz to 67 GHz

Minimum Settable Power	Without an Attenuator	–20 dBm
	With an Attenuator	–120 dBm
Minimum Leveled Output Power	Without an Attenuator	–15 dBm (–20 dBm, typ.)
	With an Attenuator	–105 dBm (MG3695C and MG3697C)
Unleveled Output Power Range (Typ.)	Without an Attenuator	>40 dB below max. power
	With an Attenuator	>130 dB below max. power
Power Level Switching Time (to within specified accuracy)	Without Change in Step Attenuator	<3 ms (typ.)
	With Change in Step Attenuator	<20 ms (typ.)
	With Change in Electronic Step Attenuator	<3 ms (typ.) Power level changes across –70 dB step will result in 20 ms delay
Step Attenuator (Option 2)	Adds a 10 dB/step attenuator with 90 dB range.	

Accuracy and Flatness	Flatness is included within the accuracy specification	
	Step Sweep and CW Modes	Attenuation Below Max. Power

Accuracy	Frequency Range			
	≤40 GHz*2	40 GHz to 50 GHz	50 GHz to 60 GHz	60 GHz to 67 GHz
0 to 25 dB	±1.0 dB	±1.5 dB	±1.5 dB	±1.5 dB
25 to 60 dB	±1.0 dB	±1.5 dB	±3.5 dB*1	N/A
60 to 100 dB	±1.0 dB	±2.5 dB*1	±3.5 dB*1	N/A

Flatness	Frequency Range			
	≤40 GHz*2	40 GHz to 50 GHz	50 GHz to 60 GHz	60 GHz to 67 GHz
0 to 25 dB	±0.8 dB	±1.1 dB	±1.1 dB	±1.1 dB
25 to 60 dB	±0.8 dB	±1.1 dB	±3.1 dB*1	N/A
60 to 100 dB	±0.8 dB	±2.1 dB*1	±3.1 dB*1	N/A

Accuracy and Flatness	Analog Sweep Mode (typ.)	Attenuation Below Max. power

Accuracy	Frequency Range			
	0.01 GHz to 0.05 GHz	0.05 GHz to 20 GHz	20 GHz to 40 GHz	40 GHz to 67 GHz
0 to 12 dB	±2.0 dB	±2.0 dB	±2.0 dB	±3.0 dB
12 to 30 dB	±3.5 dB	±3.5 dB	±4.6 dB	±5.6 dB
30 to 60 dB	±4.0 dB	±4.0 dB	±5.2 dB	±6.2 dB
60 to 122 dB	±5.0 dB	±5.0 dB	±6.2 dB	±7.2 dB

Flatness	Frequency Range			
	0.01 GHz to 0.05 GHz	0.05 GHz to 20 GHz	20 GHz to 40 GHz	40 GHz to 67 GHz
0 to 12 dB	±2.0 dB	±2.0 dB	±2.0 dB	±2.5 dB
12 to 30 dB	±3.5 dB	±3.5 dB	±4.1 dB	±5.1 dB
30 to 60 dB	±4.0 dB	±4.0 dB	±4.6 dB	±5.6 dB
60 to 122 dB	±5.0 dB	±5.0 dB	±5.2 dB	±6.2 dB

Other RF Output Power Specifications	Output Units	Output units selectable as either dBm or mV. Selection of mV assumes 50Ω load. All data entry and display are in the selected units.
	Output Power Resolution	0.01 dB or 0.001 mV
	Source Impedance	50Ω (nom.)
	Source SWR (Internal Leveling)	<2.0 (typ.)
	Power Level Stability with Temperature	±0.04 dB/°C (typ.)
	Level Offset	Offsets the displayed power level to establish a new reference level
	Output On/Off	Toggles the RF output between an Off and On state. During the Off state, the RF oscillator is turned off. The On or Off state is indicated by two LEDs located below the OUTPUT ON/OFF key on the front panel
	RF On/Off Between Frequency Steps	System menu selection of RF On or RF Off during frequency switching in CW, Step Sweep, and List Sweep modes
	RF On/Off During Retrace	System menu selection of RF On or RF Off during retrace
	Internal Leveling	Power is leveled at the output connector in all modes
	External Leveling	External Detector: Levels output power at a remote detector location. Accepts a positive or negative 0.5 mV to 500 mV input signal from the remote detector. L1 adjusts the input signal range to an optimum value. BNC connector, rear panel. External Power Meter: Levels output power at a remote power meter location. Accepts a ±1 V full scale input signal from the remote power meter. L1 adjusts the input signal range to an optimum value. BNC connector, rear panel. External Leveling Bandwidth: 30 kHz (typ.) in Detector mode. 0.7 Hz (typ.) in Power Meter mode. User Level Flatness Correction Number of points: 2 to 801 points per table Number of tables: 5 available Entry modes: GPIB power meter or computed data
CW Power Sweep	Range	Sweeps between any two power levels at a single CW frequency
	Resolution	0.01 dB/step (Log) or 0.001 mV (Linear)
	Accuracy	Same as CW power accuracy
	Log/Linear Sweep	Power sweep selectable as either log or linear. Log sweep is in dB; linear sweep is in mV.
	Step Size	User-controlled, 0.01 dB (Log) or 0.001 mV (Linear) to the full power range of the instrument
	Step Dwell Time	Variable from 1 ms to 99 seconds. If the sweep crosses a step attenuator setting, there will be a sweep dwell of approximately 20 ms to allow setting of the step attenuator.
Sweep Frequency/Step Power		A power level step occurs after each frequency sweep. Power level remains constant for the length of time required to complete each sweep.

*1: Typical

*2: Accuracy and Flatness is ±1.5 dB below 20 MHz.

Frequency/Phase Modulation (Option 12)

Option 12 adds frequency and phase modulation, driven externally via a rear panel BNC connector, 50Ω. For internal modulation, add Internal LF and Pulse Generators Option 27.
For the most accurate FM and ΦM measurements, Bessel Null methods are used. When verifying FM and ΦM, the use of the "carrier null" technique is recommended. Measured residual FM effects must be subtracted from modulation meter measurements.

	Frequency Range	Divide Ratio, n
Frequency Generator Multiplication/Division Ratios	≥10 MHz to ≤15.625 MHz (Option 4)	256
	>15.625 MHz to ≤31.25 MHz (Option 4)	128
	>31.25 MHz to ≤62.5 MHz (Option 4)	64
	>62.5 MHz to ≤125 MHz (Option 4)	32
	>125 MHz to ≤250 MHz (Option 4)	16
	>250 MHz to ≤500 MHz (Option 4)	8
	>500 MHz to ≤1050 MHz (Option 4)	4
	>1050 MHz to ≤2200 MHz (Option 4)	2
	>10 MHz to ≤2000 MHz (Option 5)	1
	>2 GHz to ≤20 GHz	1
	>20 GHz to ≤40 GHz	1/2
	>40 GHz to ≤67 GHz	1/4

Frequency Modulation:

Parameter	Modes	Conditions	Specifications	Conditions	Specifications
		For all Frequencies other than <2.2 GHz with Option 4		For Frequencies <2.2 GHz with Option 4	
Deviation	Locked	Rate = 1 kHz to 8 MHz	± [Lesser of 10 MHz or (300 * mod rate)]/n	Rate = 1 kHz to Lesser of 8 MHz or (0.03 * $F_{carrier}$)	± [Lesser of 10 MHz or (300 * mod rate)]/n
	Locked Low-noise	Rate = 50 kHz to 8 MHz	± [Lesser of 10 MHz or (3 * mod rate)]/n	Rate = 50 kHz to Lesser of 8 MHz or (0.03 * $F_{carrier}$)	± [Lesser of 10 MHz or (3 * mod rate)]/n
	Unlocked Narrow	Rate = DC to 8 MHz	±10 MHz/n	Rate = DC to Lesser of 8 MHz or (0.03 * $F_{carrier}$)	±10 MHz/n
	Unlocked Wide	Rate = DC to 100 Hz	±100 MHz/n	Rate = DC to 100 Hz	±100 MHz/n
Bandwidth (3 dB)	Locked		1 kHz to 10 MHz		1 kHz to Lesser of 10 MHz or (0.03 * $F_{carrier}$)
	Locked Low-noise		30 kHz to 10 MHz		30 kHz to Lesser of 8 MHz or (0.03 * $F_{carrier}$)
	Unlocked Narrow		DC to 10 MHz		DC to Lesser of 10 MHz or (0.03 * $F_{carrier}$)
	Unlocked Wide		DC to 100 Hz		DC to 100 Hz
Flatness	Locked	Rate = 10 kHz to 1 MHz	±1 dB relative to 100 kHz	Rate = 10 kHz to Lesser of 1 MHz or (0.01 * $F_{carrier}$)	±1 dB relative to 100 kHz
Deviation Accuracy	Locked and Low-noise Unlocked Narrow	Rate = 100 kHz sinewave Int. or 1 V_{pk} Ext.	10% (5% typ.)	Rate = 100 kHz sinewave Int. or 1 Vpk Ext.	10% (5% typ.)
Incidental AM	Locked and Low-noise Unlocked Narrow	1 MHz Rate, ±1 MHz Dev.	<2% (typ.)	Rate and Dev. = Lesser of 1 MHz or (0.01 * $F_{carrier}$)	<2% (typ.)
Harmonic Distortion	Locked	10 kHz Rate, ±1 MHz Dev.	<1%	Rate = 10 kHz, Dev.= ±1 MHz/n	<1%
External Sensitivity	Locked Locked Low-noise Unlocked Narrow Unlocked Wide	±1 V maximum input	± (10 kHz/V to 20 MHz/V)/n ± (10 kHz/V to 20 MHz/V)/n ± (10 kHz/V to 20 MHz/V)/n ± (100 kHz/V to 100 MHz/V)/n	±1 V_{pk} maximum input	± (10 kHz/V to 20 MHz/V)/n ± (10 kHz/V to 20 MHz/V)/n ± (10 kHz/V to 20 MHz/V)/n ± (100 kHz/V to 100 MHz/V)/n

Phase Modulation:

Parameter	Modes	Conditions	Specifications	Conditions	Specifications
		For all Frequencies other than <2.2 GHz with Option 4		For Frequencies <2.2 GHz with Option 4	
Deviation	Narrow	Rate = DC to 8 MHz	± [Lesser of 3 rad or (5 MHz/mod rate)]/n	Rate = DC to Lesser of 8 MHz or (0.03 * $F_{carrier}$)	± [Lesser of 3 rad or (5 MHz/mod rate)]/n
	Wide	Rate = DC to 1 MHz	± [Lesser of 400 rad or (10 MHz/mod rate)]/n	Rate = DC to Lesser of 1 MHz or (0.03 * $F_{carrier}$)	± [Lesser of 400 rad or (10 MHz/mod rate)]/n
Bandwidth (3 dB)	Narrow		DC to 10 MHz		DC to Lesser of 10 MHz or (0.03 * $F_{carrier}$)
	Wide		DC to 1 MHz		DC to Lesser of 1 MHz or (0.03 * $F_{carrier}$)
Flatness	Narrow	Rate = DC to 1 MHz	±1 dB relative to 100 kHz	Rate = DC to Lesser of 1 MHz or (0.01 * $F_{carrier}$)	±1 dB relative to 100 kHz rate
	Wide	Rate = DC to 500 kHz	±1 dB relative to 100 kHz	Rate = DC to Lesser of 500 kHz or (0.01 * $F_{carrier}$)	±1 dB relative to 100 kHz rate
Accuracy	Narrow and Wide	100 kHz Internal or 1 V_{pk} External, sine	10%	100 kHz Internal or 1 V_{pk} External, sine	10%
External Sensitivity	Narrow Wide	±1 V maximum input	± (0.0025 rad/V to 5 rad/V)/n ± (0.25 rad/V to 500 rad/V)/n	±1 V_{pk} maximum input	± (0.0025 rad/V to 5 rad/V)/n ± (0.25 rad/V to 500 rad/V)/n

Amplitude Modulation (Option 14)

Option 14 adds amplitude modulation, driven externally via a rear panel BNC connector 50Ω. For internal modulation, add Internal LF and Pulse Generators Option 27. All amplitude modulation specifications apply at 50% depth, 1 kHz rate, with RF level set 6 dB below maximum specified leveled output power, unless otherwise noted.

AM Depth (typ.)	0 to 90% linear; 20 dB log
AM Bandwidth (3 dB)*	DC to 50 kHz minimum, DC to 100 kHz (typ.)
Flatness (DC to 10 kHz rates)	±0.3 dB
Accuracy	Reading ±5%
Distortion	<5% (typ.)
Incidental Phase Modulation (30% depth, 10 kHz rate)	<0.2 radians (typ.)
External AM Input	Log AM or Linear AM input, rear panel BNC (50Ω input impedance). For internal modulation, add LF Generator Option 27. Sensitivity Log AM: Continuously variable from 0 dB per volt to 25 dB per volt. Linear AM: Continuously variable from 0% per volt to 100% per volt. Maximum Input: ±1 V_{pk}

*: Typical below 2.2 GHz, when ordered with Options 4 and 15.

Pulse Modulation (Option 26)

Option 26 adds pulse modulation, driven externally via a rear panel BNC connector, TTL. For internal modulation, add Internal LF and Pulse Generators Option 27. Pulse modulation specifications apply at maximum rated power, unless otherwise noted.

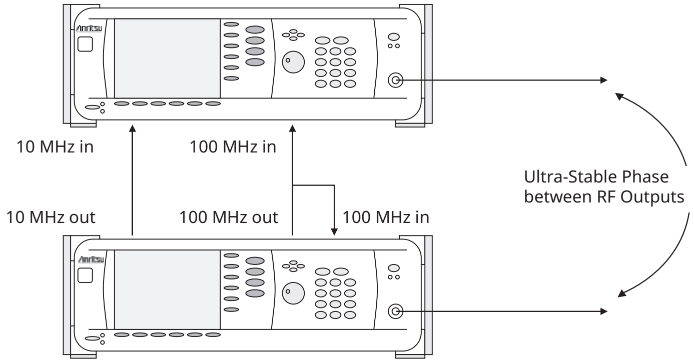
On/Off Ratio	>70 dB with Option 4 or 5 and without Option 2 at 500 MHz			
Minimum Leveled Pulse Width	100 ns, ≥1 GHz 1 μs, <1 GHz			
Minimum Unleveled Pulse Width	<10 ns			
Level Accuracy Relative to CW (100 Hz to 1 MHz PRF)	±0.5 dB, ≥1 μs pulse width ±1.0 dB, <1 μs pulse width			
Pulse Delay (typ.)	External Mode: 50 ns			
PRF Range	DC to 10 MHz, unleveled 100 Hz to 5 MHz, leveled			
Frequency Range	Rise & Fall Time (10 to 90%)	Overshoot	Pulse Width Compression*1	Video Feedthrough*1
≥10 to <31.25 MHz (Option 4)	400 ns*1	33%*1	40 ns	±70 mV
≥31.25 to <125 MHz (Option 4)	90 ns*1	22%*1	12 ns	±130 mV
≥125 to <500 MHz (Option 4)	33 ns*1	11%*1	12 ns	±70 mV
≥500 to <2200 MHz (Option 4)	15 ns	10%*1	12 ns	±50 mV
≥10 to <1000 MHz (Option 5)	15 ns/10 ns*1	10%*1	8 ns	±30 mV
≥1 to <2 GHz (Option 5)	10 ns/5 ns*1	10%*1	8 ns	±30 mV
≥2 to ≤67 GHz*2	10 ns/5 ns*1	10%*3	8 ns	±30 mV
External Input	Rear panel BNC. For internal modulation, add Pulse Generator Option 27. Drive Level: TTL compatible input Input Logic: Positive-true or negative-true, selectable from modulation menu.			

*1: Typical
*2: Rise time and Pulse Width Compression, >20 GHz.
*3: For 50 and 67 GHz units, overshoot >40 GHz is 20% typical at rated power.

Ultra-Stable Phase Tracking (Option 36)

Option 36 enables up to three MG3690C units fitted with option 3 or 3X to phase track with a very high degree of stability. Option 36 provides additional rear panel connectors to link internal reference signals together.

100 MHz Reference Output	Provides the reference signal to drive up to two other MG3690C. All must have Option 36 and either Option 3 or 3x. This signal is only intended for use with other Option 36 instruments.
100 MHz Reference Input	Accepts the 100 MHz reference signal from another MG3690C fitted with Option 36. This input is only intended for use with other Option 36 instruments.
Phase Drift	<±1° over 5 seconds (typ.); <±1.5° over 100 seconds (typ.), after 24 hours warm-up time



Internal LF and Pulse Generators (Option 27)

An internal pulse generator and two internal waveform generators are added, one providing a frequency or phase modulating signal and the other an amplitude modulating signal. This Internal LF and Pulse Generators option can only be ordered in combination with either FM/ΦM, AM, or Pulse options 12, 14, and 26 respectively.

Waveforms	Sinusoid, square-wave, triangle, positive ramp, negative ramp, Gaussian noise, uniform noise. (Check Option 10 for User-Defined)	
Rate	0.1 Hz to 10 MHz sinusoidal 0.1 Hz to 100 kHz square-wave, triangle, ramps	
Resolution	0.1 Hz	
Accuracy	Same as instrument timebase ±0.014 Hz	
Waveform Output	Two BNC connectors on the rear panel, FM/ΦM OUT and AM OUT	
Pulse Triggers	Free run, triggered, gated, delayed, triggered with delay, swept-delay	
Pulse Modes	Singlet, doublet, triplet, quadruplet.	
Pulse Parameter	Selectable Clock Rate	
	Narrow (100 MHz)	Wide (10 MHz)
Pulse Width	10 ns to 160 ms	100 ns to 1.6 s
Pulse Period*	100 ns to 160 ms	600 ns to 1.6 s
Variable Delay		
Singlet	0 to 160 ms	0 to 1.6 s
Doublet	100 ns to 160 ms	300 ns to 1.6 s
Triplet	100 ns to 160 ms	300 ns to 1.6 s
Quadruplet	100 ns to 160 ms	300 ns to 1.6 s
Resolution	10 ns	100 ns
Accuracy	10 ns (5 ns, typ.)	
Pulse Inputs/Outputs	Video pulse and sync out, rear panel BNC connectors	

*: Period must be longer than the sum of delay and width by 5 clock cycles minimum.

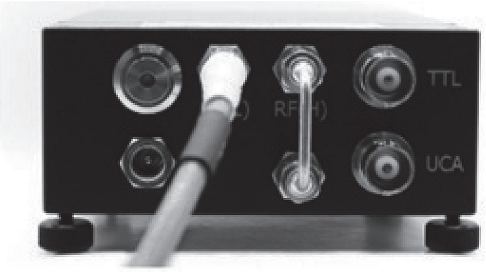
Millimeter-wave Frequency Coverage

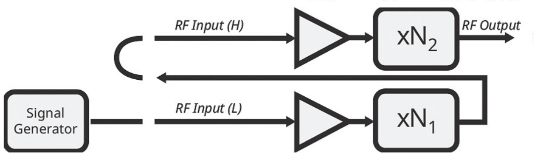
Millimeter-wave Multiplier 2000-2087-R Through 2000-2098-R Series

2000-2087-R through 2000-2098-R series of waveguide output multipliers are available for banded frequency coverage from 50 GHz (WR15) to 1.1 THz (WR1.0). These modules offer high test port power, voltage-controlled RF attenuation, and TTL controlled ON/OFF modulation rates to a few kHz as standard. The frequency multiplier modules are intended to be used in CW mode and do not preserve AM, FM, and Phase modulation.

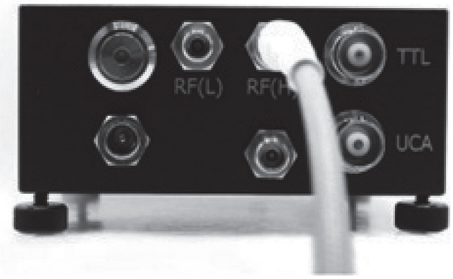
Frequency multiplier modules have two multipliers that can be configured to allow input signals in two frequency bands:

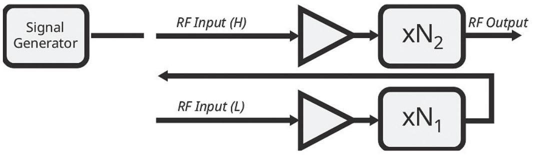
- Low frequency input for <20 GHz and 10 dBm input level
  In this configuration the RF output from the MG3690C is input into the K (f) input port on the rear panel of the multiplier module. The port is designated as RF (L). The low frequency band input configuration uses both N1 and N2 multipliers, as shown below.





- High frequency input for < 50 GHz and 0 dBm input level
  In this configuration the RF output from the MG3690C is input into the 2.4 mm (f) input port on the rear panel of the multiplier module. The port is designated as RF (H). The high frequency band input configuration uses an N2 multiplier, as shown below. This results in a lower multiplication factor and reduces unwanted harmonic signals within the band.





Specifications

General Specifications

Parameter	Description	Specification	Connector
RF Input*1, *2, *3	Low Frequency (Typical/Damage)	10 dBm ±3 dB/16 dBm	2.92 mm (f)
	High Frequency (Typical/Damage)	0 dBm ±3 dB/6 dBm	2.4 mm (f)
RF Output	VDI Precision Flange		UG-387/U-M
AC Inputs*4	Single-Volt Power Supply (+9 V/4 A)	100 VAC to 240 VAC, 3.5 A, 50 Hz to 60 Hz	U.S. or E.U.
RF Power Control	User Controlled Attenuation (UCA)	0 V-off, 5 V-full power	BNC (f)
Voltage Bias Port	For Use with External Components	+9 V	LEMO 00
Operating Temperature	Typical/Recommended	25°C/20°C to 30°C	
Maximum Weight		2.0 Lbs. (0.91 Kg.)	
Dimensions	Typical (Length × Width × Height)	5.00 × 3.50 × 1.50 inches	

*1: For low frequency operation a K120MM K(m) to K(m) cable should be ordered separately for use with MG3692C.

*2: For high frequency operation a V120MM V(m) to V(m) cable should be ordered separately for use with MG3695C.

*3: It is not recommended to use multiplier module in low frequency operation with MG3695C.

*4: It is recommended to turn the power ON only after all connections to the multiplier are made, such as RF input, AC inputs, and DC inputs. When turning power OFF, it is recommended to turn OFF the RF input from signal generator first, and then turn OFF/disconnect all other inputs and outputs of the multiplier.

Performance Specification

Parameter	Multiplier Model*5, *6, *7					
	2000-2087-R	2000-2088-R	2000-2089-R	2000-2090-R	2000-2091-R	2000-2092-R
Frequency Band (GHz)	WR-15	WR-12	WR-10	WR-8.0	WR-6.5	WR-5.1
Output Frequency*8,*9	50 GHz to 75 GHz	60 GHz to 90 GHz	75 GHz to 110 GHz	90 GHz to 140 GHz	110 GHz to 170 GHz	140 GHz to 220 GHz
Output Power (dBm Typical/ Minimum)	20/17	20/17	20/17	19/13	18/15	10/6
Multiplier Factors (Low/High Frequency)	6/3	6/3	6/3	12/6	12/6	12/6

Parameter	Multiplier Model*5, *6, *7					
	2000-2093-R	2000-2094-R	2000-2095-R	2000-2096-R	2000-2097-R	2000-2098-R
Frequency Band (GHz)	WR-4.3	WR-3.4	WR-2.8 (WM-710)	WR-2.2 (WM-570)	WR-1.5 (WM-380)	WR-1.0 (WM-250)
Output Frequency*8,*9	170 GHz to 260 GHz	220 GHz to 330 GHz	260 GHz to 400 GHz	330 GHz to 500 GHz	500 GHz to 750 GHz	750 GHz to 1100 GHz
Output Power (dBm Typical/ Minimum)	8/3	6/3	5/–1	0/–6	–7/–13	–16/–26
Multiplier Factors (Low/High Frequency)	18/6	18/9	27/9	36/18	54/18	81/27

*5: These millimeter-wave modules are produced by VDI Inc. located in Charlottesville, VA. For detailed and up-to-date specifications, please call VDI, Inc. or visit their website at http://www.vadiodes.com.

*6: Multipliers require power from an external power supply (+9 VDC, 4 A typical). The power supply adapter is a standard accessory and included with modules.

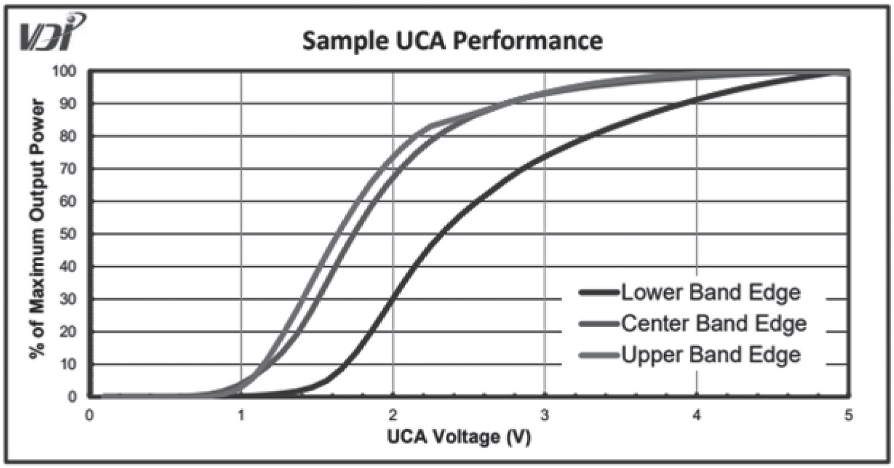
*7: Warranty period for 2000-2087-R through 2000-2098-R multiplier modules is one year.

*8: Unwanted harmonic content is better than -20 dBc typical.

*9: Frequency stability of input is degraded at the output by multiplier factor N (N1 x N2) and phase noise by 20log (N). For high frequency operation N1 = 1.

Output Attenuation

Frequency multiplier modules offer voltage-controlled RF output attenuation capability as standard. Users can input 0 to 5 V a DC voltage from an external source into the BNC connector on the rear panel designated as UCA. The output power can be varied from 90% to 10% through the UCA port. A sample curve of UCA control voltage vs. output power is shown below. The curve is subject to some variation due to measurement conditions, such as temperature and load impedance, and should be considered as representative only.



Inputs and Outputs*1

EXT ALC IN	Provides for leveling the RF output signal externally with either a detector or power meter. Signal requirements are shown in the RF Output specifications.
RF OUTPUT (Option 9)*2	Provides for RF output from 50Ω source impedance. Option 9 moves the RF Output connector to the rear panel. V Connector (female) f_{max} >50 GHz.
10 MHz REF IN	Accepts an external 10 MHz ±50 Hz, 0 to +20 dBm time-base signal. Automatically disconnects the internal high-stability time-base option, if installed. 50Ω impedance. BNC type, rear panel.
10 MHz REF OUT	Provides a 1 V_{p-p}, AC coupled, 10 MHz signal derived from the internal frequency standard. 50Ω impedance. BNC type, rear panel.
100 MHz REF IN (Option 36)	Accepts the 100 MHz signal from an MG3690C with Option 36 for ultra-stable phase tracking.
100 MHz REF OUT (Option 36)	Provides the 100 MHz signal for an MG3690C with Option 36 ultra-stable phase tracking.
HORIZ OUT (Horizontal Sweep Output)	Provides 0 V at beginning and +10 V at end of sweep, regardless of sweep width. In CW mode, the voltage is proportional to frequency between 0 V at low end and +10 V at the high end of range. In CW mode, if CW RAMP is enabled, a repetitive, 0 to +10 V ramp is provided. BNC type, rear panel.
EFC IN	Provides the capability to frequency modulate the internal crystal oscillator, allowing phase locking the synthesizer inside an external lock loop. BNC type, rear panel.
AUX I/O (Auxiliary Input/Output)	Provides for most of the rear panel BNC connections through a single, 25-pin, D-type connector. Supports primary-secondary operation with another synthesizer or allows for a single-cable interface with the Model Scalar Network Analyzer 56100A and other Anritsu instruments. Also provides an Ethernet factory default IP address reset function via pin 19. 25 pin D-type, rear panel.
SERIAL I/O (Serial Input/Output)	Provides access to RS-232 terminal ports to support service and calibration functions and Primary/Secondary operations. RJ45 type, rear panel.
ETHERNET (10/100 Base-T LAN) I/O	Provides input/output connections for Ethernet interface. RJ45 type, rear panel.
IEEE-488 GPIB	Provides input/output connections for the General Purpose Interface Bus (GPIB). Type 57, rear panel.
PULSE TRIG IN (Option 26)	Accepts an external TTL compatible signal to pulse modulate the RF output signal or to trigger or to gate the optional internal pulse generator. BNC type, rear panel.
PULSE SYNC OUT (Option 27)	Provides a TTL compatible signal, synchronized to the internal pulse modulation output. BNC type, rear panel.
PULSE VIDEO OUT (Option 27)	Provides a video modulating signal from the internal pulse generator. BNC type, rear panel.
AM IN (Option 14)	Accepts an external signal to amplitude modulate the RF output signal. 50Ω impedance. BNC type, rear panel.
FM/ΦM IN (Option 12)	Accepts an external signal to frequency or phase modulate the RF output signal. 50Ω impedance. BNC type, rear panel.
AM OUT (Option 27)	Provides the amplitude modulation waveform from the internal LF generator. BNC type, rear panel.
FM/ΦM OUT (Option 27)	Provides the frequency or phase modulation waveform from the internal LF generator,. BNC type, rear panel.

*1: Connectors may be available but not active if option not ordered.
*2: Options (7), (8 & 9) are mutually exclusive, as they share the same rear panel space.

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MG3695C	2 GHz to 50 GHz CW Generator
MG3697C	2 GHz to 67 GHz CW Generator (operational to 70 GHz)
	Standard Accessories (included)
11410-00976	Product documentation and software brochure
2000-1732-R	CAT-7 shielded, twisted-pair, Ethernet cable, 10 ft.
	Miscellaneous
	Power cord with plug-type and rating determine by destination country. 3 year factory warranty Options and Accessories. 2 year factory warranty for 2000-1694-R series.
	Options and Accessories
MG3690C/1A	Rack Mount with slides – Rack mount kit containing a set of track slides, mounting ears, and front panel handles to let the instrument be mounted in a standard 19-inch equipment rack.
MG3690C/1B	Rack Mount without slides – Modifies rack mounting hardware to install unit in a console that has mounting shelves. Includes mounting ears and front panel handles.
MG3690C/2X	Mechanical Step Attenuator – Adds a 10 dB/step attenuator. Rated RF output power is reduced. (This option comes in different versions, based on instrument configuration.)
MG3690C/3[*1]	Ultra Low Phase Noise – Adds new modules to significantly reduce SSB phase noise. (Not available with Option 3X.)
MG3690C/3X[*1]	Premium Phase Noise, improves Option 3 (<1 kHz offset). (Not available with Option 3)
MG3690C/4	8 MHz to 2.2 GHz RF coverage, Ultra-Low Phase Noise version – Uses a digital down converter to significantly reduce SSB phase noise.[*2]
MG3690C/5	8 MHz to 2 GHz RF coverage – Uses an analog down converter.[*2]
MG3690C/6	Analog Sweep Capability (limited to ≥500 MHz when used with Option 4)
MG3690C/9X	Rear Panel Output – Moves the RF output connector to the rear panel. (This option comes in different versions, based on instrument configuration.)
MG3690C/10	User-Defined Modulation Waveform Software – External software package provides the ability to download user-defined waveforms into the memory of the internal waveform generator, serially or via GPIB. External PC and an instrument with LF Generator, Option 27, are required. This external software package can only be used with Option 10 enabled instruments.
MG3690C/12	Frequency and Phase Modulation – External, via a rear panel BNC connector. For internal modulation capability, requires additionally LF Generator, Option 27.
MG3690C/14	Amplitude Modulation – External, via a rear panel BNC connector. For internal modulation capability, requires additionally LF Generator, Option 27.
MG3690C/16	High Stability Time Base – Adds an ovenized, 10 MHz crystal oscillator as a high-stability time base.
MG3690C/17	Delete Front Panel – Deletes the front panel for use in remote control applications where a front panel display and keyboard control are not needed.
MG3690C/26X[*3]	Pulse Modulation – External, via a rear panel BNC connector. For internal modulation capability, requires additionally Pulse Generator, Option 27. (This option comes in different versions, based on instrument configuration.)
MG3690C/27	Internal LF and Pulse Generators – Provides modulation waveforms for internal AM, FM, FM, and Pulse. (Not available without Option 12, 14, or 26.)
MG3690C/28X[*3]	Analog Modulation Suite – For ease of ordering and package pricing, this option bundles Options 12, 14, 26 and 27, offering internaland external AM, FM, ΦM, and Pulse Modulation. (This option comes in different versions, based on instrument configuration.)
MG3690C/36	Ultra-Stable Phase Tracking - Provides the capability for ultra-stable phase tracking between instruments using the internal 100 MHz reference. (Requires Option 3 or 3X)
MG3690C/CE	CE Compliance with CE mark.
MG3690C/98	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1 Provides a calibration certificate, decal, and "Calibration void if removed" tamper seals.
MG3690C/99	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1 Provides everything included with Option 98 plus test report and uncertainty data.

Model/Order No.	Name
	Accessories
ND36329	Primary/Secondary Interface Cable Set
63270	Transit Case
2300-469	IVI Driver, includes LabView® driver
806-97	Aux I/O Cable, 25 pin to BNC: Provides BNC access to V/GHz and Sequential Sync connections and other AUX I/O data lines
	Multiplier Model Output Frequency[*4, *5, *6, *7, *8]
2000-2087-R	50 GHz to 75 GHz
2000-2088-R	60 GHz to 90 GHz
2000-2089-R	75 GHz to 110 GHz
2000-2090-R	90 GHz to 140 GHz
2000-2091-R	110 GHz to 170 GHz
2000-2092-R	140 GHz to 220 GHz
2000-2093-R	170 GHz to 260 GHz
2000-2094-R	220 GHz to 330 GHz
2000-2095-R	260 GHz to 400 GHz
2000-2096-R	330 GHz to 500 GHz
2000-2097-R	500 GHz to 750 GHz
2000-2098-R	750 GHz to 1100 GHz
	Upgrades Economical upgrades are available to upgrade any model to any higher performing model. Consult Anritsu for details.

*1: Phase Noise performance is controlled by United States Export Control regulations. For solutions that do not require export licences, please consult your Anritsu Sales Representative.

*2: All specifications for Options 4 and 5 apply ≥10 MHz.

*3: Pulse Modulation performance is controlled by United States Export Control regulations, >31.8 GHz. For Pulse Modulation solutions that do not require export licenses, please consult with your Anritsu sales representative.

*4: These millimeter-wave modules are produced by VDI Inc. located in Charlottesville, VA. For detailed and up-to-date specifications, please call VDI, Inc. or visit their website at http://www.vadiodes.com.

*5: Multipliers require power from an external power supply (+9 VDC, 4 A typical). The power supply adapter is a standard accessory and included with modules.

*6: Warranty period for 2000-2087-R through 2000-2098-R multiplier modules is one year.

*7: Unwanted harmonic content is better than -20 dBc typical.

*8: Frequency stability of input is degraded at the output by multiplier factor N (N1 x N2) and phase noise by 20log(N). For high frequency operation N1 = 1.

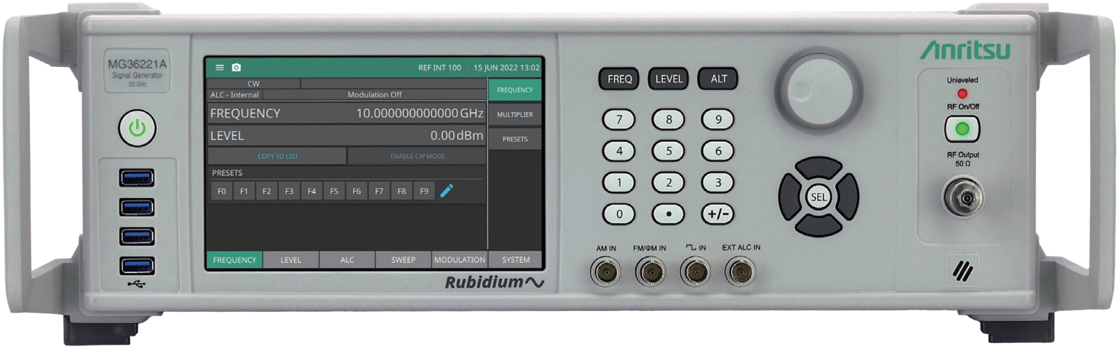
RF/Microwave Signal Generator

MG362x1A Series

9 kHz to 43.5 GHz/1.1 THz

Remote Control
GPIB | Ethernet | USB

Pushing Signal Purity and Frequency Stability to New Levels



Pushing Signal Purity and Frequency Stability to New Levels

Signal purity and frequency stability are core performance metrics that mark excellence of any RF/Microwave signal generator. Anritsu's new Rubidium MG362x1A signal generator product line pushes the performance envelope of signal purity and frequency stability to new levels that are unmatched in the industry. With best in class output power, low harmonic, and spurious, Rubidium offers offers exceptional value and overall utility to customers.

The Rubidium MG362x1A standard phase noise outperforms competition by a substantial margin. Two additional tiers of phase noise performance on top of the standard phase noise performance are offered as options. The low phase noise option delivers improved close in phase noise along with better frequency stability. The ultra-low phase noise option provides improved phase noise at higher offsets. For CW only applications between 2 GHz to 20 GHz, Rubidium provides an even lower phase noise than the ultra-low phase noise option, allowing for another 3 dB improvement on a separate RF output port at the back panel.

The low noise RF/microwave signal generator Rubidium MG362x1A offers atomic clock frequency stability with an internal rubidium frequency reference option. Alternatively, customers can get exceptional frequency stability by locking an internal oven controlled crystal (OCXO) reference to an external GNSS signal. The exceptional frequency stability coupled with low phase noise performance makes the Rubidium MG362x1A the ideal choice for many measurement applications.

The Rubidium MG362x1A modulation capabilities include amplitude, frequency, phase, and pulse modulation to address simple to complex signal simulation requirements. It offers very comprehensive pulse generation capabilities to test pulsed radar systems. It also supports Anritsu's CW power sensors.

The Rubidium MG362x1A is housed in a 3U chassis with a 7-inch touch screen on the front panel and traditional keypad/dial interface. The Rubidium MG362x1A offers a high degree of configurability through a wide range of options to achieve optimum cost to function tradeoffs for the customers.

Key Features

- Exceptionally low single sideband SSB phase noise of –136 dBc/Hz (typical) and –140 dBc/Hz (measured) at 10 GHz and 10 kHz offset
- High output power with low spurious eliminates need for external power amplification
- Very low harmonic of <–58 dBc and spurious <–63 dBc
- Atomic clock frequency stability of <8E-12 Allan deviation (over 100 sec), aging rate <1E-9 per year, with T&M grade phase noise
- Extended millimeter-Wave (mmWave) frequency coverage up to 1.1 THz with external multipliers
- Wide range of interfaces for remote control such as 6 × USB 3.0, 1 × 10/100/1000 Ethernet, 1 × GPIB
- Industry standard IVI.NET and IVI-C drivers and SCPI support for remote instrument control
- Easy to navigate GUI that supports a new 7-inch touch screen and traditional front panel keypad/dial
- Pulsed radar signal simulation with comprehensive narrow pulse generation capability

Outstanding Signal Purity

SSB Phase noise is the most important measure of signal purity in a signal generator. Phase noise of the standard Rubidium signal generator outperforms phase noise offered by most signal generators in the market today with a robust margin. Additionally, Rubidium offers two low phase noise options which provide performance that is unmatched in the market:

1. Low Phase Noise (Option 3): This option enhances close in phase noise (<1 kHz) performance and frequency stability of the Rubidium standard unit. Low close in phase noise is critical in many measurement applications such as testing doppler radars that detect very slow moving targets.
2. Ultra-Low Phase Noise (Option 13): This option offers the best phase noise across the entire range of offsets from 10 Hz to 100 MHz. Phase noise across the entire range of offsets yields superior integrated phase noise which is important when the signal generator is used as a local oscillator (LO) source for testing up/down converters or when used as a clock source to test ADCs/DACs.

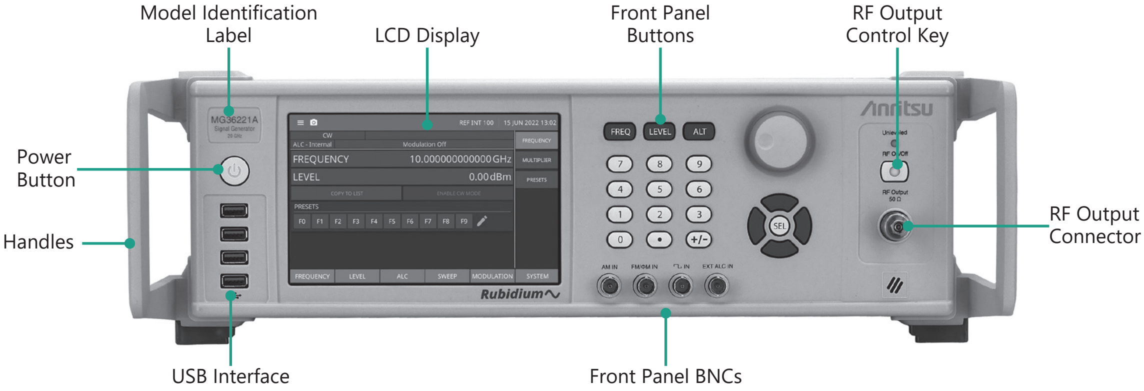
Rubidium MG362x1A Signal Generator Key Specifications

Parameter	Specification
Frequency Range	9 kHz to 20/43.5 GHz (Up to 1.1 THz with external multipliers)
Frequency Resolution	0.001 Hz
SSB Phase Noise	–136 dBc/Hz (typical) and –140 dBc/Hz (measured) @ 10 GHz output, 10 kHz offset
Internal Time Base Stability – Aging	$< \pm 5 \times 10^{-7}$ Standard $< \pm 2 \times 10^{-8}$ per year with Option 3 $< \pm 1 \times 10^{-9}$ per year with Option 56
Reference Output Frequency	10 MHz, 100 MHz, and 1.6 GHz
Output Power	–130 to +20 dBm (20 GHz, standard option) –130 to +18 dBm (43.5 GHz, standard option)
Level Accuracy and Flatness	±1 dB (40 GHz)
Harmonics (9 kHz to 20/43.5 GHz)	–58 dBc
Non Harmonics (9 kHz to 20/43.5 GHz)	–63 dBc
Modulation	AM, FM, PM, and Pulse
Pulse Modulation: Min Pulse Width	<10 ns (Unleveled)
Pulse Modulation: Rise/Fall Times	5 ns (typical)
LF Signal Generator Waveforms	Sine, square, pulse, triangle, ramp, GN/UN noise
Frequency Sweep Modes	Step, List
Frequency Sweep Width	9 kHz to full frequency range (step, list)
Power Sweep	Step, List
Power Sweep Resolution	0.01 dB/step

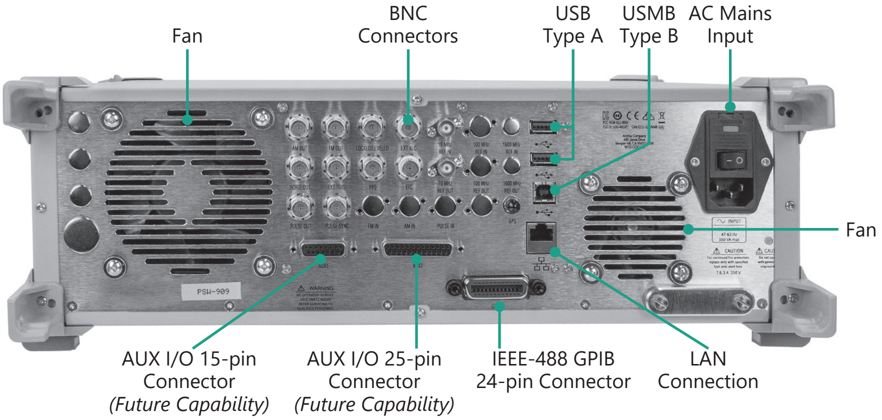
Application Use Cases for Rubidium MG362x1A Signal Generator

- Making nonlinear measurements
  - Single tone distortion – P1 dB compression point
  - Two tone intermodulation – IP2, IP3
  - In-band and out-of-band interference (C/I, blocking)
- As signal source to test devices and systems
  - Pulse modulated signal source to test radar systems
  - As pure CW source for LO substitution in testing of transceiver chains
  - Clock and CW source for testing Gbit data converters analog-to-digital converter and digital-to-analog converter (ADC and DAC)
- Making swept linear measurements
  - As additional sources synchronized with vector network analyzer
- As frequency reference in calibration and metrology labs

Interfaces



Rubidium MG362x1A Signal Generator Front Panel



Rubidium MG362x1A Signal Generator Back Panel

Inputs and Outputs

Description	Connectors may be available but not active if the option is not ordered
EXT ALC	Provides for leveling the RF output signal externally with either a detector or power meter. Signal requirements are shown in the RF output specifications. BNC type, rear panel
RF OUTPUT	Provides for RF output from 50Ω source impedance. Option 9 moves the RF Output connector from the front to the rear panel. K Connector (male) fmax ≤43.5 GHz
10 MHz REF IN	Accepts an external 10 MHz ±3 Hz, 0 dBm to +10 dBm (20 dBm no-damage level) time-base signal. Automatically disconnects the internal high-stability time-base option, if connected. 50Ω impedance BNC type, rear panel
10 MHz REF OUT	Provides a 10 dBm, AC coupled, signal derived from the internal frequency standard. 50Ω impedance BNC type, rear panel
100 MHz REF IN	Accepts an external 100 MHz ±200 Hz or 2 PPM, 12 ±1 dBm (20 dBm no-damage level) reference signal. Enabled with option 3 or 13. Automatically disconnects the internal high-stability time-base option, if connected. 50Ω impedance BNC type, rear panel
100 MHz REF OUT	Provides a 12 dBm, AC coupled, 100 MHz signal derived from the internal frequency standard. Enabled with Option 3 or 13. 50Ω impedance BNC type, rear panel
1600 MHz REF IN	Accepts an external 1600 MHz ±3.2 kHz or 2 PPM, 4 ±1 dBm (20 dBm no-damage level) reference signal. Enabled with option 3 or 13. Automatically disconnects the internal high-stability time-base option, if connected. 50Ω impedance SMA type, rear panel
1600 MHz REF OUT	Provides a 5 dBm, AC coupled, 1600 MHz signal derived from the internal frequency standard. Enabled with Option 3 or 13. 50Ω impedance SMA type, rear panel
EFC	±4 VDC 30 Hz bandwidth in wide reference PLL mode 1 MΩ input impedance. Provides the capability to frequency modulate the internal crystal oscillator, allowing phase locking of the synthesizer inside an external lock loop. BNC type, rear panel
ETHERENET (1000 Base-T)	Provides input/output connections for a Gigabit Ethernet interface. RJ45 type, rear panel
GPIB (IEEE-488)	Provides input/output connections for the General Purpose Interface Bus (GPIB)
PULSE IN	Accepts an external TTL compatible signal to pulse modulate the RF output signal or to trigger or to gate the optional internal pulse generator. Enabled with Option 26. BNC type, rear panel
PULSE SYNC	Provides a TTL compatible signal, synchronized to the internal pulse modulation output. Enabled with Option 26. BNC type, rear panel
PULSE OUT	Provides a video modulating signal from the internal pulse generator. Enabled with Option 27. BNC type, rear panel
AM IN	Accepts an external signal to amplitude modulate the RF output signal. Enabled with Option 12. 50Ω impedance BNC type, rear panel
FM IN	Accepts an external signal to frequency or phase modulate the RF output signal. Enabled with Option 12. 50Ω impedance BNC type, rear panel
AM OUT	Provides the amplitude modulation waveform from the internal LF generator. Enabled with Option 27. 50Ω impedance. BNC type, rear panel
FM OUT	Provides the frequency or phase modulation waveform from the internal LF generator. Enabled with Option 27. BNC type, rear panel
LOCKED/LEVELED	TTL high/low output signal when in internal ALC mode that is a logical AND of frequency locked condition and output leveled condition. When in Fixed Gain mode this signal indicates only frequency locked/unlocked condition
PPS	1PPS input/output from either GNSS/GPS atomic clock receiver or internal Rubidium reference option. 3.3 V CMOS I/O
GPS	Accepts GNSS/GPS antenna input
USB	Two USB 3.0 type A for peripherals such as memory device One USB 2.0 type B for USB-TMC
SD CARD	Accepts an external SDIO memory card
AC POWER INPUT	AC Input connector, with On/Off switch, and fuses 350 VA maximum, 90 to 264 VAC, 47 to 63 Hz

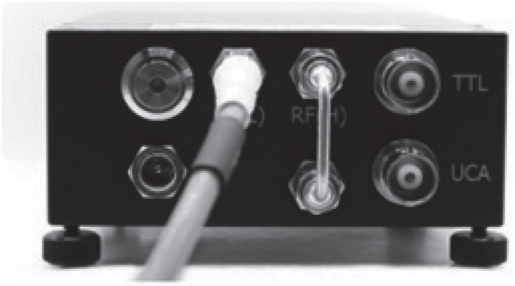
Millimeter-wave Frequency Coverage

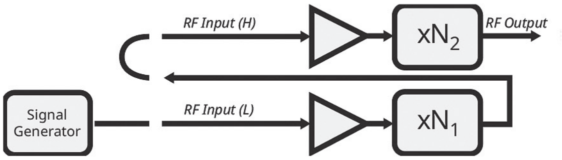
Millimeter-wave Multiplier 2000-2087-R Through 2000-2098-R Series

2000-2087-R through 2000-2098-R series of waveguide output multipliers are available for banded frequency coverage from 50 GHz (WR15) to 1.1 THz (WR1.0). These modules offer high test port power, voltage-controlled RF attenuation, and TTL controlled ON/OFF modulation rates to a few kHz as standard. The frequency multiplier modules are intended to be used in CW mode and do not preserve AM, FM, and Phase modulation.

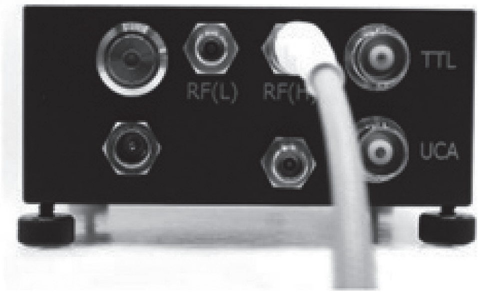
Frequency multiplier modules have two multipliers that can be configured to allow input signals in two frequency bands:

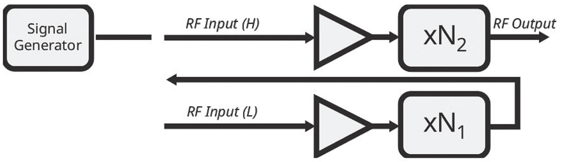
- Low frequency input for <20 GHz and 10 dBm input level
  In this configuration the RF output from the MG3690C is input into the K (f) input port on the rear panel of the multiplier module. The port is designated as RF (L). The low frequency band input configuration uses both N1 and N2 multipliers, as shown below.





- High frequency input for < 50 GHz and 0 dBm input level
  In this configuration the RF output from the MG3690C is input into the 2.4 mm (f) input port on the rear panel of the multiplier module. The port is designated as RF (H). The high frequency band input configuration uses an N2 multiplier, as shown below. This results in a lower multiplication factor and reduces unwanted harmonic signals within the band.





Specifications

General Specifications

Parameter	Description	Specification	Connector
RF Input*1, *2, *3	Low Frequency (Typical/Damage)	10 dBm ±3 dB/16 dBm	2.92 mm (f)
	High Frequency (Typical/Damage)	0 dBm ±3 dB/6 dBm	2.4 mm (f)
RF Output	VDI Precision Flange		UG-387/U-M
AC Inputs*4	Single-Volt Power Supply (+9 V/4 A)	100 VAC to 240 VAC, 3.5 A, 50 Hz to 60 Hz	U.S. or E.U.
RF Power Control	User Controlled Attenuation (UCA)	0 V-off, 5 V-full power	BNC (f)
Voltage Bias Port	For Use with External Components	+9 V	LEMO 00
Operating Temperature	Typical/Recommended	25°C/20°C to 30°C	
Maximum Weight		2.0 Lbs. (0.91 Kg.)	
Dimensions	Typical (Length × Width × Height)	5.00 × 3.50 × 1.50 inches	

*1: For low frequency operation a K120MM K(m) to K(m) cable should be ordered separately for use with MG3692C.
*2: For high frequency operation a V120MM V(m) to V(m) cable should be ordered separately for use with MG3695C.
*3: It is not recommended to use multiplier module in low frequency operation with MG3695C.
*4: It is recommended to turn the power ON only after all connections to the multiplier are made, such as RF input, AC inputs, and DC inputs. When turning power OFF, it is recommended to turn OFF the RF input from signal generator first, and then turn OFF/disconnect all other inputs and outputs of the multiplier.

Performance Specification

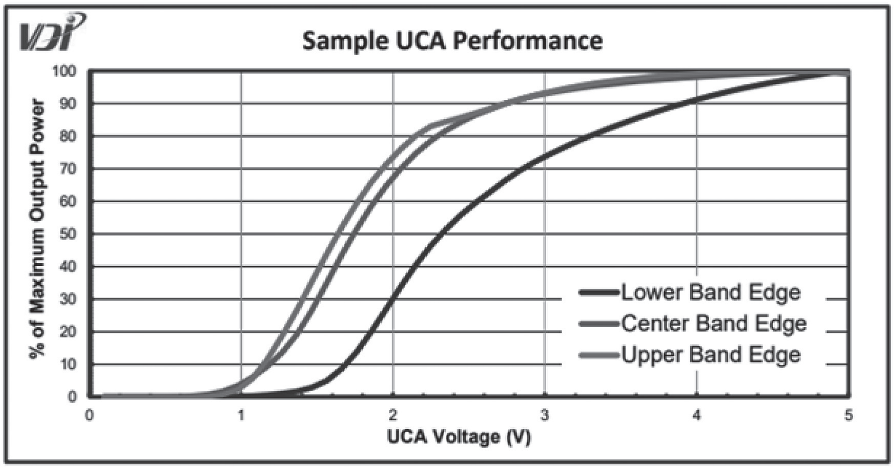
Parameter	Multiplier Model*5, *6, *7					
	2000-2087-R	2000-2088-R	2000-2089-R	2000-2090-R	2000-2091-R	2000-2092-R
Frequency Band (GHz)	WR-15	WR-12	WR-10	WR-8.0	WR-6.5	WR-5.1
Output Frequency*8,*9	50 GHz to 75 GHz	60 GHz to 90 GHz	75 GHz to 110 GHz	90 GHz to 140 GHz	110 GHz to 170 GHz	140 GHz to 220 GHz
Output Power (dBm Typical/ Minimum)	20/17	20/17	20/17	19/13	18/15	10/6
Multiplier Factors (Low/High Frequency)	6/3	6/3	6/3	12/6	12/6	12/6

Parameter	Multiplier Model*5, *6, *7					
	2000-2093-R	2000-2094-R	2000-2095-R	2000-2096-R	2000-2097-R	2000-2098-R
Frequency Band (GHz)	WR-4.3	WR-3.4	WR-2.8 (WM-710)	WR-2.2 (WM-570)	WR-1.5 (WM-380)	WR-1.0 (WM-250)
Output Frequency*8,*9	170 GHz to 260 GHz	220 GHz to 330 GHz	260 GHz to 400 GHz	330 GHz to 500 GHz	500 GHz to 750 GHz	750 GHz to 1100 GHz
Output Power (dBm Typical/ Minimum)	8/3	6/3	5/–1	0/–6	–7/–13	–16/–26
Multiplier Factors (Low/High Frequency)	18/6	18/9	27/9	36/18	54/18	81/27

*5: These millimeter-wave modules are produced by VDI Inc. located in Charlottesville, VA. For detailed and up-to-date specifications, please call VDI, Inc. or visit their website at http://www.vadiodes.com.
*6: Multipliers require power from an external power supply (+9 VDC, 4 A typical). The power supply adapter is a standard accessory and included with modules.
*7: Warranty period for 2000-2087-R through 2000-2098-R multiplier modules is one year.
*8: Unwanted harmonic content is better than -20 dBc typical.
*9: Frequency stability of input is degraded at the output by multiplier factor N (N1 x N2) and phase noise by 20log (N). For high frequency operation N1 = 1.

Output Attenuation

Frequency multiplier modules offer voltage-controlled RF output attenuation capability as standard. Users can input 0 to 5 V a DC voltage from an external source into the BNC connector on the rear panel designated as UCA. The output power can be varied from 90% to 10% through the UCA port. A sample curve of UCA control voltage vs. output power is shown below. The curve is subject to some variation due to measurement conditions, such as temperature and load impedance, and should be considered as representative only.



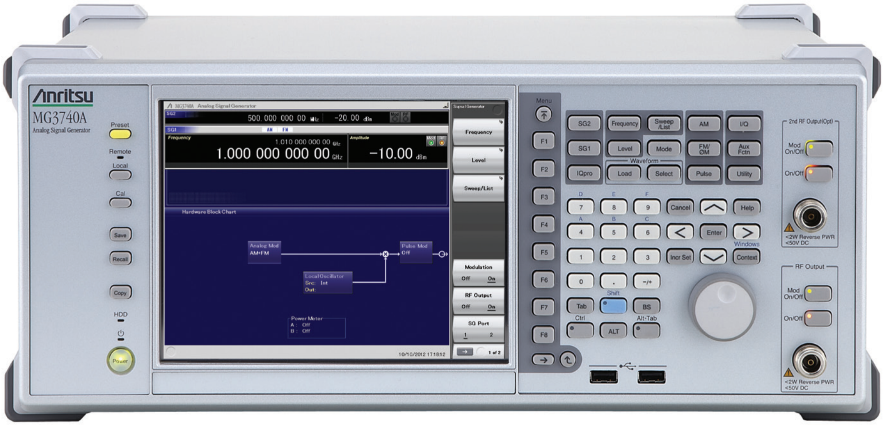
Analog Signal Generator

MG3740A

100 kHz to 2.7 GHz/4.0 GHz/6.0 GHz

Remote Control
GPIB | Ethernet | USB

Excellent RF Performance, Versatile Modulation Functions, Built-in Dual RF Outputs



The Analog Signal Generator MG3740A has excellent RF specifications, including SSB Phase Noise, output level, etc., and versatile modulation functions (AM/FM/ΦM/Pulse).

High-Purity Signal Source for Testing Analog Radio

The excellent SSB phase noise performance supports narrowband radio Rx sensitivity suppression tests.
<–140 dBc/Hz (nominal) [100 MHz, 20 kHz offset, CW]
Excellent level accuracy over a wide level range, the MG3740A is the solution for accurate tests of radio Rx sensitivity and amplifier distortion characteristics.
Setting Range: –144 to +25 dBm
(CW, MG3740A-041/071, 042/072, 043/073 installed)

Cuts Tact Time

To shorten tact times on production lines the MG3740A supports two standard modes.
The List/Sweep mode switches the frequency and level faster than 600 µs.

Cut Equipment Costs

The dual RF outputs supporting wanted + interference waves for tests of Rx characteristics, evaluation of wireless and amplifier intermodulation characteristics, and output of RF/LO signals for mixer tests, cut test costs by eliminating the need for two signal generators.

Extendible Narrowband Digital Modulation Function

Adding the digital modulation option adds a digital modulation signal generator function providing a cost-effective solution for testing public safety digital radio systems.
Digital Modulation Performance

- RF Modulation Bandwidth: 2 MHz
- Sampling Rate: 20 kHz to 8 MHz

Main Applications

- Testing Rx characteristics of analog radio
- Testing amplifier distortion and intermodulation characteristics
- RF/LO Signal source for evaluating mixer characteristics
- Testing Rx characteristics of narrowband digital radio

Key Features

Basic Performance

- SSB Phase Noise Performance
  <–140 dBc/Hz (nom.) @100 MHz, 20-kHz offset, CW
  <–131 dBc/Hz (typ.) @1 GHz, 20-kHz offset, CW
  <–125 dBc/Hz (typ.) @2 GHz, 20-kHz offset, CW
- High-power Output [MG3740A-041/071]
  +23 dBm @CW, 400 MHz to 3 GHz
- High-speed Switching
  < 600 µs @List/Sweep mode
- High Level Accuracy
  Absolute Level Accuracy: ±0.5 dB
  Linearity: ±0.2 dB (typ.)
- Choice of Reference Oscillators
  Standard
  Aging rate ±1 × 10^{-6}/year, ±1 × 10^{-7}/day
  High Stability Reference Oscillator [MG3740A-002]
  Aging rate ±1 × 10^{-7}/year, ±1 × 10^{-8}/day
  Rubidium Reference Oscillator [MG3740A-001]
  Aging rate ±1 × 10^{-10}/month

Dual RF

- One Unit Supports Two RF Outputs Max.
  Frequency Range
  1stRF: 100 kHz to 2.7/4.0/6.0 GHz [MG3740A-032/034/036]
  2ndRF: 100 kHz to 2.7/4.0/6.0 GHz [MG3740A-062/064/066]
  Independent Baseband and RF Outputs

Expandability

- Analog modulation (AM/FM/ΦM) functions and pulse modulation (PM) functions [Standard]
- Additional analog modulation input options [MG3740A-050/080]
- USB Power Sensors [Sold separately]

Operability

- Simple Touch-panel Operation
- Signal Flowcharts with Signal Block Diagrams
- Frequency Channel Table

Connections with External Equipment

- Remote Control Interfaces
- USB Connections

Expansion to Digital Modulation Signal Generator

- Digital Modulation [MG3740A-020]
  Adding the digital modulation option [MG3740A-020] supports generation of digital modulation signals by outputting narrowband digital modulation signals.
  Digital Modulation Performance
    RF Modulation Bandwidth: 2 MHz
    Sampling Rate: 20 kHz to 8 MHz
  Waveform generation software: IQproducer (License sold separately)
    TDMA IQproducer
    Fading IQproducer
- BER Test Function [MG3740A-021]
- Output Two Signals from One RF Out [MG3740A-048/078]
  Wanted Signal + Interfere Signal
  Wanted Signal + Delayed Signal, etc.

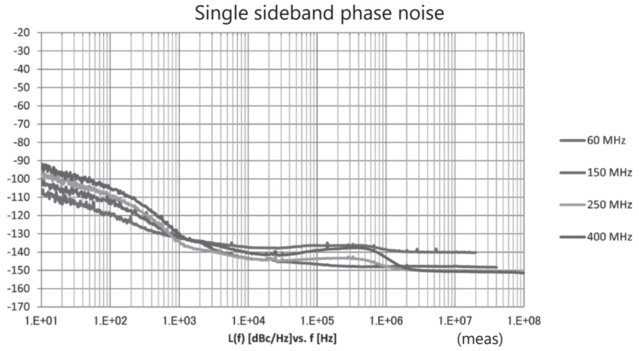
Basic Performance

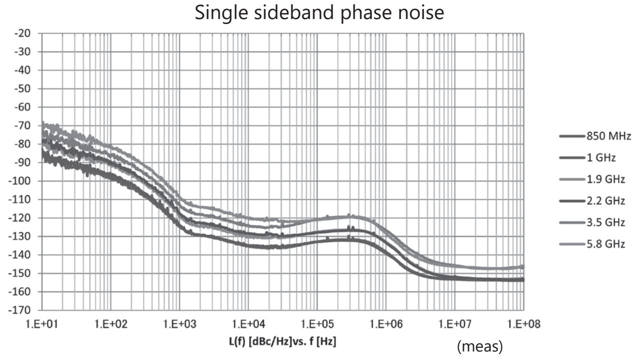
SSB Phase Noise

<–140 dBc/Hz (nom.)	@100 MHz, 20-kHz offset, CW
<–131 dBc/Hz (typ.)	@1 GHz, 20-kHz offset, CW
<–125 dBc/Hz (typ.)	@2 GHz, 20-kHz offset, CW

SSB phase noise is an important performance index for signal generators. For example, when using a signal generator for the following purposes, it is important to pre-confirm that the signal generator performance satisfies the measurement specifications.

- Communications with narrow bandwidth of several kHz
- CW interference waveforms
- Full range of reference and local signals





Example: SSB Phase Noise
(Phase Noise Optimization <200 kHz, CW,
Optimize S/N Off, with MG3740A-002)

Low-power Output [MG3740A-042*1/072*2]

*1: Low Power Extension for 1stRF [MG3740A-042]
*2: Low Power Extension for 2ndRF [MG3740A-072]

Amplitude Setting Range

Options	Setting Range [dBm]	
	without Reverse Power Protection*3	with Reverse Power Protection*3
Standard	–110 to +17	–110 to +17
with High-power Extension	–110 to +30	–110 to +25
with Low-power Extension	–144 to +17	–144 to +17
with High-power Extension and Low-power Extension	–144 to +30	–144 to +25

*3: Reverse Power Protection for 1stRF/2ndRF [MG3740A-043/073]

The MG3740A supports a convenient option for extending the lower RF output limit when performing high-sensitivity Rx tests.

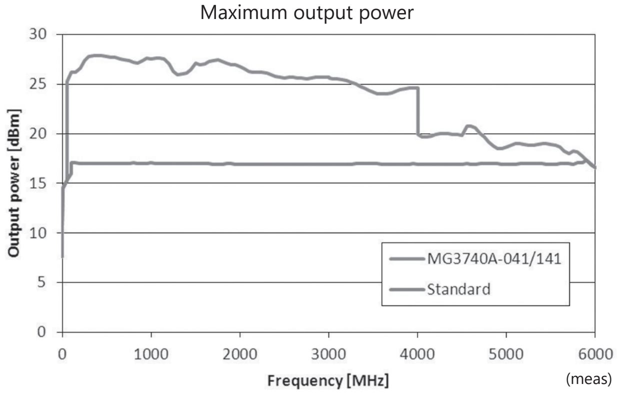
High-power Output [MG3740A-041*[1]/071*[2]]

*1: High Power Extension for 1stRF [MG3740A-041]
*2: High Power Extension for 2ndRF [MG3740A-071]

Level Accuracy is assured at high levels (CW)

Frequency Range	Standard	MG3740A-041/071
100 kHz ≤ f < 10 MHz	+5 dBm	+5 dBm
10 MHz ≤ f < 50 MHz	+10 dBm	+10 dBm
50 MHz ≤ f < 400 MHz	+13 dBm	**+20 dBm**
400 MHz ≤ f ≤ 3 GHz		**+23 dBm**
3 GHz < f ≤ 4 GHz		**+20 dBm**
4 GHz < f ≤ 5 GHz		+13 dBm
5 GHz < f ≤ 6 GHz	+11 dBm	+11 dBm

These options expand the MG3740A RF output upper limit.
They are used when compensating for level losses of parts in the measurement path.



Supports Rubidium Reference Oscillator (Option)

Three reference oscillator options are supported. Select the high-stability reference oscillator option [MG3740A-002] when requiring high accuracy depending on the measurement conditions; for even higher accuracy, select the rubidium reference oscillator [MG3740A-001]. However, if external high-accuracy reference signals are available, selecting the standard reference oscillator option helps reduce unnecessary costs.

- Reference Oscillator
  - Standard
    - Aging Rate: ±1 × 10^{-6}/year, ±1 × 10^{-7}/day
    - Temperature Stability: ±2.5 × 10^{-6} (5°C to 45°C)
  - High Stability Reference Oscillator [MG3740A-002]
    - Aging Rate: ±1 × 10^{-7}/year, ±1 × 10^{-8}/day
    - Temperature Stability: ±2 × 10^{-8} (5°C to 45°C)
    - Start-up Characteristics*: ±5 × 10^{-7} (2 minutes after power-on)
      ±5 × 10^{-8} (5 minutes after power-on)
  - Rubidium Reference Oscillator [MG3740A-001]
    - Aging Rate: ±1 × 10^{-10}/month
    - Temperature Stability: ±2 × 10^{-9} (5°C to 45°C)
    - Start-up Characteristics*: ±1 × 10^{-9} (7.5 minutes after power-on)

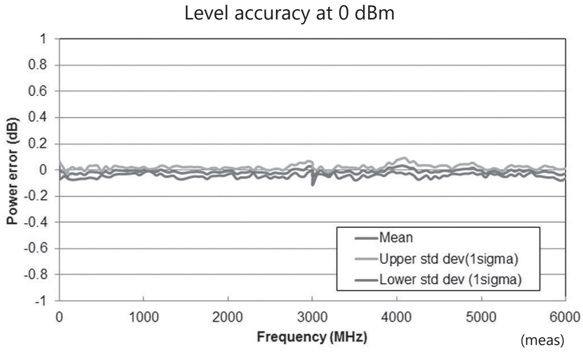
*: Compared to frequency after 24-h warm-up at 23°C

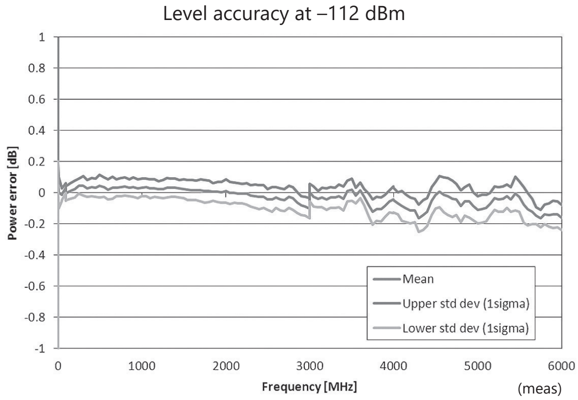
High Level Accuracy

Absolute Level Accuracy: ±0.5 dB*[1]
Linearity: ±0.2 dB (typ.)*[2]

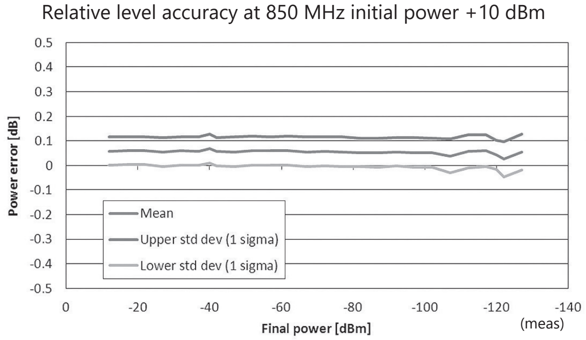
*1: 400 MHz to 3 GHz, –110 to +10 dBm
*2: 50 MHz to 3 GHz, –110 to –1 dBm

Excellent level accuracy and linearity are key factors with a large impact on measurement accuracy.

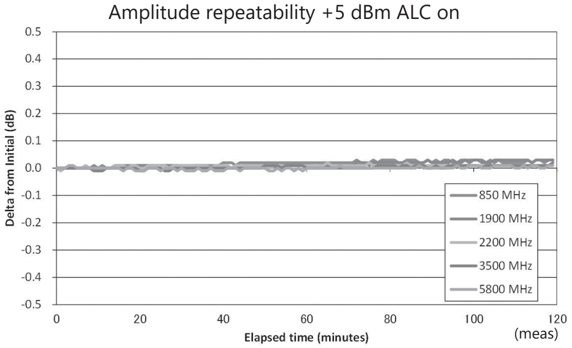




Frequency Characteristic



Linearity



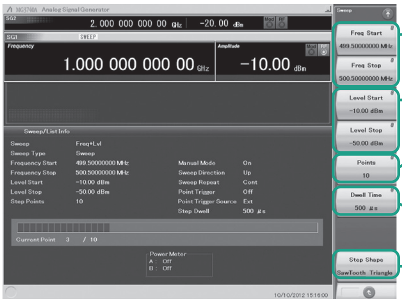
Aging

High-speed Switching

<600 µs @List/Sweep mode

To shorten tact times on production lines the MG3740A supports two standard modes each with high-speed frequency and level switching.

- Sweep Mode
  In this mode, the dwell time per point or number of points is split between the frequency range and level range (Start/Stop).
  This mode is used when matching dwell time per point and frequency/level steps.



Freq Start 499.50000000 MHz
Freq Stop 500.50000000 MHz
Level Start −10.00 dBm
Level Stop −50.00 dBm
Points 10
Dwell Time 500 µs

Sweep/List Info
Sweep Freq+Lvl
Sweep Type Sweep
Frequency Start 499.50000000 MHz
Frequency Stop 500.50000000 MHz
Level Start −10.00 dBm
Level Stop −50.00 dBm
Step Points 10
Manual Mode On
Sweep Direction Up
Sweep Repeat Cont
Point Trigger Off
Point Trigger Source Ext
Step Dwell 500 µs
Current Point 3 / 10
A : Off
B : Off
10/10/2012 15:16:00

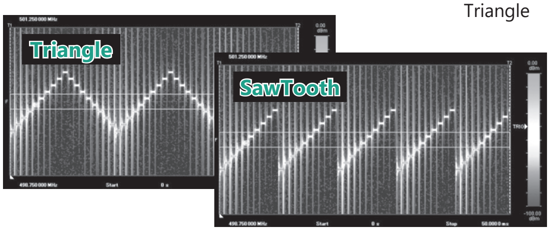
Frequency Range

Level Range

Points:
2 to 1000 (Sawtooth)
2 to 500 (Triangle)

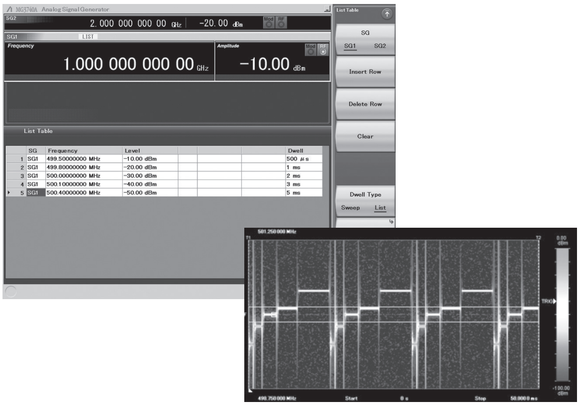
Dwell Time:
100 µs to 16 s

Step Shape:
Sawtooth
Triangle



10 points, 500-µs Dwell Time

- List Mode
  In this mode, the frequency, level and dwell time can be set for each of up to 500 points. This mode is used when wanting to set any dwell time, and frequency/level step per point.



List Table

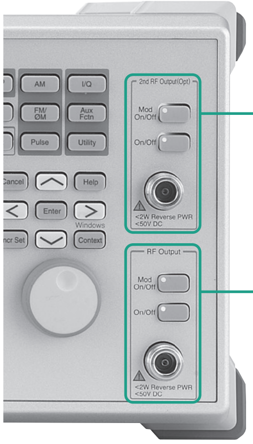
	SG	Frequency	Level				Dwell
1	SG1	499.50000000 MHz	−10.00 dBm				500 µs
2	SG1	499.80000000 MHz	−20.00 dBm				1 ms
3	SG1	500.00000000 MHz	−30.00 dBm				2 ms
4	SG1	500.10000000 MHz	−40.00 dBm				3 ms
5	SG1	500.40000000 MHz	−50.00 dBm				5 ms

5 points, Any Dwell Time

Dual VSG: Two RF Outputs

The MG3740A supports two RF outputs (1stRF/2ndRF) max. in one unit. Moreover, different frequencies can be set independently at 1stRF and 2ndRF.
Not only different frequencies but also different levels and modulations can be set independently at each SG while each is tracking the other.
The all-in-one MG3740A eliminates the need for two conventional signal generators when requiring wanted + interference waveforms for evaluating Rx signal characteristics, testing intermodulation characteristics of radio equipment and amplifiers, and generating RF/LO signals for evaluating mixers.

Notes: Supported frequency bands cannot be changed after shipment.
IQ input is supported only by SG1 (1stRF) and requires MG3740A-017.



2ndRF
Frequency Range:
100 kHz to 2.7 GHz [MG3740A-062]
100 kHz to 4.0 GHz [MG3740A-064]
100 kHz to 6.0 GHz [MG3740A-066]
* Whether or not install and the frequency model can be selected at any time.

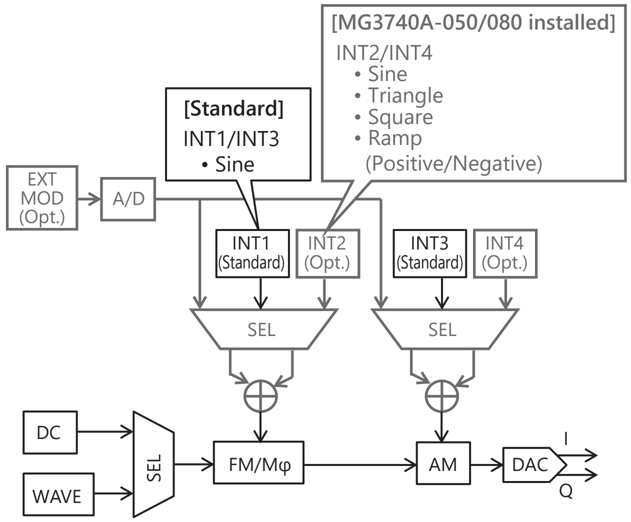
1stRF
Frequency Range:
100 kHz to 2.7 GHz [MG3740A-032]
100 kHz to 4.0 GHz [MG3740A-034]
100 kHz to 6.0 GHz [MG3740A-036]
* Must install any one of these.

Expandability

AM/FM/ΦM/Pulse Function

This option supports the following modulation functions as standard. Analog modulation (AM/FM/ΦM) is supported using both CW and internal modulation signals.
Pulse modulation can be performed at any cycle or timing and also supports modulation using an external input signal.

- Amplitude Modulation (Internal Modulation Source)
  Depth: 0 to 100% (Linear)
  0 to 10 dB (Exponential)
  Modulation Frequency: 0.1 Hz to 50 MHz
- Frequency Modulation (Internal Modulation Source)
  Deviation: 0 to 40 MHz
  Modulation Frequency: 0.1 Hz to 40 MHz, or (50 MHz-FM Rate), whichever smaller
- Φ-Modulation (Internal Modulation Source)
  Deviation angle: 0 to 160 rad.
  or (40 MHz/ΦM Rate) rad., whichever smaller
  Modulation Frequency: 0.1 Hz to 40 MHz,
  or (40 MHz/ΦM Deviation), whichever smaller
- Pulse Modulation (Internal Modulation Source)
  Modulation Frequency: 0.1 Hz to 10 MHz
  Modulation Period: 10 ns to 20 s
- Additional Analog Modulation Input [MG3740A-050/080]
  Adding additional analog modulation input options (MG3740A-050/080) extends to two internal modulation sources (AM/FM/ΦM) and one external modulation source supporting simultaneous two-signal modulation. This is used when superimposing tone squelch signals.
  AM + FM
  AM + ΦM
  Internal 1 + Internal 2
  Internal + External
  *: FM + ΦM does not support.



USB Power Sensors [Sold separately]

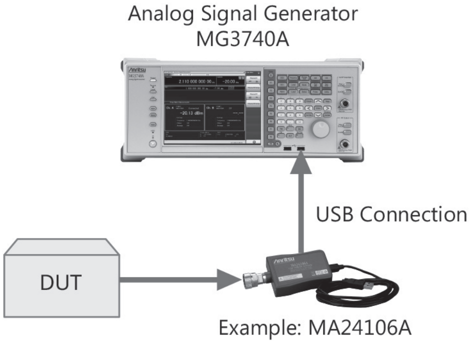
Up to two USB power sensors can be connected to the MG3740A to display the measurement results on the MG3740A screen.

Compatible USB power sensors

Model	Frequency Range	Dynamic Range
MA24104A*	600 MHz to 4 GHz	+3 to +51.76 dBm
MA24105A	350 MHz to 4 GHz	+3 to +51.76 dBm
MA24106A	50 MHz to 6 GHz	–40 to +23 dBm
MA24108A	10 MHz to 8 GHz	–40 to +20 dBm
MA24118A	10 MHz to 18 GHz	–40 to +20 dBm
MA24126A	10 MHz to 26 GHz	–40 to +20 dBm

*: MA24104A has been discontinued. Replacement model is MA24105A.

Level Offset: –100 to +100 dB
Average: 1 to 2048
Unit: dBm, W
COM Port: 2 to 8



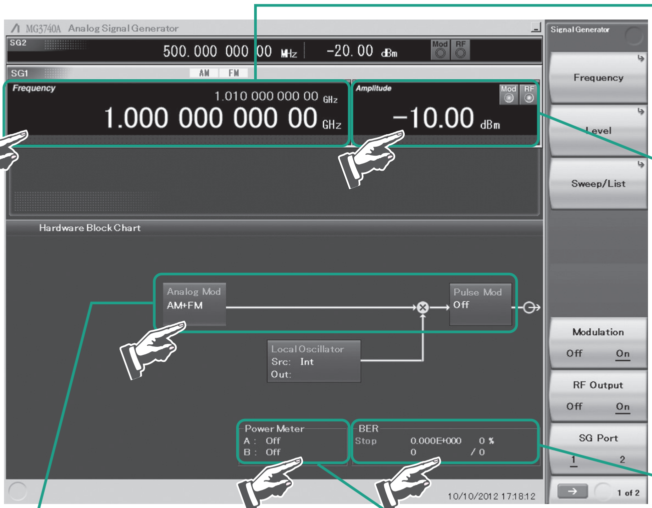
SG2 2. 000 000 000 00 GHz -20. 00 dBm
SG1
Frequency 1.000 000 000 00 GHz
Amplitude −10.00 dBm
Ch. A COM 5 MA24106A Connected
−20.13 dBm
Settings
Frequency 1.00000000000 GHz
Offset Off
Average Off
Ch. B COM 2 MA24106A Off
--.--
Settings
Frequency 1.00000000000 GHz
Offset Off
Average Off
Power Meter
A : Off
B : Off
10/10/2012 15:28:33

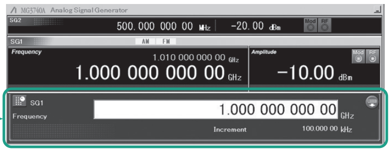
Power Meter Measurement Screen

Operability

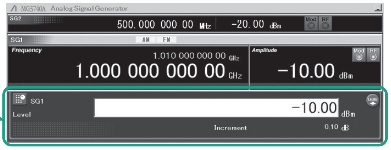
Easy Touch-panel Operation

Simply touching parts of the screen display with a finger fetches related function keys and numeric inputs, offering a fast and easy way of navigating through multilayer menus.

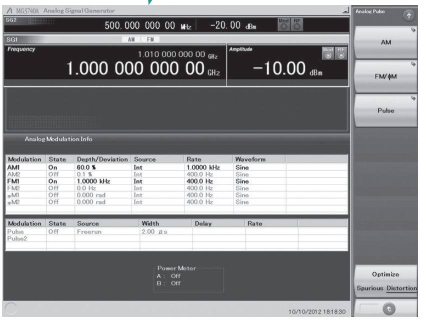




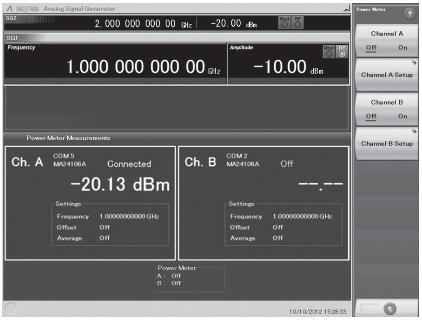
Frequency Setting



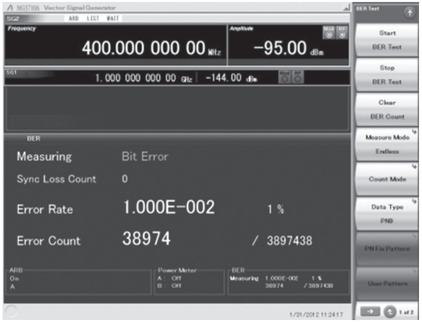
Level Setting



AM/FM/ΦM/Pulse Function



Power Meter Function



BER Function [MG3740A-021]

Signal Flowcharts

The Hardware Block Chart provides an intuitive at-a-glance understanding of the settings and signals for each block (Analog Mod, Pulse Mod, Local, etc.)

Hardware Block Chart Screen

Frequency Channel Table

Sometimes frequencies need setting by Channel No. The built-in frequency channel table where frequencies are set by channel number is ideal for this application. Once set and saved, these pre-settings can be read whenever needed.

- Channel Table Setting
  Group: 1 to 19
  Start Channel: 0 to 20000
  End Channel: (Start Channel) to 20000
  Start Frequency
  Channel Spacing

Connection with External Equipment

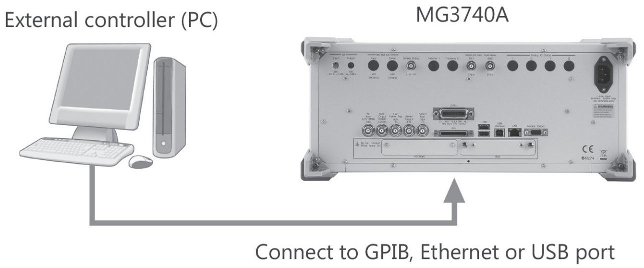
Remote Control Interfaces

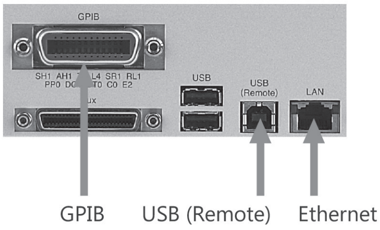
The MG3740A has GPIB, Ethernet and USB interfaces as standard, supporting the following functions:

- Control all functions, except power switch
- Read all status conditions and settings
- Interrupts and serial polls

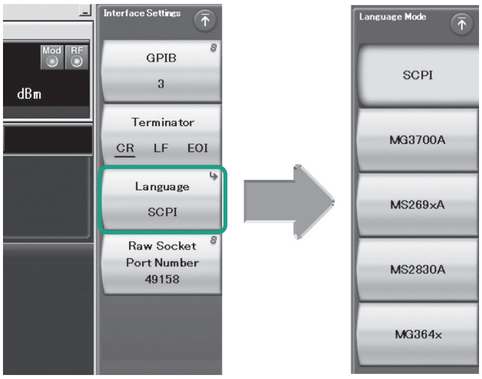
While in the Local status, the interface is determined automatically by the communication start command from the external controller (PC). To change the interface, put the MG3740A into the Local status again by pressing the Local key on the front panel and then send a command via the desired interface.

- GPIB: Conforms to IEEE 488.1/IEEE 488.2 standards
  SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2
- Ethernet: Conforms to VXI-11 protocol using TCP/IP Control programs
  SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0
- USB: Conforms to USBTMC-USB488 protocols
  SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0n





To remotely control the MG3740A, either select the SCPI mode command format defined by the SCPI Consortium, or select backwards compatible modes supporting earlier MG3700A, MS269xA, MS2830A, and MG364xA commands



Interface Settings

GPIB 3

Terminator CR LF EOI

Language SCPI

Raw Socket Port Number 49158

Language Mode

SCPI

MG3700A

MS269xA

MS2830A

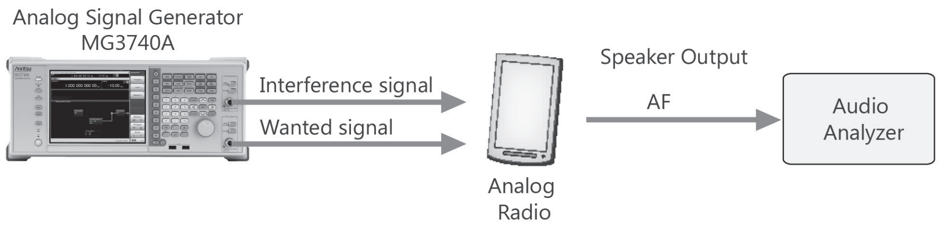
MG364x

Command Format Setting Example

USB Connections

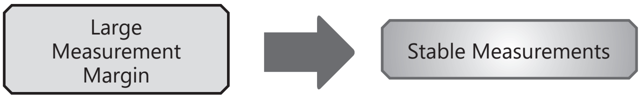
The two type-A USB2.0 connectors on the front and rear panels support keyboard, mouse and USB memory connections. Supported USB power sensors can be connected too.

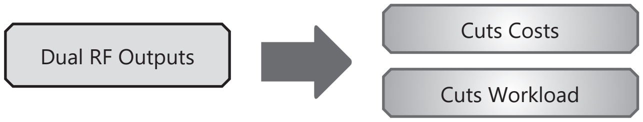
Analog Radio Rx Characteristics Tests



Setup for analog radio Rx characteristics tests

The MG3740A outputs RF signals for radio operation verification tests and evaluation of Rx characteristics, when the radio AF output can be measured with an external audio analyzer.





High-Purity Signal Source for Testing Analog Radio

Supports SSB Phase Noise Performance –140 dBc/Hz nom. (@100 MHz)
Phase noise performance affects measurement results at narrow bandwidths of several kHz. In particular, high phase-noise performance is required for interference waveforms.
The excellent SSB phase noise performance supports narrowband radio Rx sensitivity suppression tests.

<–140 dBc/Hz (nom.)	@100 MHz, 20-kHz offset, CW
<–131 dBc/Hz (typ.)	@1 GHz, 20-kHz offset, CW
<–125 dBc/Hz (typ.)	@2 GHz, 20-kHz offset, CW

The excellent level accuracy over a wide output level range supports accurate Rx sensitivity tests.

Amplitude setting range: –110 to +17 dBm (Standard)
–144 to +17 dBm (with MG3740A-042/072)
Absolute level accuracy: ±0.5 dB*1
Linearity 1: ±0.2 dB (typ)*2

*1: 400 MHz to 3 GHz, –110 to +10 dBm
*2: 50 MHz to 3 GHz, –110 to –1 dBm

Supports Maximum Two RF Outputs

The dual RF outputs of the all-in-one MG3740A help cut infrastructure costs by eliminating the need for two signal sources when outputting wanted + interference waves for RX characteristics tests, and evaluating intermodulation characteristics, etc. Additionally, there is no need for troublesome settings at each of two separate signal generators helping cut operation time and costs using the frequency/level synchronization function.

AM/FM/ΦM/Pulse Function (Standard)

Supports built-in analog modulation (AM/FM/ΦM) functions and pulse modulation (PM) functions.
Adding additional analog modulation input options (MG3740A-050/080) supports modulation by external signal input. This is used when superimposing tone squelch signals.

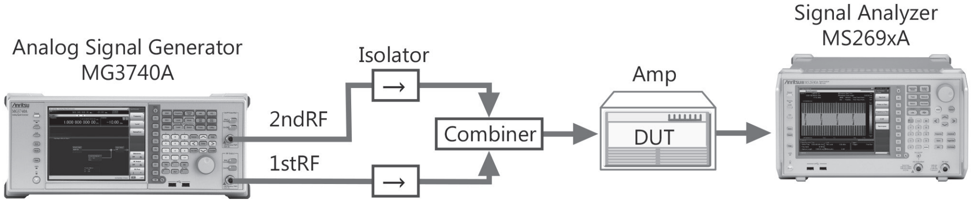
AM + FM
AM + ΦM
Internal 1 + Internal 2
Internal + External

* FM + ΦM does not support.

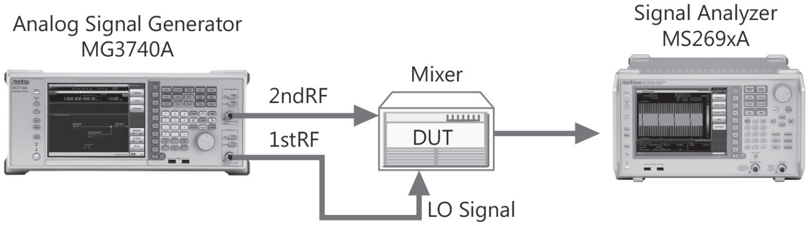
Analog Radio Main Rx Characteristics Evaluation Items

Test Items	MG3740A Key Features	
Sensitivity	✓	Wide level range, High level accuracy, Internal modulation function (standard)
Passing Bandwidth, Attenuation	✓	High level accuracy, Frequency offset setting function
AF Level	✓	Internal modulation function (standard)
Demodulation Frequency Characteristics	✓	Internal modulation function (standard)
Demodulation Distortion	✓	Internal modulation function (standard)
Demodulation S/N	✓	Internal modulation function (standard), External modulation function (Option)
Spurious Response	✓	High level accuracy, Internal modulation function (standard)
Sensitivity Suppression Effect	✓	Dual RF, Low SSB Phase Noise *All-in-one evaluation without requiring two separate signal sources.
Intermodulation Characteristics	✓	Dual RF, Low SSB Phase Noise *Two units of MG3740A support evaluation without requiring three separate signal sources.

Reference Signal Generator for Evaluating Characteristics of Amplifiers, Mixers, etc.



Setup for evaluating intermodulation characteristics of amplifier



Setup for evaluating distortion characteristics of Mixer

The dual RF outputs of the MG3740A are ideal for evaluating intermodulation (IM3) characteristics of amplifiers, etc., as well as for use as RF/LO signal sources for testing mixers, eliminating the need for two separates signal generators. The high-performance MS269xA Signal Analyzer series is recommended for intermodulation and harmonic wave distortion measurements.

Dual RF Outputs
Cuts Costs
Cuts Workload

No External Amp
Stable Level Accuracy
Cuts Risk of Damage to DUT

Supports Maximum Two RF Outputs

Usually, two general signal generators are required to output two continuous waveforms when evaluating the intermodulation characteristics of amplifiers, etc., or for use as RF/LO signal sources at mixer tests. A maximum of two RF outputs (1stRF/2ndRF) can be installed in the MG3740A and the product lineup includes models with different 1stRF and 2ndRF frequencies.

Different frequencies and levels can be set at the two signal outputs and the frequency/level synchronization function cuts the setting workload too.

USB Power Sensor
Efficient Equipment Investment

USB Power Sensor

Up to two USB power sensors (separately sold) can be connected to the MG3740A.

USB connectors to display the measurement results on the MG3740A screen.

Compatible USB power sensors

Model	Frequency Range	Dynamic Range
MA24104A*	600 MHz to 4 GHz	+3 to +51.76 dBm
MA24105A	350 MHz to 4 GHz	+3 to +51.76 dBm
MA24106A	50 MHz to 6 GHz	–40 to +23 dBm
MA24108A	10 MHz to 8 GHz	–40 to +20 dBm
MA24118A	10 MHz to 18 GHz	–40 to +20 dBm
MA24126A	10 MHz to 26 GHz	–40 to +20 dBm

*: MA24104A has been discontinued. Replacement model is MA24105A.

High-power Output Option Supports CW Levels of +23 dBm (MG3740A-041/071)

In general, an external amp is required when the output of a signal generator is insufficient, such as covering the measurement system transmission path loss and inputting high-level modulation signals for amp distortion characteristics tests. Since the output of an external amp cannot be assured, it must be checked with a power meter each time the frequency and level are changed. Moreover, when using an external amp, sometimes the DUT may be damaged by mishandling errors. The MG3740A high-power output supports signals required for measuring path loss. In addition, stable measurement is assured when used within the guaranteed setting range. And the risk of mistakenly damaging the DUT is reduced, even at the output limit.

Expansion to Digital Modulation Signal Generator

The MG3740A can be expanded to add digital modulation generation functions, supporting evaluation of digital public safety radio systems. All-in-one support for both analog and digital tests maximizes equipment investment efficiency.

Digital Modulation [MG3740A-020]

Adding the digital modulation option [MG3740A-020] supports generation of digital modulation signals by outputting narrowband digital modulation signals.

Digital Modulation Performance
  RF Modulation Bandwidth: 2 MHz
  Sampling Rate: 20 kHz to 8 MHz

Dual Waveform Memory: Four Waveform Outputs Max.

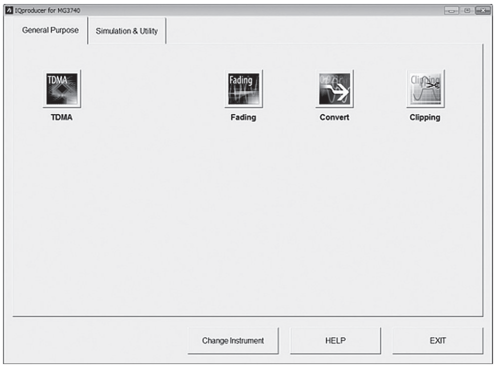
In the standard configuration, one RF (1stRF or 2ndRF) has one waveform memory. However, adding the baseband signal combine option (MG3740A-048/078) upgrades to two memories for one RF. In other words, models with two RFs (1stRF and 2ndRF) installed can have a maximum of four waveform memories. Two waveform patterns can be set easily on-screen for one RF, each with different frequency offset, level offset and delay time settings to output a combined baseband RF signal. With this setup, one MG3740A supports the following test environment — a setup that previously required two signal generators:

Wanted Signal + Interference Signal
Wanted Signal + Delayed Signal

Waveform Generation Software (Separate License)

The IQproducer system provides an easy-to-use GUI for setting parameters according to each communications method.
The parameter setting results file can be saved as a file for easy recall later.

* For detail, refer to the IQproducer catalog.



IQproducer Main Screen

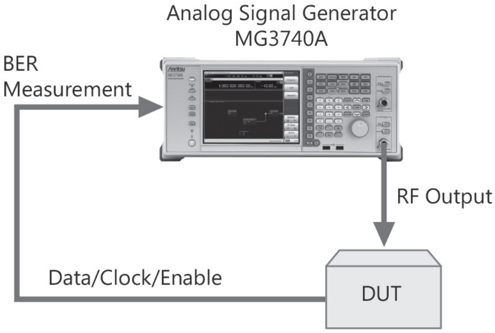
MG3740A Option IQproducer

- TDMA IQproducer MX370102A
  Sets required parameters for TDMA waveform patterns and generates various waveform patterns.
- Fading IQproducer MX370107A
  Performs IQ channel fading processing, correlation matrix calculation, AWGN combination.

BER Test Function [MG3740A-021]

This option installs a BER measurement function for measuring error rates between 100 bps and 40 Mbps using the DUT demodulated Data/Clock/Enable signals. The results are displayed on the MG3740A screen.

- Input Bit Rate: 100 bps to 40 Mbps
- Input Signal: Data, Clock, Enable
  (Polarity reversal supported)
- Input Level: TTL
- Measured Patterns: PN9/11/15/20/23, ALL1, ALL0,
  Alternate (0101...), User Data,
  PN9fix/11fix/15fix/20fix/23fix
- Count Mode
  Data: Measures until specified Data count
  Error: Measures until specified Error count
- Measurable Bit Count: ≤2^{32} – 1 (4,294,967,295 bits)
- Measurement Mode
  Single: Measures specified measurement bit count once
  Continuous: Repeats Single measurement
  Endless: Continues measurement to upper limit of measurement bits

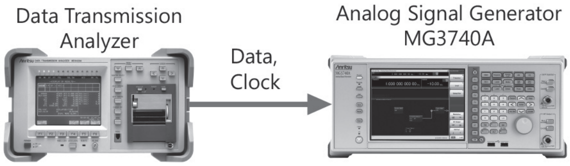


The BER can be measured using
the DUT-demodulated Data/Clock/Enable.

BER Measurement Upper Limit

The table below shows one example of a BER measurement that indicates SyncLoss. Actual results depend on the specific communication systems and data rate, and will not necessarily match the measurement values below.

Error Rate	PN9	PN11	PN15	PN20	PN23
6.0%	–	–	–	–	–
5.0%	OK	–	–	–	–
4.0%	OK	OK	–	–	–
3.0%	OK	OK	OK	–	–
2.5%	OK	OK	OK	–	–
2.0%	OK	OK	OK	OK	OK
1.0%	OK	OK	OK	OK	OK



Key Differences from MG3710E Vector Signal Generator

Installing the Digital Modulation Option (MG3740A-020) in the MG3740A Analog Signal Generator adds the functions of a digital modulation signal generator. The key differences in the main functions compared to the conventional MG3710E Vector Signal Generator are listed below.

Key Functional Differences between Analog Signal Generator MG3740A and Vector Signal Generator MG3710E

	MG3740A Analog Signal Generator	MG3710E[*1] Vector Signal Generator	Remarks
Frequency Range	100 kHz to 2.7 GHz (MG3740A-032/062) 100 kHz to 4.0 GHz (MG3740A-034/064) 100 kHz to 6.0 GHz (MG3740A-036/066)	100 kHz to 2.7 GHz (MG3710E-032/062) 100 kHz to 4.0 GHz (MG3710E-034/064) 100 kHz to 6.0 GHz (MG3710E-036/066)	Supports two signal generators (1stRF/2ndRF output) in one unit
Analog Modulation Internal Source	[Standard]	[Standard]	AM, FM/ΦM Each one internal source
Additional Analog Modulation Input	[MG3740A-050/080]	[MG3710E-050/080]	Extends to one external input, two internal source (AM, FM/ΦM)
Digital Modulation	[MG3740A-020] Digital modulation performance - RF modulation bandwidth: 2 MHz - Sampling rate: 20 kHz to 8 MHz	[Standard] Digital modulation performance - RF modulation bandwidth: 160 MHz[*2]/120 MHz - Sampling rate: 20 kHz to 200 MHz[*2]/160 MHz	
Pre-installed Waveform Patterns	No	Yes	LTE FDD/TDD (E-TM1.1 to E-TM3.3) W-CDMA/HSDPA, GSM/EDGE, CDMA2000 1X/1xEV-DO, WLAN (802.11a/11b/11g), etc.
Waveform pattern/IQproducer	TDMA IQproducer Fading IQproducer	Listed bellow	Listed bellow
ARB Memory Upgrade (per RF)	[MG3740A-045/075] Max. 256 Msamples	[MG3710E-046/076] Max. 1024 Msamples	Standard: 64 Msamples
Combination of Baseband Signal	[MG3740A-048/078]	[MG3710E-048/078]	
AWGN Generator	No	[MG3710E-049/079]	
Analog IQ Input/Output	No	[MG3710E-018]	
Universal Input/Output	[MG3740A-017] - Sweep Output (1stRF) - AUX-BNC conversion adapter	[MG3710E-017] - Baseband Reference Clock Input/Output - Sweep Output (1stRF) - Local Signal Input/Output - AUX-BNC conversion adapter	
BER Measurement Function	[MG3740A-021]	[MG3710E-021]	

*1: The MG3710E Vector Signal Generator is recommended for many purposes.
For detail, refer to the MG3710E product brochure.

*2: Only when using WLAN IQproducer MX370111A and 802.11ac (160 MHz) option MX370111A-002.

Waveform Pattern Support Systems

Main frame support Waveform Pattern

Waveform pattern Support Systems	MG3740A (with MG3740A-020)	MG3710E
MX370073B DFS Radar Pattern	—	✓
MX370075A DFS (ETSI) Waveform Pattern	—	✓

For detail, refer to the MX3700xxA Waveform pattern product brochure.

IQproducer Support Systems

Main frame support IQproducer

IQproducer Support Systems		MG3740A (with MG3740A-020)	MG3710E
Standard Accessories	W-CDMA IQproducer	—	✓
	AWGN IQproducer	—	✓
Options	MX370101A HSDPA/HSUPA IQproducer	—	✓
	MX370102A TDMA IQproducer	✓	✓
	MX370103A CDMA2000 1xEV-DO IQproducer	—	✓
	MX370104A Multi-carrier IQproducer	—	✓
	MX370106A DVB-T/H IQproducer	—	✓
	MX370107A Fading IQproducer	✓	✓
	MX370108A LTE IQproducer	—	✓
	MX370108A-001 LTE-Advanced FDD Option	—	✓
	MX370110A LTE TDD IQproducer	—	✓
	MX370110A-001 LTE-Advanced TDD Option	—	✓
	MX370111A WLAN IQproducer	—	✓
	MX370111A-002 802.11ac (160 MHz) Option	—	✓
	MX370112A TD-SCDMA IQproducer	—	✓
	MX370113A 5G NR TDD sub-6 GHz IQproducer	—	✓
	MX370114A 5G NR FDD sub-6 GHz IQproducer	—	✓

For detail, refer to the MX3701xxA IQproducer product brochure.

Specifications

Refer to the Data Sheet for specification details such as guaranteed setting ranges, etc.

Frequency Setting Range

1stRF

MG3740A-032	9 kHz to 2.7 GHz
MG3740A-034	9 kHz to 4 GHz
MG3740A-036	9 kHz to 6 GHz

2ndRF

MG3740A-062	9 kHz to 2.7 GHz
MG3740A-064	9 kHz to 4 GHz
MG3740A-066	9 kHz to 6 GHz

Switching Speed (List Mode)

Frequency	≤600 μs
Level	≤600 μs

Amplitude Setting Range

Options	Setting Range [dBm]	
	without Reverse Power Protection	with Reverse Power Protection
Standard	–110 to +17	–110 to +17
with High-power Extension	–110 to +30	–110 to +25
with Low-power Extension	–144 to +17	–144 to +17
with High-power Extension and Low-power Extension	–144 to +30	–144 to +25

Level Accuracy is assured at high levels (CW)

Frequency Range	Standard	MG3740A-041/071
100 kHz ≤ f < 10 MHz	+5 dBm	+5 dBm
10 MHz ≤ f < 50 MHz	+10 dBm	+10 dBm
50 MHz ≤ f < 400 MHz	+13 dBm	**+20 dBm**
400 MHz ≤ f ≤ 3 GHz		**+23 dBm**
3 GHz < f ≤ 4 GHz		**+20 dBm**
4 GHz < f ≤ 5 GHz		+13 dBm
5 GHz < f ≤ 6 GHz	+11 dBm	+11 dBm

Absolute Level Accuracy

CW, 18°C to 28°C, –110 to +5 dBm

±0.5 dB (typ.)	(100 kHz ≤ f < 50 MHz)
±0.5 dB	(50 MHz ≤ f ≤ 3 GHz)
±0.7 dB	(3 GHz < f ≤ 4 GHz)
±0.8 dB	(4 GHz < f ≤ 6 GHz)

Harmonics

<–30 dBc

Non-Harmonics

Output level ≤+5 dBm, CW, Frequency offset ≥10 kHz

<–62 dBc (100 kHz ≤ f ≤ 187.5 MHz)
<–68 dBc (187.5 MHz < f ≤ 750 MHz)
<–62 dBc (750 MHz < f ≤ 1.5 GHz)
<–56 dBc (1.5 GHz < f ≤ 3 GHz)
<–50 dBc (3 GHz < f ≤ 6 GHz)

Single Sideband Phase Noise

CW, 20 kHz offset

<–140 dBc/Hz (nom.)	(100 MHz)
<–131 dBc/Hz (typ.)	(1 GHz)
<–125 dBc/Hz (typ.)	(2 GHz)

Analog Modulation

- Amplitude Modulation (Internal Modulation Source)
  Depth: 0 to 100% (Linear)
  0 to 10 dB (Log)
  Modulation Frequency: 0.1 Hz to 50 MHz
- Frequency Modulation (Internal Modulation Source)
  Deviation: 0 Hz to 40 MHz
  Modulation Frequency: 0.1 Hz to 40 MHz, or (50-MHz FM Rate), whichever smaller
- Φ-Modulation (Internal Modulation Source)
  Deviation angle: 0 to 160 rad., or (40 MHz/ΦM Rate) rad., whichever smaller
  Modulation Frequency: 0.1 Hz to 40 MHz, or (40 MHz/ΦM Deviation), whichever smaller
- Pulse Modulation (Internal Modulation Source)
  Modulation Frequency: 0.1 Hz to 10 MHz
  Modulation Period: 10 ns to 20 s

Digital Modulation Performance [MG3740A-020 installed]

- RF Modulation Bandwidth
  2 MHz
- ARB Memory Size

64 Msamples (256 MB)	[with 1stRF, 2ndRF]
256 Msamples (1 GB)	[MG3740A-045/075]

- Sampling Rate
  20 kHz to 8 MHz
- DAC Resolution
  14/15/16 bits

CE Marking

EMC: 2014/30/EU, EN61326-1, EN61000-3-2
LVD: 2014/35/EU, EN61010-1
RoHS: 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018

UKCA Marking

EMC: S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
LVD: S.I. 2016 No.1101, EN 61010-1
RoHS: S.I. 2012 No.3032, EN IEC 63000:2018

Dimensions, Mass

426 (W) × 177 (H) × 390 (D) mm
≤13.7 kg (with 1stRF, excluding other option)

Power Supply

100 VAC to 120 VAC, 200 VAC to 240 VAC
50 Hz to 60 Hz

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name	Remarks
	Main Frame	
MG3740A	Analog Signal Generator	
	Standard Accessories	
	Power Cord: 1 pc	
P0031A	USB Memory	USB2.0 Flash Driver, ≥256 MB
	Install CD-ROM	Operation manual (PDF) and application software (IQproducer)
	Options	
	(Common Parts)	
MG3740A-001	Rubidium Reference Oscillator	Select when ordering main frame, aging rate: ±1 × 10^{-10}/month
MG3740A-002	High Stability Reference Oscillator	Select when ordering main frame, aging rate: ±1 × 10^{-7}/year
MG3740A-011	2ndary HDD	Select when ordering main frame, spare HDD for saving user data without Windows OS
MG3740A-017	Universal Input/Output	Select when ordering main frame, Adds BNC connectors for Sweep Output signal (only supports SG1) to rear panel of main frame, includes AUX Conversion Adapter J1539A
MG3740A-020	Digital Modulation	Select when ordering main frame, Built-in Digital Modulation function. Digital modulation Performance: - RF modulation bandwidth: 2 MHz - Sampling rate: 20 kHz to 8 MHz
MG3740A-021	BER Test Function	Select when ordering main frame, Built-in BER measurement, Bit Rate: 100 bps to 40 Mbps AUX Conversion Adapter J1539A required for Data/Clock/Enable signal input
MG3740A-101	Rubidium Reference Oscillator Retrofit	Retrofitted to shipped MG3740A
MG3740A-102	High Stability Reference Oscillator Retrofit	Retrofitted to shipped MG3740A
MG3740A-111	2ndary HDD Retrofit	Retrofitted to shipped MG3740A
MG3740A-117	Universal Input/Output Retrofit	Retrofitted to shipped MG3740A
MG3740A-120	Digital Modulation Retrofit	Retrofitted to shipped MG3740A
MG3740A-121	BER Test Function Retrofit	Retrofitted to shipped MG3740A The CPU/Windows 10 Upgrade Retrofit MG3740A-182 is required when retrofitting the MG3740A-121 to the MG3740A with built-in WES2009 (Windows XP) or Windows 7 Professional (MG3740A-029/129). Refer to the description in the Options Configuration Guide for how to determine the built-in OS.
MG3740A-182	CPU/Windows10 Upgrade Retrofit	Retrofitted to shipped MG3740A Due to OS license restrictions, this option cannot be installed in MG3740A units with Removable HDD MG3740A-313 (sales discontinued) installed.
MG3740A-282	CPU/Windows10 Upgrade Retrofit	Retrofitted to shipped MG3740A MG3740A-2xx is the option for customers to upgrade at their nearest local service center outside Japan. Due to OS license restrictions, this option cannot be installed in MG3740A units with Removable HDD MG3740A-313 (sales discontinued) installed.
	(For 1stRF)	
MG3740A-032	1stRF 100 kHz to 2.7 GHz	Select when ordering main frame, select 1stRF frequency range, frequency cannot be changed after installation
MG3740A-034	1stRF 100 kHz to 4 GHz	Select when ordering main frame, select 1stRF frequency range, frequency cannot be changed after installation
MG3740A-036	1stRF 100 kHz to 6 GHz	Select when ordering main frame, select 1stRF frequency range, frequency cannot be changed after installation
MG3740A-041	High Power Extension for 1stRF	Select when ordering main frame, increases upper limit of output signal power setting range
MG3740A-042	Low Power Extension for 1stRF	Select when ordering main frame, increases lower limit of output signal power setting range
MG3740A-043	Reverse Power Protection for 1stRF	Select when ordering main frame, prevents damage caused by reverse input to output connector
MG3740A-045	ARB Memory Upgrade 256 Msample for 1stRF	Select when ordering main frame, expands ARB memory capacity. Requires MG3740A-020.
MG3740A-048	Combination of Baseband Signal for 1stRF	Select when ordering main frame, adds baseband combine function. Requires MG3740A-020.
MG3740A-050	Additional Analog Modulation Input for 1stRF	Select when ordering main frame, Adds BNC connector for inputting external signals to rear panel of mainframe.
MG3740A-141	High Power Extension for 1stRF Retrofit	Retrofitted to shipped MG3740A
MG3740A-142	Low Power Extension for 1stRF Retrofit	Retrofitted to shipped MG3740A
MG3740A-143	Reverse Power Protection for 1stRF Retrofit	Retrofitted to shipped MG3740A
MG3740A-145	ARB Memory Upgrade 256 Msample for 1stRF Retrofit	Retrofitted to shipped MG3740A. Requires MG3740A-020/120.
MG3740A-148	Combination of Baseband Signal for 1stRF Retrofit	Retrofitted to shipped MG3740A. Requires MG3740A-020/120.
MG3740A-150	Additional Analog Modulation Input for 1stRF Retrofit	Retrofitted to shipped MG3740A
	(For 2ndRF)	
MG3740A-062	2ndRF 100 kHz to 2.7 GHz	Select when ordering main frame, select 2ndRF frequency range, frequency cannot be changed after installation
MG3740A-064	2ndRF 100 kHz to 4 GHz	Select when ordering main frame, select 2ndRF frequency range, frequency cannot be changed after installation
MG3740A-066	2ndRF 100 kHz to 6 GHz	Select when ordering main frame, select 2ndRF frequency range, frequency cannot be changed after installation
MG3740A-071	High Power Extension for 2ndRF	Select when ordering main frame, increases upper limit of output signal power setting range
MG3740A-072	Low Power Extension for 2ndRF	Select when ordering main frame, increases lower limit of output signal power setting range
MG3740A-073	Reverse Power Protection for 2ndRF	Select when ordering main frame, prevents damage caused by reverse input to output connector
MG3740A-075	ARB Memory Upgrade 256 Msample for 2ndRF	Select when ordering main frame, expands ARB memory capacity. Requires MG3740A-020.
MG3740A-078	Combination of Baseband Signal for 2ndRF	Select when ordering main frame, adds baseband combine function. Requires MG3740A-020.
MG3740A-080	Additional Analog Modulation Input for 2ndRF	Select when ordering main frame, Adds BNC connector for inputting external signals to rear panel of mainframe.
MG3740A-162	2ndRF 100 kHz to 2.7 GHz Retrofit	Retrofitted to shipped MG3740A when 2ndRF not installed
MG3740A-164	2ndRF 100 kHz to 4 GHz Retrofit	Retrofitted to shipped MG3740A when 2ndRF not installed
MG3740A-166	2ndRF 100 kHz to 6 GHz Retrofit	Retrofitted to shipped MG3740A when 2ndRF not installed
MG3740A-171	High Power Extension for 2ndRF Retrofit	Retrofitted to shipped MG3740A
MG3740A-172	Low Power Extension for 2ndRF Retrofit	Retrofitted to shipped MG3740A
MG3740A-173	Reverse Power Protection for 2ndRF Retrofit	Retrofitted to shipped MG3740A
MG3740A-175	ARB Memory Upgrade 256 Msample for 2ndRF Retrofit	Retrofitted to shipped MG3740A. Requires MG3740A-020/120.
MG3740A-178	Combination of Baseband Signal for 2ndRF Retrofit	Retrofitted to shipped MG3740A. Requires MG3740A-020/120.
MG3740A-180	Additional Analog Modulation Input for 2ndRF Retrofit	Retrofitted to shipped MG3740A

Continued on next page

Model/Order No.	Name	Remarks
	Maintenance Service	
MG3740A-ES210	2 Years Extended Warranty Service	
MG3740A-ES310	3 Years Extended Warranty Service	
MG3740A-ES510	5 Years Extended Warranty Service	
	Softwares (IQproducer)	(License for IQproducer)
MX370102A	TDMA IQproducer	IQproducer software, license for main frame, manual (PDF)
MX370107A	Fading IQproducer	IQproducer software, license for main frame, manual (PDF)
	Optional Accessories	
W3580AE	MG3710A/MG3710E/MG3740A Operation Manual (Main Unit)	Booklet, for MG3710A/MG3710E/MG3740A Main Frame (Operation, Remote Control)
W2496AE	MG3710A/MG3710E/MG3740A Operation Manual (IQproducer)	Booklet, for IQproducer (Operation for Common Parts)
W2916AE	MX370102A Operation Manual	Booklet, for TDMA IQproducer
W2995AE	MX370107A Operation Manual	Booklet, for Fading IQproducer
J1539A	AUX Conversion Adapter	Converts MG3740A rear-panel AUX connector to BNC connector
Z1572A	Installation Kit	Required when retrofitting hardware options or installing IQproducer (MX3701xxA)
MA24105A	Inline Peak Power Sensor	350 MHz to 4 GHz, Inline type, with USB A to micro-B Cable
MA24106A	USB Power Sensor	50 MHz to 6 GHz, with USB A to mini-B Cable
MA24108A	Microwave USB Power Sensor	10 MHz to 8 GHz, with USB A to micro-B Cable
MA24118A	Microwave USB Power Sensor	10 MHz to 18 GHz, with USB A to micro-B Cable
MA24126A	Microwave USB Power Sensor	10 MHz to 26 GHz, with USB A to micro-B Cable
K240B	Power Divider (K connector)	DC to 26.5 GHz, K-J, 50 Ω, 1 Wmax
MA1612A	Four-Port Junction Pad	5 MHz to 3 GHz, N-J
J0576B	Coaxial Cord, 1.0 m	N-P · 5D-2W · N-P
J0576D	Coaxial Cord, 2.0 m	N-P · 5D-2W · N-P
J0127A	Coaxial Cord, 1.0 m	BNC-P · RG-58A/U · BNC-P
J0127B	Coaxial Cord, 2.0 m	BNC-P · RG-58A/U · BNC-P
J0127C	Coaxial Cord, 0.5 m	BNC-P · RG-58A/U · BNC-P
J0322A	Coaxial Cord, 0.5 m	SMA-P · SMA-P, DC to 18 GHz, 50 Ω
J0322B	Coaxial Cord, 1.0 m	SMA-P · SMA-P, DC to 18 GHz, 50 Ω
J0322C	Coaxial Cord, 1.5 m	SMA-P · SMA-P, DC to 18 GHz, 50 Ω
J0322D	Coaxial Cord, 2.0 m	SMA-P · SMA-P, DC to 18 GHz, 50 Ω
J0004	Coaxial Adapter	N-P · SMA-J Conversion Adapter, DC to 12.4 GHz
J1261B	Ethernet Cable (Shield Type)	Straight-through, 3 m
J1261D	Ethernet Cable (Shield Type)	Crossover, 3 m
J0008	GPIB Cable, 2.0 m	
B0635A	Rack Mount Kit	EIA
B0657A	Rack Mount Kit (JIS)	JIS
B0636C	Carrying Case	Hard Type. With Casters and Front Cover B0671A
B0671A	Front Cover for 1MW4U	
Z0975A	Keyboard (USB)	
Z0541A	USB Mouse	

Typical (typ.): Performance not warranted. Must products meet typical performance.
Nominal (nom.): Values not warranted. Included to facilitate application of product.
Measured (meas): Performance not warranted. Data actually measured by randomly selected measuring instruments.

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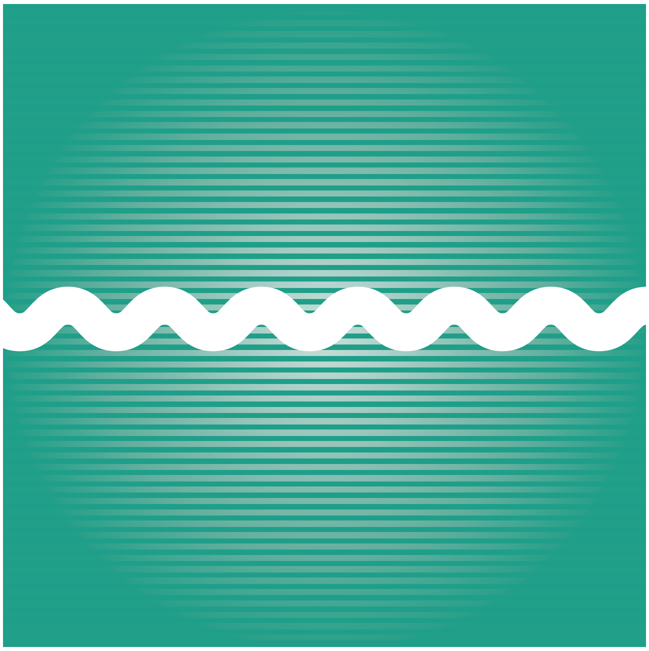


RF MICROWAVE MEASURING INSTRUMENTS

Power Meters

ML2430A Series

Remote Control
GPIB

For Measuring Wide Dynamic Range Power

The Power Meters ML2430A series combine the advantages of thermal meter accuracy, diode meter speed, and peak power meter display graphics. The result is a single instrument that achieves 90 dB dynamic range with a single sensor. The ML2430A series includes graphics display capability as a standard feature. The ruggedized housing and optional high-capacity NiMH battery bring convenience and accuracy to field service applications.

Performance

Speed and Dynamic Range

The 90 dB range standard diode sensor MA2470D series' high sensitivity reaches stable power readings to –70 dBm. 35 kHz sample rates profile cellular, PCS, and other pulsed signals to 0.1 µsec resolution. Superior connector technology achieves industry-leading return loss for improved accuracy through 50 GHz. The 87 dB range MA2440D series high accuracy sensors further improve return loss performance by adding a matching circuit to the MA2470D series' front end.

New power sensor technology achieves industry-leading measurement linearity and high sensitivity.

Universal Power Sensors

The universal power sensor MA2480D series will measure any modulated or multi-tone signal thanks to a patented sensor architecture with three diode pairs. Universal power sensors deliver over 80 dB of dynamic range with speed and accuracy.
Average power measurements on W-CDMA signals can now be made without the need for special power meters. Universal sensors are also ideal for power measurements on other digitally modulated carriers such as HDTV, DAB, or QAM modulated radio links.
The sensor architecture ensures that one of the diode pairs is always operating in its square law region. The meter selects the diode pair operating in its square law region and is designed so that even the peaks of CDMA signals are measured accurately. Anritsu's three stage diode pair approach leads to a very much faster measurement time than the two stage approach used in previous generations of average power sensors. No slowing of measurement speed is observed at switching points, making them transparent to the user.
Universal power sensors are also ideal for applications where multiple signals are present, such as intermodulation measurements and satellite multi carrier power loading measurements.
A unique additional capability of the Anritsu universal power sensor is the ability to use it as a standard diode sensor for fast CW measurements and pulse or TDMA measurements. In this mode the fast response of diode sensors is maintained across the full dynamic range of the sensor, meaning that for the majority of users it is the only sensor that they will ever need - a truly universal power sensor.

GPIB Speed

A speed of >600 continuous readings per second is achieved under a variety of operating conditions including averaging settings, sensor control settings, triggering conditions, operating mode, sensor type, and GPIB interface manufacturer. The ML2430A series offers the ability to measure and transfer a high-speed burst of 200 data points using profile operating mode with sampling rates of 35k per second.

GPIB Emulation

With 99.9% emulation of older meters, the ML2430A series improves ATE system productivity. Typical test system speed improvement is 2 to 10 times faster system speed depending upon the number of measurements taken during the test, the minimal use of wait statements within the code, and the meter model emulated.

Triggering Controls

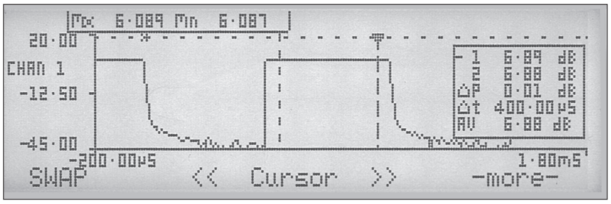
What use is high speed without triggering and sample controls? Data acquisition event arming and triggering functions traditionally found on expensive peak power meters are standard in the ML2430A series. Triggering delay and the sample integration time per reading can be directly controlled by the operator. Trigger sources include, continuous, internal, external TTL, and manual. Thus, data acquisition can be optimally controlled for synchronization with other test equipment.

Burst profile graphics display

The ML2430A features random repetitive sampling for high resolution of fast signals. A time domain graphic display profiles pulsed signals over a power range of –40 to +20 dBm. 35 kHz sampling speed produces clear power profiles of cellular and PCS signals including TDMA, PHS, GSM, and DCS-1800. Pulse top power is easily and repeatably measured using between cursor averaging. Measure pulsetop power over >80 dB dynamic range in readout mode at GPIB speeds >200 readings per second.

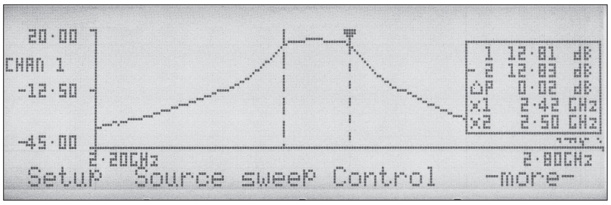
Power vs. Time Graphics Display

The power versus time mode is a strip chart style display for monitoring gain and output power variations over time/temperature, supply voltage, or a component tolerance. In service applications, measurement of power versus time aids trouble shooting of unusual conditions, such as intermittent switches or abnormal power control in a mobile telephone base stations. The power versus time mode provides a clear strip chart display of RF power variation.



Source Sweep Graphic Display

Power sweep or frequency sweep data are acquired at more than 10 sweeps per second over GPIB. Synchronization with synthesizers requires connection (BNC) of a 10.0 V sweep ramp input and an RF blanking/dwell input.



Parallel Printer Connector

Many deskjet series printers can be connected directly to the ML2430A for fast documentation of performance on the bench or in the field. Meter calibration, triggering, and averaging settings are listed with the display printout. Thus, evidence of DUT (device under test) anomalies can be duplicated quickly.

90 dB Dynamic Range

Typical communications industry ATE systems operate over a 60 to 80 dB dynamic range. The MA2470D series' 90 dB dynamic range replaces two 50 dB sensors. Furthermore, an RF switch is no longer needed for the two sensors. This reduces software control complexity and further speeds test execution.

Sensor EEPROM

All power sensor MA2400D series sensors are equipped with internal EEPROMs for storage of calibration factor data vs. frequency. This allows the power meter to interpolate and correct readings automatically, improving accuracy and convenience.

High Reliability

A rugged polycarbonate chassis handles drop shocks and rough field treatment. The absence of vent holes makes the meter splash resistant. A front cover panel and softcase are optional for further environmental protection. Power sensors are also ruggedized for rough handling.

Improved Accuracy

Mismatch uncertainty is typically the largest source of error. The MA2400D series offer a typical 5 to 6 dB improvement in sensor return loss, typically cutting mismatch uncertainty in half. The high accuracy sensors MA2440D series incorporate a matching pad which further improves return loss by 5 to 6 dB — again halving mismatch uncertainty.

Offset Table for Path Loss Correction

Compensating for the true frequency response of attenuators, couplers, cables, switches, and other test setup devices improves measurement accuracy. For this reason, the ML2430A series can apply an offset table of attenuation-versus-frequency in addition to the traditional fixed dB offset capability. When a power sensor connection is preceded with a wideband power limiter, the offset table compensates for frequency response. Thus, the combination achieves an accurate, "burnout-proof" sensor.

Softkey Menu Control

Softkey menus simplify instrument control by making the user interface easier to understand. The numerical keypad simplifies the operator interface.

Battery

The optional NiMH "smart" battery supports high charge density for a typical 8 hour day of operation. Accurate fuel gauging, <2 hour fast charge cycling, and the elimination of NiCd style memory effect further enhance the convenience of this battery technology.

Voltmeter

The ML2430A series also supports high-speed voltage measurement. A rear panel BNC measures voltage or operates as V/GHz input supporting automated sensor calibration factor correction.

High-Power Applications

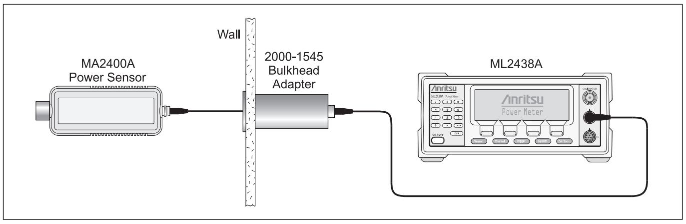
Traditional high-power sensors are expensive and have degraded accuracy specifications. Further, their annual calibration requires more time and expense. Anritsu's User Calibration Factor Tables avoid these problems. Any attenuator or coupler can be compensated by entering frequency and attenuation values into the MA2400D series internal EEPROM. The attenuation device can be semi-permantly attached; the power meter automatically applies compensation during the 0.0 dBm, 50 MHz calibration reference process. The User Calibration Factor Tables are easily deactivated – allowing the power sensor to be used standalone also.

Remote Monitoring by Telephone

Monitor transmitter performance remotely with standard telephone lines using the ML2430A's full duplex RS232 and dial-out capabilities. When the ML2430A detects a high or low limit line violation, it will automatically dial a phone number. The meter's data acquisition settings can adjust to monitor average power or the burst power of specific timeslots. The RS232 port uses the same commands as the GPIB. Contact your Anritsu representative for PC compatible software.

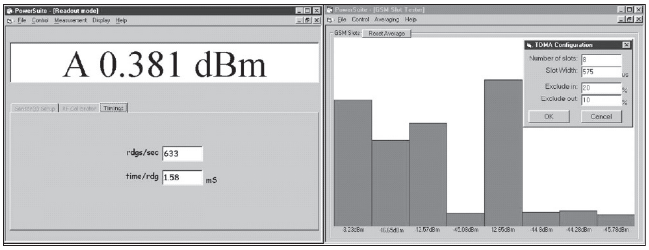
Locate Power Sensors Remotely

When a power sensor's cable must pass through walls or shielded enclosures, the model 2000-1545 bulkhead adapter provides a convenient connection between two sensor cables.



PowerSuite

PowerSuite software runs on a standard PC running Windows® 95 (or higher), via GPIB or RS232. PowerSuite is a very flexible package that provides full user control over measurement settings. The PC screen can be set for continuous update so that changes to the device or system under test can be viewed instantly. Alternatively, plots can be archived for later analysis.



A 0.381 dBm

rdgs/sec 633

time/rdg 1.58 mS

Number of slots: 8

Slot Width: 575 us

Exclude in: 20 %

Exclude out: 10 %

Power Meter Specifications

Model	ML2437A	ML2438A	Comments
Signal Inputs	1	2	
Frequency Range	100 kHz to 65 GHz (sensor dependent)		
Dynamic Range Continuous or Peak	–70 to +20 dBm (dependent on sensor, external coupler or attenuator)		Continuous
Performance	100 kHz (Profile mode)		Nominal video BW
	31.25 kS/s		Sampling rate
Accuracy (Defined by uncertainty calculations with relevant sensor and source match conditions)	CW Mode <0.5% (±0.02 dB absolute accuracy, ±0.04 dB relative accuracy)		Instrumentation Accuracy
	Equivalent Noise Power (512 Moving Average) MA2472D / MA2491A / MA24002A Range 1: 0.5 µW / 2 µW / N/A Range 2: 50 nW / 100 nW / 0.5 nW Range 3: 0.8 nW / 2 nW / 8 µW Range 4: 0.2 nW / 1 nW / 2 µW Range 5: 50 pW / 0.5 nW / 0.5 nW (CW mode)		Equivalent Noise Power is RSS of Zero Set, Zero Drift and noise. Zero Set and Drift is measured over on hour warm-up at constant ambient temperature. Noise is measured over five minutes over 512 averaging after one hour warm up at constant ambient temperature.
Operation	2		Measurement Display-Readout (Numerical)
	Power vs. Time graphic of readout data		Measurement Display-Profile (Graph)
	Single channel power sweep or frequency sweep		Source sweep
	±5 dB range CW (Readout mode) only		Peaking meter
	Dynamic range covered by five overlapping amplifier ranges, R1, R2, R3, R4, and R5 Universal sensor MA2481/82D ranges 1 to 6		Amplifier Range
	Auto or Manual (current range or selectable 1 through 5)		Range Hold
Features (summary)	Monochrome LCD, with backlight and adjustable contrast		Display
	0.1 to 0.001 dB Linear power units, 3 to 6 digit, 1 to 3 digits selectable to right of decimal nW to W; Voltage, 1 to 2 digits selectable to right of decimal		Display resolution in Readout mode
	0.01 dB		Display resolution in Profile mode
	Profile and P vs. T modes: 200 pixels display resolution For a 1 ms Profile window, cursor resolution on the display is 5 µs		Time measurement resolution
	Hold, Max, Min		Measurement hold
	Average, Min, Max		Measurements
	0.00 to 20.00 V (nom.)		Voltage measurement range
	Watt, %, Volts, dBm, dB, dBµV, dBmV, dBr		Display units (Lin) Display units (Log)
	–199.99 to +199.99 dB		Display range
	1		Measurement Gates
	2		Markers
	Fixed value high and low limits with audible, rear panel TTL output, and/or visible Pass/Fail alarm indication Failure indication can latch for transient failure detection		Limit lines
	–199.99 to +199.99 dB (Fixed value or frequency dependent table)		Offset range
Averaging	Auto (Moving), Manual (Moving, Repeat)		Type
	1 to 512		Range
	Low, Medium and High settings apply post average low pass filter to improve visibility at high display resolution		Low-level Averaging
Triggering	Internal, External (TTL or RF Blanking), GPIB, Manual, Continuous		Source
	Manual Single power value set to cover entire measurement dynamic range of sensor Auto Automatically sets trigger level for signal over measurement dynamic range		Trigger modes
	Sets the trigger arming, unless the trigger source is set to EXT TTL When ARMING is set to Blanking ON, only samples taken when the rear panel Digital Input BNC is active will be averaged in the measurement		Arming Sources
	–15 to 20 dBm (all diode sensors, selectable to –25 dBm)		Internal Trigger dynamic range
	1 dB		Internal Trigger level Accuracy (typ.)
	0.1 dB		Internal Trigger settable resolution
	0.0 to 999 ms		Trigger delay range
Triggering	TTL rising or falling edge (BNC input)		External Trigger range
	0.5% of display period or 100 ns		Trigger delay settable resolution
	Profile mode: 10 ms to 7 s P v T mode: 1 m to 24 hrs		
	On-screen indicator/message		Trigger point display (on-screen)
System Configuration	10 storage registers plus RESET default settings		Save/Recall
	Wipes non-volatile memory on power up when active.		Secure mode

Continued on next page

Model	ML2437A	ML2438A	Comments
Interfaces	Yes		Remote monitoring
	Yes		Modem Compatibility
	>600 readings/sec (per input channel) Emulation of Anritsu ML4803, Agilent 436, 437 and 438		GPIB (IEEE–488.2, IEC–625)
	Compatible with Deskjet 540 and 340 Models (other 500 Series and 300 Series and later are typically compatible). Canon BJC 80.		Parallel Printer Port
	Supports software download and Instrument control 1200, 2400, 4800, 9600, 19200, 38400, 57600 Baud rates supported		RS232
	Operating Modes: Display voltage reading on selected channel Voltage proportional to frequency for sensor calibration factor compensation Blanking Input -TTL levels only Selectable positive or negative polarity Input Range: 0 to 20 V Resolution: 0.5 mV Control: Adjustable voltage to frequency relationship		Cal Factor Voltage Input (BNC)
	TTL, maximum frequency of 800 kHz		External trigger (BNC)
	Two outputs configurable to Log or Lin Operating Modes: Selectable channel adjusted for calibration factors and other power reading correction settings Pass/Fail – Selectable TTL High or Low Channel output -Near real time analog Uncalibrated AC Modulation Output -Output 1 only Dwell Output -Output 2 only Output Range: –5.0 to +5.0 V Resolution: 0.1 mV		Analogue Output (BNC)
Reference Calibrator	1 mW		Power
	±1.2% per year		Power accuracy (Traceable to National Standards)
	50 MHz (nom.)		Frequency
	<1%		Frequency Accuracy
	<1.04		VSWR
	N (f)		Connector type
General	MIL-T28800F, class 3		
Non Volatile RAM Battery	Lithium (10 year life)		
Battery Option	>6 hr usable with 3000 mAhr (NiMH) battery		
DC Power Requirements	12 to 24 VDC, Reverse protected to –40 V Maximum input 30 V		
AC Power Requirements	85 VAC to 264 VAC, 47 Hz to 440 Hz, 40 VA (max.)		
CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: (EU) 2015/863		
RCM	Australia and New Zealand: RCM AS/NZS 4417:2012		
KCC	South Korea: KCC-REM-A21-0004		
Operating Temperature	0°C to +50°C		
Storage Temperature	–40°C to +70°C		
Moisture	Splash and rain resistant, 95% humidity non-condensing		
Dimensions	223 (W) × 88 (H) × 390 (D) mm		
Mass	3 kg (excluding battery option)		
Warranty	Power meters have a standard 3 year warranty. Power sensors have a standard 1 year warranty.		

Power Sensors

Power Sensors for every application

Anritsu's power sensors have been designed with just one thing in mind: everything. The range of sensors provide frequency coverage to 50 GHz, with dynamic range up to 90 dB, and includes both diode and thermal based technologies.
The Anritsu diode-based sensors offer speed, sensitivity, and dynamic range with designs using half- or full-wave diode rectifiers constructed from zero-bias Schottky diodes. The rectifier output is low-pass filtered, forming an envelope detector.

Standard Diode Sensors: MA2470D

Designed for high dynamic range, high accuracy CW and TDMA measurements, these power sensors have 90 dB dynamic range and linearity better than 1.8%. This makes them the choice for precision measurements. The rise-time of these sensors is fast enough for power measurements on GSM and similar TDMA systems that use GMSK modulation.

High Accuracy Diode Sensors: MA2440D

With its built in 3 dB attenuator, the MA2440D sensors minimize input VSWR. They are typically used when high measurement accuracy is required over a large dynamic range, for example when measuring amplifiers. High accuracy diode sensors have a dynamic range of 87 dB compared to the 90 dB of standard diode sensors. In all other respects, the performance of the sensors is identical to the standard diode sensor.

Universal Power Sensors: MA2480D

The MA2480A series are true RMS sensors with a dynamic range of 80 dB. These power sensors are modulation independent and can be used for average power measurements on a wide variety of signals, including multi-tone or W-CDMA signals. The sensor architecture consists of three pairs of diodes, each one configured to work in its square law region over the dynamic range of the sensor. Option 1 provides TDMA measurement capability, calibrating one of the diode pairs for linearity over a wide dynamic range.

Thermal Power Sensors: MA24000A

The Anritsu thermal sensors MA24000A series provide excellent power measurement accuracy over 50 dB of dynamic range. Thermal sensors use Seebeck elements, where the combined effect of a thermal gradient and charge migration between dissimilar metals gives a true reading of the average power of any incident waveform. Anritsu thermal sensors have class leading SWR and a built-in EEPROM with calibration factor and linearity correction data. This results in assured accuracy when measuring any signal.

Power Sensor Specifications

Sensor	Frequency Range	CW Dynamic Range (dBm)	SWR	Rise Time[*1] (ms)	Sensor Linearity[*2]	RF Connector[*3]
Standard Diode Sensors						
MA2472D	10 MHz to 18 GHz	–70 to +20 CW mode –43 to +20 Profile mode	<1.17; 10 MHz to 50 MHz[*4] <1.90; 10 MHz to 50 MHz <1.17; 50 MHz to 150 MHz <1.12; 150 MHz to 2 GHz <1.22; 2 GHz to 12.4 GHz <1.25; 12.4 GHz to 18 GHz <1.35; 18 GHz to 32 GHz <1.50; 32 GHz to 40 GHz <1.63; 40 GHz to 50 GHz	<0.004	<1.8%, ≤18 GHz <2.5%, ≤40 GHz <3.5%, ≤50 GHz for MA2475D[*5]	N (m)
MA2473D	10 MHz to 32 GHz					K (m)
MA2474D	10 MHz to 40 GHz					K (m)
MA2475D	10 MHz to 50 GHz					V (m)
Temperature accuracy: <1% <40 GHz, <1.5% <50 GHz, 5°C to 50°C						
High Accuracy Diode Sensors						
MA2442D	10 MHz to 18 GHz	–67 to +20 CW mode –40 to +20 Profile mode	<1.17; 10 MHz to 150 MHz <1.08; 150 MHz to 2 GHz <1.16; 2 GHz to 12.4 GHz <1.21; 12.4 GHz to 18 GHz <1.29; 18 GHz to 32 GHz <1.44; 32 GHz to 40 GHz <1.50; 40 GHz to 50 GHz	<0.004	<1.8%, ≤18 GHz <2.5%, ≤40 GHz <3.5%, ≤50 GHz for MA2445D[*6]	N (m)
MA2444D	10 MHz to 40 GHz					K (m)
MA2445D	10 MHz to 50 GHz					V (m)
Temperature accuracy: <1% <40 GHz, <1.5% <50 GHz, 5°C to 50°C						
Universal Power Sensors						
MA2481D	10 MHz to 6 GHz	–60 to +20	<1.17; 10 MHz to 150 MHz <1.12; 150 MHz to 2 GHz <1.22; 2 GHz to 6 GHz <1.22; 6 GHz to 12.4 GHz <1.25; 12.4 GHz to 18 GHz	<0.004 with Option 1 only	<3%, ≤6 GHz <3%, ≤18 GHz (1.8% CW with Option 1)	N (m)
MA2482D	10 MHz to 18 GHz					
Option 1	Adds fast CW mode to Universal Power Sensors for high speed measurements of CW signal plus TDMA and pulse measurements.					
Temperature accuracy: <1%, 15°C to 35°C						
Thermal Sensor						
MA24002A	10 MHz to 18 GHz	–30 to +20	<1.90; 10 MHz to 50 MHz <1.17; 50 MHz to 150 MHz <1.10; 150 MHz to 2 GHz <1.15; 2 GHz to 12.4 GHz <1.20; 12.4 GHz to 18 GHz <1.25; 18 GHz to 32 GHz <1.30; 32 GHz to 40 GHz <1.40; 40 GHz to 50 GHz	<15	1.8%, <18 GHz[*7] 2.0%, <40 GHz[*7] 2.5%, <50 GHz[*7]	N (m)
MA24004A	10 MHz to 40 GHz					K (m)
MA24005A	10 MHz to 50 GHz					V (m)
Temperature accuracy: <1% <30 GHz <+10 dBm, <1.5% ≥30 GHz ≥+10 dBm						

*1: 0.0 dBm, room temperature with standard 1.5 m sensor cable.

*2: Sensor linearity specifications are ± value. Pulse/modulated performance only specified with 1.5 m sensor cable length option.

*3: Each MA2400A/D Series sensor incorporates precision RF connectors with hexagon coupling nut for attachment by industry standard torque wrench.

*4: MA2472D only.

*5: MA2475D Linearity applicable from –70 to +15 dBm.
Add 1% for power levels >+15 dBm
2000-1537-R supplied as standard with the power meter.

*6: MA2445D Linearity applicable from –67 to +15 dBm.
Add 1% for power levels >+15 dBm

*7: MA245005D Linearity applicable from –30 to +15 dBm.
Add 1% for power levels >+15 dBm

Power Meters & Sensors Selection Guide

Choose the right power meter and power sensor for your measurement application.

Power Sensors	Standard Diode	High-Accuracy Diode	Universal	Thermal
Model Number	MA2470D Series	MA2440D Series	MA2480D Series	MA2400xA
Power Measurement	Average (RMS)	Average (RMS)	Average (RMS)	Average (RMS)
Measurement Application (Examples)	CW, GMSK, GFSK, 8PSK	CW, GMSK	CW, GMSK, GFSK, 8PSK, QPSK, QAM	Any Modulation
	TDMA, FDMA, IS136	TDMA, FDMA	TDMA, FDMA, CDMA, OFDM, Radar	Any Access Scheme
Compatible Power Meters	ML24xxA/B	ML24xxA/B	ML24xxA/B	ML24xxA/B

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Power Meter Models
ML2437A	CW Power Meter, Single Input
ML2438A	CW Power Meter, Dual Input
	Options
ML2400A-05	Front Bail Handle
ML2400A-06	Rear Mount Input A on ML2437A
ML2400A-07	Rear Input A and Reference on ML2437A
ML2400A-08	Rear Mount Inputs A, B and Reference on ML2438A
ML2400A-09	Rear Mount Inputs A and B on ML2438A
2000-1603	NiMH Battery
2000-996-R	Desktop Battery Charger with Power Supply
2000-1534-R	Desktop Battery Charger with Power Supply (for use in Japan only)
2000-1538-R	3 m Sensor Cable
2000-1539-R	5 m Sensor Cable
2000-1540-R	10 m Sensor Cable
2000-1541-R	30 m Sensor Cable
2000-1542-R	50 m Sensor Cable
2000-1543-R	100 m Sensor Cable
2000-1545	Bulkhead Adapter
ML2400A-98	Calibration to ISO 17025 and/or ANSI/NCSL Z540
ML2400A-99	Premium Calibration
	Option 5, 2400-82, and 2400-83 are mutually exclusive for any given ML2430A unit. Options 6, 7, 8 and 9 are mutually exclusive for any given ML2430A unit. Pulse/modulated performance only specified with 1.5 m sensor cable length.
	Standard Accessories
	PowerSuite ML243xA only
	Power Cord (for destination country)
	1.5 m Sensor Cord (one per meter input)
	Certificate of Calibration (also included with sensors)

Model/Order No.	Name
	General Options and Accessories
760–209	Hard-side Transit Case
D41310	Soft Carry Case with Shoulder Strap
2000-1535	Front Panel Cover
2000-1536-R	0.3 m Sensor Cable
2000-1537-R	1.5 m Sensor Cable
2000-1538-R	3 m Sensor Cable
2000-1539-R	5 m Sensor Cable
2000-1540-R	10 m Sensor Cable
2000-1541-R	30 m Sensor Cable
2000-1542-R	50 m Sensor Cable
2000-1543-R	100 m Sensor Cable
2000-1544	RS-232 Bootload Cable
2400-82	Rack Mount, Single Unit
2400-83	Rack Mount, Side-by-Side
	(Options 5, 2400-82, and 2400-83 are mutually exclusive)
	Power Sensor Models
MA2472D	Standard Diode Sensor (10 MHz to 18 GHz, –70 to 20 dBm)
MA2473D	Standard Diode Sensor (10 MHz to 32 GHz, –70 to 20 dBm)
MA2474D	Standard Diode Sensor (10 MHz to 40 GHz, –70 to 20 dBm)
MA2475D	Standard Diode Sensor (10 MHz to 50 GHz, –70 to 20 dBm)
MA2442D	High Accuracy Diode Sensor (10 MHz to 18 GHz, –67 to 20 dBm)
MA2444D	High Accuracy Diode Sensor (10 MHz to 40 GHz, –67 to 20 dBm)
MA2445D	High Accuracy Diode Sensor (10 MHz to 50 GHz,–67 to 20 dBm)
MA2481D	Universal Sensor (10 MHz to 6 GHz, –60 to 20 dBm)
MA2482D	Universal Sensor (10 MHz to 18 GHz, –60 to 20 dBm)
MA24002A	Thermal Sensor (10 MHz to 18 GHz, –30 to 20 dBm)
MA24004A	Thermal Sensor (10 MHz to 40 GHz, –30 to 20 dBm)
MA24005A	Thermal Sensor (10 MHz to 50 GHz, –30 to 20 dBm)

See your Anritsu Representative or Components catalogue for available Attenuators, Limiters, Coaxial adapters, Waveguide-to-Coaxial adapters, Splitters & Dividers, Loads, Bridges, Open/Shorts, and Calibrated Torque wrenches.

For the complete and most up-to-date power meter and sensor specifications;
Technical Datasheet p/n: 11410-00423.

Software upgrades, Labview drivers and additional literature can be downloaded from the Anritsu website at www.anritsu.com

Inline Peak Power Sensor

MA24105A

350 MHz to 4 GHz

A Standalone, Compact, and Highly Accurate Bi-directional Inline Peak Power Sensor for your RF Power Measurement Needs

The Inline Peak Power Sensor MA24105A is designed to take accurate average power measurements from 2 mW to 150 W and peak power measurements from 2 W to 300 W, over the frequency range of 350 MHz to 4 GHz. The sensor employs a "dual path" architecture that enables True-RMS measurements over the entire frequency and dynamic range allowing users to measure CW, multi-tone and digitally modulated signals such as LTE, LTE-TDD, GSM/EDGE, CDMA, W-CDMA, WiMAX, TD-SCDMA, WLAN, and LTE. The forward direction path also include a 4 MHz bandwidth channel that has peak and comparator/integrator circuits that add measurement functions such as PEP power, crest factor, CCDF, and burst average power. Another detection circuit on the reverse direction adds reverse power measurement capabilities including reverse power, reflection coefficient (magnitude), return-loss, and SWR. The presence of a micro-controller along with signal conditioning circuitry, ADC, and power supply in the sensor makes it a complete miniature power meter. This MA24105A comes standard with application software (PowerXpert™) for use with PC that mimics the user interface of a power meter.

Features and Benefits

- Broad frequency range (350 MHz to 4 GHz)
  - Covers all major cellular and communication bands, such as LTE, LTE-TDD, GSM/EDGE, CDMA/EV-DO, W-CDMA/HSPA+, WiMAX, and TD-SCDMA
- Widest dynamic range inline power sensor in its class
  - Eliminates need for additional low level power sensors
- Forward and reverse measurements
  - Measures both transmitted power and reflection from antenna or other reflections using the single inline tool
- True-RMS measurements to 150 W
  - Enables accurate average power measurements of modulation signals
- Standalone, low cost, plug-and-play device
  - No extra elements or element holder required

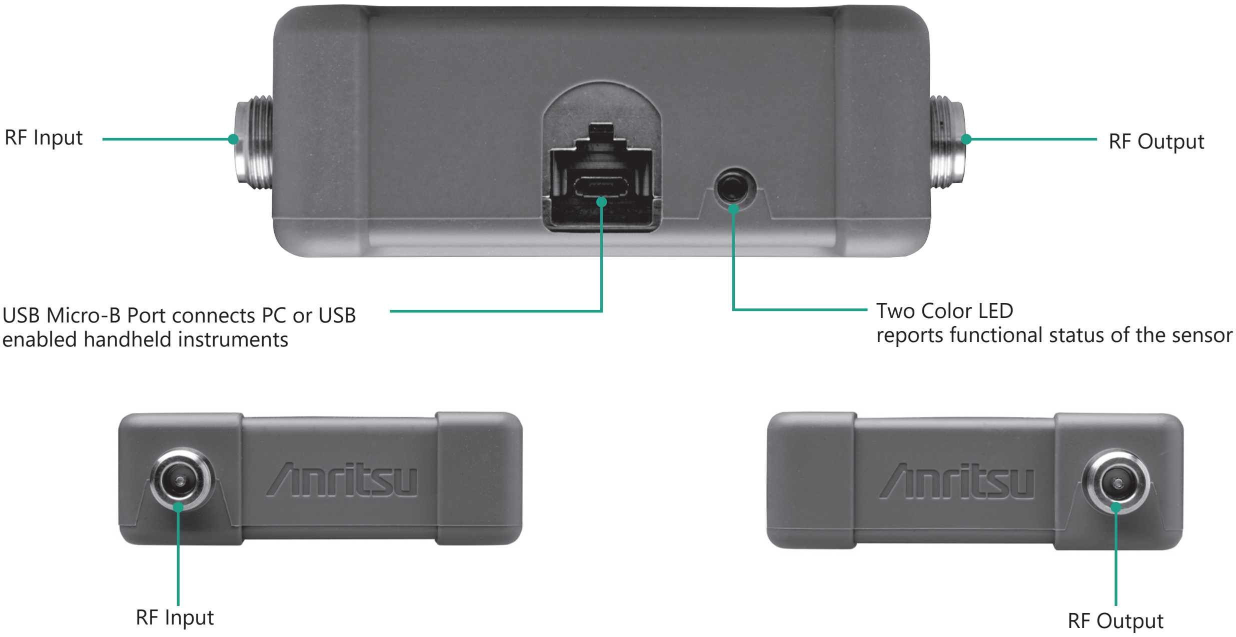
Complements Your Existing Instrument

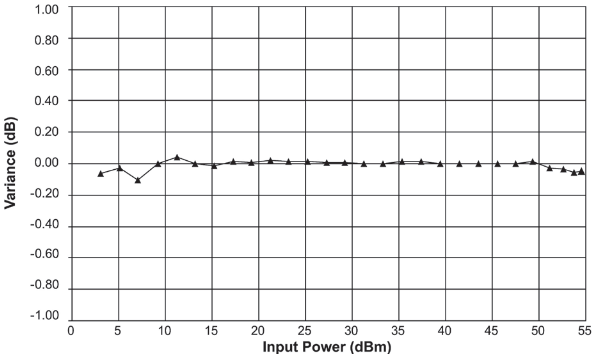
Operation with Personal Computer (PC)

The power sensor can be used with a personal computer running Microsoft® Windows via USB. It comes with a complimentary copy of the PowerXpert application (version 2.11 or greater) for data display, analysis, and sensor control. The software provides a front panel display making the personal computer appear like a traditional power meter. The application has abundant features like data logging, power versus time graph, and offset table that enable quick and accurate measurements.

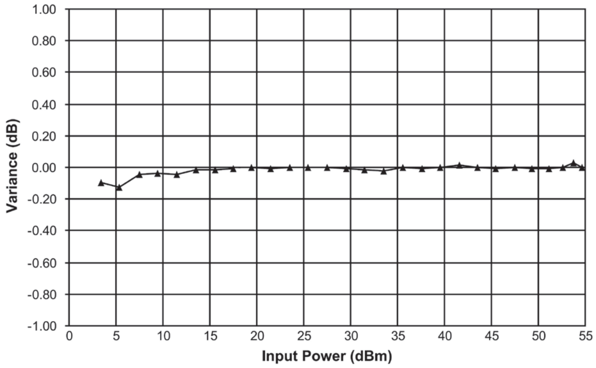
Operation with Anritsu Handheld Instruments

The MA24105A is compatible with most Anritsu RF and microwave handheld analyzers. In some cases the high-accuracy power meter software option (Option 19) is required.

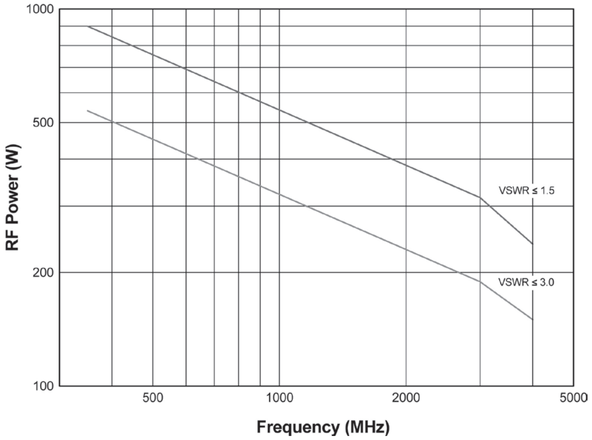




Measurement linearity error referenced to an ideal thermal power sensor measurement of a 900 MHz CW signal in the forward direction.



Measurement linearity error referenced to an ideal thermal power sensor measurement of a 900 MHz CW signal in the reverse direction.



Maximum power handling capacity of the sensor terminated with a load having VSWR of ≤ 1.5 and ≤ 3.0.

High-Accuracy Measurements

Accurate power measurements in the field are important for verifying that transmitter outputs are operating at specified levels. For example, service technicians need to verify base station output power because lower output power can quickly translate into large coverage differences. Highly accurate average power measurements to 150 W are assured as the calibration data is stored directly in the sensor and all necessary corrections (frequency and temperature) are done inside the microprocessor of the sensor. Also, the return loss and directivity of the instrument are optimized to maintain high accuracy. The standards used to calibrate this sensor are directly traceable to NIST.

Continuous Monitoring of Radio Systems

This sensor is designed to have good match and low insertion loss making it ideal for continuous power monitoring of transmitter systems and antennas. The data logging function in the PowerXpert software application for PC equips the user the ability to record measured power over time to a hard disk or other storage media. This is useful for long term drift measurements, environmental testing, and trend analysis. A user settable data logging interval allows measurement speed adjustment to match the user test application requirements. Data are stored as comma-separate files that can be directly opened in Microsoft Excel allowing powerful custom analysis of measured data.

Ideal for Field Use

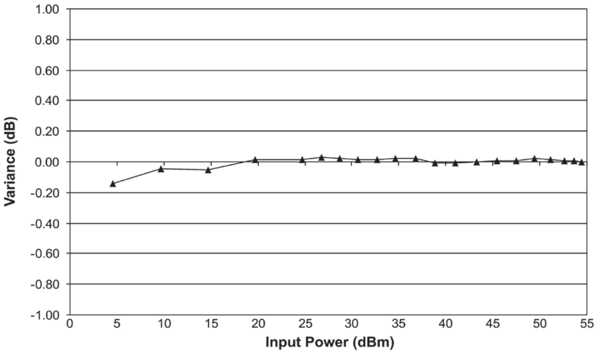
The MA24105A provides lab performance accuracy in a rugged and portable field solution. The sensor is accurate over a wide temperature range (0°C to 55°C), making it perfect for cellular base station installation and maintenance applications. Field and service technicians will appreciate the small size and lightweight of this stand-alone unit as they will not have to carry extra elements, heavy high power attenuators, or power meters. A very easy-to-use PC application with a large display makes the job even easier for technicians who need accurate measurement results quickly.

Average Measurements of CW, Pulsed, or Modulated Signals

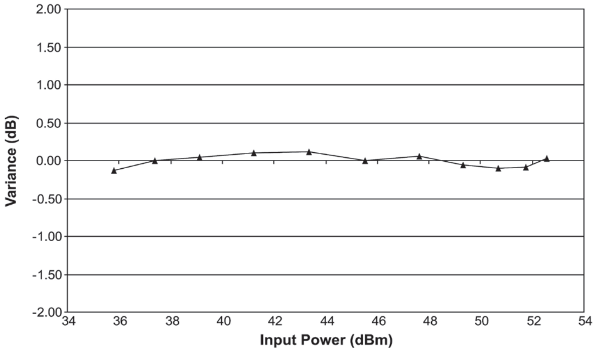
The MA24105A is rated to meet all specifications up to an average input power level of 150 W. Although the average power of all signals should be kept at or below 150 W, time varying and burst signals having peak powers less than the limits shown in the Maximum Power graph can be measured. To ensure accurate readings, the peak to average ratio (crest factor) of signals must be less than 12 dB.

Peak Power, Crest Factor, Burst Average, and Complementary Cumulative Distribution Function (CCDF)

The MA24105A and associated PowerXpert application provide information critical to development, manufacture and operation of modern communications systems. The peak power function enables the user to determine the maximum power of the modulated signal envelope. The ratio between the peak power and average power result provides the crest factor. Of particular use in TDMA systems, the burst average function uses duty cycle information obtained either automatically or as user-entry to calculate the average power during a burst based on the measurement of average power. Critical to those working with spread spectrum systems, which exhibit a non-deterministic envelope, the CCDF feature shows the percentage of the time that the peak power exceeds a user-set threshold.



Forward average power linearity error referenced to an ideal thermal power sensor measurement of a W-CDMA signal at 2 GHz.



Forward peak power linearity error referenced to Anritsu MA2491A peak power sensor measurement of a W-CDMA signal.

Reverse Power, Reflection Coefficient (magnitude), Return Loss, and Standing Wave Ratio (SWR)

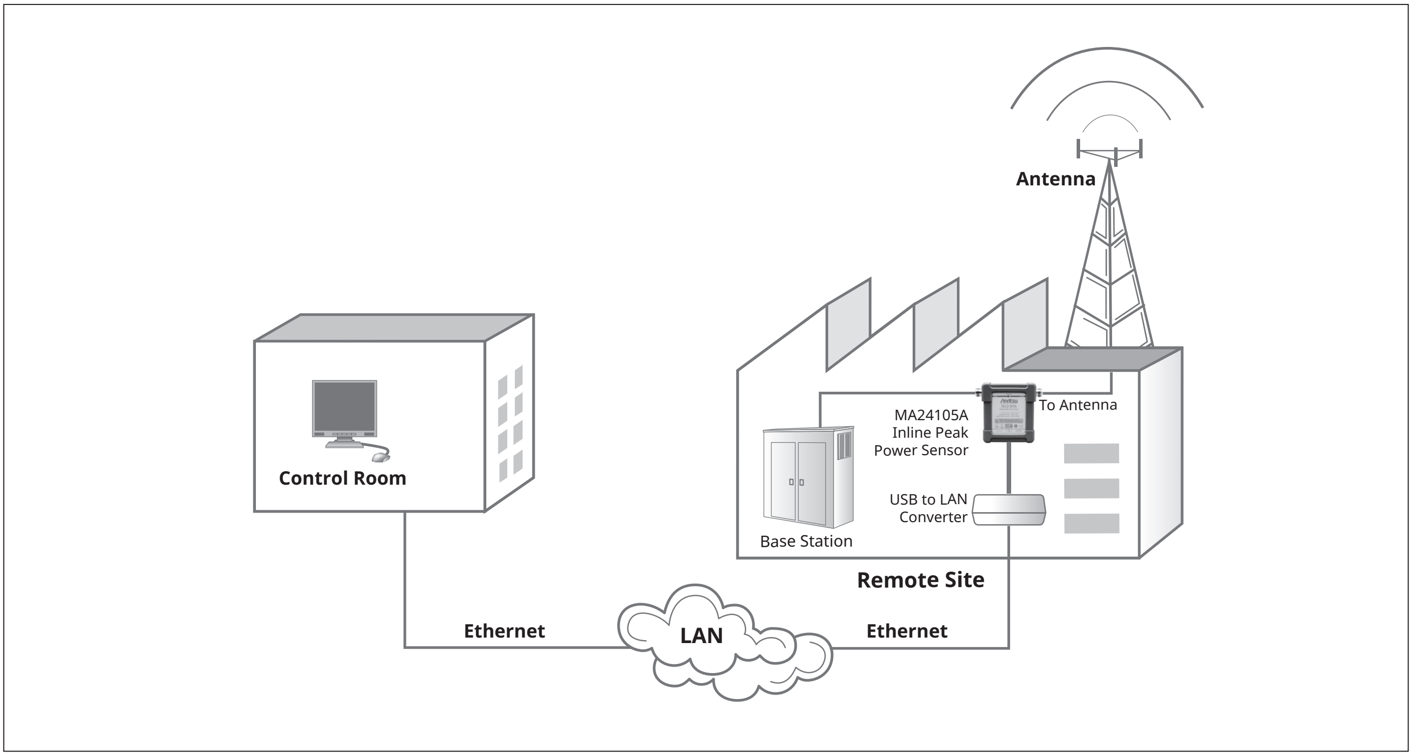
The MA24105A sensor's capability to measure both forward and reverse average power also permits the user to gain information about the load mismatch. This result is conveniently available in reflection coefficient (magnitude), return loss and SWR forms.

Optimized for Production

The MA24105A facilitates lab quality measurements on the production floor for a fraction of cost of existing solutions. Since the sensor is connected directly to the PC, there is no need for a base unit saving valuable rack space. The inline sensor can measure signals with levels as low as 2 mW, thus eliminating the need of terminated power sensors in the production line resulting in reduced capital expenditure and set up costs. The sensor's speed is optimized for best accuracy and noise performance thus making it suitable for wide variety of ATE applications. Multiple sensors can be connected and remote controlled via a single PC allowing flexibility to match specific measurement needs. A software toolkit is supplied with every sensor containing a sample program with source code for controlling the sensor. The 1 mW reference calibrator typically needed by power meters has also been eliminated as the connecting USB cable only transfers digital data (corrected power), minimizing test station complexity, sensor handling and test times.

Remote Monitoring via LAN or Data-Logging

Since the USB cable connected to the sensor only transfers corrected power back to the host, a 1 mW reference calibrator is not required. USB data transfer capabilities limit the cable length to 5 meters prohibiting remote monitoring. However, this limitation can be overcome by installing a low cost USB-to-LAN hub converter at the measurement site along with the MA24105A.
In this way, power monitoring can be performed across continents if desired or data can be logged in a .csv file for offline analysis.



Specifications

Sensor	Frequency Range	350 MHz to 4 GHz				
	Dynamic Range	2 mW to 150 W (+3 to +51.76 dBm)				
	Input Return Loss	≥29.5 dB from 350 MHz to 3 GHz ≥26.5 dB from >3 GHz to 4 GHz				
	Insertion Loss (typ.)	≤0.15 dB from 350 MHz to 1.25 GHz ≤0.20 dB from >1.25 GHz to 4 GHz				
	Directivity	≥28 dB from 350 MHz to <1 GHz ≥30 dB from ≥1 GHz to ≤3 GHz ≥28 dB from >3 GHz to 4 GHz				
	Measurement Channel	2 (Forward and Reverse)				
	Signal Channel Bandwidth	Average: 100 Hz Peak (Selectable): 4 MHz (full) 200 kHz 4 kHz				
Base Average Power Measurement	Measurement Range	Range 1: 2 mW to 6.31 W (+3 to +38 dBm) Range 2: 6.31 W to 150 W (+38 to +51.76 dBm)				
	Maximum Power*1	150 W average, 300 W pulse				
	Measurement Uncertainty*2	±3.8% (Range 1 and Range 2)				
	Effect of Noise*3	±170 µW (Range 1) ±1.9 mW (Range 2)				
	Effect of Zero Set*4	±250 µW (Range 1) ±3.0 mW (Range 2)				
	Effect of Zero Drift*4	±230 µW (Range 1) ±2.7 mW (Range 2)				
	Effect of Temperature (0°C to 50°C)	±0.06 dB				
	Effect of Digital Modulation*5	±0.02 dB				
Forward Average Power Measurement	Forward Average Power Uncertainty is same as Base Average Power Uncertainty					
Forward Peak Power Measurement*6	Measurement Range	2 W to 300 W (+33 to +54.77 dBm)				
	Burst Signal Measurement Base Uncertainty	Repetition Rate: ≥10/s Duty Cycle: ≥10%	Full Bandwidth: ± (Base Average Power Uncertainty +7% + 400 mW)			
			4 kHz and 200 kHz Bandwidth: ± (Base Average Power Uncertainty + 3% + 200 mW)			
	Effect of Low Repetition Rate (≤ 10/s)	±1.6% ±150 mW				
	Effect of Low Duty Cycle (0.1 to 10%)	±100 mW				
	Effect of Short Burst Width (500 ps to 1 µs) (200 ps to <500 ps)	±5% ±10%				
	Effect of Temperature on Peak Circuit (0°C to 50°C)	±6%				
	Spread-spectrum Measurement Uncertainty	± (Base Average Power Uncertainty + 15% + 400 mW)				
Reverse Power Measurement*6	Measurements Range	2 mW to 150 W (+3 to +51.76 dBm)				
	Maximum Power*1	150 W average				
	Measurement Uncertainty*2	± (Base Average Power Uncertainty)				
	Spread-spectrum Measurement Uncertainty	± (Base Average Power Uncertainty + 15% + 400 mW)				
Complementary Cumulative Distribution Function (CCDF)	Measurement Uncertainty*7	±0.2%				
	Threshold Range	2 mW to 300 mW (+3 to +54.77 dBm)				
	Accuracy of Threshold	± (Base Average Power Uncertainty + 5% + 500 mW)				
Burst Average Power	Measurement Uncertainty (User Mode)	Same as Base Average Power Uncertainty except Zero Set, Zero Drift and Noise are divided by duty cycle (t/T)				
	Measurement Uncertainty (Auto Mode)*8	± (Base Average Power Uncertainty except Zero Set, Zero Drift and Noise are divided by duty cycle (t/T) ±2%)				
Combination Measurements	Reflection Measurement Uncertainty	± (Base Average Power Uncertainty + Reverse Power Measurement Uncertainty)				
	Crest Factor Uncertainty	± (Base Average Power Uncertainty + Forward Peak Power Measurement Uncertainty)				
System	Measurand	Forward/Reverse True-RMS/Average power	Peak Power	Crest Factor	Burst Average Power	CCDF
	Measurement Resolution	0.01 dB				0.01%
	Offset Range	100 dB				100%
	Averaging Range	1 to 512				
	Measurement Speed (typ.)	1.7 meas. per second	2.5 meas. per second	1.4 meas. per second	0.7 meas. per second	1.6 meas. per second
	Interface	USB 2.0				
	Host Operating System (PowerXpert version 2.11 compatibility)	Microsoft Window 7, Windows Vista, Windows XP, and Windows 2000				

Continued on next page

General	USB	Current (via host USB)*10	180 mA (typ.) at 5 V
	Dimensions*9	87 (W) × 102 (H) × 30 (D) mm	
	Mass	535 g (1.18 lb)	
Environmental*11	Operating Temperature Range	0°C to +50°C	
	Storage Temperature Range	–51°C to +71°C	
	Humidity	45% relative humidity at +55°C (non-condensing) 75% relative humidity at +40°C (non-condensing) 95% relative humidity at +30°C (non-condensing)	
	Shock	30 g's half-sine, 11 ms duration	
	Vibration	Sinusoidal: 5 Hz to 55 Hz, 3 g's max. Random: 10 Hz to 500 Hz Power Spectral Density: 0.03 g^2/Hz	
	CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: (EU) 2015/863	

All specs are applicable after twenty minutes warm-up at room temperature and after zeroing unless specified otherwise.

*1: Expanded uncertainty with K = 2 for power measurements of a CW signal with a matched load. Measurement results referenced to the input side of the sensor.

*2: Expanded uncertainty with K = 2 after zero operation when measured with 128 averages for 5 minutes. In high aperture time mode, noise is 50 µW and 12 mW in range 1 and range 2 respectively.

*3: After one hour warm-up and zero operation. Measured with 128 averages for one hour keeping the temperature within ±1°C.

*4: Measurement uncertainty with reference to a CW signal of equal power and frequency at 25°C.

*5: All measurement errors "Effects" should be RSSed before directly added to "Base" error for overall measurement uncertainty.

*6: 150 mA max.

*7: Maximum power depends upon the system SWR and frequency of operation

*8: Not including N connector.

*9: Measurement speed is the rate at which the measurement or calculation is updated in a data log.

*10: Pulse Power >+37 dBm, T >50 µs (Full BW), T >400 µs (200 kHz BW), T >20 ms (4 kHz BW)

*11: Average Power >+33 dBm, Pulse width >5 µs (Full BW), Pulse Width >40 µs (200 kHz BW), Pulse Width >2 ms (4 kHz BW)

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MA24105A	Inline Peak Power Sensor
	Available Options
MA24105A-098	Option 98, Standard calibration to Z540, ISO-17025
MA24105A-099	Option 99, Premium calibration to Z540, ISO-17025
	Included Accessories
2000-1606-R	1.8 m USB 2.0 A to Micro-B cable
10585-00021	Quick Start Guide
	Optional Accessories
	Calibrated Torque Wrenches
01-200	Calibrated torque wrench for N connector
	Power Attenuators
3-1010-122	DC to 12.4 GHz, 20 dB, 5 W, 50Ω, N (m) to N (f)
3-1010-123	DC to 8.5 GHz, 30 dB, 50 W, 50Ω, N (m) to N (f)
3-1010-124	DC to 8.5 GHz, 40 dB, 100 W, 50Ω, N (m) to N (f)
42N50-20	DC to 18 GHz, 20 dB, 5 W, 50Ω, N (m) to N (f)
42N50A-30	DC to 18 GHz, 30 dB, 50 W, 50Ω, N (m) to N (f)
1010-121	DC to 18 GHz, 40 dB, 100 W, 50Ω, N (m) to N (f)
1010-127-R	DC to 3 GHz, 30 dB, 150 W, 50Ω, N (m) to N (f)
1010-128-R	DC to 3 GHz, 40 dB, 150 W, 50Ω, N (m) to N (f)
	Precision Terminations
	(To be used in conjunction with appropriate Power Attenuators)
28N50-3	DC to 8.6 GHz, 50Ω, N (m)
28N50-2	DC to 18 GHz, 40 dB, 50Ω, N (m)
28NF50-2	DC to 18 GHz, 40 dB, 50Ω, N (f)
	Precision Coaxial Adapters
510-90	DC to 3.3 GHz, N (m) to 7/16 DIN (f)
510-91	DC to 3.3 GHz, N (f) to 7/16 DIN (f)
510-92	DC to 3.3 GHz, N (m) to 7/16 DIN (m)
510-93	DC to 3.3 GHz, N (f) to 7/16 DIN (m)
33NFNF50B	DC to 18 GHz, N (f) to N (f)
33NNF50B	DC to 18 GHz, N (m) to N (f)
33NN50B	DC to 18 GHz, N (m) to N (m)
34AN50	DC to 18 GHz, GPC-7 to N (m)
34ANF50	DC to 18 GHz, GPC-7 to N (f)
34NFK50	DC to 18 GHz, N (f) to K (m)
34NFKF50	DC to 18 GHz, N (f) to K (f)
34NK50	DC to 18 GHz, N (m) to K (m)
34NKF50	DC to 18 GHz, N (m) to K (f)

USB Power Sensors

MA24106A/MA24108A/MA24118A/MA24126A

50 MHz to 6 GHz/10 MHz to 8 GHz/10 MHz to 18 GHz/10 MHz to 26 GHz

Low Cost, Compact, and Highly Accurate Power Sensors for RF and Microwave Applications

MA24106A

MA24118A

MA24108A

MA24126A

Anritsu USB power sensors eliminate the need of traditional benchtop power meters. These are highly accurate, standalone instruments that communicate with a PC via USB. The power measurement capability of these sensors is intended to mimic that of a traditional thermal (thermo-electric) power sensor with a wider dynamic range. These sensors are ideal for measuring average power of CW, modulated RF waveforms such as 3G, 4G, OFDM, and multi-tone signals. In other words, these sensors measure true RMS power regardless of the type of the input signal.
The presence of a micro-controller along with signal conditioning circuitry, ADC, and power supply in the sensors makes them a complete miniature power meter. These Anritsu USB power sensors come standard with application software (PowerXpert™) for use with PC that mimics the user interface of a power meter.
In addition to the average power measurement capability, the MA24108A, MA24118A and MA24126A sensors have internal and external triggering capability that facilitates individual slot power measurements of TDMA waveforms as well as burst power measurements of periodic and non-periodic waveforms.
These capabilities can be invoked in the power sensor by operating the sensor in Scope or Time slot mode.
Anritsu USB power sensors are compatible with most Anritsu RF and microwave handheld instruments. The high accuracy power meter software option (e.g., Option 19) may be required.

Features and Benefits

- Broad frequency range (10 MHz to 26 GHz)
  - Covers all major cellular bands
- True RMS measurements over 63 dB or more of dynamic range enables accurate modulated power measurements
- NIST Traceable calibrations
  - Provides traceable measurements needed for aerospace applications
- Compatible with Anritsu handhelds
  - No base unit needed
- Built-in internal and external trigger (only used with PC)
  - Facilitates multi-slot measurement of TDD waveforms (e.g. GSM, WiMAX, and TD-SCDMA)
- High power handling (+33 dBm)
  - Provides protection from overpowering the sensors
- 1 mW calibration need eliminated
  - Reduces test time and handling in production
- Worldwide calibration and service centers
  - Ensure reduced downtime and quick support

MA24106A Specifications

Sensor	Frequency Range	50 MHz to 6 GHz
	Dynamic Range	–40 to +23 dBm
	Input Return Loss	>26 dB (50 MHz to <2 GHz) >20 dB, (2 GHz to 6 GHz)
	Measurement Ranges	Range 1, –40 to –5 dBm Range 2, –5 to +23 dBm
	Signal Channel Bandwidth	100 Hz (typ.)
Measurement Uncertainty	Linearity	±0.13 dB (power level <+18 dBm) ±0.18 dB (power level ≥+18 dBm)
	Calibration Factor*1	±0.035 dB
	Noise*2	<2.5 nW (–40 to –5 dBm) <0.6 µW (–5 to +23 dBm)
	Zero Set	<10 nW (–40 to –5 dBm) <1.7 µW (–5 to +23 dBm)
	Zero Drift*3	<3.0 nW (–40 to –5 dBm) <0.5 µW (–5 to +23 dBm)
	Temperature Compensation*4 (0°C to 50°C)	±0.06 dB
	Effect of Digital Modulation*4	±0.02 dB (power level <+18 dBm) ±0.10 dB (power level ≥+18 dBm)
System	Measurand	True-RMS/Average power
	Measurement Resolution	0.01 dB
	Offset Range	±100 dB
	Averaging Range	1 to 256
	Measurement Speed*5	10 measurement per second (typ.)
	Range	Auto ranging between Range 1 and Range 2
	Interface	USB 2.0
	Host Operating System (Anritsu Power Meter PC application compatibility)	Microsoft® Windows 7/8/10, Windows Vista®, Windows XP and Windows 2000
General	Current (via host USB)*6	100 mA typical at 5 V
	Maximum DC Voltage at RF Port	±25 V
	Maximum CW Power	+33 dBm
	Dimensions*7	60.4 (W) × 22.2 (H) × 84.2 (L) mm (typ.) (2.37 × 0.87 × 3.31 in)
	Mass	180 grams (typ.) (6.4 oz.)
Environmental*8	Operating Temperature Range	0°C to +50°C
	Storage Temperature Range	–51°C to +71°C
	Humidity	45% relative humidity at +55°C (non-condensing) 75% relative humidity at +40°C (non-condensing) 95% relative humidity at +30°C (non-condensing)
	Shock	30 g half-sine, 11 ms duration
	Vibration	Sinusoidal: 5 Hz to 55 Hz, 3 g max. Random: 10 Hz to 500 Hz, Power Spectral Density 0.03 g^2/Hz
	CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: (EU) 2015/863

Notes: All specs are applicable after twenty minutes warm-up at room temperature unless specified otherwise.

*1: Expanded uncertainty with K = 2 for absolute power measurements on CW signal at 0 dBm calibration level from 50 MHz to 6 GHz.
*2: Expanded uncertainty with K = 2 after zero operation when measured with 128 averages for 5 minutes.
In high aperture time mode, noise is 1.3 nW and 0.3 µW in range 1 and range 2 respectively.
*3: After one hour warm-up and zero operation. Measured with 128 averages for one hour keeping the temperature within ±1°C.
*4: Measurement error with reference to a CW signal of equal power and frequency at 25°C.
*5: One measurement per second, typical in high aperture time mode.
*6: 150 mA max.
*7: Not including N connector.
*8: Tests were performed per MIL-PRF-28800F (Class 2)

MA24108A/MA24118A/MA24126A Specifications

Model		MA24108A	MA24118A	MA24126A
Sensor	Frequency Range	10 MHz to 8 GHz	10 MHz to 18 GHz	10 MHz to 26 GHz
	Dynamic Range (CW)	–40 to +20 dBm		
	Dynamic Range (Timeslot)	–40 to +20 dBm		
	Dynamic Range (Scope)	–40 to +20 dBm		
	SWR	<1.17, 10 MHz to 150 MHz <1.12, 150 MHz to 2 GHz <1.22, 2 GHz to 8 GHz	<1.17, 10 MHz to 150 MHz <1.12, 150 MHz to 2 GHz <1.22, 2 GHz to 12 GHz <1.25, 12 GHz to 18 GHz	<1.90, 10 MHz to 50 MHz <1.17, 50 MHz to 150 MHz <1.12, 150 MHz to 2 GHz <1.22, 2 GHz to 12 GHz <1.25, 12 GHz to 18 GHz <1.35, 18 GHz to 26 GHz
	Signal Channel Rise Time	8 µs (typ.)		
	Video Bandwidth	50 kHz (typ.)		
	Sampling Rate	140 ks/s (typ.)		
	Measurement Ranges	Range 1, +20 to –7 dBm (typ.) Range 2, –7 to –40 dBm (typ.) Auto ranging between range 1 and 2		
Measurement Uncertainty	Linearity	<3%		
	Cal Factor*1	<2.3% at 10 MHz <1.5%, 50 MHz to 8 GHz	<2.3% at 10 MHz <1.5%, 50 MHz to 18 GHz	<3.5% at 10 MHz <2.0%, 50 MHz to 2 GHz <2.5%, 3 GHz to 8 GHz <3.0%, 9 GHz to 15 GHz <3.5%, 16 GHz to 26 GHz
	Noise*2	<8 µW, Range 1 <40 nW, Range 2		
	Zero Set*3	<1 µW, Range 1 <10 nW, Range 2		
	Zero Drift*4	<0.5 µW, Range 1 <3 nW, Range 2		
	Effect of Temperature	<1.4%		
	Effect of Digital Modulation*5	<0.5%, <+18 dBm <1.4%, >+18 dBm		
System	Measurand	Average power		
	Measurement Resolution*6	0.01 dB max via PowerXpert, 0.001 dB max via remote command		
	Offset Correction*7	–100 to +150 dB		
	Averaging	Auto, Manual		
	Type	Moving, Repeat		
	Number of Averages (manual)*8	1 to 40,000		
	Auto Average	Resolution*9: 1 dB, 0.1 dB, 0.01 dB, 0.001 dB Source (slot # or scope data point number) Timeslot: 1 to 128 Scope: 1 to 1024		
Continuous Average Mode	Duty Cycle Correction	0.01% to 100%		
	Aperture Time	0.01 ms to 300 ms		
	Measurement Time*10	N × (Capture Time × 2.5) + T_d + T_{com}		
Scope Mode	Capture Time	0.01 ms to 300 ms		
	Data Points	1 to 1024		
	Resolution	0.007 ms, max via remote command 0.01 ms, max via PowerXpert		
	Measurement Time*11	N × (Capture Time × 3.75) +(P_n × T_{dp}) + T_{com}		
Time Slot Mode	Maximum Number of Slots	128		
	Slot width	0.01 ms to 100 ms		
	Maximum Capture Time	300 ms (slot width × number of slots)		
	Resolution	0.007 ms, max via remote command 0.01 ms, max via PowerXpert		
	Exclusion Periods	Start Exclusion: 0 ms to 10 ms End Exclusion: 0 ms to 10 ms		
	Measurement Time*11	N × (Capture Time × 3.75) + (P_n × T_{dp}) + T_{com}		

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Model		MA24108A	MA24118A	MA24126A
Trigger	Source[*12]	Bus, Continuous, Internal, and External		
	Internal Trigger	Dynamic Range: –20 to +20 dBm Level Accuracy: ± 0.5 dB (typ.) Slope: Positive or negative Delay Range: –5 ms to +10 s Delay Resolution: 10 µs		
	External Trigger	Impedance: 100kΩ Type: TTL/CMOS Slope: Positive or negative Delay Range: –5 ms to +10 s Delay Resolution: 10 µs Positive Threshold Voltage: 2.0 V (typ.) Negative Threshold Voltage: 1.2 V (typ.) Hysteresis: 0.8 V (typ.)		
General	RF Connector	N (m), K (m) (MA24126A)		
	Interface to Host	USB 2.0 full speed (compatible with USB 1.0 and 1.1)		
	Current Consumption	150 mA (typ.)		
	External Trigger Input	MCX (f), 12 V max		
	Damage Levels at RF Port	+33 dBm, ±20 V DC		
	Dimensions	45 (W) × 25 (H) × 110 (L) mm, excluding N connector and silicone protective covering		
	Mass	230 g (0.51 lb)		
Environmental[*13]	Operating Temperature Range	0°C to +55°C		
	Storage Temperature Range	–51°C to +71°C		
	Humidity	45% relative humidity at 55°C (non-condensing) 75% relative humidity at 40°C (non-condensing) 95% relative humidity at 30°C (non-condensing)		
	Shock	30 g half-sine, 11 ms duration		
	Vibration	Sinusoidal: 5 Hz to 55 Hz, 3 g max. Random: 10 Hz to 500 Hz Power Spectral Density: 0.03 g^2/Hz		
	CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: (EU) 2015/863		
PowerXpert v2.0 (PC requirements)	Processor and RAM	Minimum: Equivalent to Intel® Pentium® III with 1 GB RAM or Intel® Pentium® IV with 512 MB RAM Recommended: Equivalent to Intel® Pentium® IV with 1 GB RAM		
	Operating System	Microsoft® Windows 7, Windows Vista®, Windows XP and Windows 2000		
	Hard-disk Free Space	100 MB, minimum		
	Display Resolution	1024 × 768, minimum		
	Interface	USB 2.0 full speed (compatible with USB 1.0 and 1.1)		

Notes: All specs are applicable after twenty minutes warm-up at room temperature unless specified otherwise.

*1: Expanded uncertainty with K = 2 for absolute power measurements on CW signal at 0 dBm and calibration frequencies 10 MHz, 50 MHz, 100 MHz, 300 MHz, 500 MHz, and 1 GHz to 8 GHz (for MA24108A), or to 18 GHz (MA24118A) or to 26 GHz (for MA24126A) in 1 GHz increments.

*2: Expanded uncertainty with K = 2 after zero operation when measured with 1 average, and 20 ms aperture time for 5 minutes. Effect of Noise can be reduced by increasing the number of averages and/or increasing the aperture time. Noise goes down as square root of number of averages and aperture time. For example with 128 averages, the Noise is 3.5 nW (40 nW divided by $\sqrt{128}$). Effect of increased aperture time is calculated in the same way.

*3: Expanded uncertainty with K = 2 after zero operation when measured with 1 average, and 20 ms aperture time for 5 minutes.

*4: Expanded uncertainty with K = 2 after one hour warm-up and zero operation, 1 average, 20 ms aperture time, and keeping the temperature within ±1°C.

*5: Measurement error with reference to a CW signal of equal power and frequency at 25°C.

*6: Resolution in PowerXpert application is 2 digits after the decimal. Native resolution of the sensor is 3 digits after the decimal.

*7: Offset correction feature is available only through PowerXpert application. There is no remote command for it in the sensor firmware.

*8: Maximum number of averages allowed in Continuous Average mode and Timeslot mode is 40,000. In scope, the maximum number of averages is equal to 8231936 divided by data points.

*9: Averaging resolution of 0.001 dB is not available with PowerXpert application. It is defined as the place after the decimal to which the reading becomes stable. E.g. if 0.01 is selected then the reading will typically be stable ±0.01 dB. Please refer to the remote operation chapter in the user guide for information regarding access to this feature.

*10: Speed is defined as the data throughput at the "A" end of the USB A to Micro-B Cable (p/n 2000-1606-R). T_d is the delay compensation for smaller Capture Times, T_d = 0 for Capture Time >9 ms, T_d = 3 ms for 2 ms <Capture Time <9 ms, T_d = 5 ms for Capture Time <2 ms, T_{com} = 5 ms, command processing time.

*11: Speed is defined as the data throughput at the "A" end of the USB A to Micro-B Cable (p/n 2000-1606-R). Where N is the number of repeat averages, N = 1 for moving average mode, P_n = Number of points, T_{dp} = 0.05 ms (Communication delay (approx) due to each point), T_{com} = 5 ms, command processing time.

*12: Bus trigger not available in PowerXpert application.

*13: Tests were performed per MIL-PRF-28800F (Class 2).

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MA24106A	True-RMS USB Power Sensor, 50 MHz to 6 GHz
	Included Accessories
2000-1566-R	1.8 m USB A to Mini-B Cable
10585-00021	Quick Start Guide
	Available Options
MA24106A-097	Option 97, Accredited calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included
MA24106A-098	Option 98, Standard calibration to ISO17025 and ANSI/NCSL Z540
MA24106A-099	Option 99, Premium calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included
	Optional Accessories
2000-1593-R	3.0 m USB A to Mini-B cable
2000-1594-R	5.0 m USB A to Mini-B cable
01-200	Calibrated torque wrench for N connector
01-204	Calibrated torque wrench for K and V connectors
3-1010-123	N (m) to N (f), DC to 8.5 GHz, 30 dB, 50 W, 50Ω
3-1010-124	N (m) to N (f), DC to 8.5 GHz, 40 dB, 100 W, 50Ω
3-1010-122	N (m) to N (f), DC to 12.4 GHz, 20 dB, 5 W, 50Ω
42N50-20	N (m) to N (f), DC to 18 GHz, 20 dB, 5 W, 50Ω
42N50-30	N (m) to N (f), DC to 18 GHz, 30 dB, 50 W, 50Ω
510-90	N (m) to 7/16 DIN (f), DC to 3.3 GHz
510-91	N (f) to 7/16 DIN (f), DC to 3.3 GHz
510-92	N (m) to 7/16 DIN (m), DC to 3.3 GHz
510-93	N (f) to 7/16 DIN (m), DC to 3.3 GHz
33NFNF50B	N (f) to N (f), DC to 18 GHz
33NNF50B	N (m) to N (f), DC to 18 GHz
33NN50B	N (m) to N (m), DC to 18 GHz
34AN50	GPC-7 to N (m), DC to 18 GHz
34ANF50	GPC-7 to N (f), DC to 18 GHz
34NFK50	N (f) to K (m), DC to 18 GHz
34NFKF50	N (f) to K (f), DC to 18 GHz
34NK50	N (m) to K (m), DC to 18 GHz
34NKF50	N (m) to K (f), DC to 18 GHz
2300-528	Sensor calibration utility, MA24106A CalXpert™

Model/Order No.	Name
	Main Frame
MA24108A	10 MHz to 8 GHz USB Power Sensor
MA24118A	10 MHz to 18 GHz USB Power Sensor
MA24126A	10 MHz to 26 GHz USB Power Sensor
	Included Accessories
10585-00021	Quick Start Guide
2000-1605-R	1.5 m BNC (m) to MCX (m) cable
2000-1606-R	1.8 m USB A to Micro-B cable with latch
	Available Options
MA24108A-097	Option 97, Accredited calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included
MA24108A-098	Option 98, Standard calibration to ISO17025 and ANSI/NCSL Z540
MA24108A-099	Option 99, Premium calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included
MA24118A-097	Option 97, Accredited calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included
MA24118A-098	Option 98, Standard calibration to ISO17025 and ANSI/NCSL Z540
MA24118A-099	Option 99, Premium calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included
MA24126A-097	Option 97, Accredited calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included
MA24126A-098	Option 98, Standard calibration to ISO17025 and ANSI/NCSL Z540
MA24126A-099	Option 99, Premium calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included
	Optional Accessories
01-200	Calibrated torque wrench for N connector
01-204	Calibrated torque wrench for K and V connectors
2000-1614-R	Cable, 5.0 m USB A to Micro-B cable with latch
3-1010-123	N (m) to N (f), DC to 8.5 GHz, 30 dB, 50 W, 50Ω
3-1010-124	N (m) to N (f), DC to 8.5 GHz, 40 dB, 100 W, 50Ω
3-1010-122	N (m) to N (f), DC to 12.4 GHz, 20 dB, 5 W, 50Ω
42N50-20	N (m) to N (f), DC to 18 GHz, 20 dB, 5 W, 50Ω
42N50-30	N (m) to N (f), DC to 18 GHz, 30 dB, 50 W, 50Ω
41KB-3	Power attenuator, DC to 26.5 GHz, 3 dB, 50Ω, K (m) to K (f)
41KB-6	Power attenuator, DC to 26.5 GHz, 6 dB, 50Ω, K (m) to K (f)
41KB-10	Power attenuator, DC to 26.5 GHz, 10 dB, 50Ω, K (m) to K (f)
41KB-20	Power attenuator, DC to 26.5 GHz, 20 dB, 50Ω, K (m) to K (f)
43KB-3	Power attenuator, DC to 26.5 GHz, 3 dB, 50Ω, K (m) to K (f)
43KB-6	Power attenuator, DC to 26.5 GHz, 6 dB, 50Ω, K (m) to K (f)
43KB-10	Power attenuator, DC to 26.5 GHz, 10 dB, 50Ω, K (m) to K (f)
43KB-20	Power attenuator, DC to 26.5 GHz, 20 dB, 50Ω, K (m) to K (f)
510-90	N (m) to 7/16 DIN (f), DC to 3.3 GHz
510-91	N (f) to 7/16 DIN (f), DC to 3.3 GHz
510-92	N (m) to 7/16 DIN (m), DC to 3.3 GHz
510-93	N (f) to 7/16 DIN (m), DC to 3.3 GHz
33NFNF50B	N (f) to N (f), DC to 18 GHz
33NNF50B	N (m) to N (f), DC to 18 GHz
33NN50B	N (m) to N (m), DC to 18 GHz
34AN50	GPC-7 to N (m), DC to 18 GHz
34ANF50	GPC-7 to N (f), DC to 18 GHz
34NFK50	N (f) to K (m), DC to 18 GHz
34NFKF50	N (f) to K (f), DC to 18 GHz
34NK50	N (m) to K (m), DC to 18 GHz
34NKF50	N (m) to K (f), DC to 18 GHz
1091-26	Precision coaxial adapter, DC to 18 GHz, N (m) to SMA (m)
1091-27	Precision coaxial adapter, DC to 18 GHz, N (m) to SMA (f)
1091-80-R	Precision coaxial adapter, DC to 18 GHz, N (f) to SMA (m)
1091-81-R	Precision coaxial adapter, DC to 18 GHz, N (f) to SMA (f)

Microwave Universal USB Power Sensors

MA24208A/MA24218A

True-RMS, 10 MHz to 8/18 GHz

Remote Control
USB

Low Cost, Compact, and Highly Accurate Power Sensors for RF and Microwave Applications

The Universal USB power sensors MA24208A and MA24218A are designed to provide accurate average power measurements from 10 MHz to 8 GHz and 18 GHz, respectively, over 80 dB of dynamic range.
The sensors employ a patented “triple path” architecture that provides True-RMS measurements over the entire frequency and dynamic range (similar to thermal sensors), enabling users to make highly accurate average power measurements for CW, multi-tone, and digitally modulated signals up to 18 GHz.

Features and Benefits

- Broad frequency range (10 MHz to 18 GHz): ideal for general purpose, aerospace and satellite and wireless communications applications
- True-RMS measurements over 80 dB dynamic range: enables average power measurement on CW, multi-tone, and digitally modulated signals - independent of modulation bandwidth
- Best-in-Class damage protection (+30 dBm CW, +34 dBm peak <10 µs): protects instrumentation investment
- No zeroing required (for signals >–45 dBm) and elimination of 1 mW reference calibration: reduces test time and handling in production while maintaining absolute accuracy
- Advanced trigger capabilities: facilitates time dependent power measurements (for example, GSM, WiMAX, TD-SCDMA, and LTE)
- NIST traceable calibration: provides high-accuracy measurements
- Easy to use with PC or select Anritsu handheld instruments: no benchtop power meter unit needed
- Silicone protective covering (removable): provides additional field durability
- External trigger latching: for pulses as narrow as 20 ns

Definitions

All specifications and characteristics apply under the following conditions, unless otherwise stated:

Warm-Up Time	60 minutes
Operating Temperature Range	0°C to 50°C
Characteristic Performance	Characteristic specifications are not tested and are not warranted.
ISO GUM Measurement Uncertainty	Zero and Noise uncertainty expressed with three sigma confidence level. Average and Relative Power uncertainty expressed with two sigma confidence level.
Calibration Cycle	Anritsu recommended calibration interval is 12 months. All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu website: www.anritsu.com

Notes: MA24208A and MA24218A sensors may have degraded performance when dropped without the removable protective covering.
This cover is required for warranted operation.

Sensor Specifications

Frequency

MA24208A	10 MHz to 8 GHz
MA24218A	10 MHz to 18 GHz

Power Measurement

Dynamic Range	–60 to +20 dBm			
	≤150 MHz	>150 MHz to 2 GHz	>2 GHz to 12.4 GHz	>12.4 GHz to 18 GHz
VSWR, max	1.17:1	1.12:1	1.22:1	1.25:1
Measurement Range 1	+20 to +4 dBm approximate			
Measurement Range 2	<+4 to –16 dBm approximate			
Measurement Range 3	<–16 to –60 dBm approximate Auto and fixed ranging available			
Damage Levels at RF Port	+30 dBm, ±20 V DC (+34 dBm peak < 10 µs pulse and 10% duty cycle), minimum			

Response

Signal Channel Rise Time	8 µs characteristic
Sampling Rate	140 kS/s

Trigger

Source*1	Bus, Continuous, Internal, External
Arm Type (for Internal/External)	Auto, Single, Multiple, Standby

Internal Trigger

Dynamic Range	–35 to +20 dBm
Level Accuracy	±0.5 dB characteristic
Slope	Positive or Negative
Delay Range	–5 ms to +10 s
Delay Resolution	10 µs
Hysteresis	0 to 10 dB, with 0.1 dB resolution
Trigger Hold Off	0 to 10 sec, with 0.01 ms resolution

External Trigger

External Trigger Input	MCX (f), 5.5 V (max.)
Impedance	4kΩ (nom.)
Type	TTL/CMOS
Slope	Positive or Negative
Delay Range	–5 ms to +10 s
Delay Resolution	10 µs
High Level Input Voltage	2.3 V (min.), 3.0 V (max.)
Low Level Input Voltage	1.3 V (min.), 1.6 V (max.)
Latency*2	7.1 µs (max.)
Trigger Pulse Width	20 ns (min.)
Trigger Repetition Period	7.1 µs (min.)
Trigger Hold Off	0 to 10 s with 0.01 ms resolution

*1: Bus trigger is not available in PowerXpert application.
*2: Latency is defined as the time delay between the defined edge of the applied trigger and the sensor switching into the triggered state.

Measurement Uncertainty

Average Power (dB)*1

	Over 0°C to 50°C ambient temperature range:			
Range (dBm)	≤0.05 GHz	>0.05 GHz to 2 GHz	>2 GHz to 12.4 GHz	>12.4 GHz to 18 GHz
–60 to <–16	0.14	0.14	0.14	0.17
–16 to <+4	0.14	0.14	0.13	0.13
+4 to +20	0.14	0.15	0.15	0.14
	Over 20°C to 30°C ambient temperature range:			
Range (dBm)	≤0.05 GHz	>0.05 GHz to 2 GHz	>2 GHz to 12.4 GHz	>12.4 GHz to 18 GHz
–60 to <–16	0.13	0.12	0.14	0.14
–16 to <+4	0.11	0.10	0.13	0.11
+4 to +20	0.11	0.10	0.10	0.11

Relative Power (dB)*1

≤0.05 GHz:

	Over 0°C to 50°C			Over 20°C to 30°C		
Range (dBm)	+4 to +20	–16 to <+4	–60 to <–16	+4 to +20	–16 to <+4	–60 to <–16
–60 to <–16	0.14	0.13	0.03	0.08	0.09	0.03
–16 to <+4	0.14	0.04	0.13	0.06	0.03	0.09
+4 to +20	0.05	0.14	0.14	0.05	0.06	0.08

>0.05 GHz to 2 GHz:

	Over 0°C to 50°C			Over 20°C to 30°C		
Range (dBm)	+4 to +20	–16 to <+4	–60 to <–16	+4 to +20	–16 to <+4	–60 to <–16
–60 to <–16	0.16	0.16	0.03	0.11	0.12	0.03
–16 to <+4	0.17	0.05	0.16	0.09	0.04	0.12
+4 to +20	0.06	0.17	0.16	0.06	0.09	0.11

>2 GHz to 12.4 GHz:

	Over 0°C to 50°C			Over 20°C to 30°C		
Range (dBm)	+4 to +20	–16 to <+4	–60 to <–16	+4 to +20	–16 to <+4	–60 to <–16
–60 to <–16	0.16	0.16	0.04	0.12	0.14	0.04
–16 to <+4	0.17	0.05	0.16	0.10	0.04	0.14
+4 to +20	0.06	0.17	0.16	0.07	0.10	0.12

>12.4 GHz to 18 GHz:

	Over 0°C to 50°C			Over 20°C to 30°C		
Range (dBm)	+4 to +20	–16 to <+4	–60 to <–16	+4 to +20	–16 to <+4	–60 to <–16
–60 to <–16	0.14	0.15	0.04	0.12	0.14	0.04
–16 to <+4	0.11	0.06	0.15	0.10	0.05	0.14
+4 to +20	0.06	0.11	0.14	0.06	0.10	0.12

Zero*2

	Set		Drift	
Range (dBm)	Watts	dBm	Watts	dBm
–60 to <–16	3.32E-10	–64.78	3.44E-10	–64.64
–16 to <+4	3.87E-08	–44.12	4.29E-08	–43.67
+4 to +20	1.07E-06	–29.70	9.96E-07	–30.02

Noise*3

Range (dBm)	Watts
–60 to <–16	1.23E-10
–16 to <+4	1.01E-08
+4 to +20	8.56E-07

Effect of Digital Modulation*4

Range (dBm)	dB
–60 to <–16	–0.048 to 0.080
–16 to <+4	–0.038 to 0.088
+4 to +20	–0.055 to 0.067

*1: Power uncertainty expressed with two sigma confidence level for CW measurement after zero operation Includes calibration factor and linearity over temperature uncertainties, but not the effects of mismatch, zero set and drift, or noise.

*2: Zero uncertainty expressed with three sigma confidence level. One hour warm-up followed by a Zero operation. Measured with 256 averages and 40 ms aperture and with the temperature kept within ±1°C. Zero Set: Average of the reported power over one hour. Zero Drift: Two sigma value of the reported power over one hour.

*3: Two sigma noise at 10.2 seconds of integration time (integration time = aperture time x averaging number). Effect of noise can be reduced by increasing the number of averages and/or increasing the aperture time. Noise is inversely proportional to the square root of number of ADC samples used per measurement; the number of ADC samples per measurement is the product of the sample rate, aperture time, and number of averages used. Noise uncertainty is expressed with three sigma confidence level.

*4: Measurement error with reference to a CW signal of equal power and frequency between 20°C to 30°C in Normal mode and average power ≤+20 dBm. In general, the error caused by modulation depends on the peak to average power ratio and RF bandwidth of the signal.

PowerXpert™

PC Requirements (version 3.0 or greater)

Processor and RAM	Minimum: Equivalent to Intel® Pentium® III with 1 GB RAM or Intel® Pentium® IV with 512 MB RAM Recommended: Equivalent to Intel® Pentium® IV with 1 GB RAM
Operating System	Microsoft® Windows® 8, Windows® 7, and Windows® XP
Hard-Disk Free Space	100 MB minimum
Display Resolution	1024 × 768 minimum
Interface	USB 2.0 high speed

System

Measurand	Average power
Measurement Resolution	0.01 dB max via PowerXpert™, 0.001 dB max via remote command
Offset Correction*1	–100 to +150 dB
Averaging	Auto, Manual
Type	Moving, Repeat
Number of Averages (Manual)*2	1 to 65,536
Auto Average Resolution*3	1 dB, 0.1 dB, 0.01 dB
Auto Average Source	Timeslot Number: 1 to 128 Scope Data Point Number: 1 to 16,384

Continuous Average Mode

Duty Cycle Correction	0.01 to 100%
Aperture Time	0.01 ms to 1 s
Measurement Time*4	N × (aperture time × C_t) + 0.375 ms + T_{com} Continuous: >1,600 readings/s (minimum aperture, one average) Buffered: >11,000 readings/s (minimum aperture, one average)
Buffer Size	8192

Scope Mode

Capture Time	0.01 ms to 1 s
Data Points	1 to 16,384
Resolution	0.01 ms max
Measurement Time*5	N × (capture time × C_t) + (P_n × 0.042 ms) + T_{com}

Timeslot Mode

Maximum Number of Slots	128
Slot Width	0.01 ms to 100 ms
Maximum Capture Time	1000 ms (slot width × number of slots)
Resolution	0.01 ms max via remote command 0.01 ms max via PowerXpert™
Exclusion Periods	Start Exclusion: 0 ms to 10 ms End Exclusion: 0 ms to 10 ms
Measurement Time*6	N × (slot width × number of slots × C_t) + (P_n × 0.064 ms) + T_{com}

List Mode

Number of Measurements	1 to 1000
Input Parameters	Frequency (GHz), aperture time (ms), averages

*1: Offset correction feature is available only through the PowerXpert application. There is no remote command for it in the sensor firmware.

*2: Maximum number of averages allowed in Continuous Average mode and Timeslot mode is 65,536. In Scope mode, the maximum number of averages is equal to 16,777,216 divided by the number of data points.

*3: Averaging resolution of 0.001 dB is not available with the PowerXpert application. It is defined as the place after the decimal to which the reading becomes stable. For example, if 0.01 is selected, then the reading will typically be stable within ±0.01 dB. Please refer to the remote operation chapter in the user guide for information regarding access to this feature.

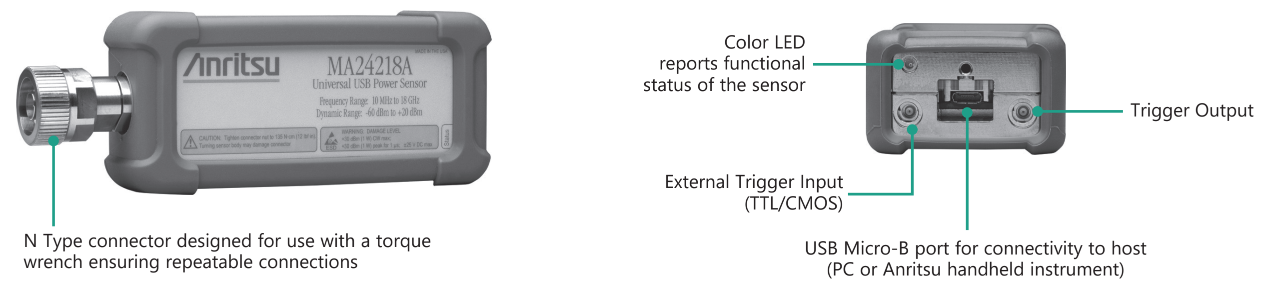
*4: Speed is defined as the data throughput at the "A" end of the USB A to Micro-B Cable (p/n 2000-1816-R), where:
Number of Repeat Averages = N (N = 1 for moving average mode)
Capture Time Coefficient = C_t = 1.62
Command Processing Time = T_{com} = 0.2 ms
Speed may vary depending on the speed of and load on the CPU controlling the sensor. Specified results obtained with Intel® Core™ i5-3550 CPU running at 3.30 GHz

*5: Speed is defined as the data throughput at the "A" end of the USB A to Micro-B Cable (p/n 2000-1816-R), where:
Number of Repeat Averages = N (N = 1 for moving average mode)
Capture Time Coefficient = C_t = 1.645
Number of Points = P_n
Command Processing Time = T_{com} = 0.24 ms

*6: Speed is defined as the data throughput at the "A" end of the USB A to Micro-B Cable (p/n 2000-1816-R), where:
Number of Repeat Averages = N (N = 1 for moving average mode)
Capture Time Coefficient = C_t = 1.625
Number of Points = P_n
Command Processing Time = T_{com} = 0.29 ms

General

RF Connector	N male
Interface to Host	USB 2.0 high speed
Current Consumption	410 mA to 450 mA characteristic (20°C to 30°C)
Dimensions	110 (W) × 46 (H) × 25.6 (D) mm, excluding N connector and silicone protective covering
Mass	397 g (0.88 lb)
Warranty	1 year



Operational Requirements

Tests were performed per MIL-PRF-28800F (Class 3).

Operating Temperature Range	0°C to +50°C
Storage Temperature Range	–40°C to +71°C
Relative Humidity	45% relative humidity at 50°C (non-condensing) 75% relative humidity at 40°C (non-condensing) 95% relative humidity at 30°C (non-condensing)
Altitude	4600 m operational max
Shock	30 g_n half-sine, 11 ms duration
Vibration	Sinusoidal: 5 Hz to 55 Hz, 3 g max Random: 10 Hz to 500 Hz, 2.34 g rms Power Spectral Density: 0.01 g^2/Hz
CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: (EU) 2015/863
RCM	Australia and New Zealand: RCM AS/NZS 4417-2012
KCC	South Korea: KCC-REM-A21-0004

Training at Anritsu

Anritsu has designed courses to help you stay up to date with technologies important to your job. For available training courses, visit: www.anritsu.com/training

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Available Models
MA24208A	8 GHz USB Universal Power Sensor
MA24218A	18 GHz USB Universal Power Sensor
	Included Accessories
10585-00021	Quick Start Guide
2000-1605-R	1.5 m BNC (m) to MCX (m) cable
2000-1816-R	1.8 m USB A to Micro-B cable
	Available Options
MA24208A-097	Option 97: ISO/IEC 17025 and ANSI/NCSL Z540-1 or ANSI/NCSLI Z540.3 (includes test report, uncertainty data, and accreditation symbol)
MA24208A-098	Option 98: Standard calibration ISO/IEC 17025 and ANSI/NCSL Z540-1
MA24208A-099	Option 99: Premium calibration ISO/IEC 17025 and ANSI/NCSL Z540-1 (includes test report and uncertainty data)
MA24218A-097	Option 97: ISO/IEC 17025 and ANSI/NCSL Z540-1 or ANSI/NCSLI Z540.3 (includes test report, uncertainty data, and accreditation symbol)
MA24218A-098	Option 98: Standard calibration ISO/IEC 17025 and ANSI/NCSL Z540-1
MA24218A-099	Option 99: Premium calibration ISO/IEC 17025 and ANSI/NCSL Z540-1 (includes test report and uncertainty data)
	Optional Accessories
	Calibrated Torque Wrenches
01-200	Calibrated torque wrench for N connector
01-204	Calibrated torque wrench for K and V connectors

Model/Order No.	Name
	Power Attenuators
3-1010-123	DC to 8.5 GHz, 30 dB, 50 W, 50Ω, N (m) to N (f)
3-1010-124	DC to 8.5 GHz, 40 dB, 100 W, 50Ω, N (m) to N (f)
3-1010-122	DC to 12.4 GHz, 20 dB, 5 W, 50Ω, N (m) to N (f)
42N50-20	DC to 18 GHz, 20 dB, 5 W, 50Ω, N (m) to N (f)
42N50A-30	DC to 18 GHz, 30 dB, 50 W, 50Ω, N (m) to N (f)
41KB-3	DC to 26.5 GHz, 3 dB, 50Ω, K (m) to K (f)
41KB-6	DC to 26.5 GHz, 6 dB, 50Ω, K (m) to K (f)
41KB-10	DC to 26.5 GHz, 10 dB, 50Ω, K (m) to K (f)
41KB-20	DC to 26.5 GHz, 20 dB, 50Ω, K (m) to K (f)
43KB-3	DC to 26.5 GHz, 3 dB, 50Ω, K(m) to K (f)
43KB-6	DC to 26.5 GHz, 6 dB, 50Ω, K (m) to K (f)
43KB-10	DC to 26.5 GHz, 10 dB, 50Ω, K (m) to K (f)
43KB-20	DC to 26.5 GHz, 20 dB, 50Ω, K (m) to K (f)
	Precision Coaxial Adapters
510-90-R	DC to 3.3 GHz, N (m) to 7/16 DIN (f)
510-91-R	DC to 3.3 GHz, N (f) to 7/16 DIN (f)
510-92-R	DC to 3.3 GHz, N (m) to 7/16 DIN (m)
510-93-R	DC to 3.3 GHz, N (f) to 7/16 DIN (m)
33NFNF50B	DC to 18 GHz, N (f) to N (f)
33NNF50B	DC to 18 GHz, N (m) to N (f)
33NN50B	DC to 18 GHz, N (m) to N (m)
34AN50	DC to 18 GHz, GPC-7 to N (m)
34ANF50	DC to 18 GHz, GPC-7 to N (f)
34NFK50	DC to 18 GHz, N (f) to K (m)
34NFKF50	DC to 18 GHz, N (f) to K (f)
34NK50	DC to 18 GHz, N (m) to K (m)
34NKF50	DC to 18 GHz, N (m) to K (f)
1091-26-R	DC to 18 GHz, N (m) to SMA (m)
1091-27-R	DC to 18 GHz, N (m) to SMA (f)
1091-80-R	DC to 18 GHz, N (f) to SMA (m)
1091-81-R	DC to 18 GHz, N (f) to SMA (f)

Microwave CW USB Power Sensors

MA24330A MA24340A MA24350A

10 MHz to 33 GHz 10 MHz to 40 GHz 10 MHz to 50 GHz

Low Cost, Compact, and Highly Accurate Power Sensors for RF and Microwave Applications

The Microwave CW USB Power Sensors MA243x0A series employ a single-path diode architecture to provide fast, accurate average power measurements from 10 MHz up to 50 GHz with 90 dB of dynamic range.

Key Features

- Broad frequency range (10 MHz up to 50 GHz): ideal for general purpose, aerospace, satellite, and wireless communications applications
- Accurate power measurements with over 90 dB dynamic range
- Best-in-Class damage protection (+26 dBm CW, +32 dBm peak <10 µs): protects instrumentation investment
- No zeroing required (for signals >–50 dBm) and elimination of 1 mW reference calibration: reduces test time and handling in production while maintaining absolute accuracy
- Advanced trigger capabilities: facilitates time dependent power measurements
- NIST traceable calibration: provides high-accuracy measurements and ensures absolute accuracy
- Calibration traceable to SI units via National Metrology Institutes
- Easy to use with PC or select Anritsu handheld instruments: no benchtop power meter unit needed
- Silicone protective covering (removable): provides additional field durability
- External trigger latching: for pulses as narrow as 20 ns

Definitions

All specifications and characteristics apply under the following conditions, unless otherwise stated:

Warm-Up Time	60 minutes
Operating Temperature Range	0°C to 50°C
Characteristic Performance	Characteristic specifications are not tested and are not warranted.
ISO GUM Measurement Uncertainty	Zero and Noise uncertainty expressed with coverage factor of k = 3. Average and Relative Power uncertainty expressed with coverage factor of k = 2.
Calibration Cycle	Anritsu recommended calibration interval is 12 months. All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu website: www.anritsu.com

Notes: Sensors may have degraded performance when dropped without the removable protective covering.
This cover is required for warranted operation.

MA243x0A Specifications

Sensor Specifications

Frequency	10 MHz to 33 GHz, K (m) Connector (MA24330A) 10 MHz to 40 GHz, K (m) Connector (MA24340A) 10 MHz to 50 GHz, V (m) Connector (MA24350A)								
Power Measurement	VSWR	<50 MHz	50 MHz to 150 MHz	>0.15 GHz to 2 GHz	>2 GHz to 6 GHz	>6 GHz to 18 GHz	>18 GHz to 33 GHz	>33 GHz to 40 GHz	>40 GHz to 50 GHz
		1.9:1	1.17:1	1.08:1	1.16:1	1.21:1	1.29:1	1.44:1	1.5:1
	Dynamic Range	–70 to +20 dBm							
	Damage Levels at RF Port	+26 dBm, ±20 V DC (+32 dBm peak < 10 µs pulse and 10% duty cycle), minimum							
Response	Signal Channel Rise Time	8 µs characteristic							
	Sampling Rate	140 kS/s							
Trigger	Source*1	Bus, Continuous, Internal, External							
	Arm Type (for Internal/External)	Auto, Single, Multiple, Standby							

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Internal Trigger	Dynamic Range	–35 to +20 dBm
	Level Accuracy	±0.5 dB characteristic
	Slope	Positive or Negative
	Delay Range	–5 ms to +10 s
	Delay Resolution	10 µs
	Hysteresis	0 to 10 dB, with 0.1 dB resolution
	Trigger Hold Off	0 to 10 s, with 0.01 ms resolution
External Trigger	External Trigger Input	MCX (f), 5.5 V maximum
	Input Impedance	4kΩ (nom.)
	Type	TTL/CMOS
	Slope	Positive or Negative
	Delay Range	–5 ms to +10 s
	Delay Resolution	10 µs
	High Level Input Voltage	2.3 V min, 3.0 V max
	Low Level Input Voltage	1.3 V min, 1.6 V max
	Latency[*2]	7.1 µs max
	Trigger Pulse Width	20 ns min
	Trigger Repetition Period	7.1 µs min
	Trigger Holdoff	0 to 10 s with 0.01 ms resolution

*1: Bus trigger is not available in PowerXpert application.
*2: Latency is defined as the time delay between the defined edge of the applied trigger and the sensor switching into the triggered state.

Measurement Uncertainty

		25°C to 35°C			0°C to 50°C		
Average Power (dB)[*3]	Range (dBm)	≤18 GHz	>18 GHz to 40 GHz	>40 GHz to 50 GHz	≤18 GHz	>18 GHz to 40 GHz	>40 GHz to 50 GHz
	–70 to <+15	0.11	0.13	0.19	0.14	0.17	0.25
	+15 to +20	0.14	0.17	0.23	0.18	0.21	0.29

		Set		Drift	
Zero[*4]	Range (dBm)	Watt	dBm	Watt	dBm
	–70 to –20	9.68E-11	–70.14	8.90E-11	–70.50
	>–20 to 0	4.95E-09	–53.05	4.14E-09	–53.83
	>0 to +20	1.56E-08	–48.08	1.72E-08	–47.65

Noise[*5]	Range (dBm)	Watt	dBm
	–70 to –20	3.53E-11	–74.52
	>–20 to 0	6.51E-11	–71.86
	>0 to +20	6.30E-10	–62.01

*3: Power uncertainty expressed with coverage factor of k = 2 for CW measurement after zero operation. Includes calibration factor and linearity over temperature uncertainties, but not the effects of mismatch, zero set and drift, or noise.
*4: Zero uncertainty expressed with coverage factor of k = 3. One hour warm-up followed by a Zero operation. Measured with 256 averages and 40 ms aperture and with the temperature kept within ±1°C.
Zero Set: Average of the reported power over one hour.
Zero Drift: Two sigma value of the reported power over one hour.
Specified Zero Set, Drift and Noise are valid at 30°C±5°C.
*5: Two sigma noise at 10.2 seconds of integration time (integration time = aperture time × averaging number). Effect of noise can be reduced by increasing the number of averages and/or increasing the aperture time. Noise is inversely proportional to the square root of number of ADC samples used per measurement; the number of ADC samples per measurement is the product of the sample rate, aperture time, and number of averages used. Noise uncertainty is expressed with coverage factor of k = 3.

PowerXpert™

PC Requirements (version 3.0 or greater)	Processor and RAM	Minimum: Equivalent to Intel® Pentium® III with 1 GB RAM or Intel® Pentium® IV with 512 MB RAM Recommended: Equivalent to Intel® Pentium® IV with 1 GB RAM
	Operating System	Microsoft® Windows® 8, Windows® 7, and Windows® XP
	Hard-Disk Free Space	100 MB minimum
	Display Resolution	1024 × 768 minimum
	Interface	USB 2.0 high speed
System	Measurand	Average power
	Measurement Resolution	0.01 dB max via PowerXpert™, 0.001 dB max via remote command
	Offset Correction[*6]	–100 to +150 dB
	Averaging	Auto, Manual
	Type	Moving, Repeat
	Number of Averages (Manual)[*7]	1 to 65,536
	Auto Average Resolution[*8]	1, 0.1, 0.01 dB
	Auto Average Source	Scope Data Point Number: 1 to 16,384
Continuous Average Mode	Duty Cycle Correction	0.01% to 100%
	Aperture Time	0.01 ms to 1 s
	Measurement Time[*9]	N × (aperture time × C_t) + T_{com} Continuous: >2,100 readings/s (minimum aperture, one average) Buffered: >5,600 readings/s (minimum aperture, one average)
	Buffer Size	8192

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Scope Mode	Capture Time	0.01 ms to 1 s
	Data Points	1 to 16,384
	Resolution	0.01 ms max
	Measurement Time*10	N × (capture time × C_t) + (P_n × 0.038 ms) + T_{com}
List Mode	Number of Measurements	1 to 1000
	Input Parameters	Frequency (GHz), aperture time (ms), averages
General	RF Connector	K (m) (MA24330A, MA24340A) V (m) (MA24350A)
	Interface to Host	USB 2.0 high speed
	Current Consumption	410 mA to 450 mA characteristic (+20°C to +30°C)
	Dimensions	110 (W) × 46 (H) × 25.6 (D) mm, excluding K or V connector and silicone protective covering
	Mass	397 g (0.88 lb)
	Warranty	1 year
Operational Requirements Tests were performed per MIL-PRF-28800F (Class 3).	Operating Temperature Range	0°C to +50°C
	Storage Temperature Range	–40°C to +71°C
	Humidity	45% relative humidity at +50°C (non-condensing) 75% relative humidity at +40°C (non-condensing) 95% relative humidity at +30°C (non-condensing)
	Altitude	4600 m operational max
	Shock	30 g_n half-sine, 11 ms duration
	Vibration	Sinusoidal: 5 Hz to 55 Hz, 3 g max Random: 10 Hz to 500 Hz Power Spectral Density: 0.03 g^2/Hz
	CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: (EU) 2015/863
	RCM	Australia and New Zealand: RCM AS/NZS 4417: 2012
	KCC	South Korea: KCC-REM-A21-0004

*6: Offset correction feature is available only through the PowerXpert application. There is no remote command for it in the sensor firmware.

*7: Maximum number of averages allowed in Continuous Average mode is 65,536. In Scope mode, the maximum number of averages is equal to 16,777,216 divided by the number of data points.

*8: Averaging resolution of 0.001 dB is not available with the PowerXpert application. It is defined as the place after the decimal to which the reading becomes stable. For example, if 0.01 is selected, then the reading will typically be stable within ±0.01 dB. Please refer to the remote operation chapter in the user guide for information regarding access to this feature.

*9: Speed is defined as the data throughput at the "A" end of the USB A to Micro-B Cable (p/n 2000-1816-R), where:
Number of Repeat Averages = N (N = 1 for moving average mode)
Capture Time Coefficient = C_t = 8.238
Command Processing Time = T_{com} = 0.347 ms
Speed may vary depending on the speed of and load on the CPU controlling the sensor. Specified results obtained with Intel® Core™ i5-3550 CPU running at 3.30 GHz

*10: Speed is defined as the data throughput at the "A" end of the USB A to Micro-B Cable (p/n 2000-1816-R), where:
Number of Repeat Averages = N (N = 1 for moving average mode)
Capture Time Coefficient = C_t = 8.238
Number of Points = P_n
Command Processing Time = T_{com} = 0.289 ms

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Available Models
MA24330A	33 GHz USB Power Sensor
MA24340A	40 GHz USB Power Sensor
MA24350A	50 GHz USB Power Sensor
	Included Accessories
10585-00021	Quick Start Guide
2000-1605-R	1.5 m BNC (m) to MCX (m) cable
2000-1816-R	1.8 m USB A to Micro-B cable
	Available Options
MA24330A-097	ISO/IEC 17025 and ANSI/NCSL Z540-1 or ANSI/NCSLI Z540.3
MA24340A-097	(includes test report, uncertainty data, and accreditation symbol)
MA24330A-098	Standard calibration ISO/IEC 17025 and ANSI/NCSL Z540-1
MA24340A-098	
MA24350A-098	
MA24330A-099	Premium calibration ISO/IEC 17025 and ANSI/NCSL Z540-1
MA24340A-099	(includes test report and uncertainty data)
MA24350A-099	
	Optional Accessories
	Calibrated Torque Wrenches
01-201	Calibrated torque wrench for K and V connectors

Model/Order No.	Name
	Precision Fixed Attenuators
41KB-3	DC to 26.5 GHz, 3 dB, 50Ω, K (m) to K (f)
41KB-6	DC to 26.5 GHz, 6 dB, 50Ω, K (m) to K (f)
41KB-10	DC to 26.5 GHz, 10 dB, 50Ω, K (m) to K (f)
41KB-20	DC to 26.5 GHz, 20 dB, 50Ω, K (m) to K (f)
41KC-3	DC to 40 GHz, 3 dB, 50Ω, K (m) to K (f)
41KC-6	DC to 40 GHz, 6 dB, 50Ω, K (m) to K (f)
41KC-10	DC to 40 GHz, 10 dB, 50Ω, K (m) to K (f)
41KC-20	DC to 40 GHz, 20 dB, 50Ω, K (m) to K (f)
41VA-3	DC to 70 GHz, 3 dB, 50Ω, V (m) to V (f)
41VA-6	DC to 70 GHz, 6 dB, 50Ω, V (m) to V (f)
41VA-10	DC to 70 GHz, 10 dB, 50Ω, V (m) to V (f)
41VA-20	DC to 70 GHz, 20 dB, 50Ω, V (m) to V (f)
41VA-30	DC to 70 GHz, 30 dB, 50Ω, V (m) to V (f)
41VA-40	DC to 70 GHz, 40 dB, 50Ω, V (m) to V (f)
43KB-3	DC to 26.5 GHz, 3 dB, 50Ω, K (m) to K (f)
43KB-6	DC to 26.5 GHz, 6 dB, 50Ω, K (m) to K (f)
43KB-10	DC to 26.5 GHz, 10 dB, 50Ω, K (m) to K (f)
43KB-20	DC to 26.5 GHz, 20 dB, 50Ω, K (m) to K (f)
43KC-3	DC to 40 GHz, 3 dB, 50Ω, K (m) to K (f)
43KC-6	DC to 40 GHz, 6 dB, 50Ω, K (m) to K (f)
43KC-10	DC to 40 GHz, 10 dB, 50Ω, K (m) to K (f)
43KC-20	DC to 40 GHz, 20 dB, 50Ω, K (m) to K (f)
	Precision Coaxial Adapters
33KFKF50B	DC to 40 GHz, 50Ω, K (f) to K (f)
33KKF50B	DC to 40 GHz, 50Ω, K (m) to K (f)
33VFVF50C	DC to 70 GHz, 50Ω, V (f) to V (f)
33VVF50C	DC to 70 GHz, 50Ω, V (m) to V (f)
34NKF50	DC to 18 GHz, 50Ω, N (m) to K (f)
34NFKF50	DC to 18 GHz, 50Ω, N (f) to K (f)

mmWave Power Analyzer

MA24507A/MA24510A Power Master™

9 kHz to 70 GHz, 9 kHz to 110 GHz

Frequency Selectable mmWave Power Analyzer

Excellent Eco Product

MA24507A

MA24507A

MA24510A

Traditional power meters are broadband and have limited power ranges, so engineers and technicians are using spectrum analyzers that include many unneeded features, cost hundreds of thousands of dollars, and take up half the test bench just to make simple, frequency-based RF amplitude measurements. The Power Master MA24507A and MA24510A solutions are the world's first frequency selectable mmWave power analyzer. Unlike spectrum analyzers that are bulky, expensive, and complex or power meters that are not frequency dependent and have limited dynamic range, the MA24507A enables simple, numeric, frequency-based amplitude measurements of up to six signals from 9 kHz to 70 GHz with a device foot print slightly larger than a cell phone and at a fraction of the price of a spectrum analyzer with equivalent frequency and dynamic range coverage.

Key Features

- Able to measure very low power signals as low as –90 dBm
- Excellent for over-the-air testing, especially with mmWave signals that have high propagation loss
- User settings to control measurement speeds and noise floor
- Channel Monitor mode in PowerXpert for monitoring up to six frequency channels at once
- Power Hunter mode in PowerXpert for searching up to six signals within a frequency range
- Mounting holes for direct mounting to probes for on-wafer testing

Definitions

All specifications and characteristics apply under the following conditions, unless otherwise stated:

Warm-Up Time	30 minutes
Operating Temperature Range	0°C to 50°C
Typical Performance	Typical performance indicates the measured performance of an average unit. Typical performance does not include guard-bands and is not covered by the product warranty. Typical specifications are shown in parenthesis, such as (–102 dB), or noted as Typical.
Characteristic Performance	Characteristic performance indicates a performance designed-in and verified during the design phase. Characteristic performance is not covered by the product warranty.
ISO GUM Measurement Uncertainty	Uncertainty expressed with coverage factor of k = 2.
Calibration Cycle	Anritsu recommended calibration interval is 12 months.
Specifications Subject to Change	All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu website: www.anritsu.com

Specifications

Frequency

Range	MA24507A: 9 kHz to 70 GHz, V (m) Connector (1.85 mm) MA24510A: 9 kHz to 110 GHz, W1 (m) Connector (1.0 mm)
Internal Reference	Accuracy: ±0.2 ppm (0°C to 50°C) Aging: ±1.0 ppm/year aging
Continuous Mode Span	30 kHz to 2 GHz max. in Channel Power Measurement 10 kHz to Full Span in CW Max. Measurement
Channel Monitor Mode Span	1 kHz to 20 MHz

Power Measurement

Maximum Amplitude

Frequency	Max. Power*
≤6.15 GHz	+15 dBm
>6.15 GHz	+10 dBm

*: Characteristic

Average Noise Floor

Channel Power Measurement	Channel Span	Noise Floor*1
	30 kHz	–88 dBm
	10 MHz	–64 dBm
	1 GHz	–40 dBm
CW Max. Measurement	Resolution	NoiseFloor*2
	High	–100 dBm
	Medium	–90 dBm
	Low	–80 dBm

*1: Measured at 1 GHz center frequency
*2: Measured at 1 GHz center frequency; 3 MHz span

Damage Level

Continuous	+30 dBm CW, ±10 VDC max.

Ranges*

Lower	≤–10 dBm
Upper	>–10 dBm

*: Power Master allows the user to define the operating range. To avoid clipping or saturating signals, the upper range is recommended for signals above –10 dBm. Signals at or below –10 dBm will typically be able to use the lower range.

Input Match (typical)

Frequency	V Connector		W1 Connector	
	VSWR	Return Loss	VSWR	Return Loss
9 kHz to 12.4 GHz	1.29:1	18 dB	1.29:1	18 dB
>12.4 GHz to 26.5 GHz	1.43:1	15 dB	1.67:1	12 dB
>26.5 GHz to 40 GHz	1.58:1	13 dB	1.67:1	12 dB
>40 GHz to 50 GHz	1.67:1	12 dB	1.67:1	12 dB
>50 GHz to 70 GHz	2.10:1	9 dB	2.10:1	9 dB
>70 GHz to 110 GHz	—	—	2.10:1	9 dB

Measurement Speed (readings/s, characteristic)

		Span*		
		300 kHz	20 MHz	1 GHz
Channel Power Measurement		7	20	10
CW Max. Measurement	High	0.8	15	6
	Medium	4	25	10
	Low	20	25	10

*: Measured at 1 GHz center frequency; no averages

Trigger Source

Bus
Continuous

Measurement Uncertainty

Power Measurements

Amplitude Accuracy*

Frequency	20°C to 30°C (after 30 minute warm-up)		0°C to 50°C (after 60 minute warm-up)	
	Maximum	Typical	Maximum	Typical
9 kHz to 644 MHz	±1.3 dB	±0.5 dB	±2.0 dB	±0.5 dB
>644 MHz to 40 GHz	±1.8 dB	±0.5 dB	±3.0 dB	±1.0 dB
>40 GHz to 70 GHz	±2.0 dB	±0.5 dB	±3.0 dB	±1.0 dB
>70 GHz to 90 GHz	±2.2 dB	±0.5 dB	±3.0 dB	±1.0 dB
>90 GHz to 110 GHz	±2.5 dB	±0.5 dB	±3.0 dB	±1.0 dB

*: Accuracy excludes effects of Noise and Mismatch uncertainty. Characteristic values between 67 GHz and 70 GHz.

Relative Power Accuracy

Frequency	Accuracy
9 kHz to <6.15 GHz	±0.3 dB
6.15 GHz to <40 GHz	±0.3 dB
40 GHz to ≤110 GHz	±0.3 dB (typical with W1 connector)

PowerXpert™

PC Requirements (version 4.0 or greater)

Processor and RAM	Equivalent to Quad Core i5 fourth generation or higher CPU, 8 GB RAM
Operating System	Microsoft® Windows® 10, 8.1, or 7; 64-bit
Hard-Disk Free Space	100 MB minimum
Display Resolution	1024 × 768 minimum
Interface	USB 3.0

System

Measurand	Channel power, CW peak power
Measurement Resolution	0.01 dB max. via PowerXpert, 0.01 dB max. via remote command
Offset Correction*	–100 dB to +150 dB
Units	dBm, nW, μW, mW, W
Averaging	Manual
Averaging Type	Moving
Number of Averages	1 to 1,000

*: Offset correction feature is available only through the PowerXpert application. There is no remote command for it in the analyzer firmware.

Continuous Mode

Measurements	Channel power, CW max.
Center Frequency	9.5 kHz to (Max. Freq. – 500 Hz)
Span	30 kHz to 2 GHz (Channel power), 1 kHz to Full span (CW max.)
Resolution	High, medium, low

Power Hunter Mode

Measurement	CW max. only
Start Frequency	9 kHz to (Max. Freq. – 1 kHz)
Stop Frequency	10 kHz to Max. Freq.
Set Minimum Power Range	–130 to 0 dBm

Channel Monitor Mode

Measurements	Channel power, CW max.
Channel Frequencies	(9 kHz + Span/2) to (Max. Freq. – Span/2)
Span	1 kHz to 20 MHz
Number of Channels	Up to 6

General

RF Connector	MA24507A: V male (1.85 mm) MA24510A: W1 male (1.0 mm)
Interface to Host	USB 3.0
Current Consumption	900 mA max.
Dimensions	84 (W) × 155 (H) × 27 (D) mm (3.3 × 6.1 × 1.1 in)
Mass	282 g (0.62 lb)
Warranty	1 year

Operational Requirements

Tests were performed per MIL-PRF-28800F (Class 3).

Operating Temperature Range	0°C to +50°C
Storage Temperature Range	–40°C to +71°C
Relative Humidity (non-condensing)	45% at +50°C 75% at +40°C 95% at +30°C
Altitude	4600 m operational max.
Shock	30 g half-sine, 11 ms duration
Vibration	Sinusoidal: 5 Hz to 55 Hz, 3 g max. Random: 10 Hz to 500 Hz, 2.34 g rms Power Spectral Density: 0.01 g^2/Hz

Compliance

CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/65/EU, EN61010-1 RoHS: (EU) 2015/863 Australia and New Zealand RCM AS/NZS 4417:2012 South Korea KCC-REM-A21-0004

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MA24507A	9 kHz to 70 GHz mmWave Power Analyzer
MA24510A	9 kHz to 110 GHz mmWave Power Analyzer
	Included Accessories
2000-1605-R	1.5 m BNC (m) to MCX (m) cable
2000-1859-R	USB 3.0 Type C to Type A Cable, 1 m
	Available Options
MA24507A-098	Standard Calibration ISO/IEC 17025 and ANSI/NCSL Z540-1
MA24507A-099	Premium Calibration ISO/IEC 17025 and ANSI/NCSL Z540-1 (includes test report and uncertainty data)
MA24510A-098	Standard Calibration ISO/IEC 17025 and ANSI/NCSL Z540-1
MA24510A-099	Premium Calibration ISO/IEC 17025 and ANSI/NCSL Z540-1 (includes test report and uncertainty data)
	Optional Accessories
	Calibrated Torque Wrenches
01-201	Calibrated torque wrench for K and V connectors
	Precision Fixed Attenuators
41VA-3	DC to 70 GHz, 3 dB, 50Ω, V (m) to V (f)
41VA-6	DC to 70 GHz, 6 dB, 50Ω, V (m) to V (f)
41VA-10	DC to 70 GHz, 10 dB, 50Ω, V (m) to V (f)
41VA-20	DC to 70 GHz, 20 dB, 50Ω, V (m) to V (f)
41VA-30	DC to 70 GHz, 30 dB, 50Ω, V (m) to V (f)
41VA-40	DC to 70 GHz, 40 dB, 50Ω, V (m) to V (f)
	Precision Coaxial Adapters
33VFVF50C	DC to 70 GHz, 50Ω, V (f) to V (f)
33VVF50C	DC to 70 GHz, 50Ω, V (m) to V (f)
34WV50	DC to 65 GHz, W1 (m) to V (m), 50Ω
34WVF50	DC to 65 GHz, W1 (m) to V (f), 50Ω
34WFV50	DC to 65 GHz, W1 (f) to V (m), 50Ω
34WFVF50	DC to 65 GHz, W1 (f) to V (f), 50Ω
33WW50	DC to 110 GHz, W1 (m) to W1 (m), 50Ω
33WWF50	DC to 110 GHz, W1 (m) to W1 (f), 50Ω
33WFWF50	DC to 110 GHz, W1 (f) to W1 (f), 50Ω
	Waveguide to Coaxial Adapters (right angle)
35WR22VF	33 GHz to 50 GHz, WR22 to V (f)
35WR19VF	40 GHz to 60 GHz, WR19 to V (f)
35WR15VF	50 GHz to 65 GHz, WR15 to V (f)
35WR10WF	75 GHz to 110 GHz, WR10 to W1 (f)
SC7442	60 GHz to 90 GHz, WR12 to W1 (f)
	Waveguide to Coaxial End Launch Adapters (straight through)
1091-460-R	17.6 GHz to 26.7 GHz, WR42 to V (f)
1091-459-R	26.4 GHz to 40.1 GHz, WR28 to V (f)
1091-458-R	33.0 GHz to 50.1 GHz, WR22 to V (f)
1091-457-R	39.3 GHz to 59.7 GHz, WR19 to V (f)
1091-456-R	49.9 GHz to 67.0 GHz, WR15 to V (f)
1091-402-R	49.9 GHz to 75.8 GHz, WR15 to W1 (f)
1091-401-R	60.5 GHz to 92.0 GHz, WR12 to W1 (f)
1091-400-R	73.8 GHz to 110 GHz, WR10 to W1 (f)
	Directional Horn Antennas
2000-1867-R	17.6 GHz to 26.7 GHz, WR42, 25 dBi gain
2000-1868-R	26.4 GHz to 40.1 GHz, WR28, 25 dBi gain
2000-1869-R	33.0 GHz to 50.1 GHz, WR22, 25 dB gain
2000-1870-R	39.3 GHz to 59.7 GHz, WR19, 25 dBi gain
2000-1871-R	49.9 GHz to 75.8 GHz, WR15, 25 dBi gain
2000-1872-R	60.0 GHz to 90.0 GHz, WR12, 25 dBi gain
2000-1873-R	75.0 GHz to 110.0 GHz, WR10, 25 dBi gain
	USB Cable Extenders
2000-1888-R	USB 3.0 Powered Cable Extender, 10 m, (32 ft) (up to two can be used in series for a total length of 20 m)

USB Peak Power Sensors

MA24400A (MA24406A/08A/18A/19A/40A/41A) series

High-Speed Response Peak Power Sensor Equipped with Various Modulated Wave Signal Measurement and Analysis Functions

MA24406A

MA24408A

MA24418A

MA24419A

MA24440A

MA24441A

The USB Peak Power Sensors MA24400A are designed to meet the challenges of signal measurement and characterization in a complex world of wireless communications. This series is designed to provide accurate, peak power measurements from 50 MHz to 6/8/18/40 GHz with up to 80 dB of dynamic range and 195 MHz of video bandwidth. The MA24400A sensors employ a parallel processing methodology that performs the multi-step process of RF power measurement at incredible, unmatched speeds. While conventional power meters and USB sensors perform steps serially, resulting in long re-arm times and missed data, the MA24400A sensors capture, display, and measure every pulse, glitch, and detail with virtually no gaps in data and zero latency.

Key Features

- 6/8/18/40 GHz RF power sensors
- Up to 195 MHz VBW with 3 ns rise time
- 100,000 measurements per second
- 10 GSa/s effective sample rate
- 100 MSa/s continuous sample rate
- Crest factor and statistical measurements (e.g. CCDF)
- Synchronized multi-channel measurements
- Microwave peak power analyzer advanced measurement and analysis software

Specifications

Frequency Range

Model	MA24406A	MA24408A	MA24418A	MA24419A	MA24440A	MA24441A
Frequency Range	50 MHz to 6 GHz	50 MHz to 8 GHz	50 MHz to 18 GHz	50 MHz to 18 GHz	50 MHz to 40 GHz	50 MHz to 40 GHz

Power Measurement

Model		MA24406A	MA24408A	MA24418A	MA24419A	MA24440A	MA24441A
Dynamic Range	Average	–60 to +20 dBm	–53 to +20 dBm*1	–34 to +20 dBm	–50 to +20 dBm	–34 to +20 dBm	–50 to +20 dBm
	Pulse	–50 to +20 dBm	–43 to +20 dBm*2	–24 to +20 dBm	–40 to +20 dBm	–24 to +20 dBm	–40 to +20 dBm
VSWR (max.) (GHz)		1.25 (0.05 to 6)	1.20 (0.05 to 6) 1.25 (6 to 8)	1.15 (0.05 to 2.0) 1.28 (2.0 to 16) 1.34 (16 to 18)	1.15 (0.5 to 2.0) 1.20 (2.0 to 6.0) 1.28 (6.0 to 16) 1.34 (16 to 18)	1.25 (0.05 to 4.0) 1.65 (4.0 to 38) 2.00 (38 to 40)	1.25 (0.05 to 4.0) 1.65 (4.0 to 38) 2.00 (38 to 40)
Damage Level	RF Port Input	+23 dBm, ±10.0 VDC (+30 dBm peak for 1 µs), minimum					
Response	Single Channel Rise Time (fast/std)	3 ns/<10 µs	4 ns/<10 µs	5 ns/<10 µs	<100 ns/<10 µs	5 ns/<10 µs	<100 ns/<10 µs
	Video Bandwidth (fast/std)	195 MHz/350 kHz	165 MHz/350 kHz	70 MHz/350 kHz	6 MHz/350 kHz	70 MHz/350 kHz	6 MHz/350 kHz
	Single Shot Bandwidth	35 MHz	35 MHz	35 MHz	6 MHz	35 MHz	6 MHz
	Sampling Rate	100 MS$_{a/s}$, characteristic					
	Effective Sampling Rate	10 GS$_{a/s}$, characteristic					

*1: –53 dBm > 6 GHz, –60 dBm < 6 GHz
*2: –43 dBm > 6 GHz, –50 dBm < 6 GHz

Triggering

Model		MA24406A	MA24408A	MA24418A	MA24419A	MA24440A	MA24441A
Source		Continuous, Internal, External TTL, Crossover (from another sensor)					
Arm Type		Continuous, Single, Trigger Holdoff, Frame (gap) Holdoff					
Internal Trigger	Dynamic Range	–38 to 20 dBm	–38 to 20 dBm	–10 to 20 dBm	–27 to 20 dBm	–10 to 20 dBm	–27 to 20 dBm
	Min Pulse Width (fast/std)	10 ns/3 µs	3 µs	10 ns/3 µs	200 ns/3 µs	10 ns/3 µs	200 ns/3 µs
	Slope	Positive or Negative					
	Trigger Holdoff	100 ns to 1 s with 10 ns resolution					
External Trigger	External Trigger Input	SMB (f)					
	Impedance	10 kΩ					
	Type	TTL					
	Slope	Positive or Negative					
	High Level Input Voltage	2.4 V min, 5.5 V max.					
	Low Level Input Voltage	–0.1 V min, 0.7 V max.					
	Latency	<10 ns (Latency is defined as the time delay between the defined edge of the applied trigger and the sensor switching into the triggered state.)					
	Trigger Pulse Width	10 ns min.					
	Trigger Repetition Period	20 ns min.					
	Trigger Holdoff	100 ns to 1 s with 10 ns resolution					

PC Requirements

Processor	1.3 GHz or higher recommended
RAM	512 MB (1 GB or more recommended)
Operating System	Microsoft® Windows® 10 Microsoft® Windows® 8 (32-bit and 64-bit) Microsoft® Windows® 7 (32-bit and 64-bit)
Hard-Disk Free Space	Min 1.0 GB free space to install and run
Display Resolution	800 × 600 (1280 × 1024 or higher recommended)
Interface	USB 2.0 high speed

General

RF Connector	N (m) (MA24406A, MA24408A, MA24418A, MA24119A) 2.92 mm (m) (MA24440A, MA24441A)
Interface to Host	USB 2.0 high speed
Size	145 (W) × 43 (H) × 43 (D) mm, excluding N connector
Mass	363 g (0.8 lb)
Warranty	3 year

Environmental Requirements

Operating Temperature Range	0°C to +55°C
Storage Temperature Range	–40°C to +70°C
Relative Humidity (non-condensing)	45% at 50°C 75% at 40°C 95% at 30°C
Altitude	3048 m operational max.
Shock	30 g half-sine, 11 ms duration
Vibration	Sinusoidal: 5 Hz to 55 Hz, 3 g max. Random: 10 Hz to 500 Hz, 2.34 g rms Power Spectral Density: 0.01 g^2/Hz

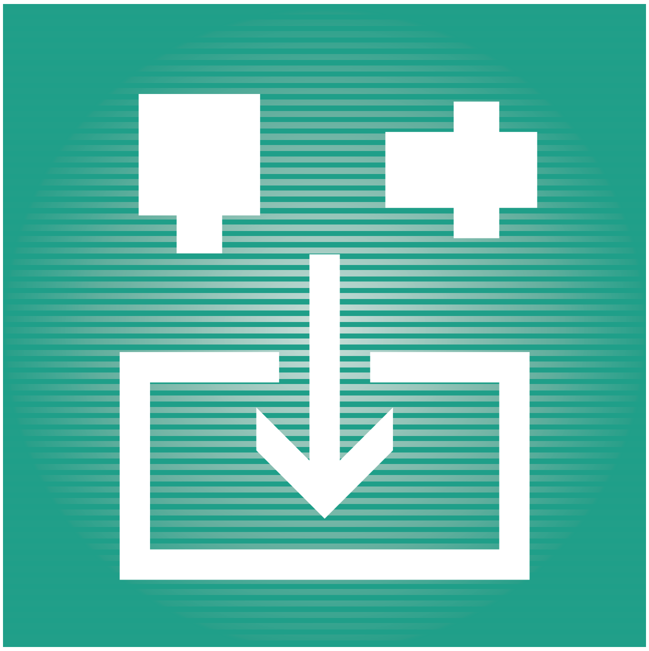
Regulatory Compliance

CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: (EU) 2015/863

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MA24406A	USB Peak Power Sensor, 50 MHz to 6 GHz
MA24408A	USB Peak Power Sensor, 50 MHz to 8 GHz
MA24418A	USB Peak Power Sensor, 50 MHz to 18 GHz
MA24419A	USB Peak Power Sensor, 50 MHz to 18 GHz
MA24440A	USB Peak Power Sensor, 50 MHz to 40 GHz
MA24441A	USB Peak Power Sensor, 50 MHz to 40 GHz
	Included Accessories
11410-00976	Information Card
806-390-R	0.9 m BNC (m) to SMB (m) cable
806-389-R	0.9 m SMB (m) to SMB (m) cable
806-391-R	1.8 m USB A (m) to USB B (m) cable
	Available Options
MA24406A-097 MA24408A-097 MA24418A-097 MA24419A-097 MA24440A-097 MA24441A-097	Accredited Calibration to ISO/IEC 17025 and ANSI/NCSL Z540-1 or ANSI/NCSL Z540.3 (includes test report, uncertainty data, and accreditation symbol)
	Optional Accessories
	Attenuators
3-1010-122	Attenuator, DC to 12.4 GHz, 20 dB, 5 W, N (m) to N (f), 50Ω
3-1010-123	Attenuator, DC to 8.5 GHz, 30 dB, 50 W, N (m) to N (f), 50Ω
3-1010-124	Attenuator, DC to 8.5 GHz, 40 dB, 100 W, N (f) to N (m), 50Ω
42N50-20	Attenuator, DC to 18 GHz, 20 dB, 5 W, N (m) to N (f), 50Ω
42N50A-30	Attenuator, DC to 18 GHz, 30 dB, 50 W, N (m) to N (f), 50Ω
43KB-3	Fixed Attenuator, 3 dB, DC to 26.5 GHz, K (m) to K (f), 50Ω
43KB-6	Fixed Attenuator, 6 dB, DC to 26.5 GHz, K (m) to K (f), 50Ω
43KB-10	Fixed Attenuator, 10 dB, DC to 26.5 GHz, K (m) to K (f), 50Ω
43KB-20	Fixed Attenuator, 20 dB, DC to 26.5 GHz, K (m) to K (f), 50Ω
43KC-3	Fixed Attenuator, 3 dB, DC to 40 GHz, K (m) to K (f), 50Ω
43KC-6	Fixed Attenuator, 6 dB, DC to 40 GHz, K (m) to K (f), 50Ω
43KC-10	Fixed Attenuator, 10 dB, DC to 40 GHz, K (m) to K (f), 50Ω
43KC-20	Fixed Attenuator, 20 dB, DC to 40 GHz, K (m) to K (f), 50Ω
41KB-3	Precision Fixed Attenuator, 3 dB, DC to 26.5 GHz, K (m) to K (f), 50Ω
41KB-6	Precision Fixed Attenuator, 6 dB, DC to 26.5 GHz, K (m) to K (f), 50Ω
41KB-10	Precision Fixed Attenuator, 10 dB, DC to 26.5 GHz, K (m) to K (f), 50Ω
41KB-20	Precision Fixed Attenuator, 20 dB, DC to 26.5 GHz, K (m) to K (f), 50Ω
41KC-3	Precision Fixed Attenuator, 3 dB, DC to 40 GHz, K (m) to K (f), 50Ω
41KC-6	Precision Fixed Attenuator, 6 dB, DC to 40 GHz, K (m) to K (f), 50Ω
41KC-10	Precision Fixed Attenuator, 10 dB, DC to 40 GHz, K (m) to K (f), 50Ω
41KC-20	Precision Fixed Attenuator, 20 dB, DC to 40 GHz, K (m) to K (f), 50Ω
	Coaxial Adapters
510-90-R	Adapter, DC to 3.3 GHz, N (m) to 7/16 DIN (f), 50Ω
510-91-R	Adapter, DC to 3.3 GHz, N (f) to 7/16 DIN (f), 50Ω
510-92-R	Adapter, DC to 3.3 GHz, N (m) to 7/16 DIN (m), 50Ω
510-93-R	Adapter, DC to 3.3 GHz, N (f) to 7/16 DIN (m), 50Ω
1091-26-R	Adapter, DC to 18 GHz, N (m) to SMA (m), 50Ω
1091-27-R	Adapter, DC to 18 GHz, N (m) to SMA (f), 50Ω
1091-80-R	Adapter, DC to 18 GHz, N (f) to SMA (m), 50Ω
1091-81-R	Adapter, DC to 18 GHz, N (f) to SMA (f), 50Ω
34AN50	Precision Adapter, DC to 18 GHz, GPC-7 to N (m), 50Ω
34ANF50	Precision Adapter, DC to 18 GHz, GPC-7 to N (f), 50Ω
34NFK50	Precision Adapter, DC to 18 GHz, N (f) to K (m), 50Ω
34NFKF50	Precision Adapter, DC to 18 GHz, N (m) to K (f), 50Ω
34NK50	Precision Adapter, DC to 18 GHz, N (m) to K (m), 50Ω
34NKF50	Precision Adapter, DC to 18 GHz, N (m) to K (f), 50Ω
33NFNF50B	Calibration Grade Adapter, DC to 18 GHz, N (f) to N (f), 50Ω
33NNF50B	Calibration Grade Adapter, DC to 18 GHz, N (m) to N (f), 50Ω
33NN50B	Calibration Grade Adapter, DC to 18 GHz, N (m) to N (m), 50Ω

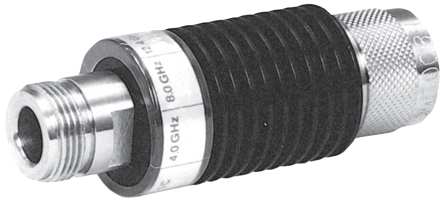


COMPONENTS

Fixed Attenuators for High Power Measurement

J0063, J0078, J0395, B0472

DC to 9 GHz/12.4 GHz/18 GHz



J0063

Specifications

Model	J0063	J0395
Frequency Range	DC to 12.4 GHz	DC to 9 GHz
Attenuation	30 dB	30 dB
Attenuation Accuracy	±0.7 dB	±0.5 dB
VSWR (max.)	1.06 + 0.02f (GHz)	1.2 (DC to 4.0 GHz) 1.3 (4.0 GHz to 9.0 GHz)
Maximum Allowable Power	10 W (40 dBm)	30 W (44.7 dBm)
Connector	N-type, 50Ω	
CE	RoHS: 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018	
UKCA	RoHS: S.I. 2012 No.3032, EN IEC 63000: 2018	

Model	B0472*	J0078*
Frequency Range	DC to 18 GHz	DC to 18 GHz
Attenuation	30 dB	20 dB
Attenuation Accuracy	±1.0 dB	±0.5 dB
VSWR (max.)	1.25 (DC to 8.0 GHz) 1.35 (8.0 GHz to 12.4 GHz) 1.45 (12.4 GHz to 18.0 GHz)	1.15 (DC to 4.0 GHz) 1.20 (4.0 GHz to 8.0 GHz) 1.25 (8.0 GHz to 12.4 GHz) 1.40 (12.4 GHz to 18.0 GHz)
Maximum Allowable Power	100 W (50 dBm)	10 W (40 dBm)
Connector	N-type, 50Ω	

*: RoHS non-compliant product
Cannot be shipped to the EU, UK and EFTA.

Fixed Attenuators

J1750A, J1751A, J1752A, J1753A, J1754A

DC to 18 GHz

NEW

J1751A

Specifications

Model	J1750A	J1751A	J1752A
Frequency Range	DC to 18 GHz		
Attenuation*1	10 dB	20 dB	30 dB
Attenuation Accuracy*1	±0.60	−0.5, +0.8	±0.85
VSWR	1.20 (DC to 4 GHz), 1.25 (4 GHz to 8 GHz), 1.30 (8 GHz to 12.4 GHz), 1.6 typ. (12.4 GHz to 18 GHz)		
Maximum Allowable Power*2	5W		
Connector	N-P/N-J		
Impedance	50Ω		
Operating Temperature Range	−55°C to +100°C		
Dimensions and Mass	Maximum diameter: 20.62 × Length: 48.26 mm, <50 g		
CE	RoHS: 2011/65/EU, (EU)2015/863, EN IEC 63000: 2018		
UKCA	RoHS: S.I. 2012 No.3032, EN IEC 63000: 2018		

Model	J1753A	J1754A
Frequency Range	DC to 18 GHz	
Attenuation*1	3 dB	6 dB
Attenuation Accuracy*1	±0.40	
VSWR	1.20 (DC to 4 GHz), 1.25 (4 GHz to 8 GHz), 1.30 (8 GHz to 12.4 GHz), 1.6 typ. (12.4 GHz to 18 GHz)	
Maximum Allowable Power*2	5W	
Connector	N-P/N-J	
Impedance	50Ω	
Operating Temperature Range	−55°C to +100°C	
Dimensions and Mass	Maximum diameter: 20.62 × Length: 48.26 mm, <50 g	
CE	RoHS: 2011/65/EU, (EU)2015/863, EN IEC 63000: 2018	
UKCA	RoHS: S.I. 2012 No.3032, EN IEC 63000: 2018	

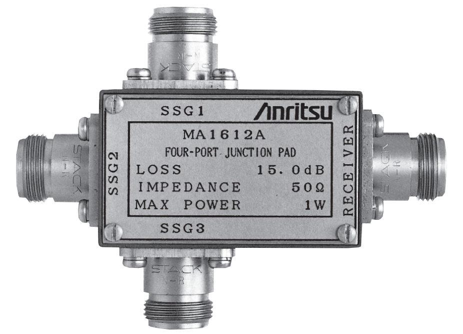
*1: At 25°C, accuracy includes frequency and power variations. Temperature coefficient for attenuation: .0004 dB/dB/°C typ.

*2: Average power at 25°C ambient, derate linearly to 2 W at 100°C.

Four-Port Junction Pad

MA1612A

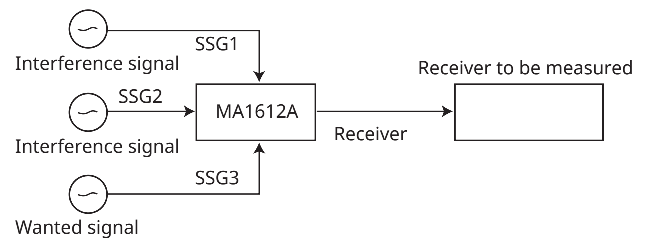
5 MHz to 3 GHz



The MA1612A are used as an impedance matching box applying the mixed output of three RF signal generators to a receiver input terminal for measurement of three-signal characteristics (such as receiver SINAD performance).

Specifications

Frequency Range	5 MHz to 3 GHz
Insertion Loss	15 ±1.0 dB (<1 GHz) 15 ±1.5 dB (≥1 GHz)
Impedance Characteristics	50Ω VSWR: ≤1.4 (<1 GHz) ≤2.0 (≥1 GHz)
Connector	N (S)-J
Isolation	SSG1-SSG2, SSG1-SSG3: ≥30 dB (<1 GHz) ≥25 dB (<2 GHz) ≥20 dB (≤3 GHz) SSG2-SSG3: ≥20 dB
Maximum Allowable Power	1 W
Operating Temperature Range	0°C to 50°C
CE	RoHS: 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	RoHS: S.I. 2012 No.3032, EN IEC 63000: 2018



2Way/4Way Low Amplitude Error Divider

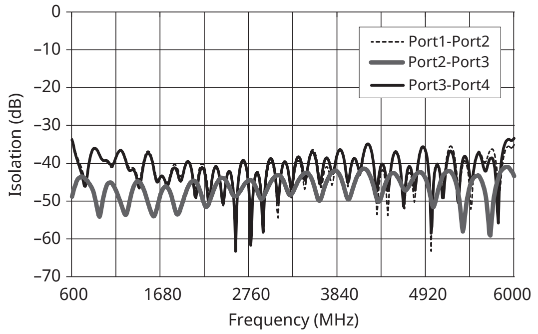
J1941A/J1942A

0.6 GHz to 6 GHz

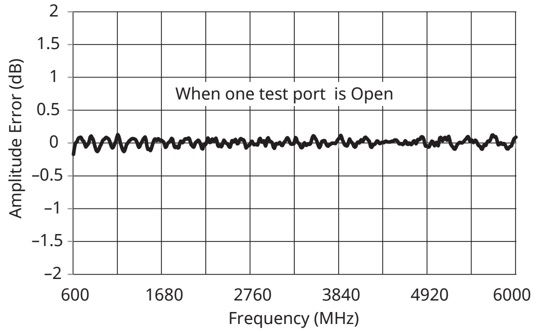
Specifications

Model	J1941A	J1942A
Frequency Range	0.6 GHz to 6 GHz	
Divide Number	2	4
Ports Unbalance	≤0.1 dB (0.6 GHz to 4 GHz) ≤0.15 dB (4 GHz to 6 GHz)	
Amplitude Error	≤0.5 dB	
Insertion Loss	≤0.5f + 7 dB	≤0.5f + 10 dB
VSWR (Common port)	<1.5	
VSWR (Test port)	<1.3	
Input Level (Max.)	+38 dBm (max., Duty ≤50%, ≤30°C)	
Connector	SMA (J)	
CE	RoHS: 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018	
UKCA	RoHS: S.I. 2012 No.3032, EN IEC 63000: 2018	

J1941A/J1942A of low amplitude error 2 divider/4 divider is a divider that suppresses occurrence of amplitude error even if there is an open end on the test port side.



J1942A Isolation Performance (Actual measurement value)

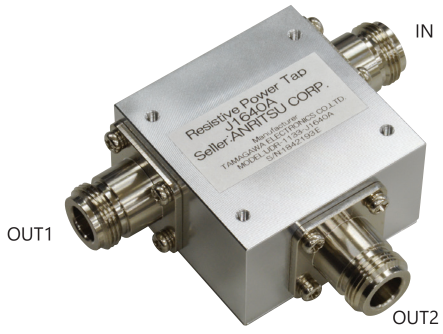


J1942A Amplitude Error Performance (Actual measurement value)

Resistive Power Tap

J1640A

DC to 3000 MHz

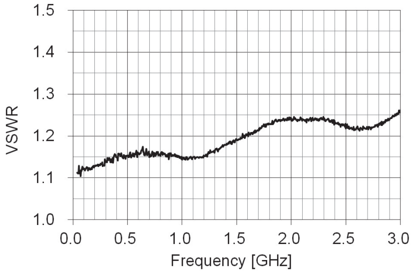


The Resistive Power Tap J1640A is used to branch the transmitted signal when measuring the spurious characteristics of a transmitter with a field strength meter or spectrum analyzer. It has flat attenuation frequency characteristics over DC to 3000 MHz, eliminating the need to consider frequency characteristics when making measurements.
The maximum allowable input power is 16 Watts.

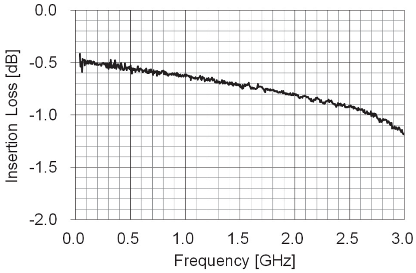
Specifications

Frequency Range	DC to 3000 MHz
Impedance	50Ω (nom.)
VSWR	≤1.35 (DC to 3000 MHz) (IN, OUT1, OUT2)
Maximum Allowable Power	16 W (IN-OUT1)
Insertion Loss (IN-OUT1)	≤1.0 dB (DC to 1000 MHz) ≤1.2 dB (1000 MHz to 1700 MHz) ≤1.5 dB (1700 MHz to 3000 MHz)
Branching Attenuation	40 dB ±1 dB (100 MHz) (IN-OUT2)
Frequency Characteristics of Branching Attenuation (IN-OUT2)	±0.5 dB (DC to 300 MHz) ±1.0 dB (300 MHz to 1000 MHz) ±1.5 dB (1000 MHz to 1700 MHz) ±2.5 dB (1700 MHz to 3000 MHz)
Connectors	N (f)
Operating Temperature Range	0°C to +45°C
CE	RoHS: 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	RoHS: S.I. 2012 No.3032, EN IEC 63000: 2018

Characteristics



VSWR Characteristics: IN



Insertion Loss Characteristics: IN-OUT1

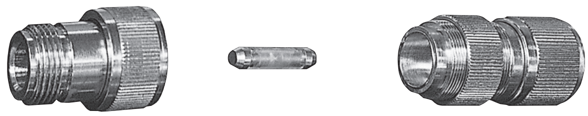
RF Fuse Holder

Fuse Element

MP612A

DC to 1 GHz

MP613A



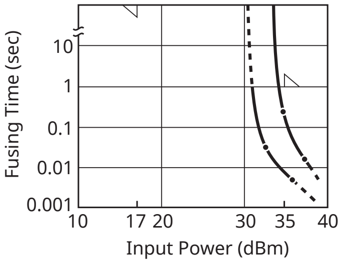
The RF Fuse Holder MP612A protects measuring instruments by preventing internal damage (parts burnout, etc.). The Fuse Element MP613A uses a vacuum-deposited metal resin film for low melting point and excellent high-frequency characteristics. The high fuse performance is designed to prevent damage even to 1/16 W small resistors commonly found in measuring instruments and offers superior protection for high-frequency measuring instruments, such as Frequency Counters and Spectrum Analyzers, against excessive input power or Signal Generators, against reverse input power.

Specifications

RF Fuse Holder	MP612A (without fuse elements)
Frequency Range	DC to 1 GHz
Impedance	50Ω, unbalanced
VSWR	≤1.2 (50Ω termination)
Connector	N-P, N-J
Insertion Loss	≤0.5 dB
Rated Power	17 dBm (50Ω load)
Max. Fuse Rated Power	≤35 dBm (50Ω load)
Operating Temperature Range	0°C to 45°C
Dimensions and Mass	20ø × 65 mm, ≤110 g
CE	RoHS: 2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	RoHS: S.I. 2012 No.3032, EN IEC 63000: 2018

Fuse Element: MP613A (5 pcs/set)

The Fuse Element MP613A is not attached to the RF Fuse Holder MP612A.



Fusing time (sec) and Input power (dBm) characteristics

Precision RF & Microwave Components

The Industry Leader for High Frequency Components

Precision Components-Precision Measurements

Anritsu is a leader in the design and production of precision microwave components.

- Precision Coaxial Connector Systems to 145 GHz
- Precision Coaxial and Waveguide to Coax Adapters
- RF Detectors
- Precision Terminations
- Precision Fixed Attenuators
- Precision Directional Coupler up to 110 GHz
- Precision Step Attenuators
- Precision Power Dividers and Splitters
- Precision Kelvin and Standard Bias Tees
- Broadband Microwave Limiters

Connector Design Leadership

Anritsu is the leader of high frequency microwave connector technology and is driven by an ongoing commitment to exceed customer needs. Anritsu created and trademarked the K Connector™ with coverage to 40 GHz, along with a complete family of 40 GHz test equipment. It was an immediate success and today is used on many commercial components, test fixtures, and defense and aerospace systems.

For certain applications, users want to access frequencies up to 43.5 GHz on a K connector. Anritsu has developed and introduced Extended-K™ connectors that not only provides frequency scalability to 43.5 GHz with mode-free performance on a K connector, but is also traceable ensuring a known measurement uncertainty.

The V Connector™ offers coaxial coverage to 65 GHz and uses a 1.85 mm geometry endorsed by the International Electrotechnical Commission (IEC). It mates with commercially available 2.4 mm connectors.

The W1 Connector™ provides mode-free performance to 110 GHz and uses a 1.00 mm coaxial connector front side interface.

The 0.8 mm connector family is a complete coaxial connector system with single-mode performance to 145 GHz. It contains male and female non-hermetic connectors, male and female broadband terminations and in series adapters. The 0.8 mm connector is well suited for high frequency applications ranging from components to systems and instrumentation.

Coaxial and Waveguide to Coax Adapters

A series of precision measurement adapters are available to adapt one connector type to another. Poor adapter VSWR (or poor return loss) can be a major source of measurement error and, therefore adapters must be carefully selected. Anritsu precision adapters typically have 6-12 dB better return loss than competitive units. Coaxial adapters are available to 145 GHz. Waveguide-to-coax adapters are available to 110 GHz.

Precision Terminations and Air Lines

Anritsu is recognized as the leader in the field of impedance standards. Anritsu air lines and terminations are unsurpassed for accuracy and impedance match. Not only do these products increase measurement accuracy, they also provide the only method of certifying the performance of SWR autotesters, bridges, directional couplers, and other devices.

Precision Fixed Attenuators

Anritsu attenuators offer superior performance in a low cost package. The low VSWR (excellent return loss) minimizes signal reflections and simultaneously reduces ripple effects in the output frequency response. This assures flat, consistent attenuation characteristics regardless of other devices reflection characteristics.
The 41K, 41VA, and 41W Series attenuators are specifically designed for applications where accuracy is a basic requirement. Available frequency ranges cover DC to 26.5, 40, 70, and 110 GHz.

Many other attenuator applications principal objective is the reduction of power. Since the attenuator might not be inserted at a measurement point, the measurement precision discussed earlier is not required.
In such a power-reducing system application, attenuators are often required in large quantities, making price an important consideration.
The 43K Series includes models covering DC to 26.5 GHz, and DC to 40 GHz. All are available with 3, 6, 10, or 20 dB attenuation values.
All have the Anritsu K Connectors and are compatible with 3.5 mm and SMA connectors.

Whatever your fixed attenuator needs might be, Anritsu provides the solution.

Precision Step Attenuators

Anritsu offers low loss, high precision step attenuators. These programmable step attenuators are available with 10 dB steps from 0 to 70 dB or 0 to 110 dB ranges. DC to 40 GHz frequency range ensures the broadest attenuation and frequency coverage available. Contact Anritsu for needs above 40 GHz or for custom step sizes.

Precision Power Dividers and Splitters

Anritsu offers the world's only W1 coaxial power divider and power splitter solution up to 110 GHz. Anritsu produces precision V Connector dividers and splitters to 65 GHz and precision K Connector dividers and splitters to 40 GHz. All Anritsu power dividers are 3-resistor symmetrical designs with excellent amplitude and phase tracking. Anritsu power splitters are 2-resistor designs, used to accurately split signals for ratio measurements.

Precision Bias Tees

Anritsu bias tees are used to combine DC and RF for active device measurements. Low RF throughline loss and low SWR ensure negligible effect on measurements from 50 kHz to 65 GHz. For users that require the most precision measurements by eliminating DC errors, Anritsu offers Kelvin bias tees. A high resistance of the DC coil results in voltage drop that leads to biasing voltage error which can be corrected through a sense coil on the Kelvin bias tee. Kelvin bias tees are available from 50 kHz to 10/65/110 GHz.

Broadband DC Blocks

Anritsu DC Blocks are used to prevent DC signals from passing through and are available up to 110 GHz.

Broadband Microwave Limiters

Anritsu broadband microwave limiters provide the widest frequency range available in a limiter. Designed to protect sensitive microwave equipment, these limiters incorporate unique single-side limiting to provide soft limiting characteristics over 10 MHz to 26.5 GHz.

RF Detectors

Just as directivity is the principal error contributor in reflection measurements, the impedance match of the signal source and RF detector is a significant error contributor in transmission measurements.

Anritsu offers a complete line of coaxial RF detectors covering from 10 MHz to 50 GHz with the lowest SWR available. The excellent impedance match of the detectors, along with that of the test port on the SWR Autotesters and bridges, minimize errors when making simultaneous transmission and measurements.

Calibration and Verification Kits

Anritsu offers calibration kits which contain all of the precision components and tools required to calibrate an Anritsu VNA in a connector style of your choice. Anritsu K, V, and W coaxial calibration kits offer optional data-based calibration files. Data-based calibration, along with precision components, provide superior VNA accuracy for R&D and production environments.

Specials

Anritsu also manufactures assemblies and components to meet specific customer requirements in both coaxial and waveguide structures. These include such components as Connectors, Bias Tee, Step Attenuator, Detector, Power Sensors, Waveguide, Coaxial Adapters, and RF Cables etc.

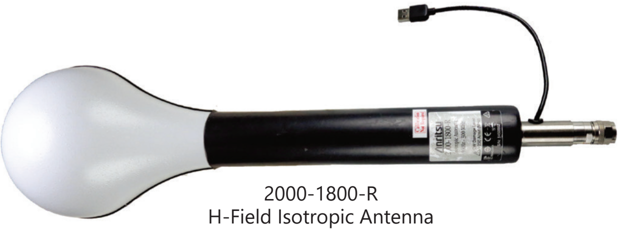
When requesting quotations on special assemblies, as a minimum please provide this information: frequency range, electrical characteristics, mechanical details and outline dimensions if any.

H-Field/E-Field sensor/E-Field Isotropic Antenna

2000-1800-R/2000-1791-R/2000-1792-R EMF Option 444

ElectroMagnetic Field Measurements

The Isotropic Antennas are Tri-axis with Integrated RF Switches.



2000-1800-R
H-Field Isotropic Antenna
9 kHz to 300 MHz

2000-1791-R
E-Field Isotropic Antenna
700 MHz to 6 GHz

2000-1792-R
E-Field Isotropic Antenna
30 MHz to 3 GHz

Anritsu's ElectroMagnetic Field (EMF) measurements are designed to measure radiation compliance with various national standards for personal safety set by governmental regulatory authorities. Many countries have mandated EMF safety testing in areas where cellular or other high power transmission antennas are located. The EMF option is primarily targeted to both cellular operators and government regulators. Additionally, contractors and small service companies perform building inspections and field surveys to monitor radiation exposure intensities in areas situated near transmission antennas.

Anritsu's EMF measurements are designed to be easy to use, while providing the user with numerous automated features which will enable them to do their job quickly and more efficiently. EMF measurements (EMF, Option 444) are available on the following Anritsu products: Field Master Pro™ MS2090A; Spectrum Master™ MS2711E, MS2712E, MS2713E, and MS2720T; Cell Master™ MT8213E; and LMR Master™ S412E. Firmware version 1.56 or later is required for the MS2711E/12E/13E and MT8213E. For the MS2720T and S412E, firmware version 1.12 or later is required. For the MS2090A, firmware version V2020.4.2 or later is required.

EMF Option (444) provides the capability to measure electromagnetic field radiation when used in conjunction with an Anritsu isotropic antenna. Automated measurements can be taken using user-definable time intervals.

EMF Measurements Key Features and Benefits

- Limit lines that are user-settable at various power levels across the spectrum
- Limits can be saved for recall at a later time
- Axis dwell time is user-settable (time that each axis [X, Y, and Z] measures radiation before switching to next axis)
- Pass/Fail indicators on screen for immediate feedback on test results
- Automatic save feature for easy storage of measurement results to internal memory (autologging) or USB stick
- Results provided for maximum, minimum, average of all measurements conducted
- Clear display of measurement status, measurement time, number of measurements taken, and most other user settings
- Measurement time is user-configurable
- Pre-amp standard for measurements of low-level signals (optional for MS2711E)

Available field strength units include the following:
(S412E supports spectrum analyzer and LTE modes only; MS2090A supports spectrum analyzer mode only.)

Spectrum analyzer mode: dBm/m^2, dBmV/m, dBuV/m, V/m, W/m^2, dBW/m^2, A/m, dBA/m, W/cm^2, MS2090A is dBm/m^2 and dBW/m^2 only

- LTE and TD-LTE mode: dBm/m^2, V/m, W/m^2
- W-CDMA mode: dBm/m^2, V/m, W/m^2, % of Limit (V/m), % of Limit (W/m^2)

For wideband radiation measurements, the EMF option operates in spectrum analyzer mode. Total radiation from all sources can be measured over the frequency band desired. The EMF option will also conduct radiation measurements of demodulated signals in specific frequency bands. In this way, measurements can be extrapolated assuming a fully loaded traffic channel in order to present a worst-case analysis. Option 444 will work with demodulated signals of the following types: (S412E supports LTE only)

- W-CDMA
- LTE
- TD-LTE

If the user desires to measure EMF with a demodulated signal, the appropriate demodulation option also will need to be purchased. Additionally, Option 9 (demodulation) will need to be purchased if not offered as standard with the spectrum analyzer being used.

Customers with spectrum analyzers purchased previously may upgrade their units with the EMF Option 444. If EMF demodulation measurements are required, the appropriate demodulation option will also need to be purchased and installed.

Isotropic Antenna

In order to conduct EMF measurements, an Anritsu isotropic antenna is required. Anritsu offers three isotropic antennas covering a frequency range from 9 kHz to 6 GHz. These antennas along with their corresponding frequency ranges are shown below.

- 9 kHz to 300 MHz H-Field Isotropic Antenna (Anritsu part number: 2000-1800-R)
- 30 MHz to 3 GHz E-Field Isotropic Antenna (Anritsu part number: 2000-1792-R)
- 700 MHz to 6 GHz E-Field Isotropic Antenna (Anritsu part number: 2000-1791-R)

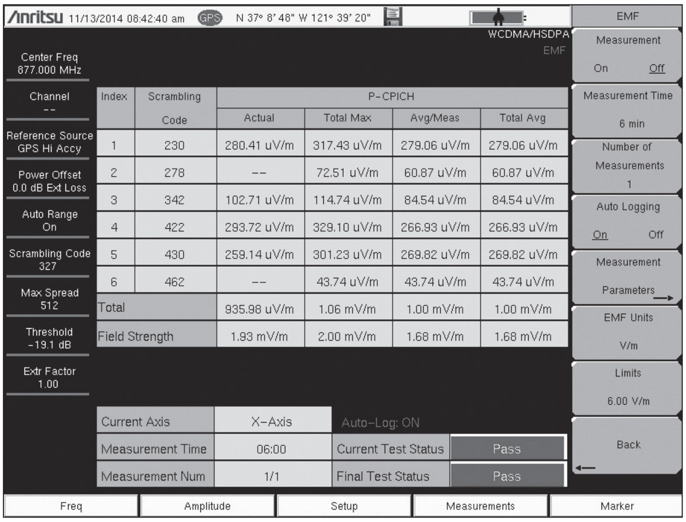
Each antenna contains a tri-axis sensor with an integrated RF switch device, microcontroller and memory. Each of the three sensors is situated orthogonally inside the antenna housing to transmit and receive a spherical radiation pattern. In this way, all radiation at the antenna's geographical position is measured, regardless of direction of arrival.

EMF Measurements on Demodulated Signals

Users may purchase the EMF option in order to make radiation power measurements in Spectrum Analyzer mode. These are power measurements for either narrowband or wideband field strength measurements across the frequency range of the Spectrum Analyzer and isotropic antenna being used. Additionally, EMF testing can be conducted on demodulated signals in various cellular channels. This includes the LTE, TD-LTE, and W-CDMA standards.
To measure demodulated W-CDMA signals, Option 35 is required for the MS2712E/13E and MT8213E platforms. For MS2720T, Option 81 is required for W-CDMA. Option 9 is also required for the MS2712E/13E and MS2720T platforms for W-CDMA demodulation capability. The field strength of the pilot channel (P-CPICH) is measured for all such signals present. Results are then displayed for each individual scrambling code as well as for total power levels for all measurements combined. Additionally, the analog signal strength across the channel is measured and displayed for comparison. In order to present a "worst case" result, extrapolation factors can be automatically calculated and displayed where a fully loaded traffic channel is assumed.

For LTE and TD-LTE, options 546 and 556 respectively are required for the MS2712E/13E and MT8213E platforms. Option 83 is required for either LTE or TD-LTE on the MS2720T platform. Option 9 is also required for the MS2712E/13E and MS2720T platforms for LTE or TD-LTE demodulation capability. For LTE only, Options 31 and 546 are required for the S412E. Primary Synchronization Signals (P-SS), Secondary Synchronization Signals (S-SS), and Reference Signals (RS) are measured and displayed based on each Cell ID received. In addition, the total radiation field resulting from all cell site signals combined is calculated and displayed. The analog signal strength across the channel is also measured and displayed for comparison. In order to present a "worst case" result, extrapolation factors can be automatically calculated and displayed where a fully loaded traffic channel is assumed. See the picture below for a sample display of an LTE EMF measurement. The display for the TD-LTE EMF measurement is identical.

The RF switch, microcontroller, and memory inside the antenna are controlled by firmware in the Spectrum Analyzer via a USB cable. The microcontroller operates the RF switch, controlling which probe is active. Once all three probes are switched, a composite RMS calculation is made. The memory inside the antenna is used to store parameters associated with that particular antenna. This includes serial number, E-Field Isotropic Antenna 30 MHz to 3 GHz 2000-1792-R date of calibration, antenna frequency range, and calibration factors.
Each isotropic antenna is calibrated over its entire frequency range. The antenna factors are stored in the antenna's memory and automatically downloaded into the Spectrum Analyzer once the antenna USB cable is inserted.



11/13/2014 08:42:40 am
N 37° 8' 48" W 121° 39' 20"
WCDMA/HSDPA
EMF

Center Freq
877.000 MHz
Channel
--
Reference Source
GPS Hi Accy
Power Offset
0.0 dB Ext Loss
Auto Range
On
Scrambling Code
327
Max Spread
512
Threshold
-19.1 dB
Extr Factor
1.00

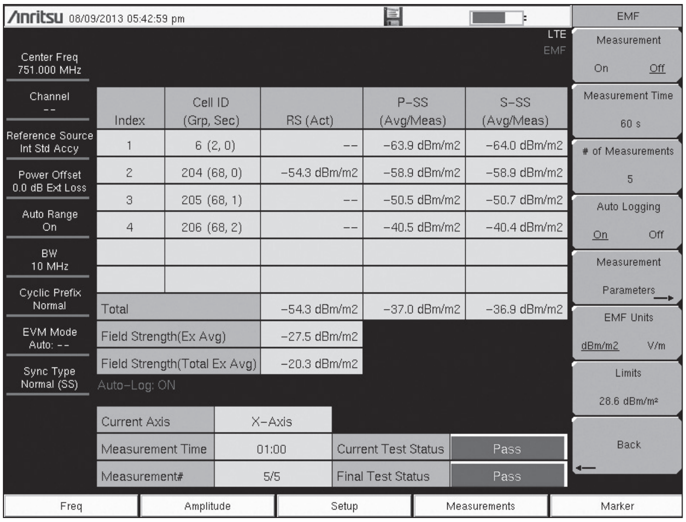
Index	Scrambling Code	P-CPICH			
		Actual	Total Max	Avg/Meas	Total Avg
1	230	280.41 uV/m	317.43 uV/m	279.06 uV/m	279.06 uV/m
2	278	--	72.51 uV/m	60.87 uV/m	60.87 uV/m
3	342	102.71 uV/m	114.74 uV/m	84.54 uV/m	84.54 uV/m
4	422	293.72 uV/m	329.10 uV/m	266.93 uV/m	266.93 uV/m
5	430	259.14 uV/m	301.23 uV/m	269.82 uV/m	269.82 uV/m
6	462	--	43.74 uV/m	43.74 uV/m	43.74 uV/m
Total		935.98 uV/m	1.06 mV/m	1.00 mV/m	1.00 mV/m
Field Strength		1.93 mV/m	2.00 mV/m	1.68 mV/m	1.68 mV/m

Auto-Log: ON

Current Axis	X-Axis		
Measurement Time	06:00	Current Test Status	Pass
Measurement Num	1/1	Final Test Status	Pass

Measurement Time
6 min
Number of Measurements
1
Auto Logging
On Off
EMF Units
V/m
Limits
6.00 V/m

Sample Display of W-CDMA Measurement



08/09/2013 05:42:59 pm
LTE
EMF

Center Freq
751.000 MHz
Channel
--
Reference Source
Int Std Accy
Power Offset
0.0 dB Ext Loss
Auto Range
On
BW
10 MHz
Cyclic Prefix
Normal
EVM Mode
Auto: --
Sync Type
Normal (SS)

Index	Cell ID (Grp, Sec)	RS (Act)	P-SS (Avg/Meas)	S-SS (Avg/Meas)
1	6 (2, 0)	--	-63.9 dBm/m2	-64.0 dBm/m2
2	204 (68, 0)	-54.3 dBm/m2	-58.9 dBm/m2	-58.9 dBm/m2
3	205 (68, 1)	--	-50.5 dBm/m2	-50.7 dBm/m2
4	206 (68, 2)	--	-40.5 dBm/m2	-40.4 dBm/m2
Total		-54.3 dBm/m2	-37.0 dBm/m2	-36.9 dBm/m2
Field Strength(Ex Avg)		-27.5 dBm/m2		
Field Strength(Total Ex Avg)		-20.3 dBm/m2		

Auto-Log: ON

Current Axis	X-Axis		
Measurement Time	01:00	Current Test Status	Pass
Measurement#	5/5	Final Test Status	Pass

Measurement Time
60 s
# of Measurements
5
Auto Logging
On Off
EMF Units
dBm/m2 V/m
Limits
28.6 dBm/m²

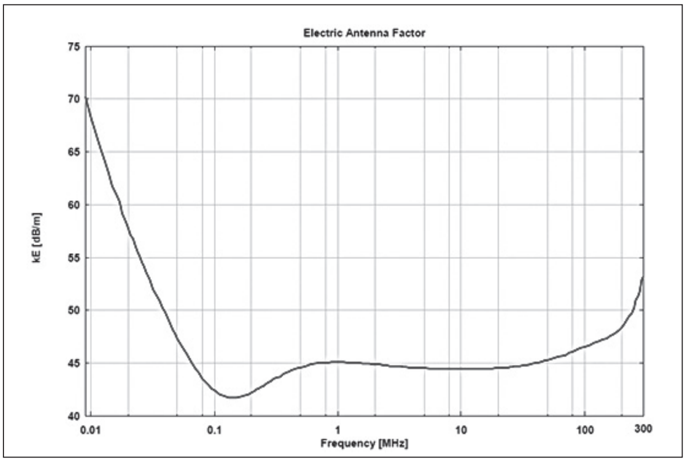
Sample Display of EMF LTE Measurement

Isotropic Antenna Specifications

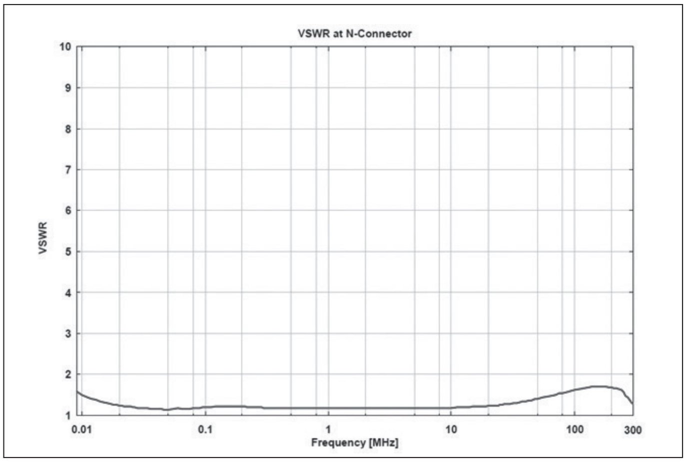
The 2000-1800-R isotropic antenna is a tri-axis H-Field sensor with an integrated RF switch. The RF switch is controlled by the analyzer via a USB port. Each antenna comes with a calibration certificate and supporting test data.

Electrical Characteristics (2000-1800-R)

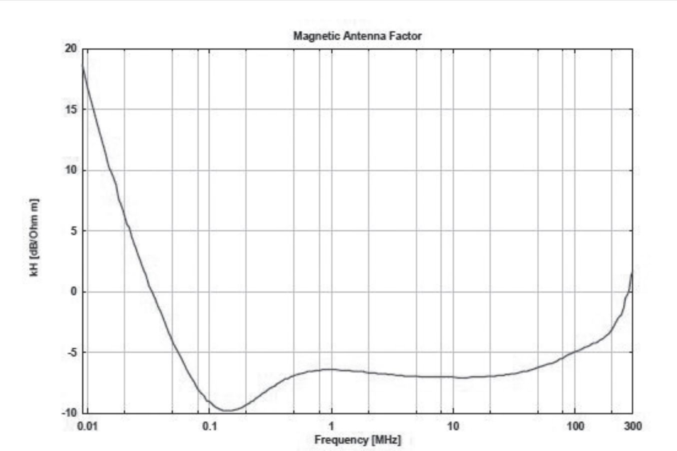
2000-1800-R	H-Field sensor
Sensor Type	Three axis sensor with scanned axes
Frequency Range	9 kHz to 300 MHz
1 dB Compression Point at Output	118 dBµV (typ.)
Decoupling of the Axis	>20 dB (typ.)
VSWR	<1.5 (20 kHz to 50 MHz) (typ.)
RF Connector	N-Connector (m), 50Ω
Supply and Control	USB



Antenna Factors (typ.)



VSWR (typ.)



Magnetic Antenna Factor (typ.)

Mechanical Characteristics (2000-1800-R)

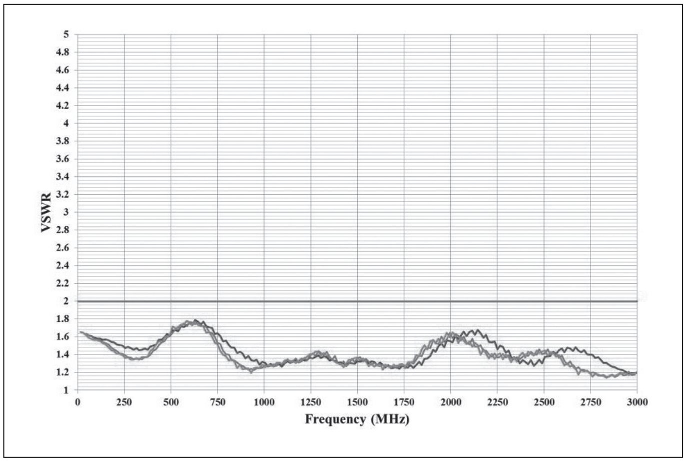
Color	Body: B-39047 "Light Grey" Handle: "Black"
Mass	850 g
Environmental Conditions	–10°C to +50°C, IP54
Mechanical Compliancy	Operating: 7M3 (IEC 60721-3)
Dimensions	550 × 146 mm

Isotropic Antenna Specifications

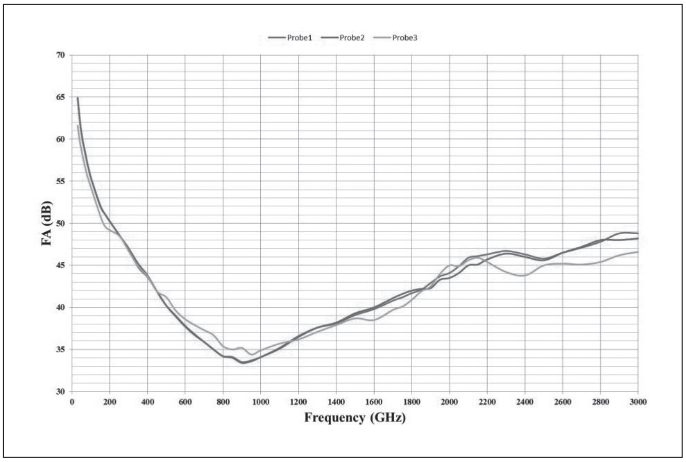
The 2000-1792-R isotropic antenna is a tri-axis E-Field sensor with an integrated RF switch. The RF switch is controlled by the analyzer via a USB port. Each antenna comes with a calibration certificate and supporting test data.

Electrical Characteristics (2000-1792-R)

2000-1792-R	E-Field sensor
Sensor Type	Three axis sensor with scanned axes
Frequency Range	30 MHz to 3 GHz
Typical 3D Isotropy	<±1.5 dB (300 MHz to 1 GHz) <±2.3 dB (1 GHz to 3 GHz)
Dynamic Range (with 1 kHz RBW)	0.1 mV/m to 200 V/m (typ.) 25 µV at 900 MHz 35 µV at 1800 MHz 50 µV at 3000 MHz
Maximum Field Strength	500 V/m (destruction limit)
Switching Time	<10 µs
RF Connector	N-Connector (m), 50Ω
Supply and Control	USB



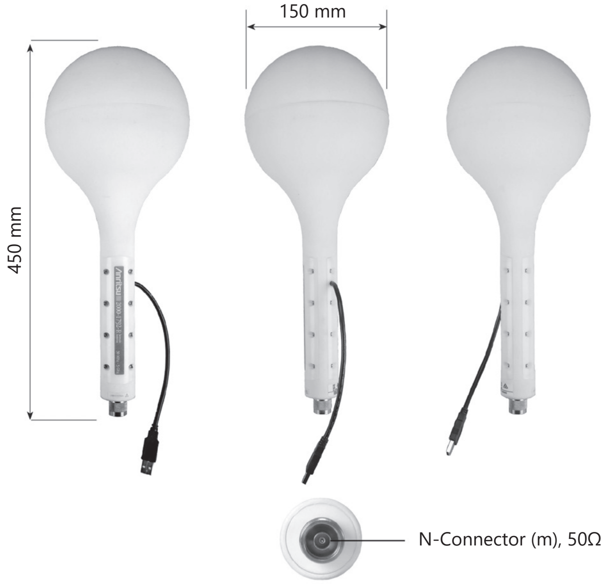
VSWR (typ.)



Antenna Factors (typ.)

Mechanical Characteristics (2000-1792-R)

Radome Material	ABS	
Color	Body: B-39047 "Light Grey" Handle: B-39042 "Dark Grey"	
Mass	800 g	
Climatic Compliancy	Operating: 7K3 (IEC 60721-3)	
Mechanical Compliancy	Operating: 7M3 (IEC 60792-3)	
Operating Temperature Range	–25°C to +70°C	
Humidity	100% at +40°C for up to 96 hours	
Dimensions	Maximum Length	Maximum Width
	450 mm ±5 mm (with connector)	150 mm ±1 mm



EU Standards (CE Marking)

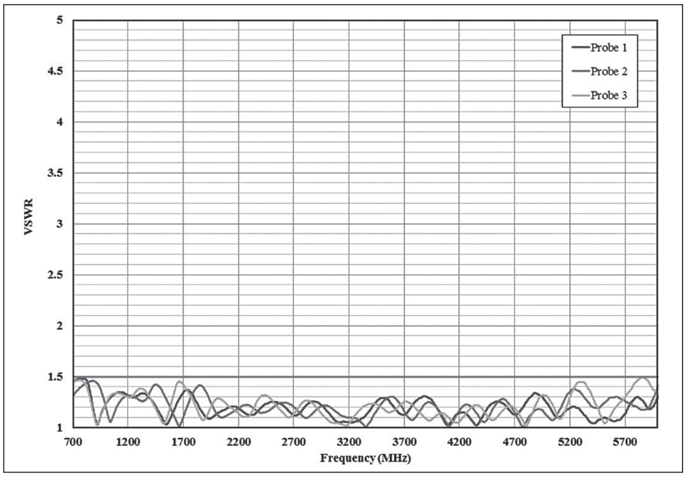
(EU) 2015/863

Isotropic Antenna Specifications

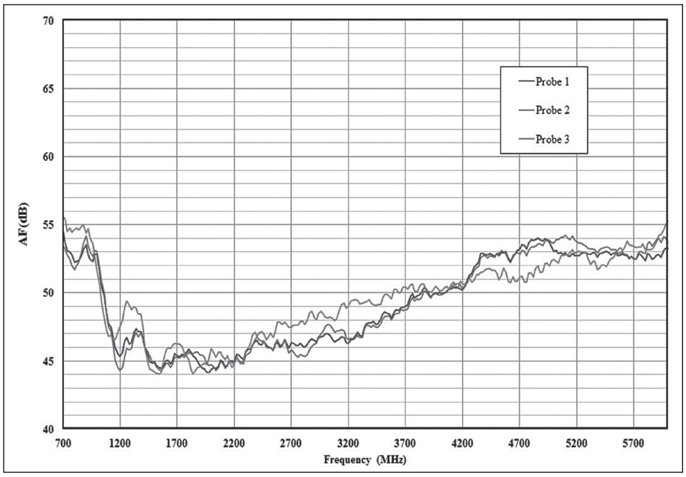
The 2000-1791-R isotropic antenna is a tri-axis E-Field sensor with an integrated RF switch. The RF switch is controlled by the analyzer via a USB port.

Electrical Characteristics (2000-1791-R)

2000-1791-R	E-Field sensor
Sensor Type	Three axis sensor with scanned axes
Frequency Range	700 MHz to 6 GHz
Typical 3D Isotropy	≤±2 dB (0.7 GHz to 2 GHz) ≤±2.5 dB (2 GHz to 3.6 GHz) ≤±3.5 dB (3.6 GHz to 6 GHz)
Dynamic Range (with 1 kHz RBW)	0.2 mV/m to 200 V/m (typ.)
Maximum Field Strength	500 V/m (destruction limit)
Switching Time	<10 µs
RF Connector	N-Connector (m), 50Ω
Supply and Control	USB



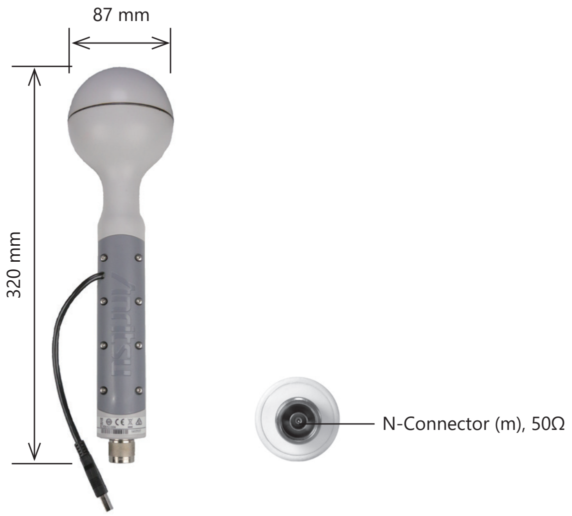
VSWR (typ.)



Antenna Factors (typ.)

Mechanical Characteristics (2000-1791-R)

<table>
<tr><td>Radome Material</td><td colspan="2">ABS</td></tr>
<tr><td>Color</td><td colspan="2">Body: B-39047 "Light Grey"
Handle: B-39042 "Dark Grey"</td></tr>
<tr><td>Mass</td><td colspan="2">450 g</td></tr>
<tr><td>Climatic Compliancy</td><td colspan="2">Operating: 7K3 (IEC 60721-3)</td></tr>
<tr><td>Mechanical Compliancy</td><td colspan="2">Operating: 7M3 (IEC 60792-3)</td></tr>
<tr><td>Operating Temperature Range</td><td colspan="2">–25°C to +70°C</td></tr>
<tr><td>Humidity</td><td colspan="2">100% at +40°C for up to 96 hours</td></tr>
<tr><td rowspan="2">Dimensions</td><td>Maximum Length</td><td>Maximum Width</td></tr>
<tr><td>320 mm ±5 mm
(with connector)</td><td>87 mm ±1 mm</td></tr>
</table>



Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Required Instrument Options and Accessories
MS2711E-0444	EMF Option 444 for MS2711E
MS2712E-0444	EMF Option 444 for MS2712E
MS2713E-0444	EMF Option 444 for MS2713E
MS2720T-0444	EMF Option 444 for MS2720T
MS2090A-0444	EMF Option 444 for MS2090A
MT8213E-0444	EMF Option 444 for MT8213E
S412E-0444	EMF Option 444 for S412E
2000-1800-R	Isotropic Antenna, 9 kHz to 300 MHz, N Connector (m), 50Ω
2000-1792-R	Isotropic Antenna, 30 MHz to 3 GHz, N Connector (m), 50Ω
2000-1791-R	Isotropic Antenna, 700 MHz to 6 GHz, N Connector (m), 50Ω
200-1528-R	GPS Antenna, SMA (m) with 15 ft cable
	Related Instrument Options
MS2712E-0009	20 MHz Bandwidth Demodulation for MS2712E
MS2713E-0009	20 MHz Bandwidth Demodulation for MS2713E
MS2720T-0009	20 MHz Bandwidth Demodulation for MS2720T
MS2712E-0035	W-CDMA OTA Measurements for MS2712E*
MS2713E-0035	W-CDMA OTA Measurements for MS2713E*
MS2720T-0881	W-CDMA OTA Measurements for MS2720T*
MT8213E-0035	W-CDMA OTA Measurements for MT8213E
MS2712E-0546	LTE OTA Measurements for MS2712E*
MS2713E-0546	LTE OTA Measurements for MS2713E*
MS2720T-0883	LTE OTA Measurements for MS2720T*
MS2090A-0883	LTE FDD Measurement for MS2090A (requires Option 31)
MT8213E-0546	LTE OTA Measurements for MT8213E
MS2712E-0556	TD-LTE OTA Measurements for MS2712E*
MS2713E-0556	TD-LTE OTA Measurements for MS2713E*
MS2720T-0883	TD-LTE OTA Measurements for MS2720T*
MT8213E-0556	TD-LTE OTA Measurements for MT8213E
S412E-0006	6 GHz Coverage for S412E Spectrum Analyzer
S412E-0031	GPS Receiver for S412E (Requires suitable GPS Antenna)
S412E-0546	LTE OTA Measurement for S412E (Requires Option 31)

*: Requires Option 9, Option 31 recommended

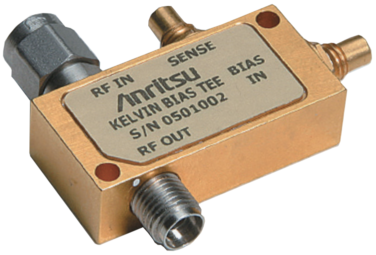
Cell Master MT8213E
with 2000-1800-R
Isotropic Antenna

Spectrum Master MS2712E
with 2000-1792-R
Isotropic Antenna

Kelvin Bias Tee

K252, V252, W252MF, W252FM

100 MHz to 110 GHz



K252

W252

For precision bias applications, the Kelvin connection bias tee is available. The high resistance of the standard bias tee DC coil results in a voltage drop that can lead to DC biasing voltage errors in the bias signal.
A Kelvin connection bias tee is used to eliminate DC biasing errors by allowing a user to measure the DC bias signal through the sense connector, post DC coil. Kelvin connection bias tees, unlike standard bias tees, are designed for applications where the user can accurately measure the DC signal to a device under test (DUT), effectively creating a precision bias signal.

Features

- 100 MHz to 110 GHz frequency coverage on kelvin bias tee products
- The W1 connector™ is compatible with 1.00 mm connectors
- The V connector™ is compatible with 2.4 and 1.85 mm connectors
- The K connector™ is compatible with SMA, 3.5, and 2.92 mm connectors
- Design is robust and well suited for high-frequency system and instrumentation applications

Specifications

Model Name	K252	V252
Frequency Range	100 MHz to 40 GHz	100 MHz to 65 GHz
Insertion Loss	<2.5 dB (typ.)	<3.7 dB (typ.)
Return Loss	11 dB	10 dB (60 GHz) 8 dB (65 GHz)
Maximum DC Voltage	50 V	
Maximum Direct Current	0.5 A	
RF Power	1 W	
RF Connector	Input: K (m), Output: K (f)	Input: V (m), Output: V (f)
DC Connector	SCM (m)	
Temperature Range	0°C to +50°C	
CE	RoHS Directive (EU) 2015/863	

Model Name	W252FM	W252MF
Frequency Range	100 MHz to 110 GHz	
Insertion Loss	<3.5 dB	
Return Loss	12 dB (Min.) (100 MHz to 26 GHz) 9.5 dB (Min.) (>26 GHz to >65 GHz) 8 dB (Min.) (>65 GHz to 110 GHz)	
Rise Time	<3.2 ps (typ.)	
Group Delay	108±20 psl (typ.)	
Maximum DC Voltage	16 V	
Maximum Direct Current	0.4 A	
RF Power	1 W	
RF Connector	Input: W1 (f), Output: W1 (m)	Input: W1 (m), Output: W1 (f)
DC Connector	SCM (m)	
Temperature Range	0°C to +50°C	
CE	RoHS Directive (EU) 2015/863	

PERIPHERAL EQUIPMENT

Coaxial Cords, Adapters

List of Principal Coaxial Cables

Coaxial Cable	Characteristic Impedance	Nominal Attenuation (10 MHz)	Nominal Capacitance	Finished Diameter	Mass (g/m)	Remarks
3C-2V	75 ±3Ω (10 MHz)	0.042 dB/m	67 pF/m	5.8 mm	48	Single outer conductor, PVC covered
3C-2W				6.5 mm	75	Double outer conductor, PVC covered
3C-2Z				3.8 mm	28	Single outer conductor, No PVC covered
3C-2T		(0.013 dB/m, 1 MHz)		7.4 mm	110	Triple outer conductor, PVC covered
3C-2WS	75 ±1Ω (10 MHz)	0.048 dB/m		6.6 mm	76	Double outer conductor, PVC covered
5C-2V	75 ±3Ω (10 MHz)	0.027 dB/m		7.8 mm	75	Single outer conductor, PVC covered
5C-2W				8.5 mm	110	Double outer conductor, PVC covered
5C-2Z				5.8 mm	48	Single outer conductor, No PVC covered
3D-2W	50 ±2Ω (10 MHz)	0.047 dB/m	100 pF/m	6.4 mm	75	Double outer conductor, PVC covered
5D-2V		0.031 dB/m		7.5 mm	85	Single outer conductor, PVC covered
5D-2W				8.2 mm	120	Double outer conductor, PVC covered
RG-55/U	53.5 ±2.5Ω (4 MHz)	0.0328 dB/m	93.5 pF/m	5.25 mm	55	Double outer conductor, PE covered
RG-58/U				4.95 mm	50	Single outer conductor, PVC covered
RG-58A/U	50 ±2Ω (10 MHz)	0.0427 dB/m				

Connecting Cords

J0576B/D

Coaxial cord: 1 m (J0576B)
2 m (J0576D)
N-P · 5D-2W · N-P
Impedance: 50Ω

J0133A

Coaxial cord: 1 m (J0133A)
3CA-P2 · RG-58A/U · 3CA-P2
Impedance: 50Ω

J0025A

Coaxial cord: 1 m (J0025A)
S-5DWP · 5D-2W · S-5DWP
Impedance: 50Ω

Conversion Connectors

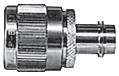
J0038

Coaxial adapter
N-P · N-P
Impedance: 50Ω

J0039

Coaxial adapter
N-J · N-J
Impedance: 50Ω

J0040



Coaxial adapter
N-P · BNC-J
Impedance: 50Ω

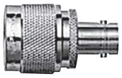
J0044

Coaxial adapter
N-J · BNC-J
Impedance: 50Ω

J0043

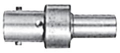
Coaxial adapter
N-J · BNC-P
Impedance: 50Ω

J0055



Coaxial adapter
NC-P · BNC-J
Impedance: 75Ω

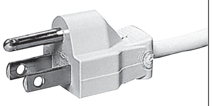
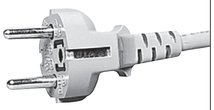
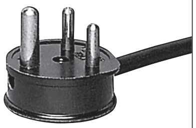
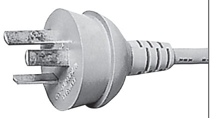
J0052



Coaxial adapter
SP-3CP · 3C-J (BNC-J)
Impedance: 75Ω
RoHS non-compliant

Power Cord Plugs

Power Cord Plugs for Export

Plug Type	A2	B4	C7	P4	S3
Safety Standard Compliance	UL, CSA	BS	VDE, OVE, KEMA, SEMKO, NEMKO, FIMCO, DEMCO, CEBEC	—	SAA
Rating	125 V	250 V	250 V	250 V	250 V
Shape*					
Main Countries/ Regions	U.S.A. Canada Taiwan	U.K. Singapore Malaysia Hong Kong South Africa	Europe Korea	India Sri Lanka	Australia New Zealand China

The supplied accessory power cord depends on the national specifications and instrument rating.
Contact Anritsu when ordering extra cords.

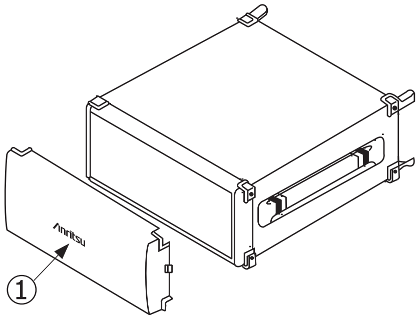
*: This table shows the plug shape, but the actual power cord may be different from that shown.

Accessories for F-Series Cabinets

Anritsu's F-series cabinet was designed using basic dimensions that conform to EIA and IEC racking specifications, permitting compatible equipment to be easily stacked up to form a system, or to be mounted on the EIA/IEC standard rack.
The accessories of the F-series cabinet are easy to mount and use, and blend with the design of the cabinet. The F-series can be identified by its green feet.

Protective Cover

Protects front of cabinet

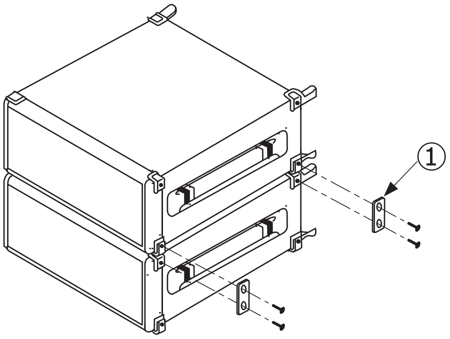


No.	Description	Quantity
①	Protective cover	1

Item	Order No.
Protective cover 3/4MW4U	B0329G
Protective cover 1/2MW2U	B0329L

Coupler

To mount two or more F-series cabinets in a stack

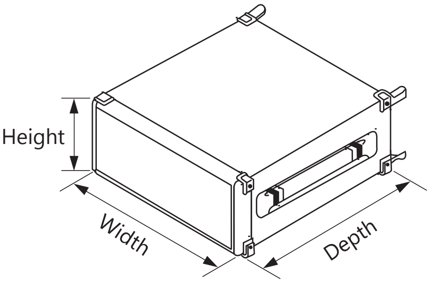


No.	Description	Quantity
①	Coupler	4

Item	Order No.
Coupler	B0332*

*: B0332 is not RoHS ((EU) 2015/863) compliant.

Symbol and Dimensions of F-series Cabinet



Width

Symbol	Dimension (mm)
1MW	426
3/4MW	320
2/3MW	284
1/2MW	213

Height

Symbol	Dimension (mm)
2U	88
3U	132.5
4U	177
5U	221.5
6U	266

Depth

Symbol	Dimension (mm)
250D	251
350D	351
450D	451

Note: Knobs, handles, and feet are not included in cabinet external dimensions.

Anritsu

Advancing beyond

https://www.anritsu.com