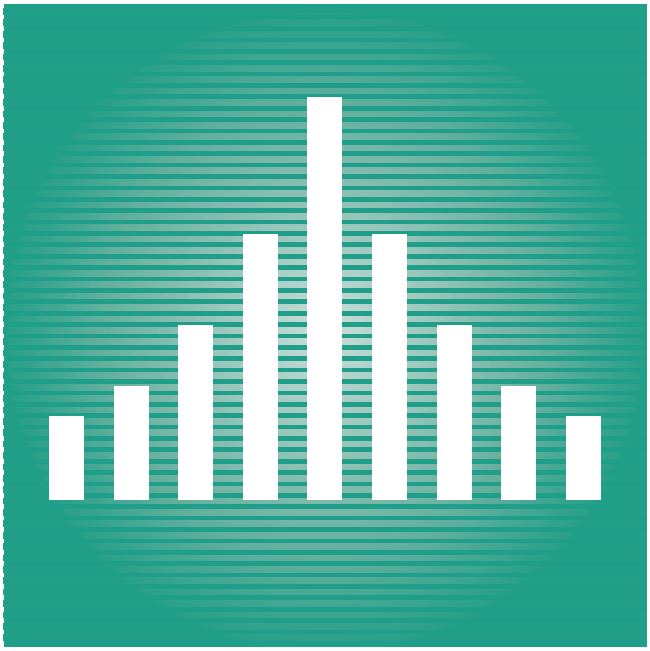


SIGNAL ANALYZERS/ SPECTRUM ANALYZERS

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
MS2691A	50 Hz to 13.5 GHz															
MS2692A	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	
MS2711E	9 kHz to 3 GHz	−137 to +26	100 Hz to 3 MHz	−90*3	−70	+28	✓	✓	—	✓	✓	✓	✓	—	USB	Handheld (<3.5 kg)
MS2712E	9 kHz to 4 GHz	−157 to +26	1 Hz to 3 MHz	−100*3	−70	+28	✓	✓	—	✓	✓	✓	✓*1	✓	USB Ethernet	
MS2713E	9 kHz to 6 GHz	−157 to +26	1 Hz to 3 MHz	−100*3	−70	+33	✓	✓	—	✓	✓	✓	✓*1	✓		
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													✓		
	9 kHz to 32 GHz													—		
	9 kHz to 43 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)
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

Signal Analyzer

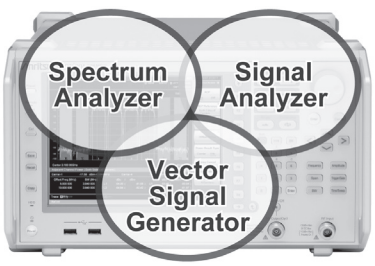
MS2690A 50 Hz to 6.0 GHz
MS2691A 50 Hz to 13.5 GHz
MS2692A 50 Hz to 26.5 GHz

Remote Control
GPIB | Ethernet | USB

Signal Analyzer Solving Wireless Communications Issues

Excellent Eco Product

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: $\pm 1 \times 10^{-8}$/day
  Start-up Characteristics: $\pm 5 \times 10^{-8}$ (5 minutes after power-on)
  Rubidium Reference Oscillator (MS269xA-001/037)
  Aging Rate: $\pm 1 \times 10^{-10}$/month
  Start-up Characteristics:
  $\pm 1 \times 10^{-9}$ (MS269xA-001: 7 minutes after power-on,
  MS269xA-037: 15 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	MS269xA-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.

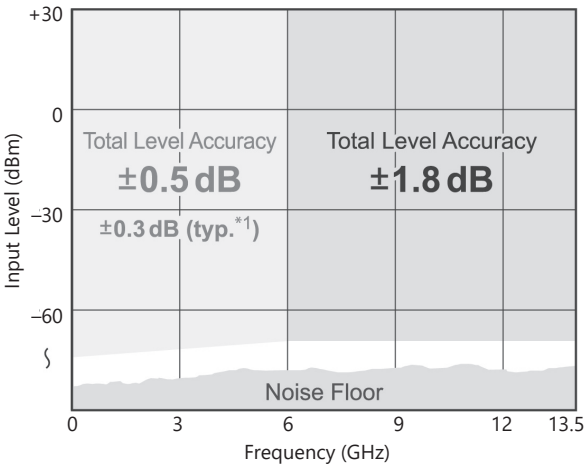
Advantage of 6 GHz Basic Band

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 kHz to 6 GHz, minimizing measurement errors in this frequency range.

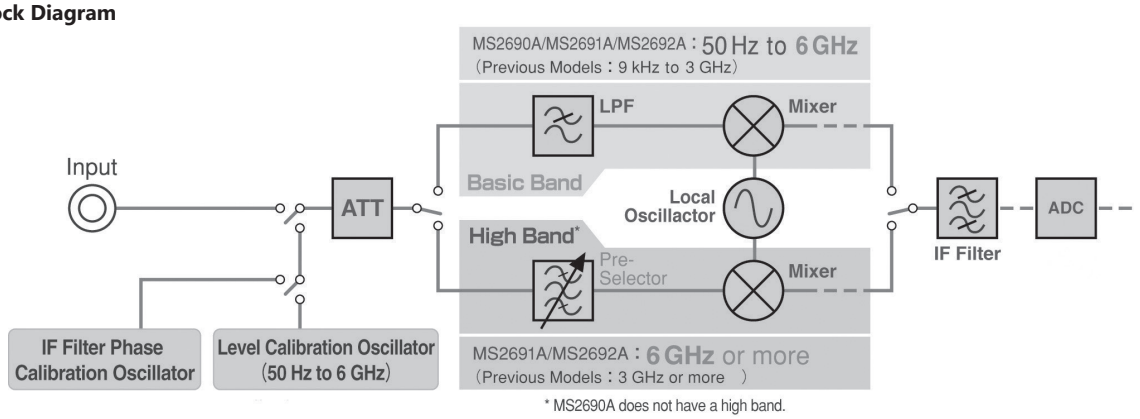
The MS269xA total level accuracy includes:
- Frequency characteristics
- Linearity
- Attenuator switching error



Note: Eliminates effect of noise floor
Used only when Uncal does not occur

*1: Excluding Guard band

MS269xA Block Diagram



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.

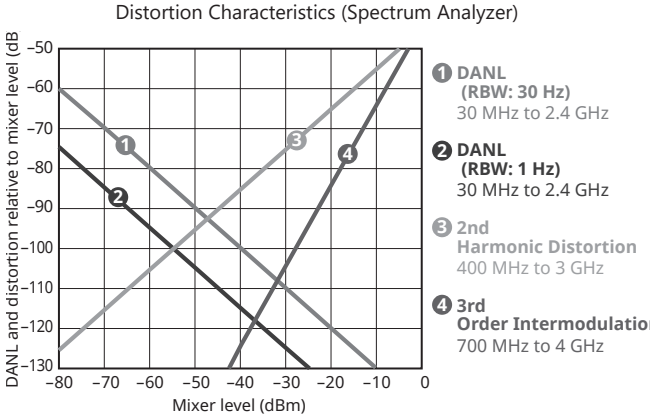
The MS269xA has an excellent dynamic range supporting true performance measurements of devices, such as base stations, requiring wideband measuring instruments.
For example, the 3GPP category-B spurious measurement specification requires a measuring instrument with severe dynamic range specifications. 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*

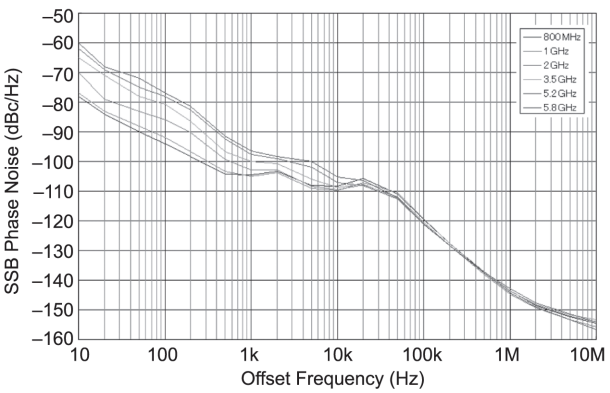
Bypasses the preselector to improve the RF frequency characteristics and the in-band frequency characteristics.
When the preselector option is set to On, the image response elimination filter is bypassed.
Therefore, this function is not appropriate for spurious measurement to receive the image response.

*: MS2692A-067 can be installed in MS2692A.

Distortion Characteristics (Spectrum Analyzer)



Example: SSB Phase Noise
(Spectrum Analyzer/Signal Analyzer Common)

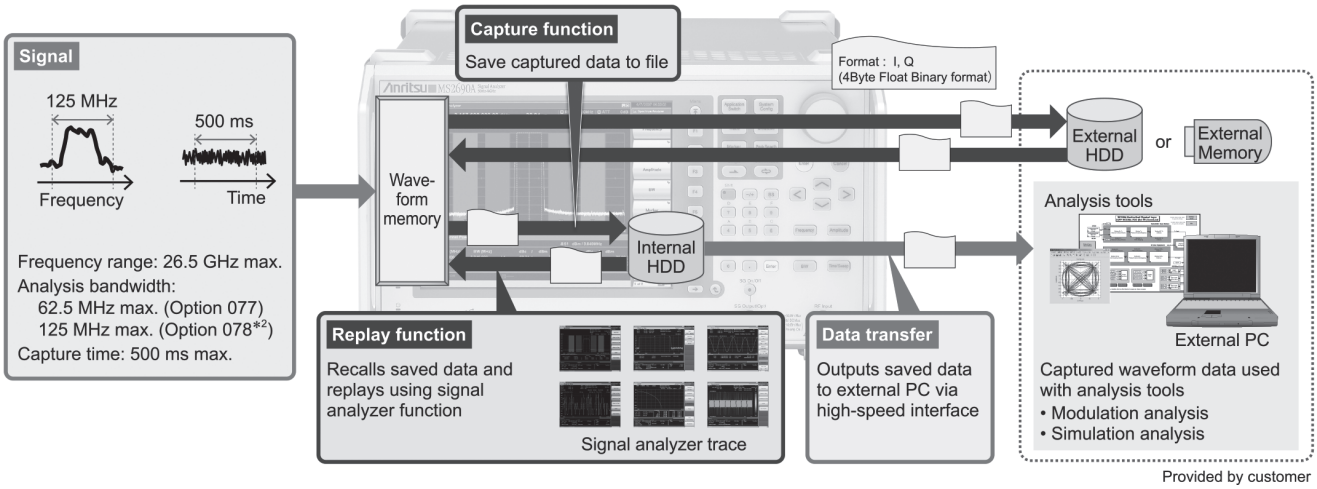


Supports 125 MHz Wideband Measurements up to 26.5 GHz

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.

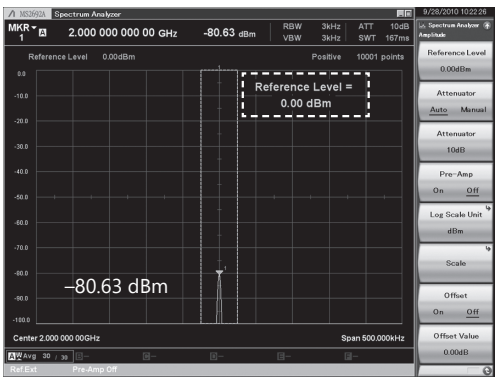
Supports wideband analysis with high frequencies for satellite communications
Microwave preselector bypass frequency range: 6 GHz to 26.5 GHz (MS2692A)
Installing the microwave preselector bypass supports signal analyzer measurement functions in the above frequency range.

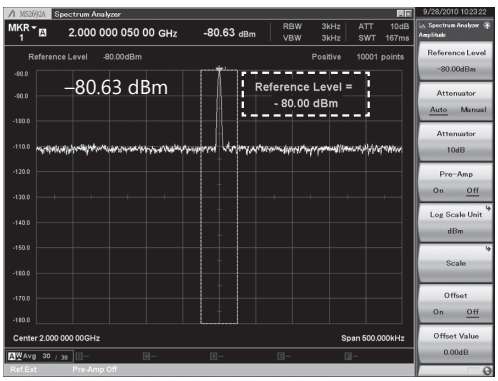


Improved Level Linearity

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

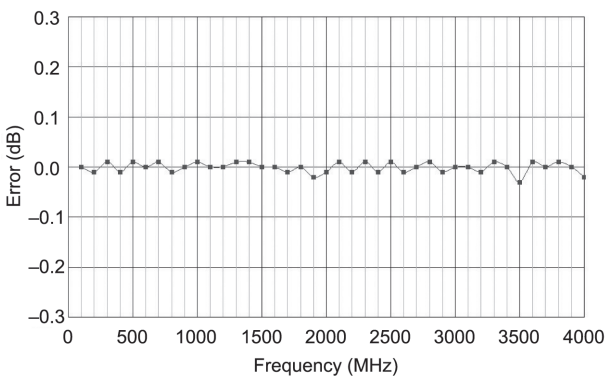




Dual Sweep Speed: Normal/Fast

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 us 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.

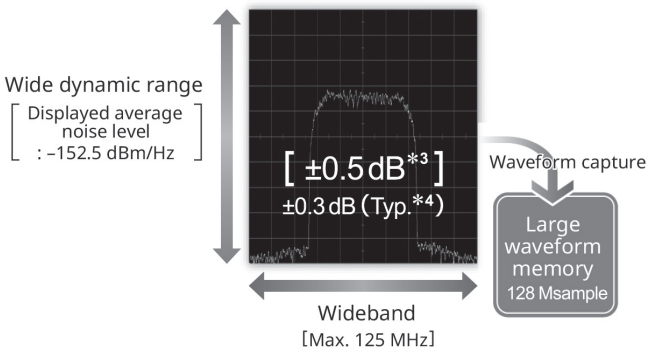
- Screen dump file type
  BMP
  PNG
- The color of the screen hard copy can be set as follows:
  Normal (same as screen display)
  Reverse
  Monochrome
  Reversed Monochrome

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.

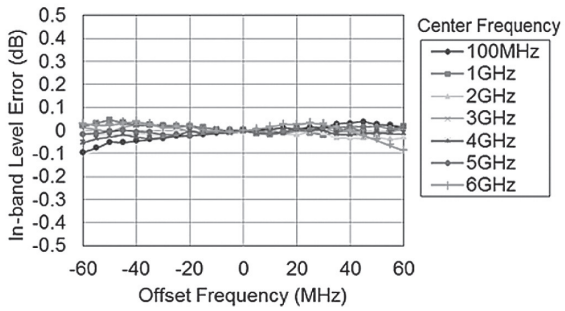
Extra Band Cal Frequency Range

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

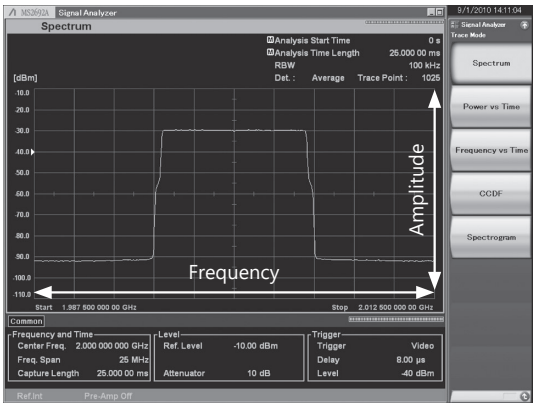
This function reads saved data and replays it using the signal analyzer measurement function.

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

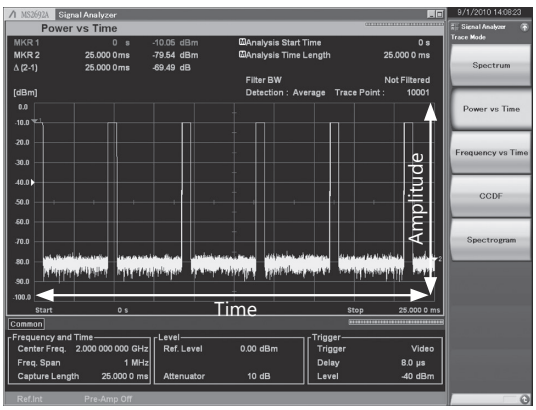
Spectrum

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.



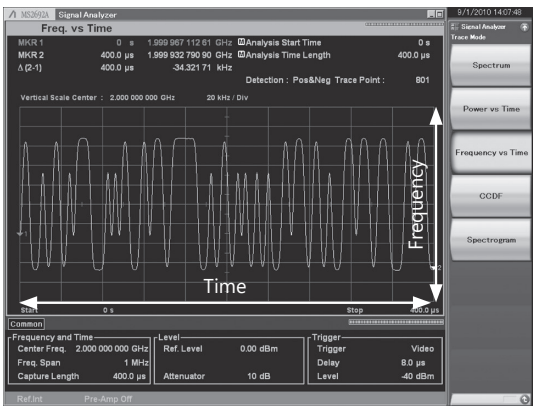
Power vs. Time

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.



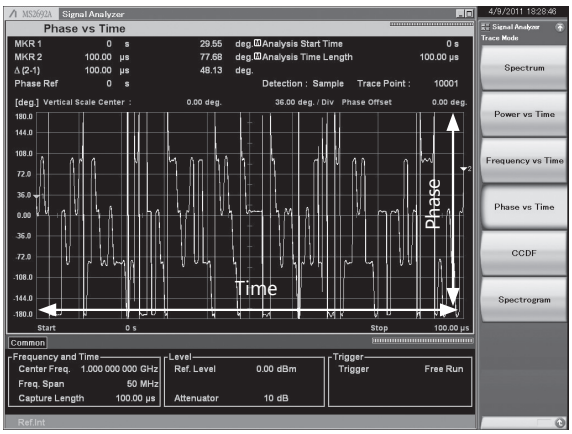
Frequency vs. Time

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

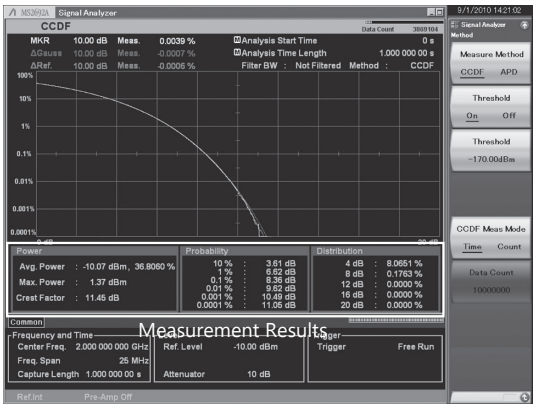
The Phase vs. Time trace displays a graph with phase on the y-axis and time on the x-axis to confirm time variation of the measured signal phase.



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)



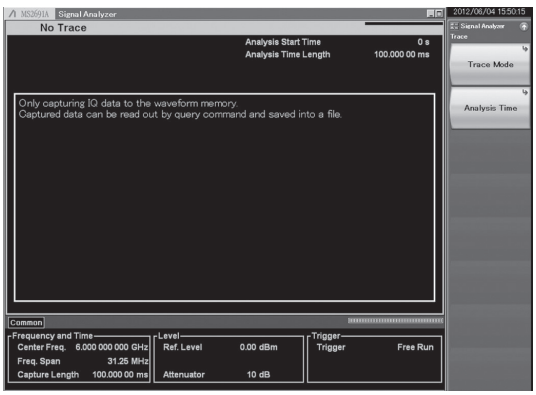
Measurement Results
- CCDF: The CCDF display indicates the cumulative distribution of transient power variations compared to average power.
- APD: The APD display indicates the probability distribution of transient power fluctuations compared to average power.

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.

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.

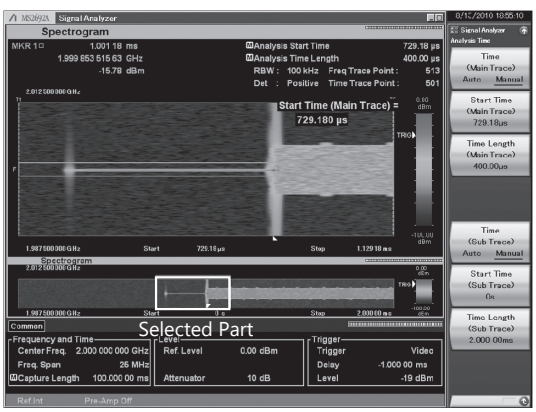


Measurement with Sub-trace Display

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.



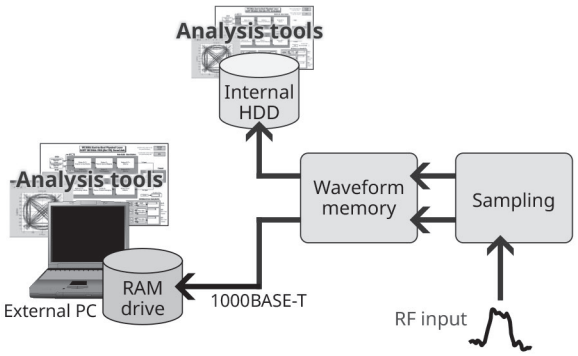
Signal Analyzer: Applications

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.

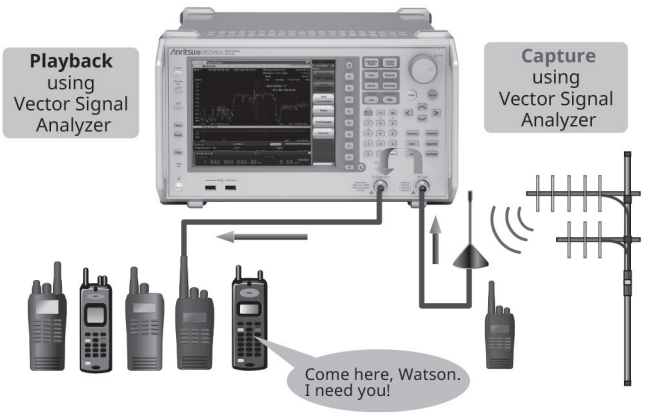
Capture & Playback Real-World Signals

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.

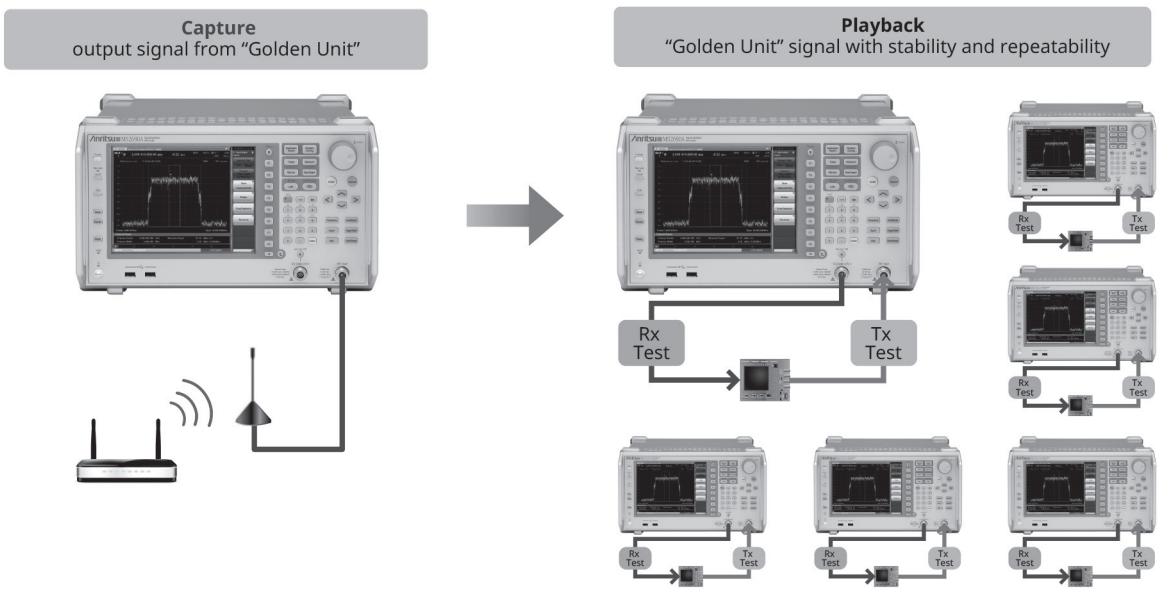


Applications for ***Capture & Playback***

- 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.



Repeatably Test Device Performance
using "Real-World" RF Environments



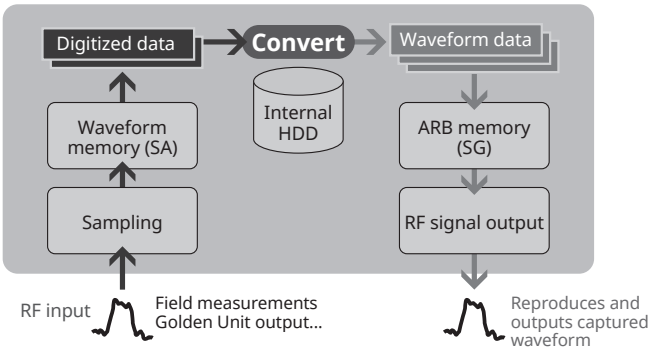
Use "Golden Unit" Signal for Manufacturing Test and Calibration

Capture & Playback Highlights

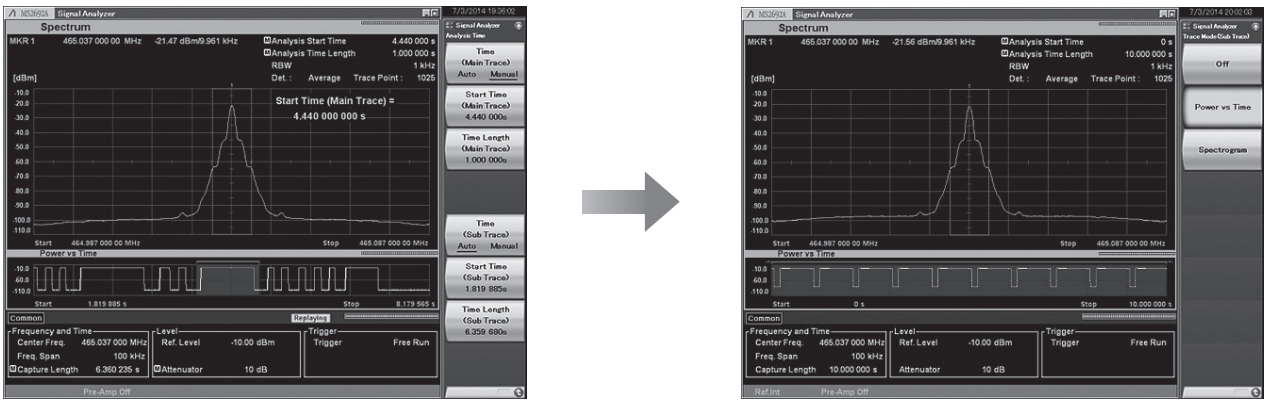
- Bandwidth and Time Limits
  Minimum 10 kHz Bandwidth (2000 s maximum duration)*
  Maximum 100 MHz Bandwidth (500 ms maximum duration)*

  *: 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



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.

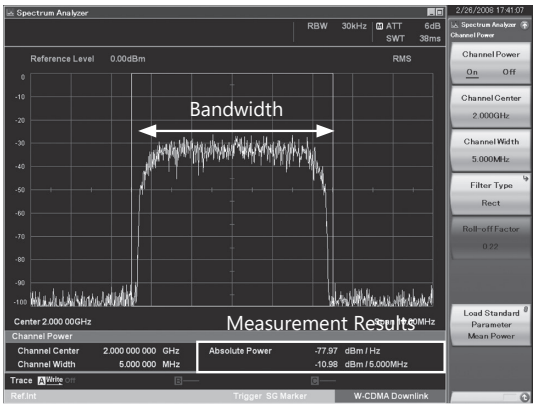
Measure Function	SPA*1	VSA*2
Channel Power	✓	✓
Occupied Bandwidth	✓	✓
Adjacent Channel Leakage Power	✓	✓
Spectrum Emission Mask	✓	
Burst Average Power	✓	✓
Spurious Emission	✓	
AM Depth		✓
FM Deviation		✓
Multi-marker & Marker List	✓	✓
Highest 10 Markers	✓	✓
Limit Line	✓	
Frequency Counter	✓	
2-tone 3rd-order 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.

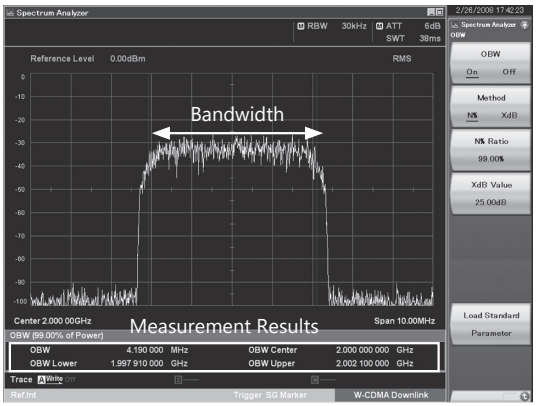


Measurement Results
- Absolute power per Hz in channel band
- Total power in channel band

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.

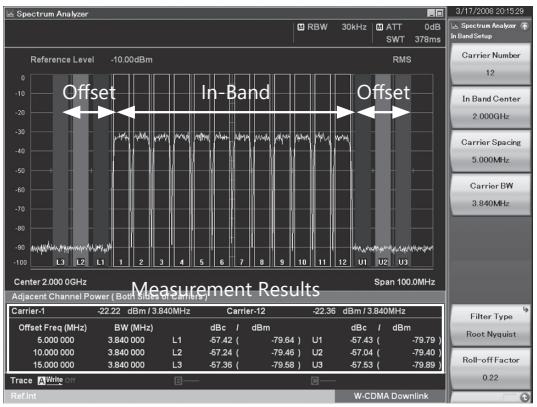


Measurement Results
- Bandwidth for specified conditions

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.

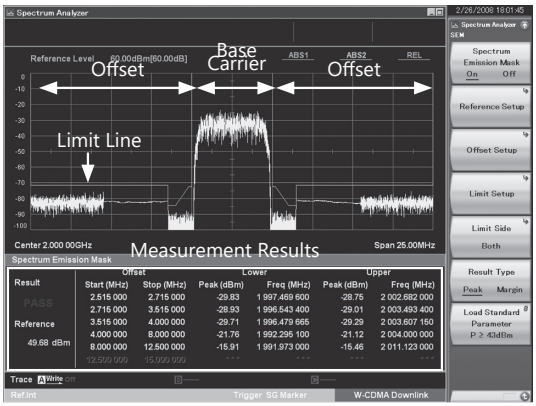


Measurement Results
- Absolute power of Offset channel
- Relative values in relation to reference power selected in ACP reference

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.

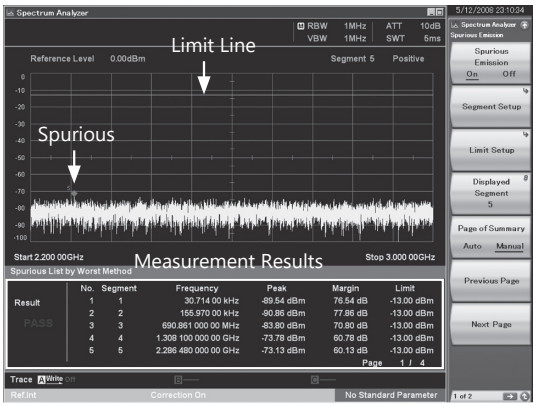


Measurement Results
- Peak power (or margin) at offset
- Each peak frequency

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.

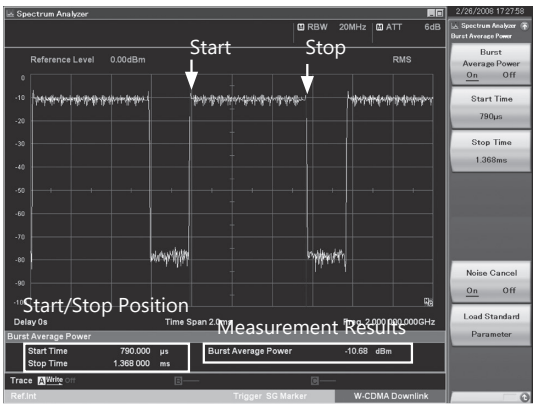


Measurement Results
- Each segment peak power and margin
- Each peak frequency

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.

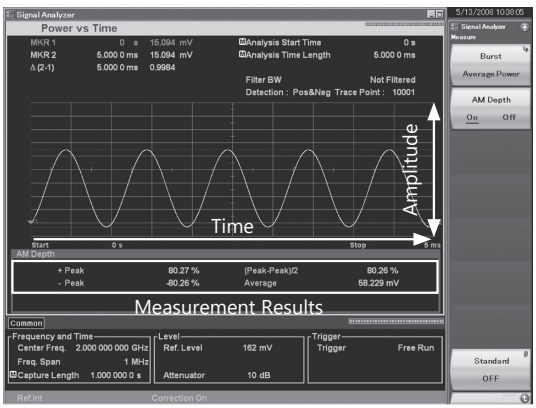


Measurement Results
- Average power of specified range

AM Depth

VSA

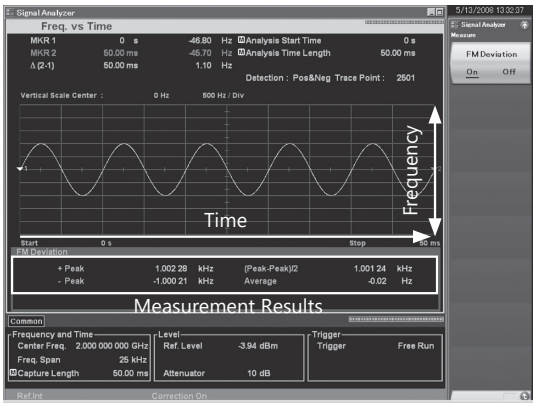
The Power vs. Time trace measurement function is used to confirm AM depth.
It measures the measured signal AM based on trace data at the displayed marker. When marker is Off, the whole range is measured.



Measurement Results
- +Peak, –Peak, (Peak-Peak)/2, Average

FM Deviation VSA

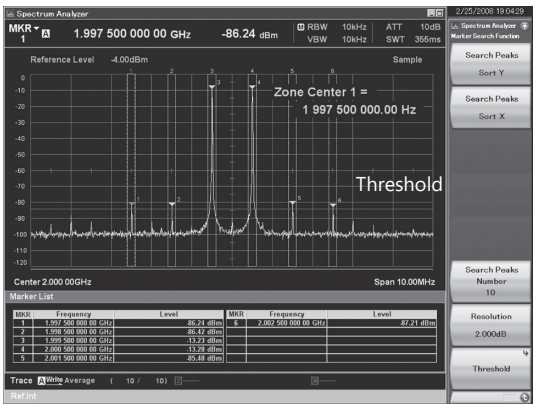
The Frequency vs. Time trace measurement is used to confirm the FM deviation. It measures the maximum and minimum frequencies from trace data in the marker range. When marker is Off, the whole range is measured.



Measurement Results
- +Peak, –Peak, (Peak-Peak)/2, Average

Multi-marker & Marker List SPA VSA

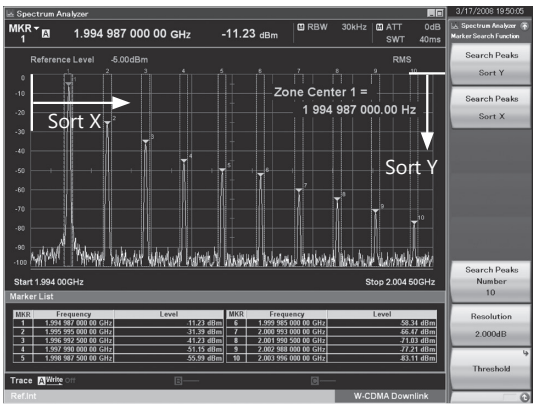
Up to 10 markers can be set for this function. Markers may be either a spot or a zone. Using a zone marker, the peak of a signal with an unstable variable frequency can be tracked and measured. Not only can the 10 markers be listed below the trace but the differences between markers can be calculated 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

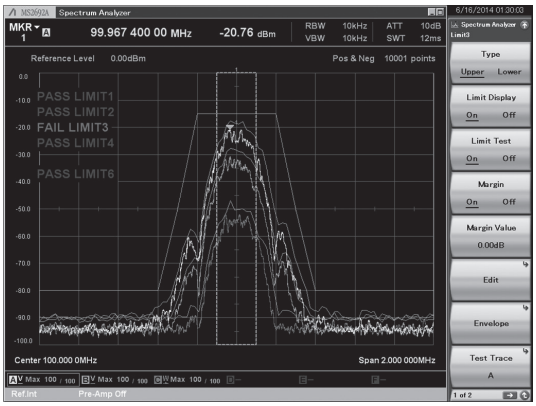
This function sets the threshold level and auto-detects peaks in the X (frequency) and Y (level/time) directions.



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

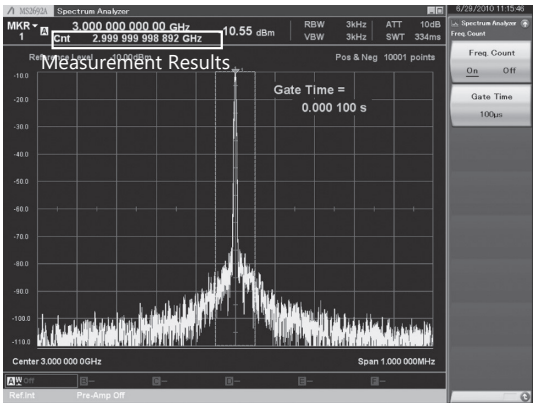


Example:
PASS/FAIL evaluation is performed by changing the input signal level.
The evaluation results for the five line types can be displayed simultaneously on one screen.

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

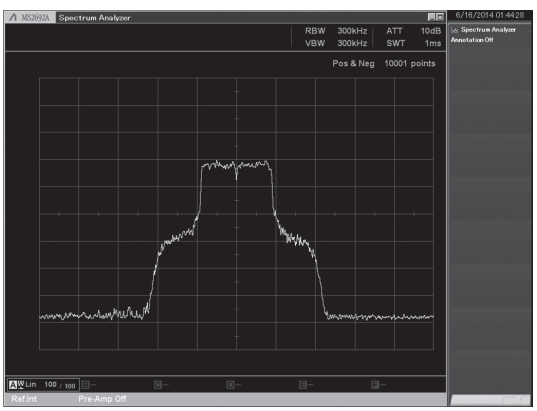
2-tone 3rd-order Intermodulation Distortion (SPA)

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.

Measurement Results
- TOI: [dBm]
- Amplitude: [dBc]

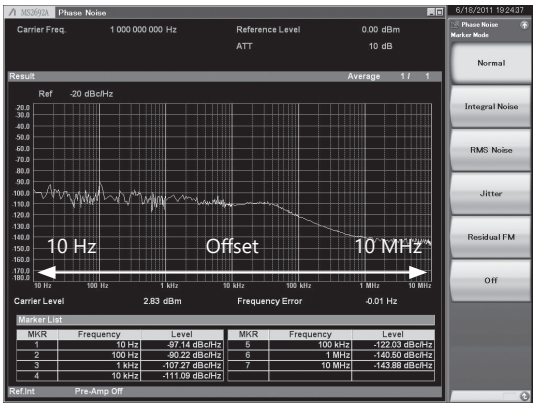
Annotation Display (SPA)

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.



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.

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*.

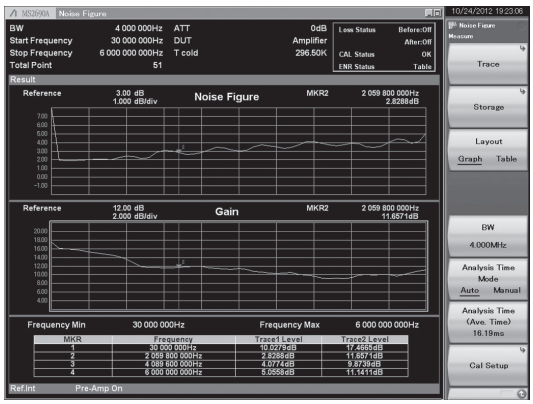
Frequency Mode: Fixed, List, Sweep
DUT Mode: Amplifier, Down Converter, Up Converter
Screen Layout: Graph, Table

*: Supports noise sources from Noisecom NC346 series.
See the MS2690A/MS2691A/MS2692A catalog for more details.

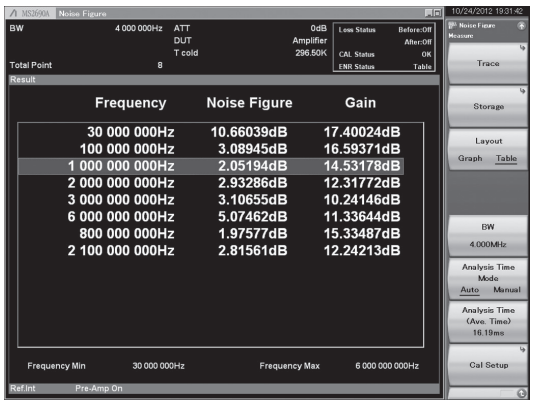
Measurement Results Display

Graph/List/Spot

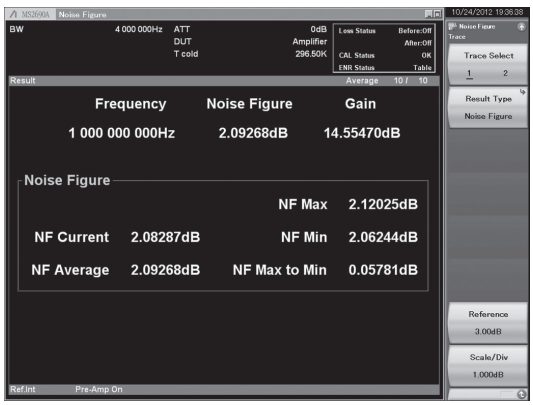
Displays measurement results for each trace (Trace1/Trace2).
Noise Figure (NF) [dB]
Noise Factor (F) [Linear]
Gain
Y-Factor: Power ratio when Noise Source is turned On/Off
T effective: Effective noise temperature
P Hot: Power measured when Noise Source is On.
P Cold: Power measured when Noise Source is Off.



Measurement Result: Example of Graph display
(Frequency Mode: Sweep, Screen Layout: Graph)



Measurement Result: Example of List display
(Frequency Mode: List, Screen Layout: List)



Measurement Result: Example of Spot display
(Frequency Mode: Fixed)

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

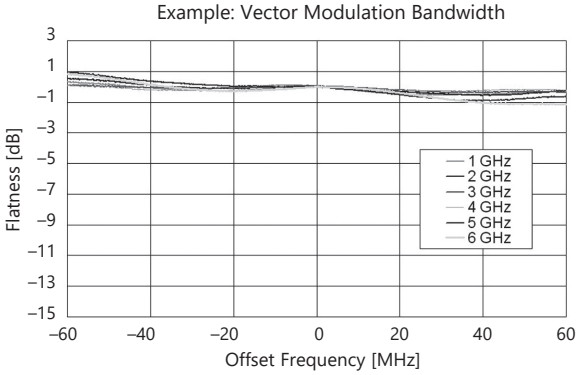
The Vector Signal Generator (MS269xA-020) frequency range is 125 MHz to 6 GHz, covering the key wireless communication range.

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.

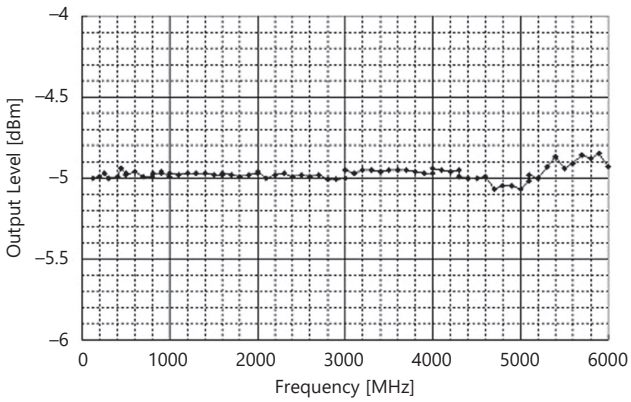
Example: Vector Modulation Bandwidth



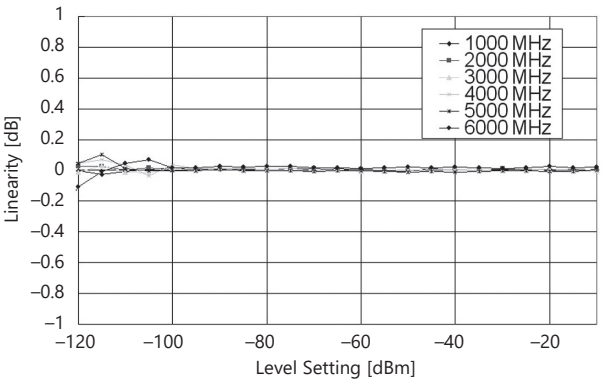
Level Accuracy ±0.5 dB

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)

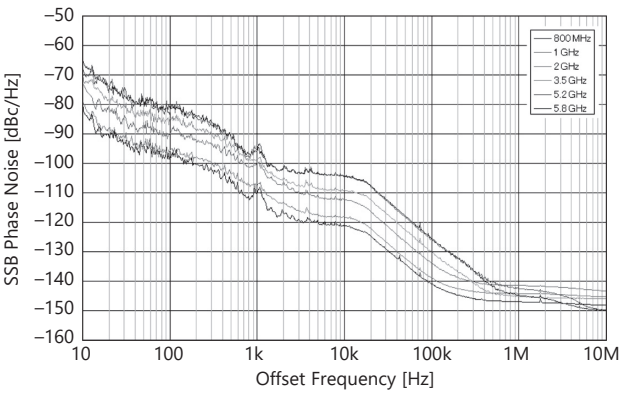
Example: Frequency Characteristics (Referenced to –5 dBm)



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.

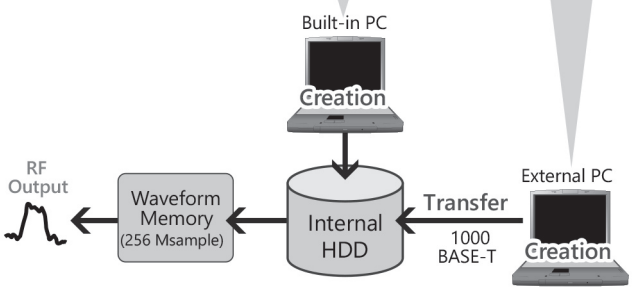
Creating Waveform Using IQproducer

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
- Mobile WiMAX 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 ±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)
- Rubidium Reference Oscillator MS2690A/MS2691A/MS2692A-037
  This option is a 10 MHz reference crystal oscillator with excellent frequency stability startup characteristics of ±1 × 10^{-9} at 15 minutes after power-on.
  Aging Rate: ±1 × 10^{-10}/month
  Start-up Characteristics: ±1 × 10^{-9} (15 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 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):
$\pm5 \times 10^{-7}$ (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 characteristics: $\pm2 \times 10^{-8}$ (5°C to 45°C)
With MS269xA-001/037 Rubidium Reference Oscillator
Start-up characteristics (23°C, referenced to frequency at 24 h after power-on):
$\pm1 \times 10^{-9}$ (MS269xA-001: 7 minutes after power-on, MS269xA-037: 15 minutes after power-on)
Aging rate: $\pm1 \times 10^{-10}$/month
Temperature characteristics: $\pm1 \times 10^{-9}$ (5°C to 45°C)
Note: Unlike the MS269xA-001, the MS269xA-037 start-up characteristics are specified at 15 minutes after power-on.
Other specifications are the same for both options.</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

<table>
<tr><td>Measurement Range</td><td>Without MS269xA-008, or Preamp: Off
DANL to +30 dBm
With MS269xA-008, Preamp: On
DANL to +10 dBm</td></tr>
<tr><td>Max. Input Level</td><td>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</td></tr>
<tr><td>Input Attenuator</td><td>0 to 60 dB, 2 dB steps</td></tr>
<tr><td>Input Attenuator Switching Error</td><td>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)</td></tr>
</table>

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

2nd Harmonic Distortion	Without MS269xA-008, or Preamp: Off, Mixer input level: –30 dBm Harmonic (dBc) / SHI (dBm) ≤–60 / ≥+30 (10 Hz ≤ Frequency ≤ 400 MHz) ≤–75 / ≥+45 (400 MHz < Frequency ≤ 3.0 GHz) Without MS2692A-067, Mixer input level: –10 dBm Harmonic (dBc) / SHI (dBm) ≤–90 / ≥+80 (>3.0 GHz, Frequency band mode: Normal) ≤–90 / ≥+80 (≥1.5 GHz, Frequency band mode: Spurious) With MS2692A-067, Microwave Preselector Bypass: Off, Mixer input level: –10 dBm Harmonic (dBc) / SHI (dBm) ≤–70 / ≥+60 (3 GHz < Frequency ≤ 13.25 GHz) With MS269xA-008, Preamp: On, Preamp input level: –45 dBm Harmonic (dBc) / SHI (dBm) ≤–50 / ≥+5 (10 Hz ≤ Frequency ≤ 400 MHz) ≤–55 / ≥+10 (400 MHz < Frequency ≤ 3.0 GHz)
Residual Response	Frequency: ≥1 MHz, Input attenuator: 0 dB, 50Ω terminated Signal Analyzer: with MS269xA-077/078, Except bandwidth setting: >31.25 MHz ≤–100 dBm

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

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>
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<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>
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With MS269xA-008, Preamp: On
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</table>
With MS269xA-008, Preamp: Off
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<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

Function Outline	Captured waveforms can be replayed again by using the VSA function to read saved digitize data
Measurable Waveform Data Condition	Format: I, Q (Binary format) Combination of Span, Sampling rate, and Minimum capture sample:

Span	Sampling Rate	Minimum Capture Sample
1 kHz	2 kHz	74000 (37 s)
2.5 kHz	5 kHz	160000 (32 s)
5 kHz	10 kHz	310000 (31 s)
10 kHz	20 kHz	610000 (30.5 s)
25 kHz	50 kHz	730000 (14.6 s)
50 kHz	100 kHz	730000 (7.3 s)
100 kHz	200 kHz	730000 (3.65 s)
250 kHz	500 kHz	730000 (1.46 s)
500 kHz	1 MHz	730000 (730 ms)
1 MHz	2 MHz	730000 (365 ms)
2.5 MHz	5 MHz	730000 (146 ms)
5 MHz	10 MHz	730000 (73 ms)
10 MHz	20 MHz	730000 (36.5 ms)
18.6 MHz	20 MHz	730000 (36.5 ms)
20 MHz	25 MHz	730000 (29.2 ms)
25 MHz	50 MHz	730000 (14.6 ms)
31.25 MHz	50 MHz	730000 (14.6 ms)
50 MHz	100 MHz	730000 (7.3 ms)
62.5 MHz	100 MHz	730000 (7.3 ms)
100 MHz	200 MHz	730000 (3.65 ms)
125 MHz	200 MHz	730000 (3.65 ms)

Rubidium Reference Oscillator MS2690A/MS2691A/MS2692A-001

Function Outline	Generates 10 MHz reference signal with higher frequency stability

Rubidium Reference Oscillator MS2690A/MS2691A/MS2692A-037

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

Measurement Range	Displayed average noise level to +10 dBm
Max. Input Level	CW average power: +10 dBm (Input attenuator: 0 dB) DC voltage: 0 Vdc
Gain	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)
Noise Factor	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)
Displayed Average Noise Level (DANL)	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

Frequency Range	Max. (Spectrum Analyzer function)	Max. (Vector Signal Analysis Function)	Frequency Band Mode
100 kHz	–150.0 [dBm/Hz]	–147.5 [dBm/Hz]	
1 MHz	–159.0 [dBm/Hz]	–156.5 [dBm/Hz]	
30 MHz ≤ Frequency < 2.4 GHz	–166.0 [dBm/Hz]	–163.5 [dBm/Hz]	
2.4 GHz ≤ Frequency < 3.0 GHz	–165.0 [dBm/Hz]	–162.5 [dBm/Hz]	
3.0 GHz ≤ Frequency < 4.0 GHz	–164.0 [dBm/Hz]	–161.5 [dBm/Hz]	Normal
4.0 GHz ≤ Frequency < 5.0 GHz	–161.0 [dBm/Hz]	–158.5 [dBm/Hz]	Normal
5.0 GHz ≤ Frequency ≤ 6.0 GHz	–159.0 [dBm/Hz]	–156.5 [dBm/Hz]	Normal

Preamp: Off

Frequency Range	Max. (Spectrum Analyzer function)	Max. (Vector Signal Analysis Function)	Frequency Band Mode
100 kHz	–135.0 [dBm/Hz]	–132.5 [dBm/Hz]	
1 MHz	–145.0 [dBm/Hz]	–142.5 [dBm/Hz]	
30 MHz ≤ Frequency < 2.4 GHz	–153.0 [dBm/Hz]	–150.5 [dBm/Hz]	
2.4 GHz ≤ Frequency < 3.0 GHz	–152.0 [dBm/Hz]	–149.5 [dBm/Hz]	
3.0 GHz ≤ Frequency < 4.0 GHz	–151.0 [dBm/Hz]	–148.5 [dBm/Hz]	Normal
4.0 GHz ≤ Frequency < 5.0 GHz	–150.0 [dBm/Hz]	–147.5 [dBm/Hz]	Normal
5.0 GHz ≤ Frequency < 6.0 GHz	–149.0 [dBm/Hz]	–146.5 [dBm/Hz]	Normal

Input Attenuator Switching Error	Frequency band mode: Normal ±0.65 dB (≤6.0 GHz, 10 to 60 dB)

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 (Option)]
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	$\leq 2^{32} - 1$ bits
Measured Error Bit Count	$\leq 2^{31} - 1$ bits
Measurement End Conditions	Measured bit count, Measured error bit count
Auto Re-synchronization Function	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)
MS2691A	Signal Analyzer (50 Hz to 13.5 GHz)
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
MS2690A-001	Rubidium Reference Oscillator
MS2690A-037	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-07
MS2691A-001	Rubidium Reference Oscillator
MS2691A-037	Rubidium Reference Oscillator
MS2691A-003	Extension of Preselector Lower Limit to 3 GHz (Extends lower limit of preselector to 3 GHz)
MS2691A-008	6 GHz Preamplifier (100 kHz to 6 GHz)
MS2691A-017	Noise Figure Measurement Function
MS2691A-020	Vector Signal Generator (125 MHz to 6 GHz)
MS2691A-077	Analysis Bandwidth Extension to 62.5 MHz
MS2691A-078*2	Analysis Bandwidth Extension to 125 MHz (Requires MS2691A-077)
MS2692A-001	Rubidium Reference Oscillator
MS2692A-037	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-020	Vector Signal Generator (125 MHz to 6 GHz)
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)
	Retrofit options
MS2690A-101	Rubidium Reference Oscillator Retrofit
MS2690A-137	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-137	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-137	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

*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.

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)
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
MS2691A-ES210	2 Years Extended Warranty Service
MS2691A-ES310	3 Years Extended Warranty Service
MS2691A-ES510	5 Years Extended Warranty Service
MS2692A-ES210	2 Years Extended Warranty Service
MS2692A-ES310	3 Years Extended Warranty Service
MS2692A-ES510	5 Years Extended Warranty Service

Continued on next page

*3: Cannot be installed simultaneously with MS2692A-003/103/008/108 and MS2692A-004/104 option (discontinued).

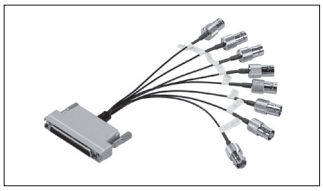
*4: These options replaces the MS269xA CPU with Windows XP or Windows 7 and upgrades to Windows 10.
The MS269xA with Windows 7 has a sticker marked “C1” near the serial number of the main unit, and Windows 10 has a sticker marked “C2”. No seal is attached to Windows XP.
Installation of Windows 10 is 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

Model/Order No.	Name
	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)
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

Model/Order No.	Name
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
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)

*5: The AUX Conversion Adapter J1373A is not a standard accessory for the MS269xA-020/120 Vector Signal Generator Option.


AUX Conversion Adapter J1373A


USB Power Sensor MA24106A


Carrying Case B0589A (Hard type)

Signal Analyzer

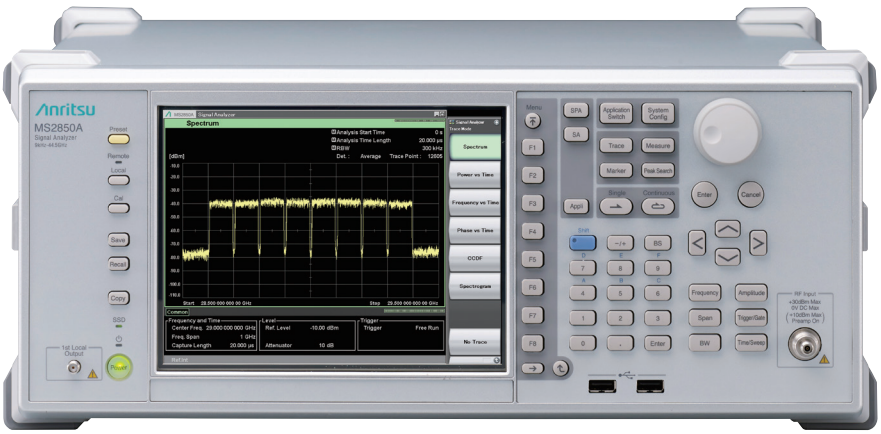
MS2850A

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

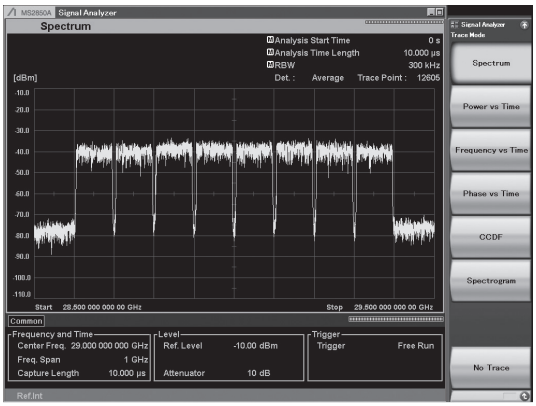
The MS2850A is a spectrum analyzer/signal analyzer with a maximum analysis bandwidth of 1 GHz and a frequency range of 9 kHz to either 32 GHz or 44.5 GHz. Its high cost-performance helps cut rising R&D and manufacturing CAPEX costs in future deployments of microwave and millimeter-wave wideband communications 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)



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

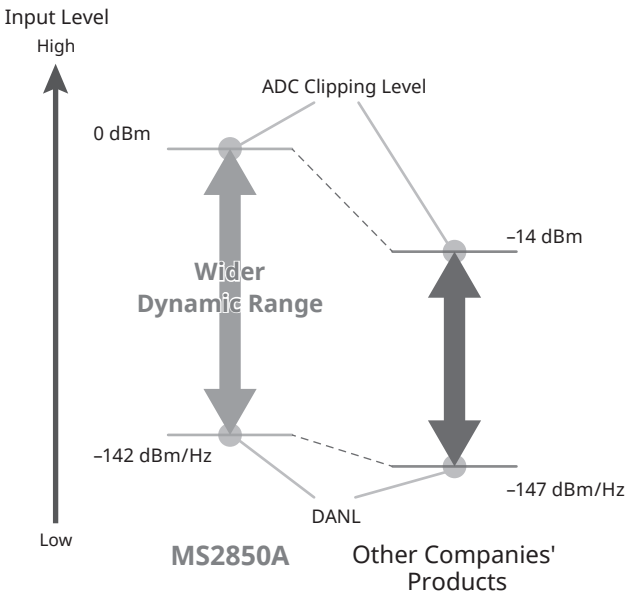
Wide Dynamic Range

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.

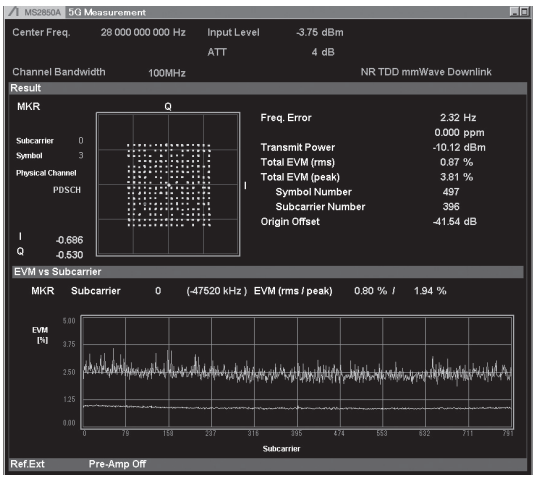
Frequency Setting Range:
100 MHz to 32 GHz (with MS2850A-047 installed)
100 MHz to 44.5 GHz (with MS2850A-046 installed)

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.



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

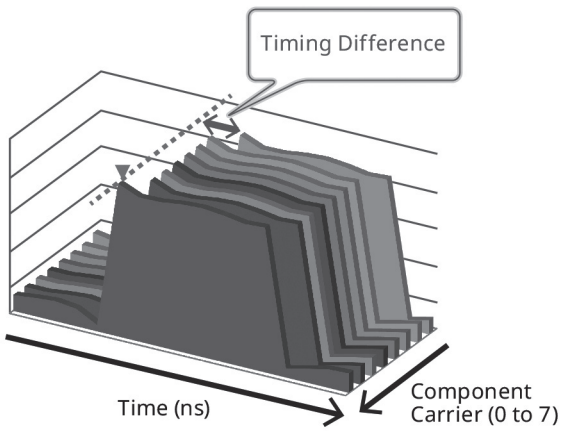
Tx Total Power -11.16 dBm
Tx Power Flatness 0.56 dB

	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.



*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

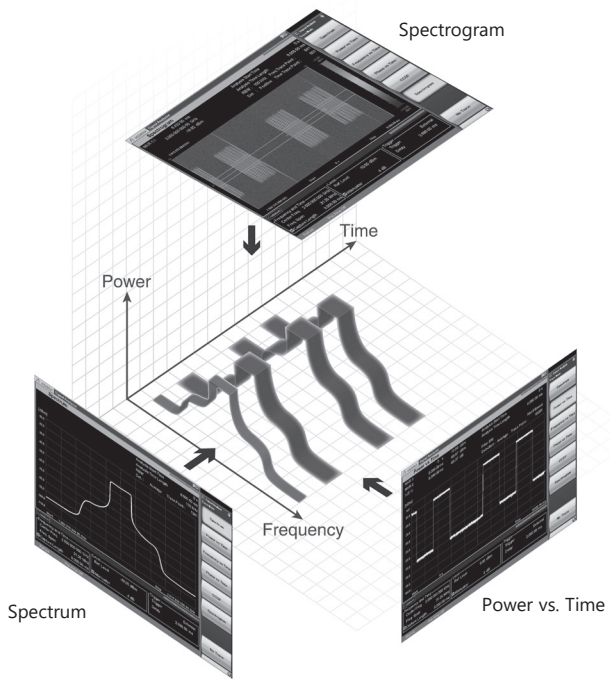
Analysis Bandwidth	Frequency Measurement Range
255 MHz (standard)	100 MHz to 32 GHz/44.5 GHz
510 MHz (option)	100 MHz to 32 GHz/44.5 GHz
1 GHz (option)	4.2 GHz to 32 GHz/44.5 GHz

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.

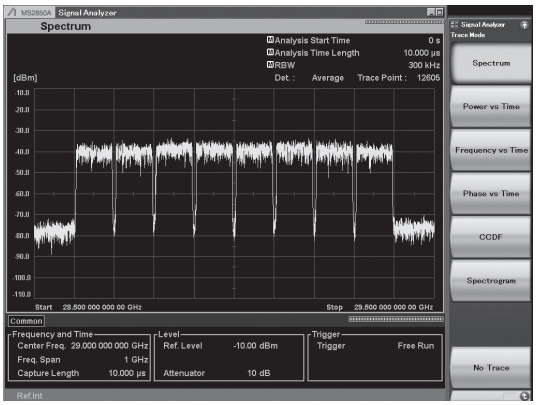
Maximum capture times for each frequency span

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.

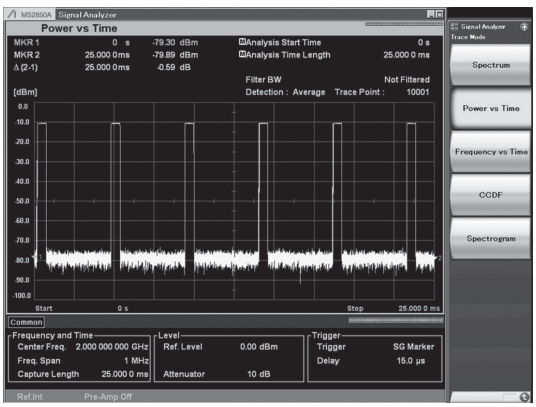
Spectrum Display

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.



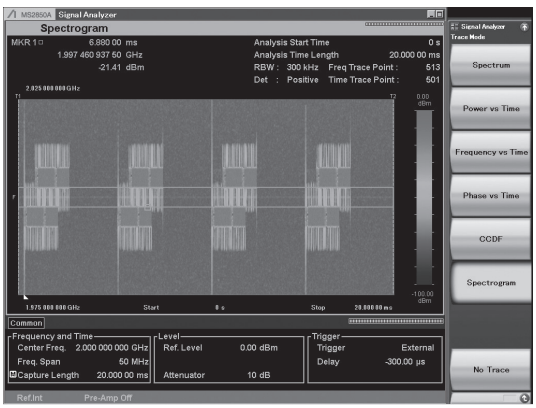
Power vs. Time

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.



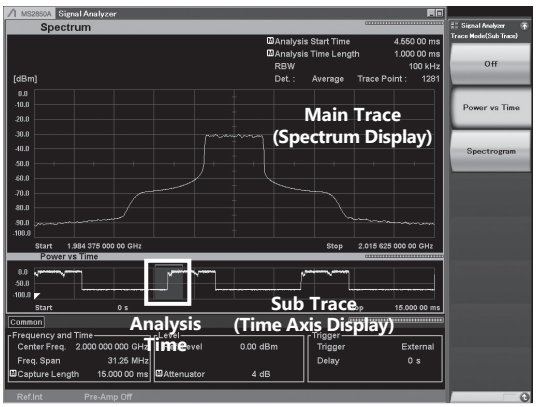
Spectrogram

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.



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.

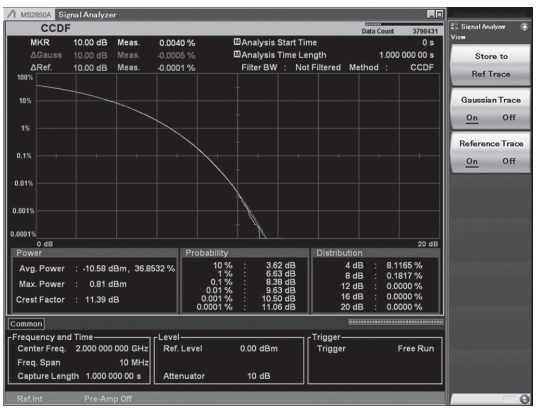


CCDF/APD

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.

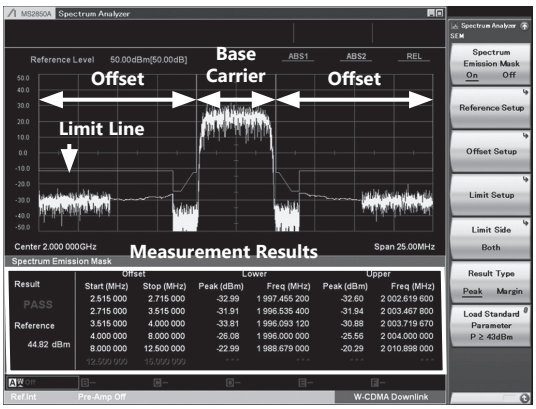
APD (Amplitude Probability Density):
The APD display indicates the probability distribution of transient power



Versatile Built-in Functions

Spectrum Emission Mask

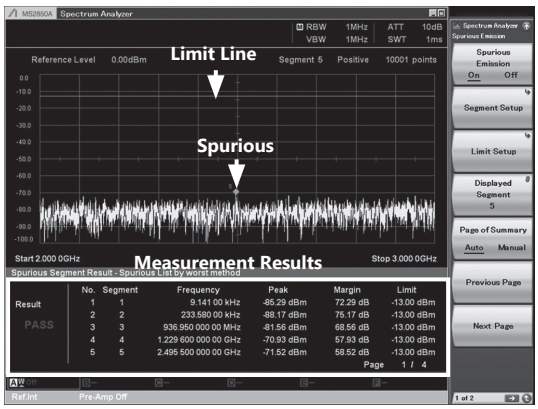
This function splits the offset part into up to 12 segments; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment. The results are tabulated below the trace and marked PASS/FAIL. Pre-installed templates for each standard support easy parameter setting.



Measurement Results
- Peak power (or margin) at offset
- Each peak frequency

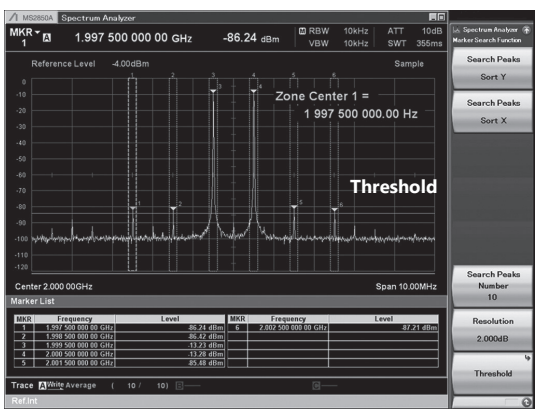
Spurious Emission

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



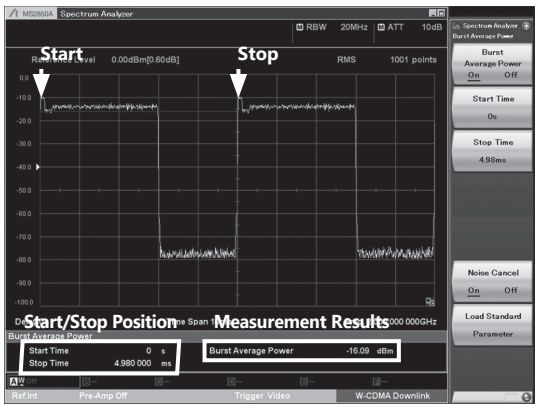
Multi-marker & Marker List

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.



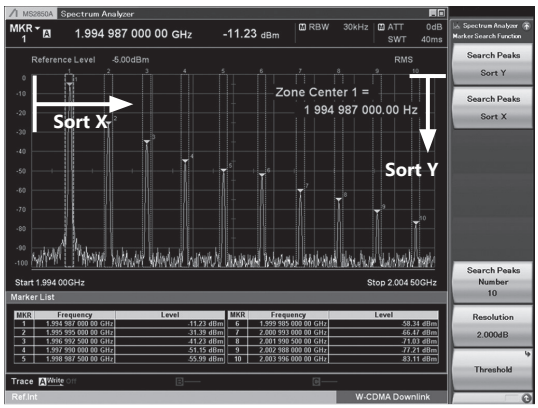
Burst Average Power

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.



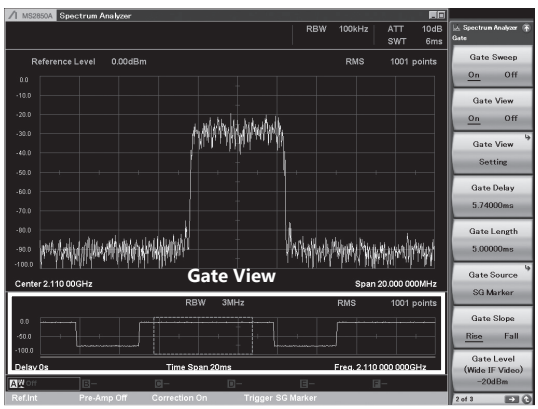
Highest 10 Markers

This function sets the threshold level and auto-detects peaks in the X (frequency) and Y (level/time) directions.



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)

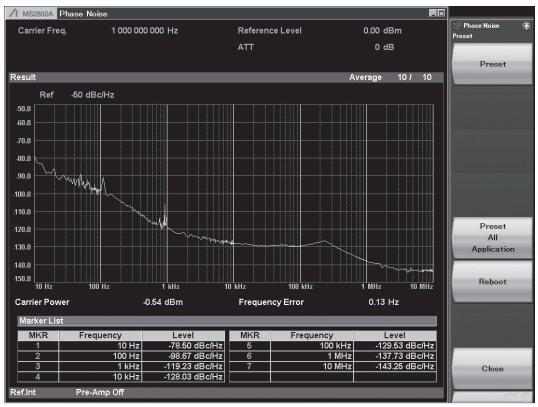
Passing the input signal through a preselector removes generated spurious at microwave and mmWave band measurements. However, in this case, the signal passband width is restricted and the flatness of the in-band frequency characteristics is degraded, both of which can adversely affect FFT analysis and 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.



Measurement Screen

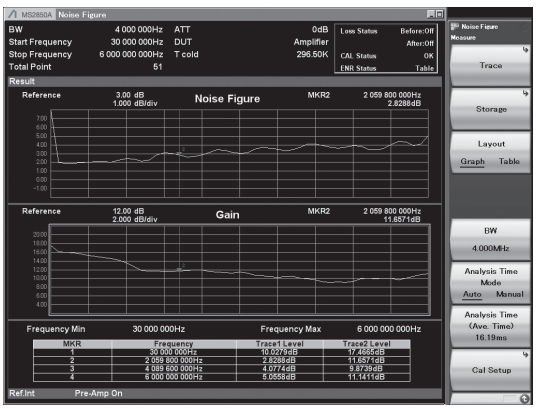
Secondary Storage Device (MS2850A-011)

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.

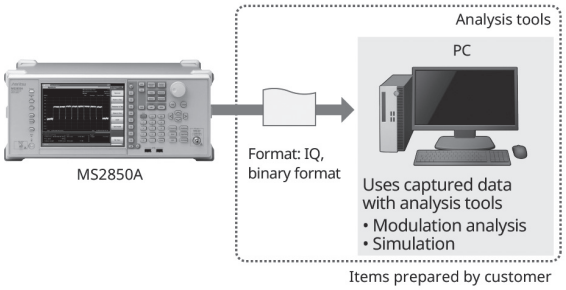
*: Refer to the MS2850A data sheet for details.



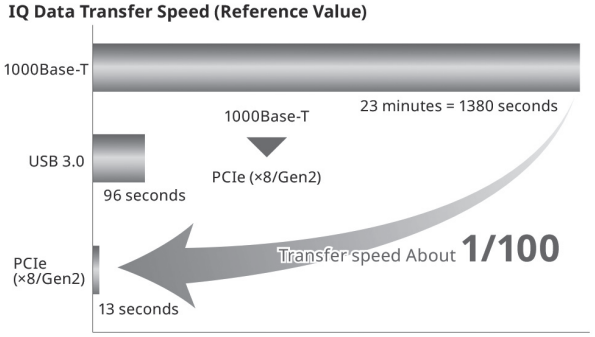
Measurement Result: Example of Graph display
(Frequency Mode: Sweep, Screen Layout: Graph)

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.

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

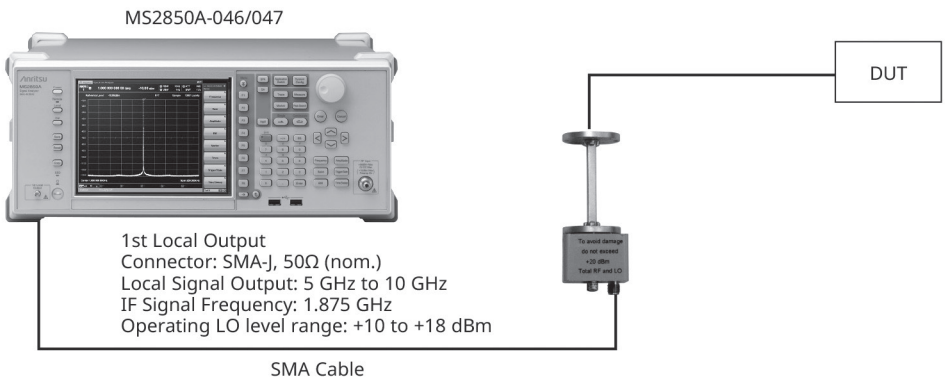
For further information see MA2806A/MA2808A page.

MA2808A

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
MA2741C	External Mixer	A Band	26.5 GHz to 40 GHz	WR28	MIL-DTL-3922/54-003
MA2742C	External Mixer	Q Band	33 GHz to 50 GHz	WR22	MIL-DTL-3922/67D-006
MA2743C	External Mixer	U Band	40 GHz to 60 GHz	WR19	MIL-DTL-3922/67D-007
MA2744C	External Mixer	V Band	50 GHz to 75 GHz	WR15	MIL-DTL-3922/67D-008
MA2745C	External Mixer	E Band	60 GHz to 90 GHz	WR12	MIL-DTL-3922/67D-009
MA2746C	External Mixer	W Band	75 GHz to 110 GHz	WR10	MIL-DTL-3922/67D-010
MA2747C	External Mixer	F Band	90 GHz to 140 GHz	WR08	MIL-DTL-3922/67D-M08
MA2748C	External Mixer	D Band	110 GHz to 170 GHz	WR06	MIL-DTL-3922/67D-M06
MA2749C	External Mixer	G Band	140 GHz to 220 GHz	WR05	MIL-DTL-3922/67D-M05
MA2750C	External Mixer	Y Band	170 GHz to 260 GHz	WR04	MIL-DTL-3922/67D-M04
MA2751C	External Mixer	J Band	220 GHz to 325 GHz	WR03	MIL-DTL-3922/67D-M03



Connection Setup

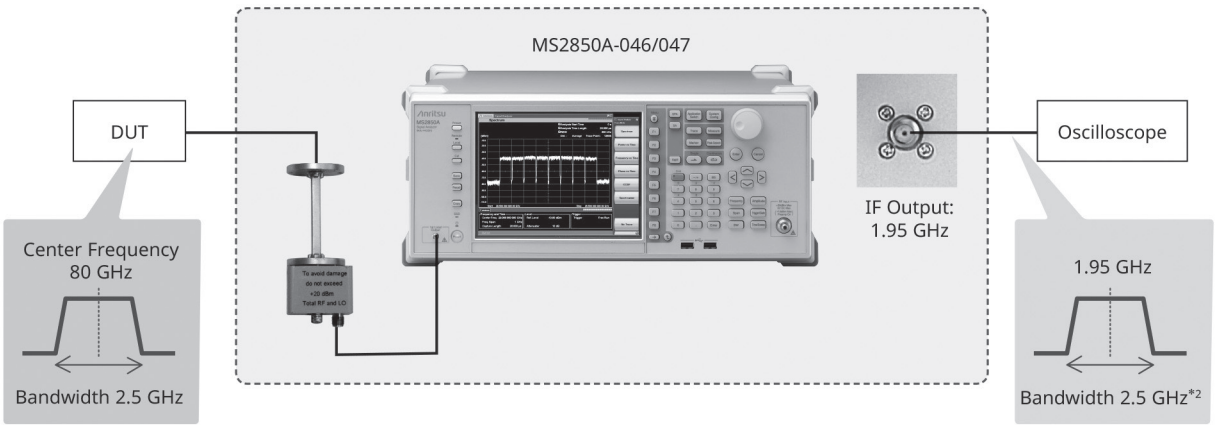
FFT Analysis in Millimeter Wave Band

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 convertor 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, 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

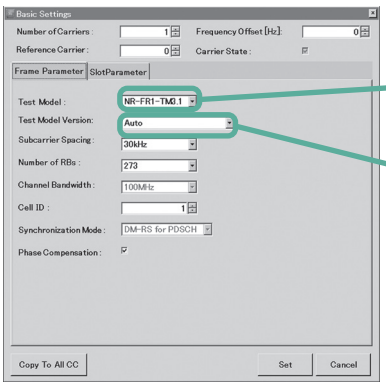
Both 5G NR sub-6 GHz and mmWave are covered by installing the MX285051A options.
Setting Frequency Ranges: 100 MHz to 32 GHz (with MS2850A-047 installed), 100 MHz to 44.5 GHz (with MS2850A-046 installed)

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 FDD mmW Downlink MX285051A-021	✓	✓	✓
NR TDD sub-6 GHz Uplink MX285051A-061	✓	—	—
NR FDD sub-6 GHz Uplink MX285051A-081	✓	—	—
NR FDD mmW Uplink MX285051A-071	✓	—	—

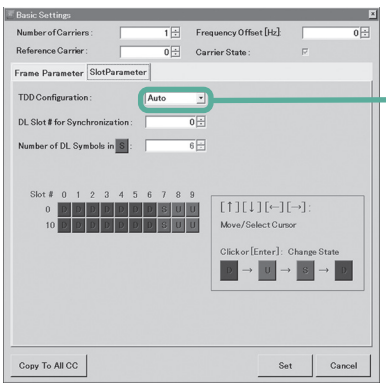
Easy operability for higher measurement/test efficiency

- The Phy channel can be measured simply by specifying the measured test model.



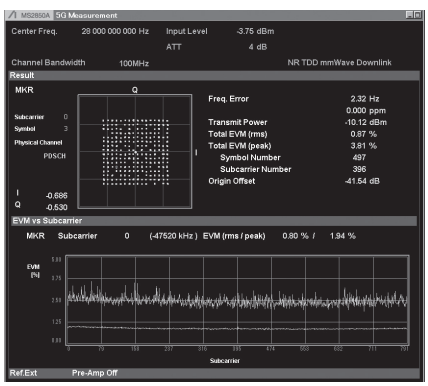
Easy physical channel setting by selecting test model name

Auto-detect function eliminates setting problems

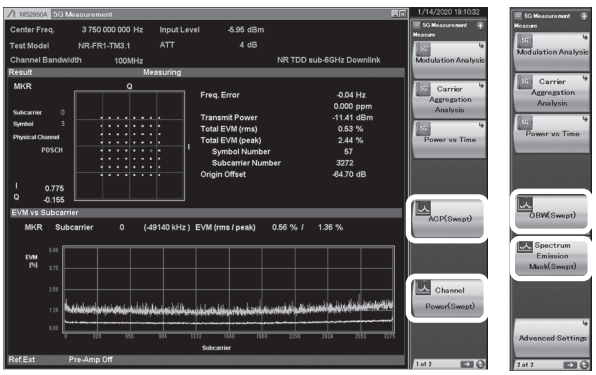


In addition to the 3GPP-defined TDD Configuration, the TDD Configuration signal in actual use can be measured easily using the auto-detect function

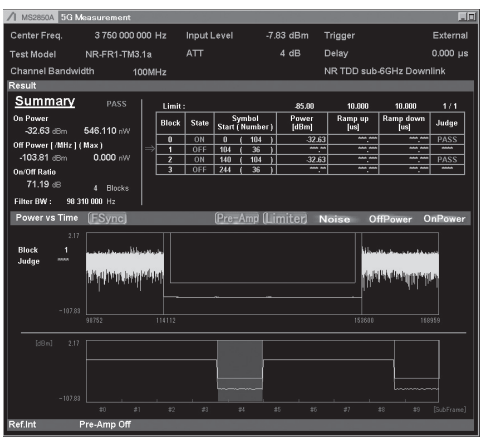
- The one-button Auto Range function optimizes the complex built-in attenuator settings, required for more accurate EVM measurement.



- 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.



- 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.



All-at-Once Measurement and Analysis of 8 CCs max in 1-GHz Analysis Bandwidth

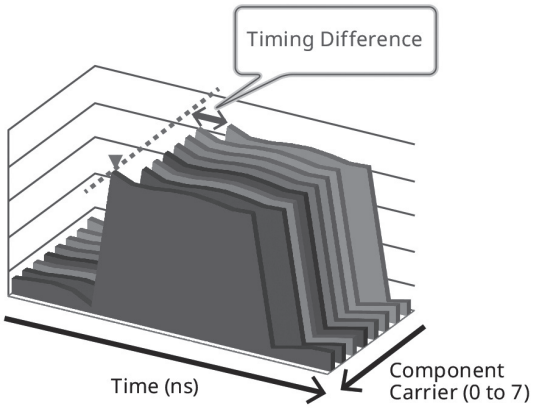
Combined use with the Analysis Bandwidth Extension to 1 GHz option (MS2850A-034) supports all-at-once measurement of up to 8 CCs (8 carriers × 100 MHz). Since this eliminates individual measurement of multiple component carriers, the characteristics of single carriers can be evaluated in shorter times. 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="4">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></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><td>Frequency Range</td><td>Preamp Off, or without Preamp</td><td>Preamp On</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>±1.48 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><td>Channel Bandwidth</td><td>Without MS2850A-033</td><td>With MS2850A-033</td></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="4">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></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">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></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><td>Channel Bandwidth</td><td>Without MS2850A-033</td><td>With MS2850A-033</td></tr><tr><td>≤100 MHz</td><td>162.5 MHz</td><td>162.5 MHz</td></tr></table></td></tr>
</table>

5G Standard Measurement Software (Base License) **MX285051A**
NR TDD mmWave Downlink **MX285051A-021**
NR TDD mmWave Uplink **MX285051A-071**

Specifications

<table>
<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="3">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 rowspan="3">Modulation/ Frequency Measurement</td><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 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>
<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><td>Channel Bandwidth</td><td>Without MS2850A-033</td><td>With MS2850A-033</td></tr><tr><td>≤100 MHz</td><td>162.5 MHz</td><td>162.5 MHz</td></tr><tr><td>>100 MHz</td><td>325 MHz</td><td>650 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.
–86.2 dBm/MHz (nominal)</td><td>—</td></tr>
</table>

Signal Analyzer MS2850A 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

$\pm 1 \times 10^{-7}$/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)

EU Standards (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

OS

Windows 10 (64 bits)

• 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 MX285051A-001 and/or 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-011/MX269051A-011/MX285051A-021/MX285051A-061/MX269051A-061/MX285051A-071 Operation Manual (Operation)
W3925AE	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: Power Cord:	1 pc 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

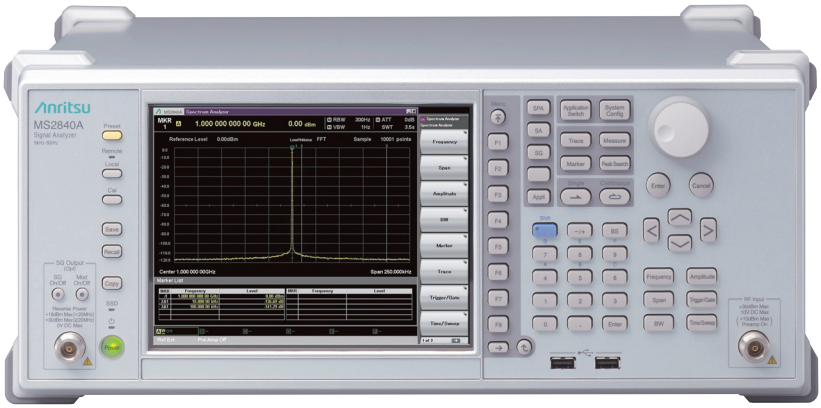
MS2840A

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.

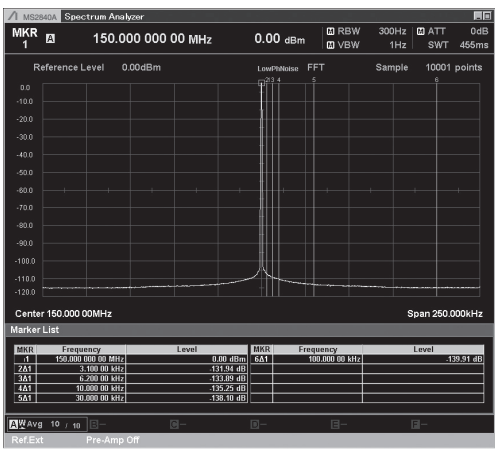
Close-in Phase Noise Performance (Spectrum Analyzer Function)

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.)	—	—

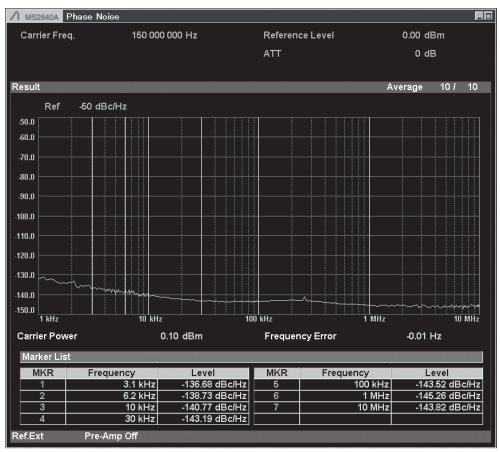
*: Value measured at design but not guaranteed specification, and value measured by Phase Noise Measurement function.

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

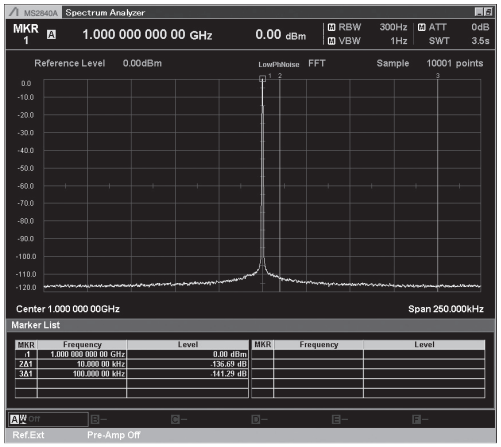


Spectrum Display
Low Phase Noise Performance MS2840A-066 On
150 MHz Measurement Frequency, Preamp Off

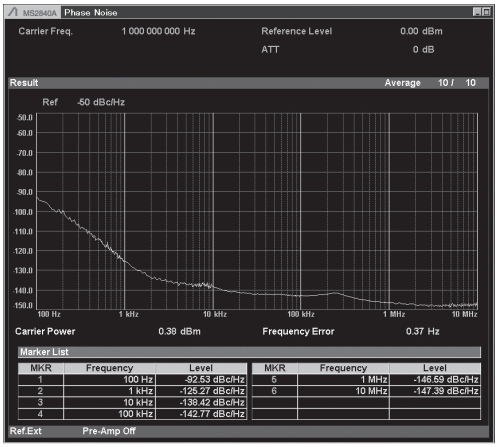


Phase Noise Measurement
Low Phase Noise Performance MS2840A-066 On
150 MHz Measurement Frequency, Preamp Off

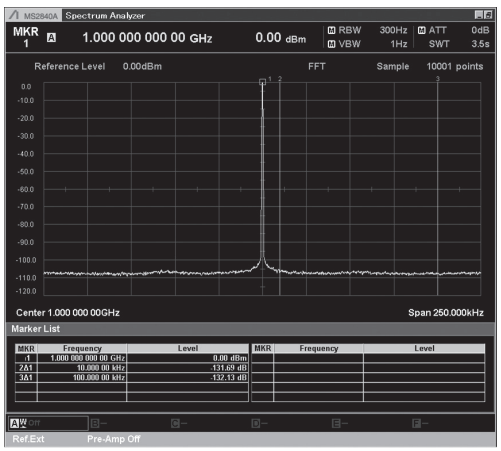
Measurement Examples



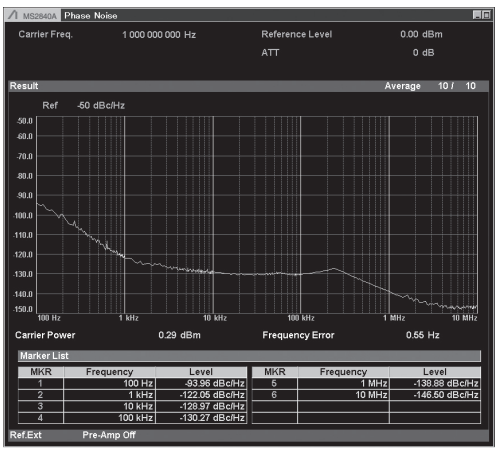
Spectrum Display
Low Phase Noise Performance MS2840A-066 On
1 GHz Measurement Frequency, Preamp Off



Phase Noise Measurement
Low Phase Noise Performance MS2840A-066 On
1 GHz Measurement Frequency, Preamp Off



Spectrum Display
Low Phase Noise Performance MS2840A-066 Off
1 GHz Measurement Frequency, Preamp 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.

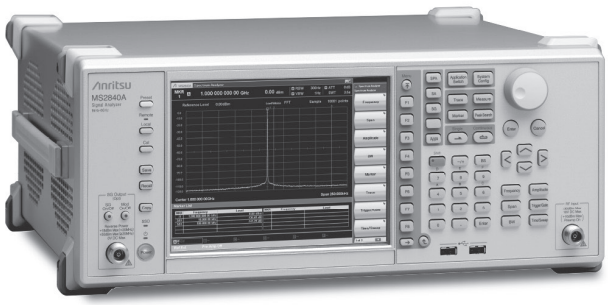
Noise Floor Reduction (MS2840A-051)

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.

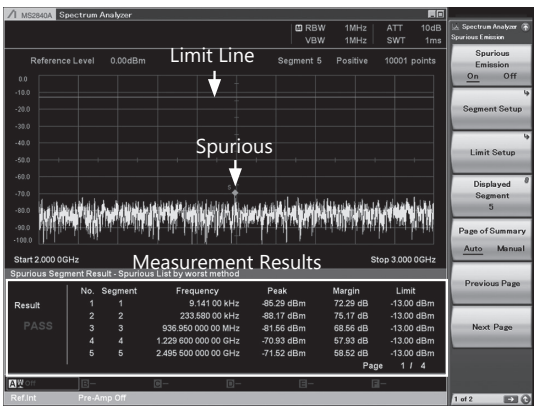
Compatible USB power sensors.

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.

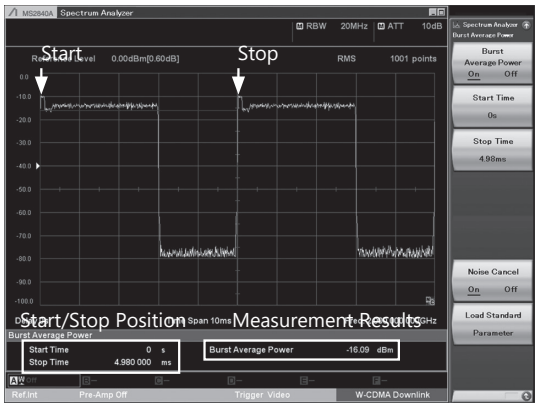
Spurious Emission

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.



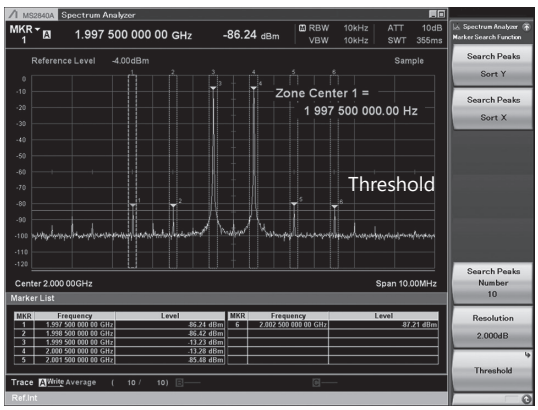
Burst Average Power

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.



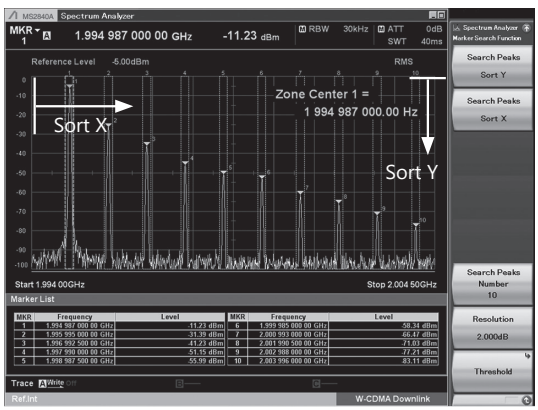
Multi-marker & Marker List

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.



Highest 10 Markers

This function sets the threshold level and auto-detects peaks in the X (frequency) and Y (level/time) directions.

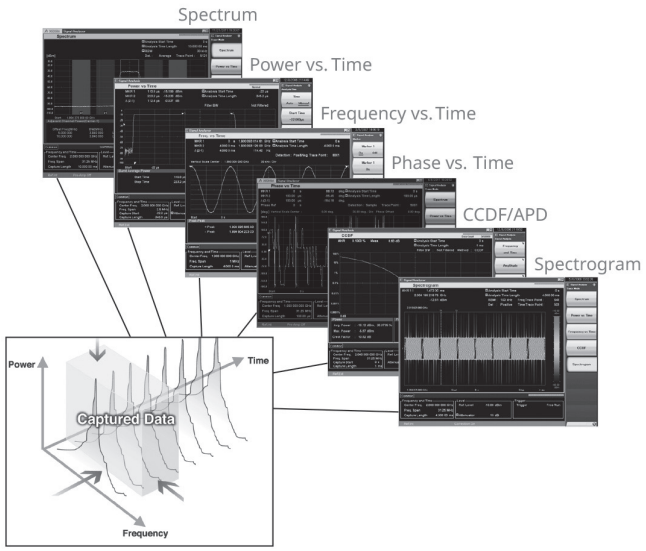


Signal Analyzer (Standard)

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 series MS2690A/91A/92A 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

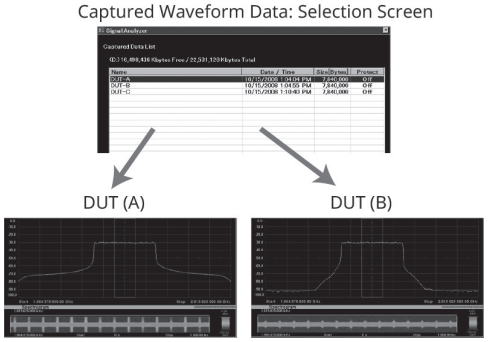
Waveform data can be saved (captured) to the internal memory.
In addition, previously saved waveform data can be loaded (replayed) to reproduce result displays whenever necessary using measurement functions.
The following chart shows the maximum capture time per frequency span.

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

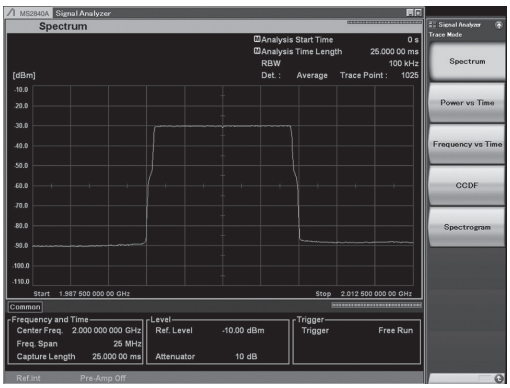
- Sharing data between development and manufacturing sections at separate locations
- Transferring signals captured onsite for later in-house analysis
- Saving product shipping data for later warranty-claim confirmation

Captured Waveform Data: Selection Screen



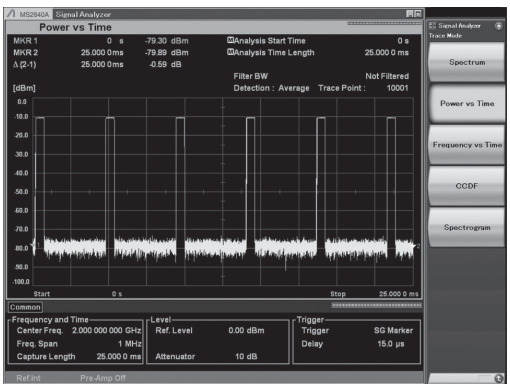
Spectrum trace

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.



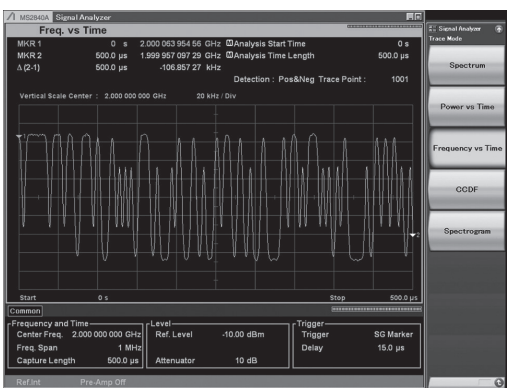
Power vs. Time

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.



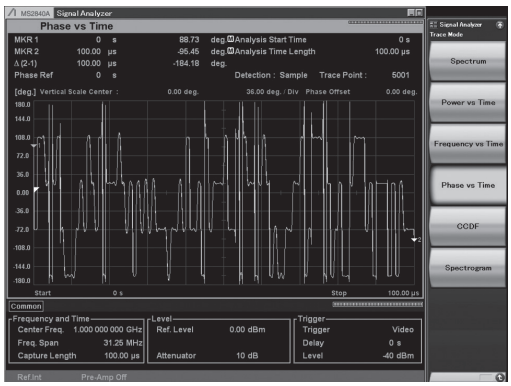
Frequency vs. Time

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.

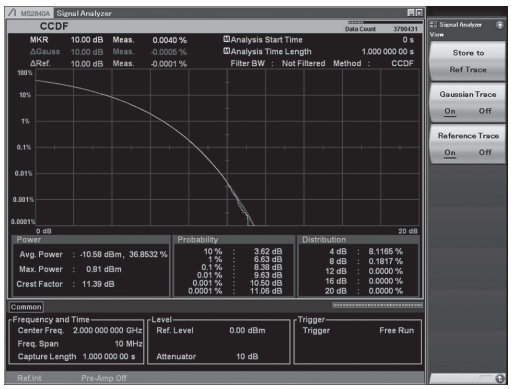


CCDF/APD

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.

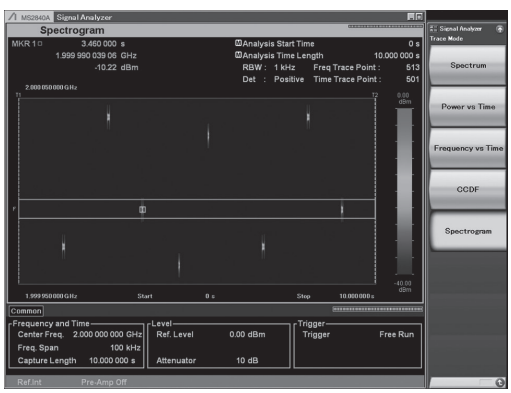
CCDF (Complementary Cumulative Distribution Function):
The CCDF display indicates the cumulative distribution of transient power variations compared to average power.

APD (Amplitude Probability Density):
The APD display indicates the probability distribution of transient power.



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.



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

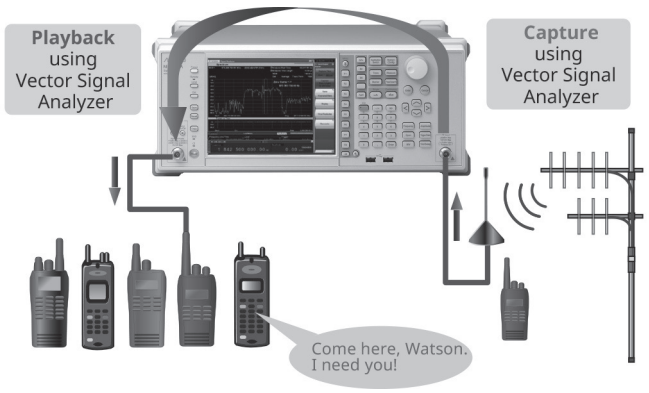
Captured signals can be used to initiate a communications link and perform receiver sensitivity testing with a device under test (DUT) using signals captured from a Golden Unit.

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

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

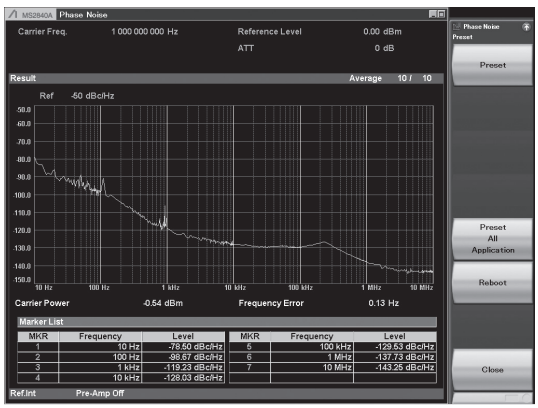
There are four measurement modes using different loop filters, which are switched to match the DUT.

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 close-in 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.



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.

Measurement Software Options

Vector Modulation Analysis Software (MX269017A)

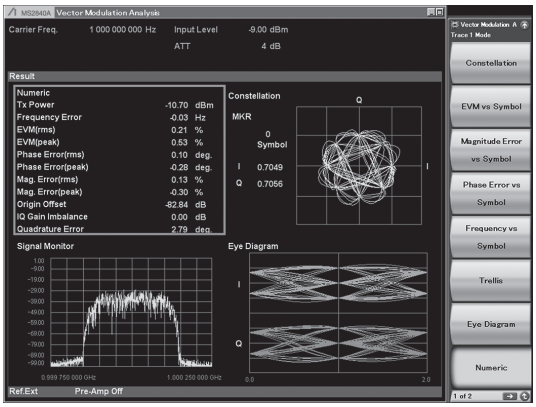
This software measures the modulation accuracy, carrier frequency, Tx power, etc., for each type of digital radio.

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 Upper frequency limit
(300 MHz to Upper frequency limit depending on measured symbol rate and installed option)



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

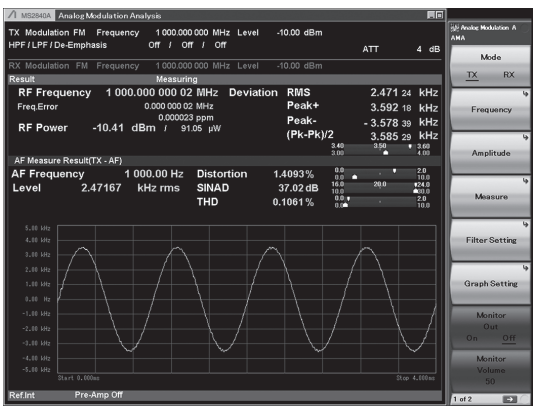
100 kHz to Upper frequency limit
(At Wide Band FM measurement: 10 MHz to Upper frequency limit)

Weighting Filter

CCITT, C-Message, CCIR 468, CCIR-ARM, A-Weighting

De-emphasis

25, 50, 75, 500, 750 µs



Measurement Screen

Refer to the MX2690xxA Series Measurement Software brochure for details.

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)

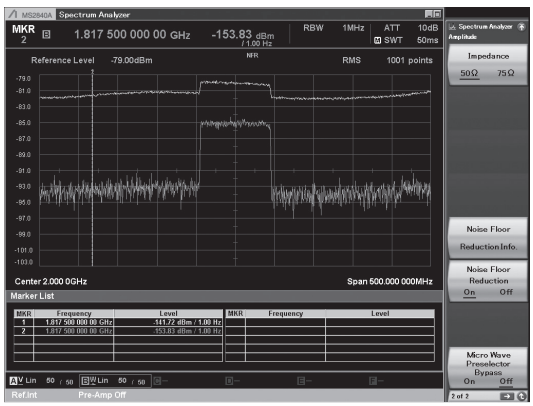
The Noise Floor Reduction (NFR) function increases the measurement accuracy for low-level signals. It subtracts the internal noise components (11 dB max. nominal) of the measuring instrument itself from the displayed measurement result.

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.



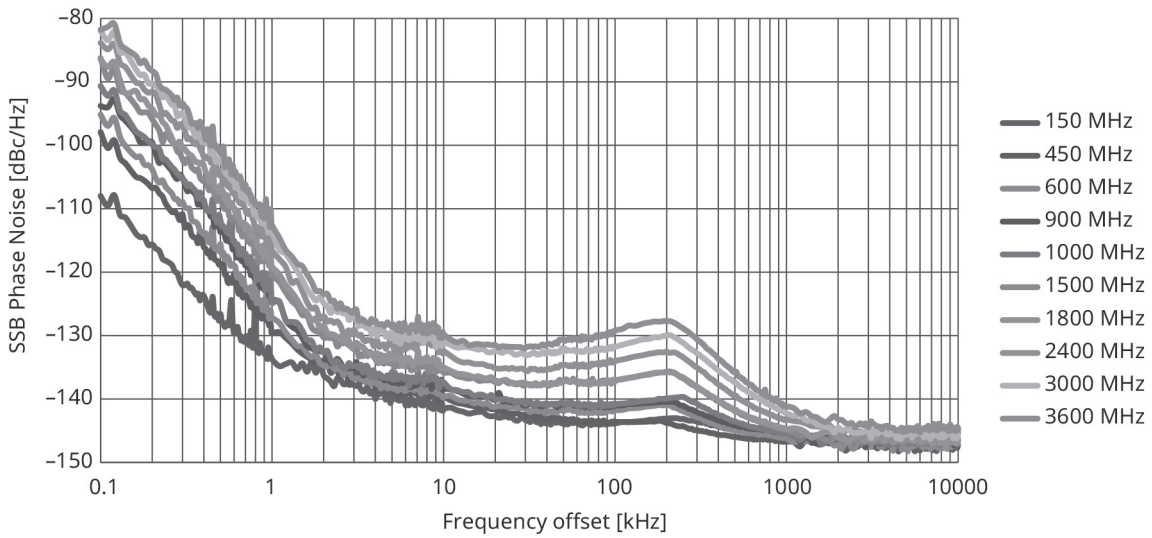
Measurement Screen

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.

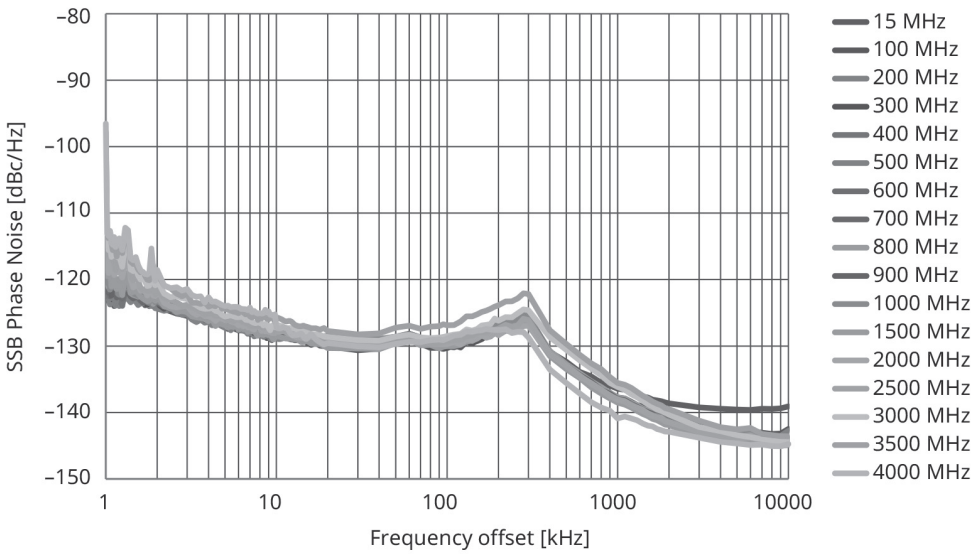
Phase Noise Performance (Spectrum Analyzer Function)

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)

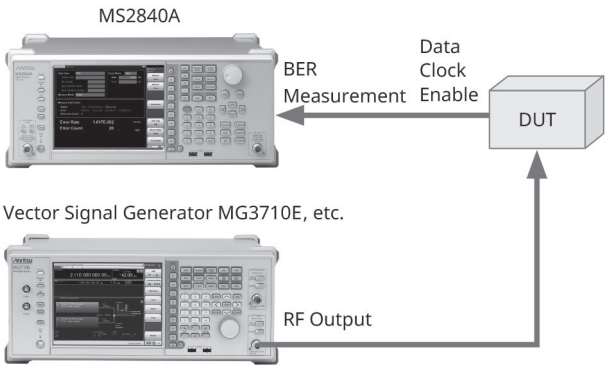
This option adds a vector signal generator function to the Analog Signal Generator MS2840A-088.
The specifications of this vector signal generator are the same as the Vector Signal Generator MS2840A-020 with a frequency range of 250 kHz to 3.6 GHz; the output level is the same as the Low Power Extension for Vector Signal Generator MS2840A-022.

Other Measurement Functions

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

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 $\pm 1 \times 10^{-9}$ at 7 or 15 minutes after power-on.
Aging Rate: $\pm 1 \times 10^{-10}$/month, $\pm 1 \times 10^{-9}$/year
Start-up Characteristics: $\pm 1 \times 10^{-9}$ (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 $\pm 1 \times 10^{-7}$/year.
Aging Rate: $\pm 1 \times 10^{-7}$/year
Start-up Characteristics: $\pm 5 \times 10^{-8}$ (5 minutes after power-on)

2ndary SSD (MS2840A-011)

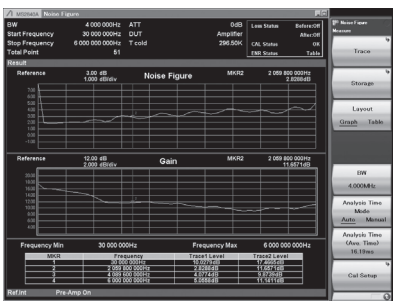
This removable SSD is for storing user data.
It has no installed OS. It is shipped mounted in the Secondary HDD/SSD slot of the MS2840A main unit.

Noise Figure Measurement Function (MS2840A-017)

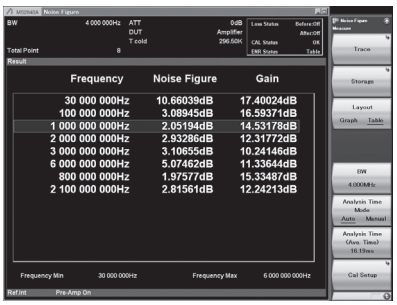
Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source.
The Noisecom NC346 series* of noise sources is supported.

*: Refer to the MS2840A Data Sheet for more details.

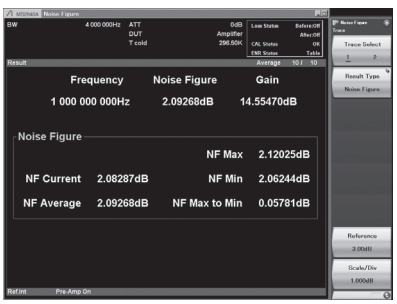
Frequency Range (Noise sauce): 0.01 GHz to 40.0 GHz
Frequency Mode: Fixed, List, Sweep
DUT Mode: Amplifier, Down Converter, Up Converter
Screen Layout: Graph, Table
Measurement Results Display
Graph/List/Spot
Displays measurement results for each trace (Trace1/Trace2).
Noise Figure (NF) [dB]
Noise Factor (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.



Measurement Result:
Example of Graph display
(Frequency Mode: Sweep,
Screen Layout: Graph)



Measurement Result:
Example of List display
(Frequency Mode: List,
Screen Layout: List)



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	

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 MX269017A
MX269017A-011	Higher-Order QAM Analysis	Requires MX269017A
MX269018A	Analog Measurement Software	Requires USB Audio A0086D
MX269902A	TDMA IQproducer	
MX269904A	Multi-Carrier IQproducer	

Signal Analyzer MS2840A 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

$\pm 1 \times 10^{-6}$/year (Standard)
$\pm 1 \times 10^{-7}$/year
(with High Stability Reference Oscillator MS2840A-002 installed)
$\pm 1 \times 10^{-10}$/month, $\pm 1 \times 10^{-9}$/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)

EU Standards (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

OS

Windows 10 (64 bits)

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 (Requires MX269017A)	
MX269017A-011	Higher-Order QAM Analysis (Requires MX269017A)	
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)
J1640A	Resistive Power Tap (DC to 3000 MHz, Maximum Allowable Power: 16 W)
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)
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*2	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*2	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	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*1	Carrying Case (Hard type, with casters)
B0671A*1	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)

*1: The Carrying Case B0636C includes the Front Panel Protective Cover (B0671A).
*2: RoHS non-compliant product
Cannot be shipped to the EU, UK and EFTA.

Sygnal Analyzer

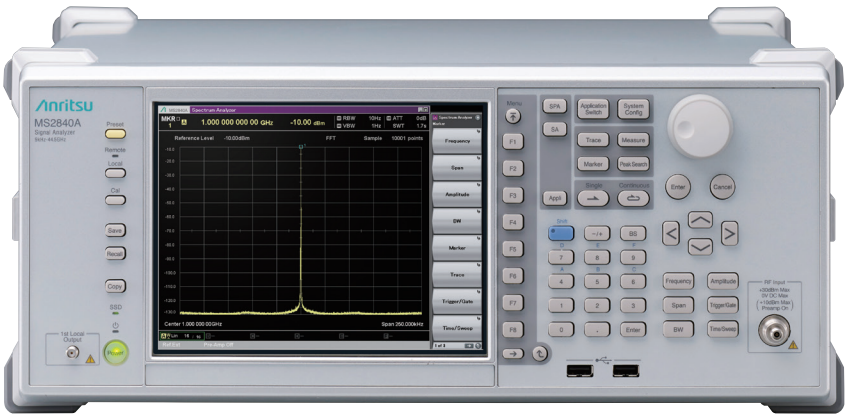
MS2840A

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

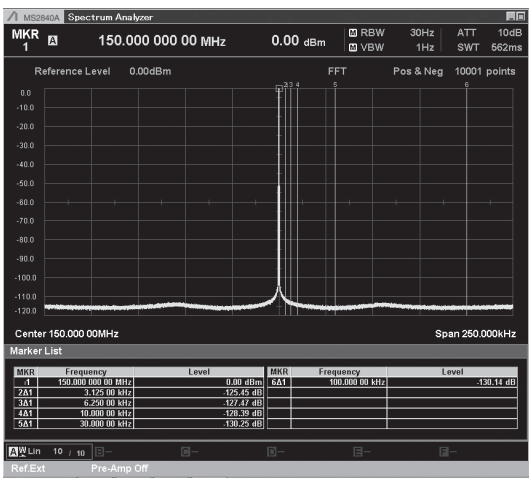
Since 2000 most spectrum analyzers have been designed for mobile communications and the phase noise performance has been optimized for offset frequencies of several MHz. Consequently, customers requiring good close-in phase noise performance have been limited to a narrow choice of usable spectrum analyzers, 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

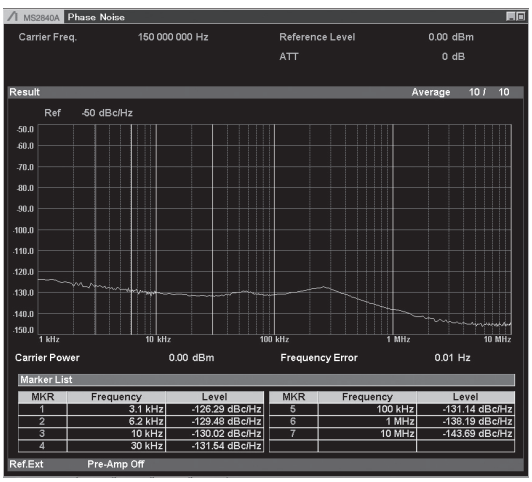
Specification at 1 GHz Measurement Frequency
(Spectrum Analyzer Function)

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.)

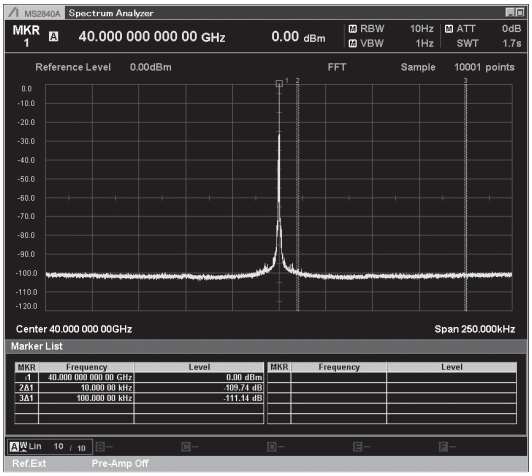
Measurement Examples



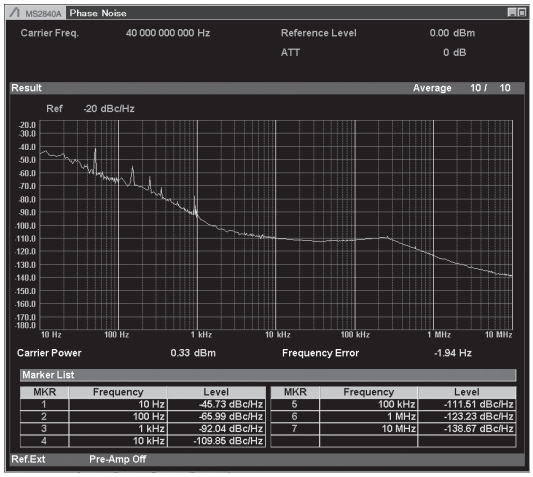
Spectrum Display
150 MHz Measurement Frequency, Preamp Off



Phase Noise Measurement
150 MHz Measurement Frequency, Preamp Off



Spectrum Display
40 GHz Measurement Frequency, Preamp Off



Phase Noise Measurement
40 GHz Measurement Frequency, Preamp Off

Better Than Expected Close-in Phase Noise Performance (High-Performance Waveguide Mixer)

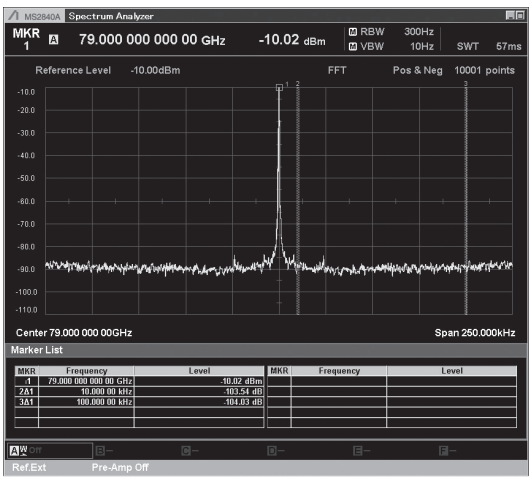
The MS2840A series (26.5 GHz/44.5 GHz models) is supported by two types of mixer: the high-performance waveguide mixers (50 GHz to 90 GHz) for measurements in the millimeter wave band, and external harmonic mixers (26.5 GHz to 325 GHz). In particular, the high-performance waveguide mixers make maximum 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

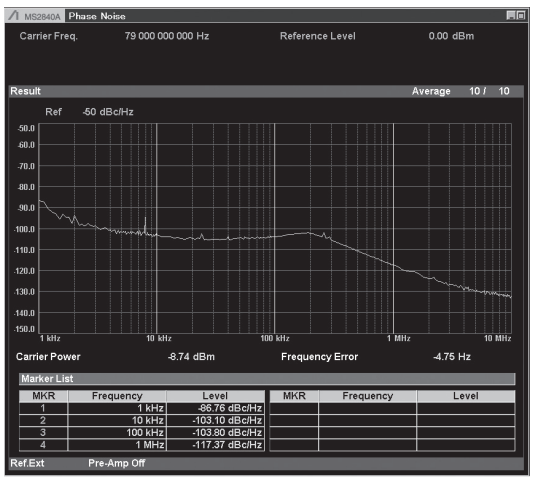
High-Performance Waveguide Mixers

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



Spectrum Display
79 GHz Measurement Frequency
(Using High-Performance Waveguide Mixer MA2808A)



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)

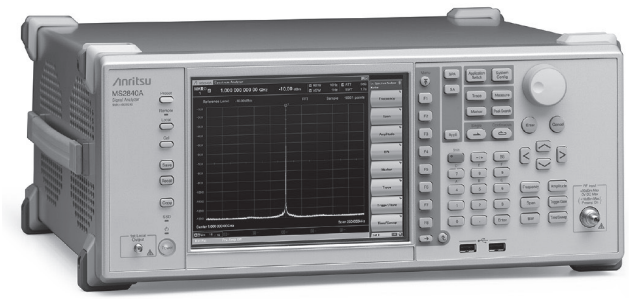
The Noise Floor Reduction (NFR) function increases the measurement accuracy for low-level signals. It subtracts the internal noise components (11 dB max. nominal) of the measuring instrument itself from the displayed measurement result.

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.

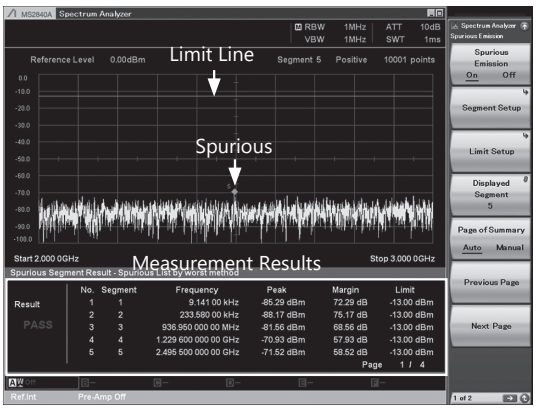
Compatible USB power sensors.

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.

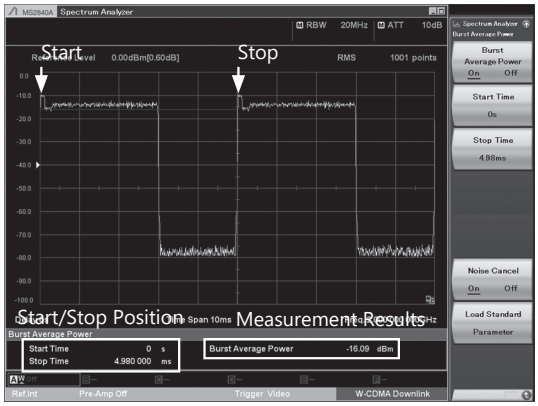
Spurious Emission

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.



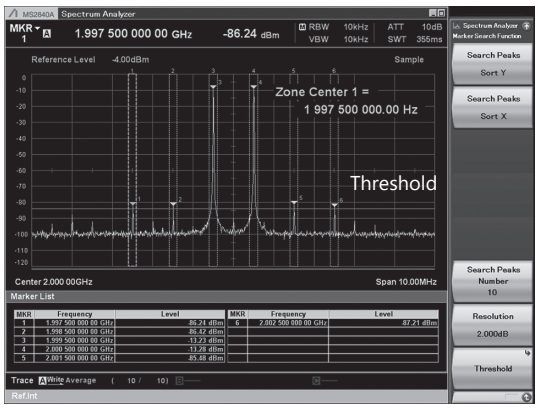
Burst Average Power

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.



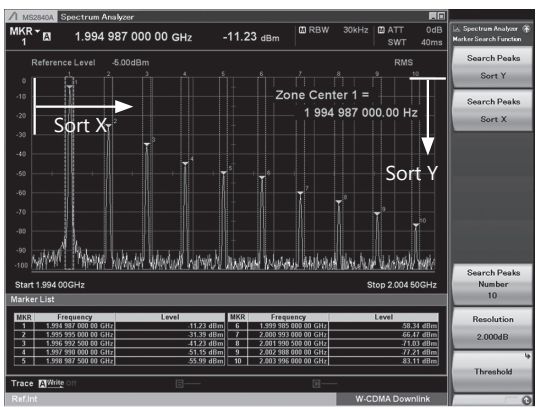
Multi-marker & Marker List

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.



Highest 10 Markers

This function sets the threshold level and auto-detects peaks in the X (frequency) and Y (level/time) directions.

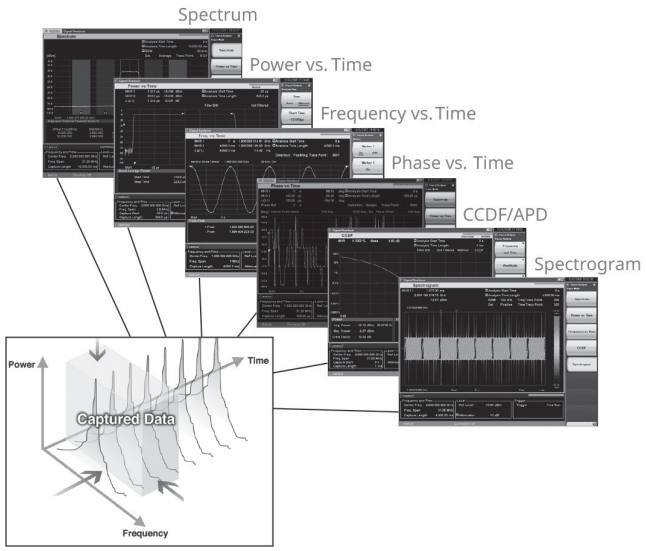


Signal Analyzer (Standard)

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.

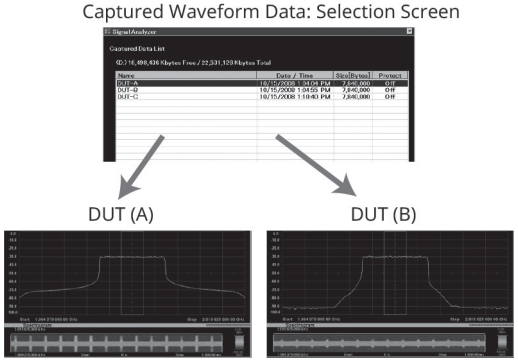
The following chart shows the maximum capture time per frequency span.

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

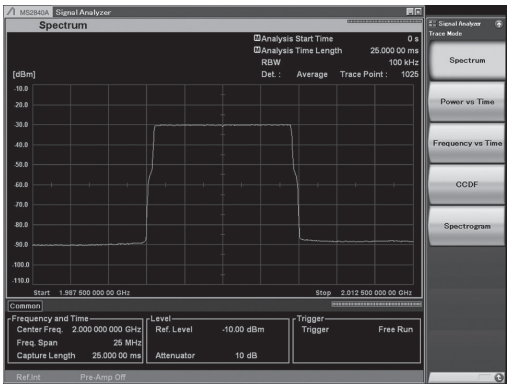
- Sharing data between development and manufacturing sections at separate locations
- Transferring signals captured onsite for later in-house analysis
- Saving product shipping data for later warranty-claim confirmation

Captured Waveform Data: Selection Screen



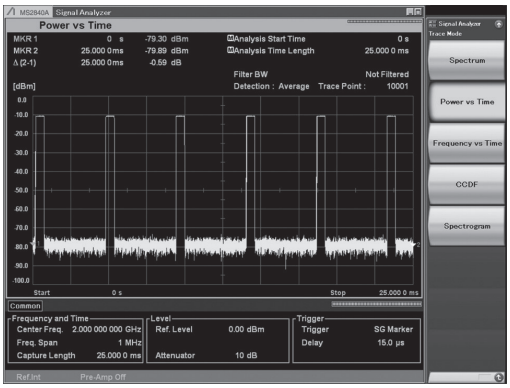
Spectrum trace

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.



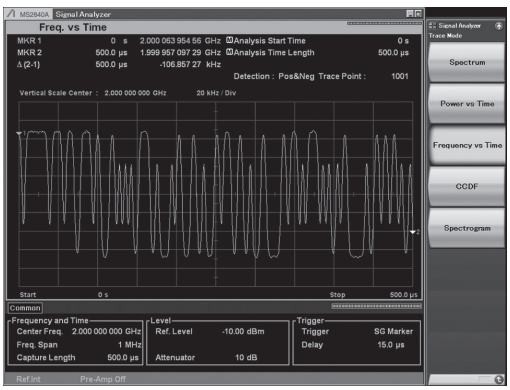
Power vs. Time

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.



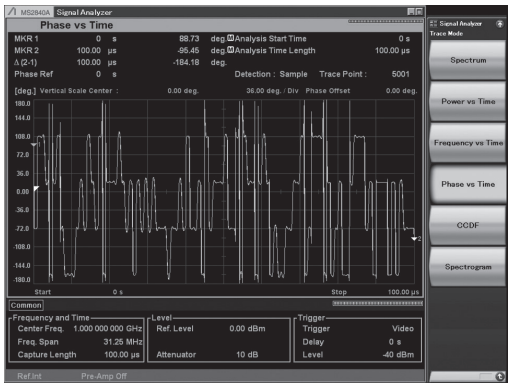
Frequency vs. Time

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.

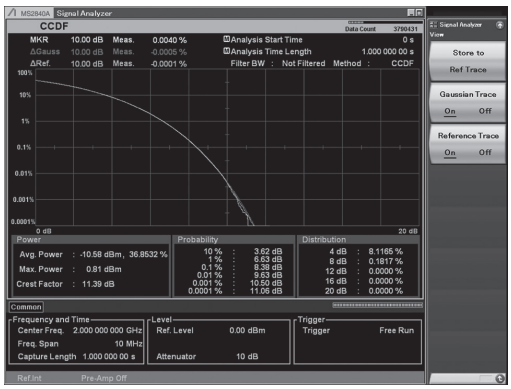


CCDF/APD

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.

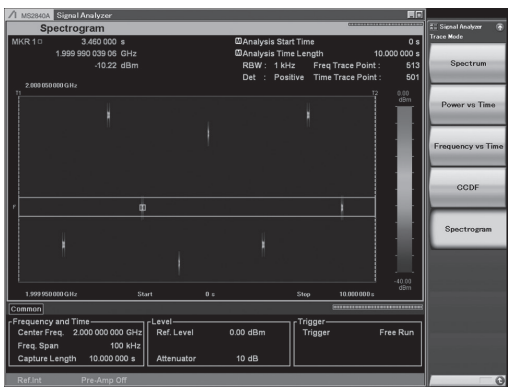
CCDF (Complementary Cumulative Distribution Function):
The CCDF display indicates the cumulative distribution of transient power variations compared to average power.

APD (Amplitude Probability Density):
The APD display indicates the probability distribution of transient power.



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.



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

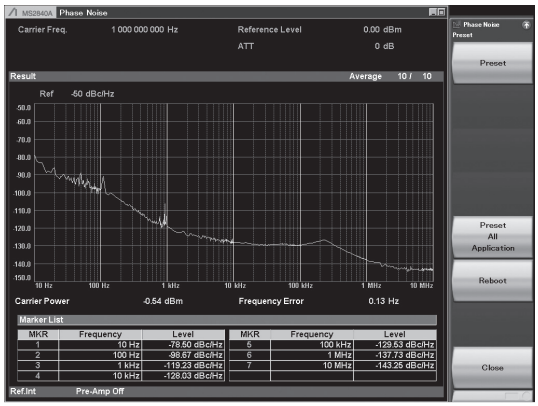
There are four measurement modes using different loop filters, which are switched to match the DUT.

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.



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.

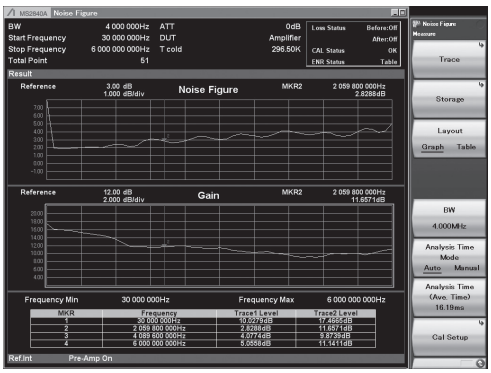
Noise Figure Measurement Function (MS2840A-017)

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.

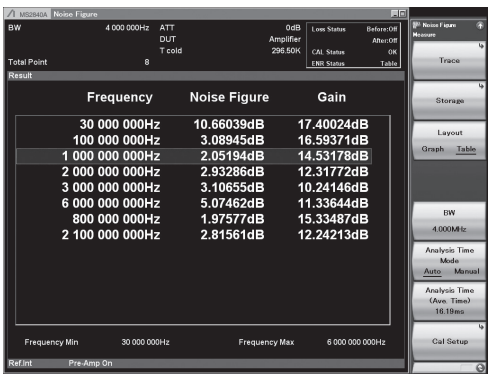
Frequency Range (Noise sauce): 0.01 GHz to 40.0 GHz
Frequency Mode: Fixed, List, Sweep
DUT Mode: Amplifier, Down Converter, Up Converter
Screen Layout: Graph, Table

Measurement Results Display
Graph/List/Spot

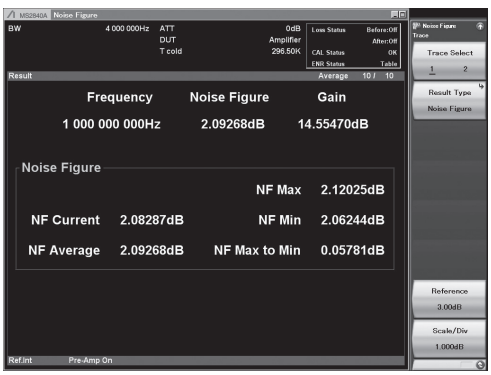
Displays measurement results for each trace (Trace1/Trace2).
Noise Figure (NF) [dB]
Noise Factor (F) [Linear]
Gain
Y-Factor: Power ratio when Noise Source is turned On/Off
T effective: Effective noise temperature
P Hot: Power measured when Noise Source is On.
P Cold: Power measured when Noise Source is Off.



Measurement Result: Example of Graph display
(Frequency Mode: Sweep, Screen Layout: Graph)



Measurement Result: Example of List display
(Frequency Mode: List, Screen Layout: List)



Measurement Result: Example of Spot display
(Frequency Mode: Fixed)

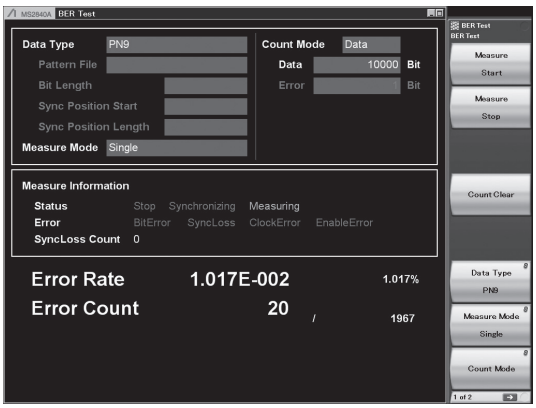
BER Measurement Function (MS2840A-026)

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.

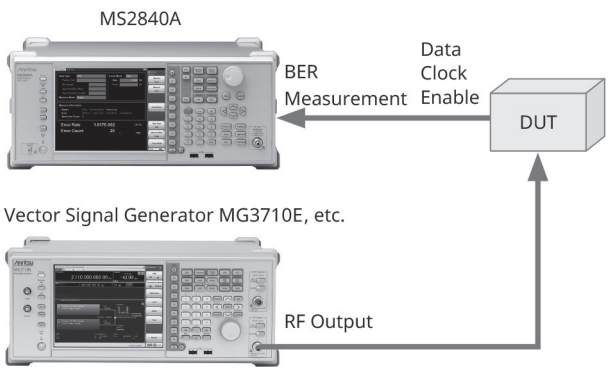
- Input Signal: Data, Clock, Enable (Polarity reversal supported)
- Input Bit Rate: 100 bps to 10 Mbps
- Input Level: TTL 3.3 V
- Connector: Rear panel, AUX connector*

*: 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



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

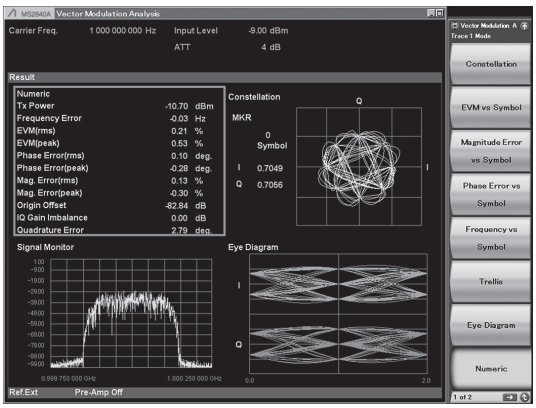
*: Used for APCO-P25 Phase2 Inbound measurement

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)



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

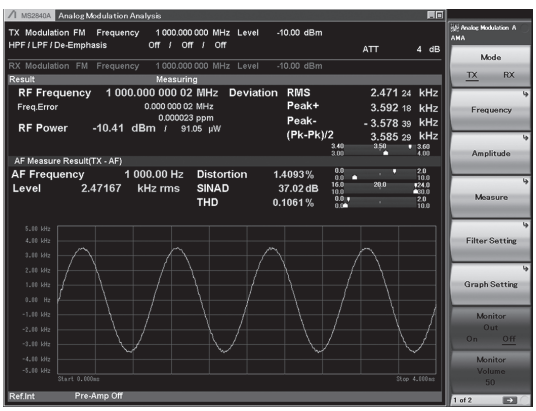
100 kHz to 2700 MHz
(At Wide Band FM measurement: 10 MHz to 2700 MHz)

Weighting Filter

CCITT, C-Message, CCIR 468, CCIR-ARM, A-Weighting

De-emphasis

25, 50, 75, 500, 750 µs



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 $\pm 1 \times 10^{-9}$ at 7 minutes after power-on.
Aging Rate: $\pm 1 \times 10^{-10}$/month, $\pm 1 \times 10^{-9}$/year
Start-up Characteristics: $\pm 1 \times 10^{-9}$ (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)

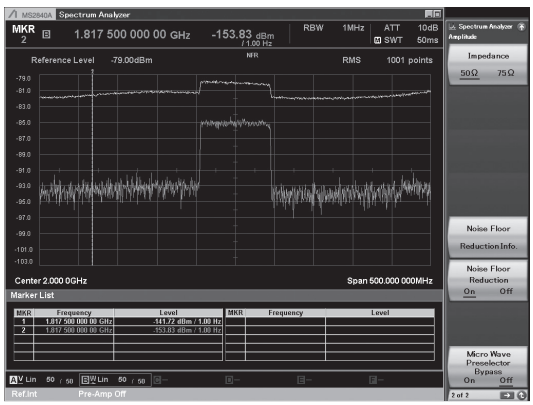
The Noise Floor Reduction (NFR) function increases the measurement accuracy for low-level signals. It subtracts the internal noise components (11 dB max. nominal) of the measuring instrument itself from the displayed measurement result.

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.



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
MA2741C	External Mixer	A Band	26.5 GHz to 40 GHz	WR28	MIL-DTL-3922/54-003
MA2742C	External Mixer	Q Band	33 GHz to 50 GHz	WR22	MIL-DTL-3922/67D-006
MA2743C	External Mixer	U Band	40 GHz to 60 GHz	WR19	MIL-DTL-3922/67D-007
MA2744C	External Mixer	V Band	50 GHz to 75 GHz	WR15	MIL-DTL-3922/67D-008
MA2745C	External Mixer	E Band	60 GHz to 90 GHz	WR12	MIL-DTL-3922/67D-009
MA2746C	External Mixer	W Band	75 GHz to 110 GHz	WR10	MIL-DTL-3922/67D-010
MA2747C	External Mixer	F Band	90 GHz to 140 GHz	WR08	MIL-DTL-3922/67D-M08
MA2748C	External Mixer	D Band	110 GHz to 170 GHz	WR06	MIL-DTL-3922/67D-M06
MA2749C	External Mixer	G Band	140 GHz to 220 GHz	WR05	MIL-DTL-3922/67D-M05
MA2750C	External Mixer	Y Band	170 GHz to 260 GHz	WR04	MIL-DTL-3922/67D-M04
MA2751C	External Mixer	J Band	220 GHz to 325 GHz	WR03	MIL-DTL-3922/67D-M03

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	Standard Software	MX269000A
Analysis Bandwidth 10 MHz	MS2840A-006	Analysis Bandwidth 10 MHz	MS2840A-006
Bandwidth Extension to 31.25 MHz	MS2840A-005	Bandwidth Extension to 31.25 MHz for Millimeter Wave	MS2840A-009

The following options are installed as standard and do not require separate orders when ordering the MS2840A-046.

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-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 Retrofit Kit Z1932A.

Model	Name	Remarks
MX269017A	Vector Modulation Analysis Software	
MX269017A-001	APSK Analysis	Requires MX269017A
MX269017A-011	Higher-Order QAM Analysis	Requires 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

Signal Analyzer 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

$\pm 1 \times 10^{-7}$/year (standard)
$\pm 1 \times 10^{-10}$/month, $\pm 1 \times 10^{-9}$/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]

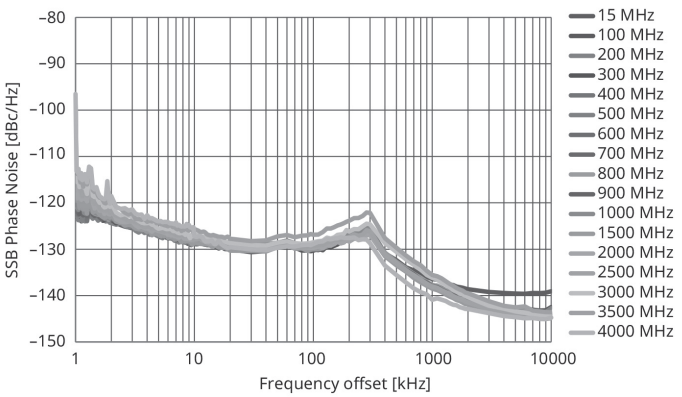
Video Bandwidth (VBW)

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)

EU Standards (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

OS

Windows 10 (64 bits)

High Performance Waveguide Mixer MA2806A/MA2808A Specifications

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.
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 (Requires MX269017A)	
MX269017A-011	Higher-Order QAM Analysis (Requires MX269017A)	
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

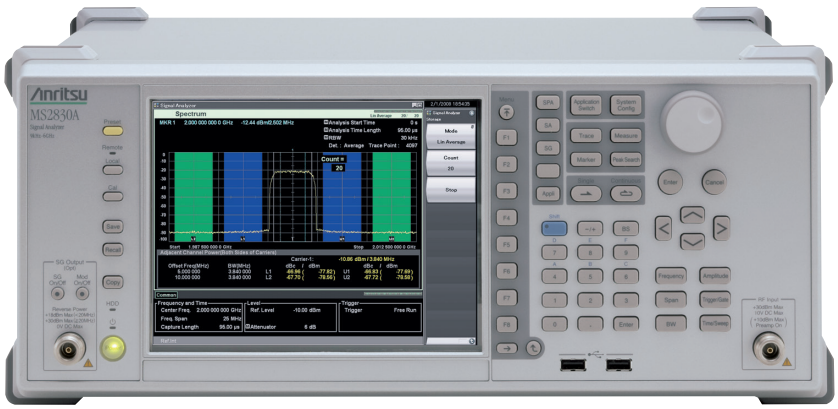
MS2830A

9 kHz to 3.6 GHz/6.0 GHz/13.5 GHz

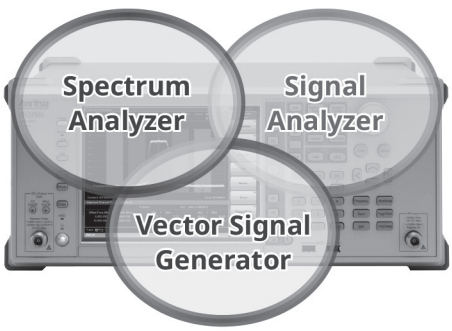
Remote Control
GPIB | Ethernet | USB

[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.



*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)]

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: $\pm 1 \times 10^{-6}$/year, $\pm 1 \times 10^{-7}$/day
  Start-up Characteristics: $\pm 5 \times 10^{-7}$ (5 minutes after power-on)
  Rubidium Reference Oscillator (MS2830A-001)
  Aging Rate: $\pm 1 \times 10^{-10}$/month
  Start-up Characteristics: $\pm 1 \times 10^{-9}$ (7 minutes after power-on)
  High Stability Reference Oscillator (MS2830A-002)
  Aging Rate: $\pm 1 \times 10^{-7}$/year, $\pm 1 \times 10^{-8}$/day
  Start-up Characteristics: $\pm 5 \times 10^{-8}$ (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.)

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 series MS2690A/91A/92A 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)

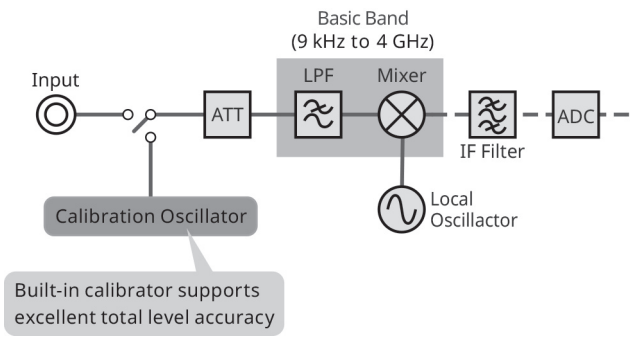
With a level calibration over a wide frequency range, the MS2830A has excellent total level accuracy.
The Absolute Amplitude Accuracy specification described in catalogs of other spectrum analyzers ignores the important frequency characteristics, linearity, and attenuator switching errors.
In contrast, 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



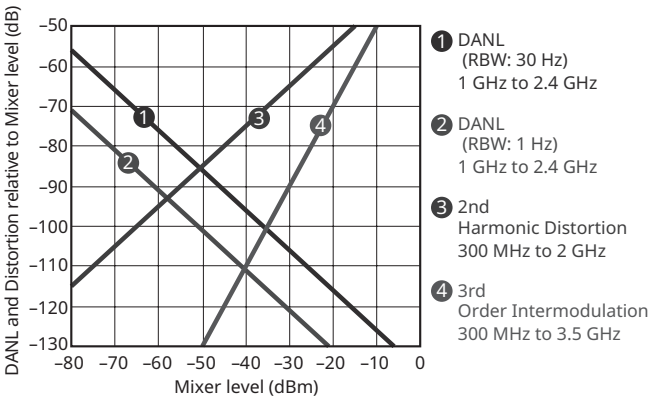
Wide Dynamic Range

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)

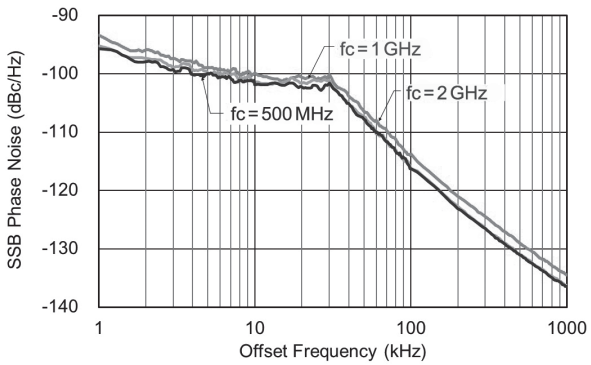
*1: Difference between TOI and DANL as simple guide.
*2: TOI (Third Order Intercept)
*3: DANL (Displayed Average Noise Level)

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.

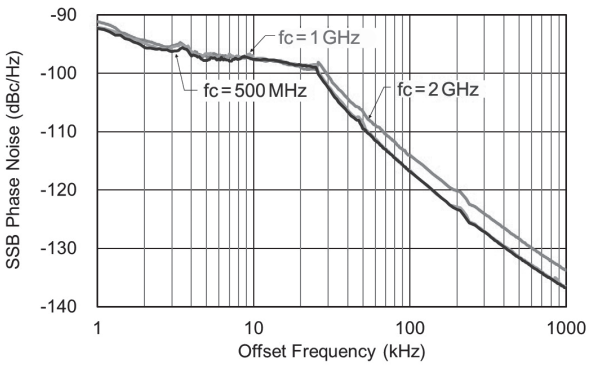
Distortion Characteristics (Spectrum Analyzer)
MS2830A-040/041/043



Example: SSB Phase Noise
(Spectrum Analyzer/Signal Analyzer Common)



(Applies for instruments with serial number ≥ 6201349078)

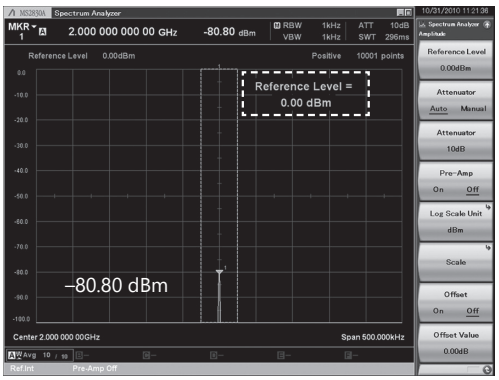


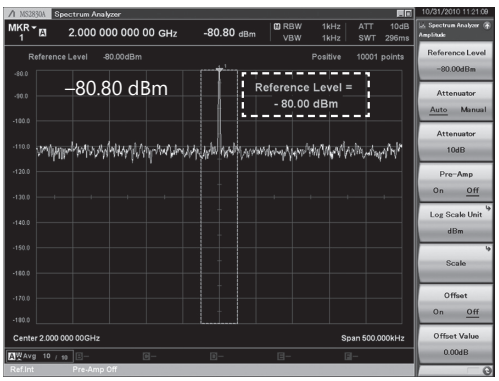
(Applies for instruments with serial number < 6201349078)

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

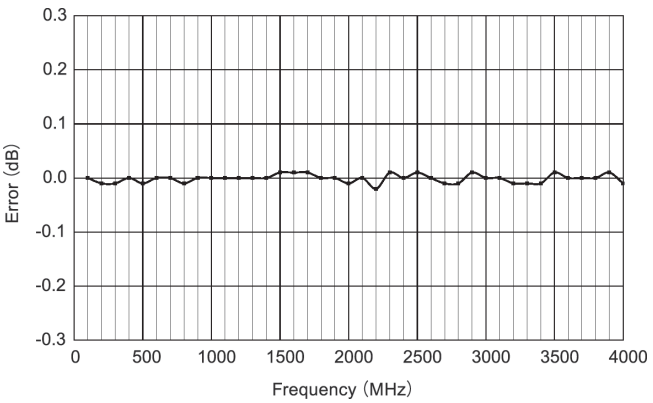




Dual Sweep Speed: Normal/Fast

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- 40, 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

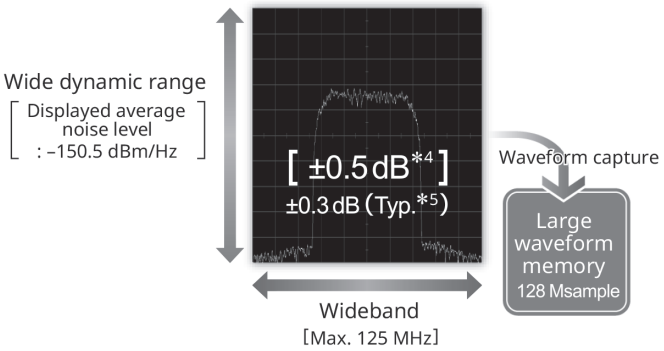
Signal Analyzer: Basic Performance/Functions

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 series MS2690A/91A/92A is recommended for other measurement purposes.

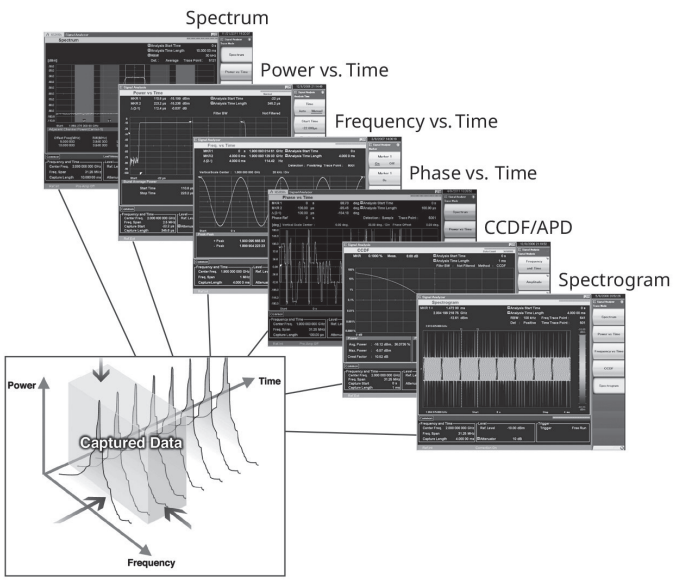
Based on the excellent level accuracy and wide dynamic range of the MS2830A, a signal with an FFT analysis bandwidth of up to 125 MHz can be captured with a level accuracy of ±0.3 dB.



*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

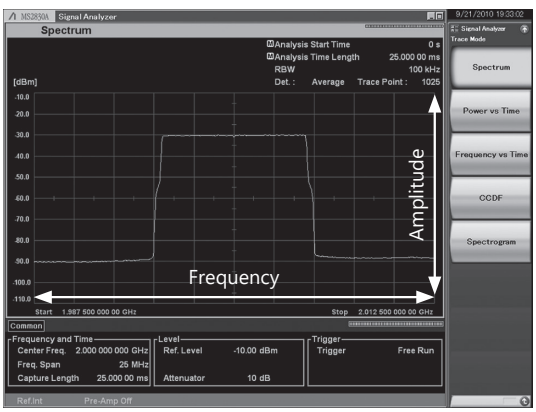
This function reads saved data and replays it using the signal analyzer measurement function.

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

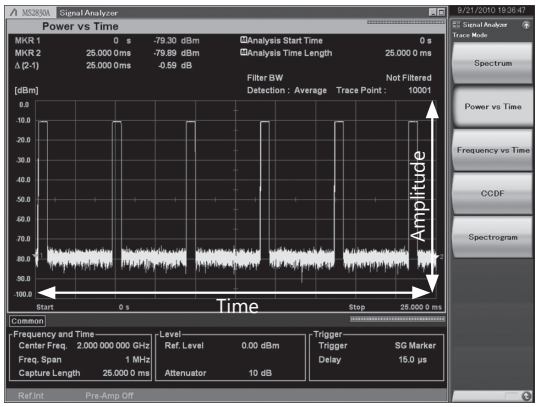
Spectrum

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.



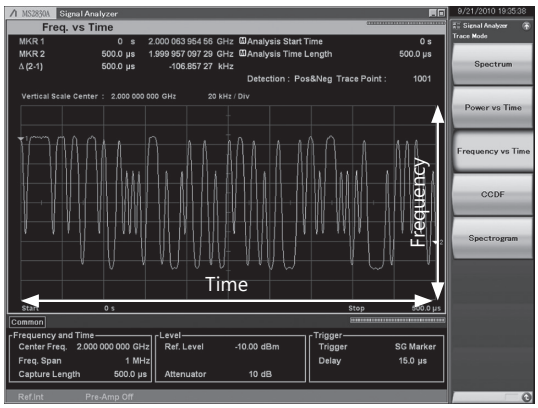
Power vs. Time

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.



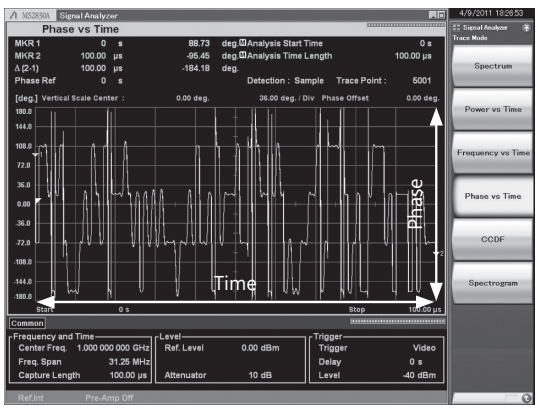
Frequency vs. Time

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

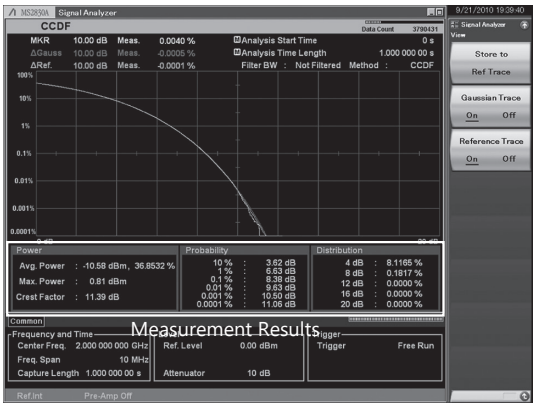
The Phase vs. Time trace displays a graph with phase on the y-axis and time on the x-axis to confirm time variation of the measured signal phase.



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.

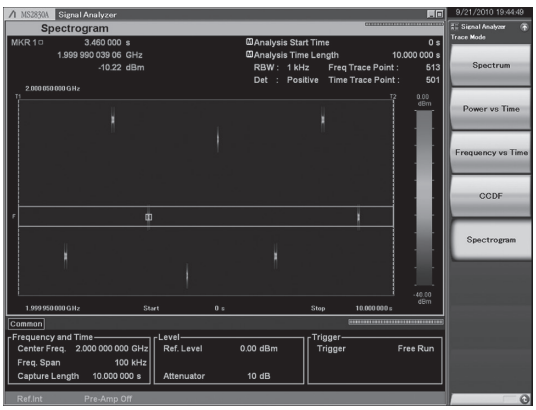
*1: CCDF (Complementary Cumulative Distribution Function)
*2: APD (Amplitude Probability Density)



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.

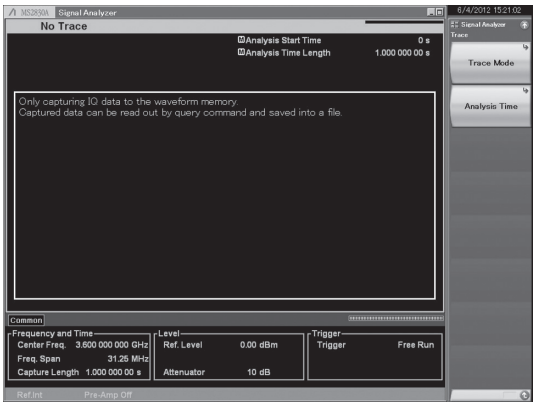
Spectrogram

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.



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.

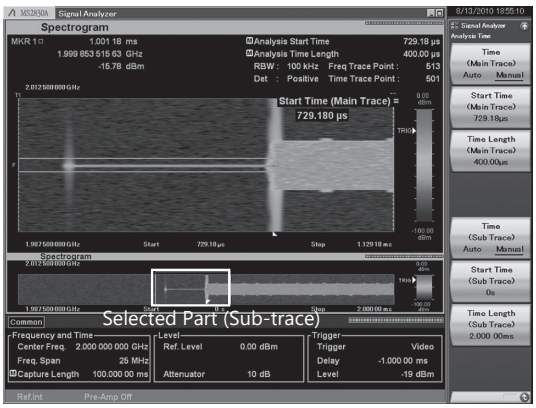


Measurement with Sub-trace Display

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

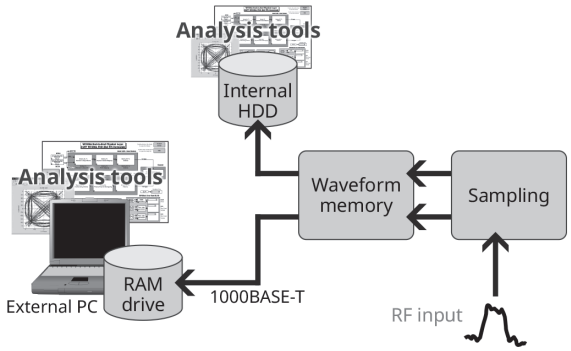
The part of a previously captured long-term signal to be monitored can be selected on the sub-trace to display the problem part only on the main trace.



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.

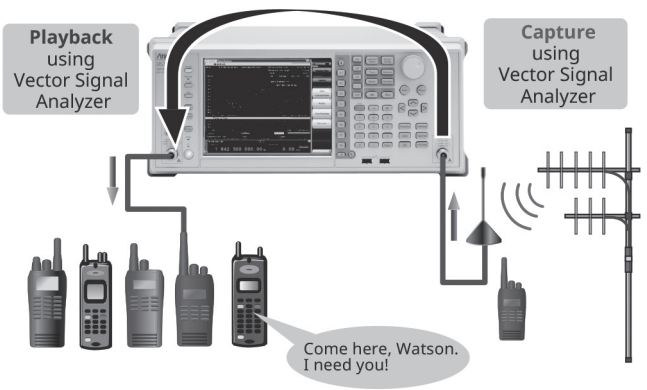


Capture & Playback Real-World Signals

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.

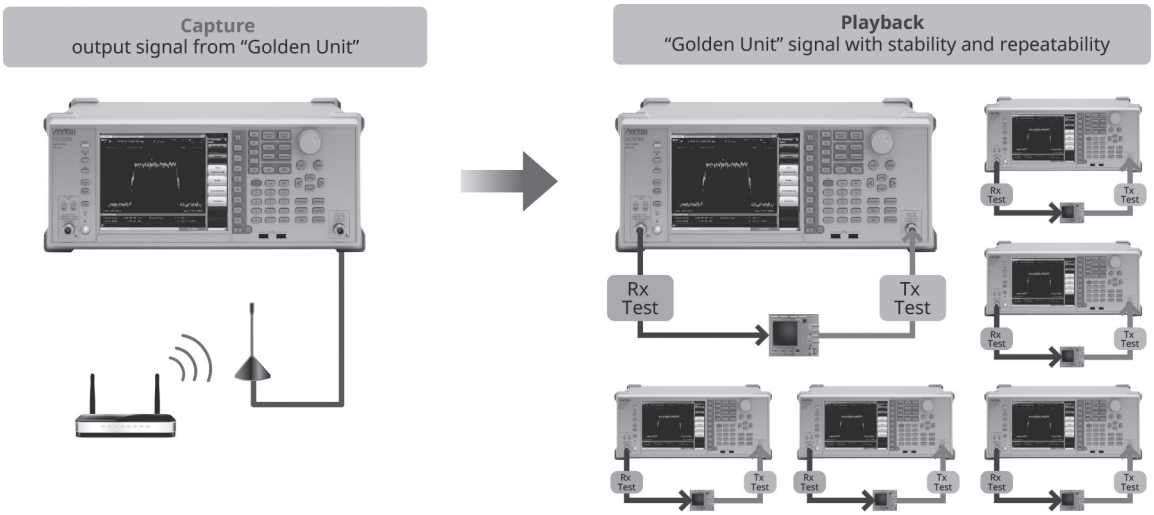
Applications for *Capture & Playback*

- 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

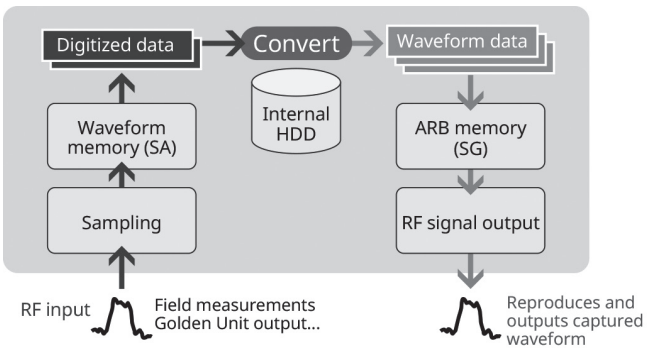
Wi-Fi® is a registered trademark of Wi-Fi Alliance.



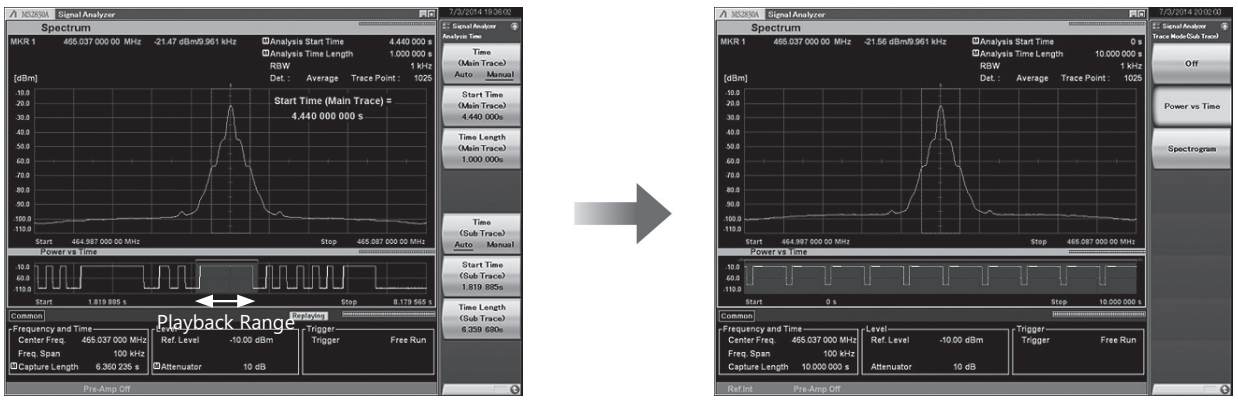
Use "Golden Unit" Signal for Manufacturing Test and Calibration

***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



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.

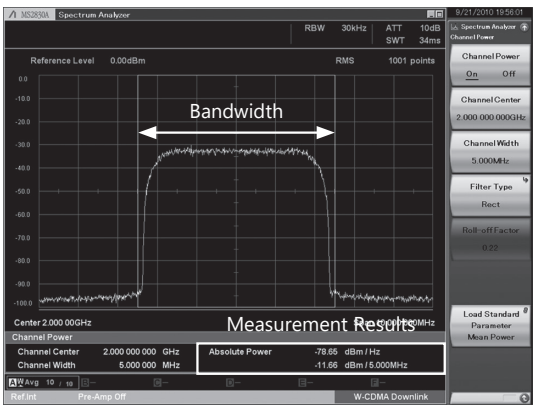
Measure Function	SPA*1	VSA*2
Channel Power	✓	✓
Occupied Bandwidth	✓	✓
Adjacent Channel Leakage Power	✓	✓
Spectrum Emission Mask	✓	
Burst Average Power	✓	✓
Spurious Emission	✓	
AM Depth		✓
FM Deviation		✓
Multi-marker & Marker List	✓	✓
Highest 10 Markers	✓	✓
Limit Line	✓	
Frequency Counter	✓	
2-tone 3rd-order 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.

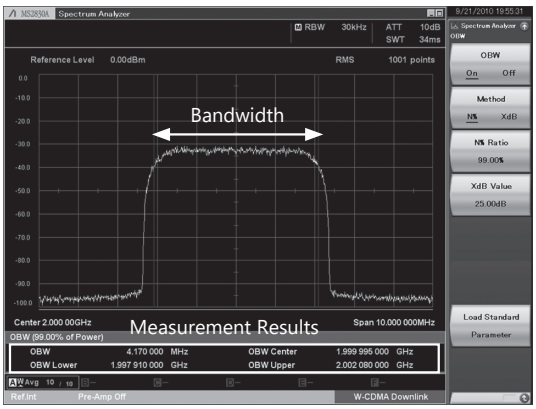


Measurement Results
• Absolute power per Hz in channel band
• Total power in channel band

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.

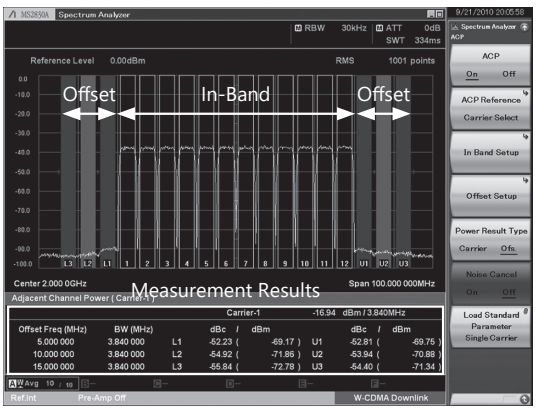


Measurement Results
• Bandwidth for specified conditions

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.

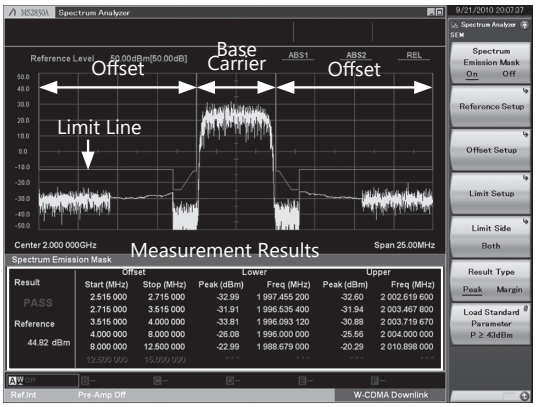


Measurement Results
• Absolute power of Offset channel
• Relative values in relation to reference power selected in ACP reference

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.

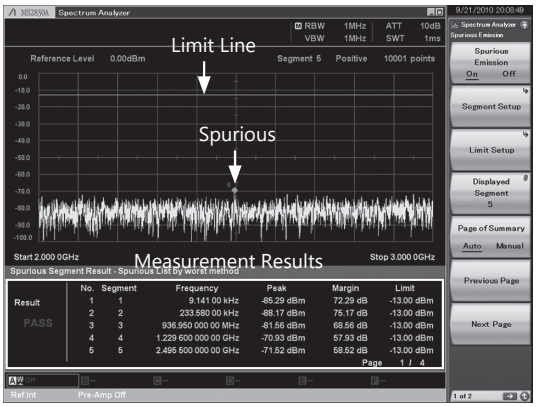


Measurement Results
- Peak power (or margin) at offset
- Each peak frequency

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.

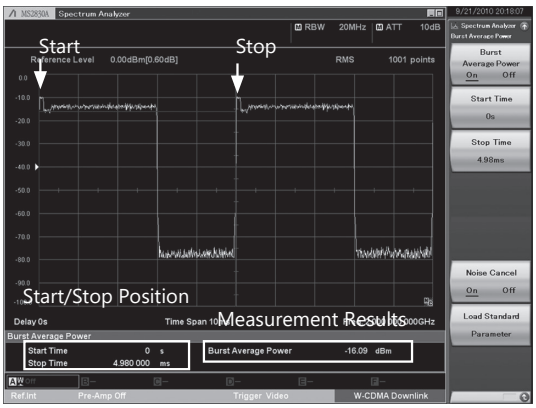


Measurement Results
- Each segment peak power and margin
- Each peak frequency

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.

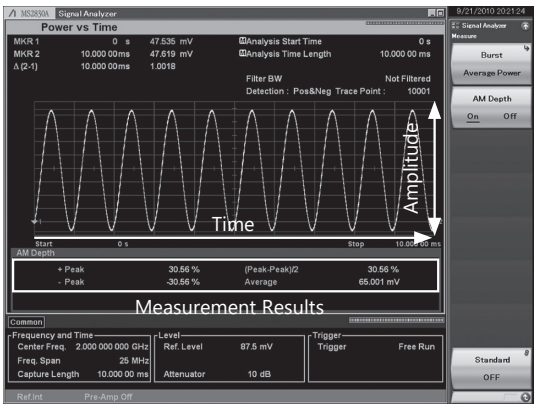


Measurement Results
- Average power of specified range

AM Depth

VSA

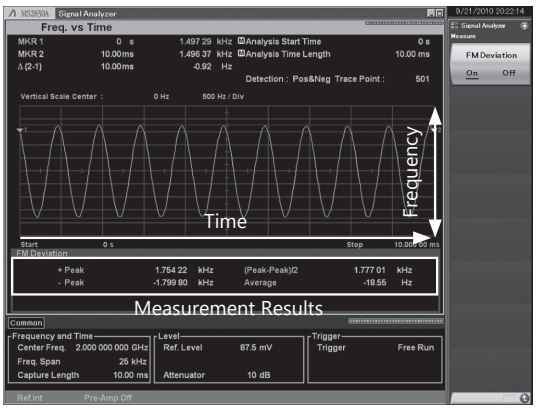
The Power vs. Time trace measurement function is used to confirm AM depth.
It measures the measured signal AM based on trace data at the displayed marker. When marker is Off, the whole range is measured.



Measurement Results
- +Peak, –Peak, (Peak-Peak)/2, Average

FM Deviation VSA

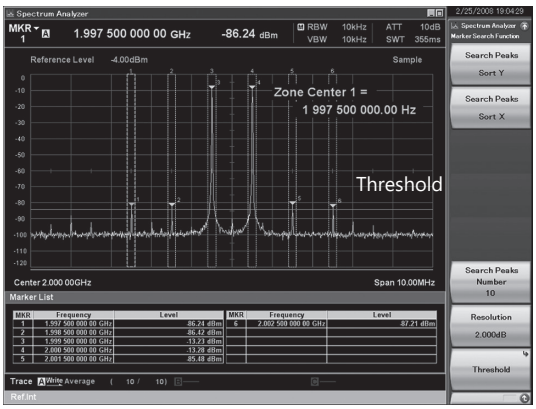
The Frequency vs. Time trace measurement is used to confirm the FM deviation. It measures the maximum and minimum frequencies from trace data in the marker range. When marker is Off, the whole range is measured.



Measurement Results
- +Peak, –Peak, (Peak-Peak)/2, Average

Multi-marker & Marker List SPA VSA

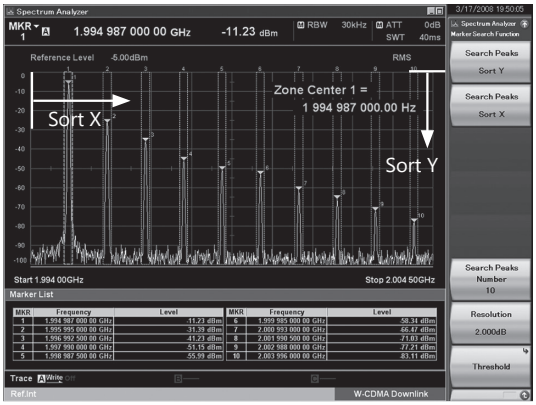
Up to 10 markers can be set for this function. Markers may be either a spot or a zone. Using a zone marker, the peak of a signal with an unstable variable frequency can be tracked and measured. Not only can the 10 markers be listed below the trace but the differences between markers can be calculated 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.

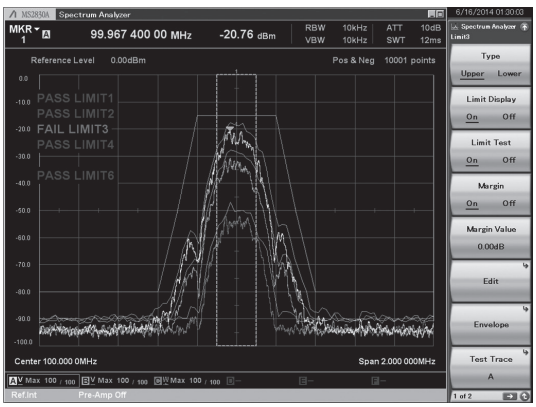


Measurement Results
- Peak Search Y:
  Sets up to 10 markers in order of peak level
- Peak Search X:
  Sets up to 10 markers in order of frequency (time) level

Limit 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



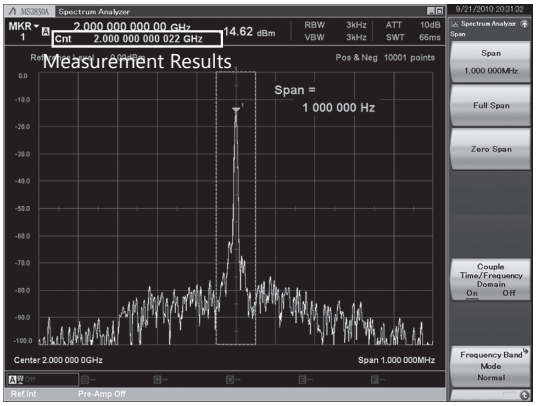
Example:
PASS/FAIL evaluation is performed by changing the input signal level. The evaluation results for the five line types can be displayed simultaneously on one screen.

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

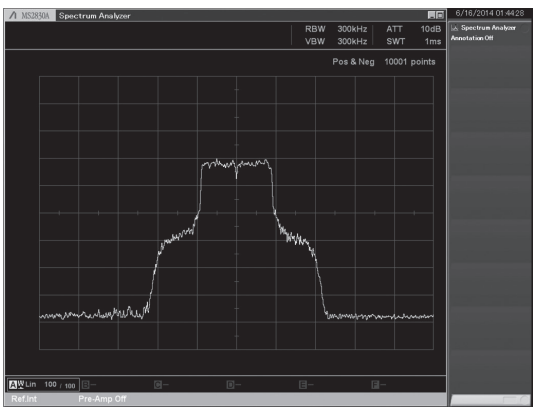
By inputting two different frequency CW signals (desired waves), two-tone third-order intermodulation distortion is generated close to the desired waves according to non-linear characteristics of Device Under Test (DUT). Then, Third Order Intercept (TOI) is calculated from the two-tone third-order intermodulation distortion.

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.

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

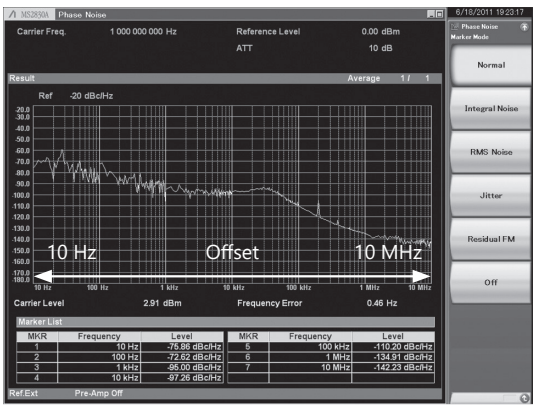
*: MA24104A has been discontinued.

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.



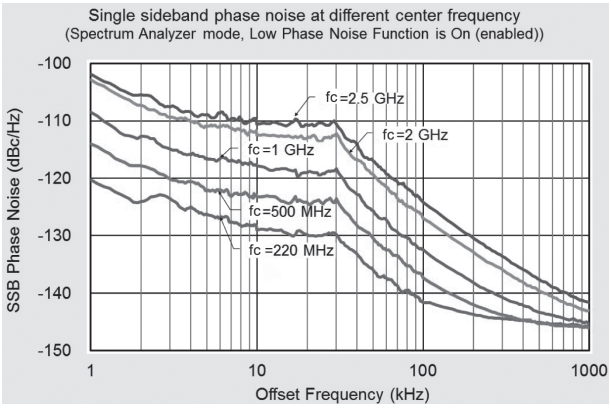
Measurement Results
- Carrier level
- Error between set frequency and carrier frequency
- Marker point phase noise level

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.



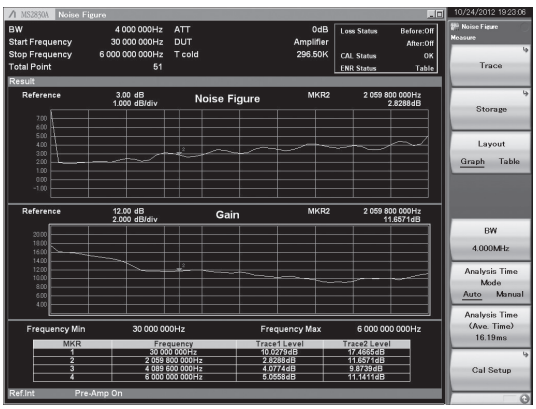
Noise Figure Measurement (MS2830A-017)

Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source*.

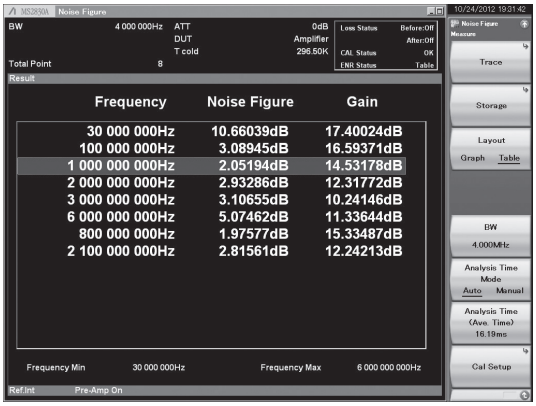
Frequency Mode: Fixed, List, Sweep
DUT Mode: Amplifier, Down Converter, Up Converter
Screen Layout: Graph, Table

Measurement Results Display
Graph, List, Spot

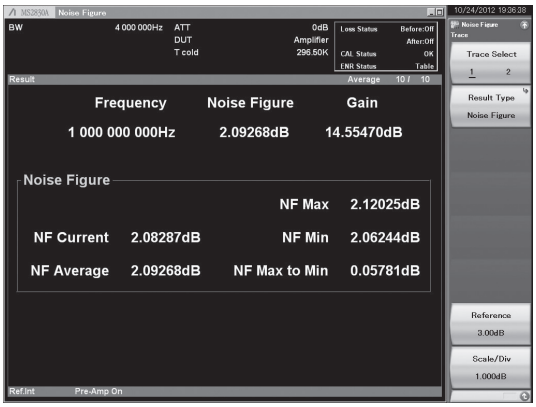
Displays measurement results for each trace (Trace1/Trace2).
Noise Figure (NF) [dB]
Noise Factor (F) [Linear]
Gain
Y-Factor: Power ratio when Noise Source is turned On/Off
T effective: Effective noise temperature
P Hot: Power measured when Noise Source is On.
P Cold: Power measured when Noise Source is Off.



Measurement Result: Example of Graph display
(Frequency Mode: Sweep, Screen Layout: Graph)



Measurement Result: Example of List display
(Frequency Mode: List, Screen Layout: List)



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.

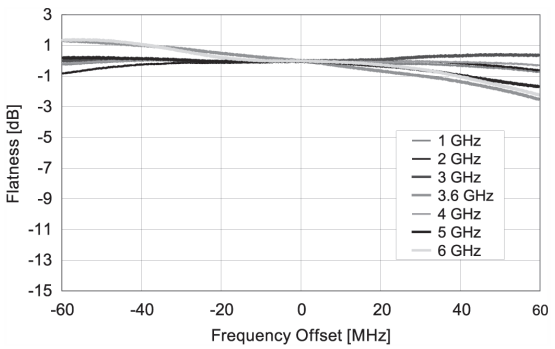
Output Level Range

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.

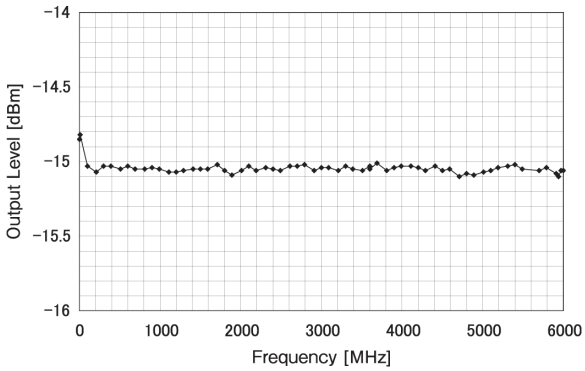
Example: Vector Modulation Bandwidth



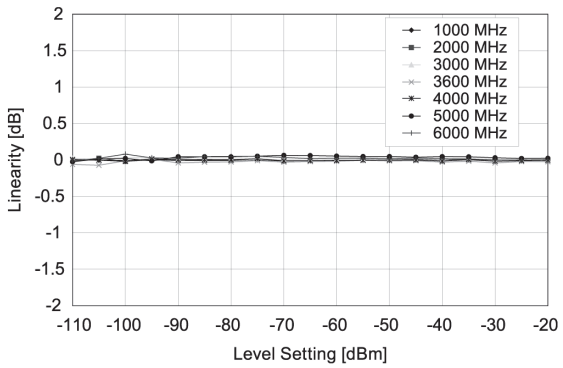
Level Accuracy ±0.5 dB

Output Level Accuracy (CW):
±0.5 dB (typ.)
(–110 dBm ≤ Level ≤ +4 dBm,100 MHz ≤ Frequency ≤ 3.6 GHz)

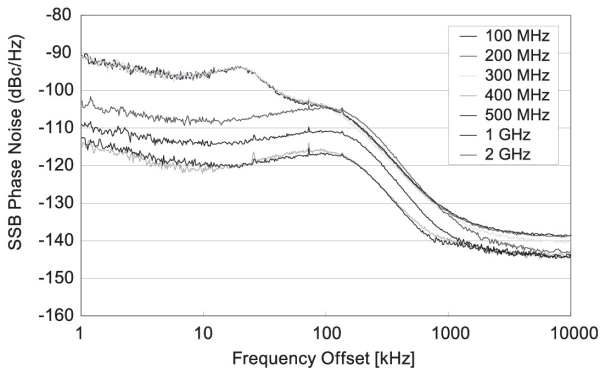
Example: Frequency Characteristics (Referenced to –15 dBm)



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.

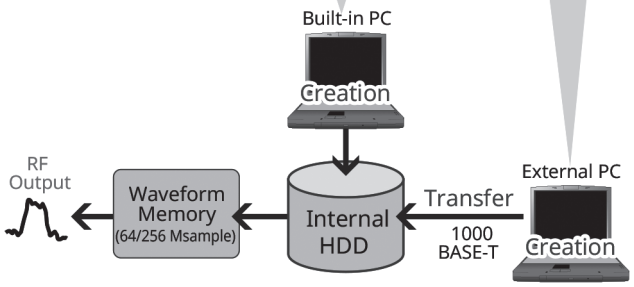
Creating Waveform Using IQproducer

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

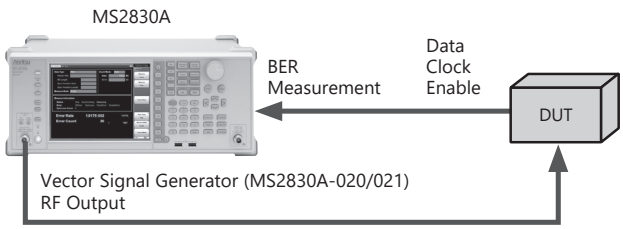
The MS2830A with the BER Measurement Function MS2830A-026 supports measurement up to 10 Mbps.
It supports Rx sensitivity tests by inputting the receiver-demodulated Data/Clock/Enable to the back of the MS2830A.

- 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*

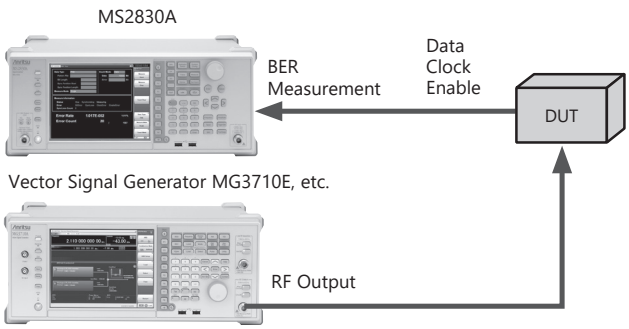
*: Can convert to BNC by connecting AUX conversion adapter (J1556A).

- 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

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 $\pm 1 \times 10^{-9}$ 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)
- High Stability Reference Oscillator/Retrofit MS2830A-002/102
  The 10 MHz reference oscillator improving frequency stability up to aging rate: $\pm 1 \times 10^{-8}$/day
  Aging Rate: $\pm 1 \times 10^{-8}$/day
  Start-up Characteristics: $\pm 5 \times 10^{-8}$ (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 series MS2690A/91A/92A 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	✓	✓	✓	✓	✓+*1	✓+*1
	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	✓	✓	✓	✓	✓+*1	✓+*1
	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	✓	✓*2	✓	✓+*3	✓+*3	✓+*3
Analog (FM/ΦM/AM)	MX269018A	Analog Measurement Software	✓*4	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*5	802.11ac (80 MHz) Measurement Software	✓	✓	✓	✓	✓	✓

*1: The LTE-Advanced Carrier Aggregation measurement range varies as follows, depending on the Analysis Bandwidth Extension option configuration.

Main Frame	Analysis Bandwidth Extension Option Configuration	Maximum Analysis Bandwidth (In-band carrier aggregation range)	Maximum Number of Bands	Maximum Number of Component Carriers
MS2830A	MS2830A-078 installed	125 MHz	1	5
	MS2830A-077 installed	31.25 MHz	3	5
	MS2830A-005/009 installed	31.25 MHz	3	5
MS269xA	MS269xA-078 installed	125 MHz	3	5
	MS269xA-077 installed	31.25 MHz	3	5
	Standard	31.25 MHz	3	5

*2: By the measurement of the narrowband signal, add MS2830A-066. (Channel bandwidth: x kHz to 100 kHz)
MS2830A-044/045 cannot be installed MS2830A-066.

*3: The Symbol Rate setting range varies as follows, depending on the option configuration.

	O-QPSK	FSK	Except FSK	
			Frame Formatted	Non-Formatted
MS2830A-078, 077, 005, 006 installed	0.1 ksps to 12.5 Msps	0.1 ksps to 25 Msps	0.1 ksps to 50 Msps	0.1 ksps to 140 Msps
MS2830A-077, 005, 006 installed	0.1 ksps to 6.25 Msps	0.1 ksps to 12.5 Msps	0.1 ksps to 25 Msps	0.1 ksps to 70 Msps
MS2830A-005, 006 installed	0.1 ksps to 3.125 Msps	0.1 ksps to 6.25 Msps	0.1 ksps to 12.5 Msps	0.1 ksps to 35 Msps
MS2830A-006 installed	0.1 ksps to 1.25 Msps	0.1 ksps to 2.5 Msps	0.1 ksps to 5 Msps	0.1 ksps to 5 Msps

*4: MS2830A-043 can implement only either MS2830A-020/021 or MS2830A-066.
By the system that MS2830A-066 is necessary, MS2830A-020/021 is not added to MS2830A-043.

*5: Requires MX269028A. The IEEE 802.11ac measurement range varies as follows, depending on the Analysis Bandwidth Extension option configuration.

Model			Bandwidth of 802.11ac signal				
Main Frame	Measurement Software	Analysis Bandwidth Extension Option Configuration	20 MHz	40 MHz	80 MHz	160 MHz	80 MHz + 80 MHz
MS2830A	MX269028A-001 (Only for MS2830A)	MS2830A-078 installed	✓	✓	✓*5-2		
		MS2830A-077 installed	✓	✓			
		MS2830A-005/009 installed	✓	✓			
MS269xA	MX269028A-002 (Only for MS269xA)	MS269xA-078 installed	✓	✓	✓	✓	✓*5-1
		MS269xA-077 installed	✓	✓			
		Standard	✓	✓			

*5-1: Measurement required for each carrier signal (80-MHz bandwidth)
*5-2: Measurement is only possible when the carrier signal (80-MHz bandwidth) is input due to the effect of the image response.

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
- 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

*1: Requires MX269908A
*2: Requires MX269910A
*3: Requires MX269911A

IQproducer™ is a trademark of Anritsu Corporation.

Waveform patterns for MS2830A-020/021 VSG

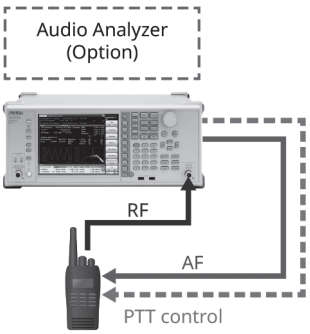
Various waveforms with preset parameters matching each communication method are provided. The MS2830A-020/021 Vector Signal Generator option outputs RF signals.
Pre-installed reference waveforms are saved on the MS2830A hard disk for free use.

- 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

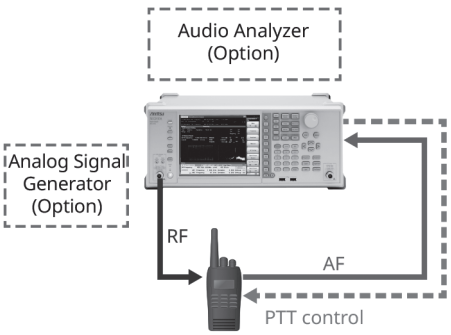
Excellent-Expandability Platform (Analog Radio Equipment Measurement)

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

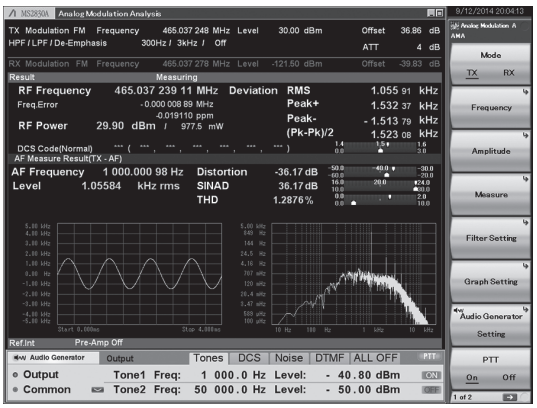


Rx Sensitivity Test Setup

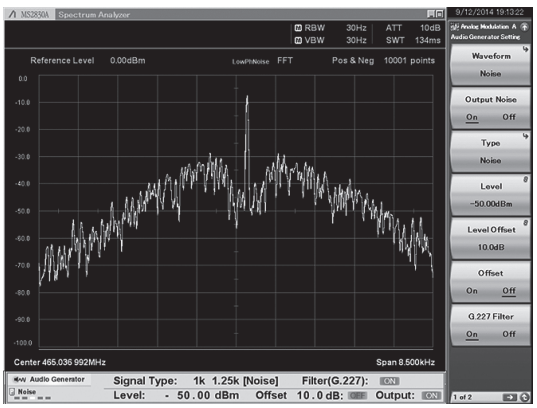
• Tx Tests

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)



Example of AF Signal Output (bottom) and FM Signal (top) Measurement

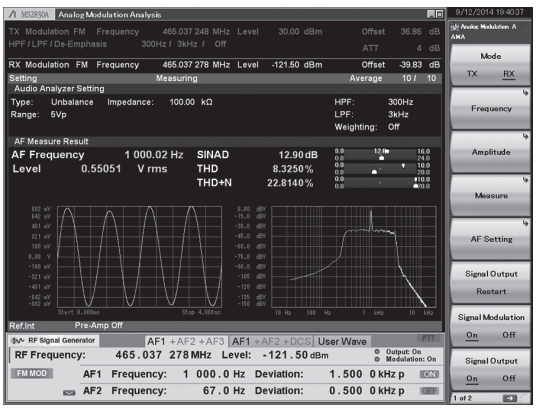


Example of White Noise (ITU-T G.227) Output (bottom) and Spectrum Analyzer (top)

• 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



Example of FM Signal Output (bottom) and AF Signal (top) Measurement

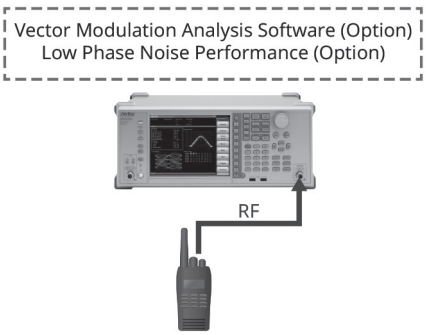
Excellent-Expandability Platform (Digital LMR/PMR Measurement)

Digital Radio (π/4DQPSK, 4FSK, etc.)

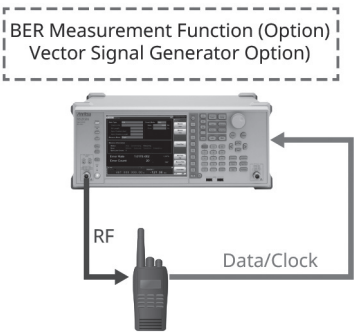
Combining the Vector Modulation Analysis Software MX269017A with the Low Phase Noise Performance MS2830A-066, 3.6 GHz Vector Signal Generator MS2830A-020, and BER Measurement Function MS2830A-026 supports all-in-one measurement of key TRx characteristics of narrow-band digital radio.
As Tx test items, 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,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.

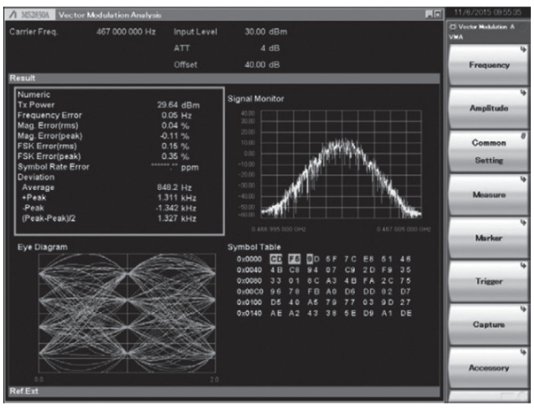


Tx Characteristics Test Setup

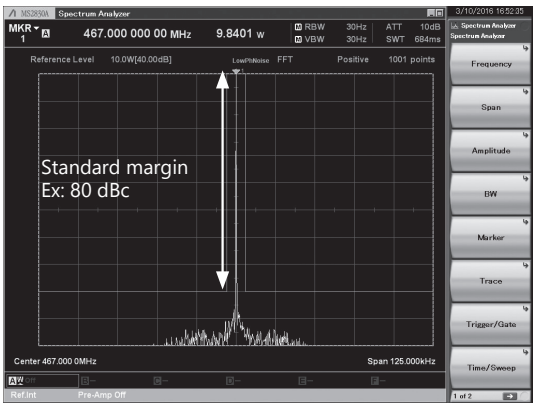


Rx Sensitivity Test Setup

- 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



4FSK Modulation Analysis Measurement Example



Spurious Emissions (out-of-band) Measurement Example

- Rx Tests
  Key Test Items
  Rx Sensitivity (BER)

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

Frequency Range	9 kHz to 3.6 GHz [MS2830A-040] 9 kHz to 6 GHz [MS2830A-041] 9 kHz to 13.5 GHz [MS2830A-043]
Frequency Bands	Frequency Range / Band / Mixer Harmonics Order (N) 9 kHz to 4 GHz / 0 / 1 3.5 GHz to 4.4 GHz / 1 / 1/2 4.3 GHz to 6.1 GHz / 1 / 1 5.9 GHz to 10.575 GHz / 2 / 1 10.425 GHz to 13.6 GHz / 2 / 2
Frequency Setting Range	–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
Pre-Selector Range	MS2830A-041 / MS2830A-043 4 GHz to 6 GHz / 4 GHz to 13.5 GHz (Frequency band mode: Normal) 3.5 GHz to 6 GHz / 3.5 GHz to 13.5 GHz (Frequency band mode: Spurious)
Internal Reference Oscillator	Without MS2830A-001/002 Aging rate: ±1 × 10^{-6}/year, ±1 × 10^{-7}/day Temperature stability: ±2.5 × 10^{-6} (5°C to 45°C) With MS2830A-001 23°C , Referenced to frequency at 24-hour after power-on Start-up characteristics: ±1 × 10^{-9} (7 minutes after power-on) Aging rate: ±1 × 10^{-10}/month Temperature stability: ±1 × 10^{-9} (5°C to 45°C) With MS2830A-002 23°C , Referenced to frequency at 24-hour after power-on Start-up characteristics: ±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 stability: ±2 × 10^{-8} (5°C to 45°C)
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)

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

Second Harmonic Distortion	Without MS2830A-008, or Preamp: Off Mixer input level: –30 dBm

Harmonic Distortion	SHI	
≤–60 dBc	≥+30 dBm	(10 MHz ≤ f ≤ 300 MHz)
≤–65 dBc	≥+35 dBm	(300 MHz < f ≤ 2 GHz)

Mixer input level: –10 dBm

Harmonic Distortion	SHI	
≤–70 dBc	≥+60 dBm	(2 GHz < f ≤ 3 GHz, Frequency band mode: Normal)
≤–70 dBc	≥+60 dBm	(1.75 GHz ≤ f ≤ 3 GHz, Frequency band mode: Spurious)
≤–70 dBc	≥+60 dBm	(3 GHz < f ≤ 6.75 GHz)

With MS2830A-008, Preamp: On
Preamp input level: –45 dBm

Harmonic Distortion	SHI	
≤–50 dBc	≥+5 dBm	(10 MHz ≤ f ≤ 300 MHz)
≤–55 dBc	≥+10 dBm	(300 MHz < f ≤ 3 GHz)

SHI: Second Harmonic Intercept

Residual Responses	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)

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 projections) ≤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
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

Detector	Positive & Negative, Positive peak, Sample, Negative peak, RMS Quasi-Peak, CISPR-AVG, RMS-AVG (with MS2830A-016)
Sweep (trace) Point	SPAN / (blank) 500 MHz < SPAN ≤ 13.5 GHz / 1001 to 30001 100 MHz < SPAN ≤ 500 MHz / 101 to 30001 300 Hz ≤ SPAN ≤ 100 MHz and Sweep Time > 10 s / 101 to 30001 300 Hz ≤ SPAN ≤ 100 MHz and Sweep Time ≤ 10 s / 11 to 30001 SPAN = 0 Hz and Sweep Time > 10 s / 101 to 30001 SPAN = 0 Hz and Sweep Time ≤ 10 s / 11 to 30001 Setting resolution: 1 point
Scale	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)
Trigger	Free run (Trigger off), Video, Wide IF video, External, Frame SG Marker (with MS2830A-020/021)
Gate	Off, Wide IF video, External, Frame SG Marker (with MS2830A-020/021)

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) 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

Function Outline	Captured waveforms can be replayed again by using the VSA function to read saved digitize data
Conditions for Measurable Waveform Data	Format: I, Q (binary format) Combination of span, sampling rate, and minimum capture sample

Span	Sampling Rate	Minimum Capture Sample
1 kHz	2 kHz	74000 (37 s)
2.5 kHz	5 kHz	160000 (32 s)
5 kHz	10 kHz	310000 (31 s)
10 kHz	20 kHz	610000 (30.5 s)
25 kHz	50 kHz	730000 (14.6 s)
50 kHz	100 kHz	730000 (7.3 s)
100 kHz	200 kHz	730000 (3.65 s)
250 kHz	500 kHz	730000 (1.46 s)
500 kHz	1 MHz	730000 (730 ms)
1 MHz	2 MHz	730000 (365 ms)
2.5 MHz	5 MHz	730000 (146 ms)
5 MHz	10 MHz	730000 (73 ms)
10 MHz	20 MHz	730000 (36.5 ms)
18.6 MHz	20 MHz	730000 (36.5 ms)
20 MHz	25 MHz	730000 (29.2 ms)
25 MHz	50 MHz	730000 (14.6 ms)
31.25 MHz	50 MHz	730000 (14.6 ms)
50 MHz	100 MHz	730000 (7.3 ms)
62.5 MHz	100 MHz	730000 (7.3 ms)
100 MHz	200 MHz	730000 (3.65 ms)
125 MHz	200 MHz	730000 (3.65 ms)

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)

Connector Type	Balanced: 1/4-inch phone jack (3-pole, Φ6.3 mm) Unbalanced: BNC-J
Impedance	Balanced: 100Ω/600Ω (AC coupled, nom.) Unbalanced: 50Ω/600Ω (AC coupled, nom.)
Output Waveform	Single tone Multi tone: Tone × 3, DCS, White noise (ITU-T G.227), DTMF
Guaranteed Frequency Range	20 Hz to 25 kHz
Frequency Setting Range	10 Hz to 50 kHz
Frequency Resolution	0.01 Hz
Output Level Range	Using sub supply/audio revision 2*1 Single tone Open circuit voltage (≥100kΩ termination) / Balanced: Off, 1 mV rms to 12.4 V rms Open circuit voltage (≥100kΩ termination) / Unbalanced: Off, 1 mV rms to 6.2 V rms 600Ω termination* / Balanced: Off, –63 dBm (equivalent to 0.5 mV rms) to +18 dBm (equivalent to 6.2 V rms) 600Ω termination* / Unbalanced: Off, –63 dBm (equivalent to 0.5 mV rms) to +12 dBm (equivalent to 3.1 V rms) White noise (through ITU-T G.227 filter) Open circuit voltage (≥100kΩ termination) / Balanced: Off, 1.545 mV rms to 3.083 V rms (nom.) Open circuit voltage (≥100kΩ termination) / Unbalanced: Off, 1.545 mV rms to 1.545 V rms (nom.) 600Ω termination* / Balanced: Off, –60 dBm (equivalent to 0.774 mV rms) to +6 dBm (equivalent to 1.545 V rms) (nom.) 600Ω termination* / Unbalanced: Off, –60 dBm (equivalent to 0.774 mV rms) to 0 dBm (equivalent to 0.774 V rms) (nom.) *: Output Impedance = 600Ω , and Output Impedance Reference = 600Ω
Output Level Resolution	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.)
Level Accuracy	Single tone: ±0.3 dB (1 kHz, 100 kΩ termination, 18°C to 28°C) White noise (through ITU-T G.227 filter): ±3 dB
Maximum Output Currency	100 mA (nom., no short circuit)
THD + N (Total Harmonic Distortion + Noise)	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.)

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

Setting Range	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)
Units	dBm, dBμV (terminated, open)
Resolution	0.01 dB
Output Level Accuracy	18°C to 28°C , CW Without MS2830A-022

	Output Level [p] (dBm)
±0.5 dB (typ., ≤25 MHz)	–40 ≤ p ≤ +2
±0.5 dB (typ., 25 MHz < f ≤ 375 MHz)	–40 ≤ p ≤ +9
±0.5 dB (375 MHz ≤ f ≤ 3.6 GHz)	–40 ≤ p ≤ +9
±0.8 dB (>3.6 GHz)	–40 ≤ p ≤ +4

With MS2830A-022

	Output Level [p] (dBm)
±1.0 dB (typ., ≤25 MHz)	–110 ≤ p ≤ –3
±1.0 dB (typ., 25 MHz < f < 100 MHz)	–110 ≤ p ≤ +4
±0.5 dB (typ., 100 MHz ≤ f < 375 GHz)	–110 ≤ p ≤ +4
±0.5 dB (375 MHz ≤ f ≤ 3.6 GHz)	–110 ≤ p ≤ +4
±0.8 dB (>3.6 GHz)	–110 ≤ p ≤ –1
±1.0 dB (100 MHz ≤ f ≤ 3.6 GHz)	–120 ≤ p < –110
±1.0 dB (typ., 100 MHz ≤ f ≤ 3.6 GHz)	–127 ≤ p < –120
±2.5 dB (typ., >3.6 GHz)	–127 ≤ p < –110

Output Level Linearity

18°C to 28°C , CW

Without MS2830A-022, Referenced to –10 dBm output

	Output Level [p] (dBm)
±0.2 dB (typ., ≤3.6 GHz)	–40 ≤ p ≤ –10
±0.3 dB (typ., >3.6 GHz)	–40 ≤ p ≤ –10

With MS2830A-022, Referenced to –15 dBm output

	Output Level [p] (dBm)
±0.2 dB (typ., ≤3.6 GHz)	–110 ≤ p ≤ –15
±0.3 dB (typ., >3.6 GHz)	–110 ≤ p ≤ –15

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

Vector Accuracy	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)
Carrier Leak	18°C to 28°C , RMS: 0 dB ≤–40 dBc (375 MHz ≤ f ≤ 2.4 GHz)
Image Rejection	18°C to 28°C , use sine wave <10 MHz ≤–40 dBc
ACLR	18°C to 28°C , W-CDMA (Test Model 1 64DPCH) Output level: ≤0 dBm (without MS2830A-022), ≤–5 dBm (with MS2830A-022)

	5 MHz Offset	10 MHz Offset
375 MHz ≤ f ≤ 2.4 GHz	≤–64 dBc/3.84 MHz	≤–67 dBc/3.84 MHz
2.4 GHz < f ≤ 3.6 GHz	≤–59 dBc/3.84 MHz	≤–63 dBc/3.84 MHz
3.6 GHz < f ≤ 6 GHz	≤–56 dBc/3.84 MHz	≤–60 dBc/3.84 MHz

CW and Level Error at Vector Modulation	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

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	$\leq 2^{32} - 1$ 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

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 series MS2690A/91A/92A 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

Output Setting Level	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)
Output Level Accuracy	18°C to 28°C , CW MS2830A-029/088 Output Level [p] (dBm): ±3.0 dB (typ., 100 kHz ≤ f < 250 kHz) / –110 ≤ p ≤ –3 Refer to the MS2830A-020/021 Vector Signal Generator section (with MS2830A-022) for the output level accuracy for other frequency ranges.

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	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.
*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)
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

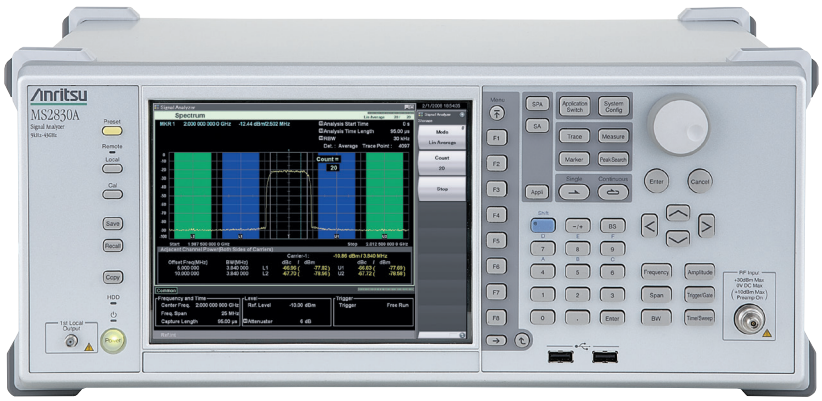
MS2830A Microwave

9 kHz to 26.5 GHz/43 GHz (26.5 GHz to 325 GHz)

Remote Control
GPIB | Ethernet | USB

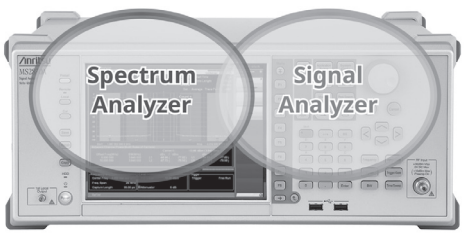
[High Speed + High Performance] × [Low Cost] + Eco-friendly

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.



*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

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: $\pm 1 \times 10^{-7}$/year, $\pm 1 \times 10^{-8}$/day
  Start-up Characteristics: $\pm 5 \times 10^{-8}$ (5 minutes after power-on)
  Rubidium Reference Oscillator (MS2830A-001)
  Aging Rate: $\pm 1 \times 10^{-10}$/month
  Start-up Characteristics: $\pm 1 \times 10^{-9}$ (7 minutes after power-on)

• Versatile Built-in Functions

Channel Power	Occupied Bandwidth
Adjacent Channel Leakage Power	Spectrum Emission Mask*1
Spurious Emission*1	Burst Average Power
Frequency Counter*1	AM Depth*2
FM Deviation*2	Multi-marker & Marker List
Highest 10 Markers	Limit Line*1
2-tone 3rd-order Intermodulation Distortion*1	
Annotation Display (On/Off)	Power Meter*3
Phase Noise*4	Noise Figure*5

• Low-power Consumption
MS2830A-044/045: 190 VA (nom.)

*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)]

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 series MS2690A/91A/92A 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

*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

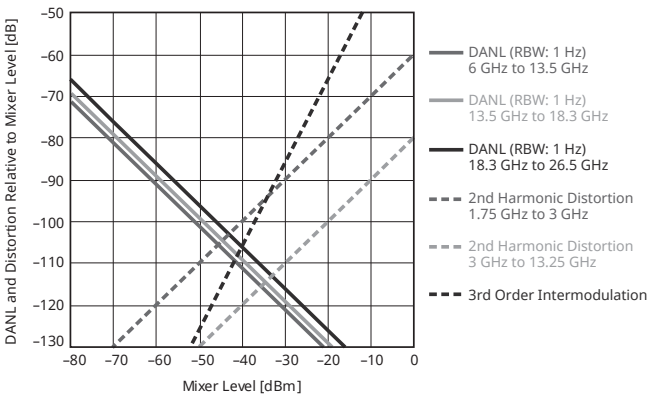
Dynamic Range*10

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 (nom., at 40 GHz)
TOI: ≥ +13 dBm (nom., 26.5 GHz < f ≤ 40 GHz)
DANL: −144 dBm/Hz (34 GHz < f ≤ 40 GHz)

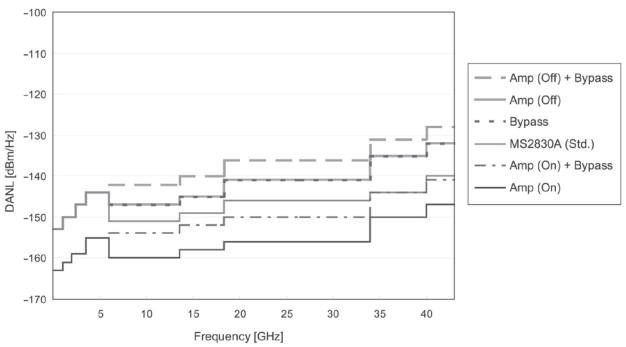
*10: Difference between TOI and DANL as simple guide
*11: TOI (Third Order Intercept)
*12: DANL (Displayed Average Noise Level)

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.

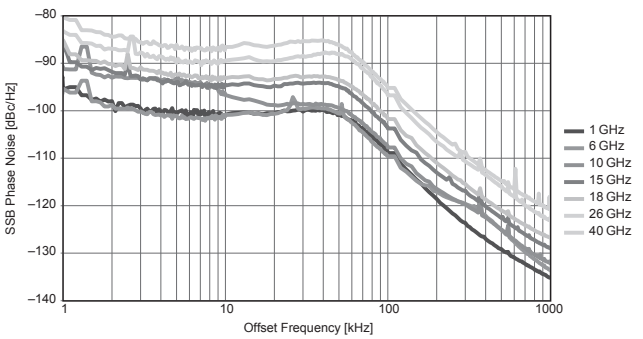
Distortion Characteristics (Spectrum Analyzer)



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

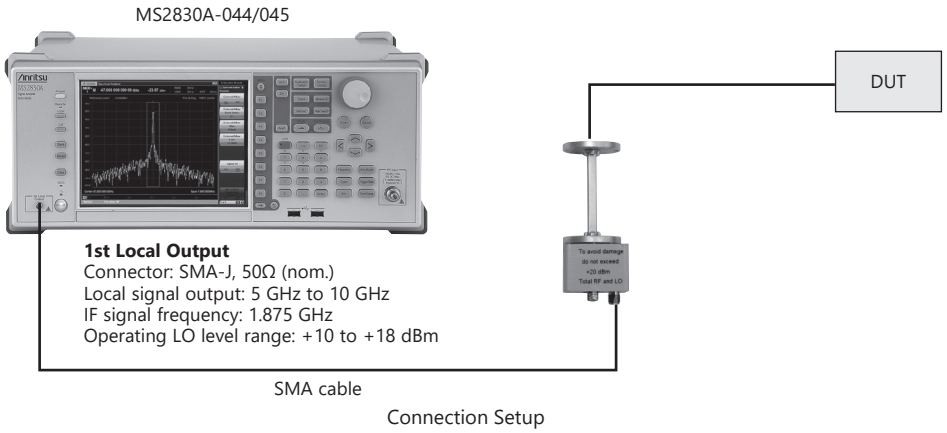
Model No.	Name	Notes
MS2830A	Signal Analyzer	Main unit
MS2830A-044	26.5 GHz Signal Analyzer	Select upper frequency Select one of MS2830A-044 or MS2830A-045 options
MS2830A-045	43 GHz Signal Analyzer	
MA2806A	High Performance Waveguide Mixer (50 to 75 GHz)	Select mixer model Select one of MA2806A or MA2808A
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
MA2741C	External Mixer	A Band	26.5 GHz to 40 GHz	4	+	23	MIL-DTL-3922/54-003	WR28
MA2742C	External Mixer	Q Band	33 GHz to 50 GHz	5	+	26	MIL-DTL-3922/67D-006	WR22
MA2743C	External Mixer	U Band	40 GHz to 60 GHz	6	+	28	MIL-DTL-3922/67D-007	WR19
MA2744C	External Mixer	V Band	50 GHz to 75 GHz	8	+	32	MIL-DTL-3922/67D-008	WR15
MA2745C	External Mixer	E Band	60 GHz to 90 GHz	9	+	36	MIL-DTL-3922/67D-009	WR12
MA2746C	External Mixer	W Band	75 GHz to 110 GHz	11	+	39	MIL-DTL-3922/67D-010	WR10
MA2747C	External Mixer	F Band	90 GHz to 140 GHz	14	+	40	MIL-DTL-3922/67D-M08	WR08
MA2748C	External Mixer	D Band	110 GHz to 170 GHz	17	+	45	MIL-DTL-3922/67D-M06	WR06
MA2749C	External Mixer	G Band	140 GHz to 220 GHz	22	+	50	MIL-DTL-3922/67D-M05	WR05
MA2750C	External Mixer	Y Band	170 GHz to 260 GHz	26	+	65	MIL-DTL-3922/67D-M04	WR04
MA2751C	External Mixer	J Band	220 GHz to 325 GHz	33	+	70	MIL-DTL-3922/67D-M03	WR03

*: The Conversion loss is a typical value near the center frequency of each band but is not a guaranteed specification.

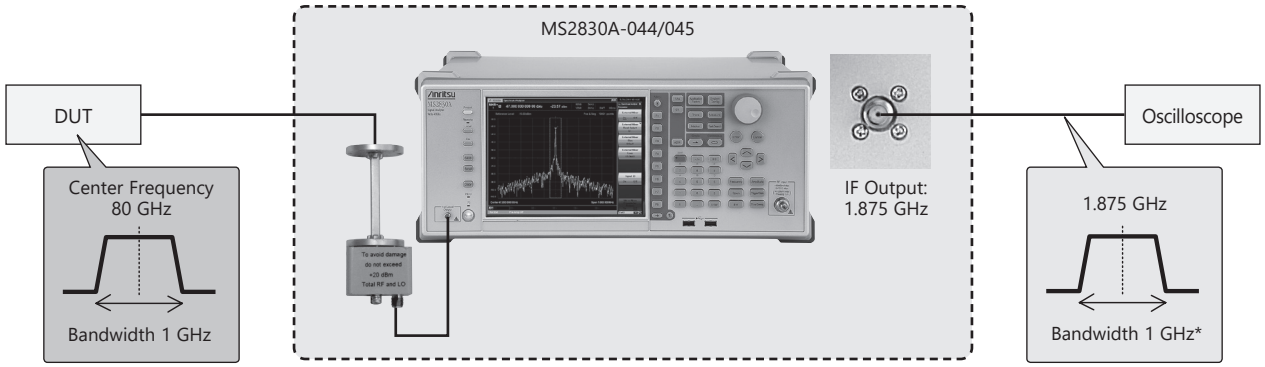


Connection Setup

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

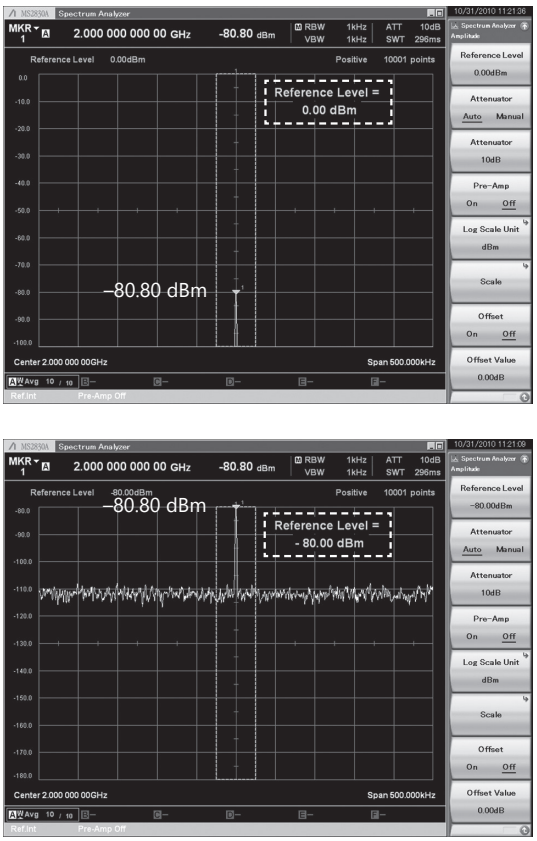
Frequency range: 4 GHz to 26.5 GHz (MS2830A-044, Frequency band mode: Normal)
4 GHz to 43 GHz (MS2830A-045, Frequency band mode: Normal)

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.

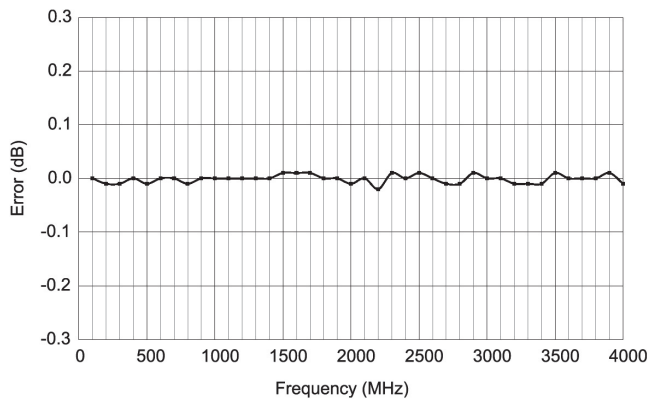
Example: Level Stability by Switching Reference Level



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-005/009.
*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

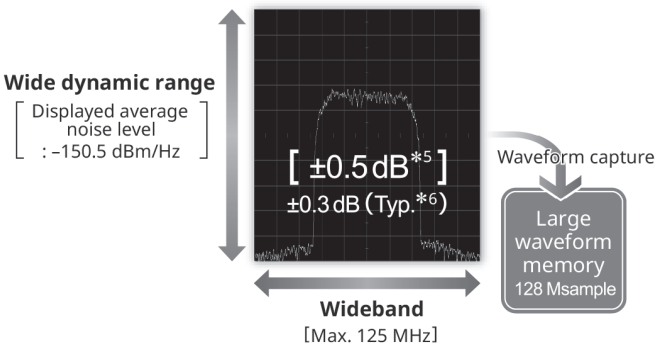
Signal Analyzer: Basic Performance/Functions

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 series MS2690A/91A/92A is recommended for other measurement purposes.

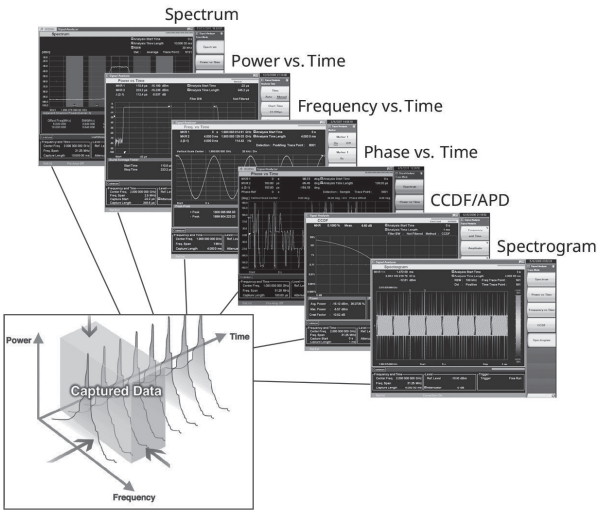
Based on the excellent level accuracy and wide dynamic range of the MS2830A, a signal with an FFT analysis bandwidth of up to 125 MHz can be captured with a level accuracy of ±0.3 dB.



*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

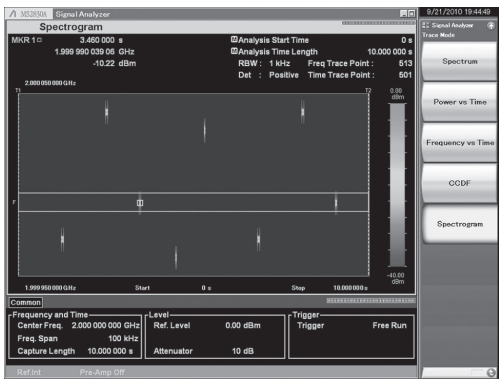
The CCDF trace displays the power variation probability on the y-axis and power variation on the y-axis to confirm the CCDF and APD of measured signals.

*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.

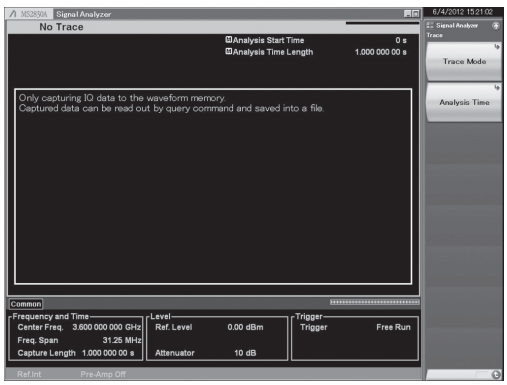
Spectrogram

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.



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.

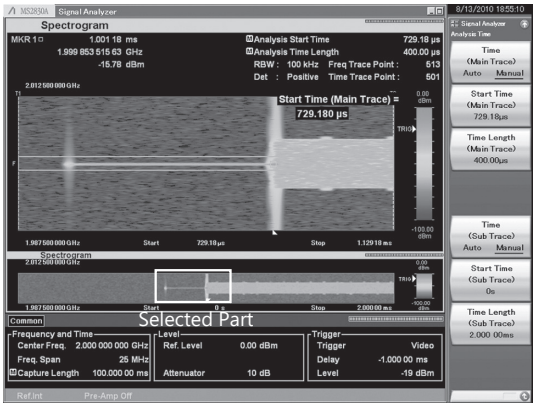


Measurement with Sub-trace Display

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.



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

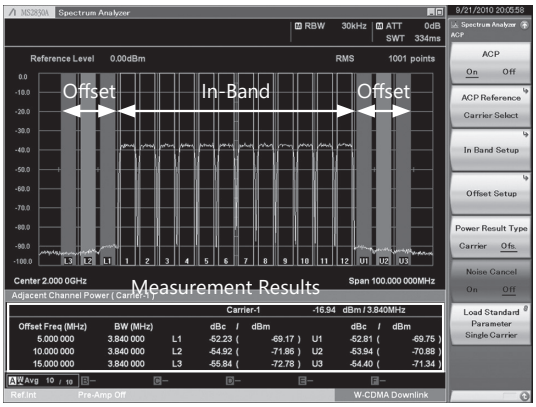
Occupied bandwidth is measured by selecting either the N% or X-dB mode.
Pre-installed templates for each standard support easy parameter setting.

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.

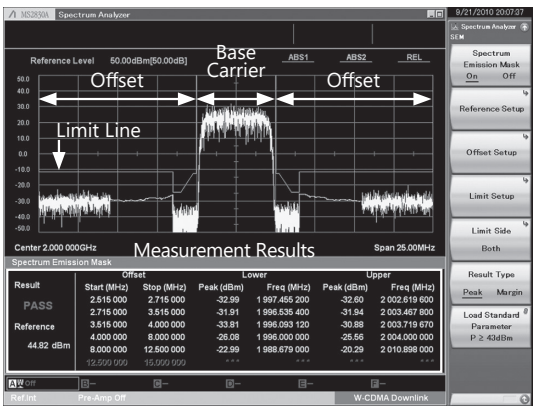


Measurement Results
• Absolute power of Offset channel
• Relative values in relation to reference power selected in ACP reference

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.

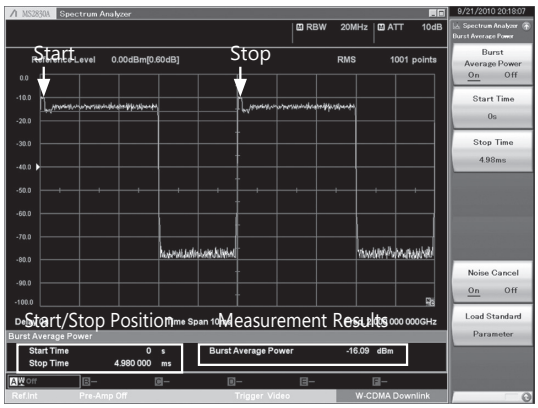


Measurement Results
• Peak power (or margin) at offset
• Each peak frequency

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.

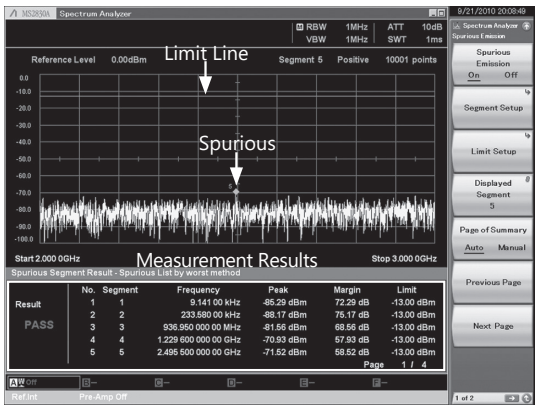


Measurement Results
• Average power of specified range

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.



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

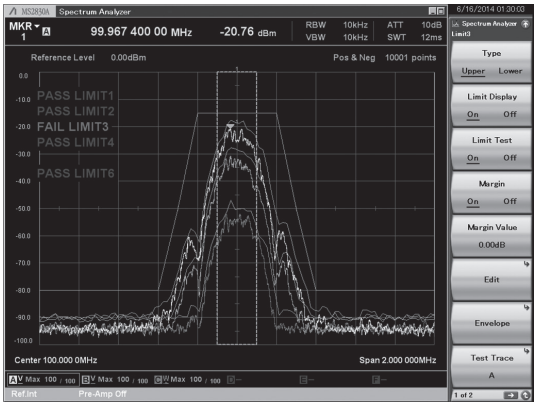
Highest 10 Markers SPA VSA

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



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

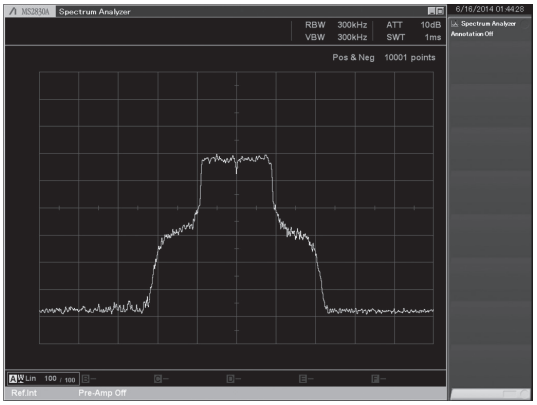
By inputting two different frequency CW signals (desired waves), two-tone third-order intermodulation distortion is generated close to the desired waves according to non-linear characteristics of Device Under Test (DUT). Then, Third Order Intercept (TOI) is calculated from the two-tone third-order intermodulation distortion.

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.

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

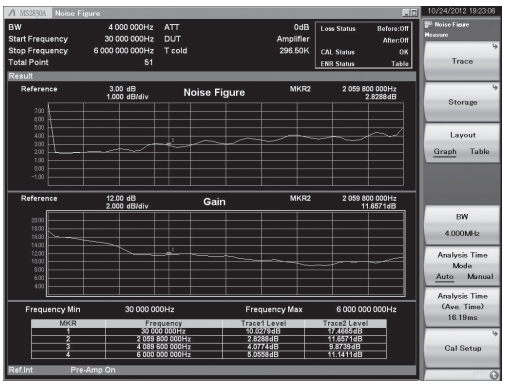
Noise Figure Measurement (MS2830A-017)

Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source*.

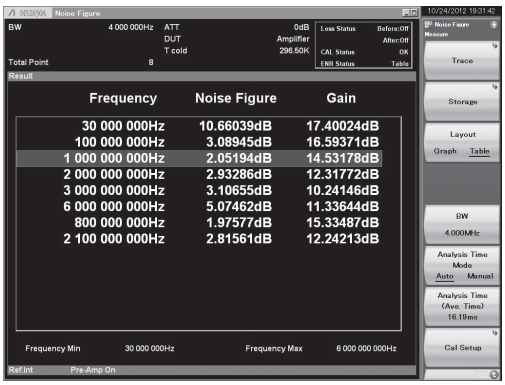
Frequency Mode: Fixed, List, Sweep
DUT Mode: Amplifier, Down Converter, Up Converter
Screen Layout: Graph, Table

Measurement Results Display
Graph, List, Spot

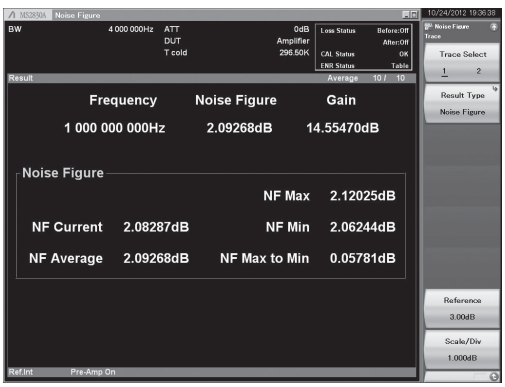
Displays measurement results for each trace (Trace1/Trace2).
Noise Figure (NF) [dB]
Noise Factor (F) [Linear]
Gain
Y-Factor: Power ratio when Noise Source is turned ON/OFF
T effective: Effective noise temperature
P Hot: Power measured when Noise Source is On.
P Cold: Power measured when Noise Source is Off.



Measurement Result: Example of Graph display
(Frequency Mode: Sweep, Screen Layout: Graph)



Measurement Result: Example of List display
(Frequency Mode: List, Screen Layout: List)



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

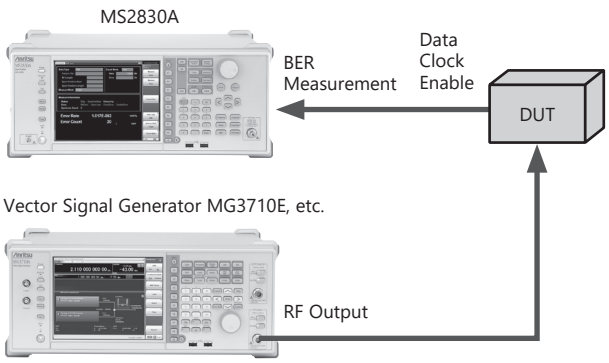
The MS2830A with the BER Measurement Function MS2830A-026 supports measurement up to 10 Mbps.
It supports Rx sensitivity tests by inputting the receiver-demodulated Data/Clock/Enable to the back of the MS2830A.

- 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

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 series MS2690A/91A/92A 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	✓	✓	✓	✓	✓+*1	✓+*1
	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	✓	✓	✓	✓	✓+*1	✓+*1
	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	✓	✓*2	✓	✓+*3	✓+*3	✓+*3
Analog Wireless	MX269018A	Analog Measurement Software	✓*4	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*5	802.11ac (80 MHz) Measurement Software	✓	✓	✓	✓	✓	✓

*1: The LTE-Advanced Carrier Aggregation measurement range varies as follows, depending on the Analysis Bandwidth Extension option configuration.

Main Frame	Analysis Bandwidth Extension Option Configuration	Maximum Analysis Bandwidth (In-band carrier aggregation range)	Maximum Number of Bands	Maximum Number of Component Carriers
MS2830A	MS2830A-078 installed	125 MHz	1	5
	MS2830A-077 installed	31.25 MHz	3	5
	MS2830A-005/009 installed	31.25 MHz	3	5
MS269xA	MS269xA-078 installed	125 MHz	3	5
	MS269xA-077 installed	31.25 MHz	3	5
	Standard	31.25 MHz	3	5

*2: By the measurement of the narrowband signal, add MS2830A-066. (Channel bandwidth: x kHz to 100 kHz)
MS2830A-044/045 cannot be installed MS2830A-066.

*3: The Symbol Rate setting range varies as follows, depending on the option configuration.

	O-QPSK	FSK	Except FSK	
			Frame Formatted	Non-Formatted
MS2830A-078, 077, 005, 006 installed	0.1 ksps to 12.5 Msps	0.1 ksps to 25 Msps	0.1 ksps to 50 Msps	0.1 ksps to 140 Msps
MS2830A-077, 005, 006 installed	0.1 ksps to 6.25 Msps	0.1 ksps to 12.5 Msps	0.1 ksps to 25 Msps	0.1 ksps to 70 Msps
MS2830A-005, 006 installed	0.1 ksps to 3.125 Msps	0.1 ksps to 6.25 Msps	0.1 ksps to 12.5 Msps	0.1 ksps to 35 Msps
MS2830A-006 installed	0.1 ksps to 1.25 Msps	0.1 ksps to 2.5 Msps	0.1 ksps to 5 Msps	0.1 ksps to 5 Msps

*4: MS2830A-043 can implement only either MS2830A-020/021 or MS2830A-066.
By the system that MS2830A-066 is necessary, MS2830A-020/021 is not added to MS2830A-043.

*5: Requires MX269028A. The IEEE 802.11ac measurement range varies as follows, depending on the Analysis Bandwidth Extension option configuration.

Model			Bandwidth of IEEE 802.11ac signal				
Main Frame	Measurement Software	Analysis Bandwidth Extension Option Configuration	20 MHz	40 MHz	80 MHz	160 MHz	80 MHz + 80 MHz
MS2830A	MX269028A-001 (Only for MS2830A)	MS2830A-078 installed	✓	✓	✓*5-2		
		MS2830A-077 installed	✓	✓			
		MS2830A-005/009 installed	✓	✓			
MS269xA	MX269028A-002 (Only for MS269xA)	MS269xA-078 installed	✓	✓	✓	✓	✓*5-1
		MS269xA-077 installed	✓	✓			
		Standard	✓	✓			

*5-1: Measurement required for each carrier signal (80-MHz bandwidth)
*5-2: Measurement is only possible when the carrier signal (80-MHz bandwidth) is input due to the effect of the image response.

See each software catalog for more details.

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: ±5 × 10^{-7} (2 minutes after power-on), ±5 × 10^{-8} (5 minutes after power-on)
Aging rate: ±1 × 10^{-7}/year
Temperature stability: ±2 × 10^{-8} (5°C to 45°C)
With MS2830A-001
23°C, Referenced to frequency at 24-hour after power-on
Start-up characteristics: ±1 × 10^{-9} (7 minutes after power-on)
Aging rate: ±1 × 10^{-10}/month
Temperature stability: ±1 × 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

<table>
<tr><td>Level Measurement Range</td><td>Without MS2830A-008/068, or Preamp: Off
DANL to +30 dBm
With MS2830A-008/068, Preamp: On
DANL to +10 dBm</td></tr>
<tr><td>Maximum Input Level</td><td>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</td></tr>
<tr><td>Input Attenuator Range</td><td>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)</td></tr>
<tr><td>Input Attenuator Switching Uncertainty</td><td>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)</td></tr>
</table>

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

Second Harmonic Distortion

Without MS2830A-008/068, without MS2830A-067
Mixer input level: –30 dBm

Harmonic Distortion	SHI	
≤–60 dBc	≥+30 dBm	(10 MHz ≤ f ≤ 300 MHz)
≤–65 dBc	≥+35 dBm	(300 MHz < f ≤ 1 GHz)
≤–65 dBc	≥+35 dBm	(1 GHz < f ≤ 2 GHz, Frequency band mode: Normal)
≤–65 dBc	≥+35 dBm	(1 GHz < f < 1.75 GHz, Frequency band mode: Spurious)

Mixer input level: –10 dBm

Harmonic Distortion	SHI	
≤–70 dBc	≥+60 dBm	(2 GHz < f ≤ 3 GHz, Frequency band mode: Normal)
≤–70 dBc	≥+60 dBm	(1.75 GHz ≤ f ≤ 3 GHz, Frequency band mode: Spurious)
≤–90 dBc	≥+80 dBm	(3 GHz < f ≤ 13.25 GHz)
≤–90 dBc	≥+80 dBm	(13.25 GHz < f ≤ 21.5 GHz, nom.)

With MS2830A-068, Preamp: Off, or with MS2830A-067, Microwave Preselector Bypass: Off
Mixer input level: –30 dBm

Harmonic Distortion	SHI	
≤–60 dBc	≥+30 dBm	(10 MHz ≤ f ≤ 300 MHz)
≤–65 dBc	≥+35 dBm	(300 MHz < f ≤ 1 GHz)
≤–65 dBc	≥+35 dBm	(1 GHz < f ≤ 2 GHz, Frequency band mode: Normal)
≤–65 dBc	≥+35 dBm	(1 GHz < f < 1.75 GHz, Frequency band mode: Spurious)

Mixer input level: –10 dBm

Harmonic Distortion	SHI	
≤–70 dBc	≥+60 dBm	(2 GHz < f ≤ 3 GHz, Frequency band mode: Normal)
≤–70 dBc	≥+60 dBm	(1.75 GHz ≤ f ≤ 3 GHz, Frequency band mode: Spurious)
≤–70 dBc	≥+60 dBm	(2 GHz < f ≤ 3 GHz, Frequency band mode: Spurious)
≤–70 dBc	≥+60 dBm	(3 GHz < f ≤ 13.25 GHz)
≤–70 dBc	≥+60 dBm	(13.25 GHz < f ≤ 21.5 GHz, nom.)

With MS2830A-008/068, Preamp: On, with MS2830A-067, Microwave Preselector Bypass: Off
Preamp input level: –45 dBm

Harmonic Distortion	SHI	
≤–50 dBc	≥+5 dBm	(10 MHz ≤ f ≤ 300 MHz)
≤–55 dBc	≥+10 dBm	(300 MHz < f ≤ 2 GHz)
≤–45 dBc	≥0 dBm	(2 GHz < f ≤ 13.25 GHz)
≤–40 dBc	≥–5 dBm	(13.25 GHz < f < 21.5 GHz, nom.)

SHI: Second harmonic intercept

Residual Responses

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)

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

Detector	Positive & Negative, Positive peak, Sample, Negative peak, RMS
CISPR Detector	Quasi-Peak, CISPR-AVG, RMS-AVG (with MS2830A-016)
Sweep (Trace) Point	SPAN / Sweep (Trace) Point: > 30 GHz: 5001 to 30001 500 MHz < SPAN ≤ 30 GHz: 1001 to 30001 100 MHz < SPAN ≤ 500 MHz: 101 to 30001 300 Hz ≤ SPAN ≤ 100 MHz and Sweep Time > 10 s: 101 to 30001 300 Hz ≤ SPAN ≤ 100 MHz and Sweep Time ≤ 10 s: 11 to 30001 SPAN = 0 Hz and Sweep Time > 10 s: 101 to 30001 SPAN = 0 Hz and Sweep Time ≤ 10 s: 11 to 30001 Setting resolution: 1 point
Scale	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)
Trigger	Free run (Trigger off), Video, Wide IF video, External, Frame
Gate	Off, Wide IF video, External, Frame

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) With MS2830A-077/078: See Analysis Bandwidth Extension MS2830A-077/078 (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

External Mixer Function (26.5 GHz to 325 GHz)

External Mixer*

Frequency
Frequency range: 26.5 GHz to 325 GHz
Frequency bands:

Model	Band	Frequency Range	Mixer Harmonics Order (N)
MA2741C	A	26.5 GHz to 40 GHz	4+
MA2742C	Q	33 GHz to 50 GHz	5+
MA2743C	U	40 GHz to 60 GHz	6+
MA2744C	V	50 GHz to 75 GHz	8+
MA2745C	E	60 GHz to 90 GHz	9+
MA2746C	W	75 GHz to 110 GHz	11+
MA2747C	F	90 GHz to 140 GHz	14+
MA2748C	D	110 GHz to 170 GHz	17+
MA2749C	G	140 GHz to 220 GHz	22+
MA2750C	Y	170 GHz to 260 GHz	26+
MA2751C	J	220 GHz to 325 GHz	33+

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

*: 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.

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 series MS2690A/91A/92A 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 (For MS2830A. 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: Power Cord:	1 pc 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)
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)
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.))
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 J1556A AUX Conversion Adapter is a standard accessory supplied with BER Measurement Function MS2830A-026/126.

*8: The B0636C Carrying Case 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

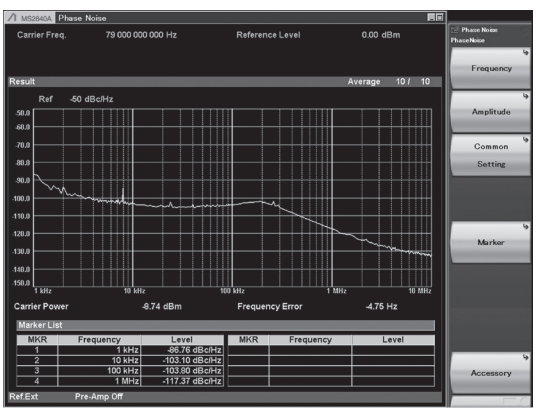
MA2808A

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.

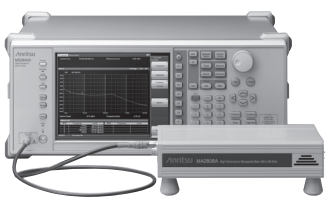
Moreover, by using the high IF frequency*2 of the MS2850A/MS2840A series (26.5 GHz/44.5 GHz models)/MS2830A series (26.5 GHz/43 GHz models), spectrum mask measurements can be made over a wide measurement span with no impact from image-response effects. Spectrum mask measurements require measurement over 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.

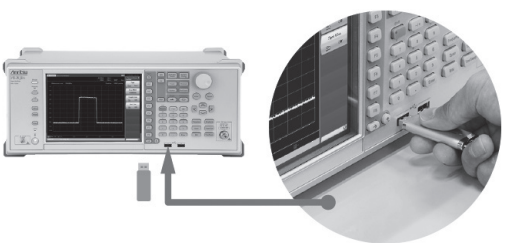
*1: Example when connected with MS2840A. Value measured at design but not guaranteed specification.
*2: 1.8755 GHz (MS2850A/MS2840A), 1.875 GHz (MS2830A)



Phase Noise measurement with MS2840A using High Performance Waveguide Mixer MA2808A (Measurement frequency: 79 GHz)

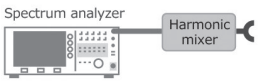
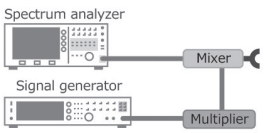


Simple Connection



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

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

V2X 802.11p Message Evaluation Software

MX727000A

Decrease Burden for V2X Middleware Development

V2X 802.11p Message Evaluation Software MX727000A

Supports Required Message Evaluations and Measurements for V2V and V2I Communications

The V2X 802.11p Measurement and Analysis Software MX727000A is designed to be used in conjunction with the Signal Analyzer MS269xA/MS2830A to demodulate, analyze, and display V2X messages.
The MX727000A has the application options shown in Figure 1.

V2X 802.11p Message Evaluation Software MX727000A

- **V2X Message Analysis for US Standard MX727020A**
  - Message Definition US2016 MX727020A-PL016
- **V2X Message Analysis for EU Standard MX727030A**
  - Message Definition EU2016 MX727030A-PL016
- **V2X Message Analysis for Japanese Standard MX727040A**
  - Message Definition JP2016 MX727030A-PL016

Figure 1: V2X 802.11p Message Evaluation Software MX727000A Configuration

V2X Message Analysis MX727020A/30A/40A

The V2X Message Analysis is the MX727000A application to capture the signal with V2X Message using the Signal Analyzer MS269xA/MS2830A, and to decode, display V2X Message. It supports V2X message standards for the three main markets of United States, Europe, and Japan, and shows its power at middleware development.

Middleware Evaluation Tools

Conventionally, developers face big challenges in correctly evaluating key data (messages) sent by wireless equipment at V2X middleware development. Previously, developers ran two-way tests between test prototypes after collating bit strings and ASCII code, which caused heavy work burdens. However, debugging two-way communications at tests between prototypes is not simple and particularly so for different regional communications standards. However, this way is not difficult to find the bug because developers cannot find such bug with two-way test and developer may interpret something wrongly. With its integrated development environment for comparing V2X messages developed in-house and by other companies, the V2X Message Analysis MX727020A/30A/40A software makes it easy to objectively evaluate messages using impartial measurements. Figure 2 shows a typical setup.

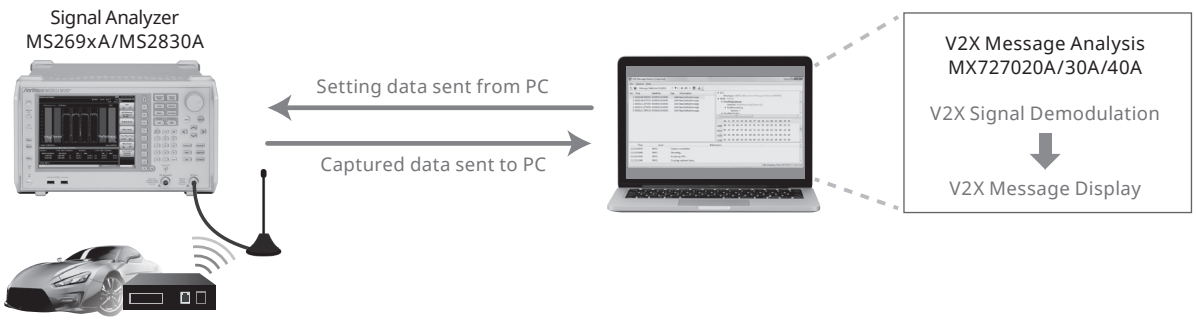
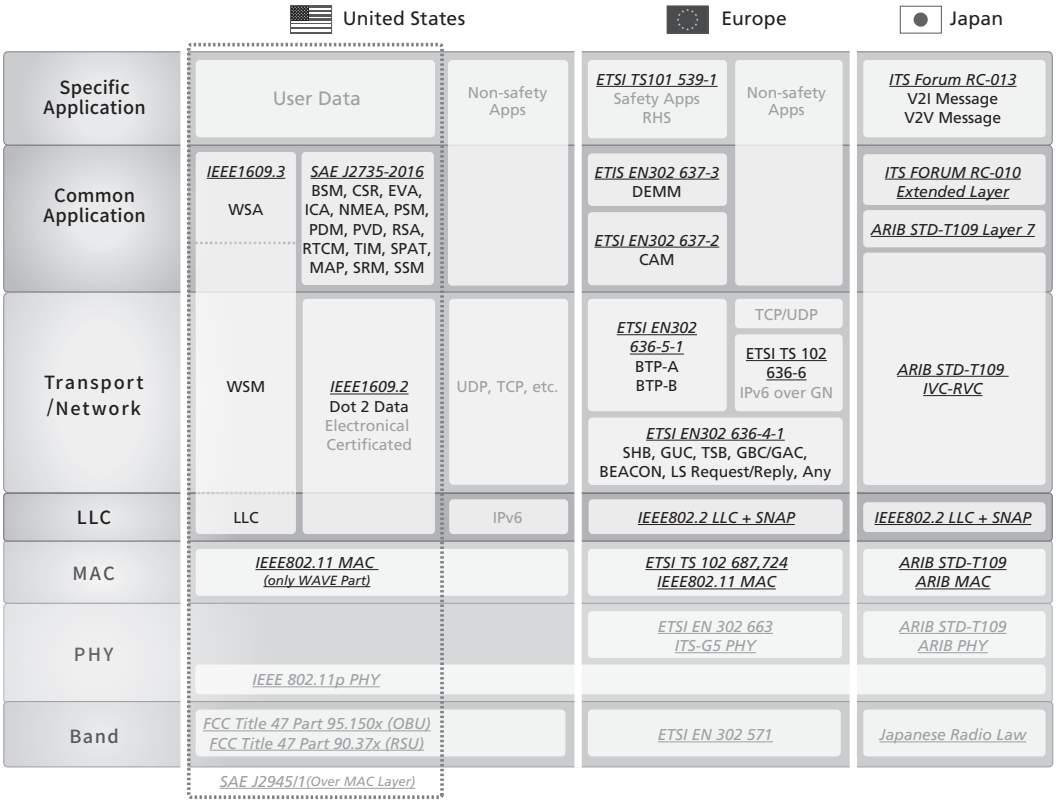


Figure 2: V2X Message Analysis using MX727020A/30A/40A

Evaluations from MAC to Applications Layers/Standard Tools for, United States, Europe and Japanese Message Definitions

Due to different standard in US, Europe and Japan, the developers need to develop V2X Message stack for all regions.
The V2X Message Analysis MX727020A/30A/40A supports the safety message definition of US, Europe and Japanese standard, and also supports the wide-ranging evaluation from MAC to Application layers which are extremely difficult to analyze using wireless two-way testing.
This means that not only can V2X messages be evaluated in-house with no need to visit Plugfest events and/or perform field tests, but also test engineers have a "magic wand" for improving V2X product quality and cutting development and test man hours. Message definitions that can be evaluated are listed in Figure 3.



*: Items in black are supported.

Figure 3: Message Definition Evaluations Supported by V2X Message Evaluation MX727020A/30A/40A

Easy-to-Understand Displays of Incorrect Messages from Wireless Equipment

When bugs occur in V2V and V2I complex middleware, it can be extremely difficult to troubleshoot the cause. If the V2X Message Analysis software discovers an error in a supported message definition or an argument in a message definition, the background of the relevant part changes as shown in the following figure, helping cut debugging time and improve development efficiency.

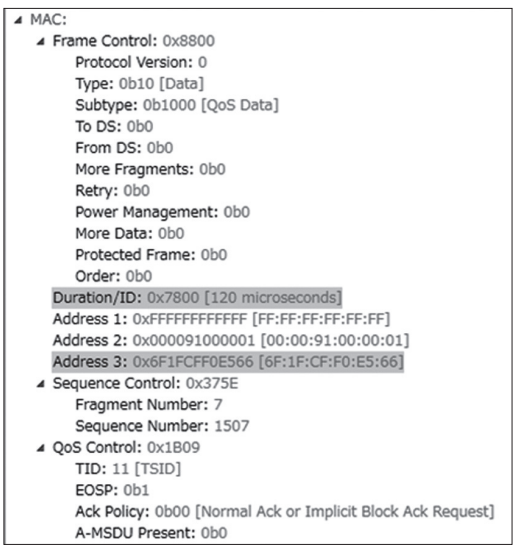


Figure 4: Undefined Message Display Examples

Specifications

V2X 802.11p Message Evaluation Software MX727000A

PC	Operating Environment OS: Microsoft Windows 7 SP1 (64-bit) Microsoft Windows 10 (64-bit) Memory: 8 GB min. HDD Free Space: 20 GB min. Screen Resolution: Full HD 1920 × 1080 min Ethernet I/F: 1000BASE-T (RJ-45) * Other: National Instruments NI-VISA version 16.0, Microsoft NET Framework version 4.6.2

V2X Message Analysis MX727020A/30A/40A

Supported Measuring Instruments	Signal Analyze MS2692A/91A/90A, MS2830A The signal analyzer and vector signal generator embedded OS requires Windows 7.
Supported Standards	United States: IEEE802.11-2012, IEEE802.2-1998, IEEE1609.2-2016 (partly), IEEE1609.3-2016, IEEE1609.12-2016, SAR J2735 MAR 2016 Europe: IEEE802.11-2012, IEEE802.2-1998, IEEE802-2014, ETSI EN302 636-4-1 v1.2.1, ETSI EN 302 636-5-1 v1.2.1, ETSI EN 302 637-2 v1.2.1, ETSI EN 302 637-3 v1.2.1, ETSI TS 103 097 v1.2.1 Japan: IEEE Std 802.11-2012, ARIB STD-109 Ver.1.2, ITS Forum RC-010 Ver.1.0, ITS Forum RC-013 Ver.1.0

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
MX727000A	V2X 802.11p Message Evaluation Software
MX727020A	V2X Message Analysis for US Standard
MX727020A-PL016	Message Definition US2016
MX727030A	V2X Message Analysis for EU Standard
MX727030A-PL016	Message Definition EU2016
MX727040A	V2X Message Analysis for Japanese Standard
MX727040A-PL016	Message Definition JP2016

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, 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. 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, 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 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, Full Span, Last Span, Zero Span
Amplitude	Reference Level (Manual/Auto), Scale/Division, Ref Level Offset, Attenuation (Auto, Manual), Units (dBm), Preamp (On/Off)
Bandwidth	RBW, Auto RBW, VBW, Auto VBW, VBW/RBW Ratio, Span/RBW Ratio, VBW Log/Lin Averaging

Sweep Functions

Sweep	Single/Continuous, Restart, Sweep Once, Sweep to N, Gated Sweep (see Gated Sweep (Option 90))
Sweep Time	60 ns to 3600 s in zero span
Sweep Time Accuracy	±2% in zero span
Sweep Points	10 to 10,001 (1001 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

Spectrogram

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
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

General Specifications

Setup Parameters

Date and Time	Date and Time settings, Time Zone settings, Time synced to Internet/GPS
Languages	English
Display	Brightness adjustment, Auto screen dimming shutoff timer (on/off), Color schemes (Standard, Inverted)
Screen Shot Settings	Image capture size, Image header/footer
Option Configuration	Enable options using file (USB)
GPS	GPS Receiver (Option 31)
Ethernet	Ethernet (IP4 & IP6 formats), Type (DHCP, Static)
WLAN (Wi-Fi)	2 × 2 MIMO, 802.11 a/b/g/n/ac, On/Off, Auto detect wireless networks
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	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)
External Power	5.5 mm barrel connector, 13.5 V 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 (connect FAT32 formatted media and power sensors) USB 3 Type C (connect secondary devices)
Headset Jack	3.5 mm 3-wire headset jack (functionality supported in future software update)
External Reference In	SMB (m), 50Ω, maximum input +10 dBm
External Reference Out	SMB (m), 50Ω, 10 MHz
External Trigger	SMB (m), 50Ω, TTL-compatible levels, maximum input +5 VDC
IF Out	SMB (m), 50Ω (Zero Span IF Output (Option 89))
DC Bias Voltage	SMB (m), 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
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 drawer, shortcuts, screen capture, lock status (touchscreen), notification bar, 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, EN61000-4-2 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

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-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-0421	Pulse Analyzer
MS2090A-0431	Coverage Mapping
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, 7 ft/213 cm
2000-1931-R	Stylus
3-2000-1928	Shoulder Strap
633-75	Li-Ion 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
2000-1938-R	SMB Plug to BNC Jack Adapter (qty 3)
806-366-R	BNC to SMB Cable, 1 m
	Certificate of Calibration and Conformance

Spectrum Master™ High Performance Handheld Spectrum Analyzer

MS2720T

9 kHz to 9 GHz, 13 GHz, 20 GHz, 32 GHz, 43 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
	MS2720T-0732	9 kHz to 32 GHz
	MS2720T-0743	9 kHz to 43 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 43 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, 732, 743; 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
	32 GHz, 43 GHz Instruments				
	>100 kHz to 13 GHz	±1.3 dB	±0.5 dB	±2.3 dB	±0.5 dB
	>13 GHz to 40 GHz	±2.3 dB	±0.5 dB	±3.3 dB	±0.5 dB
	>40 GHz to 43 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
	13 GHz to 43 GHz Instruments				
	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 13 GHz	–136 dBm	–139 dBm	–156 dBm	–159 dBm
	20 GHz Instrument				
	>13 GHz to 20 GHz	–136 dBm	–142 dBm	–155 dBm	–161 dBm
	32 GHz to 43 GHz Instruments				
	>13 GHz to 20 GHz	–134 dBm	–141 dBm	–152 dBm	–158 dBm
	>20 GHz to 32 GHz	–135 dBm	–140 dBm	–154 dBm	–159 dBm
	>32 GHz to 40 GHz	–127 dBm	–130 dBm	–148 dBm	–151 dBm
	>40 GHz to 43 GHz	—	–130 dBm	—	–151 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.)	
	>20 GHz to 32 GHz	–80 dBm (max.)		–100 dBm (max.)	
	>32 GHz to 43 GHz	–80 dBm (max.)		–95 dBm (max.)	
	Input-Related Spurious (–30 dBm input)	Maximum*2		Typical	
		–60 dBc		–70 dBc	

*1: Values below 100 kHz are with the preamplifier turned off.
*2: Instrument centered on single signal, span <1.7 GHz

Continued on next page

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.)
	>20 GHz to 32 GHz	+15 dBm (typ.)
	>32 GHz to 43 GHz	+20 dBm (typ.)
P1dB	<4 GHz	+5 dBm (nom.)
	4 GHz to 20 GHz	+12 dBm (nom.)
	>20 GHz to 32 GHz	+7 dBm (nom.)
	>32 GHz to 43 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.)
	13 GHz to 43 GHz Instruments	
	<20 GHz	1.5:1 (typ.)
	20 GHz to 43 GHz	2.0:1 (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)

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, Pre-Amp, Detection			
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span			
	Bandwidth	RBW, Auto RBW, VBW, Auto VBW, VBW/Average Type (Linear/Log), RBW/VBW Ratio, Span/RBW Ratio			
	Generator	On/Off, Output Power, Mode (CW/Tracking), Settings, Transmission Measurement			
	Tracking Generator Settings	External Gain/Loss, Power Statistics (On/Off)			
	Transmission Measurement Settings	Normalize (Off/On), Scale, Reference Position and Amplitude, Transmission Statistics and Offset			
	Maximum Continuous Input	+23 dBm, ±50 VDC			
Frequency	MS2720T-0809	100 kHz to 9 GHz			
	MS2720T-0813	100 kHz to 13 GHz			
	MS2720T-0820	100 kHz to 20 GHz			
	Frequency Accuracy	Aging: ±1.0 × 10^{-6} per 10 years Accuracy: ±0.3 × 10^{-6} (25°C±25°C) plus aging			
Output Power	100 kHz to 20 GHz	–40 to 0 dBm			
	Step Size	0.1 dB (nom.)			
	Dynamic Range				
	9 GHz Instrument	>110 dB (typ.) 100 kHz to 7 GHz >100 dB (typ.) >7 GHz to 9 GHz			
	13 GHz and 20 GHz Instruments	>100 dB (typ.) 100 kHz to 12 GHz >80 dB (typ.) >12 GHz to 20 GHz			
Level Accuracy (At least 30 minute warm-up after 1 hour non-operating at 15°C to 35°C ambient, excludes load VSWR effects)	Frequency Range	20°C to 30°C (after 30 minute warm-up)		0°C to 50°C (after 60 minute warm-up)	
	100 kHz to 9 GHz >9 GHz to 13 GHz >13 GHz to 18 GHz	Maximum ±1.5 dB ±1.6 dB ±2.0 dB	Typical ±0.5 dB ±1.0 dB ±1.0 dB	Maximum ±2.0 dB ±2.1 dB ±2.5 dB	Typical ±1.0 dB ±1.5 dB ±1.5 dB
VSWR	100 kHz to 5 GHz	2:1 (typ.)			
	>5 GHz to 20 GHz	4:1 (typ.)			

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

Continued on next page

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
MS2720T	**Main Frame** Spectrum Master (Requires Option 709, 713, 720, 732, or 743)
	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
MS2720T-0732	Frequency Range 9 kHz to 32 GHz
MS2720T-0743	Frequency Range 9 kHz to 43 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

Continued on next page

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

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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)

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 2300-1605-R	USB 3.0 Type C to Type A Cable, 1 m 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

MS2711E 9 kHz to 3 GHz
MS2712E 9 kHz to 4 GHz
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 3 GHz, 4 GHz, or 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 3 GHz (MS2711E)
- 9 kHz to 4 GHz (MS2712E)
- 9 kHz to 6 GHz (MS2713E)
- Interference Analyzer:
  Spectrogram, Signal Strength, RSSI, Signal ID, Interference Mapping
- DANL: –142 dBm in 100 Hz RBW with Preamp Option (MS2711E)
  –162 dBm in 1 Hz RBW (MS2712E/MS2713E)
- Dynamic Range:
  >85 dB in 100 Hz RBW (MS2711E)
  >102 dB in 1 Hz RBW (MS2712E/MS2713E)
- Phase Noise:
  –90 dBc/Hz max @ 10 kHz offset at 1 GHz (MS2711E)
  –100 dBc/Hz max @ 10 kHz offset at 1 GHz (MS2712E/MS2713E)
- Frequency Accuracy:
  <±1.5 ppm, <±50 ppb with GPS Option 31 (MS2711E)
  <±50 ppb with GPS On (MS2712E/MS2713E)

Functions and Description

MS2711E

- Store 2000 Traces internally
- Internal Preamplifier Optional
- Internal Power Meter Optional
- High Accuracy Power Meter Optional
- EMF Test Optional
- 4, 6, 8, 18, 26 GHz Power Sensors
- Channel Scanner Optional
- <5 minute warm-up time
- Touchscreen keyboard
- USB Data Transfer
- Master Software Tools
- 3 hour battery operation time
- Tracking Generator Optional

MS2712E and MS2713E

- 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

*: Indicates option not available in the MS2711E

Specifications

Spectrum Analyzer

Frequency	Frequency Range	9 kHz to 3 GHz (tunable to 0 Hz) (MS2711E), 9 kHz to 4 GHz (MS2712E), 9 kHz to 6 GHz (MS2713E) (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 3 GHz including zero span (MS2711E), 10 Hz to 4 GHz including zero span (MS2712E), 10 Hz to 6 GHz including zero span (MS2713E)
	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) (100 Hz to 3 MHz for MS2711E)
	Video Bandwidth (VBW)	1 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth) (auto or manually selectable) (10 Hz to 3 MHz for MS2711E)
	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	–90 dBc/Hz, –100 dBc/Hz typical @ 10 kHz offset (MS2711E) –95 dBc/Hz, –102 dBc/Hz typical @ 100 kHz offset (MS2711E) –105 dBc/Hz, –111 dBc/Hz typical @ 1 MHz offset (MS2711E) –100 dBc/Hz, –110 dBc/Hz (typ., 10 kHz offset) (MS2712E/MS2713E) –105 dBc/Hz, –112 dBc/Hz (typ., 100 kHz offset) (MS2712E/MS2713E) –115 dBc/Hz, –121 dBc/Hz (typ., 1 MHz offset) (MS2712E/MS2713E)
Amplitude Ranges	Dynamic Range	>85 dB (2.4 GHz), 2/3 (TOI-DANL) in 100 Hz RBW (MS2711E) >102 dB (2.4 GHz), 2/3 (TOI-DANL) in 1 Hz RBW (MS2712E/MS2713E)
	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 3.0 GHz	±1.25 dB, ±0.5 dB (typ.) (MS2711E)
	100 kHz to 4.0 GHz	±1.25 dB, ±0.5 dB (typ.) (MS2712E/MS2713E)
	>4.0 GHz to 6 GHz	±1.50 dB, ±0.5 dB (typ.) (MS2712E/MS2713E)

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Displayed Average Noise Level (DANL)

RBW Normalized to 1 Hz, 0 dB attenuation (MS2711E)

	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 3 GHz	–137 dBm	–141 dBm	–154 dBm	–159 dBm

RBW= 100 Hz, 0 dB attenuation (MS2711E)

	Preamp Off (Reference level –20 dBm)		Preamp On (Reference level –50 dBm)	
	Maximum	Typical	Maximum	Typical
10 MHz to 2.4 GHz	–121 dBm	–126 dBm	–137 dBm	–142 dBm
>2.4 GHz to 3 GHz	–117 dBm	–121 dBm	–134 dBm	–139 dBm

RBW= 1 Hz, 0 dB attenuation (MS2712E/MS2713E)

	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 3.0 GHz (MS2711E) >2.2 GHz to 5.0 GHz (MS2712E/MS2713E)	+28 dBm (typ.)
	>5.0 GHz to 6.0 GHz (MS2712E/MS2713E)	+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 3 GHz (MS2711E), 500 kHz to 4 GHz (MS2712E), 500 kHz to 6 GHz (MS2713E)
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) (MS2712E/MS2713E)

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 3 GHz (MS2711E), 10 MHz to 4 GHz (MS2712E), 10 MHz to 6 GHz (MS2713E)
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	Triangulate location of interference with on-display maps (MS2711E) Draw multiple bearings of signal strength from GPS location on on-screen map (MS2712E/MS2713E) Pan and Zoom on-screen maps (MS2712E/MS2713E) Support for MA2700A Handheld Interference Hunter (see Optional Accessories) (MS2712E/MS2713E)
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other) (MS2712E/MS2713E)

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	100 kHz to 3 GHz (MS2711E), 9 kHz to 4 GHz (MS2712E), 9 kHz to 6 GHz (MS2713E)
Frequency Accuracy	±10 Hz + Time base error
Measurement Range	–110 to +26 dBm
Application Options	Impedance (50Ω, 75Ω, Other) (MS2711E) Bias-Tee (On/Off) (MS2712E/MS2713E)

Gated Sweep (Option 90) (MS2712E/MS2713E)

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) (MS2712E/MS2713E) (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 (MS2712E/MS2713E)	P-SS, S-SS, and RS are measured and displayed based on each Cell ID received
	W-CDMA OTA (MS2712E/MS2713E)	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 3 GHz (MS2711E) 2000-1791-R: 700 MHz to 6 GHz (MS2712E/MS2713E)
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) (MS2712E/MS2713E)
	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
MS2711E	Spectrum Analyzer (9 kHz to 3 GHz)
MS2712E	Spectrum Analyzer (9 kHz to 4 GHz)
MS2713E	Spectrum Analyzer (9 kHz to 6 GHz)
	MS2711E Options
MS2711E-0019	High-Accuracy Power Meter (Requires External Power Sensor)
MS2711E-0025	Interference Analyzer (Option 31 recommended)
MS2711E-0027	Channel Scanner
MS2711E-0029	Power Meter
MS2711E-0444	EMF Measurements (Requires Anritsu Isotropic Antenna)
MS2711E-0098	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate.
MS2711E-0099	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate, test report, and uncertainty data.
MS2711E-0008	Preamplifier
MS2711E-0020	Tracking Generator
MS2711E-0031	GPS Receiver (Requires antenna)
MS2711E-0509	AM/FM/PM Analyzer
	MS2712E Options
MS2712E-0010	Bias-Tee
MS2712E-0009	20 MHz BW Demod
MS2712E-0031	GPS Receiver (Requires GPS antenna)
MS2712E-0019	High-Accuracy Power Meter (Requires External Power Sensor)
MS2712E-0029	Power Meter
MS2712E-0025	Interference Analyzer (Option 31 recommended)
MS2712E-0027	Channel Scanner
MS2712E-0431	Coverage Mapping (Requires Option 31)
MS2712E-0444	EMF Measurements (Requires Anritsu Isotropic Antenna)
MS2712E-0090	Gated Sweep
MS2712E-0020	Tracking Generator
MS2712E-0509	AM/FM/PM Analyzer
MS2712E-0880	GSM/GPRS/EDGE Measurements (Requires Option 9)
MS2712E-0881	W-CDMA/HSPA+ Measurements (Requires Option 9; Option 31 recommended)
MS2712E-0882	TD-SCDMA/HSPA+ Measurements (Requires Option 9; requires Option 31 for full functionality)
MS2712E-0883	LTE/LTE-A FDD/TDD Measurements (Requires Option 9; requires Option 31 for full functionality)
MS2712E-0884	CDMA/EV-DO Measurements (Requires Option 9; requires Option 31 for full functionality)
MS2712E-0885	WiMAX Fixed/Mobile Measurements (Requires Option 9; requires Option 31 for full functionality)
MS2712E-0886	LTE 256QAM Demodulation (Requires Option 883)
MS2712E-0887	NB-IoT Measurements (Requires Option 9)
MS2712E-0030	ISDB-T Digital Video Measurements (Requires Option 9)
MS2712E-0032	ISDB-T SFN Measurements (Requires Option 9)
MS2712E-0079	ISDB-T BER Measurements (Requires Options 9 and 30. Cannot be ordered with Option 759)
MS2712E-0064	DVB-T/H Digital Video Measurements (Requires Option 9)
MS2712E-0078	DVB-T/H SFN Measurements (Requires Option 9)
MS2712E-0057	DVB-T/H BER Measurements (Requires Option 64. Cannot be ordered with Option 759)
MS2712E-0098	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate.
MS2712E-0099	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate, test report, and uncertainty data.
	MS2713E 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)

Continued on next page

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

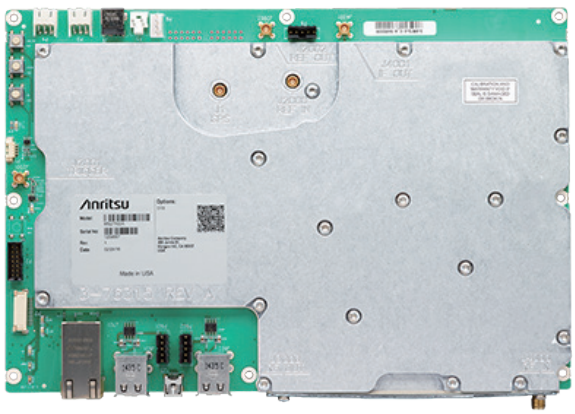
Model/Order No.	Name
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N (m) - N (f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N (m) - N (f)
42N50A-30	30 dB, 50 W, DC to 18 GHz, N (m) - N (f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N (m) - N (f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N (m) - N (f)
3-1010-124	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 (MS2712E, MS2713E)
1091-418-R	N (m) to QMA (m), DC to 18 GHz, 50Ω (MS2712E, MS2713E)
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 (MS2712E, MS2713E)
510-91-R	7/16 DIN (f) to N (f), DC to 7.5 GHz, 50Ω (MS2712E, MS2713E)
510-92-R	7/16 DIN (m) to N (m), DC to 7.5 GHz, 50Ω (MS2712E, MS2713E)
510-93-R	7/16 DIN (m) to N (f), DC to 7.5 GHz, 50Ω (MS2712E, MS2713E)
510-96-R	7/16 DIN (m) to 7/16 DIN (m), DC to 7.5 GHz, 50Ω (MS2712E, MS2713E)
510-97-R	7/16 DIN (f) to 7/16 DIN (f), DC to 7.5 GHz, 50Ω (MS2712E, MS2713E)
510-102-R	N (m) to N (m), DC to 11 GHz, 50Ω, 90 degrees right angle (MS2712E, MS2713E)
	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

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	<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
Amplitude Units	Log Scale Modes: dBm, dBµV

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
MS27100A	**Standard Hardware** Spectrum Monitor Module with 1 RF IN Port (requires one frequency option)
MS27100A-0406 MS27100A-0706	**Hardware Options** Enables USB Interface to 6-port RF multiplexer (requires 2000-1894-R) 9 kHz to 6 GHz Frequency Range
40-187-R	**Standard Accessories** (includes with instrument) AC-DC Adapter
2000-1849-R 3-67367	**Optional Accessories** 6-Port Multiplexer Module (requires software Option 406 above) USB-A to HC5 5-pin header cable, 30 cm (included with 2000-1894-R)

Remote Spectrum Monitor

MS27101A/MS27102A/MS27103A

9 kHz to 6 GHz

For Remote RF Signal Monitoring

Excellent Eco Product

MS27101A
1/2 Rack model

MS27102A
Operates outodoor model

MS27103A
Multi-port model

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.

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

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) Typical

≤3 GHz	>40 dB
>3 GHz	>30 dB

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

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)

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
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-0479	Vision AM Demodulation/FM Deviation
MS27101A-0485	Vision Spectrum Occupancy (Requires Option 400)
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-0479	Vision AM Demodulation/FM Deviation
MS27102A-0485	Vision Spectrum Occupancy (Requires Option 400)
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-0479	Vision AM Demodulation/FM Deviation
MS27103A-0485	Vision Spectrum Occupancy (Requires Option 400)
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)

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.

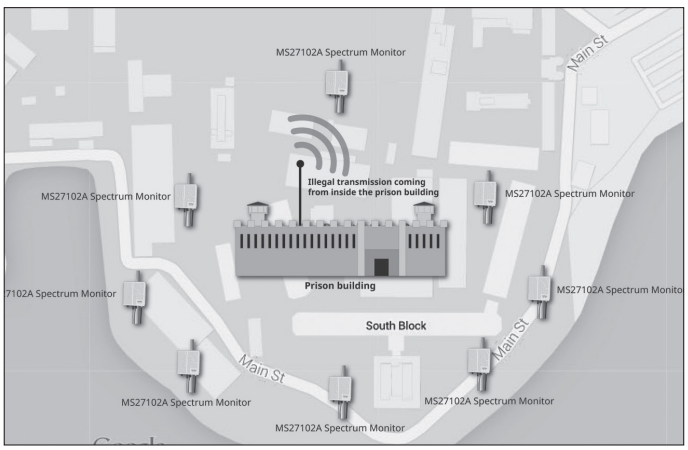


Figure 1: Monitoring for Illegal Transmissions from Prison Facility

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.

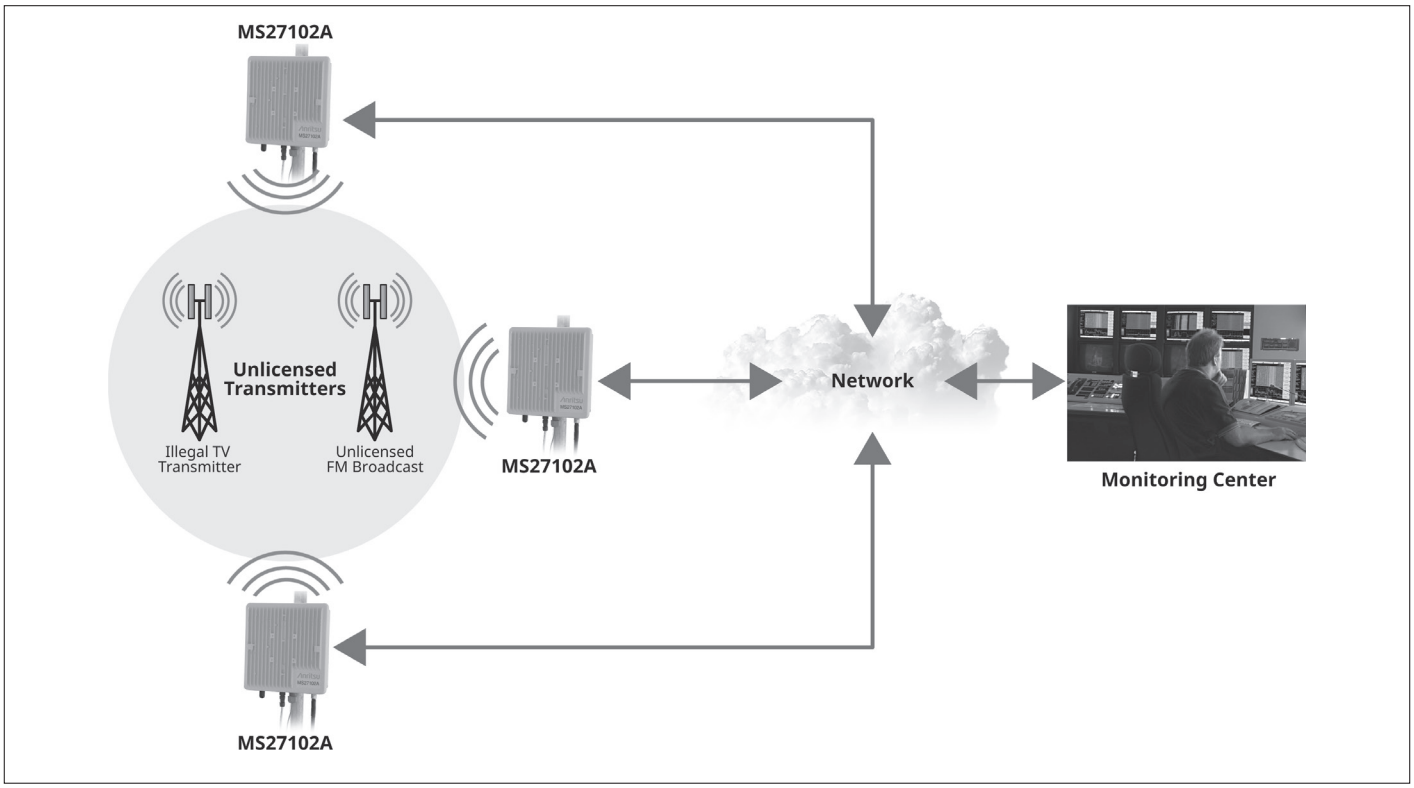


Figure 2: Spectrum Monitoring System

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, or 10). 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.

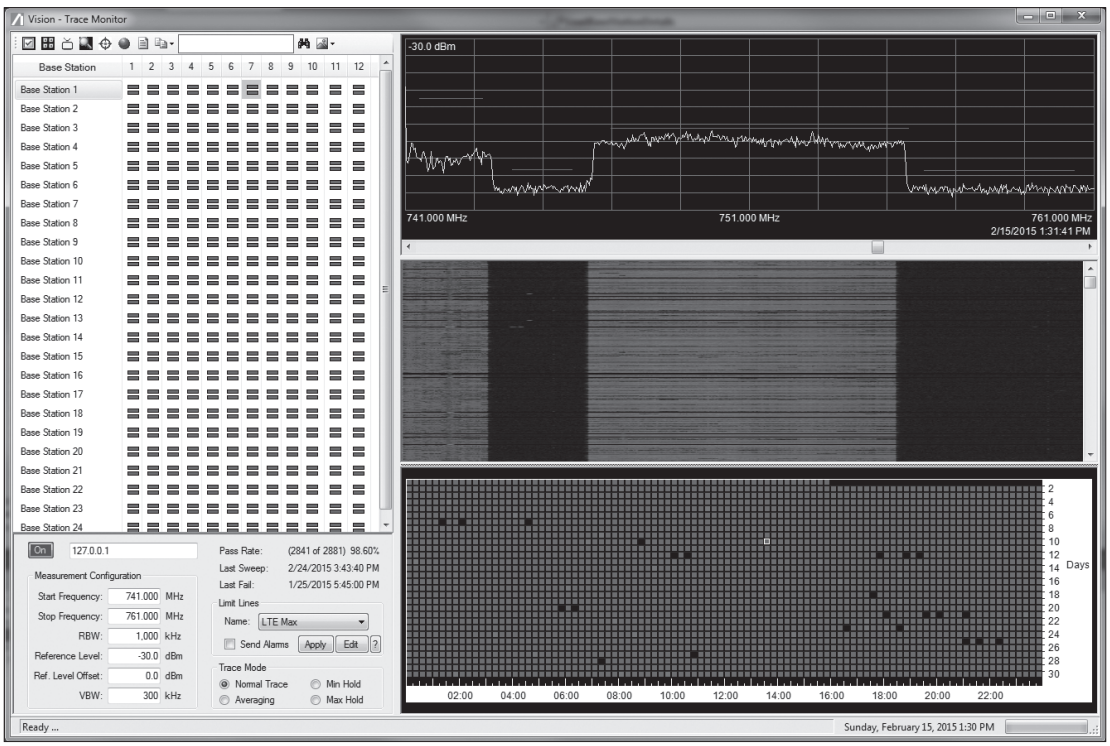


Figure 6: Vision Monitor Screen

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.

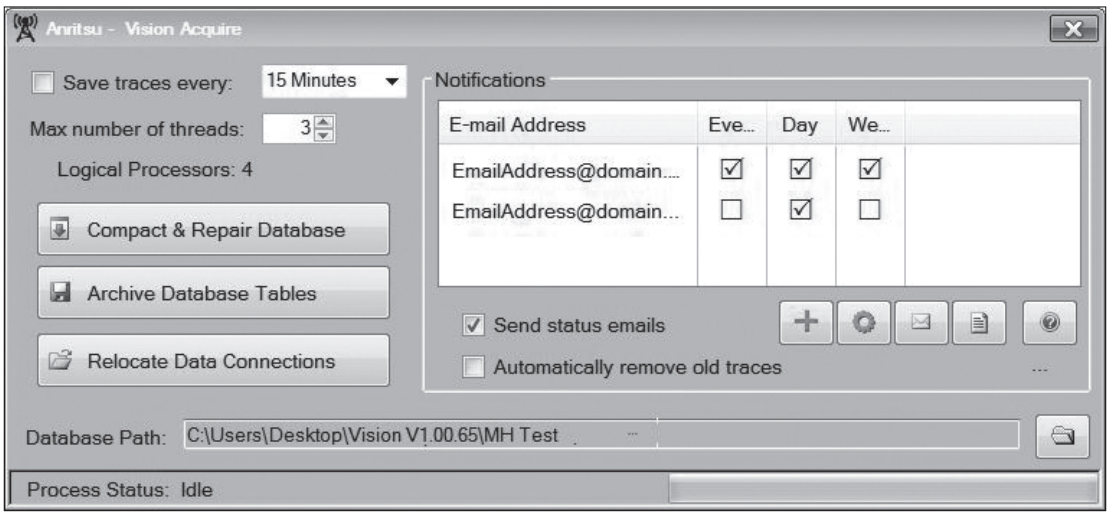


Figure 7: Vision Monitor Measurement and Database Control

With Vision Monitor, the user 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 overlayed on a map. Both GoogleMaps and OpenStreetMap are available to use with Vision Monitor. 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.

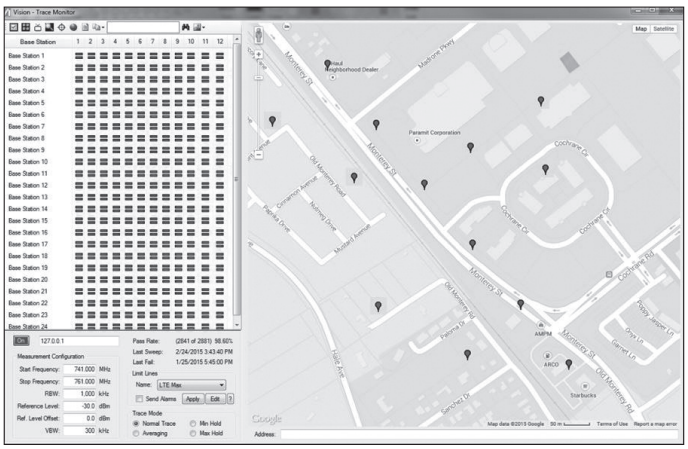


Figure 8: Monitor Positions Overlaid on Map

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.

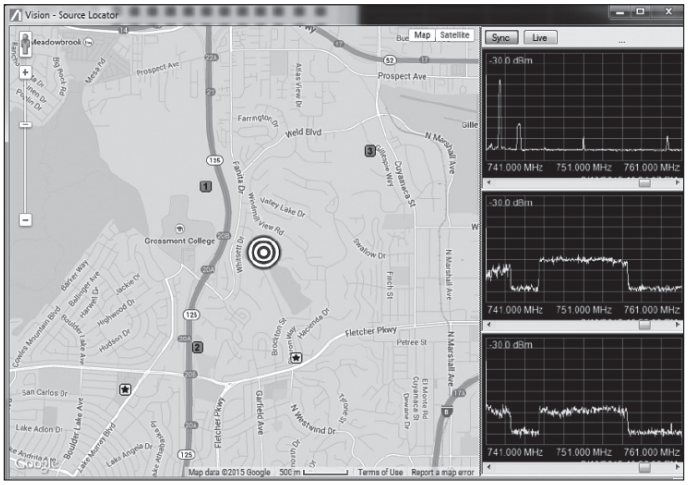


Figure 9: Geo-Location of Interference Position

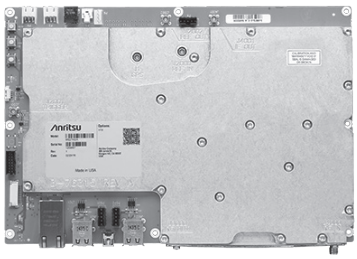
Remote Spectrum Monitoring Hardware

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.

Remote Spectrum Monitor MS27103A
(24-Port RF Input option shown)

Remote Spectrum Monitor MS27101A

Remote Spectrum Monitor MS27102A



Remote Spectrum Monitor MS27100A

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

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)