Anritsu Advancing beyond

For Signal Analyzer MS2690A/MS2691A/MS2692A
For Signal Analyzer MS2850A/MS2840A/MS2830A

MX2690xxA series
MX2830xxA series
MX2840xxA series
MX2850xxA series

Measurement Software

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

Signal Analyzers MS269xA, MS2830A, MS2840A and MS2850A

The Signal Analyzer MS269xA is the high-end model supporting best-of-class high-accuracy, a wide dynamic range and 125 MHz wideband analysis. The MS2850A, MS2840A and MS2830A are the mid-range model with excellent cost performance supporting superior RF performance, best-of-class speed, and low power consumption.

Model	Feature	Frequency Range	Analysis Bandwidth
MS269xA*1 (High-end model) 	■ High level accuracy up to 6 GHz expandable to 5G, and 125 MHz wideband ■ 177 dB dynamic range without external filter for spurious measurements	MS2690A 50 Hz to 6 GHz MS2691A 50 Hz to 13.5 GHz MS2692A 50 Hz to 26.5 GHz	31 .25 MHz (Standard) 62 .5 MHz (Option: MS269xA-077) 125 MHz (Option: MS269xA-078)
MS2850A (Middle-range model) 	■ Analysis bandwidth: 1 GHz max. ■ For R&D and manufacturing cost reduction of 5G and wideband systems including microwave/millimeter wave communications systems, such as satellite broadcasting	9 kHz to 32 GHz 9 kHz to 44.5 GHz	255 MHz (Standard) 510 MHz (Option: MS2850A-033) 1 GHz (Option: MS2850A-034)
MS2840A (Middle-range model) 	■ Highest level phase noise performance among middle-range models ■ High cost-performance ratio as replacement for aging high-end models	9 kHz to 3.6 GHz 9 kHz to 6 GHz 9 kHz to 26.5 GHz 9 kHz to 44.5 GHz	31 .25 MHz (Standard) 62 .5 MHz (Option: MS2840A-077)*2 125 MHz (Option: MS2840A-078)*2
MS2830A (Middle-range model) 	■ High-speed, low-cost, low power consumption cuts manufacturing costs ■ Environment-friendly energy saving design ■ Multiple versatile measurement options	9 kHz to 3.6 GHz 9 kHz to 6 GHz 9 kHz to 13.5 GHz 9 kHz to 26.5 GHz 9 kHz to 43 GHz	None (Standard) 10 MHz (Option: MS2830A-006) 31 .25 MHz (Option: MS2830A-005/009) 62 .5 MHz (Option: MS2830A-077)*2 125 MHz (Option: MS2830A-078)*2

*1: The software package can be purchased separately.
*2: 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/MS2830A analysis bandwidth (125 MHz max.).
The Signal Analyzer MS2850A is recommended for other measurement purposes.

Main Unit Measurement Functions

The MS2850A, MS2840A and MS2830A series of signal analyzers has the following built-in spectrum analyzer and signal analyzer functions used in combination with measurement software.

- Spectrum
- Spectrum Emission Mask
- FM Deviation
- Frequency Counter
- Frequency vs. Time
- Channel Power
- Burst Average Power
- Multi-marker & Marker List
- 2-tone 3rd-order Intermodulation Distortion
- Phase vs. Time
- Occupied Bandwidth
- Spurious Emission
- Highest 10 Markers
- Annotation Display
- CCDF/APD*
- Adjacent Channel Leakage Power
- AM Depth
- Limit Line
- Power vs. Time
- Spectrogram

*: CCDF: Complementary Cumulative Distribution Function, APD: Amplitude Probability Density

Hardware Option (Measurement Functions)

The following measurement functions can be added as hardware options to the MS2850A, MS2840A and MS2830A series of signal analyzers (depending on the model). For details refer to the relevant main-frame brochure.
Phase Noise Measurement Function, Noise Figure Measurement Function, Precompliance EMI Function, etc.

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

Signal Analyzers MS269xA, MS2830A, MS2840A and MS2850A

The MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series of measurement software can be used by the MS269xA, MS2850A, MS2840A and MS2830A.

■ Required Analysis Bandwidth Options for Each Model

✓ = Can be installed, R = Require, U = Upgrade

Communications Systems	Name	Model	Page	MS269xA	MS269xA Option	MS2830A	MS2830A Option			MS2840A	MS2840A Option	MS2850A	MS2850A Option	
					077/078		006	005/009	077/078		077/078		033	034
W-CDMA/HSPA/ HSPA Evolution	W-CDMA/HSPA Downlink Measurement Software	MX269011A	5	✓		✓	R					✓		
	W-CDMA/HSPA Uplink Measurement Software	MX269012A	7	✓		✓	R					✓		
GSM/EDGE	GSM/EDGE Measurement Software	MX269013A	9	✓		✓	R					✓		
EDGE Evolution	EDGE Evolution Measurement Software	MX269013A-001*8	9	✓		✓	R					✓		
ETC/DSRC	ETC/DSRC Measurement Software	MX269014A	11	✓										
Vector Modulation	Vector Modulation Analysis Software	MX269017A	13	✓	U	✓	R	U	U	✓	U	✓		
	APSK Analysis	MX269017A-001*17	13							✓	U	✓		
	Higher-Order QAM Analysis	MX269017A-011*17	13							✓	U	✓		
Analog (FM/øM/AM)	Analog Measurement Software	MX269018A*9	23			✓				✓				
Pulse Radar	Pulse Radar Measurement Function	MX284059B*19	32							✓				
LTE/ LTE-Advanced (FDD)	LTE Downlink Measurement Software	MX269020A	35	✓		✓	R	R				✓		
	LTE-Advanced FDD Downlink Measurement Software	MX269020A-001*10	35	✓	U	✓	R	R	U			✓		
	LTE Uplink Measurement Software	MX269021A	41	✓		✓	R	R				✓		
	LTE-Advanced FDD Uplink Measurement Software	MX269021A-001*13	41	✓	U	✓	R	R	U			✓		
LTE/ LTE-Advanced (TDD)	LTE TDD Downlink Measurement Software	MX269022A	35	✓		✓	R	R				✓		
	LTE-Advanced TDD Downlink Measurement Software	MX269022A-001*11	35	✓	U	✓	R	R	U			✓		
	LTE TDD Uplink Measurement Software	MX269023A	41	✓		✓	R	R				✓		
	LTE-Advanced TDD Uplink Measurement Software	MX269023A-001*14	41	✓	U	✓	R	R	U			✓		
5G	5G Standard Measurement Software (Base License)	MX285051A	57									✓		
	Pre-Standard CP-OFDM Downlink	MX285051A-001*16	57									✓	U	U
	Pre-Standard CP-OFDM Uplink	MX285051A-051*16	57									✓	U	U
	NR TDD sub-6 GHz Downlink	MX285051A-011*16	59									✓		
	NR TDD sub-6 GHz Uplink	MX285051A-061*16	59									✓		
	NR FDD sub-6 GHz Downlink	MX285051A-031*16	59									✓		
	NR FDD sub-6 GHz Uplink	MX285051A-081*16	59									✓		
	NR TDD mmWave Downlink	MX285051A-021*16	59									✓	U	U
	NR TDD mmWave Uplink	MX285051A-071*16	59									✓	U	U
	5G Standard Measurement Software (Base License)	MX269051A	66	✓										
	NR TDD sub-6 GHz Downlink	MX296051A-011*18	66	✓	U									
	NR TDD sub-6 GHz Uplink	MX269051A-061*18	66	✓	U									
	NR FDD sub-6 GHz Downlink	MX296051A-031*18	66	✓	U									
	NR FDD sub-6 GHz Uplink	MX269051A-081*18	66	✓	U									
WLAN	WLAN (802.11) Measurement Software (Supports IEEE 802.11a/11b/11g/11j/11n/11p)	MX269028A	47	✓		✓	R	R						
	802.11ac (80 MHz) Measurement Software	MX269028A-001*12	47			✓	R	R	R					
	802.11ac (160 MHz) Measurement Software	MX269028A-002*12	47	✓	R									
Millimeter Wave Radar/Sensor	External Mixer Connection Function	MX284090A*20	71			✓	R			✓		✓		

Signal Analyzers MS269xA, MS2830A, MS2840A and MS2850A

Note, the MS269xA, MS2830A, MS2840A and MS2850A require the following options:

[MS269xA Options]	
Analysis Bandwidth Extension to 62.5 MHz	MS269xA-077
Analysis Bandwidth Extension to 125 MHz	MS269xA-078*1
[MS2850A Options]	
Analysis Bandwidth Extension 510 MHz	MS2850A-033
Analysis Bandwidth Extension 1 GHz	MS2850A-034*17
[MS2840A Options]	
Analysis Bandwidth Extension to 62.5 MHz	MS2840A-077
Analysis Bandwidth Extension to 125 MHz	MS2840A-078*2
[MS2830A Options]	
Analysis Bandwidth Extension to 31.25 MHz	MS2830A-005*3
Analysis Bandwidth 10 MHz	MS2830A-006
Bandwidth Extension to 31.25 MHz for Millimeter-wave	MS2830A-009*4
Analysis Bandwidth Extension to 62.5 MHz	MS2830A-077*5, *7
Analysis Bandwidth Extension to 125 MHz	MS2830A-078*6, *7

*1: MS269xA-077 is necessary.
*2: MS2840A-077 is necessary.
*3: Available only when MS2830A-040/041/043/044 is installed. Requires MS2830A-006.
*4: Available only when MS2830A-045 is installed. Requires MS2830A-006.
*5: Requires MS2830A-006 and MS2830A-005 (for MS2830A-040/041/043/044).
Requires MS2830A-006 and MS2830A-009 (for MS2830A-045).
*6: Requires MS2830A-006, MS2830A-005, and MS2830A-077 (for MS2830A-040/041/043/044).
Requires MS2830A-006, MS2830A-009, and MS2830A-077 (for MS2830A-045).
*7: 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 MS2850A is recommended for other measurement purposes.

*8: Requires MX269013A
*9: MS2830A-066 and A0086D required by MS2830A; A0086D required by MS2840A.
*10: Requires MX269020A
*11: Requires MX269022A
*12: Requires MX269028A
*13: Requires MX269021A
*14: Requires MX269023A
*15: Requires MS2850A-033
*16: Requires MX285051A
*17: Requires MX269017A
*18: Requires MX269051A
*19: For MS2840A-044/046. MS2840A-046 requires MS2840A-019. Unavailable when MS2840A-069/068/067 is simultaneously installed.
*20: Either MS2830A-044 or MS2830A-045 required by MS2830A, or either MS2840A-044 or MS2840A-046 required by MS2840A.

W-CDMA/HSPA Downlink Measurement Software MX269011A

MS269xA MS2850A MS2830A

The W-CDMA/HSPA Downlink Measurement Software MX269011A supports measurement of the RF Tx characteristics of W-CDMA/HSDPA/HSUPA/HSPA Evolution base stations.
Installing it in the MS269xA/MS2850A/MS2830A supports fast, high-accuracy measurements ideal for efficient R&D and early rollout of base stations and base-station components.

Versatile Functions for W-CDMA/HSPA/HSPA Evolution Development

Modulation analysis, Tx Power measurements, etc., required for development of W-CDMA/HSPA/HSPA Evolution base stations and device components are performed at high speed with superior accuracy.

■ Modulation Analysis

- Frequency Error
- Mean Power
- Vector Error/Amplitude Error/Phase Error
- Origin Offset
- Peak Code Domain Error
- Constellation
- Vector Error/Amplitude Error/Phase Error vs. Chip

■ Code Domain

- Mean Power
- P-CPICH/P-SCH/S-SCH
- Vector Error/Amplitude Error/Phase Error
- Code Power
- Code Domain/Code Domain Error
- Constellation
- Vector Error/Amplitude Error/Phase Error/Code Power vs. Symbol

■ Code vs. Time

- Mean Power
- P-CPICH/P-SCH/S-SCH
- Vector Error/Amplitude Error/Phase Error
- Code Power
- Code vs. Time
- Code Domain/Code Domain Error

■ Spectrum

- Adjacent Channel Leakage Power
- Channel Power
- Occupied Bandwidth
- Spectrum Emission Mask

Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature.
The specifications are defined under the following condition unless otherwise specified.
Attenuator mode: Mechanical Attenuator Only (MS2830A only)

Signal Analyzer		MS269xA	MS2830A MS2850A
Target Signals		W-CDMA, HSPA, HSPA Evolution Downlink Supports QPSK, 16QAM, and 64QAM HS-PDSCH modulation methods (excludes MIMO Tx signals)	
Measurement Frequency Range		400 MHz to 3 GHz	
Modulation/ Frequency Measurement	Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –30 to +10 dBm (Preamp On)	
	Carrier Frequency Measurement Accuracy	At 18°C to 28°C, after calibration, EVM = 1% signal	
		± (Accuracy of reference frequency × Carrier frequency + 5) Hz	± (Accuracy of reference frequency × Carrier frequency + 6) Hz
	Modulation Accuracy	At 18°C to 28°C, After calibration, When input signal within measurement level range and less than input level	
		Residual Vector Error: ≤1.0% (rms)	Residual Vector Error: ≤1.3% (rms)
	Waveform Display	EVM vs. Chip, Amplitude Error vs. Chip, Phase error vs. Chip, IQ Constellation	
Amplitude Measurement	Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –30 to +10 dBm (Preamp On)	–15 to +30 dBm (Preamp Off, or Preamp not installed)
	Average Power Measurement Accuracy (Found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit)	At 18°C to 28°C, After calibration, Input attenuator ≥10 dB When input signal within measurement level range and less than input level	
		±0.6 dB (Preamp Off, or Preamp not installed) ±1.1 dB (Preamp On)	±0.6 dB (Preamp Off, or Preamp not installed)
Code Domain Measurement	Measurement Level Range	–15 to +30 dBm (Preamp Off or Preamp not installed) –30 to +10 dBm (Preamp On)	
	Code Domain Power	At 18°C to 28°C, After calibration, When input signal within measurement level range and less than input level	
		Relative Accuracy: ±0.02 dB (Code Power ≥10 dBc) ±0.05 dB (Code Power ≥20 dBc) ±0.10 dB (Code Power ≥30 dBc)	Relative Accuracy: ±0.02 dB (Code Power ≥10 dBc) ±0.10 dB (Code Power ≥20 dBc) ±0.15 dB (Code Power ≥30 dBc)
	Code Domain Error	At 18°C to 28°C, After calibration, When input signal within measurement level range and less than input level	
		Residual Error: ≤–46 dB	Residual Error: ≤–42 dB
		Accuracy: ±0.3 dB (Code Domain Error ≥–30 dBc) ±1.0 dB (Code Domain Error ≥–40 dBc)	
	Waveform Display	EVM vs. Symbol, Amplitude Error vs. Symbol, Phase Error vs. Symbol, Symbol Constellation, Code Domain Power, Code Domain Error	
Spectrum Measurement	Measurement Functions	Adjacent Channel Leakage Power, Channel Power, Occupied Bandwidth, Spectrum Emission Mask	

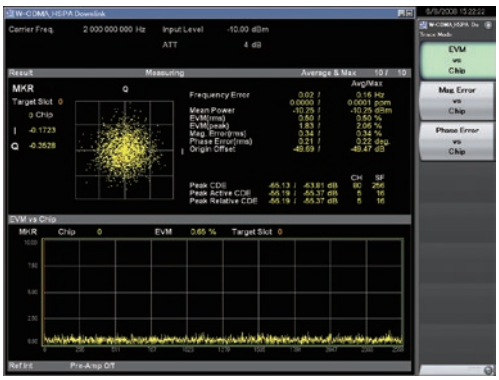
W-CDMA/HSPA Downlink Measurement Software MX269011A (Continued)

MS269xA MS2850A MS2830A

Measurement Functions

• Frequency Error/Modulation Accuracy

This function supports modulation analysis of W-CDMA/HSDPA/HSUPA/HSPA Evolution downlink signals with simultaneous display of max and mean values of frequency and vector error, etc., for up to 15 slots to evaluate DUT dispersion characteristics.



Modulation Analysis Screen

• Code vs. Time

This function is convenient for monitoring time variations in Mean Power for all codes and Code Power for up to 300 slots. It is useful when performing tests specified by 3GPP TS 25.141, 6.4.1 Inner Loop Power Control and 6.4.2 Power Control Steps.

Code vs. Time

• Code Domain

This function displays results for each code as a constellation and numeric table, making it easy to discover transient code-dependent signal degradation.

In addition, graphs can be displayed with any of Vector Error, Amplitude Error, and Phase Error on the vertical axis to discover transient time-dependent (symbol units) signal degradation for a specific code.

Code Domain (Constellation)

Code Domain (Vector Error vs. Symbol)

W-CDMA/HSPA Uplink Measurement Software MX269012A

MS269xA MS2850A MS2830A

The W-CDMA/HSPA Uplink Measurement Software MX269012A supports measurement of the RF Tx characteristics of W-CDMA/HSDPA/HSUPA/HSPA Evolution mobile terminals.
Installing it in the MS269xA/MS2850A/MS2830A supports fast, high-accuracy measurements ideal for efficient R&D and early rollout of mobile terminals and mobile-terminal components.

Versatile Functions for W-CDMA/HSPA/HSPA Evolution Development

Modulation analysis, Tx Power measurements, etc., required for development of W-CDMA/HSPA/HSPA Evolution mobile terminals and device components are performed at high speed with superior accuracy.

■ Modulation Analysis

- Frequency Error
- Mean Power
- Vector Error/Amplitude Error/Phase Error
- Origin Offset
- Peak Code Domain Error
- Constellation
- Vector Error/Amplitude Error/Phase Error vs. Chip

■ Code Domain

- Mean Power
- Vector Error/Amplitude Error
- Code Power
- Code Domain/Code Domain Error
- Constellation
- Vector Error/Amplitude Error/Code Power vs. Symbol

■ Spectrum

- Adjacent Channel Leakage Power
- Channel Power
- Occupied Bandwidth
- Spectrum Emission Mask

Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature.
The specifications are defined under the following condition unless otherwise specified.
Attenuator mode: Mechanical Attenuator Only (MS2830A only)

Signal Analyzer		MS269xA	MS2830A MS2850A
Target Signal		W-CDMA/HSPA/HSPA Evolution Uplink	
Measurement Frequency Range		400 MHz to 3 GHz	
Modulation/ Frequency Measurement	Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –30 to +10 dBm (Preamp On)	
	Carrier Frequency Measurement Accuracy	At 18°C to 28°C, After calibration, EVM = 1% signal	
		± (Accuracy of reference frequency × Carrier frequency + 5) Hz	± (Accuracy of reference frequency × Carrier frequency + 6) Hz
	Modulation Accuracy	At 18°C to 28°C, After calibration, When input signal within measurement level range and less than input level	
		Residual Vector Error: ≤1.0% (rms)	Residual Vector Error: ≤1.2 % (rms)
	Waveform Display	EVM vs. Chip, Amplitude Error vs. Chip, Phase Error vs. Chip, IQ Constellation	
Amplitude Measurement	Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –30 to +10 dBm (Preamp On)	–15 to +30 dBm (Preamp Off, or Preamp not installed)
	Average Power Measurement Accuracy (Found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit)	At 18°C to 28°C, After calibration, Input attenuator ≥10 dB, When input signal within measurement level range and less than input level	
		±0.6 dB (Preamp Off, or Preamp not installed) ±1.1 dB (Preamp On)	±0.6 dB (Preamp Off, or Preamp not installed)
Code Domain Measurement	Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –30 to +10 dBm (Preamp On)	
	Code Domain Power	At 18°C to 28°C, After calibration, When input signal within measurement level range and less than input level	
		Relative Accuracy: ±0.02 dB (Code Power ≥–10 dBc) ±0.05 dB (Code Power ≥–20 dBc) ±0.10 dB (Code Power ≥–30 dBc)	Relative Accuracy: ±0.02 dB (Code Power ≥–10 dBc) ±0.10 dB (Code Power ≥–20 dBc) ±0.15 dB (Code Power ≥–30 dBc)
	Code Domain Error	At 18°C to 28°C, After calibration, When input signal within measurement level range and less than input level	
		Residual Error: ≤–46 dB	Residual Error: ≤–42 dB
		Accuracy: ±0.3 dB (Code Domain Error ≥–30 dBc) ±1.0 dB (Code Domain Error ≥–40 dBc)	
	Waveform Display	EVM vs. Symbol, Amplitude Error vs. Symbol, Vector Error vs. Symbol, Symbol Constellation, Code Domain Error, Code Domain Power	
Spectrum Measurement	Measurement Functions	Adjacent Channel Leakage Power, Channel Power, Occupied Bandwidth, Spectrum Emission Mask	

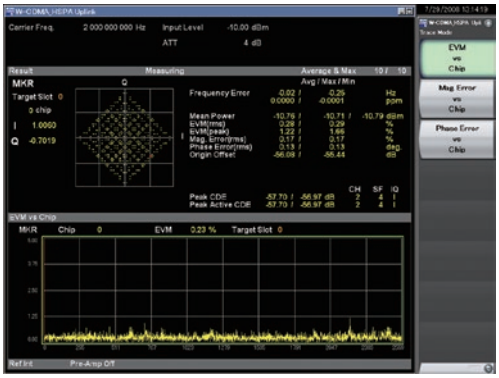
W-CDMA/HSPA Uplink Measurement Software MX269012A (Continued)

MS269xA MS2850A MS2830A

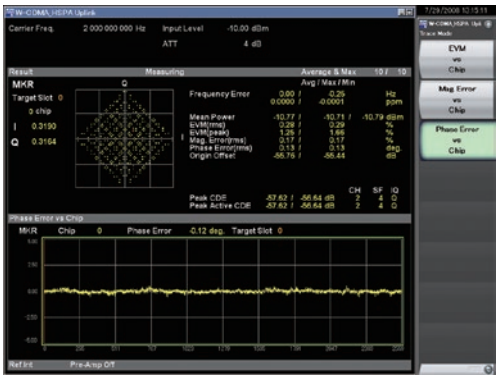
Measurement Functions

• Frequency Error/Mean Power/Modulation Accuracy

The Frequency Error, Mean Power, and Modulation Accuracy are displayed simultaneously as a constellation and graphs showing changes in Vector Error/Amplitude Error/Phase Error over time (Chip units). Instantaneous characteristics can be measured due to the excellent residual EVM characteristics of the MS269xA.



Constellation and Vector Error vs. Chip



Constellation and Phase Error vs. Chip

• Code Domain

Code Power and Code Errors can be displayed simultaneously as a specified code constellation and as graphs showing changes in Vector Error/Amplitude Error/Code Power over time (Symbol units). These time domain graphs allow the designer to find demodulation errors between RF and baseband.

Code Domain Power and Constellation

Code Domain Power and Code Power vs. Symbol

GSM/EDGE Measurement Software MX269013A
EDGE Evolution Measurement Software MX269013A-001

MS269xA MS2850A MS2830A

The GSM/EDGE Measurement Software MX269013A and EDGE Evolution Measurement Software MX269013A-001 support measurement of the RF Tx characteristics of GSM/EDGE (EGPRS) and EDGE Evolution (EGPRS2) signals.
Installation in the MS269xA/MS2850A/MS2830A supports fast, high-accuracy measurements ideal for efficient R&D and early rollout of GSM/EDGE/EDGE Evolution base stations, mobile terminals, and terminal components.

Versatile Functions for GSM/EDGE/EDGE Evolution R&D

Supports the fast, high-accuracy modulation analysis and mean power measurements required for development of GSM/EDGE/EDGE Evolution base stations, mobile terminals, and components.

■ Modulation Analysis (GMSK)
- Frequency Error
- Phase Error (Peak/rms)
- Constellation
- Phase Error vs. Symbol

■ Modulation Analysis (QPSK, 8PSK, 16QAM, 32QAM)
- Frequency Error
- Vector Error (EVM) [Peak/rms]
- Magnitude Error/Phase Error (rms)
- Origin Offset
- 95th percentile
- Droop
- Constellation
- EVM/Magnitude Error/Phase Error vs. Symbol

■ Output Spectrum Measurement
- Spectrum due to Modulation
- Spectrum due to Switching Transients

■ Power vs. Time
- Slot Power
- Slot Status
- Symbol Power Graph
- Time Offset

Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature.
Unless otherwise noted, same specifications for MX269013A and MX269013A-001.
The specifications are defined under the following condition unless otherwise specified.
Attenuator mode: Mechanical Attenuator Only (MS2830A only)

Signal Analyzer		MS269xA	MS2830A MS2850A
Supported Signals		MX269013A: GSM/EDGE Downlink and Uplink MX269013A-001: EDGE Evolution Downlink and Uplink	
Modulation Method		MX269013A: GMSK, 8PSK, AQPSK (Normal Burst, Continuous) MX269013A-001: QPSK, 16QAM, 32QAM (Normal Burst, Higher Symbol Rate Burst, Continuous)	
Measured Frequency Range		400 MHz to 2 GHz	
Modulation/ Frequency Measurement	Measured Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –30 to +10 dBm (Preamp On)	
	Carrier Frequency Measurement Accuracy	At 18°C to 28°C, After calibration, with EVM = 1% signal	
		± (Accuracy of reference frequency × Carrier frequency + 5) Hz	± (Accuracy of reference frequency × Carrier frequency + 8) Hz
	Modulation Accuracy	At 18°C to 28°C, After calibration, With input signal in measurement level range and less than Input level	
		MX269013A Residual Vector Error (8PSK/AQPSK): ≤0.6% (rms) MX269013A-001 Residual Vector Error: ≤0.6% (rms)	MX269013A Residual Vector Error (8PSK/AQPSK): ≤1.0% (rms) MX269013A-001 Residual Vector Error: ≤1.0% (rms)
		MX269013A Residual Phase Error (GMSK): ≤0.5 degrees (rms)	MX269013A Residual Phase Error (GMSK): ≤0.7 degrees (rms)
	Waveform Display	MX269013A Constellation, EVM vs. Symbol (8PSK/AQPSK), Magnitude error vs. Symbol (8PSK/AQPSK), Phase error vs. Symbol MX269013A-001 Constellation, EVM vs. Symbol, Magnitude Error vs. Symbol, Phase Error vs. Symbol	
Amplitude Measurement	Measured Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –30 to +10 dBm (Preamp On)	–15 to +30 dBm (Preamp Off, or Preamp not installed)
	Average Power Measurement Accuracy (Found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit)	At 18°C to 28°C, After calibration, With input attenuator ≥10 dB and input signal in measurement level range and less than input level	
		±0.6 dB (Preamp Off, or Preamp not installed) ±1.1 dB (Preamp On)	±0.6 dB (Preamp Off, or Preamp not installed)
	Waveform Display	Rise, Fall, Slot, Frame	
Output RF Spectrum Measurement		At 18°C to 28°C, After calibration, With input attenuator ≥10 dB and input signal 0 to +30 dBm (at Preamp Off, or no Preamp installed), Carrier frequency of 400 MHz to 2000 MHz, 5-pole filter	
	Modulation Part Measurement	Measurement Points: ±100, ±200, ±250, ±400, ±600, ±800, ±1000, ±1200, ±1400, ±1600, ±1800, ±3000, ±6000 kHz	
		Measurement Range: <–41 dB (100 kHz detuning), <–66 dB (200 kHz detuning), <–74 dB (250 kHz detuning), <–79 dB (400 kHz detuning), <–80 dB (<1200 kHz detuning), <–83 dB (<1800 kHz detuning), <–80 dB (≥1800 kHz detuning)	—
	Switching Transients Measurement	Measurement Points: ±400, ±600, ±1200, ±1800 kHz	
		Measurement Range: <–71 dB (400 kHz detuning), <–72 dB (600 kHz detuning), <–75 dB (1200 kHz detuning), <–75 dB (1800 kHz detuning)	—

GSM/EDGE Measurement Software MX269013A
EDGE Evolution Measurement Software MX269013A-001 (Continued)

MS269xA MS2850A MS2830A

Measurement Functions

• Frequency Error/Modulation Accuracy

As well as displaying frequency error, modulation accuracy and numeric average and maximum values, the constellation and temporal changes in vector, amplitude and phase errors can are displayed simultaneously as graphs (symbol units) to monitor symbol-dependent changes in modulation accuracy.

• Output Spectrum Measurements

The power spectrum is measured from the center frequency to a specified offset frequency. Modulation measures the spectrum due to modulation near the burst center; Switching Transients measures the spectrum due to the burst wave rise/fall.

Modulation Part

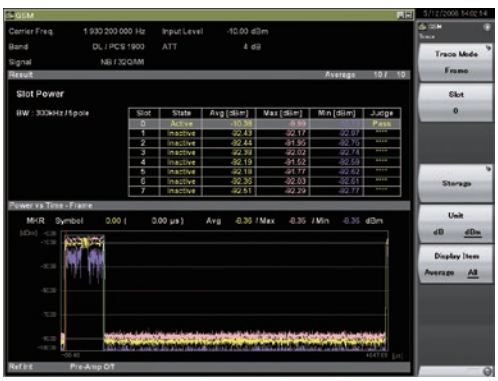
Switching Transients Part

• Power vs. Time

Variations in power with time are monitored at rise/fall, slot and frame displays to support Pass/Fail evaluation. The burst characteristics are easily understood from the single average, max. and min. display.

Rise/Fall (Average)

Slot (Average)



Frame (Average/Max./Min.)

ETC/DSRC Measurement Software MX269014A

MS269xA

The ETC/DSRC Measurement Software MX269014A supports measurement of the RF Tx characteristics of ARIB STD T75 narrow-band wireless devices. Installing it in the MS269xA supports fast, high-accuracy measurements ideal for efficient R&D, early rollout, and evaluation of DSRC wireless devices.

High-accuracy and High-speed Measurements Support Higher Manufacturing Efficiency

The MS2690A series supports modulation analysis and spectrum measurement for manufacturing and servicing DSRC wireless equipment. High-accuracy measurements are supported by extending the baseband upper frequency limit to 6 GHz. The ±0.6 dB accuracy for Tx power measurement in the 5.8-GHz band using ETC/DSRC improves yield, while manufacturing and inspection times are cut to 110 ms* and 190 ms*, respectively, for analyzing π/4DQPSK and ASK modulation signals to improve production throughout.

*: Average with graph display OFF (reference value); approximately 120 ms (π/4DQPSK) and 350 ms (ASK) with graph display ON.

■ Modulation Analysis (π/4DQPSK)

- Frequency Error
- Tx Power
- Vector Error (EVM) [Peak/rms]
- Origin Offset
- Droop Factor
- Constellation

■ Modulation Analyzer (ASK)

- Frequency Error
- Tx Power
- Peak Power
- Modulation Index
- Eye Opening
- Eye Diagram

■ Spectrum

- Adjacent Channel Leakage Power
- Occupied Bandwidth

Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature.

Signal Analyzer		MS269xA
Common Specifications	Modulation Method	π/4DQPSK, ASK
	Target Signals	Downlink, Uplink
	Target Channel	MDC
Modulation/ Frequency Measurement	Measurement Frequency Range	5700 MHz to 5900 MHz
	Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –30 to +10 dBm (Preamp On)
	Carrier Frequency Measurement Accuracy	At 18°C to 28°C, after calibration, with EVM = 1% signal ± (Accuracy of reference frequency × Carrier frequency + 20) Hz
	Residual Vector Error	At 18°C to 28°C, after calibration, when modulation is π/4DQPSK <1.0% (rms)
Amplitude Measurement	Tx Power Measurement Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit.)	At 18°C to 28°C, after calibration, with input attenuator ≥10 dB and input signal in measurement level range and less than Input level ±0.6 dB (Preamp Off, or Preamp not installed) ±1.1 dB (Preamp On)
Waveform Display	Modulation/Frequency	Constellation (π/4DQPSK), Eye Diagram (ASK)
	Spectrum	Adjacent Channel Leakage Power, Occupied Bandwidth

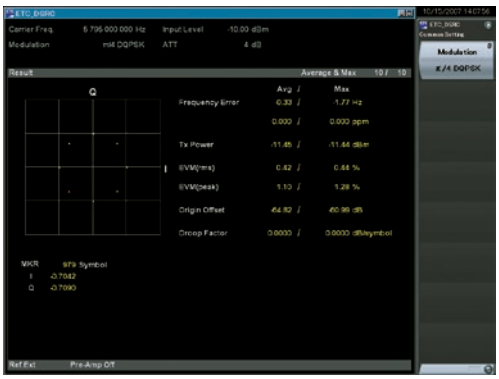
ETC/DSRC Measurement Software MX269014A (Continued)

MS269xA

Measurement Functions

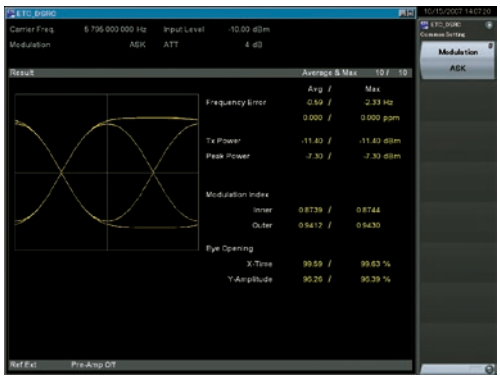
- **Modulation Analysis (π/4DQPSK)**

This analysis displays the π/4DQPSK modulation signal results along with a constellation graph. The dispersion of RF characteristics is measured easily using simultaneous display of maximum and average values.



- **Modulation Analysis (ASK)**

This analysis displays the ASK modulation signal results along with an eye diagram.



Vector Modulation Analysis Software MX269017A
APSK Analysis MX269017A-001
Higher-Order QAM Analysis MX269017A-011

MS269xA MS2850A MS2840A MS2830A

The Vector Modulation Analysis software MX269017A supports various digital wireless modulation analyses.
Installing it in the MS269xA/MS2850A/MS2840A/MS2830A supports fast, high-accuracy measurements ideal for R&D and early rollout of digital radio equipment and components serving a wide range of applications, ranging from public safety (PMR/LMR)*1 to aerospace and satellite communications.

*1: Can measure TETRA, DMR, dPMR, APCO-P25 Phase1/Phase2, NXDN, ARIB STD-T98, T102, etc.

Versatile Functions for Digital Wireless Communication Development

Fast and high-accuracy modulation analysis for R&D into digital radio equipment and components for public, aerospace, and satellite applications.

■ Numeric result display

BPSK, QPSK, O-QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 512QAM, 1024QAM, 2048QAM, MSK, 16APSK, 32APSK

- Tx Power
- Filtered Power
- Frequency Error (Hz, ppm)
- Vector Error (EVM) [Peak/rms]
- Offset Vector Error (EVM) [Peak/rms] (O-QPSK)
- Phase Error (Peak/rms)
- Magnitude Error (Peak/rms)
- Symbol Rate Error
- BER (only BER = On)
- Specific Word (Hex)
- Origin Offset
- Droop Factor (BPSK, π/4DQPSK, 8PSK, MSK)
- IQ Gain Imbalance
  (QPSK, O-QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, MSK)
- Quadrature Error
  (QPSK, O-QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, MSK)
- MER (Peak/rms)
- Offset EVM [Peak/rms] (O-QPSK)
- Timing Offset

2FSK, 4FSK, H-CPM*

- Tx Power
- Filtered Power
- Frequency Error (Hz, ppm)
- Magnitude Error (Peak/rms)
- FSK Error (Peak/rms)
- BER (only BER = On)
- Modulation Fidelity (Peak/rms)
- Symbol Rate Error
- Specific Word (Hex)
- Jitter (P-P Min., P-P Max.)
- Deviation (Average, +Peak, –Peak, (Peak-Peak)/2)
- Deviation rms [%] (2FSK)
- Deviation at Ts/2
  [Average, +Max. Peak, +Min. Peak, –Max. Peak, –Min. Peak, (Peak-Peak)/2, +Max. Peak%, –Min. Peak%] (2FSK, 4FSK)
- Timing Offset

*: Used at APCO-P25 Phase2 Inbound measurement

2ASK

- Tx Power
- Filtered Power
- Frequency Error (Hz, ppm)
- Vector Error (EVM) [Peak/rms]
- Magnitude Error (Peak/rms)
- BER (only BER = On)
- Specific Word (Hex)
- Droop Factor
- MER (Peak/rms)
- Symbol Rate Error
- Modulation Index (rms)
- Eye Opening (X-Time)
- Eye Opening (Y-Amplitude)
- Timing Offset

■ Graph display

BPSK, QPSK, O-QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 512QAM, 1024QAM, 2048QAM, 2ASK, 4ASK, 16APSK, 32APSK

- Constellation
- EVM vs. Symbol
- Magnitude Error vs. Symbol
- Phase Error vs. Symbol
- Trellis
- Eye Diagram
- I and Q vs. Symbol
- Magnitude vs. Symbol
- Phase vs. Symbol
- Signal Monitor
- Symbol Table
- Equalizer Amplitude
- Equalizer Phase
- Equalizer Group Delay
- Equalizer Impulse Response

2FSK, 4FSK, H-CPM*, MSK

- Constellation
- EVM vs. Symbol
- Magnitude Error vs. Symbol
- Phase Error vs. Symbol
- Frequency vs. Symbol
- Trellis
- Eye Diagram
- I and Q vs. Symbol
- Magnitude vs. Symbol
- Phase vs. Symbol
- Signal Monitor
- Symbol Table
- FSK Error vs. Symbol
- Fidelity vs. Symbol (2FSK, 4FSK, H-CPM)
- Histogram

*: Used at APCO-P25 Phase2 Inbound measurement

Vector Modulation Analysis Software MX269017A
APSK Analysis MX269017A-001
Higher-Order QAM Analysis MX269017A-011 (Continued)

MS269xA MS2850A MS2840A MS2830A

Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature.
The specifications are defined under the following condition unless otherwise specified.
Attenuator mode: Mechanical Attenuator Only (MS2840A/MS2830A)

■ Common Specifications

Signal Analyzer		MS269xA	MS2850A	MS2840A	MS2830A
Measurement Symbol Rate Range	BPSK, QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 2ASK, 4ASK, MSK	0.1 ksps to 12.5 Msps	0.1 ksps to 12.5 Msps	0.1 ksps to 12.5 Msps (MS2840A-006/009 installed)	0.1 ksps to 12.5 Msps (MS2830A-005/009, 006 installed) 0.1 ksps to 5 Msps (MS2830A-006 installed)
	2FSK, 4FSK	0.1 ksps to 6.25 Msps	0.1 ksps to 6.25 Msps	0.1 ksps to 6.25 Msps (MS2840A-006/009 installed)	0.1 ksps to 6.25 Msps (MS2830A-005/009, 006 installed) 0.1 ksps to 2.5 Msps (MS2830A-006 installed)
Modulation Method	Standard	BPSK, DBPSK, π/2DBPSK, QPSK, O-QPSK, DQPSK, π/4 DQPSK, 8PSK, D8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 2FSK, 4FSK, H-CPM, 2ASK, 4ASK, MSK			
	Option	—	16APSK, 32APSK (MX269017A-001) 512QAM, 1024QAM, 2048QAM (MX269017A-011)		—

■ Frequency Setting Range

MS269xA				
Condition				Frequency Setting Range
Option	Modulation Type	Measuring Object	Symbol Rate	
With MS269xA-067/167	BPSK, QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 2ASK, 4ASK, MSK	Frame Format	>12.5 Msps	100 MHz to the upper limit of the main unit
		Non-Formatted (Span Up = On)	>12.5 Msps	100 MHz to the upper limit of the main unit
		Non-Formatted (Span Up = Off)	>35 Msps	100 MHz to the upper limit of the main unit
	2FSK, 4FSK	—	>6.25 Msps	100 MHz to the upper limit of the main unit
	O-QPSK	—	>3.125 Msps	100 MHz to the upper limit of the main unit
Without MS269xA-067/167	BPSK, QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 2ASK, 4ASK, MSK	Frame Format	>12.5 Msps	100 MHz to 6 GHz
		Non-Formatted (Span Up = On)	>12.5 Msps	100 MHz to 6 GHz
		Non-Formatted (Span Up = Off)	>35 Msps	100 MHz to 6 GHz
	2FSK, 4FSK	—	>6.25 Msps	100 MHz to 6 GHz
	O-QPSK	—	>3.125 Msps	100 MHz to 6 GHz
Other than above				100 kHz to the upper limit of the main unit

MS2850A				
Condition				Frequency Setting Range
	Modulation Type	Measuring Object	Symbol Rate	
MS2850A-067 (standard)	BPSK, QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM 64QAM, 128QAM, 256QAM, 2ASK, 4ASK, MSK	Frame Format	>12.5 Msps	300 MHz to the upper limit of the main unit
		Non-Formatted (Capture OSR = 4)	>12.5 Msps	300 MHz to the upper limit of the main unit
		Non-Formatted (Capture OSR = 4)	>35 Msps	300 MHz to the upper limit of the main unit
	2FSK, 4FSK	—	>6.25 Msps	300 MHz to the upper limit of the main unit
	O-QPSK	—	>3.125 Msps	300 MHz to the upper limit of the main unit
Other than above				100 kHz to the upper limit of the main unit

MS2840A MS2830A				
Condition				Frequency Setting Range
Option	Modulation Type	Measuring Object	Symbol Rate	
With MS2840A-067/167, MS2830A-067/167	BPSK, QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 2ASK, 4ASK, MSK	Frame Format	>12.5 Msps	300 MHz to the upper limit of the main unit
		Non-Formatted (Span Up = On)	>12.5 Msps	300 MHz to the upper limit of the main unit
		Non-Formatted (Span Up = Off)	>35 Msps	300 MHz to the upper limit of the main unit
	2FSK, 4FSK	—	>6.25 Msps	300 MHz to the upper limit of the main unit
	O-QPSK	—	>3.125 Msps	300 MHz to the upper limit of the main unit
Without MS2840A-067/167, MS2830A-067/167	BPSK, QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 2ASK, 4ASK, MSK	Frame Format	>12.5 Msps	300 MHz to 6 GHz or the upper limit of the main unit, whichever is lower.
		Non-Formatted (Span Up = On)	>12.5 Msps	300 MHz to 6 GHz or the upper limit of the main unit, whichever is lower.
		Non-Formatted (Span Up = Off)	>35 Msps	300 MHz to 6 GHz or the upper limit of the main unit, whichever is lower.
	2FSK, 4FSK	—	>6.25 Msps	300 MHz to 6 GHz or the upper limit of the main unit, whichever is lower.
	O-QPSK	—	>3.125 Msps	300 MHz to 6 GHz or the upper limit of the main unit, whichever is lower.
Other than above				100 kHz to the upper limit of the main unit

Vector Modulation Analysis Software MX269017A
APSK Analysis MX269017A-001
Higher-Order QAM Analysis MX269017A-011 (Continued)

MS269xA MS2850A MS2840A MS2830A

■ Symbol Rate Setting Range

Firmware package version 12.00.00 and later:

Model	Option			
MS2830A	With 006/106	With 005/105/007/009	With 077	With 078
MS2840A	With 006/106	With 005/105/009/109	With 077/177	With 078/178
MS269xA		Except as described on right	With 077/177	With 004/078/178
Maximum Sampling Rate (SP)	20 MHz	50 MHz	100 MHz	200 MHz
Maximum Analysis Bandwidth (SPAN)	10 MHz	31.25 MHz	62.5 MHz	125 MHz
"Capture OSR"	Maximum setting symbol rate [symbol/s] (Min.: 0.1k Max.: SP/Capture OSR)			
"32"	0.625 M	1.5625 M	3.125 M	6.25 M
"16"	1.25 M	3.125 M	6.25 M	12.5 M
"8"	2.5 M	6.25 M	12.5 M	25 M
"4"	5 M	12.5 M	25 M	50 M
"2"	10 M	25 M	50 M	100 M
"1"	20 M	50 M	100 M	200 M

Model	Option		
MS2850A	With 032	With 033	With 034
Maximum Sampling Rate (SP)	325 MHz	650 MHz	1300 MHz
Maximum Analysis Bandwidth (SPAN)	255 MHz	510 MHz	1000 MHz
"Capture OSR"	Maximum setting symbol rate [symbol/s] (Min.: 0.1k Max.: SP/Capture OSR)		
"32"	10.15625 M	20.3125 M	40.625 M
"16"	20.3125 M	40.625 M	81.25 M
"8"	40.625 M	81.25 M	162.5 M
"4"	81.25 M	162.5 M	325 M
"2"	162.5 M	325 M	650 M
"1"	325 M	650 M	1300 M

■ Modulation/Frequency Measurement

<table>
<tr><th colspan="2">Signal Analyzer</th><th>MS269xA</th><th>MS2850A</th><th>MS2840A</th><th>MS2830A</th></tr>
<tr><td colspan="2">Measurement Level Range</td><td colspan="4">–15 to +30 dBm (Preamp Off, or Preamp not installed)
–25 to +10 dBm (Preamp On)</td></tr>
<tr><td rowspan="8">Carrier Frequency Measurement Accuracy</td><td rowspan="3">BPSK, QPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 2FSK, 4FSK, MSK</td><td colspan="4">Without MS269xA-001, With MS2840A-002, With MS2830A-002, At 18°C to 28°C, after calibration, with EVM = 1% signal
For firmware package version 12.00.00 and later, Capture OSR = 4</td></tr>
<tr><td rowspan="2">± (Accuracy of reference frequency × Carrier frequency + 10) Hz
(Center Frequency: 30 MHz to 6.0 GHz)
(Note that a range of 3 GHz or above is not available when MS269xA-003 is installed and with Frequency Band Mode set to Spurious.)</td><td>± (Accuracy of reference frequency × Carrier frequency + 10) Hz
(Center Frequency: 30 MHz to 3.5 GHz, symbol rate: 4 ksps to 5 Msps)</td><td colspan="2" rowspan="2">± (Accuracy of reference frequency × Carrier frequency + 10) Hz
(Center Frequency: 30 MHz to 3.5 GHz)</td></tr>
<tr><td>± (Accuracy of reference frequency × Carrier frequency + 10) Hz
(Center Frequency: 800 MHz to 3.5 GHz, symbol rate: 5 Msps to 50 Msps)</td></tr>
<tr><td rowspan="3">Π/4DQPSK, 2ASK, 4ASK</td><td colspan="4">Without MS269xA-001, With MS2840A-002, With MS2830A-002, At 18°C to 28°C, after calibration, with EVM = 1% signal
For firmware package version 12.00.00 and later, Capture OSR = 4</td></tr>
<tr><td rowspan="2">± (Accuracy of reference frequency × Carrier Frequency + 10) Hz
(Center Frequency: 30 MHz to 6.0 GHz)
(Note that a range of 3 GHz or above is not available when MS269xA-003 is installed and with Frequency Band Mode set to Spurious.)</td><td>± (Accuracy of reference frequency × Carrier frequency +10) Hz
(Center frequency: 30 MHz to 3.5 GHz, symbol rate: 4 ksps to 5 Msps)</td><td colspan="2" rowspan="2">± (Accuracy of reference frequency × Carrier frequency + 10) Hz
(Center Frequency: 30 MHz to 3.5 GHz)
± (Accuracy of reference frequency × Carrier frequency + 10) Hz
(Center Frequency: 5.7 GHz to 5.9 GHz, nom.)</td></tr>
<tr><td>± (Accuracy of reference frequency × Carrier frequency + 10) Hz
(Center Frequency: 800 MHz to 3.5 GHz, symbol rate: 5 Msps to 50 Msps)</td></tr>
<tr><td rowspan="3">512QAM
1024QAM
2048QAM</td><td colspan="4">With MS2840A-002, At 18°C to 28°C, after calibration, with EVM = 1% signal
For firmware package version 12.00.00 and later, Capture OSR = 4</td></tr>
<tr><td rowspan="2">—</td><td>With MX269017-011
± (Accuracy of reference frequency × Carrier frequency +10) Hz
(Center frequency: 30 MHz to 3.5 GHz, symbol rate: 500 ksps to 5 Msps)</td><td rowspan="2">with MX269017A-011
± (Accuracy of reference frequency × Carrier frequency +10) Hz
(Center Frequency: 30 MHz to 3.5 GHz)</td><td rowspan="2">—</td></tr>
<tr><td>With MX269017A-011
± (Accuracy of reference frequency × Carrier frequency +10) Hz
(Center frequency: 800 MHz to 3.5 GHz, symbol rate: 5 Msps to 50 Msps, Equalizer = On)</td></tr>
</table>

Vector Modulation Analysis Software MX269017A
APSK Analysis MX269017A-001
Higher-Order QAM Analysis MX269017A-011 (Continued)

MS269xA MS2850A MS2840A MS2830A

Signal Analyzer		MS269xA	MS2850A	MS2840A	MS2830A
Carrier Frequency Measurement Accuracy	16APSK 32APSK	With MS2840A-002, At 18°C to 28°C, after calibration, with EVM = 1% signal For firmware package version 12.00.00 and later, Capture OSR = 4			
		—	With MX269017A-001 ± (Accuracy of reference frequency × Carrier frequency +10) Hz (Center Frequency: 30 MHz to 3.5 GHz, symbol rate: 500 Ksps to 5 Msps)	With MX269017A-001 ± (Accuracy of reference frequency × Carrier frequency +10) Hz (Center Frequency: 30 MHz to 3.5 GHz)	—
			With MX269017A-001 ± (Accuracy of reference frequency × Carrier frequency + 10) Hz (Center frequency: 800 MHz to 3.5 GHz, symbol rate 5 Msps to 50 Msps, Equalizer = On)	—	
Residual Vector Error	BPSK, QPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM	Without MS269xA-001, With MS2840A-002, With MS2830A-002 At 18°C to 28°C, after calibration, Filter type: Root Nyquist or Nyquist, when input signal within measurement level range and less than input level, 20-times averaging For firmware package version 12.00.00 and later, Capture OSR = 4			
		<0.5% (rms) Symbol rate: 4 ksps to 500 ksps Measurement time length: ≤50 ms Carrier Frequency: 50 MHz to 500 MHz <1.0% (rms) Symbol rate: 500 ksps to 5 Msps Carrier Frequency: 50 MHz to 6 GHz (Note that a range of 3 GHz or above is not available when MS269xA-003 is installed and with Frequency Band Mode set to Spurious.)	<0.5 % (rms) Symbol rate: 4 ksps to 500 ksps Measurement time length: ≤50 ms Carrier frequency: 50 MHz to 500 MHz <1.0 % (rms) Symbol rate: 500 ksps to 5 Msps Carrier frequency: 50 MHz to 3.5 GHz <1.0 % (rms) Symbol rate: 5 Msps to 50 Msps Carrier frequency: 800 MHz to 3.5 GHz	<1.0% (rms) Symbol rate: 4 ksps to 500 ksps Measurement time length: ≤50 ms Carrier Frequency: 50 MHz to 500 MHz <1.5% (rms) Symbol rate: 500 ksps to 5 Msps Carrier Frequency: 50 MHz to 3.5 GHz	
	Π/4DQPSK	Without MS269xA-001, With MS2840A-002, With MS2830A-002 At 18°C to 28°C, after calibration, Filter type: Root Nyquist or Nyquist, when input signal within measurement level range and less than input level, 20-time averaging For firmware package version 12.00.00 and later, Capture OSR = 4			
		<0.5% (rms) Symbol rate: 4 ksps to 500 ksps Measurement time length: ≤50 ms Carrier Frequency: 50 MHz to 500 MHz <1.0% (rms) Symbol rate: 500 ksps to 5 Msps Carrier Frequency: 50 MHz to 6 GHz (Note that a range of 3 GHz or above is not available when MS269xA-003 is installed and with Frequency Band Mode set to Spurious.)	<0.5 % (rms) Symbol rate: 4 ksps to 500 ksps Measurement time length: ≤50 ms Carrier frequency: 50 MHz to 500 MHz <1.0 % (rms) Symbol rate: 500 ksps to 5 Msps Carrier frequency: 50 MHz to 3 .5 GHz <1.0 % (rms) Symbol rate: 5 Msps to 50 Msps Carrier frequency: 800 MHz to 3 .5 GHz	<1.0% (rms) Symbol rate: 4 ksps to 500 ksps Measurement time length: ≤50 ms Carrier Frequency: 50 MHz to 500 MHz <1.5% (rms) Symbol rate: 500 ksps to 5 Msps Carrier Frequency: 50 MHz to 3.5 GHz <1.5% (rms) (nom.) Symbol rate: 500 ksps to 5 Msps Carrier Frequency: 5.7 GHz to 5.9 GHz	
	MSK	Without MS269xA-001, With MS2840A-002, With MS2830A-002 At 18°C to 28°C, after calibration, Measurement Filter: None, Reference Filter: Gaussian BT 0.5, when input signal within measurement level range and less than input level, 20-time averaging For firmware package version 12.00.00 and later, Capture OSR = 4			
		<0.5% (rms) Symbol rate: 4 ksps to 500 ksps Measurement time length: ≤50 ms Carrier Frequency: 50 MHz to 500 MHz <1.0% (rms) Symbol rate: 500 ksps to 5 Msps Carrier Frequency: 50 MHz to 6 GHz (Note that a range of 3 GHz or above is not available when MS269xA-003 is installed and with Frequency Band Mode set to Spurious.)	<0.5 % (rms) Symbol rate: 4 ksps to 500 ksps Measurement time length: ≤50 ms Carrier frequency: 50 MHz to 500 MHz <1.0 % (rms) Symbol rate: 500 ksps to 5 Msps Carrier frequency: 50 MHz to 3 .5 GHz <1.0 % (rms) Symbol rate: 5 Msps to 50 Msps Carrier frequency: 800 MHz to 3 .5 GHz	<1.0% (rms) Symbol rate: 4 ksps to 500 ksps Measurement time length: ≤50 ms Carrier Frequency: 50 MHz to 500 MHz <1.5% (rms) Symbol rate: 500 ksps to 5 Msps Carrier Frequency: 50 MHz to 3.5 GHz	

Vector Modulation Analysis Software MX269017A
APSK Analysis MX269017A-001
Higher-Order QAM Analysis MX269017A-011 (Continued)

MS269xA MS2850A MS2840A MS2830A

Signal Analyzer		MS269xA	MS2850A	MS2840A	MS2830A
Residual Vector Error	512QAM 1024QAM 2048QAM	With MS2840A-002 At 18°C to 28°C, after calibration, Measurement Filter: Root Nyquist, Reference Filter: Nyquist, when input signal within measurement level range and less than input level, 20-time averaging For firmware package version 12.00.00 and later, Capture OSR = 4			
		—	With MX269017A-011 <1.0 % (rms) Symbol rate: 500 ksps to 5 Msps Carrier frequency: 50 MHz to 3.5 GHz <1.0 % (rms) Symbol rate: 5 Msps to 50 Msps Carrier frequency: 800 MHz to 3.5 GHz (Note that Equalizer = On)	With MX269017A-011 <1.0 % (rms) Symbol rate: 500 ksps to 5 Msps Carrier frequency: 50 MHz to 3.5 GHz	—
	16APSK 32APSK	With MS2840A-002 At 18°C to 28°C, after calibration, Measurement Filter: Root Nyquist, Reference Filter: Nyquist, when input signal within measurement level range and less than input level, 20-time averaging For firmware package version 12.00.00 and later, Capture OSR = 4			
		—	With MX269017A-001 <1.0 % (rms) Symbol rate: 500 ksps to 5 Msps Carrier frequency: 50 MHz to 3.5 GHz <1.5 % (rms) Symbol rate: 5 Msps to 50 Msps Carrier frequency: 800 MHz to 3.5 GHz	With MX269017A-001 <1.0 % (rms) Symbol rate: 500 ksps to 5 Msps Carrier frequency: 50 MHz to 3.5 GHz	—
Symbol Rate Error		After CAL execution at 18°C to 28°C, according to the 10 MHz common reference*, when: Modulation Type: 2FSK, Filter Type: Gaussian, BT = 0.5, Symbol Rate 100 ksps, slot length 160 symbol, The signal measured is within the measurement level range and less than or equal to Input Level, and Average = 10 times For firmware package version 12.00.00 and later, Capture OSR = 4			
		Without MS269xA-001, 30 MHz to 6 GHz <±1.0 ppm (Note that a range of 3 GHz or above is not available when MS269xA-003 is installed and with Frequency Band Mode set to Spurious.)	30 MHz to 3.5 GHz <±1.0 ppm	With MS2840A/MS2830A-002, 30 MHz to 3.5 GHz <±1.0 ppm	

*: Connect 10 MHz Reference between signal source and signal analyzer

■ Amplitude Measurement

Signal Analyzer	MS269xA	MS2850A	MS2840A	MS2830A
Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –25 to +10 dBm (Preamp On)	–15 to +30 dBm (Preamp Off, or Preamp not installed)		
Tx Power Measurement Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit.)	At 18°C to 28°C, after calibration, with input attenuator ≥10 dB, SPAN ≤31.25 MHz and input signal in measurement level range and less than Input level			
	30 MHz to 6 GHz ±0.6 dB (at Pre-Amp Off, or Pre-Amp not installed.) ±1.1 dB (at Pre-Amp On) (Note that a range of 3 GHz or above is not available when MS269xA-003 is installed and with Frequency Band Mode set to Spurious.)	30 MHz to 3.5 GHz ±0.6 dB (at Pre-Amp Off, or Pre-Amp not installed.)		

Vector Modulation Analysis Software MX269017A
APSK Analysis MX269017A-001
Higher-Order QAM Analysis MX269017A-011 (Continued)

MS269xA MS2850A MS2840A MS2830A

Measurement Functions (Trace Mode)

(1) Modulation Analysis

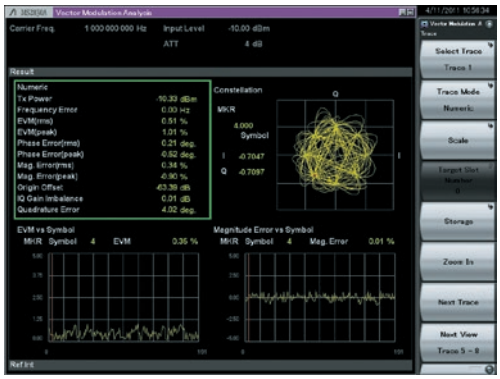
A maximum of eight traces can be measured using the results for four traces displayed in four panes on one screen. Instantaneous toggling between two screens supports at-a-glance monitoring of eight traces.

Measurement Functions

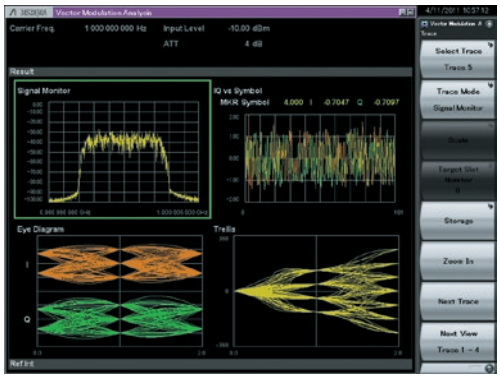
Trace Mode	Modulation Type		
	BPSK QPSK O-QPSK π/4DQPSK 8PSK 2ASK 4ASK	16QAM 32QAM 64QAM 128QAM 256QAM 512QAM 1024QAM 2048QAM 16APSK 32APSK	2FSK 4FSK H-CPM*1 MSK
Constellation	✓	✓	✓
EVM vs. Symbol	✓	✓	✓
Magnitude Error vs. Symbol	✓	✓	✓
Phase Error vs. Symbol	✓	✓	✓
Frequency vs. Symbol	—	—	✓
Trellis	✓	✓	✓
Eye Diagram	✓	✓	✓
Numeric	✓	✓	✓
I and Q vs. Symbol	✓	✓	✓
Magnitude vs. Symbol	✓	✓	✓
Phase vs. Symbol	✓	✓	✓
Signal Monitor	✓	✓	✓
Symbol Table	✓	✓	✓
Equalizer Amplitude	✓	✓	—
Equalizer Phase	✓	✓	—
Equalizer Group Delay	✓	✓	—
Equalizer Impulse Response	✓	✓	—
FSK Error vs. Symbol	—	—	✓
Fidelity vs. Symbol	—	—	✓*2
Histogram	—	—	✓
Custom Numeric	✓	✓	✓

✓: Displays measured results.
—: Does not display measured results.

*1: Used at APCO-P25 Phase2 Inbound measurement
*2: Available when Modulation Type is set to 2FSK, 4FSK, H-CPM.

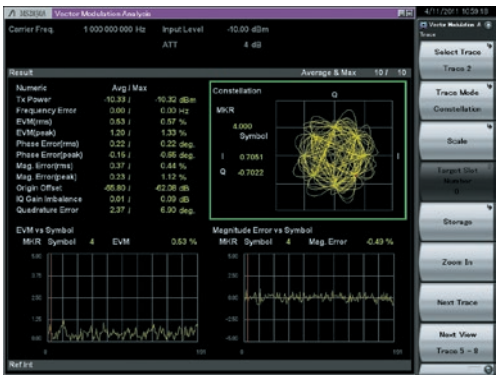


4-pane Screen (Traces 1-4)

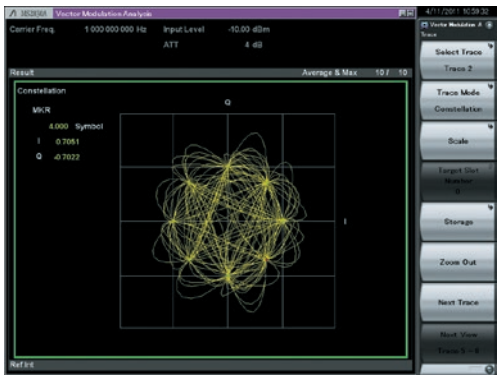


4-pane Screen (Traces 5-8)

Double-clicking the screen toggles between the four-pane and zoom screens to raise design verification efficiency through optimized operability.



4-pane Screen



Zoom Screen

Vector Modulation Analysis Software MX269017A
APSK Analysis MX269017A-001
Higher-Order QAM Analysis MX269017A-011 (Continued)

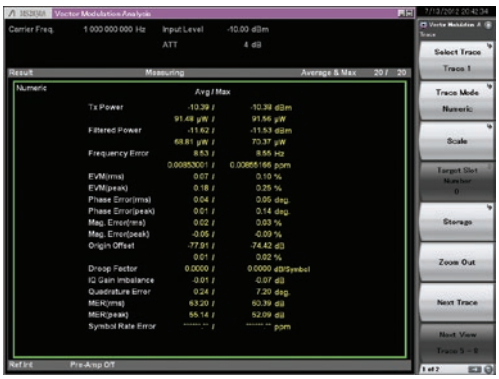
MS269xA MS2850A MS2840A MS2830A

- **Numeric Display**

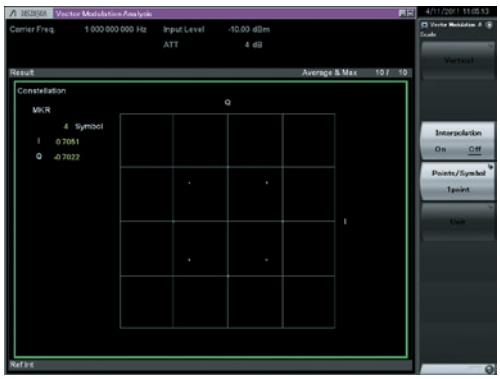
The results of Frequency Error and EVM, etc., can be listed numerically. Selecting Avg/Max displays the average and worst value simultaneously, helping clarify signal dispersion at a glance.

- **Constellation**

This displays the constellation for each modulation method. Interpolation On displays the state transition.

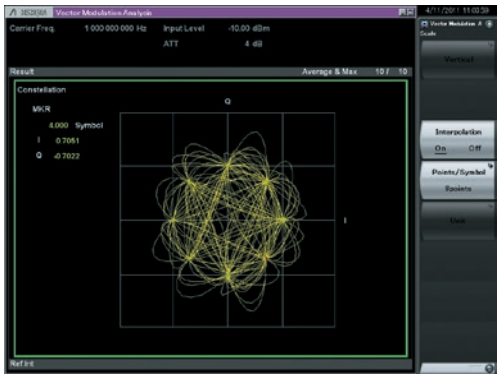


Modulation method: π/4DQPSK example

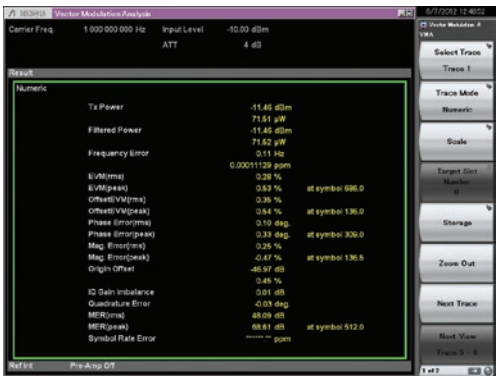


Interpolation: Off

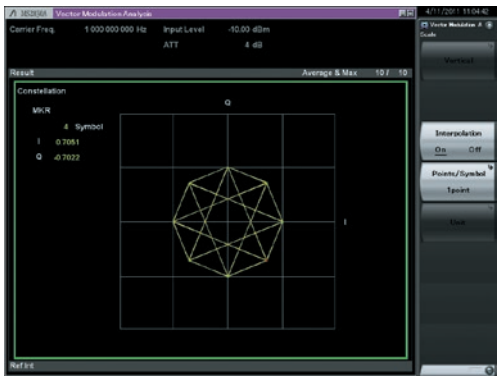
Modulation method: 4FSK example



Interpolation: On, Points/Symbol: 8points



Modulation method: O-QPSK example



Interpolation: On, Points/Symbol: 1 point

Vector Modulation Analysis Software MX269017A
APSK Analysis MX269017A-001
Higher-Order QAM Analysis MX269017A-011 (Continued)

MS269xA MS2850A MS2840A MS2830A

• vs. Symbol

This displays the temporal Symbol variation for each of nine characteristics.

- EVM vs. Symbol
- Magnitude Error vs. Symbol
- Phase Error vs. Symbol
- Frequency vs. Symbol
- I and Q vs. Symbol
- Magnitude vs. Symbol
- Phase vs. Symbol
- FSK Error vs. Symbol
- Fidelity vs. Symbol

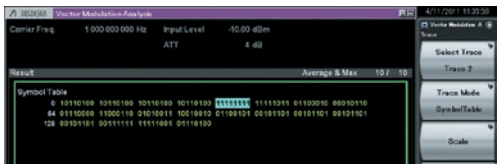
EVM vs. Symbol

Phase Error vs. Symbol

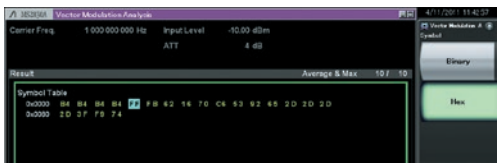
I and Q vs. Symbol

• Symbol Table

This displays the symbol decoding result. The display can be switched between binary and hexadecimal. When a synchronized word is detected, it is reverse-displayed.



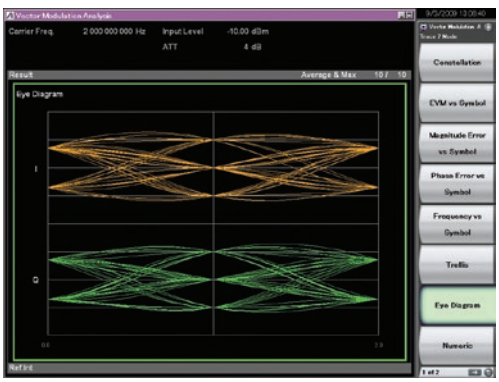
Binary example



Hexadecimal example

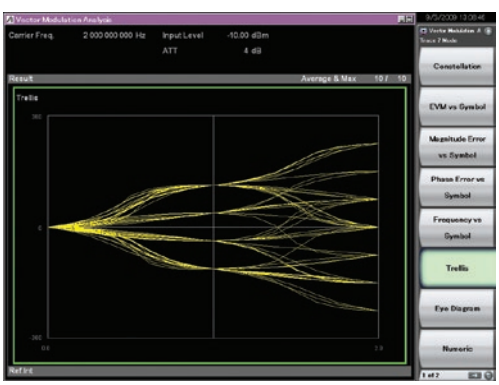
• Eye Diagram

Signal quality can be evaluated visually from the openness of the eye for each symbol at the Eye Diagram screen.



• Trellis

The Trellis screen is used to examine phase transitions of different symbols.



Vector Modulation Analysis Software MX269017A
APSK Analysis MX269017A-001
Higher-Order QAM Analysis MX269017A-011 (Continued)

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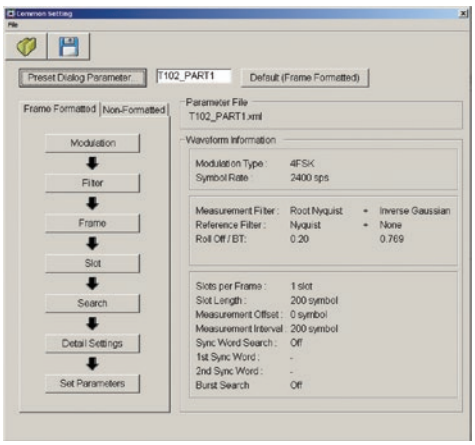
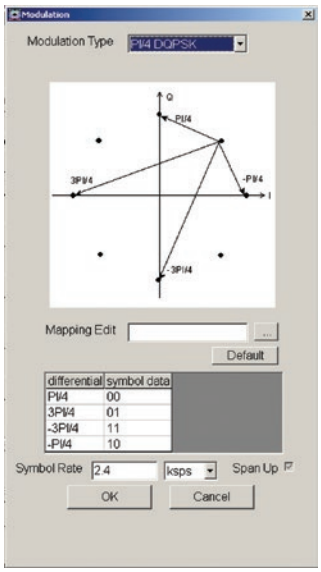
• Graphical Setting Display

Setting is easy using the simple GUI, and the setting parameter Save/Recall function lightens the burden of complex settings.



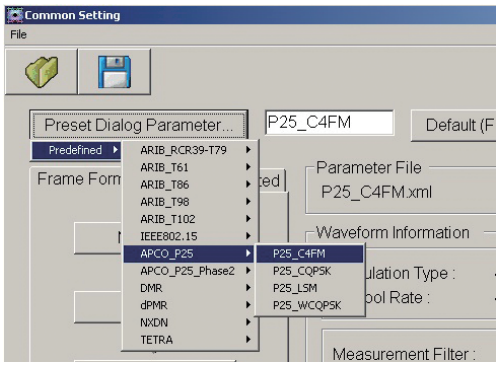
Common Setting



Modulation

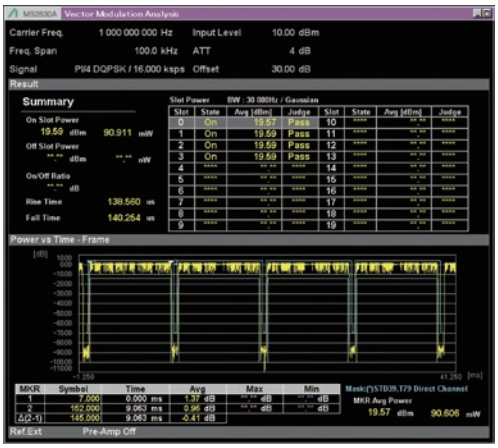
• Simple Parameter Setting Function

Simply selecting the standard name at [Preset Dialog Parameter...] Measurement parameters can be set easily for APCO-P25 Phase1/Phase2, NXDN, TETRA, DMR, dPMR, IEEE 802.15.4/4d , RCR STD-28, 39, and ARIB STD-T61, T79, T86, T98, T102.



(2) Power vs. Time

The measured-signal Rise and Fall, Slot, and Frame status can be confirmed using the time-axis graph, and a Mask can be drawn on the graph.
The numeric results indicate the On Slot average power, Off Slot average power, difference in each average power, and the Rise Time and Fall Time. In addition, the power for each Slot can be displayed as a list, while setting a Mask supports On Slot pass/fail evaluation.
Moreover, the Marker function can be used to display the Max., Min., and Average power at the selected marker position as well as to display the average power between markers.
The marker start position for the analyzed section can be set in 0.125 symbol units as standard.



Frame Results Display

Vector Modulation Analysis Software MX269017A
APSK Analysis MX269017A-001
Higher-Order QAM Analysis MX269017A-011 (Continued)

MS269xA MS2850A MS2840A MS2830A

• Wide Dynamic Range Function*

This function is used mainly for measurements, such as Power Ramp Time and Off Slot Power specified by the LMR/PMR standards.
This measurement finds the power of the On Slot and Off Slot as well as the power difference when the radio is transmitting.
For example, when measuring a power of 47 dBm (50 W) during the On Slot and –50 dBm or less during the Off Slot, a spectrum analyzer (signal analyzer) requires a wide dynamic range of at least 100 dB, taking the measurement margin into account. This is a severe requirement, but since the purpose of this function is to widen the measurement dynamic range, it is possible to measure the On Slot and Off Slot power once each by changing the setting of the signal analyzer built-in RF attenuator. In addition, the time-axis graph can display the combined results for the two measurements.
Furthermore, measurement by selecting the standard name using the previously described Simple Parameter Setting Function (Preset Dialog Parameter) enables confirmation that the input-signal On Slot and Off Slot satisfy the standard (Mask). The supported standards are as follows.

• Mask and Filter Standards Set Automatically at Preset Dialog Parameter

RCR STD-28, RCR STD-39, ARIB STD-T61, ARIB STD-T79, ARIB STD-T85, ARIB STD-T86

Other standards can also be measured by setting any Mask, filter, etc.

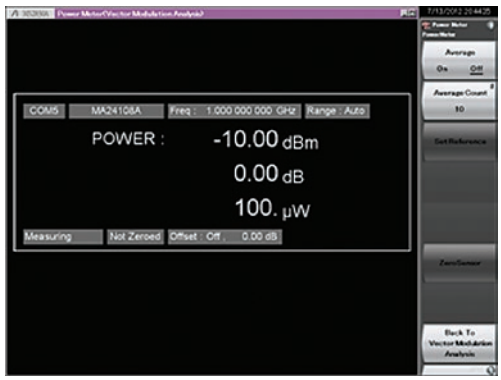
Measurement Results Example
(WDR is displayed on the screen when this function is in use.)

*: The Wide Dynamic Range Function is not supported by some units of the MS2830A 3.6 GHz/6 GHz models (MS2830A-040/041) shipped before November 2011 that do not have either the [M] or [M2] sticker attached to the back panel.

(3) Others

• Power Meter Measurement Function

The power meter measurement can performed by calling the main-frame. Power meter function can connect a USB power sensor to the main-frame and read the measurement values. Settings of Carrier Frequency, Offset, and Offset Value are automatically reflected on the corresponding parameters.



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.

Analog Measurement Software MX269018A

MS2840A MS2830A

The Analog Measurement Software MX269018A supports measurement of TRx characteristics of analog mobile radio.
Installing this software in the MS2840A and MS2830A supports fast and accurate measurement, offering an ideal and efficient evaluation platform for development, production, and maintenance of analog wireless equipment.

The various functions for development, production and maintenance of analog mobile radio are supported

All the TRx performance tests (FM/ΦM/AM) required by analog mobile radio are supported.

■ Supported Signal Analyzer MS2830A Functions

Both RF and AF signal TRx functions can be implemented simultaneously by combining the MS2830A with the analog signal generator and audio analyzer options, supporting all-in-one tests of key analog mobile radio TRx characteristics. All the high-pass, low-pass, and band-pass (weighting) filters as well as de-mphasis functions required for measuring AF signals for each type of analog mobile radio are provided for monitoring demodulated audio signals. The Audio Analyzer option with PTT (Push To Talk) connector controls the analog mobile radio PTT On/Off function.

Table 1. Functions of Analog Measurement Software and Required Configuration (MS2830A)

Analog Measurement Software Function*1			Modulation Method of Target Signal			Required Options (Refer to details of each item in Table 2.)
			FM	ΦM	AM	
Tx Tests	*RF Measurements*	Carrier Frequency and Carrier Frequency Error *RF Frequency*	✓	✓	✓	1, 2, 3, 4 are mandatory 1. Signal Analyzer (MS2830A-040/041/043*) 2. Low Phase Noise Performance (MS2830A-066) 3. Analog Measurement Software (MX269018A) 4. USB Audio (A0086D) 5. Commercial loudspeaker *: As shown above, the analog signal generator 7 cannot be installed in the MS2830A-043 because the MS2830A-066 is required.
		Transmit Power *RF Power*	✓	✓	✓	
		Modulation Measurement *Deviation (FM), Radian (ΦM), Depth (AM)*	✓	✓	✓	
		Result of Analyzed DCS Code *DCS Code*	✓	—	—	
	AF Measurements (Demodulation)	Demodulation Frequency *AF Frequency*	✓	✓	✓	
		Effective Level Value at Demodulation Frequency *Level*	✓	✓	✓	
		Distortion Ratio of Demodulation Frequency Distortion *Distortion, SINAD, THD*	✓	✓	✓	
		Time vs. Level, Frequency vs. Level *Graph Result*	✓	✓	✓	
		Demodulates input RF signals from analog mobile radio and outputs sound from USB Audio connector*2	✓*3	✓	✓	
		Demodulates input RF signals from analog mobile radio and outputs sound from internal speaker, headphone jack and demodulation output connector	✓*3	—	—	1 + 2 + 3 + 4 +6 Audio Analyzer (MS2830A-018)
	AF Output (Audio Generator Function)	AF Tone, DCS, White Noise (ITU-T Recommendation G.227), DTMF	✓	✓	✓	
	PTT (Push To Talk) Control		✓	✓	✓	
Rx Tests	RF Output	Modulation Signal Output (FM, ΦM, AM)	✓	✓	✓	1 + 2 + 3 + 4 +7 Analog Signal Generator (Refer to Table 3.)
		Internal Modulation Signal Source (AF Tone)	✓	✓	✓	
		Internal Modulation Signal Source (DCS)	✓	—	—	
	AF Measurements (Audio Analyzer Function)	Frequency *AF Frequency*	✓	✓	✓	1 + 2 + 3 + 4 +6 Audio Analyzer (MS2830A-018) +7 Analog Signal Generator (Refer to Table 3.)
		Effective Level Value *Level*	✓	✓	✓	
		Distortion Ratio *SINAD, THD, THD+N*	✓	✓	✓	
		Graph (Time vs. Level, Frequency vs. Level) *Graph Result*	✓	✓	✓	
	PTT (Push To Talk) Control		✓	✓	✓	

*1: Spurious can also be measured using the standard spectrum analyzer measurement function.
*2: Voice can be monitored by connecting a commercial loudspeaker using the A0086A, A0086B, A0086C or A0086D USB Audio option.
*3: The Wide Band FM measurement mode is not supported.

Analog Measurement Software MX269018A (Continued)

MS2840A MS2830A

Table 2. Ordering Information for Analog Measurement Software (MS2830A)

	Name	Model		Note
		New	Retrofit	
Mandatory	3.6 GHz Signal Analyzer	MS2830A-040	—	9 kHz to 3.6 GHz **This option cannot be retrofitted.**
	6 GHz Signal Analyzer	MS2830A-041	—	9 kHz to 6 GHz **This option cannot be retrofitted.**
	13.5 GHz Signal Analyzer	MS2830A-043	—	9 kHz to 13.5 GHz **This option cannot be retrofitted.** **The MS2830A-066 and signal generator options cannot be installed simultaneously.**
Mandatory	Low Phase Noise Performance	MS2830A-066	—	**This option cannot be retrofitted.** It improves phase noise performance.
Mandatory	Analog Measurement Software	MX269018A		Retrofit it is supported.
Mandatory	USB Audio	A0086D		Required for output of demodulated audio
Recommended	3.6 GHz Analog Signal Generator	MS2830A-088	MS2830A-188	Frequency setting range: 100 kHz to 3 GHz Required for Rx tests Refer to the selection conditions in Table 3.
	Audio Analyzer	MS2830A-018	MS2830A-118	
	Vector Function Extension for Analog Signal Generator	—	MS2830A-189	Add vector function to MS2830A-088/188
	3.6 GHz Vector Signal Generator	MS2830A-020	MS2830A-120	250 kHz to 3.6 GHz
	6 GHz Vector Signal Generator	MS2830A-021	MS2830A-121	250 kHz to 6 GHz
	Low Power Extension for Vector Signal Generator	MS2830A-022	MS2830A-122	Extends lower output level limit Mandatory for MS2830A-029
	Analog Function Extension for Vector Signal Generator	MS2830A-029	*	Adds analog function to MS2830A-020/021 (Requires MX269018A) Required for Rx tests Refer to the selection conditions in Table 3.

*: Please contact our sales representative

Table 3. Optional Combination Necessary for Mounting Analog Signal Generator (MS2830A)

Option model are decided by the MS2830A which required Analog Signal Generator (SG).

Please note that there is a case where an analog SG function cannot be installed for a part of MS2830A composition.

MS2830A with Installed Analog SG		New MS2830A	When Retrofitting Analog SG in MS2830A		
MS2830A Frequency Option		↓	MS2830A-040/041		MS2830A-043
Installed Vector SG		↓	Not installed	MS2830A-020/021	↓
Supported SG addition	Analog SG	MS2830A-088	MS2830A-188	*1	Cannot be installed
	Analog SG + Vector SG	MS2830A-020 or MS2830A-021 + MS2830A-022 + MS2830A-029	MS2830A-188*2 + MS2830A-189*2	—	

*1: Please contact our sales representative
*2: Can select only 3.6 GHz Vector SG/Analog SG

Analog Measurement Software MX269018A (Continued)

MS2840A MS2830A

■ Supported Signal Analyzer MS2840A Functions

Combining the MS2840A with the analog signal generator option provides all-in-one support for tests of TRx characteristics of analog mobile radio. As well as RF measurements including Tx frequency, Tx power, FM deviation, etc., Tx tests can also be used to the demodulation frequency, distortion, etc., of demodulated AF signals. High-pass filters, low-pass filters, band-pass filters (weighting filters), and de-emphasis functions support measurement of demodulated signals for each wireless type. Additionally, at Rx tests, a modulation signal can be output from the analog signal generator and AF tones and DCS codes can also be output using the built-in modulation output function.
However, the audio analyzer option and analog wireless automatic measurement software are not supported.

Table 4. Supported Signal Analyzer MS2840A Frequency Options

✓: Supported, — : Not supported

Option \ Frequency Option	MS2840A-040 (3.6 GHz) MS2840A-041 (6 GHz)	MS2840A-044 (26.5 GHz) MS2840A-046 (44.5 GHz)
Analog Measurement Software (MX269018A)	✓	✓
Analog Signal Generator (MS2840A-088, 029)	✓	—
Audio Analyzer	—	—

Table 5. Functions of Analog Measurement Software and Required Configuration (MS2840A)

✓: Supported, — : Not supported

Analog Measurement Software Function*1			Modulation Method of Target Signal			Required Options (Refer to details of each item in Table 6.)
			FM	ΦM	AM	
Tx Tests	*RF Measurements*	Carrier Frequency and Carrier Frequency Error *RF Frequency*	✓	✓	✓	1, 2, and 3 are mandatory 1. Signal Analyzer (MS2840A-040/041/044/046) 2. Analog Measurement Software (MX269018A) 3. USB Audio (A0086D) 4. Commercial loudspeaker
		Transmit Power *RF Power*	✓	✓	✓	
		Modulation Measurement *Deviation (FM), Radian (ΦM), Depth (AM)*	✓	✓	✓	
		Result of Analyzed DCS Code *DCS Code*	✓	—	—	
	AF Measurements (Demodulation)	Demodulation Frequency *AF Frequency*	✓	✓	✓	
		Effective Level Value at Demodulation Frequency *Level*	✓	✓	✓	
		Distortion Ratio of Demodulation Frequency Distortion *Distortion, SINAD, THD*	✓	✓	✓	
		Time vs. Level, Frequency vs. Level *Graph Result*	✓	✓	✓	
		Demodulates input RF signals from analog mobile radio and outputs sound from USB Audio connector*2	✓*3	✓	✓	
		Demodulates input RF signals from analog mobile radio and outputs sound from internal speaker*3, headphone jack*3 and demodulation output connector*3	—	—	—	Not supported by MS2840A
	AF Output (Audio Generator Function)	AF Tone, DCS, White Noise (ITU-T Recommendation G.227), DTMF	—	—	—	
	PTT (Push To Talk) Control		—	—	—	
Rx Tests	RF Output	Modulation Signal Output (FM, ΦM, AM)	✓	✓	✓	Not supported by MS2840A-044/046 1 + 2 + 3 + 5 Analog Signal Generator (Refer to Table 7.)
		Internal Modulation Signal Source (AF Tone)	✓	✓	✓	
		Internal Modulation Signal Source (DCS)	✓	—	—	
	AF Measurements (Audio Analyzer Function)	Frequency *AF Frequency*	—	—	—	Not supported by MS2840A
		Effective Level Value *Level*	—	—	—	
		Distortion Ratio *SINAD, THD, THD+N*	—	—	—	
		Graph (Time vs. Level, Frequency vs. Level) *Graph Result*	—	—	—	

*1: Spurious can also be measured using the standard spectrum analyzer measurement function.
*2: Voice can be monitored by connecting a commercial loudspeaker using the A0086A, A0086B, A0086C or A0086D USB Audio option.
*3: The Wide Band FM measurement mode is not supported.

Analog Measurement Software MX269018A (Continued)

MS2840A MS2830A

Table 6. Ordering Information for Analog Measurement Software (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. And the MS2830A requires the Low Phase Noise Performance MS2830A-066 but the MS2840A does not require the Low Phase Noise Performance MS2840A-066.

With 3.6 GHz Signal Analyzer (MS2840A-040) or 6 GHz Signal Analyzer (MS2840A-041)

	Name	Model		Note
		New	Retrofit	
Mandatory	3.6 GHz Signal Analyzer	MS2840A-040	—	9 kHz to 3.6 GHz **This option cannot be retrofitted.**
	6 GHz Signal Analyzer	MS2840A-041	—	9 kHz to 6 GHz **This option cannot be retrofitted.**
Mandatory	Analog Measurement Software	MX269018A		Frequency range (Tx Tests): 100 kHz to 2.7 GHz (At Wide Band FM measurement: 10 MHz to 2.7 GHz) Retrofit is supported.
Mandatory	USB Audio	A0086D		Required for output of demodulated audio
Recommended	Low Phase Noise Performance	MS2840A-066	MS2840A-166	Improves phase noise performance. This option greatly improves SSB phase noise performance.
	3.6 GHz Analog Signal Generator	MS2840A-088	MS2840A-188	100 kHz to 3 GHz Required for Rx tests Refer to the selection conditions in Table 7.
	Vector Function Extension for Analog Signal Generator	—	MS2840A-189	Add vector function to MS2840A-088/188
	3.6 GHz Vector Signal Generator	MS2840A-020	MS2840A-120	250 kHz to 3.6 GHz
	6 GHz Vector Signal Generator	MS2840A-021	MS2840A-121	250 kHz to 6 GHz
	Low Power Extension for Vector Signal Generator	MS2840A-022	MS2840A-122	Extends lower output level limit Mandatory for MS2840A-029
	Analog Function Extension for Vector Signal Generator	MS2840A-029	MS2840A-129	Adds analog function to MS2840A-020/021 (Requires MX269018A) Required for Rx tests Refer to the selection conditions in Table 7.

With 26.5 GHz Signal Analyzer (MS2840A-044) or 44.5 GHz Signal Analyzer (MS2840A-046)

	Name	Model		Note
		New	Retrofit	
Mandatory	26.5 GHz Signal Analyzer	MS2840A-044	—	9 kHz to 22.5 GHz **This option cannot be retrofitted.**
	44.5 GHz Signal Analyzer	MS2840A-046	—	9 kHz to 44.5 GHz **This option cannot be retrofitted.**
Mandatory	Analog Measurement Software	MX269018A		Frequency range (Tx Tests): 100 kHz to 2.7 GHz (At Wide Band FM measurement: 10 MHz to 2.7 GHz) Retrofit is supported.
Mandatory	USB Audio	A0086D		Required for output of demodulated audio

Table 7. Optional Combination Necessary for Mounting Analog Signal Generator (MS2840A)

Option model are decided by the MS2840A which required Analog Signal Generator (SG).

MS2840A with Installed Analog SG		New MS2840A	When Retrofitting Analog SG in MS2840A	
MS2840A Frequency Option		↓	MS2840A-040/041	
Installed Vector SG		↓	Not installed	MS2840A-020/021
Supported SG addition	Analog SG	MS2840A-088	MS2840A-188	MS2840A-129 + MS2840A-122*2
	Analog SG + Vector SG	MS2840A-020 or 021 + MS2840A-022 + MS2840A-029	MS2840A-188*1 + MS2840A-189*1	—

*1: Can select only 3.6 GHz Vector SG/Analog SG
*2: Unnecessary when MS2840A-022 already installed

Analog Measurement Software MX269018A (Continued)

MS2840A MS2830A

Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature.
The specifications are defined under the following condition unless otherwise specified.
Attenuator mode: Mechanical Attenuator Only, The correct level is set for the input signal.

The Tx measurement specifications apply to the MS2840A, and the MS2830A with built-in MS2830A-062/066 Low Phase Noise Performance Option.

Signal Analyzer			MS2840A	MS2830A	
Tx Measurements			No Audio Analyzer option	Without MS2830A-018/118 Audio Analyzer Option	With MS2830A-018/118 Audio Analyzer Option
	Common Specification	Target Signal	FM, ΦM, AM signal		
		Frequency Range	100 kHz to 2700 MHz At Wide Band FM measurement: 10 MHz to 2700 MHz		
		Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –25 to +10 dBm (Preamp On)		
		Carrier Frequency Accuracy	At 18°C to 28°C, after calibration ± (Accuracy of reference frequency × Carrier frequency + 1) Hz		
	FM Measurement	Frequency Deviation	FM: 0 < Frequency Deviation ≤ 20 kHz, 20 kHz < Frequency Deviation ≤ 40 kHz (nom.) Wide Band FM: 0 < Frequency Deviation ≤ 20 kHz, 20 kHz < Frequency Deviation ≤ 1 MHz (nom.)		
		Demodulation Frequency Range	20 Hz to 20 kHz		
		Frequency Deviation Accuracy	1% of indicated value ± Residual FM		
		Residual FM	3.35 Hz rms, S/N: >50 dB (1.5 kHz Deviation, Demodulation Band: 0.3 kHz to 3 kHz)		
		Demodulation Distortion	0.3% (Demodulation Frequency: 1 kHz, Frequency Deviation: 5 kHz, Demodulation Band: 0.3 kHz to 3 kHz)		
		DCS Measurement Function	Digital Code Squelch demodulated result display		
	ΦM Measurement	ΦM Deviation	0 to (20 kHz/Demodulation Frequency [Hz]) rad		
		Demodulation Frequency Range	20 Hz to 20 kHz		
		ΦM Deviation Accuracy	1% of indicated value ± Residual ΦM		
		Residual ΦM	0.01 rad rms (Demodulation Band: 0.3 kHz to 3 kHz)		
		Demodulation Distortion	1% (Demodulation Band: 0.3 kHz to 3 kHz)		
	AM Measurement	AM	0 to 98%		
		Demodulation Frequency Range	20 Hz to 20 kHz		
		AM Accuracy	1% of indicated value ± Residual AM		
		Residual AM	0.3% (Demodulation Band: 0.3 kHz to 3 kHz)		
		Demodulation Distortion	0.3% (Demodulation Band: 0.3 kHz to 3 kHz)		
	Filter	Low Pass	300 Hz, 3, 15, 20 kHz		
		High Pass	< 1*, < 20*, 50, 300, 400 Hz, 30 kHz *: FM only		
		Band Pass (Weighting filter)	CCITT, C-Message, CCIR 468, CCIR-ARM, A-Weighting		
		De-emphasis	25, 50, 75, 500, 750 µs		
	Amplitude Measurement	Transmit Power Accuracy	At 18°C to 28°C, after calibration, Input attenuator: ≥10 dB, Input signal in measurement level range and less than Input level, Preamp Off, or Preamp not installed ±0.5 dB Transmit Power Accuracy based on MS2840A and MS2830A main unit Absolute Amplitude Accuracy		
	Audio Monitor (Demodulation Output)		Outputs demodulated signal to USB Audio equipment connected to MS2840A/MS2830A USB terminal (Wide Band FM measurement not supported		FM/ΦM/AM: Output demodulated signal to USB audio equipment connected to MS2830A USB terminal (Wide Band FM measurements not supported) FM: Internal speaker, headphone jack or demodulation output connector (Wide Band FM measurements not supported)

Analog Measurement Software MX269018A (Continued)

MS2840A MS2830A

Signal Analyzer			MS2840A	MS2830A	
Rx Measurements			No Audio Analyzer option	Without MS2830A-018/118 Audio Analyzer Option	With MS2830A-018/118 Audio Analyzer Option
			This function is enabled either when the MS2830A/MS2840A-088 3.6 GHz Analog Signal Generator is installed, or when the MS2830A/MS2840A-020/021 Vector Signal Generator and MS2830A/MS2840A-022 Low Power Extension for Vector Signal Generator and MS2830A/MS2840A-029 Analog Function Extension for Vector Signal Generator are installed		
	RF Signal Output		The performance specifications are for the MS2830A-088 or MS2830A-020/021 when the MS2830A-029 is installed		
		Frequency Setting Range	100 kHz to 3000 MHz		
		Frequency Setting Resolution	1 Hz		
		Output Setting Level	–136 to +15 dBm (Rx frequency > 25 MHz) –136 to –3 dBm (Rx frequency ≤ 25 MHz)		
	FM	Frequency Deviation Setting Range	0 to 100 kHz		
		Frequency Deviation Setting Resolution	0.1 Hz		
		Frequency Deviation Accuracy	±1% of set value (excludes Residual FM)		
		Internal Modulation Signal Source	AF Tone Source × 2 Digital Code Squelch Signal Generator		AF Tone Source × 3 Digital Code Squelch Signal Generator
		Internal Modulation Frequency Range	Tone Frequency: 20 Hz to 40 kHz		
		Internal Modulation Frequency Resolution	0.1 Hz, Setting value ±3 Hz on use of Digital Code Squelch signal		
		DCS Code Setting Range	DCS Code: 000 to 777 (octal, 3-digit)		
	ΦM	Phase Deviation Setting Range	Settable with the range of 0 to 50.0 rad. (internal modulation frequency × phase deviation) < 100 kHz		
		Phase Deviation Setting Resolution	0.01 rad.		
		Phase Deviation Accuracy	±1% of set value (excludes Residual ΦM)		
		Internal Modulation Signal Source	AF Tone Source × 2		AF Tone Source × 3
		Internal Modulation Frequency Range	Tone Frequency: 20 Hz to 40 kHz		
		Internal Modulation Frequency Resolution	0.1 Hz		
	AM	Modulation Setting Range	0 to 100%		
		Modulation Setting Resolution	1%		
		Modulation Accuracy	±1% of set value (excludes Residual AM)		
		Internal Modulation Signal Source	AF Tone Source × 2		AF Tone Source × 3
		Internal Modulation Frequency Range	Tone Frequency: 20 Hz to 40 kHz		
		Internal Modulation Frequency Resolution	0.1 Hz		

Analog Signal Generator Option		MS2840A-029/129/088/188	MS2830A-029/088/188
Max. Reverse Input		0 Vdc (max.) +18 dBm (<20 MHz), +30 dBm (≥20 MHz)	
Function/Performance		The following specifications (see MS2840A catalog) are added to the specifications when the MS2840A-020/021 and MS2840A-022 are installed	The following specifications (see MS2830A catalog) are added to the specifications when the MS2830A-020/021 and MS2830A-022 are installed
	Frequency Setting Range	100 kHz to 3000 MHz	100 kHz to 3000 MHz
	Frequency Setting Resolution	1 Hz	
	Output Setting Level	–136 to +15 dBm (Rx frequency > 25 MHz) –136 to –3 dBm (Rx frequency ≤ 25 MHz)	
	Output Level Accuracy	18°C to 28°C, CW MS2830A-029/088/188 MS2840A-029/129/088/188	

	Output level [p] (dBm)
±3.0 dB (typ., 100 kHz ≤ f < 250 kHz)	–110 ≤ p ≤ –3
±1.0 dB (typ., 250 kHz ≤ f ≤ 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 GHz)	–110 ≤ p ≤ +4
±1.0 dB (100 MHz ≤ f ≤ 3 GHz)	–120 ≤ p < –110
±1.0 dB (typ., 100 MHz ≤ f ≤ 3 GHz)	–127 ≤ p < –120

Arbitrary Signal Generator	Available when the MS2830A-020, 021 or 189 (Vector Signal Generator) is installed	

Analog Measurement Software MX269018A (Continued)

MS2840A MS2830A

Audio Analyzer Option			MS2830A-018/118
Audio Analyzer Function			The specifications for single tone measurement are listed below
	Measurement Function		Amplitude, Frequency, THD, THD+N, SINAD
	Connection Type		Balanced: 1/4-inch phone jack (3-pole, Φ6.3 mm) Unbalanced: BNC-J
	Impedance		Balanced: 200 kΩ (AC coupled, nom.) Unbalanced: 100 kΩ (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	Low-pass	Off, 3, 15, 20, 30, 50 kHz
		High-pass	Off, 20, 50, 100, 300, 400 Hz, 30 kHz
		Bandpass (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)
	Connection Type		Balanced: 1/4-inch phone jack (3-pole, Φ6.3 mm) Unbalanced: BNC-J
	Interface		Balanced: 100 Ω/600 Ω (AC coupled, nom.) Unbalanced: 50 Ω/600 Ω (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 = 600 Ω, and Output Impedance Reference = 600 Ω
	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 (nom.)
	Maximum Output Currency		100 mA (nominal, no short circuit)
	THD + N (Total Harmonic Distortion + Noise)		At 1 kHz, 0.7 V rms, Band: 20 Hz to 25 kHz, 100 kΩ termination, 18°C to 28°C <–60 dB <–80 dB (nom.)
Other Function			
	Demodulation Output (FM only)*2	Connector Type	BNC-J
		Demodulation Output Level	–10 dBm ±2 dB (Frequency deviation: 3.5 kHz, 600 Ω)
		Demodulation Output Impedance	600 Ω
		Sound Monitor	Internal speaker or 3.5 mm phone jack (2-pole, monaural)
	Crosstalk		Crosstalk from Audio Generator to Audio Analyzer >80 dB
	PTT (Push To Talk) Control		Banana jack (Φ4.0 mm, 30 V, 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 mobile radio. Wide Band FM measurements not supported.

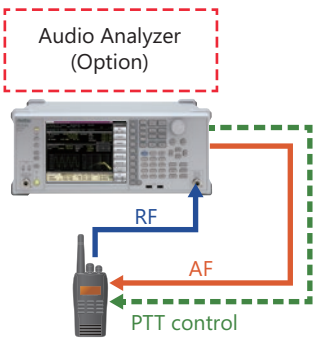
Analog Measurement Software MX269018A (Continued)

MS2840A MS2830A

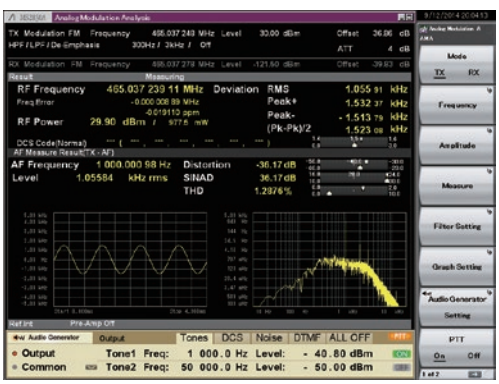
Tx Tests

- **Inputting AF Signal to analog mobile radio and Measuring Characteristics of RF Signal Output from Radio**

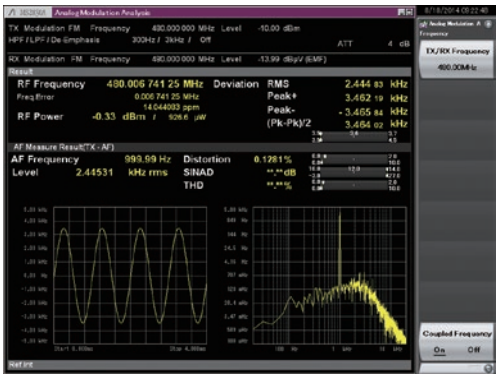
Combining the MS2830A with the audio analyzer option supports tuning of the AF signal output (AF signal input to the analog mobile radio) and testing of the radio RF transmission characteristics by monitoring at one screen.
As well as outputting the AF signal simultaneously as up to three tones, tone + DCS, white noise (ITU-T G.227) and DTMF signals can be output too. At the analog mobile radio RF Tx characteristics test, the FM/ΦM/AM frequency, power, modulation degree, demodulated AF signal frequency, level, distortion, as well as time vs. level, and frequency vs. level graphs are displayed simultaneously. At FM modulation, the DCS (Digital Code Squelch) Code analysis is displayed as well. Moreover, frequency deviation measurement can be extended up to 1 MHz in the Wide FM measurement mode (usually up to 40 kHz in the normal FM measurement mode).
Various AF filters can be set according to the analog mobile radio when analyzing demodulated AF signals. As well as the common high-pass and low-pass filter settings, there are five CCITT, C-Message, CCIR 468, CCIR-ARM, and A-Weighting bandpass filters (weighting filters) plus five types of De-emphasis setting (25, 50, 75, 500, and 750 µs).
Other application software such as a spectrum analyzer can be used simultaneously at AF signal output. For example, in addition to outputting white noise (ITU-T G.227), both spurious and occupied bandwidth (OBW) measurements can be made using the spectrum analyzer display.
The Audio Analyzer option has a PTT (Push To Talk) connector for On/Off control of the analog mobile radio PTT.



Tx Characteristics Test Setup



Example of AF Signal Output and
FM Modulation Signal Measurement Screen
(with Audio Analyzer Option)



Example of FM Modulation Signal Measurement Screen
(without Audio Analyzer Option)

Rx Tests

- **Outputting FM/ΦM/AM Signal to analog mobile radio and Measuring AF Signal Demodulated by Measuring Instrument**

Combining the MS2830A with the analog signal generator and audio analyzer options supports tuning of the RF signal output (RF signal input to the analog mobile radio) and testing of the AF signal characteristics output from the radio by monitoring on one screen.
The RF signal output from the analog signal generator supports FM/ΦM/AM modulations, and in addition to outputting up to three AF tones from the internal modulation signal source simultaneously, can also output signals created as DCS (FM only) and Wave audio format files.
At measurement of AF signals using the Audio Analyzer option, not only the frequency, level, and distortion (SINAD measurement, etc.), but also graphs of the time vs. level and frequency vs. level can be displayed simultaneously. The distortion display can either be as a numeric display or as a graph for easy SINAD tuning at the Rx sensitivity test.
As well as high-pass and low-pass filter settings for AF filters, up to five types of CCITT, C-Message, CCIR 468, CCIR-ARM, and A-Weighting bandpass filters (weighting filters) can be set.

<About Internal Modulation Signal Source>

Up to three*1 AF tone signal sources and one DCS signal source are provided.
For example, the analog mobile radio operation confirmation test can use any of the following combinations:

- AF + AF + AF
  (1 kHz audio signal + Tone squelch signal + Audio signal of any frequency)
- AF + AF + DCS
  (1 kHz audio signal + Audio signal of any frequency + DCS signal)
- AF (Wave audio format)*2

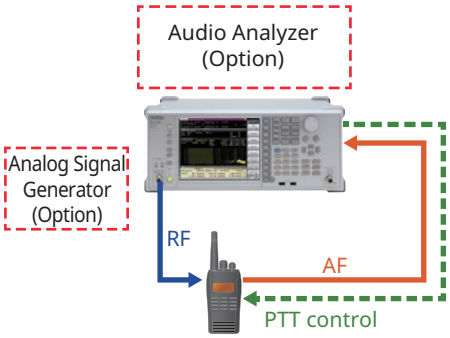
*1: Two when Audio Analyzer option not installed
*2: Output of a Wave audio format signal can also be set with the internal modulation signal source. An RF signal, such as DTMF (Dual Tone Multiple Frequency), can be output.
The following limitations apply:

- Linear PCM file
  (It is not possible to support ADPCM and the compressed format for enhanced PCM.)
- The reproduction is monaural or stereo.
  (Multi-channel is not supported and the L-Channel is used to reproduce stereo.)
- The sampling quantization bit rate is 8 or 16 bits (full-scale at modulation and modulation depth set)
- Data replay of 10 s or less
- The sampling frequency is either 44.1, 48, or 96 kHz.

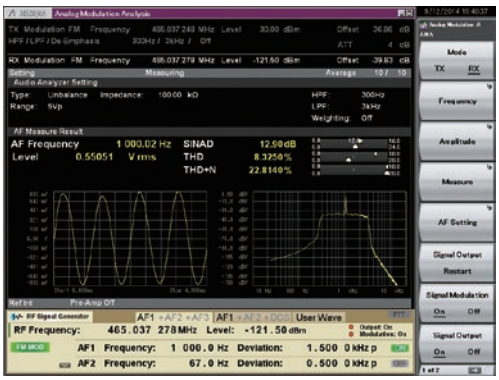
Note: Sometimes, the Wave audio format file may not be loaded even if it meets the above specifications.

Analog Measurement Software MX269018A (Continued)

MS2840A MS2830A



Rx Sensitivity Test Setup



Example of RF Signal Output and AF Signal Measurement Screen
(with Analog Signal Generator and Audio Analyzer Options)

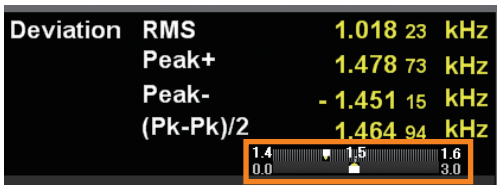
Example of RF Output Measurement Screen
(with Analog Signal Generator)

Using Meter Displays

- **Useful Meter Displays for Rx Sensitivity Test and Frequency Deviation Measurements**

Results can be displayed both as numeric and convenient meter values for confirming and tuning SINAD, THD, Distortion, and frequency deviation measurements.
Meters are split into upper and lower sections; setting a narrow range at the upper meter and a wider range at the lower meter makes it possible to clearly understand the range for tuning at the lower meter, as well as perform fine adjustments in a narrow range at the upper meter when approaching the required value.
Using these meters offers a more intuitive adjustment method than directly reading numeric values that fluctuate when adjusting SINAD at Rx sensitivity tests and frequency deviation at Tx tests (FM only).

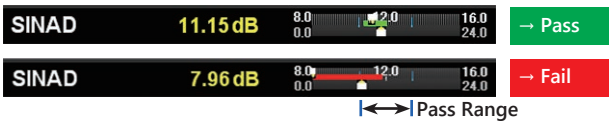
SINAD Meter



Frequency Deviation Meter (FM only)

- **Pass/Fail Displays**

Pass/Fail evaluations are displayed at all meters by setting the values for the pass range and number of measurement times.



Demodulated Voice Output

- **Demodulating RF Signal from analog mobile radio to Output Audio Signal**

The RF signal from the analog mobile radio is demodulated and the audio signal is output from the USB connector. The audio signal output from the USB Audio option can be monitored using a commercial loudspeaker.
Additionally, when the Audio Analyzer option is installed, the audio signal can be monitored either at the internal speaker, the headphone jack or the demodulation output connector.*

*: Only supports FM and Wide FM measurement mode not supported.

Pulse Radar Measurement Function MX284059B

MS2840A

The Pulse Radar Measurement Function MX284059B software option for the Signal Analyzer MS2840A (26.5/44.5 GHz models) facilitates automated measurement of key transmission evaluation items for radar maintenance and manufacturing inspections. The MS2840A itself performs measurement by controlling the USB Peak Power Sensor according to the target signal and measurement items to support a wide range of radar types.

The measured results can be saved as both numeric values and waveform images with Pass/Fail evaluation. Emissions measurement calculates the ITU-R-recommended 40-dB bandwidth automatically.

Advantages of Introduction

- Simple setup for easy test equipment transport and handling
- Pre-registered measurement parameters reduce measurement operation and setting mistakes as well as cut measurement times
- Automated PC-free measurement environment

Function Outline

- Supports wide pulse width range for S-, C-, X- and Ku-band meteorological, maritime, coastguard, aerospace, etc., radar
- Evaluates specific pulse-radar transmission items, including 40-dB bandwidth calculation, emissions measurement, and more (selectable from 20 dB, 30 dB, 40 dB/decade)
- Supports short/long/multi-pulse conditions used by modern solid-state radar

Modulation Type

Non-FM Pulse Radar, FM Pulse Radar

Key Measurement Items

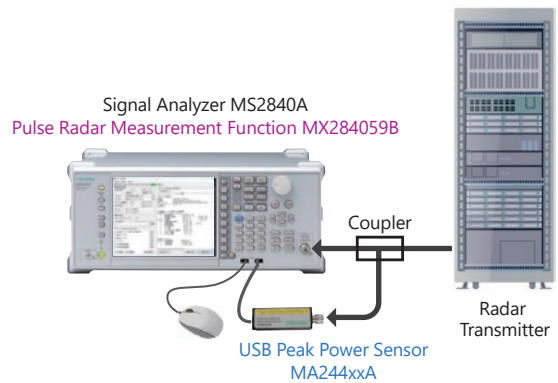
- Tx power
- Tx frequency
- Pulse time (pulse width, rise/fall time, pulse repetition frequency)
- Frequency deviation (for FM chirp)
- 40-dB bandwidth*
- Emissions (out-of-band domain, spurious domain)
- Occupied bandwidth
- Graph display*
  - Out-of-band mask and 40-dB bandwidth and limit
  - Spurious and limit
  - Occupied bandwidth

*: Supports 40-dB bandwidth calculation formula (39) for Non-FM Pulse Radars and (40) (44) for FM Pulse Radars described in ITU-R SM.1541-6 (08/2015) standard and Public Notice of Japan MIC No. 1232, October 2005/No. 67, June 2019.

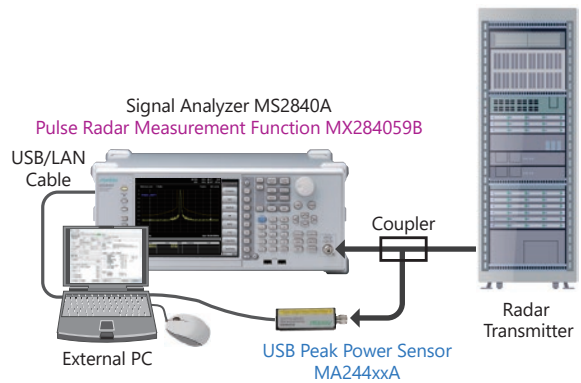
Setup (With USB Peak Power Sensor)

Can install same application software in both MS2840A and external PC

<Automated Measurement with Standalone Signal Analyzer>



<Automated Measurement with External PC and Signal Analyzer>



Can transfer measured data from signal analyzer to PC when using external PC

MX284059B Controllable USB Peak Power Sensors

Model	Frequency Range	VBW (high/std)	Power Measurement Range		RF Connector
			Pulse	Average	
MA24406A	50 MHz to 6 GHz	195 MHz/350 kHz	–50 to +20 dBm	–60 to +20 dBm	N (male)
MA24418A	50 MHz to 18 GHz	70 MHz/350 kHz	–24 to +20 dBm	–34 to +20 dBm	N (male)
MA24440A	50 MHz to 40 GHz	70 MHz/350 kHz	–24 to +20 dBm	–34 to +20 dBm	K (male)

The USB Peak Power Sensor MA244xxA cannot use the MS2840A Power Meter function.

Pulse Radar Measurement Function MX284059B (Continued)

MS2840A

Measurement Screen Image (Settings, Numeric Results)

Measurement target settings

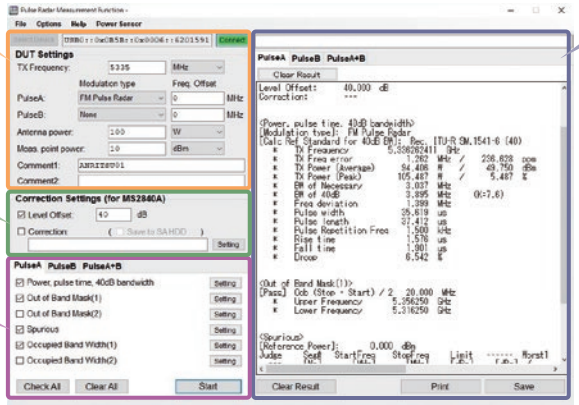
Sets frequency and Tx power used as the measurement reference. Three types of pulses are available: A only, B only, and A & B.

Correction settings

Compensates for level offset and path loss at the monitor terminal.

Measurement item selection for each pulse

Select each of the three types of measurement items A/B/A & B.



View results

The measured numerical results are displayed on the right side of the screen.

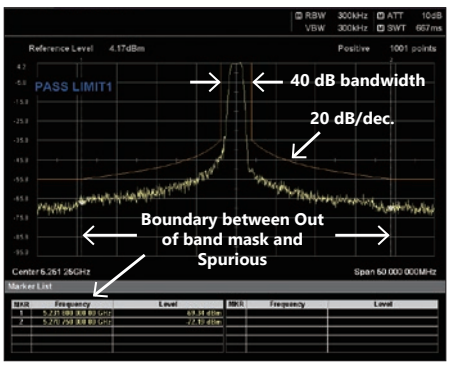
Clicks [Save] to save numerical results and measurement screens. When controlling from an external PC, transfer numerical results and measurement screens to the external PC.

Measurement Screen Image (Waveform Display)

The screen displays the measured waveform as well as the mask at emissions measurement. The measurement screen can be saved as an image file.

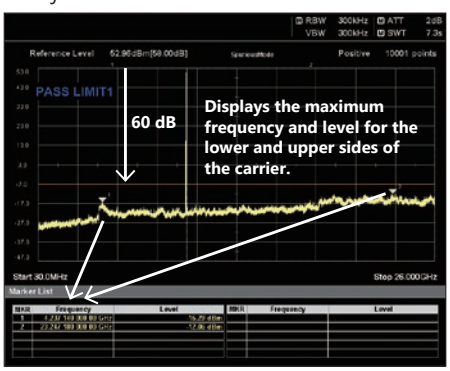
- **40 dB Bandwidth, Out of Band Mask**

The 40-dB bandwidth and 20/30/40 dB decade mask are calculated and drawn automatically. Furthermore, the spurious area and out-of-band area are Pass/Fail evaluated automatically.



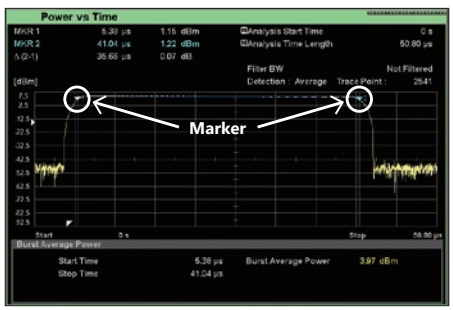
- **Spurious**

MS2840A can measure 60 dBc as defined by Japanese Radio Law without a band rejection filter.



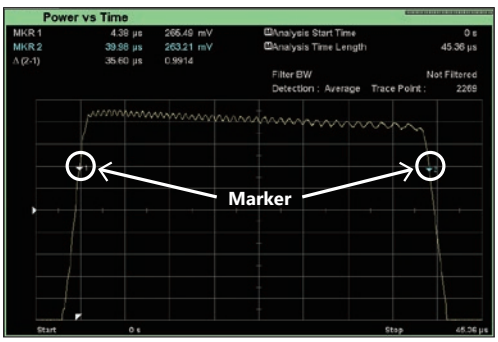
- **Average Power**

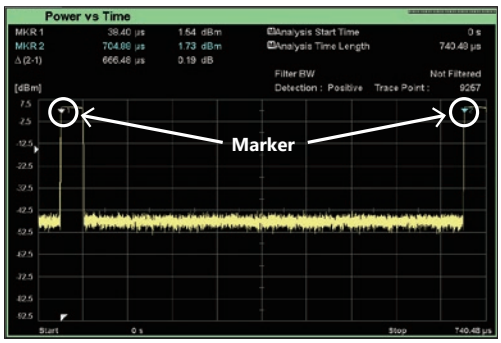
Automatically identifies the pulse duration and measures the average power.



- **Pulse Time (Pulse Width, Pulse Repetition Interval)**

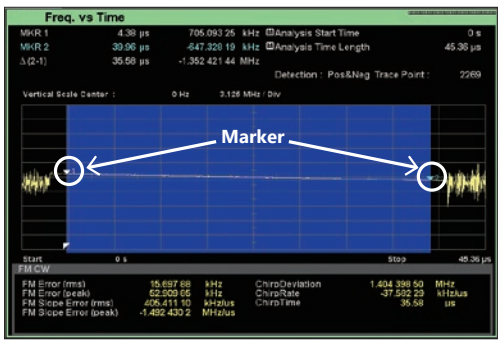
Automatically identifies the pulse On section and measures the pulse duration and pulse period.





- **Frequency Deviation**

The frequency deviation is measured using the standard function (FMCW function) of MS2840A.



Pulse Radar Measurement Function MX284059B (Continued)

MS2840A

Specifications

Item		MS2840A
Carrier	Frequency Range	MS2840A-044: 300 MHz to 26,500 MHz MS2840A-046 300 MHz to 36,000 MHz
	Amplitude Range	–5 to +30 dBm USB Peak Power Sensor MA244xxA measurement time depends on other specifications
Emissions	Frequency Range	MS2840A-044: 30 MHz to 26,500 MHz MS2840A-046: 30 MHz to 44,500 MHz
Measurement Frequency Accuracy (standard)		±2.2 × 10^{-8} (1 hour after power-on at 18°C to 28°C)
Supported Signal Conditions	Pulse Types	2 (Pulse A, Pulse B)
	Modulation Type	Non-FM Pulse Radar, FM Pulse Radar
	Pulse Width	0.5 µs to 2000 µs (without USB Peak Power Sensor MA244xxA) 0.2 µs to 2000 µs (with USB Peak Power Sensor MA244xxA)
	Pulse Repetition Interval	0.05 ms to 100 ms (PRF = 10 Hz to 20 kHz)
	Frequency Deviation	0 to 31 MHz (with pulse width of ≥0.5 µs)

Operating Environment

Using MX284059B installed in MS2840A
Firmware Version: 21.01.00 or newer
To control the USB peak power sensor MA244xxA, the USB Peak Power Sensor application software MA24400A must be installed.

Using MX284059B installed in external PC
OS: Windows 10 English/Japanese 64 bit
Software: NI-VISA™ 17.5
The installer is saved on the DVD-ROM provided with the MS2840A. It is also available from the National Instruments™ website.
To control the USB peak power sensor MA244xxA, the USB Peak Power Sensor application software MA24400A must be installed.

Recommended Configuration

Signal Analyzer

Model	Name	Note
MS2840A	Signal Analyzer	
MS2840A-044	26.5 GHz Signal Analyzer	N-connector Requires N-SMA Adapter J1398A for measurement at ≥18 GHz using recommended configuration with N-connector
MX284059B	Pulse Radar Measurement Function	

Model	Name	Note
MS2840A	Signal Analyzer	
MS2840A-046	44.5 GHz Signal Analyzer	K-connector
MS2830A-019	2 dB Steps Attenuator	Installation required
MX284059B	Pulse Radar Measurement Function	

DANL is higher when the following options are installed. It is better not to install these options for emissions measurement.
MS2840A-067 Microwave Preselector Bypass
MS2840A-068 Microwave Band Preamplifier (MS2840A-046 only)
MS2840A-069 26.5 GHz Microwave Band Preamplifier (for MS2840A-044 only)

The MX284059B can be retrofitted to the customer's MS2840A. Note the above hardware option configuration conditions.

USB Peak Power Sensor

Model	Name	Note
MA24406A	USB Peak Power Sensor	N-connector, 50 MHz to 6 GHz
MA24418A	USB Peak Power Sensor	N-connector, 50 MHz to 18 GHz
MA24440A	USB Peak Power Sensor	K-connector, 50 MHz to 40 GHz

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

MS269xA MS2850A MS2830A

The LTE Downlink Measurement Software MX269020A and LTE TDD Downlink Measurement Software MX269022A support measurement of RF characteristics of 3GPP Release 8 LTE (Long Term Evolution) downlink signals.
The LTE-Advanced FDD Downlink Measurement Software MX269020A-001*1 and LTE-Advanced TDD Downlink Measurement Software MX269022A-001*2 support measurement of RF characteristics of 3GPP Release 10 LTE-Advanced downlink signals.

*1: Requires MX269020A
*2: Requires MX269022A

The MS269020A and the MS269020A-001 support FDD (Frequency Division Duplex) measurement systems while the MX269022A and the MX269022A-001 support TDD (Time Division Duplex) systems.
Installing these software applications in the MS269xA/MS2850A/MS2830A signal analyzers offers fast and accurate measurements for improving the quality and efficiency of 3GPP LTE base station and device component development and manufacturing.

Features

■ Support Testing of 3GPP TS 36.141 Release 8 and Release 10 Downlink RF Characteristics

■ Easy Setting of Measurement Conditions

- At prototype signal measurement, measurement is performed simply by specifying the parameter test model.
- Synchronization to the input signal is performed automatically using a Synchronization Signal or Reference Signal.

■ Versatile Analysis Results Formats and Graphs

- Full Output Power, Frequency Error, and EVM
- Power and EVM for each Physical channel
- Both sub-carrier and symbol EVM and I/Q constellation displays
- Power, EVM and I/Q constellation displays for each RB
- Display of EVM and PHY channel type for each resource element
- Spectrum flatness/graph: Amplitude, Phase and Group Delay frequency characteristics

■ MIMO Summary Function: Measures Timing Difference between up to 4 MIMO Tx Signal Antennas

■ Batch Measurement Function: Batch measures and lists displays multiple items such as modulation accuracy and power spectrum

■ Replay Function for Troubleshooting Faults

■ Supports LTE-Advanced Carrier Aggregation Signal Measurements (requires installed LTE-Advanced measurement option)

- Multi-band and multi-carrier measurements
  In-band continuous carrier batch measurement
  Inter-band discontinuous carrier measurement as one sequence
- Adjacent channel leakage power, spurious and continuous carrier occupied bandwidth measurements for each band

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

Main unit	Analysis Bandwidth Extension Option	Maximum Analysis Bandwidth (In-band carrier aggregation range)	Maximum Number of Band	Maximum Number of Component Carrier
MS269xA	MS269xA-078 installed	125 MHz	3	5
	MS269xA-077 installed	31.25 MHz	3	5
	Standard	31.25 MHz	3	5
MS2850A	Standard	125 MHz	3	5
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

■ Measurement Items

- Frequency Error
- Output Power
- RSTP (RS TX power)
- OSTP (OFDM Symbol TX power)
- EVM (Peak/RMS)
- EVM of each Physical Channel: RS/P-SS/S-SS/PBCH/PCFICH/PHICH/PDSCH
- Origin Offset
- Timing Offset (External Trigger)
- MIMO Summary: Frequency Error, Power, Timing Offset,
  EVM based on RS of each antenna

■ Graphical Display

- Constellation
- EVM vs. Subcarrier
- EVM vs. Symbol
- Spectral Flatness
- Power vs. Resource Block
- EVM vs. Resource Block
- Resource Element (RE) Map
- Power vs. Time (only MX269022A)

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 (Continued)

MS269xA MS2850A MS2830A

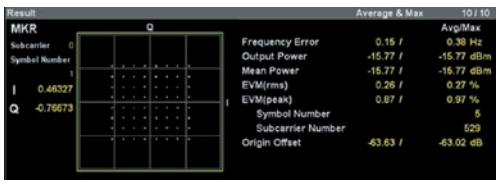
Measurement Functions

• Easy Measurement of Test Model Signals

Test model signals defined in 3GPP TS 36.141 as test patterns for BTS Tx tests are easily measured by selecting the test model name.

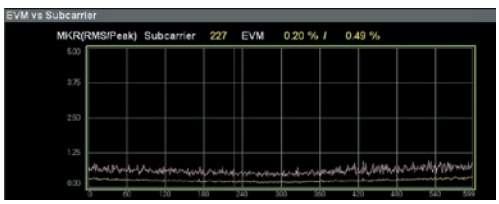
• Frequency Error/Transmit Power/EVM

This displays the frequency error, transmit power and EVM of all subcarriers in a specified measurement segment as a constellation. When averaging is performed, the maximum and mean values are displayed simultaneously.
In addition, the "Auto mode" automatically evaluates the modulation scheme of the input signal to support measurement of DL signals including different modulation schemes for each release block.



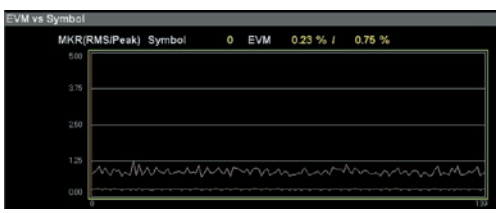
• EVM vs. Subcarrier

This displays a graph of the vector errors for each subcarrier for a specified symbol or for all symbols in a specified segment.
Simultaneous display of mean (rms) and peak values.



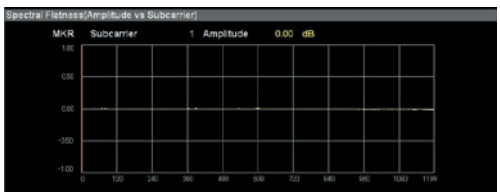
• EVM vs. Symbol

This displays a graph of the vector errors for each symbol for a specified subcarrier or for all subcarriers.
Simultaneous display of mean (rms) and peak values.



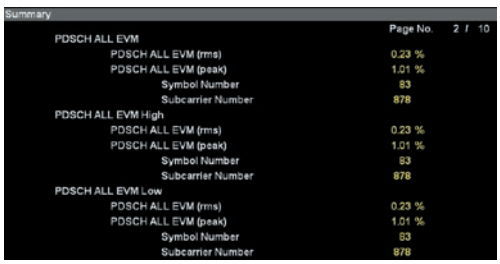
• Spectral Flatness

This displays a graph of amplitude, amplitude difference, phase, and group delay for each subcarrier for all symbols in a specified measurement segment.

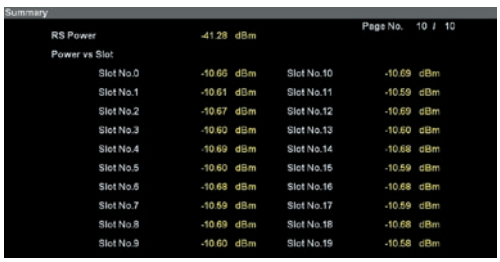


• Summary Display

This displays a list of various information, such as EVM for each channel (PDSCH, PUSCH, PDCCH, RS, SS, PBCH) and the power of each slot.



PDSCH EVM Display



Power vs. Slot

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 (Continued)

MS269xA MS2850A MS2830A

• Power vs. Resource Block

This displays the power of each resource block in a specified subframe or specified subframe segment. Power boosting over each resource block can be checked easily by visual monitoring of the power distribution.
Moreover, simultaneous display of the constellation for a specified resource block makes troubleshooting easy.

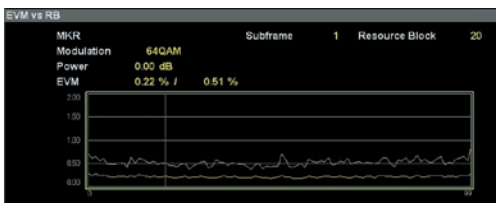
Specified Subframe

Power Display for Each Resource Block

Constellation for Specified Resource Block

• EVM vs. Resource Block

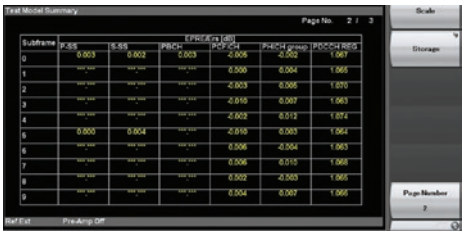
This displays a graph of the EVM distribution for each resource block in a specified subframe segment, making it easy to check resource-block dependent EVM deterioration.



• Test Model Summary Display

This displays the analysis results for the signal types set at Test Model.

- RS boosting for each subframe
- EPRE for each channel for each subframe
- PDSCH EPRE for each modulation method for each subframe



Test Model Summary

• MIMO Summary Display

The results for each antenna port are displayed when measuring MIMO. The results are displayed for the number of antenna signals specified at Number of Antenna Ports.

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 (Continued)

MS269xA MS2850A MS2830A

• Power vs. Time Function (MX269022A and MS269xA)

Following numeric result is displayed in the upper part of the screen and displays time variation of signal in 1 Frame section in the lower part of screen.

- Off Power
- Transient Period
- Mask Judge
- On Power
- Power at Mask Edge

• Batch Measurement Function

This function supports batch measurement and list display of the modulation accuracy and Tx power spectrum to shorten the measurement time and comprehensively check the measurement results. When the MS269020A-001 and MX269022A-001 are installed, multiple bands and multiple carriers can be measured at the batch-measurement function screen*.

*: If the LTE-Advanced option is not installed, measurement is limited to only one carrier.

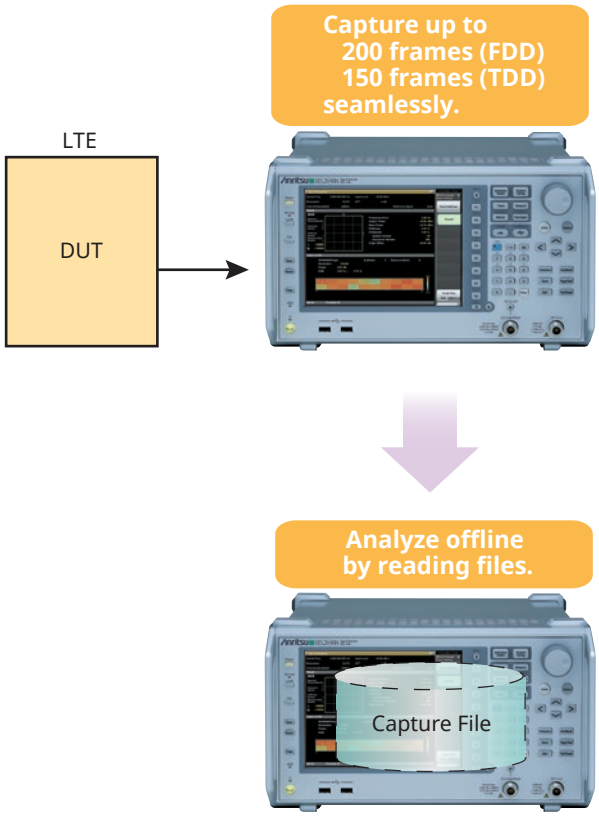
Batch Measurement Screen
(Measurement example for in-band 5 continuous carriers)

Batch Measurement Screen
(Measurement example for carriers in 2 bands)

• Replay Function for Troubleshooting Faults

Up to 200 frames of LTE signals can be captured as a file for replay by the LTE measurement software to perform analyses such as EVM measurement.*

*: Batch measurement is not supported when the MX269020A-001 is installed.



Example of R&D use

Save data for comparing each DUT test version
→ Supports comparison of retrofitting improvement effects

Example of production line use

Save delivery inspection data
→ Supports rechecking of performance data for troubleshooting post-delivery faults

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 (Continued)

MS269xA MS2850A MS2830A

Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature.
The specifications are defined under the following condition unless otherwise specified.
Attenuator mode: Mechanical Attenuator Only (MS2830A only)

LTE Downlink Measurement Software MX269020A, LTE-Advanced FDD Downlink Measurement Software MX269020A-001

Signal Analyzer		MS269xA	MS2830A MS2850A
Common Specifications	Channel Bandwidth	1.4, 3, 5, 10, 15, 20 MHz	
	Target Signals	Downlink	
	Capture Time	Auto: 1 Frame Manual: 1 to 200 Frame	
Modulation/ Frequency Measurement	Measurement Frequency Range	600 MHz to 4 GHz	MS2830A-041/043/044/045: 600 MHz to 4 GHz MS2830A-040: 600 MHz to 3.6 GHz MS2850A: 600 MHz to 4 GHz
	Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –15 to +10 dBm (Preamp On)	
	Carrier Frequency Accuracy	After CAL execution at 18°C to 28°C For a signal of EVM = 1% For Measurement Interval = 10 Subframe	
		± (Accuracy of reference frequency × Carrier frequency + 3) Hz (Excluding the Batch Measurement when MS269xA-004 is installed)	MS2830A (MS2830A-078 not installed), MS2850A: ± (Accuracy of reference frequency × carrier frequency + 3.5) Hz (center frequency: 600 MHz to 2700 MHz) ± (Accuracy of reference frequency × carrier frequency + 8.0) Hz (center frequency: 2700 MHz to 4000 MHz) MS2830A (At CC of center frequency when MS2830A-078 installed. At input level of –4 dBm when MS2830A-045 installed) ± (Accuracy of reference frequency × carrier frequency + 4.0) Hz (center frequency: 600 MHz to 2700 MHz) ± (Accuracy of reference frequency × carrier frequency + 8.0) Hz (center frequency: 2700 MHz to 4000 MHz)
	Residual Vector Error	After CAL execution at 18°C to 28°C At measurement Interval = 10 subframe	
		<1.0% (rms) (Excluding the Batch Measurement when MS269xA-078 is not installed or MS269xA-004 is installed) <1.3% (rms) (In the CC of the center frequency when MS269xA-078 is installed)	<1.3% (rms) (At the input level of –4 dBm when MS2830A-045 is installed)
Amplitude Measurement	Tx Power Measurement Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit.)	After CAL execution, input attenuator ≥10 dB, at 18°C to 28°C, the input signal is within the measurement level range and below the value set in Input Level.	
		Excluding the Batch Measurement when the MS269xA-004 is installed. ±0.6 dB (at Preamp Off, or Preamp not installed.) ±1.1 dB (at Preamp On)	MS2830A: ±0.6 dB (at Preamp Off or Preamp not installed) MS2850A: ±0.6 dB (at Preamp Off or Preamp not installed) ±1.1 dB (at Preamp On)
Waveform Display		Provides functions for displaying waveforms below. Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Power vs. Resource Block, EVM vs. Resource Block, Spectral Flatness	
Adjacent Channel Leakage Power Measurement	Measurement Method	Executes the adjacent channel power measurement function of the Spectrum Analyzer or Signal Analyzer.	
Occupied Bandwidth Measurement	Measurement Method	Executes the occupied bandwidth measurement function of the Spectrum Analyzer or Signal Analyzer.	
Channel Power Measurement	Measurement Method	Executes the channel power measurement function of the Spectrum Analyzer or Signal Analyzer.	
Spectrum Emission Mask Measurement	Measurement Method	Executes the spectrum emission mask measurement function of the Spectrum Analyzer.	
Digitize Function	Function Overview	Capable of outputting captured waveform data to internal or external storage device.	
	Waveform Data	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 the absolute amplitude accuracy and in-band frequency characteristics of the signal analyzer.	
Replay Function	Function Overview	Analyzes traces of saved waveform data Format: I, Q (32 bit floating point binary format) Sampling rate: 50 MHz	

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 (Continued)

MS269xA MS2850A MS2830A

LTE TDD Downlink Measurement Software MX269022A, LTE-Advanced TDD Downlink Measurement Software MX269022A-001

Signal Analyzer		MS269xA	MS2830A MS2850A
Common Specifications	Channel Bandwidth	1.4, 3, 5, 10, 15, 20 MHz	
	Target Signals	LTE TDD Downlink	
	Capture Time	Auto: 5 frame Manual: 5 to 150 frame	
Modulation/ Frequency Measurement	Measurement Frequency Range	600 MHz to 4 GHz	MS2830A-041/043/044/045: 600 MHz to 4 GHz MS2830A-040: 600 MHz to 3.6 GHz MS2850A: 600 MHz to 4 GHz
	Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –30 to +10 dBm (Preamp On)	
	Carrier Frequency Accuracy	After CAL execution at 18°C to 28°C For a signal of EVM = 1% When Downlink 10 Subframe is the measurement target	
		± (Accuracy of reference frequency × Carrier frequency + 3) Hz (Excluding the Batch Measurement when MS269xA-004 is installed)	MS2830A (MS2830A-078 not installed) ± (Accuracy of reference frequency × carrier frequency + 3.5) Hz (center frequency: 600 MHz to 2700 MHz) ± (Acccuracy of reference frequency × carrier frequency + 8.0) Hz (center frequency: 2700 MHz to 4000 MHz) MS2830A (At CC of center frequency when MS2830A-078 installed. At input level of –4 dBm when MS2830A-045 installed.), MS2850A: ± (Acccuracy of reference frequency × carrier frequency + 4.0) Hz (center frequency: 600 MHz to 2700 MHz) ± (Acccuracy of reference frequency × carrier frequency + 8.0) Hz (center frequency: 2700 MHz to 4000 MHz)
	Residual Vector Error	After CAL execution at 18°C to 28°C When Downlink 10 Subframe is the measurement target	
		<1.0% (rms) (Excluding the Batch Measurement when MS269xA-078 is not installed or MS269xA-004 is installed) <1.3% (rms) (In the CC of the center frequency when MS269xA-078 is installed)	MS2830A: <1.3% (rms) (With MS2830A-078 not installed, At input level of –4 dBm when MS2830A-045 installed) <1.3% rms) (At CC of center frequency when MS2830A-078 installed, At input level of –4 dBm when MS2830A-045 installed) MS2850A: <1.3% (rms)
Amplitude Measurement	Measurement Level Range	–15 to +30 dBm (Preamp Off or Preamp not installed) –30 to +10 dBm (Preamp On)	MS2830A: –15 to +30 dBm (Preamp Off or Preamp not installed) MS2850A: –15 to +30 dBm (Preamp Off or Preamp not installed) –30 to +10 dBm (Preamp On)
	Tx Power Measurement Accuracy (Found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit)	At 18°C to 28°C, After calibration, Input attenuator ≥10 dB, With input signal within measurement level range and below value set at Input Level	
		Excluding batch measurement when MS269xA-004 installed ±0.6 dB (at Preamp Off or Preamp not installed) ±1.1 dB (at Preamp On)	MS2830A: ±0.6 dB (at Preamp Off or Preamp not installed) MS2850A: ±0.6 dB (at Preamp Off or Preamp not installed) ±1.1 dB (at Preamp On)
Waveform Display		Provides functions for displaying waveforms below. Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Power vs. Resource Block, EVM vs. Resource Block, Spectral Flatness	
Adjacent Channel Leakage Power Measurement	Measurement Method	Executes the adjacent channel power measurement function of the Spectrum Analyzer or Signal Analyzer.	
Occupied Bandwidth Measurement	Measurement Method	Executes the occupied bandwidth measurement function of the Spectrum Analyzer or Signal Analyzer.	
Channel Power Measurement	Measurement Method	Executes the channel power measurement function of the Spectrum Analyzer or Signal Analyzer.	
Spectrum Emission Mask Measurement	Measurement Method	Executes the spectrum emission mask measurement function of the Spectrum Analyzer.	
Digitize Function	Function Overview	Capable of outputting captured waveform data to internal or external storage device.	
	Waveform Data	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 the absolute amplitude accuracy and in-band frequency characteristics of the signal analyzer.	
Replay Function	Function Overview	Analyzes traces of saved waveform data Format: I, Q (32 bit floating point binary format) Sampling rate: 50 MHz	
Power vs. Time	Function Overview	Provides measurements for Transmitter OFF Power, Time Mask, and Transmitter Transient Period. This function can be used only in the MS269xA series.	
	Dynamic Range	121.4 dB (nom.)*1, *2	

*1: This is the value when Channel bandwidth is 5 MHz. For the other channel bandwidth, the following formula can be used.
$10\log_{10}$(Channel bandwidth/5.0 MHz) dB
*2: Wide Dynamic Range = On, Noise Correction = On

LTE Uplink Measurement Software MX269021A
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LTE TDD Uplink Measurement Software MX269023A
LTE-Advanced TDD Uplink Measurement Software MX269023A-001

MS269xA MS2850A MS2830A

LTE Uplink Measurement Software MS269021A is for testing RF characteristics of 3GPP LTE FDD Uplink signal. LTE-Advanced FDD Uplink Measurement Software MX269021A-001 expands the Carrier Aggregation measurement function to MX269021A.

LTE Uplink Measurement Software MS269023A is for testing RF characteristics of 3GPP LTE TDD Uplink signal. LTE-Advanced TDD Uplink Measurement Software MX269023A-001 expands the Carrier Aggregation measurement function to MX269023A.

These applications improve the quality and efficiency of 3GPP LTE terminal and device component development and manufacturing.

Features

■ Support Testing of 3GPP TS 36.521-1 V10.5.0 (2013-03) Uplink RF Characteristics

■ Versatile Analysis Results Formats and Graphs

- Full Output Power, Frequency Error, and EVM
- Power and EVM for each Physical channel
- Both sub-carrier and symbol EVM and I/Q constellation displays
- Spectrum flatness/graph: Amplitude, Phase and Group Delay frequency characteristics
- Time Based EVM
- EVM vs. Demod-Symbol
- In-Band Emission
- Power vs. Time

■ Replay Function for Troubleshooting Faults

■ Measurement Items

[Text Display]

- Frequency Error
- Output Power
- EVM (rms)/(peak)
- Origin Offset
- Timing Offset (External Trigger)

[Graphical Display]

- Constellation
- EVM vs. Subcarrier
- EVM vs. Symbol
- Spectral Flatness
- Time Based EVM
- EVM vs. Demod-Symbol
- In-Band Emission

[Summary Display]

- PUSCH EVM (rms)/(peak)
- DMRS EVM (rms)/(peak)
- Frequency Error
- Output Power, Mean Power
- EVM (rms)/(peak)
- Origin Offset
- Time Offset
- Total EVM (Time Based)
- PUSCH QPSK/16QAM/64QAM EVM (Time Based)
- Total EVM (Frequency Based)
- PUSCH ALL/QPSK/16QAM/64QAM EVM
- DMRS EVM
- Frequency Error vs. Slot
- Origin Offset vs. Slot
- In-Band Emission
- Inside/Outside Flatness
- EVM Equalizer Spectrum Flatness

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LTE-Advanced TDD Uplink Measurement Software MX269023A-001 (Continued)

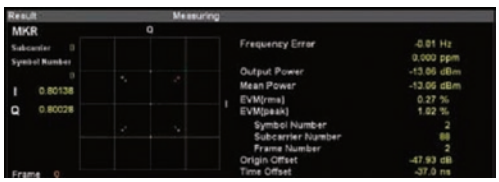
MS269xA MS2850A MS2830A

Measurement Functions

• Constellation/Numerical Results

The Constellation/Numerical value results are displayed.

- Frequency Error
- Output Power (Mean power in 31.25 MHz bandwidth)
- Mean Power (Mean power in channel bandwidth)
- EVM [Peak/rms]
- Origin Offset
- Time Offset (time offset between the trigger input and head of the frame)

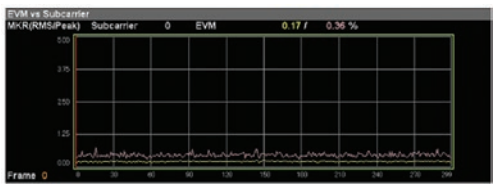


• EVM vs. Subcarrier

This displays the EVM vs. Subcarrier graph (horizontal axis = Subcarrier, vertical axis = EVM) at the bottom of the screen.
The following EVM can be selected by switching EVM vs. Subcarrier View.

Averaged over all Symbols: Mean value of all analysis symbols
Each Symbol: Value of symbol selected by marker

It is useful for checking in-band interference signals.



• EVM vs. Symbol

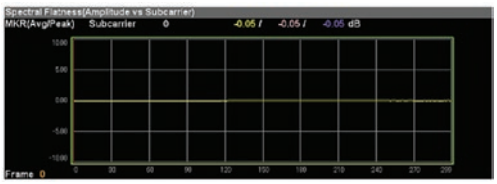
This displays the EVM vs. Symbol graph (horizontal axis = Symbol, vertical axis = EVM) at the bottom of the screen.
It is useful for checking characteristics in the time direction and faults at a specific symbol.

• Spectral Flatness

Four kinds of graphs are switched.

1. Amplitude vs. Subcarrier
   Relative power of each subcarrier to average power of all subcarriers
2. Difference Amplitude vs. Subcarrier
   Power difference between adjoined subcarriers
3. Phase vs. Subcarrier
   Phase error of each subcarrier
4. Group Delay
   Group delay between adjoined subcarriers

It is useful for checking frequency response (Amplitude and Group Delay).

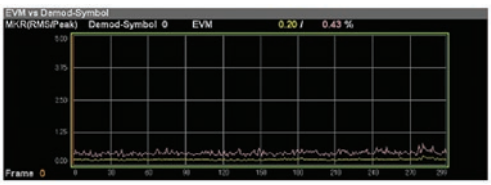


• Time Base EVM

This displays a graph of each measured symbol in the time domain (horizontal axis) vs. EVM (vertical axis) at the bottom of the screen.
The results are displayed for symbols that have a PUSCH.
It is useful for checking characteristics in the time direction and faults at a specific symbol.

• EVM vs. Demodulation Symbol

This displays a graph of the EVM vs. Demodulation Symbol (horizontal axis = Demodulation Symbol, vertical axis = EVM) at the bottom of the screen.
It is useful for checking characteristics in the time direction and faults at a specific symbol.



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- **In-Band Emission**

The following two types of graph can be selected and displayed at the bottom of the screen by switching In-Band Emission View.

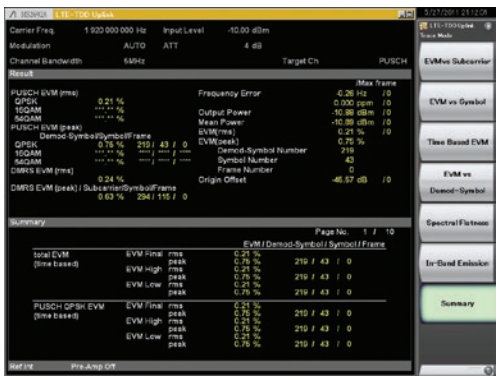
Averaged over all Slots: Average of In-Band Emission for measured slots

Each Slot: In-Band Emission value for each slot specified by Graph Slot Number

It is useful for checking in-band emission at a specific subcarrier and resource block.

- **Summary Display Function**

This function batch-displays the power and EVM for each channel.

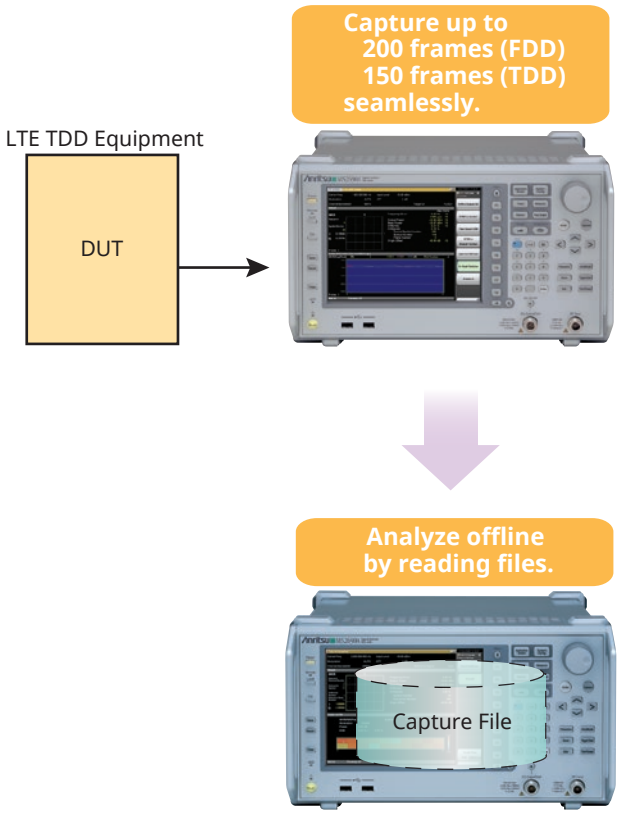


Page 1: List of EVM and Power for Each Channel Uplink (PUSCH) (MX269023A)

Replay Function for Troubleshooting Faults

Up to 150 frames of LTE TDD signals can be captured as a file for replay by the LTE TDD Measurement Software to perform EVM measurement analyses, etc.*

*: Batch measurement is not supported when the MX269022A-001 is installed.



Example of R&D use

Save data for comparing each DUT test version
→ Supports comparison of retrofitting improvement effects

Example of production line use

Save delivery inspection data
→ Supports rechecking of performance data for troubleshooting post-delivery faults

LTE Uplink Measurement Software MX269021A
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MS269xA MS2850A MS2830A

Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature.
The specifications are defined under the following condition unless otherwise specified.
Attenuator mode: Mechanical Attenuator Only (MS2830A only)

LTE Uplink Measurement Software MX269021A , LTE-Advanced FDD Uplink Measurement Software MX269021A-001

Signal Analyzer		MS269xA	MS2830A MS2850A
Common Specifications	Channel Bandwidth	1.4, 3, 5, 10, 15, 20 MHz	
	Target Signals	Uplink	
	Span Setting	MS269xA, MS2830A LTE-Advanced can be selected when MX269021A-001 installed When LTE selected: Span = 31.25 MHz fixed When LTE-Advanced selected and Option 077/177/078/178 not installed: Span = 31.25 MHz When LTE-Advanced selected and Option 077/177 installed: Span = 62.5 MHz When LTE-Advanced selected and Option 078/178 installed: Span = 125 MHz MS2850A When LTE selected: Span = 31.25 MHz	
	Capture Time	The condition "When Span = 62.5 MHz and 125 MHz" is applied when MX269021A-001 is installed. • When Span = 31.25 MHz Capture Time = Auto: 1 Frame Capture Time = Manual: 1 to 200 Frame • When Span = 62.5 MHz Capture Time = Auto: 1 Frame Capture Time = Manual: 1 to 100 Frame • When Span = 125 MHz Capture Time = Auto: 1 Frame Capture Time = Manual: 1 to 50 Frame	
Modulation/ Frequency Measurement	Measurement Frequency Range	400 MHz to 5 GHz	MS2830A-040: 400 MHz to 3.6 GHz MS2830A-041/043/044/045: 400 MHz to 5 GHz MS2850A: 400 MHz to 5 GHz
	Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed.) –15 to +10 dBm (Preamp On)	MS2830A: –15 to +30 dBm (Preamp Off or Preamp not installed) MS2850A: –15 to +30 dBm (Preamp Off or Preamp not installed) –15 to +10 dBm (Preamp On)
	Carrier Frequency Accuracy	After CAL execution at 18°C to 28°C. For a signal of EVM = 1%. For Measurement Interval = 10 Subframe	
		± (Accuracy of reference frequency × Carrier frequency + 8) Hz	± (Accuracy of reference frequency × Carrier frequency + 8) Hz (At the input level is –4 dBm when MS2830A-045 is installed)
	Residual Vector Error	After CAL execution at 18°C to 28°C. For Measurement Interval = 10 Subframe. The condition "When Span = 62.5 MHz or 125 MHz" is applied when MX269021A-001 is installed.	
		<1.0% (rms) (When Span = 31.25 MHz) <1.3% (rms) (When Span = 62.5 MHz or 125 MHz)	MS2830A: <1.2% (rms) (When Span = 31.25 MHz) <1.3% (rms) (When Span = 62.5 MHz or 125 MHz) (At input level of –4 dBm when MS2830A-045 installed) MS2850A: <1.3% (rms) (When Span = 31.25 MHz)
Amplitude Measurement	Tx Power Measurement Accuracy	Transmitter power accuracy is calculated from the RSS (root sum of squares) error of the absolute amplitude accuracy and the in-band frequency characteristics of the MS2690A/MS2691A/MS2692A or MS2830A. At 18°C to 28°C after calibration when the input attenuator = ≥10 dB, the measured input signal is within the measurement level range and below the value set at Input Level when Span = 31.25 MHz.	
		±0.6 dB (Preamp Off, or Preamp not installed.) ±1.1 dB (Preamp On)	MS2830A: ±0.6 dB (Preamp Off or Preamp not installed) MS2850A: ±0.6 dB (Preamp Off or Preamp not installed) ±1.1 dB (Preamp On)
Measurement Target Channel Signal		LTE Selected: • PUSCH • PUCCH • SRS • PRACH LTE-Advanced Selected: • PUSCH • PUCCH Measures and displays the result per channel. The channel setting is mutually exclusive.	

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LTE-Advanced TDD Uplink Measurement Software MX269023A-001 (Continued)

MS269xA MS2850A MS2830A

Signal Analyzer		MS269xA	MS2830A MS2850A
Waveform Display		Provides functions for displaying waveforms below. Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Time Based EVM, EVM vs. Demod-Symbol, Spectral Flatness, In-Band Emission, Power vs. Time	
Adjacent Channel Leakage Power Measurement	Measurement Method	Executes the adjacent channel power measurement function of the Spectrum Analyzer or Signal Analyzer.	
Occupied Bandwidth Measurement	Measurement Method	Executes the occupied bandwidth measurement function of the Spectrum Analyzer or Signal Analyzer.	
Channel Power Measurement	Measurement Method	Executes the channel power measurement function of the Spectrum Analyzer or Signal Analyzer.	
Spectrum Emission Mask Measurement	Measurement Method	Executes the spectrum emission mask measurement function of the Spectrum Analyzer.	
Digitize Function	Function Overview	Capable of outputting captured waveform data to internal or external storage device.	
	Waveform Data	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 the absolute amplitude accuracy and in-band frequency characteristics of the signal analyzer.	
Replay Function		Analyzes traces of saved waveform data Format: I, Q (32 bit floating point binary format) Sampling rate: The condition "When Span = 62.5 MHz and 125 MHz" is applied when MX269021A-001 is installed. 50 MHz (when Span = 31.25 MHz) 100 MHz (when Span = 62.5 MHz) 200 MHz (when Span = 125 MHz)	
Component Carrier (CC) Allocated Condition (Using MX269021A-001)	Maximum Number of CCs	2	
	Channel Bandwidth of Each CC	1.4, 3, 5, 10, 15, 20 MHz	
	Frequency Offset Range of Each CC	– (Span – Channel bandwidth of each CC)/2 to (Span – Channel bandwidth of each CC)/2	

LTE TDD Uplink Measurement Software MX269023A, LTE-Advanced TDD Uplink Measurement Software MX269023A-001

Signal Analyzer		MS269xA	MS2830A MS2850A
Common Specifications	Channel Bandwidth	1.4, 3, 5, 10, 15, 20 MHz	
	Target Signals	Uplink	
	Span Setting	MS269xA, MS2830A LTE-Advanced can be selected when the MX269023A-001 is installed. When LTE selected: Span = 31.25 MHz fixed When LTE-Advanced selected and Option 077/177/078/178 not installed: Span = 31.25 MHz When LTE-Advanced selected and Option 077/177 installed: Span = 62.5 MHz When LTE-Advanced selected and Option 078/178 installed: Span = 125 MHz MS2850A When LTE selected: Span = 31.25 MHz	
	Capture Time	The condition "When Span = 62.5 MHz and 125 MHz" is applied when MX269023A-001 is installed. • When Span = 31.25 MHz Capture Time = Auto: 5 Frame Capture Time = Manual: 5 to 150 Frame • When Span = 62.5 MHz Capture Time = Auto: 5 Frame Capture Time = Manual: 5 to 100 Frame • When Span = 125 MHz Capture Time = Auto: 5 Frame Capture Time = Manual: 5 to 50 Frame	
Modulation/ Frequency Measurement	Measurement Frequency Range	400 MHz to 5 GHz	MS2830A-040: 400 MHz to 3.6 GHz MS2830A-041/043/044/045: 400 MHz to 5 GHz MS2850A: 400 MHz to 5 GHz
	Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed.) –15 to +10 dBm (Preamp On)	MS2830A: –15 to +30 dBm (Preamp Off or Preamp not installed) MS2850A: –15 to +30 dBm (Preamp Off or Preamp not installed) –15 to +10 dBm (Preamp On)

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 (Continued)

MS269xA MS2850A MS2830A

Signal Analyzer		MS269xA	MS2830A MS2850A
Modulation/ Frequency Measurement	Carrier Frequency Accuracy	After CAL execution at 18°C to 28°C. For a PUSCH signal of EVM = 1% and Full RB. For Measurement Interval = 10 Subframe	
		± (Accuracy of reference frequency × Carrier frequency + 8) Hz	MS2830A: ± (Accuracy of reference frequency × Carrier frequency + 8) Hz (At input level of –4 dBm when MS2830A-045 installed) MS2850A: ± (Accuracy of reference frequency × Carrier frequency + 8) Hz (Span = 31.25 MHz)
	Residual Vector Error	After CAL execution at 18°C to 28°C. For Measurement Interval = 10 Subframe. The condition "When Span = 62.5 MHz or 125 MHz" is applied when MX269023A-001 is installed.	
		<1.0% (rms) (When Span = 31.25 MHz) <1.3% (rms) (When Span = 62.5 MHz or 125 MHz)	MS2830A: <1.2% (rms) (When Span = 31.25 MHz) <1.3% (rms) (When Span = 62.5 MHz or 125 MHz) (At input level of –4 dBm when MS2830A-045 installed) MS2850A: <1.3% (rms) (When Span = 31.25 MHz)
Amplitude Measurement	Tx Power Measurement Accuracy	Transmitter power accuracy is calculated from the RSS (root sum of squares) error of the absolute amplitude accuracy and the in-band frequency characteristics of the MS2690A/MS2691A/MS2692A or MS2830A. At 18°C to 28°C after calibration when input attenuator = ≥10 dB, the measured input signal is within the measurement level range and below the value set at Input Level when Span = 31.25 MHz.	
		±0.6 dB (Preamp Off or Preamp not installed) ±1.1 dB (Preamp On)	MS2830A: ±0.6 dB (Preamp Off or Preamp not installed) MS2850A: ±0.6 dB (Preamp Off or Preamp not installed) ±1.1 dB (Preamp On)
Measurement Target Channel Signal		LTE Selected: • PUSCH • PUCCH • PRACH LTE-Advanced Selected: • PUSCH • PUCCH Measures and displays the result per channel. The channel setting is mutually exclusive.	
Waveform Display		Provides functions for displaying waveforms below. Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Time Based EVM, EVM vs. Demod-Symbol, Spectral Flatness, In-Band Emission, Power vs. Time	
Adjacent Channel Leakage Power Measurement	Measurement Method	Executes the adjacent channel power measurement function of the Spectrum Analyzer or Signal Analyzer.	
Occupied Bandwidth Measurement	Measurement Method	Executes the occupied bandwidth measurement function of the Spectrum Analyzer or Signal Analyzer.	
Channel Power Measurement	Measurement Method	Executes the channel power measurement function of the Spectrum Analyzer or Signal Analyzer.	
Spectrum Emission Mask Measurement	Measurement Method	Executes the spectrum emission mask measurement function of the Spectrum Analyzer.	
Digitize Function	Function Overview	Capable of outputting captured waveform data to internal or external storage device.	
	Waveform Data	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 the absolute amplitude accuracy and in-band frequency characteristics of the signal analyzer.	
Replay Function		Analyzes traces of saved waveform data Format: I, Q (32 bit floating point binary format) Sampling rate: The condition "When Span = 62.5 MHz and 125 MHz" is applied when MX269021A-001 is installed. 50 MHz (when Span = 31.25 MHz) 100 MHz (when Span = 62.5 MHz) 200 MHz (when Span = 125 MHz)	
Component Carrier (CC) Allocated Condition (Using MX269021A-001)	Maximum Number of CCs	2	
	Channel Bandwidth of Each CC	1.4, 3, 5, 10, 15, 20 MHz	
	Frequency Offset Range of Each CC	– (Span – Channel bandwidth of each CC)/2 to (Span – Channel bandwidth of each CC)/2	

WLAN (802.11) Measurement Software MX269028A
802.11ac (80 MHz) Measurement Software MX269028A-001
802.11ac (160 MHz) Measurement Software MX269028A-002

MS269xA MS2830A

Installing the WLAN (802.11) Measurement Software MX269028A in the MS269xA/MS2830A main unit supports modulation analysis of IEEE 802.11a/b/g/j/n/p signals with display of numerical and graphical results. The 802.11ac (80 MHz) Measurement Software MX269028A-001*1, and 802.11ac (160 MHz) Measurement Software MX269028A-002*2 are MX269028A software options for modulation analysis of IEEE 802.11ac signals. Moreover, Tx tests of RF signals are supported when used in combination with MS269xA/MS2830A functions, such as adjacent channel leakage power, occupied bandwidth, spectrum emission mask, spurious, etc.

*1: Only For MS2830A. Requires MX269028A.
*2: Only For MS269xA. Requires MX269028A.

Features

- One software package supporting IEEE 802.11a/b/g/j/n/p signal (MX269028A)
- Adding optional software supports modulation analysis of IEEE 802.11ac signal (MX269028A-001/002).
  MX269028A-001: Supports up to 80-MHz bandwidth. (Only for MS2830A)
  MX269028A-002: Supports up to 160-MHz bandwidth. (Only for MS269xA)
- Displays numerical results and analysis graphs (for R&D, quality assurance and manufacturing)
- Catch and replay function*3 (saves*4 signals for later modulation analysis troubleshooting)

*3: This function is not supported when the MX269028A-002 (only for MS269xA) is installed and the channel bandwidth is set to 160 MHz.
*4: Data for 1 burst signal

Evaluation of Tx Characteristics for WLAN Modulation Accuracy (EVM)

The MX269028A supports WLAN modulation analysis and has an easy-to-use graph function for verification at Tx tests of WLAN equipment and parts.

■ Measurement Signals

MX269028A

- IEEE 802.11a
- IEEE 802.11b
- IEEE 802.11g ERP-DSSS/CCK
- IEEE 802.11g ERP-OFDM
- IEEE 803.11g DSSS-OFDM
- IEEE 802.11j
- IEEE 802.11n (HT-Mixed, HT-Greenfield, Non-HT)
- IEEE 802.11p

Measures both continuous and burst signals.

MX269028A-001/002

- IEEE 802.11ac (VHT)

Measures burst signals only.

■ Capture & Replay Function*5

When faults are detected, this function captures*6 on-site signals to internal/external hard disk for later troubleshooting using analysis functions.

*5: This function is not supported when the MX269028A-002 (only for MS269xA) is installed and the channel bandwidth is set to 160 MHz.
*6: Data for 1 burst signal

■ MS269xA/MS2830A Main Unit Functions

The following measurements are performed by calling the main-frame spectrum analyzer functions. These functions prepare each measurement standard templates.

- Adjacent Channel Leakage Power
- Occupied Bandwidth
- Spectrum Emission Mask
- Spurious Emission

■ Supports IEEE 802.11ac signals up to 160-MHz bandwidth

The IEEE 802.11ac measurement range varies as follows, depending on the Analysis Bandwidth Extension option configuration.

Table 1. Supported measurement range for IEEE 802.11ac signals

Model			Bandwidth of IEEE 802.11ac Signal				
Main unit	Measurement software	Analysis Bandwidth Extension Option Configuration	20 MHz	40 MHz	80 MHz	160 MHz	80 MHz + 80 MHz
MS269xA	MX269028A-002	MS269xA-078*1 installed	✓	✓	✓	✓	✓*6
		MS269xA-077/004*2 installed	✓	✓			
		Standard	✓	✓			
MS2830A	MX269028A-001	MS2830A-078*3 installed	✓	✓	✓*7		
		MS2830A-077*4 installed	✓	✓			
		MS2830A-005/009*5 installed	✓	✓			

*1: MS269xA-078 Analysis Bandwidth Extension to 125 MHz
*2: MS269xA-077 Analysis Bandwidth Extension to 62.5 MHz
MS269xA-004 Analysis Bandwidth Extension to 125 MHz
*3: MS2830A-078 Analysis Bandwidth Extension to 125 MHz
*4: MS2830A-077 Analysis Bandwidth Extension to 62.5 MHz
*5: MS2830A-005 Analysis Bandwidth Extension to 31.25 MHz
MS2830A-009 Analysis Bandwidth Extension to 31.25 MHz for Millimeter-wave
*6: Measurement is required for each carrier signal (80-MHz bandwidth)
*7: Measurement is only possible when the carrier signal (80-MHz bandwidth) is input due to the effect of the image response.

WLAN (802.11) Measurement Software MX269028A
802.11ac (80 MHz) Measurement Software MX269028A-001
802.11ac (160 MHz) Measurement Software MX269028A-002 (Continued)

MS269xA MS2830A

■ **Analysis Function (Numerical Results and Graph display)**

Item		11a/j/n/p 11g (ERP-OFDM) 11g (DSSS-OFDM)	11b 11g (ERP-DSSS/CCK)	11ac
Modulation Analysis Function	Numerical Result Display			
	Frequency Error	✓	✓	✓
	Symbol Clock Error/Chip Clock Error	✓	✓	✓
	Transmit Power	✓	✓	✓
	Time Offset	✓	✓	✓
	EVM [rms]	✓	✓	✓
	Data EVM, Pilot EVM	✓	—	✓
	SIG EVM (rms)	✓*1	—	—
	L-SIG EVM (rms)	✓*2	—	✓
	HT-SIG EVM (rms)	✓*3	—	—
	VHT-SIG-A EVM (rms), VHT-SIG-B EVM (rms)	—	—	✓
	EVM [Peak]	✓	✓	✓
	Symbol Number, Subcarrier Number/Chip Number	✓	✓	✓
	Quadrature Error	✓	—	✓*6
	IQ Gain Imbalance	✓	—	✓*6
	Center Frequency Leakage	✓	—	✓
	Spectral Flatness (Amplitude/Phase/Group Delay)	✓	—	✓
	Outside Subcarrier Amplitude Max and Min Value	✓	—	✓
	Inside Subcarrier Amplitude Max and Min Value	✓	—	✓
	Phase Error	—	✓	—
	Magnitude Error	—	✓	—
	IQ Origin Offset	—	✓	—
	Detect Parameter	✓	✓	✓
	Data Rate, Modulation Method, Symbol Length/Chip Length	✓*4	✓	—
	Preamble	✓*5	✓	—
	MCS, Stream ID, Symbol Length, Guard Interval	✓*2	—	✓
	Graph Display			
	Constellation	✓	✓	✓
	EVM vs. Subcarrier	✓	—	✓
	EVM vs. Symbol/EVM vs. Chip	✓	✓	✓
	Spectral Flatness (Amplitude/Phase/Group Delay)	✓	—	✓
	Phase Error vs. Chip	—	✓	—
	Eye diagram	—	✓	—
Power vs. Time Function	Numerical Result Display			
	Transmit Power	✓	✓	—
	Power Flatness Max	✓	✓	—
	Carrier Off Power	✓	✓	—
	On/Off Ratio	✓	✓	—
	Peak Power Spectrum Density (PSD)	✓	✓	—
	Transient time (power-on ramp, power-off ramp)	—	✓	—
	Graph Display			
	Burst	✓	✓	—
	Transient	✓	✓	—

*1: IEEE 802.11a
*2: IEEE 802.11n
*3: IEEE 802.11n (HT-Mixed, HT-Greenfield)
*4: Exclude IEEE 802.11n
*5: IEEE 802.11g DSSS-OFDM
*6: Exclude Channel Bandwidth 160 MHz setting

WLAN (802.11) Measurement Software MX269028A
802.11ac (80 MHz) Measurement Software MX269028A-001
802.11ac (160 MHz) Measurement Software MX269028A-002 (Continued)

MS269xA MS2830A

Common Setup Parameter

Standard	MX269028A: IEEE 802.11a, IEEE 802.11b, IEEE 802.11g ERP-DSSS/CCK, IEEE 802.11g ERP-OFDM, IEEE 802.11g DSSS-OFDM, IEEE 802.11j, IEEE 802.11n, IEEE 802.11p, MX269028A-001 or MX269028A-002: IEEE 802.11ac
Measuring Object	Burst Signal, Continuous Signals: IEEE 802.11a/b/g/j/n/p Burst Signal: IEEE 802.11ac
Channel Bandwidth	MX269028A IEEE 802.11n: 20 MHz, 40 MHz, 40 MHz (Upper), 40 MHz (Lower) IEEE 802.11j/p: 5, 10, 20 MHz MX269028A-001 IEEE 802.11ac: 20, 40, 80 MHz* MX269028A-002 IEEE 802.11ac: 20, 40, 80, 160 MHz*
PPDU Format	MX269028A IEEE 802.11n: Non-HT, HT-Mixed, HT-Greenfield MX269028A-001 IEEE 802.11ac: VHT

*: Refer to [Table1: Supported measurement range for IEEE 802.11ac signals]

Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature. Typical values are for reference only and are not guaranteed. Values are guaranteed after executing CAL at 18°C to 28°C, and the measured signal is within the measurement level range and is less than or equal to Input Level.
The specifications are defined under the following condition unless otherwise specified.
Attenuator mode: Mechanical Attenuator Only (MS2830A only)

WLAN (802.11) Measurement software MX269028A

Signal Analyzer			MS269xA	MS2830A
Standard			IEEE 802.11n HT Mixed, HT Greenfield, Non-HT, (Direct Mapping supported), MCS = 0 to 76 supported	
Modulation/ Frequency Measurements	Frequency Range		2.4 GHz band: 2412 MHz to 2472 MHz (channel No. 1 to 13) 2484 MHz (channel No. 14) 5 GHz band: 5180 MHz to 5320 MHz (channel No. 36 to 64) 5500 MHz to 5700 MHz (channel No. 100 to 140) 5745 MHz to 5825 MHz (channel No. 149 to 165)	
	Measurement Level Range		2.4 GHz band: –15 to +30 dBm (MS269xA Preamp Off, or Preamp not installed) –15 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 not installed) –9 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 installed) –30 to +10 dBm (Preamp On) 5 GHz band: –15 to +30 dBm (MS269xA Preamp Off, or Preamp not installed) –12 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 not installed) –6 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 installed) –30 to +10 dBm (Preamp On)	
	Carrier Frequency Accuracy	20 MHz channel	Burst length ≥250 µs ± (Accuracy of reference frequency × Carrier frequency + 13) Hz (2.4 GHz band) ± (Accuracy of reference frequency × Carrier frequency + 16) Hz (5 GHz band)	
		40 MHz channel	Burst length >250 µs ± (Accuracy of reference frequency × Carrier frequency + 62) Hz (2.4 GHz band) ± (Accuracy of reference frequency × Carrier frequency + 102) Hz (5 GHz band)	
	Residual Vector Error	20 MHz channel	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal	
			≤1.2% (rms) (2.4 GHz band) ≤1.6% (rms) (5 GHz band)	≤1.2% (rms) (2.4 GHz band) (Preamp Off) ≤1.6% (rms) (5 GHz band) (Preamp Off)
		40 MHz channel	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal	
			≤1.5% (rms) (2.4 GHz band) ≤1.9% (rms) (5 GHz band)	≤1.6% (rms) (2.4 GHz band) (Preamp Off) ≤2.0% (rms) (5 GHz band) (Preamp Off)
	Center Frequency Leakage Floor		≤–50 dBc (nom.)	
Amplitude Measurement	Tx Power Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit.)	20 MHz channel	Input attenuator ≥10 dB	
			2.4 GHz band: ±0.6 dB (Preamp Off, or Preamp not installed) ±1.1 dB (Preamp On) 5 GHz band: ±0.6 dB (Preamp Off, or Preamp not installed) ±1.1 dB (Preamp On)	2.4 GHz band: ±0.6 dB (Preamp Off, or Preamp not installed) 5 GHz band: ±1.9 dB (Preamp Off, or Preamp not installed)
		40 MHz channel	Input attenuator ≥10 dB	
			2.4 GHz band: ±0.7 dB (Preamp Off, or Preamp not installed) ±1.1 dB (Preamp On) 5 GHz band: ±0.7 dB (Preamp Off, or Preamp not installed) ±1.1 dB (Preamp On)	2.4 GHz band: ±0.8 dB (Preamp Off, or Preamp not installed) 5 GHz band: ±2.0 dB (Preamp Off, or Preamp not installed)

WLAN (802.11) Measurement Software MX269028A
802.11ac (80 MHz) Measurement Software MX269028A-001
802.11ac (160 MHz) Measurement Software MX269028A-002 (Continued)

MS269xA MS2830A

Signal Analyzer		MS269xA	MS2830A
Standard		IEEE 802.11p	
Modulation/ Frequency Measurements	Frequency Range	5835 MHz to 5925 MHz (channel No. 167 to 185) 300 MHz to 862 MHz	
	Measurement Level Range	5835 MHz to 5925 MHz (Channel No. 167 to 185): –15 to +30 dBm (MS269xA Preamp Off, or Preamp not installed) –12 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 not installed) –6 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 installed) –30 to +10 dBm (Preamp On) 300 MHz to 862 MHz: –15 to +30 dBm (MS269xA Preamp Off, or Preamp not installed) –15 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 not installed) –9 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 installed) –30 to +10 dBm (Preamp On)	
Modulation/ Frequency Measurements	Carrier Frequency Accuracy	5 MHz channel: Burst length ≥1 ms, 10 MHz channel: Burst length ≥500 µs 20 MHz channel: Burst length ≥250 µs ± (Accuracy of reference frequency × Carrier frequency + 16) Hz	
	Residual Vector Error	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal	
		5835 MHz to 5925 MHz (channel No. 167 to 185): ≤1.5% (rms) 300 MHz to 862 MHz: ≤0.5% (rms)	5835 MHz to 5925 MHz (channel No. 167 to 185): ≤1.6% (rms) (Preamp Off) 300 MHz to 862 MHz: ≤0.8% (rms) (Preamp Off)
	Center Frequency Leakage Floor	≤–50 dBc (nom.)	
Amplitude Measurement	Tx Power Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit.)	Input attenuator ≥10 dB	
		±0.6 dB (Preamp Off, or Preamp not installed) ±1.1 dB (Preamp On)	5835 MHz to 5925 MHz (Channel No.: 167 to 185) ± 1.9 dB (at Preamp Off, or Preamp not installed.) 300 MHz to 862 MHz ±0.7 dB (Preamp Off, or Preamp not installed)
Standard		IEEE 802.11a	
Modulation/ Frequency Measurements	Frequency Range	5180 MHz to 5320 MHz (channel No. 36 to 64) 5500 MHz to 5700 MHz (channel No. 100 to 140) 5745 MHz to 5825 MHz (channel No. 149 to 165)	
	Measurement Level Range	–15 to +30 dBm (MS269xA Preamp Off, or Preamp not installed) –12 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 not installed) –6 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 installed) –30 to +10 dBm (Preamp On)	
	Carrier Frequency Accuracy	Burst length ≥250 µs ± (Accuracy of reference frequency × Carrier frequency + 16) Hz	
	Residual Vector Error	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal	
		≤1.5% (rms)	≤1.6% (rms) (Preamp Off)
	Center Frequency Leakage Floor	≤–50 dBc (nom.)	
Amplitude Measurement	Tx Power Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit.)	Input attenuator ≥10 dB	
		±0.6 dB (Preamp Off, or Preamp not installed) ±1.1 dB (Preamp On)	±1.9 dB (Preamp Off, or Preamp not installed)
Standard		IEEE 802.11b, IEEE 802.11g ERP-DSSS/CCK	
Modulation/ Frequency Measurements	Frequency Range	2412 MHz to 2472 MHz (channel No.1 to 13) 2484 MHz (channel No.14)	
	Measurement Level Range	–15 to +30 dBm (MS269xA Preamp Off, or Preamp not installed) –15 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 not installed) –9 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 installed) –30 dBm to +10 dBm (at Preamp On)	
	Carrier Frequency Accuracy	Burst length ≥400 µs ± (Accuracy of reference frequency × Carrier frequency + 21) Hz	
	Residual Vector Error	Specify filter with same characteristics as used for measurement signal, Burst signal	
		≤1.2% (rms)	≤1.9% (rms) (Preamp Off)
	Center Frequency Leakage Floor	≤–50 dBc (nom.)	
Amplitude Measurement	Tx Power Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit.)	Input attenuator ≥10 dB	
		±0.6 dB (Preamp Off, or Preamp not installed) ±1.1 dB (Preamp On)	±0.6 dB (Preamp Off, or Preamp not installed)
Standard		IEEE 802.11g ERP-OFDM	
Modulation/ Frequency Measurements	Frequency Range	2412 MHz to 2472 MHz (channel No.1 to 13) 2484 MHz (channel No.14)	
	Measurement Level Range	–15 to +30 dBm (MS269xA Preamp Off, or Preamp not installed) –15 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 not installed) –9 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 installed) –30 to +10 dBm (Preamp On)	
	Carrier Frequency Accuracy	Burst length ≥250 µs ± (Accuracy of reference frequency × Carrier frequency + 13) Hz	
	Residual Vector Error	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signals	
		≤1.2% (rms)	≤1.2% (rms) (Preamp Off)
	Center Frequency Leakage Floor	≤–50 dBc (nom.)	
Amplitude Measurement	Tx Power Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit.)	Input attenuator ≥10 dB	
		±0.6 dB (Preamp Off, or Preamp not installed) ±1.1 dB (Preamp On)	±0.6 dB (Preamp Off, or Preamp not installed)

WLAN (802.11) Measurement Software MX269028A
802.11ac (80 MHz) Measurement Software MX269028A-001
802.11ac (160 MHz) Measurement Software MX269028A-002 (Continued)

MS269xA MS2830A

Signal Analyzer		MS269xA	MS2830A
Standard		IEEE 802.11j	
Modulation/ Frequency Measurements	Frequency Range	4920 MHz to 4980 MHz	
	Measurement Level Range	–15 to +30 dBm (MS269xA Preamp Off, or Preamp not installed) –12 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 not installed) –6 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 installed) –30 to +10 dBm (Preamp On)	
	Carrier Frequency Accuracy	Burst length ≥1 ms (Channel Bandwidth: 5 MHz), or Burst length ≥500 µs (Channel Bandwidth: 10 MHz), Burst length ≥250 µs (Channel Bandwidth: 20 MHz) ± (Accuracy of reference frequency × Carrier frequency + 16) Hz	
Modulation/ Frequency Measurements	Residual Vector Error	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal	
		≤1.5% (rms)	≤1.6% (rms) (Preamp Off)
	Center Frequency Leakage Floor	≤–50 dBc (nom.)	
Amplitude Measurement	Tx Power Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit.)	Input attenuator ≥10 dB	
		±0.6 dB (Preamp Off, or Preamp not installed) ±1.1 dB (Preamp On)	±1.9 dB (Preamp Off, or Preamp not installed)

802.11ac (80 MHz) Measurement software MX269028A-001 (MS2830A Option)
802.11ac (160 MHz) Measurement software MX269028A-002 (MS269xA Option)

Signal Analyzer			MS269xA	MS2830A
Standard			IEEE 802.11ac	
Modulation/ Frequency Measurements	Frequency Measurements		20 MHz Channel/40 MHz Channel 5180 MHz to 5320 MHz (channel No. 36 to 64) 5500 MHz to 5700 MHz (channel No. 100 to 140) 5745 MHz to 5825 MHz (channel No. 149 to 165) 80 MHz Channel/160 MHz Channel 5180 MHz to 5825 MHz (channel No. 36 to 165)	
	Measurement Level Range		20 MHz Channel/40 MHz Channel –15 to +30 dBm (MS269xA Preamp Off, or Preamp not installed) –15 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 not installed) –9 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 installed –30 to +10 dBm (Preamp On) 80 MHz Channel/160 MHz Channel –10 to +30 dBm (MS269xA Preamp Off, or Preamp not installed) –10 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 not installed) –4 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 installed) –20 to +10 dBm (Preamp On)	
	Carrier Frequency Accuracy	20 MHz channel	Burst length ≥250 µs ± (Accuracy of reference frequency × Carrier frequency + 16) Hz	
		40 MHz channel	Burst length ≥250 µs ± (Accuracy of reference frequency × Carrier frequency + 102) Hz	
		80 MHz channel	Burst length ≥250 µs ± (Accuracy of reference frequency × Carrier frequency + 102) Hz	
		160 MHz channel	Burst length ≥250 µs ± (Accuracy of reference frequency × Carrier frequency + 102) Hz	—
	Residual Vector Error	20 MHz channel	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal	
			≤0.7% (rms) (Preamp Off) ≤0.9% (rms) (Preamp On)	≤0.9% (rms) (Preamp Off)
		40 MHz channel	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal	
			≤0.8% (rms) (Preamp Off) ≤1.0% (rms) (Preamp On)	≤1.0% (rms) (Preamp Off)
		80 MHz channel	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal	
			≤0.9% (rms) (Preamp Off) ≤1.1% (rms) (Preamp On)	≤1.1% (rms) (Preamp Off)
		160 MHz channel	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal ≤1.5% (rms) (Preamp Off) ≤1.7% (rms) (Preamp On)	—
	Center Frequency Leakage Floor		≤–50 dBc (nom.)	
Amplitude Measurement	Tx Power Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit.)	20 MHz channel	Input attenuator ≥10 dB	
			±0.6 dB (Preamp Off, or Preamp not installed) ±1.1 dB (Preamp On)	±1.9 dB (Preamp Off, or Preamp not installed)
		40 MHz channel	Input attenuator ≥10 dB	
			±0.7 dB (Preamp Off, or Preamp not installed) ±1.1 dB (Preamp On)	±2.0 dB (Preamp Off, or Preamp not installed)
		80 MHz channel	Input attenuator ≥10 dB	
			±1.2 dB (Preamp Off, or Preamp not installed) ±1.6 dB (Preamp On)	±3.2 dB (Preamp Off, or Preamp not installed)
		160 MHz channel	Input attenuator ≥10 dB ±1.3 dB (Preamp Off, or Preamp not installed) ±1.7 dB (Preamp On)	—

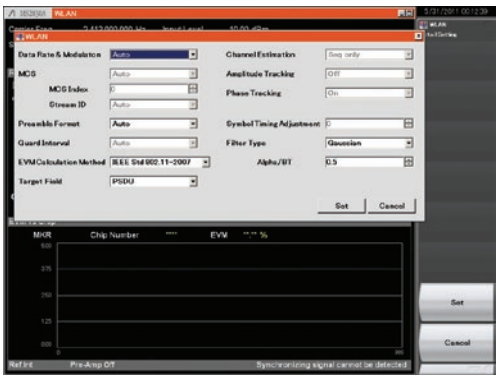
WLAN (802.11) Measurement Software MX269028A
802.11ac (80 MHz) Measurement Software MX269028A-001
802.11ac (160 MHz) Measurement Software MX269028A-002 (Continued)

MS269xA MS2830A

Measurement Functions

• Parameter Setting

Standard-compliant parameters as well as frequency/level are set at the following screen.
Parameters other than numerical values are set easily by selecting pull-down menus.



Modulation Analysis Function

• Summary

This displays detected parameters as well as numerical results. The dispersion of RF characteristics is measured easily using simultaneous display of maximum and average values.

MX269028A (IEEE 802.11a, 11b, 11g, 11j, 11n, 11p)

- Frequency Error
- Symbol Clock Error/Chip Clock Error
- Transmit Power
- EVM [rms]
  (Data EVM, Pilot EVM, SIG EVM (rms), L-SIG EVM (rms), HT-SIG EVM (rms))
- EVM [Peak]
  (Symbol Number, Subcarrier Number/Chip Number)
- Quadrature Error
- IQ Gain Imbalance
- Center Frequency Leakage
- Phase Error
- Magnitude Error
- IQ Origin Offset
- Detect Parameter
  (Data Rate, Modulation Method, Symbol Length/Chip Length, Preamble, MCS Index, Stream ID, Symbol Length, GI)

MX269028A-001/002 (IEEE 802.11ac)

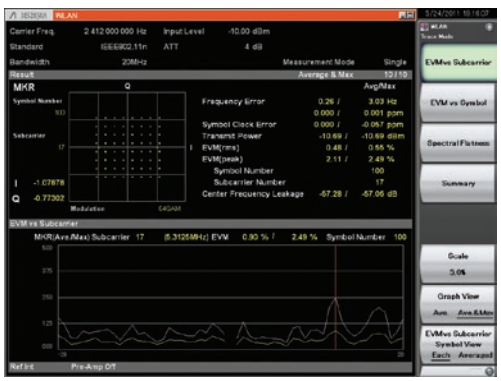
- Frequency Error
- Symbol Clock Error
- Transmit Power
- EVM [rms] (Data EVM, Pilot EVM, L-SIG EVM (rms), VHT-SIG-A EVM (rms), VHT-SIG-B EVM (rms))
- EVM [Peak] (Symbol Number, Subcarrier Number)
- Quadrature Error*
- IQ Gain Imbalance*
- Center Frequency Leakage
- Detect Parameter
  (MCS Index, Stream ID, Symbol Length, GI)

*: Exclude Channel Bandwidth 160 MHz setting

• Constellation/Numerical Result

The Constellation/numerical value results are displayed at the top of the screen. The Constellation screen displays IQ coordinates and subcarrier information for the position selected by the marker.
The dispersion of characteristics is measured easily using simultaneous display of maximum and average values.

MX269028A (IEEE 802.11a, 11b, 11g, 11j, 11n, 11p)



Measurement signal:
IEEE 802.11a, 11g (ERP-OFDM, DSSS-OFDM), 11j, 11n, 11p

- Frequency Error
- Symbol Clock Error
- Transmit Power
- EVM [rms/peak]
- Center Frequency Leakage

WLAN (802.11) Measurement Software MX269028A
802.11ac (80 MHz) Measurement Software MX269028A-001
802.11ac (160 MHz) Measurement Software MX269028A-002 (Continued)

MS269xA MS2830A

Measurement signal: IEEE 802.11b, 11g (ERP-DSSS/CCK)

- Frequency Error
- Chip Clock Error
- Transmit Power
- EVM [rms/peak]
- IQ Origin Offset

MX269028A-001/002 (IEEE 802.11ac)

Measurement Signal: IEEE 802.11ac

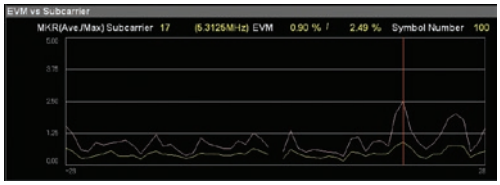
- Frequency Error
- Symbol Clock Error
- Transmit Power
- EVM (rms/Peak)
- Center Frequency Leakage

- **EVM vs. Subcarrier**

This displays the EVM vs. Subcarrier graphs (horizontal axis: Subcarrier, vertical axis: EVM) at the bottom of the screen. The EVM calculation method can be selected from:

Averaged: Mean value of all analysis symbols
Each: Symbol value selected by the marker

It is useful for checking in-band interference signals.



- **EVM vs. Symbol**

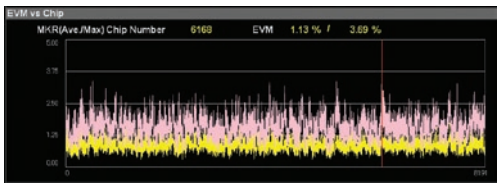
This displays the EVM vs. Symbol graphs (horizontal axis: Symbol, vertical axis: EVM) at the bottom of the screen.

It is useful for checking characteristics in the time direction and faults at a specific symbol.

- **EVM vs. Chip**

This displays the EVM vs. Chip graphs (horizontal axis: Chip, vertical axis: EVM) at the bottom of the screen.

It is useful for checking characteristics in the time direction and faults at a specific chip.



- **Phase Error vs. Chip**

This displays the Phase Error vs. Chip graphs (horizontal axis: Chip, vertical axis: Phase Error) at the bottom of the screen.

It is useful for checking a phase change in time direction.

WLAN (802.11) Measurement Software MX269028A
802.11ac (80 MHz) Measurement Software MX269028A-001
802.11ac (160 MHz) Measurement Software MX269028A-002 (Continued)

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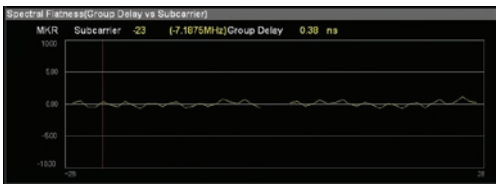
• Spectral Flatness

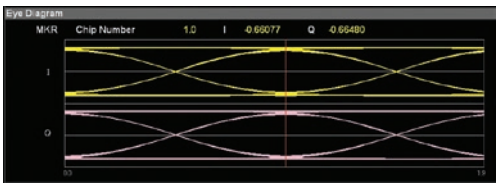
A graph of Amplitude vs. Subcarrier (horizontal axis: Subcarrier, vertical axis: Amplitude), Phase vs. Subcarrier (horizontal axis: Subcarrier, vertical axis: Phase) and Group Delay vs. Subcarrier (horizontal axis: Subcarrier, vertical axis: Group Delay) can be selected.

It is useful for checking frequency response (Amplitude, Phase, Group Delay).



• Eye Diagram

This displays the I/Q vs. Chip graphs (horizontal axis: Chip, vertical axis: I/Q) at the bottom of the screen.



Power vs. Time Function*

*: Supports IEEE 802.11a/b/g/j/n/p

• Numerical Results

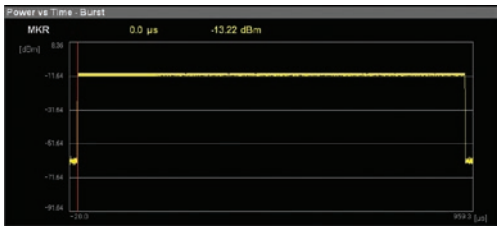
The numerical results are displayed at the top of the screen.

- Transmit Power
- Power Flatness Max
- Carrier Off Power
- On/Off Ratio
- Peak PSD
- Transient Time
  - Power-on Ramp
  - Power-off Ramp

The dispersion of characteristics is measured easily using simultaneous display of maximum and average values.

• Burst

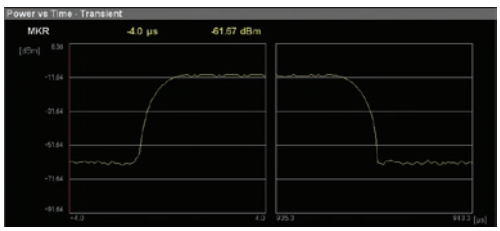
This displays the Power vs. Time graph (horizontal axis: Time, vertical axis: Power) for one burst waveform at the bottom of the screen.



• Transient

This zoom-displays the rising and falling edges of a burst waveform (horizontal axis: Time, vertical axis: Power) at the bottom of the screen. Displayed time scale is adjustable.

It is useful for checking power-on ramp and power-down ramp of burst signal.



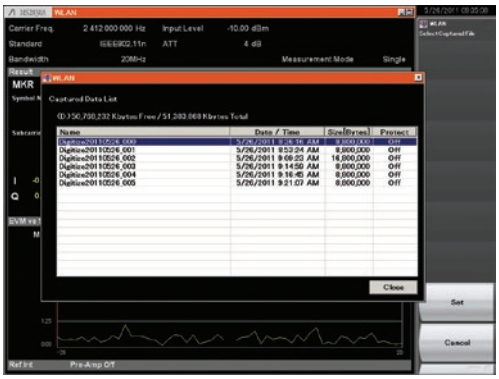
WLAN (802.11) Measurement Software MX269028A
802.11ac (80 MHz) Measurement Software MX269028A-001
802.11ac (160 MHz) Measurement Software MX269028A-002 (Continued)

MS269xA MS2830A

Powerful Capture & Replay Function for Fault Analysis*1

When faults are detected on-site, this function captures*2 and saves*2 signals to a file for later replay by the WLAN Measurement Software to troubleshoot items, such as EVM measurements.

*1: This function is not supported when the MX269028A-002 (only for MS269xA) is installed and the channel bandwidth is set to 160 MHz.
*2: Data for 1 burst signal



Example of R&D use

Save data for comparing each DUT test version
→ Supports comparison of retrofitting improvement effects

Example of production line use

Save delivery inspection data
→ Supports rechecking of performance data for troubleshooting post-delivery faults

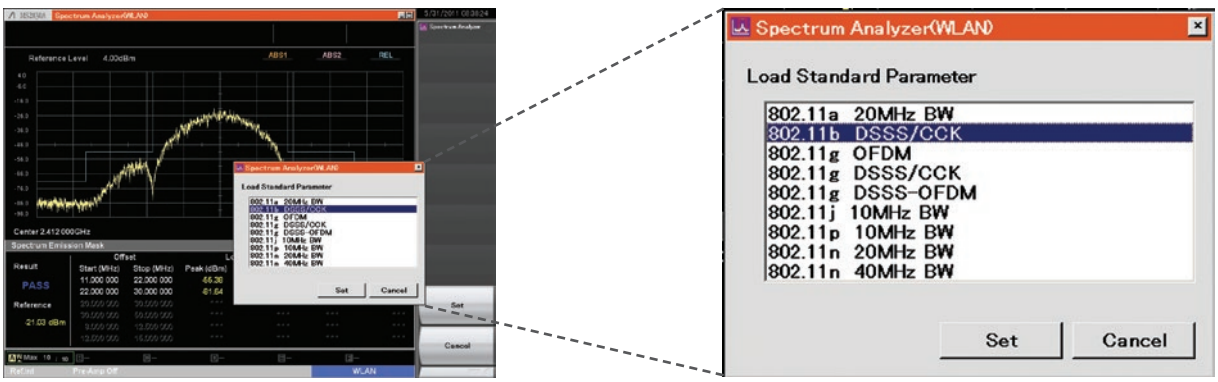
WLAN (802.11) Measurement Software MX269028A
802.11ac (80 MHz) Measurement Software MX269028A-001
802.11ac (160 MHz) Measurement Software MX269028A-002 (Continued)

MS269xA MS2830A

MS269xA/MS2830A Main Unit Measurement Functions

The following measurements are performed by calling the main-frame spectrum analyzer functions. These functions prepare each measurement standard templates.

- Adjacent Channel Leakage Power (ACP)
- Occupied Bandwidth (OBW)
- Spectrum Emission Mask (SEM)
- Spurious Emission



ex.) Template of Spectrum Emission Mask (SEM)

Each Measurement Standard Templates

Standard	Bandwidth	Supported Template			
		ACP	OBW	SEM	Spurious
IEEE 802.11n	20 MHz	✓ TELEC T403	✓ TELEC T403 ✓ ETSI	✓ IEEE ✓ ETSI	✓ TELEC T403 ✓ ETSI ✓ FCC
	40 MHz	✓ TELEC T403	✓ TELEC T403 ✓ ETSI	✓ IEEE ✓ ETSI	✓ TELEC T403 ✓ ETSI ✓ FCC
IEEE 802.11p	5 MHz	—	✓ ETSI	✓ ETSI	✓ TELEC T405 ✓ ETSI ✓ FCC
	10 MHz	—	✓ ETSI	✓ ETSI	✓ TELEC T405 ✓ ETSI ✓ FCC
	20 MHz	✓ TELEC T403	✓ TELEC T403 ✓ ETSI	✓ ETSI	✓ TELEC T403 ✓ ETSI ✓ FCC
IEEE 802.11a	—	✓ TELEC T403	✓ TELEC T403 ✓ ETSI	✓ IEEE ✓ ETSI	✓ TELEC T403 ✓ ETSI ✓ FCC
IEEE 802.11b	—	—	✓ TELEC T401	✓ IEEE	✓ TELEC T401 ✓ ETSI
IEEE 802.11g ERP-DSSS/CCK	—	—	✓ TELEC T401	✓ IEEE	✓ TELEC T401 ✓ ETSI
IEEE 802.11g ERP-OFDM	—	—	✓ TELEC T401 ✓ ETSI	✓ IEEE ✓ ETSI	✓ TELEC T401 ✓ ETSI
IEEE 802.11g DSSS-OFDM	—	—	✓ TELEC T401 ✓ ETSI	✓ IEEE ✓ ETSI	✓ TELEC T401 ✓ ETSI
IEEE 802.11j	5 MHz	—	✓ ETSI	✓ ETSI	✓ TELEC T405
	10 MHz	—	✓ ETSI	✓ IEEE ✓ ETSI	✓ TELEC T405
	20 MHz	✓ TELEC T403	✓ TELEC T403 ✓ ETSI	✓ IEEE ✓ ETSI	✓ TELEC T403
IEEE 802.11ac	20 MHz	—	✓ ETSI	✓ IEEE ✓ ETSI	—
	40 MHz	—	✓ ETSI	✓ IEEE ✓ ETSI	—
	80 MHz	—	✓ ETSI	✓ IEEE	—
	160 MHz	—	✓ ETSI	✓ IEEE	—

5G Standard Measurement Software (Base License) MX285051A
Pre-Standard CP-OFDM Downlink MX285051A-001
Pre-Standard CP-OFDM Uplink MX285051A-051

MS2850A

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
Pre-Standard CP-OFDM Downlink MX285051A-001
Pre-Standard CP-OFDM Uplink MX285051A-051 (Continued)

MS2850A

Specifications

Signal Analyzer		MS2850A	
Option		Pre-Standard CP-OFDM Downlink MX285051A-001	Pre-Standard CP-OFDM Uplink MX285051A-051
Electrical Characteristics	Target Signals	TS V5G.211 compliant downlink signal	TS V5G.211 compliant uplink signal
	Channel Bandwidth	MS2850A-032 installed: Max. 100 MHz × 2 carriers MS2850A-033 installed: Max. 100 MHz × 5 carriers MS2850A-034 installed: Max. 100 MHz × 8 carriers	
	Capture Time	1 Frame	
	Frequency Setting Range	MS2850A-047: 800 MHz to 32 GHz MS2850A-046: 800 MHz to 44.5 GHz	
Modulation/ Frequency Measurement	Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –30 to +10 dBm (Preamp On)	
	Carrier Frequency Measurement Accuracy	At 18°C to 28°C, After calibration, EVM = 2% signal 50 subframes at downlink signal Only 1 carrier of 100 MHz width at center frequency ± (Accuracy of reference frequency × carrier frequency + 10) Hz (nom.)	At 18°C to 28°C, After calibration, EVM = 2% signal 50 subframes at uplink signal Only 1 carrier of 100 MHz width at center frequency ± (Accuracy of reference frequency × carrier frequency + 10) Hz (nom.)
	Residual Vector Error	At 18°C to 28°C, After calibration 50 subframes at downlink signal Only 1 carrier of 100 MHz width at center frequency <2.0% (nom.)	At 18°C to 28°C, After calibration 50 subframes at uplink signal Only 1 carrier of 100 MHz width at center frequency <2.0% (nom.)
Amplitude Measurement	Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –30 to +10 dBm (Preamp On)	
	Tx Power Measurement Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit.)	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 ±2.54 dB (nom.) (Preamp Off, or Preamp not installed) ±3.74 dB (nom.) (Preamp On)	
Waveform Display		Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Spectral Flatness, Power vs. RB, EVM vs. RB	
Digitize Function	Function Overview	Supports output of captured waveform data to internal storage or external storage	
	Waveform Data	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	
	Replay Function	Analyzes traces of saved waveform data Format: I, Q (32 bit floating point binary format) Sampling rate: 325 MHz 650 MHz (with MS2850A-033 installed) 1300 MHz (with MS2850A-034 installed) Under the following conditions, Capture two times with a 650 MHz sampling rate and save measured IQ data Center frequency <4.2 GHz Carriers ≥6	

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

MS2850A

5G Standard Measurement Software (Base License)	**MX285051A**		
NR TDD sub-6 GHz Downlink	**MX285051A-011**	**NR TDD sub-6 GHz Uplink**	**MX285051A-061**
NR FDD sub-6 GHz Downlink	**MX285051A-031**	**NR FDD sub-6 GHz Uplink**	**MX285051A-081**
NR TDD mmWave Downlink	**MX285051A-021**	**NR TDD mmWave Uplink**	**MX285051A-071**

The 5G measurement software are installed in the MS2850A for developing and manufacturing 5G radio equipment.
They support analyses of both uplink and downlink signals used by the sub-6 GHz and mmWave bands in the 5G NR standards by specifying combinations of multiple component carriers (up to 400 MHz) and subcarrier spacing.

Features

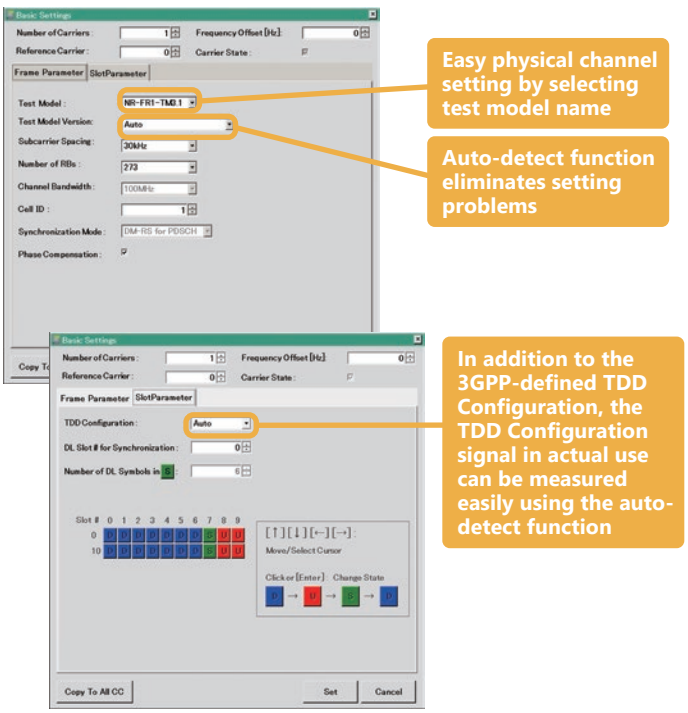
- **All-in-one sub-6 GHz and mmWave Coverage**

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

Supported Measurement Functions

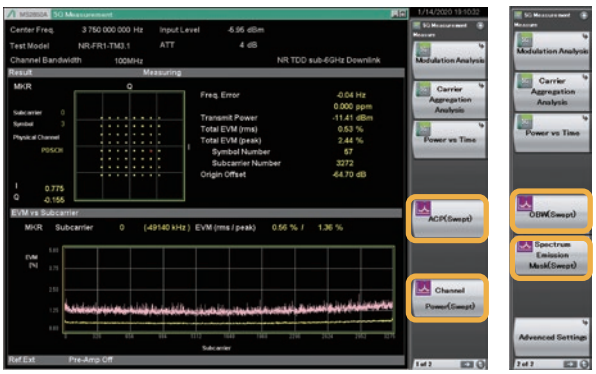
Supported Software	Modulation Analysis	Carrier Aggregation Analysis	Power vs. Time
NR TDD sub-6 GHz Downlink MX285051A-011	✓	✓	✓
NR FDD sub-6 GHz Downlink MX285051A-031	✓	✓	—
NR TDD mmW Downlink MX285051A-021	✓	✓	✓
NR TDD sub-6 GHz Uplink MX285051A-061	✓	—	—
NR FDD sub-6 GHz Uplink MX285051A-081	✓	—	—
NR TDD mmW Uplink MX285051A-071	✓	—	—

- **Easy Operability for Higher Measurement/Test Efficiency**
- The Phy channel can be measured simply by specifying the measured test model.



- 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 that are required for 3GPP TS 38.141-1/2 specified Transient On/Off Power are supported.
The measurement results are displayed with Power vs. Time graph.

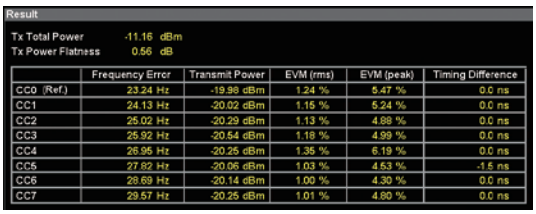
5G Standard Measurement Software (Base License) MX285051A

MS2850A

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** (Continued)

- **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.

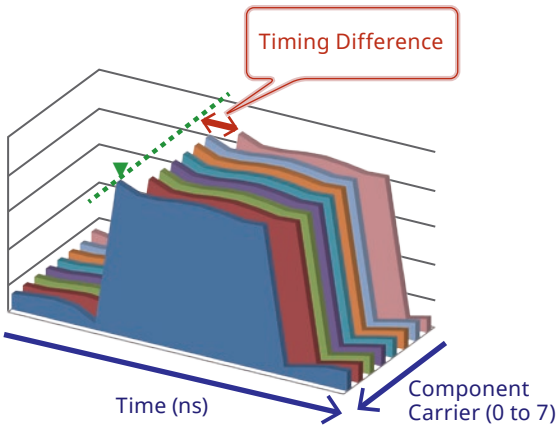


Result

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

MS2850A

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** (Continued)

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)
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			✓

MS2850A

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** (Continued)

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

MS2850A

Specifications

<table>
<tr><th colspan="2">Signal Analyzer</th><th colspan="2">MS2850A</th></tr>
<tr><td colspan="2">Option</td><td>NR TDD sub-6 GHz Downlink
MX285051A-011</td><td>NR TDD sub-6 GHz Uplink
MX285051A-061</td></tr>
<tr><td rowspan="5">Electrical Characteristics</td><td>Target Signals</td><td>TS 38.211 Sub-6 GHz compliant downlink signal</td><td>TS 38.211 Sub 6-GHz compliant uplink signal</td></tr>
<tr><td>Channel Bandwidth</td><td colspan="2"><table><tr><th>Subcarrier Spacing</th><th>Channel Bandwidth</th></tr><tr><td>15 kHz</td><td>5 MHz (RB: 25), 10 MHz (RB: 52), 15 MHz (RB: 79), 20 MHz (RB: 106), 25 MHz (RB: 133), 30 MHz (RB: 160), 40 MHz (RB: 216), 50 MHz (RB: 270)</td></tr><tr><td>30 kHz</td><td>5 MHz (RB: 11), 10 MHz (RB: 24), 15 MHz (RB: 38), 20 MHz (RB: 51), 25 MHz (RB: 65), 30 MHz (RB: 78), 40 MHz (RB: 106), 50 MHz (RB: 133), 60 MHz (RB: 162), 70 MHz (RB: 189), 80 MHz (RB: 217), 90 MHz (RB: 245), 100 MHz (RB: 273)</td></tr><tr><td>60 kHz</td><td>10 MHz (RB: 11), 15 MHz (RB: 18), 20 MHz (RB: 24), 25 MHz (RB: 31), 30 MHz (RB: 38), 40 MHz (RB: 51), 50 MHz (RB: 65), 60 MHz (RB: 79), 70 MHz (RB: 93), 80 MHz (RB: 107), 90 MHz (RB: 121), 100 MHz (RB: 135)</td></tr></table></td></tr>
<tr><td>Capture Time</td><td colspan="2">1 to 2 Frame</td></tr>
<tr><td>Frequency Setting Range</td><td colspan="2">MS2850A-047: 100 MHz to 32 GHz
MS2850A-046: 100 MHz to 44.5 GHz</td></tr>
<tr><td>Measurement Frequency Range</td><td colspan="2">800 MHz to 5 GHz</td></tr>
<tr><td rowspan="3">Modulation/ Frequency Measurement</td><td>Measurement Level Range</td><td colspan="2">–10 to +30 dBm (Preamp Off, or Preamp not installed)
–30 to +10 dBm (Preamp On)</td></tr>
<tr><td>Carrier Frequency Measurement Accuracy</td><td>At 18°C to 28°C, After calibration, EVM = 1% (rms) signal 1 Frame at downlink signal
Only 1 carrier of 100 MHz width (Subcarrier Spacing: 30 kHz) or 50 MHz width (Subcarrier Spacing: 15 kHz) at center frequency
± (Accuracy of reference frequency × carrier frequency + 10) Hz</td><td>At 18°C to 28°C, After calibration, EVM = 1% (rms) signal 1 Frame at uplink signal
Only 1 carrier of 100 MHz width (Subcarrier Spacing: 30 kHz) or 50 MHz width (Subcarrier Spacing: 15 kHz) at center frequency
± (Accuracy of reference frequency × carrier frequency + 10) Hz</td></tr>
<tr><td>Residual Vector Error</td><td>At 18°C to 28°C, After calibration
1 Frame at downlink signal
Only 1 carrier of 100 MHz width (Subcarrier Spacing: 30 kHz) or 50 MHz width (Subcarrier Spacing: 15 kHz) at center frequency
≤1.0%</td><td>At 18°C to 28°C, After calibration
1 Frame at uplink signal
Only 1 carrier of 100 MHz width (Subcarrier Spacing: 30 kHz) or 50 MHz width (Subcarrier Spacing: 15 kHz) at center frequency
≤1.0%</td></tr>
<tr><td rowspan="2">Amplitude Measurement</td><td>Measurement Level Range</td><td colspan="2">–10 to +30 dBm (Preamp Off, or Preamp not installed)
–30 to +10 dBm (Preamp On)</td></tr>
<tr><td>Tx Power Measurement Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit.)</td><td colspan="2">At 18°C to 28°C, After calibration, Input attenuator ≥10 dB
Input signal within measurement level range and below value set at Input Level
Only 1 carrier at center frequency
<table><tr><th>Frequency Range</th><th>Preamp Off, or without Preamp</th><th>Preamp On</th></tr><tr><td>800 MHz ≤ Frequency < 4 GHz</td><td>±0.74 dB (nom.)</td><td>±1.27 dB (nom.)</td></tr><tr><td>4 GHz ≤ Frequency < 4.2 GHz</td><td>±1.48 dB (nom.)</td><td>±2.11 dB (nom.)</td></tr><tr><td>4.2 GHz ≤ Frequency ≤ 5 GHz</td><td>±1.45 dB (nom.)</td><td>±1.94 dB (nom.)</td></tr></table></td></tr>
<tr><td colspan="2">Waveform Display</td><td colspan="2">Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Spectral Flatness, Power vs. RB, EVM vs. RB, Power vs. Time (NR TDD sub-6 GHz Downlink MX285051A-011)</td></tr>
<tr><td rowspan="3">Digitize Function</td><td>Function Overview</td><td colspan="2">Supports output of captured waveform data to internal storage or external storage</td></tr>
<tr><td>Waveform Data</td><td colspan="2">Format: I, Q (32 bit floating point binary format)
Level: Assumes as $\sqrt{(I^2 + Q^2)}$ = 1 for 0 dBm input
Level accuracy: Same as absolute amplitude accuracy and in-band frequency characteristics of the signal analyzer</td></tr>
<tr><td>Replay Function</td><td colspan="2">Analyzes traces of saved waveform data
Format: I, Q (32 bit floating point binary format)
Sampling Rate:
<table><tr><th>Channel Bandwidth</th><th>Without MS2850A-033</th><th>With MS2850A-033</th></tr><tr><td>≤100 MHz</td><td>162.5 MHz</td><td>162.5 MHz</td></tr></table></td></tr>
<tr><td>Power vs. Time Measurement</td><td>Displayed Average Noise</td><td>This is calculated up to 5 GHz from the Display Average Noise Level for the signal analyzer with MS2850A-033/034 option installed at no signal input and an ambient temperature range of 18°C to 28°C when Wide Dynamic Range = On, Noise Correction = On, Pre-AMP = On.
–95 dBm/MHz (nominal)</td><td>—</td></tr>
</table>

5G Standard Measurement Software (Base License) MX285051A
NR FDD sub-6 GHz Downlink MX285051A-031
NR FDD sub-6 GHz Uplink MX285051A-081

MS2850A

Specifications

Signal Analyzer		MS2850A	
Option		NR FDD sub-6 GHz Downlink MX285051A-031	NR FDD sub-6 GHz Uplink MX285051A-081
Electrical Characteristics	Target Signals	TS 38.211 Sub-6 GHz compliant downlink signal	TS 38.211 Sub 6-GHz compliant uplink signal
	Channel Bandwidth	Subcarrier Spacing: 15 kHz — 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) Subcarrier Spacing: 30 kHz — 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) Subcarrier Spacing: 60 kHz — 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)	
	Capture Time	1 to 2 Frame	
	Frequency Setting Range	MS2850A-047: 100 MHz to 32 GHz MS2850A-046: 100 MHz to 44.5 GHz	
	Measurement Frequency Range	400 MHz to 6 GHz	
Modulation/ Frequency Measurement	Measurement Level Range	–10 to +30 dBm (Preamp Off, or Preamp not installed) –30 to +10 dBm (Preamp On)	
	Carrier Frequency Measurement Accuracy	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	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
	Residual Vector Error	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%	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%
Amplitude Measurement	Measurement Level Range	–10 to +30 dBm (Preamp Off, or Preamp not installed) –30 to +10 dBm (Preamp On)	
	Tx Power Measurement Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit.)	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	

Frequency Range	Preamp Off, or without Preamp	Preamp On
400 MHz ≤ Frequency < 800 MHz	±0.72 dB (nom.)	±1.14 dB (nom.)
800 MHz ≤ Frequency < 4 GHz	±0.74 dB (nom.)	±1.27 dB (nom.)
4 GHz ≤ Frequency < 4.2 GHz	±1.45 dB (nom.)	±2.11 dB (nom.)
4.2 GHz ≤ Frequency ≤ 6 GHz	±1.45 dB (nom.)	±1.94 dB (nom.)

Waveform Display		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)
Digitize Function	Function Overview	Supports output of captured waveform data to internal storage or external storage
	Waveform Data	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
	Replay Function	Analyzes traces of saved waveform data Format: I, Q (32 bit floating point binary format) Sampling Rate:

Channel Bandwidth	Without MS2850A-033	With MS2850A-033
≤100 MHz	162.5 MHz	162.5 MHz

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

MS2850A

Specifications

Signal Analyzer		MS2850A	
Option		NR TDD mmWave Downlink MX285051A-021	NR TDD mmWave Uplink MX285051A-071
Electrical Characteristics	Target Signals	TS 38.211 mmWave compliant downlink signal	TS 38.211 mmWave compliant uplink signal
	Channel Bandwidth	Subcarrier Spacing: Channel Bandwidth 60 kHz: 50 MHz (RB: 66), 100 MHz (RB: 132), 200 MHz (RB: 264) 120 kHz: 50 MHz (RB: 32), 100 MHz (RB: 66), 200 MHz (RB: 132), 400 MHz (RB: 264)	
	Capture Time	1 to 2 Frame	
	Frequency Setting Range	MS2850A-047: 100 MHz to 32 GHz MS2850A-046: 100 MHz to 44.5 GHz	
Modulation/ Frequency Measurement	Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –30 to +10 dBm (Preamp On)	
	Carrier Frequency Measurement Accuracy	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	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
	Residual Vector Error	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%	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%
Amplitude Measurement	Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –30 to +10 dBm (Preamp On)	
	Tx Power Measurement Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main unit.)	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 Frequency Range: Preamp Off, or without Preamp: Preamp On 26.5 GHz < Frequency ≤ 40 GHz: ±2.54 dB (nom.): ±3.74 dB (nom.)	
Waveform Display		Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Spectral Flatness, Power vs. RB, EVM vs. RB, Power vs. Time (NR TDD mmW Downlink MX285051A-021)	
Digitize Function	Function Overview	Supports output of captured waveform data to internal storage or external storage	
	Waveform Data	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	
	Replay Function	Analyzes traces of saved waveform data Format: I, Q (32 bit floating point binary format) Sampling Rate: Channel Bandwidth: Without MS2850A-033: With MS2850A-033 ≤100 MHz: 162.5 MHz: 162.5 MHz >100 MHz: 325 MHz: 650 MHz	
Power vs. Time Measurement	Displayed Average Noise	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)	—

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

MS269xA

5G Standard Measurement Software (Base License)	**MX269051A**		
NR TDD sub-6 GHz Downlink	**MX269051A-011**	**NR TDD sub-6 GHz Uplink**	**MX269051A-061**
NR FDD sub-6 GHz Downlink	**MX269051A-031**	**NR FDD sub-6 GHz Uplink**	**MX269051A-081**

The 5G measurement Software MX269051A are are installed in the MS269xA main unit to support development and production of 5G wireless communication device. The software support signal analysis and RF characteristics by supporting GPP-compliant sub-6 GHz uplink signal and downlink signal and specifying combinations from multiple component carriers and subcarrier spacing.

Features

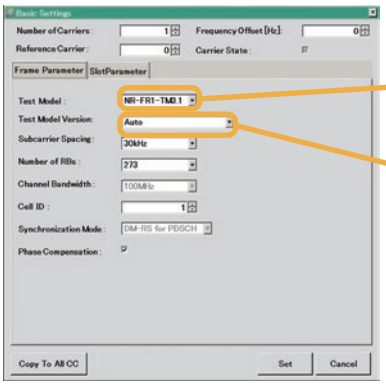
- **Supports Both Downlink and Uplink Signal Measurement in sub-6 GHz**

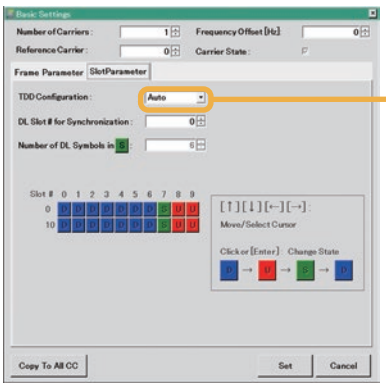
The 5G measurement Software MX269051A are are installed to support both Downlink and Uplink signal in 5G NR sub-6 GHz.
Combining with MS269xA-x077/078 can analyze a carrier with up to 100 MHz bandwidth.

Supported Measurement Functions

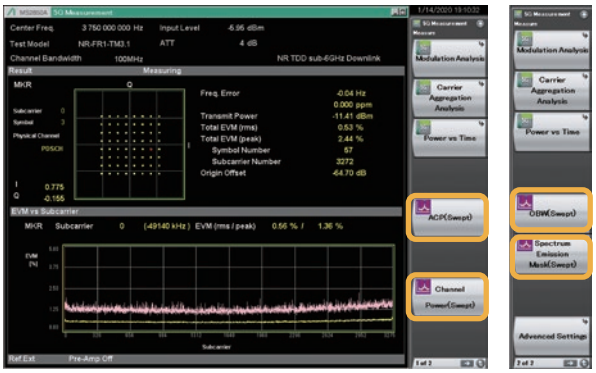
Supported Software	Modulation Analysis	Power vs. Time
NR TDD sub-6 GHz Downlink MX269051A-011	✓	✓
NR FDD sub-6 GHz Downlink MX269051A-031	✓	—
NR TDD sub-6 GHz Uplink MX269051A-061	✓	—
NR FDD sub-6 GHz Uplink MX269051A-081	✓	—

- **Easy Operability for Higher Measurement/Test Efficiency**
- The Phy channel can be measured simply by specifying the measured test model.



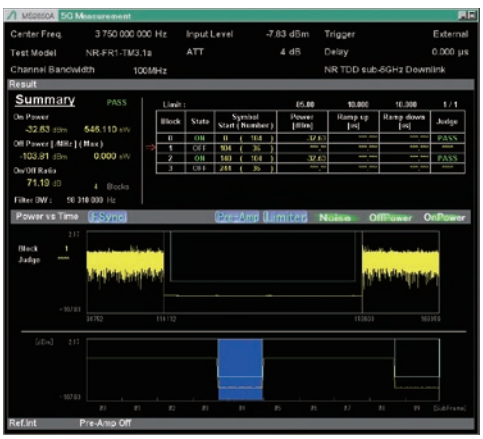


- This function makes it easy to measure Channel Power, OBW, ACLR and SEM.
  The measurement software calls Signal Analyzer function and the measurement performed according to the handed over parameter settings.



- Power vs. Time measurements are supported.

Off power and Transient period measurements that are required for 3GPP TS 38.141-1/2 specified Transient On/Off Power are supported.
Measurement results are displayed along with Power vs. Time graphs.



Numeric Results

Name	Unit	Modulation 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
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)
Uplink				
PUSCH	%, dB, dBm	✓		
DM-RS (PUSCH)		✓		

Graph Displays

Name	Modulation 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		✓

5G Standard Measurement Software (Base License) MX269051A
NR TDD sub-6 GHz Downlink MX269051A-011 **NR TDD sub-6 GHz Uplink MX269051A-061**
NR FDD sub-6 GHz Downlink MX269051A-031 **NR FDD sub-6 GHz Uplink MX269051A-081** (Continued)

MS269xA

Standard	3GPP TS 38.211 (2019-06)			
Model/Name	NR TDD sub-6 GHz			
	NR TDD sub-6 GHz Downlink MX269051A-011	NR FDD sub-6 GHz Downlink MX269051A-031	NR TDD sub-6 GHz Uplink MX269051A-061	NR FDD sub-6 GHz Uplink MX269051A-081
Measurement Frequency Range	800 MHz to 5 GHz	400 MHz to 6 GHz	800 MHz to 5 GHz	400 MHz to 6 GHz

Frequency Setting Range

	Analysis Bandwidth	MS269xA-067	Frequency Range
MS2690A	≤31.25 MHz (Standard)	—	100 MHz to 6 GHz
	≤62.5 MHz (MS269xA-077) ≤125 MHz (MS269xA-078)	—	100 MHz to 6 GHz
MS2691A	≤31.25 MHz (Standard)	—	100 MHz to 13.5 GHz
	≤62.5 MHz (MS269xA-077) ≤125 MHz (MS269xA-078)	—	100 MHz to 6 GHz
MS2692A	≤31.25 MHz (Standard)	—	100 MHz to 26.5 GHz
	≤62.5 MHz (MS269xA-077) ≤125 MHz (MS269xA-078)	Without MS269xA-067/ Preselector Bypass off	100 MHz to 6 GHz
	≤62.5 MHz (MS269xA-077) ≤125 MHz (MS269xA-078)	Preselector Bypass on	100 MHz to 26.5 GHz

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	—
Subcarrier Spacing (SCS)	15 kHz, 30 kHz, 60 kHz	15 kHz, 30 kHz, 60 kHz
Channel Bandwidth	5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz	5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 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 PUSCH	PUSCH, PT-RS for PUSCH

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

Channel Bandwidth

The maximum channel bandwidth is determined by the Analysis Bandwidth option.

		Maximum Analysis Bandwidth
MS269xA	Standard	31.25 MHz
	MS269xA-077	62.5 MHz
	MS269xA-078	125 MHz

5G Standard Measurement Software (Base License) MX269051A
NR TDD sub-6 GHz Downlink MX269051A-011
NR TDD sub-6 GHz Uplink MX269051A-061

MS269xA

Specifications

Signal Analyzer		MS269xA	
Option		NR TDD sub-6 GHz Downlink MX269051A-011	NR TDD sub-6 GHz Uplink MX269051A-061
Electrical Characteristics	Target Signals	TS 38.211 Sub-6 GHz compliant downlink signal	TS 38.211 Sub 6-GHz compliant uplink signal

Channel Bandwidth

Subcarrier Spacing	Channel Bandwidth
15 kHz	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)
30 kHz	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)
60 kHz	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)

Capture Time: 1 to 2 Frame

Frequency Setting Range

	Analysis Bandwidth	MS269xA-067	Frequency Range
MS2690A	≤31.25 MHz (Standard)	—	100 MHz to 6 GHz
	≤62.5 MHz (MS269xA-077) ≤125 MHz (MS269xA-078)	—	100 MHz to 6 GHz
MS2691A	≤31.25 MHz (Standard)	—	100 MHz to 13.5 GHz
	≤62.5 MHz (MS269xA-077) ≤125 MHz (MS269xA-078)	—	100 MHz to 6 GHz
MS2692A	≤31.25 MHz (Standard)	—	100 MHz to 26.5 GHz
	≤62.5 MHz (MS269xA-077) ≤125 MHz (MS269xA-078)	Without MS269xA-067/ Preselector Bypass off	100 MHz to 6 GHz
	≤62.5 MHz (MS269xA-077) ≤125 MHz (MS269xA-078)	Preselector Bypass on	100 MHz to 26.5 GHz

Measurement Frequency Range: 600 MHz to 5 GHz

Modulation/ Frequency Measurement	Measurement Level Range	–10 to +30 dBm (Preamp Off, or Preamp not installed) –25 to +10 dBm (Preamp On)	
	Carrier Frequency Measurement Accuracy	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	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
	Residual Vector Error	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%	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%
Amplitude Measurement	Measurement Level Range	–10 to +30 dBm (Preamp Off, or Preamp not installed) –25 to +10 dBm (Preamp On)	
	Tx Power Measurement Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of MS269xA main unit.)	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	

Frequency Range	Preamp Off, or without Preamp	Preamp On
600 MHz ≤ Frequency < 5 GHz	±1.91 dB (nom.)	±2.20 dB (nom.)

Waveform Display		Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Spectral Flatness, Power vs. RB, EVM vs. RB	
Digitize Function	Function Overview	Supports output of captured waveform data to internal storage or external storage	
	Waveform Data	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	
	Replay Function	Analyzes traces of saved waveform data Format: I, Q (32 bit floating point binary format) Sampling Rate:	

Channel Bandwidth	Without MS269xA-077 Without MS269xA-078	With MS269xA-077 Wihtout MS269xA-078	With MS269xA-077 With MS269xA-078
≤100 MHz	50 MHz	100 MHz	200 MHz

Power vs. Time Measurement	Displayed Average Noise	This is calculated up to 5 GHz from the Display Average Noise Level for the signal analyzer with MS269xA-077/078 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. –94 dBm/MHz (nominal)	—

5G Standard Measurement Software (Base License) MX269051A
NR FDD sub-6 GHz Downlink MX269051A-031
NR FDD sub-6 GHz Uplink MX269051A-081

MS269xA

Specifications

Signal Analyzer		MS269xA	
Option		NR FDD sub-6GHz Downlink MX269051A-031	NR FDD sub-6GHz Uplink MX269051A-081
Electrical Characteristics	Target Signals	TS 38.211 Sub-6 GHz compliant downlink signal	TS 38.211 Sub 6-GHz compliant uplink signal
	Channel Bandwidth		
	Capture Time	1 to 2 Frame	
	Frequency Setting Range		
	Measurement Frequency Range	400 MHz to 6 GHz	
Modulation/ Frequency Measurement	Measurement Level Range	–10 to +30 dBm (Preamp Off, or Preamp not installed) –25 to +10 dBm (Preamp On)	
	Carrier Frequency Measurement Accuracy	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	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
	Residual Vector Error	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%	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%
Amplitude Measurement	Measurement Level Range	–10 to +30 dBm (Preamp Off, or Preamp not installed) –25 to +10 dBm (Preamp On)	
	Tx Power Measurement Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of MS269xA main unit.)	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	
Waveform Display		Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Spectral Flatness, Power vs. RB, EVM vs. RB	
Digitize Function	Function Overview	Supports output of captured waveform data to internal storage or external storage	
	Waveform Data	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	
	Replay Function	Analyzes traces of saved waveform data Format: I, Q (32 bit floating point binary format) Sampling Rate:	

Subcarrier Spacing	Channel Bandwidth
15 kHz	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)
30 kHz	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)
60 kHz	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)

	Analysis Bandwidth	MS269xA-067	Frequency Range
MS2690A	≤31.25 MHz (Standard)	—	100 MHz to 6 GHz
	≤62.5 MHz (MS269xA-077) ≤125 MHz (MS269xA-078)	—	100 MHz to 6 GHz
MS2691A	≤31.25 MHz (Standard)	—	100 MHz to 13.5 GHz
	≤62.5 MHz (MS269xA-077) ≤125 MHz (MS269xA-078)	—	100 MHz to 6 GHz
MS2692A	≤31.25 MHz (Standard)	—	100 MHz to 26.5 GHz
	≤62.5 MHz (MS269xA-077) ≤125 MHz (MS269xA-078)	Without MS269xA-067/ Preselector Bypass off	100 MHz to 6 GHz
	≤62.5 MHz (MS269xA-077) ≤125 MHz (MS269xA-078)	Preselector Bypass on	100 MHz to 26.5 GHz

Frequency Range	Preamp Off, or without Preamp	Preamp On
400 MHz ≤ Frequency < 6 GHz	±1.91 dB (nom.)	±2.20 dB (nom.)

Channel Bandwidth	Without MS269xA-077 Without MS269xA-078	With MS269xA-077 Wihtout MS269xA-078	With MS269xA-077 With MS269xA-078
≤100 MHz	50 MHz	100 MHz	200 MHz

External Mixer Connection Function MX284090A

MS2850A MS2840A MS2830A

Adding the External Mixer Connection Function MX284090A to a signal analyzer extends the frequency measured using either Eravant or VDI external mixers.
It supports spectrum analysis of wideband millimeter wave transmitters expected to be used in a wide application range, such as millimeter and automotive radar.

Eravant External Mixer

VDI External Mixer

Recommended Eravant or VDI External Mixers

Model	Name	Maker	Frequency Range	LO Multiplier
STC-N12-15-S1-IDP	V-Band Full Waveguide Band Down-Converter	Eravant	50 GHz to 75 GHz	8
WR12SAX-Z-M	Spectrum Analyzer Extender (SAX)	VDI	60 GHz to 90 GHz	12

Features

- Supports Image-Response Free Bandwidth ≤7.5 GHz with High IF and PS Function*1
- Easy Setup Using LO/IF Coaxial Cables
- Accessory USB Memory with Mixer Conversion Loss Data

Using the Signal Analyzer with high IF supports spectrum mask measurement over a wide frequency span without any image-response effect. Furthermore, Anritsu's proprietary PS (Polarity Swap) supports image-response-free bandwidths of up to 7.5 GHz.

High-sensitivity measurement is supported because the number of required LO multipliers is reduced by the 1st Local signal 5 to 10 GHz high frequency band.

Setup between the Signal Analyzer and external mixer is simple. Just connect a coaxial cable between the Signal Analyzer 1st Local Output port and external mixer. The Mixer's unique conversion loss data is stored on the accessory USB memory provided with each mixer, and is applied to measured values simply by loading into the Signal Analyzer.

*1: Patented

Frequency Expansion Range

The following frequency ranges can be selected to match the supported frequency range of an external mixer connected to the Signal Analyzer.*2

*2: Only supported by Signal Analyzer with installed External Mixer Connection Function MX284090A

Frequency Range	40 GHz to 60 GHz	50 GHz to 75 GHz	60 GHz to 90 GHz	75 GHz to 110 GHz	90 GHz to 140 GHz	110 GHz to 170 GHz
	120 GHz to 170 GHz	140 GHz to 220 GHz	150 GHz to 220 GHz	170 GHz to 240 GHz	240 GHz to 325 GHz	220 GHz to 325 GHz

Software Combinations

When using an external mixer, the MS2830A/MS2840A/MS2850A signal analyzers can be used in combination with the following software.

- OBW Measurement Function
- SEM Measurement Function
- Noise Floor Attenuation Function*3
- SA Function (Spectrum)
- Chirp Signal Analysis Function (Frequency vs. Time)
- Phase Noise Measurement Function*4

*3: Dedicated MS2840A/MS2850A option
Requires MS2840A-051/MS2850A-051 hardware option
*4: Requires MS2830A-010/MS2840A-010/MS2850A-010 hardware option

External Mixer Connection Function MX284090A

MS2850A MS2840A MS2830A

Supported Signal Analyzers and Standard Option Configuration

• MS2840A

Model	Name	Note
MS2840A	Signal Analyzer	Required
MS2840A-044	26.5 GHz Signal Analyzer	Required Select either one.
MS2840A-046	44.5 GHz Signal Analyzer	
MX284090A	External Mixer Connection Function	Required
J1692B	Coaxial Cord, 1 m	Recommended, Required to connect MS2840A IF port and converter SMA-P · SUCOFLEX126E · SMA-P, DC to 18 GHz, 50Ω

• MS2830A

Model	Name	Note
MS2830A	Signal Analyzer	Required
MS2830A-044	26.5 GHz Signal Analyzer	Required Select either one.
MS2830A-045	43 GHz Signal Analyzer	
MX284090A	External Mixer Connection Function	Required
MS2830A-006	Analysis Bandwidth 10 MHz	Recommended, Required when RBW setting is 20 MHz or more. Unnecessary when RBW setting is 10 MHz or less.
MS2830A-005	Analysis Bandwidth Extension to 31.25 MHz	Recommended, Required when RBW setting is 20 MHz or more. Option 006 is required when this option is installed. Select either option according to configuration. • Option 005: When MS2830A-044 included in configuration • Option 009: When MS2830A-045 included in configuration
MS2830A-009	Bandwidth Extension to 31.25 MHz for Millimeter-wave	
J1692B	Coaxial Cord, 1 m	Recommended, Required to connect MS2830A IF port and converter SMA-P · SUCOFLEX126E · SMA-P, DC to 18 GHz, 50Ω

• MS2850A

Model	Name	Note
MS2850A	Signal Analyzer	Required
MS2850A-047	32 GHz Signal Analyzer	Required Select either one.
MS2850A-046	44.5 GHz Signal Analyzer	
MX284090A	External Mixer Connection Function	Required
J1692B	Coaxial Cord, 1 m	Recommended, Required to connect MS2850A IF port and converter SMA-P · SUCOFLEX126E · SMA-P, DC to 18 GHz, 50Ω

The MX284090A can be retrofitted to your MS2830A/MS2840A/MS2850A. Pay attention to the above hardware configuration option conditions.

MS2850A/MS2840A/MS2830A Configuration

Options Configuration

Refer two table shown below about the hardware/software which each frequency model of MS2830A can implement.

- **MS2830A Hardware Configuration**

Frequency range (MS2830A-040/041/043/044/045) not upgradable.

✓ = Can be installed, No = Cannot be installed, R = Require, U = Upgrade

Opt.	Name	Retrofit	Addition to Main unit					Combination with "Option" (Refer to the left line)																											
			040	041	043	044	045	001	002	005	006	009	077	078	008	010	011	014	016	017	018	020	021	022	026	052	027	028	029	066	067	068	088	189	182
001	Rubidium Reference Oscillator		✓	✓	✓	✓	✓		*9																										
002	High Stability Reference Oscillator		✓	✓	✓	No	No	*9				No																			No	No			
005	Analysis Bandwidth Extension to 31.25 MHz		✓	✓	✓	✓	No				R	No																							
006	Analysis Bandwidth 10 MHz		✓	✓	✓	✓	✓			U		U	U	U																					
009	Bandwidth Extension to 31.25 MHz for Millimeter-wave		No	No	No	No	✓		No	No	R										No	No	No	No			No	No	No	No			No	No	
077	Analysis Bandwidth Extension to 62.5 MHz	No	✓	✓	✓	✓	✓			*5	R	*5																							
078	Analysis Bandwidth Extension to 125 MHz	No	✓	✓	✓	✓	✓			*5	R	*5	R																						
008	Preamplifier		✓	✓	✓	*1	*1																									*1			
010	Phase Noise Measurement Function		✓	✓	✓	✓	✓																												
011	2ndary HDD		✓	✓	✓	✓	✓																												
014	Removable HDD, Win10	*13	✓	✓	✓	✓	✓																												
016	Precompliance EMI Function		✓	✓	✓	✓	✓																												
017	Noise Figure Measurement Function		✓	✓	✓	✓	✓								U																	U			
018	Audio Analyzer*4		✓	✓	*7	No	No					No																		R	No	No			
020	3.6 GHz Vector Signal Generator		✓	✓	*2	No	No					No											No			*11				*2	No	No	No	No	
021	6 GHz Vector Signal Generator		✓	✓	*2	No	No					No										No				*11				*2	No	No	No	No	
022	Low Power Extension for Vector Signal Generator		✓	✓	✓	No	No					No											R								No	No	No	No	
026	BER Measurement Function		✓	✓	✓	✓	✓																												
052	Internal Signal Generator Control Function	*12	✓	✓	*2	No	No																*11							*2			*11		
027	ARB Memory Upgrade 256 MSa for Vector Signal Generator		✓	✓	✓	No	No					No											R								No	No	*3	*3	
028	AWGN		✓	✓	✓	No	No					No											R								No	No	*3	*3	
029	Analog Function Extension for Vector Signal Generator*4	*8	✓	✓	No	No	No					No											R	R						R	No	No	No	No	
066	Low Phase Noise Performance	No	✓	✓	*2	No	No					No											*2			*2					No	No			
067	Microwave Preselector Bypass		No	No	No	✓	✓		No												No	No	No	No			No	No	No	No			No	No	
068	Microwave Preamplifier		No	No	No	*1	*1		No						*1						No	No	No	No			No	No	No	No			No	No	
088	3.6 GHz Analog Signal Generator*4		✓	✓	No	No	No					No										No	No	No		*11	*3	*3	No	R	No	No		U	
189	Vector Function Extension for Analog Signal Generator Retrofit		✓	✓	No	No	No					No										No	No	No			*3	*3	No	R	No	No	R		
182	CPU/Windows10 Upgrade Retrofit	*10	✓	✓	✓	✓	✓																												

*1: Cannot be installed simultaneously MS2830A-008 and MS2830A-068/168. When MS2830A-168 is added to Signal Analyzer with MS2830A-008, only MS2830A-168 becomes effective.
*2: MS2830A-043 can implement only either MS2830A-020/021 or MS2830A-066.
*3: MS2830A-027 and MS2830A-028 are not used in analog signal generator (MS2830A-088/188).
After vector function (MS2830A-189) was added, the vector signal generator function can add MS2830A-027 and MS2830A-028.
*4: Requires MX269018A.
*5: MS2830A-040/041/043/044 require MS2830A-005.
MS2830A-045 requires MS2830A-009.
*6: 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 MS2850A is recommended for other measurement purposes.
*7: The MS2830A-018 can be installed with MS2830A-043 but cannot be installed simultaneously with a signal generator (MS2830A-088/020/021/029) because MS2830A-066 is required. Consequently, analog wireless Rx tests cannot be performed using the same main unit when the MS2830A-018 and MS2830A-043 are combined.
*8: Please contact our sales representative when requesting retrofitting.
*9: The Rubidium Reference Oscillator can be retrofitted to MS2830A-040/041/043 with installed High Stability Reference Oscillator.
In this case, the Rubidium Reference Oscillator is functional.
*10: Replace the MS2830A CPU board with either Windows Embedded Standard 2009 (Windows XP) or Windows Embedded Standard 7 (Windows 7) and upgrade the operating system to Windows 10 IoT Enterprise LTSC2019.
Windows XP is installed in MS2830A units ordered until August 2016.
Windows 7 is installed in MS2830A units ordered from September 2016 which have a label indicating C1 attached near the serial number.
Windows 10 is installed in MS2830A units ordered from September 2020 and has a label indicating C2 attached near the serial number.
*11: Installing the MS2830A-052 requires any of the MS2830A-020/120, 021/121, or 088/188 options.
*12: When retrofitting signal generator-linked functions (MS2830A-352), the license is delivered on an accessory DVD which is used to install the license in the MS2830A.
It is not necessary to return the MS2830A to Anritsu for upgrading.
*13: The CPU/Windows10 Upgrade Retrofit MS2830A-182/282 option is required when the MS2830A OS is not Windows 10.

MS2850A/MS2840A/MS2830A Configuration (Continued)

• MS2840A Hardware Configuration

Frequency range (MS2840A-040/041/044/046) not upgradable.

✓ = Can be installed, No = Cannot be installed, R = Require, U = Upgrade

Opt.	Name	Retrofit	Addition to Main unit				Combination with "Opt." (Refer to the left line)																										
			040 (3.6 GHz)	041 (6 GHz)	044 (26.5 GHz)	046 (44.5 GHz)	001	002	005 (standard install)	006 (standard install)	009 (standard install)	077	078	008	069	068	019	010	011	014	016	017	026	051	066	067	020	021	189	022	027	028	088	029	182
001	Rubidium Reference Oscillator	Yes	✓	✓	✓	✓		*5																											
002	High Stability Reference Oscillator	Yes	✓	✓	Equivalent function installed		*5				No				No	No	No									No									
005	Analysis Bandwidth Extension to 31.25 MHz	–	Standard install	Standard install	Standard install	No					No					No																			
006	Analysis Bandwidth 10 MHz	–	Standard install	Standard install	Standard install	Standard install																													
009	Bandwidth Extension to 31.25 MHz for Millimeter-wave	–	No	No	No	Standard install		No	No																No		No	No	No	No	No	No	No	No	
077	Analysis Bandwidth Extension to 62.5 MHz*1	Yes	✓	✓	✓	✓																													
078	Analysis Bandwidth Extension to 125 MHz*1	Yes	✓	✓	✓	✓						R																							
008	Preamplifier	Yes	✓	✓	✓	✓									*6	*6																			
069	26.5 GHz Microwave Preamplifier	Yes	No	No	✓	No		No			No			*6		No									No		No	No	No	No	No	No	No	No	
068	Microwave Preamplifier	Yes	No	No	No	✓		No		No				*6	No										No		No	No	No	No	No	No	No	No	
019	2 dB Step Attenuator for Millimeter-wave	Yes	No	No	No	✓		No		No					No										No		No	No	No	No	No	No	No	No	
010	Preamplifier	Yes	✓	✓	✓	✓																													
011	2ndary SSD	Yes	✓	✓	✓	✓																													
014	Removable SSD, Win10	Yes*7	✓	✓	✓	✓																													
016	Precompliance EMI Function	Yes	✓	✓	✓	✓																													
017	Noise Figure Measurement Function	Yes	✓	✓	✓	✓								U	U	U																			
026	BER Measurement Function	Yes	✓	✓	✓	✓																													
051	Noise Floor Reduction	Yes	✓	✓	✓	✓																													
066	Low Phase Noise Performance	Yes	✓	✓	No	No					No				No	No										No									
067	Microwave Preselector Bypass	Yes	No	No	✓	✓		No																	No		No	No	No	No	No	No	No	No	
020	3.6 GHz Vector Signal Generator	Yes	✓	✓	No	No					No				No	No										No		No	No				No		
021	6 GHz Vector Signal Generator	Yes	✓	✓	No	No					No				No	No										No	No		No				No		
189	Vector Function Extension for Analog Signal Generator Retrofit	Yes	✓	✓	No	No					No				No	No										No	No	No		No			R	No	
022	Low Power Extension for Vector Signal Generator	Yes	✓	✓	No	No					No				No	No										No		R	No				No		
027	ARB Memory Upgrade 256 Msa for Vector Signal Generator*2	Yes	✓	✓	No	No					No				No	No										No		R							
028	AWGN*2	Yes	✓	✓	No	No					No				No	No										No		R							
088	3.6 GHz Analog Signal Generator*3	Yes	✓	✓	No	No					No				No	No										No	No	No		No				No	
029	Analog Function Extension for Vector Signal Generator*3	Yes	✓	✓	No	No					No				No	No										No		R	No	R			No		
182	CPU/Windows10 Upgrade Retrofit*4	Yes	✓	✓	✓	✓																													

*1: 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 MS2850A is recommended for other measurement purposes.

*2: The ARB Memory Upgrade 256 Msa for Vector Signal Generator (MS2840A-027) and AWGN (MS2840A-028) are non-functional in the Analog Signal Generator (MS2840A-029/088).

*3: Requires Analog Measurement Software (MX269018A).

*4: Replace the MS2840A CPU board with Windows Embedded Standard 7 (Windows 7) and upgrade the operating system to Windows 10 IoT Enterprise LTSC2019.
Windows 7 is installed in MS2840A units ordered until August 2020.
Windows 10 is installed in MS2840A units ordered from September 2020 and has a label indicating C2 attached near the serial number.

*5: The Rubidium Reference Oscillator can be retrofitted to the MS2840A-040/041 with installed High Stability Reference Oscillator.
In this case, the Rubidium Reference Oscillator is functional.

*6: The 26.5 GHz Microwave Preamplifier or Microwave Preamplifier can be retrofitted to the MS2840A-044/046 with installed Preamplifier.
In this case, the 26.5 GHz Microwave Preamplifier or Microwave Preamplifier are functional.

*7: The CPU/Windows10 Upgrade Retrofit MS2840A-182/282 option is required when the MS2840A OS is not Windows 10.

MS2850A/MS2840A/MS2830A Configuration (Continued)

- **MS2850A Hardware Configuration**

Frequency range (MS2850A-046/047) not upgradable.

✓ = Can be installed, No = Cannot be installed, R = Require, U = Upgrade

Option	Name	Retrofit	Addition to Main unit		Combination with "Option" (Refer to the left line)														
			MS2850A-046 (44.5 GHz model)	MS2850A-047 (32 GHz model)	MS2850A-032 (standard install)	MS2850A-033	MS2850A-034	MS2850A-010	MS2850A-017	MS2850A-067 (standard install)	MS2850A-068	MS2850A-072	MS2850A-076	MS2850A-051	MS2850A-011	MS2850A-014	MS2850A-053	MS2850A-054	MS2850A-182
MS2850A-032	Analysis Bandwidth 255 MHz	—	Standard install	Standard install															
MS2850A-033	Analysis Bandwidth Extension to 510 MHz	Yes	✓	✓															
MS2850A-034	Analysis Bandwidth Extension to 1 GHz	Yes	✓	✓		R													
MS2850A-010	Phase Noise Measurement Function	Yes	✓	✓															
MS2850A-017	Noise Figure Measurement Function	Yes	✓	✓							U								
MS2850A-067	Microwave Preselector Bypass	—	Standard install	Standard install															
MS2850A-068	Microwave Preamplifier	Yes	✓	✓															
MS2850A-072	Extended Specifications	Yes	✓	✓															
MS2850A-076	Low Second Harmonic Distortion	Yes	✓	✓															
MS2850A-051	Noise Floor Reduction	Yes	✓	✓															
MS2850A-011	Secondary Storage Device	Yes	✓	✓															
MS2850A-014	Removable SSD, Win10	Yes*1	✓	✓															
MS2850A-053	External Interface for High Speed Data Transfer PCIe	Yes	✓	✓															
MS2850A-054	External Interface for High Speed Data Transfer USB3.0	Yes	✓	✓															
MS2850A-182	CPU/Windows10 Upgrade Retrofit*2	Yes	✓	✓															

*1: The CPU/Windows10 Upgrade Retrofit MS2850A-182/282 option is required when the MS2850A OS is not Windows 10.

*2: Replace the MS2850A CPU board with Windows Embedded Standard 7 (Windows 7) and upgrade the operating system to Windows 10 IoT Enterprise LTSC2019.
Windows 7 is installed in MS2850A units ordered until August 2020.
Windows 10 is installed in MS2850A units ordered from September 2020 and has a label indicating C2 attached near the serial number.

MS2850A/MS2840A/MS2830A Configuration (Continued)

• MS2830A Software Configuration

✓ = Can be installed, No = Cannot be installed, R = Require, U = Upgrade

Model	Name	Addition to Main frame					Analysis Bandwidth					Note
		040	041	043	044	045	005	006	009	077	078	
MX269011A	W-CDMA/HSPA Downlink Measurement Software	✓	✓	✓	✓	✓		R				
MX269012A	W-CDMA/HSPA Uplink Measurement Software	✓	✓	✓	✓	✓		R				
MX269013A	GSM/EDGE Measurement Software	✓	✓	✓	✓	✓		R				
MX269013A-001	EDGE Evolution Measurement Software	✓	✓	✓	✓	✓		R				Requires MX269013A
MX269017A	Vector Modulation Analysis Software	✓	✓	✓	✓*3	✓*3	U	R	U*1	U	U	U: Upgrade of the phase noise performance (MS2830A-066) (Measured signal: Frequency <3.6 GHz, Bandwidth <1 MHz)
MX269018A	Analog Measurement Software	✓	✓	✓*2	No	No			No			Requires MS2830A-066 and A0086D (See MX2690xxA series Measurement Software catalog for detail) Note) MS2830A-043 cannot implement a signal generator for Rx test (Because MS2830A-066 is required)
MX269020A	LTE Downlink Measurement Software	✓	✓	✓	✓	✓	R	R	R*1			
MX269020A-001	LTE-Advanced FDD Downlink Measurement Software	✓	✓	✓	✓	✓	R	R	R*1	U	U	Requires MX269020A
MX269021A	LTE Uplink Measurement Software	✓	✓	✓	✓	✓	R	R	R*1			
MX269021A-001	LTE-Advanced FDD Uplink Measurement Software	✓	✓	✓	✓	✓	R	R	R*1	U	U	Requires MX269021A
MX269022A	LTE TDD Downlink Measurement Software	✓	✓	✓	✓	✓	R	R	R*1			
MX269022A-001	LTE-Advanced TDD Downlink Measurement Software	✓	✓	✓	✓	✓	R	R	R*1	U	U	Requires MX269022A
MX269023A	LTE TDD Uplink Measurement Software	✓	✓	✓	✓	✓	R	R	R*1			
MX269023A-001	LTE-Advanced TDD Uplink Measurement Software	✓	✓	✓	✓	✓	R	R	R*1	U	U	Requires MX269023A
MX269028A	WLAN (802.11) Measurement Software	✓	✓	✓	✓	✓	R	R	R*1			
MX269028A-001	802.11ac (80 MHz) Measurement Software	✓	✓	✓	✓	✓	R	R	R*1	R	R	Only for MS2830A. Requires MX269028A
MX284090A	External Mixer Connection Function	No	No	No	✓	✓	U	U	U	U	U	Requires external mixer*4

*1: MS2830A-045 cannot be installed MS2830A-005. Add MS2830A-009 in substitution for MS2830A-005.
*2: 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.
*3: 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.
*4: Refer to page 71 for recommended external mixer.

• MS2840A Software Configuration

✓ = Can be installed, No = Cannot be installed, R = Require, U = Upgrade

Model	Name	Addition to Main frame				Analysis Bandwidth	
		040 (3.6 GHz)	041 (6 GHz)	044 (26.5 GHz)	046 (44.5 GHz)	077 (62.5 MHz)	078 (125 MHz)
MX269017A	Vector Modulation Analysis Software	✓	✓	✓	✓	✓	✓
MX269017A-001	APSK Analysis	✓	✓	✓	✓	✓	✓
MX269017A-011	Higher-Order QAM Analysis	✓	✓	✓	✓	✓	✓
MX269018A	Analog Measurement Software*5	✓	✓	✓	✓		
MX284059B	Pulse Radar Measurement Function*6	No	No	✓	✓		
MX284090A	External Mixer Connection Function*6	No	No	✓	✓	✓	✓

*5: Requires USB Audio A0086D
*6: Requires external mixer. Refer to page 71 for recommended external mixer.

MS2850A/MS2840A/MS2830A Configuration (Continued)

- **MS2850A Software Configuration**

Option	Name	Addition to Main frame ✓ = Can be installed		Analysis Bandwidth option U = Upgrade		Note
		MS2850A-046 (44.5 GHz model)	MS2850A-047 (32 GHz model)	MS2850A-033 (510 MHz)	MS2850A-034 (1 GHz)	
MX285051A	5G Standard Measurement Software (Base License)	✓	✓	U	U	This license can't be used alone. Requires any one of MX285051A-001/011/021/031/051/061/071/081
MX285051A-001	Pre-Standard CP-OFDM Downlink	✓	✓	U	U	Requires MX285051A
MX285051A-051	Pre-Standard CP-OFDM Uplink	✓	✓	U	U	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	✓	✓	U	U	Requires MX285051A
MX285051A-071	NR TDD mmWave Uplink	✓	✓	U	U	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
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
MX269017A	Vector Modulation Analysis Software	✓	✓			
MX269017A-001	APSK Analysis	✓	✓			Requires MX269017A
MX269017A-011	Higher-Order QAM Analysis	✓	✓			Requires MX269017A
MX269017A-011	Higher-Order QAM Analysis	✓	✓			Requires MX269017A
MX284090A	External Mixer Connection Function	✓	✓	U	U	Requires external mixer*

*: Refer to page 71 for recommended external mixer.

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.
The MS269xA software package can be purchased separately.

Model/Order No	Name
	Main Unit
MS2850A-047	Signal Analyzer (9 kHz to 32 GHz)
MS2850A-046	Signal Analyzer (9 kHz to 44.5 GHz)
MS2840A-040	Signal Analyzer (9 kHz to 3.6 GHz)
MS2840A-041	Signal Analyzer (9 kHz to 6 GHz)
MS2840A-044	Signal Analyzer (9 kHz to 26.5 GHz)
MS2840A-046	Signal Analyzer (9 kHz to 44.5 GHz)
MS2830A-040	Signal Analyzer (9 kHz to 3.6 GHz)
MS2830A-041	Signal Analyzer (9 kHz to 6 GHz)
MS2830A-043	Signal Analyzer (9 kHz to 13.5 GHz)
MS2830A-044	Signal Analyzer (9 kHz to 26.5 GHz)
MS2830A-045	Signal Analyzer (9 kHz to 43 GHz)
	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 (MS269xA only)
MX269017A	Vector Modulation Analysis Software
MX269017A-001	APSK Analysis (Requires MX269017A)
MX269017A-011	Higher-Order QAM Analysis (Requires MX269017A)
MX269018A	Analog Measurement Software (For MS2840A and MS2830A. MS2830A-066 and A0086D are required for MS2830A. A0086D is required for MS2840A.)
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)
MX269028A	WLAN (802.11) Measurement Software
MX269028A-001	802.11ac (80 MHz) Measurement Software (MS2830A only, Requires MX269028A)
MX269028A-002	802.11ac (160 MHz) Measurement Software (MS269xA only, Requires MX269028A)
MX284059B	Pulse Radar Measurement Function (MS2840A-044/046 only)
MX285051A	5G Standard Measurement Software (Base License) (MS2850A only, Requires any one of MX285051A-001/011/021/031/051/061/071/081)
MX285051A-001	Pre-Standard CP-OFDM Downlink (MS2850A only, Requires MX285051A)
MX285051A-051	Pre-Standard CP-OFDM Uplink (MS2850A only, Requires MX285051A)
MX285051A-011	NR TDD sub-6 GHz Downlink (MS2850A only, Requires MX285051A)
MX285051A-061	NR TDD sub-6 GHz Uplink (MS2850A only, Requires MX285051A)
MX285051A-031	NR FDD sub-6 GHz Downlink (MS2850A only, Requires MX285051A)
MX285051A-081	NR FDD sub-6 GHz Uplink (MS2850A only, Requires MX285051A)
MX285051A-021	NR TDD mmWave Downlink (MS2850A only, Requires MX285051A)
MX285051A-071	NR TDD mmWave Uplink (MS2850A only, Requires MX285051A)

Model/Order No	Name
MX269051A	5G Standard Measurement Software (Base License) (MS269xA only, Requires any one of MX269051A-011/031/061/081)
MX269051A-011	NR TDD sub-6 GHz Downlink (MS269xA only, Requires MX269051A)
MX269051A-061	NR TDD sub-6 GHz Uplink (MS269xA only, Requires MX269051A)
MX269051A-031	NR FDD sub-6 GHz Downlink (MS269xA only, Requires MX269051A)
MX269051A-081	NR FDD sub-6 GHz Uplink (MS269xA only, Requires MX269051A)
MX284090A	External Mixer Connection Function (image-response-free bandwidth: 7.5 GHz) (Requires any one of MS2830A-044, MS2830A-045, MS2840A-044, MS2840A-046, MS2850A)
	Application Parts
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)
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)
W3528AE	MX269028A Operation Manual (Operation)
W3529AE	MX269028A Operation Manual (Remote Control)
W4101AE	MX284059B Operation Manual
W3922AE	MX285051A/MX269051A Operation Manual (Operation)
W3924AE	MX285051A-001/MX285051A-051 Operation Manual (Operation)
W3925AE	MX285051A-001/MX285051A-051 Operation Manual (Remote Control)
W3963AE	MX285051A-011/MX269051A-011/MX285051A-021/MX285051A-061/MX269051A-061/MX285051A-071 Operation Manual (Operation)
W3964AE	MX285051A-011/MX269051A-011/MX285051A-021/MX285051A-061/MX269051A-061/MX285051A-071 Operation Manual (Remote Control)
W4035AE	MX285051A-031/MX269051A-031/MX285051A-081/MX269051A-081 Operation Manual (Operation)
W4036AE	MX285051A-031/MX269051A-031/MX285051A-081/MX269051A-081 Operation Manual (Remote Control)

Note

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