

Anritsu envision : ensure

Signal Analyzer MS2690A/MS2691A/MS2692A
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 (High-end model) 	<ul style="list-style-type: none"> High level accuracy up to 6 GHz expandable to 5G, and 125 MHz wideband 177 dB dynamic range without external filter for spurious measurements 	50 Hz to 6 GHz 50 Hz to 13.5 GHz 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) 	<ul style="list-style-type: none"> 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) 	<ul style="list-style-type: none"> 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)* 125 MHz (Option: MS2840A-078)*
MS2830A (Middle-range model) 	<ul style="list-style-type: none"> 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)* 125 MHz (Option: MS2830A-078)*

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

Main Frame Measurement Functions

The MS269xA, 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	• Channel Power	• Occupied Bandwidth	• Adjacent Channel Leakage Power
• Spectrum Emission Mask	• Burst Average Power	• Spurious Emission	• AM Depth
• FM Deviation	• Multi-marker & Marker List	• Highest 10 Markers	• Limit Line
• Frequency Counter	• 2-tone 3rd-order Intermodulation Distortion	• Annotation Display	• Power vs. Time
• Frequency vs. Time	• Phase vs. Time	• CCDF/APD*	• 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 MS269xA, MS2850A, MS2840A and MS2830A series of signal analyzers (depending on the model). For details refer to the relevant main-frame catalog.

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	6	✓		✓	R				✓			
	W-CDMA/HSPA Uplink Measurement Software	MX269012A	8	✓		✓	R				✓			
GSM/EDGE	GSM/EDGE Measurement Software	MX269013A	10	✓		✓	R				✓			
EDGE Evolution	EDGE Evolution Measurement Software	MX269013A-001*8	10	✓		✓	R				✓			
ETC/DSRC	ETC/DSRC Measurement Software	MX269014A	12	✓										
TD-SCDMA	TD-SCDMA Measurement Software	MX269015A	14	✓		✓	R				✓			
World Digital Wireless Standards	Vector Modulation Analysis Software	MX269017A	16	✓	U	✓	R	U	U	✓	U	✓		
	APSK Analysis	MX269017A-001*17	16							✓	U	✓		
	Higher-Order QAM Analysis	MX269017A-011*17	16							✓	U	✓		
Analog (FM/ϕM/AM)	Analog Measurement Software	MX269018A*9	26			✓				✓				
Pulse Radar	Pulse Radar Measurement Function	MX284059A*19	35							✓				
LTE/LTE-Advanced (FDD)	LTE Downlink Measurement Software	MX269020A	37	✓		✓	R	R			✓			
	LTE-Advanced FDD Downlink Measurement Software	MX269020A-001*10	37	✓	U	✓	R	R	U		✓			
	LTE Uplink Measurement Software	MX269021A	43	✓		✓	R	R			✓			
	LTE-Advanced FDD Uplink Measurement Software	MX269021A-001*13	43	✓	U	✓	R	R	U		✓			
LTE/LTE-Advanced (TDD)	LTE TDD Downlink Measurement Software	MX269022A	37	✓		✓	R	R			✓			
	LTE-Advanced TDD Downlink Measurement Software	MX269022A-001*11	37	✓	U	✓	R	R	U		✓			
	LTE TDD Uplink Measurement Software	MX269023A	43	✓		✓	R	R			✓			
	LTE-Advanced TDD Uplink Measurement Software	MX269023A-001*14	43	✓	U	✓	R	R	U		✓			
CDMA2000	CDMA2000 Forward Link Measurement Software	MX269024A	49	✓		✓	R							
	All Measure Function	MX269024A-001	49	✓		✓	R							
1xEV-DO	EV-DO Forward Link Measurement Software	MX269026A	49	✓		✓	R							
	All Measure Function	MX269026A-001	49	✓		✓	R							
5G	5G Standard Measurement Software (Base License)	MX285051A	64								✓			
	Pre-Standard CP-OFDM Downlink	MX285051A-001*16	64								✓	U	U	
	Pre-Standard CP-OFDM Uplink	MX285051A-051*16	64								✓	U	U	
	NR TDD sub-6 GHz Downlink	MX285051A-011*16	66								✓			
	NR TDD sub-6 GHz Uplink	MX285051A-061*16	66								✓			
	NR FDD sub-6 GHz Downlink	MX285051A-031*16	66								✓			
	NR FDD sub-6 GHz Uplink	MX285051A-081*16	66								✓			
	NR TDD mmWave Downlink	MX285051A-021*16	66								✓	U	U	
	NR TDD mmWave Uplink	MX285051A-071*16	66								✓	U	U	
	5G Standard Measurement Software (Base License)	MX269051A	73	✓										
	NR TDD sub-6 GHz Downlink	MX296051A-011*18	73	✓	U									
	NR TDD sub-6 GHz Uplink	MX269051A-061*18	73	✓	U									
	NR FDD sub-6 GHz Downlink	MX296051A-031*18	73	✓	U									
	NR FDD sub-6 GHz Uplink	MX269051A-081*18	73	✓	U									
WLAN	WLAN (802.11) Measurement Software (Supports IEEE 802.11a/11b/11g/11j/11n/11p)	MX269028A	52	✓		✓	R	R						
	802.11ac (80 MHz) Measurement Software	MX269028A-001*12	52			✓	R	R	R					
	802.11ac (160 MHz) Measurement Software	MX269028A-002*12	52	✓	R									
W-CDMA/HSPA	W-CDMA BS Measurement Software	MX269030A	62	✓		✓	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 MS2690A/91A/92A series is recommended for other measurement purposes.

*8: Requires MX269013A

*9: MS2830A-066 and A0086C required by MS2830A; A0086C 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.

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

Signal Analyzers MS269xA, MS2830A, MS2840A and MS2850A

Measurement Software for Smart Meter (For MS269xA and MS2830A)

This software is for PC. This software supports automatic measurement of the PHY layer and protocol analysis of the PHY/MAC layer of smart utility network wireless communications (Wi-SUN).

Wi-SUN PHY Measurement Software MX705010A*1
Wi-SUN Protocol Monitor MX705110A*2

The MX705010A*1 supports automatic measurement of Wi-SUN Alliance PHY Conformance test cases. The MS269xA/MS2830A is controlled by remote commands from this software.

*1: Cannot be installed in MS269xA/MS2830A.

Requires the latest firmware of MS269xA/MS2830A.

This service, which provides updated versions of firmware and software for downloading by product customers, is available on Anritsu's website.

<<https://www.my.anritsu.com/home>>

Main frame	Options configuration examples
MS269xA	MX269017A, MS269xA-020, MX269902A
MS2830A	MS2830A-041, MS2830A-002, MS2830A-006, MX269017A, MS2830A-020, MS2830A-022, MS2830A-027, MX269902A

MX705110A*2 supports Wi-SUN protocol analysis. The wireless signals*3 between communicating devices are captured as I/Q data using the MS269xA digitize function and data analysis is performed by this software. Data analysis displays the PHY/MAC frame format, Tx timing, etc.

*2: Cannot be installed in MS269xA/MS2830A.

Requires the latest firmware of MS269xA/MS2830A.

MS2830A-006 is necessary for MS2830A.

*3: IEEE 802.15.4g/e (GFSK)

CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA).

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

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.

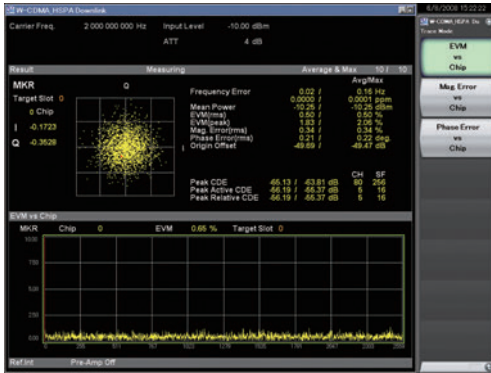
Attenuator mode: Mechanical Attenuator Only (MS2830A only)

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 frame)	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
	Waveform Display	Accuracy: ±0.3 dB (Code Domain Error ≥-30 dBc) ±1.0 dB (Code Domain Error ≥-40 dBc)			
Spectrum Measurement	Measurement Functions	EVM vs. Symbol, Amplitude Error vs. Symbol, Phase Error vs. Symbol, Symbol Constellation, Code Domain Power, Code Domain Error			
Spectrum Measurement		Adjacent Channel Leakage Power, Channel Power, Occupied Bandwidth, Spectrum Emission Mask			

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 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.



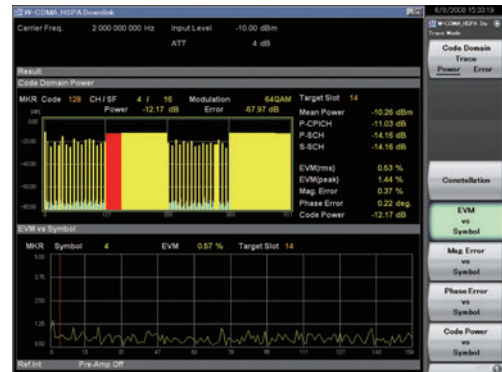
Code Domain (Constellation)

- Code 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 (Vector Error vs. Symbol)

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.

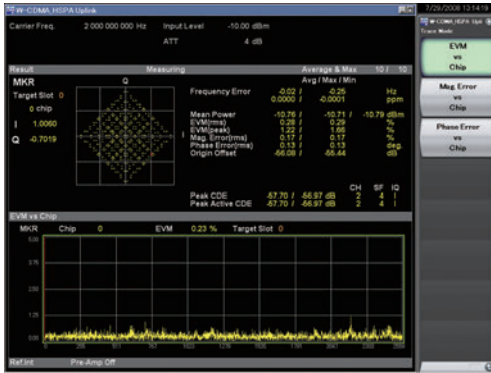
Attenuator mode: Mechanical Attenuator Only (MS2830A only)

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)	
	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 frame)	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 Accuracy: ±0.3 dB (Code Domain Error ≥-30 dBc) ±1.0 dB (Code Domain Error ≥-40 dBc)	Residual Error: ≤-42 dB
	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	

Measurement Functions

• Frequency Error/Mean Power/Modulation Accuracy

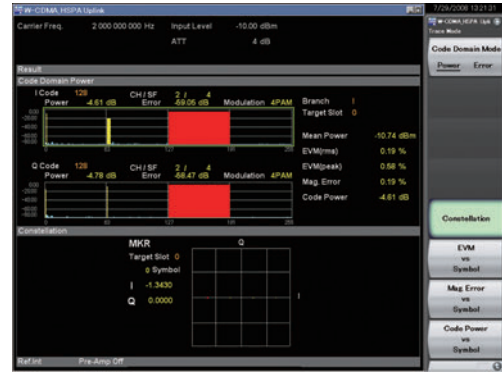
The Frequency Error, Mean Power, and Modulation Accuracy are displayed simultaneously as a constellation and graphs showing changes in Vector Error/Amplitude Error/Phase Error over time (Chip units). Instantaneous characteristics can be measured due to the excellent residual EVM characteristics of the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



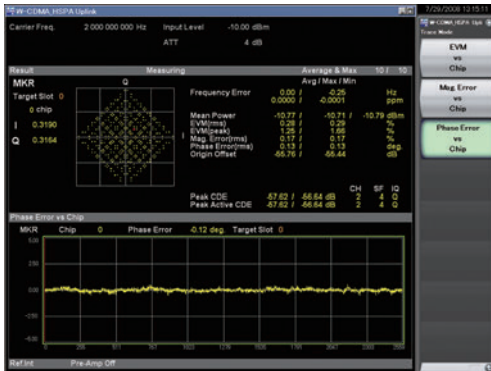
Constellation and Vector Error vs. Chip

• 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



Constellation and Phase Error vs. Chip



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.

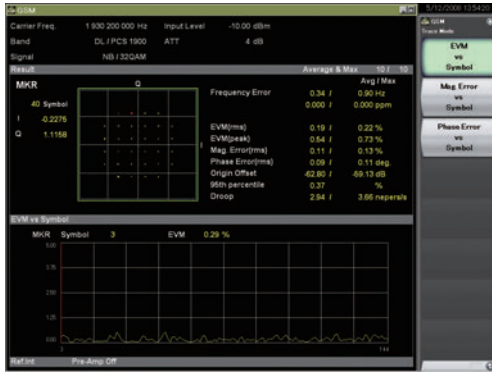
Attenuator mode: Mechanical Attenuator Only (MS2830A only)

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							
	Modulation Accuracy	At 18°C to 28°C, After calibration, With input signal in measurement level range and less than Input level							
		<table border="0"> <tr> <td>MX269013A Residual Vector Error (8PSK/AQPSK): ≤0.6% (rms)</td> <td>MX269013A Residual Vector Error (8PSK/AQPSK): ≤1.0% (rms)</td> </tr> <tr> <td>MX269013A-001 Residual Vector Error: ≤0.6% (rms)</td> <td>MX269013A-001 Residual Vector Error: ≤1.0% (rms)</td> </tr> <tr> <td>MX269013A Residual Phase Error (GMSK): ≤0.5 degrees (rms)</td> <td>MX269013A Residual Phase Error (GMSK): ≤0.7 degrees (rms)</td> </tr> </table>		MX269013A Residual Vector Error (8PSK/AQPSK): ≤0.6% (rms)	MX269013A Residual Vector Error (8PSK/AQPSK): ≤1.0% (rms)	MX269013A-001 Residual Vector Error: ≤0.6% (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)
MX269013A Residual Vector Error (8PSK/AQPSK): ≤0.6% (rms)	MX269013A Residual Vector Error (8PSK/AQPSK): ≤1.0% (rms)								
MX269013A-001 Residual Vector Error: ≤0.6% (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	<table border="0"> <tr> <td>MX269013A Constellation, EVM vs. Symbol (8PSK/AQPSK), Magnitude error vs. Symbol (8PSK/AQPSK), Phase error vs. Symbol</td> <td>MX269013A-001 Constellation, EVM vs. Symbol, Magnitude Error vs. Symbol, Phase Error vs. Symbol</td> </tr> </table>		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					
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 frame)	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	Modulation Part 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							
		<table border="0"> <tr> <td>Measurement Points: ±100, ±200, ±250, ±400, ±600, ±800, ±1000, ±1200, ±1400, ±1600, ±1800, ±3000, ±6000 kHz</td> <td></td> </tr> <tr> <td>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)</td> <td>—</td> </tr> <tr> <td>Measurement Points: ±400, ±600, ±1200, ±1800 kHz</td> <td></td> </tr> <tr> <td>Measurement Range: <-71 dB (400 kHz detuning), <-72 dB (600 kHz detuning), <-75 dB (1200 kHz detuning), <-75 dB (1800 kHz detuning)</td> <td>—</td> </tr> </table>		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)	—	Measurement Points: ±400, ±600, ±1200, ±1800 kHz	
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)	—								
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)	—								

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 be displayed simultaneously as graphs (symbol units) to monitor symbol-dependent changes in modulation accuracy.



• 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)

• 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.



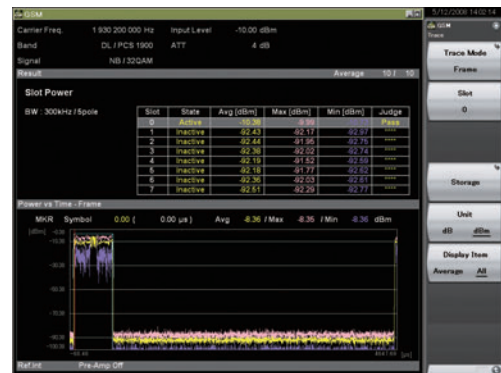
Modulation Part



Slot (Average)



Switching Transients Part



Frame (Average/Max/Min.)

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 MS269xA 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 $\pi/4$ DQPSK and ASK modulation signals to improve production throughput.

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

■ Modulation Analysis ($\pi/4$ DQPSK)

- 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

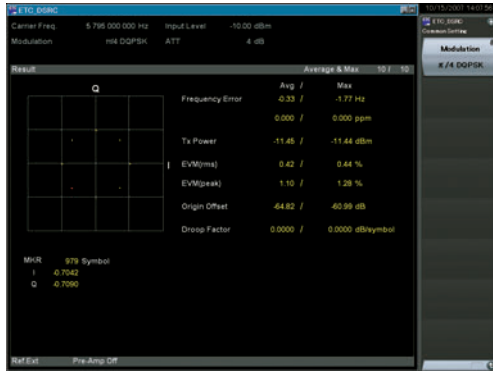
The specification is the value after 30-minute warm-up at a constant ambient temperature.

Signal Analyzer		MS269xA
Common Specifications	Modulation Method	$\pi/4$ DQPSK, 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 \pm (Accuracy of reference frequency \times Carrier frequency + 20) Hz
	Residual Vector Error	At 18°C to 28°C, after calibration, when modulation is $\pi/4$ DQPSK < 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 frame.)	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 ($\pi/4$ DQPSK), Eye Diagram (ASK)
	Spectrum	Adjacent Channel Leakage Power, Occupied Bandwidth

Measurement Functions

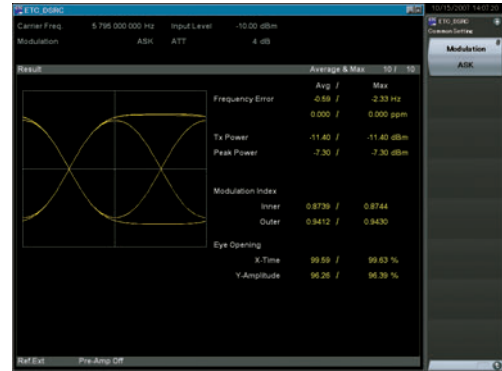
• **Modulation Analysis ($\pi/4$ DQPSK)**

This analysis displays the $\pi/4$ DQPSK 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.



The TD-SCDMA Measurement Software MX269015A supports measurement of the TRx characteristics of TD-SCDMA 3G digital mobile devices. Installing it in the MS269xA/MS2850A/MS2830A supports fast, high-accuracy measurements ideal for R&D and early rollout of base stations, repeaters, mobile terminals, and components.

Supports Various Functions for R&D and Manufacturing of TD-SCDMA Wireless Equipment and Devices

Modulation analysis and spectrum measurement results can be displayed as both numeric values and graphs.

The efficiency of base station and repeater tests is increased by using the Multi Carrier and Multi Slot Power measurement functions as well as the Multi Carrier Adjacent Channel Leakage Power measurement function.

■ Modulation Analysis

- Frequency Error
- Tx Power
- Vector Error (EVM) [Peak/rms]
- Origin Offset
- Peak Code Domain Error
- Constellation
- Code Domain Graph
- Multi-Carrier Power
- Multi-Slot Power

■ Spectrum

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

■ Power vs. Time

- Time Mask
- Off Power
- On Power
- TSi Power
- Power vs. Time Graph

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
Channel Bandwidth		1.6 MHz	
Measurement Frequency Range		1850 MHz to 2620 MHz	
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, with EVM = 1% signal ± (Accuracy of reference frequency × Carrier frequency + 20) Hz	
	Modulation Accuracy	At 18°C to 28°C, After calibration, With input signal in measurement level range and less than input level Residual Vector Error: ≤1.0% (rms)	
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 frame)	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)
	Code Domain Power	At 18°C to 28°C, After calibration, With input signal in measurement level range and less than input level Relative Accuracy: ±0.18 dB (Code Power ≥-10 dBc) ±0.32 dB (Code Power ≥-30 dBc)	
Code Domain Measurement	Code Domain Error	At 18°C to 28°C, After calibration, With input signal in measurement level range and less than input level Residual Error: ≤-40 dB Accuracy: ±1.0 dB (Code Domain Error ≥-40 dBc)	
	Waveform Displays	Code Domain Power, Code Domain Error, IQ Constellation	
Spectrum Measurement	Measurement Functions	Adjacent Channel Leakage Power, Occupied Bandwidth, Spectrum Emission Mask, Power vs. Time	

Measurement Functions

• Frequency Error/Tx Power/Modulation Accuracy

The Frequency Error, Tx Power, and Modulation Accuracy for the specified carrier are displayed simultaneously as constellation and code domain power graphs. Instantaneous characteristics can be measured due to the excellent residual EVM characteristics of the MS269xA.



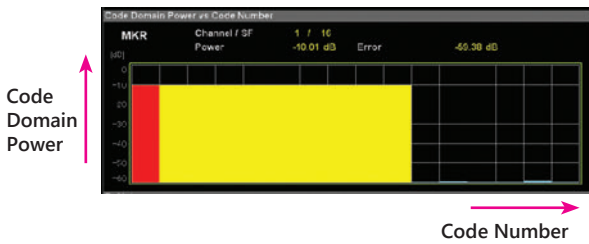
Constellation and Code Domain Power

• Multi Carrier/Multi Slot Power Measurements

The Multi Carrier measurement function simultaneously displays the Tx Power for all carriers and slots of the multi carrier signal, while the Multi Slot Power measurement function simultaneously displays the mean and partial Tx Powers for all slots.



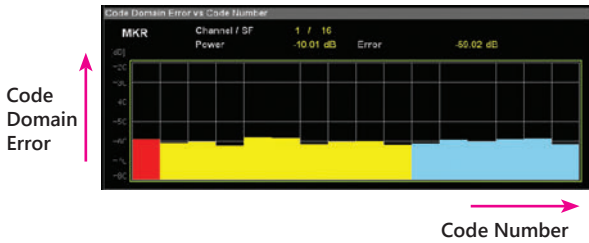
Multi Carrier Power



Code Domain Power vs. Code Number



Multi Slot Power



Code Domain Error vs. Code Number

• Power vs. Time Measurements

Provides measurements for Transmitter OFF Power and Time Mask. This function can be used only in MS269xA series.



Power vs. Time

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

MS269xA MS2850A MS2840A MS2830A

APSK Analysis MX269017A-001

Higher-Order QAM Analysis MX269017A-011 (Continued)

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, $\pi/4$ DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 2ASK, 4ASK, MSK	0.1 ksp/s to 12.5 Msps	0.1 ksp/s to 12.5 Msps	0.1 ksp/s to 12.5 Msps (MS2840A-006/009 installed)	0.1 ksp/s to 12.5 Msps (MS2830A-005/009, 006 installed) 0.1 ksp/s to 5 Msps (MS2830A-006 installed)
	2FSK, 4FSK	0.1 ksp/s to 6.25 Msps	0.1 ksp/s to 6.25 Msps	0.1 ksp/s to 6.25 Msps (MS2840A-006/009 installed)	0.1 ksp/s to 6.25 Msps (MS2830A-005/009, 006 installed) 0.1 ksp/s to 2.5 Msps (MS2830A-006 installed)
Modulation Method	Standard	BPSK, DBPSK, $\pi/2$ DBPSK, QPSK, O-QPSK, DQPSK, $\pi/4$ 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, $\pi/4$ DQPSK, 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, $\pi/4$ DQPSK, 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, $\pi/4$ DQPSK, 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, $\pi/4$ DQPSK, 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, $\pi/4$ DQPSK, 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

MS269xA MS2850A MS2840A MS2830A

APSK Analysis MX269017A-001

Higher-Order QAM Analysis MX269017A-011 (Continued)

■ 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

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)			
Carrier Frequency Measurement Accuracy	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			
	BPSK, QPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 2FSK, 4FSK, MSK	± (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.)	± (Accuracy of reference frequency × Carrier frequency + 10) Hz (Center Frequency: 30 MHz to 3.5 GHz, symbol rate: 4 ksps to 5 Msps) ± (Accuracy of reference frequency × Carrier frequency + 10) Hz (Center Frequency: 800 MHz to 3.5 GHz, symbol rate: 5 Msps to 50 Msps)	± (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.)
	Π/4DQPSK, 2ASK, 4ASK	± (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.)	± (Accuracy of reference frequency × Carrier frequency + 10) Hz (Center frequency: 30 MHz to 3.5 GHz, symbol rate: 4 ksps to 5 Msps) ± (Accuracy of reference frequency × Carrier frequency + 10) Hz (Center Frequency: 800 MHz to 3.5 GHz, symbol rate: 5 Msps to 50 Msps)	± (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.)
Carrier Frequency Measurement Accuracy	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			
	512QAM, 1024QAM, 2048QAM	—	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) 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)	with MX269017A-011 ± (Accuracy of reference frequency × Carrier frequency + 10) Hz (Center Frequency: 30 MHz to 3.5 GHz)

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

Vector Modulation Analysis Software MX269017A

MS269xA

MS2850A

MS2840A

MS2830A

APSK Analysis MX269017A-001

Higher-Order QAM Analysis MX269017A-011 (Continued)

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: 800 MHz to 3.5 GHz, symbol rate 5 Msps to 50 Msps, Equalizer = On)	With MX269017A-001 ± (Accuracy of reference frequency × Carrier frequency + 10) Hz (Center Frequency: 30 MHz to 3.5 GHz)	—	
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		
		<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	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

MS269xA MS2850A MS2840A MS2830A

APSK Analysis MX269017A-001

Higher-Order QAM Analysis MX269017A-011 (Continued)

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 kspss 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 kspss to 5 Msps Carrier frequency: 50 MHz to 3.5 GHz	—
Residual Vector Error	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 kspss 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 kspss 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 kspss, 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 frame.)		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

MS269xA

MS2850A

MS2840A

MS2830A

APSK Analysis MX269017A-001

Higher-Order QAM Analysis MX269017A-011 (Continued)

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 $\pi/4$ DQPSK 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.

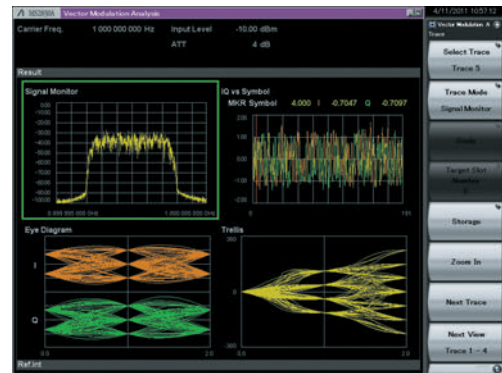
—: Does not display measured results.

*1: Used at APCO-P25 Phase2 Inbound measurement

*2: Available when Modulation Type is set to 2FSK, 4FSK, H-CPM.

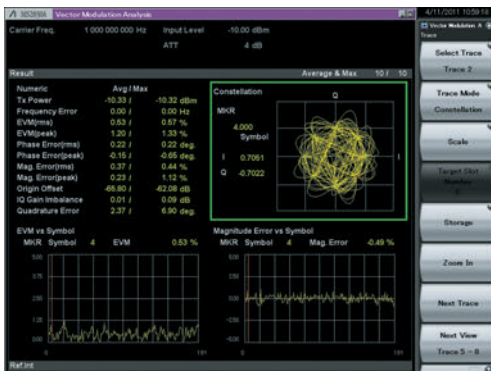


4-pane Screen (Traces 1-4)

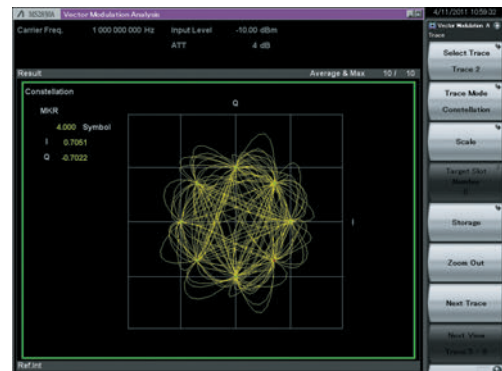


4-pane Screen (Traces 5-8)

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

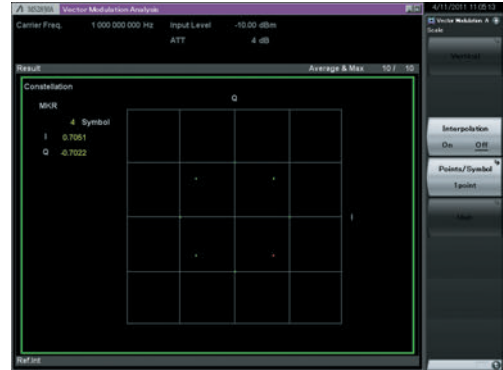
The results of Frequency Error and EVM, etc., can be listed numerically. Selecting Avg/Max displays the average and worst value simultaneously, helping clarify signal dispersion at a glance.



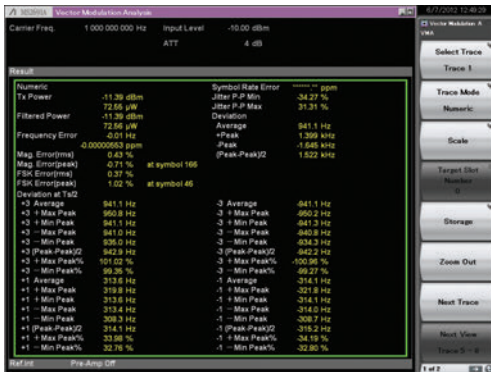
Modulation method: $\pi/4$ DQPSK example

• Constellation

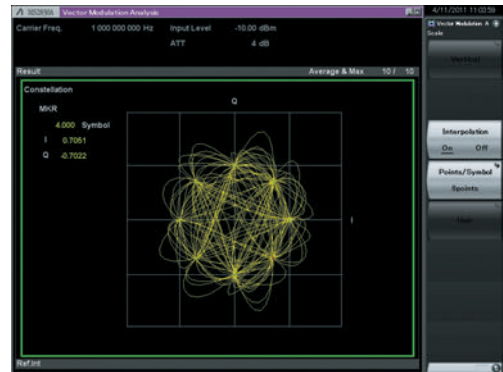
This displays the constellation for each modulation method. Interpolation On displays the state transition.



Interpolation: Off



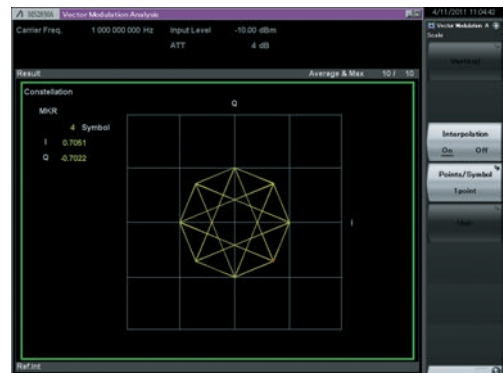
Modulation method: 4FSK example



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



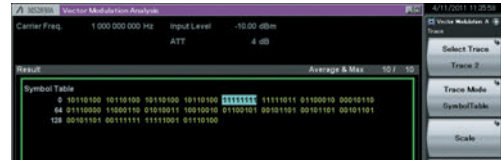
Phase Error vs. Symbol



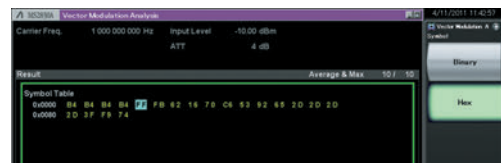
I and Q vs. Symbol

• 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

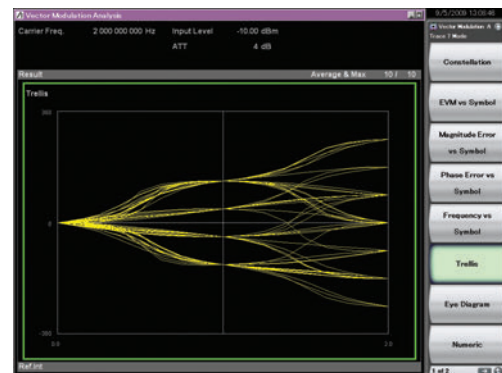
• Eye Diagram

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.

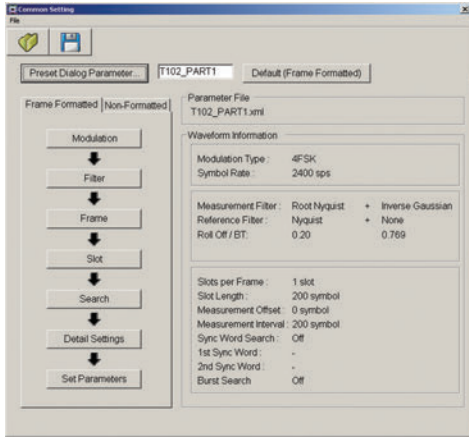


Vector Modulation Analysis Software MX269017A
 APSK Analysis MX269017A-001
 Higher-Order QAM Analysis MX269017A-011 (Continued)

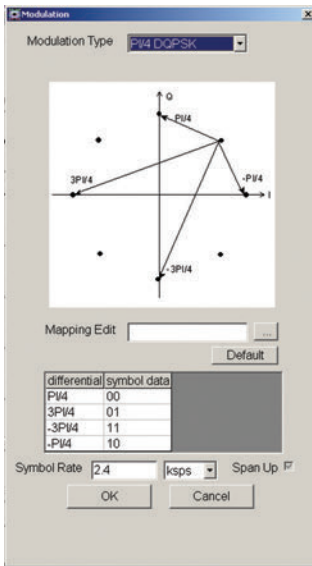
MS269xA MS2850A MS2840A MS2830A

Graphical Setting Display

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



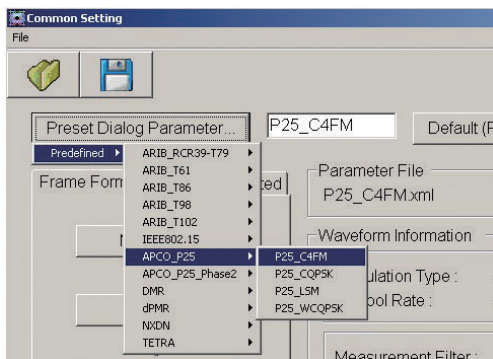
Common Setting



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.



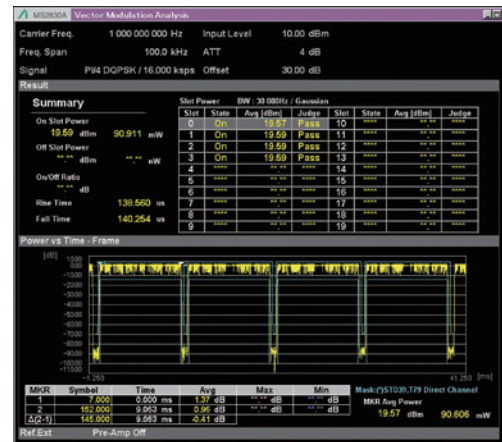
(2) Power vs. Time

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.

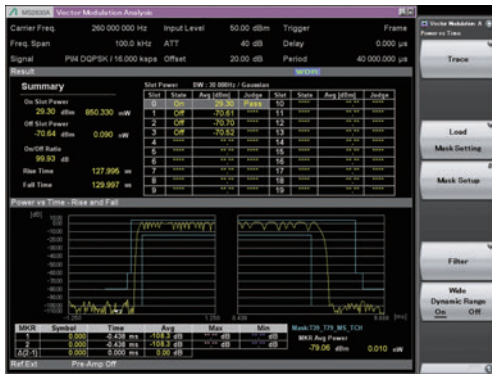
For example, when measuring a power of 47 dBm (50 W) during the On Slot and -50 dBm or less during the Off Slot, a spectrum analyzer (signal analyzer) requires a wide dynamic range of at least 100 dB, taking the measurement margin into account. This is a severe requirement, but since the purpose of this 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

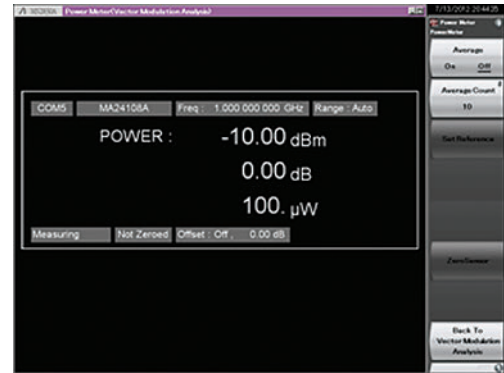
(WDR is displayed on the screen when this function is in use.)

*: 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 be 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.

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-emphasis 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 <i>RF Frequency</i>	✓	✓	✓	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 (A0086C) 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 <i>RF Power</i>	✓	✓	✓	
		Modulation Measurement <i>Deviation (FM), Radian (ΦM), Depth (AM)</i>	✓	✓	✓	
		Result of Analyzed DCS Code <i>DCS Code</i>	✓	—	—	
	AF Measurements (Demodulation)	Demodulation Frequency <i>AF Frequency</i>	✓	✓	✓	
		Effective Level Value at Demodulation Frequency <i>Level</i>	✓	✓	✓	
		Distortion Ratio of Demodulation Frequency Distortion <i>Distortion, SINAD, THD</i>	✓	✓	✓	
		Time vs. Level, Frequency vs. Level <i>Graph Result</i>	✓	✓	✓	
		Demodulates input RF signals from analog mobile radio and outputs sound from USB Audio connector*2	✓*3	✓	✓	
	AF Output (Audio Generator Function)	Demodulates input RF signals from analog mobile radio and outputs sound from internal speaker, headphone jack and demodulation output connector	✓*3	—	—	
AF Tone, DCS, White Noise (ITU-T Recommendation G.227), DTMF		✓	✓	✓	+6 Audio Analyzer (MS2830A-018)	
PTT (Push To Talk) Control		✓	✓	✓		
Rx Tests	RF Output	Modulation Signal Output (FM, ΦM, AM)	✓	✓	✓	1 + 2 + 3 + 4
		Internal Modulation Signal Source (AF Tone)	✓	✓	✓	+7 Analog Signal Generator
		Internal Modulation Signal Source (DCS)	✓	—	—	(Refer to Table 3.)
	AF Measurements (Audio Analyzer Function)	Frequency <i>AF Frequency</i>	✓	✓	✓	1 + 2 + 3 + 4 +6 Audio Analyzer (MS2830A-018) +7 Analog Signal Generator (Refer to Table 3.)
		Effective Level Value <i>Level</i>	✓	✓	✓	
		Distortion Ratio <i>SINAD, THD, THD+N</i>	✓	✓	✓	
	Graph (Time vs. Level, Frequency vs. Level) <i>Graph Result</i>	✓	✓	✓		
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 or A0086C USB Audio option.

*3: The Wide Band FM measurement mode is not supported.

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	A0086C		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

■ 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 <i>RF Frequency</i>	✓	✓	✓	1, 2, and 3 are mandatory 1. Signal Analyzer (MS2840A-040/041/044/046) 2. Analog Measurement Software (MX269018A) 3. USB Audio (A0086C) 4. Commercial loudspeaker
		Transmit Power <i>RF Power</i>	✓	✓	✓	
		Modulation Measurement <i>Deviation (FM), Radian (ΦM), Depth (AM)</i>	✓	✓	✓	
		Result of Analyzed DCS Code <i>DCS Code</i>	✓	—	—	
	AF Measurements (Demodulation)	Demodulation Frequency <i>AF Frequency</i>	✓	✓	✓	
		Effective Level Value at Demodulation Frequency <i>Level</i>	✓	✓	✓	
		Distortion Ratio of Demodulation Frequency Distortion <i>Distortion, SINAD, THD</i>	✓	✓	✓	
		Time vs. Level, Frequency vs. Level <i>Graph Result</i>	✓	✓	✓	
		Demodulates input RF signals from analog mobile radio and outputs sound from USB Audio connector*2	✓*3	✓	✓	
	AF Output (Audio Generator Function)	Demodulates input RF signals from analog mobile radio and outputs sound from internal speaker*3, headphone jack*3 and demodulation output connector*3	—	—	—	
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 <i>AF Frequency</i>	—	—	—	Not supported by MS2840A
		Effective Level Value <i>Level</i>	—	—	—	
		Distortion Ratio <i>SINAD, THD, THD+N</i>	—	—	—	
		Graph (Time vs. Level, Frequency vs. Level) <i>Graph Result</i>	—	—	—	

*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 or A0086C USB Audio option.

*3: The Wide Band FM measurement mode is not supported.

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	A0086C		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	A0086C		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

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, Φ M, 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 \pm (Accuracy of reference frequency \times Carrier frequency + 1) Hz	
FM Measurement	Frequency Deviation	FM: 0 < Frequency Deviation \leq 20 kHz, 20 kHz < Frequency Deviation \leq 40 kHz (nom.) Wide Band FM: 0 < Frequency Deviation \leq 20 kHz, 20 kHz < Frequency Deviation \leq 1 MHz (nom.)	
	Demodulation Frequency Range	20 Hz to 20 kHz	
	Frequency Deviation Accuracy	1% of indicated value \pm 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		
Φ M Measurement	Φ M Deviation	0 to (20 kHz/Demodulation Frequency [Hz]) rad	
	Demodulation Frequency Range	20 Hz to 20 kHz	
	Φ M Deviation Accuracy	1% of indicated value \pm Residual Φ M	
	Residual Φ M	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 \pm 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 μ s	
Amplitude Measurement	Transmit Power Accuracy	At 18°C to 28°C, after calibration, Input attenuator: \geq 10 dB, Input signal in measurement level range and less than Input level, Preamp Off, or Preamp not installed \pm 0.5 dB Transmit Power Accuracy based on MS2840A and MS2830A main frame 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/ Φ M/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)

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	

Audio Analyzer Option		MS2830A-018/118		
Audio Analyzer Function		The specifications for single tone measurement are listed below		
Audio Analyzer	Measurement Function	Amplitude, Frequency, THD, THD+N, SINAD		
	Connection Type	Balanced: 1/4-inch phone jack (3-pole, Φ 6.3 mm) Unbalanced: BNC-J		
	Impedance	Balanced: 200 k Ω (AC coupled, nom.) Unbalanced: 100 k Ω (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 \leq f \leq 25 kHz) ± 3.0 dB (25 kHz < f \leq 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)		
Audio Generator	Connection Type	Balanced: 1/4-inch phone jack (3-pole, Φ 6.3 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 \times 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 (≥ 100 k Ω termination)	Balanced	Off, 1 mV rms to 12.4 V rms
			Unbalanced	Off, 1 mV rms to 6.2 V rms
		600 Ω termination*	Balanced	Off, -63 dBm (equivalent to 0.5 mV rms) to +18 dBm (equivalent to 6.2 V rms)
			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 (≥ 100 k Ω termination)	Balanced	Off, 1.545 mV rms to 3.083 V rms (nom.)
			Unbalanced	Off, 1.545 mV rms to 1.545 V rms (nom.)
600 Ω termination*		Balanced	Off, -60 dBm (equivalent to 0.774 mV rms) to +6 dBm (equivalent to 1.545 V rms) (nom.)	
	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 \leq 6.2 V rms) 100 μ V (35 mV rms < Output Level \leq 350 mV rms) 10 μ V (Output Level \leq 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 k Ω termination, 18°C to 28°C) White noise (through ITU-T G.227 filter): ± 3 dB (nom.)			
Maximum Output Current	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 k Ω 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 (Φ 4.0 mm, 30 V, 500 mA max.)			
General Input/Output (Audio Function)	Connector: D-Sub 15 pin (jack) Function: Open Collector \times 1 (5 V, 100 mA max.), TTL Output \times 2, TTL Input \times 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] \rightarrow [F5] System Information \rightarrow [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.

Tx Tests

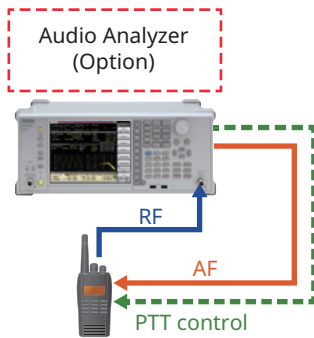
• **Inputting AF Signal to analog mobile radio and Measuring Characteristics of RF Signal Output from Radio**

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.

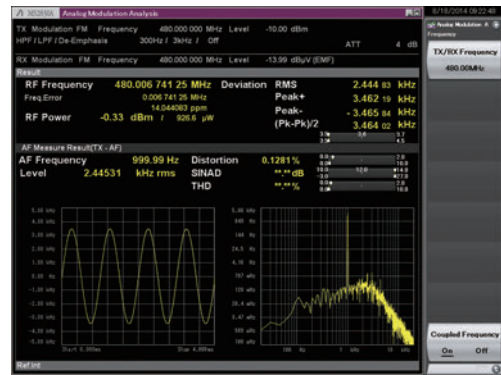
As well as outputting the AF signal simultaneously as up to three tones, tone + DCS, white noise (ITU-T G.227) and DTMF signals can be output too. At the analog mobile radio RF Tx characteristics test, the FM/ΦM/AM frequency, power, modulation degree, demodulated AF signal frequency, level, distortion, 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 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

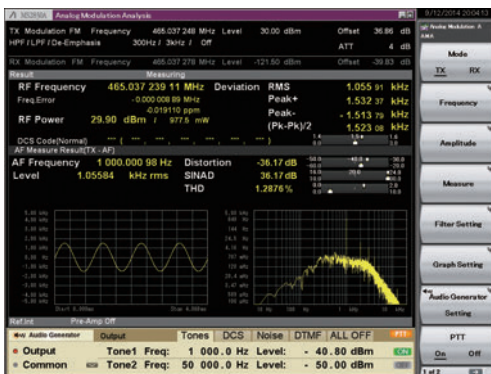
*1: Two when Audio Analyzer option not installed

*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.

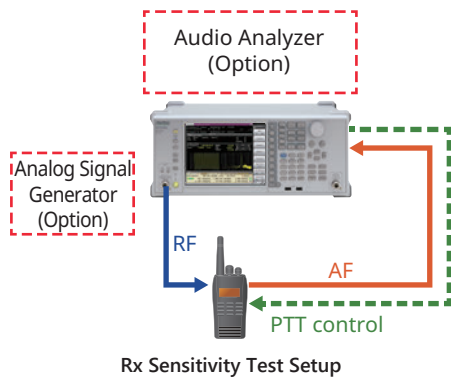
The following limitations apply:

- 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.



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



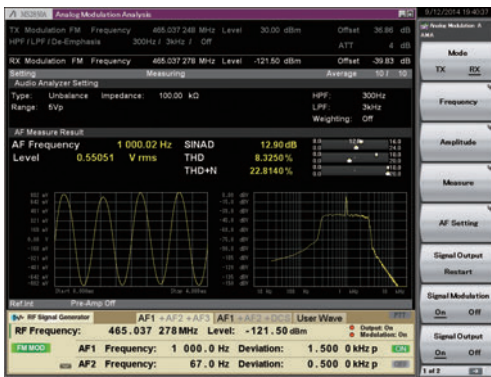
Using Meter Displays

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.

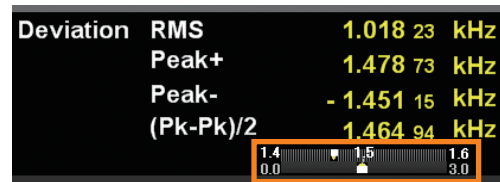
Using these meters offers a more intuitive adjustment method than directly reading numeric values that fluctuate when adjusting SINAD at Rx sensitivity tests and frequency deviation at Tx tests (FM only).



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



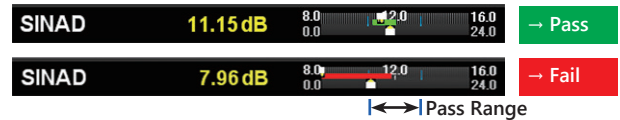
SINAD Meter



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.



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

Pulse Radar Measurement Function MX284059A

MS2840A

Pulse Radar Measurement Function MX284059A, when combined with the signal analyzer MS2840A, automatically measures Tx characteristics of equipment that use pulse modulation and chirp signals, such as weather radar and marine radar. In addition, it automatically saves numerical results and measurement screen.

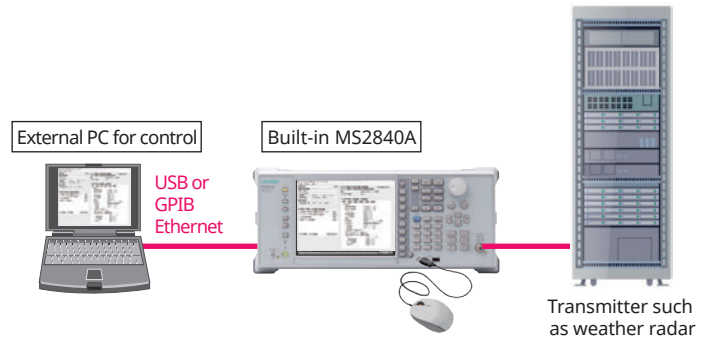
Features

- Specializing in Tx test of pulse radar equipment such as calculating 40 dB bandwidth and Out of band mask. (Selectable from 20 dB, 30 dB, 40 dB/decade)
- Supporting short pulse/long pulse/multi-pulse conditions used in modern solid state radar techniques
- Installing inside MS2840A or controlling from an external PC

Main Measurement items

- Tx power
- Tx frequency
- Pulse time (pulse width, Rise time, Fall time, pulse repetition frequency)
- Frequency deviation (For FM chirp)
- 40 dB bandwidth
- Spurious (Out of band mask, Spurious)
- Occupied bandwidth
 - Out of band mask & 40 dB bandwidth & Limmit
 - Spurious & Limmit
 - Occupied bandwidth

Connection Example



Specification

Signal Analyzer		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
Spurious	Frequency Range	MS2840A-044: 30 MHz to 26,500 MHz MS2840A-046: 30 MHz to 44,500 MHz
Measurement Frequency Accuracy (standard)		$\pm 2.2 \times 10^{-8}$ (18°C to 28°C, 1 hour after power on)
Supported Signal Conditions	Pulse Types	2 types (Pulse A, Pulse B)
	Modulation Type	Non-FM Pulse Radar/FM Pulse Radar
	Pulse Width	0.5 μ s to 500 μ s
	Pulse Repetition Interval	0.05 ms to 5 ms (PRF = 200 Hz to 20,000 kHz)
Frequency Deviation		0 to 31 MHz

Screen Image of Pulse Radar Measurement Function MX284059A (Settings, Numeric Results)

The screenshot shows the software interface with several callouts:

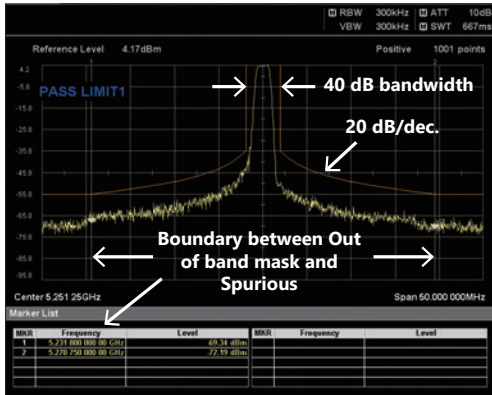
- Measurement target settings:** Points to the 'DUT Settings' section where TX Frequency (5250 MHz), Modulation type, and Antenna power (100000 W) are configured.
- Correction settings:** Points to the 'Correction Settings' section, including Level Offset (0 dB) and Correction options.
- Measurement item selection for each pulse:** Points to the 'PulseA PulseB PulseA+B' section where various measurement items like 'Power, pulse time, 40dB bandwidth', 'Out of Band Mask', 'Spurious', and 'Occupied Band Width' are selected.
- View results:** Points to the right-hand pane displaying numeric results such as TX Frequency (5.250963512 GHz), TX Power (Average: -286.488 dBm), and 40dB bandwidth (29.841 MHz).

Measurement screen Image of MS2840A

MX284059A controls the signal analyzer MS2840A to perform automatic measurement. When saving the measurement results as a screen image, it is possible to save the image including mask limits and numerical results.

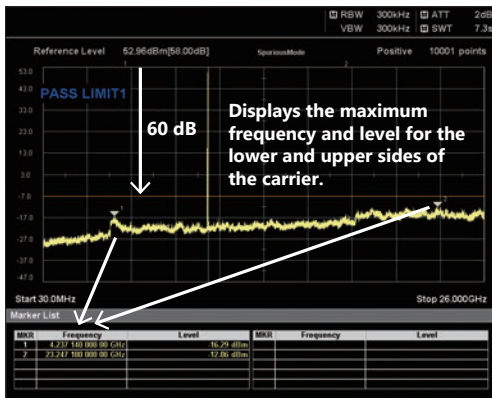
40 dB Bandwidth, Out of Band Mask

40 dB bandwidth and 20 dB/dec. mask is calculated and drawn automatically. Furthermore, the spurious area and out-of-band area are automatically judged and Pass/Fail judgment is performed.



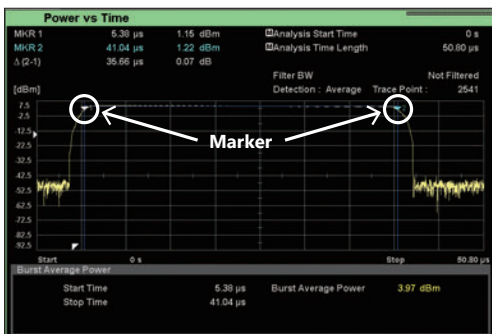
Spurious

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



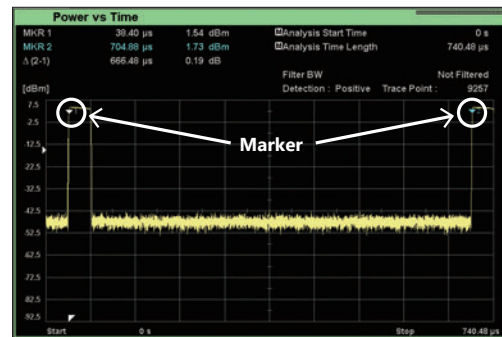
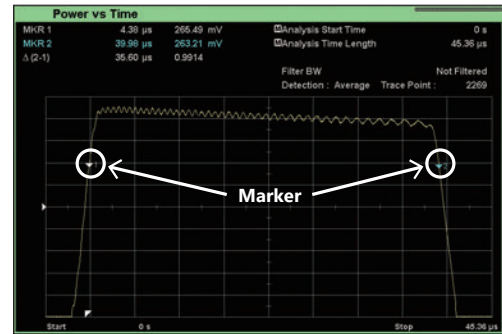
Average Power

Automatically identifies the pulse duration and measures the average power.



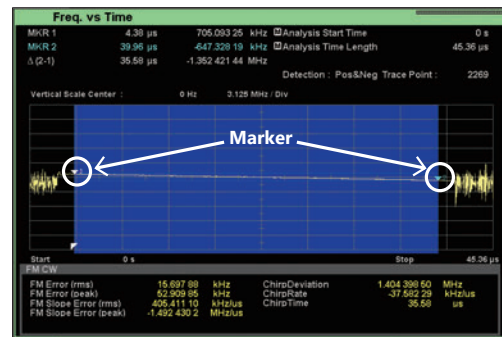
Pulse Time (Pulse Width, Pulse Repetition Interval)

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.



Operating Environment

Using MX284059A installed in MS2840A
Firmware Version: 14.00.00 or newer

Using MX284059A installed in external PC
OS: Windows 10 English/Japanese 32 bit/64 bit
Software: NI-VISA™ 17.5

The installer is stored on the DVD-ROM attached to MS2840A. It is also available on the National Instruments™ Web site.

Precaution

MX284059A is dedicated for MS2840A-044/046. MS2840A-046 requires a option below.

MX2840A-019: 2 dB Step Attenuator for Millimeter-wave
(For MS2840A-046)

Floor noise (DANL) and 2nd harmonic distortion is increase when the following options are installed. The following options are simultaneously unavailable to install with MX284059A.

MS2840A-067: Microwave Preselector Bypass

MS2840A-068: Microwave Preamplifier (For MS2840A-046)

MS2840A-069: 26.5 GHz Microwave Preamplifier (For MS2840A-044)

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

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 frame	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

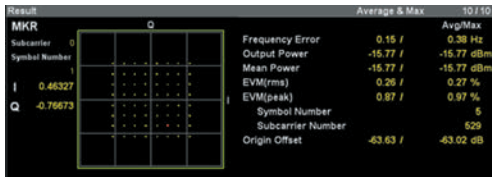
Test model signals defined in 3GPP TS 36.141 as test patterns for BTS Tx tests are easily measured by selecting the test model name.



Easy measurement by selecting test model name

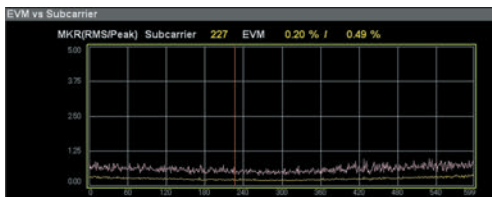
• Frequency Error/Transmit Power/EVM

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.



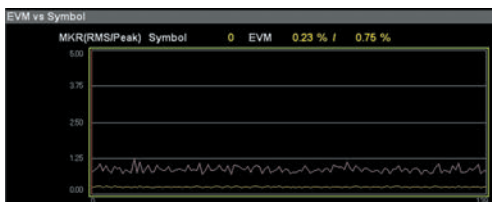
• EVM vs. Subcarrier

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.



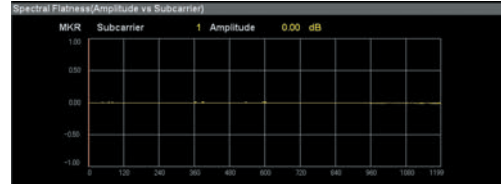
• EVM vs. Symbol

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.

The screenshot shows a 'Summary' screen with the following data:

Summary		Page No. 2 / 10
PDSCH ALL EVM		
PDSCH ALL EVM (rms)	0.23 %	
PDSCH ALL EVM (peak)	1.01 %	
Symbol Number	83	
Subcarrier Number	878	
PDSCH ALL EVM High		
PDSCH ALL EVM (rms)	0.23 %	
PDSCH ALL EVM (peak)	1.01 %	
Symbol Number	83	
Subcarrier Number	878	
PDSCH ALL EVM Low		
PDSCH ALL EVM (rms)	0.23 %	
PDSCH ALL EVM (peak)	1.01 %	
Symbol Number	83	
Subcarrier Number	878	

PDSCH EVM Display

The screenshot shows a 'Summary' screen with the following data:

Summary		Page No. 10 / 10	
RS Power	-11.28 dBm		
Power vs Slot			
Slot No.0	-10.68 dBm	Slot No.10	-10.69 dBm
Slot No.1	-10.61 dBm	Slot No.11	-10.59 dBm
Slot No.2	-10.67 dBm	Slot No.12	-10.69 dBm
Slot No.3	-10.60 dBm	Slot No.13	-10.60 dBm
Slot No.4	-10.69 dBm	Slot No.14	-10.68 dBm
Slot No.5	-10.60 dBm	Slot No.15	-10.59 dBm
Slot No.6	-10.68 dBm	Slot No.16	-10.68 dBm
Slot No.7	-10.59 dBm	Slot No.17	-10.59 dBm
Slot No.8	-10.69 dBm	Slot No.18	-10.68 dBm
Slot No.9	-10.60 dBm	Slot No.19	-10.58 dBm

Power vs. Slot

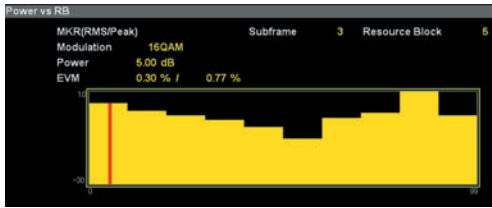
LTE Downlink Measurement Software MX269020A LTE-Advanced FDD Downlink Measurement Software MX269020A-001 LTE TDD Downlink Measurement Software MX269022A LTE-Advanced TDD Downlink Measurement Software MX269022A-001 (Continued)

MS269xA MS2850A MS2830A

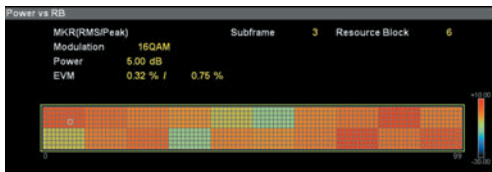
• Power vs. Resource Block

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



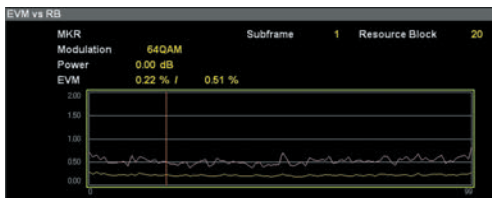
Power Display for Each Resource Block



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.



MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

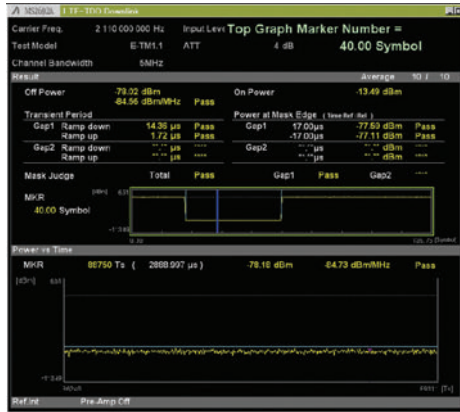
LTE Downlink Measurement Software MX269020A
LTE-Advanced FDD Downlink Measurement Software MX269020A-001
LTE TDD Downlink Measurement Software MX269022A
LTE-Advanced TDD Downlink Measurement Software MX269022A-001 (Continued)

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.

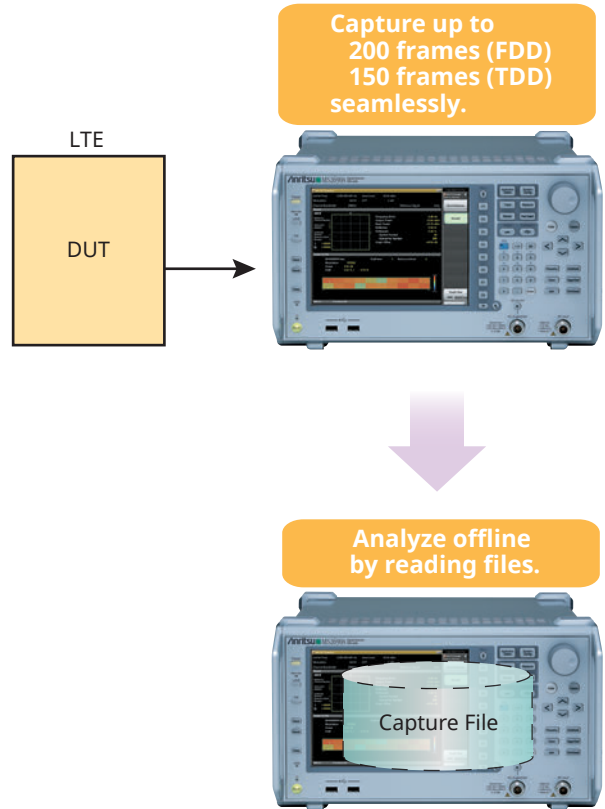
- Off Power
- On Power
- Transient Period
- Power at Mask Edge
- Mask Judge



• 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.*

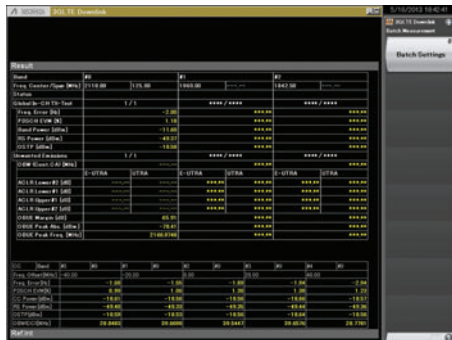
*: Batch measurement is not supported when the MX269020A-001 is installed.



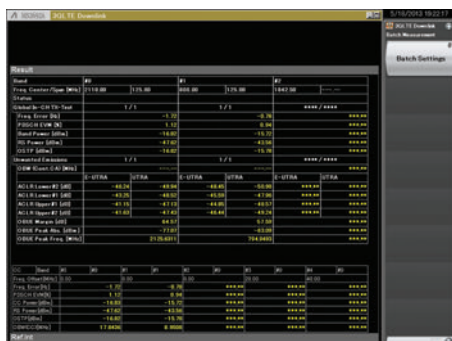
• Batch Measurement Function

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)

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 frame.)	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	

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

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	
	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) ± (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.), MS2850A: ± (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 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)	
	Tx Power Measurement Accuracy (Found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main frame)	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: -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) 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.
 $10 \log_{10}(\text{Channel bandwidth}/5.0 \text{ MHz}) \text{ dB}$

*2: Wide Dynamic Range = On, Noise Correction = 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

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

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)

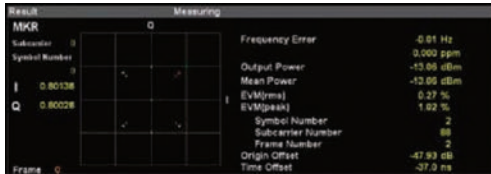
MS269xA MS2850A MS2830A

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)



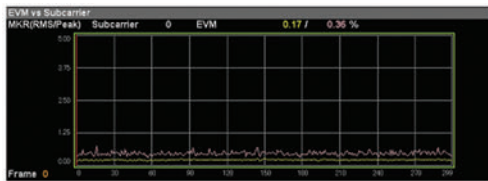
• EVM vs. Subcarrier

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.

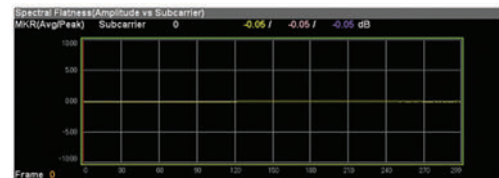


• Spectral Flatness

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.

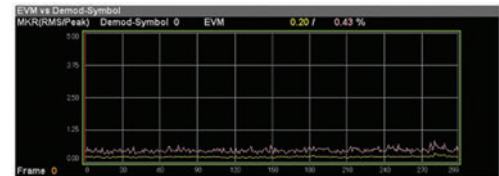
It is useful for checking characteristics in the time direction and faults at a specific symbol.



• 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.



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

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

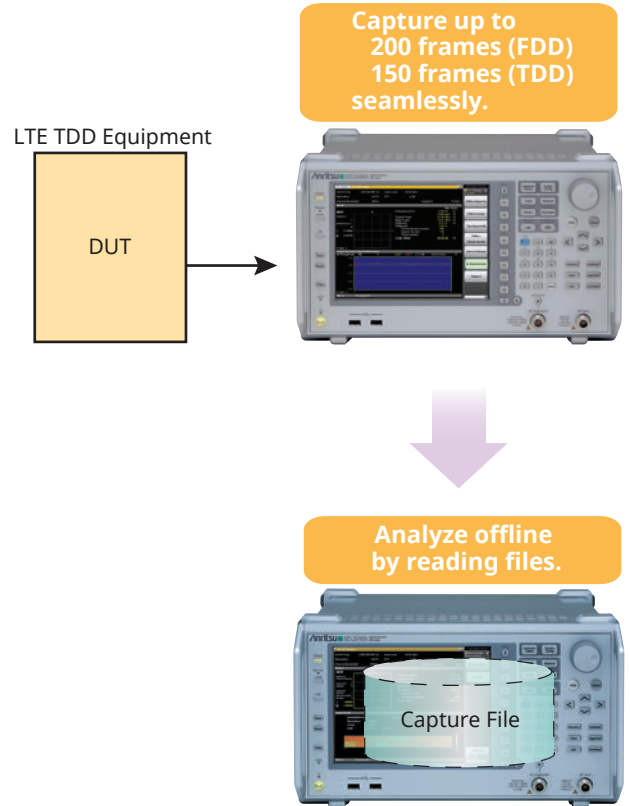
It is useful for checking in-band emission at a specific subcarrier and resource block.



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.



Summary Display Function

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

Summary		Page No. 1 / 10	
Total EVM (time based)	EVM Final	rms	0.21 %
	EVM High	prms	0.75 %
	EVM Low	prms	0.21 %
	EVM Low	prms	0.21 %
	EVM Low	prms	0.75 %
PUSCH QPSK EVM (time based)	EVM Final	rms	0.21 %
	EVM High	prms	0.75 %
	EVM Low	prms	0.21 %
	EVM Low	prms	0.21 %
	EVM Low	prms	0.75 %

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

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
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

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 $\pm (\text{Accuracy of reference frequency} \times \text{Carrier frequency} + 8) \text{ Hz}$	$\pm (\text{Accuracy of reference frequency} \times \text{Carrier frequency} + 8) \text{ Hz}$ (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.		

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

LTE Uplink Measurement Software MX269021A

MS269xA

MS2850A

MS2830A

LTE-Advanced FDD Uplink Measurement Software MX269021A-001

LTE TDD Uplink Measurement Software MX269023A

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

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: <ul style="list-style-type: none"> • PUSCH • PUCCH • PRACH LTE-Advanced Selected: <ul style="list-style-type: none"> • 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	

CDMA2000 Forward Link Measurement Software MX269024A All Measure Function MX269024A-001 EV-DO Forward Link Measurement Software MX269026A All Measure Function MX269026A-001

MS269xA MS2830A

The CDMA2000 Forward Link Measurement Software MX269024A supports measurement of RF characteristics of 3GPP2 C.S0002/C.S0010 CDMA2000 Forward Link signals. The EV-DO Forward Link Measurement Software MX269026A supports measurement of RF characteristics of 3GPP2 C.S0024/C.S0032 EV-DO Forward Link signals.

Installing the All Measure Function MX269024A-001 in a unit in which the MX269024A has been installed supports single-capture batch-measurement of multiple CDMA2000 Tx characteristics, such as modulation analysis accuracy, power spectrum, etc.

Similarly, installing the All Measure Function MX269026A-001 in a unit in which the MX269026A has been installed supports single-capture batch-measurement of multiple EV-DO Tx characteristics such as modulation accuracy, power spectrum, etc.

Features

■ Support Testing of 3GPP2 CDMA2000/EV-DO Revision 0, Revision A Forward Link RF Characteristics

■ Easy Setting of Measurement Conditions

- Signal analyzer automatically synchronized to input signal
- CDMA2000 Rev. 0 (Subtype0/1) and Rev. A (Subtype2) switching: CDMA2000
- Data Tx and Idle state switching: EV-DO

■ Versatile Analysis Results Formats and Graphs

- Text displays for Frequency Error, Output Power, Waveform Quality, p, Timing Error, etc.
- Code Domain Power Graph
- Conducted Spurious Emissions
- Occupied Bandwidth
- Power vs. Time (only EV-DO)

■ All Measurement Function

Batch-measures and list displays multiple items, such as modulation accuracy and power spectrum (requires installation of All Measure Function option)

MX269024A CDMA2000 Forward Link

• Code Domain Graph

The code domain analysis result (graph and numerical value) is displayed at the top of the screen. This is the result for the slot set as Target Slot Number.

The numeric modulation analysis result is displayed at the bottom of the screen as an average for the number of slots set as Measurement Interval.

In addition, the measurement result is averaged when Average is On.



Code Domain Screen: CDMA2000 Forward Link

• All Measure Screen

Installing the MX269024A-001 All Measure Function supports high-speed batch-measurement of CDMA2000 Forward Link multiple Tx characteristics, such as modulation accuracy, power spectrum, etc.



All Measure Screen: CDMA2000 Forward Link

CDMA2000 Forward Link Measurement Software MX269024A
All Measure Function MX269024A-001
EV-DO Forward Link Measurement Software MX269026A
All Measure Function MX269026A-001 (Continued)

MS269xA MS2830A

MX269026A EV-DO Forward Link

• **Code Domain Graph**

The code domain analysis result (graph and numerical value) is displayed at the top of the screen. "MAC" or "Data" is switched at the code domain screen. The numeric modulation analysis result is displayed at the bottom of the screen.



Code Domain Power Screen: EV-DO Forward Link

• **All Measure Screen**

Installing the MX269026A-001 All Measure Function supports high-speed batch-measurement of EV-DO Forward Link multiple Tx characteristics, such as modulation accuracy, power spectrum, etc.



All Measure Screen: EV-DO Forward Link

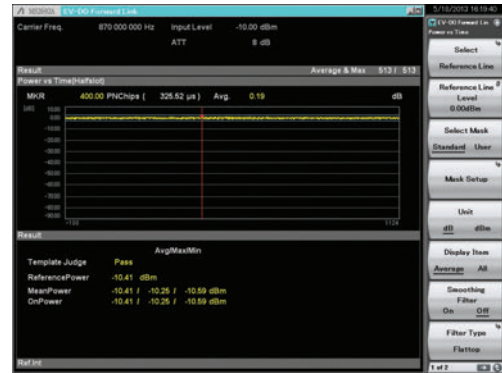
• **Power vs. Time Graph**

The Time Domain Graph (Avg./Max./Min. level) is displayed at the top of the screen. The three screens are switched as follows:

■ **Halfslot**

Displays half slot time.

- 1st Half slot: Displays first half
- 2nd Half slot: Displays second half
- Full slot: Displays mean of first and second half



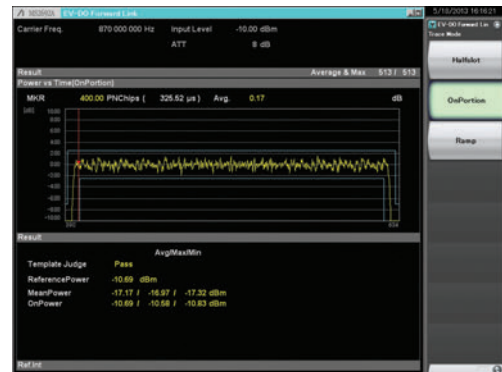
Power vs. Time Screen (Data Tx state): EV-DO Forward Link



Power vs. Time Screen (Idle state): EV-DO Forward Link

■ **OnPortion**

Displays Pilot/MAC.



Power vs. Time Screen - OnPortion- (Idle state): EV-DO Forward Link

CDMA2000 Forward Link Measurement Software MX269024A
All Measure Function MX269024A-001
EV-DO Forward Link Measurement Software MX269026A
All Measure Function MX269026A-001 (Continued)

MS269xA MS2830A

■ Ramp

Displays Ramp Part of Pilot/MAC.



Power vs. Time Screen - Ramp - (Idle state):
EV-DO Forward Link

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
Modulation/ Frequency Measurement	Frequency Range	400 MHz to 2700 MHz	
	Measurement Level Range	-15 to +30 dBm (Preamp Off, or Preamp not installed) -15 to +10 dBm (Preamp On)	-15 to +30 dBm (Preamp Off, or Preamp not installed)
	Carrier Frequency Measurement Accuracy	At 18°C to 28°C, after calibration, EVM = 1% signal ± (Accuracy of reference frequency × Carrier frequency + 10) Hz	
	Residual Vector Error	At 18°C to 28°C, after calibration < 1.0% (rms)	< 1.5% (rms)
	Waveform Quality (p)	> 0.99990	
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 frame.)	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)
		At 18°C to 28°C, after calibration, input signal in measurement level range and less than Input level, MAC region is average ≥ 16 ± 0.02 dB (Code Power ≥ -10 dBc) ± 0.05 dB (Code Power ≥ -20 dBc) ± 0.10 dB (Code Power ≥ -30 dBc)	
Code Domain Measurement	Power Accuracy	At 18°C to 28°C, after calibration, input signal in measurement level range and less than Input level, MAC region is average ≥ 16 ± 0.02 dB (Code Power ≥ -10 dBc) ± 0.05 dB (Code Power ≥ -20 dBc) ± 0.10 dB (Code Power ≥ -30 dBc)	
Measurement Items	MX269024A	Modulation Analysis	
		<ul style="list-style-type: none"> • Frequency Error • RF Level • ρ • Vector Error (Peak/rms) • Origin Offset • TIM (Difference between "Set position of PN Offset of RF input" and "Trigger input") 	
		Code Domain Graph Target Slot, Total Active CH, Output Power, Pilot Power, Active CH Power, Inactive CH Power	
	MX269026A	Adjacent Channel Leakage Power, Occupied Bandwidth, Channel Power, Spectrum Emission Mask	
		Modulation Analysis	
		<ul style="list-style-type: none"> • Frequency Error • ρ (pilot/MAC/Data/Overall) • Vector Error (Peak/rms) • Origin Offset • Data Modulation Scheme • Timing Error • (Difference between "Set position of PN Offset of RF input" and "Trigger input") • MAC Inactive CH • Data Active CH 	
Code Domain Graph I Code/CH/Power/ρ, Q code/CH/Power/ρ, Total Pilot Power, Total MAC Power, Total Data Power, I Active CH, I Inactive CH, Q Active CH, Q Inactive CH			
Power vs. Time Graph Average, Maximum, Minimum			
Adjacent Channel Leakage Power, Occupied Bandwidth, Channel Power, Spectrum Emission Mask			

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 frame 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/CKK
- 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 Frame 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 frame	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.

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

WLAN (802.11) Measurement Software MX269028A

MS269xA MS2830A

802.11ac (80 MHz) Measurement Software MX269028A-001

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

■ 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

MS269xA MS2830A

802.11ac (80 MHz) Measurement Software MX269028A-001

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

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 $\geq 250 \mu s$ \pm (Accuracy of reference frequency \times Carrier frequency + 13) Hz (2.4 GHz band) \pm (Accuracy of reference frequency \times Carrier frequency + 16) Hz (5 GHz band)	
		40 MHz channel	Burst length $> 250 \mu s$ \pm (Accuracy of reference frequency \times Carrier frequency + 62) Hz (2.4 GHz band) \pm (Accuracy of reference frequency \times Carrier frequency + 102) Hz (5 GHz band)	
	Residual Vector Error	20 MHz channel	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal $\leq 1.2\%$ (rms) (2.4 GHz band) $\leq 1.6\%$ (rms) (5 GHz band)	$\leq 1.2\%$ (rms) (2.4 GHz band) (Preamp Off) $\leq 1.6\%$ (rms) (5 GHz band) (Preamp Off)
40 MHz channel		Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal $\leq 1.5\%$ (rms) (2.4 GHz band) $\leq 1.9\%$ (rms) (5 GHz band)	$\leq 1.6\%$ (rms) (2.4 GHz band) (Preamp Off) $\leq 2.0\%$ (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 frame.)	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)	
		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: ± 0.6 dB (Preamp Off, or Preamp not installed)	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)	5 GHz band: ± 1.9 dB (Preamp Off, or Preamp not installed)	
		2.4 GHz band: ± 0.8 dB (Preamp Off, or Preamp not installed)	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)	5 GHz band: ± 2.0 dB (Preamp Off, or Preamp not installed)	

WLAN (802.11) Measurement Software MX269028A

MS269xA MS2830A

802.11ac (80 MHz) Measurement Software MX269028A-001

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

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 μ s 20 MHz channel: Burst length ≥ 250 μ s \pm (Accuracy of reference frequency \times Carrier frequency + 16) Hz	
	Residual Vector Error	5835 MHz to 5925 MHz (channel No. 167 to 185): $\leq 1.5%$ (rms) 300 MHz to 862 MHz: $\leq 0.5%$ (rms)	5835 MHz to 5925 MHz (channel No. 167 to 185): $\leq 1.6%$ (rms) (Preamp Off) 300 MHz to 862 MHz: $\leq 0.8%$ (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 frame.)	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 μ s \pm (Accuracy of reference frequency \times Carrier frequency + 16) Hz	
	Residual Vector Error	$\leq 1.5%$ (rms)	$\leq 1.6%$ (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 frame.)	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 μ s \pm (Accuracy of reference frequency \times Carrier frequency + 21) Hz	
	Residual Vector Error	Specify filter with same characteristics as used for measurement signal, Burst signal $\leq 1.2%$ (rms)	$\leq 1.9%$ (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 frame.)	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 μ s \pm (Accuracy of reference frequency \times Carrier frequency + 13) Hz	
	Residual Vector Error	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signals $\leq 1.2%$ (rms)	$\leq 1.2%$ (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 frame.)	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

MS269xA MS2830A

802.11ac (80 MHz) Measurement Software MX269028A-001

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

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 μ s (Channel Bandwidth: 10 MHz), Burst length ≥ 250 μ s (Channel Bandwidth: 20 MHz) \pm (Accuracy of reference frequency \times Carrier frequency + 16) Hz	
Modulation/ Frequency Measurements	Residual Vector Error	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal $\leq 1.5\%$ (rms) $\leq 1.6\%$ (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 frame.)	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 μ s \pm (Accuracy of reference frequency \times Carrier frequency + 16) Hz
			40 MHz channel	Burst length ≥ 250 μ s \pm (Accuracy of reference frequency \times Carrier frequency + 102) Hz
	80 MHz channel		Burst length ≥ 250 μ s \pm (Accuracy of reference frequency \times Carrier frequency + 102) Hz	
	Residual Vector Error	160 MHz channel	Burst length ≥ 250 μ s \pm (Accuracy of reference frequency \times Carrier frequency + 102) Hz	—
		20 MHz channel	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal $\leq 0.7\%$ (rms) (Preamp Off) $\leq 0.9\%$ (rms) (Preamp On)	
			40 MHz channel	
80 MHz channel			Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal $\leq 0.9\%$ (rms) (Preamp Off) $\leq 1.1\%$ (rms) (Preamp On)	
160 MHz channel		Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal $\leq 1.5\%$ (rms) (Preamp Off) $\leq 1.7\%$ (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 frame.)	Input attenuator ≥ 10 dB		
		20 MHz channel	± 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	± 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	± 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

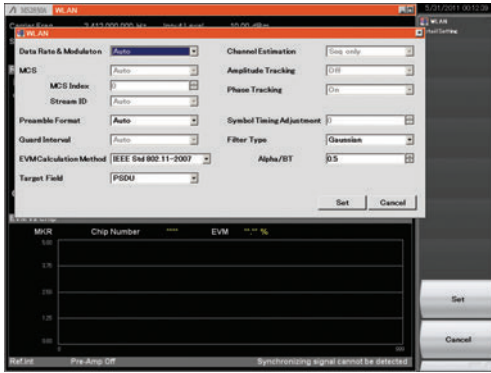
MS2830A

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)

• 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.

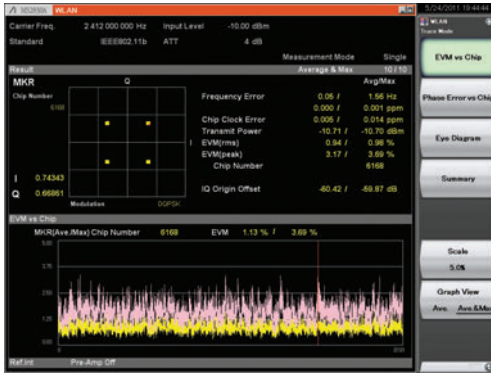
MX269028A (IEEE 802.11a, 11b, 11g, 11j, 11n, 11p)



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

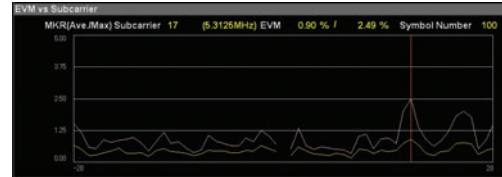


• EVM vs. Subcarrier

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.



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)

• 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.



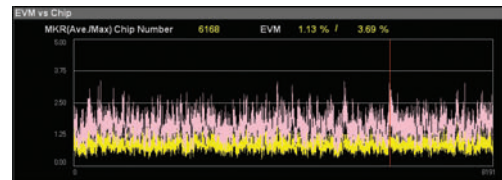
• EVM vs. Chip

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.

Measurement Signal: IEEE 802.11ac

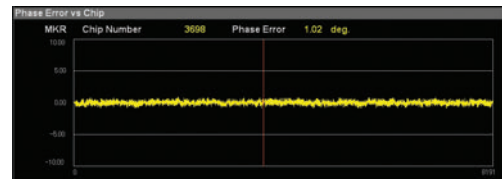
- Frequency Error
- Symbol Clock Error
- Transmit Power
- EVM (rms/Peak)
- Center Frequency Leakage



• 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.

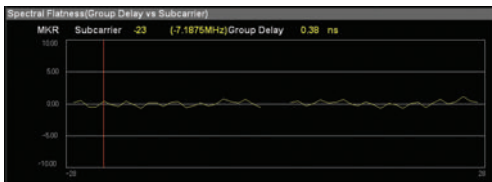
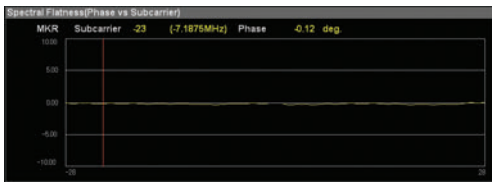
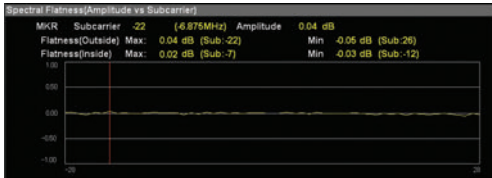
It is useful for checking a phase change in time direction.



Spectral Flatness

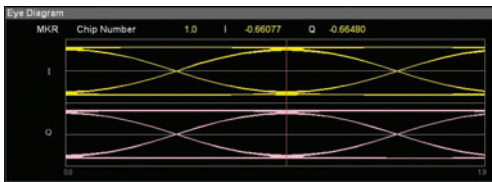
A graph of Amplitude vs. Subcarrier (horizontal axis: Subcarrier, vertical axis: Amplitude), Phase vs. Subcarrier (horizontal axis: Subcarrier, vertical axis: Phase) and Group Delay vs. Subcarrier (horizontal axis: Subcarrier, vertical axis: Group Delay) can be selected.

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.

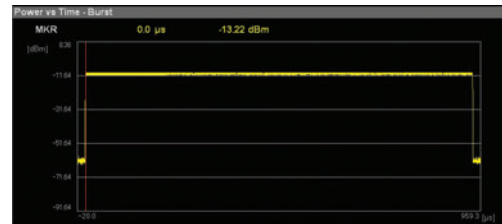
- Transmit Power
- Power Flatness Max
- Carrier Off Power
- On/Off Ratio
- Peak PSD
- Transient Time
 - Power-on Ramp
 - Power-off Ramp

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



Burst

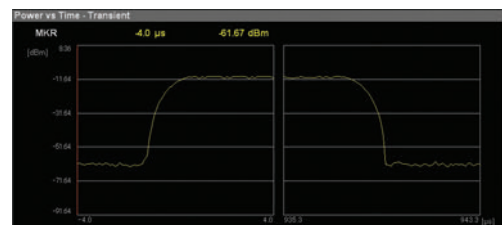
This displays the Power vs. Time graph (horizontal axis: Time, vertical axis: Power) for one burst waveform at the bottom of the screen.



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)

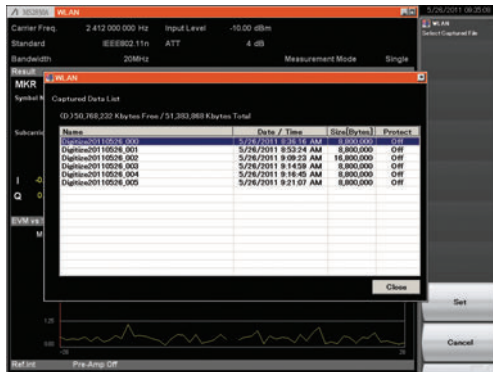
MS269xA MS2830A

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

MS269xA MS2830A

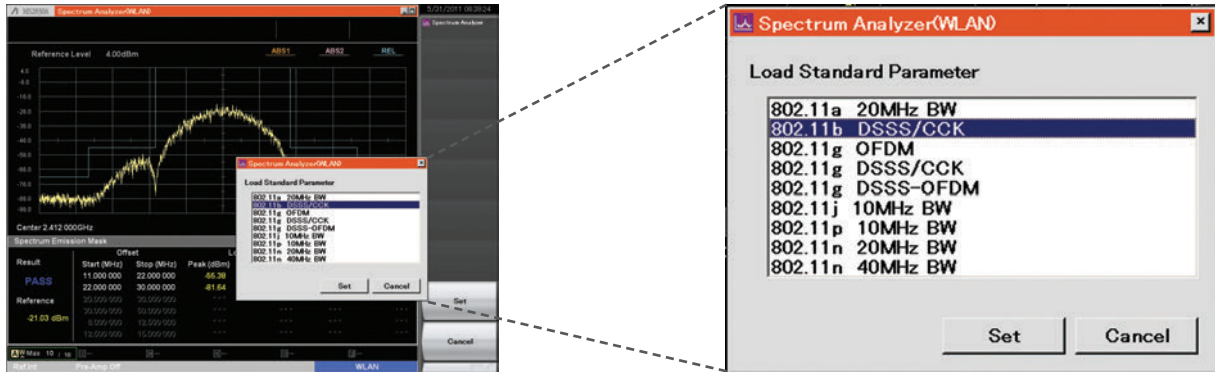
802.11ac (80 MHz) Measurement Software MX269028A-001

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

MS269xA/MS2830A Main Frame 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	—

The W-CDMA BS Measurement Software MX269030A is targeted at manufacturing of W-CDMA/HSPA base stations, repeaters, and power amplifiers. It supports measurement of the RF Tx characteristics of high-speed W-CDMA/HSPA downlink signals. Installation in the MS269xA or MS2830A supports fast, high-accuracy measurements to cut tact times.

Functions Supporting Manufacturing of W-CDMA/HSPA Base Stations

Supports fast, high-accuracy modulation analyses and spectrum measurements for manufacturing W-CDMA/HSPA base stations, repeaters, and power amplifiers.

■ Modulation Analysis

- Mean Power
- CPICH Power
- Carrier Frequency Error
- Vector Error (EVM) [Peak/rms]
- Peak Code Domain Error (PCDE)
- IQ Origin Offset
- Relative Code Domain Error (RCDE)
- Scrambling Code
- PCDE CH/SF/Slot
- Constellation (all codes)
- Code Domain Graph

■ Spectrum

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

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	
Common Specifications	Target Signal	W-CDMA/HSPA Downlink		
	Frequency Range	400 MHz to 3 GHz		
	Input Level Setting Range	-24 to +30 dBm (Preamp Off, or Preamp not installed)		
Modulation/ Frequency Measurement	Carrier Frequency Measurement Accuracy	Input level range: Input Level to Input Level -10 dB (Input Level \geq -4 dBm), for 1 wave multiplexed signals with EVM = 1%		
		\pm (Accuracy of reference frequency \times Carrier frequency + 4) Hz	\pm (Accuracy of reference frequency \times Carrier frequency + 6) Hz	
	Residual Vector Error	Input level range: Input Level to Input Level -10 dB (Input Level \geq -4 dBm), for 64DPCH multiplexed signals conforming to 3GPP TS 25.141 TestModel1		
		\leq 1.0% (rms)	\leq 1.3% (rms)	
	Code Domain Power Relative Value Accuracy	Input level range: Input Level to Input Level -10 dB (Input Level \geq -4 dBm), for signals conforming to 3GPP TS 25.141 TestModel2		
	\pm 0.02 dB (Code Domain Power \geq -10 dBc) \pm 0.10 dB (Code Domain Power \geq -30 dBc)	\pm 0.02 dB (Code Domain Power \geq -10 dBc) \pm 0.15 dB (Code Domain Power \geq -30 dBc)		
	Residual Code Domain Error	Input level range: Input Level to Input Level -10 dB (Input Level \geq -4 dBm), for signals conforming to 3GPP TS 25.141 TestModel3		
		\leq -50 dB	\leq -47 dB	
	Code Domain Error Accuracy	Input level range: Input Level to Input Level -10 dB (Input Level \geq -4 dBm), for signals conforming to 3GPP TS 25.141 TestModel3, with code domain error of -40 dBc		
		\pm 0.75 dB	\pm 0.79 dB	
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 frame.)	At 18°C to 28°C, after calibration, for signals with the input level range of Input Level to Input Level -10 dB (Input Level \geq -4 dBm)		
		\pm 0.6 dB		
Spectrum Measurement	Occupied Bandwidth Measurement	Attained with 99% method on spectrum waveforms attained by FFT calculation.		
	Adjacent Channel Leakage Power Measurement	Performs RRC filter processing ($\alpha = 0.22$) on spectrum waveforms attained by FFT calculation. 18°C to 28°C, for single carrier, Input Level \geq -4 dBm		
		-65 dB (5 MHz offset) -66 dB (10 MHz offset)	-64 dB (5 MHz offset, nom.) -65 dB (10 MHz offset, nom.)	
	Spectrum Emission Mask Measurement	18°C to 28°C, for single carrier, Input Level \geq -4 dBm		
		-78 dB/30 kHz (\geq 2.515 MHz offset)	-77 dB/30 kHz (\geq 2.515 MHz offset, nom.)	

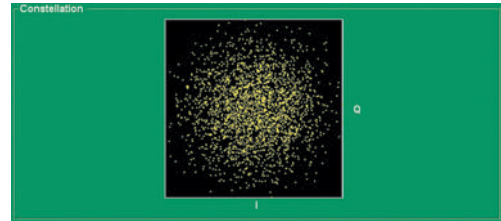
Measurement Functions

• Batch Modulation Analysis and Spectrum Measurements

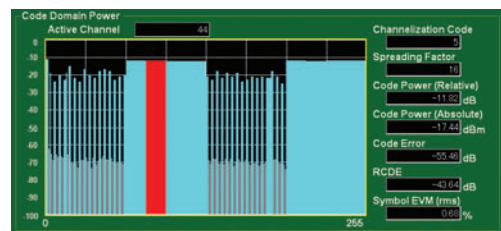
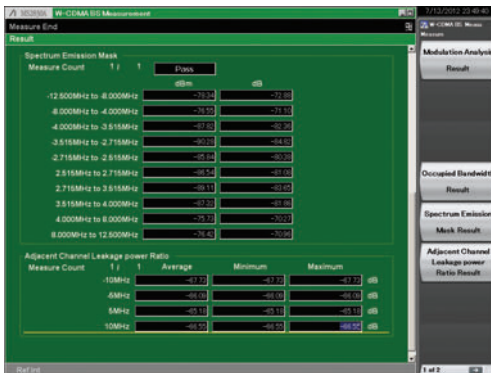
Measures all modulation analysis items (Mean Power, Carrier Frequency Error/EVM/PCDE, etc.), and spectrum measurements (ACL/OBW/SEM) in about 100 ms to cut tact times.

• Convenient Graph Display

Supports convenient graph function for checking signals to troubleshoot unexpected problems on production lines, etc., as quickly as possible.



Constellation (all codes)



Code Domain Display

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

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 frame.)	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

5G Standard Measurement Software (Base License) MX285051A

MS2850A

NR TDD sub-6 GHz Downlink
NR FDD sub-6 GHz Downlink
NR TDD mmWave Downlink

MX285051A-011
MX285051A-031
MX285051A-021

NR TDD sub-6 GHz Uplink
NR FDD sub-6 GHz Uplink
NR TDD mmWave Uplink

MX285051A-061
MX285051A-081
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.

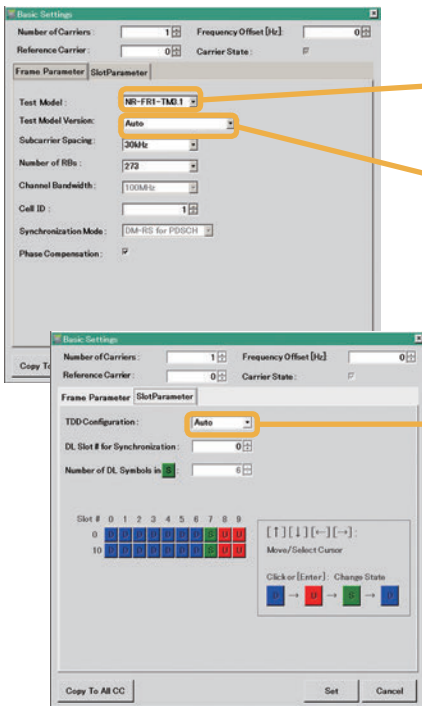
Setting Frequency Ranges: 100 MHz to 32 GHz (with MS2850A-047 installed), 100 MHz to 44.5 GHz (with MS2850A-046 installed)

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.



Easy physical channel setting by selecting test model name

Auto-detect function eliminates setting problems

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

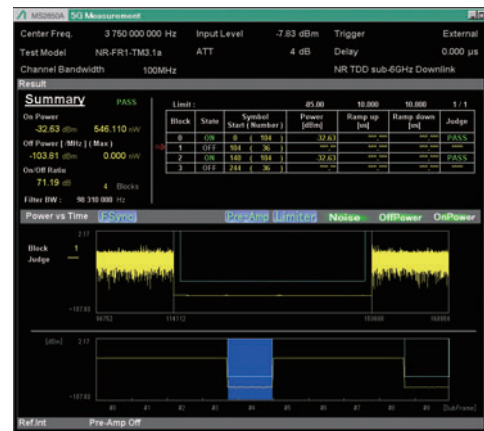
- This function makes it easy to measure Channel Power, OBW, ACLR and SEM.

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.

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



MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

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)

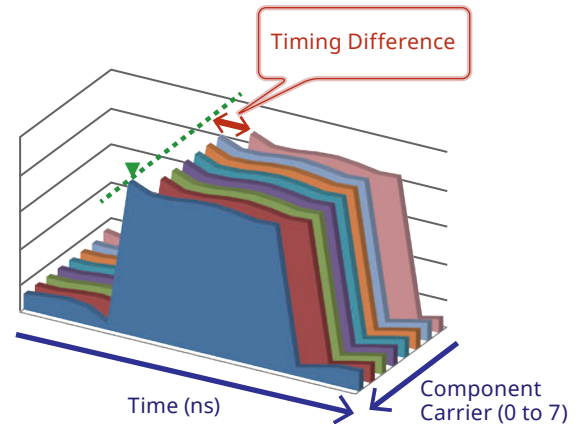
• All-at-Once Measurement and Analysis of 8 CCs max in 1-GHz Analysis Bandwidth

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	26.96 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	-20.26 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)	5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz	2
	MS2850A-033 (Max. Analysis Bandwidth: 510 MHz)		
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

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

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)

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			✓

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

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)

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

Signal Analyzer		MS2850A		
Option		NR TDD sub-6 GHz Downlink MX285051A-011	NR TDD sub-6 GHz Uplink MX285051A-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		
		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	MS2850A-047: 100 MHz to 32 GHz MS2850A-046: 100 MHz to 44.5 GHz			
Measurement Frequency Range	800 MHz to 5 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 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) -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 frame.)	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
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:		
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. -95 dBm/MHz (nominal)		
		—		

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 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	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°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 ≤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 frame.)	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

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

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 \pm (Accuracy of reference frequency \times 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 \pm (Accuracy of reference frequency \times 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 $\leq 2.0\%$	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 $\leq 2.0\%$	
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 frame.)	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 \leq 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

5G Standard Measurement Software (Base License) MX269051A

NR TDD sub-6 GHz Downlink
NR FDD sub-6 GHz Downlink

MX269051A-011
MX269051A-031

NR TDD sub-6 GHz Uplink
NR FDD sub-6 GHz Uplink

MX269051A-061
MX269051A-081

MS269xA

The 5G measurement Software MX269051A 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**

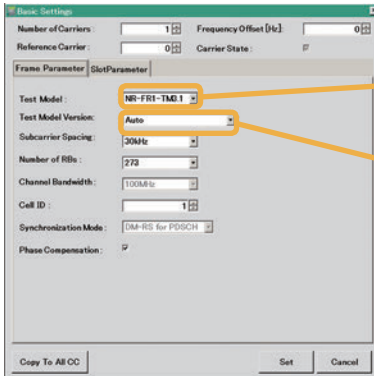
The 5G measurement Software MX269051A are installed to support both Downlink and Uplink signal in 5G NR sub-6 GHz. Combining with MS269xA-x077/078 can analyze a carrier with up to 100 MHz bandwidth.

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	✓	—

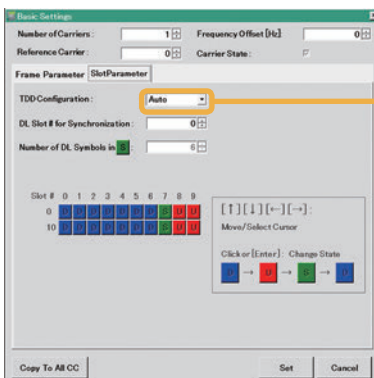
- **Easy Operability for Higher Measurement/Test Efficiency**

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



Easy physical channel setting by selecting test model name

Auto-detect function eliminates setting problems



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

- 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.



MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

5G Standard Measurement Software (Base License) MX269051A

MS269xA

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)

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)		✓		
PDCCCH		✓		
DM-RS (PDCCCH)		✓		
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		✓

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

5G Standard Measurement Software (Base License) MX269051A

MS269xA

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)

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)	—	100 MHz to 6 GHz
		≤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)	—	100 MHz to 6 GHz
		≤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)	Without MS269xA-067/ Preselector Bypass off	100 MHz to 6 GHz
		≤125 MHz (MS269xA-078)	Without MS269xA-067/ Preselector Bypass off	100 MHz to 6 GHz
≤62.5 MHz (MS269xA-077)		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	
	Channel Bandwidth		5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz	
	Modulation		CP-OFDM 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	MS2690A	MS269xA-067	Frequency Range	
			≤31.25 MHz (Standard)	—	100 MHz to 6 GHz	
			≤62.5 MHz (MS269xA-077)	—	100 MHz to 6 GHz	
			≤125 MHz (MS269xA-078)	—	100 MHz to 6 GHz	
MS2691A			—	100 MHz to 13.5 GHz		
≤31.25 MHz (Standard)			—	100 MHz to 6 GHz		
MS2692A	≤125 MHz (MS269xA-078)	—	100 MHz to 26.5 GHz			
	≤62.5 MHz (MS269xA-077)	Without MS269xA-067/ Preselector Bypass off	100 MHz to 6 GHz			
	≤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		
		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%		
	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%				
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 frame.)	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 Without 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	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	MS2690A		MS269xA-067	
			≤31.25 MHz (Standard)		—	
			≤62.5 MHz (MS269xA-077)		—	
			≤125 MHz (MS269xA-078)		—	
MS2691A			—			
≤31.25 MHz (Standard)			—			
≤62.5 MHz (MS269xA-077)		—				
≤125 MHz (MS269xA-078)		—				
MS2692A	≤31.25 MHz (Standard)		—			
	≤62.5 MHz (MS269xA-077)		Without MS269xA-067/ Preselector Bypass off			
	≤125 MHz (MS269xA-078)		—			
	≤62.5 MHz (MS269xA-077)		Preselector Bypass on			
≤125 MHz (MS269xA-078)		—				
Measurement Frequency Range	400 MHz to 6 GHz					
Measurement Level Range	-10 to +30 dBm (Preamp Off, or Preamp not installed) -25 to +10 dBm (Preamp On)					
Modulation/ Frequency Measurement	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°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 ≤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 frame.)	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		
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 Without MS269xA-078	With MS269xA-077 With MS269xA-078	
≤100 MHz	50 MHz	100 MHz	200 MHz			

This product was jointly developed with the National Institute of Information and Communications Technology (NICT).

Wi-SUN PHY Measurement Software MX705010A supports automatic measurement of Smart Utility Network wireless communications “Wi-SUN Alliance” PHY Conformance test cases. The MX705010A also supports automatic ARIB STD T-108 (TELEC-T245) tests. The MS269xA/MS2830A signal analyzer is controlled by remote commands from this software.

This is the ideal solution for efficient RF tests of Wi-SUN wireless equipment and improves design work.

* The measurement results obtained using this software may sometimes not obtain certification for the Japan Technical Standards Conformance Test.

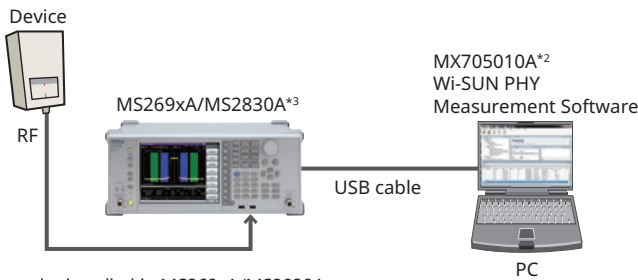
Supports Wi-SUN RF Conformance Auto-Test

Supports automatic measurement of RF conformance test required for development and evaluation of Wi-SUN wireless equipment.

- Wi-SUN PHY Transmitter Test: Automatic measurement of Wi-SUN Alliance PHY Conformance test items
- Wi-SUN PHY Receiver Test: Supports Wi-SUN Alliance PHY Conformance test signals and Tx control methods
- ARIB STD T-108/TELEC T245 Test*1: Automatic measurement and result evaluation
- Modulation: 2FSK

*1: There is restriction by a Wi-SUN standard

Configurations



*2: Cannot be installed in MS269xA/MS2830A.

*3: Requires the latest firmware of MS269xA/MS2830A.

This service, which provides updated versions of firmware and software for downloading by product customers, is available on Anritsu’s website.
<<https://www.my.anritsu.com/home>>

Measurement Functions

Measurement Items

Wi-SUN PHY Transmitter Test

- Modulation Quality
- Transmitter Frequency Offset
- Transmitter Adjacent Channel Power Ratio
- Test Vectors

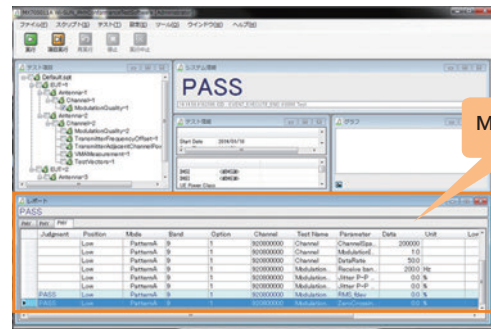
Wi-SUN PHY Receiver Test

- Receiver Sensitivity Test
- Packet Test

Test Items Equivalent to Japan Technical Standards Conformance Test

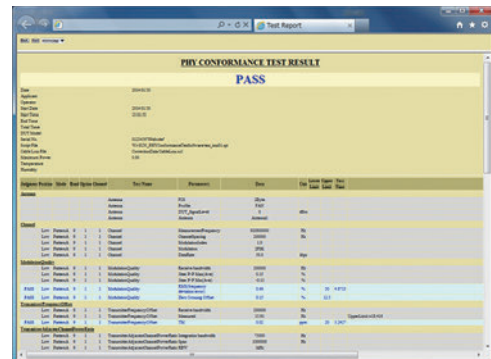
- Frequency Tolerance
- Occupied Bandwidth (OBW)
- Unwanted Emissions
- Antenna Power Tolerance
- Adjacent Channel Leakage
- Secondary Unwanted Emission
- Tx Time Control Equipment
- Carrier Sense Function

Screens



Measurement

Main Screen



Results Output Screen

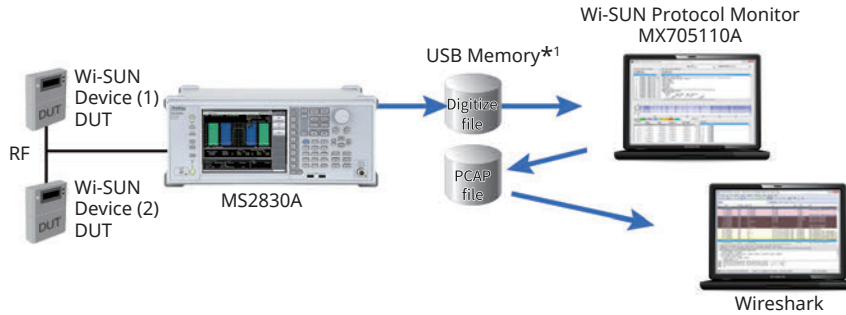
Signal Analyzer Configuration Examples

Main frame	Required Items
MS269xA	MX269017A, MS269xA-020, MX269902A
MS2830A	MS2830A-041, MS2830A-002, MS2830A-006, MX269017A, MS2830A-020, MS2830A-022, MS2830A-027, MX269902A

This product was jointly developed with the National Institute of Information and Communications Technology (NICT).

The Wi-SUN Protocol Monitor MX705110A supports protocol analysis of Smart Utility Network wireless communications at the “Wi-SUN Alliance” PHY/MAC layer. The wireless signals (IEEE 802.15.4g/e, GFSK) between communicating wireless equipment are captured as I/Q data using the MS269xA/MS2830A digitize function and data analysis is performed by the MX705110A. Data analysis displays the PHY/MAC frame format, Tx timing, etc. In addition, the details of the Wi-SUN protocol can be confirmed using the built-in Wireshark Dissector for Wi-SUN. The MX705110A is a powerful tool for Troubleshooting communications problems by checking the status of communications between wireless equipment.

Configuration



*1: Analysis requires copying of data recorded by the signal analyzer to a PC using USB flash memory, etc.

IEEE 802.15.4g/e (GFSK) Analysis Function

Analysis Items

- PHY layer frame data binary display (Preamble, SFD)
- MAC layer frame data header analysis display
- FCS16/32 auto-identification and display
- RF analysis display (Tx timing, Tx power, Time vs. Tx power graph)
- Conversion of IQ data captured using Wireshark to PCAP format file

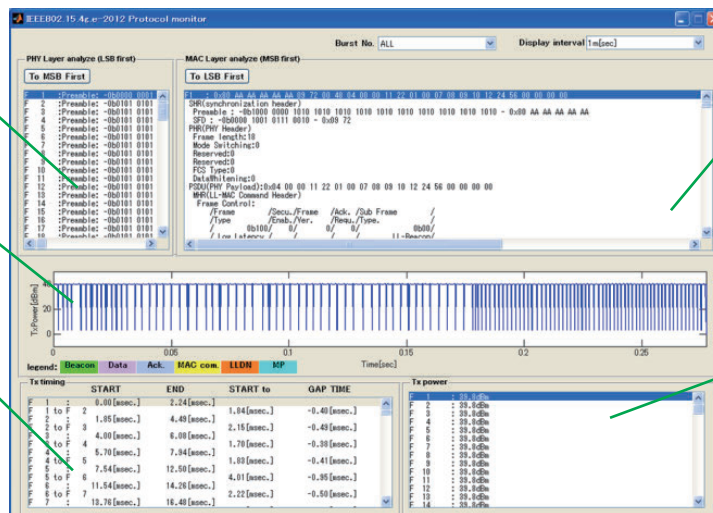
Demodulation Results for Each Burst (LSB/MSB First Switching)

Time vs. Tx Power Graph

Tx Timing of Each Burst

MAC Frame Analysis Results (LSB/MSB First Switching)

Tx Power



Signal Analyzer Configuration Examples

Main frame	Options Configuration Examples
MS269xA	MX269017A*2
MS2830A	MS2830A-041, MS2830A-002*2, MS2830A-006, MX269017A*2

*2: Recommended installed option

Vector Modulation Analysis Software MX269017A

Supports modulation error measurements and frequency and level, etc., measurements under modulation condition, etc., measurements using Wi-SUN PHY

Transmitter Test modulation analysis function

High Stability Reference Oscillator MS2830A-002

Supports frequency accuracy ($\pm 20 \times 10^{-7}$) required for TELEC-T245 Frequency Tolerance measurement

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

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 frame				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	016	017	026	051	066	067	020	021	189	022	027	028	088	029					
001	Rubidium Reference Oscillator	Yes	✓	✓	✓	✓	✗ ^{*4}	✗																														
002	High Stability Reference Oscillator	Yes	✓	✓	Equivalent function installed		✗ ^{*4}	✗		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	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	✓	✓	✓	✓																																
069	26.5 GHz Microwave Preamplifier	Yes	No	No	✓	No		No		No														No		No	No	No	No	No	No	No	No	No	No	No	No	
068	Microwave Preamplifier	Yes	No	No	No	✓		No	No															No		No	No	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	No	No	No	
010	Preamplifier	Yes	✓	✓	✓	✓																																
011	2ndary SSD	Yes	✓	✓	✓	✓																																
016	Precompliance EMI Function	Yes	✓	✓	✓	✓																																
017	Noise Figure Measurement Function	Yes	✓	✓	✓	✓																																
026	BER Measurement Function	Yes	✓	✓	✓	✓																																
051	Noise Floor Reduction	Yes	✓	✓	✓	✓																																
066	Low Phase Noise Performance	Yes	✓	✓	No	No				No				No	No									No		No												
067	Microwave Preselector Bypass	Yes	No	No	✓	✓		No															No	✗	No	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	No	
021	6 GHz Vector Signal Generator	Yes	✓	✓	No	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	No	
022	Low Power Extension for Vector Signal Generator	Yes	✓	✓	No	No				No				No	No									No		R	No	✗								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	No
029	Analog Function Extension for Vector Signal Generator ^{*3}	Yes	✓	✓	No	No				No				No	No									No		R	No	R								No	✗	No

*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 series MS2690A/91A/92A 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: 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.

*5: 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.

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

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 frame		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-053	MS2850A-054		
MS2850A-032	Analysis Bandwidth 255 MHz	—	Standard install	Standard install	X														
MS2850A-033	Analysis Bandwidth Extension to 510 MHz	Yes	✓	✓	X														
MS2850A-034	Analysis Bandwidth Extension to 1 GHz	Yes	✓	✓	X	R													
MS2850A-010	Phase Noise Measurement Function	Yes	✓	✓															
MS2850A-017	Noise Figure Measurement Function	Yes	✓	✓															
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-053	External Interface for High Speed Data Transfer PCIe	Yes	✓	✓															
MS2850A-054	External Interface for High Speed Data Transfer USB3.0	Yes	✓	✓															

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

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				Require MX269013A
MX269015A	TD-SCDMA Measurement Software	✓	✓	✓	✓	✓		R				
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			Require MS2830A-066 and A0086C (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	Require MX269020A
MX269021A	LTE Uplink Measurement Software	✓	✓	✓	✓	✓	R	R	R*1			
MX269021A-001	LTE-Advanced FDD Uplink Measurement Software	✓	✓	✓	✓	✓	R	R	R*1	U	U	Require 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	Require 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	Require MX269023A
MX269024A	CDMA2000 Forward Link Measurement Software	✓	✓	✓	✓	✓		R				
MX269024A-001	All Measure Function	✓	✓	✓	✓	✓		R				Require MX269024A
MX269026A	EV-DO Forward Link Measurement Software	✓	✓	✓	✓	✓		R				
MX269026A-001	All Measure Function	✓	✓	✓	✓	✓		R				Require MX269026A
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. Require MX269028A
MX269030A	W-CDMA BS Measurement Software	✓	✓	✓	✓	✓		R				

*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.

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*	✓	✓	✓	✓		
MX284059A	Pulse Radar Measurement Function	No	No	✓	✓		

*: Requires USB Audio A0086C

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

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. Require MX285051A-001/011/021/031/ 051/061/071/081
MX285051A-001	Pre-Standard CP-OFDM Downlink	✓	✓	U	U	Require MX285051A
MX285051A-051	Pre-Standard CP-OFDM Uplink	✓	✓	U	U	Require MX285051A
MX285051A-011	NR TDD sub-6 GHz Downlink	✓	✓			Require MX285051A
MX285051A-061	NR TDD sub-6 GHz Uplink	✓	✓			Require MX285051A
MX285051A-031	NR FDD sub-6 GHz Downlink	✓	✓			Require MX285051A
MX285051A-081	NR FDD sub-6 GHz Uplink	✓	✓			Require MX285051A
MX285051A-021	NR TDD mmWave Downlink	✓	✓	U	U	Require MX285051A
MX285051A-071	NR TDD mmWave Uplink	✓	✓	U	U	Require 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	✓	✓			Require MX269013A
MX269015A	TD-SCDMA Measurement Software	✓	✓			
MX269020A	LTE Downlink Measurement Software	✓	✓			
MX269020A-001	LTE-Advanced FDD Downlink Measurement Software	✓	✓			Require MX269020A
MX269021A	LTE Uplink Measurement Software	✓	✓			
MX269021A-001	LTE-Advanced FDD Uplink Measurement Software	✓	✓			Require MX269021A
MX269022A	LTE TDD Downlink Measurement Software	✓	✓			
MX269022A-001	LTE-Advanced TDD Downlink Measurement Software	✓	✓			Require MX269022A
MX269023A	LTE TDD Uplink Measurement Software	✓	✓			
MX269023A-001	LTE-Advanced TDD Uplink Measurement Software	✓	✓			Require MX269023A
MX269017A	Vector Modulation Analysis Software	✓	✓			
MX269017A-001	APSK Analysis	✓	✓			Require MX269017A
MX269017A-011	Higher-Order QAM Analysis	✓	✓			Require MX269017A

MX2690xxA/MX2830xxA/MX2840xxA/MX2850xxA series Measurement Software

Ordering Information

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

Model/Order No	Name	Model/Order No	Name
	Main Frame		
MS2690A	Signal Analyzer (50 Hz to 6 GHz)	MX269051A	5G Standard Measurement Software (Base License) (MS269xA only, Requires MX269051A-011/031/061/081)
MS2691A	Signal Analyzer (50 Hz to 13.5 GHz)	MX269051A-011	NR TDD sub-6 GHz Downlink (MS269xA only, Requires MX269051A)
MS2692A	Signal Analyzer (50 Hz to 26.5 GHz)	MX269051A-061	NR TDD sub-6 GHz Uplink (MS269xA only, Requires MX269051A)
MS2850A-047	Signal Analyzer (9 kHz to 32 GHz)	MX269051A-031	NR FDD sub-6 GHz Downlink (MS269xA only, Requires MX269051A)
MS2850A-046	Signal Analyzer (9 kHz to 44.5 GHz)	MX269051A-081	NR FDD sub-6 GHz Uplink (MS269xA only, Requires MX269051A)
MS2840A-040	Signal Analyzer (9 kHz to 3.6 GHz)		Measurement Software Options These software are for PC.
MS2840A-041	Signal Analyzer (9 kHz to 6 GHz)	MX705010A*	Wi-SUN PHY Measurement Software (For MS269xA and MS2830A)
MS2840A-044	Signal Analyzer (9 kHz to 26.5 GHz)	MX705110A	Wi-SUN Protocol Monitor (For MS269xA and MS2830A. MS2830A-006 is necessary for MS2830A.)
MS2840A-046	Signal Analyzer (9 kHz to 44.5 GHz)		Application Parts
MS2830A-040	Signal Analyzer (9 kHz to 3.6 GHz)	W3098AE	MX269011A Operation Manual (Operation)
MS2830A-041	Signal Analyzer (9 kHz to 6 GHz)	W3099AE	MX269011A Operation Manual (Remote Control)
MS2830A-043	Signal Analyzer (9 kHz to 13.5 GHz)	W3060AE	MX269012A Operation Manual (Operation)
MS2830A-044	Signal Analyzer (9 kHz to 26.5 GHz)	W3061AE	MX269012A Operation Manual (Remote Control)
MS2830A-045	Signal Analyzer (9 kHz to 43 GHz)	W3100AE	MX269013A Operation Manual (Operation)
	Software Options	W3101AE	MX269013A Operation Manual (Remote Control)
MX269011A	CD-ROM with license and operation manuals	W3031AE	MX269014A Operation Manual (Operation)
MX269012A	W-CDMA/HSPA Downlink Measurement Software	W3032AE	MX269014A Operation Manual (Remote Control)
MX269013A	W-CDMA/HSPA Uplink Measurement Software	W3044AE	MX269015A Operation Manual (Operation)
MX269013A-001	GSM/EDGE Measurement Software	W3045AE	MX269015A Operation Manual (Remote Control)
	EDGE Evolution Measurement Software (Requires MX269013A)	W3305AE	MX269017A Operation Manual (Operation)
MX269014A	ETC/DSRC Measurement Software (MS269xA only)	W3306AE	MX269017A Operation Manual (Remote Control)
MX269015A	TD-SCDMA Measurement Software	W3555AE	MX269018A Operation Manual (Operation)
MX269017A	Vector Modulation Analysis Software	W3556AE	MX269018A Operation Manual (Remote Control)
MX269017A-001	APSK Analysis (Requires MX269017A)	W3014AE	MX269020A Operation Manual (Operation)
MX269017A-011	Higher-Order QAM Analysis (Requires MX269017A)	W3064AE	MX269020A Operation Manual (Remote Control)
MX269018A	Analog Measurement Software (For MS2840A and MS2830A. MS2830A-066 and A0086C are required for MS2830A. A0086C is required for MS2840A.)	W3015AE	MX269021A Operation Manual (Operation)
	LTE Downlink Measurement Software	W3065AE	MX269021A Operation Manual (Remote Control)
MX269020A	LTE-Advanced FDD Downlink Measurement Software (Requires MX269020A)	W3209AE	MX269022A Operation Manual (Operation)
MX269021A	LTE Uplink Measurement Software	W3210AE	MX269022A Operation Manual (Remote Control)
MX269021A-001	LTE-Advanced FDD Uplink Measurement Software (Requires MX269021A)	W3521AE	MX269023A Operation Manual (Operation)
	LTE TDD Downlink Measurement Software	W3522AE	MX269023A Operation Manual (Remote Control)
MX269022A	LTE-Advanced TDD Downlink Measurement Software (Requires MX269022A)	W3201AE	MX269024A Operation Manual (Operation)
MX269022A-001	LTE TDD Uplink Measurement Software	W3202AE	MX269024A Operation Manual (Remote Control)
	LTE-Advanced TDD Uplink Measurement Software (Requires MX269023A)	W3203AE	MX269026A Operation Manual (Operation)
MX269023A	CDMA2000 Forward Link Measurement Software	W3204AE	MX269026A Operation Manual (Remote Control)
MX269024A	All Measure Function (Requires MX269024A)	W3528AE	MX269028A Operation Manual (Operation)
MX269024A-001	EV-DO Forward Link Measurement Software	W3529AE	MX269028A Operation Manual (Remote Control)
MX269026A	All Measure Function (Requires MX269026A)	W2860AE	MX269030A Operation Manual (Operation)
MX269026A-001	WLAN (802.11) Measurement Software	W2861AE	MX269030A Operation Manual (Remote Control)
MX269028A	802.11ac (80 MHz) Measurement Software (MS2830A only, Requires MX269028A)	W4029AE	MS2840A Signal Analyzer Operation Manual (Pulse Radar Measurement Function)
MX269028A-001	802.11ac (160 MHz) Measurement Software (MS269xA only, Requires MX269028A)	W3922AE	MX285051A/MX269051A Operation Manual (Operation)
MX269028A-002	W-CDMA BS Measurement Software	W3924AE	MX285051A-001/MX285051A-051 Operation Manual (Operation)
MX269030A	Pulse Radar Measurement Function (MS2840A-044/046 only)	W3925AE	MX285051A-001/MX285051A-051 Operation Manual (Remote Control)
MX284059A	5G Standard Measurement Software (Base License)	W3963AE	MX285051A-011/MX269051A-011/MX285051A-021/ MX285051A-061/MX269051A-061/MX285051A-071 Operation Manual (Operation)
MX285051A	(MS2850A only, Requires MX285051A-001/011/021/031/051/ 061/071/081)	W3964AE	MX285051A-011/MX269051A-011/MX285051A-021/ MX285051A-061/MX269051A-061/MX285051A-071 Operation Manual (Remote Control)
MX285051A-001	Pre-Standard CP-OFDM Downlink (MS2850A only, Requires MX285051A)	W4035AE	MX285051A-031/MX269051A-031/MX285051A-081/ MX269051A-081 Operation Manual (Operation)
MX285051A-051	Pre-Standard CP-OFDM Uplink (MS2850A only, Requires MX285051A)	W4036AE	MX285051A-031/MX269051A-031/MX285051A-081/ MX269051A-081 Operation Manual (Remote Control)
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)		

*:	Main frame	Options configuration examples
	MS269xA	MX269017A, MS269xA-020, MX269902A
	MS2830A	MS2830A-041, MS2830A-002, MS2830A-006, MX269017A, MS2830A-020, MS2830A-022, MS2830A-027, MX269902A

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