Product Brochure

Anritsu envision : ensure

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

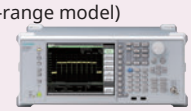
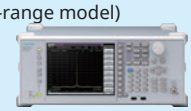
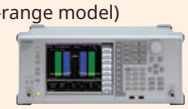
MX2690xxA series
MX2830xxA series
MX2850xxA series

Measurement Software

MX2690xxA/MX2830xxA/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) 	■ High level accuracy up to 6 GHz expandable to 4 GHz, 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) 	■ Analysis bandwidth: 1 GHz max. ■ For R&D and manufacturing cost reduction of 5G and wideband systems including microwave/ millimeter wave communications systems, such as satellite broadcasting	9 kHz to 32 GHz 9 kHz to 44.5 GHz	255 MHz (Standard) 510 MHz (Option: MS2850A-033) 1 GHz (Option: MS2850A-034)
MS2840A (Middle-range model) 	■ Highest level phase noise performance among middle-range models ■ High cost-performance ratio as replacement for aging high-end models	9 kHz to 3.6 GHz 9 kHz to 6 GHz 9 kHz to 26.5 GHz 9 kHz to 44.5 GHz	31 .25 MHz (Standard) 62 .5 MHz (Option: MS2840A-077)* 125 MHz (Option: MS2840A-078)*
MS2830A (Middle-range model) 	■ High-speed, low-cost, low power consumption cuts manufacturing costs ■ Environment-friendly energy saving design ■ Multiple versatile measurement options	9 kHz to 3.6 GHz 9 kHz to 6 GHz 9 kHz to 13.5 GHz 9 kHz to 26.5 GHz 9 kHz to 43 GHz	None (Standard) 10 MHz (Option: MS2830A-006) 31 .25 MHz (Option: MS2830A-005/009) 62 .5 MHz (Option: MS2830A-077)* 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/MX2850xxA series Measurement Software

Signal Analyzers MS269xA, MS2830A, MS2840A and MS2850A

MX2690xxA/MX2830xxA/MX2850xxA series Measurement Software

The MX2690xxA/MX2830xxA/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*19	16							✓	U	✓		
	Higher-Order QAM Analysis	MX269017A-011*19	16							✓	U	✓		
Analog (FM/øM/AM)	Analog Measurement Software	MX269018A*9	26			✓				✓				
LTE/ LTE-Advanced (FDD)	LTE Downlink Measurement Software	MX269020A	35	✓		✓	R	R				✓		
	LTE-Advanced FDD Downlink Measurement Software	MX269020A-001*10	35	✓	U	✓	R	R	U			✓		
	LTE Uplink Measurement Software	MX269021A	41	✓		✓	R	R				✓		
	LTE-Advanced FDD Uplink Measurement Software	MX269021A-001*15	41	✓	U	✓	R	R	U			✓		
LTE/ LTE-Advanced (TDD)	LTE TDD Downlink Measurement Software	MX269022A	35	✓		✓	R	R				✓		
	LTE-Advanced TDD Downlink Measurement Software	MX269022A-001*11	35	✓	U	✓	R	R	U			✓		
	LTE TDD Uplink Measurement Software	MX269023A	41	✓		✓	R	R				✓		
	LTE-Advanced TDD Uplink Measurement Software	MX269023A-001*16	41	✓	U	✓	R	R	U			✓		
CDMA2000	CDMA2000 Forward Link Measurement Software	MX269024A	47	✓		✓	R							
	All Measure Function	MX269024A-001	47	✓		✓	R							
1xEV-DO	EV-DO Forward Link Measurement Software	MX269026A	47	✓		✓	R							
	All Measure Function	MX269026A-001	47	✓		✓	R							
Femtocell	TRX Sweep Calibration	MX283087A	69			✓	R	R						
5G	5G Standard Measurement Software (Base License)	MX285051A	72									✓		
	Pre-Standard CP-OFDM Downlink	MX285051A-001*18	72									✓	U	U
	Pre-Standard CP-OFDM Uplink	MX285051A-051*18	72									✓	U	U
	NR TDD sub-6GHz Downlink	MX285051A-011*18	75									✓		
	NR TDD sub-6GHz Uplink	MX285051A-061*18	75									✓		
	NR TDD mmWave Downlink	MX285051A-021*18	75									✓	U	U
	NR TDD mmWave Uplink	MX285051A-071*18	75									✓	U	U
WLAN	WLAN (802.11) Measurement Software (Supports IEEE 802.11a/11b/11g/11j/11n/11p)	MX269028A	50	✓		✓	R	R						
	802.11ac (80 MHz) Measurement Software	MX269028A-001*12	50			✓	R	R	R					
	802.11ac (160 MHz) Measurement Software	MX269028A-002*12	50	✓	R									
W-CDMA/HSPA	W-CDMA BS Measurement Software	MX269030A	60	✓		✓	R							
WLAN	Wireless Network Device Test Software	MX283027A	62			✓								
	WLAN Test Software (Supports IEEE 802.11a/11b/11g/11n)	MX283027A-001 *13, *14	62			✓	R	R						
Bluetooth	Bluetooth Test Software	MX283027A-002*13	62			✓	R	R						

MX2690xxA/MX2830xxA/MX2850xxA series Measurement Software

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*1	MS269xA-078

[MS2850A Options]

Analysis Bandwidth Extension 510 MHz	MS2850A-033
Analysis Bandwidth Extension 1 GHz*17	MS2850A-034

[MS2840A Options]

Analysis Bandwidth Extension to 62.5 MHz	MS2840A-077
Analysis Bandwidth Extension to 125 MHz*2	MS2840A-078

[MS2830A Options]

Analysis Bandwidth Extension to 31.25 MHz*3	MS2830A-005
Analysis Bandwidth 10 MHz	MS2830A-006
Bandwidth Extension to 31.25 MHz for Millimeter-wave*4	MS2830A-009
Analysis Bandwidth Extension to 62.5 MHz*5, *7	MS2830A-077
Analysis Bandwidth Extension to 125 MHz*6, *7	MS2830A-078

*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 MX283027A
*14: MX283027A-001 includes WLAN IQproducer MX269911A (Cannot order MX283027A-001 and MX269911A at same time).
*15: Requires MX269021A
*16: Requires MX269023A
*17: Requires MS2850A-033
*18: Requires MX285051A
*19: Requires MX269017A

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*1	MX705010A
Wi-SUN Protocol Monitor*2	MX705110A

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)

W-CDMA/HSPA Downlink Measurement Software MX269011A

MS269xA MS2850A MS2830A

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

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

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

■ Modulation Analysis

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

■ Code Domain

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

■ Code vs. Time

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

■ Spectrum

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

Specifications

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

Signal Analyzer		MS269xA	MS2830A MS2850A
Target Signals		W-CDMA, HSPA, HSPA Evolution Downlink Supports QPSK, 16QAM, and 64QAM HS-PDSCH modulation methods (excludes MIMO Tx signals)	
Measurement Frequency Range		400 MHz to 3 GHz	
Modulation/ Frequency Measurement	Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –30 to +10 dBm (Preamp On)	
	Carrier Frequency Measurement Accuracy	At 18° 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° 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° 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° 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° to 28°C, After calibration, When input signal within measurement level range and less than input level	
		Residual Error: ≤–46 dB	Residual Error: ≤–42 dB
		Accuracy: ±0.3 dB (Code Domain Error ≥–30 dBc) ±1.0 dB (Code Domain Error ≥–40 dBc)	
	Waveform Display	EVM vs. Symbol, Amplitude Error vs. Symbol, Phase Error vs. Symbol, Symbol Constellation, Code Domain Power, Code Domain Error	
Spectrum Measurement	Measurement Functions	Adjacent Channel Leakage Power, Channel Power, Occupied Bandwidth, Spectrum Emission Mask	

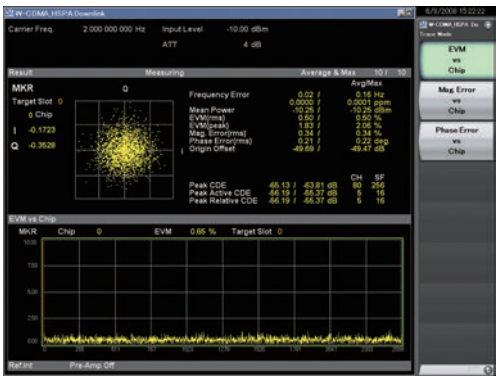
W-CDMA/HSPA Downlink Measurement Software MX269011A (Continued)

MS269xA MS2850A MS2830A

Measurement Functions

- **Frequency Error/Modulation Accuracy**

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



Modulation Analysis Screen

- **Code vs. Time**

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

Code vs. Time

- **Code Domain**

This function displays results for each code as a constellation and numeric table, making it easy to discover transient code-dependent signal degradation.
In addition, graphs can be displayed with any of Vector Error, Amplitude Error, and Phase Error on the vertical axis to discover transient time-dependent (symbol units) signal degradation for a specific code.

Code Domain (Constellation)

Code Domain (Vector Error vs. Symbol)

W-CDMA/HSPA Uplink Measurement Software MX269012A

MS269xA MS2850A MS2830A

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

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

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

■ Modulation Analysis

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

■ Code Domain

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

■ Spectrum

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

Specifications

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

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

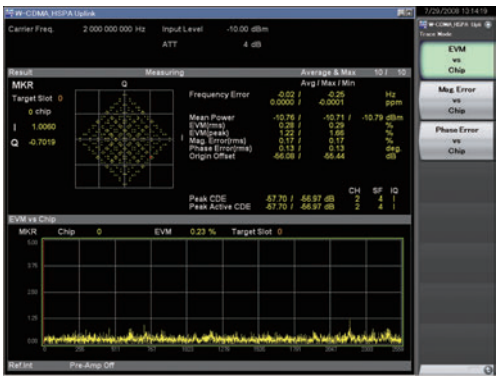
W-CDMA/HSPA Uplink Measurement Software MX269012A (Continued)

MS269xA MS2850A MS2830A

Measurement Functions

- **Frequency Error/Mean Power/Modulation Accuracy**

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

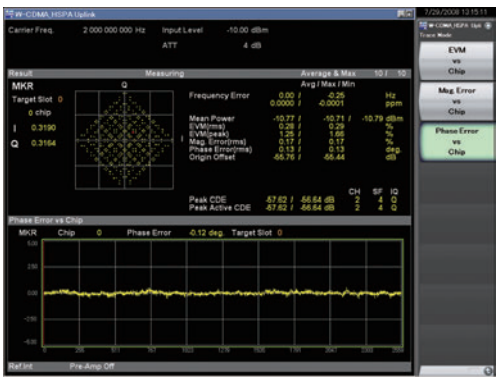


Constellation and Vector Error vs. Chip

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

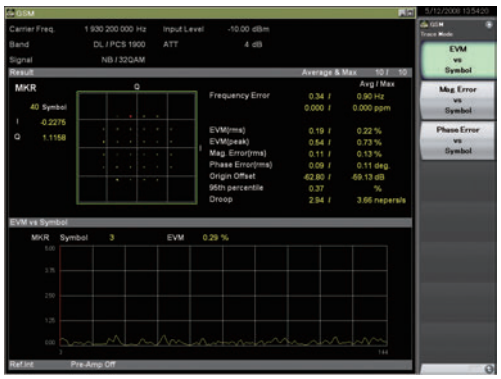
GSM/EDGE Measurement Software MX269013A
EDGE Evolution Measurement Software MX269013A-001 (Continued)

MS269xA MS2850A MS2830A

Measurement Functions

- **Frequency Error/Modulation Accuracy**

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



- **Output Spectrum Measurements**

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

Modulation Part

Switching Transients Part

- **Power vs. Time**

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

Rise/Fall (Average)

Slot (Average)

Frame (Average/Max./Min.)

ETC/DSRC Measurement Software MX269014A

MS269xA

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

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

The 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 π/4DQPSK and ASK modulation signals to improve production throughout.

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

■ Modulation Analysis (π/4DQPSK)

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

■ Modulation Analyzer (ASK)

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

■ Spectrum

- Adjacent Channel Leakage Power
- Occupied Bandwidth

Specifications

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

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

ETC/DSRC Measurement Software MX269014A (Continued)

MS269xA

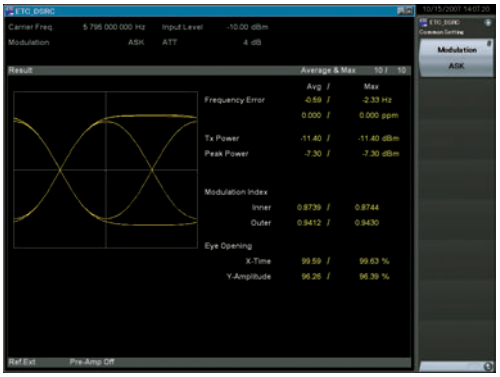
Measurement Functions

- **Modulation Analysis (π/4DQPSK)**

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

- **Modulation Analysis (ASK)**

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



TD-SCDMA Measurement Software MX269015A

MS269xA MS2850A MS2830A

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° to 28°C, After calibration, with EVM = 1% signal ± (Accuracy of reference frequency × Carrier frequency + 20) Hz	
	Modulation Accuracy	At 18° to 28°C, After calibration, With input signal in measurement level range and less than input level	
		Residual Vector Error: ≤1.0% (rms)	Residual Vector Error: ≤1.2% (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° 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 Measurement	Code Domain Power	At 18° 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 Error	At 18° 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	

TD-SCDMA Measurement Software MX269015A (Continued)

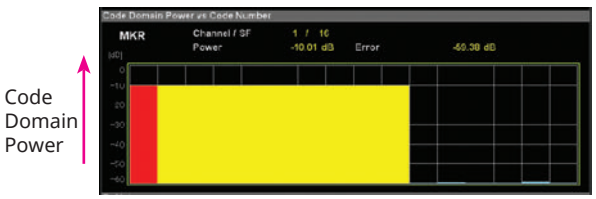
MS269xA MS2850A MS2830A

Measurement Functions

- **Frequency Error/Tx Power/Modulation Accuracy**

The Frequency Error, Tx Power, and Modulation Accuracy for the specified carrier slot 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



Code Domain Power vs. Code Number

Code Domain Error vs. Code Number

- **Multi Carrier/Multi Slot Power Measurements**

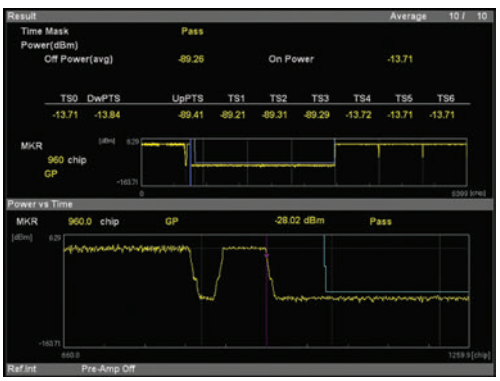
The Multi Carrier measurement function simultaneously displays the Tx Power for all carriers and slots of the multi carrier signal, while the Multi Slot Power measurement function simultaneously displays the mean and partial Tx Powers for all slots.

Multi Carrier Power

Multi Slot Power

- **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
APSK Analysis MX269017A-001
Higher-Order QAM Analysis MX269017A-011 (Continued)

MS269xA MS2850A MS2840A MS2830A

Specifications

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

■ **Common Specifications**

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

■ **Frequency Setting Range**

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

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

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

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

MS269xA MS2850A MS2840A MS2830A

■ Symbol Rate Setting Range

Firmware package version 12.00.00 and later:

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

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

■ Modulation/Frequency Measurement

<table>
<tr><td colspan="2">Signal Analyzer</td><td>MS269xA</td><td>MS2850A</td><td>MS2840A</td><td>MS2830A</td></tr>
<tr><td colspan="2">Measurement Level Range</td><td colspan="4">–15 to +30 dBm (Preamp Off, or Preamp not installed)
–25 to +10 dBm (Preamp On)</td></tr>
<tr><td rowspan="6">Carrier Frequency Measurement Accuracy</td><td rowspan="2">BPSK, QPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 2FSK, 4FSK, MSK</td><td colspan="4">Without MS269xA-001, With MS2840A-002, With MS2830A-002, At 18° to 28°C, after calibration, with EVM = 1% signal
For firmware package version 12.00.00 and later, Capture OSR = 4</td></tr>
<tr><td>± (Accuracy of reference frequency × Carrier frequency + 10) Hz
(Center Frequency: 30 MHz to 6.0 GHz)
(Note that a range of 3 GHz or above is not available when MS269xA-003 is installed and with Frequency Band Mode set to Spurious.)</td><td>± (Accuracy of reference frequency × Carrier frequency + 10) Hz
(Center Frequency: 30 MHz to 3.5 GHz, symbol rate: 4 ksps to 5 Msps)
± (Accuracy of reference frequency × Carrier frequency + 10) Hz
(Center Frequency: 800 MHz to 3.5 GHz, symbol rate: 5 Msps to 50 Msps)</td><td>± (Accuracy of reference frequency × Carrier frequency + 10) Hz
(Center Frequency: 30 MHz to 3.5 GHz)</td><td></td></tr>
<tr><td rowspan="2">Π/4DQPSK, 2ASK, 4ASK</td><td colspan="4">Without MS269xA-001, With MS2840A-002, With MS2830A-002, At 18° to 28°C, after calibration, with EVM = 1% signal
For firmware package version 12.00.00 and later, Capture OSR = 4</td></tr>
<tr><td>± (Accuracy of reference frequency × Carrier Frequency + 10) Hz
(Center Frequency: 30 MHz to 6.0 GHz)
(Note that a range of 3 GHz or above is not available when MS269xA-003 is installed and with Frequency Band Mode set to Spurious.)</td><td>± (Accuracy of reference frequency × Carrier frequency +10) Hz
(Center frequency: 30 MHz to 3.5 GHz, symbol rate: 4 ksps to 5 Msps)
± (Accuracy of reference frequency × Carrier frequency + 10) Hz
(Center Frequency: 800 MHz to 3.5 GHz, symbol rate: 5 Msps to 50 Msps)</td><td>± (Accuracy of reference frequency × Carrier frequency + 10) Hz
(Center Frequency: 30 MHz to 3.5 GHz)
± (Accuracy of reference frequency × Carrier frequency + 10) Hz
(Center Frequency: 5.7 GHz to 5.9 GHz, nom.)</td><td></td></tr>
<tr><td rowspan="2">512QAM
1024QAM
2048QAM</td><td colspan="4">With MS2840A-002, At 18° to 28°C, after calibration, with EVM = 1% signal
For firmware package version 12.00.00 and later, Capture OSR = 4</td></tr>
<tr><td>—</td><td>With MX269017-011
± (Accuracy of reference frequency × Carrier frequency +10) Hz
(Center frequency: 30 MHz to 3.5 GHz, symbol rate: 500 ksps to 5 Msps)
With MX269017-011
± (Accuracy of reference frequency × Carrier frequency +10) Hz
(Center frequency: 800 MHz to 3.5 GHz, symbol rate: 5 Msps to 50 Msps, Equalizer = On)</td><td>with MX269017A-011
± (Accuracy of reference frequency × Carrier frequency +10) Hz
(Center Frequency: 30 MHz to 3.5 GHz)</td><td>—</td></tr>
</table>

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

MS269xA MS2850A MS2840A MS2830A

<table>
<tr><th colspan="2">Signal Analyzer</th><th>MS269xA</th><th>MS2850A</th><th>MS2840A</th><th>MS2830A</th></tr>
<tr><td rowspan="3">Carrier Frequency Measurement Accuracy</td><td rowspan="3">16APSK
32APSK</td><td colspan="4">With MS2840A-002, At 18° to 28°C, after calibration, with EVM = 1% signal
For firmware package version 12.00.00 and later, Capture OSR = 4</td></tr>
<tr><td rowspan="2">—</td><td>With 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)</td><td>With MX269017A-001
± (Accuracy of reference frequency × Carrier frequency +10) Hz
(Center Frequency: 30 MHz to 3.5 GHz)</td><td rowspan="2">—</td></tr>
<tr><td>With MX269017A-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)</td><td>—</td></tr>
<tr><td rowspan="6">Residual Vector Error</td><td rowspan="2">BPSK, QPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM</td><td colspan="4">Without MS269xA-001, With MS2840A-002, With MS2830A-002
At 18° 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</td></tr>
<tr><td><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.)</td><td><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</td><td><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</td></tr>
<tr><td rowspan="2">Π/4DQPSK</td><td colspan="4">Without MS269xA-001, With MS2840A-002, With MS2830A-002
At 18° to 28°C, after calibration, Filter type: Root Nyquist or Nyquist, when input signal within measurement level range and less than input level, 20-time averaging
For firmware package version 12.00.00 and later, Capture OSR = 4</td></tr>
<tr><td><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.)</td><td><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</td><td><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</td></tr>
<tr><td rowspan="2">MSK</td><td colspan="4">Without MS269xA-001, With MS2840A-002, With MS2830A-002
At 18° 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</td></tr>
<tr><td><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.)</td><td><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</td><td><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</td></tr>
</table>

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

MS269xA MS2850A MS2840A MS2830A

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

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

■ Amplitude Measurement

Signal Analyzer	MS269xA	MS2850A	MS2840A	MS2830A
Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –25 to +10 dBm (Preamp On)	–15 to +30 dBm (Preamp Off, or Preamp not installed)		
Tx Power Measurement Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main frame.)	At 18° 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.)		

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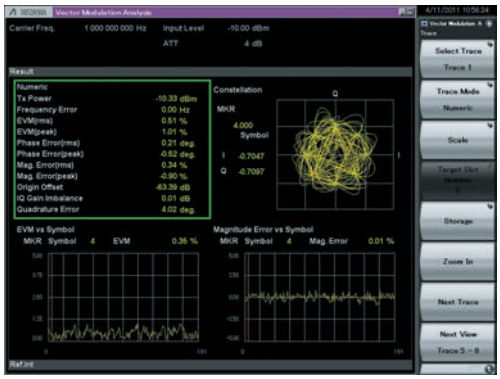
Measurement Functions (Trace Mode)

(1) Modulation Analysis

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

Measurement Functions

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



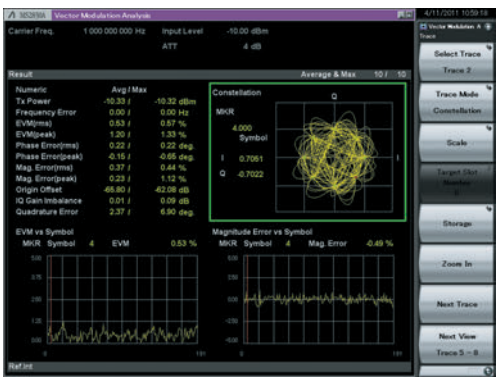
4-pane Screen (Traces 1-4)

4-pane Screen (Traces 5-8)

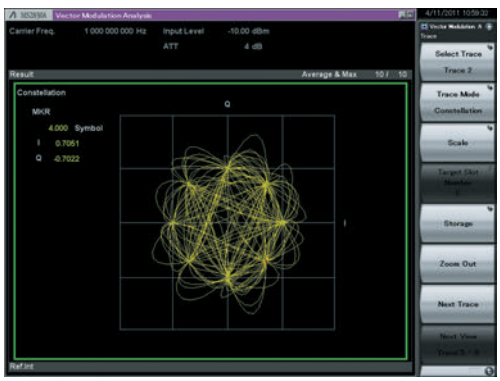
✓: Displays measured results.
—: Does not display measured results.

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

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

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Higher-Order QAM Analysis MX269017A-011 (Continued)

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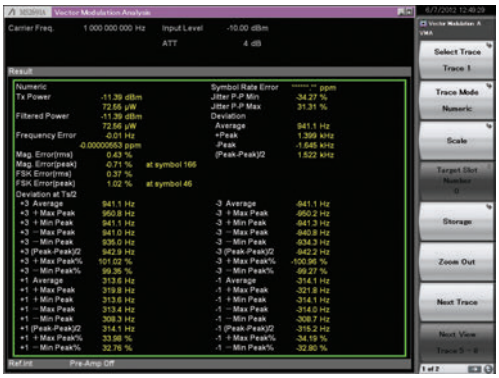
• Numeric Display

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: π/4DQPSK example

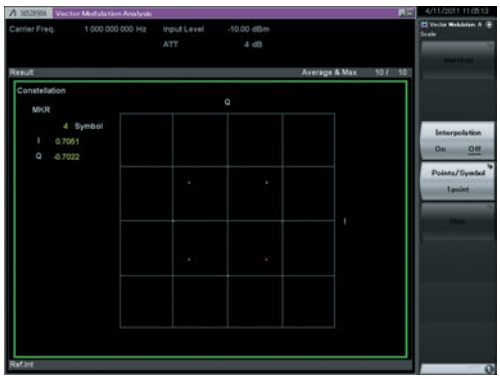


Modulation method: 4FSK example

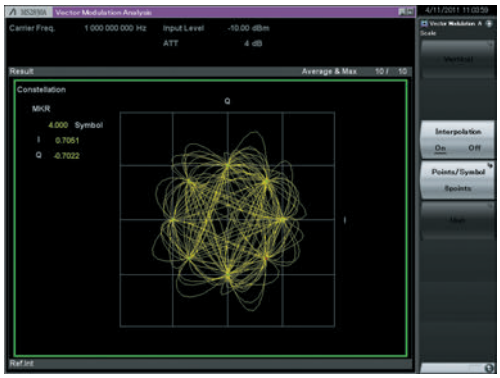
Modulation method: O-QPSK example

• Constellation

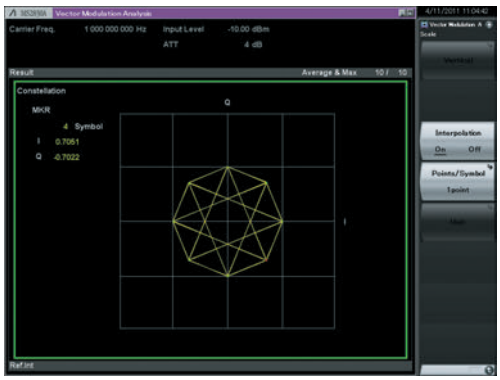
This displays the constellation for each modulation method. Interpolation On displays the state transition.



Interpolation: Off



Interpolation: On, Points/Symbol: 8points



Interpolation: On, Points/Symbol: 1 point

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• 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

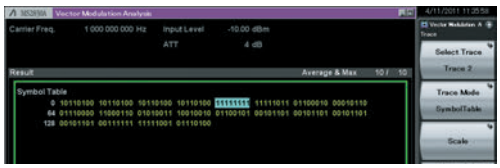
EVM vs. Symbol

Phase Error vs. Symbol

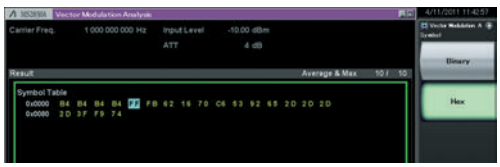
I and Q vs. Symbol

• 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.



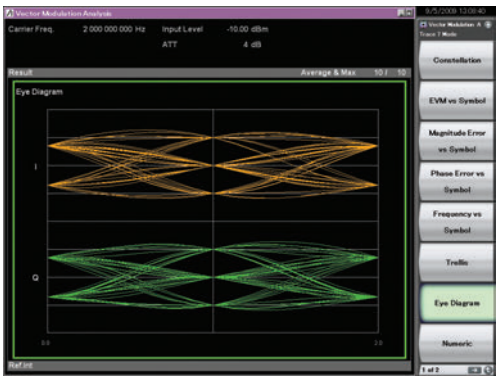
Binary example



Hexadecimal example

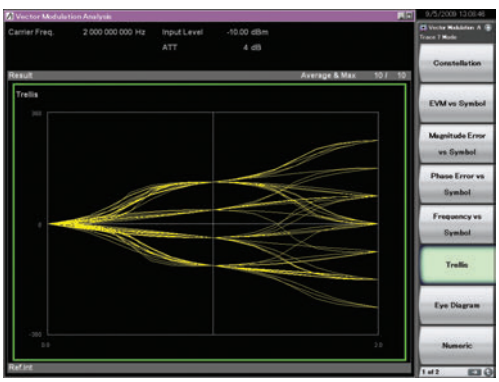
• Eye Diagram

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.

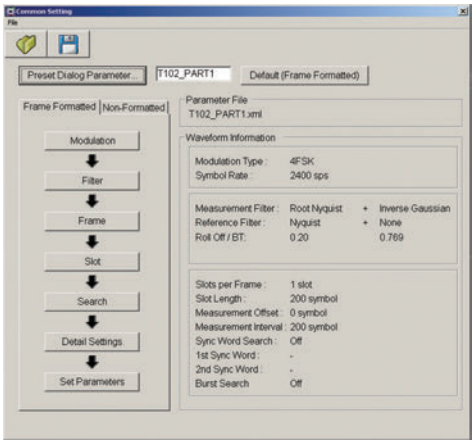


Vector Modulation Analysis Software MX269017A
APSK Analysis MX269017A-001
Higher-Order QAM Analysis MX269017A-011 (Continued)

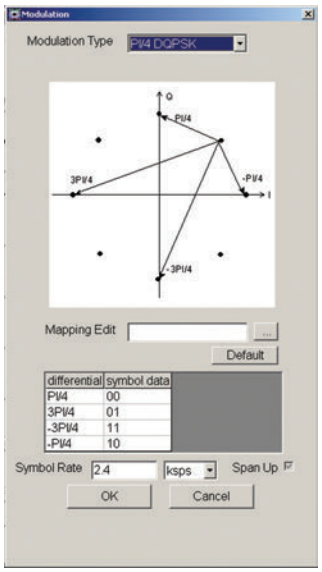
MS269xA MS2850A MS2840A MS2830A

• Graphical Setting Display

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



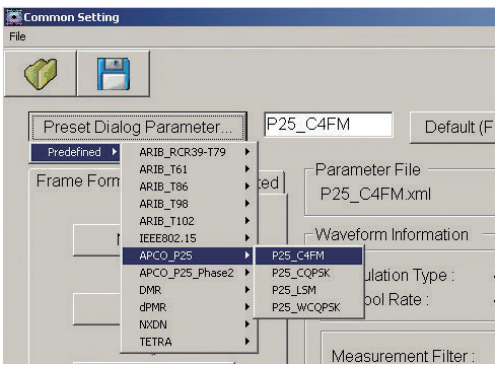
Common Setting



Modulation

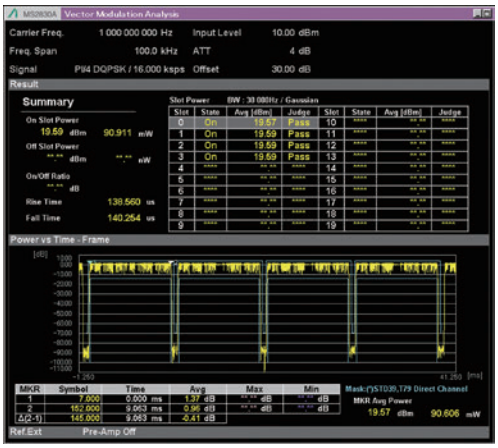
• Simple Parameter Setting Function

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

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

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• Wide Dynamic Range Function*

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

• Mask and Filter Standards Set Automatically at Preset Dialog Parameter

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

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

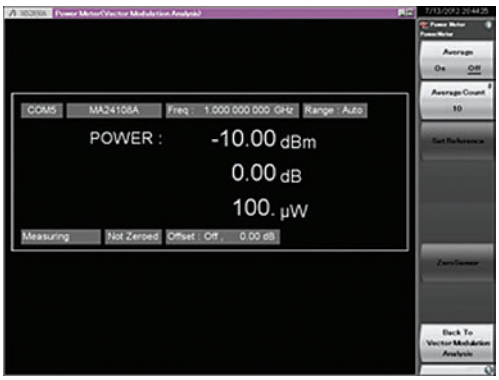
Measurement Results Example
(WDR is displayed on the screen when this function is in use.)

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

(3) Others

• Power Meter Measurement Function

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



Compatible USB Power Sensors

Model	Frequency Range	Dynamic Range
MA24104A*	600 MHz to 4 GHz	+3 to +51.76 dBm
MA24105A	350 MHz to 4 GHz	+3 to +51.76 dBm
MA24106A	50 MHz to 6 GHz	–40 to +23 dBm
MA24108A	10 MHz to 8 GHz	–40 to +20 dBm
MA24118A	10 MHz to 18 GHz	–40 to +20 dBm
MA24126A	10 MHz to 26 GHz	–40 to +20 dBm

*: MA24104A has been discontinued.

Analog Measurement Software MX269018A

MS2840A MS2830A

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

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

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

■ Supported Signal Analyzer MS2830A Functions

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

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

Analog Measurement Software Function*1			Modulation Method of Target Signal			Required Options (Refer to details of each item in Table 2.)
			FM	ΦM	AM	
Tx Tests	*RF Measurements*	Carrier Frequency and Carrier Frequency Error *RF Frequency*	✓	✓	✓	1, 2, 3, 4 are mandatory 1. Signal Analyzer (MS2830A-040/041/043*) 2. Low Phase Noise Performance (MS2830A-066) 3. Analog Measurement Software (MX269018A) 4. USB Audio (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 *RF Power*	✓	✓	✓	
		Modulation Measurement *Deviation (FM), Radian (ΦM), Depth (AM)*	✓	✓	✓	
		Result of Analyzed DCS Code *DCS Code*	✓	—	—	
	AF Measurements (Demodulation)	Demodulation Frequency *AF Frequency*	✓	✓	✓	
		Effective Level Value at Demodulation Frequency *Level*	✓	✓	✓	
		Distortion Ratio of Demodulation Frequency Distortion *Distortion, SINAD, THD*	✓	✓	✓	
		Time vs. Level, Frequency vs. Level *Graph Result*	✓	✓	✓	
		Demodulates input RF signals from analog mobile radio and outputs sound from USB Audio connector*2	✓*3	✓	✓	
		Demodulates input RF signals from analog mobile radio and outputs sound from internal speaker, headphone jack and demodulation output connector	✓*3	—	—	1 + 2 + 3 + 4 +6 Audio Analyzer (MS2830A-018)
	AF Output (Audio Generator Function)	AF Tone, DCS, White Noise (ITU-T Recommendation G.227), DTMF	✓	✓	✓	
	PTT (Push To Talk) Control		✓	✓	✓	
Rx Tests	RF Output	Modulation Signal Output (FM, ΦM, AM)	✓	✓	✓	1 + 2 + 3 + 4 +7 Analog Signal Generator (Refer to Table 3.)
		Internal Modulation Signal Source (AF Tone)	✓	✓	✓	
		Internal Modulation Signal Source (DCS)	✓	—	—	
	AF Measurements (Audio Analyzer Function)	Frequency *AF Frequency*	✓	✓	✓	1 + 2 + 3 + 4 +6 Audio Analyzer (MS2830A-018) +7 Analog Signal Generator (Refer to Table 3.)
		Effective Level Value *Level*	✓	✓	✓	
		Distortion Ratio *SINAD, THD, THD+N*	✓	✓	✓	
		Graph (Time vs. Level, Frequency vs. Level) *Graph Result*	✓	✓	✓	
	PTT (Push To Talk) Control		✓	✓	✓	

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

Analog Measurement Software MX269018A (Continued)

MS2840A MS2830A

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

	Name	Model		Note
		New	Retrofit	
Mandatory	3.6 GHz Signal Analyzer	MS2830A-040	—	9 kHz to 3.6 GHz **This option cannot be retrofitted.**
	6 GHz Signal Analyzer	MS2830A-041	—	9 kHz to 6 GHz **This option cannot be retrofitted.**
	13.5 GHz Signal Analyzer	MS2830A-043	—	9 kHz to 13.5 GHz **This option cannot be retrofitted.** **The MS2830A-066 and signal generator options cannot be installed simultaneously.**
Mandatory	Low Phase Noise Performance	MS2830A-066	—	**This option cannot be retrofitted.** It improves phase noise performance.
Mandatory	Analog Measurement Software	MX269018A		Retrofit it is supported.
Mandatory	USB Audio	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

Analog Measurement Software MX269018A (Continued)

MS2840A MS2830A

■ Supported Signal Analyzer MS2840A Functions

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

Table 4. Supported Signal Analyzer MS2840A Frequency Options

✓: Supported, — : Not supported

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

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

✓: Supported, — : Not supported

Analog Measurement Software Function*1			Modulation Method of Target Signal			Required Options (Refer to details of each item in Table 6.)
			FM	ΦM	AM	
Tx Tests	*RF Measurements*	Carrier Frequency and Carrier Frequency Error *RF Frequency*	✓	✓	✓	1. Signal Analyzer (MS2840A-040/041/044/046) 2. Analog Measurement Software (MX269018A) 3. USB Audio (A0086C) 4. Commercial loudspeaker
		Transmit Power *RF Power*	✓	✓	✓	
		Modulation Measurement *Deviation (FM), Radian (ΦM), Depth (AM)*	✓	✓	✓	
		Result of Analyzed DCS Code *DCS Code*	✓	—	—	1, 2, and 3 are mandatory
	AF Measurements (Demodulation)	Demodulation Frequency *AF Frequency*	✓	✓	✓	
		Effective Level Value at Demodulation Frequency *Level*	✓	✓	✓	
		Distortion Ratio of Demodulation Frequency Distortion *Distortion, SINAD, THD*	✓	✓	✓	
		Time vs. Level, Frequency vs. Level *Graph Result*	✓	✓	✓	
		Demodulates input RF signals from analog mobile radio and outputs sound from USB Audio connector*2	✓*3	✓	✓	
		Demodulates input RF signals from analog mobile radio and outputs sound from internal speaker*3, headphone jack*3 and demodulation output connector*3	—	—	—	Not supported by MS2840A
	AF Output (Audio Generator Function)	AF Tone, DCS, White Noise (ITU-T Recommendation G.227), DTMF	—	—	—	
	PTT (Push To Talk) Control		—	—	—	
Rx Tests	RF Output	Modulation Signal Output (FM, ΦM, AM)	✓	✓	✓	Not supported by MS2840A-044/046 1 + 2 + 3 + 5 Analog Signal Generator (Refer to Table 7.)
		Internal Modulation Signal Source (AF Tone)	✓	✓	✓	
		Internal Modulation Signal Source (DCS)	✓	—	—	
	AF Measurements (Audio Analyzer Function)	Frequency *AF Frequency*	—	—	—	Not supported by MS2840A
		Effective Level Value *Level*	—	—	—	
		Distortion Ratio *SINAD, THD, THD+N*	—	—	—	
		Graph (Time vs. Level, Frequency vs. Level) *Graph Result*	—	—	—	

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

Analog Measurement Software MX269018A (Continued)

MS2840A MS2830A

Table 6. Ordering Information for Analog Measurement Software (MS2840A)

This software cannot be installed in the MS2830A 26.5 GHz/43 GHz models, but can be installed in the MS2840A 26.5 GHz/44.5 GHz models.
And the MS2830A requires the Low Phase Noise Performance MS2830A-066 but the MS2840A does not require the Low Phase Noise Performance MS2840A-066.

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

	Name	Model		Note
		New	Retrofit	
Mandatory	3.6 GHz Signal Analyzer	MS2840A-040	—	9 kHz to 3.6 GHz **This option cannot be retrofitted.**
	6 GHz Signal Analyzer	MS2840A-041	—	9 kHz to 6 GHz **This option cannot be retrofitted.**
Mandatory	Analog Measurement Software	MX269018A		Frequency range (Tx Tests): 100 kHz to 2.7 GHz (At Wide Band FM measurement: 10 MHz to 2.7 GHz) Retrofit is supported.
Mandatory	USB Audio	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

Analog Measurement Software MX269018A (Continued)

MS2840A MS2830A

Specifications

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

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

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

Analog Measurement Software MX269018A (Continued)

MS2840A MS2830A

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

Analog Signal Generator Option		MS2840A-029/129/088/188	MS2830A-029/088/188
Max. Reverse Input		0 Vdc (max.) +18 dBm (<20 MHz), +30 dBm (≥20 MHz)	
Function/Performance		The following specifications (see MS2840A catalog) are added to the specifications when the MS2840A-020/021 and MS2840A-022 are installed	The following specifications (see MS2830A catalog) are added to the specifications when the MS2830A-020/021 and MS2830A-022 are installed
	Frequency Setting Range	100 kHz to 3000 MHz	100 kHz to 3000 MHz
	Frequency Setting Resolution	1 Hz	
	Output Setting Level	–136 to +15 dBm (Rx frequency > 25 MHz) –136 to –3 dBm (Rx frequency ≤ 25 MHz)	
	Output Level Accuracy	18° to 28°C, CW MS2830A-029/088/188 MS2840A-029/129/088/188	
	Arbitrary Signal Generator	Available when the MS2830A-020, 021 or 189 (Vector Signal Generator) is installed	

	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

Analog Measurement Software MX269018A (Continued)

MS2840A MS2830A

Audio Analyzer Option			MS2830A-018/118
Audio Analyzer Function			The specifications for single tone measurement are listed below
	Measurement Function		Amplitude, Frequency, THD, THD+N, SINAD
	Connection Type		Balanced: 1/4-inch phone jack (3-pole, Φ6.3 mm) Unbalanced: BNC-J
	Impedance		Balanced: 200 kΩ (AC coupled, nom.) Unbalanced: 100 kΩ (AC coupled, nom.)
	Frequency Measurement Range		20 Hz to 50 kHz
	Level Measurement Range		1 mV rms to 25 V rms (30 V rms, max.)
	Input Range Setting		50 mV peak, 500 mV peak, 5 V peak, 50 V peak
	Level Accuracy		18° to 28°C ±0.4 dB (20 Hz ≤ f ≤ 25 kHz) ±3.0 dB (25 kHz < f ≤50 kHz)
	THD + N (Total Harmonic Distortion + Noise)		At 1 kHz, 1.4 V rms, Band: 20 Hz to 20 kHz, Range: 5 Vp-p, 18° to 28°C <–60 dB <–80 dB (nom.)
	Audio Filter	Low-pass	Off, 3, 15, 20, 30, 50 kHz
		High-pass	Off, 20, 50, 100, 300, 400 Hz, 30 kHz
		Bandpass (Weighting filter)	Off, CCITT, C-Message, CCIR468, CCIR-ARM, A-Weighting
Audio Generator Function			The specifications for all single-tone measurements except White Noise (through ITU-T G.227 filter)
	Connection Type		Balanced: 1/4-inch phone jack (3-pole, Φ6.3 mm) Unbalanced: BNC-J
	Interface		Balanced: 100 Ω/600 Ω (AC coupled, nom.) Unbalanced: 50 Ω/600 Ω (AC coupled, nom.)
	Output Waveform		Single tone, multi-tone: Tone × 3, DCS, White noise (ITU-T G.227), DTMF
	Guaranteed Frequency Range		20 Hz to 25 kHz
	Frequency Setting Range		10 Hz to 50 kHz
	Frequency Resolution		0.01 Hz
	Output Level Range		Using Sub Supply/Audio Revision 2*1 Single tone Open circuit voltage (≥100kΩ termination): Balanced: Off, 1 mV rms to 12.4 V rms Open circuit voltage (≥100kΩ termination): Unbalanced: Off, 1 mV rms to 6.2 V rms 600Ω termination*: Balanced: Off, –63 dBm (equivalent to 0.5 mV rms) to +18 dBm (equivalent to 6.2 V rms) 600Ω termination*: Unbalanced: Off, –63 dBm (equivalent to 0.5 mV rms) to +12 dBm (equivalent to 3.1 V rms) White noise (through ITU-T G.227 filter) Open circuit voltage (≥100kΩ termination): Balanced: Off, 1.545 mV rms to 3.083 V rms (nom.) Open circuit voltage (≥100kΩ termination): Unbalanced: Off, 1.545 mV rms to 1.545 V rms (nom.) 600Ω termination*: Balanced: Off, –60 dBm (equivalent to 0.774 mV rms) to +6 dBm (equivalent to 1.545 V rms) (nom.) 600Ω termination*: Unbalanced: Off, –60 dBm (equivalent to 0.774 mV rms) to 0 dBm (equivalent to 0.774 V rms) (nom.) *: Output Impedance = 600 Ω, and Output Impedance Reference = 600 Ω
	Output Level Resolution		Single tone: 1 mV (350 mV rms < Output Level ≤ 6.2 V rms) 100 µV (35 mV rms < Output Level ≤ 350 mV rms) 10 µV (Output Level ≤ 35 mV rms) White noise (through ITU-T G.227 filter): 0.01 dB (nom.)
	Level Accuracy		Single tone: ±0.3 dB (1 kHz, 100 kΩ termination, 18° to 28°C) White noise (through ITU-T G.227 filter): ±3 dB (nom.)
	Maximum Output Currency		100 mA (nominal, no short circuit)
	THD + N (Total Harmonic Distortion + Noise)		At 1 kHz, 0.7 V rms, Band: 20 Hz to 25 kHz, 100 kΩ termination, 18° to 28°C <–60 dB <–80 dB (nom.)
Other Function			
	Demodulation Output (FM only)*2	Connector Type	BNC-J
		Demodulation Output Level	–10 dBm ±2 dB (Frequency deviation: 3.5 kHz, 600 Ω)
		Demodulation Output Impedance	600 Ω
		Sound Monitor	Internal speaker or 3.5 mm phone jack (2-pole, monaural)
	Crosstalk		Crosstalk from Audio Generator to Audio Analyzer >80 dB
	PTT (Push To Talk) Control		Banana jack (Φ4.0 mm, 30 V, 500 mA max.)
	General Input/Output (Audio Function)		Connector: D-Sub 15 pin (jack) Function: Open Collector × 1 (5 V, 100 mA max.), TTL Output × 2, TTL Input × 2

*1: Sub Supply/Audio Revision is the MS2830A-018/118 printed-circuit board version.
<Sub Supply/Audio Revision Confirmation Method>
(1) MS2830A units with Sub Supply/Audio Revision 2 have a sticker marked 'A1' next to the main-frame serial number.
(2) The MS2830A Sub Supply/Audio Revision can be confirmed as follows:
Press [System Config] → [F5] System Information → [F4] Board Revision View to list the Board Revisions; check the displayed Sub Supply/Audio Revision number. (It may be either 1 or 2.)

*2: For Tx test of analog mobile radio. Wide Band FM measurements not supported.

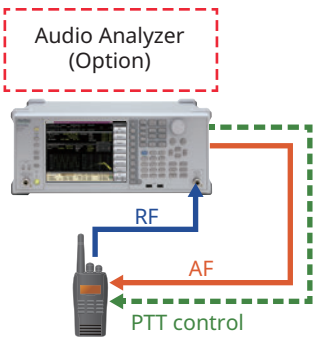
Analog Measurement Software MX269018A (Continued)

MS2840A MS2830A

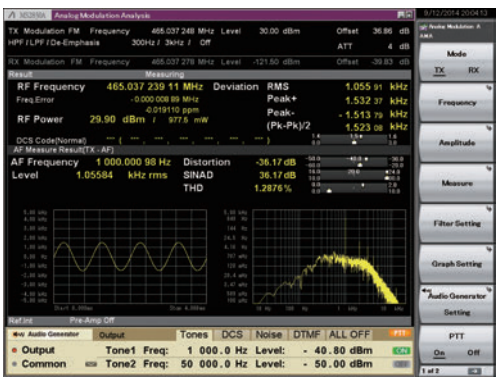
Tx Tests

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

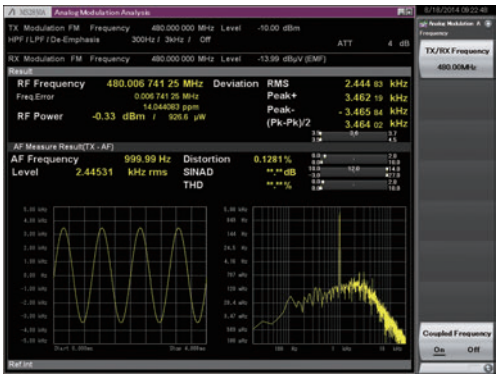
Combining the MS2830A with the audio analyzer option supports tuning of the AF signal output (AF signal input to the analog mobile radio) and testing of the radio RF transmission characteristics by monitoring at one screen.
As well as outputting the AF signal simultaneously as up to three tones, tone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



Tx Characteristics Test Setup



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



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

Rx Tests

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

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

<About Internal Modulation Signal Source>

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

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

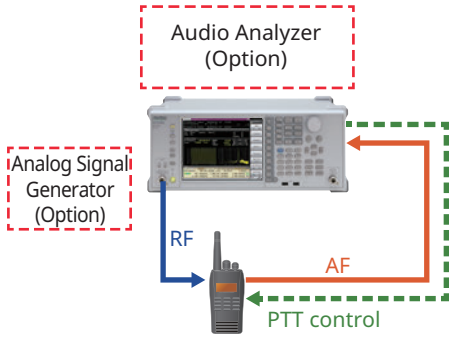
*1: Two when Audio Analyzer option not installed
*2: Output of a Wave audio format signal can also be set with the internal modulation signal source. An RF signal, such as DTMF (Dual Tone Multiple Frequency), can be output.
The following limitations apply:

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

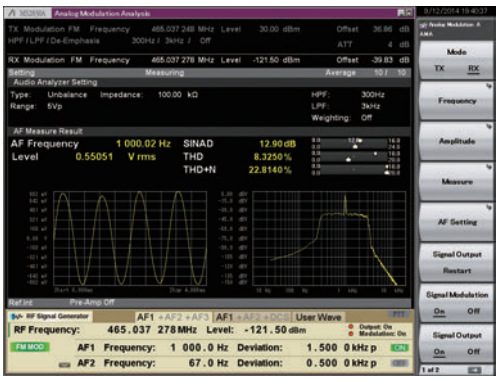
Note: Sometimes, the Wave audio format file may not be loaded even if it meets the above specifications.

Analog Measurement Software MX269018A (Continued)

MS2840A MS2830A



Rx Sensitivity Test Setup



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

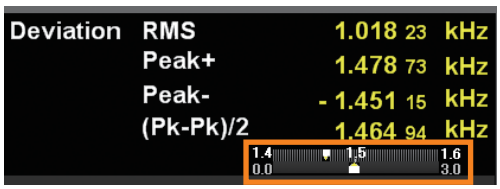
Example of RF Output Measurement Screen
(with Analog Signal Generator)

Using Meter Displays

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

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

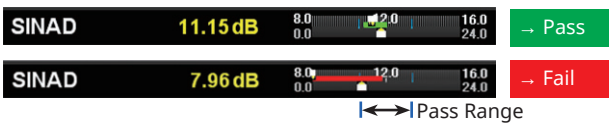
SINAD Meter



Frequency Deviation Meter (FM only)

- **Pass/Fail Displays**

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



Demodulated Voice Output

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

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

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

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

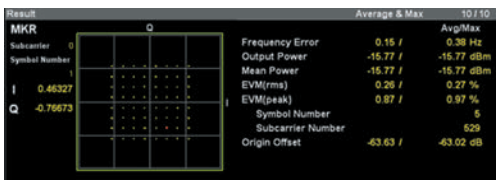
Measurement Functions

• 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.

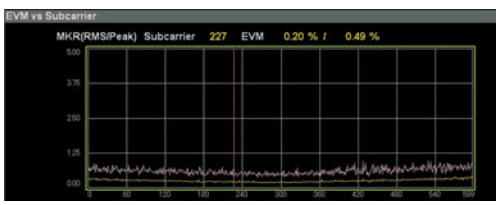
• Frequency Error/Transmit Power/EVM

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



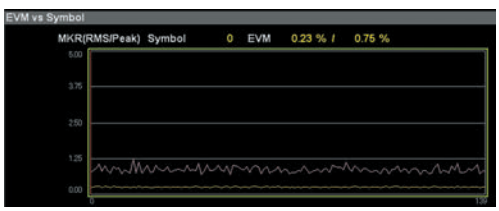
• EVM vs. Subcarrier

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



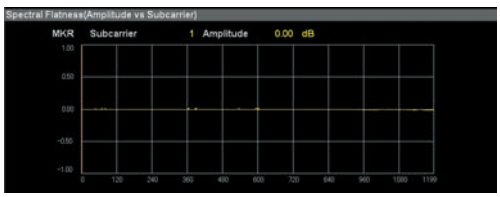
• EVM vs. Symbol

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



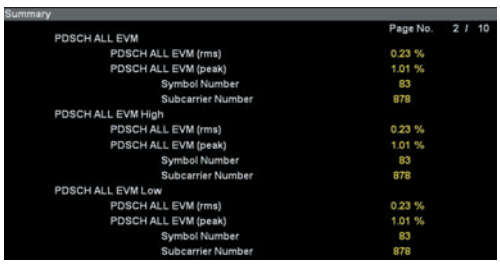
• Spectral Flatness

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



• Summary Display

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



PDSCH EVM Display

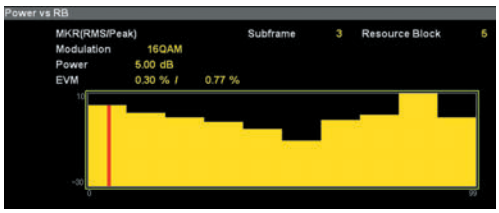
Power vs. Slot

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

MS269xA MS2850A MS2830A

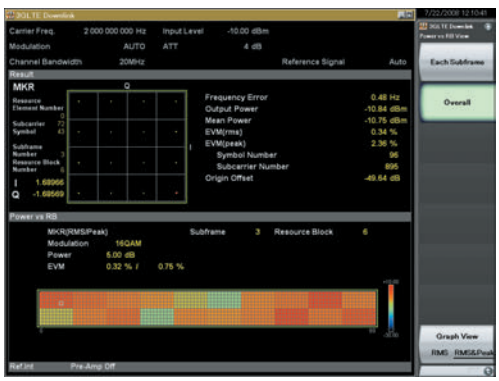
• Power vs. Resource Block

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



Specified Subframe

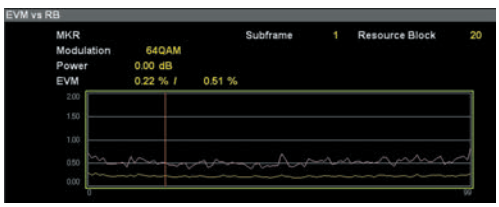
Power Display for Each Resource Block



Constellation for Specified Resource Block

• EVM vs. Resource Block

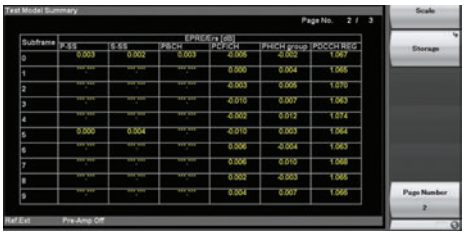
This displays a graph of the EVM distribution for each resource block in a specified subframe segment, making it easy to check resource-block dependent EVM deterioration.



• Test Model Summary Display

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

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



Test Model Summary

• MIMO Summary Display

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

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

MS269xA MS2850A MS2830A

• Power vs. Time Function (MX269022A and MS269xA)

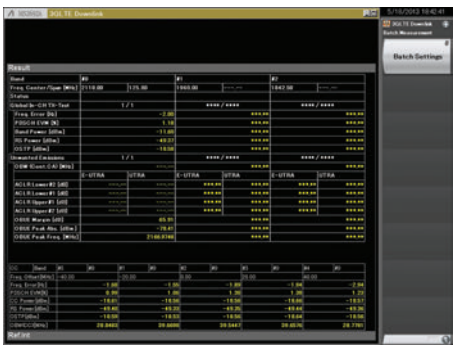
Following numeric result is displayed in the upper part of the screen and displays time variation of signal in 1 Frame section in the lower part of screen.

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

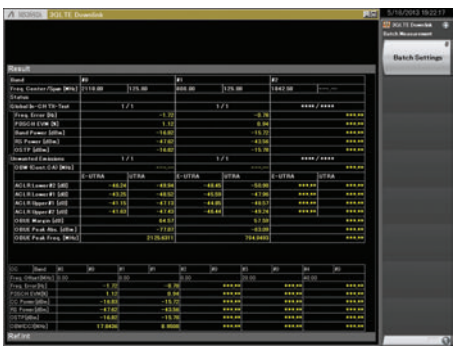
• Batch Measurement Function

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

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



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

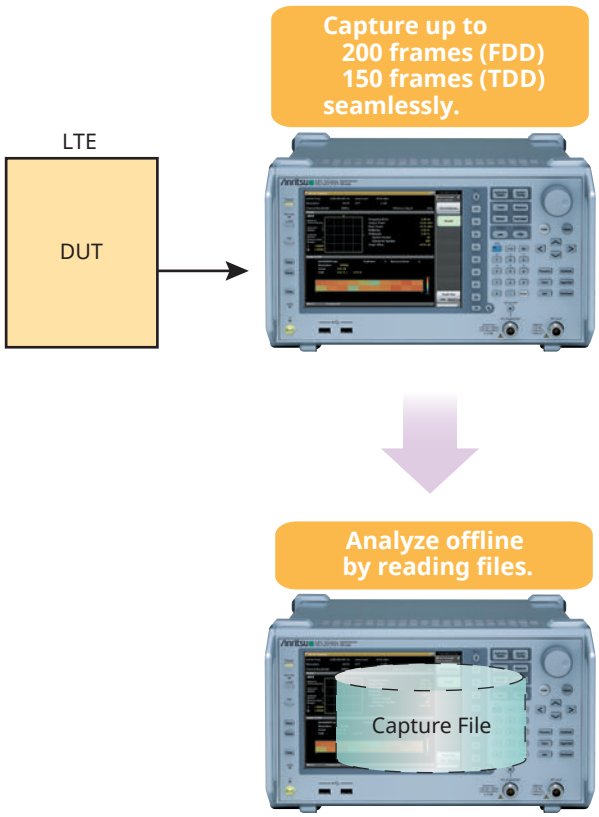


Batch Measurement Screen
(Measurement example for carriers in 2 bands)

• Replay Function for Troubleshooting Faults

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

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



Example of R&D use

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

Example of production line use

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

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

MS269xA MS2850A MS2830A

Specifications

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

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

Signal Analyzer		MS269xA	MS2830A MS2850A
Common Specifications	Channel Bandwidth	1.4, 3, 5, 10, 15, 20 MHz	
	Target Signals	Downlink	
	Capture Time	Auto: 1 Frame Manual: 1 to 200 Frame	
Modulation/ Frequency Measurement	Measurement Frequency Range	600 MHz to 4 GHz	MS2830A-041/043/044/045: 600 MHz to 4 GHz MS2830A-040: 600 MHz to 3.6 GHz MS2850A: 600 MHz to 4 GHz
	Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –15 to +10 dBm (Preamp On)	
	Carrier Frequency Accuracy	After CAL execution at 18° 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° 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° to 28°C, the input signal is within the measurement level range and below the value set in Input Level.	
		Excluding the Batch Measurement when the MS269xA-004 is installed. ±0.6 dB (at Preamp Off, or Preamp not installed.) ±1.1 dB (at Preamp On)	MS2830A: ±0.6 dB (at Preamp Off or Preamp not installed) MS2850A: ±0.6 dB (at Preamp Off or Preamp not installed) ±1.1 dB (at Preamp On)
Waveform Display		Provides functions for displaying waveforms below. Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Power vs. Resource Block, EVM vs. Resource Block, Spectral Flatness	
Adjacent Channel Leakage Power Measurement	Measurement Method	Executes the adjacent channel power measurement function of the Spectrum Analyzer or Signal Analyzer.	
Occupied Bandwidth Measurement	Measurement Method	Executes the occupied bandwidth measurement function of the Spectrum Analyzer or Signal Analyzer.	
Channel Power Measurement	Measurement Method	Executes the channel power measurement function of the Spectrum Analyzer or Signal Analyzer.	
Spectrum Emission Mask Measurement	Measurement Method	Executes the spectrum emission mask measurement function of the Spectrum Analyzer.	
Digitize Function	Function Overview	Capable of outputting captured waveform data to internal or external storage device.	
	Waveform Data	Format: I, Q (32 bit floating point binary format) Level: Assumes as $\sqrt{(I^2 + Q^2)} = 1$ for 0 dBm input Level accuracy: Same as the absolute amplitude accuracy and in-band frequency characteristics of the signal analyzer.	
Replay Function	Function Overview	Analyzes traces of saved waveform data Format: I, Q (32 bit floating point binary format) Sampling rate: 50 MHz	

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

MS269xA MS2850A MS2830A

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

Signal Analyzer		MS269xA	MS2830A MS2850A
Common Specifications	Channel Bandwidth	1.4, 3, 5, 10, 15, 20 MHz	
	Target Signals	LTE TDD Downlink	
	Capture Time	Auto: 5 frame Manual: 5 to 150 frame	
Modulation/ Frequency Measurement	Measurement Frequency Range	600 MHz to 4 GHz	MS2830A-041/043/044/045: 600 MHz to 4 GHz MS2830A-040: 600 MHz to 3.6 GHz MS2850A: 600 MHz to 4 GHz
	Measurement Level Range	–15 to +30 dBm (Preamp Off, or Preamp not installed) –30 to +10 dBm (Preamp On)	
	Carrier Frequency Accuracy	After CAL execution at 18° to 28°C For a signal of EVM = 1% When Downlink 10 Subframe is the measurement target	
		± (Accuracy of reference frequency × Carrier frequency + 3) Hz (Excluding the Batch Measurement when MS269xA-004 is installed)	MS2830A (MS2830A-078 not installed) ± (Accuracy of reference frequency × carrier frequency + 3.5) Hz (center frequency: 600 MHz to 2700 MHz) ± (Acccuracy of reference frequency × carrier frequency + 8.0) Hz (center frequency: 2700 MHz to 4000 MHz) MS2830A (At CC of center frequency when MS2830A-078 installed. At input level of –4 dBm when MS2830A-045 installed.), MS2850A: ± (Acccuracy of reference frequency × carrier frequency + 4.0) Hz (center frequency: 600 MHz to 2700 MHz) ± (Acccuracy of reference frequency × carrier frequency + 8.0) Hz (center frequency: 2700 MHz to 4000 MHz)
	Residual Vector Error	After CAL execution at 18° to 28°C When Downlink 10 Subframe is the measurement target	
		<1.0% (rms) (Excluding the Batch Measurement when MS269xA-078 is not installed or MS269xA-004 is installed) <1.3% (rms) (In the CC of the center frequency when MS269xA-078 is installed)	MS2830A: <1.3% (rms) (With MS2830A-078 not installed, At input level of –4 dBm when MS2830A-045 installed) <1.3% rms) (At CC of center frequency when MS2830A-078 installed, At input level of –4 dBm when MS2830A-045 installed) MS2850A: <1.3% (rms)
Amplitude Measurement	Measurement Level Range	–15 to +30 dBm (Preamp Off or Preamp not installed) –30 to +10 dBm (Preamp On)	MS2830A: –15 to +30 dBm (Preamp Off or Preamp not installed) MS2850A: –15 to +30 dBm (Preamp Off or Preamp not installed) –30 to +10 dBm (Preamp On)
	Tx Power Measurement Accuracy (Found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main frame)	At 18° to 28°C, After calibration, Input attenuator ≥10 dB, With input signal within measurement level range and below value set at Input Level	
		Excluding batch measurement when MS269xA-004 installed ±0.6 dB (at Preamp Off or Preamp not installed) ±1.1 dB (at Preamp On)	MS2830A: ±0.6 dB (at Preamp Off or Preamp not installed) MS2850A: ±0.6 dB (at Preamp Off or Preamp not installed) ±1.1 dB (at Preamp On)
Waveform Display		Provides functions for displaying waveforms below. Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Power vs. Resource Block, EVM vs. Resource Block, Spectral Flatness	
Adjacent Channel Leakage Power Measurement	Measurement Method	Executes the adjacent channel power measurement function of the Spectrum Analyzer or Signal Analyzer.	
Occupied Bandwidth Measurement	Measurement Method	Executes the occupied bandwidth measurement function of the Spectrum Analyzer or Signal Analyzer.	
Channel Power Measurement	Measurement Method	Executes the channel power measurement function of the Spectrum Analyzer or Signal Analyzer.	
Spectrum Emission Mask Measurement	Measurement Method	Executes the spectrum emission mask measurement function of the Spectrum Analyzer.	
Digitize Function	Function Overview	Capable of outputting captured waveform data to internal or external storage device.	
	Waveform Data	Format: I,Q (32 bit floating point binary format) Level: Assumes as $\sqrt{(I^2 + Q^2)} = 1$ for 0 dBm input Level accuracy: Same as the absolute amplitude accuracy and in-band frequency characteristics of the signal analyzer.	
Replay Function	Function Overview	Analyzes traces of saved waveform data Format: I, Q (32 bit floating point binary format) Sampling rate: 50 MHz	
Power vs. Time	Function Overview	Provides measurements for Transmitter OFF Power, Time Mask, and Transmitter Transient Period. This function can be used only in the MS269xA series.	
	Dynamic Range	121.4 dB (nom.)*1, *2	

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

LTE Uplink Measurement Software MX269021A
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)

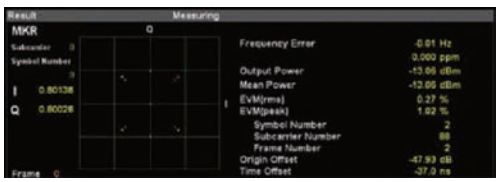
MS269xA MS2850A MS2830A

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)

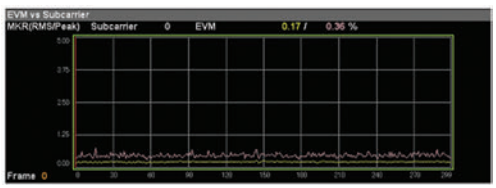


- **EVM vs. Subcarrier**

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**

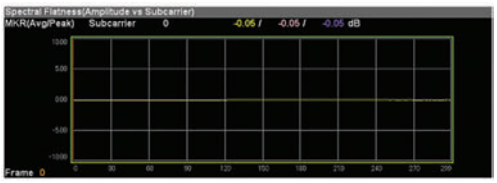
This displays the EVM vs. Symbol graph (horizontal axis = Symbol, vertical axis = EVM) at the bottom of the screen.
It is useful for checking characteristics in the time direction and faults at a specific symbol.

- **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).

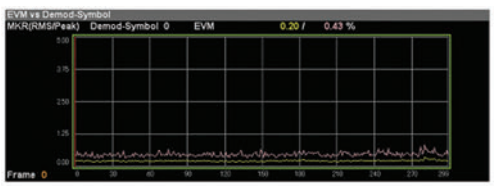


- **Time Base EVM**

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

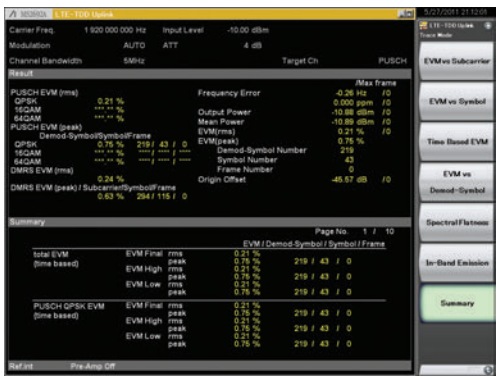
The following two types of graph can be selected and displayed at the bottom of the screen by switching In-Band Emission View.

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.

• Summary Display Function

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

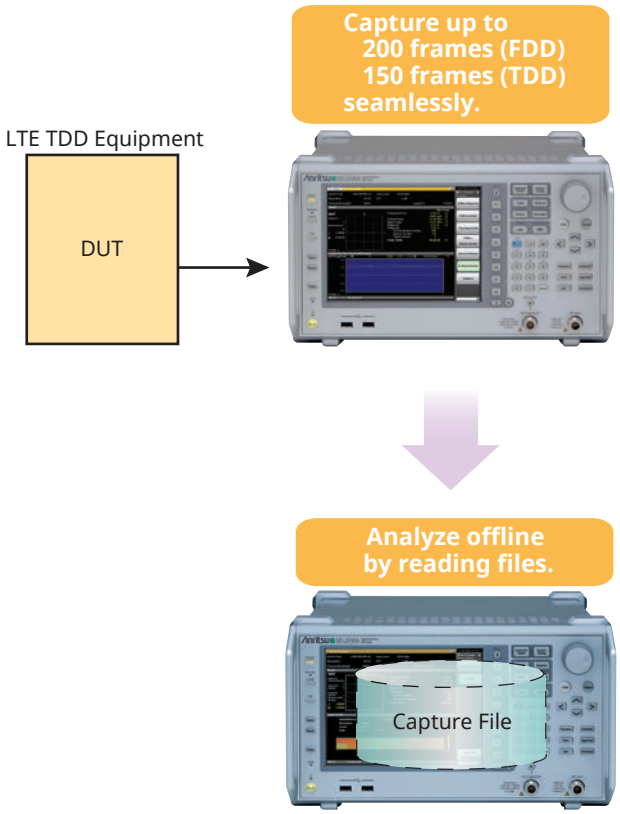


Page 1: List of EVM and Power for Each Channel Uplink (PUSCH) (MX269023A)

Replay Function for Troubleshooting Faults

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

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



Example of R&D use

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

Example of production line use

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

LTE Uplink Measurement Software MX269021A
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° to 28°C. For a signal of EVM = 1%. For Measurement Interval = 10 Subframe	
		± (Accuracy of reference frequency × Carrier frequency + 8) Hz	± (Accuracy of reference frequency × Carrier frequency + 8) Hz (At the input level is –4 dBm when MS2830A-045 is installed)
	Residual Vector Error	After CAL execution at 18° 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° 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.	

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
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° 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° 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° to 28°C after calibration when input attenuator = ≥10 dB, the measured input signal is within the measurement level range and below the value set at Input Level when Span = 31.25 MHz.	
		±0.6 dB (Preamp Off or Preamp not installed) ±1.1 dB (Preamp On)	MS2830A: ±0.6 dB (Preamp Off or Preamp not installed) MS2850A: ±0.6 dB (Preamp Off or Preamp not installed) ±1.1 dB (Preamp On)
Measurement Target Channel Signal		LTE Selected: • PUSCH • PUCCH • PRACH LTE-Advanced Selected: • PUSCH • PUCCH Measures and displays the result per channel. The channel setting is mutually exclusive.	
Waveform Display		Provides functions for displaying waveforms below. Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Time Based EVM, EVM vs. Demod-Symbol, Spectral Flatness, In-Band Emission, Power vs. Time	
Adjacent Channel Leakage Power Measurement	Measurement Method	Executes the adjacent channel power measurement function of the Spectrum Analyzer or Signal Analyzer.	
Occupied Bandwidth Measurement	Measurement Method	Executes the occupied bandwidth measurement function of the Spectrum Analyzer or Signal Analyzer.	
Channel Power Measurement	Measurement Method	Executes the channel power measurement function of the Spectrum Analyzer or Signal Analyzer.	
Spectrum Emission Mask Measurement	Measurement Method	Executes the spectrum emission mask measurement function of the Spectrum Analyzer.	
Digitize Function	Function Overview	Capable of outputting captured waveform data to internal or external storage device.	
	Waveform Data	Format: I, Q (32 bit floating point binary format) Level: Assumes as $\sqrt{(I^2 + Q^2)} = 1$ for 0 dBm input Level accuracy: Same as the absolute amplitude accuracy and in-band frequency characteristics of the signal analyzer.	
Replay Function		Analyzes traces of saved waveform data Format: I, Q (32 bit floating point binary format) Sampling rate: The condition "When Span = 62.5 MHz and 125 MHz" is applied when MX269021A-001 is installed. 50 MHz (when Span = 31.25 MHz) 100 MHz (when Span = 62.5 MHz) 200 MHz (when Span = 125 MHz)	
Component Carrier (CC) Allocated Condition (Using MX269021A-001)	Maximum Number of CCs	2	
	Channel Bandwidth of Each CC	1.4, 3, 5, 10, 15, 20 MHz	
	Frequency Offset Range of Each CC	– (Span – Channel bandwidth of each CC)/2 to (Span – Channel bandwidth of each CC)/2	

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, ρ, 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

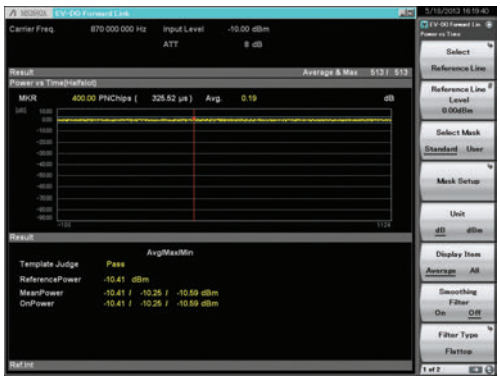
• Power vs. Time Graph

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° to 28°C, after calibration, EVM = 1% signal ± (Accuracy of reference frequency × Carrier frequency + 10) Hz	
	Residual Vector Error	At 18° to 28°C, after calibration	
		<1.0% (rms)	<1.5% (rms)
	Waveform Quality (ρ)	>0.99990	>0.99978
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° 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 Measurement	Power Accuracy	At 18° 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 • 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	
		Adjacent Channel Leakage Power, Occupied Bandwidth, Channel Power, Spectrum Emission Mask	
	MX269026A	Modulation Analysis • 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*1 (saves*2 signals for later modulation analysis troubleshooting)

∗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

Evaluation of Tx Characteristics for WLAN Modulation Accuracy (EVM)

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

■ Measurement Signals

MX269028A

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

Measures both continuous and burst signals.

MX269028A-001/002

- IEEE 802.11ac (VHT)

Measures burst signals only.

■ Capture & Replay Function*1

When faults are detected, this function captures*2 on-site signals to internal/external hard disk for later troubleshooting using analysis functions.

∗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

■ 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.

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

MS269xA MS2830A

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

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

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

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

MS269xA MS2830A

Common Setup Parameter

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

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

Specifications

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

WLAN (802.11) Measurement software MX269028A

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

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

MS269xA MS2830A

Signal Analyzer		MS269xA	MS2830A
Standard		IEEE 802.11p	
Modulation/ Frequency Measurements	Frequency Range	5835 MHz to 5925 MHz (channel No. 167 to 185) 300 MHz to 862 MHz	
	Measurement Level Range	5835 MHz to 5925 MHz (Channel No. 167 to 185): –15 to +30 dBm (MS269xA Preamp Off, or Preamp not installed) –12 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 not installed) –6 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 installed) –30 to +10 dBm (Preamp On) 300 MHz to 862 MHz: –15 to +30 dBm (MS269xA Preamp Off, or Preamp not installed) –15 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 not installed) –9 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 installed) –30 to +10 dBm (Preamp On)	
Modulation/ Frequency Measurements	Carrier Frequency Accuracy	5 MHz channel: Burst length ≥1 ms, 10 MHz channel: Burst length ≥500 µs 20 MHz channel: Burst length ≥250 µs ± (Accuracy of reference frequency × Carrier frequency + 16) Hz	
	Residual Vector Error	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal	
		5835 MHz to 5925 MHz (channel No. 167 to 185): ≤1.5% (rms) 300 MHz to 862 MHz: ≤0.5% (rms)	5835 MHz to 5925 MHz (channel No. 167 to 185): ≤1.6% (rms) (Preamp Off) 300 MHz to 862 MHz: ≤0.8% (rms) (Preamp Off)
	Center Frequency Leakage Floor	≤–50 dBc (nom.)	
Amplitude Measurement	Tx Power Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main 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 µs ± (Accuracy of reference frequency × Carrier frequency + 16) Hz	
	Residual Vector Error	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal	
		≤1.5% (rms)	≤1.6% (rms) (Preamp Off)
	Center Frequency Leakage Floor	≤–50 dBc (nom.)	
Amplitude Measurement	Tx Power Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main 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 µs ± (Accuracy of reference frequency × Carrier frequency + 21) Hz	
	Residual Vector Error	Specify filter with same characteristics as used for measurement signal, Burst signal	
		≤1.2% (rms)	≤1.9% (rms) (Preamp Off)
	Center Frequency Leakage Floor	≤–50 dBc (nom.)	
Amplitude Measurement	Tx Power Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main 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 µs ± (Accuracy of reference frequency × Carrier frequency + 13) Hz	
	Residual Vector Error	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signals	
		≤1.2% (rms)	≤1.2% (rms) (Preamp Off)
	Center Frequency Leakage Floor	≤–50 dBc (nom.)	
Amplitude Measurement	Tx Power Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main 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
802.11ac (80 MHz) Measurement Software MX269028A-001
802.11ac (160 MHz) Measurement Software MX269028A-002 (Continued)

MS269xA MS2830A

Signal Analyzer		MS269xA	MS2830A
Standard		IEEE 802.11j	
Modulation/ Frequency Measurements	Frequency Range	4920 MHz to 4980 MHz	
	Measurement Level Range	–15 to +30 dBm (MS269xA Preamp Off, or Preamp not installed) –12 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 not installed) –6 to +30 dBm (MS2830A Preamp Off, or Preamp not installed, MS2830A-045 installed) –30 to +10 dBm (Preamp On)	
	Carrier Frequency Accuracy	Burst length ≥1 ms (Channel Bandwidth: 5 MHz), or Burst length ≥500 µs (Channel Bandwidth: 10 MHz), Burst length ≥250 µs (Channel Bandwidth: 20 MHz) ± (Accuracy of reference frequency × Carrier frequency + 16) Hz	
Modulation/ Frequency Measurements	Residual Vector Error	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal ≤1.5% (rms)	≤1.6% (rms) (Preamp Off)
	Center Frequency Leakage Floor	≤–50 dBc (nom.)	
Amplitude Measurement	Tx Power Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main 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 µs ± (Accuracy of reference frequency × Carrier frequency + 16) Hz	
		40 MHz channel	Burst length ≥250 µs ± (Accuracy of reference frequency × Carrier frequency + 102) Hz	
		80 MHz channel	Burst length ≥250 µs ± (Accuracy of reference frequency × Carrier frequency + 102) Hz	
		160 MHz channel	Burst length ≥250 µs ± (Accuracy of reference frequency × Carrier frequency + 102) Hz	—
	Residual Vector Error	20 MHz channel	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal ≤0.7% (rms) (Preamp Off) ≤0.9% (rms) (Preamp On)	≤0.9% (rms) (Preamp Off)
		40 MHz channel	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal ≤0.8% (rms) (Preamp Off) ≤1.0% (rms) (Preamp On)	≤1.0% (rms) (Preamp Off)
		80 MHz channel	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal ≤0.9% (rms) (Preamp Off) ≤1.1% (rms) (Preamp On)	≤1.1% (rms) (Preamp Off)
		160 MHz channel	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal ≤1.5% (rms) (Preamp Off) ≤1.7% (rms) (Preamp On)	—
	Center Frequency Leakage Floor		≤–50 dBc (nom.)	
Amplitude Measurement	Tx Power Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main frame.)	20 MHz channel	Input attenuator ≥10 dB ±0.6 dB (Preamp Off, or Preamp not installed) ±1.1 dB (Preamp On)	±1.9 dB (Preamp Off, or Preamp not installed)
		40 MHz channel	Input attenuator ≥10 dB ±0.7 dB (Preamp Off, or Preamp not installed) ±1.1 dB (Preamp On)	±2.0 dB (Preamp Off, or Preamp not installed)
		80 MHz channel	Input attenuator ≥10 dB ±1.2 dB (Preamp Off, or Preamp not installed) ±1.6 dB (Preamp On)	±3.2 dB (Preamp Off, or Preamp not installed)
		160 MHz channel	Input attenuator ≥10 dB ±1.3 dB (Preamp Off, or Preamp not installed) ±1.7 dB (Preamp On)	—

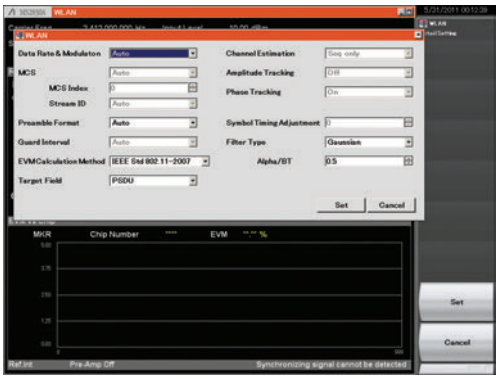
WLAN (802.11) Measurement Software MX269028A
802.11ac (80 MHz) Measurement Software MX269028A-001
802.11ac (160 MHz) Measurement Software MX269028A-002 (Continued)

MS269xA MS2830A

Measurement Functions

• Parameter Setting

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



Modulation Analysis Function

• Summary

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

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

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

MX269028A-001/002 (IEEE 802.11ac)

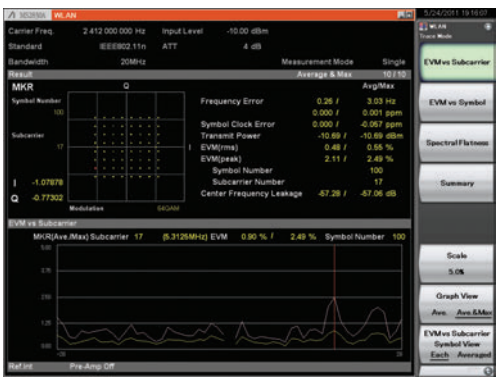
- Frequency Error
- Symbol Clock Error
- Transmit Power
- EVM [rms] (Data EVM, Pilot EVM, L-SIG EVM (rms), VHT-SIG-A EVM (rms), VHT-SIG-B EVM (rms))
- EVM [Peak] (Symbol Number, Subcarrier Number)
- Quadrature Error*
- IQ Gain Imbalance*
- Center Frequency Leakage
- Detect Parameter (MCS Index, Stream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

*: Exclude Channel Bandwidth 160 MHz setting

• Constellation/Numerical Result

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

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



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

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

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

MS269xA MS2830A

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

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

MX269028A-001/002 (IEEE 802.11ac)

Measurement Signal: IEEE 802.11ac

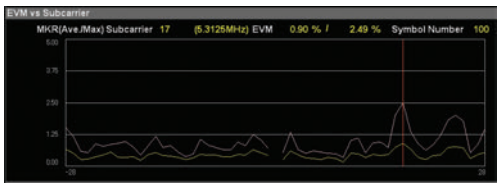
- Frequency Error
- Symbol Clock Error
- Transmit Power
- EVM (rms/Peak)
- Center Frequency Leakage

• EVM vs. Subcarrier

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

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

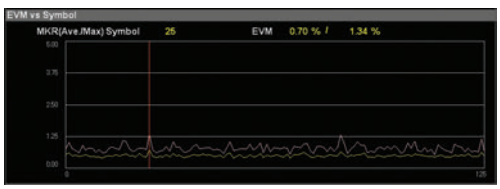
It is useful for checking in-band interference signals.



• EVM vs. Symbol

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

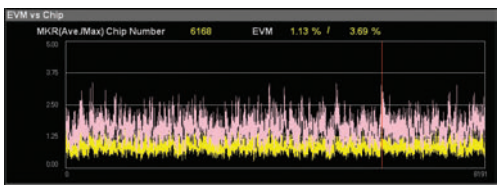
It is useful for checking characteristics in the time direction and faults at a specific symbol.



• EVM vs. Chip

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

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



• Phase Error vs. Chip

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

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

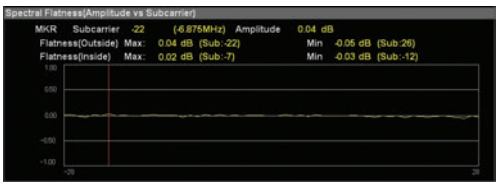
WLAN (802.11) Measurement Software MX269028A
802.11ac (80 MHz) Measurement Software MX269028A-001
802.11ac (160 MHz) Measurement Software MX269028A-002 (Continued)

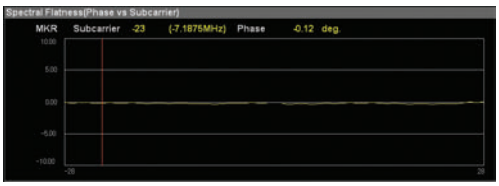
MS269xA MS2830A

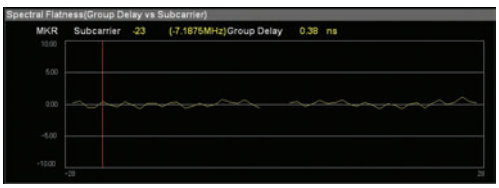
- **Spectral Flatness**

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

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

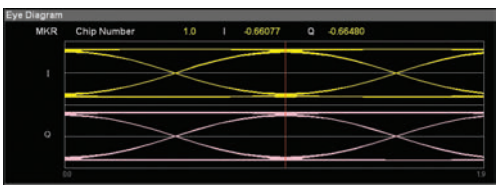






- **Eye Diagram**

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



Power vs. Time Function*

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

- **Numerical Results**

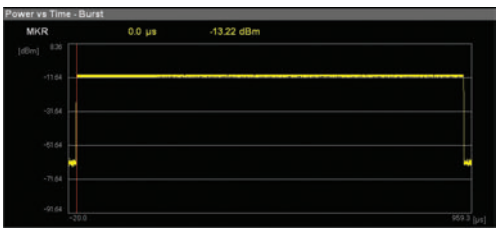
The numerical results are displayed at the top of the screen.

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

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

- **Burst**

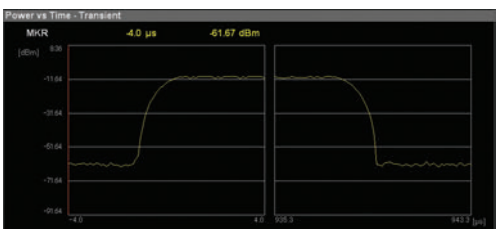
This displays the Power vs. Time graph (horizontal axis: Time, vertical axis: Power) for one burst waveform at the bottom of the screen.



- **Transient**

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

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



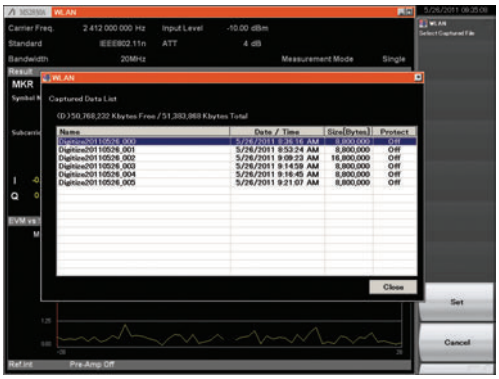
WLAN (802.11) Measurement Software MX269028A
802.11ac (80 MHz) Measurement Software MX269028A-001
802.11ac (160 MHz) Measurement Software MX269028A-002 (Continued)

MS269xA MS2830A

Powerful Capture & Replay Function for Fault Analysis*1

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

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



Example of R&D use

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

Example of production line use

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

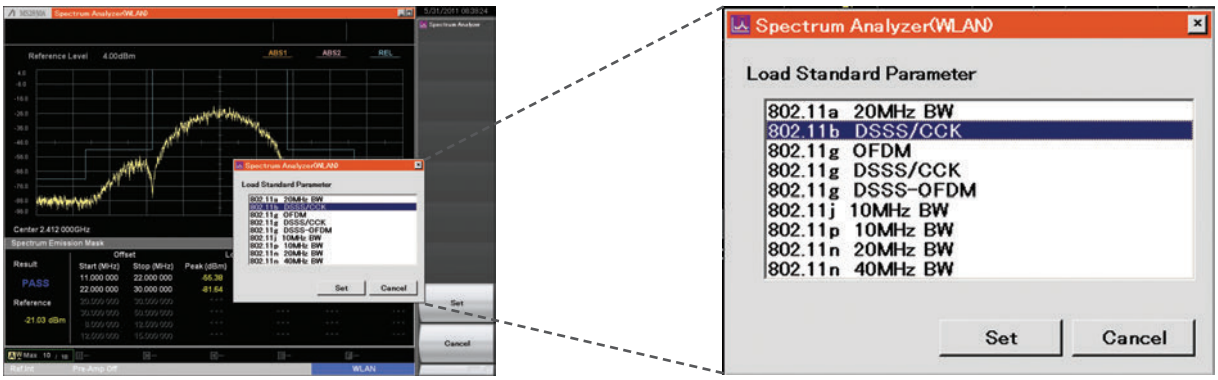
WLAN (802.11) Measurement Software MX269028A
802.11ac (80 MHz) Measurement Software MX269028A-001
802.11ac (160 MHz) Measurement Software MX269028A-002 (Continued)

MS269xA MS2830A

MS269xA/MS2830A Main 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	—

W-CDMA BS Measurement Software MX269030A

MS269xA MS2830A

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 ≥–4 dBm), for 1 wave multiplexed signals with EVM = 1%	
		± (Accuracy of reference frequency × Carrier frequency + 4) Hz	± (Accuracy of reference frequency × Carrier frequency + 6) Hz
	Residual Vector Error	Input level range: Input Level to Input Level –10 dB (Input Level ≥–4 dBm), for 64DPCH multiplexed signals conforming to 3GPP TS 25.141 TestModel1	
		≤1.0% (rms)	≤1.3% (rms)
	Code Domain Power Relative Value Accuracy	Input level range: Input Level to Input Level –10 dB (Input Level ≥–4 dBm), for signals conforming to 3GPP TS 25.141 TestModel2	
		±0.02 dB (Code Domain Power ≥–10 dBc) ±0.10 dB (Code Domain Power ≥–30 dBc)	±0.02 dB (Code Domain Power ≥–10 dBc) ±0.15 dB (Code Domain Power ≥–30 dBc)
	Residual Code Domain Error	Input level range: Input Level to Input Level –10 dB (Input Level ≥–4 dBm), for signals conforming to 3GPP TS 25.141 TestModel3	
		≤–50 dB	≤–47 dB
	Code Domain Error Accuracy	Input level range: Input Level to Input Level –10 dB (Input Level ≥–4 dBm), for signals conforming to 3GPP TS 25.141 TestModel3, with code domain error of –40 dBc	
		±0.75 dB	±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° to 28°C, after calibration, for signals with the input level range of Input Level to Input Level –10 dB (Input Level ≥–4 dBm) ±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 (α = 0.22) on spectrum waveforms attained by FFT calculation. 18° to 28°C, for single carrier, Input Level ≥–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° to 28°C, for single carrier, Input Level ≥–4 dBm	
		–78 dB/30 kHz (≥2.515 MHz offset)	–77 dB/30 kHz (≥2.515 MHz offset, nom.)

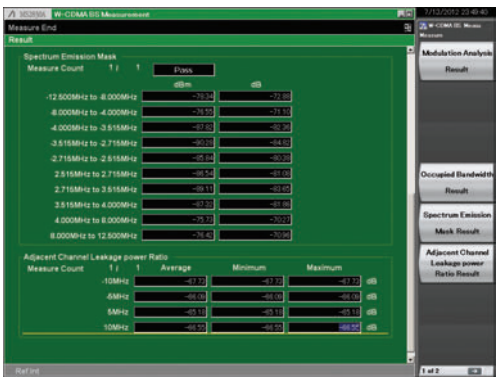
W-CDMA BS Measurement Software MX269030A (Continued)

MS269xA MS2830A

Measurement Functions

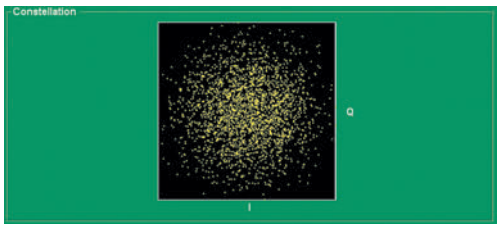
- **Batch Modulation Analysis and Spectrum Measurements**

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

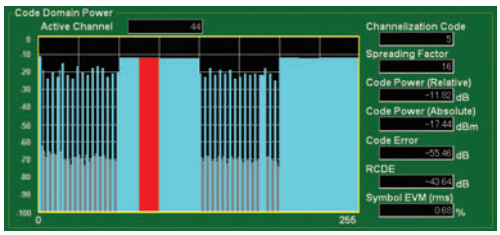


- **Convenient Graph Display**

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

Wireless Network Device Software MX283027A
WLAN Test Software MX283027A-001
Bluetooth Test Software MX283027A-002

MS2830A

The Wireless Network Device Software MX283027A, WLAN Test Software MX283027A-001, and Bluetooth Test Software MX283027A-002 are for measuring the RF characteristics of wireless terminals and devices.
Installing these options in the MS2830A Signal Analyzer with MS2830A-020/021 Vector Signal Generator option supports TRx tests of WLAN and Bluetooth devices/modules using one measurement unit.
Shortening test times by eliminating measurement screens helps facilitate high-speed, high-accuracy measurements on production lines.

Features

- One software package supporting IEEE 802.11a/b/g/n (MX283027A-001)
- One software package supporting Basic Rate/Enhanced Data Rate/Bluetooth Low Energy (MX283027A-002)
- One hardware unit supporting high-speed TRx measurements (with vector signal generation option (MS2830A-020/021))

Points for High-speed Measurement

- Eliminates measurement screens to cut measurement time
- Batch processing minimizes signal loading and processing of multiple measurements
- Simplifies batch measurements by remote commands

WLAN High-speed TRx Characteristics Measurements

• WLAN Test Software* MX283027A-001

One unit supports high-speed measurements of TRx characteristics of devices and modules based on WLAN standards.
Installing the Vector Signal Generator option (MS2830A-020/021) outputs WLAN signals and measures Rx characteristics.

No measurement screen is displayed at the main frame.
Measurement setting and execution, and reading of numerical results are under remote control.

■ Measurement Signals

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

■ Tx Characteristics Tests

Batch measurements are executed to measure the following items and read the numerical results by remote control.

- Modulation Analysis
- Tx Power Measurements
- Transmit Spectrum Mask Measurements
- Occupied Bandwidth Measurements

■ Rx Characteristics Tests

Installing the Vector Signal Generator option (MS2830A-020/021) supports the following WLAN signal outputs:

- Preinstalled WLAN Waveform Pattern (IEEE 802.11a/b/g)
- WLAN IQproducer Generation Waveform Pattern* (IEEE 802.11a/b/g/j/n/p)

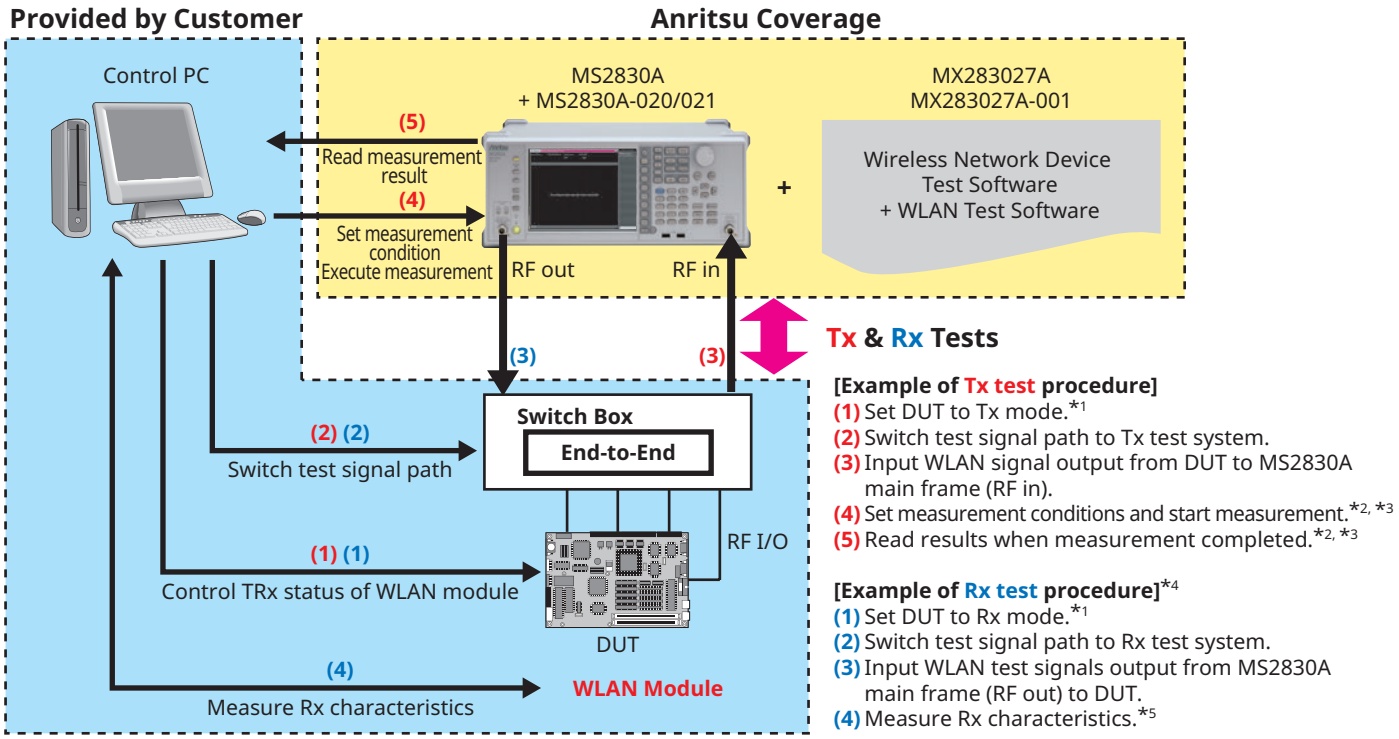
Numerical Value
Modulation Analysis
Vector Error (EVM) [rms/Peak]
Vector Error (EVM) [rms/Peak] pass/fail judgement result
Frequency Error
Frequency Error pass/fail judgement result
Center Frequency Leakage Power
Center Frequency Leakage Power pass/fail judgement result
IQ Offset
IQ Offset pass/fail judgement result
Spectrum Flatness pass/fail judgement result
IQ Gain Imbalance
Quadrature Error
Symbol Clock Error
Symbol Clock Error pass/fail judgement result
Chip Clock Error
Chip Clock Error pass/fail judgement result
Count of modulation accuracy measurements
Tx Power Measurement
Tx Power
Tx Power pass/fail judgement result
Peak Power Spectrum Density (PSD)
Peak Power Spectrum Density (PSD) pass/fail judgement result
Burst waveform rise time
Burst waveform fall time
Rise and fall time pass/fail judgement result
Count of transmit power measurements
Transmit Spectrum Mask
Peak PSD of reference channel
Absolute value of spectrum density at frequency where margin from limit line becomes minimum within offset frequency range [positive/negative side]
Margin from limit line at frequency where margin is minimum for limit line within offset frequency range [positive/negative side]
Frequency where margin from limit line becomes minimum within offset frequency range [positive/negative side]
Pass/fail judgement result within offset frequency range
Count of Tx spectrum mask measurements
Absolute value of spectrum density at start frequency of offset [positive/negative side]
Absolute value of spectrum density at end frequency of offset [positive/negative side]
Occupied Bandwidth Measurement
Occupied Bandwidth
Occupied Bandwidth pass/fail judgement result
Count of Occupied Bandwidth measurements

*: MX283027A-001 includes WLAN IQproducer MX269911A (Cannot order MX283027A-001 and MX269911A at same time).

Wireless Network Device Software MX283027A
WLAN Test Software MX283027A-001
Bluetooth Test Software MX283027A-002 (Continued)

MS2830A

Example of WLAN Module TRx Characteristics Measurement System



[Example of Tx test procedure]
(1) Set DUT to Tx mode.*1
(2) Switch test signal path to Tx test system.
(3) Input WLAN signal output from DUT to MS2830A main frame (RF in).
(4) Set measurement conditions and start measurement.*2, *3
(5) Read results when measurement completed.*2, *3

[Example of Rx test procedure]*4
(1) Set DUT to Rx mode.*1
(2) Switch test signal path to Rx test system.
(3) Input WLAN test signals output from MS2830A main frame (RF out) to DUT.
(4) Measure Rx characteristics.*5

*1: Direct control measurements
Measure TRx characteristics after setting DUT to Tx or Rx mode using control software provided by chipset maker.
Please prepare the Control software for the DUT.
*2: Measurement settings and execution, and reading of numerical results are executed by remote control.
*3: No measurement screen displayed on main frame.
*4: Installing Vector Signal Generator option (MS2830A-020/021) outputs WLAN signals.
*5: Evaluate Rx characteristics with DUT or control PC.

Bluetooth High-speed TRx Characteristics Measurements

- **Bluetooth Test Software MX283027A-002**

One unit supports measurement of high-speed TRx characteristics of Bluetooth devices and modules.
Installing the Vector Signal Generator option (MS2830A-020/021) outputs Bluetooth signals and measures Rx characteristics.

No measurement screen is displayed on the main frame.
Measurement settings and execution, and reading of numerical results are executed by remote control.

■ Measurement Signals

- Basic Rate
- Enhanced Data Rate
- Bluetooth Low Energy

■ Tx Characteristics Tests

Batch measurements are executed to measure the following items and read the numerical results by remote control.

- Output Power Measurements
- Modulation Characteristics Measurements
- ICFT Measurements
- Carrier Frequency Drift
- EDR Frequency Stability/Modulation Accuracy Measurements
- EDR Relative Tx Power Measurements
- EDR Differential Phase Decode Measurements
- Demodulation Data Measurements

■ Rx Characteristics Tests

Installing the Vector Signal Generator option (MS2830A-020/021) supports the following Bluetooth signal outputs:

Preinstalled Bluetooth Waveform Pattern

Packet format
DH1, DH3, DH5 [Clean/Dirty/Dirty withFM]
DH3_3SlotOff, DH5_5SlotOff
2-DH1, 2-DH3, 2-DH5 [Clean/Dirty/Dirty withFM]
3-DH1, 3-DH3, 3-DH5 [Clean/Dirty/Dirty withFM]
2-DH3_3SlotOff, 2-DH5_5SlotOff
3-DH3_3SlotOff, 3-DH5_5SlotOff
BLE, BLE_Dirty, BLE_Dirty_withFM, BLE_CRC_corruped
No packet format
GFSK-PN9, GFSK-PN15
PI_4_DQPSK-PN9, PI_4_DQPSK-PN15
8DPSK-PN9, 8DPSK-PN15
GMSK-PN15_BLE

Wireless Network Device Software MX283027A
WLAN Test Software MX283027A-001
Bluetooth Test Software MX283027A-002 (Continued)

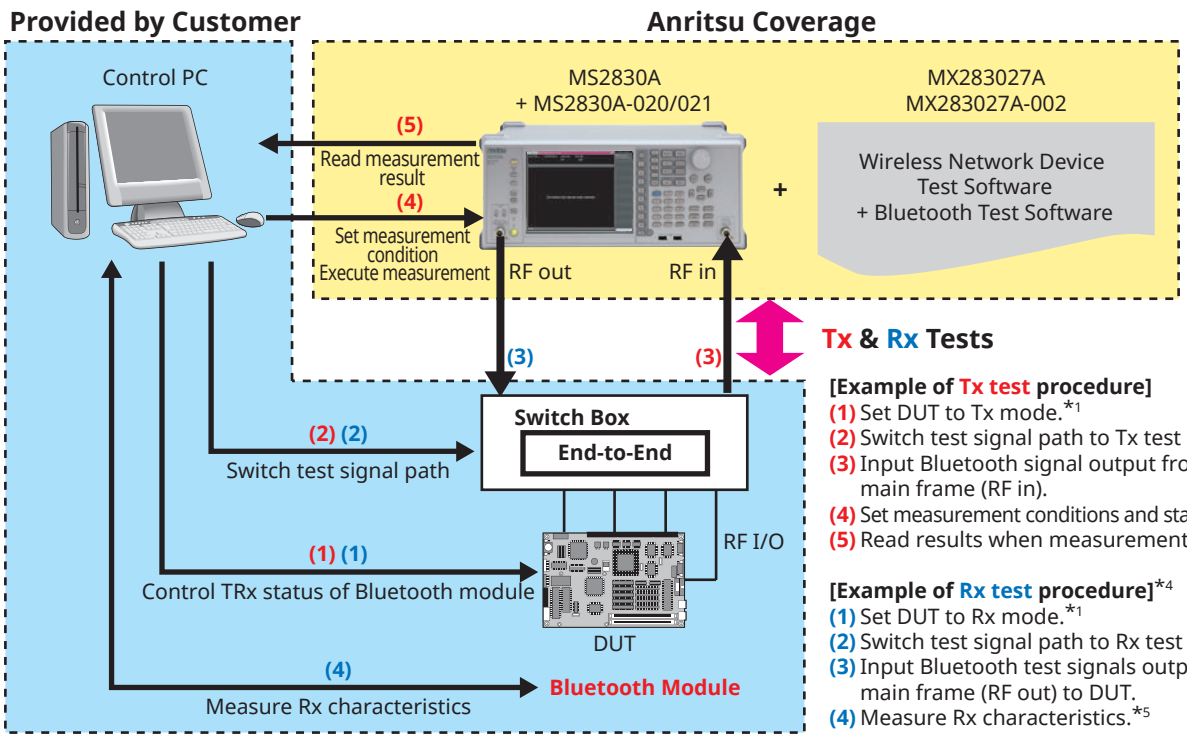
MS2830A

Tx Characteristics Measurement Numerical Results
Output Power Measurements
GFSK average power, peak power
GFSK average power pass/fail judgement result
Count of output power measurements
Modulation Characteristics Measurements
∠f1 (payload data: 11110000/00001111) Average frequency error
∠f2 (payload data: 10101010/01010101) Average frequency error
∠f1 maximum frequency error
∠f2 maximum frequency error
∠f2 maximum frequency error > lower limit ratio
∠f2 average frequency error/∠f1 average frequency error
∠f1 average frequency error pass/fail judgement result
∠f2 maximum frequency error > Lower limit ratio pass/fail judgement result
∠f2 average frequency error/∠f1 average frequency error pass/fail judgement result
Count of modulation characteristics measurements
Initial Center Frequency Tolerance (ICFT) Measurements
ICFT
ICFT pass/fail judgement result
Count of ICFT measurements
Carrier Frequency Drift Measurements
Frequency drift
Maximum drift rate
Frequency drift pass/fail judgement result
Maximum drift rate pass/fail judgement result
Count of carrier frequency drift measurement

Tx Characteristics Measurement Numerical Results
EDR Frequency Stability/Modulation Accuracy Measurements
Frequency error
Differential vector error (DEVM) [RMS value/peak value/99% value]
Frequency error pass/fail judgement result
Differential vector error (DEVM) pass/fail judgement result
Count of EDR frequency stability/modulation accuracy measurements
EDR Relative Tx Power Measurements
GFSK average power
DPSK average power
Relative power (difference between GFSK and DPSK average power)
Relative power pass/fail judgement result
Count of EDR relative Tx power measurements

Rx Characteristics Measurement Numerical Results
EDR Differential Phase Encoding Measurements
Bit error rate (BER)
Bit error
Packet error rate (PER)
Packet error rate (PER) pass/fail judgement result
Count of EDR differential phase encoding measurements
Demodulation Data Measurements
Packet type
Payload length
Payload

Example of Bluetooth Module TRx Characteristics Measurement System



Tx & Rx Tests

[Example of Tx test procedure]
(1) Set DUT to Tx mode.*1
(2) Switch test signal path to Tx test system.
(3) Input Bluetooth signal output from DUT to MS2830A main frame (RF in).
(4) Set measurement conditions and start measurement.*2, *3
(5) Read results when measurement completed.*2, *3

[Example of Rx test procedure]*4
(1) Set DUT to Rx mode.*1
(2) Switch test signal path to Rx test system.
(3) Input Bluetooth test signals output from MS2830A main frame (RF out) to DUT.
(4) Measure Rx characteristics.*5

*1: Direct control measurements
Measure TRx characteristics after setting DUT to Tx or Rx mode using control software provided by chipset maker.
Please prepare the Control software for the DUT.
*2: Measurement settings and execution, and reading of numerical results are executed by remote control.
*3: No measurement screen displayed on main frame.
*4: Installing Vector Signal Generator option (MS2830A-020/021) outputs Bluetooth signals.
*5: Evaluate Rx characteristics with DUT or control PC.

Wireless Network Device Software MX283027A
WLAN Test Software MX283027A-001
Bluetooth Test Software MX283027A-002 (Continued)

MS2830A

Specifications

- **WLAN Test Software MX283027A-001**

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° 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

Signal Analyzer		MS2830A
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	–12 to +30 dBm (MS2830A-045 not installed) –6 to +30 dBm (MS2830A-045 installed)
	Carrier Frequency Accuracy	Burst length ≥250 µs ± (Accuracy of reference frequency × Carrier frequency + 16) Hz
	Residual Vector Error	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off ≤1.6% (rms)
	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 ±1.9 dB
Spectrum Measurement	Tx Spectrum Mask Dynamic Range	≥68 dB (11 MHz Offset from carrier frequency) ≥68 dB (20 MHz Offset from carrier frequency) ≥68 dB (30 MHz Offset from carrier frequency) The dynamic range refers to the transmitted power ratio for specified frequency offset It is applied if RBW = 100 kHz and Mixer Level = –19 to –14 dBm
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 (MS2830A-045 not installed) –9 to +30 dBm (MS2830A-045 installed)
	Carrier Frequency Accuracy	Burst length ≥400 µs ± (Accuracy of reference frequency × Carrier frequency + 21) Hz
	Residual Vector Error	Specify filter with same characteristics as used for measured signal ≤1.9% (rms)
	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
Spectrum Measurement	Tx Spectrum Mask Dynamic Range	≥68 dB (11 MHz Offset from carrier frequency) ≥68 dB (22 MHz Offset from carrier frequency) ≥68 dB (33 MHz Offset from carrier frequency) The dynamic range refers to the transmitted power ratio for specified frequency offset It is applied if RBW = 100 kHz and Mixer Level = –19 to –14 dBm
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 (MS2830A-045 not installed) –9 to +30 dBm (MS2830A-045 installed)
	Carrier Frequency Accuracy	Burst length ≥250 µs ± (Accuracy of reference frequency × Carrier frequency + 13) Hz
	Residual Vector Error	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off ≤1.2% (rms)
	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

Wireless Network Device Software MX283027A
WLAN Test Software MX283027A-001
Bluetooth Test Software MX283027A-002 (Continued)

MS2830A

Signal Analyzer			MS2830A
Spectrum Measurement	Tx Spectrum Mask Dynamic Range		≥68 dB (11 MHz Offset from carrier frequency) ≥68 dB (20 MHz Offset from carrier frequency) ≥68 dB (30 MHz Offset from carrier frequency) The dynamic range refers to the transmitted power ratio for the specified frequency offset It is applied if RBW = 100 kHz and Mixer Level = –19 to –4 dBm
Standard			IEEE 802.11n HT Mixed, HT Greenfield (STBC, MIMO not supported), MCS = 0 to 7, 32 supported Channel Bandwidth: 20 MHz, 40 MHz
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 (MS2830A-045 not installed) –9 to +30 dBm (MS2830A-045 installed) 5 GHz band: –12 to +30 dBm (MS2830A-045 not installed) –6 to +30 dBm (MS2830A-045 installed)
	Carrier Frequency Accuracy	20 MHz channel	Burst length ≥250 µs ± (Accuracy of reference frequency × Carrier frequency + 13) Hz (2.4 GHz band) ± (Accuracy of reference frequency × Carrier frequency + 16) Hz (5 GHz band)
		40 MHz channel	Burst length ≥250 µs ± (Accuracy of reference frequency × Carrier frequency + 62) Hz (2.4 GHz band) ± (Accuracy of reference frequency × Carrier frequency + 102) Hz (5 GHz band)
	Residual Vector Error	20 MHz channel	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off ≤1.2% (rms) (2.4 GHz band) ≤1.6% (rms) (5 GHz band)
		40 MHz channel	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off ≤1.6% (rms) (2.4 GHz band) ≤2.0% (rms) (5 GHz band)
	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 ±0.6 dB (2.4 GHz band) ±1.9 dB (5 GHz band)
		40 MHz channel	Input attenuator ≥10 dB ±0.8 dB (2.4 GHz band) ±2.0 dB (5 GHz band)
Spectrum Measurement	Tx Spectrum Mask Dynamic Range	20 MHz channel	2.4 GHz band: ≥68 dB (11 MHz Offset from carrier frequency) ≥68 dB (20 MHz Offset from carrier frequency) ≥68 dB (30 MHz Offset from carrier frequency) 5 GHz band: ≥68 dB (11 MHz Offset from carrier frequency) ≥68 dB (20 MHz Offset from carrier frequency) ≥68 dB (30 MHz Offset from carrier frequency) The dynamic range refers to the transmitted power ratio for the specified frequency offset It is applied if RBW = 100 kHz and Mixer Level = –19 to –14 dBm
		40 MHz channel	2.4 GHz band: ≥60 dB (21 MHz Offset from carrier frequency) ≥69 dB (40 MHz Offset from carrier frequency) ≥69 dB (60 MHz Offset from carrier frequency) 5 GHz band: ≥60 dB (21 MHz Offset from carrier frequency) ≥69 dB (40 MHz Offset from carrier frequency) ≥69 dB (60 MHz Offset from carrier frequency) The dynamic range refers to the transmitted power ratio for the specified frequency offset It is applied if RBW = 100 kHz and Mixer Level = –19 to –14 dBm

Wireless Network Device Software MX283027A
WLAN Test Software MX283027A-001
Bluetooth Test Software MX283027A-002 (Continued)

MS2830A

- **Bluetooth Test Software MX283027A-002**

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° 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

Signal Analyzer		MS2830A
Standard		Basic Rate, Bluetooth Low Energy
Modulation/ Frequency Measurements	Frequency Range	2402 MHz to 2480 MHz (channel No. 0 to 78)
	Measurement Level Range	–15 to +30 dBm
	Initial Carrier Frequency Tolerance	Packet type: DH1, DH3, DH5, BLE Reference Packet Payload data: All Measurement range: 0 to ±100 kHz (nom.) Measurement accuracy: ± (Accuracy of reference frequency × Carrier frequency + 2 kHz)
	Modulation Characteristics	Packet type: DH1, DH3, DH5, BLE Reference Packet Payload data: 0xF0, 0x0F, 0xAA, 0x55 Frequency error measurement accuracy: ±1 kHz (nom.)
	Carrier Frequency Drift	Packet type: DH1, DH3, DH5, BLE Reference Packet Payload data: 0xAA, 0x55 Measurement accuracy: ±2 kHz (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
Standard		Enhanced Data Rate
Modulation/ Frequency Measurements	Frequency Range	2402 MHz to 2480 MHz (channel No. 0 to 78)
	Measurement Level Range	–15 to +30 dBm
	EDR Modulation Accuracy	Packet type: 2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5 Payload data: All DEVM floor ≤1.2% (rms)
	EDR Carrier Frequency Stability	Packet type: 2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5 Payload data: All Measurement accuracy: ± (Accuracy of reference frequency × Carrier frequency + 2 kHz)
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

Wireless Network Device Software MX283027A
WLAN Test Software MX283027A-001
Bluetooth Test Software MX283027A-002 (Continued)

MS2830A

Recommended Configuration

- **For WLAN Test Software MX283027A-001**

✓✓: Required ✓: Selected ×: Not selected

Test target	2.4 GHz band			5 GHz band		
	Tx Test		Rx Test (Signal Generator*1)	Tx Test		Rx Test (Signal Generator*1)
	Not for Spurious Test	For Spurious Test		Not for Spurious Test	For Spurious Test	
Main Frame						
MS2830A-040	✓✓	×	✓✓ (MS2830A-020/021)	×	×	×
MS2830A-041				✓✓		✓✓ (MS2830A-021)
MS2830A-043		✓✓				
MS2830A-044			×		✓✓	×
MS2830A-045						
Hardware Options						
MS2830A-002	✓	✓		✓	✓	
MS2830A-005/009	✓✓	✓✓		✓✓	✓✓	
MS2830A-006						
Vector Signal Generator Options (MS2830A-020/021 cannot be installed in MS2830A-044/045.)						
MS2830A-020			✓✓			×
MS2830A-021						✓✓
MS2830A-022						
MS2830A-027			✓			✓
MS2830A-028						
Software Options						
MX283027A	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
MX283027A-001*2						

*1: Installing the Vector Signal Generator option (MS2830A-020/021) outputs WLAN signals. MS2830A-020/021 can use as a reference signal source of the Rx test. MS2830A main functions sets the pattern send count.
*2: MX283027A-001 includes MX269911A WLAN IQproducer (Cannot order MX283027A-001 and MX269911A at same time).

- **For Bluetooth Test Software MX283027A-002**

✓✓: Required ✓: Selected ×: Not selected

Test target	Basic Rate, Enhanced Data Rate, Bluetooth Low Energy		
	Tx Test		Rx Test (Signal Generator*)
	Not for Spurious Test	For Spurious Test	
Main Frame			
MS2830A-040	✓✓	×	✓✓ (MS2830A-020/021)
MS2830A-041			
MS2830A-043		✓✓	
MS2830A-044			×
MS2830A-045			
Hardware Options			
MS2830A-002	✓	✓	
MS2830A-005/009	✓✓	✓✓	
MS2830A-006			
Vector Signal Generator Options (MS2830A-020/021 cannot be installed in MS2830A-044/045.)			
MS2830A-020			✓✓
MS2830A-021			
MS2830A-022			
MS2830A-027			✓
MS2830A-028			
Software Options			
MX283027A	✓✓	✓✓	✓✓
MX283027A-002			

*: Installing the Vector Signal Generator option (MS2830A-020/021) outputs Bluetooth signals. MS2830A-020/021 can use as a reference signal source of the Rx test. MS2830A main functions sets the pattern send count.

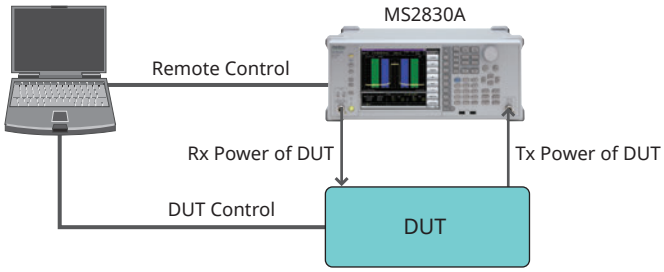
Ordering Information

Model/Order No	Name	Remarks
Main Frame		
MS2830A-040	3.6 GHz Signal Analyzer	9 kHz to 3.6 GHz
MS2830A-041	6 GHz Signal Analyzer	9 kHz to 6 GHz
MS2830A-043	13.5 GHz Signal Analyzer	9 kHz to 13.5 GHz
MS2830A-044	26.5 GHz Signal Analyzer	9 kHz to 26.5 GHz
MS2830A-045	43 GHz Signal Analyzer	9 kHz to 43 GHz
Hardware Options		
MS2830A-002	High Stability Reference Oscillator	Aging rate: 1×10^{-8}/day
MS2830A-005	Analysis Bandwidth Extension to 31.25 MHz	Required for MX283027A-001/002. Option for MS2830A-040/041/043/044.
MS2830A-006	Analysis Bandwidth 10 MHz	Required for MX283027A-001/002
MS2830A-009	Bandwidth Extension to 31.25 MHz for Millimeter-wave	Required for MX283027A-001/002 and MS2830A-005/009. Option for MS2830A-045.
Vector Signal Generator Options (MS2830A-020/021 cannot be installed in MS2830A-044/045.)		
MS2830A-020	3.6 GHz Vector Signal Generator	250 kHz to 3.6 GHz
MS2830A-021	6 GHz Vector Signal Generator	250 kHz to 6 GHz
MS2830A-022	Low Power Extension for Vector Signal Generator	–136 to +15 dBm (>25 MHz), –136 to –3 dBm (≥25 MHz)
MS2830A-027	ARB Memory Upgrade 256 Msa for Vector Signal Generator	Memory: 256 Msamples (MS2830A-027 installed), 64 Msamples (MS2830A-027 not installed)
MS2830A-028	AWGN	Absolute CN Ratio: ≤40 dB
Software Options		
MX283027A	Wireless Network Device Test Software	
MX283027A-001	WLAN Test Software	MX283027A-001 includes MX269911A WLAN IQproducer (Cannot order MX283027A-001 and MX269911A at same time)
MX283027A-002	Bluetooth Test Software	

TRX Sweep Calibration MX283087A

MS2830A

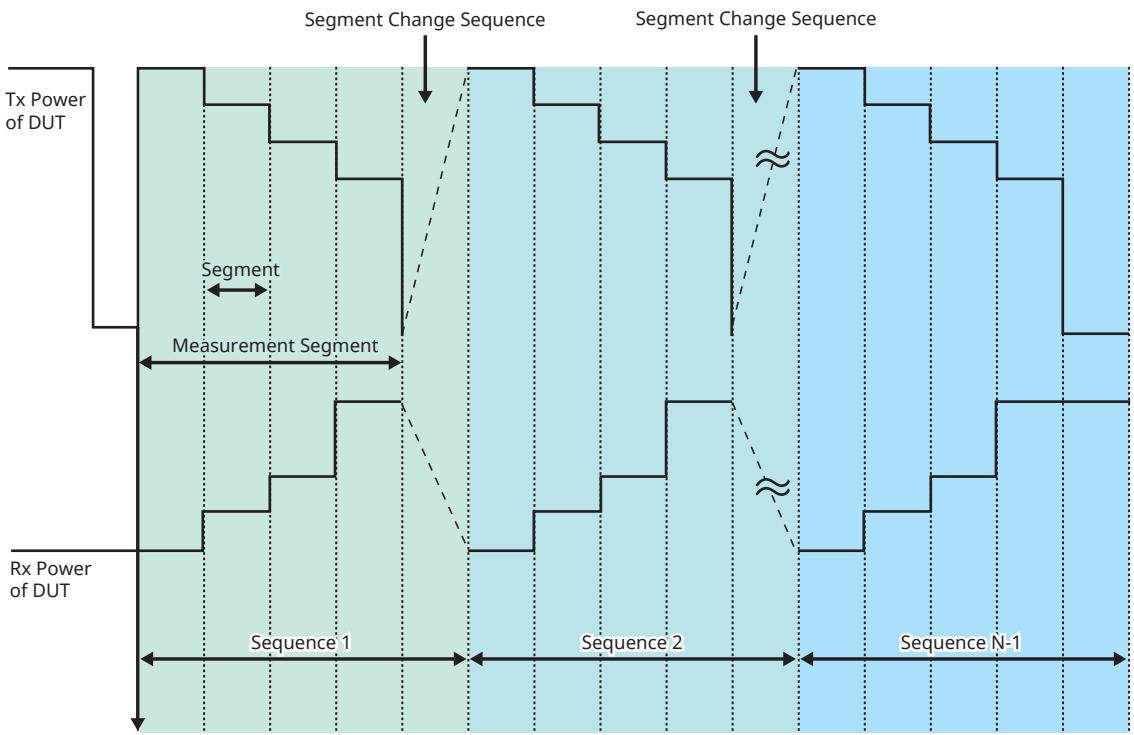
The MX283087A TRX Sweep Calibration is TRx power measurement software for the power adjustment function incorporated in femtocell base stations, etc. When the target DUT Tx and Rx powers change in a stepwise manner at each time determined by the frequency and level, this software can adjust the power quickly for each measured/output signal at a predetermined timing without repeatedly changing the measuring instruments settings.
Use of this application software requires a function for stepwise synchronization of the Tx and Rx power measurement with the DUT as well as a measurement system for synchronizing the DUT and measuring instrument.



Features

- Uses signal analyzer function and installed vector signal generator option to perform high-speed TRx adjustment with one MS2830A unit
- Supports two measurement modes: TRx Mode for measuring both Tx and Rx signal simultaneously, and Rx Mode for measuring only Rx signals
- Sets frequency and level for predetermined measurement points using remote commands (program) and auto-switches frequency and level at trigger input (List Mode)

In the TRx measurement mode, the DUT is synchronized as shown in the following diagram using adjustment of the Tx and Rx powers.

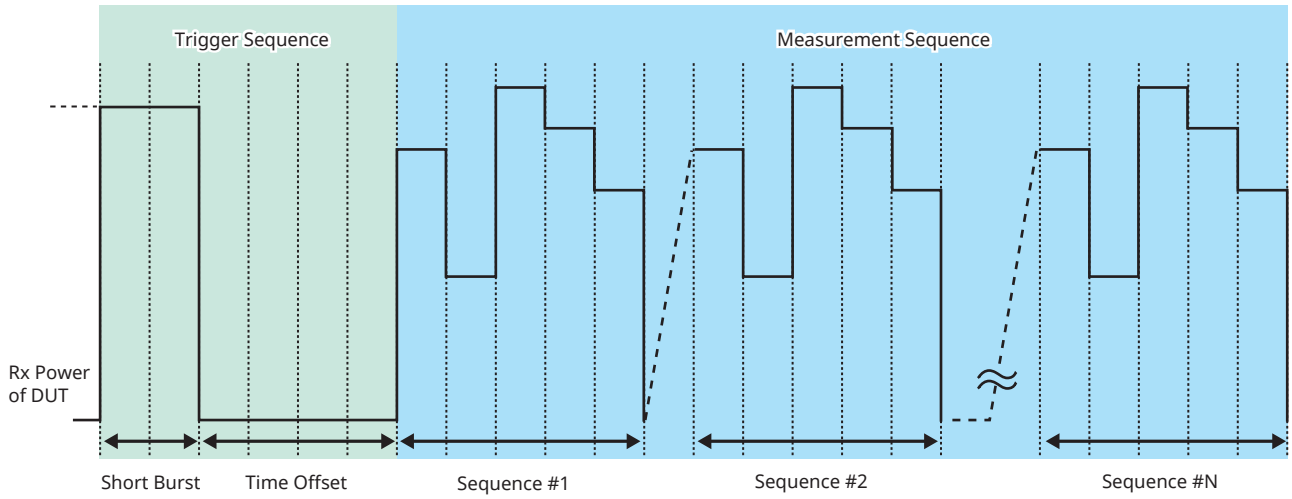


Adjustment time base position = Tx adjustment signal rising edge

TRX Sweep Calibration MX283087A (Continued)

MS2830A

In the Rx measurement mode, the MS2830A vector signal generator outputs a trigger sequence to prepare the DUT to receive the signal and then a preprogrammed signal pattern is output for adjusting the Rx power.



MS2830A Recommended Configuration

Model/Order No.	Name	Remarks
MS2830A-040 MS2830A-041 MS2830A-043	Signal Analyzer	MX283087A cannot be installed in MS2830A-044/045.
MX283087A	TRX Sweep Calibration	
MS2830A-006	Analysis Bandwidth 10 MHz	Necessary for MX283087A
MS2830A-005	Analysis Bandwidth Extension to 31.25 MHz	Necessary for MX283087A
MS2830A-020 MS2830A-021	3.6 GHz Vector Signal Generator 6 GHz Vector Signal Generator	Necessary for MX283087A
MS2830A-022	Low Power Extension for Vector Signal Generator	Necessary for MX283087A

TRX Sweep Calibration Screen

TRX Sweep Calibration MX283087A (Continued)

MS2830A

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. The specifications are defined under the following condition unless otherwise specified.
Attenuator mode: Mechanical Attenuator Only (MS2830A only)

Signal Analyzer		MS2830A
Function		Performs measurement while switching both the level for each measurement unit (segment) according to the level list and the frequency for each measurement unit group (sequence) according to the frequency list.
Measurement Mode		TRX mode: Performs transmission measurement and reception measurement at the same time. RX mode: Performs reception measurement only. In the RX mode, a trigger signal, which consists of output On (active) and Off (inactive) intervals, can be output before a measurement signal.
Items Common to Transmission and Reception	Frequency Range	400 MHz to 3500 MHz
	Setting Range of Segment Length	10 ms, 20 ms
	Setting Range of Segment	1 to 80
	Setting Range of Sequence	1 to 20
Transmitter Power Measurement	Analysis Bandwidth	2.5, 5, 10, 25 MHz
	Measurement Time Range	Symmetric about the center of the segment and 20 to 90% of the specified segment length
	Trigger	Trigger mode: Free Run (Trig Off), Video (Trig On) Trigger setting range: –30 to –10 dB (compared to the measurement level specified for the first segment)
	Measured Level Range	–30 to +30 dBm
	Transmitter Power Accuracy	After CAL execution at 18° to 28°C, the input signal level is within the measurement level range, and the input level is as follows: ±0.7 dB The transmitter power accuracy is calculated from an input attenuator switching error, a measured linearity error, and a root sum square (RSS) error of the absolute amplitude accuracy and in-band frequency characteristics.
Reception Power Measurement	Output Level Range	–120 to –5 dBm
	Output Level Accuracy	CW, at 18° to 28°C ±0.5 dB (Output level ≥–110 dBm) ±1 dB (Output level <110 dBm) The output level accuracy is based on that of the MS2830A-020/021 Vector Signal Generator Option.
	Level Error From CW during Vector Modulation	AWGN signal whose bandwidth is 5 MHz, at 18° to 28°C, with an output frequency of 100 MHz or higher ±0.2 dB Based on the level error from CW during vector modulation with MS2830A-020/021 Vector Signal Generator Option.
	Trigger Signal	Output On interval (short burst) and Off interval (time offset) Short burst interval setting range: 1 to 100 Segment Time offset interval setting range: 1 to 100 Segment

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

Measurement Functions

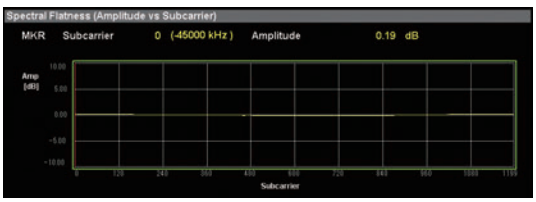
- **Single Carrier Measurement**

Constellation

The frequency error for all sub-carriers, Tx power, EVM, etc., are displayed together on a constellation graph. Since peak values can be displayed simultaneously with mean values, the randomness of characteristics can be evaluated by comparing both values. Characteristics can be confirmed easily using the many intuitive graph displays.

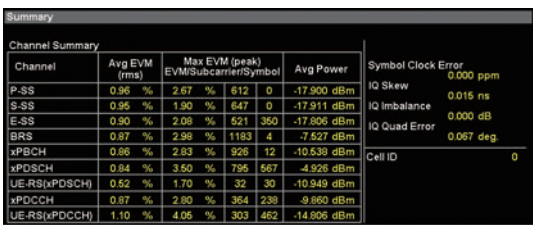
Spectral Flatness

Graphs of the amplitude and phase for each sub-carrier are displayed for all symbols in a specified measurement region.



Summary

Various data, such as the EVM and power for each channel (SS, xPDSCH, xPUSCH, xPDCCH), are tabulated.



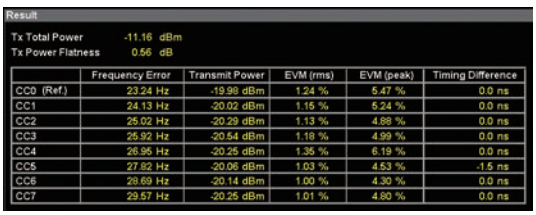
- **Multi Carrier Measurement**

EVM vs. RB
Power vs. RB

Up to eight carriers can be analyzed at once as a batch to display the EVM and power for each resource block in the sub-frame section as a gradation. Since the power boosting applied to each resource block and the location of the degraded EVM caused by in-band interference can be monitored and compared visually for each carrier, this function plays a key role at R&D troubleshooting.

Summary

Various data, such as the frequency error, Tx power, EVM, etc., can be analyzed at once as a batch for each carrier, which is useful for measuring the timing difference with other carriers based on a specified carrier.



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° 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° 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° 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° 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° 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	

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

MS2850A

The 5G measurement and NR software options 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-6GHz and mmWave bands in the 5G NR standards by specifying combinations of multiple component carriers (up to 400 MHz) and subcarrier spacing.

Standard	3GPP TS 38.211			
Model/Name	NR TDD sub-6GHz (Range1)		NR TDD mmWave (Range2)	
	Downlink MX285051A-011	Uplink MX285051A-061	Downlink MX285051A-021	Uplink MX285051A-071
Frequency Range	800 MHz to 5 GHz		800 MHz to 32 GHz (MS2850A-047) 800 MHz to 44.5 GHz (MS2850A-046)	
Subcarrier Spacing (SCS)	15 kHz, 30 kHz		120 kHz	
Channel Bandwidth	25, 40, 50, 80, 100 MHz		50, 100, 200, 400 MHz	
Modulation	CP-OFDM QPSK, 16QAM, 64QAM, 256QAM, Auto (excluding 256QAM)		CP-OFDM QPSK, 16QAM, 64QAM, 256QAM, Auto (excluding 256QAM)	
Measurement Channel	SS-Block, PDSCH, PDCCH	PUSCH	SS-Block, PDSCH, PDCCH	PUSCH
Component Carrier	1CC (up to 100 MHz)	1CC (up to 100 MHz)	1CC (up to 400 MHz) Future multicarrier support	1CC (up to 400 MHz)

RB Number Table

The channel bandwidth is defined in accordance with SCS and RB.

		NR TDD sub-6GHz DL/UL Channel Bandwidth [MHz] (1CC)												
		5	10	15	30	20	25	40	50	60	70	80	90	100
SCS [kHz]	15	—	—	—	—	—	133	216	270	N.A	N.A	N.A	N.A	N.A
	30	—	—	—	—	—	65	106	133	—	—	217	—	273
	60	N.A	—	—	—	—	—	—	—	—	—	—	—	—

		NR TDD mmWave DL/UL Channel Bandwidth [MHz] (1CC)			
		50	100	200	400
SCS [kHz]	60	—	—	—	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-6GHz Downlink MX285051A-011
NR TDD sub-6GHz Uplink MX285051A-061

MS2850A

Specifications

<table>
<tr><td colspan="2">Signal Analyzer</td><td>MS2850A</td><td></td></tr>
<tr><td colspan="2">Option</td><td>NR TDD sub-6GHz Downlink
MX285051A-011</td><td>NR TDD sub-6GHz Uplink
MX285051A-061</td></tr>
<tr><td rowspan="5">Electrical Characteristics</td><td>Target Signals</td><td>TS 38.211 Range1 (Sub-6GHz) compliant downlink signal</td><td>TS 38.211 Range1 (Sub 6-GHz) compliant uplink signal</td></tr>
<tr><td>Channel Bandwidth</td><td colspan="2"><table><tr><td>Subcarrier Spacing</td><td>Channel Bandwidth</td></tr><tr><td>15 kHz</td><td>25 MHz (RB: 133), 40 MHz (RB: 216), 50 MHz (RB: 270)</td></tr><tr><td>30 kHz</td><td>25 MHz (RB: 65), 40 MHz (RB: 106), 50 MHz (RB: 133), 80 MHz (RB: 217),
100 MHz (RB: 273)</td></tr></table></td></tr>
<tr><td>Capture Time</td><td colspan="2">1 Frame</td></tr>
<tr><td>Frequency Setting Range</td><td colspan="2">MS2850A-047: 800 MHz to 32 GHz
MS2850A-046: 800 MHz to 44.5 GHz</td></tr>
<tr><td>Measurement Frequency Range</td><td colspan="2">800 MHz to 5 GHz</td></tr>
<tr><td rowspan="3">Modulation/ Frequency Measurement</td><td>Measurement Level Range</td><td colspan="2">–10 to +30 dBm (Preamp Off, or Preamp not installed)
–30 to +10 dBm (Preamp On)</td></tr>
<tr><td>Carrier Frequency Measurement Accuracy</td><td>At 18° to 28°C, After calibration, EVM = 1% signal
1 Frame at downlink signal
Only 1 carrier of 100 MHz width at center frequency
± (Accuracy of reference frequency × carrier frequency + 10) Hz</td><td>At 18° to 28°C, After calibration, EVM = 1% signal
1 Frame at uplink signal
Only 1 carrier of 100 MHz width at center frequency
± (Accuracy of reference frequency × carrier frequency + 10) Hz</td></tr>
<tr><td>Residual Vector Error</td><td>At 18° to 28°C, After calibration
1 Frame at downlink signal
Only 1 carrier of 100 MHz width at center frequency
≤1.0%</td><td>At 18° to 28°C, After calibration
1 Frame at uplink signal
Only 1 carrier of 100 MHz width at center frequency
≤1.0%</td></tr>
<tr><td rowspan="2">Amplitude Measurement</td><td>Measurement Level Range</td><td colspan="2">–10 to +30 dBm (Preamp Off, or Preamp not installed)
–30 to +10 dBm (Preamp On)</td></tr>
<tr><td>Tx Power Measurement Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main frame.)</td><td colspan="2">At 18° to 28°C, After calibration, Input attenuator ≥10 dB
Input signal within measurement level range and below value set at Input Level
Only 1 carrier at center frequency
<table><tr><td>Frequency Range</td><td>Preamp Off,
or without Preamp</td><td>Preamp On</td></tr><tr><td>800 MHz ≤ Frequency < 4 GHz</td><td>±0.68 dB (nom.)</td><td>±1.15 dB (nom.)</td></tr><tr><td>4 GHz ≤ Frequency < 4.2 GHz</td><td>±1.53 dB (nom.)</td><td>±2.01 dB (nom.)</td></tr><tr><td>4.2 GHz ≤ Frequency ≤ 5 GHz</td><td>±1.45 dB (nom.)</td><td>±1.94 dB (nom.)</td></tr></table></td></tr>
<tr><td colspan="2">Waveform Display</td><td colspan="2">Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Spectral Flatness, Power vs. RB, EVM vs. RB</td></tr>
<tr><td rowspan="3">Digitize Function</td><td>Function Overview</td><td colspan="2">Supports output of captured waveform data to internal storage or external storage</td></tr>
<tr><td>Waveform Data</td><td colspan="2">Format: I, Q (32 bit floating point binary format)
Level: Assumes as $\sqrt{(I^2 + Q^2)}$ = 1 for 0 dBm input
Level accuracy: Same as absolute amplitude accuracy and in-band frequency characteristics of the signal analyzer</td></tr>
<tr><td>Replay Function</td><td colspan="2">Analyzes traces of saved waveform data
Format: I, Q (32 bit floating point binary format)
Sampling Rate:
<table><tr><td>Channel Bandwidth</td><td>Without MS2850A-033</td><td>With MS2850A-033</td></tr><tr><td>≤100 MHz</td><td>162.5 MHz</td><td>162.5 MHz</td></tr></table></td></tr>
</table>

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

MS2850A

Specifications

<table>
<tr><td colspan="2">Signal Analyzer</td><td colspan="2">MS2850A</td></tr>
<tr><td colspan="2">Option</td><td>NR TDD mmWave Downlink
MX285051A-021</td><td>NR TDD mmWave Uplink
MX285051A-071</td></tr>
<tr><td rowspan="4">Electrical Characteristics</td><td>Target Signals</td><td>TS 38.211 Range2 (mmWave) compliant downlink signal</td><td>TS 38.211 Range2 (mmWave) compliant uplink signal</td></tr>
<tr><td>Channel Bandwidth</td><td colspan="2"><table><tr><td>Subcarrier Spacing</td><td>Channel Bandwidth</td></tr><tr><td>120 kHz</td><td>50 MHz (RB: 32), 100 MHz (RB: 66), 200 MHz (RB: 132), 400 MHz (RB: 264)</td></tr></table></td></tr>
<tr><td>Capture Time</td><td colspan="2">1 Frame</td></tr>
<tr><td>Frequency Setting Range</td><td colspan="2">MS2850A-047: 800 MHz to 32 GHz
MS2850A-046: 800 MHz to 44.5 GHz</td></tr>
<tr><td rowspan="3">Modulation/ Frequency Measurement</td><td>Measurement Level Range</td><td colspan="2">–15 to +30 dBm (Preamp Off, or Preamp not installed)
–30 to +10 dBm (Preamp On)</td></tr>
<tr><td>Carrier Frequency Measurement Accuracy</td><td>At 18° to 28°C, After calibration, EVM = 2% signal
1 Frame at downlink signal
Only 1 carrier of 100 MHz width at center frequency setting of 28 GHz
± (Accuracy of reference frequency × carrier frequency + 10) Hz</td><td>At 18° to 28°C, After calibration, EVM = 2% signal
1 Frame at uplink signal
Only 1 carrier of 100 MHz width at center frequency setting of 28 GHz
± (Accuracy of reference frequency × carrier frequency + 10) Hz</td></tr>
<tr><td>Residual Vector Error</td><td>At 18° to 28°C, After calibration
1 Frame at downlink signal
Only 1 carrier of 100 MHz width at center frequency setting of 28 GHz
≤2.0%</td><td>At 18° to 28°C, After calibration
1 Frame at uplink signal
Only 1 carrier of 100 MHz width at center frequency setting of 28 GHz
≤2.0%</td></tr>
<tr><td rowspan="2">Amplitude Measurement</td><td>Measurement Level Range</td><td colspan="2">–15 to +30 dBm (Preamp Off, or Preamp not installed)
–30 to +10 dBm (Preamp On)</td></tr>
<tr><td>Tx Power Measurement Accuracy (This is found from root sum of squares (RSS) of absolute amplitude accuracy and in-band frequency characteristics of main frame.)</td><td colspan="2">At 18° to 28°C, After calibration, Input attenuator ≥10 dB
Input signal within measurement level range and below value set at Input Level
Only 1 carrier of 100 MHz width at center frequency
<table><tr><td>Frequency Range</td><td>Preamp Off,
or without Preamp</td><td>Preamp On</td></tr><tr><td>26.5 GHz < Frequency ≤ 40 GHz</td><td>±2.54 dB (nom.)</td><td>±3.74 dB (nom.)</td></tr></table></td></tr>
<tr><td colspan="2">Waveform Display</td><td colspan="2">Constellation, EVM vs. Subcarrier, EVM vs. Symbol, Spectral Flatness, Power vs. RB, EVM vs. RB</td></tr>
<tr><td rowspan="3">Digitize Function</td><td>Function Overview</td><td colspan="2">Supports output of captured waveform data to internal storage or external storage</td></tr>
<tr><td>Waveform Data</td><td colspan="2">Format: I, Q (32 bit floating point binary format)
Level: Assumes as $\sqrt{(I^2 + Q^2)} = 1$ for 0 dBm input
Level accuracy: Same as absolute amplitude accuracy and in-band frequency characteristics of the signal analyzer</td></tr>
<tr><td>Replay Function</td><td colspan="2">Analyzes traces of saved waveform data
Format: I, Q (32 bit floating point binary format)
Sampling Rate:
<table><tr><td>Channel Bandwidth</td><td>Without MS2850A-033</td><td>With MS2850A-033</td></tr><tr><td>≤100 MHz</td><td>162.5 MHz</td><td>162.5 MHz</td></tr><tr><td>>100 MHz</td><td>325 MHz</td><td>650 MHz</td></tr></table></td></tr>
</table>

Wi-SUN PHY Measurement Software MX705010A

MS269xA MS2830A

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.

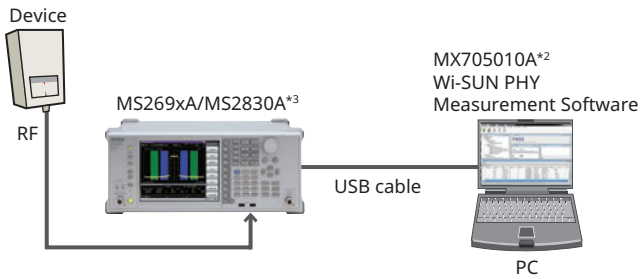
Supports Wi-SUN RF Conformance Auto-Test

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

∗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

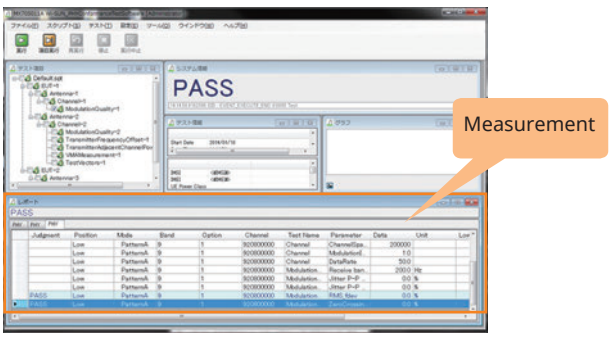
■ Wi-SUN PHY Receiver Test

- Receiver Sensitivity Test
- Packet Test

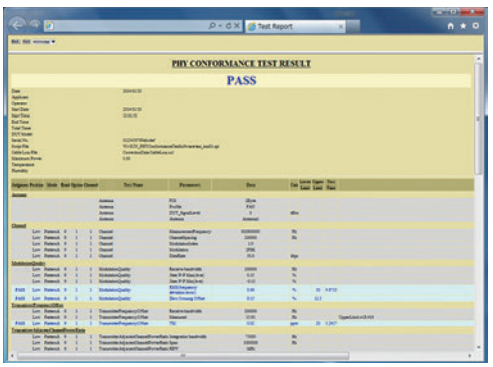
■ Test Items Equivalent to Japan Technical Standards Conformance Test

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

• Screens



Main Screen



Results Output Screen

Signal Analyzer Configuration Examples

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

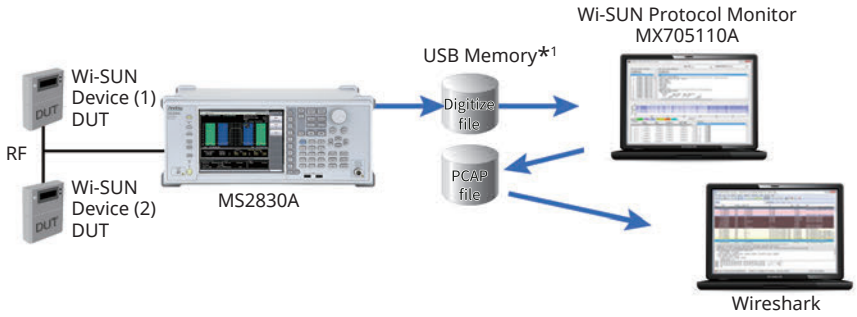
Wi-SUN Protocol Monitor MX705110A

MS269xA MS2830A

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

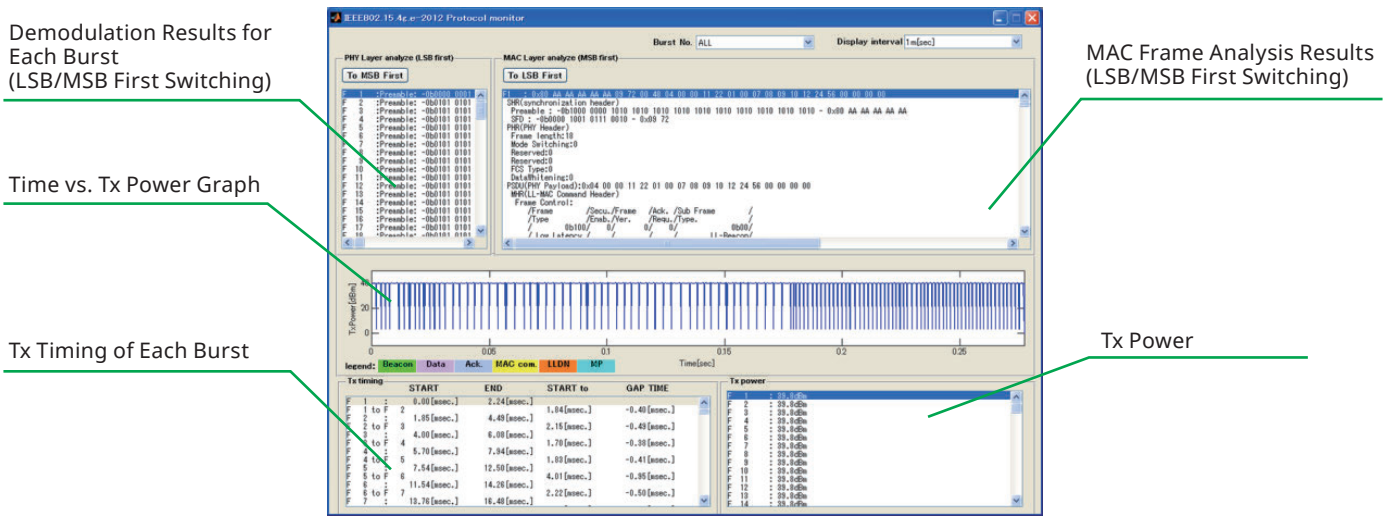


*1: Analysis requires copying of data recorded by the signal analyzer to a PC using USB flash memory, etc.

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



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 (±20 × 10^{-7}) required for TELEC-T245 Frequency Tolerance measurement

MS2850A/MS2840A/MS2830A Configuration

Options Configuration

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

- **MS2830A Hardware Configuration**

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

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

Opt.	Name	Retrofit	Addition to Main frame					Combination with "Option" (Refer to the left line)																												
			040	041	043	044	045	001	002	005	006	009	077	078	008	010	011	016	017	018	020	021	022	026	052	027	028	029	066	067	068	088	189	180
001	Rubidium Reference Oscillator		✓	✓	✓	✓	✓		*9																									
002	High Stability Reference Oscillator		✓	✓	✓	No	No	*9																										
005	Analysis Bandwidth Extension to 31.25 MHz		✓	✓	✓	✓	No				R	No																						
006	Analysis Bandwidth 10 MHz		✓	✓	✓	✓	✓			U		U	U	U																				
009	Bandwidth Extension to 31.25 MHz for Millimeter-wave		No	No	No	No	✓		No	No	R									No	No	No	No			No	No	No	No			No	No	
077	Analysis Bandwidth Extension to 62.5 MHz	No	✓	✓	✓	✓	✓			*5	R	*5																						
078	Analysis Bandwidth Extension to 125 MHz	No	✓	✓	✓	✓	✓			*5	R	*5	R																						
008	Preamplifier		✓	✓	✓	*1	*1																								*1				
010	Phase Noise Measurement Function		✓	✓	✓	✓	✓																												
011	2ndary HDD		✓	✓	✓	✓	✓																												
016	Precompliance EMI Function		✓	✓	✓	✓	✓																												
017	Noise Figure Measurement Function		✓	✓	✓	✓	✓								U																U				
018	Audio Analyzer*4		✓	✓	*7	No	No					No																	R	No	No			
020	3.6 GHz Vector Signal Generator		✓	✓	*2	No	No					No										No			*11				*2	No	No	No	No	
021	6 GHz Vector Signal Generator		✓	✓	*2	No	No					No									No				*11				*2	No	No	No	No	
022	Low Power Extension for Vector Signal Generator		✓	✓	✓	No	No					No									R									No	No	No	No	
026	BER Measurement Function		✓	✓	✓	✓	✓																												
052	Internal Signal Generator Control Function	*12	✓	✓	*2	No	No														*11								*2			*11		
027	ARB Memory Upgrade 256 MSa for Vector Signal Generator		✓	✓	✓	No	No					No									R									No	No	*3	*3	
028	AWGN		✓	✓	✓	No	No					No									R									No	No	*3	*3	
029	Analog Function Extension for Vector Signal Generator*4	*8	✓	✓	No	No	No					No									R	R							R	No	No	No	No	
066	Low Phase Noise Performance	No	✓	✓	*2	No	No					No									*2				*2					No	No			
067	Microwave Preselector Bypass		No	No	No	✓	✓		No											No	No	No	No			No	No	No	No			No	No	
068	Microwave Preamplifier		No	No	No	*1	*1		No						*1					No	No	No	No			No	No	No	No			No	No	
088	3.6 GHz Analog Signal Generator*4		✓	✓	No	No	No					No									No	No	No		*11	*3	*3	No	R	No	No		U	
189	Vector Function Extension for Analog Signal Generator Retrofit		✓	✓	No	No	No					No									No	No	No			*3	*3	No	R	No	No	R		
180	CPU/Windows 7 64 bit Upgrade Retrofit	*10	✓	✓	✓	✓	✓																												

*1:Cannot be installed simultaneously MS2830A-008 and MS2830A-068/168. When MS2830A-168 is added to Signal Analyzer with MS2830A-008, only MS2830A-168 becomes effective.
*2:MS2830A-043 can implement only either MS2830A-020/021 or MS2830A-066.
*3:MS2830A-027 and MS2830A-028 are not used in analog signal generator (MS2830A-088/188).
After vector function (MS2830A-189) was added, the vector signal generator function can add MS2830A-027 and MS2830A-028.
*4:Require MX269018A.
*5:MS2830A-040/041/043/044 require MS2830A-005.
MS2830A-045 requires MS2830A-009.
*6:An image response is received when setting the bandwidth to more than 31.25 MHz.
This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.).
The Signal Analyzer series MS2690A/91A/92A is recommended for other measurement purposes.
*7:The MS2830A-018 can be installed with MS2830A-043 but cannot be installed simultaneously with a signal generator (MS2830A-088/020/021/029) because MS2830A-066 is required. Consequently, analog wireless Rx tests cannot be performed using the same main frame when the MS2830A-018 and MS2830A-043 are combined.
*8:Please contact our sales representative when requesting retrofitting.
*9:The Rubidium Reference Oscillator can be retrofitted to MS2830A-040/041/043 with installed High Stability Reference Oscillator.
In this case, the Rubidium Reference Oscillator is functional.
*10:Replace current CPU board of MS2830A which Windows Embedded Standard 2009 (Windows XP) is installed (it was ordered until August 2016 approximately) and upgrade the operating system to Windows Embedded Standard 7 (Windows 7).
A seal labeled “C1” is affixed near the serial number label of MS2830A which is installed Windows 7.
*11: Installing the MS2830A-052 requires any of the MS2830A-020/120, 021/121, or 088/188 options.
*12: When retrofitting signal generator-linked functions (MS2830A-352), the license is delivered on an accessory DVD which is used to install the license in the MS2830A. It is not necessary to return the MS2830A to Anritsu for upgrading.

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
077	Analysis Bandwidth Extension to 62.5 MHz*1	Yes	✓	✓	✓	✓																											
078	Analysis Bandwidth Extension to 125 MHz*1	Yes	✓	✓	✓	✓						R																					
008	Preamplifier	Yes	✓	✓	✓	✓									*5	*5																	
069	26.5 GHz Microwave Preamplifier	Yes	No	No	✓	No		No			No			*5		No								No		No	No	No	No	No	No	No	No
068	Microwave Preamplifier	Yes	No	No	No	✓		No		No				*5	No									No		No	No	No	No	No	No	No	No
019	2 dB Step Attenuator for Millimeter-wave	Yes	No	No	No	✓		No		No					No									No		No	No	No	No	No	No	No	No
010	Preamplifier	Yes	✓	✓	✓	✓																											
011	2ndary SSD	Yes	✓	✓	✓	✓																											
016	Precompliance EMI Function	Yes	✓	✓	✓	✓																											
017	Noise Figure Measurement Function	Yes	✓	✓	✓	✓								U	U	U																	
026	BER Measurement Function	Yes	✓	✓	✓	✓																											
051	Noise Floor Reduction	Yes	✓	✓	✓	✓																											
066	Low Phase Noise Performance	Yes	✓	✓	No	No					No				No	No									No								
067	Microwave Preselector Bypass	Yes	No	No	✓	✓		No																No		No	No	No	No	No	No	No	No
020	3.6 GHz Vector Signal Generator	Yes	✓	✓	No	No					No				No	No									No		No	No				No	
021	6 GHz Vector Signal Generator	Yes	✓	✓	No	No					No				No	No									No	No		No				No	
189	Vector Function Extension for Analog Signal Generator Retrofit	Yes	✓	✓	No	No					No				No	No									No	No	No		No			R	No
022	Low Power Extension for Vector Signal Generator	Yes	✓	✓	No	No					No				No	No									No	R		No				No	
027	ARB Memory Upgrade 256 Msa for Vector Signal Generator*2	Yes	✓	✓	No	No					No				No	No									No	R							
028	AWGN*2	Yes	✓	✓	No	No					No				No	No									No	R							
088	3.6 GHz Analog Signal Generator*3	Yes	✓	✓	No	No					No				No	No									No	No	No		No				No
029	Analog Function Extension for Vector Signal Generator*3	Yes	✓	✓	No	No					No				No	No									No	R		No	R			No	

*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.

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													
MS2850A-033	Analysis Bandwidth Extension to 510 MHz	Yes	✓	✓													
MS2850A-034	Analysis Bandwidth Extension to 1 GHz	Yes	✓	✓		R											
MS2850A-010	Phase Noise Measurement Function	Yes	✓	✓													
MS2850A-017	Noise Figure Measurement Function	Yes	✓	✓							U						
MS2850A-067	Microwave Preselector Bypass	—	Standard install	Standard install													
MS2850A-068	Microwave Preamplifier	Yes	✓	✓													
MS2850A-072	Extended Specifications	Yes	✓	✓													
MS2850A-076	Low Second Harmonic Distortion	Yes	✓	✓													
MS2850A-051	Noise Floor Reduction	Yes	✓	✓													
MS2850A-011	Secondary Storage Device	Yes	✓	✓													
MS2850A-053	External Interface for High Speed Data Transfer PCIe	Yes	✓	✓													
MS2850A-054	External Interface for High Speed Data Transfer USB3.0	Yes	✓	✓													

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	✶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	✶1			
MX269020A-001	LTE-Advanced FDD Downlink Measurement Software	✓	✓	✓	✓	✓	R	R	✶1	U	U	Require MX269020A
MX269021A	LTE Uplink Measurement Software	✓	✓	✓	✓	✓	R	R	✶1			
MX269021A-001	LTE-Advanced FDD Uplink Measurement Software	✓	✓	✓	✓	✓	R	R	✶1	U	U	Require MX269021A
MX269022A	LTE TDD Downlink Measurement Software	✓	✓	✓	✓	✓	R	R	✶1			
MX269022A-001	LTE-Advanced TDD Downlink Measurement Software	✓	✓	✓	✓	✓	R	R	✶1	U	U	Require MX269022A
MX269023A	LTE TDD Uplink Measurement Software	✓	✓	✓	✓	✓	R	R	✶1			
MX269023A-001	LTE-Advanced TDD Uplink Measurement Software	✓	✓	✓	✓	✓	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	✶1			
MX269028A-001	802.11ac (80 MHz) Measurement Software	✓	✓	✓	✓	✓	R	R	✶1	R	R	Only for MS2830A. Require MX269028A
MX269030A	W-CDMA BS Measurement Software	✓	✓	✓	✓	✓		R				
MX283027A	Wireless Network Device Test Software	↓	↓	↓	↓	↓	↓	↓	↓			
MX283027A-001	WLAN Test Software	✓	✓	✓	✓	✓	R	R	✶1			Require MX283027A✶4
MX283027A-002	Bluetooth Test Software	✓	✓	✓	✓	✓	R	R				Require MX283027A
MX283087A	TRX Sweep Calibration	✓	✓	✓	No	No	R	R				Require MS2830A-020/021 and MS2830A-022

✶1: MS2830A-045 cannot be installed MS2830A-005. Add MS2830A-009 in substitution for MS2830A-005.
✶2: MS2830A-043 can implement only either MS2830A-020/021 or MS2830A-066.
By the system that MS2830A-066 is necessary, MS2830A-020/021 is not added to MS2830A-043.
✶3: By the measurement of the narrowband signal, add MS2830A-066. (Channel bandwidth: x kHz to 100 kHz)
MS2830A-044/045 cannot be installed MS2830A-066.
✶4: MX283027A-001 includes MX269911A WLAN IQproducer (Cannot order MX283027A-001 and MX269911A at same time).

• 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*	✓	✓	✓	✓		

✶: Requires USB Audio A0086C

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-001/011/021/051/061/071
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-6GHz Downlink	✓	✓			Require MX285051A
MX285051A-061	NR TDD sub-6GHz 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

Ordering Information

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

Model/Order No	Name
	Main frame
MS2690A	Signal Analyzer (50 Hz to 6 GHz)
MS2691A	Signal Analyzer (50 Hz to 13.5 GHz)
MS2692A	Signal Analyzer (50 Hz to 26.5 GHz)
MS2850A-047	Signal Analyzer (9 kHz to 32 GHz)
MS2850A-046	Signal Analyzer (9 kHz to 44.5 GHz)
MS2840A-040	Signal Analyzer (9 kHz to 3.6 GHz)
MS2840A-041	Signal Analyzer (9 kHz to 6 GHz)
MS2840A-044	Signal Analyzer (9 kHz to 26.5 GHz)
MS2840A-046	Signal Analyzer (9 kHz to 44.5 GHz)
MS2830A-040	Signal Analyzer (9 kHz to 3.6 GHz)
MS2830A-041	Signal Analyzer (9 kHz to 6 GHz)
MS2830A-043	Signal Analyzer (9 kHz to 13.5 GHz)
MS2830A-044	Signal Analyzer (9 kHz to 26.5 GHz)
MS2830A-045	Signal Analyzer (9 kHz to 43 GHz)
	Software options
	CD-ROM with license and operation manuals
MX269011A	W-CDMA/HSPA Downlink Measurement Software
MX269012A	W-CDMA/HSPA Uplink Measurement Software
MX269013A	GSM/EDGE Measurement Software
MX269013A-001	EDGE Evolution Measurement Software (Requires MX269013A)
MX269014A	ETC/DSRC Measurement Software (MS269xA only)
MX269015A	TD-SCDMA Measurement Software
MX269017A	Vector Modulation Analysis Software
MX269017A-001	APSK Analysis (Requires MX269017A)
MX269017A-011	Higher-Order QAM Analysis (Requires MX269017A)
MX269018A	Analog Measurement Software (For MS2840A and MS2830A. MS2830A-066 and A0086C are required for MS2830A. A0086C is required for MS2840A.)
MX269020A	LTE Downlink Measurement Software
MX269020A-001	LTE-Advanced FDD Downlink Measurement Software (Requires MX269020A)
MX269021A	LTE Uplink Measurement Software
MX269021A-001	LTE-Advanced FDD Uplink Measurement Software (Requires MX269021A)
MX269022A	LTE TDD Downlink Measurement Software
MX269022A-001	LTE-Advanced TDD Downlink Measurement Software (Requires MX269022A)
MX269023A	LTE TDD Uplink Measurement Software
MX269023A-001	LTE-Advanced TDD Uplink Measurement Software (Requires MX269023A)
MX269024A	CDMA2000 Forward Link Measurement Software
MX269024A-001	All Measure Function (Requires MX269024A)
MX269026A	EV-DO Forward Link Measurement Software
MX269026A-001	All Measure Function (Requires MX269026A)
MX269028A	WLAN (802.11) Measurement Software
MX269028A-001	802.11ac (80 MHz) Measurement Software (MS2830A only, Requires MX269028A)
MX269028A-002	802.11ac (160 MHz) Measurement Software (MS269xA only, Requires MX269028A)
MX269030A	W-CDMA BS Measurement Software
MX283027A	Wireless Network Device Test Software
MX283027A-001	WLAN Test Software (Requires MX283027A)
MX283027A-002	Bluetooth Test Software (Requires MX283027A)
MX283087A	TRX Sweep Calibration
MX285051A	5G Standard Measurement Software (Base License) (MS2850A only, Requires MX285051A-001/011/021/051/061/071)
MX285051A-001	Pre-Standard CP-OFDM Downlink (MS2850A only, Requires MX285051A)
MX285051A-051	Pre-Standard CP-OFDM Uplink (MS2850A only, Requires MX285051A)
MX285051A-011	NR TDD sub-6GHz Downlink (MS2850A only, Requires MX285051A)
MX285051A-061	NR TDD sub-6GHz 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)
	Measurement Software Options
	These software are for PC.
MX705010A*	Wi-SUN PHY Measurement Software (For MS269xA and MS2830A)
MX705110A	Wi-SUN Protocol Monitor (For MS269xA and MS2830A. MS2830A-006 is necessary for MS2830A.)
	Application parts
W3098AE	MX269011A Operation Manual (Operation)
W3099AE	MX269011A Operation Manual (Remote Control)
W3060AE	MX269012A Operation Manual (Operation)
W3061AE	MX269012A Operation Manual (Remote Control)
W3100AE	MX269013A Operation Manual (Operation)
W3101AE	MX269013A Operation Manual (Remote Control)
W3031AE	MX269014A Operation Manual (Operation)
W3032AE	MX269014A Operation Manual (Remote Control)
W3044AE	MX269015A Operation Manual (Operation)
W3045AE	MX269015A Operation Manual (Remote Control)
W3305AE	MX269017A Operation Manual (Operation)
W3306AE	MX269017A Operation Manual (Remote Control)
W3555AE	MX269018A Operation Manual (Operation)
W3556AE	MX269018A Operation Manual (Remote Control)
W3014AE	MX269020A Operation Manual (Operation)
W3064AE	MX269020A Operation Manual (Remote Control)
W3015AE	MX269021A Operation Manual (Operation)
W3065AE	MX269021A Operation Manual (Remote Control)
W3209AE	MX269022A Operation Manual (Operation)
W3210AE	MX269022A Operation Manual (Remote Control)
W3521AE	MX269023A Operation Manual (Operation)
W3522AE	MX269023A Operation Manual (Remote Control)
W3201AE	MX269024A Operation Manual (Operation)
W3202AE	MX269024A Operation Manual (Remote Control)
W3203AE	MX269026A Operation Manual (Operation)
W3204AE	MX269026A Operation Manual (Remote Control)
W3528AE	MX269028A Operation Manual (Operation)
W3529AE	MX269028A Operation Manual (Remote Control)
W2860AE	MX269030A Operation Manual (Operation)
W2861AE	MX269030A Operation Manual (Remote Control)
W3471AE	MX283027A Operation Manual (Operation)
W3473AE	MX283027A-001 Operation Manual (Operation)
W3474AE	MX283027A-001 Operation Manual (Remote Control)
W3516AE	MX283027A-002 Operation Manual (Operation)
W3517AE	MX283027A-002 Operation Manual (Remote Control)
W3448AE	MX283087A Operation Manual (Operation)
W3449AE	MX283087A Operation Manual (Remote Control)
W3922AE	MX285051A Operation Manual (Operation)
W3924AE	MX285051A-001/MX285051A-051 Operation Manual (Operation)
W3925AE	MX285051A-001/MX285051A-051 Operation Manual (Remote Control)

*:

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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Specifications are subject to change without notice.

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