

MX269028A WLAN (802.11) Measurement Software

MS2690A/MS2691A/MS2692A/MS2830A
Signal Analyzer

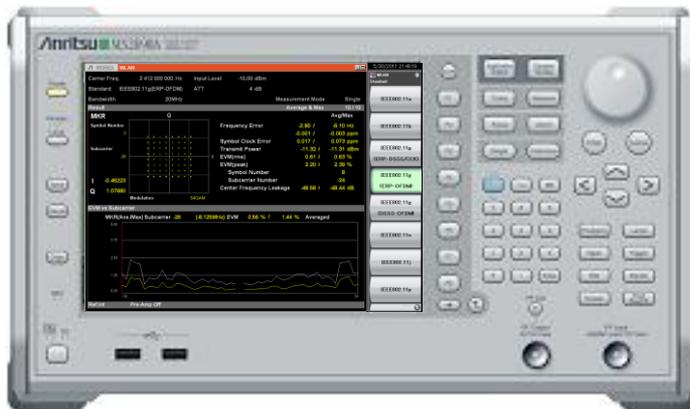
MS2690A/MS2691A/MS2692A/MS2830A Signal Analyzer

MX269028A WLAN (802.11) Measurement Software

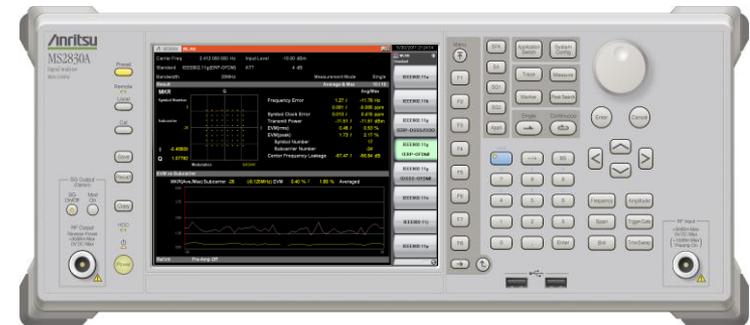
NEW MX269028A-001 802.11ac (80 MHz) Measurement Software

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

Product Introduction



MS269xA



MS2830A

Version 2.00

ANRITSU CORPORATION

What is MX269028A WLAN (802.11) Measurement Software?

Installing the MX269028A WLAN (802.11) Measurement Software in the MS269xA/MS2830A Signal Analyzer main frame supports modulation analysis of IEEE802.11n/p/a/b/g/j signals with display of numerical and graphical results.

MX269028A-001 802.11ac (80 MHz) Measurement Software, and MX269028A-002 802.11ac (160 MHz) Measurement Software are MX269028A software options for modulation analysis of IEEE802.11ac 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.

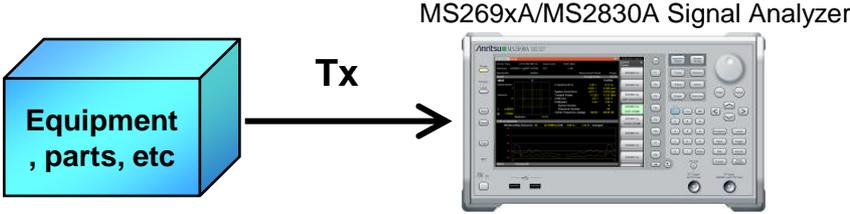
Features

- Supports modulation analysis for IEEE802.11n/p/a/b/g/j
- Adding optional software supports modulation analysis of IEEE802.11ac signal.

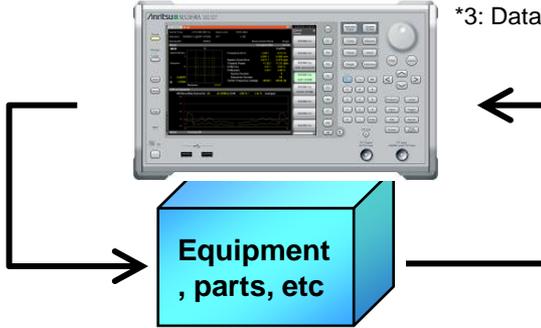
NEW MX269028A-001*1: Supports up to 80-MHz bandwidth. (Only for MS2830A)
MX269028A-002*1: Supports up to 160-MHz bandwidth. (Only for MS269xA)

- Displays numerical results and analysis graphs
(For R&D, quality assurance and manufacturing)
- Capture and Replay function*2
(Saves*3 signals for later modulation analysis troubleshooting)

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



The measurement software performs modulation analysis and the MS269xA/MS2830A Spectrum Analyzer performs basic RF measurements, such as spectrum mask and spurious.



The MS269xA supports the Vector Signal Generator option. The MS269xA is the ideal solution for evaluation using both standard signal sources and a spectrum analyzer.

What is MX269028A WLAN (802.11) Measurement Software?

■ Measurement Signals

MX269028A

- IEEE802.11n
(HT-Mixed, HT-Greenfield, Non-HT)
- IEEE802.11p
- IEEE802.11a
- IEEE802.11b
- IEEE802.11g ERP-DSSS/CCK
- IEEE802.11g ERP-OFDM
- IEEE803.11g DSSS-OFDM
- IEEE802.11j

Measures both continuous and burst signals.

NEW MX269028A-001^{*1}/002^{*1}

- IEEE802.11ac (VHT)

Measures burst signals only.

MX269028A-001: Supports up to 80-MHz bandwidth. (Only for MS2830A)

MX269028A-002: Supports up to 160-MHz bandwidth. (Only for MS269xA)

*1: Requires MX269028A.

■ Capture & Replay Function^{*2}

When faults are detected, this function captures^{*3} on-site signals to internal/external hard disk for later troubleshooting using analysis functions.

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

*3: 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 Mask
- Spurious Emission

What is MX269028A WLAN (802.11) Measurement Software?



MX269028A-001/002: Supports IEEE802.11ac signals up to 160-MHz bandwidth

The IEEE802.11ac measurement range varies as follows, depending on the Analysis Bandwidth Extension option configuration.

Model			Bandwidth of IEEE802.11ac signal		
Main frame	Measurement software	Analysis Bandwidth Extension Option Configuration	20 MHz	40 MHz	80 MHz
MS269xA	MX269028A-002	Opt-078* ¹ installed	✓	✓	✓
		Opt-077/004* ² installed	✓	✓	
		Standard	✓	✓	
MS2830A	MX269028A-001	Opt-078* ³ installed	✓	✓	✓* ⁷
		Opt-077* ⁴ installed	✓	✓	
		Opt-005/009* ⁵ installed	✓	✓	

Model			Bandwidth of IEEE802.11ac signal	
Main frame	Measurement software	Analysis Bandwidth Extension Option Configuration	160 MHz	80 MHz + 80 MHz
MS269xA	MX269028A-002	Opt-078* ¹ installed	✓	✓* ⁶
		Opt-077/004* ² installed		
		Standard		
MS2830A	MX269028A-001	Opt-078* ³ installed		
		Opt-077* ⁴ installed		
		Opt-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.



What is MX269028A WLAN (802.11) Measurement Software?

■ Analysis Function (Numerical Results and Graph display)

Item	11n/p/a/j 11g (ERP-OFDM) 11g (DSSS-OFDM)	11b 11g (ERP-DSSS/CCK)	11ac
	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	—	✓	—

Item	11n/p/a/j 11g (ERP-OFDM) 11g (DSSS-OFDM)	11b 11g (ERP-DSSS/CCK)	11ac
	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	✓	✓	—

Power vs. Time Function

- *1: IEEE802.11a
- *2: IEEE802.11n
- *3: IEEE802.11n (HT-Mixed, HT-Greenfield)
- *4: Exclude IEEE802.11n
- *5: IEEE802.11g DSSS-OFDM
- *6: Exclude Channel Bandwidth 160 MHz setting

MX269028A Measurement Screen [Modulation Analysis Function]

◆ Constellation/Numerical Result: MX269028A (IEEE802.11n/p/a/b/g/j)

The Constellation/numerical value results are displayed at the top of the screen when Trace Mode is EVM vs. Subcarrier, EVM vs. Symbol, EVM vs. Chip, Spectrum Flatness, Phase Error vs. Chip, or Eye Diagram.



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

Some basic transmission test items, such as EVM, frequency error, and output powers can be checked at this screen.

(1) Constellation

The constellation of the symbol (chip) selected by the marker is displayed. In addition, when Subcarrier is selected by the marker, IQ coordinates and subcarrier information at the position are displayed.

Symbol Number	Symbol number selected by marker
Subcarrier	Symbol number selected by marker
Chip Number	Chip number selected by marker
I, Q	IQ amplitude value at marker
Modulation	Subcarrier modulation (chip) method at marker

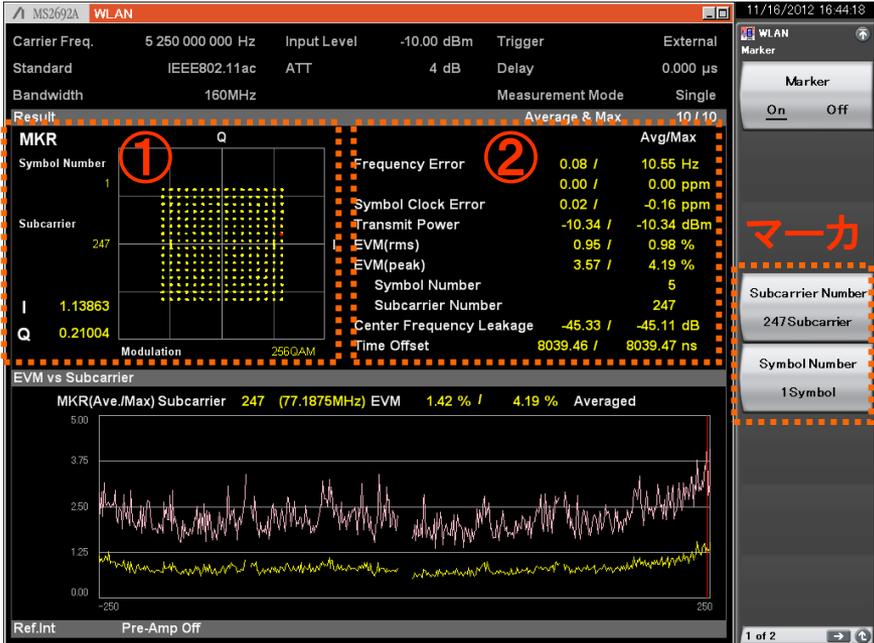
(2) Numerical Result

I : 11n, 11p, 11a, 11g(ERP-OFDM, DSSS-OFDM), 11j		
II : 11b, 11g(ERP-DSSS/CCK)		
Item	I	II
Frequency Error	✓	✓
Symbol Clock Error/Chip Clock Error	✓	✓
Transmit Power	✓	✓
EVM (rms)	✓	✓
EVM (Peak)	✓	✓
Symbol Number, Subcarrier Number/Chip Number	✓	✓
Center Frequency Leakage	✓	
IQ Origin Offset		✓
Time Offset	✓	✓

MX269028A Measurement Screen [Modulation Analysis Function]

◆ Constellation/Numerical Result: MX269028A-001/002 (IEEE802.11ac)

The Constellation/numerical value results are displayed at the top of the screen when Trace Mode is EVM vs. Subcarrier, EVM vs. Symbol, Spectrum Flatness.



MX269028A-001: Supports up to 80-MHz bandwidth. (Only for MS2830A)
 MX269028A-002: Supports up to 160-MHz bandwidth. (Only for MS269xA)

(1) Constellation

The constellation of the symbol selected by the marker is displayed. In addition, when Subcarrier is selected by the marker, IQ coordinates and subcarrier information at the position are displayed.

Symbol Number	Symbol number selected by marker
Subcarrier	Subcarrier number selected by marker
I, Q	IQ amplitude value at marker
Modulation	Subcarrier modulation method at marker

(2) Numerical Result

Item	11ac
Frequency Error	✓
Symbol Clock Error	✓
Transmit Power	✓
EVM (rms)	✓
EVM (Peak)	✓
Symbol Number, Subcarrier Number	✓
Center Frequency Leakage	✓
Time Offset	✓

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

Some basic transmission test items, such as EVM, frequency error, and output powers can be checked at this screen.

MX269028A Measurement Screen [Modulation Analysis Function]

◆ Summary: MX269028A (IEEE802.11n/p/a/b/g/j)

*1: IEEE802.11a *3: IEEE802.11n(HT-Mixed, HT-Greenfield)
 *2: IEEE802.11n *4: Exclude IEEE802.11n
 *5: IEEE802.11g DSSS-OFDM

Decode information as well as numerical results from the previous slide are summarized on one screen.



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

Numerical results, such as EVM and decode results can be checked with the list.

I : 11n, 11p, 11a, 11g(ERP-OFDM, DSSS-OFDM), 11j II : 11b, 11g(ERP-DSSS/CCK)		
Item	I	II
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	
EVM(Peak)	✓	✓
Symbol Number, Subcarrier Number/Chip Number	✓	✓
Quadrature Error	✓	
IQ Gain Imbalance	✓	
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	

MX269028A Measurement Screen [Modulation Analysis Function]

◆ Summary: MX269028A (IEEE802.11ac)

Decode information as well as numerical results from the previous slide are summarized on one screen.

MX269028A-001: Supports up to 80-MHz bandwidth. (Only for MS2830A)
 MX269028A-002: Supports up to 160-MHz bandwidth. (Only for MS269xA)



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

Numerical results, such as EVM and decode results can be checked with the list.

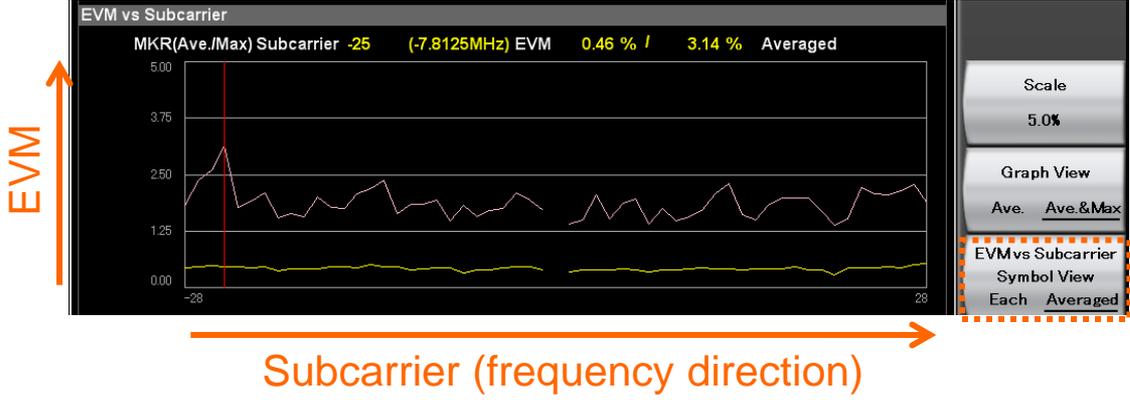
Item	11ac
Frequency Error	✓
Symbol Clock Error/Chip Clock Error	✓
Transmit Power	✓
Time Offset	✓
EVM(rms)	✓
Data EVM, Pilot EVM	✓
L-SIG EVM(rms)	✓
VHT-SIG-A EVM(rms), VHT-SIG-B EVM(rms)	✓
EVM(Peak)	✓
Symbol Number, Subcarrier Number	✓
Quadrature Error	✓*1
IQ Gain Imbalance	✓*1
Center Frequency Leakage	✓
Spectral Flatness (Amplitude/Phase/Group Delay)	✓
Outside Subcarrier Amplitude Max and Min Value	✓
Inside Subcarrier Amplitude Max and Min Value	✓
Detect Parameter	✓
MCS, Stream ID, Symbol Length, Guard Interval	✓

*1: Exclude Channel Bandwidth 160 MHz setting

MX269028A Measurement Screen [Modulation Analysis Function]

◆ EVM vs Subcarrier

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

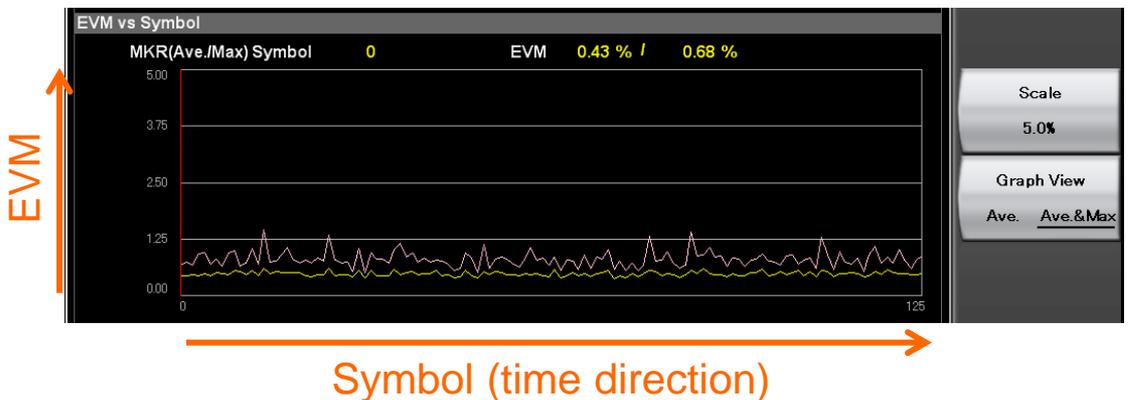


In-band interference signals can be checked.

The EVM calculation method can be selected from:
Each: Subcarrier EVM per symbol
Average: Averaged subcarrier EVM for all symbols

◆ EVM vs Symbol

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

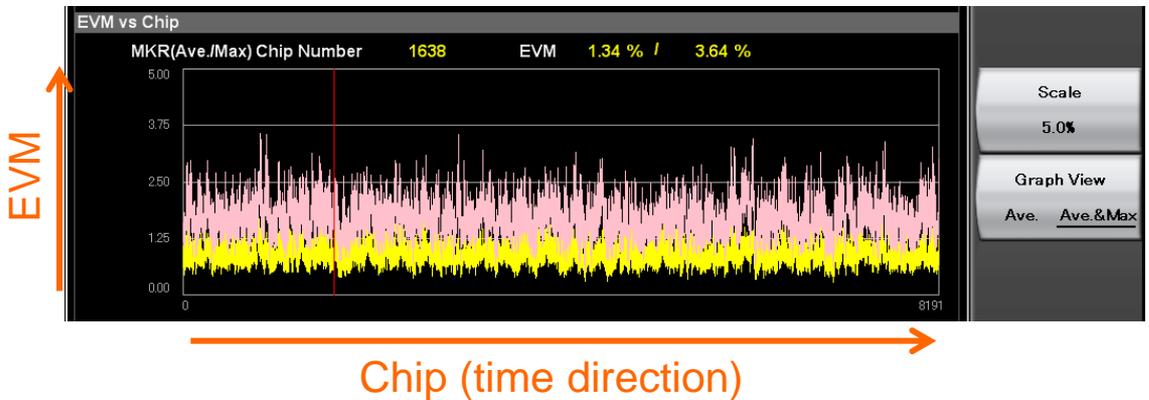


"Confirmation of characteristics in time direction" and "Trouble only at specific Symbol" can be checked.

MX269028A Measurement Screen [Modulation Analysis Function]

◆ EVM vs Chip

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



"Confirmation of characteristics in time direction" and "Trouble only at specific Chip" can be checked.

◆ 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.



Phase error can be checked.

MX269028A Measurement Screen [Modulation Analysis Function]

◆ 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.

Frequency characteristics (Amplitude, Phase, Group Delay) can be checked.

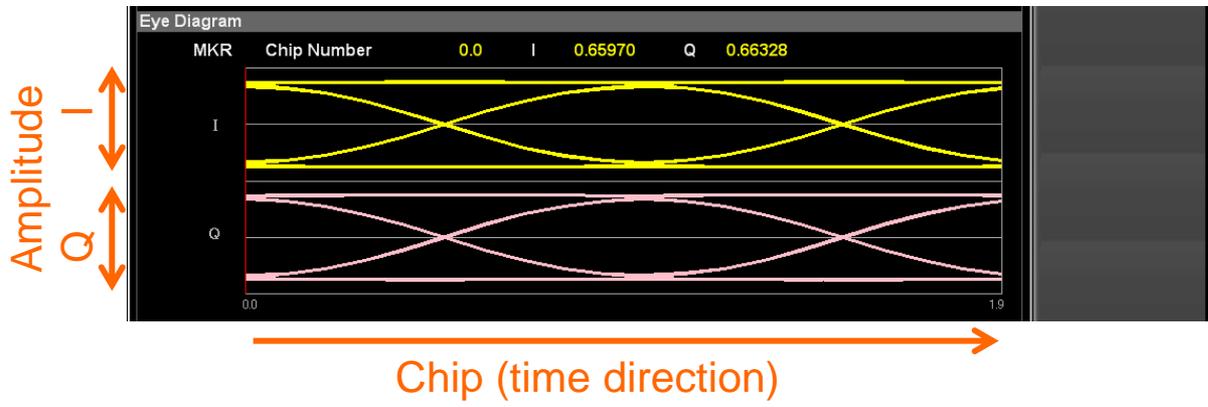


Subcarrier (frequency direction)

MX269028A Measurement Screen [Modulation Analysis Function]

◆ Eye Diagram

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



MX269028A Measurement Screen [Power vs. Time Function*]

◆ Burst/Transient

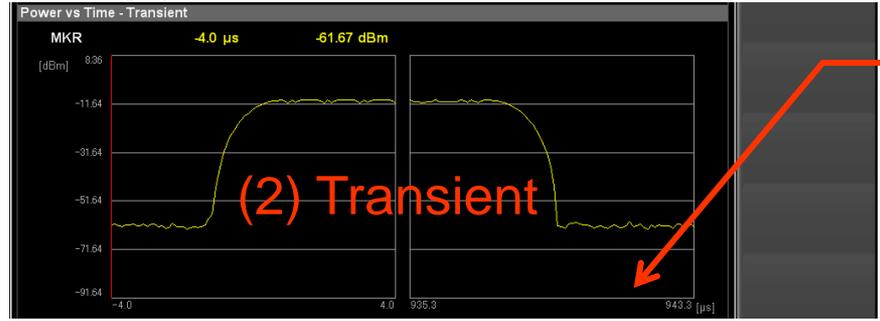
*: Supports EEE802.11n/p/a/b/g/j

This displays the numerical results at the top of the screen and the Power vs. Time graph (horizontal axis: Time, vertical axis: Power) at the bottom of the screen.



(1) Numerical Result

I : 11n, 11p, 11a, 11g(ERP-OFDM, DSSS-OFDM), 11j II : 11b, 11g(ERP-DSSS/CCK)		
Item	I	II
Transmit Power	✓	✓
Power Flatness Max	✓	✓
Carrier Off Power	✓	✓
On/Off Ratio	✓	✓
Peak Power Spectrum Density (PSD)	✓	✓
Transient time (power-on ramp, power-off ramp)		✓



(2) Graph Display

Burst	Displays one burst waveform
Transient	Zooms burst rise and fall Burst length = analysis length + preamble length Displayed time scale is adjustable

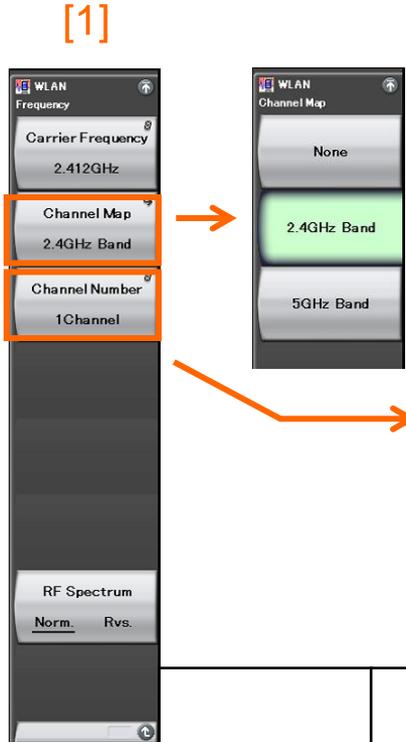
Burst rise and fall waveforms can be checked.

MX269028A Basic Settings (1/7)

When Channel Map is 2.4 GHz Band

- WLAN
- Frequency
- Amplitude
- Common Setting
- Measure
- Marker
- Trigger
- Capture
- Accessory

- [1] Frequency
- [2] Level
- [3] Common Setting
- [4] Measurement
- [5] Marker
- [6] Trigger
- [7] Capture



Channel Number	Carrier Frequency	Channel Number	Carrier Frequency
1	2412 MHz	8	2447 MHz
2	2417 MHz	9	2452 MHz
3	2422 MHz	10	2457 MHz
4	2427 MHz	11	2462 MHz
5	2432 MHz	12	2467 MHz
6	2437 MHz	13	2472 MHz
7	2442 MHz	14	2484 MHz

When Channel Map is 5 GHz Band

Channel Number	Carrier Frequency
0	5000 MHz
1	5005 MHz
:	:
199	5995 MHz
200	6000 MHz

Carrier frequency = 5 GHz + (5 MHz x n)
(n = Channel Number)

*: MX269028A-001/002 installed



Front-panel function keys switch to setting screens.

Frequency Range	Meas. Range	2412 MHz to 2472 MHz 2484 MHz	IEEE802.11n (2.4GHz Band) IEEE802.11b, IEEE802.11g
			5180 MHz to 5320 MHz 5500 MHz to 5700 MHz 5745 MHz to 5825 MHz
		5180 MHz to 5825 MHz	IEEE802.11ac* (80MHz/160MHz Channel)
		5835 MHz to 5925 MHz 300MHz to 862MHz	IEEE802.11p
		4920 MHz to 4980 MHz	IEEE802.11j
	Setting Range	100 MHz to upper limit frequency	
Channel Map	None , 2,4GHz Band, 5GHz Band		
Channel No.	1 to 14 (2.4GHz Band), 0 to 200 (5GHz Band)		

MX269028A Basic Settings (2/7)

[2]



- [1] Frequency
- [2] Level
- [3] Common Setting
- [4] Measurement
- [5] Marker
- [6] Trigger
- [7] Capture



[2]

Measurement Level Range	Meas. Range	<p>Preamp Off, or Preamp not installed</p> <p>MS269xA -15 to +30 dBm (11n/11p/11a/11b/11g: 2.4/5GHz band, 11p: 700MHz band, 11j: 4.9GHz band) 11ac*: 20/40MHz Channel) -10 to +30 dBm (11ac*: 80/160MHz Channel)</p> <p>MS2830A-040/041/043/044 -15 to +30 dBm (11n/11b/11g: 2.4GHz band, 11p: 700MHz band, 11ac*: 20/40MHz Channel) -12 to +30 dBm (11n/11p/11a: 5GHz band, 11j: 4.9GHz band) -10 to +30 dBm (11ac*: 80/160MHz Channel)</p> <p>MS2830A-045 -9 to +30 dBm (11n/11b/11g: 2.4GHz band, 11p: 700MHz band, 11ac*: 20/40MHz Channel) -6 to +30 dBm (11n/11p/11a: 5GHz band, 11j: 4.9GHz band) -4 to +30 dBm (11ac*: 80/160MHz Channel)</p> <p>Preamp On MS269xA ,MS2830A -30 to +10 dBm (11n/11p/11a/11b/11g: 2.4/5GHz band, 11p: 700MHz band, 11j: 4.9GHz band, 11ac*: 20/40MHz Channel) -20 to +10 dBm (11ac*: 80/160MHz Channel)</p>
	Setting Range	<p>Preamp Off, or Preamp not installed (-60.00 + Offset Value) to (30.00 + Offset Value) dBm</p> <p>Preamp On (-80.00 + Offset Value) to (10.00 + Offset Value) dBm</p>

*: MX269028A-001/002 installed

MX269028A Basic Settings Basic Settings (3/7)



- [1] Frequency
- [2] Level
- [3] Common Setting
- [4] Measurement
- [5] Marker
- [6] Trigger
- [7] Capture

[3]



See slide 18

[4]



See slide 19 to 21

[5]



[6]



[7]



[6]

[5]



[4]

MX269028A Basic Settings (4/7)

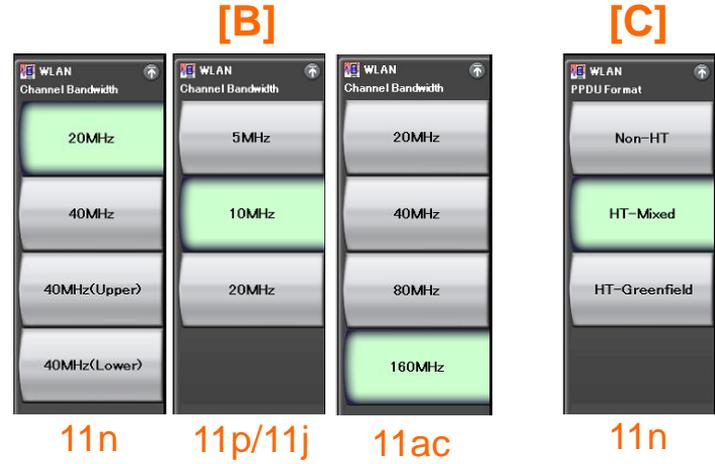
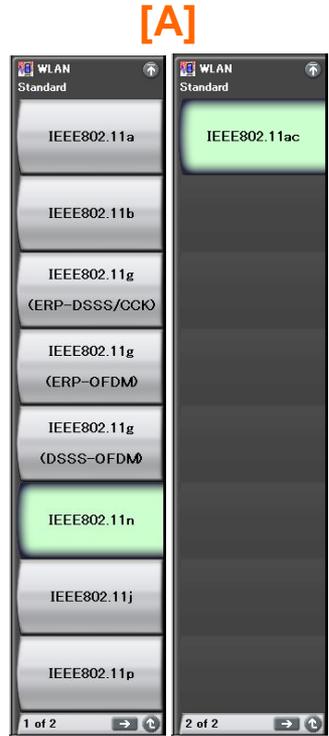
[3] Common Setting



[A] 11n/p/a/b/g/j:
Measures Continuous signals as well as Burst signal.

[B] 11ac*1:
Measures Burst signals only.

[C] Detailed settings for modulation analysis (see slide 22).



[A]	Measurement Target Standard Specification	IEEE802.11n
		IEEE802.11p
		IEEE802.11a
		IEEE802.11b
		IEEE802.11g ERP-DSSS/CCK
		IEEE802.11g ERP-OFDM
		IEEE802.11g DSSS-OFDM
		IEEE802.11ac*1
[B]	Channel Bandwidth	IEEE802.11n: 20MHz, 40MHz, 40MHz (Upper), 40MHz (Lower)
		IEEE802.11p/j: 5MHz, 10MHz, 20MHz
		IEEE802.11ac*1: 20MHz, 40MHz, 80MHz, 160MHz*2
[C]	PPDU Format	IEEE802.11n: Non-HT, HT-Mixed, HT-Greenfield
		IEEE802.11ac*1: VHT

*1: MX269028A-001/002 installed
*2: MX269028A-002 installed

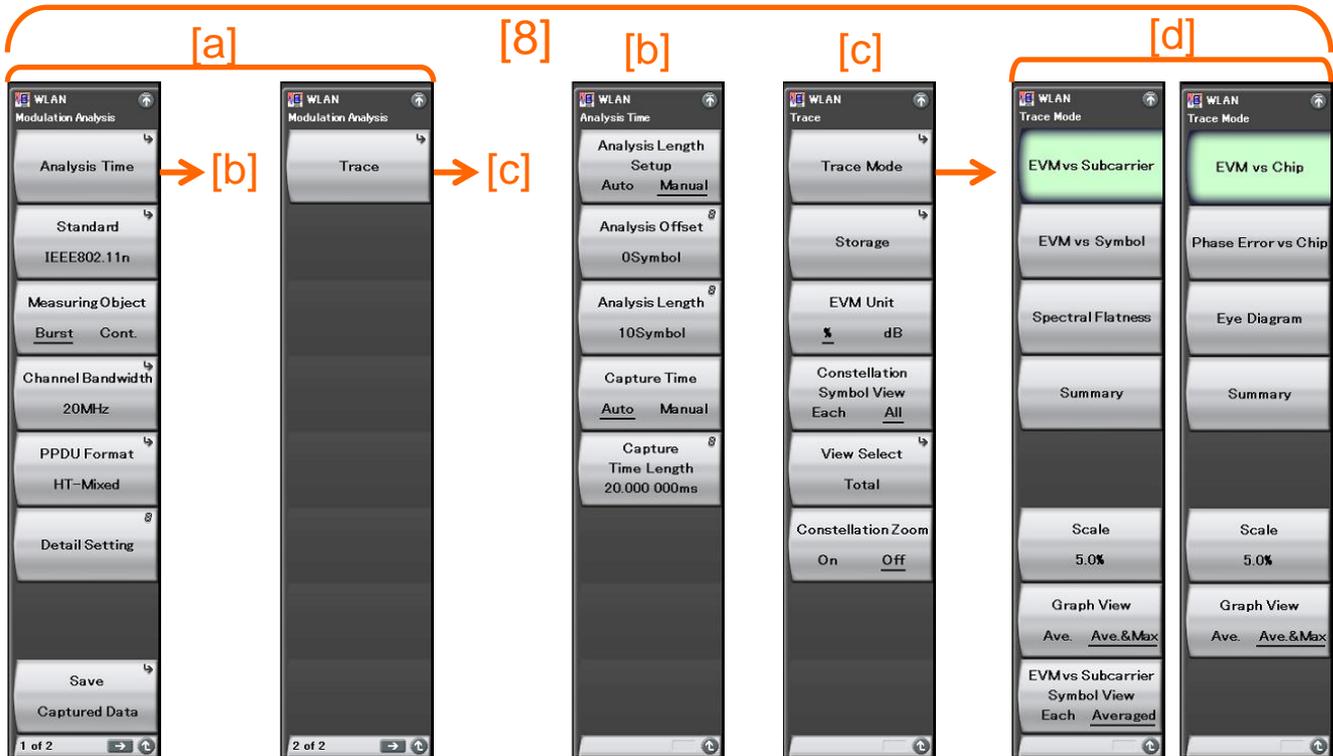
MX269028A Basic Settings (5/7)

[4] Measurement

Modulation analysis



- [A]
- [B]
- [C]
- [D]
- [E]
- [F]



[8][d]: Modulation Analysis Function Trace Mode *: MX269028A-001/002 installed



- [8][c]
- [8][b]



[4]

Graph Display	EVM vs. Subcarrier	IEEE802.11n, 11p, 11a, 11j, 11g (ERP-OFDM, DSSS-OFDM) 11ac*
	EVM vs. Symbol	
	Spectral Flatness (Amplitude/Phase/Group Delay)	
	EVM vs. Chip	IEEE802.11b, 11g (ERP-DSSS/CCK)
	Phase Error vs. Chip	
Summary Display	Eye diagram	Common

MX269028A Basic Settings (6/7)

[4] Measurement

Power vs. Time

[A] Modulation Analysis

[B] Power vs Time

[C] ACP(Swept)

[D] OBW(Swept)

[E] Spectrum Emission Mask(Swept)

[F] Spurious Emission(Swept)

[a] Analysis Time

[b] Trace

[8] Analysis Length
1.000 000ms

[c] Trace Mode

[d] Burst
Transient

[8][c] Frequency Amplitude

[8][b] Span Trigger/Gate

[4] Trace Measure

Marker Peak Search

[8][d]: Power vs. Time Trace Mode
Supports IEEE802.11n/p/a/b/g/j

Graph Display	Burst	Displays one burst waveform
	Transient	Zooms burst rise and fall Burst length = analysis length + preamble length

MX269028A Basic Settings (7/7)

[4] Measurement



**MS269xA/MS2830A
Main Frame Functions**



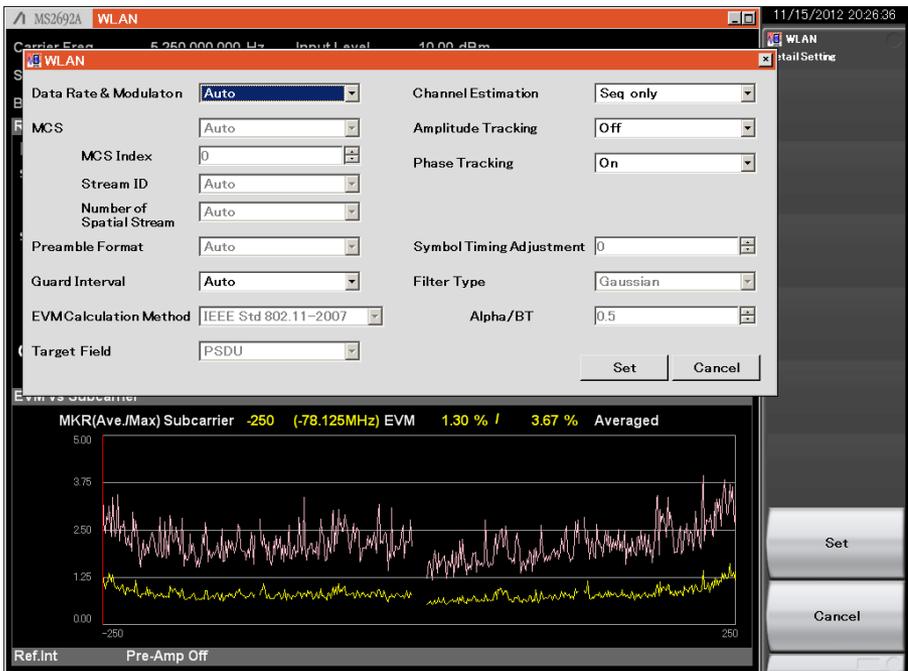
The following measurements are performed by calling the main-frame spectrum analyzer functions. Each standard template can select.

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



[4]

MX269028A Detailed Parameter Settings (1/6)



Item	Setting
Number of Spatial Stream Setting Range: See slide 25.	Sets stream number for measurement target signals
Preamble Format Setting Range: See slide 25.	Sets preamble for measurement target signals
Guard Interval Setting Range: See slide 25.	Sets guard interval for measurement target signals
EVM Calculation Method Setting Range: See slide 26.	Sets EVM calculation method
Target Field Setting Range: See slide 26.	Selects either Preamble or PSDU as measurement target field
Channel Estimation Setting Range: See slide 26.	Sets target for channel estimation processing
Amplitude Tracking Setting Range: See slide 26.	Sets amplitude tracking ON/Off
Phase Tracking Setting Range: See slide 26.	Sets phase tracking ON/Off
Symbol Timing Adjustment Setting Range: See slide 27.	Sets FFT Window position at modulation analysis measurement
Filter Type Setting Range: See slide 27.	Sets reference filter for EVM calculation
Alpha/BT Setting Range: See slide 27.	Sets alpha value of square-root Nyquist filter or BT product of Gauss filter

Item	Setting
Data Rate & Modulation Setting Range: See slide 23.	Sets transmission speed and modulation method for measurement target signals
MCS Setting Range: See slide 24.	MCS can be set either manually or automatically. Auto-setting sets the MCS value obtained after decoding the HT-SIG field.
MCS Index Setting Range: See slide 25.	Sets MCS Index
Stream ID Setting Range: See slide 25.	Sets stream ID for measurement target signals

MX269028A Detailed Parameter Settings (2/6)

■ Data Rate & Modulation Setting Range

Measurement Target Signal	802.11n (PPDU Format: Non-HT, Channel Bandwidth: 20 MHz or 40 MHz) 802.11p (Channel Bandwidth: 20 MHz) 802.11a 802.11g (ERP-OFDM) 802.11g (DSSS-OFDM) 802.11j (Channel Bandwidth: 20 MHz)
Options	Setting
Auto	Automatically sets transmission speed and modulation method
6Mbps-BPSK	Transmission speed: 6 Mbps, Modulation method: BPSK
9Mbps-BPSK	Transmission speed: 9 Mbps, Modulation method: BPSK
12Mbps-QPSK	Transmission speed: 12 Mbps, Modulation method: QPSK
18Mbps-QPSK	Transmission speed: 18 Mbps, Modulation method: QPSK
24Mbps-16QAM	Transmission speed: 24 Mbps, Modulation method: 16QAM
36Mbps-16QAM	Transmission speed: 36 Mbps, Modulation method: 16QAM
48Mbps-64QAM	Transmission speed: 48 Mbps, Modulation method: 64QAM
54Mbps-64QAM	Transmission speed: 54 Mbps, Modulation method: 64QAM

Measurement Target Signal	802.11b 802.11g (ERP-DSSS/CCK)
Options	Setting
Auto	Automatically sets transmission speed and modulation method
1Mbps-DBPSK	Transmission speed: 1 Mbps, Modulation method: DBPSK
2Mbps-DQPSK	Transmission speed: 2 Mbps, Modulation method: DQPSK
5.5Mbps-CCK	Transmission speed: 5.5 Mbps, Modulation method: CCK
11Mbps-CCK	Transmission speed: 11 Mbps, Modulation method: CCK

Measurement Target Signal	802.11p (Channel Bandwidth: 10 MHz) 802.11j (Channel Bandwidth: 10 MHz)
Options	Setting
Auto	Automatically sets transmission speed and modulation method
3Mbps-BPSK	Transmission speed: 3 Mbps, Modulation method: BPSK
4.5Mbps-BPSK	Transmission speed: 4.5 Mbps, Modulation method: BPSK
6Mbps-QPSK	Transmission speed: 6 Mbps, Modulation method: QPSK
9Mbps-QPSK	Transmission speed: 9 Mbps, Modulation method: QPSK
12Mbps-16QAM	Transmission speed: 12 Mbps, Modulation method: 16QAM
18Mbps-16QAM	Transmission speed: 18 Mbps, Modulation method: 16QAM
24Mbps-64QAM	Transmission speed: 24 Mbps, Modulation method: 64QAM
27Mbps-64QAM	Transmission speed: 27 Mbps, Modulation method: 64QAM

Measurement Target Signal	802.11p (Channel Bandwidth = 5 MHz) 802.11j (Channel Bandwidth = 5 MHz)
Options	Setting
Auto	Automatically sets transmission speed and modulation method
1.5Mbps-BPSK	Transmission speed: 1.5 Mbps, Modulation method: BPSK
2.25Mbps-BPSK	Transmission speed: 2.25 Mbps, Modulation method: BPSK
3Mbps-QPSK	Transmission speed: 3 Mbps, Modulation method: QPSK
4.5Mbps-QPSK	Transmission speed: 4.5 Mbps, Modulation method: QPSK
6Mbps-16QAM	Transmission speed: 6 Mbps, Modulation method: 16QAM
9Mbps-16QAM	Transmission speed: 9 Mbps, Modulation method: 16QAM
12Mbps-64QAM	Transmission speed: 12 Mbps, Modulation method: 64QAM
13.5Mbps-64QAM	Transmission speed: 13.5 Mbps, Modulation method: 64QAM

Notes:

- Cannot set when measurement target signal is 802.11n (PPDU Format: HT-Mixed or HT-Greenfield).
- Cannot set when measurement target signal is 802.11ac.
- Auto cannot be set when Measuring Object is Continuous (continuous signals).

MX269028A Detailed Parameter Settings (3/6)

■MCS Setting Range

Option	Setting
Auto	Automatic MCS setting
Manual	Manual MCS setting

Note:

- Cannot set when measurement target signal is not 802.11n (PPDU Format: HT-Mixed or HT-Greenfield).
- Fixed to manual when Measuring Object setting is Continuous (continuous signals).

■MCS Index Setting Range

Setting Range	Band	No. of Tx Stream	Modulation Method
0to7	20/40 M	1	-----
8 to15	20/40 M	2	Same in multiple streams
16to23	20/40 M	3	Same in multiple streams
24to31	20/40 M	4	Same in multiple streams
32	40 M	1	-----
33to38	20/40 M	2	Different in multiple streams
39to52	20/40 M	3	Different in multiple streams
53to76	20/40 M	4	Different in multiple streams

Note:

- Cannot set when MCS is Auto.
- Only 0 to 7 can be set when the Measuring Object setting is Continuous (continuous signal).

MCS Index for 802.11ac Setting range: 0 to 9

Number of Spatial Stream	Channel Bandwidth			
	20MHz	40MHz	80MHz	160MHz
1	0 to 8	0 to 9	0 to 9	0 to 9
2	0 to 8	0 to 9	0 to 9	0 to 9
3	0 to 9	0 to 9	0 to 5, 7 to 9	0 to 8
4	0 to 8	0 to 9	0 to 9	0 to 9
5	0 to 8	0 to 9	0 to 9	0 to 9
6	0 to 9	0 to 9	0 to 8	0 to 9
7	0 to 8	0 to 9	0 to 5, 7 to 9	0 to 9
8	0 to 8	0 to 9	0 to 9	0 to 9

Note:

- When WLAN Standard is 802.11ac, the setting range of the MCS index depends on the channel bandwidth and number of spatial stream.

MX269028A Detailed Parameter Settings (4/6)

Stream ID Setting Range

MCS Index	Setting Range
0to7	Auto/1
8 to15	Auto/1/2
16to23	Auto/1/2/3
24to31	Auto/1/2/3/4
32	Auto/1
33to38	Auto/1/2
39to52	Auto/1/2/3
53to76	Auto/1/2/3/4

Note:
• Cannot set when MCS is Auto.

Stream ID for 802.11ac Setting range: 1 to 8

Number of Spatial Stream Setting Range

Number of Spatial Stream Setting range: 1 to 8

Note:
• It is forcibly set to Auto when MCS is Auto.

Preamble Format Setting Range

Option	Setting
Auto	Automatically evaluate and analyze preamble format
Long	Analyze preamble as Long
Short	Analyzer preamble as Short

Note:
• Can set only when measurement target signal is 802.11b, 802.11g (ERP-DSSS/CCK), or 802.11g (DSSS-OFDM).
• Cannot set when Measuring Object is Continuous (continuous signal).

Guard Interval Setting Range

Option	Setting
Auto	Automatically evaluate and analyze guard interval
Long	Analyze guard interval as Long
Short	Analyzer guard interval as Short

Note:
• This is only available when WLAN Standard is 802.11n, and PPDU Format is HT-Mixed or HT-Greenfield. However, it is available when WLAN Standard is 802.11ac.
• Cannot set when Measuring Object is Continuous (continuous signal).



MX269028A Detailed Parameter Settings (5/6)

■EVM Calculation Method Setting Range

Option	Setting
IEEE Std 802.11-1999	Calculate EVM based on IEEE Std 802.11-1999
IEEE Std 802.11-2007	Calculate EVM based on IEEE Std 802.11-2007

Note:
• Can set only when measurement target signal is 802.11b, or 802.11g (ERP-DSSS/CCK).

■Target Field Setting Range

Option	Setting
PSDU	Measurement start position is start of PSDU
Preamble	Measurement start position is start of Preamble

Note:
• Can set only when measurement target signal is 802.11b, or 802.11g (ERP-DSSS/CCK).
• Cannot set when Measuring Object is Continuous (continuous signal).

■Channel Estimation Setting Range

Option	Setting
Seq only	Target long training sequence for channel estimation
Seq & Data	Target all packets for channel estimation

Note:
• Can set only when measurement target signal 802.11b, or 802.11g (ERP-DSSS/CCK).
• Seq & Data when Measuring Object is Continuous (continuous signal).

■Amplitude Tracking Setting Range

Option	Setting
Off	No amplitude calibration
On	Calibrate amplitude

Note:
• Can set only when measurement target signal is 802.11b, or 802.11g (ERP-DSSS/CCK).

■Phase Tracking Setting Range

Option	Setting
Off	No phase calibration
On	Calibrate phase

Note:
• Can set only when measurement target signal is 802.11b, or 802.11g (ERP-DSSS/CCK).

MX269028A Detailed Parameter Settings (6/6)

■ Symbol Timing Adjustment Setting Range

Sets FFT window position in guard interval range based on guard interval center

Setting Range	Measurement target signal
-16 to 16	802.11a, 802.11g (ERP-OFDM), 802.11g (DSSS-OFDM), 802.11n (Guard Interval: Long), 802.11j, 802.11p
-8 to 8	802.11n, 802.11ac (Guard Interval: Short)

Note:

- Can set only when measurement target signal is 802.11b, or 802.11g (ERP-DSSS/CCK).
- Cannot set when measurement target signal is 802.11n and Guard Interval is Auto.

■ Filter Type Setting Range

Option	Setting
No Filter	Analyze without reference filter
Gaussian	Analyze Gaussian filter as reference filter
Root Nyquist	Analyze Root Nyquist filter as reference filter

Note:

- Can set only when measurement target signal is 802.11b, or 802.11g (ERP-DSSS/CCK).

■ Filter Type Setting Range

Setting Range	Setting
0.3 to 1.0	Sets alpha value of square-root Nyquist filter or BT product of Gaussian filter.

Note:

- Can set only when measurement target signal is 802.11b, or 802.11g (ERP-DSSS/CCK)
- Cannot set when Filter Type is No Filter.

[Merit 1] MX269028A Usage

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 MX269028A to troubleshoot items, such as EVM measurements.

Capture!

Save Data

Replay!

Name	Date / Time	Size[Bytes]	Protect
Digitize20110526_000	5/26/2011 8:36:16 AM	8,800,000	Off
Digitize20110526_001	5/26/2011 8:53:24 AM	8,800,000	Off
Digitize20110526_002	5/26/2011 8:08:23 AM	16,800,000	Off
Digitize20110526_003	5/26/2011 9:14:59 AM	8,800,000	Off
Digitize20110526_004	5/26/2011 9:16:45 AM	8,800,000	Off
Digitize20110526_005	5/26/2011 9:21:07 AM	8,800,000	Off

◆ **R&D Usage**
 Save data for DUT prototype versions.
 ⇒ Make detailed comparison to improve performance.

◆ **Usage on production line**
 Save data at shipment.
 ⇒ Verify performance data for post-shipment problems.

*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

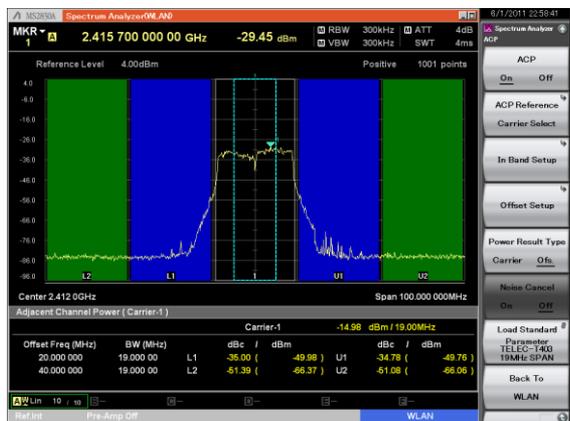
[Merit 2] MS269xA/MS2830A Main Frame Measurement Functions

- Supports Tx Characteristics tests for RF signals, such as spurious measurements (1/2) -

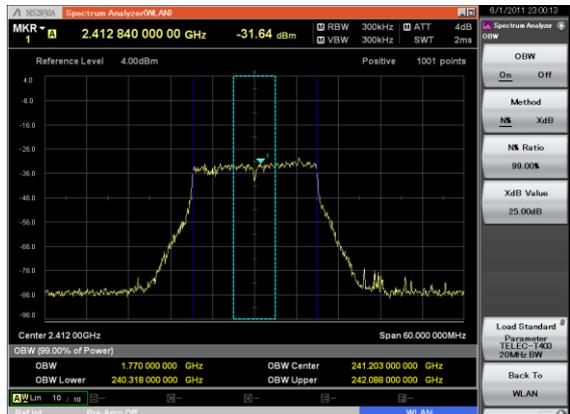
The MX269028A supports modulation analysis, such as EVM measurements.

Moreover, the following measurements are performed by calling the main-frame spectrum analyzer functions.

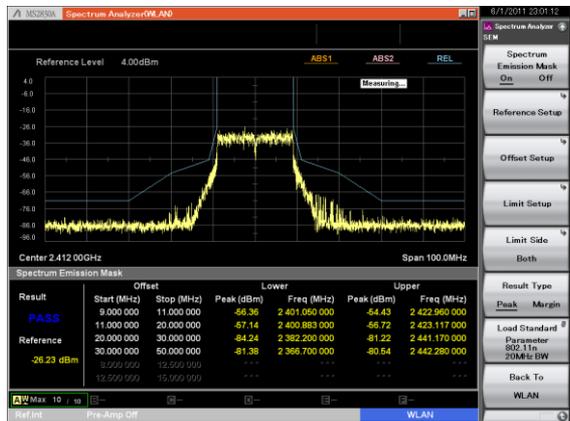
◆ Adjacent Channel Power (ACP)



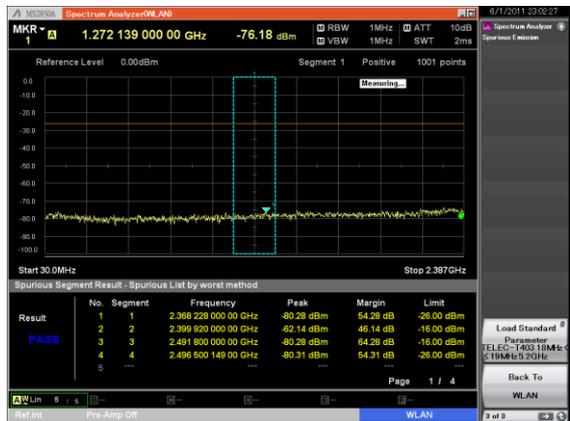
◆ Occupied Bandwidth (OBW)



◆ Spectrum Emission Mask (SEM)



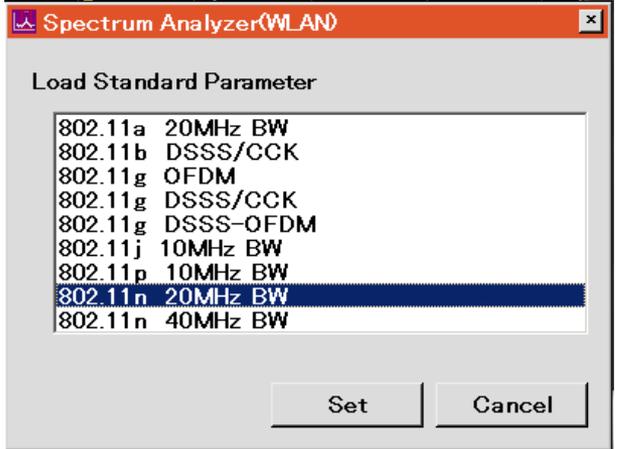
◆ Spurious



[Merit 2] MS269xA/MS2830A Main Frame Measurement Functions

- Supports Tx Characteristics tests for RF signals, such as spurious measurements (2/2) -
 Template for each standard

These functions prepare each measurement standard templates.



Example: Spurious Emission Mask (SEM) Measurement Template

Standard	Bandwidth	Supported Template			
		ACP	OBW	SEM	Spurious
IEEE802.11n	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
IEEE802.11p	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
IEEE802.11a	---	✓ TELEC T403	✓ TELEC T403 ✓ ETSI	✓ IEEE ✓ ETSI	✓ TELEC T403 ✓ ETSI ✓ FCC
IEEE802.11b	---	---	✓ TELEC T401	✓ IEEE	✓ TELEC T401 ✓ ETSI
IEEE802.11g ERP-DSSS/CCK	---	---	✓ TELEC T401	✓ IEEE	✓ TELEC T401 ✓ ETSI
IEEE802.11g ERP-OFDM	---	---	✓ TELEC T401 ✓ ETSI	✓ IEEE ✓ ETSI	✓ TELEC T401 ✓ ETSI
IEEE802.11g DSSS-OFDM	---	---	✓ TELEC T401 ✓ ETSI	✓ IEEE ✓ ETSI	✓ TELEC T401 ✓ ETSI
IEEE802.11j	5 MHz	---	✓ ETSI	✓ ETSI	✓ TELEC T405
	10 MHz	---	✓ ETSI	✓ IEEE ✓ ETSI	✓ TELEC T405
	20 MHz	✓ TELEC T403	✓ TELEC T403 ✓ ETSI	✓ IEEE ✓ ETSI	✓ TELEC T403
IEEE802.11ac	20 MHz	---	✓ ETSI	✓ IEEE ✓ ETSI	---
	40 MHz	---	✓ ETSI	✓ IEEE ✓ ETSI	---
	80 MHz	---	✓ ETSI	✓ IEEE	---
	160 MHz	---	✓ ETSI	✓ IEEE	---

[Merit 3] MS269xA/MS2830A Main Frame Measurement Functions

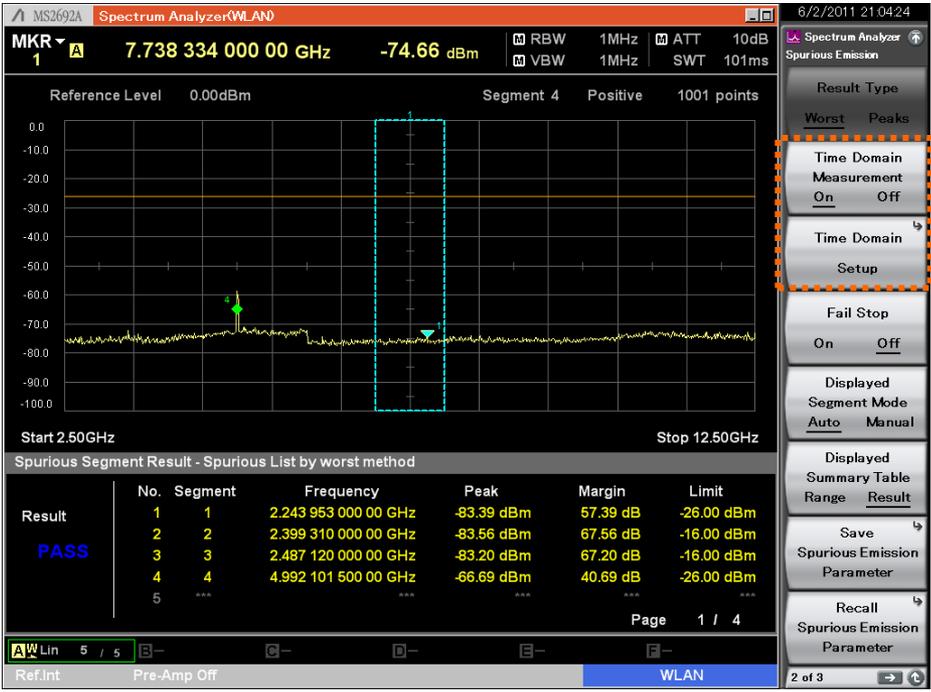
- TELEC-compliant “Time Domain” mode -

At TELEC (Telecom Engineering Center) spurious measurements, after searching for the peak by sweeping the frequency span, the peak can be measured using the “Time Domain (zero SPAN)” method.

The spurious measurement, which is MS269xA/MS2830A standard function, supports “Time Domain” ON/Off and tests can be performed simply and in accordance with TELEC.

Spurious measurements with Time Domain mode!

Individual parameter settings with max. 20 segments (frequency bandwidth) RBW/VBW/Sweep Time/Detection



[Merit 4] Built-in Vector Signal Generator

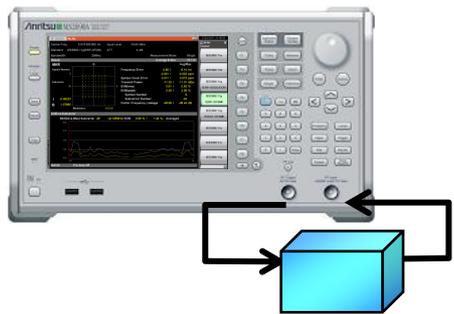
- Ideal for evaluation using both SA/SG -

The MS269xA/MS2830A supports the Vector Signal Generator option. It is the ideal solution for evaluation using both standard signal sources and spectrum analyzer.

Standard for conventional models!
 W-CDMA, CDMA2000, 1xEV-DO,
 GSM/EDGE, ISDB-T, WLAN, Bluetooth

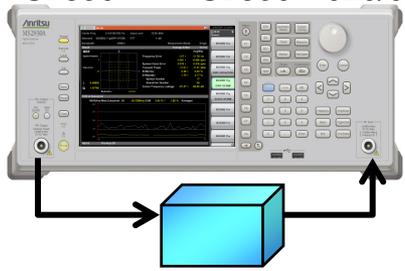
Expandable next generation!
 3GPP LTE, HSPA, Mobile WiMAX,
 XG-PHS, Multi-Carrier

MS269xA + MS269xA-020



Equipment and parts, etc.

MS2830A + MS2830A-020/021



Equipment and parts, etc.

Main Frame	MS269xA	MS2830A	
Vector Signal Generator Option	MS269xA-020	MS2830A-020*	MS2830A-021*
Frequency Range	125 MHz to 6 GHz	250 kHz to 3.6 GHz	250 kHz to 6 GHz
Vector Modulation Bandwidth	120 MHz	120 MHz	
Absolute Level Accuracy	±0.5 dB	±0.5 dB	
Linearity	±0.2 dB typ.	±0.2 dB typ.	
AWGN Addition Function	Standard	Option MS2830A-028* AWGN	
Wanted signal + AWGN output	CN ratio ≤ 40 dB	MS2830A-028* installed CN ratio ≤ 40 dB	
Setting number of transmission packet	No	Frame Count Setting	
BER Function	Standard	No	

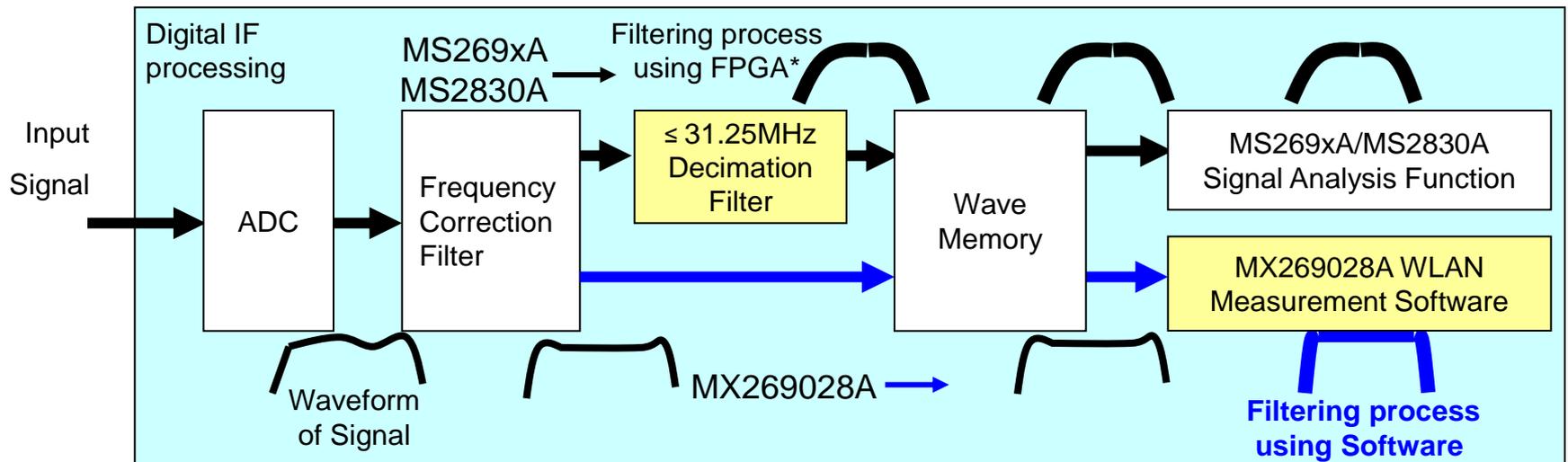
*: MS2830A-044/045 cannot install MS2830A-020/021.

MX269028A Specifications (1/6)

The following specifications are guaranteed after 30-minute warm-up at a stable ambient temperature. Typical values are for reference only and are not guaranteed. Values are guaranteed after executing CAL at 18°to28°C, and the measured signal is within the measurement level range and is less than or equal to Input Level.

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

Note: Support 40MHz BW for IEEE802.11n



*FPGA: Field Programmable Gate Array

● MS269xA/MS2830A: Signal Analysis Function

- Filtering process using **FPGA** circuit
- **High speed** processing
- **Flexible** analysis bandwidth **upto31.25 MHz**

★ MX269028A: Modulation Analysis for WLAN signal

- Filtering process using WLAN measurement **software**
- **Optimized filtering for WLAN measurement**
- **Upto40 MHz** analysis bandwidth
 - => **Remove spurious** caused by dithering and aliasing
 - => **Highly accurate EVM measurement**

MX269028A Specifications (2/6)

The following specifications are guaranteed after 30-minute warm-up at a stable ambient temperature. Typical values are for reference only and are not guaranteed. Values are guaranteed after executing CAL at 18°to28°C, and the measured signal is within the measurement level range and is less than or equal to Input Level.

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)	
	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)	
	Center Frequency Leakage Floor	≤-50 dBc (nominal)	
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 Pre-Amp Off, or Pre-Amp not installed.) 300 MHz to 862 MHz ±0.7 dB (Preamp Off, or Preamp not installed)

MX269028A Specifications (3/6)

The following specifications are guaranteed after 30-minute warm-up at a stable ambient temperature. Typical values are for reference only and are not guaranteed. Values are guaranteed after executing CAL at 18°to28°C, and the measured signal is within the measurement level range and is less than or equal to Input Level.

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 $\geq 250 \mu\text{s}$ \pm (Accuracy of reference frequency \times Carrier frequency + 16) Hz	
	Residual Vector Error	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal $\leq 1.5\%$ (rms) $\leq 1.6\%$ (rms) (Preamp Off)	
	Center Frequency Leakage Floor	≤ -50 dBc (nominal)	
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 Pre-Amp On)	
	Carrier Frequency Accuracy	Burst length $\geq 400 \mu\text{s}$ \pm (Accuracy of reference frequency \times Carrier frequency + 21) Hz	
	Residual Vector Error	Specify filter with same characteristics as used for measurement signal, Burst signal $\leq 1.2\%$ (rms) $\leq 1.9\%$ (rms) (Preamp Off)	
	Center Frequency Leakage Floor	≤ -50 dBc (nominal)	
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)

MX269028A Specifications (4/6)

The following specifications are guaranteed after 30-minute warm-up at a stable ambient temperature. Typical values are for reference only and are not guaranteed. Values are guaranteed after executing CAL at 18°to28°C, and the measured signal is within the measurement level range and is less than or equal to Input Level.

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 $\geq 250 \mu s$ \pm (Accuracy of reference frequency \times Carrier frequency + 13) Hz	
	Residual Vector Error	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signals $\leq 1.2\%$ (rms) $\leq 1.2\%$ (rms) (Preamp Off)	
	Center Frequency Leakage Floor	≤ -50 dBc (nominal)	
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)

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 $\geq 500 \mu s$ (Channel Bandwidth: 10 MHz), Burst length $\geq 250 \mu s$ (Channel Bandwidth: 20 MHz) \pm (Accuracy of reference frequency \times Carrier frequency + 16) Hz	
Modulation/ Frequency Measurements	Residual Vector Error	Channel Estimation: SEQ, Phase Tracking: On, Amplitude Tracking: Off, Burst signal $\leq 1.5\%$ (rms) $\leq 1.6\%$ (rms) (Preamp Off)	
	Center Frequency Leakage Floor	≤ -50 dBc (nominal)	
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)

MX269028A Specifications (5/6)

MX269028A-001 802.11ac (80MHz) Measurement Software: Only for MS2830A

MX269028A-002 802.11ac (160MHz) Measurement Software: Only for MS269xA

The following specifications are guaranteed after 30-minute warm-up at a stable ambient temperature. Typical values are for reference only and are not guaranteed. Values are guaranteed after executing CAL at 18°to28°C, and the measured signal is within the measurement level range and is less than or equal to Input Level.

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 $\geq 250 \mu\text{s}$ \pm (Accuracy of reference frequency \times Carrier frequency + 16) Hz	
		40 MHz channel	Burst length $\geq 250 \mu\text{s}$ \pm (Accuracy of reference frequency \times Carrier frequency + 102) Hz	
	80 MHz channel	Burst length $\geq 250 \mu\text{s}$ \pm (Accuracy of reference frequency \times Carrier frequency + 102) Hz		
	160 MHz channel	Burst length $\geq 250 \mu\text{s}$ \pm (Accuracy of reference frequency \times Carrier frequency + 102) Hz	—	

MX269028A Specifications (6/6)

MX269028A-001 802.11ac (80MHz) Measurement Software: Only for MS2830A

MX269028A-002 802.11ac (160MHz) Measurement Software: Only for MS269xA

The following specifications are guaranteed after 30-minute warm-up at a stable ambient temperature. Typical values are for reference only and are not guaranteed. Values are guaranteed after executing CAL at 18°to28°C, and the measured signal is within the measurement level range and is less than or equal to Input Level.

Signal Analyzer		MS269xA		MS2830A	
Standard		IEEE 802.11ac			
Modulation/ Frequency Measurements	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 (nominal)			
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)		—	

Ordering Information

◆ MS269xA

Main Frame

Model/Order No.	Name	Remarks
MS2690A	Signal Analyzer	50 Hz to 6 GHz
MS2691A		50 Hz to 13.5 GHz
MS2692A		50 Hz to 26.5 GHz
Standard	High Stability Reference Oscillator	Aging rate 1×10^{-8} /day
Standard	Analysis Bandwidth 31.25 MHz	
Standard	Phase Noise Measurement Function	
MS2690A-077	Analysis Bandwidth Extension to 62.5 MHz	
MS2691A-077		
MS2692A-077		
MS2690A-078	Analysis Bandwidth Extension to 125 MHz	MS269xA-077 is necessary
MS2691A-078		
MS2692A-078		

Vector Signal Generator Options

Model/Order No.	Name	Remarks
MS2690A-020	Vector Signal Generator	125 MHz to 6 GHz
MS2691A-020		
MS2692A-020		
Standard	ARB Memory	256 Msamples
Standard	AWGN addition function	CN Ratio absolute value: ≤ 40 dB
Standard	BER Measurement function	Input Bit Rate 100 bps to 10 Mbps

Installing the Vector Signal Generator option (MS269xA-020) supports the following WLAN signal outputs:

- WLAN Waveform Patterns (IEEE802.11a/b/g) pre-installed in the MS269xA-020 Vector Signal Generator option
- Generation Waveform Patterns (IEEE802.11n/p/a/b/g/j) by the MX269911A WLAN IQproducer
- Generation Waveform Patterns (IEEE802.11ac) by the MX269911A-001 802.11ac (80 MHz) Option (Requires MX269911A)

Ordering Information

◆ MS2830A

Main Frame

Model/Ordering No.	Name	Remarks
MS2830A-040	Signal Analyzer	9 kHz to 3.6 GHz
MS2830A-041		9 kHz to 6 GHz
MS2830A-043		9 kHz to 13.5 GHz
MS2830A-044		9 kHz to 26.5 GHz
MS2830A-045		9 kHz to 43 GHz
MS2830A-002	High Stability Reference Oscillator	Aging rate: 1×10^{-8} /day
MS2830A-005 ^{*1}	Analysis Bandwidth Extension to 31.25 MHz	Requires MS2830A-006, For MS2830A-040/041/043/044
MS2830A-006	Analysis Bandwidth 10 MHz	
MS2830A-009 ^{*1}	Bandwidth Extension to 31.25 MHz for Millimeter-wave	Requires MS2830A-006, For MS2830A-045
MS2830A-077 ^{*2}	Analysis Bandwidth Extension to 62.5 MHz	Requires MS2830A-006/005, For MS2830A-040/041/043/044
		Requires MS2830A-006/009, For MS2830A-045
MS2830A-078 ^{*2}	Analysis Bandwidth Extension to 125 MHz	Requires MS2830A-006/005/077, For MS2830A-040/041/043/044
		Requires MS2830A-006/009/-077, For MS2830A-045
MS2830A-010	Phase Noise Measurement Function	Add phase noise measurement function

*1: MS2830A-045 cannot install MS2830A-005. Please install MS2830A-009 for analysis bandwidth extension to 31.25 MHz.

*2: Retrofit not supported.

Vector Signal Generator Options (MS2830A-044/045 cannot install MS2830A-020/021)

Model/Ordering No.	Name	Remarks
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 ^{*3}	ARB Memory Upgrade 256 Msa for Vector Signal Generator	Memory: 64 Msamples (without MS2830A-027) 256 Msamples (with MS2830A-027)
MS2830A-028	AWGN	CN Ratio absolute value: ≤ 40 dB

*3: Must be installed to use the pre-installed IEEE802.11b "11b_DSSS_2Mbps_PN9 (Continuous PN9 data between PSDUs)" waveform pattern.

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

- WLAN Waveform Patterns (IEEE802.11a/b/g) pre-installed in the MS2830A-020/021 Vector Signal Generator option
- Generation Waveform Patterns (IEEE802.11n/p/a/b/g/j) by the MX269911A WLAN IQproducer
- Generation Waveform Patterns (IEEE802.11ac) by the MX269911A-001 802.11ac (80 MHz) Option (Requires MX269911A)

Ordering Information

◆MS2830A

Main frame and options configuration table

	MS2830A-040	MS2830A-041	MS2830A-043	MS2830A-044	MS2830A-045
MS2830A-002	✓	✓	✓	Standard	
MS2830A-005	✓	✓	✓	✓	----*1
MS2830A-006	✓	✓	✓	✓	✓
MS2830A-009	Selects MS2830A-005				✓*1
MS2830A-077	✓	✓	✓	✓	✓
MS2830A-078	✓	✓	✓	✓	✓
MS2830A-020	✓	✓	✓	MS2830A-044/045 cannot install these options.	
MS2830A-021	✓	✓	✓		
MS2830A-022	✓	✓	✓		
MS2830A-027	✓	✓	✓		
MS2830A-028	✓	✓	✓		
MX269028A	✓	✓	✓	✓	✓
MX269028A-001	✓	✓	✓	✓	✓

*1: MS2830A-045 cannot install MS2830A-005.

Please Install MS2830A-009 for analysis bandwidth extension to 31.25 MHz

Ordering Information

◆ MS269xA/MS2830A Common

Software Options

Model/Order No.	Name	Remarks
MX269028A	WLAN (802.11) Measurement Software	IEEE 802.11n/p/a/b/g/j supported MS2830A: Requires MS2830A-006, 005/009
MX269028A-001	802.11ac (80MHz) Measurement Software	IEEE 802.11ac supported. Requires MX269028A. Supports up to 80-MHz bandwidth. Only for MS2830A. Requires MS2830A-006, 005/009, 077, 078.
MX269028A-002	802.11ac (160MHz) Measurement Software	IEEE 802.11ac supported. Requires MX269028A. Supports up to 160-MHz bandwidth. Only for MS269xA. Requires MS269xA-077, 078.
MX269911A	WLAN IQproducer	Generation Waveform Patterns (IEEE802.11n/p/a/b/g/j) Requires Vector signal generator option (MS269xA-020 / MS2830A-020/021)
MX269911A-001	802.11ac (80MHz) Option	Generation Waveform Patterns (IEEE802.11ac) Requires MX269911A.

Application parts

Model/Order No.	Name	Remarks
W3528AE	MX269028A Operation Manual (Operation)	
W3529AE	MX269028A Operation Manual (Remote Control)	
W3488AE	MX370111A/MX269911A Operation Manual	
J1373A	AUX Conversion Adaptor	AUX => BNC, for MS2690A-020, output marker, BER measurement
J1487A	AUX Conversion Adaptor	AUX => BNC, for MS2830A-020/021, output marker
Z0975A	Keyboard	USB

Recommended Configuration

◆MS269xA

✓✓: Requires, No: Not selects

Test Target	2.4 GHz band			5 GHz band		
	Tx Test		Rx Test	Tx Test		Rx Test
	Without Spurious Test	With Spurious Test	(Signal Generator)	Without Spurious Test	With Spurious Test	(Signal Generator)
Main Frame						
MS2690A	✓✓	No	✓✓ (Opt.020)	✓✓	No	✓✓ (Opt.020)
MS2691A		✓✓				
MS2692A		✓✓				
Hardware Option						
MS269xA-077	----	----	----	✓✓ ^{*2}	✓✓ ^{*2}	----
MS269xA-078						
Vector Signal Generator Option						
MS2692A-020 ^{*1}	----	----	✓✓	----	----	✓✓
Software Option						
MX269028A (IEEE802.11n/p/a/b/g/j)	✓✓	✓✓	----	✓✓	✓✓	----
MX269028A-002 (IEEE802.11ac)	----	----	----	✓✓ ^{*2}	✓✓ ^{*2}	----
MX269911A (IEEE802.11n/p/a/b/g/j)	----	----	✓✓	----	----	✓✓
MX269911A-001 (IEEE802.11ac)	----	----	----	----	----	✓✓

*1: Installing the Vector Signal Generator option (MS269xA-020) outputs WLAN signals.
MS269xA cannot set the pattern send and sends the same pattern repeatedly

*2: Combining the MS269xA-078 and MX269028A-002 (only for MS269xA) supports modulation analysis up to 160-MHz bandwidth signals of the IEEE802.11ac.

Recommended Configuration

◆MS2830A

✓✓: Requires, ✓: Selects, No: Not selects

Test Target	2.4 GHz band			5 GHz band			
	Tx Test		Rx Test	Tx Test		Rx Test	
Main Frame	Without Spurious Test	With Spurious Test	(Signal Generator)	Without Spurious Test	With Spurious Test	(Signal Generator)	
	MS2830A-040	✓✓	No	✓✓ (Opt.020/021)	No	No	No
	MS2830A-041				✓✓		✓✓ (Opt.021)
	MS2830A-043		✓✓	No			
	MS2830A-044		✓✓	✓✓			
	MS2830A-045		✓✓	No			
Hardware Option							
MS2830A-002	✓	✓	-----	✓	Standard (Opt.044/045)	-----	
MS2830A-005/009	✓✓	✓✓	-----	✓✓	✓✓	-----	
MS2830A-006	✓✓	✓✓	-----	✓✓	✓✓	-----	
MS2830A-077	-----	-----	-----	✓✓*2	✓✓*2	-----	
MS2830A-078							
Vector Signal Generator Option (MS2830A-044/045 cannot install MS2830A-020/021)							
MS2830A-020 ^{*2}	-----	-----	✓✓	-----	-----	No	
MS2830A-021 ^{*2}			✓✓			✓✓	
MS2830A-022			✓			✓	
MS2830A-027			✓			✓	
MS2830A-028			✓			✓	
Software Option							
MX269028A (IEEE802.11n/p/a/b/g/j)	✓✓	✓✓	-----	✓✓	✓✓	-----	
MX269028A-001 (IEEE802.11ac)	-----	-----	-----	✓✓*2	✓✓*2	-----	
MX269911A (IEEE802.11n/p/a/b/g/j)	-----	-----	✓✓	-----	-----	✓✓	
MX269911A-001 (IEEE802.11ac)	-----	-----	-----	-----	-----	✓✓	

*1: Installing the Vector Signal Generator option (MS2830A-020/021) outputs WLAN signals. MS2830A main functions sets the pattern send count.
*2: Combining the MS269xA-078 and MX269028A-002 (only for MS269xA) supports modulation analysis up to 80-MHz bandwidth signals of the IEEE802.11ac.

Recommended Configuration



MX269028A-001 802.11ac (80MHz) Measurement Software: only for MS2830A
MX269028A-002 802.11ac (160MHz) Measurement Software: only for MS269xA

The IEEE802.11ac measurement range varies as follows, depending on the Analysis Bandwidth Extension option configuration.

Model			Bandwidth of IEEE802.11ac signal		
Main frame	Measurement software	Analysis Bandwidth Extension Option Configuration	20 MHz	40 MHz	80 MHz
MS269xA	MX269028A-002	Opt-078*1 installed	✓	✓	✓
		Opt-077/004*2 installed	✓	✓	
		Standard	✓	✓	
MS2830A	MX269028A-001	Opt-078*3 installed	✓	✓	✓*7
		Opt-077*4 installed	✓	✓	
		Opt-005/009*5 installed	✓	✓	

Model			Bandwidth of IEEE802.11ac signal	
Main frame	Measurement software	Analysis Bandwidth Extension Option Configuration	160 MHz	80 MHz + 80 MHz
MS269xA	MX269028A-002	Opt-078*1 installed	✓	✓*6
		Opt-077/004*2 installed		
		Standard		
MS2830A	MX269028A-001	Opt-078*3 installed		
		Opt-077*4 installed		
		Opt-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.



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