

# MX860830A/MX860930A

## Wireless LAN Measurement Software

(For MS8608A/MS8609A Digital Mobile Radio Transmitter Tester)



*For Evaluation of Wireless LAN Equipment and Devices*



# *For evaluation of Wireless LAN equipment and Devices*

## *Compatible with IEEE802.11a/b/g, HiperLAN2, HiSWANa*

### **– From Development and Production to Construction and Maintenance –**

The MS860830A/MS860930A Wireless LAN Measurement Software is application software used by the MS8608A/MS8609A Digital Mobile Radio Transmitter Tester. A transmission system conforming to the wireless LAN standards can be evaluated by installing this wireless LAN measurement software into the spectrum analyzer.

#### **Features**

- Conforms to the IEEE802.11a, IEEE802.11b, IEEE802.11g (ERP-OFDM, DSSS-OFDM, ERP-DSSS/CCK), HiSWANa and HiperLAN2 standards.
- Analyzes OFDM signals those realize high-speed data transfer at 54 Mbps.
- Integrates a high-performance DSP, enabling high-speed and high-accuracy measurement using the fast A/D sampling (at 64 MHz). Modulation accuracy measurement can be completed in 1 sec or less.
- Capable of measuring harmonics up to 5-time waves of the 5-GHz band wireless LAN (IEEE802.11a, HiSWANa, HiperLAN2) in use of MS2687B.
- One-touch operation of tests on transmission characteristics, including modulation analysis and spurious.
- Provides a batch measurement function which automatically measures items that were individually measured before, and displays judgement results for the specified reference value.

#### **Measurement items**

Modulation analysis:

[IEEE802.11a, IEEE802.11g (ERP-OFDM, DSSS-OFDM), HiSWANa, HiperLAN2]

Frequency (Carrier frequency, Carrier frequency error)

Modulation Characteristic (EVM-RMS, EVM-Peak, Phase error-RMS)

OFDM-spectrum (Carrier leak, Spectrum flatness)

Display waveform (Constellation, EVM vs Sub-carrier, EVM vs Symbol, Phase error vs Symbol, Spectrum flatness)

[IEEE802.11b, IEEE802.11g (ERP-DSSS/CCK)]

Frequency (Carrier frequency, Carrier frequency error)

Modulation Characteristic (EVM-RMS, EVM-Peak, Phase error-RMS, Amplitude error-RMS, Origin offset)

Display waveform (Constellation, EVM vs Symbol, EVM vs Sub-carrier, Phase error vs Symbol, Spectrum flatness)

Power:

Average power, Maximum Power, Carrier off power,

Burst on/off ratio, Burst rising/falling time

Occupied bandwidth, Spreading bandwidth

Adjacent channel power

Spectrum mask

Spurious, Out-band leakage power

CCDF, APD

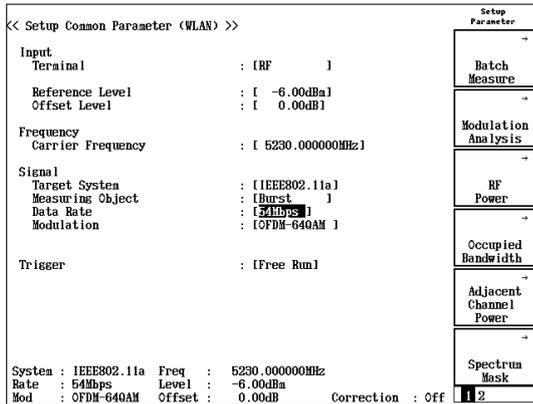
Macro function (Batch processing)

Chip clock tolerance

Symbol rate error

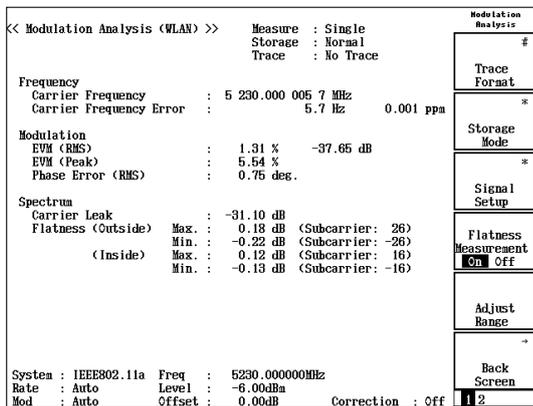
## Setup Common Parameter

This screen is used to set common parameters such as signaling system, input level, frequency, data rate, and target system before starting analysis. Setting these parameters simplifies measurement operations.



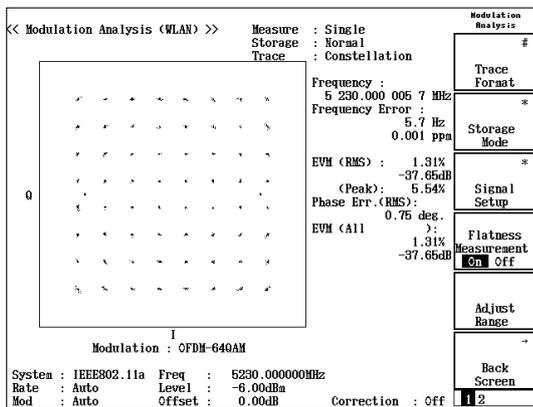
## Modulation Analysis

Displays numeric results, including the frequency, execution value and maximum value of the modulation accuracy (EVM) and the execution value of the phase error.



## Modulation Analysis: Constellation

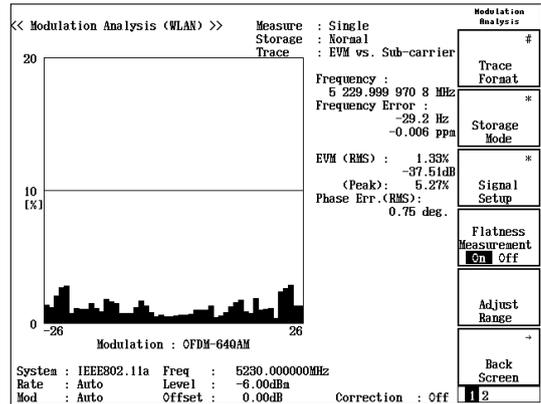
Displays the constellation in graph form.



## Modulation Analysis:

### Modulation Accuracy (EVM) vs. Sub-carrier

Displays the modulation accuracy (EVM) for each sub-carrier in graph form if a measured signal is OFDM. Graphs are displayed on the left side, and numeric results on the right side.

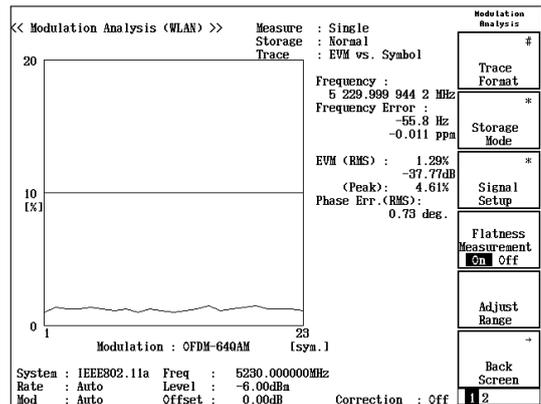


### Modulation Analysis: Phase Error vs. Symbol/Chip

Displays the phase error for each symbol/chip in graph form. Graphs are displayed on the left side, and numeric results on the right side.

### Modulation Analysis: Modulation Accuracy (EVM) vs. Symbol/Chip

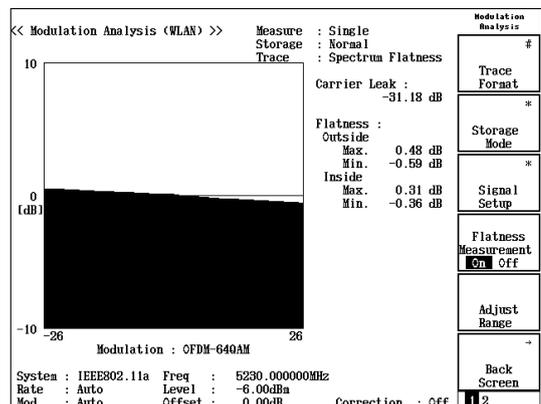
Displays the modulation accuracy (EVM) for each symbol/chip in graph form.



## Modulation Analysis: Spectrum Flatness

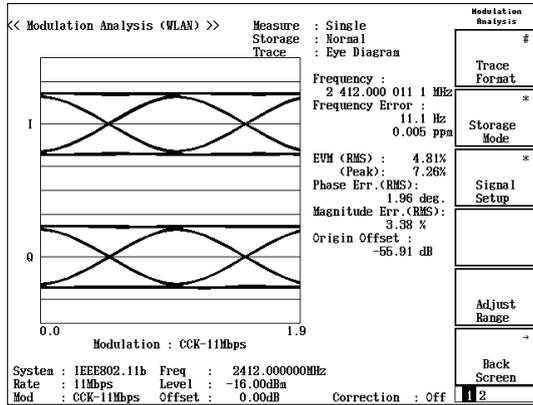
### Modulation Analysis: Spectrum Flatness

Displays the spectrum flatness for each sub-carrier in graph form [IEEE802.11a, IEEE802.11g (ERP-OFDM, DSSS-OFDM), HiSWANa, HiperLAN2].



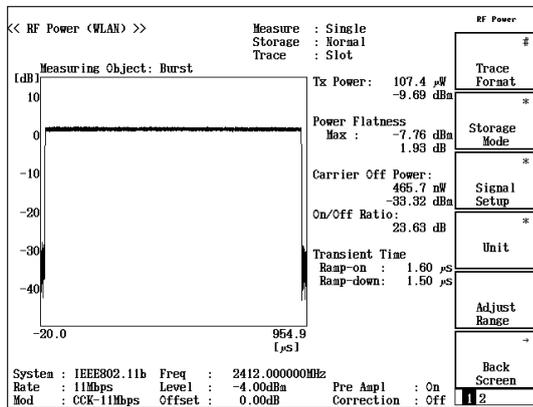
## Modulation Analysis: Eye-Diagram

Displays the eye diagrams [IEEE802.11b, IEEE802.11g (ERP-DSSS/CCK)].



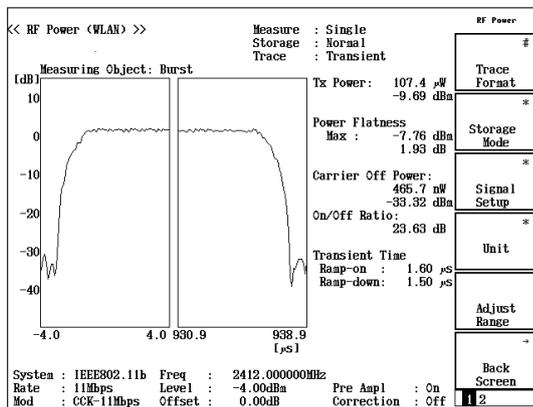
## Power: Slot display

Displays a burst waveform of one slot. Numeric results such as the average power and maximum instantaneous power are also displayed.



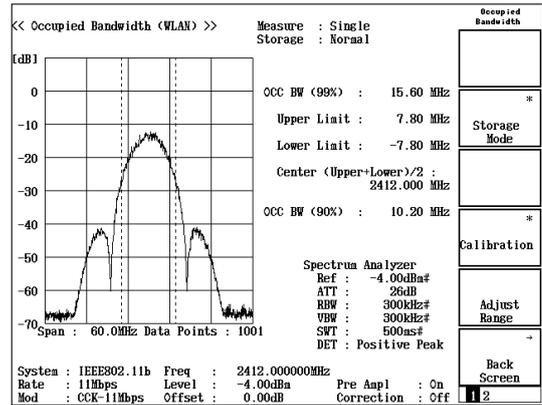
## Power: Transient display

Displays an enlarged version of the rising/falling edge of the burst waveform of the slot. The rising/falling time is also displayed in the IEEE802.11b/11g. [IEEE802.11b, IEEE802.11g (ERP-DSSS/CCK)]



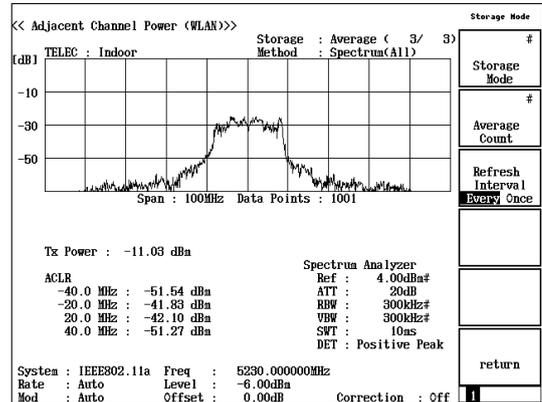
## Occupied Bandwidth

Displays the occupied bandwidth, which includes 99% of the total emission power, in graph and numeric data forms. Also, the IEEE802.11b/11g displays the numeric data of spreading bandwidth, which includes 90% of the total emission power.



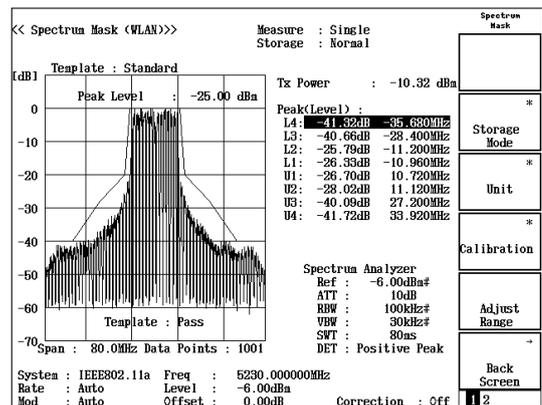
## Adjacent Channel Power

Displays the power to second adjacent channel in wide-range graph and numeric data forms. It is also possible to display the power for each channel separately.



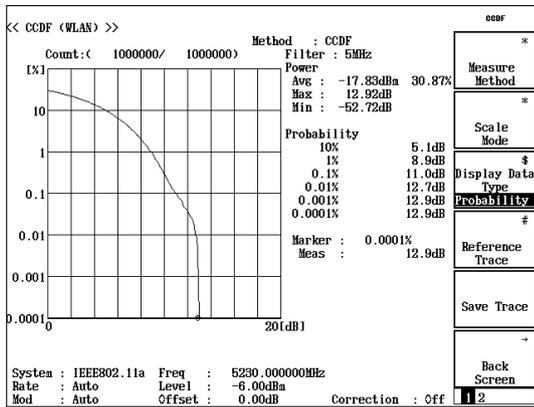
## Spectrum Mask

Executes pass/fail judgement using the standard line corresponding to each wireless LAN system. The level difference of the measured value or the measured level value is also displayed with its frequency.



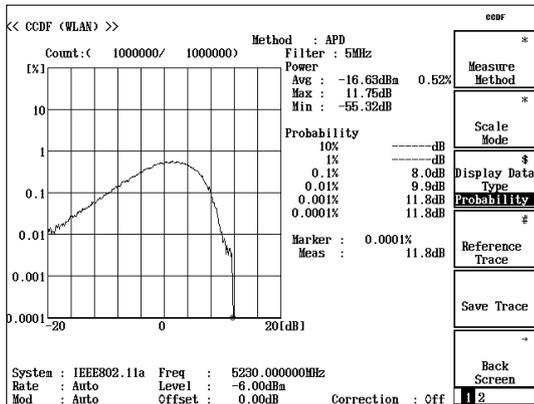
### CCDF

Displays the cumulative distribution for the difference between the instantaneous value and the average value of the power that is band-limited by a filter.



### APD

Displays the distribution for the difference between the instantaneous value and the average value of the power that is band-limited by a filter.



### Spurious

Displays the measured results for the spurious, including frequency, level, judgement result (PASS/FAIL), specifications, RBW and VBW in three sweep modes, on three separate screens.

Measured results are automatically judged and the PASS/FAIL is displayed by presetting the Limit.

Frequency	Level	Judgement	Limit
f 1 = 5 130.240 000 MHz	0.000 $\mu$ W/M	PASS	2.50 $\mu$ W/M
f 2 = 5 146.272 000 MHz	0.000 $\mu$ W/M	PASS	15.0 $\mu$ W/M
f 3 = 5 250.616 000 MHz	0.000 $\mu$ W/M	PASS	15.0 $\mu$ W/M
f 4 = 5 260.028 000 MHz	0.000 $\mu$ W/M	PASS	0.200 $\mu$ W/M
f 5 = ----- MHz	----- $\mu$ W/M	-----	----- $\mu$ W/M
f 6 = ----- MHz	----- $\mu$ W/M	-----	----- $\mu$ W/M
f 7 = ----- MHz	----- $\mu$ W/M	-----	----- $\mu$ W/M
f 8 = ----- MHz	----- $\mu$ W/M	-----	----- $\mu$ W/M
f 9 = ----- MHz	----- $\mu$ W/M	-----	----- $\mu$ W/M
f 10 = ----- MHz	----- $\mu$ W/M	-----	----- $\mu$ W/M
f 11 = ----- MHz	----- $\mu$ W/M	-----	----- $\mu$ W/M
f 12 = ----- MHz	----- $\mu$ W/M	-----	----- $\mu$ W/M
f 13 = ----- MHz	----- $\mu$ W/M	-----	----- $\mu$ W/M
f 14 = ----- MHz	----- $\mu$ W/M	-----	----- $\mu$ W/M
f 15 = ----- MHz	----- $\mu$ W/M	-----	----- $\mu$ W/M

Total Judgement : PASS

### Macro Function (Batch Processing)

By presetting the judgement values, each item listed below is batch measured and judged automatically. Measured results are displayed on four separate screens.

- Frequency accuracy,
- EVM-RMS, EVM-Peak,
- Phase error-RMS,
- Amplitude error-RMS,
- Origin offset,
- Carrier leak,
- Spectrum flatness (at burst signal),
- TX-power,
- Carrier off power (at burst signal),
- On/Off ratio (at burst signal),
- Burst signal rising/falling time (at burst signal),
- Occupied bandwidth,
- Adjacent channel power,
- Spectrum mask,
- Spurious (Two tables can be chosen)

Modulation Analysis	Result	Value	Limit
Frequency Error	PASS	-125.9 Hz	(200000.0 Hz)
EVM(RMS)	PASS	-37.96 dB	(-16.00 dB)
(Peak)	PASS	4.53 %	(----- %)
Phase Error	PASS	0.70 deg.	(179.86 deg.)
Carrier Leak	PASS	-30.44 dB	(-15.00 dB)
Flatness(Outside)	PASS	-0.04 dB	-0.13 dB (-4.00, 2.00)
(Inside)	PASS	0.04 dB	-0.04 dB (-2.00, 2.00)

RF Power	Result	Value	Limit
TX Power	PASS	-12.26 dBm	(-15.00, -8.00)
Carrier Off Power	PASS	55.87 $\mu$ W	(----- $\mu$ W)
On/Off Ratio	PASS	30.27 dB	(----- dB)

Occupied Bandwidth	Result	Value	Limit
Occupied Bandwidth(99%)	PASS	16.64 MHz	(18.00 MHz)

Adjacent Channel Power	Result	Value	Limit
20MHz(Lower & Upper)	PASS	-35.14 dB	-35.25 dB (-25.00 dB)
40MHz(Lower & Upper)	PASS	-44.37 dB	-44.51 dB (-40.00 dB)

Spectrum Mask	Result
Spectrum Mask	PASS

Total Judgement : PASS

Spurious Emission 1	Result	Value	Limit
f 1 = 3 236.984 340 MHz	PASS	0.000 $\mu$ W/M	(2.50 $\mu$ W/M)
f 2 = 5 091.928 840 MHz	PASS	0.000 $\mu$ W/M	(15.0 $\mu$ W/M)
f 3 = 5 281.593 860 MHz	PASS	0.000 $\mu$ W/M	(15.0 $\mu$ W/M)
f 4 = 7 744.154 240 MHz	PASS	0.000 $\mu$ W/M	(0.200 $\mu$ W/M)
f 5 = 11 757.928 500 MHz	PASS	0.000 $\mu$ W/M	(0.000 $\mu$ W/M)
f 6 = 14 841.154 500 MHz	PASS	0.000 $\mu$ W/M	(0.000 $\mu$ W/M)
f 7 = 16 244.813 840 MHz	PASS	0.000 $\mu$ W/M	(0.000 $\mu$ W/M)
f 8 = ----- MHz	PASS	----- $\mu$ W/M	(----- $\mu$ W/M)
f 9 = ----- MHz	PASS	----- $\mu$ W/M	(----- $\mu$ W/M)
f 10 = ----- MHz	PASS	----- $\mu$ W/M	(----- $\mu$ W/M)
f 11 = ----- MHz	PASS	----- $\mu$ W/M	(----- $\mu$ W/M)
f 12 = ----- MHz	PASS	----- $\mu$ W/M	(----- $\mu$ W/M)
f 13 = ----- MHz	PASS	----- $\mu$ W/M	(----- $\mu$ W/M)
f 14 = ----- MHz	PASS	----- $\mu$ W/M	(----- $\mu$ W/M)
f 15 = ----- MHz	PASS	----- $\mu$ W/M	(----- $\mu$ W/M)

Total Judgement : PASS



# Specifications

Specified values are obtained after warming up the equipment for 30 minutes at a constant ambient temperature and then performing calibration.

Guaranteed specifications after Adjust Range and Level Calibration keys pressed.

Pre-amp On can be set when MS8608A-08 and MS8609A-08 are installed in the main frame.

## • IEEE802.11a, IEEE802.11g (ERP-OFDM, DSSS-OFDM), HiSWANa<sup>(※1)</sup>, HiperLAN2<sup>(※2)</sup> 1/3

Model		MX860830A	MX860930A
Modulation type		OFDM-64QAM, OFDM-16QAM, OFDM-QPSK, OFDM-BPSK	
Data rate		[IEEE802.11a, IEEE802.11g (ERP-OFDM, DSSS-OFDM) ]: 54, 48, 36, 24, 18, 12, 9, 6 Mbps, Auto (automatic recognition at burst signal only) [HiSWANa, HiperLAN2]: 54, 36, 27, 18, 12, 9, 6 Mbps	
Modulation analysis	Measurement items	Frequency (carrier frequency, carrier frequency error), Modulation Characteristic (EVM-RMS, EVM-Peak, phase error-RMS), OFDM-spectrum (carrier leak, spectrum flatness)	
	Frequency range	[IEEE802.11a, HiSWANa, HiperLAN2]: 100 MHz to 6 GHz, 100 MHz to 3 GHz (pre-amp On) [IEEE802.11g (ERP-OFDM, DSSS-OFDM) ] : 100 MHz to 3 GHz	
	Measurement frequency intake range	[IEEE802.11a, HiSWANa, HiperLAN2] Temperature: +18° to +35 °C, setting frequency: ±120 kHz (3 to 6 GHz), ±80 kHz (100 MHz to 3 GHz) [IEEE802.11g (ERP-OFDM, DSSS-OFDM)] Temperature: +18° to +35 °C, setting frequency: ±80 kHz	
	Measurement level range	High Input: -6 to +38 dBm, -26 to +38 dBm (pre-amp On) Low Input: -26 to +18 dBm, -46 to +18 dBm (pre-amp On)	-26 to +18 dBm, -26 to +26 dBm (With Opt. 32), -46 to +18 dBm (pre-amp On)
	Carrier frequency accuracy	[IEEE802.11a, HiSWANa, HiperLAN2]: Frequency: 4.9 to 6 GHz [IEEE802.11g (ERP-OFDM, DSSS-OFDM) ]: Frequency: 2.4 to 2.5 GHz Input level: -10 dBm, (MS8608A: Low Input) Averaging 30 times, Temperature: +18° to +35 °C, ± (reference frequency accuracy x setting frequency + 500 Hz)	
	Modulation accuracy	[IEEE802.11a, HiSWANa, HiperLAN2]: Frequency: 4.9 to 6 GHz [IEEE802.11g (ERP-OFDM, DSSS-OFDM)]: Frequency: 2.4 to 2.5 GHz Input level: -10 dBm (MS8608A Low Input), Averaging 30 times, Temperature: +18° to +35 °C 1.5 %rms (typ.)	
	Display waveform	Constellation, EVM vs symbol number, EVM vs Sub-carrier number Phase error vs symbol number, spectrum flatness	
	Constellation	Display format: 1) All, 2) First Symbol, 3) Last Symbol, 4) Pilot Only, 5) One Sub-Carrier, 6) Outside Pair (When "Target system: HiSWANa" and "Data rate: Auto" are set, 2) and 3) are not selectable) Error scale: 5%, 10%, 20%, 35%, OFF ("Error scale" is available when "Data rate" is not set to "Auto" and "Modulation type" is set to "OFDM-BPSK" or "OFDM-QPSK")	
	EVM vs symbol	Vertical line (full scale): 5%, 10%, 20%, 50%, 100% Horizontal line: Symbol number, 1 to 1367 symbol	
	EVM vs sub-carrier	Vertical line (full scale): 5 %, 10 %, 20 %, 50 %, 100 % Horizontal line: Sub-carrier number -26 to +26	
	Phase error vs symbol	Vertical line (full scale): 5 deg, 10 deg, 20 deg, 50 deg, 100 deg Horizontal line: Symbol number, 1 to 1367 symbol	
	Spectrum flatness	Vertical line (full scale): 5 dB, 10 dB, 20 dB, 50 dB, 100 dB Horizontal line: Sub-carrier number -26 to +26	
	Analysis length	Setting range: 1 to 1367OFDM symbol Setting resolution: 1OFDM symbol Setting method: Manual setting, Auto setting (at burst signal only. When "Data rate" is set to "AUTO." HiperLAN2 is not supported.)	
	Analysis start position (HiSWANa only)	Setting range: 1 to [1367 - ("Analysis length" setting value) + 1] OFDM symbol Setting resolution: 1 OFDM symbol	
Storage mode	Normal: Refresh waveform/data for each measurement. Average: Data display averages the result for the designated number of measurements. Averaging count: 2 to 999. Waveform display is same as "Normal" mode. Overwrite: Waveform is overwritten without erasing previous waveform. Data display is same as "Normal" mode.		

• IEEE802.11a, IEEE802.11g (ERP-OFDM, DSSS-OFDM), HiSWANa<sup>(※1)</sup>, HiperLAN2<sup>(※2)</sup> 2/3

Model		MX860830A	MX860930A
RF power	Measurement frequency range	[IEEE802.11a, HiSWANa, HiperLAN2]: 100 MHz to 6 GHz, 100 MHz to 3 GHz (pre-amp On) [IEEE802.11g(ERP-OFDM, DSSS-OFDM)]: 100 MHz to 3 GHz	
	Measurement level range	High Input: -6 to +38 dBm, -26 to +38 dBm (pre-amp On) Low Input: -26 to +18 dBm, -46 to +18 dBm (pre-amp On)	-26 to +18 dBm, -26 to +26 dBm (With Opt. 32), -46 to +18 dBm(pre-amp On)
	Measurement items <sup>*3</sup>	Average power, Maximum power, Carrier off power (at burst signal), Burst on/off ratio (at burst signal)	
	Burst average power accuracy	(MS8608A: Low Input) [IEEE802.11a, HiSWANa, HiperLAN2] Frequency: 4.9 to 6 GHz, Input level: -18 to 0 dBm, Averaging 30 times ≤±2.7 dB [IEEE802.11g (ERP-OFDM, DSSS-OFDM)] Frequency: 2.4 to 2.5 GHz, Input level: -18 to 0 dBm, -38 to 0 dBm (pre-amp On), Averaging 30 times ≤±1.7 dB, ≤±2.0 dB (pre-amp On)	
	Burst rising detection method	Choose from (1) and (2). (1) The rising edge is detected from change of a signal level. (2) The rising edge is detected from a preamble signal. (Preamble Search)	
	Burst signal length detection method	Choose from (1) and (2). (1) Input data length (2) The falling edge is detected from change of a signal level. (Ramp-down Detection)	
	Slot display	A time domain waveform is displayed. Vertical line: Unit = dBm, dB, % Horizontal line At burst signal: -20.0 (fixed) to 5680.0 μs (based on burst length) At continuous signal: 0.0 to 5660.0 μs (fixed)	
	Transient display	Displays zoom of the rising and falling edges of a slot. Vertical line: Unit = dBm, dB, % Horizontal line: 8.0 to 40.0 μs (setting resolution: 0.1 μs)	
	Analysis length	Setting range: 1 to 1367 OFDM symbol (DSSS-OFDM: 1 to 1300 OFDM symbol) Setting resolution: 1 OFDM symbol Setting method: Manual setting, Auto setting (at burst signal only.)	
	Storage mode	Normal: Refresh waveform/data for each measurement. Average: Data display averages the result for the designated number of measurements. Averaging count: 2 to 999. Waveform display is same as "Normal" mode. Overwrite: Waveform is overwritten without erasing previous waveform. Data display is same as "Normal" mode.	
Occupied frequency bandwidth	Frequency range	[IEEE802.11a, HiSWANa, HiperLAN2]: 100 MHz to 6 GHz, 100 MHz to 3 GHz (pre-amp On) [IEEE802.11g (ERP-OFDM, DSSS-OFDM)]: 100 MHz to 3 GHz	
	Reference level range	High Input: -6 to +38 dBm, -26 to +38 dBm (pre-amp On) Low Input: -26 to +18 dBm, -46 to +18 dBm (pre-amp On)	-26 to +18 dBm, -26 to +26 dBm (With Opt. 32), -46 to +18 dBm (pre-amp On)
	Measurement method	BW (99%): 99% of the total radiation power is defined as the contained frequency width.	
	Storage mode	Normal: Displays the measured result value and waveform after every measurement. Average: Displays the measured result value averaged for the designated number of measurements. Averaging count: 2 to 999. Waveform display is same as Normal mode.	
Adjacent channel leakage power	Target system	IEEE802.11a, HiSWANa, HiperLAN2	
	Frequency range	100 MHz to 6 GHz, 100 MHz to 3 GHz (pre-amp On)	
	Reference level range	High Input: +4 to +38 dBm, -16 to +38 dBm (pre-amp On) Low Input: -16 to +18 dBm, -36 to +18 dBm (pre-amp On)	-16 to +18 dBm, -16 to +26 dBm (With Opt. 32), -36 to +18 dBm (pre-amp On)
	Measurement method	Sweep method (All): After measuring the signal range including upper/lower second adjacent channels at a time with the sweep type spectrum analyzer performs calculation of adjacent/second adjacent channels and displays the result. Sweep method (Separate): After measuring adjacent channel and the channel next to the adjacent channel with the sweep type spectrum analyzer performs calculation and displays the result.	
	Storage mode	Normal: Refresh waveform/data for each measurement. Average: Displays the measured result value averaged for the designated number of measurements. Averaging count: 2 to 999. Waveform display is same as "Normal" mode.	
Spectrum mask	Frequency range	[IEEE802.11a, HiSWANa, HiperLAN2]: 100 MHz to 6 GHz, 100 MHz to 3 GHz (pre-amp On) [IEEE802.11g (ERP-OFDM, DSSS-OFDM)]: 100 MHz to 3 GHz	
	Reference level range	High Input: +4 to +38 dBm, -16 to +38 dBm (pre-amp On) Low Input: -16 to +18 dBm, -36 to +18 dBm (pre-amp On)	-16 to +18 dBm, 0 to +26 dBm (With Opt. 32), -36 to +18 dBm (pre-amp On)
	Template	Corresponds to the spectrum mask defined in IEEE std 802.11a-1999 17.3.9.2 and IEEE std 802.11g-2003 19.5.4/19.7.2. Arbitrary spectrum mask is also available.	
	Storage mode	Normal: Refresh waveform/data for each measurement. Average: Displays the measured result value averaged for the designated number of measurements. Averaging count: 2 to 999. Waveform display is same as "Normal" mode.	

• IEEE802.11a, IEEE802.11g (ERP-OFDM, DSSS-OFDM), HiSWANa<sup>(\*1)</sup>, HiperLAN2<sup>(\*2)</sup> 3/3

Model		MX860830A	MX860930A
Spurious	Frequency range	9 kHz to 7.8 GHz	
	Reference level range	High Input: +14 to +38 dBm, Low Input: -6 to +18 dBm	-6 to +18 dBm, 0 to +26 dBm (With Opt. 32)
	Measurement method	Sweep method: Detects and displays the peak value after sweeping the designated frequency range with the spectrum analyzer. Calculates and displays the ratio to the transmitted power value (power ratio). Detection mode is Positive peak. Spot method: Displays the average value after measuring the designated frequency in time domain of the spectrum analyzer. Calculates and displays the ratio to the transmitted power value (power ratio). Detection mode is Sample. Search method: Measures the frequency in time domain and displays the average value after sweeping the designated frequency range with the spectrum analyzer and detecting the peak value. Calculates and displays the ratio to the transmitted power value (power ratio). Detection mode is Sample.	
	Storage mode	Normal: Refresh waveform/data for each measurement. Average: Displays the measured result value averaged for the designated number of measurements. Averaging count: 2 to 999. Waveform display is same as "Normal" mode.	
CCDF	Frequency range	100 MHz to 6 GHz, 100 MHz to 3 GHz (pre-amp On)	
	Reference level range	High Input: -6 to +38 dBm, -26 to +38 dBm (pre-amp On) Low Input: -26 to +18 dBm, -46 to +18 dBm (pre-amp On)	-26 to +18 dBm, -18 to +26 dBm (With Opt. 32), -46 to +18 dBm (pre-amp On)
	Measurement method	CCDF: Displays cumulative distribution of difference between instantaneous power and average power. APD: Displays distribution of difference between instantaneous power and average power.	
	Data count	10,000 to 2,000,000,000	
	Analysis time	0.001 to 100 ms	
	Filter Selection	22 MHz, 20 MHz, 10 MHz, 5 MHz, 3 MHz, RRC: $\alpha = 0.22$ , RC: $\alpha = 0.22$	
Batch measurement <sup>*4</sup>	Measurement items	Frequency accuracy, EVM-RMS, EVM-Peak, Phase error-RMS, Carrier leak, Spectrum flatness (at burst signal), TX-power, Carrier off power (at burst signal), On/Off ratio (at burst signal), Occupied frequency bandwidth, Adjacent channel leakage power, Spectrum mask, Spurious (Two tables can be chosen) * "Adjacent channel leakage power" can be measured complying with "IEEE802.11a, HiSWANa, HiperLAN2."	
	Judgement	According to the judgment value set per measurement item, PASS or FAIL judgment is automatically performed for each measurement item.	
Symbol rate error measurement	Target System	IEEE802.11a, IEEE802.11g (ERP-OFDM, DSSS-OFDM)	
	Frequency range	100 MHz to 6 GHz	
	Measurement level range	High Input: -6 to +38 dBm, Low Input: -26 to +18 dBm	-26 to +18 dBm, -26 to +26 dBm (With Opt. 32)
	Analysis length	250 to 1000 OFDM symbol (Setting resolution : 1 OFDM symbol)	
	Measurement range	0.0 to 50.0 ppm	
	Measurement resolution	0.1 ppm	
	Measurement accuracy	[IEEE802.11a] Frequency: 4.9 to 6 GHz [IEEE802.11g (ERP-OFDM, DSSS-OFDM)] Frequency: 2.4 to 2.5 GHz (MS8608A: Low Input) $\pm$ (reference frequency accuracy $\times 10^6 + 1.0$ ) ppm per OFDM symbol rate (250 kHz [= (4 $\mu$ s) <sup>-1</sup> ]).	
Storage mode	Normal: Refresh waveform/data for each measurement. Average: Displays the measured result value averaged for the designated number of measurements. Averaging count: 2 to 999. Waveform display is same as "Normal" mode.		

\*1: HiSWANa cannot carry out the following measurement.

- 1) Measurement for every MAC frame
- 2) Measurement of a signal whose cyclic prefix duration is not 800 ns
- 3) Measurement of a continuous signal whose modulation type is not constant.

\*2: HiperLAN2 cannot carry out the following measurement.

- 1) The same measurement as \*1'.
- 2) Measurement of a burst signal whose modulation type on payload is not constant.
- 3) Measurement of power time mask.

\*3: When burst interval is 20  $\mu$ s or less, the Wireless LAN software cannot measure the following item rightly:

- 1) Carrier off power, 2) On/Off ratio.

\*4: "Batch measurement" function cannot carry out when "Target system: HiSWANa" and "Data rate: Auto" are set.

• IEEE802.11b, IEEE802.11g (ERP-DSSS/CCK) 1/3

Model		MX860830A	MX860930A
Modulation type		CCK, DQPSK, DBPSK	
Data rate		11, 5.5, 2, 1 Mbps, Auto (at burst signal only)	
Filter		No Filter Gaussian BT = 0.3 to 1.0 (setting resolution: 0.1) Rectangular Root Raised Cosine $\alpha = 0.30$ to 1.00 (setting resolution: 0.01)	
Modulation analysis	Measurement items	Frequency (Carrier frequency, Carrier frequency error), Modulation Characteristic (EVM-RMS, EVM-Peak, Phase error-RMS, Amplitude error-RMS, Origin offset)	
	Frequency range	100 MHz to 3 GHz	
	Measurement frequency intake range	Temperature: +18° to +35 °C, setting frequency $\pm 80$ kHz	
	Measurement level range	High Input: -6 to +38 dBm, -26 to +38 dBm (pre-amp On) Low Input: -26 to +18 dBm, -46 to +18 dBm (pre-amp On)	-26 to +18 dBm, -26 to +26 dBm (With Opt. 32), -46 to +18 dBm (pre-amp On)
	Carrier frequency accuracy	Frequency: 2.4 to 2.5 GHz, Input level: -10 dBm (MS8608A: Low Input), Averaging: 30 times, Temperature: +18° to +35 °C $\pm$ (reference frequency accuracy x setting frequency + 200 Hz)	
	Modulation accuracy	Frequency: 2.4 to 2.5 GHz, Input level: -10 dBm (MS8608A: Low Input), Averaging: 30 times, Temperature: +18° to +35 °C 2.3 %rms (typ.)	
	Display waveform	Constellation, EVM vs chip number, Phase error vs chip number, Eye-diagram	
	Constellation	Error scale: 5 %, 10 %, 20 %, 35 %, OFF (It is available when "Data rate" is not set to "Auto".)	
	EVM vs chip	Vertical line (full scale): 5 %, 10 %, 20 %, 50 %, 100 % Horizontal line: Chip number 256 to 4096 chip	
	Phase error vs. chip	Vertical line (full scale): 5 deg, 10 deg, 20 deg, 50 deg, 100 deg Horizontal line: Chip number 256 to 4096 chip	
	Analysis length	Setting range: 256 to 4096 chip Setting resolution: 1 chip Setting method: Manual setting, Auto setting (at burst signal only. When "Data rate" is set to "AUTO".)	
	Storage mode	Normal: Refresh waveform/data for each measurement. Average: Displays the measured result value averaged for the designated number of measurements. Averaging count: 2 to 999. Waveform display is same as "Normal" mode. Overwrite: Waveform is overwritten without erasing previous waveform. Data display is same as "Normal" mode.	
RF power	Frequency range	100 MHz to 3 GHz	
	Measurement level range	High Input: -6 to +38 dBm, -26 to +38 dBm (pre-amp On), Low Input: -26 to +18 dBm, -46 to +18 dBm (pre-amp On)	-26 to +18 dBm, -26 to +26 dBm (With Opt. 32), -46 to +18 dBm (pre-amp On)
	Measurement items*1	Average power, Maximum Power, carrier off power (at burst signal), burst on/off ratio (at burst signal), burst rising/falling time (at burst signal)	
	Burst average power accuracy	(MS8608A: Low input) Frequency: 2.4 to 2.5 GHz, Averaging 30 times $\leq \pm 1.7$ dB (Input level: -18 to 0 dBm), $\leq \pm 2.0$ dB (Input level: -38 to 0 dBm, pre-amp On)	
	Burst rising detection method	Choose from (1) and (2). (1) The rising edge is detected from change of a signal level. (2) The rising edge is detected from a preamble signal. (Preamble Search)	
	Burst signal length detection method	Choose from (1) and (2). (1) Input data length (2) The falling edge is detected from change of a signal level. (Ramp-down Detection)	
	Slot display	A time domain waveform is displayed. Vertical line: Unit = dBm, dB, % Horizontal line At burst signal: -20.0 (fixed) to 5680.0 $\mu$ s (based on burst length.) At continuous signal: 0.0 to 5660.0 $\mu$ s (fixed)	
	Transient display	Displays zoom of the rising and falling edges of a slot. Vertical line: Unit = dBm, dB, % Horizontal line: 8.0 to 40.0 $\mu$ s (setting resolution: 0.1 $\mu$ s)	
	Analysis length	Setting range: 256 to 4096 chip Setting resolution: 1 chip Setting method: Manual setting, Auto setting (at burst signal only. When "Data rate" is set to "AUTO".)	
	Storage mode	Normal: Refresh waveform/data for each measurement. Average: Displays the measured result value averaged for the designated number of measurements. Averaging count: 2 to 999. Waveform display is same as "Normal" mode. Overwrite: Waveform is overwritten without erasing previous waveform. Data display is same as "Normal" mode.	

• IEEE802.11b, IEEE802.11g (ERP-DSSS/CCK) 2/3

Model		MX860830A	MX860930A
Occupied frequency bandwidth	Frequency range	100 MHz to 3 GHz	
	Reference level range	High Input: -6 to +38 dBm, -26 to +38 dBm (pre-amp On) Low Input: -26 to +18 dBm, -46 to +18 dBm (pre-amp On)	-26 to +18 dBm, -26 to +26 dBm (With Opt. 32), -46 to +18 dBm (pre-amp On)
	Measurement method	BW(99%): 99% of the total radiation power is defined as the contained frequency width. BW (90%): Frequency bandwidth containing 90% of the total radiation power. This value is called "spreading bandwidth" in TELEC's Technical Regulations Conformity Certification.	
	Storage mode	Normal: Refresh waveform/data for each measurement. Average: Displays the measured result value averaged for the designated number of measurements. Averaging count: 2 to 999. Waveform display is same as "Normal" mode.	
Spectrum mask	Frequency range	100 MHz to 3 GHz	
	Reference level range	High Input: +4 to +38 dBm, -16 to +38 dBm (pre-amp On) Low Input: -16 to +18 dBm, -36 to +18 dBm (pre-amp On)	-16 to +18 dBm, 0 to +26 dBm (With Opt. 32), -36 to +18 dBm (pre-amp On)
	Template	Corresponds to the spectrum mask defined in IEEE std 802.11b-1999 18.4.7.3 and IEEE std 802.11g-2003 19.5.4/19.7.2. Arbitrary spectrum mask is also available.	
	Storage mode	Normal: Refresh waveform/data for each measurement. Average: Displays the measured result value averaged for the designated number of measurements. Averaging count: 2 to 999. Waveform display is same as "Normal" mode.	
Spurious	Frequency range	9 kHz to 7.8 GHz	9 kHz to 13.2 GHz
	Reference level range	High Input: +14 to +38 dBm Low Input: -6 to +18 dBm	-6 to +18 dBm, 0 to +26 dBm (With Opt. 32)
	Measurement method	Sweep method: Detects and displays the peak value after sweeping the designated frequency range with the spectrum analyzer. Calculates and displays the ratio to the transmitted power value (power ratio). Detection mode is Positive Peak. Spot method: Displays the average value after measuring the designated frequency in time domain of the spectrum analyzer. Calculates and displays the ratio to the transmitted power value (power ratio). Detection mode is Sample. Search method: Measures the frequency in time domain and displays the average value after sweeping the designated frequency range with the spectrum analyzer and detecting the peak value. Calculates and displays the ratio to the transmitted power value (power ratio). Detection mode is Sample.	
	Storage mode	Normal: Refresh waveform/data for each measurement. Average: Displays the measured result value averaged for the designated number of measurements. Averaging count: 2 to 999. Waveform display is same as "Normal" mode.	
CCDF	Frequency range	100 MHz to 6 GHz, 100 MHz to 3 GHz (pre-amp On)	
	Reference level range	High Input: -6 to +38 dBm, -26 to +38 dBm (pre-amp On), Low Input: -26 to +18 dBm, -46 to +18 dBm (pre-amp On)	-26 to +18 dBm, -18 to +26 dBm (With Opt. 32), -46 to +18 dBm (pre-amp On)
	Measurement method	CCDF: Displays cumulative distribution of difference between instantaneous power and average power. APD: Displays distribution of difference between instantaneous power and average power.	
	Data count	10,000 to 2,000,000,000	
	Analysis time	0.001 to 100 ms	
	Filter selection	22 MHz, 20 MHz, 10 MHz, 5 MHz, 3 MHz, RRC: $\alpha = 0.22$ , RC: $\alpha = 0.22$	
Trigger	Free run: Regardless of the state of an input signal, a signal is taken in continuously. Wide IF: A signal is taken in synchronizing with a video signal. Trigger edge: Rise, Fall Trigger delay: -10000 to +10000 $\mu$ s Trigger level: High, Middle, Low External: A signal is taken in synchronizing with the trigger signal inputted into a "Trig/Gate In" connector on the back. Trigger edge: Rise, Fall Trigger delay: -10000 to +10000 $\mu$ s		

• IEEE802.11b, IEEE802.11g (ERP-DSSS/CCK) 3/3

Model		MX860830A	MX860930A
Batch measurement	Measurement items	Frequency accuracy, EVM-RMS, EVM-Peak, Phase error-RMS, Amplitude error-RMS, Origin offset, TX-power, Carrier off power (at burst signal), On/Off ratio (at burst signal), Burst signal rising/falling time (at burst signal), Occupied frequency bandwidth, Spectrum mask, Spurious (Two tables can be chosen)	
	Judgement	According to the judgment value set per measurement item, PASS or FAIL judgment is automatically performed for each measurement item.	
Chip clock error measurement	Frequency range	100 MHz to 3 GHz	
	Measurement level range	High Input: -6 to +38 dBm, -26 to +38 dBm (pre-amp On) Low Input: -26 to +18 dBm, -46 to +18 dBm (pre-amp On)	-26 to +18 dBm, -26 to +26 dBm (With Opt. 32), -46 to +18 dBm (pre-amp On)
	Analysis length	11,000 to 44,000 chip (setting resolution: 1 chip)	
	Measurement range	0.0 to ±50.0 ppm	
	Measurement resolution	0.1 ppm	
	Measurement accuracy	(MS8608A: Low Input) Carrier frequency: 2.4 to 2.5 GHz, ± (reference frequency accuracy x 10 <sup>6</sup> + 1.0) ppm per chip rate (11 MHz).	
	Storage mode	Normal: Refresh waveform/data for each measurement. Average: Displays the measured result value averaged for the designated number of measurements. Averaging count: 2 to 999. Waveform display is same as "Normal" mode.	

\*1: When burst interval is 20 μs or less, the Wireless LAN software cannot measure the following item rightly:

- 1) Carrier off power, 2) On/Off ratio and 3) Burst rising/falling time.

• Electric performance (IQ input)

Model		MX860830A	MX860930A
Input impedance	1 MΩ (parallel capacitance <100 pF), 50 Ω		
Balance input	Differential voltage: 0.1 to 1 Vp-p (input terminals) In-phase voltage: ±2.5 V (input terminals)		
Unbalance input	0.1 to 1 Vp-p (input terminals) DC/AC coupling Changeable		
Measurement items	[IEEE802.11a, IEEE802.11g (ERP-OFDM, DSSS-OFDM)] Modulation accuracy/frequency, RF power, CCDF, Batch measurement, IQ level, Symbol rate error measurement [HiSWANa, HiperLAN2] Modulation accuracy/frequency, RF power, CCDF, Batch measurement, IQ level [IEEE802.11b, IEEE802.11g (ERP-DSSS/CCK)] Modulation accuracy/frequency, RF power, CCDF, Batch measurement, IQ level, Chip clock error measurement		
IQ level measurement	Measures input level of I and Q (rms, p-p)		
IQ phase difference measurement	When the CW signal is inputted to I and Q input terminals, measures and displays the phase difference between I-phase and Q-phase signals.		



# Ordering Information

Please specify the model/order number, name, and quantity when ordering.

Model/Order No.	Name	
MX860830A	<b>Main frame</b> Wireless LAN Measurement Software (for MS8608A)	
MX860930A	Wireless LAN Measurement Software (for MS8609A)	
	<b>Standard accessories</b>	
JT32MA3-NT1	PC ATA card (32 MB, for backup):	1 pc
W2080AE	MX268X30A/MX860X30A Operation Manual:	1 copy



Specifications are subject to change without notice.

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