

# MT8860B Specifications

Characteristic/Parameter	Specification
<b>Wireless Setup</b>	Standards supported: IEEE 802.11b–1999 IEEE 802.11g–2003 (Option 13)
<b>Frequency Range</b>	
Supported Channels	Channels 1-14 (802.11b) Channels 1-14 (802.11g DSSS) Channels 1-13 (802.11g OFDM)
<b>Data Rates and Modulation</b>	
802.11b / 802.11g (DSSS)	1 Mbps 11-chip Barker DQPSK 2 Mbps 11-chip Barker DQPSK 5.5 Mbps CCK DQPSK 11 Mbps CCK DQPSK
802.11g (OFDM)	6, 9, 12, 18, 24, 36, 48, 54 Mbps OFDM (BPSK, QPSK, 16-QAM, 64-QAM)
<b>Operating Modes</b>	<b>2 Operating Modes Are Available:</b> <b>Network Mode</b> <b>Direct Mode</b>
<b>Network Mode</b>	In this mode, testing of a DUT's RX and TX characteristics are possible after first establishing a network connection between the MT8860B and the DUT
<b>Receiver Measurements</b>	Packet Error Rate (PER) at defined level
Unicast Packet Type	The MT8860B calculates the PER based on the number of acknowledgement (ACK) packets transmitted by DUT in response to the data packets it receives from the MT8860B
Broadcast Packet Type	MT8860B transmits data packets containing the broadcast address (FFFFFFFFFFFF). The measurement of PER is calculated externally and requires access to the DUT receive frame registers. These are normally available from the client software under "Advanced Information."
<b>Transmitter Measurements</b>	
Packet Loopback Mode	MT8860B forms a connection with DUT and transmits ICMP echo response packets and analysis the echo reply packets returned by the DUT in response
<b>Network Configuration Settings</b>	
MT8860B Role (Connection Type)	Infrastructure and Ad-Hoc
Infrastructure	Supports Access Point and Client (STA) modes
Ad-Hoc	Supports creating and joining network
SSID (Network Name)	Supported in Access Point and Ad-Hoc creation modes (32 characters maximum)
Beacon Configuration	The MT8860B periodically transmits beacon management frames so that a connection can be established and maintained with a DUT. The following beacon parameters can be adjusted;  Beacon Interval: 20 to 1000 (default 200) Operational Rate Set: All Rates, Multiple Rates, Single Rate DSSS Preamble Format: Long, Short NOTE: The Beacon Interval represents a number of time units (TU), with 1 TU being equal to 1024 $\mu$ s
IP Properties	The IP settings of the DUT can be assigned manually or automatically via DHCP
<b>Direct Mode</b>	In this mode, the DUT is controlled directly by using the appropriate chipset supplier test software
Receiver Measurements	MT8860B transmits a defined number of packets to DUT Chipset supplier test software is required to read DUT receiver packet count register
Transmitter Measurements	DUT is configured for continuous transmission using chipset supplier test software. MT8860B acts as a transmitter analyzer for measurements on received packets.
<b>802.11b Measurements</b>	
<b>Transmit Power Levels</b>	<b>IEEE 802.11b–1999 (18.4.7.1)</b>
Definition	Average and peak power measurements derived from gate 1 or 2
Damage Levels	> +27 dBm
Dynamic Range	+20 dBm to –50 dBm average power (+27 dBm peak)
Accuracy (CW)	$\pm 0.6$ dB (+18 dBm to –30 dBm), $\pm 1.0$ dB (–30 dBm to –50 dBm)
Resolution	0.1 dB
Capture Width	10 $\mu$ s to 5.95 ms
Time Resolution	0.1 $\mu$ s marker resolution with 10 $\mu$ s time window
<b>Transmit Power Level Control</b>	<b>IEEE 802.11b–1999 (18.4.7.2)</b>
Definition	Peak and Average Power specification as for 18.4.7.1

<b>Transmit Spectrum Mask</b>	<b>IEEE 802.11b–1999 (18.4.7.3)</b>
Definition	Spectrum measurement derived from gate 1 or 2
Gate Width	From gate 1 or 2, 50 $\mu$ s to 5.95 ms
Dither Mode	OFF - Default mode ON - Additional Signal processing removes spurs from the spectral measurement
Frequency Span	70 MHz (fc $\pm$ 35 MHz)
Flatness Over Frequency Span	$\pm$ 1 dB
Linearity	$\pm$ 0.8 dB (50 dB dynamic range CW measurements)
Resolution	0.1 dB
Range	+20 dBm to –40 dBm modulated carrier power
Dynamic Range	>50 dB (usable dynamic range with Dither Mode set to ON)
Receiver Resolution Bandwidth	Equivalent to 100 kHz Gaussian
Noise floor (for all supported channels)	–110 dBm
Spurious specification (supported channels)	<–56 dBc
<b>Transmit Center Frequency Tolerance</b>	<b>IEEE 802.11b–1999 (18.4.7.4)</b>
Accuracy	$\pm$ 1 kHz $\pm$ reference frequency oscillator error (ppm) for gate >1 ms
Resolution	100 Hz
<b>Chip Clock Frequency Tolerance</b>	<b>IEEE 802.11b–1999 (18.4.7.5)</b>
Definition	Frequency error relative to 11MHz Chip clock. Measurement averaged over a fully coded DSSS packet with minimum payload length of 3,300 chips (300 $\mu$ s)
Display Format	Hz and ppm
Range	$\pm$ 50 ppm
Resolution	0.1 Hz, 0.1 ppm
Analysis Length	3,300 to 30,250 chips (default 5,500 chips)
<b>Transmit Power-On &amp; Power-Down Ramp</b>	<b>IEEE 802.11b–1999 (18.4.7.6)</b>
Definition	Time for 802.11 burst to transit from 10% to 90% or 90% to 10% of linear power
Resolution	0.1 $\mu$ s
Data Outputs	10%, 90% and delta values
<b>RF Carrier Suppression</b>	<b>IEEE 802.11b–1999 (18.4.7.7)</b>
Definition	Relative Level of the carrier to highest sideband for a 10101010 test pattern with scrambler disabled, data rate 2 Mbps
Range	As spectral mask range
Dynamic Range	As spectral mask dynamic range
Flatness	As spectral mask flatness
Linearity	As spectral mask linearity
Resolution	As spectral mask resolution
<b>Transmit Modulation Accuracy</b>	<b>IEEE 802.11b–1999 (18.4.7.8)</b>
Definition	Peak and Average Error Vector Magnitude measurement performed as defined in 802.11b specification for DBPSK and DQPSK modulated packets. Measurement averaged over a fully coded DSSS packet with minimum payload length of 220 chips (20 $\mu$ s)
Measurement Accuracy	<10% residual RMS EVM +18 dBm to –45 dBm
Modulation Setting	Data rate 1, 2, 5.5 or 11 Mbps. (NOTE: 1 Mbps analysis only available if Option 11 is fitted)
Displayed Measurement Range	1% to 100% dependent on modulation
<b>Measurement Configuration</b>	
RX Filter Selection	Selectable between: None Gaussian, BT 0.3 to 1.0 (default 0.5), resolution 0.1 Root Raised Cosine, $\alpha$ 0.30 to 1.00 (default 0.35), resolution 0.01 (NOTE: Rx filter selection only available if Option 11 is fitted and DSSS EVM filter calibration implemented.)
Averaging	Single measurements, or averaging applied to the EVM results
Analysis Length	220 to 11,000 chips (default 1,000 chips)
<b>Receiver Minimum Input Sensitivity</b>	<b>IEEE 802.11b–1999 (18.4.8.1)</b>
Definition	Packet Error Rate (PER) at defined power level
Power Range	See Reference Radio Transmitter section
Mode	Network: MT8860B forms connection with the DUT. Unicast and Broadcast packets supported Direct: MT8860B transmits a defined number of packets
Data Packet Structure	Complies with 802.11 specifications for MAC header formatting, scrambling, encoding, interleaving and calculation of the appropriate CRC/FCS checksum

Number of Transmitted Packets	1 to 1000 (default 500)
Payload Length	1 to 1500 bytes (default 1,024 bytes)
Preamble Format	Long or Short
Payload	All 1's, all 0's, 0101, Counting, PN7, PN9, 1010 or Random. Payload data is scrambled over air
Data Rates	1, 2, 5.5 or 11 Mbps
<b>Network Mode Settings</b>	
Inter-packet Interval	0 to 65535 ms
Inter-packet Resolution	1 ms
DUT Tx Power Level	-30 to + 30 dBm This is the expected power level of the ACK packet transmitted by the DUT in response to a correctly received Unicast packet. This value is used by the MT8860B to calculate the amount of return path attenuation required to prevent MT8860B reference radio receiver saturation.
<b>Direct Mode Settings</b>	
Inter-packet Spacing	0 to 200 slots (default 5 slots)
Inter-packet Resolution	20 $\mu$ s
DUT MAC Address Range	00-00-00-00-00-00 to FF-FF-FF-FF-FF-FF
<b>Receiver Maximum Input Level</b>	<b>IEEE 802.11b-1999 (18.4.8.2)</b>
Definition	Receiver PER specification as for 18.4.8.1
<b>Receiver Adjacent Channel Rejection</b>	<b>IEEE 802.11b-1999 (18.4.8.3)</b>
Definition	Adjacent Channel measurements made with external modulated signal source (e.g.MG3700A) using one of the interferer ports
<b>Additional Measurements</b>	
Occupied Bandwidth	Measures the frequency range within which the specified percentage power is contained
Occupied Bandwidth Percentage	1 to 99%
Frequency vs Time	Frequency drift measured over packet transmission
<b>802.11g Measurements</b>	<b>(Option 13)</b> The following applies to data rates that use OFDM modulation. For DSSS data rates, please refer to the 802.11b measurement section
<b>Transmitter Power Levels</b>	<b>IEEE 802.11g-2003 (19.4.7.1)</b>
Definition	Average, peak and crest factor power measurements on OFDM modulated signals on the supported channels
Damage Levels	> +27 dBm
Dynamic Range	+18 dBm to -50 dBm average power (+27 dBm peak)
Accuracy (CW)	$\pm 0.6$ dB (+18 dBm to -30 dBm), $\pm 1.0$ dB (-30 dBm to -50 dBm)
Resolution	0.1 dB
Capture Width	10 $\mu$ s to 5.95 ms
Time Resolution	0.1 $\mu$ s marker resolution with 10 $\mu$ s time window
<b>Transmitter Spectrum Mask</b>	<b>IEEE 802.11g-2003 (19.5.4)</b>
Definition	Display of Spectrum measurement derived from gate 1 or 2
Gate Width (spectral measurement)	From gate 1 or 2, 50 $\mu$ s to 5.95 ms
Dither Mode	OFF - Default mode ON - Additional Signal processing removes spurs from the spectral measurement
Flatness Over Frequency Span	$\pm 1$ dB
Linearity	$\pm 0.8$ dB (50 dB dynamic range CW measurements)
Resolution	0.1 dB
Frequency Span	70 MHz (fc $\pm 35$ MHz)
Range	+18 dBm to -40 dBm modulated carrier power
Dynamic Range	(Useable dynamic range for signals with 8 dB crest factor and Dither Mode set to ON) $\pm 11$ MHz from fc 30 dB (typical 46 dB) $\pm 20$ MHz from fc 40 dB (typical 48 dB) $\pm 30$ MHz from fc 43 dB (typical 50 dB)
Receiver Resolution Bandwidth	Equivalent to 100 kHz Gaussian
Noise floor (for supported channels)	-110 dBm
Spurious Specification	<-56 dBc
<b>Transmit Center Frequency Tolerance</b>	<b>IEEE 802.11g-2003 (19.4.7.2)</b>
Definition	Average Frequency of the OFDM carrier signal
Data Output Format	Hz and ppm
Accuracy	$\pm 1$ kHz $\pm$ reference frequency oscillator error (ppm) for gate >1 ms
Resolution	100 Hz

<b>Symbol Clock Frequency Tolerance</b>	<b>IEEE 802.11g–2003 (19.4.7.3)</b>
Definition	Frequency error relative to 250 kHz symbol clock as per 802.11g. Measurement averaged over a fully coded OFDM packet with minimum payload length of 16 symbols (64 $\mu$ s)
Data Output Format	Hz and ppm
Range	$\pm 40$ ppm
Resolution	0.01 Hz, 0.1 ppm
Analysis Length	16 to 500 symbols (default 55 symbols)
<b>Transmitter Center Frequency Leakage</b>	<b>IEEE 802.11g–2003 (19.4.7) Reference IEEE 802.11a–1999 (17.3.9.6.1)</b>
Definition	Measurement of the leakage of the center carrier
Data Output Format	dB
Resolution	0.1 dB
<b>Transmitter Spectral Flatness</b>	<b>IEEE 802.11g–2003 (19.4.7) Reference IEEE 802.11a–1999 (17.3.9.6.2)</b>
Definition	Graphical display of the RF sub-carrier power level Display includes limit lines (IEEE802.11a-1999) Overall Pass/Fail status indicated For measurement failure, a numeric measurement result of the failing sub-carrier(s) is reported
Unit of measurement	dBr
<b>Transmitter Modulation Accuracy</b>	<b>IEEE 802.11g–2003 (19.7.2.7)</b>
Definition	Peak and Average EVM. Measurement averaged over a fully coded OFDM packet with minimum payload length of 16 symbols (64 $\mu$ s)
Measurement Accuracy	<2% residual RMS EVM for 54 Mbps OFDM +18 dBm to –45 dBm
Modulation Setting	Data rates 6, 9, 12, 18, 24, 36, 48 or 54 Mbps
Data Output Format	Peak and average EVM all sub-carriers, dB or percentage Peak and average EVM on each sub carrier (frequency domain), % vs sub carrier –26 to +26 EVM vs symbol (time domain), % vs symbol number, 1 to specified analysis length
Analysis Length	16 to 500 symbols (default 40 symbols)
OFDM Pilot Tracking	User selection of Phase tracking only or Phase and Amplitude tracking
<b>Receiver Minimum Input Sensitivity</b>	<b>IEEE 802.11g–2003 (19.5.1)</b>
Definition	Packet Error Rate (PER) at defined power level
Power Range	See Reference Radio Transmitter section
Mode	Network: MT8860B forms connection with DUT. Unicast and Broadcast packets supported Direct: MT8860B transmits defined number of packets
Data Packet Structure	Complies with 802.11 specifications for MAC header formatting, scrambling, encoding, interleaving and calculation of the appropriate CRC/FCS checksum
Number of Transmitted Packets	1 to 1000 (default 500)
Payload Length	1 to 1,500 bytes (default 1,024 bytes)
Payload	All 1's, all 0's, 0101, Counting, PN7, PN9, 1010 or Random. Payload data is scrambled over air
Data Rates	6, 9, 12, 18, 24, 36, 48 or 54 Mbps
<b>Network Mode Settings</b>	
Inter-packet Interval	0 to 65535 ms
Inter-packet Resolution	1 ms
DUT Tx Power Level	–30 to + 30 dBm This is the expected power level of the ACK packet transmitted by the DUT in response to a correctly received Unicast packet. This value is used by the MT8860B to calculate the amount of return path attenuation required to prevent MT8860B reference radio receiver saturation.
<b>Direct Mode Settings</b>	
Inter-packet Spacing	0 to 200 slots (default 5 slots)
Inter-packet Resolution	9 $\mu$ s (OFDM)
DUT MAC Address Range	00-00-00-00-00-00 to FF-FF-FF-FF-FF-FF
<b>Receiver Adjacent Channel Rejection</b>	<b>IEEE 802.11g–2003 (19.5.2)</b>
Definition	Adjacent Channel measurements made with external modulated signal source (e.g. MG3700A) using external interferer port
<b>Receiver Maximum Input Level</b>	<b>IEEE 802.11g–2003 (19.5.3)</b>
Definition	As per IEEE 802.11g-2003 (19.5.1)

Additional Measurements	
CCDF	CCDF defined as percentage of samples against dB, where percentage of samples is normalized to the average power in the gate, and dB is defined as the relative value of samples greater than the average
Measurement Scales	Y-axis, Log scale, fixed values of 100, 10, 1, 0.1, 0.01% X-axis, dB scale, fixed values of 0 to 12 dB
TX Measurement Controls	
Triggers	
Free Run	Continuous unsynchronised
RF Edge	RF triggering on rising or falling edge, detected at RF input User set level
RF Edge Dynamic Range	+18 dBm to -40 dBm average power in auto range mode
Video	Video triggering on rising or falling edge, detected at IF, trigger level auto set
Video Trigger Dynamic Range	802.11b/802.11g (DSSS): Triggers at -10 dB below average power 802.11g (OFDM): Triggers at -20 dB below average power level +18 dBm to -50 dBm average power in auto range mode
External	TTL input, BNC on Rear Panel
Measurement Gates	Two gates for Power, Spectrum, Frequency and CCDF measurements. Gate positions set directly by GPIB
Settable Gate Range	10 $\mu$ s to 5.95 ms
Tx Analysis auto-configure function	Using this function, the following parameters are automatically configured by the MT8860B; Input Level Range Pre-trigger Capture Width Trigger settings Measurement Gate settings
Reference Radio Transmitter	Network and Direct Modes
Supported Channels	Channels 1-14 (802.11b) Channels 1-14 (802.11g DSSS) Channels 1-13 (802.11g OFDM)
Output power (for supported channels)	-3 to -100 dBm (settable to 0 dBm but performance unwarranted)
Power Accuracy (for supported channels)	$\pm$ 1.0 dB (-3 dBm to -90 dBm, CW 18 to 28° C) $\pm$ 2.0 dB typical (<-90 dBm to -100 dBm, CW 18 to 28 degrees) Specification warranted for packets transmitted during receiver sensitivity
Settable Resolution	0.1 dB
Output Impedance	50 $\Omega$ < 2:1 VSWR
Frequency Accuracy	$\pm$ 20 ppm
Modulation Accuracy (channels 1 to 13) 802.11b / 802.11g (DSSS) 802.11g (OFDM)	<10%, RMS EVM, 11 Mbps, <-20 dBm <5.6%, RMS EVM, 54 Mbps, <-20 dBm Nominally <4%, RMS EVM, 54 Mbps, <-20 dBm Nominally <5.6%, RMS EVM, 54 Mbps, -3 to -20 dBm
Reference Radio Receiver	Network and Direct Modes
Supported Channels	See Reference Radio Transmitter Section (above)
Maximum Safe Input	+27 dBm Peak Power
Damage level	+32 dBm Peak power (Excluding range 3)
Input VSWR (for supported channels)	<1.5:1
Sensitivity	-40 dBm (for <0.1% PER)
General	
Reference Frequency Oscillator	
Frequency	10 MHz
Aging	< $\pm$ 1 ppm/year, < $\pm$ 2.5 ppm/10 years
Drift	< $\pm$ 0.5 ppm 0 to +45° C
Inputs & Outputs	
Front Panel Inputs & Outputs	
Test Port In/Out	Provides connection to DUT, N-type (f), 50 $\Omega$ nominal
Interferer Inputs 1 & 2	Provides input for external signal source (e.g. MG3700A), N-type (f), 1.5:1 VSWR Max Input power +27 dBm Loss to Test Port In/Out: 20 dB $\pm$ 1 dB (for supported channels)
WLAN Reference Input	Allows an external reference radio to be used for DUT receiver measurements using only the leveling loop and attenuator of MT8860B Power output leveled to specified level for packets >110 ms Power input range +12 dBm to +18 dBm No measurements supported by MT8860B in this mode

<b>Rear Panel Inputs &amp; Outputs</b>	
GPIB	IEEE 488.2 compliant
10 MHz out	As Reference Frequency Oscillator specification, TTL
10 MHz in	TTL
<b>Digital Inputs</b>	
Input 1	BNC, TTL input for an external trigger source
Input 2	BNC, TTL input TX ON signal from an external reference radio. The TX ON signal must be the same length as the RF transmission from the external WLAN radio
<b>Digital Outputs</b>	
Output 1	BNC, TTL compatible The user can select between one of the following: 1. The TX trigger signal from the internal reference radio 2. The trigger signal from the MT8860B when the trigger source is set to RF 3. The trigger signal from the MT8860B when the trigger source is set to Video (default setting)
Output 2	BNC, TTL compatible The user can select between one of the following: 1. The TX trigger signal from the internal reference radio (default setting) 2. The trigger signal from the MT8860B when the trigger source is set to RF 3. The trigger signal from the MT8860B when the trigger source is set to Video
<b>General</b>	
Power supply	85 to 264V AC
Frequency	47 to 63 Hz
Power	100 VA
<b>Size and Weight</b>	
Dimensions	180 mm x 320 mm x 350 mm
Weight	<10 kg
Operating Temperature Range	+5°C to +40°C
Operating Humidity	<75% non condensing
Safety	Complies with BS EN 61010-1 (Equivalent to IEC 61010-1)
EMC	Conforms to the protection requirements of EEC Council Directive 89/336/EEC

<b>Ordering Information</b>	
<b>Part number</b>	<b>Description</b>
MT8860B	WLAN Test Set
<b>Standard Option</b>	
MT8860B-11	Memory expansion (for future software enhancements)
<b>Supplied accessories</b>	
	Power cable Operation manual (printed copy) Remote programming manual (printed copy) CD containing: <ul style="list-style-type: none"> <li>• LANLook software</li> <li>• Source code for LANLook</li> <li>• LANTest WLAN Production Test software</li> <li>• Source code for LANTest</li> <li>• Lab View GPIB drivers for the MT8860B</li> <li>• Operation manual (pdf)</li> <li>• Remote programming manual (pdf)</li> </ul>
<b>Options and accessories</b>	
MT8860A-10	2.4 GHz WLAN antenna and adaptor
MT8860B-13	Software option - IEEE802.11g transmitter and receiver measurement suite
MT8860B-37	Delete printed manuals
MT8860B-98	Calibration to Z540 ISO guide 25
MT8860B-99	Premium calibration
B0395A	Rack mount kit
B0331C	Front handles
13000-00230	Manual pack containing additional printed versions of Operation and Remote Programming manuals