Product Brochure

Anritsu

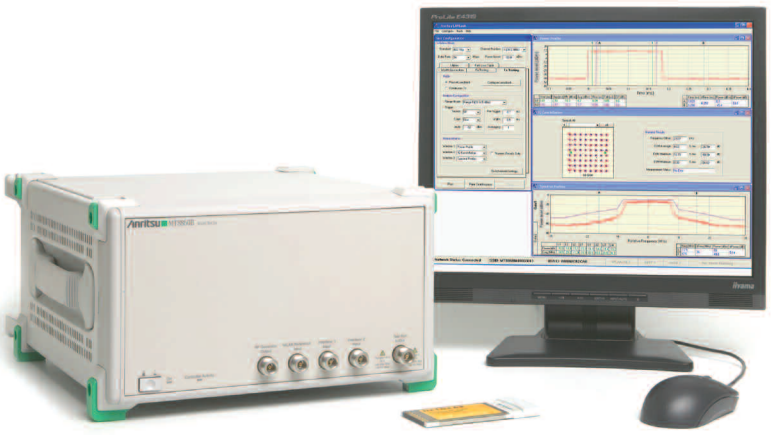
MT8860B WLAN Test Set

A Fully Integrated WLAN Measurement Solution for Design and Production

IEEE 802.11 Standards, Making the World More Mobile

Anritsu can help you succeed in this mobile world.

By eliminating the need for network cables, 802.11 WLAN technology has freed the PC from the home and office to become a truly mobile computing platform. Reading emails and surfing the internet, at an airport or in a café, has become an accepted part of daily life. Now WLAN technology is also being integrated into mobile phones and PDAs so that these users can also benefit from improved access to data while on the move.



Today, consumers expect technology to work smoothly and seamlessly “out of the box.” This is where Anritsu can help. Anritsu understands that the level of success for a technology-based product depends entirely on the end-user enjoying excellent high-quality connections every time the product is used.

For over 100 years, Anritsu has been developing and manufacturing test solutions for the communications industry. The introduction of the MT8860B is the latest instrument from Anritsu to offer an integrated test solution in development and production of products using WLAN technology.

Test 802.11 Devices Directly or in a Network

The Anritsu MT8860B is the only WLAN Test Set with Network and Direct modes for testing WLAN devices conforming to IEEE 802.11 standards.

The MT8860B is an integrated one-box test set dedicated to testing 802.11 WLAN devices. It provides a high-speed measurement solution that is ideally suited for design proving and production testing. The MT8860B replaces existing test systems that typically utilize power meters, spectrum analyzers and gold radios with external attenuators. The end result is a test instrument that is easier to integrate into production, provides traceable and repeatable measurements and offers a universal solution for all WLAN chip sets. By being simpler to maintain and calibrate, the MT8860B also reduces test system costs, increases production throughput and delivers the most flexible WLAN test system.

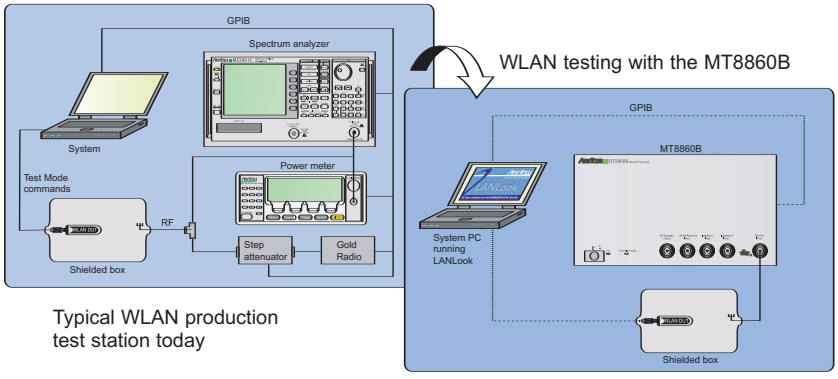
The MT8860B provides two modes of operation: Network and Direct. In “Network” mode, standard WLAN signaling is used to test both the transmitter and receiver of the device under test (DUT). In “Direct” mode, the MT8860B tests the DUT receiver by automatically creating and transmitting WLAN packets, and measures the DUT transmitter by using its built-in transmitter analyzer. In Direct mode, the DUT must be controlled by the test mode software utility from the chipset supplier.

The user interface is implemented through the supplied LANLook software package. LANLook runs on a standard PC and uses a conventional Windows®-based interface for both instrument configuration and control. Measurement results are displayed in clear numerical and graphical formats. LANLook communicates with the MT8860B through a GPIB interface.

The MT8860B
Integrates a Reference 802.11 Transmitter and Receiver

Key features

- Integrated test set for 802.11b/g transmitter and receiver measurements
- “Network” mode – allows devices to be tested by using standard WLAN protocols to establish a connection to the DUT
- Packet loopback feature for simplified DUT transmitter measurements
- Built-in reference radio for calibrated receiver Packet Error Ratio (PER) measurements
- “Direct” mode – allows WLAN devices to be tested with the support of test mode software from the silicon supplier
- Transmission of user defined WLAN packets
- Built-in transmitter analyzer
- Shorter test system design time
- High-speed transmitter measurements including power burst profile, spectral mask, spectral flatness, Error Vector Magnitude (EVM), frequency and CCDF
- LANLook software for instrument configuration and results display
- LANTest software for production test requirements



Typical WLAN production test station today

Shorter test system development times means shorter production test time

The integrated test set design of the MT8860B replaces the spectrum analyzer, power meter, gold radio and attenuator of traditional test systems. This eliminates the need for interconnections between all the test system components that have to be calibrated out. The MT8860B provides a single calibrated test port for both transmitter and receiver testing. The integral reference radio does not suffer the drift and variability of existing gold radios, resulting in more stable test systems and improved quality of output.

Programming the MT8860B is also much simpler than creating test programs that have to interface to a number of test instruments, gold radios and attenuators. Logical GPIB mnemonics can configure the MT8860B for standard WLAN measurements and read back results.

The integrated spectral processor performs transmitter measurements in parallel, significantly reducing measurement times. Peak and average power, spectral mask compliance, spectral flatness and EVM are measured and displayed in typically 300 ms. This represents a 8-fold speed improvement relative to alternative test systems.

Perform 802.11 Measurements in Network Mode

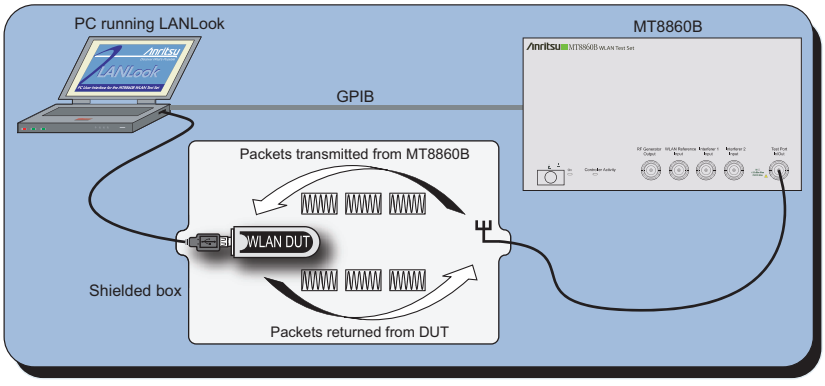
Network mode measurements

The MT8860B built-in reference radio simulates either a standard WLAN Access Point (AP) or client device/station (STA). It establishes a connection to the DUT using standard protocol in either Infrastructure or Ad-Hoc modes. When Network mode is selected, WLAN transmitters and receivers are tested without the need for test mode software from the silicon supplier, further simplifying measurement setup.

In Network mode, the device is tested under exactly the same conditions as when the device is integrated with a host product. This gives results that most accurately reflect real world performance.

Network mode transmitter testing

MT8860B quickly tests DUT transmitter performance using the “Packet Loopback” feature. Packet loopback uses standard protocol such that any DUT will return the packet configured by the user and transmitted by the MT8860B. This eliminates the need for any special test mode software from the chip set supplier.

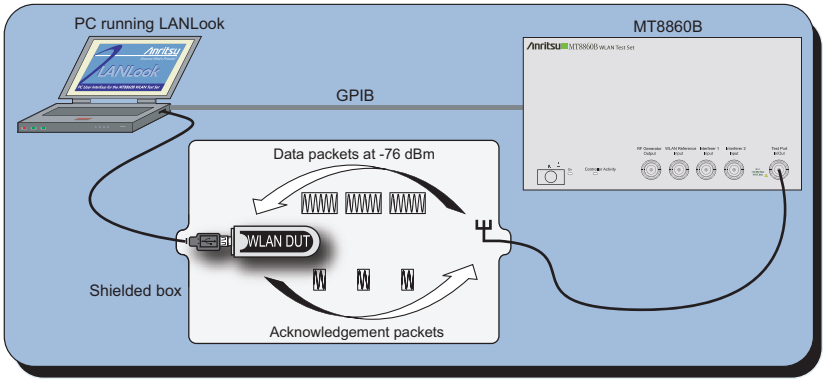


WLAN packets are automatically generated by the MT8860B with the preamble, MAC address, payload data rate, payload length and payload data defined by the user.

Complete 802.11 Measurement Capabilities

Network mode receiver testing

Receiver sensitivity testing is performed by transmitting defined packets to the DUT from the reference radio at levels down to –100 dBm. The MT8860B counts the returned acknowledgement (ACK) packets to calculate the Packet Error Rate (PER). The use of a reference radio eliminates any need to pre-configure a signal generator with custom packets and allows testing to be performed at different data rates and packet lengths directly. This measurement technique also eliminates any requirement for proprietary test mode software from the chip set supplier to read the number of packets received. The same test program can therefore be used to test any chip set.



Direct mode measurements

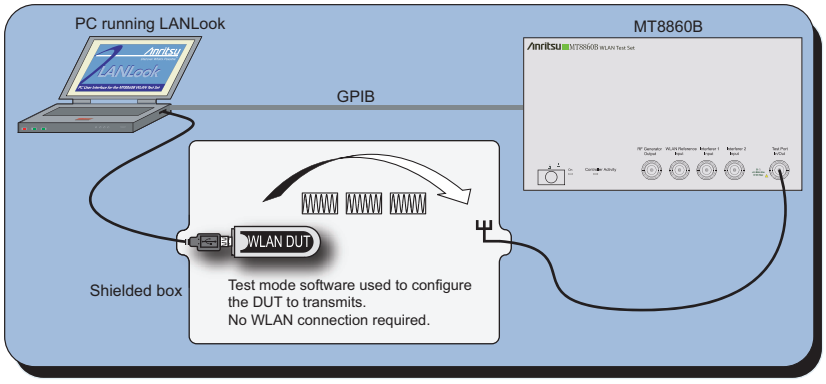
In Direct mode, the MT8860B tests both WLAN transmitters and receivers without having to first establishing a connection with the DUT. Typically Test Mode software supplied by the DUT chipset supplier must be used to configure the DUT for testing.

When configured for Direct mode measurements, the MT8860B acts as a transmitter analyzer and WLAN signal source. This is the mode of operation most similar to the test stations that use spectrum analyzers, power meters and gold radios for device testing.

Perform 802.11 Measurements in Direct Mode

Direct mode transmitter testing

Test mode software from the chipset supplier configures the WLAN device to continuously transmit packets to the MT8860B. The MT8860B triggers on the incoming packets and performs all the selected transmitter measurements in parallel. In this mode, the chipset suppliers test mode software must be used to configure the DUT transmitters channel number, data rate and packet structure.

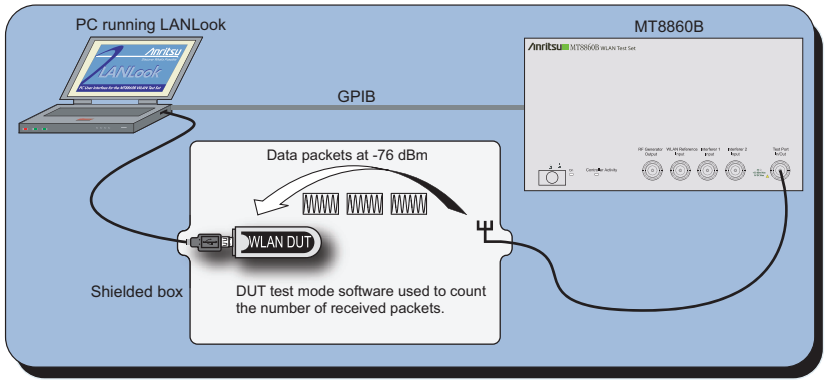


Direct mode receiver testing

To measure the DUT receiver sensitivity in Direct mode, the DUT must be configured to count received packets using the chipset suppliers test mode software. The MT8860B transmits defined packets to the DUT including a user-configurable MAC address.

Typically the chipset suppliers test mode software reads a register in the DUT and displays the number of received packets in a window on the PC. Depending on the sophistication of the test mode software, these packets may be broken down to data packets, beacons and management packets.

When testing a receiver in Direct mode, it is not possible to use LANLook for automated PER measurements or receiver sensitivity searches.



Supported Measurements

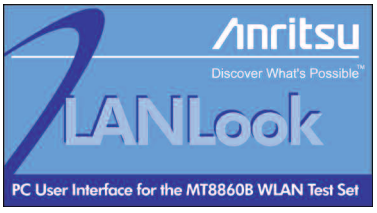
802.11b Standard

IEEE Reference	Test Name	Limit
18.4.7.1	Transmit power levels	Follows national regulatory requirements for 2.4 GHz ISM band
18.4.7.2	Transmit power level control	Required for radios >100 mW
18.4.7.3	Transmit spectrum mask	Defined limit mask
18.4.7.4	Transmit center frequency tolerance	± 25 ppm
18.4.7.5	Chip clock frequency tolerance	± 25 ppm
18.4.7.6	Transmit power-on and ower-down ramp	< 2 µs
18.4.7.7	RF carrier suppression	–15 dB for unscrambled 1010 payload
18.4.7.8	Transmit modulation accuracy	< 0.35 EVM peak for highest data rate
18.4.8.1	Receiver minimum input sensitivity	PER < 8% for –76 dBm input, 11 Mbps
18.4.8.2	Receiver maximum input level	PER < 8% for –10 dBm input, 11 Mbps
18.4.8.3	Receiver adjacent channel rejection	ACR > 35 dB with PER < 8%, @ 25 MHz separation (requires 2nd signal source)

802.11g Standard

IEEE Reference	Test Name	Limit
19.4.7.1	Transmitter power levels	Follows national regulatory requirements for 2.4 GHz ISM band
19.5.4 (17.3.9.2)	Transmitter spectrum mask	Defined limit mask
19.4.7.2	Transmit center frequency tolerance	± 25 ppm
19.4.7.3	Symbol clock frequency tolerance	± 25 ppm
19.4.7 (17.3.9.6.1)	Transmitter center frequency leakage	–15 dB relative to overall output power
19.4.7 (17.3.9.6.2)	Transmitter spectral flatness	± 2 dB maximum deviation for subcarrier 1 to 16, (+2 to –4 dB for subcarrier 17 to 26)
19.7.2.7 (17.3.9.6.3)	Transmitter constellation error	–25 dB RMS EVM for 54 Mbps
19.5.1 (17.3.10.1)	Receiver minimum input sensitivity	PER < 10% for –65 dBm input, 54 Mbps
19.5.2	Receiver adjacent channel rejection	PER < 10%, 3 dB interferer (requires 2nd signal source)
17.3.10.3	Receiver non- adjacent channel rejection	PER < 10%, 3 dB interferer (requires 2nd signal source)
19.5.3	Receiver maximum input level	PER < 10% for –20 dBm input

Powerful Software Support with Supplied LANLook & LANTest Programs



LANLook – for R&D

LANLook is a PC based User-Interface for the MT8860B WLAN Test Set. LANLook is supplied as standard and communicates with the MT8860B using a conventional GPIB interface.

All data processing and measurement analysis is performed within the MT8860B. LANLook provides a user with the capability to configure and control all aspects of the MT8860B. Transmitter and Receiver measurements can be performed and the resultant data can then be read back and displayed in both graphical and numeric formats. LANLook provides an ideal interface for development engineers validating the performance of a WLAN device.

LANLook is written in Visual Basic® and full source code is provided allowing users to customize the software to exactly match their own unique requirements.

LANTest – for verification and production testing

LANTest is the ideal PC software program for testing large numbers of WLAN devices quickly, easily and repeatedly in either a production or design verification environment. LANTest allows a user to predefine a test plan of measurements, and to use all or part of this as required to perform both Tx and Rx testing on 802.11b and 802.11g devices.

LANTest provides –

- A familiar and intuitive windows interface enabling creation of test plans with ease, speed, and flexibility.
- Full compatibility with Tx and Rx testing on all 802.11b/g devices.
- One-click operation for selection and execution of required tests.
- Real time display of test status with pass/fail indication.
- Detailed test report printed and archived.
- Database search functionality for viewing test reports that have been automatically archived in an Access database.

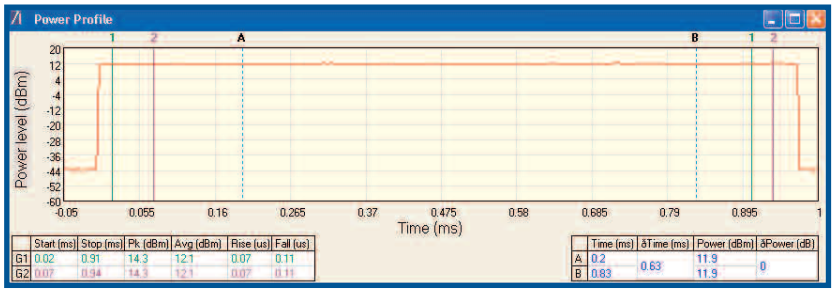
LANTest allows all combinations of channel number and data rate to be tested using a user-defined sequence of transmitter and receiver measurement scripts. For each measurement script, a channel number and data rate is specified. One or more measurements can be selected, and for each measurement pass/fail limits can be defined. Graphical data can also be requested where applicable.

LANTest is supplied as standard and is written in VB.net 2005®. Full source code is also provided, giving users the freedom to make their own modifications as required. LANTest communicates with the MT8860B using a conventional GPIB interface.

Both LANLook and LANTest can be downloaded from the Anritsu web site using the following link;
http://www.eu.anritsu.com/products/default.php?p=202&model=MT8860B

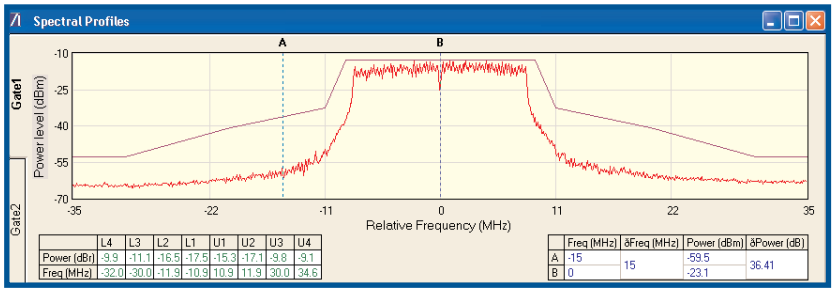
Evaluate Transmitter Performance with the MT8860B's Power and Spectral Profiles

Power Profile



Power measurements are displayed against time. Measurement triggers initiate the capture of up to 6 ms of data. Two gates are used to measure peak and average power in any defined section of the trace. This enables the measurement of power in the preamble and payload independently. Power burst Rise and Fall time are also measured and the trace can be configured to display either maximum and minimum power values or average power. For 802.11g OFDM modulations, peak and crest factor measurements can be displayed.

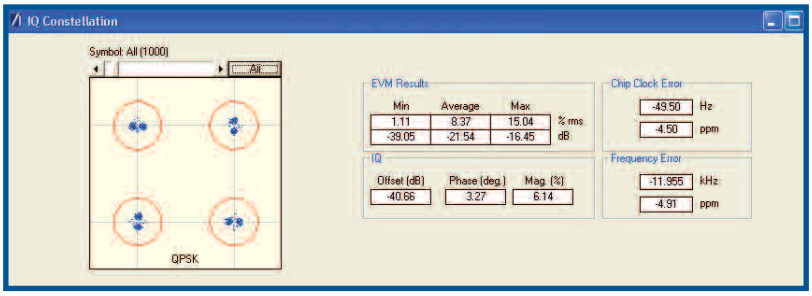
Spectral Profiles



The MT8860B automatically applies the spectral limit mask for either 802.11b or 802.11g transmitters with a results table that displays the pass/fail status of each of the mask elements. The gates in the power profile display are used to define the time period over which the spectrum is calculated, providing 2 spectral displays (1 for each gate). This is used to view the spectrum of clearly defined sections of the power burst. Numeric displays of occupied bandwidth and carrier suppression (DSSS modulation only) are also provided.

Use the MT8860B's EVM Capability to Check Transmitter Quality

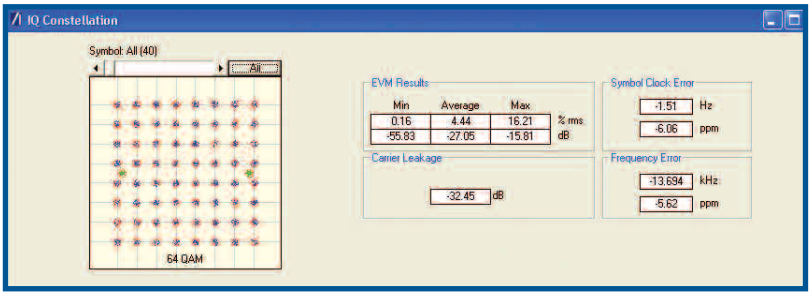
EVM (802.11b/g DSSS)



Error Vector Magnitude (EVM) is an excellent measurement of the overall transmitter quality. A poor EVM figure will typically result in a high packet error rate (PER) in the WLAN connection.

The MT8860B measures the EVM of 802.11b/g DSSS modulated carriers. The standard requires that the peak EVM of 1000 chips does not exceed 35%. The MT8860B measures both average (rms) and peak EVM for fast pass/fail analysis. In addition to EVM, the MT8860B measures IQ offset, rms phase and magnitude error, chip clock error and center frequency error. A graphical display of the IQ constellation diagram is provided.

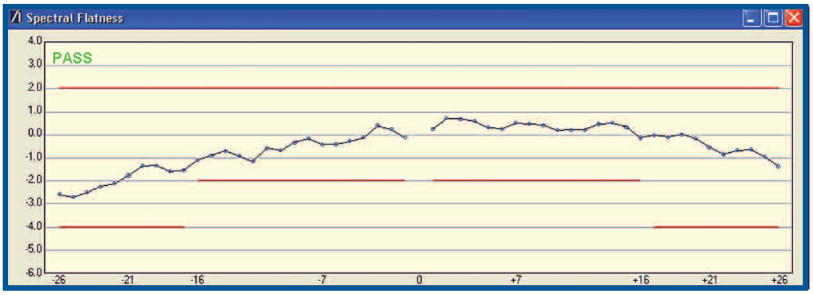
EVM (802.11g OFDM)



The MT8860B measures the EVM of 802.11g OFDM modulated carriers. Numeric results are given for EVM. Furthermore, graphical displays of the IQ constellation diagram, EVM against channel and EVM against symbol are provided. As a result, detailed analysis of the modulation distortion can be performed. In addition to the EVM results, the MT8860B also measures carrier leakage, symbol clock error and center frequency error. The MT8860B has a residual EVM figure of <2% and a best in class measurement update rate of typically 300 ms for all parameters.

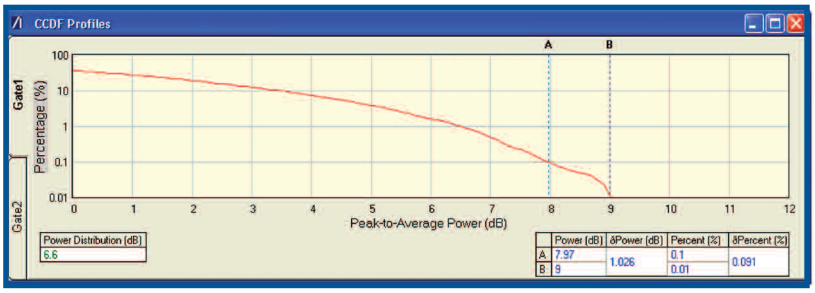
Use the MT8860B to Verify Spectral Flatness and CCDF

Spectral Flatness



The spectral flatness measurement requires the test instrument to capture the 8µs channel estimation period of the burst. The power in each sub-carrier is measured and displayed as a relative power trace. IEEE802.11g-2003 states that subcarriers +16 to -16 (excluding the 0 position sub-carrier) shall deviate no more than ± 2 dB relative to the average power over the same 32 sub-carriers. Sub-carriers ± 17 to ± 26 shall deviate no more than +2 dB to –4 dB relative to the average power of the center 32 sub-carriers. This test ensures DUT receivers will be able demodulate the transmitted packet with acceptable safety margins. The MT8860B measures and displays the spectral flatness results directly in graphical format.

CCDF Profiles

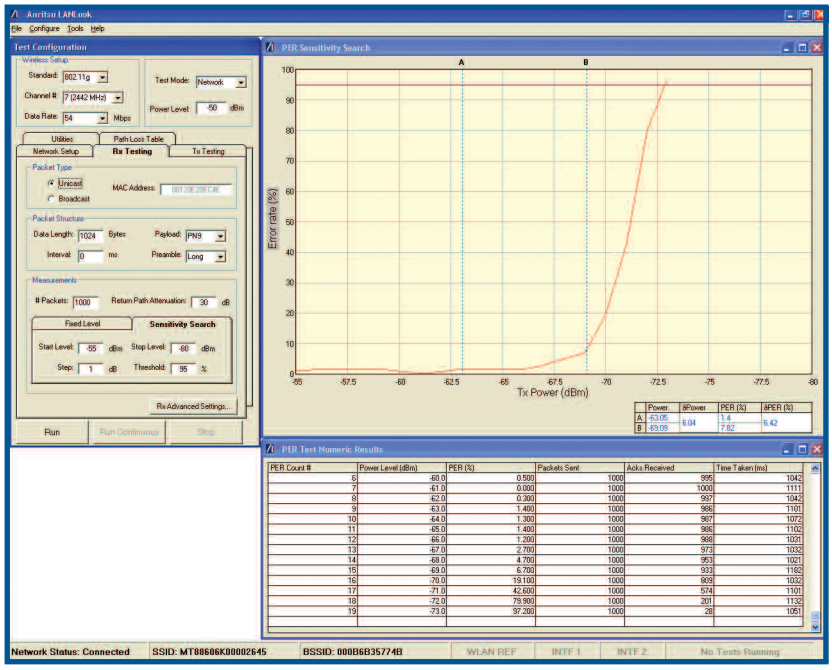


Complimentary Cumulative Distribution Function (CCDF) displays provide an insight into distortions of the transmitted signal at a glance. Any non-linearity in the DUT transmitter output stages, especially the output power amplifier, will reduce the crest factor resulting in lost packets. The 802.11g OFDM signals have a crest factor of typically 8 to 9 dB and a CCDF trace provides a visual indication of any distortion.

Perform Automated Sensitivity Searches with Receiver PER

Receiver PER
(automated measurements in Network mode only)

In Network mode, the MT8860B has the unique ability to perform automated sensitivity search measurements on any 802.11b/g device without the need for proprietary chipset supplier test mode software. This provides a convenient test solution that can quickly analyze the performance of a device at each data rate and validate conformance with the 802.11 receiver sensitivity test specification. The number of packets to be tested at each power level can be defined with the start and stop search levels and step size for a fully flexible solution. Results can be saved in both graphical and tabular numeric formats for later analysis.



As well as sensitivity search measurements, the MT8860B is able to perform strife testing of DUTs by continuously running a fixed level sensitivity test and displaying the results graphically against time. This is a powerful tool to validate a DUT ability to maintain good receiver sensitivity under a variety of conditions such as external interferers and extreme temperatures.

MT8860B Specifications

Characteristic/Parameter	Specification
Wireless Setup	Standards supported: IEEE 802.11b–1999 IEEE 802.11g–2003 (Option 13)
Frequency Range	
Supported Channels	Channels 1-14 (802.11b) Channels 1-14 (802.11g DSSS) Channels 1-13 (802.11g OFDM)
Data Rates and Modulation	
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)
Operating Modes	**2 Operating Modes Are Available:** **Network Mode** **Direct Mode**
Network Mode	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
Receiver Measurements	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."
Transmitter Measurements	
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
Network Configuration Settings	
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 µs
IP Properties	The IP settings of the DUT can be assigned manually or automatically via DHCP
Direct Mode	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.
802.11b Measurements	
Transmit Power Levels	**IEEE 802.11b–1999 (18.4.7.1)**
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)	± 0.6 dB (+18 dBm to –30 dBm), ± 1.0 dB (–30 dBm to –50 dBm)
Resolution	0.1 dB
Capture Width	10 µs to 5.95 ms
Time Resolution	0.1 µs marker resolution with 10 µs time window
Transmit Power Level Control	**IEEE 802.11b–1999 (18.4.7.2)**
Definition	Peak and Average Power specification as for 18.4.7.1

Transmit Spectrum Mask	**IEEE 802.11b–1999 (18.4.7.3)**
Definition	Spectrum measurement derived from gate 1 or 2
Gate Width	From gate 1 or 2, 50 µs to 5.95 ms
Dither Mode	OFF - Default mode ON - Additional Signal processing removes spurs from the spectral measurement
Frequency Span	70 MHz (fc ±35 MHz)
Flatness Over Frequency Span	±1 dB
Linearity	±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
Transmit Center Frequency Tolerance	**IEEE 802.11b–1999 (18.4.7.4)**
Accuracy	±1 kHz ± reference frequency oscillator error (ppm) for gate >1 ms
Resolution	100 Hz
Chip Clock Frequency Tolerance	**IEEE 802.11b–1999 (18.4.7.5)**
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 µs)
Display Format	Hz and ppm
Range	±50 ppm
Resolution	0.1 Hz, 0.1 ppm
Analysis Length	3,300 to 30,250 chips (default 5,500 chips)
Transmit Power-On & Power-Down Ramp	**IEEE 802.11b–1999 (18.4.7.6)**
Definition	Time for 802.11 burst to transit from 10% to 90% or 90% to 10% of linear power
Resolution	0.1 µs
Data Outputs	10%, 90% and delta values
RF Carrier Suppression	**IEEE 802.11b–1999 (18.4.7.7)**
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
Transmit Modulation Accuracy	**IEEE 802.11b–1999 (18.4.7.8)**
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 µs)
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
Measurement Configuration	
RX Filter Selection	Selectable between: None Gaussian, BT 0.3 to 1.0 (default 0.5), resolution 0.1 Root Raised Cosine, α 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)
Receiver Minimum Input Sensitivity	**IEEE 802.11b–1999 (18.4.8.1)**
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
Network Mode Settings	
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.
Direct Mode Settings	
Inter-packet Spacing	0 to 200 slots (default 5 slots)
Inter-packet Resolution	20 µs
DUT MAC Address Range	00-00-00-00-00-00 to FF-FF-FF-FF-FF-FF
Receiver Maximum Input Level	**IEEE 802.11b–1999 (18.4.8.2)**
Definition	Receiver PER specification as for 18.4.8.1
Receiver Adjacent Channel Rejection	**IEEE 802.11b–1999 (18.4.8.3)**
Definition	Adjacent Channel measurements made with external modulated signal source (e.g.MG3700A) using one of the interferer ports
Additional Measurements	
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
802.11g Measurements	**(Option 13)** The following applies to data rates that use OFDM modulation. For DSSS data rates, please refer to the 802.11b measurement section
Transmitter Power Levels	**IEEE 802.11g–2003 (19.4.7.1)**
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)	±0.6 dB (+18 dBm to –30 dBm), ±1.0 dB (–30 dBm to –50 dBm)
Resolution	0.1 dB
Capture Width	10 µs to 5.95 ms
Time Resolution	0.1 µs marker resolution with 10 µs time window
Transmitter Spectrum Mask	**IEEE 802.11g–2003 (19.5.4)**
Definition	Display of Spectrum measurement derived from gate 1 or 2
Gate Width (spectral measurement)	From gate 1 or 2, 50 µs to 5.95 ms
Dither Mode	OFF - Default mode ON - Additional Signal processing removes spurs from the spectral measurement
Flatness Over Frequency Span	±1 dB
Linearity	±0.8 dB (50 dB dynamic range CW measurements)
Resolution	0.1 dB
Frequency Span	70 MHz (fc ±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) ±11 MHz from fc 30 dB (typical 46 dB) ±20 MHz from fc 40 dB (typical 48 dB) ±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
Transmit Center Frequency Tolerance	**IEEE 802.11g–2003 (19.4.7.2)**
Definition	Average Frequency of the OFDM carrier signal
Data Output Format	Hz and ppm
Accuracy	±1 kHz ± reference frequency oscillator error (ppm) for gate >1 ms
Resolution	100 Hz

Symbol Clock Frequency Tolerance	**IEEE 802.11g–2003 (19.4.7.3)**
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 µs)
Data Output Format	Hz and ppm
Range	±40 ppm
Resolution	0.01 Hz, 0.1 ppm
Analysis Length	16 to 500 symbols (default 55 symbols)
Transmitter Center Frequency Leakage	**IEEE 802.11g–2003 (19.4.7)** **Reference IEEE 802.11a–1999 (17.3.9.6.1)**
Definition	Measurement of the leakage of the center carrier
Data Output Format	dB
Resolution	0.1 dB
Transmitter Spectral Flatness	**IEEE 802.11g–2003 (19.4.7)** **Reference IEEE 802.11a–1999 (17.3.9.6.2)**
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
Transmitter Modulation Accuracy	**IEEE 802.11g–2003 (19.7.2.7)**
Definition	Peak and Average EVM. Measurement averaged over a fully coded OFDM packet with minimum payload length of 16 symbols (64 µs)
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
Receiver Minimum Input Sensitivity	**IEEE 802.11g–2003 (19.5.1)**
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
Network Mode Settings	
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.
Direct Mode Settings	
Inter-packet Spacing	0 to 200 slots (default 5 slots)
Inter-packet Resolution	9 µs (OFDM)
DUT MAC Address Range	00-00-00-00-00-00 to FF-FF-FF-FF-FF-FF
Receiver Adjacent Channel Rejection	**IEEE 802.11g–2003 (19.5.2)**
Definition	Adjacent Channel measurements made with external modulated signal source (e.g. MG3700A) using external interferer port
Receiver Maximum Input Level	**IEEE 802.11g–2003 (19.5.3)**
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 µs 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)	±1.0 dB (–3 dBm to –90 dBm, CW 18 to 28° C) ±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 Ω < 2:1 VSWR
Frequency Accuracy	±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	<±1 ppm/year, <±2.5 ppm/10 years
Drift	<±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 Ω 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 ±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

Rear Panel Inputs & Outputs	
GPIB	IEEE 488.2 compliant
10 MHz out	As Reference Frequency Oscillator specification, TTL
10 MHz in	TTL
Digital Inputs	
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
Digital Outputs	
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
General	
Power supply	85 to 264V AC
Frequency	47 to 63 Hz
Power	100 VA
Size and Weight	
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

Ordering Information	
Part number	**Description**
MT8860B	WLAN Test Set
Standard Option	
MT8860B-11	Memory expansion (for future software enhancements)
Supplied accessories	Power cable Operation manual (printed copy) Remote programming manual (printed copy) CD containing: • LANLook software • Source code for LANLook • LANTest WLAN Production Test software • Source code for LANTest • Lab View GPIB drivers for the MT8860B • Operation manual (pdf) • Remote programming manual (pdf)
Options and accessories	
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

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