LitePoint IQview

iQview

Introduction

The IQview™ 802.11a/b/g WLAN Test Solution is an all-in-one test instrument developed specifically for RF testing of 802.11a/b/g WLAN products. Suitable for both development and manufacturing environments, the IQview test system integrates a vector signal analyzer (VSA) and a vector signal generator (VSG) into a single small form factor box.

Functionality

The IQview test system is expressly designed to test WLAN products, including network interface cards, access points, and embedded components.

The IQview test system's VSA capability replaces traditional spectrum analyzers and power meters, enabling the user to analyze a device under test's transmitter output and perform true error vector magnitude (EVM) measurements. Designed to receive large input signals without distortion, the IQview test system employs a wide-bandwidth Capture-Once Measure-All approach so that the device under test's transmit signal is sampled and stored in a single measurement for subsequent analysis of all desired parameters.

Similarly, the IQview test system's VSG capability replaces traditional golden units with a test signal source of much higher quality, allowing detailed analysis of the receiver performance of the device under test. The IQview test system is designed to output high-quality test signals over the full expected operating range of a WLAN receiver.

The IQview test system supports testing in both the 2.4 GHz and 5 GHz frequency bands utilized worldwide for 802.11a/b/g products. Inputs and outputs at both RF and baseband are provided, enabling detailed testing of all aspects of a WLAN product's analog design.

Features

- Seamless analysis of DSSS (802.11b/g) and OFDM (802.11a/g) WLAN signals

- Advanced Vector Signal Analyzer (VSA) and Vector Signal Generator (VSG) combined with the capabilities of a power meter and spectrum analyzer in a single instrument

- Operation in both 2.4 GHz and 5 GHz bands

- Baseband I/O facilitates product debugging

- High-performance VSA

- Wide bandwidth (±33 MHz)

  - Capture-Once Measure-All operation

  - High phase linearity, low phase noise, low noise figure

  - Graphical and numerical display of measurement results

- High-performance VSG

  - Low noise figure

  - Pre-defined 802.11a/b/g transmit test signals

  - Impairments can be introduced in real-time to the transmit test signal

  - Generation of arbitrary 802.11a/b/g waveforms simplified by optional IQwave WLAN Waveform

- Generator Software

- Simple control interfaces

  - IQsignal Signal Analysis Software Suite facilitates signal analysis, signal generation, and debugging

  - LitePoint API supports Visual C/C++ test scripts for use in manufacturing

Control Interfaces

The IQview test system is bundled with the IQsignal™ Signal Analysis Software Suite, a powerful 802.11a/b/g analysis toolbox. Operating on a separate Windows PC and connected to the IQview test system via TCP/IP over Ethernet, IQsignal provides an intuitive graphical user interface that is easy to master. Users can interactively control and analyze IQview's measurements and operation, either in real time or at their convenience.

To allow automated testing, the IQview test system supports the LitePoint API, a complete command set and associated DLL files for the development of Visual C/C++ test scripts. Whether used for product characterization in the development process or for quality assurance in manufacturing, the LitePoint API supports test setup, data capture, signal analysis, and result-handling as well as general communications and error-handling functions.

To facilitate debugging, especially in the development of test scripts with the LitePoint API, the IQview test system is supported by the IQdebug™ Monitor and Control Tool. IQdebug is a convenient stand-alone software tool with an easy-touch graphical interface that can monitor and control the test instrument and data captures.

VSA Operation

The IQsignal software offers advanced analysis options that expand standard 802.11a/b/g analysis beyond basic power measurements, EVM measurements, or spectral measurements. For example, the IQsignal software can easily analyze frequency settling and phase noise that occurs during a burst transmission. Such capabilities significantly help in understanding and debugging RF performance-related issues. The IQview test system supports analysis of all the in-band transmit specifications required for compliance with the IEEE 802.11a/b/g standards. The IQsignal software provides graphical display of these tests, including spectral mask, symbol constellation (including EVM measurements), carrier leakage, spectral flatness (for 802.11a/g OFDM signals), power on/off ramp time (for 802.11b/g DSSS signals) and frequency error transmit power vs. time.

To support product debugging, various other graphical displays are supported by the IQsignal software, including:
- Phase noise (power spectral density versus time)
- CCDF (to support compression analysis)
- Spectrogram
- Frequency error versus time (to assess frequency settling)
- Variation of OFDM short training sequence (pretzel plot)
- Eye diagram
- EVM (versus OFDM subcarriers versus time)

Besides the graphical display of VSA measurements, the IQsignal software also presents relevant numerical data, including:
- EVM
- Power (peak, average)
- I/Q amplitude imbalance
- I/Q phase imbalance
- Frequency error
- Symbol timing error
- Integrated phase noise

The IQsignal software additionally provides a wide range of compensation methods that can be used for advanced analysis of a captured signal's sensitivity to certain impairments. For example, the available compensation methods when analyzing OFDM signals include:
- Phase tracking (off, slow; fast)
- Channel estimation (based on averaging of the long training sequence, averaging of the full packet, or a 2nd order polynomial fit to the long training sequence)
- Symbol timing tracking

- Frequency synchronization (based on the short training sequence, long training sequence, or full packet)
- Amplitude tracking

Similarly, when analyzing DSSS signals, available compensation methods include equalization and DC offset removal.

VSG Operation

The IQsignal software also controls IQview's VSG capabilities. The user can select, among various pre-defined test signals, adjusting the transmit frequency, the output power, and whether the transmitter should operate continuously or only transmit a specific number of packets. Additionally, transmit impairments to the signal generated by the VSG, which could include the following, can be introduced in real time:

- I/Q amplitude imbalance
- I/Q phase imbalance
- I/Q group delay imbalance
- I- and Q-channel DC offsets

LitePoint IQwave—An Optional Software Tool

To simplify the generation of arbitrary 802.11a/b/g waveforms, LitePoint offers an optional PC-based tool, the IQwave™ WLAN Waveform Generator Software. Using IQwave software, the user can specify one or more complete packets as well as introduce impairments such as noise, fading, and frequency offset. The generated signals can then be loaded for transmission by the IQview test system by using the IQsignal software VSG control interface.

The IQwave software provides a simple GUI to specify the type of 802.11a/b/g transmit packets to be generated. The user can specify the contents of the preamble (e.g., the MAC address and SSID) as well as the actual payload data. As desired, IQwave then allows impairments to be introduced to the signal, including noise (a specific Eb/No), I/Q imbalances, frequency offsets, and channel models (for example, the ETSI Hiperlan/2 multipath channel models or a user-defined impulse response). Please contact LitePoint for more information about the IQwave software.

VSA Measurement Parameters (IQsignal Interface)

Parameter	Specification	Description
Capture Mode	Single / continuous	Enables one-shot or non-stop data capture and analysis
Capture duration	100 µs, 200 µs, 300 µs, 400 µs, 500 µs, 1 ms, 2 ms, 3 ms, 4 ms, 5 ms, 10 ms	
Signal type	802.11a/g (OFDM) 802.11b/g (DSSS)	Signal type to be analyzed Generally, analysis of the beginning of the packet determines the signal type; if both types are selected, the 802.11b specification is selected as the default type. • 802.11a/g OFDM signals: – 6 Mbps BPSK – 9 Mbps BPSK – 12 Mbps BPSK – 18 Mbps QPSK – 24 Mbps 16-QAM – 36 Mbps 16-QAM – 48 Mbps 64-QAM – 54 Mbps 64-QAM • 802.11b/g DSSS signals: – 1 Mbps BPSK DSSS

Parameter	Specification	Description
		– 2 Mbps QPSK DSSS – 5.5 Mbps CCK DSSS – 11 Mbps CCK DSSS • Turbo (2x), half-rate, and quarter-rate modes OFDM signals
Input mode	Baseband / RF	Selects type of signal input and enables appropriate ports
IQ swap	Off / on	Interchanges I and Q channel signals on input ports
Triggers	• Free run • External trigger • Signal trigger (RF input mode only)	• Data capture trigger mechanism • Signal trigger requires input power:≥-30 dBm
Max signal level	• RF input: -60 to +30 dBm in 1 dB increments • Baseband input: -60 to +30 dBV in 1 dB increments	Peak signal level at instrument input, affecting display ranges • Determined automatically using the Auto Range function • Limited by VSA performance (see below)
External attenuation	-25.0 to 125.0 dB with 0.1 dB resolution	• Attenuation between DUT output and IQview input (applied as a correction to measurements) • RF input mode only
AGC (lev auto)	Off / on	• Automatically sets peak signal level for each data capture iteration (alternatively, use Auto Range to initially set peak signal level) • RF input mode only
EVM & power averaging	1, 10, 20, 40, 60, 80, 100	Number of measurements (packets) used to calculate average EVM and power • IEEE 802.11a/g standard specifies this as 20; LitePoint API allows arbitrary number of measurements to be used
Rx IF	0 MHz, 5 MHz, 10 MHz, 11 MHz	• To assess Tx performance at IF, downconvert the signal to 5 MHz,10 MHz, or 11 MHz and input it to the baseband ports • To assess Tx performance at baseband or at a supported RF channel, set to 0 MHz
RF channel (RF mode only)	• User-defined center frequency (within 2400-2500 MHz or 4900-6000 MHz with 1 MHz resolution) • Selectable pre-programmed center frequencies:	

channel number / center frequency (MHz)

1/2412	9/2452	00/4980	52/5260	116/5580	153/5765
2/2417	10/2457	00/5040	56/5280	120/5600	157/5785
3/2422	11/2462	00/5080	60/5300	124/5620	161/5805
4/2427	12/2467	00/5100	64/5320	128/5640	00/5825
5/2432	13/2472	36/5180	100/5500	132/5660	00/5865
6/2437	14/2484	40/5200	104/5520	136/5680	00/5885
7/2442	00/4920	44/5220	108/5540	140/5700	00/5905
8/2447	00/4940	48/5240	112/5560	149/5745	00/5945

VSA Measurement Parameters – 802.11a/g OFDM Signals (IQsignal Interface)

Parameter	Specification	Description
Phase tracking / correction	- Off - Symbol-by-symbol correction (fast) 10-symbol moving average (slow)	- Phase tracking method - Symbol-by-symbol correction is specified by IEEE standard for EVM calculation but will mask measurement of Tx phase noise
Channel estimate	- Raw – averaging over long training sequence – averaging over full packet - Second order polynomial fit (using long training sequence)	- Channel estimation method - Averaging over long training sequence is most common in practical receiver implementations
Symbol timing tracking	Off / on	- Timing jitter correction - Symbol timing tracking is specified by IEEE standard
Frequency sync	- Short training sequence - Long training sequence - Full data packet	- Carrier frequency error estimation method - Estimation based on short or long training sequence is most common in practical receiver implementations
Amplitude tracking	Off / on	Automatic gain control

Note that the specified corrections are implemented prior to taking the measurement; for example, EVM is calculated after any specified corrections are applied, thereby affecting the results.

VSA Measurement Parameters – 802.11b/g DSSS Signals (IQsignal Interface)

Parameter	Specification	Description
Equalizer taps	- Off 5 taps 7 taps 9 taps	Intersymbol interference correction
Remove DC	Off / on	DC offset correction
EVM calculation	11b std Tx mod acc - RMS error vector	- Choice of transmit modulation accuracy measurements - Per 802.11b-1999 18.4.7.8 ("11b std Tx mod acc"), EVM is calculated over the last 1000 chips; or, if not available, it is calculated over the complete PSDU - Per *classic* definition of EVM ("RMS error vector"), EVM is calculated over the full PSDU; or, if not available, it is calculated over all samples after the preamble

Note that the specified corrections are implemented prior to measurement taking and that carrier and symbol timing recovery are always enabled for 802.11b/g DSSS signals.

VSA Measurement Results – Graphical Display (IQsignal Interface)

Parameter	Description
Amplitude	Instantaneous and peak power averaged over a symbol duration (dBm) versus time
Spectrogram	• 3D plot of power spectral density versus time • Time is displayed on x-axis; frequency offset on y-axis; color coding represents power (maximum strength is red; minimum strength is green)
PSD	• Power spectral density (dBm/Hz) versus frequency offset • Center frequency ± 20 MHz (LitePoint API provides ± 40 MHz) • Resolution bandwidth 156.25 kHz (LitePoint API produces 1024-point FFT)
Spectrum mask	• Power spectral density (dBm/Hz) versus frequency offset plus applicable 802.11a/b/g spectral mask • Center frequency ± 33 MHz • Resolution bandwidth 100 kHz
Symbol constellation	Visual display of each demodulated symbol in the I/Q complex plane (data symbols are red; pilot tones are green)
Spectral Flatness	Variation from average energy as a function of OFDM subcarrier number (802.11a/g OFDM signals only)
LO (DC) leakage	• 802.11a/g OFDM signals: variation from center carrier (dB) as a function of OFDM subcarrier number • 802.11b/g DSSS signals: power spectral density (dBm/Hz) versus frequency offset
Phase noise (PSD)	Phase noise power spectral density (dBc/Hz) versus frequency offset
Phase noise (time)	Integrated phase noise (degrees) versus time
CCDF (complementary cumulative distribution function)	Probability of peak signal power being greater than a given power level versus peak-to-average power ratio (dB)
Power-on ramp	• Relative power level (% of average) versus time • Accompanying numerical data – power-on time from 10% to 90% – power-on time from ≥ 90% power level to detected start of packet (not provided for 802.11a/g OFDM signals)
Power-down ramp	• Relative power level (% of average) versus time (802.11b/g CCK signals only) • Accompanying numerical data – power-off time from 90% to 10% (not reliable for 802.11a/g OFDM signals) – power-off time from ≤ 90% power level to detected end of packet (not provided for 802.11a/g OFDM signals)
I & Q signals	I/Q signal voltages (Vrms) versus time
STS pretzel	Short Training Symbols pretzel; i.e., x-y plot of I signal versus the Q signal during the short training sequence (802.11a/g OFDM signals only)
Frequency error	• Frequency error (kHz) versus time • 802.11a/g OFDM signals: frequency error during short and long training sequences • 802.11b/g DSSS signals: frequency error during entire packet
EVM versus carrier	Error Vector Magnitude averaged over all symbols for each subcarrier (dB) versus OFDM subcarrier number
EVM versus time	• 802.11a/g OFDM signals: Error Vector Magnitude averaged over all subcarriers (dB) versus time • 802.11b/g DSSS signals: instantaneous EVM per symbol (dB) versus time
Eye diagram	I and Q channels versus time (802.11b/g DSSS signals only)

Parameter	Description
Amplitude variation (amplitude versus time)	Difference between symbol power and average power of long training sequence (dB) versus symbol number (802.11a/g OFDM signals only)

VSA Measurement Results – Numerical Data (IQsignal Interface)

Parameter	Description
Packet information	• 802.11a/g OFDM signals – data rate – number of symbols – number of bytes in PSDU – coding rate – PSDU CRC (passed / failed) • 802.11b/g DSSS signals – data rate – number of bytes – preamble (short / long) – PSDU CRC (passed / failed)
Note that the above packet information is displayed only with certain graphical displays.	
EVM all	• EVM averaged over all symbols and all subcarriers (dB; %) • 802.11a/g OFDM signals only
EVM data	• EVM averaged over all symbols and all data subcarriers (dB; %) • 802.11a/g OFDM signals only
EVM pilots	• EVM averaged over all symbols and all pilot subcarriers (dB; %) • 802.11a/g OFDM signals only
PSDU: EVM av.	• EVM averaged over all PSDU data symbols (or, if "11b std Tx mod acc" is selected, over last 1000 samples) (dB; %) • 802.11b/g DSSS signals only
PSDU: EVM peak	• Peak EVM value (dB; %) • 802.11b/g DSSS signals only
Peak power	Peak power over all symbols (dBm)
RMS power (all)	Average power of complete data capture (dBm)
RMS power (no gap)	Average power over all symbols after removal of any gap between packets (dBm)
Max avg power	Peak value of the amplitude as a moving average over 40 samples (dBm)
Note that the above measurements are shown for the current data packet and as averaged over the last N packets.	
I/Q amplitude error	I/Q amplitude imbalance (%) and approximate contribution to EVM (dB)
I/Q phase error	I/Q phase imbalance (degrees) and approximate contribution to EVM (dB)
Total I/Q mismatch (combined)	Approximate contribution of amplitude and phase imbalances to EVM (dB)
Frequency error	Carrier frequency error (kHz)
Symbol clock error	Symbol clock frequency error (ppm)
RMS phase noise	Integrated phase noise (degrees)
Note that the above measurements are shown for the current data packet only.	

VSA Performance*

* All performance specified at 25°C

Parameters	Specification
Frequency	- Baseband 2400 - 2500 MHz 4900 - 6000 MHz
Analog bandwidth	60 MHz (± 30 MHz quadrature)
Quantization	14 bits
Sampling frequency	80 MHz at ADC
Sampling resolution	1 sample
Waveform Capture Duration	13 ms
Pre-trigger capture	$(2^{20} - 1)$ samples (~1,000,000 samples)
Sampling filter amplitude variation	≤ 0.25 dB (0 – 10 MHz offset frequency)
Sampling filter group delay variation	≤ 300 ps (0 – 10 MHz offset frequency)
RF Port	
Noise figure	≤ 25 dB
Input amp level	2400 – 2500 MHz: -70 to +30 dBm 4900 – 6000 MHz: -70 to +30 dBm
Power measurement accuracy	- Specification: ± 1.0 dB - Typical: ± 0.5 dB
Residual EVM	VSA contribution to measurement of 802.11a/g OFDM signals - Input power ≥ -35 dBm - Specification: ≤ -35 dB (≤ 1.78%) - Typical: -41 dB (0.89%)
SNR	VSA contribution to measurement of 802.11b/g DSSS signals - Input power ≥ -10 dBm 100 kHz resolution BW - Specification: ≥ 55 dB - Typical: 60 dB
Spurious response	802.11b/g DSSS signals - Measured w.r.t. spectral mask - out-of-band: ≤ -45 dB - In-band: ≤ -55 dB with 100 kHz resolution BW
Amplitude flatness	≤ 0.2 dB (0 – 10 MHz offset frequency)
Integrated phase noise	Typical: 0.5 degrees (100 Hz – 1 MHz)
Input return loss	≥10 dB
Baseband port	
Input level	5 - 1000 mVrms ± 1.5 V peak
Residual EVM	- VSA contribution to measurement of 802.11a/g OFDM signals 5 mVrms ≤baseband input ≤150 mVrms - Specification: ≤-45 dB (≤ 0.57%)
SNR	- VSA contribution to measurement of 802.11b/g DSSS signals 5 m Vrms ≤baseband input ≤150 mVrms 100 kHz resolution BW - Specification: ≥65 dB

Parameters	Specification
Residual I/Q DC offset	≤ 2 mV
Residual I/Q amplitude imbalance	Typical: 1%
Residual I/Q phase imbalance	Typical: 0.5 degrees
Integrated phase noise	Typical: 0.2 degrees (100 Hz – 1 MHz)

VSG Signal Parameters (IQsignal Interface)

Parameter	Specification	Description
Tx mode	Continuous / # packets (1 to 65,334)	Enables continuous transmission or transmission of the specified number of packets of the stored waveform

Signal type	• 802.11b/g DSSS signals
	– 1 Mbps BPSK DSSS
	– 2 Mbps QPSK DSSS
	– 5.5 Mbps CCK DSSS
	– 11 Mbps CCK DSSS
	• 802.11a/g OFDM signals
	– 6 Mbps BPSK
	– 9 Mbps BPSK
	– 12 Mbps QPSK
	– 18 Mbps QPSK
	– 24 Mbps 16-QAM
	– 36 Mbps 16-QAM
	– 48 Mbps 64-QAM
	– 54 Mbps 64-QAM
		Either the default supplied waveforms or custom waveform files can be used
		
		• **Default 802.11b/g DSSS signals**—long preamble and either
		– Raised cosine-filtered (length 10 symbols)
		or
		– Gaussian-filtered (length 6 chips; BT product 0.5) and convolved with a rectangular pulse with a duration of 1/11 µsec
		  o 1 Mbps (default: 100 or 1000 symbols)
		  o 2 Mbps (default: 100 or 1000 symbols)
		  o 5.5 Mbps (default: 100 or 1000 symbols)
		  o 11 Mbps (default: 1000 symbols)
		• **Default 802.11a/g OFDM signals**—raised cosine window of length 10 symbols
		– BPSK (default: 9 Mbps, 100 or 1000 symbols)
		– QPSK (default: 18 Mbps, 1000 symbols)
		– 16-QAM (default: 36 Mbps, 1000 symbols)
		– 64-QAM (default: 54 Mbps, 1000 symbols)

Output mode	Baseband / RF	• Selects type of signal output and enables appropriate ports • RF output mode enables both RF and baseband ports
IQ swap	Off / on	Interchanges I and Q channel signals on output ports
Signal level	-98.0 dBm to 10.0 dBm with 0.1 dB resolution	• Desired RMS signal level of output signal • Limited by VSG performance according to signal type (see below)
Common mode voltage	• Yes / no • If yes, I and Q channels can be set together or independently from 0.000V to 3.000V with 0.001V resolution	Sets common mode output voltage of baseband outputs
RF channel (RF output mode only)	• User-defined center frequency (within 2400-2500 MHz or 4900-6000 MHz with 1 MHz resolution) • Selectable pre-programmed center frequencies:	

channel number / center frequency (MHz)					
1 / 2412	9 / 2452	00 / 4980	52 / 5260	116 / 5580	153 / 5765
2 / 2417	10 / 2457	00 / 5040	56 / 5280	120 / 5600	157 / 5785
3 / 2422	11 / 2462	00 / 5080	60 / 5300	124 / 5620	161 / 5805

Parameter	Specification				Description	
	4 / 2427	12 / 2467	00 / 5100	64 / 5320	128 / 5640	00 / 5825
	5 / 2432	13 / 2472	36 / 5180	100 / 5500	132 / 5660	00 / 5865
	6 / 2437	14 / 2484	40 / 5200	104 / 5520	136 / 5680	00 / 5885
	7 / 2442	00 / 4920	44 / 5220	108 / 5540	140 / 5700	00 / 5905
	8 / 2447	00 / 4940	48 / 5240	112 / 5560	149 / 5745	00 / 5945
Signal impairments	• I/Q amplitude imbalance: -10.00% to +10.00% with resolution of 0.01% • I/Q phase imbalance: -10.00 degrees to +10.00 degrees with resolution of 0.01 degrees • I/Q group delay imbalance: -1.00 nsec to +1.00 nsec with resolution of 0.01 nsec • I-channel DC offset: -1.00 to +1.00 with resolution of 0.001 (units of Volts for baseband output; dBV for RF output) • Q-channel DC offset: -1.00 to +1.00 with resolution of 0.001 (units of Volts for baseband output; dBV for RF output)					

VSG Performance

Parameter	Specification
Frequency	• Baseband • 2400 - 2500 MHz • 4900 - 6000 MHz
Analog bandwidth	70 MHz (± 35 MHz quadrature)
Quantization	14 bits
Sampling frequency	80 MHz
Sampling resolution	1 sample
Waveform Duration	13 ms
Pre-trigger capture	$(2^{20} - 1)$ samples (~1,000,000 samples)
DAC filter amplitude variation	Typical: ≤ 0.25 dB (0 – 20 MHz offset frequency)
DAC filter group delay variation	Typical: ≤ 400 ps (0 – 20 MHz offset frequency)
RF Port	
Output level	• 2400 – 2500 MHz: -95 to 0 dBm • 4900 – 6000 MHz: -95 to -10 dBm
Power accuracy	• Specification: ± 1.0 dB • Typical: ± 0.6 dB

EVM	• 2400 – 2500 MHz
	 – 802.11a/g OFDM signals
	  ○ ≤-38 dB (output level: -95 to -10 dBm)
	  ○ ≤-35 dB (output level: -10 to -5 dBm)
	 – 802.11b/g DSSS signals: ≤ -30 dB (output level: -95 to 0 dBm)
	• 4900 – 6000 MHz
	 – ≤ -38 dB (output level: -95 to -15 dBm)
	 – ≤ -35 dB (output level: -15 to -10 dBm)

SNR	• 802.11b/g DSSS signals only • 100 kHz resolution BW • Specification: ≥ 55 dB • Typical: 70 dB
Undesired sideband	≤-45 dBc (0.1 – 10 MHz; CW output)

Parameter	Specification
Carrier leakage	≤ -45 dBc (CW output)
Spurious	• Specification: ≤ 50 dBc (in-band) • Typical – ≤ -20 dBc out-of-band (harmonics) – ≤ -35 dBc out-of-band (non-harmonic)
Integrated phase noise	typical: 0.5 degrees (100 Hz – 1 MHz)
Output return loss	≥ 10 dB
Baseband Port	
Output level	≤ 1000 mVrms ± 1.5 V peak
Dynamic range	≥ 60 dB
EVM	• 802.11a/g OFDM signals only • Specification: ≤ -45 dB (≤ 0.57%)
SNR	• 802.11b/g DSSS signals only • 100 kHz resolution BW • Specification: ≥ 65 dB
I/Q DC offset	≤ 2 mV immediately after automatic DC offset calibration (upon any level change)
I/Q amplitude imbalance	Typical: 1%
I/Q phase imbalance	Typical: 0.5 degrees
Integrated phase noise	Typical: 0.2 degrees (100 Hz – 1 MHz)

Interfaces

Component	Type	Description
Front Panel		
RF receive	Type N female	• RF input signal (configurable as output via LitePoint API) • 50 Ohms • Supports both 2.4-2.5GHz and 4.9-6.0 GHz bands
RF transmit	Type N female	• RF output signal (configurable as input via LitePoint API) • 50 Ohms • Supports both 2.4-2.5GHz and 4.9-6.0GHz bands
I/Q baseband receive	BNC female (2 or 4 connectors)	• Single / differential I/Q baseband input signals – I, Q (2 connectors)

Component	Type	Description
		– I-, I+, Q-, Q+ (4 connectors) • 50 Ohms
I/Q baseband transmit	BNC female (2 or 4 connectors)	• Single / differential I/Q baseband output signals – I, Q – I-, I+, Q-, Q+ • 50 Ohms
Trigger input	BNC female	• Rising-edge input trigger signal • 5V TTL interface • Input voltage ≥ 0.5V, ≤ 5.5V • Pulse width ≥ 25 ns
Marker output	BNC female	• Rising-edge output trigger signal • TTL/CMOS-compatible interface • Pulse width ≥ 25 ns • Delay to 1st sample output = 12.5 ns + 1 sample
Power	Pushbutton	• On/off • Reset (hold for 4 secs)
Rear Panel		
10/100 Mbps Ethernet	RJ-45	TCP/IP connectivity
10 MHz reference	BNC female	• 10 MHz reference clock input connector • 1 kΩ • 0.1 to 2.0 Vrms input level
AC in	15A IEC connector	• For use with country-specific cord and plug • 90–132 VAC or 198-264 VAC (automatically switched) • 47–63 Hz
0 / 1	switch	Master power switch
Unused ports	• 15-pin D-sub (VGA monitor port) • 6-pin mini-DIN female (PS2 keyboard port) • 6-pin mini-DIN female (PS2 mouse port) • 36-pin D-sub (1284-C) parallel port • USB port (2) • audio jacks (3) • DB-9 female RS-232 serial port • TV output ports (2: S-video, RCA)	FOR USE BY AUTHORIZED PERSONNEL ONLY

General

Control interfaces	• IQsignal Signal Analysis Software Suite—Windows-based tool, connected via Ethernet • LitePoint API—command set with DLL interface to support Visual C/C++ programming of test scripts • IQdebug—a Windows-based debugging tool, connected via Ethernet
Connectivity	TCP/IP over 10/100BaseT Ethernet default IP address: 192.168.100.254 ports 4000, 5001, 5002 must be open for access through a firewall
Internal Reference Oscillator	
Frequency	10 MHz
Temperature stability	±2.5 ppm (0°C to +55°C)
Aging	±1.0 ppm/year

Physical & Environmental

Dimensions	450 mm x 100 mm x 500 mm
Weight	8.2 kg
Power consumption	300W max
Operating temperature	0°C to +55°C (68-2-1, 2, 14)
Guaranteed Specification	+20°C to +30°C ambient
Storage temperature	-40°C to +70°C (68-2-1, 2, 14)
Operating humidity	15% to 95% relative humidity, non-condensing (68-2-30)

Compliance

EMI compatibility	• 89/336/EEC revised by 91/263/EEC, 92/31/EEC, 93/68/EEC • EN55011/ CISPR 11: 1998 + A1+A2 • EN61326-1: 1997 + A1 + A2 • FCC Part 15 Class A / 04.99 • IC CS003
Safety	• 73/23/EEC revised by 93/68/EEC • EN61010-1: 1993 + A2: 1995 • UL 61010A R4.02 • CAN/CSA c22.2 No. 1010

System Requirements

IQsignal Signal Analysis Software Suite; IQdebug Monitor and Control Tool

PC	Intel Pentium processor or higher
Operating system	Microsoft Windows 2000; Windows XP Professional; Windows XP Home Edition
Memory	≥ 128MB of RAM
Disk space	≥ 200MB of available hard disk space
Monitor	At least 1024 x 768 resolution
Connectivity	TCP/IP over 10/100BaseT Ethernet

Disclaimer

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