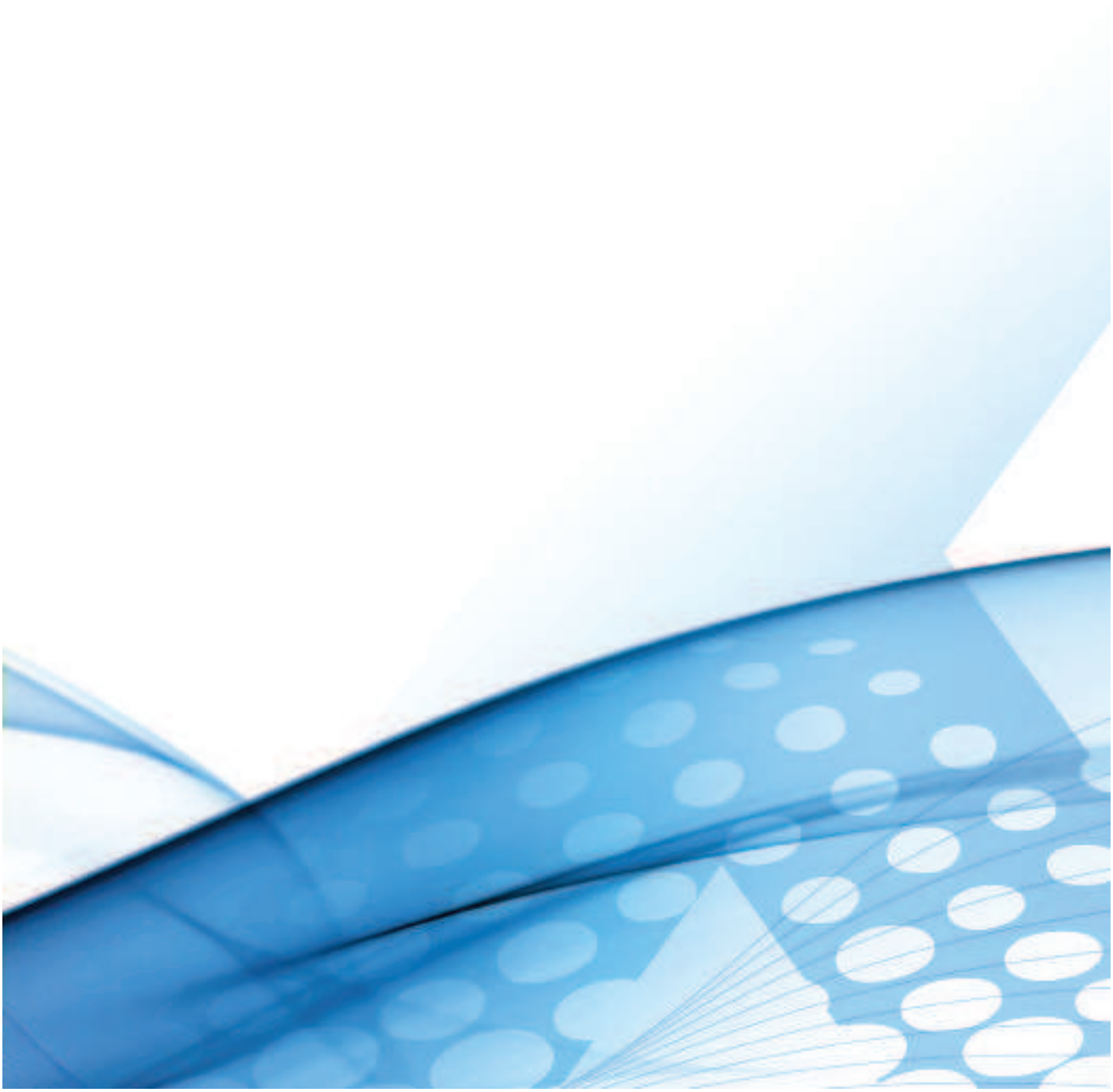
iQflex

DATA SHEET

LitePoint IQflex™



LITEPOINT

Introduction

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

Functionality

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

The IQflex 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 IQflex 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 resulting in reduced test times.

Similarly, the IQflex 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 IQflex test system is designed to output high-quality test signals over the full expected operating range of a WLAN receiver.

The IQflex test system supports testing in both the 2.4 GHz and 5 GHz frequency bands utilized worldwide for 802.11a/b/g/n and Bluetooth 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/n) WLAN and Bluetooth 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 analog I/O facilitates product debugging (IQview)
- High-performance VSA
  - Wide bandwidth (60 MHz)
  - Capture-Once Measure-All operation
- High-performance VSG
  - Pre-defined 802.11a/b/g/n and Bluetooth transmit test signals included
- Simple control interfaces
  - LitePoint API supports Visual C/C++ test scripts for use in manufacturing

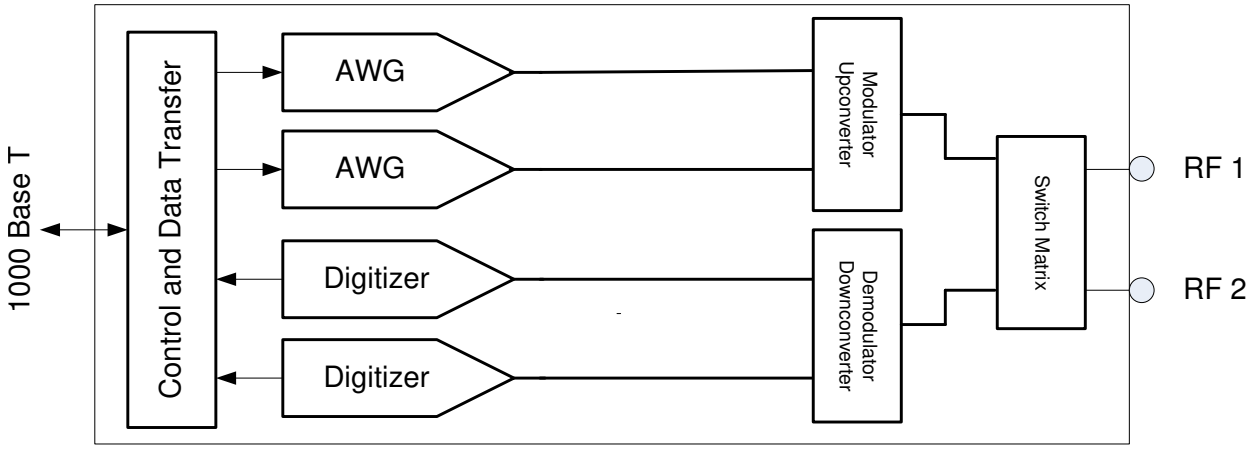


Figure 1: IQflex Test System—Hardware Block Diagram

A vector signal analyzer (VSA) provides matching capabilities covering identical frequency bands as the VSG. Each VSA consists of two digitizer (DIG) channels (I and Q) and associated quadrature downconverter. The VSG consists of two arbitrary waveform generator (AWG) sections and a quadrature upconverter.

Control Interfaces

To allow automated testing, the IQflex 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. Because the tester control connection is Ethernet, the user can connect to the instrument from anywhere on their network, allowing seamless remote operation.

To facilitate debugging, especially in the development of test scripts with the LitePoint API, the IQflex 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.

Supported WLAN Tests

The IQflex supports key WLAN tests 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)

Supported Bluetooth (1.0, 2.0, 2.1) Hardware Tests

Analyzer

- Input frequency range
- Input power range
- Measurement Bandwidth

- Quantization
- Input Return Loss
- Spurious
- Harmonics
- Integrated Phase Noise
- Signal to Noise Ratio
- Power Measurement Accuracy
- Waveform Capture Duration

Generator

- Output frequency range
- Output power range
- Signal Bandwidth
- Quantization
- Output Return Loss
- Spurious
- Harmonics
- Integrated Phase Noise
- Signal to Noise Ratio
- Carrier leakage
- Power Accuracy
- Waveform Duration

Supported Bluetooth (1.0, 2.0, 2.1) Measurement Tests

- Measurement
- TX output power
- TX output spectrum
- 20 dB bandwidth
- Frequency deviation
- Carrier frequency Tolerance
- Carrier frequency drift
- Relative transmit Power (EDR)
- Carrier frequency stability (EDR)
- Receive sensitivity
- Bit error rate (BER)
- RMS EVM (EDR)
- Peak EVM (EDR)

VSA Performance*

* All performance specified at 25°C

* All specifications apply to hardware version 1.5.7

Parameters	Specification
Frequency	• Baseband • 2400 - 2500 MHz • 4900 - 6000 MHz
Analog bandwidth	60 MHz

Parameters	Specification
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 (max)	• 2400 – 2500 MHz: +30 dBm • 4900 – 6000 MHz: +30 dBm
Power measurement accuracy	• Specification: ± 1.0 dB (for levels ≥ -50 dBm) • Typical: ± 0.5 dB
Residual EVM	VSA contribution to measurement of 802.11a/g/n 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) (2.4 GHz band)
Input return loss	≥10 dB

VSG Performance

Parameter	Specification
Frequency	• Baseband • 2400 - 2500 MHz • 4900 - 6000 MHz
Analog bandwidth	70 MHz
Quantization	14 bits
Sampling frequency	80 MHz
Sampling resolution	1 sample
Waveform Duration (max.)	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

Parameter	Specification
Output power accuracy	• Specification: ± 1.0 dB (0 to -95 dBm) • 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)
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

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

Component	Type	Description
		• Supports both 2.4-2.5GHz and 4.9-6.0GHz bands
Rear Panel 		
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)
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	FOR USE BY AUTHORIZED PERSONNEL ONLY

Component	Type	Description
	• TV output ports (2: S-video, RCA)	

General

Control interfaces	• 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

Bluetooth (1.0, 2.0, 2.1) Hardware Technical Specifications

Analyzer

Input frequency range	2400 - 2500 MHz
Input power range	+30 to -148 dBm (1 Hz BW)
Measurement Bandwidth	60 MHz (± 30 MHz quadrature)
Quantization	14 bits
Input Return Loss	> 10 dB
Spurious	< -55dBc (50 kHz RBW)
Harmonics	out-of-band: ≤ -45 dB in-band: ≤ -55 dB (100 kHz resolution BW)
Integrated Phase Noise	0.5 degrees (100 Hz – 1 MHz) (typical)
Signal to Noise Ratio	≥ 55 dB (measured in 100 kHz resolution bandwidth)
Power Measurement Accuracy	± 1.0 dB (specification) ± 0.5 dB (typical)
Waveform Capture Duration	400 ms

Generator

Output frequency range	2400 - 2500 MHz
Output power range	-95 to -10 dBm (modulated) -95 to +0 dBm (CW)
Signal Bandwidth	70 MHz (± 35 MHz quadrature)
Quantization	14 bits
Output Return Loss	> 10 dB
Spurious	specification: ≤ -50 dBc (in-band) typical ≤ -20 dBc out-of-band (harmonics, to 0 dBm output level) ≤ -35 dBc or ≤ -80 dBm (whichever is higher) out-of-band (non-harmonic)
Harmonics	out-of-band: ≤ -45 dB

	in-band: ≤ -55 dB (100 kHz resolution BW)
Integrated Phase Noise	< 0.5 degrees (f<2.5 GHz) < 0.8 degrees (f<6 GHz) 0.5 degrees (100 Hz – 1 MHz) (typical)
Signal to Noise Ratio	≥ 55 dB (measured in 100 kHz resolution bandwidth) (specification) ≥ 70 dB (measured in 100 kHz resolution bandwidth) (typical)
Carrier leakage	≤ -45 dBc (CW output) ≤ -90 dBm (between packets, when enhanced gap rejection condition enabled)
Power Accuracy	± 1.0 dB (specification) ± 0.6 dB (typical)
Waveform Duration	400 ms

Bluetooth (1.0, 2.0, 2.1) Measurement Specifications

Measurement	Description	Performance
TX output power	Transmit DUT output power (dBm)	VSA Measure Power Accuracy: ± 1.0 dB (specification) ± 0.5 dB (typical)
TX output spectrum	Transmit DUT power spectral density	
20 dB bandwidth	Bandwidth between the +/- 20 dB down points of the modulation waveform	
Frequency deviation	Average and Peak frequency deviation (Hz)	
Carrier frequency Tolerance	Carrier frequency error (Hz)	
Carrier frequency drift	Carrier frequency change over the Bluetooth burst (Hz)	
Relative transmit Power (EDR)	Average power of complete data capture (dBm)	VSA Measure Power Accuracy: ± 1.0 dB (specification) ± 0.5 dB (typical)
Carrier frequency stability (EDR)	Frequency drift over the Bluetooth EDR burst duration (Hz)	
Receive sensitivity	Receive sensitivity test using LitePoint or user generated waveforms	Source Power Accuracy: ± 1.0 dB (specification) ± 0.6 dB (typical)
Bit error rate (BER)	Bit error rate for 1 and 3 Mbps data rates	Source Power Accuracy: ± 1.0 dB (specification) ± 0.6 dB (typical)
RMS EVM (EDR)	RMS EVM for Bluetooth EDR	Residual VSA EVM: ≤ -30 dB (3.1%) (≥ -35 dBm power to + 10 dBm)
Peak EVM (EDR)	Peak EVM for Bluetooth EDR	Residual VSG EVM: ≤ -30 dB (3.1%) (≥ -35 dBm power to + 10 dBm)

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

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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