iQxel

TECHNICAL SPECIFICATIONS

IQxel™
Next Generation Connectivity Test System

LITEPOINT

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General Technical Specifications

RF Analyzer

Parameter	Ports	Value	
Input frequency range	RF1, RF2	860 to 960 MHz 1770 to 2100 MHz 2200 to 2600 MHz 4900 to 6000 MHz	
IF bandwidth	RF1, RF2	IQxel-80	120 MHz
		IQxel-160	(120 + 120) MHz
Max input power	RF1, RF2	+30 dBm peak +25 dBm average	
Input power accuracy	RF1, RF2	Specification:	± 0.75 dB (+20 to -75 dBm)
		Typical:	± 0.50 dB (+20 to -75 dBm)
Quantization		16 bits	
Input return loss	RF1, RF2	> 12 dB (> 1 GHz)	
Spurious	RF1, RF2	< -55 dBc (50 kHz RBW) (CW)	
Spectral flatness	RF1, RF2	Specification:	≤ ± 0.50 dB (+/- 40 MHz, > 1 GHz) ≤ ± 0.50 dB (+/- 8 MHz, < 1 GHz)
		Typical:	≤ ± 0.25 dB (+/- 40 MHz, > 1 GHz) ≤ ± 0.25 dB (+/- 8 MHz, < 1 GHz)
Inherent spurious floor	RF1, RF2	≤ -90 dBm	
Noise figure		≤ 30 dB at minimum input attenuation	
Integrated phase noise		< 0.5 degrees (100 Hz to 1 MHz) 0.3 degrees (100 Hz to 1 MHz) typical	
Signal to noise ratio		≥ 55 dB 100 kHz RBW	
Sampling data rate		10, 20, 40, 80, 160 MHz	
Waveform capture duration		at 10 MHz sampling data rate	3200 ms
		at 20 MHz sampling data rate	1600 ms
		at 40 MHz sampling data rate	800 ms
		at 80 MHz sampling data rate	400 ms
		at 160 MHz sampling data rate	200 ms

RF Analyzer — Signal Trigger

Parameter	Range	
Absolute minimum value	Wideband RF	-30 dBm
	Video	-40 dBm
Absolute maximum value	Limited by the maximum input power	
Trigger relative threshold	30 dB	
Level accuracy	< +/- 2 dB	

Baseband Analyzer

Parameter	Port Designations	Range
Input power range	BBA_I+, BBA_I- BBA_Q+, BBA_Q-	2 V peak-to-peak
Common mode voltage	BBA_I+, BBA_I- BBA_Q+, BBA_Q-	0 V (DC coupled)
Impedance	BBA_I+, BBA_I- BBA_Q+, BBA_Q-	50 Ω (100 Ω differential)

RF Generator

Parameter	Ports	Range	
Output frequency range	RF1, RF2	860 to 960 MHz 1770 to 2100 MHz 2200 to 2600 MHz 4900 to 6000 MHz	
IF bandwidth	RF1, RF2	IQxel-80	120 MHz
		IQxel-160	(120 + 120) MHz
		CW:	+9 to -95 dBm (1700 to 2100 MHz), P1dB +9 to -95 dBm (2200 to 2600 MHz), P1dB +7 to -95 dBm (4900 to 6000 MHz), P1dB
Output power accuracy		Specification:	± 0.75 dB (0 to -95 dBm, with ALC*)
		Typical:	± 0.50 dB (0 to -95 dBm)
Quantization		16 bits	
Output return loss	RF1, RF2	> 12 dB (> 1 GHz)	
Spurious (in channel)	RF1, RF2	Specification:	≤ -50 dBc or ≤ -95 dBm (80 MHz)
Spurious (out of channel)	RF1, RF2	Out-of-band (>± 40 MHz from carrier):	≤ -45 dBc

*Automatic Level Control (ALC) enables the internal power detector to be used for power level feedback.

Spectral flatness	RF1, RF2	Specification:	≤ ± 0.50 dB (+/- 40 MHz, > 1 GHz) ≤ ± 0.50 dB (+/- 8 MHz, < 1 GHz)
		Typical:	≤ ± 0.25 dB (+/- 40 MHz, > 1 GHz) ≤ ± 0.25 dB (+/- 8 MHz, < 1 GHz)
Integrated phase noise		< 0.5 degrees (100 Hz – 1 MHz) 0.3 degrees (100 Hz – 1 MHz) typical	
Signal to noise ratio		Specification:	≥ 60 dB 100 kHz RBW, minimum attenuation, power level = -45 dBm
		Typical:	≥ 70 dB (100 kHz RBW), power level = -45 dBm
Carrier leakage		≤ -45 dBc (CW output) ≤ -90 dBm (between packets, when enhanced gap rejection enabled)	
Gap power		≤ -90 dBm/100kHz	
Sampling data rate		10, 20, 40, 80, 160 MHz	
Waveform playback duration (non-repeat)		at 10 MHz sampling data rate	3200 ms
		at 20 MHz sampling data rate	1600 ms
		at 40 MHz sampling data rate	800 ms
		at 80 MHz sampling data rate	400 ms
		at 160 MHz sampling data rate	200 ms

Baseband Generator

Parameter	Port Designations	Range
Output power range	BBG_I+, BBG_I- BBG_Q+, BBG_Q-	2 V peak-to-peak
Common mode voltage	BBG_I+, BBG_I- BBG_Q+, BBG_Q-	0 V (DC coupled)
Impedance	BBG_I+, BBG_I- BBG_Q+, BBG_Q-	50 Ω (100 Ω differential)

Port Isolation

VSA to VSG isolation	> 80 dB typical

Timebase

Oscillator type	OCXO
Frequency	10 MHz
Initial accuracy (25°C, after 60 minute warm-up)	< +/- 0.05 ppm
Maximum aging	< +/- 0.1 ppm per year
Temperature stability	< +/-0.05 ppm over 0°C to 50°C range, referenced to 25°C
Warm-up time (to within +/-0.1 ppm at 25°C)	< 30 minutes

Wireless LAN (802.11a/b/g/n/p/ac) Measurement Specifications

Measurement	Description	Performance
EVM	EVM averaged over payload based on standard requirements	(Averaged over 20 packets, 16 data OFDM symbols long) Full packet channel estimation Residual VSA EVM: ≤ -45 dB (+20 to -20 dBm) ≤ -43 dB (-20 to -25 dBm) ≤ -38 dB (-25 to -30 dBm) Residual VSG EVM: ≤ -45 dB (-5 to -45 dBm) Preamble only channel estimation Residual VSA EVM: ≤ -42 dB (+20 to -20 dBm) ≤ -40 dB (-20 to -25 dBm) ≤ -35 dB (-25 to -30 dBm) Residual VSG EVM: ≤ -42 dB (-5 to -45 dBm) Note: 80 MHz 802.11ac waveform, measured system loopback
Peak power	Peak power over all symbols (dBm)	VSA power accuracy: ± 0.75 dB (+20 to -35 dBm)
RMS power	All: average power of complete data capture (dBm)	
	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)	
I/Q amplitude error	I/Q amplitude imbalance (%) and approximate contribution to EVM (dB)	Residual VSA I/Q imbalance: ≤ 1% (+20 to -35 dBm) Residual VSG I/Q imbalance: ≤ 1% (-5 to -70 dBm)

Measurement	Description	Performance	
I/Q phase error	I/Q phase imbalance (degrees) and approximate contribution to EVM (dB)	Residual VSA I/Q imbalance: ≤ 0.5 degree (+20 to -35 dBm) Residual VSG I/Q imbalance: ≤ 0.5 degree (-5 to -70 dBm)	
Frequency error	Carrier frequency error (kHz)	(For 802.11n packet at 16 symbols, EVM better than -25 dB) VSA measurement error: ≤ ± 0.2 ppm calibrated	
RMS phase noise	Integrated phase noise (degrees)	VSA integrated phase noise: < 0.5 degrees (100 Hz to 1 MHz) (2200 to 2600 MHz) < 0.5 degrees (100 Hz to 1 MHz) (4900 – 6000 MHz)	
PSD	Power spectral density (dBm/Hz) versus frequency offset center frequency ± 40 MHz		
Spectral mask	Transmit spectrum mask	IQxel-80	± 120 MHz
		IQxel-160	± 240 MHz
Spectral flatness	Reflects variation of signal energy as a function of OFDM subcarrier number 802.11a/g OFDM signals only	VSA flatness over ≤ 80 MHz Ch BW: ± 0.5 dB	
Sidelobe analysis (spectral mask, LO leakage)	Center peak and peaks of 1st and 2nd upper/lower sidelobes (dB) 802.11b/g DSSS signals only		
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 / power down ramp	On: relative power level (% of average) versus time (802.11b/g CCK signals only) Power-on time from 10% to 90% Power-on time from 90% power level to start of packet (Not provided for 802.11a/g OFDM signals) Off: relative power level (% of average) versus time (802.11b/g CCK signals only) Power-on time from 10% to 90% Power-on time from 90% power level to start of packet (Not provided for 802.11a/g OFDM signals)		
Eye diagram	I and Q channels versus time (802.11b/g DSSS signals only)		
PSDU data	Recovered binary data sequence, including the MAC header and Frame Check Sequence, if present		
Raw capture data	I and Q signals versus time		

Measurement	Description	Performance
General waveform analysis	DC offset, RMS level, minimum/maximum amplitude, peak-to-peak amplitude, RMS I- and Q-channel levels	
CW frequency analysis	Frequency of CW tone	

Bluetooth® (1.0, 2.0, 2.1, 3.0) Measurement Specifications

Measurement	Description	Performance
TX output power	Transmit DUT output power (dBm)	VSA power accuracy: ± 0.75 dB (+20 to -35 dBm) ± 0.50 dB (+20 to -35 dBm) typical
TX output spectrum	Transmit DUT power spectral density	
20 dB bandwidth	Bandwidth between the +/- 20 dB down points of the modulation waveform	VSA frequency accuracy: ≤ ± 0.2 ppm calibrated
In-band emissions (Adjacent channel)	Spurious emission measured at +/- 5 MHz of DUT TX frequency only	VSA spurious: < -50 dBc (50 kHz RBW) (CW)
Modulation characteristics	Average and peak frequency deviation (Hz)	(For EVM better than -25 dB) VSA measurement error: ≤ ± 0.2 ppm calibrated
Carrier frequency tolerance	Carrier frequency offset (Hz)	
Carrier frequency drift	Carrier frequency change over the Bluetooth burst (Hz)	
Relative transmit power (EDR)	Average power of complete data capture (dBm)	VSA power accuracy: ± 0.75 dB (+20 to -35 dBm)
Carrier frequency stability (EDR)	Frequency drift over the Bluetooth EDR burst duration (Hz)	
Receive sensitivity[1]	Receive sensitivity test using LitePoint or user-generated waveforms. Includes Dirty Packets.	VSG power accuracy: ± 0.75 dB (+ 5 to -95 dBm)
Maximum input signal level	Assuming single-ended BER measurement	
RMS EVM (EDR)	RMS EVM for Bluetooth EDR	Residual VSA EVM: ≤ -35 dB (+20 to -25 dBm) Residual VSG EVM: ≤ -35 dB (-5 to -70 dBm)
Peak EVM (EDR)	Peak EVM for Bluetooth EDR	

Note 1: IQxel supports testing sensitivity with Dirty Packets

Bluetooth (4.0, 4.1, 4.2) Measurement Specifications

Measurement	Description	Performance
Output power at NOC[1]		VSA power accuracy: ± 0.75 dB (+20 to -35 dBm)
Output power at EOC[1]		
In-band emissions at NOC[1]	Spurious emission measured at +/- 5 MHz of DUT TX frequency only	VSA spurious: < -50 dBc (50 kHz RBW) (CW)
In-band emissions at EOC[1]		
Modulation characteristics	Average and peak frequency deviation (Hz)	VSA frequency accuracy: ≤ ± 0.2 ppm calibrated
Carrier frequency offset and drift at NOC[1]	Carrier frequency offset (Hz) and change over the Bluetooth burst (Hz)	
Carrier frequency offset and drift at EOC[1]		
Receiver sensitivity at NOC[1,2]	Receive sensitivity test using LitePoint or user-generated waveforms	VSA power accuracy: ± 0.75 dB (+20 to -35 dBm)
Receiver sensitivity at EOC[1,2]		
C/I and receiver selectivity performance[3]		VSA spurious: < -50 dBc (50 kHz RBW) (CW)
Blocking performance[3]		
Intermodulation performance		
Maximum input signal level	Assuming single-ended BER measurement	VSG maximum output power: +9 to -95 dBm CW 0 to -95 dBm modulated
PER report integrity	Verifies the DUT PER report mechanism	

Note 1: NOC and EOC tests are the same except for the operating conditions which do not impact the test equipment requirements
Note 2: External signal source required for these measurements (not LitePoint supplied)
Note 3: IQxel provides the wanted signal only. No interfering signal is available

ZigBee (802.15.4)

Measurement	Description	Performance
Output power	Transmit DUT output power (dBm)	VSA power accuracy: ± 0.75 dB (+20 to -35 dBm) ± 0.50 dB (+20 to -35 dBm) typical
Power spectral density	Transmit DUT power spectral density	
Center Frequency Tolerance	Tx center frequency tolerance	VSA frequency accuracy: ≤ ± 0.2 ppm calibrated
EVM	Offset: compensate the I and Q offset in OQPSK Normal: no compensation applied	
Other modulation quality measurements	LO leakage, clock error, phase error, symbol clock error	
CCDF (complementary cumulative distribution function)	Probability of peak signal power being greater than a given power level versus peak-to-average power ratio (dB)	

Z-Wave (ITU-T G.9959)

Measurement	Description	Performance
Output Power	TX output power (dBm)	VSA power accuracy: +/- 0.75 dB (+20 to -35 dBm) +/- 0.50 dB (+20 to -35 dBm) typical
Power Spectral Density	TX power spectral density	
Carrier Frequency Offset	TX center frequency error	VSA frequency accuracy: <= +/- 0.2 ppm calibrated
Frequency Deviation	RMS, Min, Max Frequency Deviation	
Symbol Clock Error	Symbol Clock Error and Jitter	
RX Power Level	RF Generator Output Level Range	VSG output power: +9 to -95 dBm CW 0 to -95 dBM modulated

WiSUN MR-FSK (802.15.4g)

Measurement	Description	Performance
Output Power	TX output power (dBm)	VSA power accuracy: +/- 0.75 dB (+20 to -35 dBm) +/- 0.50 dB (+20 to -35 dBm) typical
Power Spectral Density	TX power spectral density	
Carrier Frequency Offset	TX center frequency error	VSA frequency accuracy: <= +/- 0.2 ppm calibrated
Frequency Deviation	RMS, Min, Max Frequency Deviation	
Symbol Clock Error	Symbol Clock Error and Jitter	
RX Power Level	RF Generator Output Level Range	VSG output power: +9 to -95 dBm CW 0 to -95 dBM modulated

DECT (ETSI EN 300 176-1)

Measurement	Description	Performance
Power	Normal Transmit Power	VSA power accuracy: ± 0.75 dB (+20 to -35 dBm) ± 0.50 dB (+20 to -35 dBm) typical
Power vs. time	Power time template	
Frequency offset	Frequency offset	VSA frequency accuracy: ≤ ± 0.2 ppm calibrated
Frequency drift	Frequency drift during packet transmission	
Frequency deviation	S field, B field, whole packet	

MIMO System Performance

The additional specifications in the table below apply to the complete IQxel MIMO system

Parameter	Port Designations	Range
VSA capture trigger accuracy		≤ ± 3.5 ns
VSA start trigger accuracy		≤ ± 3.5 ns

Port Descriptions

Front Panel

I/O	Function	Type
Power switch	Power on/off	Pushbutton switch
RF port 1	WiFi, Bluetooth input/output	N female
RF port 2	WiFi, Bluetooth input/output	N female
RF port 3 (IQxel-280 only)	WiFi, Bluetooth input/output	N female
RF port 4 (IQxel-280 only)	WiFi, Bluetooth input/output	N female
Power indicator	LED off - AC switch on the back panel is turned off or the AC power cable is not connected LED solid red - test system is in standby mode LED blinking red - test system is powering off LED blinking green - test system is booting up LED solid green - test system is powered on	LED indicator
Session active indicator	LED green - remote session active LED red - remote session lock	LED indicator
Status indicator	LED green - no faults/errors detected LED orange - Software error detected LED red - Hardware fault detected	LED indicator
RF port 1 indicator	LED green - port is a VSA input LED red - port is a VSG output	LED indicator
RF port 2 indicator	LED green - port is a VSA input LED red - port is a VSG output	LED indicator
USB (2 ports)	USB 2.0 compatible connection to external controller	USB Type A
IQ baseband port	Baseband port for IQ Baseband analog signals analysis	SCSI

Rear Panel

General I/O

I/O	Function	Type
10 MHz ref input	10 MHz reference input the 10 MHz reference input has a 200 ohm impedance and accepts a sine wave ranging in amplitude from 0.3 Vpp to 4 Vpp.	BNC female
10 MHz ref output	10 MHz reference output	BNC female
Marker out / trigger in 1	TTL compatible	BNC female
Marker out / trigger in 2	TTL compatible	BNC female
Marker out / trigger in 3	TTL compatible	BNC female
Marker out / trigger In 4	TTL compatible	BNC female
USB (2 ports)	USB 2.0 compatible connection to external controller	USB Type A
AC in	AC power input	100 to 240VAC (automatically switched) 50 to 60 Hz Includes hard power switch
DVI port	Display LitePoint monitor	DVI-D
VGA port	Display LitePoint monitor	VGA-15 pin

Communication I/O

LAN	1000 Base-T LAN	RJ-45

General and Environmental

Dimensions	Unit with handle: 15.5" W x 3.2" H x 20" D (370 mm W x 82 mm H x 508 mm D) Unit without handle: 14.7" W x 3.2" H x 17.1" D (373 mm W x 82 mm H x 434 mm D)
Weight	IQxel-80: 8.25 kg (18.2 pounds); IQxel-160: 9.78 kg (21.6 pounds)
Power requirements	100 to 240 VAC, < 300 W, 50 to 60 Hz
Power consumption	<235 W (maximum), <10 W (standby)
Recommended PC	Intel Core i5 2.5 GHz with 1 GB of RAM or better
Recommended browser for optimal performance	Google Chrome R10 Release
Operating temperature	+10°C to +55°C (IEC EN60068-2-1, 2, 14)
Storage temperature	-20°C to +70°C (IEC EN60068-2-1, 2, 14)
Specification validity temperature	+20°C to +30°C
Operating humidity	15% to 95% relative humidity, non-condensing (IEC EN60068-2-30)
EMC	EN 61326 Immunity for industrial environment, Class A emissions
Safety	IEC 61010-1, EN61010-1, UL3111-1, CAN/CSA-C22.2 No. 61010-1-12
Mechanical vibration	IEC 60068, IEC 61010 and MIL-T-28800D, class 5
Mechanical shock	ASTM D3332-99, Method B
Recommended calibration cycle	12 months
Warranty	12 months hardware 12 months software updates

Programming Interface and Graphical User Interface (GUI)

Programmatic interface	C++ API (LitePoint IQapi) SCPI	
Driver compatibility	C++ LabVIEW 8.5 (using LitePoint supplied driver)	
General Purpose RF (GPRF)	WiFi (IEEE 802.11) Bluetooth (1.x, 2.x, 3.0, 4.0) ZigBee (IEEE 802.15.4) Z-Wave (ITU-T G.9599) WiSUN MR-FSK (IEEE 802.15.4g) DECT (ETSI EN 300 176-1)	GUI supports built-in measurement and signal generation functions per standard as appropriate

Order Codes

Code	Product
0100-IXEL-001	IQxel Test System includes: • WLAN Measurement Suite Software for SISO 802.11a/b/g/n/p up to 40 MHz channel bandwidth • Graphical User Interface (GUI) with WLAN waveform generation capability • Programming Interface • 1 year hardware warranty
0100-IXEL-002	IQxel-80 Test System includes: • WLAN Measurement Suite Software for SISO 802.11a/b/g/n/p/ac up to 80 MHz channel bandwidth • Graphical User Interface (GUI) with WLAN waveform generation capability • Programming interface • 1 year hardware warranty
0100-IXEL-003	IQxel-160 Test System includes: • WLAN Measurement Suite Software for SISO 802.11a/b/g/n/p/ac up to 160 MHz and 80+80 MHz channel bandwidth • Graphical User Interface (GUI) with WLAN waveform generation capability • Programming interface • 1 year hardware warranty
0100-IXEL-004	IQxel and IQxel-80 baseband kit, include breakout board, software license and 8x SMB/SMA cables.
0100-IXEL-005	WLAN MIMO software license for 802.11n and 802.11ac. It also includes 9 BNC connectors and 6 T-connectors.
0100-IXEL-009	IQxel-160 baseband kit, include breakout board, software license and 16x SMB/SMA cables
0300-IXEL-001	Bluetooth software license for Bluetooth classic and LE.
0300-IXEL-004	WLAN 802.11ac software license.
0300-IXEL-009	ZigBee software license. Includes Zigbee, Z-Wave, and WiSUN.
0300-IXEL-012	DECT software license.

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