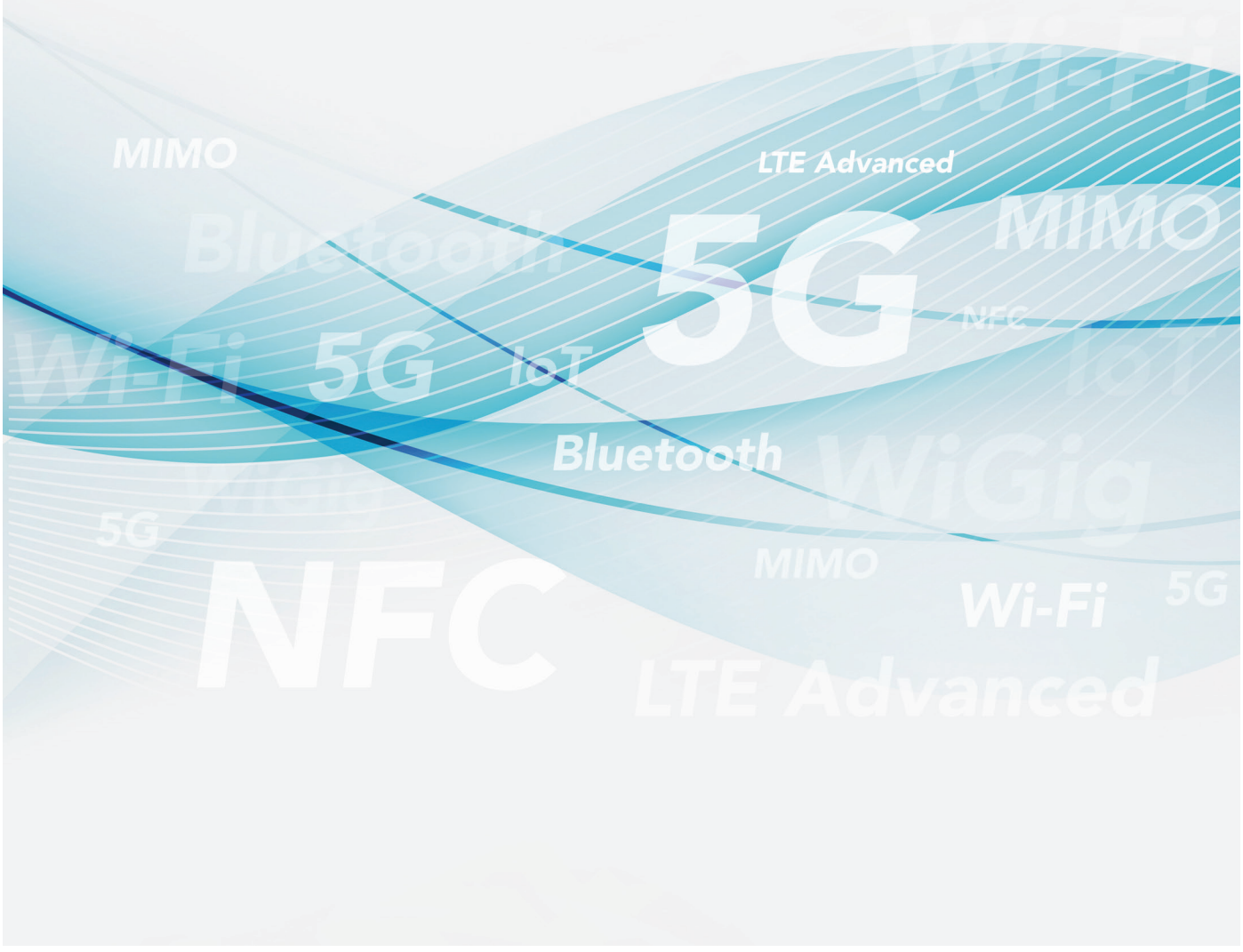
iQxel-M2W

TECHNICAL SPECIFICATIONS

IQxel-M2W™

R&D Connectivity Test System for Next Generation of Wi-Fi



LITEPOINT

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General Technical Specifications

Analyzer

Parameter	Ports (A/B)	Value	
Input frequency range	RF1	400 to 6000 MHz	
IF bandwidth	RF1	160 MHz	
Input power range	RF1	+30 dBm peak (+25 dBm average).	
Input power accuracy	RF1	Specification:	± 0.75 dB (+25 to -75 dBm)
		Typical:	± 0.50 dB (+25 to -75 dBm)
Input return loss	RF1	>12 dB (400 to 6000 MHz)	
Spurious (signal applied)	RF1	< -60 dBc (CW, for signal levels greater than -20 dBm)	
Spectral flatness	RF1	Specification:	≤ ± 1 dB (± 80 MHz)
		Typical:	± 0.50 dB (± 80 MHz)
Inherent spurious floor (no signal)	RF1	≤ -80 dBm	
Noise figure		≤ 30 dB at minimum input attenuation	
Integrated phase noise		≤ 0.3 degrees (100 Hz to 1 MHz) (400 to 6000 MHz) 0.2 degrees (100 Hz to 1 MHz) typical	
Signal to noise ratio		≥ 55 dB 100 kHz RBW	
Sampling data rate		10, 20, 40, 80, 160, 240 MHz	
Waveform capture duration		at 10 MHz sampling data rate	9600 ms
		at 20 MHz sampling data rate	4800 ms
		at 40 MHz sampling data rate	2400 ms
		at 80 MHz sampling data rate	1200 ms
		at 160 MHz sampling data rate	600 ms
		at 240 MHz sampling data rate	400 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	< ± 1 dB	

RF Generator

Parameter	Ports (A/B)	Value	
Output frequency range	RF1	400 to 6000 MHz	
IF bandwidth	RF1	160 MHz	
Output power range (CW)	RF1 (through path)	0 to -95 dBm (400 to 6000 MHz)	
Output power range (CW)	RF1 (combined path for Beamforming calibration)	-10 to -95 dBm (≤ 4900 MHz) -20 to -95 dBm (>4900 MHz)	
Output power accuracy	RF1 (1 port active)	Specification:	± 0.75 dB (0 to -95 dBm)
		Typical:	± 0.50 dB (0 to -95 dBm)
Output return loss	RF1	>12 dB (400 to 6000 MHz)	
Spurious (in channel)	RF1	Specification:	≤ -40 dBc (160 MHz, >-55 dBm) (CW)
		Typical:	≤ -50 dBc (160 MHz, >-55 dBm) (CW)
Spurious (out of channel)	RF1	Out-of-band (>± 80 MHz from carrier):	≤ -40 dBc (CW, excluding harmonics distortions)
Spectral flatness	RF1	Specification:	≤ ± 1 dB (± 80 MHz)
		Typical:	± 0.5 dB (± 80 MHz)
Integrated phase noise		≤ 0.3 degrees (100 Hz to 1 MHz) (400 to 6000 MHz) 0.2 degrees (100 Hz to 1 MHz) typical	
Signal to noise ratio		Specification:	≥ 60 dB (100 KHz signal BW), power level -40 dBm
		Typical:	≥70 dB (100 KHz signal BW), power level -40 dBm
Carrier leakage		≤ -40 dBc (CW output) for P0 > -50 dBm	
Gap power		≤ -90 dBm/100 kHz	
Sampling data rate		10, 20, 40, 80, 160, 240 MHz	
Waveform playback duration		At 10 MHz sampling data rate	9600 ms
		At 20 MHz sampling data rate	4800 ms
		At 40 MHz sampling data rate	2400 ms
		At 80 MHz sampling data rate	1200 ms
		At 160 MHz sampling data rate	600 ms
		At 240 MHz sampling data rate	400 ms

Port Isolation

Measurement	Description
Port to Port Isolation	VSA-to-VSA (through path): 100 dB, <2500 MHz, typical 90 dB, >2500 MHz, typical VSG-to-VSG (through path): 90 dB, <2500 MHz, typical 80 dB, >2500 MHz, typical VSG-to-VSA (through and combined path): 100 dB, <2500 MHz, typical 80 dB, >2500 MHz, typical

Timebase

Measurement	Description
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 0oC to 55°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/ah/ax) Measurement Specifications

Measurement	Description	Performance
EVM[1]	EVM averaged over payload based on standard requirements (Typical)	Residual VSA EVM (full packet channel estimation): ≤ -50 dB (+20 to -10 dBm) ≤ -48 dB (-10 to -20 dBm) Residual VSG EVM: (full packet channel estimation): ≤ -48 dB (-2 to -35 dBm) Residual VSA EVM (preamble only channel estimation): ≤ -47 dB (+20 to -10 dBm) ≤ -45 dB (-10 to -20 dBm) Residual VSG EVM: (preamble only channel estimation): ≤ -45 dB (-2 to -35 dBm) Note: - Measured at 5755 MHz - Averaged over 20 packets - 802.11ax waveform, 80 MHz
Peak power	Peak power over all symbols (dBm)	VSA power accuracy: ± 0.75 dB (+20 to -75 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)	
I/Q phase error	I/Q phase imbalance (degrees) and approximate contribution to EVM (dB)	
Frequency error	Carrier frequency error (kHz)	VSA measurement error: ≤ ± 0.2 ppm calibrated
RMS phase noise	Integrated phase noise (degrees)	VSA integrated phase noise: < 0.3 degrees (100 Hz to 1 MHz)
PSD	Power spectral density (dBm/Hz) versus frequency offset center frequency ± 80 MHz	
Spectral mask	Transmit spectrum mask	Spectral mask view: ± 80 MHz

1 Based on calibration ver 1.2.0, FW ver 1.6.0

Spectral flatness	Reflects variation of signal energy as a function of OFDM subcarrier number 802.11a/g OFDM signals only	VSA flatness over 160 MHz BW: ± 1 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-off time from 90% to 10% Power-off time from 90% power level to end 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	
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	
Per User (RU) TX Quality Results	Per-user EVM and Power results (802.11ax only)	See EVM specifications
Trigger Frame analysis	Decoding of AP HE Trigger frame (PSDU) with EVM and Power results (802.11ax only)	See EVM specifications and VSA power accuracy
STA Carrier Frequency Offset	(CFO) Frequency offset in Hz of the STA based on the HE trigger frame from the STA device (802.11ax only)	
STA System Timing Offset	Time offset between the HE trigger frame and the STA response (802.11ax only)	

802.11ax Waveform Generation

Feature	Specification
Uplink Single User OFMDA (SU-OFDMA) Downlink Single User OFMDA (SU-OFDMA) Uplink Multi User OFMDA (MU-OFDMA) Downlink Multi User OFMDA (MU-OFDMA)	Up to 160 MHz
Trigger Frame Waveform Generation with configurable power levels per RU	Up to 12 dB between users
Waveform Generation with DCM (Dual Carrier Modulation) and LDPC support	

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 -75 dBm) ± 0.50 dB (+20 to -75 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 -75 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 (0 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 -30 dBm) Residual VSG EVM: ≤ -35 dB (-10 to -70 dBm)
Peak EVM (EDR)	Peak EVM for Bluetooth EDR	

Note 1: IQxel-M2W 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 -75 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 -95 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: 0 to -95 dBm CW
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-M2W provides the wanted signal only. No interfering signal is available

Bluetooth 5 Measurement Specifications

Bluetooth 5 introduced a couple of new test requirements:

Data Rate: New requirements for testing with 2 Mbps, 1 Mbps, 500 kbps, 125 kbps signal

Stable Modulation: Optional requirement for device to support smaller variation in the frequency deviation during modulation (modulation index between 0.495-0.505). This enhancement gives device stable and better range coverage and thus competitive advantage

IQxel-MW is capable of testing for these new requirements

Measurement	Description	Performance
In-band emissions	Spurious emission measured at ± 5 MHz of DUT TX frequency only. Tested at 1 Mbps, 2 Mbps	VSA spurious: < -50 dBc (50 kHz RBW) (CW)
Modulation Characteristics	Average and peak frequency deviation (Hz). Tested at 1 Mbps, 2 Mbps, 125 kbps	VSA frequency accuracy: ≤ ± 0.2 ppm calibrated
Carrier Frequency offset and drift	Carrier frequency offset (Hz) and change over the Bluetooth burst (Hz). Tested at 1 Mbps, 2 Mbps, 125 kbps	
Stable Modulation Characteristics	Tested at 1 Mbps, 2 Mbps	VSA frequency accuracy: ≤ ± 0.2 ppm calibrated
Receiver Sensitivity	Receive sensitivity test using LitePoint or user-generated waveforms. Tested at 1 Mbps, 2 Mbps, 125 kbps	VSG power accuracy: ± 0.75 dB (0 to -95 dBm)
Receiver Sensitivity – Stable Modulation Index	Tested at 1 Mbps, 2 Mbps, 500 kbps, 125 kbps	
Maximum Input signal level	Assuming single-ended BER measurement. Tested at 1 Mbps, 2 Mbps	VSG maximum output power: 0 to -95 dBm
Maximum Input signal level – Stable Modulation Index	Tested at 1 Mbps, 2 Mbps	
C/I and Receiver Selectivity Performance	Tested at 1 Mbps, 2 Mbps, 500 kbps, 125 kbps	VSA spurious: < -50 dBc (50 kHz RBW) (CW)
Blocking Performance	Tested at 1 Mbps, 2 Mbps	
Intermodulation Performance	Tested at 1 Mbps, 2 Mbps	
PER Report Integrity	Verifies the DUT PER report mechanism. Tested at 1 Mbps, 2 Mbps,500 kbps, 125 kbps	

ZigBee (802.15.4)

Measurement	Description	Performance
Output power	Transmit DUT output power (dBm)	VSA power accuracy: ± 0.75 dB (+20 to -75 dBm)
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)	

DECT (ETSI EN 300 176-1)

Measurement	Description	Performance
Power	Normal Transmit Power	VSA power accuracy: ± 0.75 dB (+20 to -75 dBm)
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	

Navigation

Measurement	Range
Test Capability	Carrier-to-noise ratio
Output frequency range	GPS: 1575.42 MHz (fixed)
	GLONASS: 1598 to 1606 MHz
Number of simultaneous channels	1
Output power range[1]	-60 to -95 dBm
Level accuracy	± 0.75 dB (-60 to -95 dBm)

Note 1: Require external attenuation for the power levels below -95 dBm

MIMO System Performance

The additional specifications in the table below apply to the complete IQxel-M2W MIMO system.

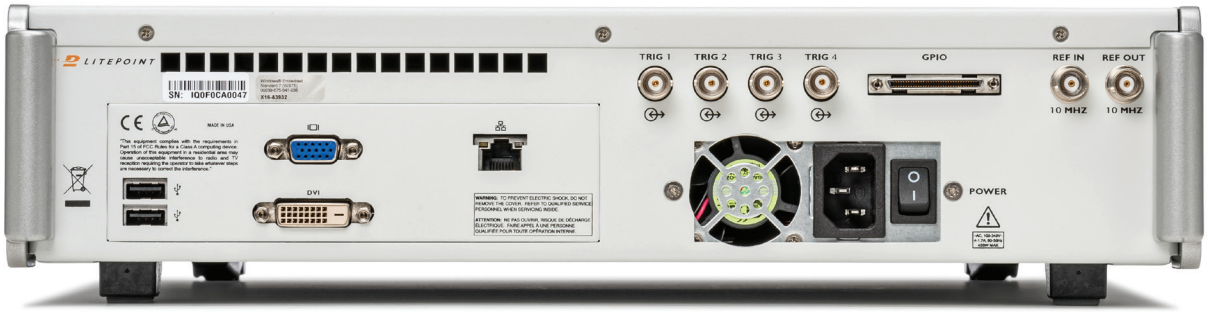
Measurement	Range
VSA capture trigger accuracy	≤ ± 3.5 ns
VSA start trigger accuracy	≤ ± 3.5 ns

Port Descriptions

Front Panel

I/O	Function	Type
Power switch	Power on/off	Pushbutton switch
RF1A/RF1B	WiFi, Bluetooth input/output	N female
Power indicator	LED green – powered up, running LED orange – powered up, standby	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 (for both A and B port)	LED green – ports RF1 A/B are in one of the following status: • OFF/IN • IN/OFF • IN/IN LED orange – ports RF1 A/B are in one of the following status: • OUT/IN • IN/OUT LED red – ports RF1 A/B are in one of the following status: • OFF/OUT • OUT/OFF • OUT/OUT	LED indicator
USB (2 ports)	USB 2.0 compatible connection to external controller	USB Type A

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	14.5" W x 3.2" H x 20.5" D (368 mm x 82 mm x 521 mm)
Weight	11.4 kg (25.2 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 4 GB of RAM or better
Recommended browser for optimal performance	Google Chrome R10 Release
Operating temperature	+10°C to +50°C (IEC EN60068-2-1, 2, 14)
Storage temperature	-20°C to +70°C (IEC EN60068-2-1, 2, 14)
Specification validity temperature[1]	+20°C to +35°C
Operating humidity	15% to 95% relative humidity, non-condensing (IEC EN60068-2-30)
EMC	EN 61326 Immunity for industrial environment, Class B emissions
Safety	IEC 61010-1, EN61010-1, UL3111-1, CAN/CSA-C22.2 No. 1010.1
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)	
Applications Graphical User Interface	WiFi SISO WiFi MIMO Bluetooth ZigBee DECT 802.11ah 802.11af 802.11ac	GUI supports built-in measurement and signal generation functions per standard as appropriate

1 Specifications valid over temperature range after invoking temperature compensation function.
For highest accuracy, recommend to enable temperature compensation if ambient temperature changes by more than 2°C.

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