

TECHNICAL SPECIFICATIONS

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# IQgig-5G™ Model B

## 5G mmWave Test System

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## Overview

The IQgig-5G is a fully-integrated, non-signaling solution for testing 5G mmWave products. All signal generation, analysis, and RF front-end routing hardware are self-contained inside a single chassis. The IQgig-5G has over 1.7 GHz of instantaneous bandwidth, supporting all 3GPP carrier aggregation test cases. The IQgig-5G solution contains a Vector Signal Generator (VSG) and Vector Signal Analyzer (VSA) and can be configured with either two or four bi-directional source and measurement ports, each with 2.4 mm connector coaxial interface. The VSG and VSA can be tuned independently to different frequencies over the entire specified frequency range. Each RF port can be switched on-the-fly to the internal VSG or VSA.

The IQgig-5G is the simplest solution for testing 5G mmWave products as all the required hardware is self-contained inside a single chassis, enabling the source and measure capabilities to be calibrated at the instrument front panel. This full hardware integration significantly reduces the test set up complexity and improves efficiency yielding the following benefits:

- Simplest test fixture set up with direct connection to the calibrated front panel interface
- Fully-integrated and calibrated – make high performance mmWave measurements in minutes instead of hours
- Seamless transition from the lab to the manufacturing floor

## Port Descriptions

### Front Panel

4-port



2-port



I/O	Function	Type
Power Button	Power On/Off	Pushbutton Switch
Power Indicator	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
RF1 Indicator	LED green – port is a VSA input LED red – port is a VSG output	LED indicator
RF2 Indicator	LED green – port is a VSA input LED red – port is a VSG output	LED indicator

I/O	Function	Type
RF3 Indicator	LED green – port is a VSA input LED red – port is a VSG output	LED indicator
RF4 Indicator	LED green – port is a VSA input LED red – port is a VSG output	LED indicator
LINK1 Indicator	LED green – LINK1 connected	LED indicator
LINK2 Indicator	LED green – LINK2 connected	LED indicator
RF1	VSA input or VSG output	2.4mm female
RF2	VSA input or VSG output	2.4mm female
RF3	VSA input or VSG output	2.4mm female
RF4	VSA input or VSG output	2.4mm female

## Rear Panel



I/O	Function	Type
10 MHz REF IN	10 MHz reference input	BNC female
10 MHz REF OUT	10 MHz reference output	BNC female
TRIG/MKR 1	TTL Trigger Input / Output	BNC female
TRIG/MKR 2	TTL Trigger Input / Output	BNC female
LO1 IN	LO1 Input	SMA female
LO1 OUT	LO1 Output	SMA female
LO2 IN	LO2 Input	SMA female
LO2 OUT	LO2 Output	SMA female
USB (4 ports)	USB 3.0 compatible connection to external controller	USB Type A
HDMI	Video Output	HDMI
LAN	1000 Base-T LAN	RJ-45
DATA 1	DATA 1 Connection	iPass PCIe x4
DATA 2	DATA 2 Connection	iPass PCIe x4
AUX 1	General Purpose I/O	iPass
AUX 2	General Purpose I/O	iPass
AUX 3	General Purpose I/O	iPass
TRIG I/O	Not Used	

## General Hardware Specifications

### Vector Signal Analyzer (VSA)

Parameters	Value	
Frequency Range	23 GHz – 45 GHz	
Center Frequency Resolution	0.01 Hz	
Frequency Settling Time (to 0.1 ppm)	<10ms	
Maximum Capture Bandwidth	1.7 GHz	
Maximum Input Power	+20 dBm (CW)	
Input Power Accuracy	$\pm 1.5$ dB (+20 to -55 dBm) (CW) $\pm 2.5$ dB (-55 to -70 dBm) (CW)	
Input Power Measurement Repeatability	0.1 dB at $\geq$ -40 dBm	
Reference Level Range	+20 to -70 dBm	
Digitizer Resolution	12 bits	
Sampling Rate	122.88, 245.76, 491.52, 983.04, 2457.6 MHz	
Waveform Capture Duration	at 122.88 MHz sampling data rate	4360 ms
	at 245.76 MHz sampling data rate	2180 ms
	at 491.52 MHz sampling data rate	1090 ms
	at 983.04 MHz sampling data rate	218 ms
	at 2457.6 MHz sampling data rate	218 ms
Spurious (signal applied) <sup>1</sup>	< -40 dBc or -70 dBm, whichever is higher, 1 MHz RBW	
Image Rejection <sup>1</sup>	< -45 dBc (CW)	
Inherent Spurious Floor <sup>1</sup> (no signal applied)	$\leq$ -80 dBm at minimum attenuation, 1 MHz RBW	
Carrier Leakage	< -35 dBc	
Spectral Flatness <sup>1</sup>	$\leq$ 2.0 dB peak to peak	
Integrated Phase Noise	< 0.7 degrees (10 kHz to 10 MHz)	
Noise Figure (at minimum input attenuation)	$\leq$ 22 dB, $\leq$ 30 GHz $\leq$ 24 dB, $>$ 30 - 43 GHz	

<sup>1</sup> Measured in 1.5 GHz modulation bandwidth

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## Vector Signal Generator (VSG)

Parameters	Value	
Frequency Range	23 GHz – 45 GHz	
Center Frequency Resolution	0.01 Hz	
Maximum Modulation Bandwidth	1.7 GHz	
Output Power Range	+10 to -70 dBm (CW) 23 GHz – 40 GHz +5 to -70 dBm (CW) > 40 GHz – 43 GHz	
Output Power Accuracy	$\pm 1.5$ dB, $\leq 40$ GHz, signal level $\geq -40$ dBm (CW) $\pm 2$ dB, $> 40$ GHz – 43 GHz, signal level $\geq -40$ dBm (CW) $\pm 2.5$ dB, $\leq 43$ GHz, signal level $< -40$ dBm to -70 dBm (CW)	
Level Settling Time	< 1 ms to 0.1 dB	
Generator Resolution	14 bits	
Generator Sampling Rate	122.88, 245.76, 491.52, 2457.6 MHz	
Waveform Playback Duration	at 122.88 MHz sampling data rate	1000 ms
	at 245.76 MHz sampling data rate	500 ms
	at 491.52 MHz sampling rate	250 ms
	at 2457.6 MHz sampling data rate	50 ms
Spectral Flatness <sup>1</sup>	$\leq 2.0$ dB peak to peak <sup>2</sup>	
Spurious (in band) <sup>3</sup>	< -40 dBc or -70 dBm, (CW) whichever is higher	
Spurious (out of band)	< -20 dBc or -70 dBm, (CW) whichever is higher	
Carrier Leakage	< -30 dBc (CW)	
Image Rejection <sup>3</sup>	< -40 dBc (CW), <42.5 GHz center frequency Output Power $\leq -10$ dBm	
Integrated Phase Noise	< 0.7 degrees (10 kHz to 10 MHz)	

<sup>1</sup> Measured in 800 MHz modulation bandwidth

<sup>2</sup> Flatness measured at 0 dBm ( $\leq 40$  GHz), at -5 dBm ( $> 40$  GHz to  $\leq 42.5$  GHz)

<sup>3</sup> Measured in 1.5 GHz modulation bandwidth

## Timebase

Parameters	Value
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 ±0.1ppm at 25°C)	60 minutes

## Frequency Reference Input

Parameters	Value
Frequency	10 MHz
Max Frequency Variation	0.5 ppm
Input Voltage Range	+1 to +16 dBm (0.7Vpp to 4.0Vpp)
Impedance	50 Ω

## Frequency Reference Output

Parameters	Value
Frequency	10 MHz
Output Voltage	+8.5 dBm minimum (1.7vpp) +11.0 dBm nominal (2.2vpp)
Impedance	50 Ω

## TTL Trigger Input/Output

Parameters	Value
Impedance	5 k Ω nominal
Trigger/Marker 1 & 2 Input Level	3.5 V – V (IH) 1.5 V – V (IL)
Trigger/Marker 1 & 2 Output Level	3.8V to 4.9V – V(OH), 32mA max 0.1V to 0.55V – V(OL), 32mA max

## General and Environmental

Parameter	Description
Dimensions	14.5" W x 3.2" H x 20.5" D (368 mm x 82 mm x 521 mm)
Weight	28 lb (12.7 kg)
Power consumption (maximum)	300W
Power consumption (average)	225W
Power requirements	100 - 240 VAC, 50-60 Hz
Supported browsers	Google Chrome, Mozilla Firefox
Operating temperature	+10°C to +50°C
Storage temperature	-20°C to +70°C (IEC EN60068-2-1, 2, 14)
Specification validity temperature	20°C to 35°C (valid range for specifications)
System warm-up time	60 minutes
Operating humidity	15% to 95% relative humidity, non-condensing (IEC EN60068-2-30)
EMC/EMI	61326-1: 2013 Industrial Environment, CISPR11 Class A per EN61326-1:2013, FCC Part 15 Class A, VCCI V-3 Class A, BSMI CNS-13438 Class A, ACMA AS/NZS CISPR11: 2011, ICES-003 Class A
Safety	IEC 61010-1, EN61010-1, UL61010-1:2012 and Canada: CSA C22.2 No. 61010-1, GI1, GI2
Mechanical vibration	MIL-STD 810G for Random Vibration
Mechanical shock	ASTM D3332-99
Recommended connector torque	8 lb-in (90 N-cm)
Recommended calibration cycle	12 months
Warranty	12 months hardware, 12 months software updates

## 5G NR Measurements

Measurement	TS 38.101-2 Paragraph Reference	Notes
Transmit Power	6.2	Maximum Power
Output Power Dynamics	6.3	Min Power Relative Power
Transmit Signal Quality	6.4	Frequency Error EVM Carrier Leakage In-Band Emissions
Output RF Spectrum Emissions	6.5	Occupied Bandwidth Spectrum Emission Mask ACLR

Receiver Sensitivity	7.3	Reference Sensitivity Power
Receiver Level	7.4	Maximum Input Level
Receiver Blocking	7.5	Adjacent Channel Selectivity (Characterization only, no recommended for manufacturing. Requires additional signal generator)
	7.6	In-Band Blocking (Characterization only, no recommended for manufacturing. Requires additional signal generator)

## 5G NR Measurement Specifications

Measurement	Performance
Maximum output power	See general H/W specifications
Minimum output power	See general H/W specifications
Transmit off power	See general H/W specifications
Frequency error	See timebase specifications
Residual EVM (Typical) <sup>1</sup>	<p>1x100 MHz CC, @ -10 dBm            &lt;0.8% (-42 dB), ≥ 24.25GHz - ≤ 40 GHz            &lt;1.0% (-40 dB), &gt; 40GHz - ≤ 43.5 GHz</p> <p>1x 400 MHz CC, @ -10 dBm            &lt;1.1% (-39 dB), ≥ 24.25GHz - ≤ 40 GHz</p> <p>8x100 MHz CC, @ -10 dBm            &lt;1.8% (-35 dB), ≥ 24.25GHz - ≤ 40 GHz</p>
Carrier leakage	See general H/W specifications
Occupied bandwidth	See general H/W specifications
ACLR	See general H/W specifications
Spectrum emission mask	See general H/W specifications
Spurious emissions	Limited to 23 GHz – 45 GHz
Reference sensitivity	DUT support required
Maximum input level	DUT support required

<sup>1</sup> Measured in system loopback with LO offset and 5G NR waveform with mu=3, CP-OFDM, 256 QAM

## 5G NR Small Cell Base Station Tests

Code	TS 38.141-2 Paragraph Reference	Notes
Radiated transmit power	6.2	
OTA Base Station Output Power	6.3	
OTA Output Power Dynamics	6.4.3	OTA Total Power Dynamic Range
OTA Transmit ON/OFF Power	6.5.1 6.5.2	OTA Transmitter OFF Power OTA Transmitter Transient Period
OTA Transmitted Signal Quality	6.6.2 6.6.3 6.6.4	OTA Frequency Error OTA Modulation Quality OTA Time Alignment Error
OTA Unwanted Emissions	6.7.2 6.7.3	OTA Occupied Bandwidth OTA Adjacent Channel Leakage Power Ratio (ACLR)
OTA Reference Sensitivity Level	7.3	DUT support required
OTA In-Band Selectivity and Blocking	7.5.1 7.5.2	OTA Adjacent Channel Selectivity OTA In-Band Blocking (Characterization only, not recommended for manufacturing. Requires additional signal generator)
OTA Receiver Intermodulation	7.8	Characterization only, not recommended for manufacturing. Requires additional signal generator
OTA In-Channel Selectivity	7.9	Characterization only, not recommended for manufacturing. Requires additional signal generator

## Order Codes

Code	Product
0100-IG5G-011	IQgig-5G Model B Test System, 4 port version
0100-IG5G-013	IQgig-5G Model B Test System, 2 port version
0300-IG5G-003	3GPP NR 5G Software License
0300-IG5G-016	5G Small Cells Measurement Suite Software License
0150-IG5G-102	5G mmWave OTA Test Chamber. Suitable for 24 to 70 GHz frequency range. Includes a 2-axis DUT rotator and flexible antenna mounting system for multiple antennas and angles.
0150-IG5G-005	5G mmWave OTA Test Chamber with temperature capability. Suitable for 24 to 70 GHz frequency range.



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#### CONTACT INFORMATION

180 Rose Orchard Way  
San Jose, CA 95134  
United States of America  
  
+1.866.363.1911  
+1.408.456.5000

LITEPOINT TECHNICAL SUPPORT  
[www.litepoint.com/support](http://www.litepoint.com/support)