TECHNICAL SPECIFICATIONS

IQFR1-5G

5G Sub-6GHz Signaling Test System

LITEPOINT

Overview

IQFR1-5G is a RF test platform supporting signaling test in the sub-6GHz frequency range between 600 MHz and 6000 MHz. The unit, sold with IQcore-5G network emulator, converts the optical signals received from the emulator to radio signals and vice versa. Together, both IQFR1-5G and IQcore-5G make up an integral part of LitePoint's IQcell-5G signaling test solution, tailored to verify RF & functional performance of cellular devices such as smartphones, CPE's, laptops, tablets, hotspots & much more.

From Development to Production to Service Centers

The IQcell-5G FR1 signaling configuration – IQcore-5G and IQFR1-5G is built to ensure smooth transition between various stages of product development cycle, supporting:

- Comprehensive RF parametric measurements for end-of-line manufacturing or R&D regression and software stability testing
- MO/MT call flow verification, end-to-end throughput test & finished product quality check
- User experience tests including SMS, file transfer, VoNR, audio loopback, latency test, eSIM, multi-SIM test, etc. for sampling & pre-production test beds

Lower Cost of Test with Multi-cell, Multi-DUT Architecture

The IQFR1-5G configuration is designed to support up to four independent cells, enabling simultaneous testing of multiple DUTs in both conducted and OTA test environment. Coupled with LitePoint's automation test tool and targeted feature support, the solution makes for an ideal manufacturing end-of-line test solution, significantly improving production throughput & minimizing execution time.

Rapid Execution & Analysis

IQcell-5G comes with an easy to use web-based GUI to support real time transmitter (Tx) & Receiver (Rx) tests based on 3GPP 58.521 specifications. The built-in GUI serves as a smart tool to enable quick RF measurements, visualization and debugging of device behavior while a call is in progress.

Solution Highlights

- **Flexible:** supports 5GNR sub-6GHz in standalone mode (SA) & legacy technologies LTE, WCDMA, GSM in non-standalone (NSA) mode when connected to LitePoint's IQcell LTE test platform
- **Scalable:** extended support for signaling test at mmWave frequencies by connecting IQgig-5GS FR2 test platform
- **Multicarrier MIMO:** Capable of aggregating up to 4 carriers with 2x2 MIMO each and 2 carriers with 4x4 MIMO each.
- **Mobility Testing:** Supports intra-band, inter-band, and inter-RAT handovers and redirection.

Port Descriptions

Front Panel

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
RF11 Indicator	LED green – port is a VSA input LED red – port is a VSG output LED orange- port is in duplex mode	LED indicator
RF12 Indicator	LED green – port is a VSA input LED red – port is a VSG output LED orange- port is in duplex mode	LED indicator
RF13 Indicator	LED green – port is a VSA input LED red – port is a VSG output LED orange- port is in duplex mode	LED indicator
RF14 Indicator	LED green – port is a VSA input LED red – port is a VSG output LED orange- port is in duplex mode	LED indicator
Link1 Indicator	LED green – LINK1 connected	LED indicator
Link2 Indicator	LED green – LINK2 connected	LED indicator
ROUT11: RF1/ RF2	VSA input VSG output VSA input and VSG output	N Female
ROUT12: RF1/ RF2	VSA input VSG output VSA input and VSG output	N Female

I/O	Function	Type
ROUT13: RF1/ RF2	VSA input VSG output VSA input and VSG output	N Female
ROUT14: RF1/ RF2	VSA input VSG output VSA input and VSG output	N Female

Rear Panel

I/O	Function	Type
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	
DATA 1	DATA 1 Connection	iPass PCIe x4
DATA 2	DATA 2 Connection	iPass PCIe x4
HDMI	Video Output	HDMI
USB (4 ports)	USB 3.0 compatible connection to external controller	USB Type A
LAN	1000 Base-T LAN	RJ-45
TRIG/MKR 1	TTL Trigger Input / Output	BNC female
TRIG/MKR 2	TTL Trigger Input / Output	BNC female
10 MHz REF IN	10 MHz reference input	BNC female
10 MHz REF OUT	10 MHz reference output	BNC female
QSFP28 4x25GbE	High bandwidth data connector	QSFP connector
AC in	AC power input	100 to 240V AC (automatically switched) 50 to 60 Hz, Includes hard power switch

General Hardware Specifications

Vector Signal Analyzer (VSA)

Parameter	Value
Frequency Range	600 – 6000 MHz
RF Bandwidth	200 MHz
Maximum Input Power	+34 dBm (avg) +36 dBm (peak)
Input Power Accuracy	For input > -40 dBm: <± 0.4 dB 600 to 3800 MHz <± 0.5 dB > 3800 MHz
Input Return Loss	>12 dB 600 to 3800 MHz >10 dB 3800 to 5300 MHz >8 dB >5300 MHz
Noise Figure	< 20 dB 600 to 4500 MHz < 25 dB >4500 MHz
Power measurement repeatability	< 0.1 dB (within 30 seconds of initial value), input power > -40 dBm
Frequency Resolution	1 Hz
Frequency Level Settling Time	< 900 ms to within 1 kHz
Port Switching Time	< 50 usec (to within 0.1 dB)
Sampling Rate	30.72, 61.44, 122.88, 245.76 MHz
Signal to Noise Ratio	> 95 dB @ RBW = 1 kHz, input power > -10 dBm
Spurious (signal applied)	< -50 dBc, (± 100 MHz, 1 MHz RBW, input power > -10 dBm) Excludes image rejection
Spurious Signals Floor (no input signal applied)	< -75 dBm (± 100 MHz, RLEV = -10 dBm)
Image Rejection	< -30 dBc (± 50 MHz, input power > -10 dBm), < 5000 MHz < -25 dBc (± 50 MHz, input power > -10 dBm), > 5000 MHz
Spectral Flatness	< 1 dB (± 100 MHz, input power > -10 dBm) max-min
Integrated Phase Noise	≤ 0.5 degrees (1 kHz to 10 MHz), 600MHz – 2100 MHz ≤ 0.8 degrees (1 kHz to 10 MHz), 2100 MHz – 4300 MHz ≤ 0.9 degrees (1 kHz to 10 MHz), > 4300 MHz

Vector Signal Generator (VSG)

Parameter	Value
Frequency Range	600 – 6000 MHz
RF Bandwidth	200 MHz
Output Power Range	0 dBm to -120 dBm (<5000 MHz) -5 dBm to -120 dBm (>5000 MHz)
Output Power Accuracy	< ± 0.5 dB @ levels ≥ -50 dBm < ± 1dB @ levels <-50 dBm
Output return loss	> 12dB 600 to 3800 MHz > 10dB 3800 to 5300 MHz > 8dB > 5300 MHz
Output Power level repeatability	< 0.1 dB (within 30 seconds of initial value), power > -40 dBm
Power Level Resolution	0.01dB
Frequency Resolution	1 Hz
Frequency Level Settling Time	< 900 ms to within 1 kHz
Sampling Rate	30.72, 61.44, 122.88, 245.76 MHz
Signal to noise ratio	≥ 60 dB power level > -30 dBm (CW)
Spurious (in channel)	≤ -40 dBc (measured at -10 dBm, 200 MHz bandwidth) (CW) Excludes carrier leakage and image rejection
Spurious (out of channel) (excluding harmonics)	< -40 dBc (power > -40 dBm, < 6 GHz)
Harmonic Attenuation	> -25 dBc (power level < -10 dBm)
Carrier Leakage	< -50 dBc, 600 – 3000 MHz (measured at -10 dBm) < -35 dBc, > 3000 MHz (measured at -10 dBm)
Image Rejection	< -30 dBc (±50 MHz, input power > -10 dBm), < 5000 MHz < -25 dBc (±50 MHz, input power > -10 dBm), > 5000 MHz
Spectral Flatness	< 1 dB (±50 MHz, measured at -10 dBm) max-min < 1 dB (±100 MHz, measured at -10 dBm, < 5 GHz) max-min
Integrated Phase Noise	≤ 0.5 degrees (1 kHz to 10 MHz), 600MHz – 2100 MHz ≤ 0.8 degrees (1 kHz to 10 MHz), 2100 MHz – 4300 MHz ≤ 0.9 degrees (1 kHz to 10 MHz), > 4300 MHz

Port to Port Isolation

Parameter	Value
VSA to VSA	> 100 dB 600 MHz to 5000 MHz > 95 dB > 5000 MHz
VSG to VSG	> 115 dB 600 MHz to 5000 MHz > 105 dB 5000 MHz to 5500 MHz > 95 dB > 5500 MHz
VSG to VSA	> 100 dB 600 MHz to 4000 MHz > 95 dB 4000 MHz to 5000 MHz > 90 dB 5000 MHz to 5500 MHz > 80 dB > 5500 MHz

Timebase

Parameter	Value
Oscillator type	OCXO
Frequency	10 MHz
Initial accuracy (25°C, after 60min 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	5 Minutes to < ±0.1ppm

Frequency Reference Input

Parameter	Value
Frequency	10 MHz
Max Frequency Variation	0.5 ppm
Input Voltage Range	0.3 Vpp to 4.0 Vpp
Impedance	50 Ω

Frequency Reference Ouput

Parameter	Value
Frequency	10 MHz
Output Voltage	> 0.8 Vpp
Impedance	50 Ω

TTL Trigger Input/Output

Parameter	Value
Impedance	5 kΩ 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 Hardware Specifications

Parameter	Value
Dimensions	15" W x 3.6" H x 21.3" D (381 mm x 91.5 mm x 541 mm)
Weight	26.4 lb. (12 kg)
Power consumption (maximum)	550 W
Power requirements	100 - 240 VAC, 50-60 Hz
Operating temperature	20°C to 35°C (valid range for specifications)
Storage temperature	-20°C to +70°C (IEC EN60068-2-1, 2, 14)
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	12 lbs-in (135 N-cm) Recommended
Recommended calibration cycle	12 months
Warranty	12 months hardware, 12 months software updates

5G NR Measurement Specifications

Parameter	Paragraph Reference	Notes
Transmit Power	6.2	Maximum Power
Output Power Dynamics	6.3	Min Power Transmit OFF Power Transmit ON/OFF time mask Power control
Transmit Signal Quality	6.4	Frequency Error EVM Carrier Leakage In-Band Emissions Spectrum Flatness System loopback EVM: 1x100 MHz CC, @-10 dBm <1.1% (-39 dB): 600 MHz - 2700MHz, 3000 - 4500 MHz <1.4% (-37 dB): 4500 MHz - 5875 MHz
Output RF Spectrum Emissions	6.5	Occupied Bandwidth Spectrum Emission Mask Adjacent Channel Leakage Ratio (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)

Configuration

IQcell-5G signaling solution provides expansive coverage across SA & NSA deployment models and frequency ranges,

- FR1 SA/NSA
- FR2 NSA
- FR1 + FR2 SA/NSA

Contact LitePoint to understand more about the test configurations.

Order Codes

Code	Product
0100-5GSG-001	IQcore-5G Signaling Baseband Unit
0100-5GSG-003	IQFR1-5G Sub-6GHz Test System
0150-5GSG-001	IQ5041 FR1 NSA/SA RF Chamber
0300-5GSG-001	5G Non-Standalone Mode License
0300-5GSG-002	5G Standalone Mode License
0300-5GSG-004	5G End User Exp Test License
0300-5GSG-005	5G 3GPP SW License
0300-5GSG-006	5G Multicell Signaling License
0300-5GSG-007	5G FR1 MIMO SW License
0100-CELL-001	IQcell LTE Anchor

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