TECHNICAL SPECIFICATIONS

IQFR2-RU

5G FR2 O-RAN Radio Unit Test System

LITEPOINT

Overview

The IQFR2-RU is LitePoint's next-generation, fully integrated 5G FR2 O-RAN Radio Unit (O-RU) tester, purpose-built for mmWave (FR2) radio validation and production testing. It combines 3GPP 5G NR RF downlink/uplink measurements with complete O-RAN C/U/M/S-plane functionality, enabling seamless configuration and control of O-RUs under test.

As the industry moves toward open and interoperable networks, O-RAN architecture introduces new challenges for testing radio units. IQFR2-RU addresses these challenges by providing a fully integrated platform that combines RF testing and fronthaul emulation in a single chassis, eliminating the need for external Distributed Unit (DU) emulators.

Key Highlights

- **Integrated VSG/VSA architecture for FR2 frequencies (23 GHz – 45 GHz), supporting up to 1.7 GHz wide instantaneous bandwidth for 5G NR carrier aggregation.**
- **Single-box simplicity with factory-calibrated RF ports, reducing setup time from hours to minutes.**
- **Supports split option 7.2x, handling C/U/S/M-plane messaging and eCPRI packet waveform playback for both uplink and downlink.**
- **Enables parametric measurements such as power, frequency error, EVM, ACLR, sensitivity and beamforming performance for FR2 bands.**
- **Includes IEEE1588 PTP support and optional 1PPS/10 MHz reference outputs for precise timing.**
- **Scalable from R&D to high-volume manufacturing, minimizing cost of test (COT) and improving throughput.**

Target Applications

- **RU RF performance validation (power, TPDR, TOOP, frequency error, EVM, TAE, OBW, ACLR, OBUE, sensitivity, dynamic range, ACS, IBB, receiver intermodulation, ICS).**
- **RAN fronthaul protocol compliance and regression testing.**
- **OTA beamforming and antenna characterization for mmWave radios.**

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
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
LINK1 Indicator	LED green – LINK1 connected	LED indicator
LINK2 Indicator	LED green – LINK2 connected	LED indicator
RF1	VSA input or VSG output	2.4 mm female
RF2	VSA input or VSG output	2.4 mm 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)

Parameter	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	±1.5 dB (+20 to -55 dBm) (CW) ±2.5 dB (-55 to -70 dBm) (CW)	
Input Power Measurement Repeatability	0.1 dB at ≥ -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 Playback 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)[1]	< -55 dBc or -70 dBm, whichever is higher, 1 MHz RBW	
Image Rejection[1]	< -45 dBc	
Inherent Spurious Floor (no signal applied)[1]	≤ -80 dBm at minimum attenuation, 1 MHz RBW	
Carrier Leakage	< -45 dBc	
Spectral Flatness[1]	≤ 2.0 dB peak to peak	
Integrated Phase Noise	< 0.7 degrees (10 kHz to 10 MHz)	
Noise Figure (at minimum input attenuation)	≤ 25 dB (≤ 27 GHz) ≤ 22 dB (> 27 - 40 GHz) ≤ 24 dB (> 40GHz)	

1 Measured in 1.5 GHz modulation bandwidth

Vector Signal Generator (VSG)

Parameter	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)	
Output Power Accuracy	±1.5 dB, (> -40 dBm) (CW) ±2.5 dB (<-40 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[1]	≤ 2.0 dB peak to peak[2]	
Spurious (in band)[3]	< -55 dBc	
Spurious (out of band)	< -20 dBc or -70 dBm, (CW) whichever is higher	
Carrier Leakage	< -30 dBc (CW)	
Image Rejection[3]	< -40 dBc (CW)	
Integrated Phase Noise	< 0.7 degrees (10 kHz to 10 MHz)	

1 Measured over 24.6 to 42.7 GHz (center frequency), with ±750 MHz modulation bandwidth
2 Flatness measured at 5 dBm
3 Measured in 1.5 GHz modulation bandwidth

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 (to within ±0.1ppm at 25°C)	60 minutes

Frequency Reference Input

Parameter	Value
Frequency	10 MHz
Max Frequency Variation	0.5 ppm
Input Voltage Range	0.7 Vpp to 4.0 Vpp
Impedance	50 Ω

Frequency Reference Output

Parameter	Value
Frequency	10 MHz
Output Voltage	> 1.4 Vpp
Impedance	50 Ω

TTL Trigger Input/Output

Parameter	Value
Impedance	5 kΩ nominal
Trigger/Marker 1 & 2 Input Level	3.5V – V(IH) 1.5V – 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	14.5" W x 3.2" H x 20.5" D (368 mm x 82 mm x 521 mm)
Weight	26.9 lb (12.2 kg)
Power consumption (average)	380W
Power consumption (maximum)	576W
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 Base Station (BS) Tests

Code	3GPP TS 38.141-2 Paragraph Reference	Notes
Radiated Transmit Power	6.2	
OTA Base Station Output Power	6.3	
OTA Output Power Dynamics	6.4.2 6.4.3	OTA RE Power Control Dynamic Range 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 6.7.4 6.7.5	OTA Occupied Bandwidth OTA Adjacent Channel Leakage Power Ratio (ACLR) OTA Operating Band Unwanted Emissions (OBUE) OTA Transmitter Spurious Emissions[1]
OTA Transmitter Intermodulation[1,2]	6.8	
OTA Sensitivity	7.2	
OTA Reference Sensitivity Level	7.3	
OTA Dynamic Range	7.4	
OTA In-Band Selectivity and Blocking	7.5.1 7.5.2	OTA Adjacent Channel Selectivity[2] OTA In-Band Blocking[2]
OTA Out-of-Band Blocking[1,2]	7.6	
OTA Receiver Spurious Emissions[1]	7.7	
OTA Receiver Intermodulation[2]	7.8	
OTA In-Channel Selectivity[2]	7.9	

1 Support in tester's frequency range
2 Require additional tester for interfering signal

Fronthaul Specifications

Parameter	Value
O-RAN Specification Compliance	O-RAN.WG4.CUS O-RAN.WG4.MP O-RAN.WG4.CONF
RU category	Category A (Category B is planned for future release)
Channel Bandwidth	100 MHz (200 MHz is planned for future release)
Sub Carrier Spacing (SCS)	60, 120 kHz
FFT Size	1024 and 2048 (4096 is planned for future release)
Carrier Aggregation	1CC (2CC and 4CC are planned for future release)
Modulation	Up to 256 QAM for both DL and UL
Duplexing Mode	TDD
Antenna streams	1T1R (2T2R is planned for future release)
Synchronization plane	PTP Master emulation SyncE ESMC Message support
C/U Plane Transport	Jumbo Ethernet Frames eCPRI Application Fragmentation
U-Plane data compression method options	No IQ compression Block Floating Point (BFP) compression
C-Plane message types	Section Type 1 Section Type 3
M-Plane	Embedded M-plane NETCONF support
Waveforms	Predefined 3GPP Test Models Downlink stimulus waveform generation Uplink stimulus waveform generation Custom configuration stimulus waveform generation On-board real time CU-Plane eCPRI packets waveform playback
Interface	Single QSFP28 / QSFP+ Port SFP or QSFP support QSFP28: 25G (50G and 100G are planned for future release) QSFP+: 10G (20G and 40G are planned for future release)
Protocol Support	Ethernet, VLAN, eCPRI and O-RAN
Cross Trigger	Configurable Trigger output
Reference clock	Ref Clock input 10 MHz; Ref Clock output 10 MHz

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