

RF Test Report

Product Name: pRRU Multi-Mode Radio Unit

Product Model: pRU01-B04

Report Number: SYBH(R)01601078EB-1

FCC ID: QISPRU01B04

IC: 6369A-PRU01B04

Reliability Laboratory of Huawei Technologies Co., Ltd.

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Notice

1. The laboratory has Passed the accreditation by China National Accreditation Service for Conformity Assessment (CNAS). The accreditation number is L0310.
2. The laboratory has Passed the accreditation by The American Association for Laboratory Accreditation (A2LA). The accreditation number is 2174.01.
3. The laboratory has been listed by the US Federal Communications Commission to perform electromagnetic emission measurements.
 - The recognition number for the test site located in Shenzhen is 97456.
 - The recognition number for the test site located in Shanghai is 684868.
 - The recognition number for the test site located in Chengdu is 216797.
4. The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements.
 - The recognition number for the test site located in Shenzhen is 6369A, which contains 6369A-1 (3m chamber in G2), 6369A-2 (3m chamber in K3) and 6369A-3 (10m chamber in K3).
 - The recognition numbers for the test site located in Shanghai is 6369D, which contains 6369D-1 (3m chamber) and 6369D-2 (10m chamber).
 - The recognition number for the test site located in Chengdu is 6369E-1.
5. The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
6. The test report is invalid if there is any evidence of erasure and/or falsification.
7. The test report is only valid for the test samples.
8. Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.



Applicant: Huawei Technologies Co., Ltd.
Address: Administration Building, Headquarters of Huawei Technologies Co., Ltd.,
Bantian, Longgang District, Shenzhen, 518129, P.R.C
Product Name: pRRU Multi-Mode Radio Unit
Product Model: pRU01-B04

Date of Receipt Sample: 2014-05-19
Start Date of Test: 2014-05-19
End Date of Test: 2014-12-19

Test Result: Pass

Approved by Senior

2014-12-19

Zhang Xinghai

Zhang Xing hai

Engineer:

Date

Name

Signature

Prepared by:

2014-12-19

Hu Wei

Hu Wei

Date

Name

Signature



Modification Record

No.	Last Report No.	Modification Description
1	---	First report.



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1 General Information

1.1 Applied Standard

Applied Rules: 47 CFR FCC Part 2 (10-1-13 Edition)
47 CFR FCC Part 27 (10-1-13 Edition)
IC RSS-Gen (Issue 4, November 2014)
IC RSS-139 (Issue 2, February 2009)

Test Method: FCC KDB 971168 D01 Power Meas License Digital Systems v02r02
(if applicable) FCC KDB 662911 D01 Multiple Transmitter Output v02r01

1.2 Test Location

Test Location 1 (TL1): Reliability Laboratory of Huawei Technologies Co., Ltd.
Address: Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

Test Location 2 (TL2): Reliability Laboratory of Huawei Technologies Co., Ltd.
Address: No.2222, Xin Jinqiao Road, Pudong New Area, Shanghai, 201206, P.R.C

Test Location 3 (TL3): Reliability Laboratory of Huawei Technologies Co., Ltd.
Address: No.1899 Xiyuan Avenue, Hi-tech Western District, Chengdu, 611731, P.R.C

1.3 Test Environment Condition

Temperature: 21 to 24 °C (Ambient)
Relative Humidity: 60 to 72 % (Ambient)
Atmospheric Pressure: Not applicable



2 Test Summary

2.1 AWS Band (1710-1755 MHz paired with 2110-2155 MHz)

2.1.1 Measurement Technical Requirements

Test Item	FCC Rule	IC Rule	Requirements			Test Result	Verdict	Test Location
Transmitter Output Power	§2.1046, §27.50(d)	RSS-Gen,§6.12; RSS-139,§6.4; RSS-139,§4.1	FCC	Base Station / Fixed Station	● Average EIRP Power ≤ 1640 W (for EBW ≤ 1 MHz). ● Average EIRP PD ≤ 1640 W/MHz (for EBW > 1 MHz). ● PAPR ≤ 13 dB@0.1%.	Appendix A1	Pass	TL1
				Mobile Station / Portable Station	● Average EIRP Power ≤ 1 W. ● PAPR ≤ 13dB@0.1%.			
			IC	Base Station / Fixed Station	● Average EIRP Power ≤ 1640 W (for ChBW ≤ 1 MHz). ● Average EIRP PD ≤ 1640 W/MHz (for ChBW > 1 MHz). ● PAPR ≤ 13 dB@0.1%.			
				Mobile Station / Portable (hand-held) Station	● Average EIRP Power ≤ 1 W. ● PAPR ≤ 13dB@0.1%.			
Bandwidth	§2.1049, §27.53(h)	RSS-Gen,§6.6; RSS-139,§2.3	FCC	● OBW: No limit. ● EBW (-26 dBc): No limit.		Appendix B1	Pass	TL1
			IC	● OBW: No limit, may in lieu of EBW (-20 dBc).				



Test Item	FCC Rule	IC Rule	Requirements		Test Result	Verdict	Test Location
				EBW (-20 dBc): No limit.			
Band Edges Compliance	§2.1051, §27.53(h)	RSS-Gen, §6.13; RSS-139, §6.5	FCC	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block. (EBW is -26 dBc EBW)	Appendix C1	Pass	TL1
			IC	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block. (EBW is -20 dBc EBW, or OBW)			
Spurious Emission at Antenna Terminals	§2.1051, §27.53(h)	RSS-Gen, §6.13; RSS-139, §6.5	≤ -13 dBm/1 MHz, from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges.		Appendix D1	Pass	TL1
Field Strength of Spurious Radiation	§2.1053, §27.53(h)	RSS-Gen, §6.13; RSS-139, §6.5	≤ -13 dBm/1 MHz.		Appendix E1	Pass	TL3
Frequency Stability	§2.1055, §27.54	RSS-Gen, §6.11; RSS-139, §6.3	FCC	- Test method: Fundamental emissions (Fc_meas) within the authorized bands of operation. - Test conditions: (1) NV, -30°C/.../+50°C step=+10°C. (2) NT, $\pm 15\%$*NV.	Appendix F1	Pass	TL1
			IC	- Test method: EBW (EBW_lower to EBW_higher) within frequency block. - Test conditions: (1) NV, -30°C/+20°C/+50°C. (2) +20°C, $\pm 15\%$*NV. (EBW is -20 dBc EBW, or OBW)			
Receiver Spurious Emissions	---	IC NOTICE 2012-DRS0126	---		Appendix G1	---	---
Photos of Test Setups	---	---	---		---	---	---

2.1.2 Non-measurement Technical Requirements

Description	FCC Rule	IC Rule	Requirements	Test Result	Verdict
Frequency Plan	§27.5(h)	RSS-139, §6.1	1710-1755 MHz paired with 2110-2155 MHz:	See technical	Comply



Description	FCC Rule	IC Rule	Requirements	Test Result	Verdict
				specification description.	
Modulation Characteristics	§2.1047	RSS-139,§6.2	Any modulation.	See technical specification description.	Comply

3 Description of the Equipment under Test (EUT)

3.1 General Description

The pRU01-B04 is the RF board of indoor remote radio unit, which is the elements of LampSite indoor coverage network solutions, need to be used with the BBU and RHUB3908 and mother board, using for support buildings scenes indoor coverage, a product at the Operators layer launched by Huawei Technologies Co., Ltd., It is the RF module of the distributed eNodeB and is installed close to the antenna. The pRU01-B04 performs modulation, demodulation, data processing, and combination and division of baseband signals and RF signals.

3.2 EUT Identity

NOTE: Unless otherwise noted in the report, the functional boards installed in the units shall be selected from the below list, but not means all the functional boards listed below shall be installed in one unit.

3.2.1 Board

Board		
Board Name	Hardware Version	Description
WD6DLPX240	Ver.C	Manufactured Board,pRU01,WD6DLPX240,LTE FDD AWS Radio Board,2T2R,2*100mW

3.2.2 Sub-Assembly

Sub-Assembly			
Sub-Assembly Name	Model	Manufacturer	Description
UMPT	UMPTb	HUAWEI	BBU3900-WD22UMPTb2-Universal Main Processing & Transmission unit with 4E1 and 2FE/GE interface, With Ublox Card
LBBP	LBBPd	HUAWEI	Manufactured Board,BBU3900,WD22LBBPD3,LTE Baseband Processing and Interface Unit(6 cell 2T2R), 1*1
WBBP	WBBPf	HUAWEI	Manufactured Board,BBU3900,QWL1WBBPF4,Baseband Processing Unit (CE:UL512/DL768),1*1
WD6EXRUIBC	pRRU Interface Board	HUAWEI	Manufactured Board, pRRU 3901-WD6EXRUIBC-pRRU Interface Board
RHUB3908	RHUB3908	HUAWEI	RHUB3908,WD6M1RBH2,pRRU pool and PoE support(2* CPRI SFP,8*CPRI OVER PHY with PSE,PSU,Global)



3.3 Technical Specification

3.3.1 AWS Band

Characteristics	Description
Radio System Type	Single Radio ☐ GSM Access Technology (Single-RAT): ☒ UMTS ☒ LTE ☐ CDMA ☐ WiMAX Multi-Standard Radio (MSR): ☐ GSM & UMTS ☐ GSM & LTE ☐ GSM & UMTS & LTE ☒ UMTS & LTE ☐ WiMAX & LTE ☐ CDMA & LTE
Equipment Type	#1 ☒ Base Station ☐ CPE (Customer Premises Equipment) Station ☐ Subscriber Station (User Equipment) #2 ☒ Fixed Station ☐ Mobile Station ☐ Portable Station #3 ☒ Indoor Station ☐ Outdoor Station
Supported Frequency Range	Transmission (TX): 2110 to 2155 MHz Receiving (RX): 1710 to 1755 MHz
TX and RX Antenna Ports	TX & RX port: 1(for UMTS), 2(for LTE) TX-only port: 0 RX-only port: 1(for UMTS), 0(for LTE)
Multiple Carrier Supported	2
Maximum RF Bandwidth	20 MHz
TX Output Power	Max. 200 mW
Supported Channel Bandwidth	GSM system: ☐ 200 kHz UMTS system: ☒ 5 MHz LTE system: ☐ 1.4 MHz, ☐ 3 MHz, ☒ 5 MHz, ☒ 10 MHz, ☒ 15 MHz, ☒ 20 MHz CDMA system: ☐ 1.23 MHz, ☐ 1.25 MHz WiMAX system: ☐ 5 MHz, ☐ 7 MHz, ☐ 10 MHz
Modulation Type	GSM system: Not applicable UMTS system: Base-band: QPSK, 16QAM, 64QAM Carrier: CDMA LTE system: Base-band: QPSK, 16QAM, 64QAM Carrier: OFDM/OFDMA CDMA system: Not applicable



Characteristics	Description
	WiMAX system: Not applicable
Designation of Emissions (Note: the necessary bandwidth of which is the worst value from the measured occupied bandwidths for each type of channel bandwidth configuration.)	GSM system: Not applicable UMTS system: 4M19F9W LTE system: 4M49D9W, 8M97D9W, 13M5D9W, 17M9D9W CDMA system: Not applicable WiMAX system: Not applicable
Power Supply	Power Supply Type: ☐ External AC mains, ☐ External DC mains, ☐ AC/DC Adapter, ☒ Powered over Ethernet (PoE) Nominal Voltage, Input to EUT: PoE power supply: -48 VDC Voltage Range, Input to EUT: PoE power supply: -36VDC to -60VDC
Antenna Assemblies	Antenna Type: ☐ External ☒ Integrated Smart Antenna: ☒ MIMO(for LTE) ☒ Non MIMO(for UMTS) Antenna Gain: 4 dBi (per antenna port, max.) Remark: When the EUT is put into service, the practical maximum antenna gain may exceed the value as described above, and if exceed, the combination of the practical output power and the practical antenna gain should NOT exceed the required ERP/EIRP limit.



4 General Test Conditions / Configurations

4.1 Test Modes

NOTE: The test mode(s) are selected according to relevant radio technology specifications, and these test mode(s) reflect the worst case scenario.

Test Mode	Test Modes Description
UMTS/TM1	UMTS system, 3GPP TS 25.141 clause 6.1.1, Test Model 1, QPSK modulation
LTE/TM1.1	LTE system, 3GPP TS 36.141 clause 6.1.1, E-TM 1.1
UL/TM1	MSR system, 3GPP TS 37.141 clause 4.9.2 (UMTS/TM1; LTE/TM1.1)

4.2 EUT Configurations

4.2.1 General Configurations

Configuration	Description
Test Antenna Ports	Until otherwise specified, - All TX tests are ONLY performed at the main TX antenna port (e.g. TRXA, TXA or similar) of the EUT, and - All RX tests are ONLY performed at the main RX antenna port (e.g. TRXA, RXB or similar) of the EUT.
Multiple RF Sources	Other than the tested RF source of the EUT, other RF source(s) are disabled or shutdown during measurements.

4.2.2 Customized Configurations

NOTE: For the carrier configurations, the description of “n*TxxxM(yyyW)@zzz” denotes the n * multiple carriers of the radio system type T (G - GSM system, U - UMTS system, L - LTE system, C - CDMA system, W - WiMAX system), for which the channel bandwidth of each carrier is xxx MHz (applicable for T supporting various channel bandwidths) and the power level of each carrier is yyy Watts, at the antenna port zzz (if specified). While the combinations of several “n*TxxxM(yyyW)@zzz”s denotes the carrier configurations of the MSR system.

4.2.2.1 AWS Band

EUT Conf.	RF Ch	RX Freq. [MHz]	TX Freq. [MHz]	Ch. BW [MHz]	Power Level [dBm]	Test Mode
5M_B	B	1712.5	2112.5	5	20@Ant 1,2	LTE/TM1.1
5M_M	M	1732.5	2132.5	5	20@Ant 1,2	LTE/TM1.1
5M_T	T	1752.5	2152.5	5	20@Ant 1,2	LTE/TM1.1
10M_B	B	1715	2115	10	20@Ant 1,2	LTE/TM1.1
10M_M	M	1732.5	2132.5	10	20@Ant 1,2	LTE/TM1.1
10M_T	T	1750	2150	10	20@Ant 1,2	LTE/TM1.1
15M_B	B	1717.5	2117.5	15	20@Ant 1,2	LTE/TM1.1
15M_M	M	1732.5	2132.5	15	20@Ant 1,2	LTE/TM1.1
15M_T	T	1747.5	2147.5	15	20@Ant 1,2	LTE/TM1.1
20M_B	B	1720	2120	20	20@Ant 1,2	LTE/TM1.1
20M_M	M	1732.5	2132.5	20	20@Ant 1,2	LTE/TM1.1
20M_T	T	1745	2145	20	20@Ant 1,2	LTE/TM1.1
1U_B	B	1712.4	2112.4	5	23@Ant 1	UMTS/TM1
1U_M	M	1732.4	2132.4	5	23@Ant 1	UMTS/TM1
1U_T	T	1752.6	2152.6	5	23@Ant 1	UMTS/TM1
2U_B	B	1712.4,1717.4	2112.4,2117.4	5,5	20,20@Ant 1	UMTS/TM1
2U_M	M	1730,1735	2130,2135	5,5	20,20@Ant 1	UMTS/TM1



EUT Conf.	RF Ch	RX Freq. [MHz]	TX Freq. [MHz]	Ch. BW [MHz]	Power Level [dBm]	Test Mode
2U_T	T	1747.6,1752.6	2147.6,2152.6	5,5	20,20@Ant 1	UMTS/TM1
1U1L5M_B	B	1712.4, 1717.4	2112.4, 2117.4	5,5	17,17@Ant 1; 17@Ant 2	UL/TM1
1U1L5M_M	M	1730, 1735	2130, 2135	5,5	17,17@Ant 1; 17@Ant 2	UL/TM1
1U1L5M_T	T	1747.6, 1752.6	2147.6, 2152.6	5,5	17,17@Ant 1; 17@Ant 2	UL/TM1
1U1L10M_B	B	1712.4, 1719.9	2112.4, 2119.9	5,10	17,17@Ant 1; 17@Ant 2	UL/TM1
1U1L10M_M	M	1730, 1737.5	2130, 2137.5	5,10	17,17@Ant 1; 17@Ant 2	UL/TM1
1U1L10M_T	T	1745.1, 1752.6	2145.1, 2152.6	10,5	17,17@Ant 1; 17@Ant 2	UL/TM1
1U1L15M_B	B	1712.4, 1722.4	2112.4, 2122.4	5,15	17,17@Ant 1; 17@Ant 2	UL/TM1
1U1L15M_M	M	1730, 1740	2130, 2140	5,15	17,17@Ant 1; 17@Ant 2	UL/TM1
1U1L15M_T	T	1742.6, 1752.6	2142.6, 2152.6	15,5	17,17@Ant 1; 17@Ant 2	UL/TM1

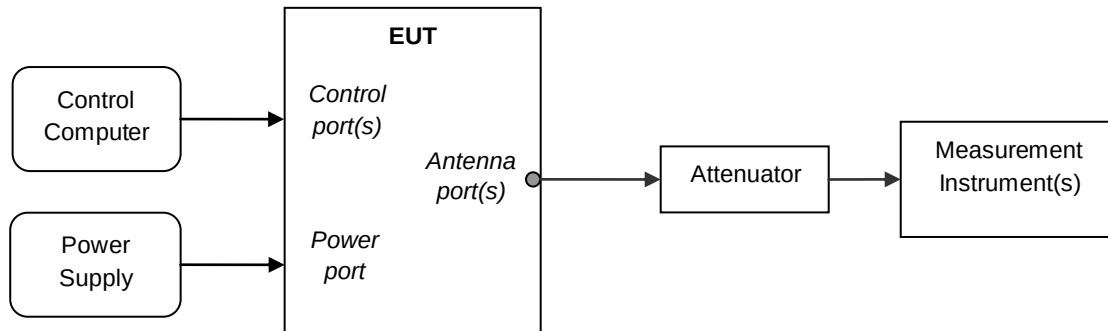


4.3 Test Environments

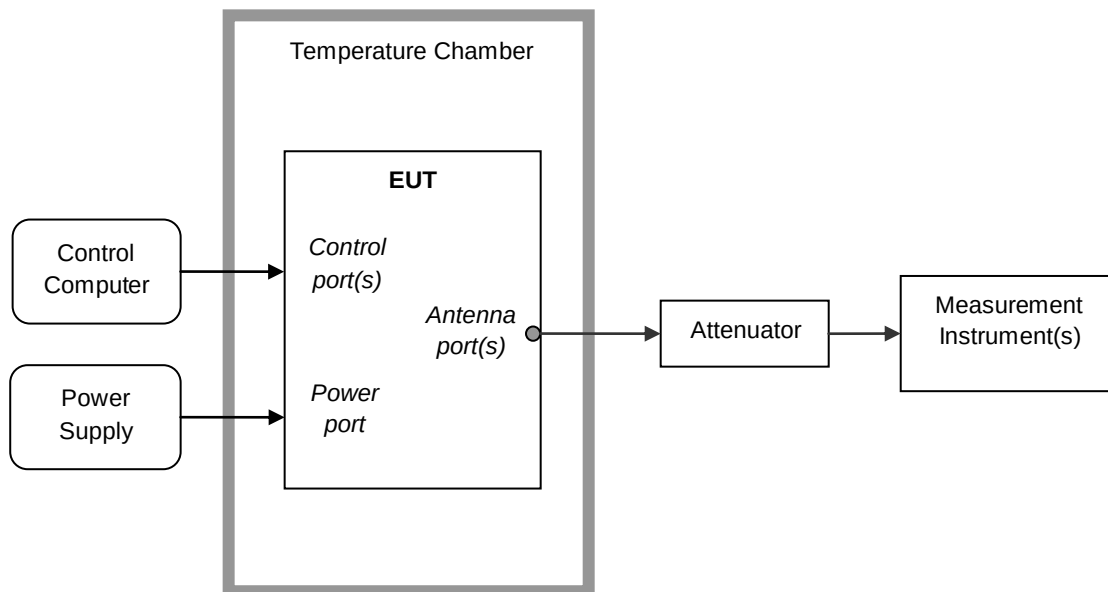
Environment Parameter	Selected Values During Tests		
	Temperature	Voltage	Relative Humidity
Ambient Climate	Ambient	---	Ambient
Rated Voltage	---	-48 VDC	---

4.4 Test Setups

4.4.1 Test Setup 1



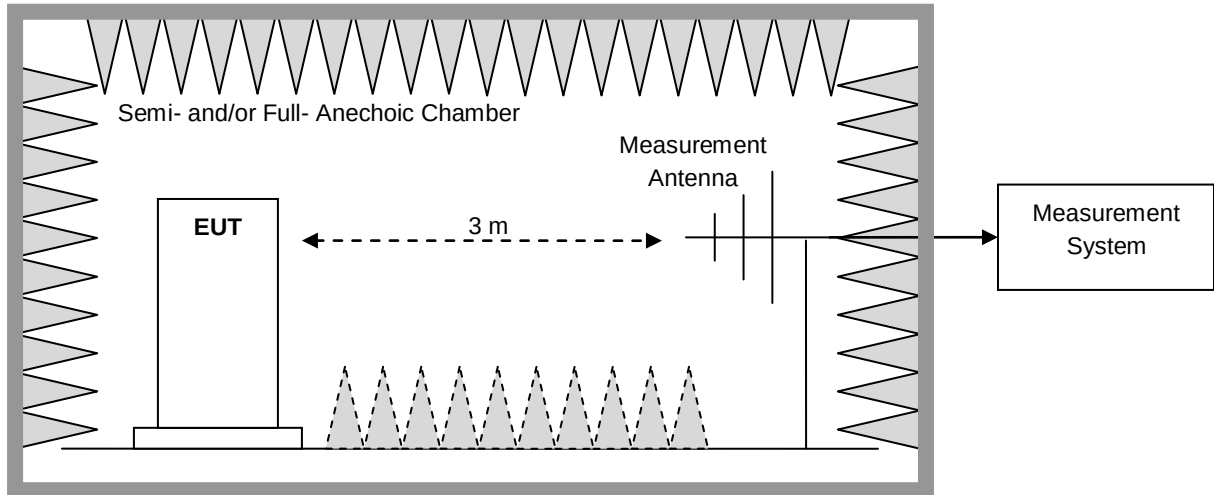
4.4.2 Test Setup 2



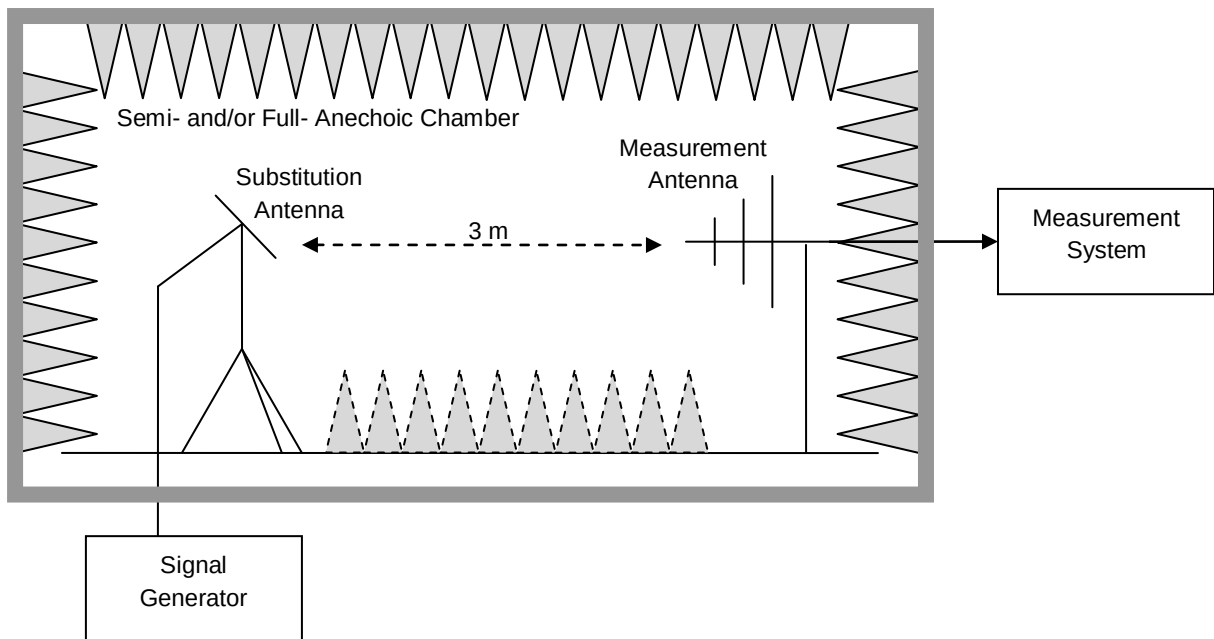
4.4.3 Test Setup 3

NOTE: Effective radiated power (ERP) refers to the radiation power output of the EUT, assuming all emissions are radiated from half-wave dipole antennas.

4.4.3.1 Step 1: Pre-test



4.4.3.2 Step 2: Substitution method to verify the maximum ERP



4.5 Test Conditions

4.5.1 AWS Band

Test Case		Test Conditions	
Transmitter Output Power	Channel Power, Total	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		EUT Conf.	5M_B,5M_M,5M_T 10M_B,10M_M,10M_T 15M_B,15M_M,15M_T 20M_B,20M_M,20M_T 1U_B,1U_M,1U_T 2U_B,2U_M,2U_T 1U1L5M_B, 1U1L5M_M, 1U1L5M_T 1U1L10M_B, 1U1L10M_M, 1U1L10M_T 1U1L15M_B, 1U1L15M_M, 1U1L15M_T
		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		EUT Conf.	5M_B,5M_M,5M_T 1U_B,1U_M,1U_T
		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		EUT Conf.	5M_B,5M_M,5M_T 1U_B,1U_M,1U_T
	Power Spectral Density	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		EUT Conf.	5M_B,5M_M,5M_T 1U_B,1U_M,1U_T
	Peak-to-Average Ratio	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		EUT Conf.	5M_B,5M_M,5M_T 1U_B,1U_M,1U_T
Bandwidth	Occupied Bandwidth	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		EUT Conf.	5M_B,5M_M,5M_T 10M_B,10M_M,10M_T 15M_B,15M_M,15M_T 20M_B,20M_M,20M_T 1U_B,1U_M,1U_T
		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		EUT Conf.	5M_B,5M_M,5M_T 10M_B,10M_M,10M_T 15M_B,15M_M,15M_T 20M_B,20M_M,20M_T 1U_B,1U_M,1U_T
	Emission Bandwidth	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		EUT Conf.	5M_B,5M_M,5M_T 10M_B,10M_M,10M_T 15M_B,15M_M,15M_T 20M_B,20M_M,20M_T 1U_B,1U_M,1U_T
Band Edges Compliance		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		EUT Conf.	5M_B,5M_T 20M_B,20M_T 1U_B,1U_T 2U_B,2U_T

Test Case		Test Conditions	
Spurious Emission at Antenna Terminals		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		EUT Conf.	5M_B,5M_M,5M_T 1U_B,1U_M,1U_T 2U_B,2U_M,2U_T 1U1L5M_B, 1U1L5M_M, 1U1L5M_T
Field Strength of Spurious Radiation		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 3
		EUT Conf.	1U_M (Worst case)
			NOTE: If applicable, the EUT Conf. that has maximum power density (based on the equivalent power level) is selected.
Frequency Stability	Frequency Error	Test Env.	(1) -30 °C to +50 °C with step 10 °C at Rated Voltage; (2) 85%, 100% and 115% of Rated Voltage at Ambient Climate.
		Test Setup	Test Setup 2
		EUT Conf.	5M_M
			NOTE: A representative EUT Conf. was selected since the un-modulation carrier configuration was required by the standards/rules.
	Frequency Range (if required)	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 2
		EUT Conf.	Not applicable
Receiver Spurious Emissions		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		EUT Conf.	Not applicable



5 Main Test Instruments

NOTE: Unless otherwise specified, the calibration intervals for test instruments were Annual (per year). The other intervals, if applicable, are marked with (##y), which denotes ## years calibration interval.

Equipment Name	Manufacturer	Model	Serial Number	Cal. Due
Test Setup 1 & 2				
Spectrum Analyzer	R&S	FSQ40	100025	2015-10-27
Spectrum Analyzer	R&S	FSQ26	201082	2015-03-17
Spectrum Analyzer	R&S	FSQ26	200941	2015-06-23
Spectrum Analyzer	Agilent	E4440A	MY49420179	2015-08-29
Spectrum Analyzer	Agilent	N9020A	MY51240619	2015-02-18
Vector Signal Generator	Agilent	E8257D	MY49281095	2015-11-03
Temperature Chamber	ESPEC	EW0470S	12113066	2015-10-20
Test Setup 3				
EMI Test receiver	Agilent	N9038A	MY52260169	2015-11-23
Spectrum analyser	Agilent	N9010A	MY52220816	2015-03-17
Bilog Antenna	TESQ	CBL 6112D	35238	2015-12-01
Horn Antenna	SWARZBECK	BBHA 9120D	1077	2015-12-01
Horn Antenna	ETS	3160-09	00117544	2015-12-26

6 Measurement Uncertainty

For a 95% confidence level ($k = 2$), the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 as following:

Test Item		Extended Uncertainty
Transmitter Output Power	Power [dBm]	U = 0.39 dB
Bandwidth	Magnitude [%]	U = 0.2%
Band Edge Compliance	Disturbance Power [dBm]	U = 2.0 dB
Spurious Emissions, Conducted	Disturbance Power [dBm]	U = 2.0 dB
Field Strength of Spurious Radiation	ERP [dBm]	For 3 m Chamber: U = 4.6 dB (30 MHz to 1GHz) U = 3.0 dB (above 1 GHz) For 10 m Chamber: U = 4.6 dB (30 MHz to 1GHz) U = 3.0 dB (above 1 GHz)
Frequency Stability	Frequency Accuracy [ppm]	U = 0.21 ppm

END