



RF Test Report

Product Name: Remote Radio Unit

Product Model: RRU3931E

Report Number: SYBH(R)02282323EB-1

FCC ID: QISRRU3931E

IC: 6369A-RRU3931E

Reliability Laboratory of Huawei Technologies Co., Ltd.

Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District,
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2. The laboratory has Passed the accreditation by The American Association for Laboratory Accreditation (A2LA). The accreditation number is 2174.01.
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 - 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).
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7. The test report is only valid for the test samples.
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Applicant: Huawei Technologies Co., Ltd.
Address: Administration Building, Headquarters of Huawei Technologies Co., Ltd.,
 Bantian, Longgang District, Shenzhen, 518129, P.R.C
Product Name: Remote Radio Unit
Product Model: RRU3931E

Date of Receipt Sample: 2015-08-20
Start Date of Test: 2015-08-20
End Date of Test: 2016-03-14

Test Result: Pass

Approved by Senior Engineer:	2016-03-26	Zhang Xinghai	<i>Zhang Xing hai</i>
	Date	Name	Signature

Prepared by:	2016-03-26	Hu Wei	<i>Hu Wei</i>
	Date	Name	Signature



Modification Record

No.	Last Report No.	Modification Description
1	---	First report. The RF module of RRU3931E is just the same with BTS3911E, so the conducted test data of RRU3931E is just quoted from the test data of BTS3911E with report No. SYBH(R)01982571EB-1(FCC ID: QISBTS3911E, IC ID: 6369A-BTS3911E), only the RSE test data is new tested.



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1 General Information

1.1 Applied Standard

Applied Rules: 47 CFR FCC Part 2 (10-1-14 Edition)
47 CFR FCC Part 24 (10-1-14 Edition)
47 CFR FCC Part 27 (10-1-14 Edition)
IC RSS-Gen (Issue 4, November 2014)
IC RSS-133 (Issue 6, January 2013)
IC RSS-139 (Issue 3, July 2015)

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: 23 to 27.5 °C (Ambient)
Relative Humidity: 48.5 to 63 % (Ambient)
Atmospheric Pressure: Not applicable



2 Test Summary

2.1 PCS Band (1850-1915 MHz paired with 1930-1995 MHz)

2.1.1 Measurement Technical Requirements

Test Item	FCC Rule	IC Rule	Requirements			Test Result	Verdict	Test Location
Transmitter Output Power	§2.1046, §24.232	RSS-Gen,§6.12; RSS-133,§6.4; RSS-133,§4.1	FCC	Base Station	<ul style="list-style-type: none"> Average EIRP Power \leq 1640 W (for EBW \leq 1 MHz). Average EIRP PD \leq 1640 W/MHz (for EBW $>$ 1 MHz). PAPR \leq 13 dB@0.1%. 	Annex A1	Pass	TL1
				Mobile Station / Portable Station	<ul style="list-style-type: none"> Average EIRP \leq 2 W. PAPR \leq 13 dB@0.1%. 			
			IC	Base Station	<ul style="list-style-type: none"> Average EIRP Power \leq 1640 W (for ChBW \leq 1 MHz). Average EIRP PD \leq 1640 W/MHz (for ChBW $>$ 1 MHz). Average Conducted Power \leq 100 W(For 1930-1995 MHz). PAPR \leq 13 dB@0.1%. 			
				Mobile Station / Hand-held Portable Station	<ul style="list-style-type: none"> Average EIRP Power \leq 2 W. PAPR \leq 13 dB@0.1%. 			
Bandwidth	§2.1049, §24.238	RSS-Gen,§6.6; RSS-133,§2.3	FCC	<ul style="list-style-type: none"> OBW: No limit. EBW (-26 dBc): No limit. 	Annex B1	Pass	TL1	



Test Item	FCC Rule	IC Rule	Requirements		Test Result	Verdict	Test Location
			IC	<ul style="list-style-type: none"> OBW: No limit, may in lieu of EBW (-20 dBc). EBW (-20 dBc): No limit. 			
Band Edges Compliance / Emission Mask	§2.1051, §24.238	RSS-Gen,§6.13; RSS-133,§6.5	FCC	$\leq -13 \text{ dBm}/1\% \cdot \text{EBW}$, in 1 MHz bands immediately outside and adjacent to the frequency block. (EBW is -26 dBc EBW)	Annex C1	Pass	TL1
			IC	$\leq -13 \text{ dBm}/1\% \cdot \text{EBW}$, 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, §24.238	RSS-Gen,§6.13; RSS-133,§6.5	$\leq -13 \text{ dBm}/1 \text{ MHz}$, from 9 kHz to 10 th harmonics but outside authorized operating frequency blocks.		Annex D1	Pass	TL1
Field Strength of Spurious Radiation / Radiated Spurious Emissions	§2.1053, §24.238	RSS-Gen,§6.13; RSS-133,§6.5	$\leq -13 \text{ dBm}/1 \text{ MHz}$.		Annex E1	Pass	TL3
Frequency Stability	§2.1055, §24.235	RSS-Gen,§6.11; RSS-133,§6.3	FCC	<ul style="list-style-type: none"> Test method: Fundamental emissions (Fc_meas) within the authorized frequency block. Test conditions: (1) NV, -30°C/.../+50°C step=+10°C. (2) NT, $\pm 15\% \cdot \text{NV}$. 	Annex F1	Pass	TL1
			IC	Base Station <ul style="list-style-type: none"> Test method option #1: $(\text{Fc_meas} - \text{Fc_meas}@20^\circ\text{C}\&\text{NV}) / \text{Fc_meas}@20^\circ\text{C}\&\text{NV} \leq \pm 1.0 \text{ ppm}$. Test method option#2: EBW (EBW_lower to EBW_higher) within frequency block. Test conditions: (1) NV, -30°C/+20°C/+50°C. (2) +20°C, $\pm 15\% \cdot \text{NV}$. (EBW is -20 dBc EBW, or OBW)			



Test Item	FCC Rule	IC Rule	Requirements	Test Result	Verdict	Test Location
			Mobile Station <ul style="list-style-type: none"> Test method option #1: (Fc_meas - Fc_meas@20°C&NV) / Fc_meas@20°C&NV ≤ ±2.5 ppm. Test method option #2: EBW (EBW_lower to EBW_higher) within frequency block. Test conditions: (1) NV, -30°C/+20°C/+50°C. (2) +20°C, ±15%*NV. (EBW is -20 dBc EBW, or OBW) 			
Receiver Spurious Emissions	---	RSS-Gen,§5; RSS-Gen,§7	---	Annex G1	---	---

2.1.2 Non-measurement Technical Requirements

Description	FCC Rule	IC Rule	Requirements	Test Result	Verdict
Frequency Plan	§24.229	RSS-133,§6.1	1850-1915 MHz paired with 1930-1995 MHz: 	See technical specification description.	Comply
Modulation Characteristics	§2.1047	RSS-133,§6.2	Digital modulation.	See technical specification description.	Comply



2.2 AWS Band(1710-1780 MHz paired with 2110-2180 MHz)

2.2.1 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,§6.5; RSS-139,§4.1	FCC	Base Station / Fixed Station	<ul style="list-style-type: none"> Average EIRP Power ≤ 1640 W (for EBW ≤ 1 MHz)(for 2110 - 2180 MHz). Average EIRP PD ≤ 1640 W/MHz (for EBW > 1 MHz)(for 2110 - 2180 MHz). Average EIRP Power ≤ 1 W (for 1710-1755 MHz) PAPR ≤ 13 dB@0.1%. 	Annex A2	Pass	TL1
				Mobile Station / Portable Station	<ul style="list-style-type: none"> Average EIRP Power ≤ 1 W(For 1710-1780 MHz). PAPR ≤ 13dB@0.1%. 			
			IC	Base Station / Fixed Station	<ul style="list-style-type: none"> Average EIRP Power ≤ 1640 W (for ChBW ≤ 1 MHz)(For 2110 - 2180 MHz). Average EIRP PD ≤ 1640 W/MHz (for ChBW > 1 MHz)(For 2110 - 2180 MHz). Average EIRP Power ≤ 1 W (for 1710-1780 MHz) PAPR ≤ 13 dB@0.1%. 			
				Mobile and Portable Transmitter	<ul style="list-style-type: none"> Average EIRP Power ≤ 1 W(For 1710-1780 MHz). PAPR ≤ 13dB@0.1%. 			
Bandwidth	§2.1049, §27.53(h)	RSS-Gen,§6.6; RSS-139,§2.3	FCC	<ul style="list-style-type: none"> OBW: No limit. EBW (-26 dBc): No limit. 	Annex B2	Pass	TL1	
			IC	<ul style="list-style-type: none"> OBW: No limit. EBW (-20 dBc): No limit. 				



Test Item	FCC Rule	IC Rule	Requirements	Test Result	Verdict	Test Location	
Band Edges Compliance / Emission Mask	§2.1051, §27.53(h)	RSS-Gen,§6.13; RSS-139,§6.6	FCC	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block. (EBW is -26 dBc EBW)	Annex C2	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,§6.6	≤ -13 dBm/1 MHz, from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges.		Annex D2	Pass	TL1
Field Strength of Spurious Radiation / Radiated Spurious Emissions	§2.1053, §27.53(h)	RSS-Gen,§6.13; RSS-139,§6.6	≤ -13 dBm/1 MHz.		Annex E2	Pass	TL3
Frequency Stability	§2.1055, §27.54	RSS-Gen,§6.11; RSS-139,§6.4	FCC	<ul style="list-style-type: none"> ● 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, ±15%*NV. 	Annex F2	Pass	TL1
			IC	<ul style="list-style-type: none"> ● Test method: OBW within frequency block. ● Test conditions: (1) NV, -30°C/+20°C/+50°C. (2) +20°C, ±15%*NV. 			
Receiver Spurious Emissions	---	RSS-Gen,§5; RSS-Gen,§7;	---		Annex G2	---	---

2.2.2 Non-measurement Technical Requirements

Description	FCC Rule	IC Rule	Requirements	Test Result	Verdict
Frequency Plan	§27.5(h) §27.5(j)	RSS-139,§6.1	1710-1780 MHz paired with 2110-2180 MHz:	See technical specification description.	Comply



Description	FCC Rule	IC Rule	Requirements	Test Result	Verdict
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 RRU3931E is an outdoor remote radio unit which is powered by AC power. It is the RF module of the distributed base station. RRU3931E is classified into RRUs with external antennas and RRUs with internal antennas. The RRU3931E performs modulation, demodulation, data processing, and combination and division of baseband signals and RF signals. By using the software-defined radio (SDR) technology, the RRU3931E can work in LTE/UMTS/UL modes.

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
WD6AIMXGW01	Ver.D	Manufactured Board,RRU3931E,WD6AIMXGW01,Transceiver Board,4T4R,PCS/AWS,1*1

3.2.2 Sub-Assembly

Sub-Assembly		
Sub-Assembly Name	Manufacturer	Description
---	---	---



3.3 Technical Specification

3.3.1 PCS Band

Characteristics	Description
Radio System Type	Single Radio <input type="checkbox"/> GSM Access Technology <input checked="" type="checkbox"/> UMTS (Single-RAT): <input checked="" type="checkbox"/> LTE <input type="checkbox"/> CDMA <input type="checkbox"/> WiMAX Multi-Standard <input type="checkbox"/> GSM & UMTS Radio <input type="checkbox"/> GSM & LTE (MSR): <input type="checkbox"/> GSM & UMTS & LTE <input checked="" type="checkbox"/> UMTS & LTE <input type="checkbox"/> WiMAX & LTE <input type="checkbox"/> CDMA & LTE
Equipment Type	#1 <input checked="" type="checkbox"/> Base Station <input type="checkbox"/> CPE (Customer Premises Equipment) Station <input type="checkbox"/> Subscriber Station (User Equipment) #2 <input checked="" type="checkbox"/> Fixed Station <input type="checkbox"/> Mobile Station <input type="checkbox"/> Portable Station #3 <input type="checkbox"/> Indoor Station <input checked="" type="checkbox"/> Outdoor Station
Supported Frequency Range	Transmission (TX): 1930 to 1990 MHz Receiving (RX): 1850 to 1910 MHz
TX and RX Antenna Ports	TX & RX port: 2 TX-only port: 0 RX-only port: 0
Multiple Carrier Supported	4
Maximum RF Bandwidth	40 MHz
TX Output Power	Max. 5 W (per port) Max. 10 W (two ports)
Supported Channel Bandwidth	GSM system: <input type="checkbox"/> 200 kHz UMTS system: <input checked="" type="checkbox"/> 5 MHz LTE system: <input type="checkbox"/> 1.4 MHz, <input type="checkbox"/> 3 MHz, <input checked="" type="checkbox"/> 5 MHz, <input checked="" type="checkbox"/> 10 MHz, <input checked="" type="checkbox"/> 15 MHz, <input checked="" type="checkbox"/> 20 MHz CDMA system: <input type="checkbox"/> 1.23 MHz, <input type="checkbox"/> 1.25 MHz WiMAX system: <input type="checkbox"/> 5 MHz, <input type="checkbox"/> 7 MHz, <input type="checkbox"/> 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



Characteristics	Description
	CDMA system: Not applicable 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: 4M14F9W LTE system: 4M48D9W, 8M95D9W, 13M4D9W, 17M9D9W CDMA system: Not applicable WiMAX system: Not applicable
Power Supply	Power Supply Type: <ul style="list-style-type: none"> <input checked="" type="checkbox"/> External AC mains, <input type="checkbox"/> External DC mains, <input type="checkbox"/> AC/DC Adapter, <input type="checkbox"/> Powered over Ethernet (PoE) Nominal Voltage, Input to EUT: 120 VAC Voltage Range, Input to EUT: 90VAC to 264VAC
Antenna Assembles	Antenna Type: <ul style="list-style-type: none"> <input checked="" type="checkbox"/> External <input type="checkbox"/> Integrated Smart Antenna: <ul style="list-style-type: none"> <input checked="" type="checkbox"/> MIMO <input checked="" type="checkbox"/> Non MIMO Antenna Gain: 12 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.

3.3.2 AWS Band

Characteristics	Description
Radio System Type	Single Radio <ul style="list-style-type: none"> <input type="checkbox"/> GSM Access Technology (Single-RAT): <ul style="list-style-type: none"> <input checked="" type="checkbox"/> UMTS <input checked="" type="checkbox"/> LTE <input type="checkbox"/> CDMA <input type="checkbox"/> WiMAX Multi-Standard Radio (MSR): <ul style="list-style-type: none"> <input type="checkbox"/> GSM & UMTS <input type="checkbox"/> GSM & LTE <input type="checkbox"/> GSM & UMTS & LTE <input checked="" type="checkbox"/> UMTS & LTE <input type="checkbox"/> WiMAX & LTE <input type="checkbox"/> CDMA & LTE
Equipment Type	#1 <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Base Station <input type="checkbox"/> CPE (Customer Premises Equipment) Station



Characteristics	Description
	<input type="checkbox"/> Subscriber Station (User Equipment) <input checked="" type="checkbox"/> Fixed Station <input type="checkbox"/> Mobile Station <input type="checkbox"/> Portable Station #2 <input type="checkbox"/> Indoor Station <input checked="" type="checkbox"/> Outdoor Station #3
Supported Frequency Range	Transmission (TX): 2110 to 2155 MHz Receiving (RX): 1710 to 1755 MHz
TX and RX Antenna Ports	TX & RX port: 2 TX-only port: 0 RX-only port: 0
Multiple Carrier Supported	4
Maximum RF Bandwidth	40 MHz
TX Output Power	Max. 5 W (per port) Max. 10 W (two ports)
Supported Channel Bandwidth	GSM system: <input type="checkbox"/> 200 kHz UMTS system: <input checked="" type="checkbox"/> 5 MHz LTE system: <input type="checkbox"/> 1.4 MHz, <input type="checkbox"/> 3 MHz, <input checked="" type="checkbox"/> 5 MHz, <input checked="" type="checkbox"/> 10 MHz, <input checked="" type="checkbox"/> 15 MHz, <input checked="" type="checkbox"/> 20 MHz CDMA system: <input type="checkbox"/> 1.23 MHz, <input type="checkbox"/> 1.25 MHz WiMAX system: <input type="checkbox"/> 5 MHz, <input type="checkbox"/> 7 MHz, <input type="checkbox"/> 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 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: 4M14F9W LTE system: 4M48D9W, 8M95D9W, 13M4D9W, 17M9D9W CDMA system: Not applicable WiMAX system: Not applicable
Power Supply	Power Supply Type: <input checked="" type="checkbox"/> External AC mains, <input type="checkbox"/> External DC mains, <input type="checkbox"/> AC/DC Adapter, <input type="checkbox"/> Powered over Ethernet (PoE) Nominal Voltage, 120 VAC Input to EUT: Voltage Range, 90VAC to 264VAC Input to EUT:



Characteristics	Description
Antenna Assembles	<p>Antenna Type: <input checked="" type="checkbox"/> External <input type="checkbox"/> Integrated</p> <p>Smart Antenna: <input checked="" type="checkbox"/> MIMO <input checked="" type="checkbox"/> Non MIMO</p> <p>Antenna Gain: 12 dBi (per antenna port, max.)</p> <p>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.</p>



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, <ul style="list-style-type: none"> ● 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 PCS Band

EUT Conf.	RF Ch	TX Freq. [MHz]	RX Freq. [MHz]	Ch. BW [MHz]	Power Level [dBm]	Test Mode
1L_5M_B	B	1932.5	---	5	37	LTE/TM1.1
1L_5M_M	M	1960	---	5	37	LTE/TM1.1
1L_5M_T	T	1987.5	---	5	37	LTE/TM1.1
1L_10M_B	B	1935	---	10	37	LTE/TM1.1
1L_10M_M	M	1960	---	10	37	LTE/TM1.1
1L_10M_T	T	1985	---	10	37	LTE/TM1.1
1L_15M_B	B	1937.5	---	15	37	LTE/TM1.1
1L_15M_M	M	1960	---	15	37	LTE/TM1.1
1L_15M_T	T	1982.5	---	15	37	LTE/TM1.1
1L_20M_B	B	1940	---	20	37	LTE/TM1.1
1L_20M_M	M	1960	---	20	37	LTE/TM1.1
1L_20M_T	T	1980	---	20	37	LTE/TM1.1
2L_5+5_B	B	1932.5,1967.5	---	5,5	34,34	LTE/TM1.1
2L_5+5_T	T	1952.5,1987.5	---	5,5	34,34	LTE/TM1.1
2L_20+20_B	B	1940,1960	---	20,20	34,34	LTE/TM1.1
2L_20+20_T	T	1960,1980	---	20,20	34,34	LTE/TM1.1
1U_B	B	1932.4	---	5	37	UMTS/TM1
1U_M	M	1960	---	5	37	UMTS/TM1

EUT Conf.	RF Ch	TX Freq. [MHz]	RX Freq. [MHz]	Ch. BW [MHz]	Power Level [dBm]	Test Mode
1U_T	T	1987.6	---	5	37	UMTS/TM1
2U_B	B	1932.4,1967.4	---	5,5	34,34	UMTS/TM1
2U_T	T	1952.6,1987.6	---	5,5	34,34	UMTS/TM1
3U_B	B	1932.4,1962.4,1967.4	---	5,5,5	32.2,32.2,32.2	UMTS/TM1
3U_T	T	1952.6,1982.6,1987.6	---	5,5,5	32.2,32.2,32.2	UMTS/TM1
4U_B	B	1932.4,1937.4,1962.4,1967.4	---	5,5,5,5	31,31,31,31	UMTS/TM1
4U_T	T	1952.6,1957.6,1982.6,1987.6	---	5,5,5,5	31,31,31,31	UMTS/TM1
1U1L_B	B	1932.4,1967.5	---	5,5	34,34	UL/TM1
1U1L_T	T	1952.4,1987.5	---	5,5	34,34	UL/TM1
2U1L_B	B	1932.4,1962.4,1967.5	---	5,5,5	32.3,32.3,32.3	UL/TM1
2U1L_T	T	1952.4,1982.4,1987.5	---	5,5,5	32.3,32.3,32.3	UL/TM1

4.2.2.2 AWS Band

EUT Conf.	RF Ch	TX Freq. [MHz]	RX Freq. [MHz]	Ch. BW [MHz]	Power Level [dBm]	Test Mode
1L_5M_B	B	2112.5	---	5	37	LTE/TM1.1
1L_5M_M	M	2132.5	---	5	37	LTE/TM1.1
1L_5M_T	T	2152.5	---	5	37	LTE/TM1.1
1L_10M_B	B	2115	---	10	37	LTE/TM1.1
1L_10M_M	M	2132.5	---	10	37	LTE/TM1.1
1L_10M_T	T	2150	---	10	37	LTE/TM1.1
1L_15M_B	B	2117.5	---	15	37	LTE/TM1.1
1L_15M_M	M	2132.5	---	15	37	LTE/TM1.1
1L_15M_T	T	2147.5	---	15	37	LTE/TM1.1
1L_20M_B	B	2120	---	20	37	LTE/TM1.1
1L_20M_M	M	2132.5	---	20	37	LTE/TM1.1
1L_20M_T	T	2145	---	20	37	LTE/TM1.1
2L_5+5_B	B	2112.5,2147.5	---	5,5	34,34	LTE/TM1.1
2L_5+5_T	T	2117.5,2152.5	---	5,5	34,34	LTE/TM1.1
2L_20+20_B	B	2120,2140	---	20,20	34,34	LTE/TM1.1
2L_20+20_T	T	2125,2145	---	20,20	34,34	LTE/TM1.1
1U_B	B	2112.4	---	5	37	UMTS/TM1



EUT Conf.	RF Ch	TX Freq. [MHz]	RX Freq. [MHz]	Ch. BW [MHz]	Power Level [dBm]	Test Mode
1U_M	M	2132.4	---	5	37	UMTS/TM1
1U_T	T	2152.6	---	5	37	UMTS/TM1
2U_B	B	2112.4,2147.4	---	5,5	34,34	UMTS/TM1
2U_T	T	2117.6,2152.6	---	5,5	34,34	UMTS/TM1
3U_B	B	2112.4,2142.4,2147.4	---	5,5,5	32.2,32.2,32.2	UMTS/TM1
3U_T	T	2117.6,2147.6,2152.6	---	5,5,5	32.2,32.2,32.2	UMTS/TM1
4U_B	B	2112.4,2117.4,2142.4,2147.4	---	5,5,5,5	31,31,31,31	UMTS/TM1
4U_T	T	2117.6,2122.6,2147.6,2152.6	---	5,5,5,5	31,31,31,31	UMTS/TM1
1U1L_B	B	2112.4,2147.5	---	5,5	34,34	UL/TM1
1U1L_T	T	2117.4,2152.5	---	5,5	34,34	UL/TM1
2U1L_B	B	2112.4, 2142.4,2147.5	---	5,5,5	32.3,32.3,32.3	UL/TM1
2U1L_T	T	2117.4, 2147.4,2152.5	---	5,5,5	32.3,32.3,32.3	UL/TM1

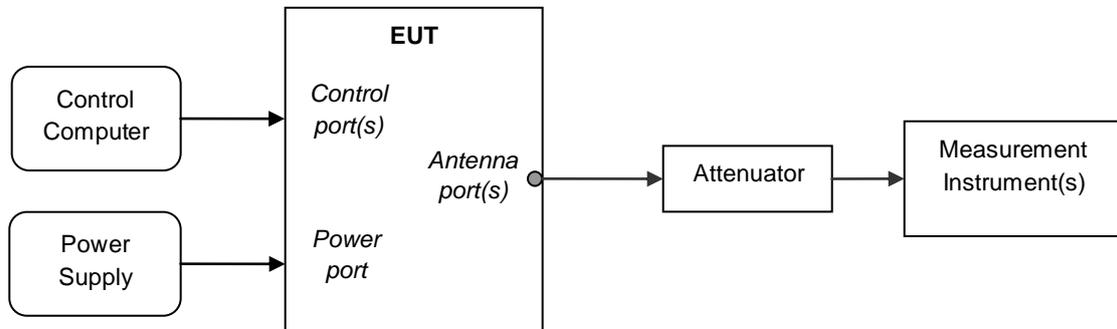


4.3 Test Environments

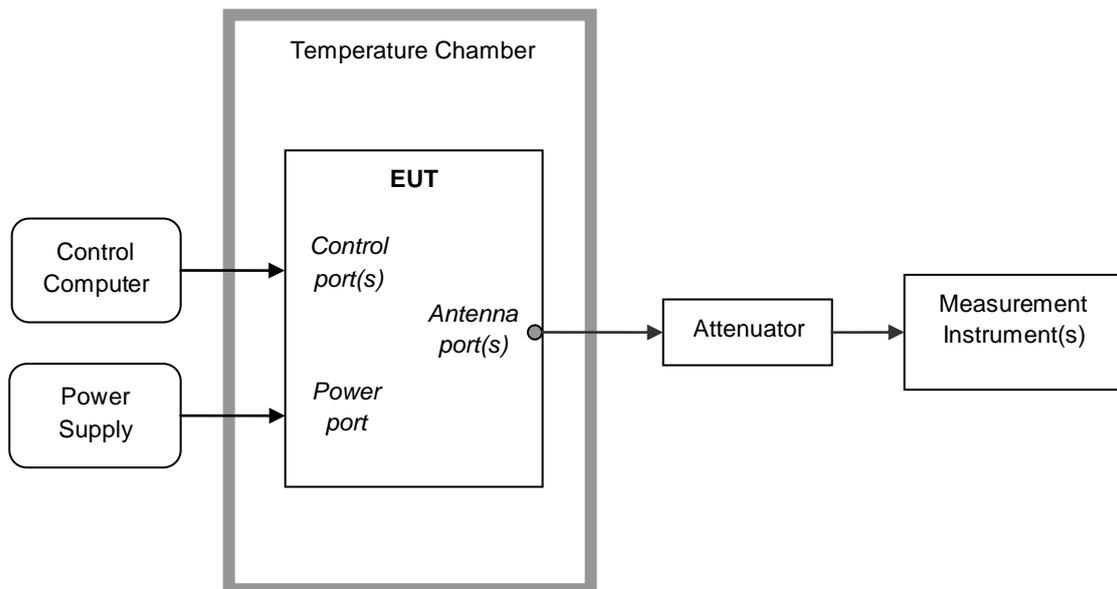
Environment Parameter	Selected Values During Tests		
	Temperature	Voltage	Relative Humidity
Ambient Climate	Ambient	---	Ambient
Rated Voltage	---	120 VAC	---

4.4 Test Setups

4.4.1 Test Setup 1



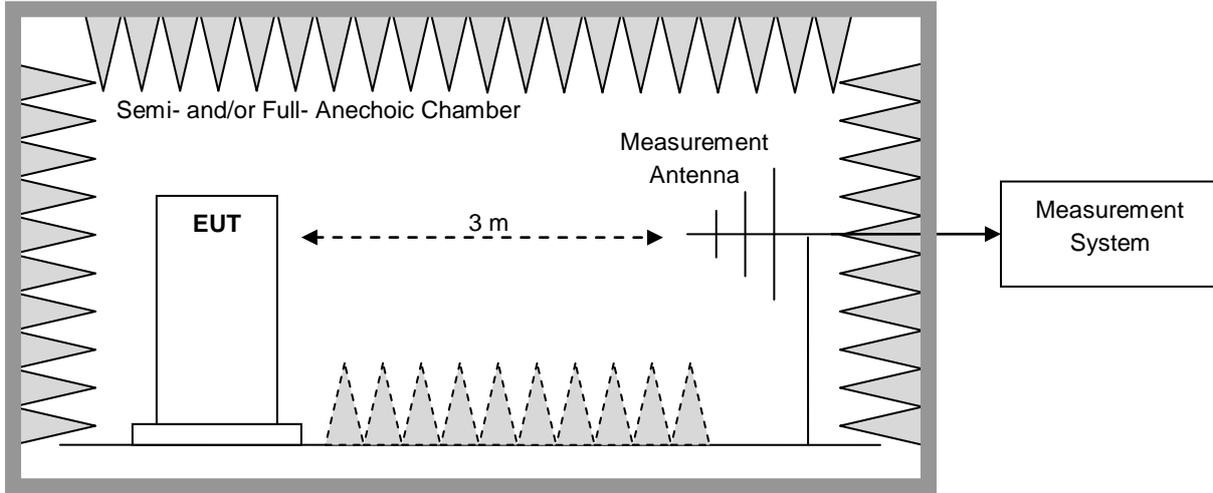
4.4.2 Test Setup 2



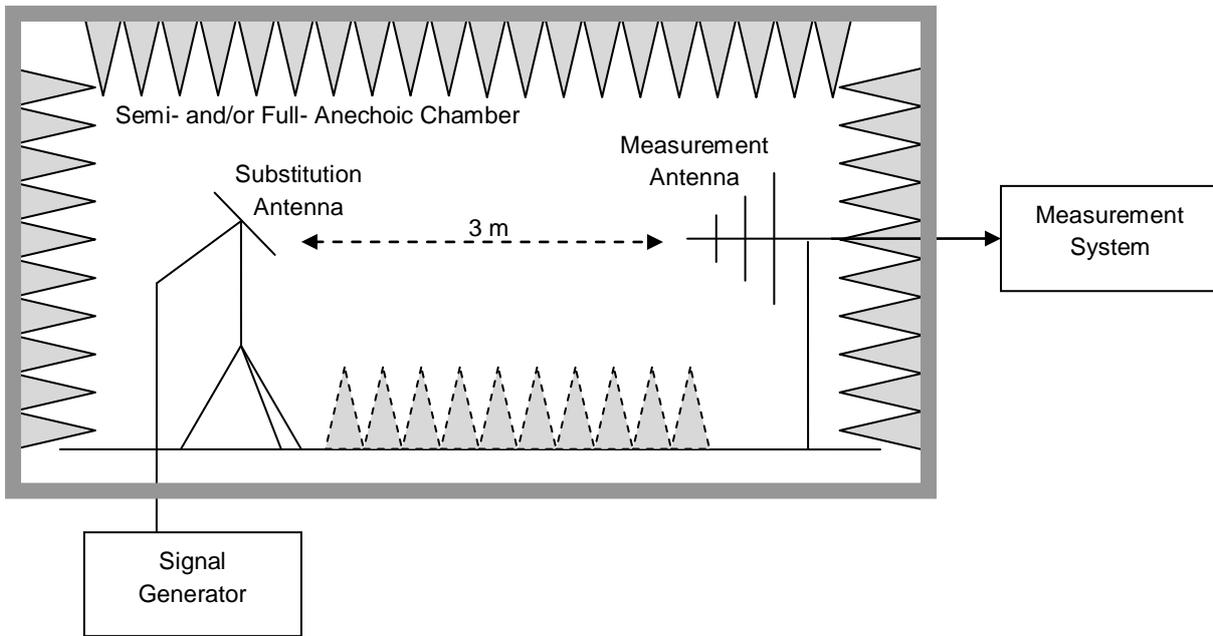
4.4.3 Test Setup 3

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 PCS Band

Test Case		Test Conditions	
Transmitter Output Power	Channel Power, Total	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		EUT Conf.	1L_5M_B, 1L_5M_M, 1L_5M_T 1L_10M_B, 1L_10M_M, 1L_10M_T 1L_15M_B, 1L_15M_M, 1L_15M_T 1L_20M_B, 1L_20M_M, 1L_20M_T 2L_5+5_B, 2L_5+5_T 2L_20+20_B, 2L_20+20_T 1U_B, 1U_M, 1U_T 2U_B, 2U_T 3U_B, 3U_T 4U_B, 4U_T 1U1L_B, 1U1L_T 2U1L_B, 2U1L_T
		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		EUT Conf.	1L_5M_B, 1L_5M_M, 1L_5M_T 1U_B, 1U_M, 1U_T
	Power Spectral Density	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		EUT Conf.	1L_5M_B, 1L_5M_M, 1L_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.	1L_5M_B, 1L_5M_M, 1L_5M_T 1L_20M_B, 1L_20M_M, 1L_20M_T 1U_B, 1U_M, 1U_T
Bandwidth	Occupied Bandwidth	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		EUT Conf.	1L_5M_B, 1L_5M_M, 1L_5M_T 1L_10M_B, 1L_10M_M, 1L_10M_T 1L_15M_B, 1L_15M_M, 1L_15M_T 1L_20M_B, 1L_20M_M, 1L_20M_T 1U_B, 1U_M, 1U_T
	Emission Bandwidth	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		EUT Conf.	1L_5M_B, 1L_5M_M, 1L_5M_T 1L_10M_B, 1L_10M_M, 1L_10M_T 1L_15M_B, 1L_15M_M, 1L_15M_T 1L_20M_B, 1L_20M_M, 1L_20M_T 1U_B, 1U_M, 1U_T
Band Edges Compliance		Test Env.	Ambient Climate & Rated Voltage



Test Case		Test Conditions	
		Test Setup	Test Setup 1
		EUT Conf.	1L_5M_B, 1L_5M_T 1L_20M_B, 1L_20M_T 1U_B, 1U_T 1U1L_B, 1U1L_T
Spurious Emission at Antenna Terminals		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		EUT Conf.	1L_5M_B, 1L_5M_M, 1L_5M_T 1L_20M_B, 1L_20M_M, 1L_20M_T 1U_B, 1U_M, 1U_T 1U1L_B, 1U1L_T
Field Strength of Spurious Radiation		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 3
		EUT Conf.	1U1L_B (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.	1L_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

4.5.2 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.	1L_5M_B, 1L_5M_M, 1L_5M_T 1L_10M_B, 1L_10M_M, 1L_10M_T 1L_15M_B, 1L_15M_M, 1L_15M_T 1L_20M_B, 1L_20M_M, 1L_20M_T



Test Case		Test Conditions			
			2L_5+5_B, 2L_5+5_T 2L_20+20_B, 2L_20+20_T 1U_B, 1U_M, 1U_T 2U_B, 2U_T 3U_B, 3U_T 4U_B, 4U_T 1U1L_B, 1U1L_T 2U1L_B, 2U1L_T		
		Power Spectral Density	Test Env.	Ambient Climate & Rated Voltage	
			Test Setup	Test Setup 1	
			EUT Conf.	1L_5M_B, 1L_5M_M, 1L_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.	1L_5M_B, 1L_5M_M, 1L_5M_T 1L_20M_B, 1L_20M_M, 1L_20M_T 1U_B, 1U_M, 1U_T	
		Bandwidth	Occupied Bandwidth	Test Env.	Ambient Climate & Rated Voltage
				Test Setup	Test Setup 1
EUT Conf.	1L_5M_B, 1L_5M_M, 1L_5M_T 1L_10M_B, 1L_10M_M, 1L_10M_T 1L_15M_B, 1L_15M_M, 1L_15M_T 1L_20M_B, 1L_20M_M, 1L_20M_T 1U_B, 1U_M, 1U_T				
Emission Bandwidth	Test Env.		Ambient Climate & Rated Voltage		
	Test Setup		Test Setup 1		
	EUT Conf.		1L_5M_B, 1L_5M_M, 1L_5M_T 1L_10M_B, 1L_10M_M, 1L_10M_T 1L_15M_B, 1L_15M_M, 1L_15M_T 1L_20M_B, 1L_20M_M, 1L_20M_T 1U_B, 1U_M, 1U_T		
Band Edges Compliance	Test Env.	Ambient Climate & Rated Voltage			
	Test Setup	Test Setup 1			
	EUT Conf.	1L_5M_B, 1L_5M_T 1L_20M_B, 1L_20M_T 1U_B, 1U_T 1U1L_B, 1U1L_T			
Spurious Emission at Antenna Terminals	Test Env.	Ambient Climate & Rated Voltage			
	Test Setup	Test Setup 1			
	EUT Conf.	1L_5M_B, 1L_5M_M, 1L_5M_T 1L_20M_B, 1L_20M_M, 1L_20M_T 1U_B, 1U_M, 1U_T			



Test Case		Test Conditions	
			1U1L_B, 1U1L_T
Field Strength of Spurious Radiation		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 3
		EUT Conf.	1U1L_B (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.	1L_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	2017-02-28
Spectrum Analyzer	R&S	FSQ26	200941	2016-04-20
Spectrum Analyzer	Agilent	E4440A	MY49420179	2017-02-28
Spectrum Analyzer	Agilent	N9020A	MY51240619	2016-11-19
Vector Signal Generator	Agilent	E8257D	MY49281095	2016-10-29
Power supply	Chroma	6530	653000008611	2016-10-20
Temperature Chamber	ESPEC	EW0470S	12113066	2016-11-08
Test Setup 3				
EMI Test receiver	Agilent	N9038A	MY52260169	2016-10-26
Spectrum analyser	Agilent	N9010A	MY52220816	2017-01-10
Bilog Antenna	TESQ	CBL 6112D	35238	2017-11-27
Horn Antenna	SWARZBECK	BBHA 9120D	1077	2017-11-27
Horn Antenna	ETS	3160-09	00117544	2017-11-06



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