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TESTING
CNAS L0310



RF Test Report

Product Name: Remote Radio Unit

Product Model: RRU3971

Report Number: SYBH(R)02495614EB-4

FCC ID: QISRRU3971PCS

IC: 6369A-RRU3971PCS

Reliability Laboratory of Huawei Technologies Co., Ltd.

Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District,
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Notice

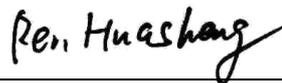
1. The laboratory has passed the accreditation by China National Accreditation Service for Conformity Assessment (CNAS). The accreditation number is L0310.
2. The laboratory has passed the accreditation by The American Association for Laboratory Accreditation (A2LA). The accreditation number is 2174.01.
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-1.
 - 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 laboratory (Reliability Lab of Huawei Technologies Co., Ltd) is also named as "Global Compliance and Testing Center of Huawei Technologies Co., Ltd"; the both names have coexisted since 2009.
6. The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
7. The test report is invalid if there is any evidence of erasure and/or falsification.
8. The test report is only valid for the test samples.
9. 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: Remote Radio Unit
Product Model: RRU3971

Date of Receipt Sample: 2015-11-20
Start Date of Test: 2015-11-23
End Date of Test: 2015-12-05

Test Result: Pass

Approved by Senior Engineer:	2016-07-21	Ren Huasheng	
	Date	Name	Signature

Prepared by:	2016-07-21	Li Guo	
	Date	Name	Signature



Modification Record

No.	Last Report No.	Modification Description
1	---	First report.
2	SYBH(R)02141419EB-1	Change the Product model name



CONTENT

1	General Information.....	6
1.1	Applied Standard.....	6
1.2	Test Location	6
1.3	Test Environment Condition.....	6
2	Test Summary	7
2.1	PCS Band (1850-1915 MHz paired with 1930-1995 MHz).....	7
3	Description of the Equipment under Test (EUT).....	10
3.1	General Description	10
3.2	EUT Identity	10
3.3	Technical Specification	11
4	General Test Conditions / Configurations.....	15
4.1	EUT Configurations.....	15
4.2	Test Environments	18
4.3	Test Setups.....	19
4.4	Test Conditions	21
5	Main Test Instruments	25
6	Measurement Uncertainty.....	26



1 General Information

1.1 **Applied Standard**

Applied Rules: 47 CFR FCC Part 2 (10-1-13 Edition)
47 CFR FCC Part 24 (10-1-13 Edition)

IC RSS-Gen (Issue 4, November 2014)
IC RSS-133 (Issue 6, January 2013)

Test Method: FCC KDB 971168 D01 Power Meas License Digital Systems v02r02
(if applicable) FCC KDB 662911 D01 Multiple Transmitter Output v02r01
MILLIMETER WAVE TEST PROCEDURES (TCB council members & FCC lab)
TR 14-1001 MMW Measurements with Harmonic Mixers (FCC)

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: 15 to 30 °C (Ambient)
Relative Humidity: 20 to 85 % (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,§4.8; RSS-133,§6.4; RSS-133,§4.1	FCC	Base Station	<ul style="list-style-type: none"> Average EIRP Power ≤ 1640 W (for EBW ≤ 1 MHz). Average EIRP PD ≤ 1640 W/MHz (for EBW > 1 MHz). PAPR ≤ 13 dB@0.1%. 	Annex A	Pass	TL1
				Mobile Station / Portable Station	<ul style="list-style-type: none"> Average EIRP ≤ 2 W. PAPR ≤ 13 dB@0.1%. 			
			IC	Base Station	<ul style="list-style-type: none"> Average EIRP Power ≤ 1640 W (for ChBW ≤ 1 MHz). Average EIRP PD ≤ 1640 W/MHz (for ChBW > 1 MHz). Average Conducted Power ≤ 100 W. PAPR ≤ 13 dB@0.1%. 			
				Mobile Station / Hand-held Portable Station	<ul style="list-style-type: none"> Average EIRP Power ≤ 2 W. PAPR ≤ 13 dB@0.1%. 			
Bandwidth	§2.1049, §24.238	RSS-Gen,§4.6; RSS-133,§2.3	FCC	<ul style="list-style-type: none"> OBW: No limit. EBW (-26 dBc): No limit. 		Annex B	Pass	TL1
			IC	<ul style="list-style-type: none"> OBW: No limit, may in lieu of EBW (-20 dBc). 				



Test Item	FCC Rule	IC Rule	Requirements		Test Result	Verdict	Test Location
				<ul style="list-style-type: none"> EBW (-20 dBc): No limit. 			
Band Edges Compliance / Emission Mask	§2.1051, §24.238	RSS-Gen,§4.9; 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 C	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,§4.9; 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 D	Pass	TL1
Field Strength of Spurious Radiation / Radiated Spurious Emissions	§2.1053, §24.238	RSS-Gen,§4.9; RSS-133,§6.5	$\leq -13 \text{ dBm}/1 \text{ MHz}$.		Annex E	Pass	TL3
Frequency Stability	§2.1055, §24.235	RSS-Gen,§4.7; 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, ±15%*NV. 	Annex F	Pass	TL1
			IC	Base Station <ul style="list-style-type: none"> Test method option #1: $(F_c_meas - F_c_meas@20^\circ\text{C}\&\text{NV}) / F_c_meas@20^\circ\text{C}\&\text{NV} \leq \pm 1.0 \text{ ppm}$. 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, ±15%*NV. (EBW is -20 dBc EBW, or OBW) 			
			Mobile Station	<ul style="list-style-type: none"> Test method option #1: 			



Test Item	FCC Rule	IC Rule	Requirements	Test Result	Verdict	Test Location
			$(F_{c_meas} - F_{c_meas@20^{\circ}C\&NV}) / F_{c_meas@20^{\circ}C\&NV} \leq \pm 2.5 \text{ ppm.}$ <ul style="list-style-type: none"> 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, $\pm 15\% * NV$. (EBW is -20 dBc EBW, or OBW) 			
Receiver Spurious Emissions	---	IC NOTICE 2012-DRS0126	---	Annex G	---	---

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



3 Description of the Equipment under Test (EUT)

3.1 General Description

The RRU3971 1900M is an outdoor remote radio unit. It is the RF part of a distributed base station, powered by a power cabinet, and can be located near the antenna. The RRU3971 1900M performs modulation, demodulation, data processing, and combination and division of baseband signals and RF signals. With the Software Defined Radio (SDR) technology, the RRU3971 1900M can support the UL dual-mode operation through corresponding software configuration.

The RRU3971 1900M has a dual-transmitter and dual-receiver (4T4R) design, which further improves the output power and the carrier capacity.

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
WD51JRXG20	Ver.C	Manufactured Board,MARP RRU,WD51JRXG20,Transceiver Board,4T4R,1900M,1*1

3.2.2 Sub-Assembly

Sub-Assembly			
Sub-Assembly Name	Model	Manufacturer	Description
UMPT	--	Huawei	Universal Main Processing & Transmission unit
UBBP	--	Huawei	Baseband Processing and Interface Unit



3.3 Technical Specification

Characteristics	Description	
Radio System Type	<input type="checkbox"/> GSM (GO) <input checked="" type="checkbox"/> UMTS (UO) <input checked="" type="checkbox"/> LTE (LO) <input type="checkbox"/> CDMA (CO) <input checked="" type="checkbox"/> GSM & UMTS (GU) <input checked="" type="checkbox"/> GSM & LTE (GL) <input checked="" type="checkbox"/> UMTS & LTE (GL) <input type="checkbox"/> GSM & UMTS & LTE (GUL) <input type="checkbox"/> CDMA & LTE (CL) Notes: GSM is only applied on antenna connector A and B	
Equipment Type	Type #1	<input checked="" type="checkbox"/> Base Station Equipment <input type="checkbox"/> CPE (Customer Premises Equipment) Equipment <input type="checkbox"/> Subscriber Equipment (User Equipment) <input type="checkbox"/> Fixed Point-to-Point Equipment
	Type #2	<input checked="" type="checkbox"/> Fixed <input type="checkbox"/> Mobile <input type="checkbox"/> Portable
	Type #3	<input checked="" type="checkbox"/> Indoor <input type="checkbox"/> Outdoor
Frequency Range (Transmission (TX) and Receiving (RX))	#1	TX: 1930 to 1990 MHz RX: 1850 to 1910 MHz
TX and RX Antenna Ports	TX & RX port: 4, TX-only port: 0, RX-only port: 0	
Multiple Carrier Supported	4	
Maximum RF Bandwidth	40 MHz	
TX Output Power	Max. 40 W (per antenna port) Max. 4*40 W (two antenna ports)	
Supported Channel Bandwidth	200 kHz 5 MHz 5 MHz, 10 MHz, 15 MHz, 20 MHz	
Modulation Type	GSM system:	Base-band: GMSK, 8PSK Carrier: TDMA
	UMTS system:	Base-band: QPSK, 16QAM, 64QAM Carrier: CDMA
	LTE system:	Base-band: QPSK, 16QAM, 64QAM Carrier: OFDM/OFDMA



Characteristics	Description	
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:	246KGXW, 245KG7W
	UMTS system:	4M15F9W
	LTE system:	4M51D9W, 8M99D9W, 13M5D9W, 18M0D9W
Power Supply	Type:	<input type="checkbox"/> External AC mains, <input checked="" type="checkbox"/> External DC mains, <input type="checkbox"/> AC/DC Adapter, <input type="checkbox"/> Powered over Ethernet (PoE)
	Nominal Voltage, Input to EUT:	-48 VDC
	Voltage Range, Input to EUT:	-36 to -57 VDC

3.3.1 Transmit Power Description for Antenna A&B

3.3.1.1 GU MSR System

Notes: For carrier configuration, G denotes GSM, U denotes UMTS, L denotes LTE

Carrier configuration	Transmit power (per antenna port)
2*G & 2*U	2*40.0 dBm (GSM) and 2*40.0 dBm (UMTS)
1*G & 2*U	1*43.0 dBm (GSM) and 2*40.0 dBm (UMTS)

3.3.1.2 GL MSR System

Carrier configuration	Transmit power (per antenna port)
1*G & 1*L	1*43.0 dBm (GSM) and 1*43.0 dBm (LTE)
	1*41.8 dBm (GSM) and 1*44.0 dBm (LTE)
1*G & 2*L	1* 43.0 dBm (GSM) and 2*40.0 dBm (LTE)
2*G & 1*L	2* 40.0 dBm (GSM) and 1*43.0 dBm (LTE)
	2* 41.8 dBm (GSM) and 1*40.0 dBm (LTE)
2*G & 2*L	2* 40.0 dBm (GSM) and 1*43.0 dBm (LTE)

3.3.1.3 UL MSR System

Carrier configuration	Transmit power (per antenna port)
1*U & 1*L	1*43.0 dBm (UMTS) & 1*43.0 dBm (LTE)
1*U & 2*L	1*43.0 dBm (UMTS) & 2*40.0 dBm (LTE)

3.3.1.4 UMTS System

Carrier configuration	Transmit power (per antenna port)
1*U	1*46.0 dBm
2*U	2*43.0 dBm

3.3.1.5 LTE System

Carrier configuration	Transmit power (per antenna port)
1*L	1*46.0 dBm (5MHz, 10MHz, 15MHz, 20MHz)
2*L	2*43.0 dBm (5MHz, 10MHz, 15MHz, 20MHz)

3.3.2 Transmit Power Description for Antenna C&D

3.3.2.1 UMTS System

Carrier configuration	Transmit power (per antenna port)
1*U	1*46.0 dBm
2*U	2*43.0 dBm 2*40.0 dBm

3.3.2.2 LTE System

Carrier configuration	Transmit power (per antenna port)
1*L	1*46.0 dBm (5MHz, 10MHz, 15MHz, 20MHz) 1*44.0 dBm (5MHz, 10MHz, 15MHz, 20MHz) 1*43.0 dBm (5MHz, 10MHz, 15MHz, 20MHz) 1*40.0 dBm (5MHz, 10MHz, 15MHz, 20MHz)
2*L	2*43.0 dBm (5MHz, 10MHz, 15MHz, 20MHz) 2*40.0 dBm (5MHz, 10MHz, 15MHz, 20MHz)

3.3.2.3 UL MSR System

Carrier configuration	Transmit power (per antenna port)
1*U & 1*L	1*43.0 dBm (UMTS) & 1*43.0 dBm (LTE)
1*U & 2*L	1*43.0 dBm (UMTS) & 2*40.0 dBm (LTE)
2*U & 1*L	2*41.8 dBm (UMTS) & 1*40.0 dBm (LTE) 2*40.0 dBm (UMTS) & 1*43.0 dBm (LTE)

3.3.3 Antenna Assemblies

NOTE 1: For the “external antenna” in the report:

- (1) It refers to the antenna external to the equipment, using an antenna connector with a cable and which has been designed or developed for one or more specific types of equipment.
- (2) It is the combination of external antenna and radio equipment that is expected to be compliant with the regulations. If the external antenna is not supplied by the equipment manufacturer, and also will not be equipped on sale, a typical or recommended configuration will be considered during lab testing. However, when the radio equipment is put into service, the practical maximum antenna gain may exceed the value as described; if this is the case, the combination of the practical output power (may be degraded) and the practical antenna gain should NOT exceed the required ERP/EIRP limit.

NOTE 2: The “integral antenna” in the report:

- (1) It refers to the antenna designed as a fixed part of the equipment, without the use of an external connector and which cannot be disconnected from the equipment by a user with the intent to connect another antenna.
- (2) For the testing purpose, a temporary RF connector may be provided.

NOTE 3: The antenna gain is the combination of basic gain (directional gain, G) and, if applicable, additional beam-forming gain (Y).

Characteristics	Description
Antenna Type	<input checked="" type="checkbox"/> External (antenna equipped on sale : <input type="checkbox"/> yes, <input checked="" type="checkbox"/> no) <input type="checkbox"/> Integral
Smart Antenna	<input type="checkbox"/> MIMO <input checked="" type="checkbox"/> Non MIMO
Antenna Gain	<input checked="" type="checkbox"/> External: 18 dBi (per antenna port, typically) <input type="checkbox"/> Integral: dBi (per antenna port, max.)

4 General Test Conditions / Configurations

4.1 EUT Configurations

4.1.1 General

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.

4.1.2 Test Modes

NOTE: The test mode(s) are selected according to relevant radio technology specifications.

Test Mode	Test Modes Description
GSM/GMSK	GSM system, GSM/GPRS, GMSK modulation
GSM/8PSK	GSM system, EDGE, 8PSK modulation
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
GU/TM1	MSR system, 3GPP TS 37.141 clause 4.9.2 (GSM/GMSK; UMTS/TM1)
GL/TM1	MSR system, 3GPP TS 37.141 clause 4.9.2 (GSM/GMSK; LTE/TM1.1)
UL/TM1	MSR system, 3GPP TS 37.141 clause 4.9.2 (UMTS/TM1; LTE/TM1.1)

4.1.3 Test Configurations

EUT Conf.	RF Ch.	Carrier Conf. Description	TX Freq. [MHz]	RX Freq. [MHz]	Ch. BW [MHz]	Power Level [dBm]	Test Mode
1U_TM1_B	B	1*U	1932.6	--	5.0	46.0	UMTS/TM1
1U_TM1_M	M	1*U	1960.0	--	5.0	46.0	UMTS/TM1
1U_TM1_T	T	1*U	1987.4	--	5.0	46.0	UMTS/TM1
2U_TM1_B	B	4*U	1932.6, 1967.8	--	5.0, 5.0,	43.0, 43.0	UMTS/TM1
2U_TM1_T	T	4*U	1952.2, 1987.4	--	5.0, 5.0,	43.0, 43.0	UMTS/TM1
1L_5M_TM1_B	B	1*L	1932.5	--	5.0	46.0	LTE/TM1.1
1L_5M_TM1_M	M	1*L	1960.0	--	5.0	46.0	LTE/TM1.1
1L_5M_TM1_T	T	1*L	1987.5	--	5.0	46.0	LTE/TM1.1
1L_10M_TM1_B	B	1*L	1935.0	--	10	46.0	LTE/TM1.1



EUT Conf.	RF Ch.	Carrier Conf. Description	TX Freq. [MHz]	RX Freq. [MHz]	Ch. BW [MHz]	Power Level [dBm]	Test Mode
1L_10M_TM1_M	M	1*L	1960.0	--	10	46.0	LTE/TM1.1
1L_10M_TM1_T	T	1*L	1985.0	--	10	46.0	LTE/TM1.1
1L_15M_TM1_B	B	1*L	1937.5	--	15	46.0	LTE/TM1.1
1L_15M_TM1_M	M	1*L	1960.0	--	15	46.0	LTE/TM1.1
1L_15M_TM1_T	T	1*L	1982.5	--	15	46.0	LTE/TM1.1
1L_20M_TM1_B	B	1*L	1940.0	--	20	46.0	LTE/TM1.1
1L_20M_TM1_M	M	1*L	1960.0	--	20	46.0	LTE/TM1.1
1L_20M_TM1_T	T	1*L	1980.0	--	20	46.0	LTE/TM1.1
2L_5M_TM1_B	B	2*L	1932.5, 1967.5	--	5.0, 5.0	43.0, 43.0	LTE/TM1.1
2L_5M_TM1_T	T	2*L	1952.5, 1987.5	--	5.0, 5.0	43.0, 43.0	LTE/TM1.1
2G2U_TM1_B	B	GUUG	1930.4, 1947.6, 1952.6, 1970.0	--	0.2, 5.0, 5.0, 0.2	40.0, 40.0, 40.0, 40.0	GU/TM1
2G2U_TM1_T	T	GUUG	1950.0, 1967.6, 1972.6, 1989.6	--	0.2, 5.0, 5.0, 0.2	40.0, 40.0, 40.0, 40.0	GU/TM1
1G_TM1_B (Note1)	B	1*G	1930.4	--	0.2	43.0	GSM/GMSK
1G_TM1_T (Note 2)	T	1*G	1989.6	--	0.2	43.0	GSM/GMSK
1G_TM2_B (Note1)	B	1*G	1930.4	--	0.2	43.0	GSM/8PSK
1G_TM2_T (Note 2)	T	1*G	1989.6	--	0.2	43.0	GSM/8PSK
2G2L_TM1_B	B	GLLG	1930.4, 1947.5, 1952.5, 1970.0	--	0.2, 5.0, 5.0, 0.2	40.0, 40.0, 40.0, 40.0	GL/TM1
2G2L_TM1_T	T	GLLG	1950.0, 1967.5, 1972.5, 1989.6	--	0.2, 5.0, 5.0, 0.2	40.0, 40.0, 40.0, 40.0	GL/TM1
1U2L_TM1_B	B	ULL	1932.6, 1952.5, 1967.5	--	5.0, 5.0, 5.0	43.0, 40.0, 40.0	UL/TM1
1U2L_TM1_T	T	ULL	1952.6, 1982.5, 1987.5	--	5.0, 5.0, 5.0	43.0, 40.0, 40.0	UL/TM1

Note 1: GSM single RAT operation is not declared by manufacture, so the GSM carrier is configured to test GSM characteristics combined with another 5MHz LTE carrier activated in 1967.5MHz. When this configuration is applied for specific test items, only GSM carrier should be tested.



EUT Conf.	RF Ch.	Carrier Conf. Description	TX Freq. [MHz]	RX Freq. [MHz]	Ch. BW [MHz]	Power Level [dBm]	Test Mode
<p>Note 2: GSM single RAT operation is not declared by manufacture, so the GSM carrier is configured to test GSM characteristics combined with another 5MHz LTE carrier activated in 1952.5MHz. When this configuration is applied for specific test items, only GSM carrier should be tested.</p>							

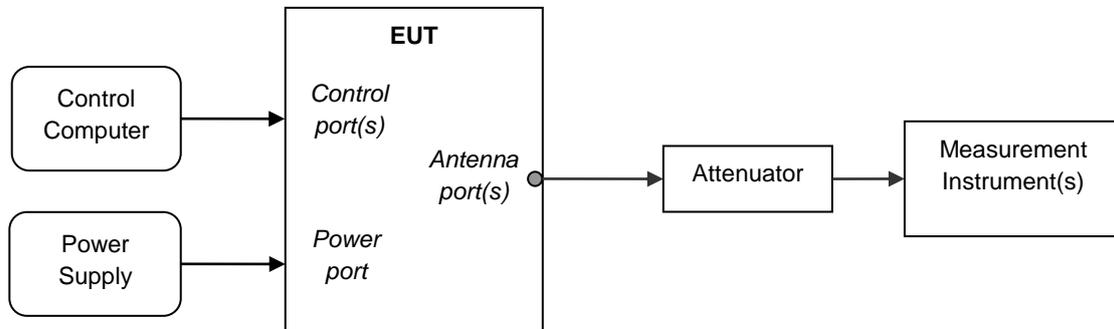


4.2 Test Environments

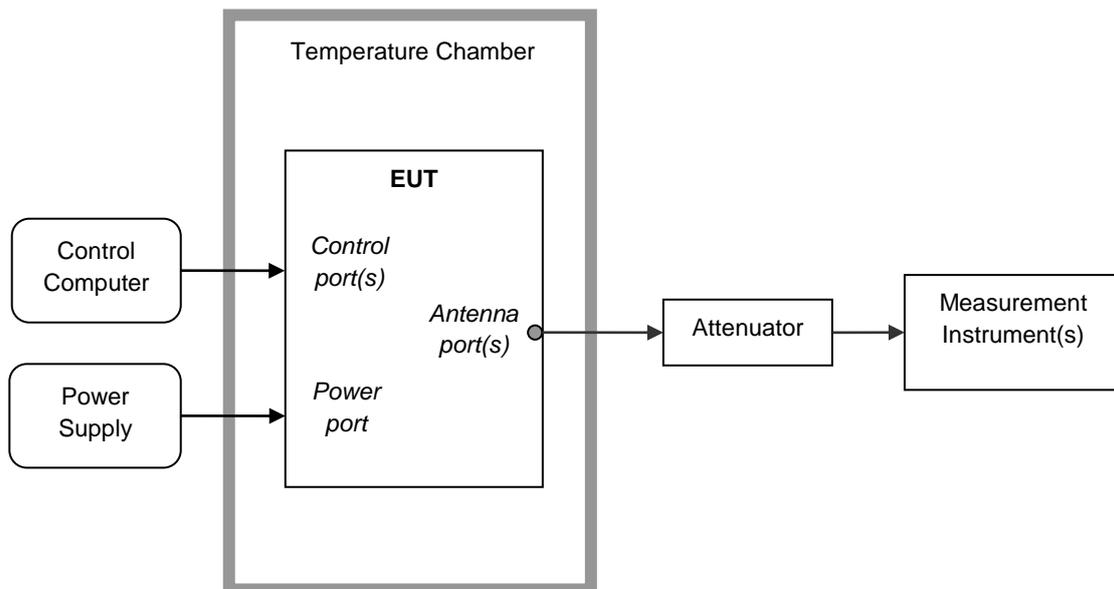
Environment Parameter	Selected Values During Tests		
	Temperature	Voltage	Relative Humidity
Ambient Climate	Ambient	---	Ambient
Rated Voltage	---	-48 VDC	---

4.3 Test Setups

4.3.1 Test Setup 1



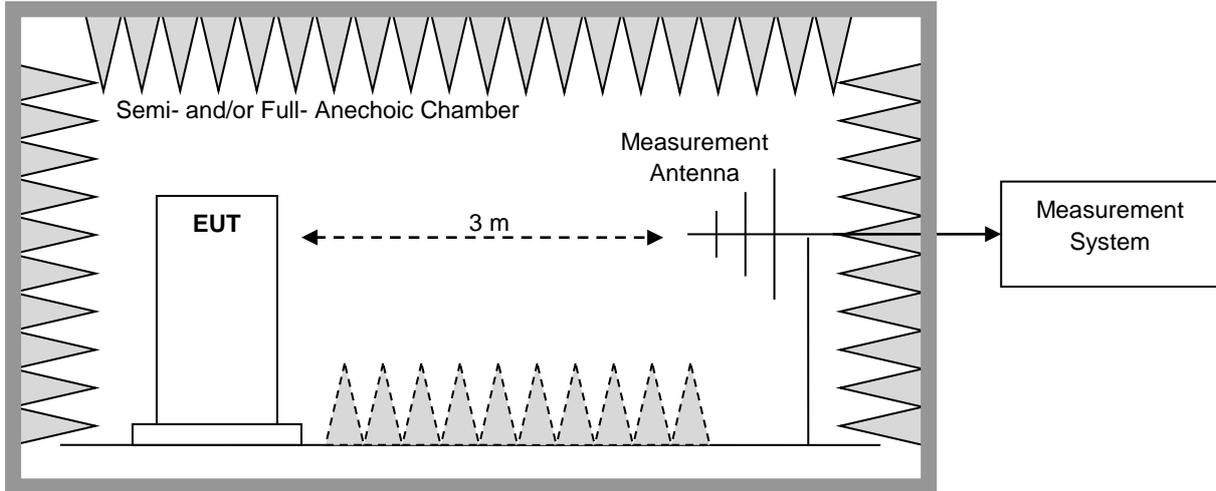
4.3.2 Test Setup 2



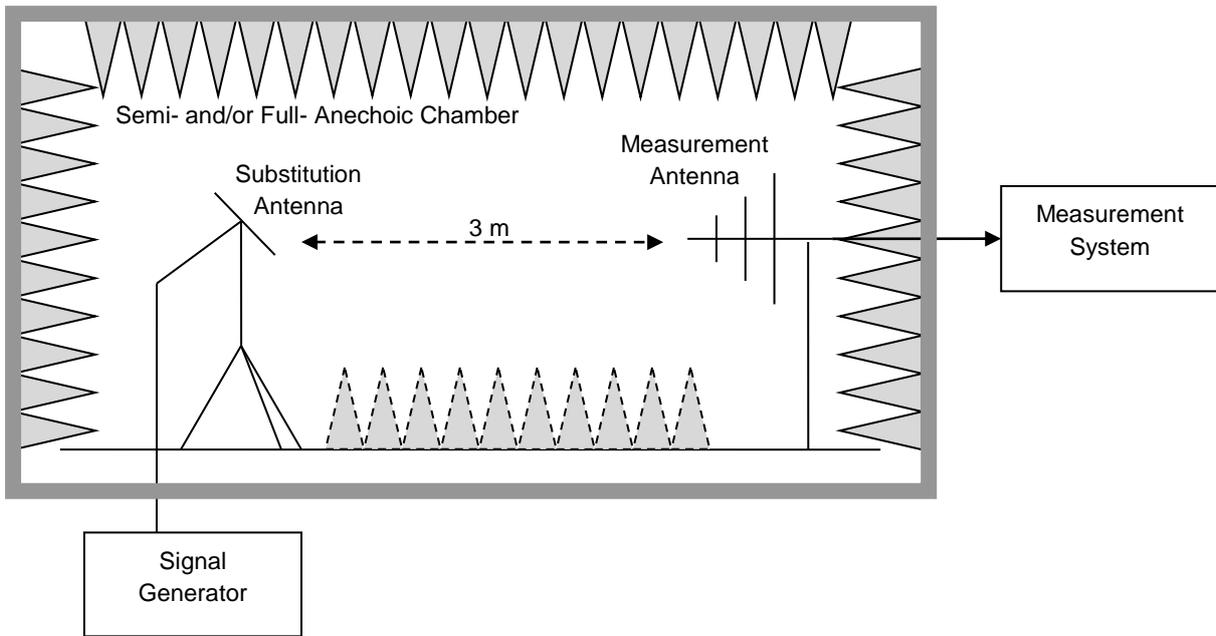
4.3.3 Test Setup 3

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

4.3.3.1 Step 1: Pre-test



4.3.3.2 Step 2: Substitution method to verify the maximum ERP



4.4 Test Conditions

Test Case		Test Conditions	
Transmitter Output Power	Channel Power, Total	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 1
		EUT Conf.	1G_TM1_B, 1G_TM1_T 1G_TM2_B, 1G_TM2_T 1U_TM1_B, 1U_TM1_M, 1U_TM1_T, 2U_TM1_B, 2U_TM1_T, 1L_5M_TM1_B, 1L_5M_TM1_M, 1L_5M_TM1_T, 1L_10M_TM1_B, 1L_10M_TM1_M, 1L_10M_TM1_T, 1L_15M_TM1_B, 1L_15M_TM1_M, 1L_15M_TM1_T, 1L_20M_TM1_B, 1L_20M_TM1_M, 1L_20M_TM1_T, 2L_5M_TM1_B, 2L_5M_TM1_T, 2G2U_TM1_B, 2G2U_TM1_T, 2G2L_TM1_B, 2G2L_TM1_T, 1U2L_TM1_B, 1U2L_TM1_T,
	Power Spectral Density	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 1
		EUT Conf.	1U_TM1_B, 1U_TM1_M, 1U_TM1_T, 1L_5M_TM1_B, 1L_5M_TM1_M, 1L_5M_TM1_T, 1L_10M_TM1_B, 1L_10M_TM1_M, 1L_10M_TM1_T, 1L_15M_TM1_B, 1L_15M_TM1_M, 1L_15M_TM1_T, 1L_20M_TM1_B, 1L_20M_TM1_M, 1L_20M_TM1_T,
	Peak-to-Average Ratio	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 1
		EUT Conf.	1G_TM1_B, 1G_TM1_T 1G_TM2_B, 1G_TM2_T 1U_TM1_B, 1U_TM1_M, 1U_TM1_T, 1L_5M_TM1_B, 1L_5M_TM1_M, 1L_5M_TM1_T, 1L_10M_TM1_B, 1L_10M_TM1_M, 1L_10M_TM1_T, 1L_15M_TM1_B, 1L_15M_TM1_M, 1L_15M_TM1_T, 1L_20M_TM1_B, 1L_20M_TM1_M, 1L_20M_TM1_T,
Bandwidth	Occupied Bandwidth	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 1
		EUT Conf.	1G_TM1_B, 1G_TM1_T 1G_TM2_B, 1G_TM2_T 1U_TM1_B, 1U_TM1_M, 1U_TM1_T, 1L_5M_TM1_B, 1L_5M_TM1_M, 1L_5M_TM1_T, 1L_10M_TM1_B, 1L_10M_TM1_M, 1L_10M_TM1_T, 1L_15M_TM1_B, 1L_15M_TM1_M, 1L_15M_TM1_T, 1L_20M_TM1_B, 1L_20M_TM1_M, 1L_20M_TM1_T,
	Emission	Test Env.	Ambient Climate & Rated Voltage



Test Case		Test Conditions	
	Bandwidth	Test Setup	Test Seup 1
		EUT Conf.	1G_TM1_B, 1G_TM1_T 1G_TM2_B, 1G_TM2_T 1U_TM1_B, 1U_TM1_M, 1U_TM1_T, 1L_5M_TM1_B, 1L_5M_TM1_M, 1L_5M_TM1_T, 1L_10M_TM1_B, 1L_10M_TM1_M, 1L_10M_TM1_T, 1L_15M_TM1_B, 1L_15M_TM1_M, 1L_15M_TM1_T, 1L_20M_TM1_B, 1L_20M_TM1_M, 1L_20M_TM1_T,
Band Edges Compliance / Emission Mask		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 1
		EUT Conf.	1G_TM1_B, 1G_TM1_T 1G_TM2_B, 1G_TM2_T 1U_TM1_B, 1U_TM1_T, 2U_TM1_B, 2U_TM1_T, 1L_5M_TM1_B, 1L_5M_TM1_T, 1L_10M_TM1_B, 1L_10M_TM1_T, 1L_15M_TM1_B, 1L_15M_TM1_T, 1L_20M_TM1_B, 1L_20M_TM1_T, 2L_5M_TM1_B, 2L_5M_TM1_T, 2G2U_TM1_B, 2G2U_TM1_T, 2G2L_TM1_B, 2G2L_TM1_T, 1U2L_TM1_B, 1U2L_TM1_T,
Spurious Emission at Antenna Terminals		Test Type	<input checked="" type="checkbox"/> Conducted <input type="checkbox"/> Radiated (go to test case of Field Strength of Spurious Radiation / Radiated Spurious Emissions) NOTE: According to FCC §2.1053 and KDB 971168 §6.1&§5.8, in the cases of the EUTs that are portable or hand-held devices utilizing one or more integral transmit antennas, measurements cannot be performed in a conducted measurement configuration, it becomes necessary to perform the described compliance measurements in a radiated test arrangement.
		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 1
		EUT Conf.	1G_TM1_B, 1G_TM1_T 1G_TM2_B, 1G_TM2_T 1U_TM1_B, 1U_TM1_T, 2U_TM1_B, 2U_TM1_T, 1L_5M_TM1_B, 1L_5M_TM1_T, 1L_10M_TM1_B, 1L_10M_TM1_T, 1L_15M_TM1_B, 1L_15M_TM1_T, 1L_20M_TM1_B, 1L_20M_TM1_T,



Test Case		Test Conditions	
		2L_5M_TM1_B, 2L_5M_TM1_T, 2G2U_TM1_B, 2G2U_TM1_T, 2G2L_TM1_B, 2G2L_TM1_T, 1U2L_TM1_B, 1U2L_TM1_T,	
Field Strength of Spurious Radiation / Radiated Spurious Emissions		Test Type	<input type="checkbox"/> Field Strength of Spurious Radiation <input checked="" type="checkbox"/> Radiated Spurious Emissions NOTE: According to FCC §2.1053 and KDB 971168, when antenna-port conducted measurements (i.e. Spurious Emission at Antenna Terminals measurement) are performed to demonstrate compliance to the applicable unwanted emission limits, a separate radiated measurement (i.e. this Field Strength of Spurious Radiation measurement) is required to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation (, and with the transmit antenna port(s) terminated). Note that when radiated measurements for spurious emissions at antenna terminals are performed to demonstrate compliance to the unwanted emission limits (e.g., an EUT with integral transmit antenna), the field strength of spurious radiation measurement is not required.
		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 3
		EUT Conf.	1G_TM1_M 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 Seup 2
		EUT Conf.	1L_5M_TM1_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 Seup 2
		EUT Conf.	--
Receiver Spurious Emissions		Test Env.	Ambient Climate & Rated Voltage



Test Case	Test Conditions	
	Test Setup	Test Seup 1
	EUT Conf.	--



5 Main Test Instruments

NOTE 1: NCR = No calibration required, VOU = Verified on use.

NOTE 2: 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	Agilent	N9030A	MY49431033	2016-05-21
Spectrum Analyzer	Agilent	N9020A	MY51240619	2016-03-25
Climate Chamber	ESPEC	EW0470S	12113066	2016-10-19
Test Setup 3				
EMI Test receiver	R&S	ESU40	100303/040	2016-01-12
Bilog antenna	SCHWARZBECK	VULB 9163	9163-480	2017-05-05
Bilog antenna	SCHWARZBECK	VULB 9163	9163-481	2017-02-06
Horn antenna	SCHWARZBECK	BBHA 9120	9120D-878	2017-05-15
Horn antenna	SCHWARZBECK	BBHA 9120	9120D-879	2017-02-06



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 / Radiated Spurious Emissions	Power [dBm] / Field Strength [dB μ V/m]	For 3 m Chamber: U = 4.15 dB (30 MHz-1 GHz) U = 3.64 dB (1 GHz-18 GHz) U = 3.26 dB (18 GHz-26.5 GHz) U = 3.83 dB (26.5 GHz-40 GHz) For 10 m Chamber: U = 4.8 dB (30MHz to 1GHz) U = 4.3 dB (1 GHz to 26.5GHz)
Frequency Stability	Frequency Accuracy [ppm]	U = 0.21 ppm

END