

RF Test Report

Product Name: Remote Radio Unit

Product Model: RRU3256

Report Number: SYBH(R)01824744EB-1

FCC ID: QISRRU3256-3600

Reliability Laboratory of Huawei Technologies Co., Ltd.

Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District,
Shenzhen, 518129, P.R.C

Tel: +86 755 28780808 Fax: +86 755 89652518

Notice

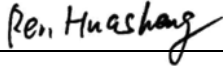
1. The laboratory has Passed the accreditation by China National Accreditation Service for Conformity Assessment (CNAS). The accreditation number is L0310.
2. The laboratory has Passed the accreditation by The American Association for Laboratory Accreditation (A2LA). The accreditation number is 2174.01.
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: Remote Radio Unit
Product Model: RRU3256

Date of Receipt Sample: 2015-05-25
Start Date of Test: 2015-06-01
End Date of Test: 2015-06-25

Test Result: Pass

Approved by Senior Engineer:	2015-06-29	Ren Huasheng	
	Date	Name	Signature

Prepared by:	2015-06-28	Liang Changguan	
	Date	Name	Signature



CONTENT

1	General Information	5
1.1	Applied Standard	5
1.2	Test Location	5
1.3	Test Environment Condition	5
2	Test Summary	6
2.1	WBS 3.7G Band (3650-3700 MHz)	6
3	Description of the Equipment under Test (EUT)	8
3.1	General Description	8
3.2	EUT Identity	8
3.3	Technical Specification	9
4	General Test Conditions / Configurations	11
4.1	EUT Configurations	11
4.2	Test Environments	12
4.3	Test Setups	13
4.4	Test Conditions	15
5	Main Test Instruments	17
6	Measurement Uncertainty	18

1 General Information

1.1 Applied Standard

Applied Rules: 47 CFR FCC Part 2 (10-1-14 Edition)
47 CFR FCC Part 90 (10-1-14 Edition)

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

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 WBS 3.7G Band (3650-3700 MHz)

2.1.1 Measurement Technical Requirements

Test Item	FCC Rule	Requirements			Test Result	Verdict	Test Location
Transmitter Output Power	§2.1046, §90.1321(a)	FCC	Base Station / Fixed Station	- EIRP Power ≤ 25 W/25 MHz. - Peak EIRP PD ≤ 1 W/1 MHz.	Annex A	Pass	TL1
			Mobile Station / Portable Station	- EIRP Power ≤ 1 W/25 MHz. - Peak EIRP PD ≤ 40 mW/1 MHz.			
Bandwidth	§2.1049	FCC	- OBW: No limit. - EBW: No limit		Annex B	Pass	TL1
Band Edges Compliance	§2.1051, §90.1323	FCC	≤ -13 dBm, in 1 MHz range (integrated with RBW ≥ 1%*EBW) outside 3650-3700 MHz.		Annex C	Pass	TL1
Spurious Emission at Antenna Terminals	§2.1051, §90.1323	FCC	≤ -13 dBm/1 MHz, from 9 kHz to 10 th harmonics but outside range from (3650-1) to (3700+1) MHz.		Annex D	Pass	TL1
Field Strength of Spurious Radiation / Radiated Spurious Emissions	§2.1053, §90.1323	FCC	≤ -13 dBm/1 MHz.		Annex E	Pass	TL1
Frequency Stability	§2.1055	FCC	No limit.		Annex F	Pass	TL1

2.1.2 Non-measurement Technical Requirements

Description	FCC Rule	Requirements	Test Result	Verdict
-------------	----------	--------------	-------------	---------

Description	FCC Rule	Requirements	Test Result	Verdict
Frequency Plan	§90.1301	3650-(3675)-3700 MHz.	See technical specification description.	Comply
Modulation Characteristics	§2.1047	Digital modulation.	See technical specification description.	Comply
Channel Bandwidth	---	ChBW $\geq$ 1 MHz.	See technical specification description.	Comply
Contention-based Protocol	§90.1305, §90.7, §90.1319(b), KDB552295	All stations operating in this band should employ a contention-based protocol.	The type of protocol implemented is CBP.	Comply
Operating Range Limitation	§90.1319(c)	- Equipment incorporating an unrestricted contention-based protocol may operate throughout the whole 3650-3700 MHz. (FCC auth) - Equipment incorporating a restricted contention-based protocol shall only tune over the 3650-3675 MHz. (TCB PBA)	Within the operating range	Comply

3 Description of the Equipment under Test (EUT)

3.1 General Description

The RRU3256 is a remote radio unit. One or more RRU3256 modules constitute the radio frequency (RF) part of a distributed E-UTRAN NodeB (eNodeB). The RRU3256 can be mounted onto a pole, stand, or concrete wall. It also can be installed close to antennas to shorten the feeder length, reduce feeder loss, and improve system coverage.

RRU3256 modulate and demodulate baseband and RF signals, process data, amplify power, and detect standing waves. RRU is short for remote radio unit, and E-UTRAN is short for evolved universal terrestrial radio access network.

The device under test complies with the requirements of an unrestricted contention based protocol. It employs spectrum sensing to determine if other devices are transmitting based on thresholds which can be configured by the operator. When the Listen Before Talk feature is enabled, transmission will be disabled when detected interference levels is above the higher threshold; similarly transmission will be enabled when detected interference levels is below the lower threshold.

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
WD5BPRX41A0	Ver.B	Transceiver Board
WD5BPHA41A8D	Ver.B	PA Unit
WD5BPHP42X0	Ver.B	Power Unit

3.2.2 Sub-Assembly

Sub-Assembly			
Sub-Assembly Name	Model	Manufacturer	Description
UMPT	---	HUAWEI	LTE Main Processing & Transmission Unit
LBBP	---	HUAWEI	LTE baseband Processing Unit

3.3 Technical Specification

Characteristics	Description
Radio System Type	☐ GSM (GO) ☐ UMTS (UO) ☒ LTE (LO) ☐ CDMA (CO) ☐ GSM & UMTS (GU) ☐ GSM & LTE (GL) ☐ GSM & UMTS & LTE (GUL) ☐ CDMA & LTE (CL) ☐ P2P
Equipment Type	Type #1 ☒ Base Station Equipment ☐ CPE (Customer Premises Equipment) Equipment ☐ Subscriber Equipment (User Equipment) ☐ Fixed Point-to-Point Equipment
	Type #2 ☒ Fixed ☐ Mobile ☐ Portable
	Type #3 ☒ Indoor ☒ Outdoor
Frequency Range (Transmission (TX) and Receiving (RX))	#1 TX: 3650 to 3700MHz RX: 3650 to 3700MHz
TX and RX Antenna Ports	TX & RX port: 4, TX-only port: 0, RX-only port: 0
Multiple Carrier Supported	4
Maximum RF Bandwidth	50 MHz
TX Output Power	Max. 1.25 W (per antenna port) Max. 4*1.25 W (four antenna ports)
Supported Channel Bandwidth	10 MHz, 20MHz
Modulation Type	LTE system: Base-band: QPSK, 16QAM, 64QAM Carrier: OFDM/OFDMA
Designation of Emissions (Note: the necessary bandwidth of which is the worst value from the measured	LTE system: 20M0D9W

Characteristics	Description	
occupied bandwidths for each type of channel bandwidth configuration.)		
Power Supply	Type:	☐ External AC mains, ☒ External DC mains, ☐ AC/DC Adapter, ☐ Powered over Ethernet (PoE)
	Nominal Voltage, Input to EUT:	-48 VDC
	Voltage Range, Input to EUT:	-36 to -60 VDC

3.3.1 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	☒ External (antenna equipped on sale : ☐ yes, ☒ no) ☐ Integral
Smart Antenna	☒ MIMO ☐ Non MIMO
Antenna Gain	☒ External: 10 dBi (per antenna port, typically) ☐ 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, - 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
LTE/TM1.1	LTE system, 3GPP TS 36.141 clause 6.1.1, E-TM 1.1

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
1L_20M_B	B	1*L(0.5W)	3660	3660	20	27	TM1.1
1L_20M_M	M	1*L(0.5W)	3675	3675	20	27	TM1.1
1L_20M_T	T	1*L(0.5W)	3690	3690	20	27	TM1.1
2L_20M_20M_B	B	2*L(0.5W, 0.5W)	3660/3680	3660/3680	20/20	27/27	TM1.1
2L_20M_20M_T	T	2*L(0.5W, 0.5W)	3670/3690	3670/3690	20/20	27/27	TM1.1
2L_20M_10M_B	B	2*L(0.5W, 0.25W)	3660/3675	3660/3675	20/10	27/24	TM1.1
2L_20M_10M_M	M	2*L(0.5W, 0.25W)	3670/3685	3670/3685	20/10	27/24	TM1.1
2L_20M_10M_T	T	2*L(0.5W, 0.25W)	3680/3695	3680/3695	20/10	27/24	TM1.1
3L_20M_20M_10M	M	3*L(0.5W, 0.5W, 0.25W)	3660/3680 /3695	3660/3680 /3695	20/20/10	27/27/24	TM1.1

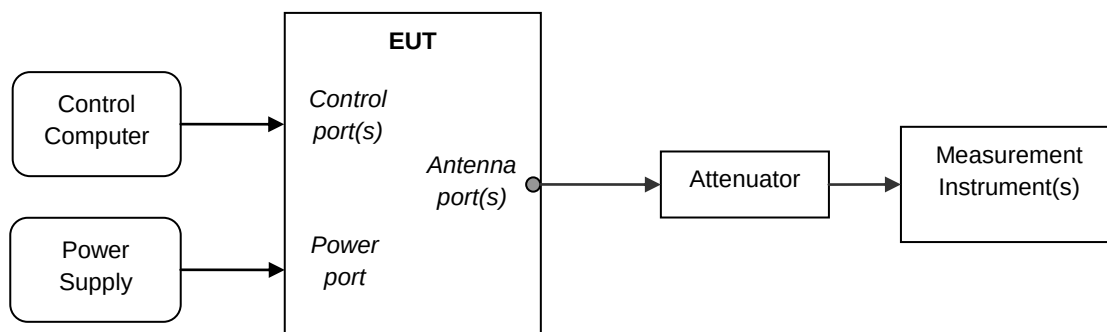


4.2 Test Environments

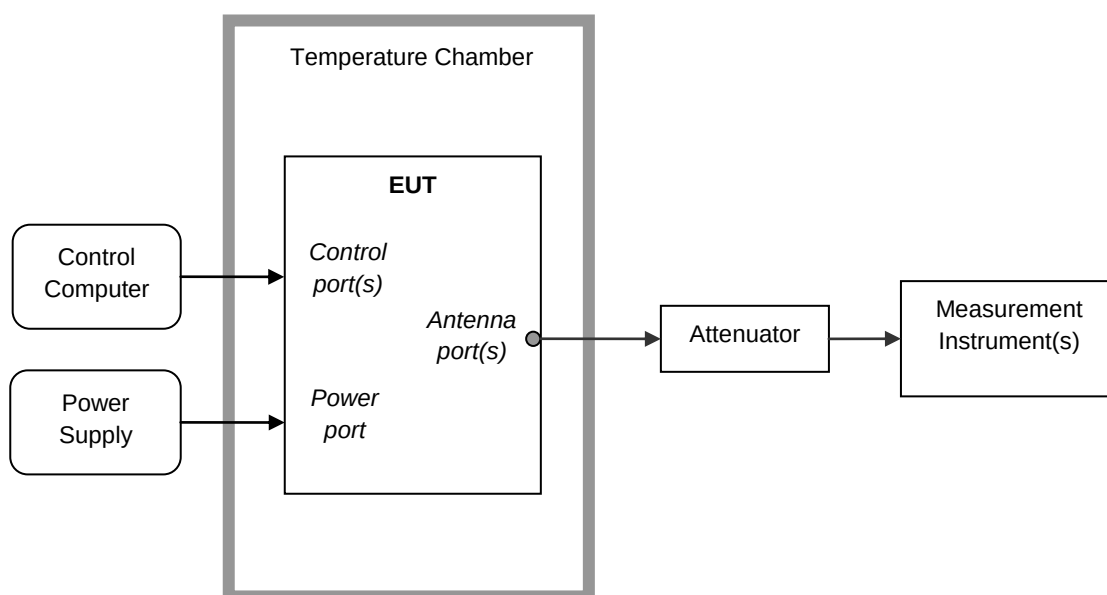
Environment Parameter	Selected Values During Tests		
	Temperature	Voltage	Relative Humidity
Ambient Climate (See clause 1.3)	Ambient	---	Ambient
Rated Voltage	---	-48 VDC	---

4.3 Test Setups

4.3.1 Test Setup 1



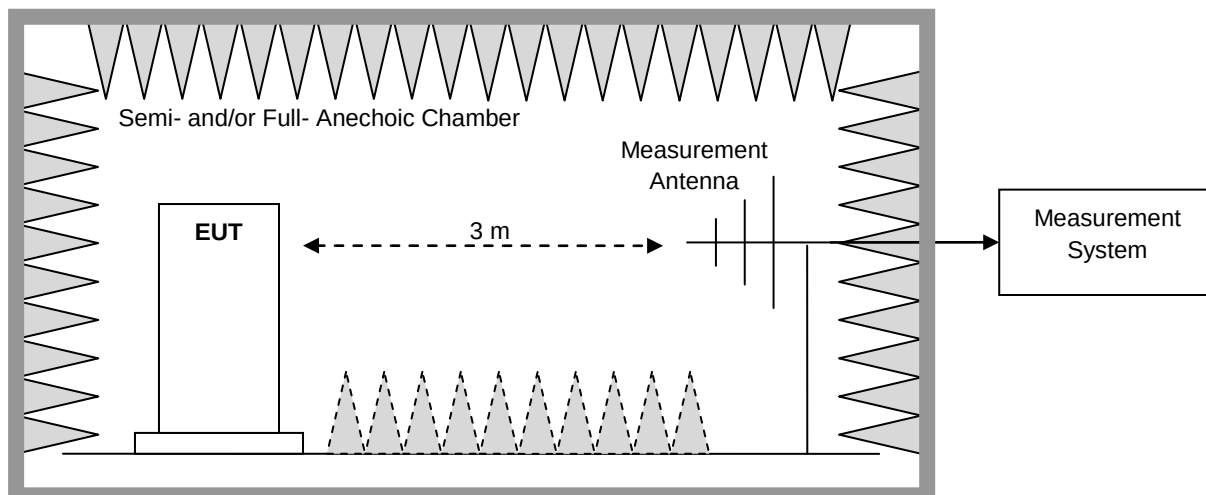
4.3.2 Test Setup 2



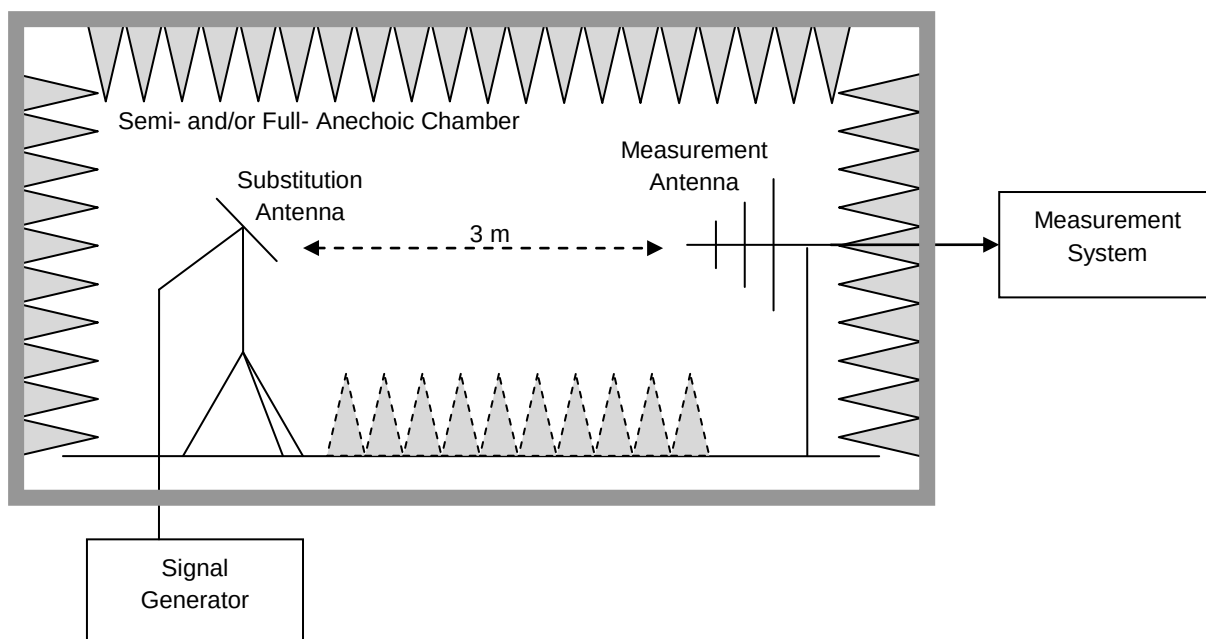
4.3.3 Test Setup 3

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.	1L_20M_B, 1L_20M_M, 1L_20M_T, 2L_20M_20M_B, 2L_20M_20M_T, 2L_20M_10M_B, 2L_20M_10M_M, 2L_20M_10M_T, 3L_20M_20M_10M
	Power Spectral Density (if required)	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 1
		EUT Conf.	1L_20M_B, 1L_20M_M, 1L_20M_T, 2L_20M_20M_B, 2L_20M_20M_T, 2L_20M_10M_B, 2L_20M_10M_M, 2L_20M_10M_T, 3L_20M_20M_10M
Bandwidth	Occupied Bandwidth	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 1
		EUT Conf.	1L_20M_B, 1L_20M_M, 1L_20M_T
Band Edges Compliance		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 1
		EUT Conf.	1L_20M_B, 1L_20M_M, 1L_20M_T, 2L_20M_20M_B, 2L_20M_20M_T, 2L_20M_10M_B, 2L_20M_10M_M, 2L_20M_10M_T, 3L_20M_20M_10M
Spurious Emission at Antenna Terminals		Test Type	☒ Conducted ☐ 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.	1L_20M_B, 1L_20M_M, 1L_20M_T, 2L_20M_20M_B, 2L_20M_20M_T, 2L_20M_10M_B, 2L_20M_10M_M, 2L_20M_10M_T, 3L_20M_20M_10M
Field Strength of Spurious Radiation / Radiated Spurious Emissions		Test Type	☒ Field Strength of Spurious Radiation ☐ Radiated Spurious Emissions NOTE: According to FCC §2.1053 and KDB 971168, when antenna-port conducted measurements (i.e. Spurious

Test Case		Test Conditions	
			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.	3L_20M_20M_10M
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_20M_B, 1L_20M_T 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.
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	E4440A	MY49420179	2016-03-29
Spectrum Analyzer	R&S	FSQ40	100025	2016-03-17
Temperature Chamber	ESPEC	EW0470S	12113066	2015-10-21
Test Setup 3				
EMI test receiver	R&S	ESU40	100144	2016-05-12
Broadband Antenna	SCHAFFNER	CBL6112B	2747	2017-01-23 (2y)
Horn Antenna	R&S	HF906	359287/006	2016-08-15
Horn Antenna	ETS.LINDGREN	3160-09	LM7129	2016-05-07 (2y)
Horn Antenna	EMCO	3116	00031541	2017-02-11

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