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CNAS L0310



RF Report

Product Name: Active Antenna Unit

Product Model: AAU3940

Report Number: SYBH(R)02511176EB-1

FCC ID: QISAAU3940

IC: 6369A-AAU3940

Reliability Laboratory of Huawei Technologies Co., Ltd.

(Global Compliance and Testing Center 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-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 Laboratory 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: Active Antenna Unit
Product Model: AAU3940

Date of Receipt Sample: 2016-07-08
Start Date of Test: 2016-07-08
End Date of Test: 2016-07-29

Test Result: Pass

Approved by Senior Engineer:	2016-07-29	Ren Huasheng	
	Date	Name	Signature

Prepared by:	2016-07-29	Hu Wei	
	Date	Name	Signature



Modification Record

No.	Last Report No.	Modification Description
1	SYBH(R)02196478EB-1	Add the UMTS/UL config and related new test data for the AWS Band, and the hardware is not changed. Other test data is just quoted from the test report SYBH(R)02196478EB-1.

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1 General Information

1.1 Applied Standard

Applied Rules/Standards:	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 Methods: (if applicable)	FCC KDB 971168 D01 Power Meas License Digital Systems v02r02 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):	Global Compliance and Testing Center of Huawei Technologies Co., Ltd. (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 1a (TL1a):	Global Compliance and Testing Center of Huawei Technologies Co., Ltd. (Reliability Laboratory of Huawei Technologies Co., Ltd.)
Address:	No.2 New City Avenue Songshan Lake Sci. &Tech. Industry Park, Dongguan, Guangdong, China
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

Ambient Temperature:	15 to 30 °C
Ambient Relative Humidity:	20 to 85 %
Atmospheric Pressure:	Not applicable

2 Test Summary

NOTE 1: Unless otherwise specified, all test items were tested in test location TL1 which has been accredited by A2LA. The test items tested in other test locations are marked with “(TL##, #####)” where “TL##” denotes test location and “#####” denotes the accreditation organization of the laboratory responsible of this report.

NOTE 2: For IC, only requirements in RSS but not in SRSP are considered for compliance measurements for certification purposes, since the requirements of SRSP are to be addressed with the device at the time of licensing (except RSS refers to requirements of SRSP).

NOTE 3: In the following table(s), the “NA” denotes “Not applicable”, the “NT” denotes “Not tested”, and “NC” denotes “No conclusion”.

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

2.1.1 Measurement Technical Requirements

The test results in the following table refer to the document of “SYBH(R) 02511176EB-1A”:

Test Item	FCC Rule	IC Rule	Requirements			Test Result	Verdict
Transmitter Output Power	§2.1046, §24.232	RSS-Gen,§6.12; RSS-133,§6.4; RSS-133,§4.1	FCC	Base Station	- Average EIRP Power (for EBW ≤ 1 MHz): - HAAT ≤ 300 m: ≤ 3280 (LPDC) or 1640 W (others), - HAAT ≤ 500 m: ≤ 2140 (LPDC) or 1070 W (others), - HAAT ≤ 1000 m: ≤ 980 (LPDC) or 490 W (others), - HAAT ≤ 1500 m: ≤ 540 (LPDC) or 270 W (others), - HAAT ≤ 2000 m: ≤ 320 (LPDC) or 160 W (others). - Average EIRP PD (for EBW > 1 MHz): - HAAT ≤ 300 m: ≤ 3280 (LPDC) or 1640 W/MHz (others), - HAAT ≤ 500 m: ≤ 2140 (LPDC) or 1070 W/MHz (others), - HAAT ≤ 1000 m: ≤ 980 (LPDC) or 490 W/MHz (others), - HAAT ≤ 1500 m: ≤ 540 (LPDC) or 270 W/MHz (others), - HAAT ≤ 2000 m: ≤ 320 (LPDC) or 160 W/MHz (others).	Annex A	Pass

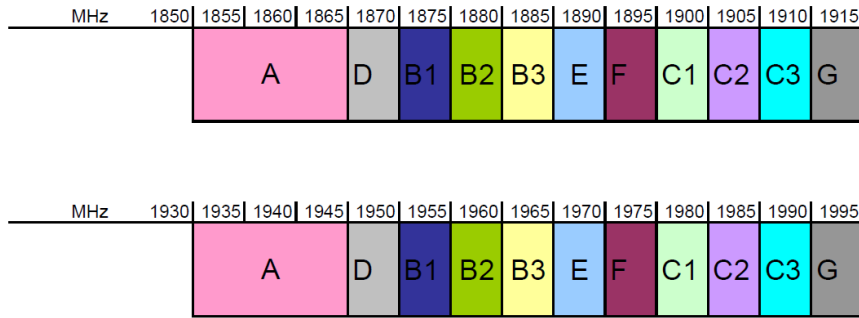
Test Item	FCC Rule	IC Rule	Requirements			Test Result	Verdict
					PAPR ≤ 13 dB@0.1%. Note 1): HAAT - Height Above Average Terrain. Note 2): LPDC - counties with population densities of 100 persons or fewer per square mile.		
				Mobile Station / Portable Station	- Average EIRP ≤ 2 W. - PAPR ≤ 13 dB@0.1%.		
			IC	Base Station	- Average EIRP Power (for ChBW ≤ 1 MHz): - HAAT ≤ 300 m: ≤ 1640 (urban) or 3280 W (others), - HAAT ≤ 500 m: ≤ 1070 W, - HAAT ≤ 1000 m: ≤ 490 W, - HAAT ≤ 1500 m: ≤ 270 W, - HAAT ≤ 2000 m: ≤ 160 W. - Average EIRP PD (for ChBW > 1 MHz): - HAAT ≤ 300 m: ≤ 1640 (urban) or 3280 W/MHz (others), - HAAT ≤ 500 m: ≤ 1070 W/MHz, - HAAT ≤ 1000 m: ≤ 490 W/MHz, - HAAT ≤ 1500 m: ≤ 270 W/MHz, - HAAT ≤ 2000 m: ≤ 160 W/MHz. - Average Conducted Power ≤ 100 W (for 1930-1995 MHz). - PAPR ≤ 13 dB@0.1%. Note 1): HAAT - Height Above Average Terrain.		
				Mobile Station / Hand-held Portable Station	- Average EIRP Power ≤ 2 W. - PAPR ≤ 13 dB@0.1%.		

Test Item	FCC Rule	IC Rule	Requirements		Test Result	Verdict
Bandwidth	§2.1049, §24.238	RSS-Gen,§6.6; RSS-133,§2.3	FCC	- OBW: No limit. - EBW (-26 dBc): No limit.	Annex B	Pass
			IC	- OBW: No limit, may in lieu of EBW (-20 dBc). - EBW (-20 dBc, RBW $\approx$ 1%*OBW): No limit.		
Band Edges Compliance / Emission Mask	§2.1051, §24.238	RSS-Gen,§6.13; RSS-133,§6.5	FCC	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block. Note 1): EBW is -26 dBc EBW.	Annex C	Pass
			IC	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block. Note 1): EBW is -20 dBc EBW, or OBW.		
Spurious Emission at Antenna Terminals	§2.1051, §24.238	RSS-Gen,§6.13; RSS-133,§6.5	FCC	≤ -13 dBm/1 MHz, from max(lowest internal frequency, 9 kHz) to min(10 * highest fundamental frequency, 40 GHz) but outside authorized operating frequency blocks.	Annex D	Pass
			IC	≤ -13 dBm/1 MHz, from max(min(lowest internal frequency, 30 MHz), 9 kHz) to min(10 * highest fundamental frequency, 40 GHz) but outside authorized operating frequency blocks.		
Field Strength of Spurious Radiation / Radiated Spurious Emissions	§2.1053, §24.238	RSS-Gen,§6.13; RSS-133,§6.5	FCC	≤ -13 dBm/1 MHz, from max(lowest internal frequency, 9 kHz) to min(10 * highest fundamental frequency, 40 GHz) but outside authorized operating frequency blocks.	Annex E	Pass
			IC	≤ -13 dBm/1 MHz, from max(min(lowest internal frequency, 30 MHz), 9 kHz) to min(10 * highest fundamental frequency, 40 GHz) but outside authorized operating frequency blocks.		
Frequency Stability	§2.1055, §24.235	RSS-Gen,§6.11; RSS-133,§6.3	FCC	- Test method: Fundamental emissions (Fc_meas) within the authorized frequency block. - Test conditions: (1) NV, -30°C/.../+50°C step=+10°C. (2) NT, $\pm 15\%$*NV.	Annex F	Pass
			IC	Base Station Test method option #1:		

Test Item	FCC Rule	IC Rule	Requirements			Test Result	Verdict
					$(F_{c_meas} - F_{c_meas@20^{\circ}C\&NV}) / F_{c_meas@20^{\circ}C\&NV} \leq \pm 1.0 \text{ ppm.}$ ● 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, $\pm 15\%*NV$.		
				Mobile Station	● Test method option #1: $(F_{c_meas} - F_{c_meas@20^{\circ}C\&NV}) / F_{c_meas@20^{\circ}C\&NV} \leq \pm 2.5 \text{ ppm.}$ ● 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, $\pm 15\%*NV$.		
Receiver Spurious Emission (Note 1)	---	RSS-Gen,§5; RSS-Gen,§7; RSS-133, §6.6	---			Annex G	---
Note 1: Only radio communication receivers operating in stand-alone mode within the band 30-960 MHz and scanner receivers are subject to IC requirements. All other receivers are excluded from any IC certification, testing, labelling and reporting requirements.							

2.1.2 Non-measurement Technical Requirements

Description	FCC Rule	IC Rule	Requirements	Exhibit	Verdict
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Description	FCC Rule	IC Rule	Requirements	Exhibit	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

The test results in the following table refer to the document of "SYBH(R) 02511176EB-1A":

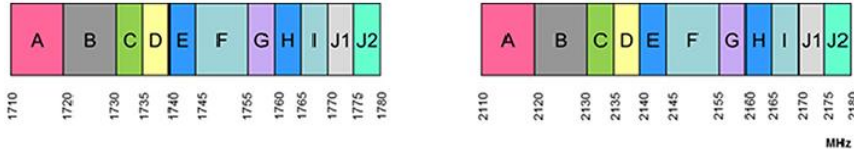
Test Item	FCC Rule	IC Rule	Requirements			Test Result	Verdict
Transmitter Output Power	\$2.1046, \$27.50(d), \$27.50(i)	RSS-Gen,\$6.12; RSS-139,\$6.5; RSS-139,\$4.1	FCC	Base Station / Fixed Station	- Average EIRP Power (for EBW $\leq$ 1 MHz & 2110 – 2180 MHz): $\leq$ 3280 (LPDC) or 1640 W (others). - Average EIRP PD (for EBW > 1 MHz & 2110 – 2180 MHz): $\leq$ 3280 (LPDC) or 1640 W/MHz (others). - Average EIRP Power $\leq$ 1 W (for 1710-1755 MHz). - Antenna height above ground $\leq$ 10 m (for 1710-1755 MHz). - PAPR $\leq$ 13 dB@0.1%. Note 1): HAAT - Height Above Average Terrain. Note 2): LPDC - counties with population densities of 100 persons or fewer per square mile.	Annex A	Pass
				Mobile Station / Portable Station	- Average EIRP Power $\leq$ 1 W (for 1710-1780 MHz). - PAPR $\leq$ 13dB@0.1%.		
			IC	Base Station / Fixed Station	- Average EIRP Power (for ChBW $\leq$ 1 MHz & 2110 – 2180 MHz): (1) HAAT $\leq$ 300 m: $\leq$ 3280 (LPDC) or 1640 W (others), (2) HAAT $\leq$ 500 m: $\leq$ 1070 W, (3) HAAT $\leq$ 1000 m: $\leq$ 490 W, (4) HAAT $\leq$ 1500 m: $\leq$ 270 W, (5) HAAT $\leq$ 2000 m: $\leq$ 160 W. - Average EIRP PD (for ChBW > 1 MHz & 2110 – 2180 MHz):		

Test Item	FCC Rule	IC Rule	Requirements		Test Result	Verdict
				(1) HAAT $\leq$ 300 m: $\leq$ 3280 (LPDC) or 1640 W/MHz (others), (2) HAAT $\leq$ 500 m: $\leq$ 1070 W/MHz, (3) HAAT $\leq$ 1000 m: $\leq$ 490 W/MHz, (4) HAAT $\leq$ 1500 m: $\leq$ 270 W/MHz, (5) HAAT $\leq$ 2000 m: $\leq$ 160 W/MHz. - Average EIRP Power $\leq$ 1 W (for 1710-1780 MHz). - PAPR $\leq$ 13 dB@0.1%. _____ Note 1): HAAT - Height Above Average Terrain. Note 2): LPDC - geographic areas at a distance greater than 26 km from large or medium population centres.		
			Mobile / Portable Transmitter	- Average EIRP Power $\leq$ 1 W. - PAPR $\leq$ 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.	Annex B	Pass
			IC	OBW: No limit		
Band Edges Compliance / Emission Mask	§2.1051, §27.53(h)	RSS-Gen,§6.13; RSS-139,§6.6	FCC	$\leq$ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block. _____ Note 1): EBW is -26 dBc EBW.	Annex C	Pass
			IC	$\leq$ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block. _____ Note 1): EBW is not defined.		
Spurious Emission at Antenna Terminals	§2.1051, §27.53(h)	RSS-Gen,§6.13; RSS-139,§6.6	FCC	$\leq$ -13 dBm/1 MHz, from max(lowest internal frequency, 9 kHz) to min(10 * highest fundamental frequency, 40 GHz) but outside authorized operating frequency ranges.	Annex D	Pass

Test Item	FCC Rule	IC Rule	Requirements		Test Result	Verdict
			IC	≤ -13 dBm/1 MHz, from max(min(lowest internal frequency, 30 MHz), 9 kHz) to min(10 * highest fundamental frequency, 40 GHz) but outside authorized operating frequency ranges.		
Field Strength of Spurious Radiation / Radiated Spurious Emissions	§2.1053, §27.53(h)	RSS-Gen,§6.13; RSS-139,§6.6	FCC	≤ -13 dBm/1 MHz, from max(lowest internal frequency, 9 kHz) to min(10 * highest fundamental frequency, 40 GHz) but outside authorized operating frequency ranges.	Annex E	Pass
			IC	≤ -13 dBm/1 MHz, from max(min(lowest internal frequency, 30 MHz), 9 kHz) to min(10 * highest fundamental frequency, 40 GHz) but outside authorized operating frequency ranges.		
Frequency Stability	§2.1055, §27.54	RSS-Gen,§6.11; RSS-139,§6.4	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, ±15%*NV.	Annex F	Pass
			IC	- Test method: OBW (OBW_lower to OBW_higher) within frequency block. - Test conditions: (1) NV, -30°C/+20°C/+50°C. (2) +20°C, ±15%*NV.		
Receiver Spurious Emission (Note 1)	---	RSS-Gen,§5; RSS-Gen,§7	---		Annex G	---
Note 1: Only radio communication receivers operating in stand-alone mode within the band 30-960 MHz and scanner receivers are subject to IC requirements. All other receivers are excluded from any IC certification, testing, labelling and reporting requirements.						

2.2.2 Non-measurement Technical Requirements

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

Description	FCC Rule	IC Rule	Requirements	Exhibit	Verdict
			 (Note: more frequency ranges than listed can be used according to FCC §27.5(h), i.e. 1695-1710, 1710-1755, 1755-1780, 1915-1920, 1995-2000, 2000-2020, 2110-2155, 2155-2180 and 2180-2200 MHz. See FCC §27.5(h) for detailed)		
Modulation Characteristics	§2.1047	RSS-139,§6.2	Any modulation.	See technical specification description.	Comply
Controlled Operations	---	RSS-139,§6.3	Mobile, portable and fixed user equipment in the band 1755-1780 MHz may operate only when under the control of a base station. The applicant shall include a statement of declaration of compliance and a description of how this control requirement is met.	See technical specification description.	Comply
Transmitter Power Control	§27.50(d)	RSS-139,§6.7	Mobile and portable equipment shall employ a means for limiting power to the minimum necessary for successful communications.	See technical specification description.	Comply
Interoperability Requirement	---	RSS-139,§6.8	Mobile and portable equipment that transmits in the band 1755-1780 MHz and receives in the band 2155-2180 MHz shall be certified only if it can be capable of operating on all frequencies in the frequency bands 1710-1780 MHz and 2110-2180 MHz.	See technical specification description.	Comply

3 Description of the Equipment under Test (EUT)

3.1 General Description

The DBS3900 WCDMA/FDD LTE, a future-oriented E-UTRAN NodeB(eNodeB) product launched by Huawei, is a distributed eNodeB supporting FDD LTE and WCDMA. The DBS3900 WCDMA/FDD LTE fully exploits Huawei platform resources and uses a variety of technologies. The Active Antenna Unit(AAU) is the remote radio unit of the DBS3900 WCDMA/FDD LTE, include Remote Radio Unit (RRU) and Antenna.

The AAU3940 is a type of Active Antenna Unit. It implements conversion between baseband signals, IF signals, and RF signals, demodulates the received radio signals, and modulates the signals to be transmitted, and amplifies the transmit power of the 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

Name	Description
WD7AZAA7ACT	VER.B
WD7AZAA7ACP	VER.B
WD7BOHSA	VER.A

3.2.2 Sub-Assembly

Name	Model	Manufacturer	Description
UMPT	WD22UMPTa2	Huawei	BBU3900-WD22UMPTa2-Universal Main Processing & Transmission unit with 4E1 and 2FE/GE interface
UBBP	WD22LBBDP6	Huawei	Manufactured Board, BBU3900, WD22UBBDP6, Baseband Processing and Interface Unit, 1*1

3.3 Technical Specification

Characteristics	Description	
Radio System Type	☐ GSM (GO) ☒ UMTS (UO) ☒ LTE (LO) ☐ CDMA (CO) ☐ GSM & UMTS (GU) ☐ GSM & LTE (GL) ☒ UMTS & LTE (UL) ☐ 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: 1930 to 1990 MHz RX: 1850 to 1910 MHz
	#2	TX: 2110 to 2155 MHz 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. 40 W (per antenna port) Max. 80 W (two antenna ports)	
Supported Channel Bandwidth	5 MHz for UMTS 5 MHz, 10 MHz, 15 MHz, 20 MHz for LTE	
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:	4M14F9W(PCS Band) 4M16F9W(AWS Band)
	LTE system:	4M50D9W, 8M97D9W, 13M5D9W, 17M9D9W(PCS Band) 4M50D9W, 8M99D9W, 13M5D9W, 18M0D9W(AWS Band)
	CDMA system:	Not applicable
	WiMAX system:	Not applicable
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 -57 VDC

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
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
LTE/TM1.2	LTE system, 3GPP TS 36.141 clause 6.1.1, E-TM 1.2
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.	TX Freq. [MHz]	RX Freq. [MHz]	Ch. BW [MHz]	Power Level [dBm]	Test Mode
1U_TM1_B_Band2	B	1932.6	--	5	46.0	UMTS/TM1
1U_TM1_M_Band2	M	1960	--	5	46.0	UMTS/TM1
1U_TM1_T_Band2	T	1987.4	--	5	46.0	UMTS/TM1
NTC_4U_TM1_B_Band2	B	1932.6/1937.6/ 1962.6/1967.6	--	5,5,5,5	40.0/40.0/40.0/40.0	UMTS/TM1
NTC_4U_TM1_T_Band2	T	1952.4/1957.4/ 1982.4/1987.4	--	5,5,5,5	40.0/40.0/40.0/40.0	UMTS/TM1
1L5M_TM1_B_Band2	B	1932.5	--	5	46.0	LTE/TM1.1
1L5M_TM1_M_Band2	M	1960	--	5	46.0	LTE/TM1.1
1L5M_TM1_T_Band2	T	1987.5	--	5	46.0	LTE/TM1.1
1L10M_TM1_B_Band2	B	1935	--	10	46.0	LTE/TM1.1
1L10M_TM1_M_Band2	M	1960	--	10	46.0	LTE/TM1.1



EUT Conf.	RF Ch.	TX Freq. [MHz]	RX Freq. [MHz]	Ch. BW [MHz]	Power Level [dBm]	Test Mode
1L10M_TM1_T_Band2	T	1985	--	10	46.0	LTE/TM1.1
1L15M_TM1_B_Band2	B	1937.5	--	15	46.0	LTE/TM1.1
1L15M_TM1_M_Band2	M	1960	--	15	46.0	LTE/TM1.1
1L15M_TM1_T_Band2	T	1982.5	--	15	46.0	LTE/TM1.1
1L20M_TM1_B_Band2	B	1940	--	20	46.0	LTE/TM1.1
1L20M_TM1_M_Band2	M	1960	--	20	46.0	LTE/TM1.1
1L20M_TM1_T_Band2	T	1980	--	20	46.0	LTE/TM1.1
NTC_4L_TM1_B_Band2	B	1932.5/1937.5/ 1962.5/1967.5	--	5,5,5,5	40.0/40.0/40.0/40.0	LTE/TM1.1
NTC_4L_TM1_T_Band2	T	1952.5/1957.5/ 1982.5/1987.5	--	5,5,5,5	40.0/40.0/40.0/40.0	LTE/TM1.1
1U_TM1_B_Band4	B	2112.6	--	5	46.0	UMTS/TM1
1U_TM1_M_Band4	M	2132.6	--	5	46.0	UMTS/TM1
1U_TM1_T_Band4	T	2152.4	--	5	46.0	UMTS/TM1
4U_TM1_B_Band4	B	2112.6/2117.6/ 2142.6/2147.6	--	5,5,5,5	40.0/40.0/40.0/40.0	UMTS/TM1
4U_TM1_T_Band4	T	2117.4/2122.4/ 2147.4/2152.4	--	5,5,5,5	40.0/40.0/40.0/40.0	UMTS/TM1
1L5M_TM1_B_Band4	B	2112.5	--	5	46.0	LTE/TM1.1
1L5M_TM1_M_Band4	M	2132.5	--	5	46.0	LTE/TM1.1
1L5M_TM1_T_Band4	T	2152.5	--	5	46.0	LTE/TM1.1
1L10M_TM1_B_Band4	B	2115	--	10	46.0	LTE/TM1.1
1L10M_TM1_M_Band4	M	2132.5	--	10	46.0	LTE/TM1.1
1L10M_TM1_T_Band4	T	2150	--	10	46.0	LTE/TM1.1
1L15M_TM1_B_Band2	B	2117.5	--	15	46.0	LTE/TM1.1
1L15M_TM1_M_Band4	M	2132.5	--	15	46.0	LTE/TM1.1
1L15M_TM1_T_Band4	T	2147.5	--	15	46.0	LTE/TM1.1
1L20M_TM1_B_Band4	B	2120	--	20	46.0	LTE/TM1.1
1L20M_TM1_M_Band4	M	2132.5	--	20	46.0	LTE/TM1.1
1L20M_TM1_T_Band4	T	2145	--	20	46.0	LTE/TM1.1
NTC_4L_TM1_B_Band4	B	2112.5/2117.5/ 2142.5/2147.5	--	5,5,5,5	40.0/40.0/40.0/40.0	LTE/TM1.1
NTC_4L_TM1_T_Band4	T	2117.5/2122.5/ 2147.5/2152.5	--	5,5,5,5	40.0/40.0/40.0/40.0	LTE/TM1.1
NTC_2U2L_TM1_B_Band4	B	2112.6/2117.6/ 2142.5/2147.5	--	5,5,5,5	40.0/40.0/40.0/40.0	UL/TM1



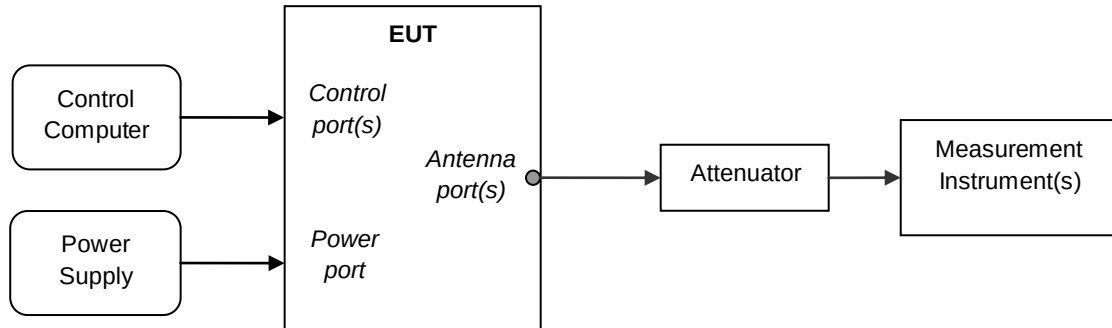
EUT Conf.	RF Ch.	TX Freq. [MHz]	RX Freq. [MHz]	Ch. BW [MHz]	Power Level [dBm]	Test Mode
NTC_2U2L_TM1_T_Band4	T	2117.4/2122.4/ 2147.5/2152.5	--	5,5,5,5	40.0/40.0/40.0/40.0	UL/TM1
1U_B_band2+1L_T_Band4	M	1932.6/2152.5	--	5,5	43.0/43.0	UL/TM1
NTC_1U1L_B_band2+ NTC_2L_T_Band4	M	1932.6/1967.5/ 2117.5/2152.5	--	5,5,5,5	40.0/40.0/40.0/40.0	UL/TM1
NTC_1U1L_B_band2+ NTC_1U1L_T_Band4	M	1932.6/1967.5/ 2117.6/2152.5	--	5,5,5,5	40.0/40.0/40.0/40.0	UL/TM1

4.2 Test Environments

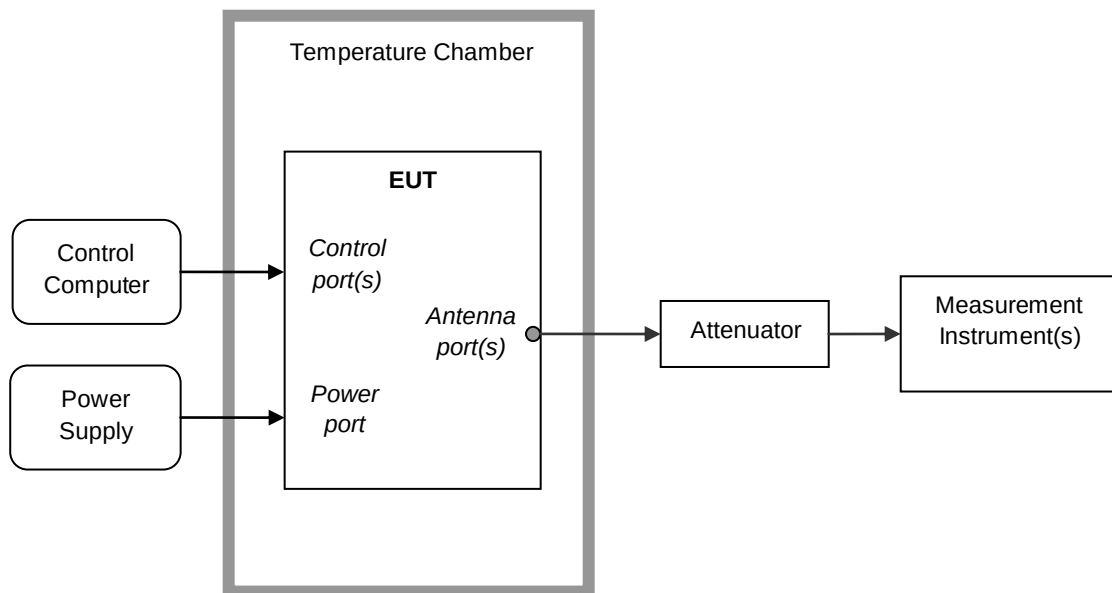
Environment Parameter	Selected Values During Tests		
	Temperature	Voltage	Relative Humidity
Ambient Climate (See clause 1.3)	Ambient	---	Ambient
Rated Voltage	---	-48 VDC	---

4.3 Test Setups

4.3.1 Test Setup 1



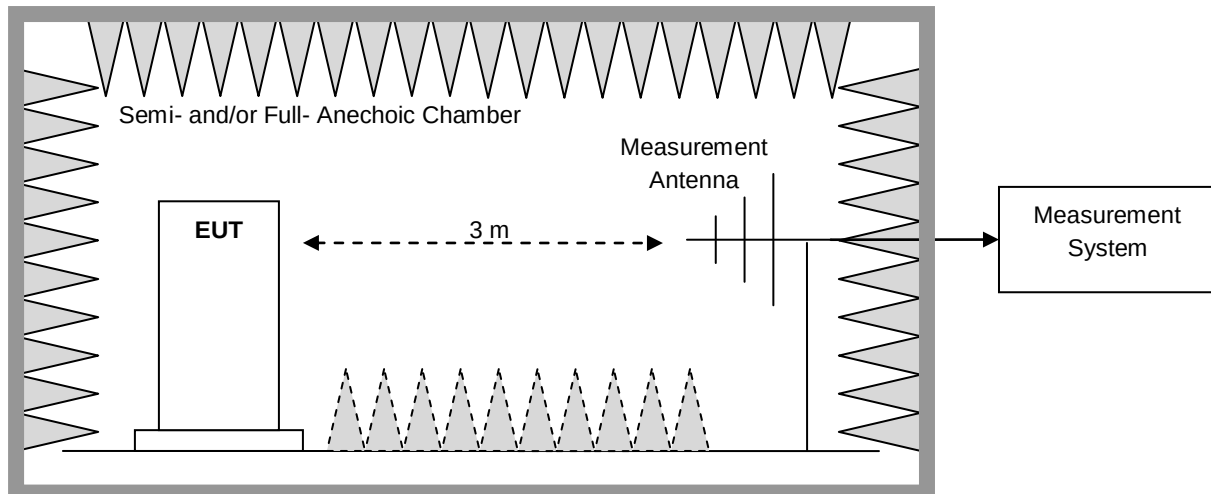
4.3.2 Test Setup 2



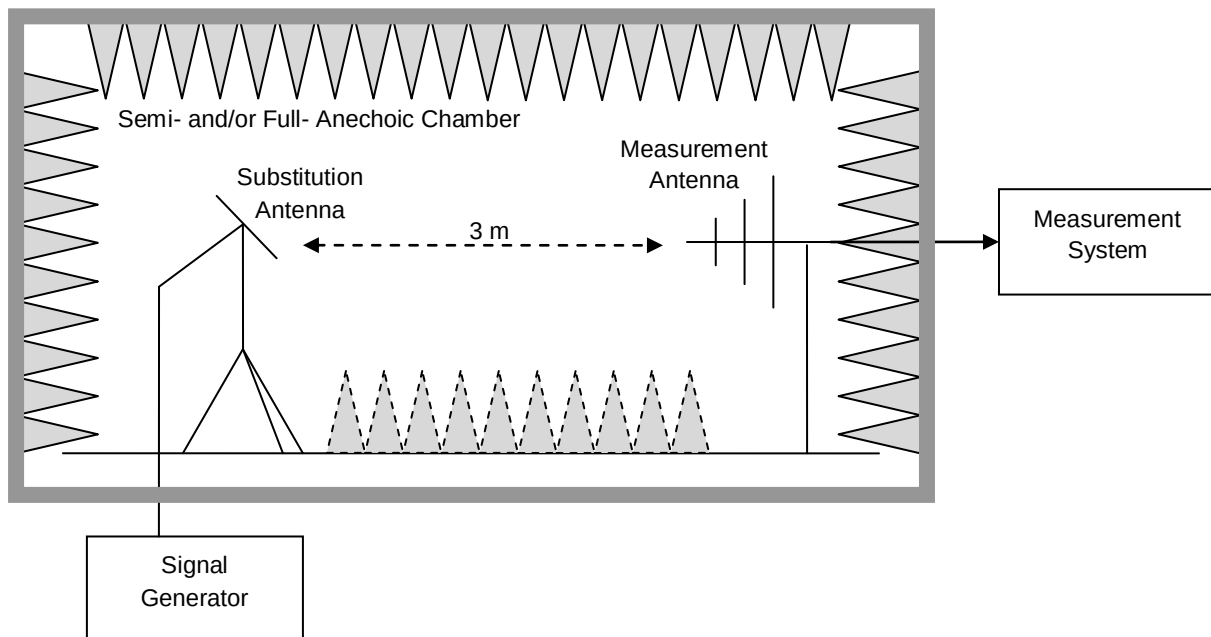
4.3.3 Test Setup 3

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.	AmbientClimate& Rated Voltage
		Test Setup	Test Seup 1
		EUT Conf.	1U_TM1_B_Band2, 1U_TM1_M_Band2, 1U_TM1_T_Band2, NTC_4U_TM1_B_Band2, NTC_4U_TM1_T_Band2, 1L5M_TM1_B_Band2, 1L5M_TM1_M_Band2, 1L5M_TM1_T_Band2, 1L10M_TM1_B_Band2, 1L10M_TM1_M_Band2, 1L10M_TM1_T_Band2, 1L15M_TM1_B_Band2, 1L15M_TM1_M_Band2, 1L15M_TM1_T_Band2, 1L20M_TM1_B_Band2, 1L20M_TM1_M_Band2, 1L20M_TM1_T_Band2, NTC_4L_TM1_B_Band2, NTC_4L_TM1_T_Band2, 1U_TM1_B_Band4, 1U_TM1_M_Band4, 1U_TM1_T_Band4, 4U_TM1_B_Band4, 4U_TM1_T_Band4 1L5M_TM1_B_Band4, 1L5M_TM1_M_Band4, 1L5M_TM1_T_Band4, 1L10M_TM1_B_Band4, 1L10M_TM1_M_Band4, 1L10M_TM1_T_Band4, 1L15M_TM1_B_Band4, 1L15M_TM1_M_Band4, 1L15M_TM1_T_Band4, 1L20M_TM1_B_Band4, 1L20M_TM1_M_Band4, 1L20M_TM1_T_Band4, NTC_4L_TM1_B_Band4, NTC_4L_TM1_T_Band4, NTC_2U2L_TM1_B_Band4, NTC_2U2L_TM1_T_Band4 1U_B_band2+1L_T_band4, NTC_1U1L_B_band2+NTC_2L_T_band4 NTC_1U1L_B_band2+NTC_1U1L_T_band4
	PowerSpectral Density (if required)	Test Env.	AmbientClimate& Rated Voltage
		Test Setup	Test Seup 1
		EUT Conf.	1U_TM1_B_Band2, 1U_TM1_M_Band2, 1U_TM1_T_Band2, 1L5M_TM1_B_Band2, 1L5M_TM1_M_Band2, 1L5M_TM1_T_Band2, 1L10M_TM1_B_Band2, 1L10M_TM1_M_Band2, 1L10M_TM1_T_Band2, 1L15M_TM1_B_Band2, 1L15M_TM1_M_Band2, 1L15M_TM1_T_Band2, 1L20M_TM1_B_Band2, 1L20M_TM1_M_Band2, 1L20M_TM1_T_Band2, 1U_TM1_B_Band4, 1U_TM1_M_Band4, 1U_TM1_T_Band4, 1L5M_TM1_B_Band4, 1L5M_TM1_M_Band4, 1L5M_TM1_T_Band4, 1L10M_TM1_B_Band4, 1L10M_TM1_M_Band4, 1L10M_TM1_T_Band4, 1L15M_TM1_B_Band4, 1L15M_TM1_M_Band4, 1L15M_TM1_T_Band4, 1L20M_TM1_B_Band4,

Test Case		Test Conditions	
	Peak-to-Average Ratio (if required)		1L20M_TM1_M_Band4, 1L20M_TM1_T_Band4,
		Test Env.	AmbientClimate& Rated Voltage
		Test Setup	Test Seup 1
		EUT Conf.	1U_TM1_B_Band2, 1U_TM1_M_Band2, 1U_TM1_T_Band2, 1L5M_TM1_B_Band2, 1L5M_TM1_M_Band2, 1L5M_TM1_T_Band2, 1L10M_TM1_B_Band2, 1L10M_TM1_M_Band2, 1L10M_TM1_T_Band2, 1L15M_TM1_B_Band2, 1L15M_TM1_M_Band2, 1L15M_TM1_T_Band2, 1L20M_TM1_B_Band2, 1L20M_TM1_M_Band2, 1L20M_TM1_T_Band2, 1U_TM1_B_Band4, 1U_TM1_M_Band4, 1U_TM1_T_Band4, 1L5M_TM1_B_Band4, 1L5M_TM1_M_Band4, 1L5M_TM1_T_Band4, 1L10M_TM1_B_Band4, 1L10M_TM1_M_Band4, 1L10M_TM1_T_Band4, 1L15M_TM1_B_Band4, 1L15M_TM1_M_Band4, 1L15M_TM1_T_Band4, 1L20M_TM1_B_Band4, 1L20M_TM1_M_Band4, 1L20M_TM1_T_Band4,
Bandwidth	Occupied Bandwidth	Test Env.	AmbientClimate& Rated Voltage
		Test Setup	Test Seup 1
		EUT Conf.	1U_TM1_B_Band2, 1U_TM1_M_Band2, 1U_TM1_T_Band2, 1L5M_TM1_B_Band2, 1L5M_TM1_M_Band2, 1L5M_TM1_T_Band2, 1L10M_TM1_B_Band2, 1L10M_TM1_M_Band2, 1L10M_TM1_T_Band2, 1L15M_TM1_B_Band2, 1L15M_TM1_M_Band2, 1L15M_TM1_T_Band2, 1L20M_TM1_B_Band2, 1L20M_TM1_M_Band2, 1L20M_TM1_T_Band2, 1U_TM1_B_Band4, 1U_TM1_M_Band4, 1U_TM1_T_Band4, 1L5M_TM1_B_Band4, 1L5M_TM1_M_Band4, 1L5M_TM1_T_Band4, 1L10M_TM1_B_Band4, 1L10M_TM1_M_Band4, 1L10M_TM1_T_Band4, 1L15M_TM1_B_Band4, 1L15M_TM1_M_Band4, 1L15M_TM1_T_Band4, 1L20M_TM1_B_Band4, 1L20M_TM1_M_Band4, 1L20M_TM1_T_Band4,
	Emission Bandwidth (if required)	Test Env.	AmbientClimate& Rated Voltage
		Test Setup	Test Seup 1
		EUT Conf.	1U_TM1_B_Band2, 1U_TM1_M_Band2, 1U_TM1_T_Band2, 1L5M_TM1_B_Band2, 1L5M_TM1_M_Band2, 1L5M_TM1_T_Band2, 1L10M_TM1_B_Band2, 1L10M_TM1_M_Band2, 1L10M_TM1_T_Band2, 1L15M_TM1_B_Band2, 1L15M_TM1_M_Band2, 1L15M_TM1_T_Band2, 1L20M_TM1_B_Band2, 1L20M_TM1_M_Band2, 1L20M_TM1_T_Band2,

Test Case		Test Conditions	
			1U_TM1_B_Band4, 1U_TM1_M_Band4, 1U_TM1_T_Band4, 1L5M_TM1_B_Band4, 1L5M_TM1_M_Band4, 1L5M_TM1_T_Band4, 1L10M_TM1_B_Band4, 1L10M_TM1_M_Band4, 1L10M_TM1_T_Band4, 1L15M_TM1_B_Band4, 1L15M_TM1_M_Band4, 1L15M_TM1_T_Band4, 1L20M_TM1_B_Band4, 1L20M_TM1_M_Band4, 1L20M_TM1_T_Band4,
Band Edges Compliance / Emission Mask	Test Env.	AmbientClimate& Rated Voltage	
	Test Setup	Test Seup 1	
	EUT Conf.	1U_TM1_B_Band2, 1U_TM1_T_Band2, NTC_4U_TM1_B_Band2, NTC_4U_TM1_T_Band2, 1L5M_TM1_B_Band2, 1L5M_TM1_T_Band2, 1L10M_TM1_B_Band2, 1L10M_TM1_T_Band2, 1L15M_TM1_B_Band2, 1L15M_TM1_T_Band2, 1L20M_TM1_B_Band2, 1L20M_TM1_T_Band2, NTC_4L_TM1_B_Band2, NTC_4L_TM1_T_Band2, 1U_TM1_B_Band4, 1U_TM1_T_Band4, 4U_TM1_B_Band4, 4U_TM1_T_Band4 1L5M_TM1_B_Band4, 1L5M_TM1_T_Band4, 1L10M_TM1_B_Band4, 1L10M_TM1_T_Band4, 1L15M_TM1_B_Band4, 1L15M_TM1_T_Band4, 1L20M_TM1_B_Band4, 1L20M_TM1_T_Band4, NTC_4L_TM1_B_Band4, NTC_4L_TM1_T_Band4, NTC_2U2L_TM1_B_Band4, NTC_2U2L_TM1_T_Band4 1U_B_band2+1L_T_band4, NTC_1U1L_B_band2+NTC_2L_T_band4 NTC_1U1L_B_band2+NTC_1U1L_T_band4	
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.	AmbientClimate& Rated Voltage	
	Test Setup	Test Seup 1	
	EUT Conf.	1U_TM1_B_Band2, 1U_TM1_M_Band2, 1U_TM1_T_Band2, NTC_4U_TM1_B_Band2, NTC_4U_TM1_T_Band2,	

Test Case		Test Conditions	
			1L20M_TM1_B_Band2, 1L20M_TM1_M_Band2, 1L20M_TM1_T_Band2, NTC_4L_TM1_B_Band2, NTC_4L_TM1_T_Band2, 1U_TM1_B_Band4, 1U_TM1_M_Band4, 1U_TM1_T_Band4, 4U_TM1_B_Band4, 4U_TM1_T_Band4 1L5M_TM1_B_Band4, 1L5M_TM1_M_Band4, 1L20M_TM1_M_Band4, 1L20M_TM1_T_Band4, NTC_4L_TM1_B_Band4, NTC_4L_TM1_T_Band4, NTC_2U2L_TM1_B_Band4, NTC_2U2L_TM1_T_Band4 1U_B_band2+1L_T_band4, NTC_1U1L_B_band2+NTC_2L_T_band4 NTC_1U1L_B_band2+NTC_1U1L_T_band4
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 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.	AmbientClimate& Rated Voltage
		Test Setup	Test Seup 3
		EUT Conf.	1U_B_band2+1L_T_band4 NOTE: If applicable, the EUT Conf. that has maximum power density (based on the equivalent power level) isselected.
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 AmbientClimate.
		Test Setup	Test Seup 2



Test Case		Test Conditions	
		EUT Conf.	1U_TM1_M_Band2, 1L20M_TM1_M_Band2, 1L5M_TM1_M_Band4, NOTE: A representative EUT Conf. was selected since the un-modulation carrier configuration was required by the standards/rules.
Receiver Spurious Emissions		Test Env.	AmbientClimate& Rated Voltage
		Test Setup	Test Seup 1
		EUT Conf.	Not Applicable

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	2017-02-28
Spectrum Analyzer	Agilent	N9020A	MY51240619	2016-11-19
Spectrum Analyzer	Agilent	E4440A	MY49420179	2017-02-28
Signal Generator	Agilent	E8257D	MY51110541	2017-04-26
Temperature Chamber	ESPEC	EW0470S	12113066	2016-11-08
Test Setup 3				
EMI test receiver	R&S	ESU26	100329	2017-03-01
Bilog antenna	TESEQ	CBL 6112D	32855	2017-05-31
Bilog antenna	TESEQ	CBL 6112D	32856	2017-05-31
Horn antenna (1-18GHz)	R&S	HF907	100314	2018-07-03 (2y)
Horn antenna (18-40GHz)	A.H.Systems	SAS-574	426	2018-02-26 (2y)

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