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Shenzhen Branch

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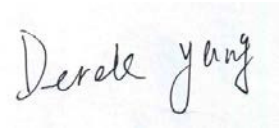
FCC REPORT

Application No:	SZEM1701000231RG
Applicant:	Huawei Technologies Co.,Ltd.
Manufacturer:	Huawei Technologies Co.,Ltd.
Product Name:	LTE USB Stick
Model No.(EUT):	604HW
Trade Mark:	HUAWEI
FCC ID:	QIS604HW
Standards:	47 CFR Part 2(2015) 47 CFR Part 22 subpart H(2015) 47 CFR Part 24 subpart E(2015) 47 CFR Part 27 subpart C(2015)
Test Method:	FCC KDB 971168 D01 Power Meas License Digital Systems v02r02
Date of Receipt:	2017-01-11
Date of Test:	2017-01-11 to 2017-01-22
Date of Issue:	2017-01-22
Test Result:	**PASS ***

* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:



Derek Yang
Wireless Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.
The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. All test results in this report can be traceable to National or International Standards.

2 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		2017-01-22		Original

Authorized for issue by:				
Tested By		 **(Mike Hu) /Project Engineer**		2017-01-22 **Date**
Checked By		 **(Jim Huang) /Reviewer**		2017-01-22 **Date**

3 Test Summary

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §22.913, §24.232 §27.50 §90.635	FCC: ERP ≤7 W. ERP≤100W EIRP ≤ 2 W.	Section 1 of Appendix B	PASS
Peak-Average Ratio	§24.232 §27.50	≤13dB	Section 2 of Appendix B	PASS
Modulation Characteristics	§2.1047	Digital modulation	Section 3 of Appendix B	PASS
Bandwidth	§2.1049(h), §22.917, §24.238 §27.53	OBW:No limit EBW: No limit	Section 4 of Appendix B	PASS
Band Edge Compliance	§2.1051, §22.917, §24.238 §27.53 §90.691	≤ -13dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Section 5 of Appendix B	PASS
Spurious emissions at antenna terminals	§2.1051, §22.917, §24.238 §27.53 §90.691	FCC: ≤ -13dBm/100 kHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	Section 6 of Appendix B	PASS
Field strength of spurious radiation	§2.1051, §22.917, §24.238 §27.53 §90.691	FCC: ≤ -13dBm/100 kHz,	Section 7 of Appendix B	PASS
Frequency stability	§2.1055, §22.355, §24.235 §27.54 §90.213	≤ ±2.5ppm.	Section 8 of Appendix B	PASS

4 Content

5 General Information

5.1 Client Information

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

5.2 General Description of EUT

Product Name:	LTE USB Stick
Model No.:	604HW
Trade Mark:	HUAWEI
Sample Type:	Portable production
Antenna Type:	Loop Antenna
Antenna Gain:	LTE Band 2: 2.0dBi, LTE Band 4: 2.9dBi ; LTE Band 12: -1.6dBi ; LTE Band 17: -1.6dBi ; LTE Band 25: 2.0dBi ; LTE Band 26: 1.6dBi ; LTE Band 41: 4.6dBi

5.3 Test Mode

Test Mode	Test Modes Description
LTE/TM1	LTE system, QPSK modulation
LTE/TM2	LTE system, 16QAM modulation
LTE/TM3	LTE system, 64QAM modulation

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

5.4 Test Environment

Environment Parameter	Selected Values During Tests	
Relative Humidity	52%	
Atmospheric Pressure:	1015Pa	
Temperature	TN	25 °C
Voltage :	VL	4.75V
	VN	5.0V
	VH	5.25V

NOTE: VL= lower extreme test voltage
VN= nominal voltage
VH= upper extreme test voltage
TN= normal temperature

5.5 Test Frequency

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 2 1.4MHz	TX	Channel 18607	Channel 18900	Channel 19193
		1850.7 MHz	1880 MHz	1909.3 MHz
	RX	Channel 607	Channel 900	Channel 1193
		1930.7 MHz	1960 MHz	1989.3 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 2 3MHz	TX	Channel 18615	Channel 18900	Channel 19185
		1851.5 MHz	1880 MHz	1908.5 MHz
	RX	Channel 615	Channel 900	Channel 1185
		1931.5 MHz	1960 MHz	1988.5 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 2 5MHz	TX	Channel 18625	Channel 18900	Channel 19175
		1852.5 MHz	1880 MHz	1907.5 MHz
	RX	Channel 625	Channel 900	Channel1175
		1932.5 MHz	1960 MHz	1987.5 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 2 10MHz	TX	Channel 18650	Channel 18900	Channel 19150
		1855 MHz	1880 MHz	1905 MHz
	RX	Channel 650	Channel 900	Channel 1150
		1935 MHz	1960 MHz	1985 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 2 15MHz	TX	Channel 18675	Channel 18900	Channel 19125
		1857.5 MHz	1880 MHz	1902.5 MHz
	RX	Channel 675	Channel 900	Channel 1125
		1937.5 MHz	1960 MHz	1982.5 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 2 20MHz	TX	Channel 18700	Channel 18900	Channel 19100
		1860 MHz	1880 MHz	1900 MHz
	RX	Channel 700	Channel 900	Channel 1100
		1940 MHz	1960 MHz	1980 MHz

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 4 1.4MHz	TX	Channel 19957	Channel 20175	Channel 20393
		1710.7 MHz	1732.5 MHz	1754.3 MHz
	RX	Channel 1957	Channel 2175	Channel 2393
		2110.7 MHz	2132.5 MHz	2154.3 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 4 3MHz	TX	Channel 19965	Channel 20175	Channel 20385
		1711.5 MHz	1732.5 MHz	1753.5 MHz
	RX	Channel 1965	Channel 2175	Channel 2385
		2111.5 MHz	2132.5 MHz	2153.5 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 4 5MHz	TX	Channel 19975	Channel 20175	Channel 20375
		1712.5 MHz	1732.5 MHz	1752.5 MHz
	RX	Channel 1975	Channel 2175	Channel 2375
		2112.5 MHz	2132.5 MHz	2152.5 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 4 10MHz	TX	Channel 20000	Channel 20175	Channel 20350
		1715 MHz	1732.5 MHz	1750 MHz
	RX	Channel 2000	Channel 2175	Channel 2350
		2115 MHz	2132.5 MHz	2150 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 4 15MHz	TX	Channel 20025	Channel 20175	Channel 20325
		1717.5 MHz	1732.5 MHz	1747.5 MHz
	RX	Channel 2025	Channel 2175	Channel 2325
		2117.5 MHz	2132.5 MHz	2147.5 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 4 20MHz	TX	Channel 20050	Channel 20175	Channel 20300
		1720 MHz	1732.5 MHz	1745 MHz
	RX	Channel 2050	Channel 2175	Channel 2300
		2120 MHz	2132.5 MHz	2145 MHz

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND12 1.4MHz	TX	Channel 23017	Channel 23095	Channel 23173
		699.7 MHz	707.5 MHz	715.3 MHz
	RX	Channel 5017	Channel 5095	Channel 5173
		729.7 MHz	737.5 MHz	745.3 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 12 3MHz	TX	Channel 23025	Channel 23095	Channel 23165
		700.5 MHz	707.5 MHz	714.5 MHz
	RX	Channel 5025	Channel 5095	Channel 5165
		730.5 MHz	737.5 MHz	744.5 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 12 5MHz	TX	Channel 23035	Channel 23095	Channel 23155
		701.5 MHz	707.5 MHz	713.5 MHz
	RX	Channel 5035	Channel 5095	Channel 5155
		731.5 MHz	737.5 MHz	743.5 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 12 10MHz	TX	Channel 23060	Channel 23095	Channel 23130
		704 MHz	707.5 MHz	711 MHz
	RX	Channel 5060	Channel 5095	Channel 5130
		734 MHz	737.5 MHz	741 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 17 5MHz	TX	Channel 23755	Channel 23790	Channel 23825
		706.5 MHz	710 MHz	713.5 MHz
	RX	Channel 5755	Channel 5790	Channel 5825
		736.5 MHz	740 MHz	743.5 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 17 10MHz	TX	Channel 23780	Channel 23790	Channel 23800
		709 MHz	710 MHz	711 MHz
	RX	Channel 5780	Channel 5790	Channel 5800
		739 MHz	740 MHz	741 MHz

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 25 1.4MHz	TX	Channel 26047	Channel 26365	Channel 26683
		1850.7 MHz	1882.5 MHz	1914.3 MHz
	RX	Channel 8047	Channel 8365	Channel 8683
		1930.7 MHz	1962.5 MHz	1994.3 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 25 3MHz	TX	Channel 26055	Channel 26365	Channel 26675
		1851.5 MHz	1882.5 MHz	1913.5 MHz
	RX	Channel 8055	Channel 8365	Channel 8675
		1931.5 MHz	1962.5 MHz	1993.5 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 25 5MHz	TX	Channel 26065	Channel 26365	Channel 26665
		1852.5 MHz	1882.5 MHz	1912.5 MHz
	RX	Channel 8065	Channel 8365	Channel 8665
		1932.5 MHz	1962.5 MHz	1992.5 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 25 10MHz	TX	Channel 26090	Channel 26365	Channel 26640
		1855 MHz	1882.5 MHz	1910 MHz
	RX	Channel 8090	Channel 8365	Channel 8640
		1935 MHz	1962.5 MHz	1990 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 25 15MHz	TX	Channel 26115	Channel 26365	Channel 26615
		1857.5 MHz	1882.5 MHz	1907.5 MHz
	RX	Channel 8115	Channel 8365	Channel 8615
		1937.5 MHz	1962.5 MHz	1987.5 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 25 20MHz	TX	Channel 26140	Channel 26365	Channel 26590
		1860 MHz	1882.5 MHz	1905 MHz
	RX	Channel 8140	Channel 8365	Channel 8590
		1940 MHz	1962.5 MHz	1985 MHz

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND26 (814-824) 1.4MHz	TX	Channel 26697	Channel 26740	Channel 26783
		814.7 MHz	819 MHz	823.3 MHz
	RX	Channel 8697	Channel 8740	Channel 8783
		859.7 MHz	864MHz	868.3 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND26 (814-824) 3MHz	TX	Channel 26705	Channel 26740	Channel 26775
		815.5 MHz	819 MHz	822.5 MHz
	RX	Channel 8705	Channel 8740	Channel 8775
		860.5 MHz	864MHz	867.5 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND26 (814-824) 5MHz	TX	Channel 26715	Channel 26740	Channel 26765
		816.5 MHz	819 MHz	821.5 MHz
	RX	Channel 8715	Channel 8740	Channel 8755
		861.5 MHz	864MHz	866.5 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND26 (814-824) 10MHz	TX	Channel 26740	Channel 26740	Channel 26740
		819 MHz	819 MHz	819 MHz
	RX	Channel 8740	Channel 8740	Channel 8740
		864MHz	864MHz	864MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND26 (824-849) 1.4MHz	TX	Channel 26797	Channel 26915	Channel 27033
		824.7 MHz	836.5 MHz	848.3 MHz
	RX	Channel 8697	Channel 8915	Channel 9033
		859.7 MHz	881.5 MHz	893.3 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND26 (824-849) 3MHz	TX	Channel 26805	Channel 26915	Channel 27025
		825.5 MHz	836.5 MHz	847.5 MHz
	RX	Channel 8805	Channel 8915	Channel 9025
		860.5 MHz	881.5 MHz	892.5 MHz

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND26 (824-849) 5MHz	TX	Channel 26815	Channel 26915	Channel 27015
		826.5 MHz	836.5 MHz	846.5 MHz
	RX	Channel 8815	Channel 8915	Channel 9015
		871.5 MHz	881.5 MHz	891.5 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND26 (824-849) 10MHz	TX	Channel 26840	Channel 26915	Channel 26990
		829 MHz	836.5 MHz	844 MHz
	RX	Channel 8840	Channel 8915	Channel 8990
		874 MHz	881.5 MHz	889 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND26 (824-849) 15MHz	TX	Channel 26865	Channel 26915	Channel 26965
		831.5 MHz	836.5 MHz	841.5 MHz
	RX	Channel 8865	Channel 8915	Channel 8965
		876.5 MHz	881.5 MHz	886.5 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 41 5MHz	TX	Channel 39675	Channel40620	Channel 41565
		2498.5 MHz	2593 MHz	2687.5 MHz
	RX	Channel 39675	Channel40620	Channel 41565
		2498.5 MHz	2593 MHz	2687.5 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 41 10MHz	TX	Channel 39700	Channel40620	Channel 41540
		2501 MHz	2593 MHz	2685 MHz
	RX	Channel 39700	Channel40620	Channel 41540
		2501 MHz	2593 MHz	2685 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 41 15MHz	TX	Channel 39725	Channel40620	Channel 41515
		2503.5 MHz	2593 MHz	2682.5 MHz
	RX	Channel 39725	Channel40620	Channel 41515
		2503.5 MHz	2593 MHz	2682.5 MHz

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
LTE BAND 41 20MHz	TX	Channel 39750	Channel40620	Channel 41490
		2506 MHz	2593 MHz	2680 MHz
	RX	Channel 39750	Channel40620	Channel 41490
		2506 MHz	2593 MHz	2680 MHz

5.6 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

5.7 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

• **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• **VCCI**

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-823, R-4188, T-1153 and C-2383 respectively.

• **FCC – Registration No.: 556682**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 556682.

• **Industry Canada (IC)**

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.

5.8 Deviation from Standards

None.

5.9 Abnormalities from Standard Conditions

None.

5.10Other Information Requested by the Customer

None.

5.11 Technical Specification

Characteristics	Description	
	☒ LTE	
	LTE band 2	Transmission (TX): 1850 to 1910 MHz
		Receiving (RX): 1930 to 1990 MHz
	LTE band 4	Transmission (TX): 1710 to 1755 MHz
		Receiving (RX): 2110 to 2155 MHz
	LTE band 12	Transmission (TX): 699 to 716 MHz
		Receiving (RX): 729to 746 MHz
	LTE band 17	Transmission (TX): 704 to 716 MHz
		Receiving (RX): 734 to 746 MHz
	LTE band 25	Transmission (TX): 1850 to 1915 MHz
		Receiving (RX): 1930 to 1995 MHz
	LTE band 26(814-824)	Transmission (TX): 814 to 824 MHz
		Receiving (RX): 859 to 869 MHz
	LTE band 26(824-849)	Transmission (TX): 824 to 849 MHz
		Receiving (RX): 869 to 894 MHz
	LTE band 41	Transmission (TX): 2496 to 2690 MHz
		Receiving (RX): 2496 to 2690 MHz
Target TX Output Power	LTE band 2: 18dBm LTE band 4: 19.5dBm LTE band 12: 23.5dBm LTE band 17: 23.5dBm LTE band 25: 18dBm LTE band 26: 22dBm LTE band41: 18dBm	
Supported Channel Bandwidth	LTE system	☒1.4 MHz;3 MHz; 5 MHz;10 MHz;15 MHz;20 MHz

Characteristics	Description	
	LTE band2	1M10G7D;1M09W7D; 1M10W7D 2M69G7D;2M69W7D; 2M69W7D 4M49G7D;4M49W7D; 4M49W7D 8M93G7D;8M95W7D; 8M93W7D 13M5G7D;13M5W7D; 13M5W7D 17M9G7D;18M0W7D; 17M9W7D
	LTE band4	1M10G7D;1M09W7D; 1M10W7D 2M69G7D;2M69W7D; 2M69W7D 4M49G7D;4M49W7D; 4M48W7D 8M93G7D;8M95W7D; 8M95W7D 13M5G7D;13M5W7D; 13M5W7D 17M9G7D;17M9W7D; 17M9W7D
	LTE band12	1M10G7D;1M09W7D; 1M10W7D 2M69G7D;2M69W7D; 2M69W7D 4M49G7D;4M49W7D; 4M48W7D 8M95G7D;8M93W7D; 8M95W7D
	LTE band17	4M49G7D;4M48W7D; 4M48W7D 8M95G7D;8M95W7D; 8M95W7D
	LTE band25	1M10G7D;1M09W7D; 1M10W7D 2M69G7D;2M69W7D; 2M69W7D 4M49G7D;4M49W7D; 4M48W7D 8M95G7D;8M95W7D; 8M95W7D 13M5G7D;13M5W7D; 13M5W7D 17M9G7D;17M9W7D; 17M9W7D
	LTE band26(814-824)	1M10G7D;1M10W7D; 1M10W7D 2M69G7D;2M69W7D; 2M69W7D 4M49G7D;4M49W7D; 4M48W7D 8M95G7D;8M93W7D; 8M93W7D
	LTE band26(824-849)	1M10G7D;1M09W7D; 1M10W7D 2M69G7D;2M69W7D; 2M69W7D 4M49G7D;4M50W7D; 4M48W7D 8M95G7D;8M95W7D;8M93W7D 13M5G7D;13M5W7D; 13M5W7D
	LTE band41	4M48G7D;4M48W7D; 4M48W7D 8M95G7D;8M93W7D; 8M95W7D 13M5G7D;13M5W7D; 13M5W7D 17M9G7D;17M9W7D; 17M9W7D

6 Description of Tests

6.1 Conducted Output Power

Measurement Procedure: FCC KDB 971168 D01 Power Meas License Digital Systems v02r02

The transmitter output was connected to a calibrated coaxial cable, attenuator and power meter, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The power output at the transmitter antenna port was determined by adding the value of the cable insertion loss to the power reading. The tests were performed at three frequencies (low channel, middle channel and high channel) and on the highest power levels, which can be setup on the transmitters.

Note: Reference test setup 1

6.2 Effective (Isotropic) Radiated Power of Transmitter

Measurement Procedure: FCC KDB 971168 D01 Power Meas License Digital Systems v02r02

Below 1GHz test procedure as below:

1). The EUT was powered ON and placed on a 0.8m high table in the chamber. The antenna of the transmitter was extended to its maximum length.

2). The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.

3). Steps 1) and 2) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.

4). The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.

5). A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 2) is obtained for this set of conditions.

6). The output power into the substitution antenna was then measured.

7). Steps 5) and 6) were repeated with both antennas polarized.

8). Calculate power in dBm by the following formula:

ERP (dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBd)

Where:

Pg is the generator output power into the substitution antenna.

Above 1GHz test procedure as below:

1). Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber

2). Calculate power in dBm by the following formula:

EIRP(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBi)

EIRP=ERP+2.15dB

Where:

Pg is the generator output power into the substitution antenna.

3). Test the EUT in the lowest channel, the middle channel the Highest channel

4). The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, Only the test worst case mode is recorded in the report.

5). Repeat above procedures until all frequencies measured was complete.

Note: Reference test setup 2

6.3 Occupied Bandwidth

Measurement Procedure: FCC KDB 971168 D01 Power Meas License Digital Systems v02r02

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyser, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at three frequencies (low channel, middle channel and high channel).The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1 percent of the selected span as is possible without being below 1 percent. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual. The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 percent of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

Note: Reference test setup 1

6.4 Band Edge at Antenna Terminals

Measurement Procedure: FCC KDB 971168 D01 Power Meas License Digital Systems v02r02

The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyser, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at three frequencies (low channel and high channel).in the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of 100kHz or 1% of the emission bandwidth of the fundamental emission of the transmitter may be employed. The EUT emission bandwidth is measured as the width of the signal between two points, outside of which all emission are attenuated at least 26dB below the transmitter power. The video bandwidth of the spectrum analyzer was set at thrice the resolution bandwidth. Detector Mode was set to peak or peak hold power.

Note: Reference test setup 1

6.5 Spurious And Harmonic Emissions at Antenna Terminal

Measurement Procedure: FCC KDB 971168 D01 Power Meas License Digital Systems v02r02

The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyzer, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at three frequencies (low channel and high channel).The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log(P) dB. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

Note: Reference test setup 1

6.6 Peak-Average Ratio

Measurement Procedure: FCC KDB 971168 D01 Power Meas License Digital Systems v02r02

A peak to average ratio measurement is performed at the conducted port of the EUT. For WCDMA signals, the spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level. For GSM signals, an average and a peak trace are used on a spectrum analyzer to determine the largest deviation between the average and the peak power of the EUT in a bandwidth greater than the emission bandwidth. The traces are generated with the spectrum analyzer set to zero span mode.

Note: Reference test setup 1

6.7 Field Strength of Spurious Radiation

Measurement Procedure: FCC KDB 971168 D01 Power Meas License Digital Systems v02r02

Below 1GHz test procedure as below:

1). The EUT was powered ON and placed on a 80cm high table in the chamber. The antenna of the transmitter was extended to its maximum length.

2). The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.

3). Steps 1) and 2) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.

4). The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.

5). A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 2) is obtained for this set of conditions.

6). The output power into the substitution antenna was then measured.

7). Steps 5) and 6) were repeated with both antennas polarized.

8) Calculate power in dBm by the following formula:

ERP(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBd)

Where:

Pd is the dipole equivalent power, Pg is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to Pg [dBm] – cable loss [dB]. The calculated Pd levels are then compared to the absolute spurious emission limit of -13dBm which is equivalent to the required minimum attenuation of 43 + 10log10(Power [Watts]).

Above 1GHz test procedure as below:

1) Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber

2) Calculate power in dBm by the following formula:

EIRP(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBi)

EIRP=ERP+2.15dB

Where:

Pg is the generator output power into the substitution antenna.

3. Test the EUT in the lowest channel, the middle channel the Highest channel

4. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, Only the test worst case mode is recorded in the report.

5. Repeat above procedures until all frequencies measured was complete

Note: Reference test setup 3

6.8 Frequency Stability / Temperature Variation

Measurement Procedure:

Frequency stability testing is performed in accordance with the guidelines of FCC KDB 971168 D01 Power Meas License Digital Systems v02r02

. The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

Specification – The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained

within ±0.00025% (±2.5 ppm) of the center frequency.

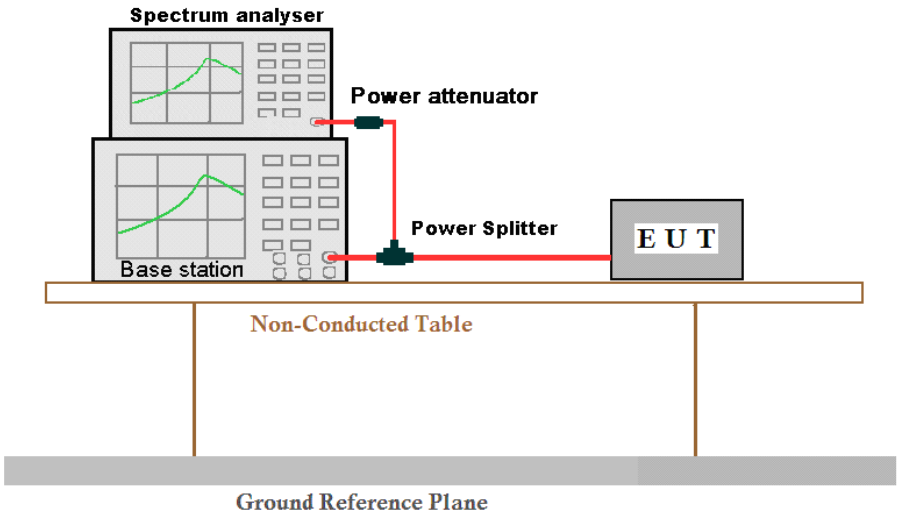
Time Period and Procedure:

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

Note: Reference test setup 4

6.9 Test Setups

6.9.1 Test Setup 1



6.9.2 Test Setup 2

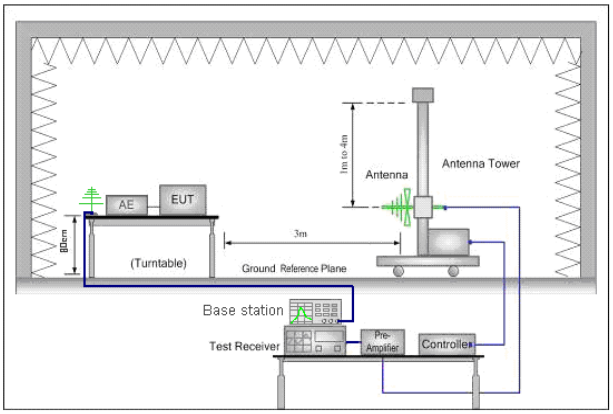


Figure 1. 30MHz to 1GHz

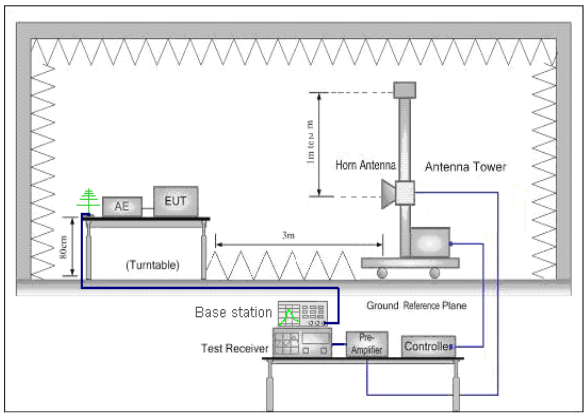


Figure 2. above 1GHz

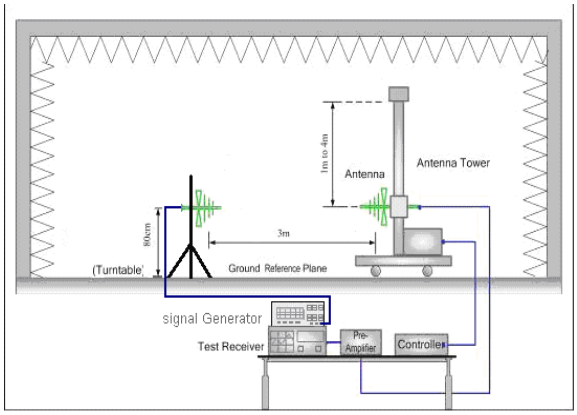


Figure 1. 30MHz to 1GHz

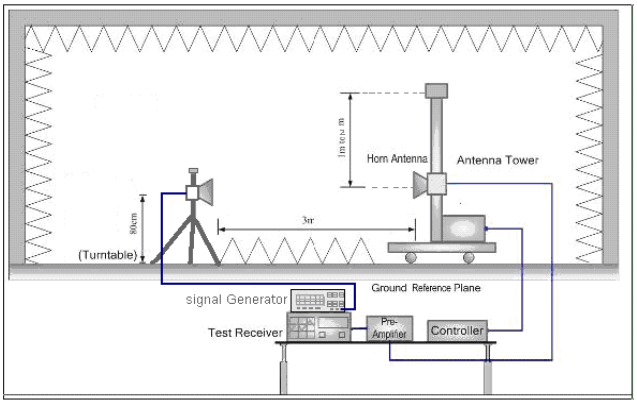


Figure 2. above 1GHz

6.9.3 Test Setup 3

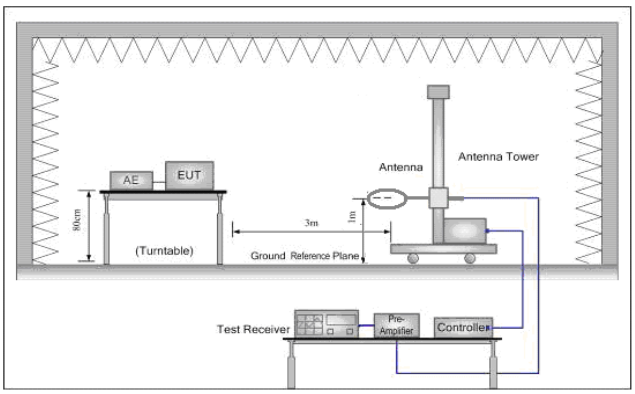


Figure 1. Below 30MHz

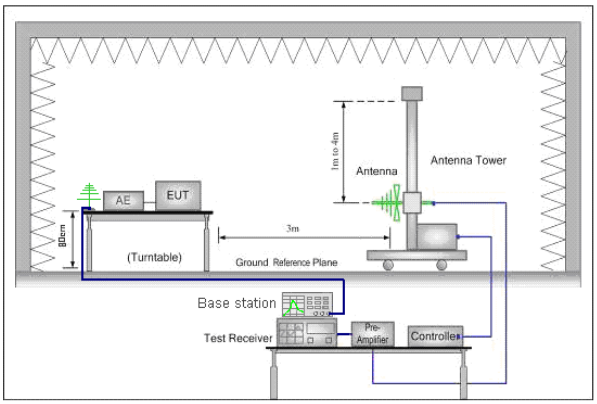


Figure 2. 30MHz to 1GHz

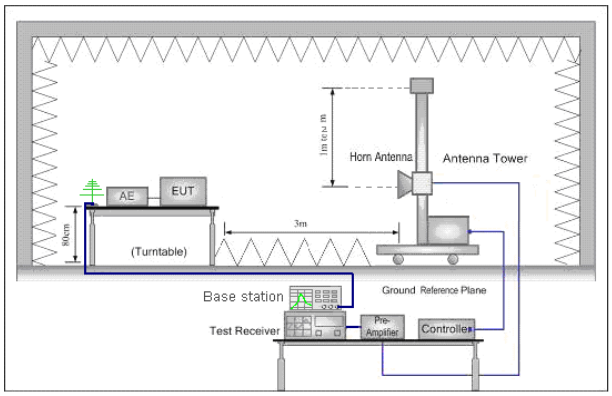


Figure 3. above 1GHz

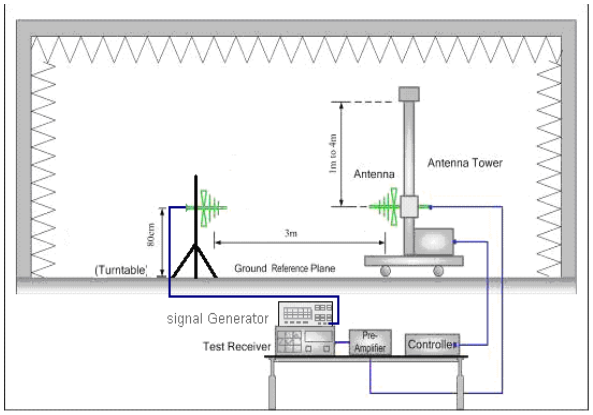


Figure 2. 30MHz to 1GHz

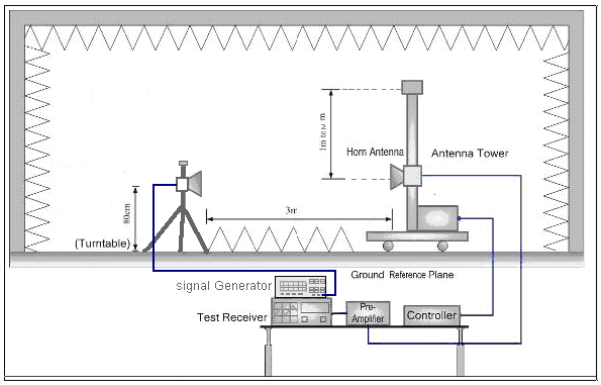
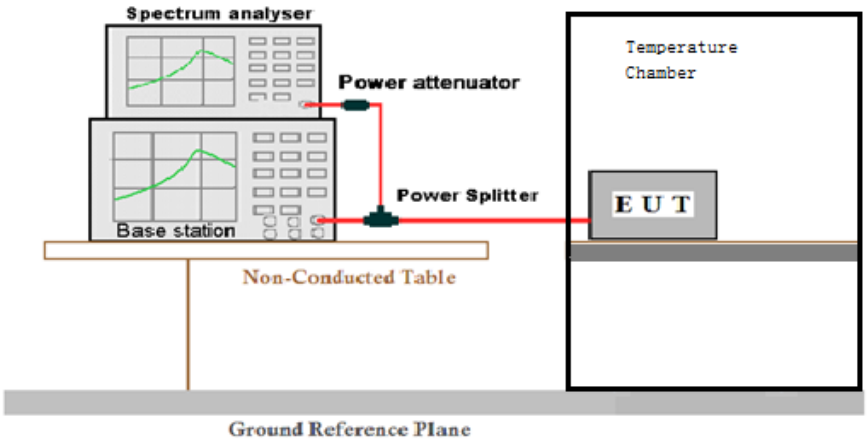


Figure 3. above 1GHz

6.9.4 Test Setup 4



6.10 Test Conditions

Test Case		Test Conditions	
Transmit Output Power Data	Average Power, Total	Test Environment	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	LTE/TM1; LTE/TM2; LTE/TM3
	Average Power, Spectral Density (if required)	Test Environment	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	LTE/TM1; LTE/TM2; LTE/TM3
Peak-to-Average Ratio (if required)		Test Environment	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	LTE/TM1; LTE/TM2; LTE/TM3
Modulation Characteristics		Test Environment	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	M (M= middle channe)
		Test Mode	LTE/TM1; LTE/TM2; LTE/TM3
Bandwidth	Occupied Bandwidth	Test Environment	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	LTE/TM1; LTE/TM2; LTE/TM3
	Emission Bandwidth (if required)	Test Environment	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	LTE/TM1; LTE/TM2; LTE/TM3

Band Edges Compliance	Test Environment	Ambient Climate & Rated Voltage
	Test Setup	Test Setup 1
	RF Channels (TX)	L, H (L= low channel, H= high channel)
	Test Mode	LTE/TM1; LTE/TM2; LTE/TM3
Spurious Emission at Antenna Terminals	Test Environment	Ambient Climate & Rated Voltage
	Test Setup	Test Setup 1
	RF Channels (TX)	L,M, H (L= low channel, M= middle channel, H= high channel)
	Test Mode	LTE/TM1
Field Strength of Spurious Radiation	Test Environment	Ambient Climate & Rated Voltage
	Test Setup	Test Setup 2
	Test Mode	LTE/TM1; LTE/TM2; LTE/TM3NOTE: If applicable, the EUT conf. that has maximum power density (based on the equivalent power level) is selected.
	RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
Frequency Stability	Test Env.	(1) -30 °C to +50 °C with step 10 °C at Rated Voltage; (2) VL, VN and VH of Rated Voltage at Ambient Climate.
	Test Setup	Test Setup 4
	RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
	Test Mode	LTE/TM1; LTE/TM2; LTE/TM3

7 Main Test Instruments

RE in Chamber						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. date (yyyy-mm-dd)**	**Cal.Due date (yyyy-mm-dd)**
1	3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2016-05-13	2017-05-13
2	EMI Test Receiver	Agilent Technologies	N9038A	SEM004-05	2017-09-16	2017-09-16
3	BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-02	2014-11-15	2017-11-15
4	Double-ridged horn (1-18GHz)	ETS-LINDGREN	3117	SEM003-11	2015-10-17	2018-10-17
5	Horn Antenna (18-26GHz)	ETS-LINDGREN	3160	SEM003-12	2014-11-24	2017-11-24
6	Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEM005-01	2016-04-25	2017-04-25
7	Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEM004-10	2016-10-17	2017-10-17
8	Band filter	Amindeon	82346	SEM023-01	N/A	N/A
9	Universal radio communication tester	Rohde & Schwarz	CMU200	SEM010-01	2016-10-23	2017-10-23
10	Universal radio communication tester	Rohde & Schwarz	CMW500	SEM010-03	2016-10-23	2017-10-23
11	DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2016-10-09	2017-10-09
12	BiConiLog Antenna (30MHz-3GHz)	Schwarzbeck	VULB9163	SEM003-05	2015-10-17	2018-10-17
13	Horn Antenna (800MHz-18GHz)	Rohde & Schwarz	HF907	SEM003-06	2015-06-14	2018-06-14

RF connected test						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. date (yyyy-mm-dd)**	**Cal.Due date (yyyy-mm-dd)**
1	Humi/ Temp Indicator	MingGao	TH101B	W006-09	2016-03-09	2017-03-09
2	Spectrum Analyzer	Rohde & Schwarz	FSP	SEL0154	2016-09-17	2017-09-17
3	MXA Signal Analyzer	Agilent	N9020A	W025-01	2016-07-18	2017-07-18
4	Barometer	ChangChun	DYM3	SEL0088	2016-05-24	2017-05-24
5	Dual Output Mobile Communication DC Source	Agilent Technologies Inc	66319D	W009-02	2016-07-23	2017-07-23
6	Digital Multimeter	Fluke	15B+	W055-01	2016-03-09	2017-03-09
7	Wireless Communications Test Set	Rohde & Schwarz	CMW500	W005-03	2016-03-08	2017-03-08
8	Universal Radio Communication Tester	R&S	CMU200	W005-01	2016-10-23	2017-10-23

8 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	Data
Transmit Output Power Data	Power [dBm]	U = 0.37 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 = 4.5 dB (30 MHz to 1GHz) U = 3.3 dB (above 1 GHz) For 10 m Chamber: U = 4.5 dB (30 MHz to 1GHz) U = 3.2 dB (above 1 GHz)
Frequency Stability	Frequency Accuracy [ppm]	U = 0.24 ppm

9 Photographs - EUT Constructional Details

Refer to Appendix A - Photographs of EUT Constructional Details for SZEM1701000231RG.

The End