FCC
RF Test Report

Product Name: LTE Module

Model Number: ME909u-523

Report No: SYBH(Z-RF)010032014-2001

FCC ID：QISME909U-523

Reliability Laboratory of Huawei Technologies Co., Ltd.

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

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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 site recognition number is 97456.

4. The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 6369A-2.

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

Date of Receipt Sample:	2014-03-01
Start Date of Test:	2014-03-16
End Date of Test:	2014-03-28

Test Result: Pass

Approved by Senior Engineer:	2014-03-28	Liu Chunlin	Liu Chunlin
	Date	Name	Signature

Prepared by:

2014-03-28	Hexiaolin	Hexiaolin
Date	Name	Signature

Modification Record

No.	Last Report No.	Modification Description
1		First report.

CONTENT

1 General Information

1.1 Applied Standard

Applied Rules:	47 CFR FCC Part 02:2013 47 CFR FCC Part 22: 2013 47 CFR FCC Part 24: 2013 47 CFR FCC Part 27: 2013 47 CFR FCC Part90: 2013
Test Method:	FCC KDB 971168 D01 Power Meas License Digital Systems v02r01

1.2 Test Location

Test Location 1:	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

Ambient Temperature:	19.5 to 25 °C
Ambient Relative Humidity:	40 to 55 %
Atmospheric Pressure:	Not applicable

2 Test Summary

2.1 Cellular Band (824-849 MHz paired with 869-894 MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §22.913	FCC: ERP ≤ 7 W.	Appendix A	PASS
Peak-Average Ratio	---	---	Appendix B	---
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	PASS
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix D	PASS
Band Edges Compliance	§2.1051, §22.917	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Appendix E	PASS
Spurious Emission at Antenna Terminals	§2.1051, §22.917	FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	Appendix F	PASS
Field Strength of Spurious Radiation	§2.1053, §22.917	FCC: ≤ -13 dBm/100 kHz.	Appendix G	PASS
Frequency Stability	§2.1055, §22.355	≤ ±2.5ppm.	Appendix H	PASS
NOTE 1: For the verdict, the “N/A” denotes “not applicable”, the “N/T” denotes “not tested”.				

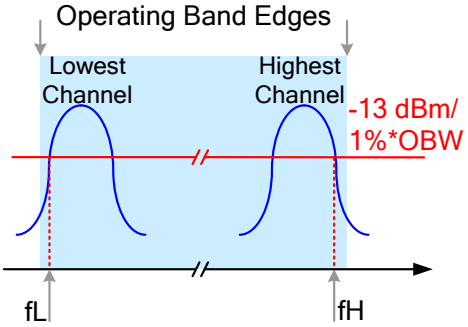
2.2 PCS Band (1850-1910 MHz paired with 1930-1990 MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §24.232	EIRP ≤ 2 W	Appendix A	PASS
Peak-Average Ratio	§2.1046, §24.232	FCC: Limit≤13 dB	Appendix B	PASS
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	PASS
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix D	PASS
Band Edges Compliance	§2.1051, §24.238	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Appendix E	PASS
Spurious Emission at Antenna Terminals	§2.1051, §24.238	≤ -13 dBm/1 MHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	Appendix F	PASS
Field Strength of Spurious Radiation	§2.1053, §24.238	≤ -13 dBm/1 MHz.	Appendix G	PASS
Frequency Stability	§2.1055, §24.235	FCC: within authorized frequency block.	Appendix H	PASS
NOTE 1: For the verdict, the “N/A” denotes “not applicable”, the “N/T” denotes “not tested”.				

2.3 AWS Band (1710-1755 MHz paired with 2110-2155 MHz)

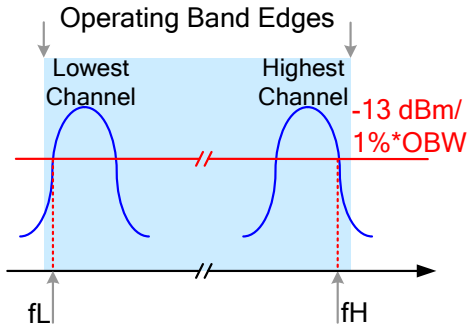
Test Item	FCC Rule No.	Requirements	Test Result	Verdict (NOTE 1)
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(d)	EIRP ≤ 1 W	Appendix A	PASS
Peak-Average Ratio	§2.1046, §27.50(d)	FCC: Limit≤13 dB	Appendix B	PASS
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	PASS
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix D	PASS
Band Edges Compliance	§2.1051, §27.53(h)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Appendix E	PASS
Spurious Emission at Antenna Terminals	§2.1051, §27.53(h)	≤ -13 dBm/1 MHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	Appendix F	PASS
Field Strength of Spurious Radiation	§2.1053, §27.53(h)	≤ -13 dBm/1 MHz.	Appendix G	PASS
Frequency Stability	§2.1055, §27.54	Within authorized bands of operation/frequency block.	Appendix H	PASS
NOTE1: For the verdict, the “N/A” denotes “not applicable”, the “N/T” denotes “not tested”.				

2.4 BRS&EBS Band (777-787 MHz paired with 746-756MHz)

Test Case	FCC Part No.	Requirements	Result
775-793MHz Band (LTE Band 13)			
Transmitter Output Power	2.1046 & 27.50(b)(10)	FCC: Avg ERP not exceed 3 W Peak-to-average ratio not exceed 13 dB	Pass
Modulation Characteristics	2.1047	Digital modulation	Pass
Occupied Bandwidth	2.1049	(Not specified)	Pass
Band Edges Compliance	2.1051 & 27.53(c)(2) & 27.53(c)(5)	Below -13 dBm/30 kHz, in 100 kHz range	Pass
Spurious Emission at Antenna Terminals	2.1051 & 27.53(c)(2) & 27.53(c)(5)	Below -33 dBm/1 kHz, 9 kHz to 150 kHz Below -23 dBm/10 kHz, 150 kHz to 30 MHz Below -13 dBm/100 kHz, 30 MHz to 10th harmonics	Pass
Field Strength of Spurious Radiation	2.1051 & 27.53(c)(2) & 27.53(c)(5)	Below -13 dBm/100kHz	Pass
Frequency Stability	2.1055 & 27.54	FCC: Within authorized bands of operation/frequency block. fL – |f(offset)| > Operating Band Left Edge, fH + |f(offset)| < Operating Band Right Edge. 	Pass

2.5 BRS&EBS Band (704-716 MHz paired with 734-746MHz)

Test Case	FCC Part No.	Requirements	Result
704-716MHz Band (LTE Band 17)			
Transmitter Output Power	2.1046 & 27.50(c)	FCC: Avg ERP not exceed 3 W PARP ≤ 13 dB	Pass
Modulation Characteristics	2.1047	Digital modulation	Pass

Test Case	FCC Part No.	Requirements	Result
Occupied Bandwidth	2.1049	(Not specified)	Pass
Band Edges Compliance	2.1051 & 27.53(g)	Below -13 dBm/30 kHz, in 100 kHz range	Pass
Spurious Emission at Antenna Terminals	2.1051 & 27.53(g)	Below -33 dBm/1 kHz, 9 kHz to 150 kHz Below -23 dBm/10 kHz, 150 kHz to 30 MHz Below -13 dBm/100 kHz, 30 MHz to 10th harmonics	Pass
Field Strength of Spurious Radiation	2.1053 & 27.53(g)	Below -13 dBm/100 kHz	Pass
Frequency Stability	2.1055 & 27.54	FCC: Within authorized bands of operation/frequency block. fL – |f(offset)| > Operating Band Left Edge, fH + |f(offset)| < Operating Band Right Edge. 	Pass

2.6 Band (1850-1915 MHz paired with 1930-1995MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §24.232	EIRP ≤ 2 W	Appendix A	PASS
Peak-Average Ratio	§2.1046, §24.232	FCC: Limit≤13 dB	Appendix B	PASS
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	PASS
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix D	PASS
Band Edges Compliance	§2.1051, §24.238	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Appendix E	PASS
Spurious Emission at	§2.1051,	≤ -13 dBm/1 MHz, from 9 kHz	Appendix F	PASS

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Antenna Terminals	§24.238	to 10th harmonics but outside authorized operating frequency ranges.		
Field Strength of Spurious Radiation	§2.1053, §24.238	≤ -13 dBm/1 MHz.	Appendix G	PASS
Frequency Stability	§2.1055, §24.235	FCC: within authorized frequency block.	Appendix H	PASS
NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".				

2.7 Band (814-849 MHz paired with 859-894MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §22.913	FCC: ERP ≤ 7 W.	Appendix A	PASS
Peak-Average Ratio	---	---	Appendix B	---
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	PASS
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix D	PASS
Band Edges Compliance	§2.1051, §22.917	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Appendix E	PASS
Spurious Emission at Antenna Terminals	§2.1051, §22.917	FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	Appendix F	PASS
Field Strength of Spurious Radiation	§2.1053, §22.917	FCC: ≤ -13 dBm/100 kHz.	Appendix G	PASS
Frequency Stability	§2.1055, §22.355	≤ ±2.5ppm.	Appendix H	PASS
Emission Mask	§90.691	Below -13 dBm/100 kHz	Appendix I	Pass
NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".				

3 Description of the Equipment under Test (EUT)

3.1 General Description

ME909u-523 LTE/HSPA+/HSUPA/HSDPA/WCDMA(UMTS) mode Wireless Module is subscriber equipment in the LTE/UMTS system. ME909u-523 implement such functions as RF signal receiving/transmitting, LTE/HSPA+/HSUPA /HSDPA /WCDMA protocol processing, data service etc.

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	
Hardware Version	Description
ML2ME909UM	Main Board

3.3 Technical Specification

Characteristics	Description	
Radio System Type	☒ UMTS ☒ LTE	
Supported Frequency Range	WCDMA850	Transmission (TX): 824 to 849 MHz
		Receiving (RX): 869 to 894 MHz
	WCDMA1900	Transmission (TX): 1850 to 1910 MHz
		Receiving (RX): 1930 to 1990 MHz
	WCDMA1700	Transmission (TX): 1710 to 1755 MHz
		Receiving (RX): 2110 to 2155 MHz
	LTE BAND2	Transmission (TX): 1850 to 1910 MHz
		Receiving (RX): 1930 to 1990 MHz
	LTE BAND4	Transmission (TX): 1710 to 1755 MHz
		Receiving (RX): 2110 to 2155 MHz
	LTE BAND5	Transmission (TX): 824 to 849 MHz
		Receiving (RX): 869 to 894 MHz
	LTE BAND13	Transmission (TX): 777 to 787 MHz
		Receiving (RX): 746 to 756 MHz
	LTE BAND17	Transmission (TX): 704 to 716 MHz
		Receiving (RX): 734 to 746 MHz
	LTE BAND25	Transmission (TX): 1850 to 1915MHz
		Receiving (RX): 1930 to 1995 MHz
	LTE BAND26	Transmission (TX): 814 to 849 MHz
		Receiving (RX): 859 to 894 MHz
TX and RX Antenna Ports	TX & RX port:	1
	TX-only port:	0
	RX-only port:	1
Target TX Output Power	UMTS850 23.5dBm UMTS1900: 23.5dBm UMTS1700 23.5dBm LTE system: 23dBm	
Supported Channel Bandwidth	UMTS system:	☒ 5 MHz
	LTE band 2	☒1.4 MHz, ☒ 3 MHz,☒ 5 MHz, ☒ 10 MHz,☒ 15 MHz, ☒ 20 MHz
	LTE band 4	☒1.4 MHz, ☒ 3 MHz,☒ 5 MHz, ☒ 10 MHz,☒ 15 MHz, ☒ 20 MHz
	LTE band 5	☒1.4 MHz, ☒ 3 MHz,☒ 5 MHz, ☒ 10 MHz,
	LTE band 13	☒ 5 MHz, ☒ 10 MHz,
	LTE band 17	☒ 5 MHz, ☒ 10 MHz,

Characteristics	Description	
	LTE band 25	☒1.4 MHz, ☒ 3 MHz,☒ 5 MHz, ☒ 10 MHz,☒ 15 MHz, ☒ 20 MHz
	LTE band 26	☒1.4 MHz, ☒ 3 MHz,☒ 5 MHz, ☒ 10 MHz,☒ 15 MHz,
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.)	UMTS850:	4M16F9W
	UMTS1900:	4M16F9W
	UMTS1700:	4M16F9W
	LTE BAND2	1M09G7D (1.4 MHz QPSK modulation), 1M09W7D (1.4 MHz 16QAM modulation) 2M71G7D (3 MHz QPSK modulation), 2M71W7D (3 MHz 16QAM modulation) 4M50G7D (5 MHz QPSK modulation), 4M51W7D (5 MHz 16QAM modulation) 8M99G7D (10 MHz QPSK modulation), 9M00W7D (10 MHz 16QAM modulation) 13M48G7D (15 MHz QPSK modulation), 13M48W7D (15 MHz 16QAM modulation) 17M96G7D (20 MHz QPSK modulation), 17M98W7D (20 MHz 16QAM modulation)
	LTE BAND4	1M09G7D (1.4 MHz QPSK modulation), 1M09W7D (1.4 MHz 16QAM modulation) 2M70G7D (3 MHz QPSK modulation), 2M71W7D (3 MHz 16QAM modulation) 4M50G7D (5 MHz QPSK modulation), 4M51W7D (5 MHz 16QAM modulation) 8M98G7D (10 MHz QPSK modulation), 8M99W7D (10 MHz 16QAM modulation) 13M47G7D (15 MHz QPSK modulation), 13M45W7D (15 MHz 16QAM modulation) 17M93G7D (20 MHz QPSK modulation), 17M94W7D (20 MHz 16QAM modulation)
	LTE BAND5	1M09G7D (1.4 MHz QPSK modulation), 1M09W7D (1.4 MHz 16QAM modulation) 2M70G7D (3 MHz QPSK modulation), 2M70W7D (3 MHz 16QAM modulation) 4M50G7D (5 MHz QPSK modulation), 4M50W7D (5 MHz 16QAM modulation) 8M99G7D (10 MHz QPSK modulation), 8M99W7D (10 MHz 16QAM modulation)
	LTE BAND13	4M51G7D (5 MHz QPSK modulation), 4M51W7D (5 MHz 16QAM modulation) 9M02G7D (10 MHz QPSK modulation), 9M01W7D (10 MHz 16QAM modulation)

Characteristics	Description	
	LTE BAND17	4M50G7D (5 MHz QPSK modulation), 4M51W7D (5 MHz 16QAM modulation) 8M97G7D (10 MHz QPSK modulation), 8M98W7D (10 MHz 16QAM modulation)
	LTE BAND25	1M09G7D (1.4 MHz QPSK modulation), 1M09W7D (1.4 MHz 16QAM modulation) 2M70G7D (3 MHz QPSK modulation), 2M70W7D (3 MHz 16QAM modulation) 4M51G7D (5 MHz QPSK modulation), 4M51W7D (5 MHz 16QAM modulation) 8M99G7D (10 MHz QPSK modulation), 8M97W7D (10 MHz 16QAM modulation) 13M47G7D (15 MHz QPSK modulation), 13M47W7D (15 MHz 16QAM modulation) 17M97G7D (20 MHz QPSK modulation), 17M96W7D (20 MHz 16QAM modulation)
	LTE BAND26	1M09G7D (1.4 MHz QPSK modulation), 1M09W7D (1.4 MHz 16QAM modulation) 2M70G7D (3 MHz QPSK modulation), 2M71W7D (3 MHz 16QAM modulation) 4M51G7D (5 MHz QPSK modulation), 4M51W7D (5 MHz 16QAM modulation) 9M01G7D (10 MHz QPSK modulation), 9M01W7D (10 MHz 16QAM modulation) 13M51G7D (15 MHz QPSK modulation), 13M50W7D (15 MHz 16QAM modulation)

4 General Test Conditions / Configurations

4.1 Test Modes

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

Test Mode	Test Modes Description
UMTS/TM1	WCDMA system, QPSK modulation
UMTS/TM2	HSDPA system, QPSK modulation
UMTS/TM3	HSUPA system, QPSK modulation
LTE/TM1	LTE system, QPSK modulation
LTE/TM2	LTE system, 16QAM modulation

NOTE: HSPA+ implementation of this device, 16QAM is not used for uplink. The uplink Category and release number is same as HSUPA, RF test is not required.

4.2 Test Environment

Environment Parameter	Selected Values During Tests	
Relative Humidity	Ambient	
Temperature	TN	Ambient
Voltage	VL	3.3V
	VN	3.8V
	VH	4.2V

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

4.3 Test Frequency

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
WCDMA850	TX	Channel 4132	Channel 4182	Channel 4233
		826.4MHz	836.4MHz	846.6MHz
	RX	Channel 4357	Channel 4407	Channel 4458
		871.4MHz	881.4MHz	891.6MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
WCDMA1900	TX	Channel 9262	Channel9400	Channel9538
		1852.4MHz	1880.0MHz	1907.6MHz
	RX	Channel 9662	Channel 9800	Channel 9938
		1932.4 MHz	1960.0 MHz	1987.6 MHz
Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
WCDMA1700	TX	Channel1312	Channel1413	Channel1513
		1712.4MHz	1732.6MHz	1752.6MHz
	RX	Channel 1537	Channel 1638	Channel 1738
		2112.4 MHz	2132.6 MHz	2152.6 MHz

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 2	TX (1.4M)	Channel 18607	Channel 18900	Channel 19193
		1850.7	1880	1909.3
	TX (3M)	Channel 18615	Channel 18900	Channel 19185

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
		1851.5	1880	1908.5
	TX (5M)	Channel18625	Channel 18900	Channel 19175
		1852.5	1880	1907.5
	TX (10M)	Channel18650	Channel 18900	Channel 19150
		1855	1880	1905
	TX (15M)	Channel 18675	Channel 18900	Channel 19125
		1857.5	1880	1902.5
	TX (20M)	Channel 18700	Channel 18900	Channel 19100
		1860	1880	1900
	RX (1.4M)	Channel 607	Channel 900	Channel 1193
		1930.7	1960	1989.3
	RX (3M)	Channel 615	Channel 900	Channel 1185
		1931.5	1960	1988.5
	RX (5M)	Channel 625	Channel 900	Channel 1175
		1932.5	1960	1987.5
	RX (10M)	Channel 650	Channel 900	Channel 1150
		1935	1960	1985
	RX (15M)	Channel 675	Channel 900	Channel 1125
		1937.5	1960	1982.5
	RX (20M)	Channel 700	Channel 900	Channel 1100
		1940	1960	1980

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)

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

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 5	TX (1.4M)	Channel 20407	Channel 20525	Channel 20643
		824.7	836.5	848.3
	TX (3M)	Channel 20415	Channel 20525	Channel 20635
		825.5	836.5	847.5
	TX (5M)	Channel 20425	Channel 20525	Channel 20625
		826.5	836.5	846.5
	TX (10M)	Channel 20450	Channel 20525	Channel 20600
		829	836.5	844
	RX (1.4M)	Channel 2407	Channel 2525	Channel 2643
		869.7	881.5	893.3
	RX (3M)	Channel 2415	Channel 2525	Channel 2635
		870.5	881.5	892.5
	RX (5M)	Channel 2425	Channel 2525	Channel 2625
		871.5	881.5	891.5
	RX (10M)	Channel 2450	Channel 2525	Channel 2600
		874	881.5	889

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 13	TX (5M)	Channel 23205	Channel 23230	Channel 23255
		779.5	782	784.5
	TX (10M)	Channel 23230	Channel 23230	Channel 23230
		782	782	782

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
	RX (5M)	Channel 5205	Channel 5230	Channel 5255
		748.5	751	753.5
	RX (10M)	Channel 5230	Channel 5230	Channel 5230
		751	751	751

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 17	TX (5M)	Channel 23755	Channel 23790	Channel 23825
		706.5	710	713.5
	TX (10M)	Channel	Channel 23790	Channel
		709	710	711
	RX (5M)	Channel	Channel 5790	Channel
		736.5	740	743.5
	RX (10M)	Channel	Channel 5790	Channel
		739	740	741

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 25	TX (1.4M)	Channel 26047	Channel 26365	Channel 26683
		1850.7	1882.5	1914.3
	TX (3M)	Channel 26055	Channel 26365	Channel 26675
		1851.5	1882.5	1913.5
	TX (5M)	Channel 26065	Channel 26365	Channel 26665
		1852.5	1882.5	1912.5

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
	TX (10M)	Channel 26090	Channel 26365	Channel 26640
		1855	1882.5	1910
	TX (15M)	Channel 26115	Channel 26365	Channel 26615
		1857.5	1882.5	1907.5
	TX (20M)	Channel 26140	Channel 26365	Channel 26590
		1860	1882.5	1905
	RX (1.4M)	Channel 8047	Channel 8365	Channel 8683
		1930.7	1962.5	1994.3
	RX (3M)	Channel 8055	Channel 8365	Channel 8675
		1931.5	1962.5	1993.5
	RX (5M)	Channel 8065	Channel 8365	Channel 8665
		1932.5	1962.5	1992.5
	RX (10M)	Channel 8090	Channel 8365	Channel 8640
		1935	1962.5	1990
	RX (15M)	Channel 8115	Channel 8365	Channel 8615
		1937.5	1962.5	1987.5
	RX (20M)	Channel 8140	Channel 8365	Channel 8590
		1940	1962.5	1985

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 26	TX (1.4M)	Channel 26697	Channel 26865	Channel 27033
		814.7	831.5	848.3
	TX (3M)	Channel 26705	Channel 26865	Channel 27025

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
		815.5	831.5	847.5
	TX (5M)	Channel 26715	Channel 26865	Channel 27015
		816.5	831.5	846.5
	TX (10M)	Channel 26750	Channel 26865	Channel 26990
		820	831.5	844
	TX (15M)	Channel 26775	Channel 26865	Channel 26965
		822.5	831.5	841.5
	RX (1.4M)	Channel 8697	Channel 8865	Channel 9033
		859.7	876.5	893.3
	RX (3M)	Channel 8705	Channel 8865	Channel 9025
		860.5	876.5	892.5
	RX (5M)	Channel 8715	Channel 8865	Channel 9015
		861.5	876.5	891.5
	RX (10M)	Channel 8750	Channel 8865	Channel 8990
		865	876.5	889
	RX (15M)	Channel 8775	Channel 8865	Channel 8965
		867.5	876.5	886.5

4.4 DESCRIPTION OF TESTS

4.4.1 Radiated Power and Radiated Spurious Emissions

Radiated spurious emissions are investigated indoors in a semi-anechoic chamber to determine the frequencies producing the worst case emissions. Final measurements for radiated power and radiated spurious emissions are performed on the 3 meter OATS per the guidelines of ANSI/TIA-603-C-2004. The equipment under test was transmitting while connected to its integral antenna and is placed on a wooden turntable 80cm above the ground plane and 3 meters from the receive antenna. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer. Emissions are also investigated with the receive antenna horizontally and vertically polarized.

A portable or small unlicensed wireless device shall be placed on a non-metallic test fixture or other non-metallic support during testing. The supporting fixture shall permit orientation of the EUT in each of three orthogonal (x, y, z) axis positions such that emissions from the EUT are maximized. Measure the EUT maximum RF power and record the result.

A half-wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT. The power of the emission is calculated using the following formula:

$$P_{d\ [dBm]} = P_{g\ [dBm]} - \text{cable loss}_{\ [dB]} + \text{antenna gain}_{\ [dBd/dBi]}$$

Where, P_d is the dipole equivalent power, P_g 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 $43 + 10\log_{10}(\text{Power}_{[\text{Watts}]})$.

Note: Reference test setup 3

4.4.2 Occupied Bandwidth

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 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.

4.4.3 Spurious and Harmonic Emissions at Antenna Terminal

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 10_{th} 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.

4.4.4 Peak-Average Ratio

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.

4.4.5 Frequency Stability / Temperature Variation

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-C-2004. 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.

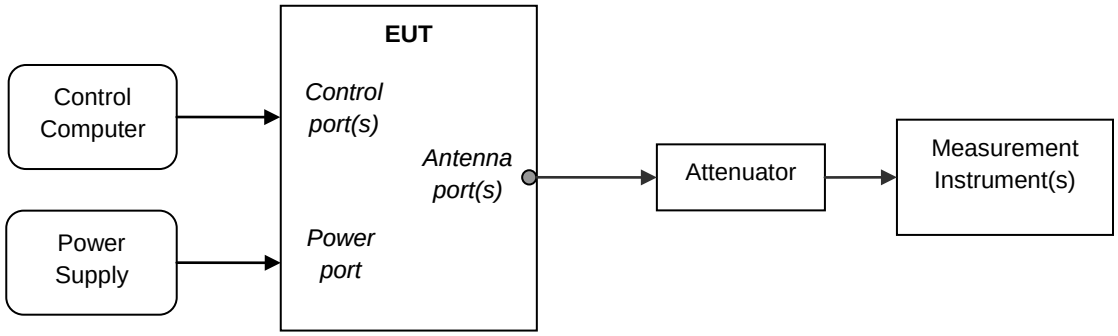
Time Period and Procedure:

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.

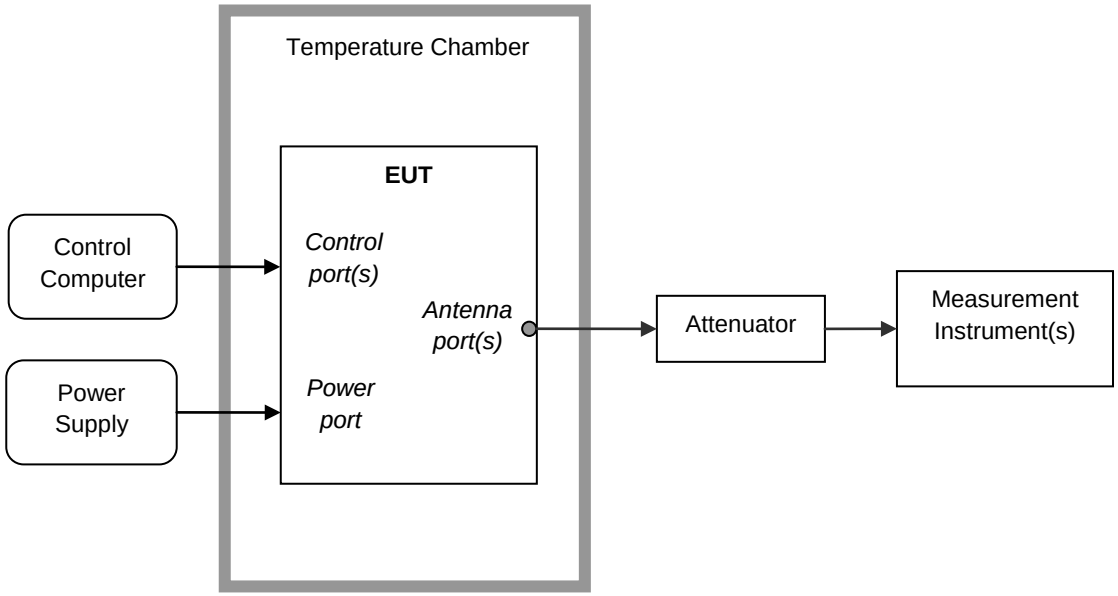
Note: Reference test setup 2.

4.5 Test Setups

4.5.1 Test Setup 1



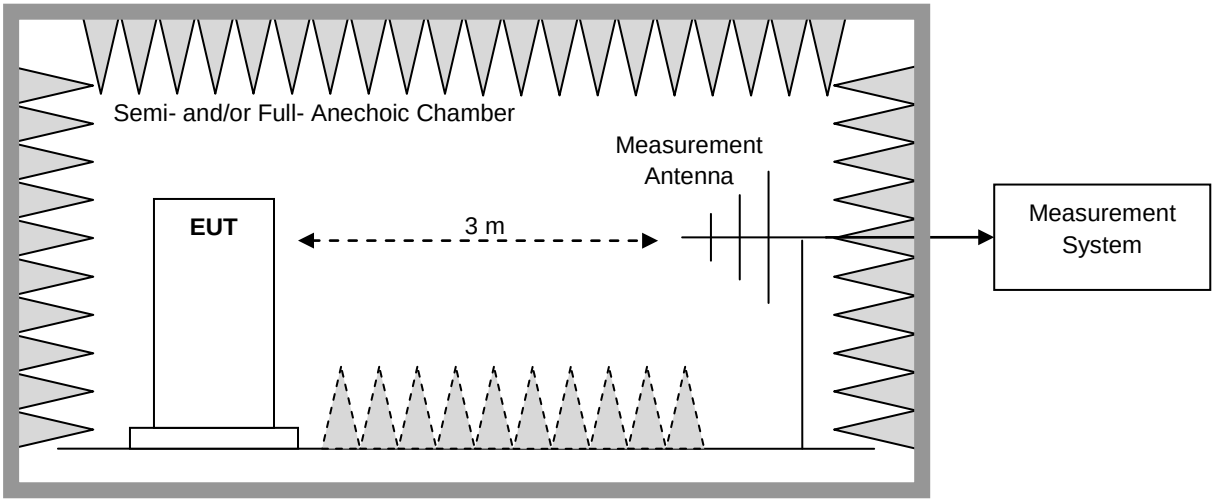
4.5.2 Test Setup 2



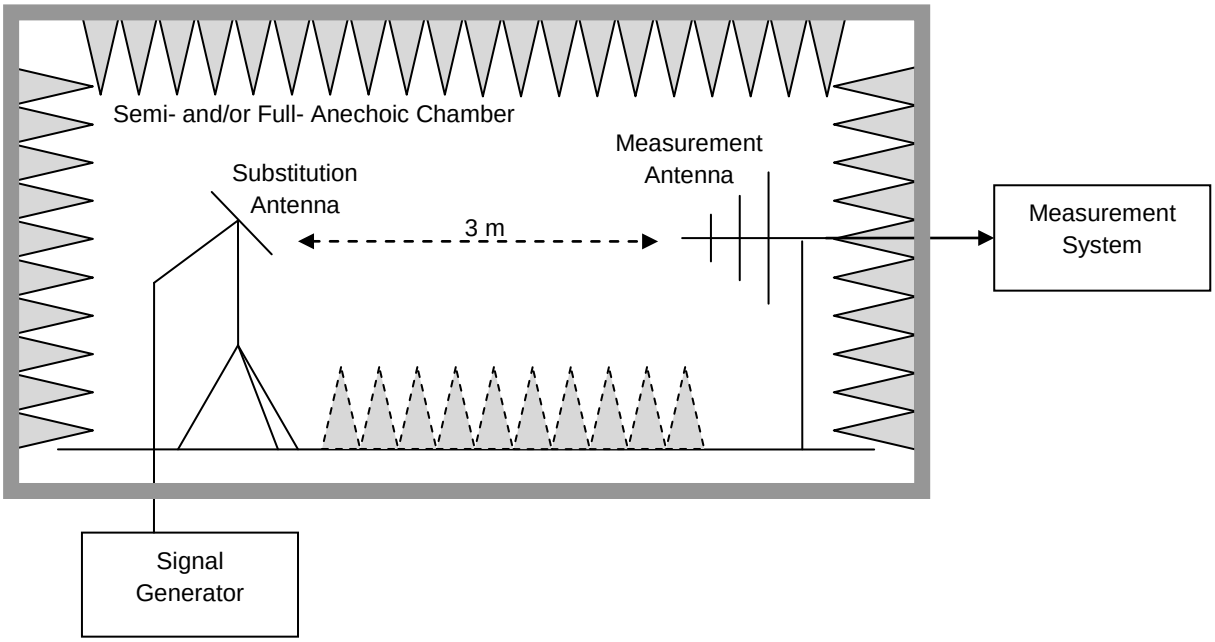
4.5.3 Test Setup 3

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

4.5.3.1 Step 1: Pre-test



4.5.3.2 Step 2: Substitution method to verify the maximum ERP



4.6 Test Conditions

Test Case		Test Conditions	
Transmit Output Power Data	Average Power, Total	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	UMTS/TM1,LTE/TM1,LTE/TM2
	Average Power, Spectral Density (if required)	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	UMTS/TM1,LTE/TM1,LTE/TM2
Peak-to-Average Ratio (if required)		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	UMTS/TM1,LTE/TM1,LTE/TM2
Modulation Characteristics		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 1
		RF Channels (TX)	M (L= low channel, M= middle channel, H= high channel)
		Test Mode	UMTS/TM1,LTE/TM1,LTE/TM2
Bandwidth	Occupied Bandwidth	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	UMTS/TM1,LTE/TM1,LTE/TM2
	Emission Bandwidth (if required)	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	UMTS/TM1,LTE/TM1,LTE/TM2
Band Edges Compliance		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 1
		RF Channels (TX)	L, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	UMTS/TM1,LTE/TM1,LTE/TM2
Spurious Emission at Antenna Terminals		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)

Test Case	Test Conditions	
	Test Mode	UMTS/TM1,LTE/TM1,LTE/TM2
Field Strength of Spurious Radiation	Test Env.	Ambient Climate & Rated Voltage
	Test Setup	Test Seup 3
	Test Mode	UMTS/TM1/TM2/TM3,LTE/TM1,LTE/TM2 NOTE: 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 Seup 2
	RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
	Test Mode	UMTS/TM1,LTE/TM1,LTE/TM2

5 Main Test Instruments

Equipment Name	Manufacturer	Model	Serial Number	Cal Date	Cal- Due
Power supply	KEITHLEY	2303	1288003	2012-11-19	2014-11-18
Wireless Communication Test set	Agilent	N4010A	MY49081592	2013-10-29	2014-10-28
Universal Radio Communication Tester	R&S	CMU200	113164	2013-07-18	2014-07-17
Universal Radio Communication Tester	R & S	CMW500	126855	2013-08-08	2015-08-09
Spectrum Analyzer	Agilent	E4440A	MY48250119	2013-08-09	2014-08-08
Signal Analyzer	R&S	FSQ31	200021	2013-10-29	2014-10-28
Spectrum Analyzer	Agilent	N9030A	MY49431698	2013-10-29	2014-10-28
Temperature Chamber	ESPEC	MW3030	06114003	2013-05-14	2014-05-13
Signal generator	Agilent	E8257D	MY51500314	2013-04-15	2014-04-14
Vector Signal Generator	R&S	SMU200A	104162	2013-10-29	2014-10-28
Test receiver	R&S	ESU26	100150	2013-05-15	2014-05-14
Spectrum analyzer	R&S	FSU3	200474	2013-12-24	2014-12-23
Spectrum analyzer	R&S	FSU43	100144	2013-12-24	2014-12-23
Double-Ridged Waveguide Horn Antenna (1G~18GHz)	R&S	HF907	100304	2013-02-02	2015-02-01
Trilog Broadband Antenna (30M~3GHz)	SCHWARZBECK	VULB 9163	9163-490	2013-02-02	2015-02-01
LOOP Antennas(9kHz-30MHz)	R&S	HFH2-Z2	100262	2013-03-23	2015-03-22
Pyramidal Horn Antenna(18GHz-26-5GHz)	ETS-LINDGREN	3160-09	5140299	2013-03-05	2015-03-04
Artificial Mains Network	R&S	ENV4200	100134	2013-12-24	2014-12-23
Artificial Mains Network	R&S	ENV216	100382	2013-12-24	2014-12-23

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
Transmit Output Power Data	Power [dBm]	U = 0.39 dB
Bandwidth	Magnitude [%]	U = 0.2%
Band Edge Compliance	Disturbance Power [dBm]	U = 2.0 dB
Spurious Emissions, Conducted	Disturbance Power [dBm]	U = 2.0 dB
Field Strength of Spurious Radiation	ERP [dBm]	For 3 m Chamber: U = 4.6 dB (30 MHz to 1GHz) U = 3.0 dB (above 1 GHz) For 10 m Chamber: U = 4.6 dB (30 MHz to 1GHz) U = 3.0 dB (above 1 GHz)
Frequency Stability	Frequency Accuracy [ppm]	U = 0.21 ppm

END