FCC RF Test Report

Product Name: **LTE Module**

Product Model: **ME906V**

Report Number: **SYBH(Z-RF)009122012**

FCC ID: **QISME906V**

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.

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Applicant:	Huawei Technologies Co., Ltd.
Address:	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C
Product Name:	LTE Module
Product Model:	ME906V

Date of Receipt Sample:	2012-12-17
Start Date of Test:	2012-12-17
End Date of Test:	2012-12-21

Test Result: Pass

Approved by Senior Engineer:	2012-12-28	Dai Linjun	Dai Linjun
	Date	Name	Signature

Prepared by:	2012-12-28	Feng Nianwei	Feng Nianwei
	Date	Name	Signature

Modification Record

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

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1 General Information

1.1 Applied Standard

Applied Rules:	47 CFR FCC Part 02:2011 47 CFR FCC Part 22: 2011 47 CFR FCC Part 24: 2011 47 CFR FCC Part 27 :2011
Test Method:	FCC KDB 971168 D01 Power Meas License Digital Systems v01 FCC KDB 662911 D01 Multiple Transmitter Output v01

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 (NOTE 2)
RF Power Output	§2.1046, §22.913	FCC: ERP ≤ 7 W. IC: EIRP ≤ 11.5 W.	Appendix A	Pass
Bandwidth	§2.1049, §22.917	OBW: No limit. EBW: No limit.	Appendix B	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 C	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 D	Pass
Field Strength of Spurious Radiation	§2.1053, §22.917	FCC: ≤ -13 dBm/100 kHz.	Appendix E	Pass
Frequency Stability	§2.1055, §22.355	≤ ±2.5ppm.	Appendix F	Pass

NOTE 1: For Receiver Spurious Emissions, If the receiver has a detachable antenna of known impedance, antenna conducted spurious emissions measurement is permitted as an alternative to radiated measurement. However, the radiated method is recommended. The antenna conducted test shall be performed with the antenna disconnected and the receiver antenna terminals connected to a measuring instrument having equal impedance to that specified for the antenna.

NOTE 2: For the verdict, the “N/A” denotes “not applicable”, the “N/T” denotes “not tested”.

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

Test Item	FCC Rule No.	Requirements	Test Result	Verdict (NOTE 2)
RF Power Output	§2.1046, §24.232	EIRP ≤ 2 W; PAR ≤ 13 dB.	Appendix A	Pass
Bandwidth	§2.1049, §22.917	OBW: No limit. EBW: No limit.	Appendix B	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 C	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 D	Pass
Field Strength of Spurious Radiation	§2.1053, §24.238	≤ -13 dBm/1 MHz.	Appendix E	Pass
Frequency Stability	§2.1055, §24.235	FCC: within authorized frequency block.	Appendix F	Pass

NOTE 1: For Receiver Spurious Emissions, If the receiver has a detachable antenna of known impedance, antenna conducted spurious emissions measurement is permitted as an alternative to radiated measurement. However, the radiated method is recommended. The antenna conducted test shall be performed with the antenna disconnected and the receiver antenna terminals connected to a measuring instrument having equal impedance to that specified for the antenna.

NOTE 2: 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 2)
RF Power Output	§2.1046, §27.50(d)	EIRP ≤ 1 W; PAR ≤ 13 dB.	Appendix A	Pass
Bandwidth	§2.1049, §27.917	OBW: No limit. EBW: No limit.	Appendix B	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 C	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 D	Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(h)	≤ -13 dBm/1 MHz.	Appendix E	Pass
Frequency Stability	§2.1055, §27.54	Within authorized bands of operation/frequency block.	Appendix F	Pass

NOTE 1: For Receiver Spurious Emissions, If the receiver has a detachable antenna of known impedance, antenna conducted spurious emissions measurement is permitted as an alternative to radiated measurement. However, the radiated method is recommended. The antenna conducted test shall be performed with the antenna disconnected and the receiver antenna terminals connected to a measuring instrument having equal impedance to that specified for the antenna.

NOTE 2: For the verdict, the “N/A” denotes “not applicable”, the “N/T” denotes “not tested”.

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

Test Item	FCC Rule No.	Requirements	Test Result	Verdict (NOTE 2)
RF Power Output	§2.1046, §27.50(b)	FCC: ERP ≤ 3 W.	Appendix A	Pass
Bandwidth	§2.1049,	OBW: No limit. EBW: No limit.	Appendix B	Pass
Band Edges Compliance	§2.1051, §27.53(c)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Appendix C	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(c)	FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	Appendix D	Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(c)	FCC: ≤ -13 dBm/100 kHz.	Appendix E	Pass
Frequency Stability	§2.1055, §27.54	≤ ±2.5ppm.	Appendix F	Pass
NOTE 1: For Receiver Spurious Emissions, If the receiver has a detachable antenna of known impedance, antenna conducted spurious emissions measurement is permitted as an alternative to radiated measurement. However, the radiated method is recommended. The antenna conducted test shall be performed with the antenna disconnected and the receiver antenna terminals connected to a measuring instrument having equal impedance to that specified for the antenna. NOTE 2: For the verdict, the “N/A” denotes “not applicable”, the “N/T” denotes “not tested”.				

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

Test Item	FCC Rule No.	Requirements	Test Result	Verdict (NOTE 2)
RF Power Output	§2.1046, §27.50(c)	FCC: ERP ≤ 3 W.	Appendix A	Pass
Bandwidth	§2.1049,	OBW: No limit. EBW: No limit.	Appendix B	Pass
Band Edges Compliance	§2.1051, §27.53(g)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Appendix C	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(g)	FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	Appendix D	Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(g)	FCC: ≤ -13 dBm/100 kHz.	Appendix E	Pass
Frequency Stability	§2.1055, §27.54	≤ ±2.5ppm.	Appendix F	Pass
NOTE 1: For Receiver Spurious Emissions, If the receiver has a detachable antenna of known impedance, antenna conducted spurious emissions measurement is permitted as an alternative to radiated measurement. However, the radiated method is recommended. The antenna conducted test shall be performed with the antenna disconnected and the receiver antenna terminals connected to a measuring instrument having equal impedance to that specified for the antenna. NOTE 2: 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

ME906V LTE/CDMA /HSDPA/HSUPA/HSPA+ /WCDMA (UMTS)/GSM/GPRS/EDGE multimode Wireless Module is subscriber equipment in the LTE/CDMA/UMTS/GSM system. ME906V implement such functions as RF signal receiving/transmitting, LTE/CDMA/ HSDPA/HSUPA/HSPA+/WCDMA and EDGE/GPRS/GSM protocol processing, data service etc. Externally it provides M.2 interface.

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	Serial Number	Description
V3	A4P01A92A2200250	ME906V Development Board

3.3 Technical Specification

Characteristics	Description		
Radio System Type	☒ GSM ☒ UMTS ☒ LTE ☒ CDMA		
Supported Frequency Range	GSM850/WCDMA850	Transmission (TX):	824 to 849 MHz
		Receiving (RX):	869 to 894 MHz
	GSM1900/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
	CDMA BC0	Transmission (TX):	824 to 849 MHz
		Receiving (RX):	869 to 894 MHz
	CDMA BC1	Transmission (TX):	1850 to 1910 MHz
		Receiving (RX):	1930 to 1990 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

Characteristics	Description	
	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
TX and RX Antenna Ports	TX & RX port:	1
	TX-only port:	0
	RX-only port:	1
TX Output Power	GSM850: 33.5dBm GSM1900 30.5dBm UMTS850: 24.5dBm UMTS1900: 24.5dBm CDMA system: 25dBm LTE system: 24dBm	
Supported Channel Bandwidth	GSM system:	☒ 200 kHz
	UMTS system:	☒ 5 MHz
	LTE band2	☒ 1.4 MHz, ☒ 3 MHz, ☒ 5 MHz, ☒ 10 MHz, ☒ 15 MHz, ☒ 20 MHz
	LTE band4	☒ 1.4 MHz, ☒ 3 MHz, ☒ 5 MHz, ☒ 10 MHz, ☒ 15 MHz, ☒ 20 MHz
	LTE band5	☒ 1.4 MHz, ☒ 3 MHz, ☒ 5 MHz, ☒ 10 MHz,
	LTE band13	☒ 5 MHz, ☒ 10 MHz,
	LTE band17	☒ 5 MHz, ☒ 10 MHz,
	CDMA system:	☒ 1.23 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.)	GSM system:	247KGXW, 249KG7W
	UMTS system:	4M16F9W
	LTE system:	1M09G7D (1.4 MHz QPSK modulation), 1M09W7D (1.4 MHz 16QAM modulation) 2M71G7D (3 MHz QPSK modulation), 2M70W7D (3 MHz 16QAM modulation) 4M50G7D (5 MHz QPSK modulation), 4M50W7D (5 MHz 16QAM modulation) 8M98G7D (10 MHz QPSK modulation), 8M97W7D (10 MHz 16QAM modulation) 13M46G7D (15 MHz QPSK modulation), 13M46W7D (15 MHz 16QAM modulation) 17M95G7D (20 MHz QPSK modulation), 17M93W7D (20 MHz 16QAM modulation)
	CDMA system:	1M29F9W, 1M28F9W

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
GSM/TM1	GSM system, GSM/GPRS, GMSK modulation
GSM/TM2	GSM system, EDGE, 8PSK modulation
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
CDMA/TM1	CDMA system, CDMA2000 1x mode QPSK modulation
CDMA/TM3	CDMA system, CDMA2000 1x mode HPSK modulation
CDMA/EV-DO/Subtype 0	CDMA system, CDMA2000 1x EV-DO mode HPSK modulation
CDMA/EV-DO/Subtype 2	CDMA2000 1x EV-DO mode The R-Data packet size determines the modulation format, R-Data Packet Size:128, 256, 512, 768 or 1024 BPSK Modulation R-Data Packet Size:1536 , 2048,3072,4096,6144 or 8192 QPSK Modulation R-Data Packet Size:12288 8-PSK Modulation

4.2 Test Environment

Environment Parameter	Selected Values During Tests	
Relative Humidity	Ambient	
Temperature	TN	Ambient
Voltage	VL	3.135V
	VN	3.3V
	VH	4.4V

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)
GSM850	TX	Channel 128	Channel 192	Channel 251
		824.2MHz	837.0MHz	848.8MHz
	RX	Channel 128	Channel 192	Channel 251
		869.2MHz	882.0MHz	893.8MHz
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)
GSM1900	TX	Channel 512	Channel 661	Channel 810
		1850.2MHz	1880.0MHz	1909.8MHz
	RX	Channel 512	Channel 661	Channel 810
		1930.2 MHz	1960.0 MHz	1989.8 MHz
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
WCDMA1700	TX	Channel1312	Channel1412	Channel1513
		1712.4MHz	1732.4MHz	1752.6MHz
	RX	Channel 1537	Channel 1637	Channel 1738
		2112.4 MHz	2132.4 MHz	2152.6 MHz

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
CDMA BC0	TX	Channel 1013	Channel 384	Channel 777
		824.7MHz	836.52MHz	848.31MHz
	RX	Channel 1013	Channel 384	Channel 777
		869.7MHz	881.52MHz	893.31MHz
CDMA BC1	TX	Channel 25	Channel 600	Channel 1175
		1851.25MHz	1880.0MHz	1908.75MHz
	RX	Channel 25	Channel 600	Channel 1175
		1931.25MHz	1960.0MHz	1988.75MHz

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 2	TX(1.4M)	Channel 18607	Channel 18900	Channel 19193
		1850.7MHz	1880 MHz	1909.3 MHz
	TX(3M)	Channel 18615	Channel 18900	Channel 19185
		1851.5MHz	1880 MHz	1908.5 MHz
	TX(5M)	Channel 18625	Channel 18900	Channel 19175
		1852.5 MHz	1880 MHz	1907.5 MHz
	TX(10M)	Channel 18650	Channel 18900	Channel 19150
		1855 MHz	1880 MHz	1905 MHz
	TX(15M)	Channel 18675	Channel 18900	Channel 19125
		1857.5 MHz	1880 MHz	1902.5 MHz
	TX(20M)	Channel 18700	Channel 18900	Channel 19100
		1860 MHz	1880 MHz	1900 MHz
	RX(1.4M)	Channel 607	Channel 900	Channel 1193

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
		1930.7 MHz	1960 MHz	1989.3 MHz
	RX(3M)	Channel 615	Channel 900	Channel1185
		1931.5 MHz	1960 MHz	1988.5 MHz
	RX(5M)	Channel 625	Channel 900	Channel 1175
		1932.5 MHz	1960 MHz	1987.5 MHz
	RX(10M)	Channel 650	Channel 900	Channel 1150
		1935 MHz	1960 MHz	1985 MHz
	RX(15M)	Channel 675	Channel 900	Channel 1125
		1937.5 MHz	1960 MHz	1982.5 MHz
	RX(20M)	Channel 700	Channel 900	Channel 1100
		1940 MHz	1960 MHz	1980 MHz

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 4	TX(1.4M)	Channel 19957	Channel 20175	Channel 20393
		1710.7MHz	1732.5 MHz	1754.3 MHz
	TX(3M)	Channel 19965	Channel 20157	Channel 20385
		1711.5MHz	1732.5 MHz	1753.5 MHz
	TX (5M)	Channel 19975	Channel 20175	Channel 20375
		1712.5 MHz	1732.5 MHz	1752.5 MHz
	TX (10M)	Channel 20000	Channel 20175	Channel 20350
		1715 MHz	1732.5 MHz	1750 MHz
	TX (15M)	Channel 20025	Channel 20175	Channel 20325
		1717.5 MHz	1732.5 MHz	1747.5 MHz

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
	TX (20M)	Channel 20050	Channel 20175	Channel 20300
		1720 MHz	1732.5 MHz	1745 MHz
	RX(1.4M)	Channel 1957	Channel 2175	Channel 2393
		2110.7 MHz	2132.5 MHz	2154.3 MHz
	RX(3M)	Channel 1965	Channel 2175	Channel 2385
		2111.5 MHz	2132.5 MHz	2153.5 MHz
	RX (5M)	Channel 1975	Channel 2175	Channel 2375
		2112.5 MHz	2132.5MHz	2152.5 MHz
	RX (10M)	Channel 2000	Channel 2175	Channel 2350
		2115 MHz	2132.5MHz	2150 MHz
	RX (15M)	Channel 2025	Channel 2175	Channel 2325
		2117.5 MHz	2132.5MHz	2147.5 MHz
	RX (20M)	Channel 2050	Channel 2175	Channel 2300
		2120 MHz	2132.5MHz	2145 MHz

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 MHz	836.5 MHz	848.3 MHz
	TX(3M)	Channel 20415	Channel 20525	Channel 20635
		825.5 MHz	836.5 MHz	847.5 MHz
	TX(5M)	Channel 20425	Channel 20525	Channel 20625
		826.5 MHz	836.5 MHz	846.5 MHz
	TX(10M)	Channel 20450	Channel 20525	Channel 20600

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
		829 MHz	836.5 MHz	844 MHz
	RX(1.4M)	Channel 2407	Channel 2525	Channel 2643
		869.7 MHz	881.5 MHz	893.3 MHz
	RX(3M)	Channel 2415	Channel 2525	Channel 2635
		870.5 MHz	881.5 MHz	892.5 MHz
	RX(5M)	Channel 2425	Channel 2525	Channel 2625
		871.5 MHz	881.5 MHz	891.5 MHz
	RX (10M)	Channel 2450	Channel 2525	Channel 2600
		874 MHz	881.5 MHz	889 MHz

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 MHz	782 MHz	784.5 MHz
	TX (10M)	Channel 23230	Channel 23230	Channel 23230
		782 MHz	782 MHz	782 MHz
	RX (5M)	Channel 5205	Channel 5230	Channel 5255
		748.5 MHz	751 MHz	753.5 MHz
	RX (10M)	Channel 5230	Channel 5230	Channel 5230
		751 MHz	751 MHz	751 MHz

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 MHz	710 MHz	713.5 MHz
	TX (10M)	Channel 23780	Channel 23790	Channel 23800
		709 MHz	710 MHz	711 MHz
	RX (5M)	Channel 5755	Channel 5790	Channel 5825
		736.5 MHz	740 MHz	743.5 MHz
	RX (10M)	Channel 5780	Channel 5790	Channel 5800
		739 MHz	740 MHz	741 MHz

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.

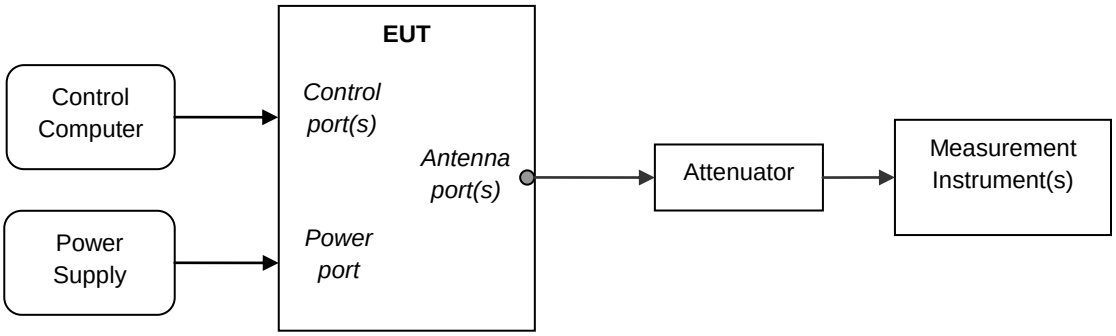
Time Period and Procedure:

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.

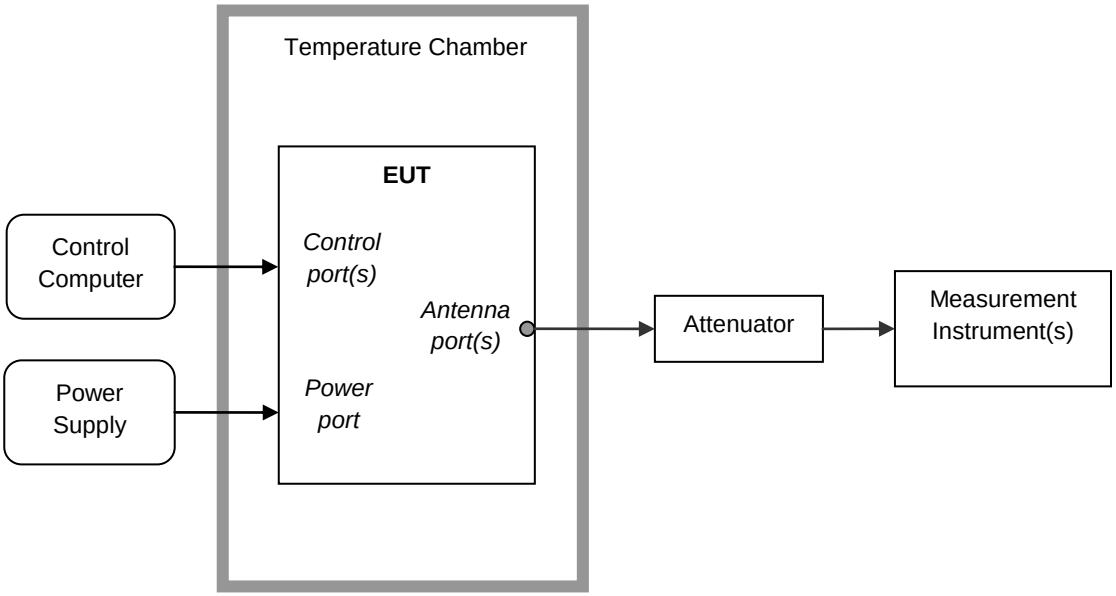
Note: Reference test setup 2.

4.5 Test Setups

4.5.1 Test Setup 1



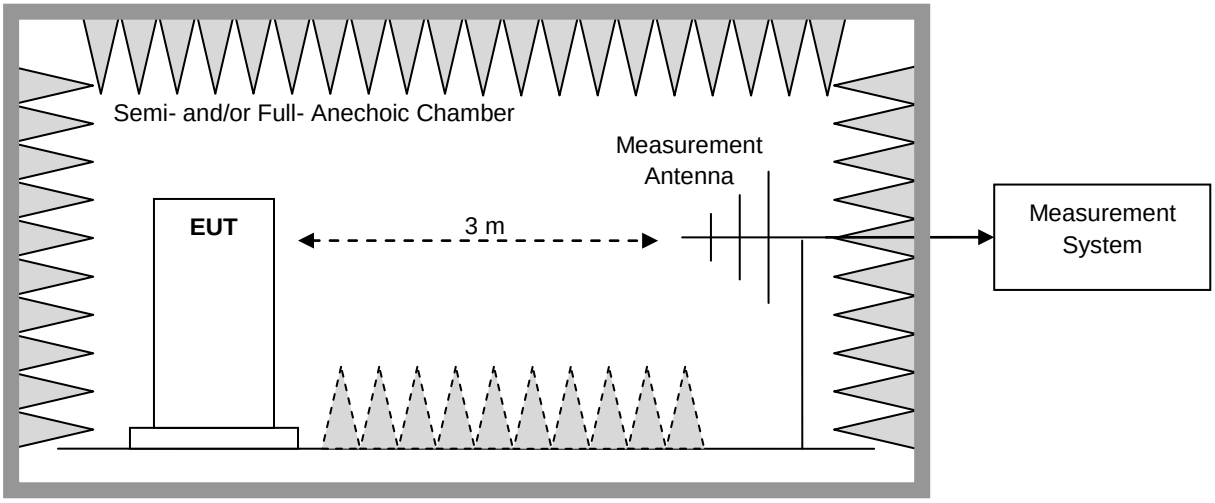
4.5.2 Test Setup 2



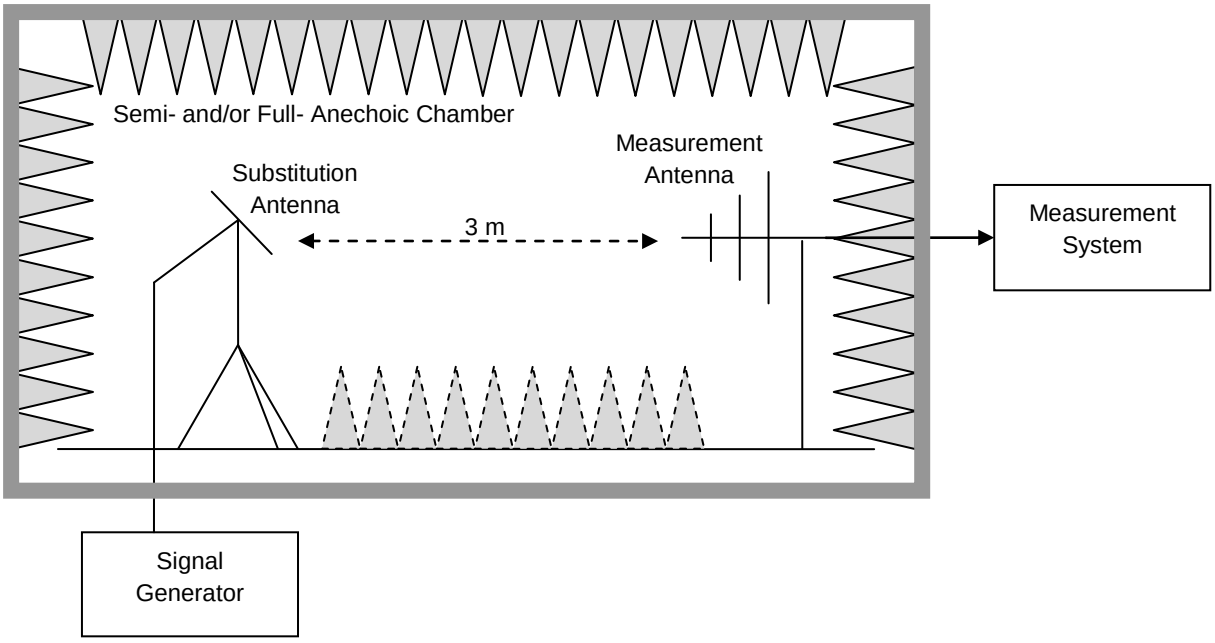
4.5.3 Test Setup 3

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	
Transmitter Output Power	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	GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2,CDMA/1X,CDMA/EV-DO
	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	GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2,CDMA/1X,CDMA/EV-DO
	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	GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2,CDMA/1X
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	GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2,CDMA/1X,CDMA/EV-DO
	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	GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2,CDMA/1X,CDMA/EV-DO
Band Edges Compliance		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	GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2,CDMA/1X,CDMA/EV-DO
Spurious Emission at Antenna Terminals		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Seup 1
		RF Channels	L, M, H

Test Case	Test Conditions	
	(TX)	(L= low channel, M= middle channel, H= high channel)
	Test Mode	GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2,CDMA/1X,CDMA/EV-DO
Field Strength of Spurious Radiation	Test Env.	Ambient Climate & Rated Voltage
	Test Setup	Test Seup 3
	Test Mode	GSM/TM1,GSM/TM2,UMTS/TM1/TM2/TM3,LTE/TM1,LTE/TM2,CDMA/1X,CDMA/EV-DO 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) 85%, 100% and 115% 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	GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2,CDMA/1X,CDMA/EV-DO

5 Main Test Instruments

Equipment Name	Manufacturer	Model	Serial Number	Cal Date	Cal. Due
Power supply	KEITHLEY	2303	1288003	2012-11-09	2013-11-08
Universal Radio Communication Tester	R&S	CMU200	117341	2012-01-13	2013-01-12
Universal Radio Communication Tester	Agilent	E5515C	MY50260239	2012-11-09	2013-11-08
Spectrum Analyzer	Agilent	E4440A	MY49420179	2012-07-18	2013-07-17
Signal Analyzer	R&S	FSQ31	200021	2012-11-09	2013-11-08
Temperature Chamber	WEISS	WKL64	24600294	2012-02-14	2013-02-13
Signal generator	Agilent	E8257D	MY49281095	2012-07-10	2013-07-09
Spectrum analyzer	R&S	FSU3	200474	2012-03-06	2013-03-05
Spectrum analyzer	R&S	FSU43	100144	2012-03-06	2013-03-05
Double-Ridged Waveguide Horn Antenna (1G~18GHz)	R&S	HF907	100304	2012-04-06	2013-04-05
Double-Ridged Waveguide Horn Antenna (1G~18GHz)	R&S	HF907	100391	2012-04-06	2013-04-05
Trilog Broadband Antenna (30M~3GHz)	SCHWARZBECK	VULB 9163	9163-521	2012-07-18	2013-07-17
Pyramidal Horn Antenna(26GHz-40GHz)	ETS-Lindgren	3160-10	00123940	2012-02-28	2013-02-27
Pyramidal Horn Antenna(18GHz-26.5GHz)	ETS-Lindgren	3160-09	00125912	2012-02-28	2013-02-27

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
RF Power Output	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