



# FCC

# RF Test Report

**Product Name: Smart Phone**

**Model Number: H1512**

**Report No: SYBH(Z-RF)012082015-2001**

**FCC ID: QISH1512**

**Reliability Laboratory of Huawei Technologies Co., Ltd.**

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## Notice

1. The laboratory has Passed the accreditation by China National Accreditation Service for Conformity Assessment (CNAS). The accreditation number is L0310.
2. The laboratory has Passed the accreditation by The American Association for Laboratory Accreditation (A2LA). The accreditation number is 2174.01.
3. The laboratory has been listed by the US Federal Communications Commission to perform electromagnetic emission measurements. The 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.
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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

**Date of Receipt Sample:** 2015-09-05  
**Start Date of Test:** 2015-09-05  
**End Date of Test:** 2015-09-10

**Test Result:** Pass

<b>Approved by Senior Engineer:</b>	2015-09-14	Liu Chunlin	
	Date	Name	Signature

<b>Prepared by:</b>	2015-09-14	maowenli	
	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: 2014  
    47 CFR FCC Part 22: 2014  
    47 CFR FCC Part 24: 2014  
    47 CFR FCC Part 27: 2014

Test Method:                                    FCC KDB 971168 D01 Power Meas License Digital Systems v02r02

### 1.2 Test Location

Test Location :                                    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. IC: EIRP ≤ 11.5 W.	Appendix A	Pass
Peak-Average Ratio	---	IC: 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, §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 10 <sup>th</sup> harmonics but outside authorized operating frequency ranges. IC: ≤ -13 dBm/100 kHz (for EBW ≤ 4 MHz) or ≤ -13 dBm/1 MHz (for EBW > 4 MHz), from 9 kHz to 10 <sup>th</sup> harmonics but outside authorized operating frequency ranges.	Appendix F	Pass
Field Strength of Spurious Radiation	§2.1053, §22.917	FCC: ≤ -13 dBm/100 kHz. IC: ≤ -13 dBm/100 kHz (for EBW ≤ 4 MHz) or ≤ -13 dBm/1 MHz (for EBW > 4 MHz).	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	$EIRP \leq 2\text{ W}$	Appendix A	Pass
Peak-Average Ratio	§2.1046, §24.232	FCC: Limit $\leq 13\text{ dB}$	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	$\leq -13\text{ dBm}/1\%*EBW$ , in 1 MHz bands immediately outside and adjacent to the frequency block.	Appendix E	Pass
Spurious Emission at Antenna Terminals	§2.1051, §24.238	$\leq -13\text{ dBm}/1\text{ MHz}$ , from 9 kHz to 10 <sup>th</sup> harmonics but outside authorized operating frequency ranges.	Appendix F	Pass
Field Strength of Spurious Radiation	§2.1053, §24.238	$\leq -13\text{ dBm}/1\text{ MHz}$ .	Appendix G	Pass
Frequency Stability	§2.1055, §24.235	FCC: within authorized frequency block. IC: $\leq \pm 2.5\text{ ppm}$ .	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
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(d)	$EIRP \leq 1\text{ W}$	Appendix A	Pass
Peak-Average Ratio	§2.1046, §27.50(d)	FCC: Limits $\leq 13\text{ dB}$	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)	$\leq -13\text{ dBm}/1\% \cdot EBW$ , 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)	$\leq -13\text{ dBm}/1\text{ MHz}$ , from 9 kHz to 10 <sup>th</sup> harmonics but outside authorized operating frequency ranges.	Appendix F	Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(h)	$\leq -13\text{ dBm}/1\text{ MHz}$ .	Appendix G	Pass
Frequency Stability	§2.1055, §27.54	Within authorized bands of operation/frequency block.	Appendix H	Pass
NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".				

**2.4 BRS&EBS Band7 (2500-2570 MHz paired with 2620-2690 MHz)**

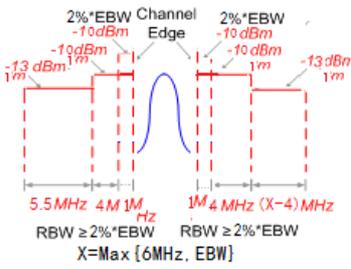
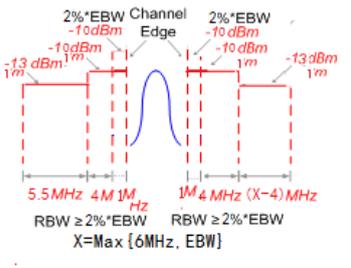
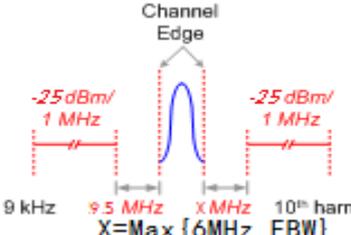
Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(h)	EIRP ≤ 2W	Appendix A	Pass
Peak-Average Ratio	---	---	Appendix B	N/T
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix D	Pass
Band Edges Compliance	§2.1051, §27.53(m)	FCC: IC: 	Appendix E	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(m)		Appendix F	Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(m)		Appendix G	Pass

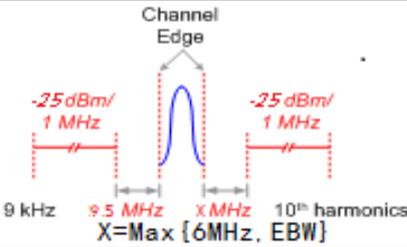
Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Frequency Stability	§2.1055, §27.54	Within authorized bands of operation/frequency block.	Appendix H	Pass
NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".				

## 2.5 Band17 (704-716MHz paired with 734-746 MHz)

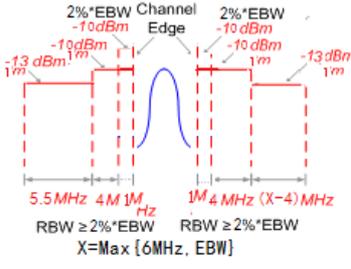
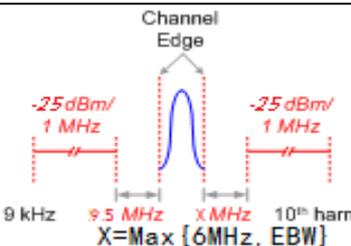
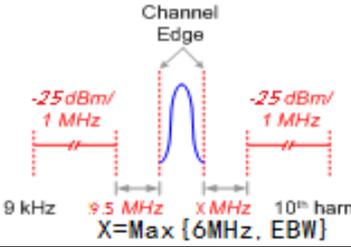
Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	FCC Rule No.	FCC: ERP $\leq$ 3 W. 698-716MHz (block A-, B-, C-) :Average EIRP Power $\leq$ 50 W. PAPR $\leq$ 13 dB@0.1%.	Appendix A	Pass
Peak-Average Ratio	§2.1046, §27.50(c)	---	Appendix B	Pass
Modulation Characteristics	---	Digital modulation	Appendix C	Pass
Bandwidth	§2.1047	OBW: No limit. EBW: No limit.	Appendix D	Pass
Band Edges Compliance	§2.1049,	$\leq$ -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(g)	FCC: $\leq$ -13 dBm/100 kHz, from 9 kHz to 10 <sup>th</sup> harmonics but outside authorized operating frequency ranges.	Appendix F	Pass
Field Strength of Spurious Radiation	§2.1051, §27.53(g)	FCC: $\leq$ -13 dBm/100 kHz.	Appendix G	Pass
Frequency Stability	§2.1053, §27.53(g)	$\leq$ $\pm$ 2.5ppm.	Appendix H	Pass
NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".				

**2.6 BRS&EBS Band38 (2570-2620 MHz paired with 2570-2620 MHz)**

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(h)	EIRP ≤ 2W	Appendix A	Pass
Peak-Average Ratio	---	---	Appendix B	N/T
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(m)	FCC:  IC: 	Appendix E	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(m)		Appendix F	Pass

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Field Strength of Spurious Radiation	§2.1053, §27.53(m)	 <p style="text-align: center;">Channel Edge</p> <p style="text-align: center;">-25 dBm/1 MHz      -25 dBm/1 MHz</p> <p style="text-align: center;">9 kHz      0.5 MHz      X MHz      10<sup>th</sup> harmonics</p> <p style="text-align: center;"><math>X = \text{Max} \{0.6\text{MHz}, \text{EBW}\}</math></p>	Appendix G	Pass
Frequency Stability	§2.1055, §27.54	Within authorized bands of operation/frequency block.	Appendix H	Pass
NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".				

**2.7 BRS&EBS Band41 (2496-2690 MHz paired with 2496-2690 MHz)**

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(h)	EIRP $\leq$ 2W	Appendix A	Pass
Peak-Average Ratio	---	---	Appendix B	N/T
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(m)	FCC: 	Appendix E	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(m)		Appendix F	Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(m)		Appendix G	Pass
Frequency Stability	§2.1055, §27.54	Within authorized bands of operation/frequency block.	Appendix H	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

H1512 is subscriber equipment in the LTE/WCDMA/CDMA/GSM system. The GSM/GPRS/EDGE frequency band includes GSM850 and GSM900 and DCS1800 and PCS1900. The HSPA+/UMTS frequency band is Band I and Band II and Band IV and Band V. The CDMA/1XEV-DO band is BC1 and BC0. The LTE frequency band is B1 and B2 and B3 and B4 and B5 and B7 and B8 and B9 and B17 and B19 and B20 and B28 and B38 and B39 and B41. But only GSM850 and GSM1900MHz and WCDMA Band II and Band IV and Band V and CDMA BC1 and BC0 and BC10 and LTE B2 and LTE B4 and LTE B5 and LTE B7 and LTE B17 and LTE B38 and LTE B41 bands test data included in this report. The Mobile Phone implements such functions as RF signal receiving/transmitting, LTE/HSPA/UMTS and GSM/GPRS/EDGE and CDMA2000 1x and 1XEV-DO protocol processing, voice, video MMS service, GPS, AGPS, NFC and WIFI etc. Externally it provides micro SD card interface (it can also used as micro SD card interface), earphone port (to provide voice service) and USIM card interface. It also provides Bluetooth module to synchronize data between a PC and the phone, or to use the built-in modem of the phone to access the Internet with a PC, or to exchange data with other Bluetooth devices.

The mobile phone H1511 and H1512 are LTE/UMTS mobile phone with NFC. The differences between H1511 and H1512 are showed in the following table in red. Other parts of the mobile phone are the same, including the appearance, the antenna, Chipset, NFC mode, Bluetooth mode, Wi-Fi mode, Battery, Main board and so on. The different frequency accord to the software to control

	H1511	H1512
LTE bands	B2/4/5/7/12/13/17/25/26/29/30/41	B2/4/5/7/17/38/41
WCDMA bands	B2/B4/B5	B2/B4/B5
CDMA Bands	BC0/1/10	BC0/1
GSM bands	850/1900	850/1900
NFC mode	the same	the same
camera	the same	the same
FLASH	the same	the same
Main board	the same	the same
PCB layout	the same	the same
Appearance	the same	the same



Bluetooth mode	the same	the same
2.4G Wi-Fi STA	2412-2462 MHz	2412-2462 MHz
2.4G Wi-Fi Hotspot	2412-2462 MHz	2412-2462 MHz
5G Wi-Fi STA	5150-5350, 5470-5850 MHz	5150-5350, 5470-5850 MHz
5G Wi-Fi Hotspot	5150-5250 MHz, 5725-5850 MHz	5150-5250 MHz, 5725-5850 MHz
BT/ WLAN antenna	the same	the same
GSM/ WCDMA /LTE antenna	the same	the same
Battery	the same	the same
Chipset	the same	the same
Memory	the same	the same
RF Parameter	The same RF Parameter in the same band	The same RF Parameter in the same band
Dimension	the same	the same

NOTE: The CDMA test data refer to SYBH(Z-RF)011072015-2001 of H1511 RF report.

The WCDMA test data refer to SYBH(Z-RF)011072015-2001 of H1511 RF report.

The 2.4G WLAN test data refer to SYBH(Z-RF)011072015-2004 of H1511 RF report.

The Bluetooth test data refer to SYBH(Z-RF)011072015-2005 of H1511 RF report.

The Bluetooth BLE test data refer to SYBH(Z-RF)011072015-2003 of H1511 RF report.

The NFC test data refer to SYBH(Z-RF)011072015-2006 of H1511 RF report.

The 5G WLAN test data refer to SYBH(Z-RF)011072015-2002 of H1511 RF report.

The LTE Band2, Band4, Band5, Band7, Band17 and Band41 test data refer to SYBH(Z-RF)011072015-2001 of H1511 RF report.

### 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		
Description	Hardware Version	Software Version
Main board	HL1NINAMH	User release M MDA2

### 3.2.2 Sub-Assembly

Sub-Assembly			
Sub-Assembly Name	Model	Manufacturer	Description
Adapter	HW-050300U00	Huawei Technologies Co., Ltd.	Input Voltage: ~100-240V 50/60Hz 0.5A Output Voltage: 5V  3A Rated Power: 5W
Adapter	HW-050300E00	Huawei Technologies Co., Ltd.	Input Voltage: ~100-240V 50/60Hz 0.5A Output Voltage: 5V  3A Rated Power: 5W
Adapter	HW-050300B00	Huawei Technologies Co., Ltd.	Input Voltage: ~100-240V 50/60Hz 0.5A Output Voltage: 5V  3A Rated Power: 5W
Adapter	HW-050300A00	Huawei Technologies Co., Ltd.	Input Voltage: ~100-240V 50/60Hz 0.5A Output Voltage: 5V  3A Rated Power: 5W
Adapter	HW-050300J00	Huawei Technologies Co., Ltd.	Input Voltage: ~100-240V 50/60Hz 0.5A Output Voltage: 5V  3A Rated Power: 5W
Adapter	HW-050300R00	Huawei Technologies Co., Ltd.	Input Voltage: ~100-240V 50/60Hz 0.5A Output Voltage: 5V  3A Rated Power: 5W
Adapter	HW-050300I00	Huawei Technologies Co., Ltd.	Input Voltage: ~100-240V 50/60Hz 0.5A Output Voltage: 5V  3A Rated Power: 5W
Battery	HB416683ECW	Huawei Technologies Co., Ltd.	Rated capacity: 3450mAh Nominal Voltage:  +3.8V Charging Voltage:  +4.35V



### 3.3 Technical Specification

Characteristics	Description	
Radio System Type	<input checked="" type="checkbox"/> LTE	
Supported Frequency Range	LTE BAND38	Transmission (TX): 2570 to 2620 MHz
		Receiving (RX): 2570 to 2620 MHz
TX and RX Antenna Ports	TX & RX port:	1
	TX-only port:	0
	RX-only port:	1
Target TX Output Power	LTE BAND38: 21.7dBm	
Supported Channel Bandwidth	LTE band 38	<input checked="" type="checkbox"/> 5 MHz, <input checked="" type="checkbox"/> 10 MHz, <input checked="" type="checkbox"/> 15 MHz, <input checked="" type="checkbox"/> 20 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.)	LTE BAND 38	4M50G7D (5 MHz QPSK modulation), 4M49W7D (5 MHz 16QAM modulation) 9M00G7D (10 MHz QPSK modulation), 9M00W7D (10 MHz 16QAM modulation) 13M5G7D (15 MHz QPSK modulation), 13M5W7D (15 MHz 16QAM modulation) 18M0G7D (20 MHz QPSK modulation), 18M0W7D (20 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
LTE/TM1	LTE system, QPSK modulation
LTE/TM2	LTE system, 16QAM modulation

### 4.2 Test Environment

Environment Parameter	Selected Values During Tests	
Relative Humidity	Ambient	
Temperature	TN	Ambient
Voltage	VL	3.5V
	VN	3.8V
	VH	4.35V

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 (B)	Middle (M)	High (T)
LTE Band 38	TX(5M)	Channel 37775	Channel 38000	Channel 38225
		2572.5 MHz	2595 MHz	2617.5 MHz
	TX(10M)	Channel 37800	Channel 38000	Channel 38200
		2575 MHz	2595 MHz	2615 MHz
	TX(15M)	Channel 37825	Channel 38000	Channel 38175
		2577.5 MHz	2595 MHz	2612.5 MHz
	TX(20M)	Channel 37850	Channel 38000	Channel 38150
		2580 MHz	2595 MHz	2610 MHz
	RX(5M)	Channel 37775	Channel 38000	Channel 38225
		2572.5 MHz	2595 MHz	2617.5 MHz
	RX(10M)	Channel 37800	Channel 38000	Channel 38200
		2575 MHz	2595 MHz	2615 MHz
	RX(15M)	Channel 37825	Channel 38000	Channel 38175
		2577.5 MHz	2595 MHz	2612.5 MHz
	RX(20M)	Channel 37850	Channel 38000	Channel 38150
		2580 MHz	2595 MHz	2610 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:

$$P_d \text{ [dBm]} = P_g \text{ [dBm]} - \text{cable loss [dB]} + \text{antenna gain [dBd/dBi]}$$

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  $P_g \text{ [dBm]} - \text{cable loss [dB]}$ .

The calculated  $P_d$  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<sup>th</sup> 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  $\pm 0.00025\%$  ( $\pm 2.5$  ppm ) of the center frequency.

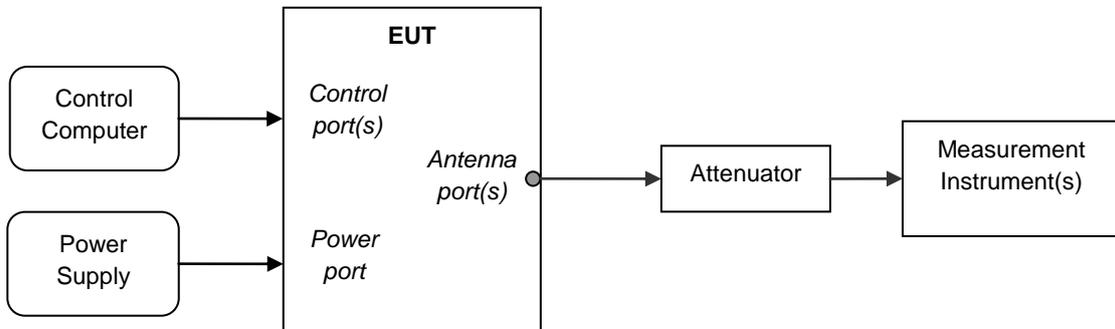
**Time Period and Procedure:**

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.

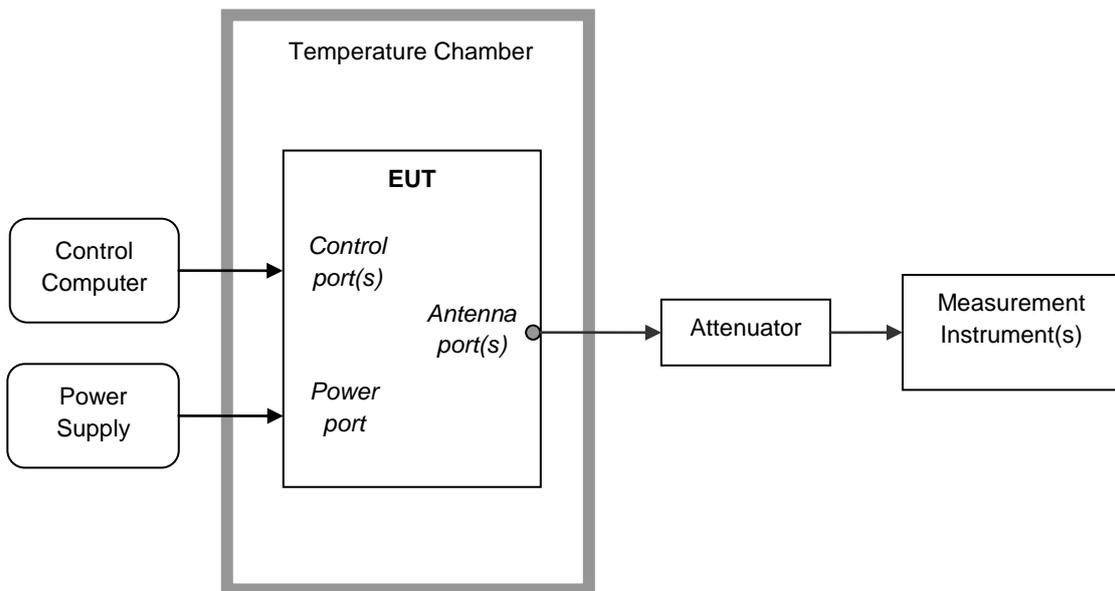
Note: Reference test setup 2.

## 4.5 Test Setups

### 4.5.1 Test Setup 1



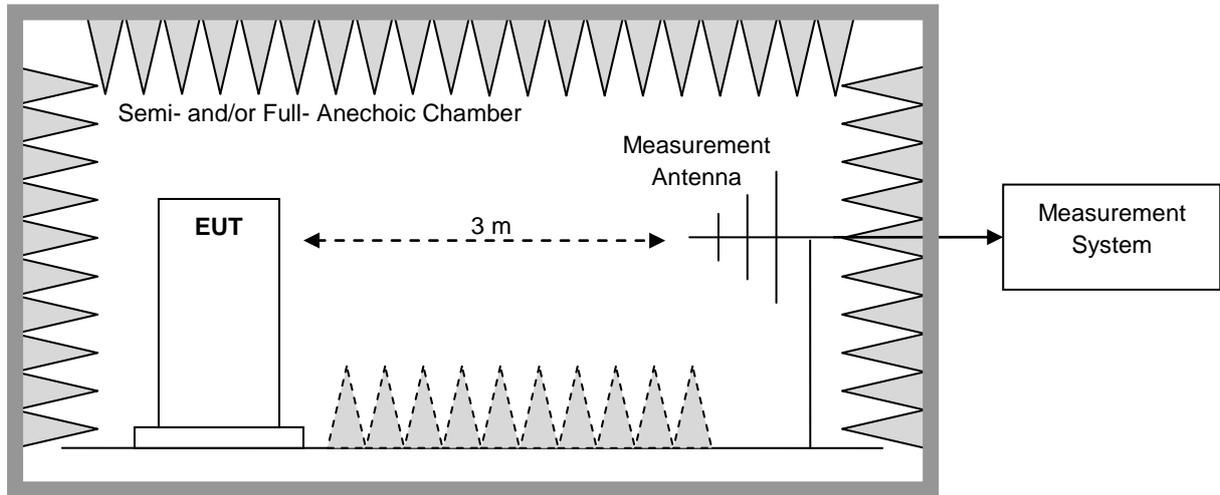
### 4.5.2 Test Setup 2



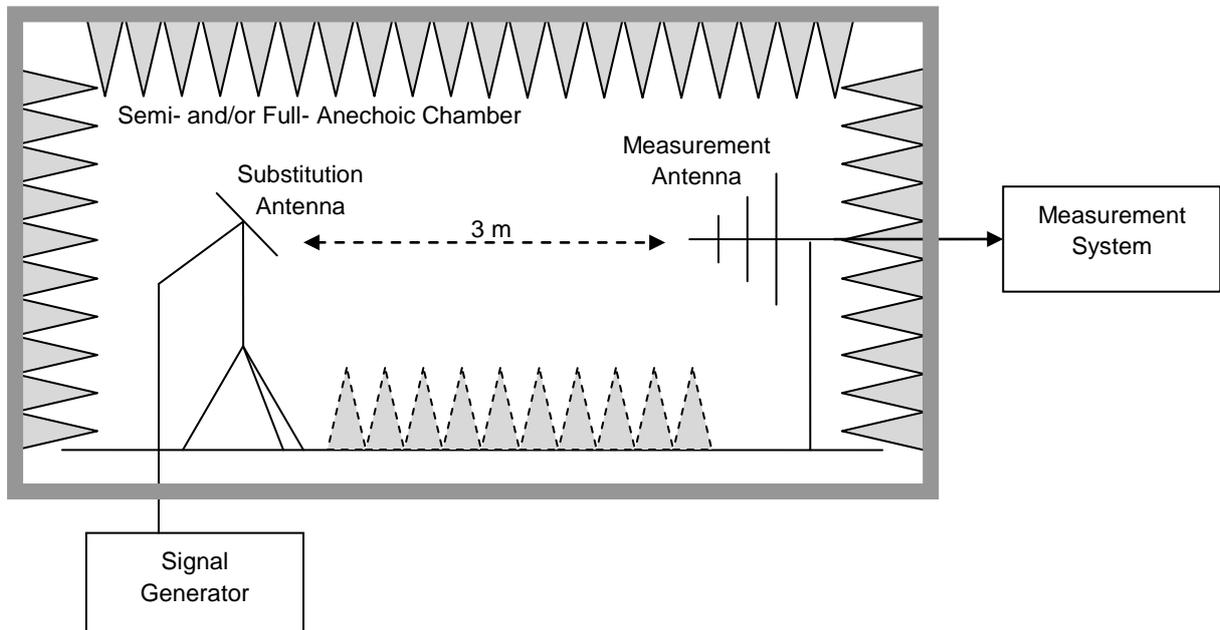
### 4.5.3 Test Setup 3

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	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	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	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	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	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	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	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	LTE/TM1,LTE/TM2
Field Strength of Spurious Radiation	Test Env.	Ambient Climate & Rated Voltage
	Test Setup	Test Seup 3
	Test Mode	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	LTE/TM1,LTE/TM2

**5 Main Test Instruments**

Equipment Name	Manufacturer	Model	Serial Number	Cal Date	Cal- Due
Power supply	KEITHLEY	2303	A120714713	2014-08-07	2016-08-06
Wireless Communication Test set	Agilent	N4010A	MY49081592	2014-11-04	2015-11-03
Universal Radio Communication Tester	R&S	CMU200	123299	2014-11-04	2015-11-03
Spectrum Analyzer	Agilent	N9020A	MY52090652	2015-07-08	2016-07-07
Universal Radio Communication Tester	R & S	CMW500	126854	2015-02-13	2016-02-12
Spectrum Analyzer	Agilent	E4440A	MY48250119	2015-07-08	2016-07-07
Signal Analyzer	R&S	FSQ31	200021	2014-11-04	2015-11-03
Spectrum Analyzer	Agilent	N9030A	MY49431698	2014-11-04	2015-11-03
Temperature Chamber	WEISS	WKL64	56246002940010	2015-02-13	2016-02-12
Signal generator	Agilent	E8257D	MY49281095	2014-11-04	2015-11-03
Vector Signal Generator	R&S	SMU200A	104162	2014-11-04	2015-11-03
Power Detecting & Sampling Unit	R&S	OSP-B157	100881	2014-09-08	2015-10-07
Signal Generator	Agilent	E4438C	MY47271904	2014-10-28	2015-10-27
Test receiver	R&S	ESU26	100387	2015-6-24	2016-06-23
Test receiver	R&S	ESCI	101163	2015-6-24	2016-06-23
Spectrum analyzer	R&S	FSU3	200474	2015-06-15	2016-06-14
Spectrum analyzer	R&S	FSU43	100144	2015-06-15	2016-06-14
LOOP Antennas(9kHz-30MHz)	R&S	HFH2-Z2	100262	2015-4-30	2017-4-29
LOOP Antennas(9kHz-30MHz)	R&S	HFH2-Z2	100263	2015-4-30	2017-4-29
Trilog Broadband Antenna (30M~3GHz)	SCHWARZ BECK	VULB 9163	9163-490	2015-4-30	2017-4-29
Trilog Broadband Antenna (30M~3GHz)	SCHWARZ BECK	VULB 9163	9163-520	2015-4-30	2017-4-29
Double-Ridged Waveguide Horn Antenna (1G~18GHz)	R&S	HF907	100304	2015-4-30	2017-4-29
double ridged horn antenna (0.8G-18GHz)	R&S	HF907	100305	2015-4-30	2017-4-29
Pyramidal Horn Antenna(18GHz-26.5GHz)	ETS-Lindgr en	3160-09	5140299	2015-7-15	2017-7-14
Artificial Main Network	R&S	ENV4200	100134	2015-6-24	2016-6-23
Line Impedance Stabilization Network	R&S	ENV216	100382	2015-6-24	2016-6-23



## 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