



# FCC

# RF Test Report

**Product Name: Smart Phone; HUAWEI Ascend G7**

**Model Number: HUAWEI G7-L01, G7-L01**

**Report No: SYBH(Z-RF)002082014-2001**

**FCC ID: QISG7-L01**

**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.
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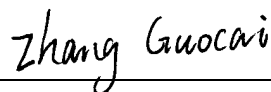


**Applicant:** Huawei Technologies Co., Ltd.  
**Address:** Administration Building, Headquarters of Huawei Technologies Co., Ltd.,  
Bantian, Longgang District, Shenzhen, 518129, P.R.C

**Date of Receipt Sample:** 2014-08-27  
**Start Date of Test:** 2014-08-28  
**End Date of Test:** 2014-09-22

**Test Result:** Pass

|                           |            |             |                                                                                       |
|---------------------------|------------|-------------|---------------------------------------------------------------------------------------|
| <b>Approved by Senior</b> | 2014-09-22 | Liu Chunlin |  |
| <b>Engineer:</b>          | Date       | Name        | Signature                                                                             |

|                     |            |              |                                                                                       |
|---------------------|------------|--------------|---------------------------------------------------------------------------------------|
| <b>Prepared by:</b> | 2014-09-22 | Zhang Guocai |  |
|                     | 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: 2013  
                                             47 CFR FCC Part 22: 2013  
                                             47 CFR FCC Part 24: 2013  
                                             47 CFR FCC Part 27: 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

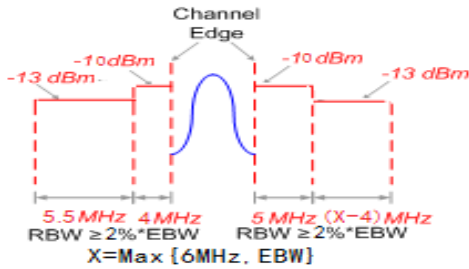
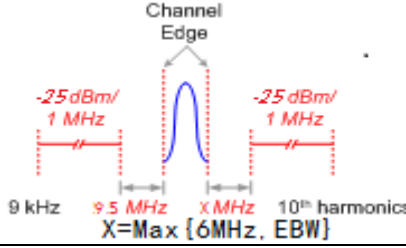
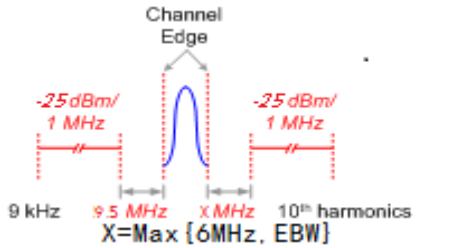
### 2.1 Cellular Band (824-849 MHz paired with 869-894 MHz)

| Test Item                                                                                    | FCC Rule No.     | Requirements                                                                                                   | Test Result | Verdict |
|----------------------------------------------------------------------------------------------|------------------|----------------------------------------------------------------------------------------------------------------|-------------|---------|
| Effective (Isotropic) Radiated Power Output Data                                             | §2.1046, §22.913 | ERP ≤ 7 W.                                                                                                     | 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.<br>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 | ≤ -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                                                         | §2.1053, §22.917 | ≤ -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 (1850-1915 MHz paired with 1930-1995 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 | Limit $\leq 13\text{ dB}$                                                                                                        | Appendix B  | Pass    |
| Modulation Characteristics                                                                   | §2.1047          | Digital modulation                                                                                                               | Appendix C  | Pass    |
| Bandwidth                                                                                    | §2.1049          | OBW: No limit.<br>EBW: No limit.                                                                                                 | Appendix D  | Pass    |
| Band Edges Compliance                                                                        | §2.1051, §24.238 | $\leq -13\text{ dBm}/1\% \cdot \text{EBW}$ , 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 $10^{\text{th}}$ 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 | 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 BRS&EBS Band (2500-2570 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.<br>EBW: No limit.                                                     | Appendix D  | Pass    |
| Band Edges Compliance                                                                        | §2.1051, §27.53(m) |   | 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". |                    |                                                                                      |             |         |

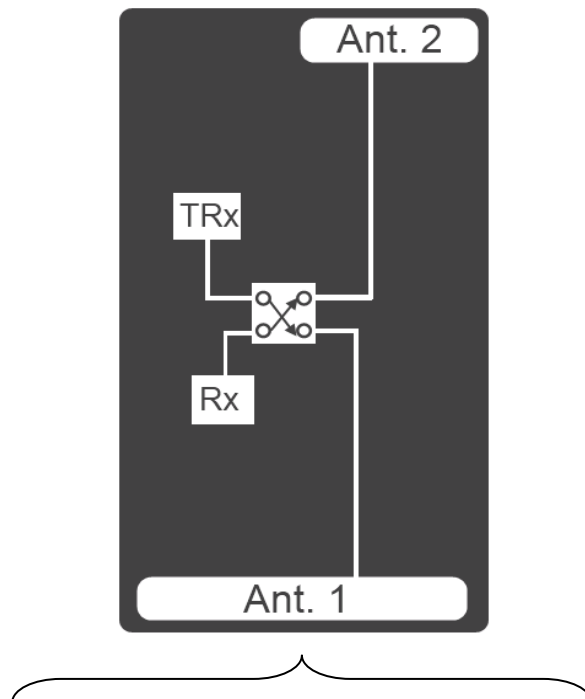
### 3 Description of the Equipment under Test (EUT)

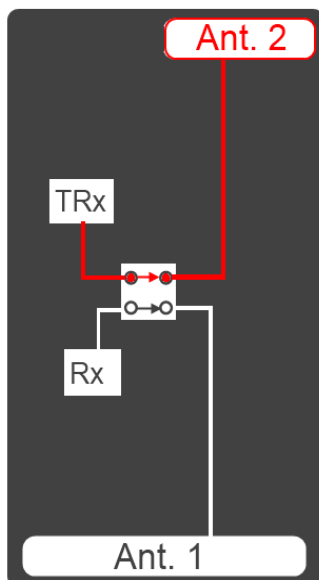
#### 3.1 General Description

HUAWEI G7-L01, G7-L01, is subscriber equipment in the LTE/WCDMA/GSM system. The HSPA+/UMTS frequency band is Band I and Band VIII. The LTE frequency band is B1, B3 and B7, B8 and B20. The GSM/GPRS/EDGE frequency band includes GSM850 and GSM900 and DCS1800 and PCS1900, but only GSM850 and GSM1900MHz and LTE B7 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 protocol processing, voice, video MMS service, GPS, AGPS, NFC and WIFI etc. Externally it provides 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.

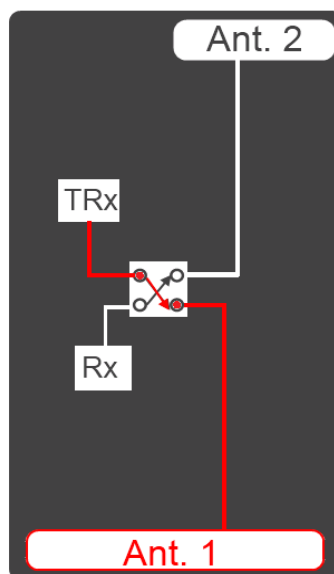
The EUT supports the dynamic antenna tuning function. It has two 2G/3G/4G Tx antennas. It can transmit from either Ant1 (Main Antenna) or Ant2 (Secondary Antenna), but these two Tx antennas can't transmit simultaneously. The device used a DPDT switch to achieve a dynamic antenna switching which is based on the antennas RSSI comparison and Switch Algorithm. The switching will refer to all of the operation bands.

The fixture is as below:





Direct Mode



Cross Mode

So Direct Mode and Cross Mode test data included in this 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  | HL1G760SM        | G7-L01V100R001C00B245 |

### 3.2.2 Sub-Assembly

| Name    | Manufacture                   | Description                                                                                                                                                                                    |
|---------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Adapter | Huawei Technologies Co., Ltd. | Model: HW-050100U2W<br>Input voltage: ~100-240V 50/60Hz 0.2A<br>Output voltage: 5V  1A<br>Rated Power: 5W |
| Adapter | Huawei Technologies Co., Ltd. | Model: HW-050100E2W<br>Input voltage: ~100-240V 50/60Hz 0.2A<br>Output voltage: 5V  1A<br>Rated Power: 5W |
| Adapter | Huawei Technologies Co., Ltd. | Model: HW-050100B2W                                                                                                                                                                            |



|                     |                               |                                                                                                                                                                                                                                                                                     |
|---------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     |                               | Input voltage: ~100-240V 50/60Hz 0.2A<br>Output voltage: 5V  1A<br>Rated Power: 5W                                                                                                               |
| Adapter             | Huawei Technologies Co., Ltd. | Model: HW-050100A2W<br>Input voltage: ~100-240V 50/60Hz 0.2A<br>Output voltage: 5V  1A<br>Rated Power: 5W                                                                                        |
| Rechargeable Li-ion | Huawei Technologies Co., Ltd. | Battery Model: HB3748B8EBC<br>Rated capacity: 3000mAh<br>Nominal Voltage:  +3.8V<br>Charging Voltage:  +4.35V |

### 3.3 Technical Specification

| Characteristics                                                                                                                                                                 | Description                                                                        |                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Radio System Type                                                                                                                                                               | <input checked="" type="checkbox"/> GSM<br><input checked="" type="checkbox"/> LTE |                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                    |
| Supported Frequency Range                                                                                                                                                       | GSM850                                                                             | Transmission (TX):                                                                                                                                                            | 824 to 849 MHz                                                                                                                                                                                                                                                                                     |
|                                                                                                                                                                                 |                                                                                    | Receiving (RX):                                                                                                                                                               | 869 to 894 MHz                                                                                                                                                                                                                                                                                     |
|                                                                                                                                                                                 | GSM1900                                                                            | Transmission (TX):                                                                                                                                                            | 1850 to 1910 MHz                                                                                                                                                                                                                                                                                   |
|                                                                                                                                                                                 |                                                                                    | Receiving (RX):                                                                                                                                                               | 1930 to 1990 MHz                                                                                                                                                                                                                                                                                   |
|                                                                                                                                                                                 | LTE BAND7                                                                          | Transmission (TX):                                                                                                                                                            | 2500 to 2570 MHz                                                                                                                                                                                                                                                                                   |
|                                                                                                                                                                                 |                                                                                    | Receiving (RX):                                                                                                                                                               | 2620 to 2690 MHz                                                                                                                                                                                                                                                                                   |
| TX and RX Antenna Ports                                                                                                                                                         | TX & RX port:                                                                      |                                                                                                                                                                               | 2                                                                                                                                                                                                                                                                                                  |
| Target TX Output Power                                                                                                                                                          | GSM850                                                                             | Direct Mode                                                                                                                                                                   | 32.5dBm                                                                                                                                                                                                                                                                                            |
|                                                                                                                                                                                 |                                                                                    | Cross Mode                                                                                                                                                                    | 31dBm                                                                                                                                                                                                                                                                                              |
|                                                                                                                                                                                 | GSM1900                                                                            | Direct Mode                                                                                                                                                                   | 29.5dBm                                                                                                                                                                                                                                                                                            |
|                                                                                                                                                                                 |                                                                                    | Cross Mode                                                                                                                                                                    | 24.5dBm                                                                                                                                                                                                                                                                                            |
|                                                                                                                                                                                 | LTE BAND7                                                                          | Direct Mode                                                                                                                                                                   | 22dBm                                                                                                                                                                                                                                                                                              |
|                                                                                                                                                                                 |                                                                                    | Cross Mode                                                                                                                                                                    | 16dBm                                                                                                                                                                                                                                                                                              |
| Supported Channel Bandwidth                                                                                                                                                     | GSM system:                                                                        | <input checked="" type="checkbox"/> 200 kHz                                                                                                                                   |                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                                 | LTE band 7                                                                         | <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<br>(Note: the necessary bandwidth of which is the worst value from the measured occupied bandwidths for each type of channel bandwidth configuration.) | GSM850                                                                             | Direct Mode                                                                                                                                                                   | 247KGXW, 244KG7W                                                                                                                                                                                                                                                                                   |
|                                                                                                                                                                                 |                                                                                    | Cross Mode                                                                                                                                                                    | 246KGXW, 245KG7W                                                                                                                                                                                                                                                                                   |
|                                                                                                                                                                                 | GSM1900                                                                            | Direct Mode                                                                                                                                                                   | 247KGXW, 246KG7W                                                                                                                                                                                                                                                                                   |
|                                                                                                                                                                                 |                                                                                    | Cross Mode                                                                                                                                                                    | 247KGXW, 248KG7W                                                                                                                                                                                                                                                                                   |
|                                                                                                                                                                                 | LTE BAND7                                                                          | Direct Mode                                                                                                                                                                   | 4M53G7D (5 MHz QPSK modulation),<br>4M52W7D (5 MHz 16QAM modulation)<br>9M01G7D (10 MHz QPSK modulation),<br>8M99W7D (10 MHz 16QAM modulation)<br>13M6G7D (15 MHz QPSK modulation),<br>13M5W7D (15 MHz 16QAM modulation)<br>18M0G7D (20 MHz QPSK modulation),<br>18M0W7D (20 MHz 16QAM modulation) |
|                                                                                                                                                                                 |                                                                                    | Cross Mode                                                                                                                                                                    | 4M51G7D (5 MHz QPSK modulation),<br>4M52W7D (5 MHz 16QAM modulation)<br>9M00G7D (10 MHz QPSK modulation),<br>8M99W7D (10 MHz 16QAM modulation)<br>13M5G7D (15 MHz QPSK modulation),<br>13M5W7D (15 MHz 16QAM modulation)<br>18M0G7D (20 MHz QPSK modulation),<br>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                |
|-----------|---------------------------------------|
| GSM/TM1   | GSM system, GSM/GPRS, GMSK modulation |
| GSM/TM2   | GSM system, EDGE, 8PSK modulation     |
| 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                           | 3.6V    |
|                       | 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 (L)     | Middle (M)  | High (H)    |
| GSM850    | TX      | Channel 128 | Channel 190 | Channel 251 |
|           |         | 824.2MHz    | 836.6MHz    | 848.8MHz    |
|           | RX      | Channel 128 | Channel 190 | Channel 251 |
|           |         | 869.2MHz    | 881.6MHz    | 893.8MHz    |
| 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  |

| Test Mode  | TX / RX  | RF Channel    |               |               |
|------------|----------|---------------|---------------|---------------|
|            |          | Low (L)       | Middle (M)    | High (H)      |
| LTE Band 7 | TX (5M)  | Channel 20775 | Channel 21100 | Channel 21425 |
|            |          | 2502.5 MHz    | 2535 MHz      | 2567.5 MHz    |
|            | TX (10M) | Channel 20800 | Channel 21100 | Channel 21400 |
|            |          | 2505 MHz      | 2535 MHz      | 2565 MHz      |
|            | TX (15M) | Channel 20825 | Channel 21100 | Channel 21375 |
|            |          | 2507.5 MHz    | 2535 MHz      | 2562.5 MHz    |
|            | TX (20M) | Channel 20850 | Channel 21100 | Channel 21350 |
|            |          | 2510 MHz      | 2535 MHz      | 2560 MHz      |
|            | RX (5M)  | Channel 2775  | Channel 3100  | Channel 3425  |
|            |          | 2622.5 MHz    | 2655 MHz      | 2687.5 MHz    |
|            | RX (10M) | Channel 2800  | Channel 3100  | Channel 3400  |
|            |          | 2625 MHz      | 2655 MHz      | 2685 MHz      |
|            | RX (15M) | Channel 2825  | Channel 3100  | Channel 3375  |
|            |          | 2627.5 MHz    | 2655 MHz      | 2682.5 MHz    |
|            | RX (20M) | Channel 2850  | Channel 3100  | Channel 3350  |
|            |          | 2630 MHz      | 2655 MHz      | 2680 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  $43 + 10\log_{10}(\text{Power [Watts]})$ .

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.

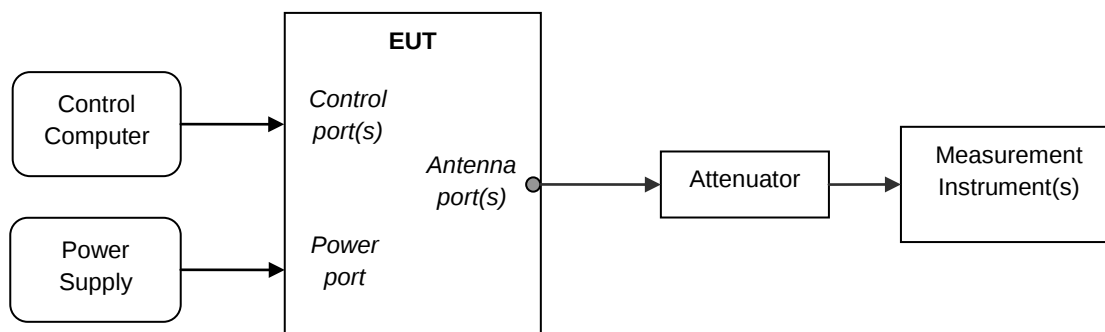
**Time Period and Procedure:**

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.

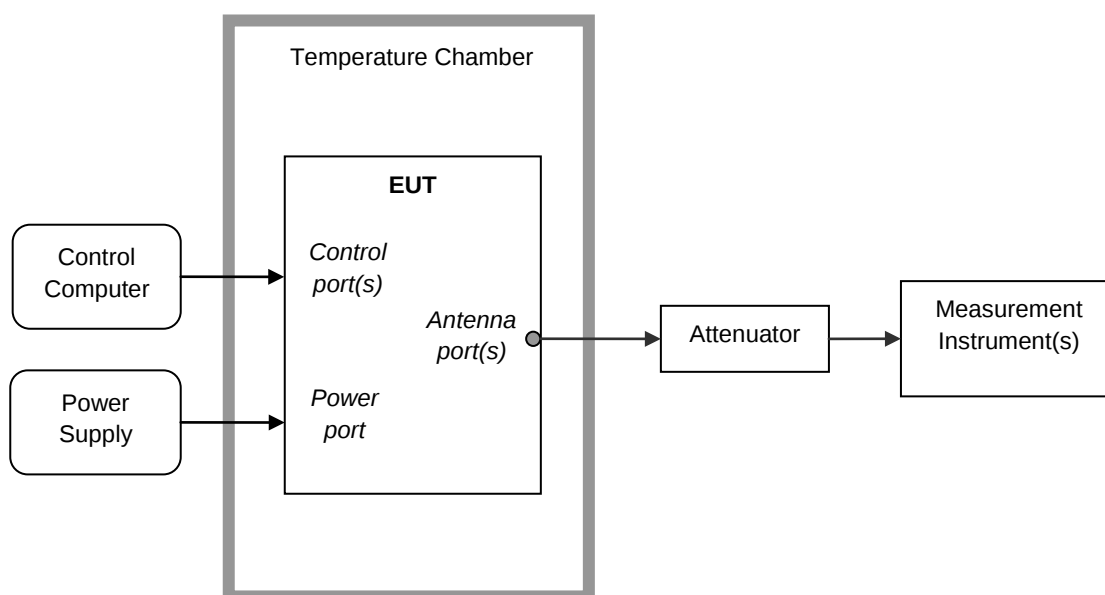
Note: Reference test setup 2.

## 4.5 Test Setups

### 4.5.1 Test Setup 1



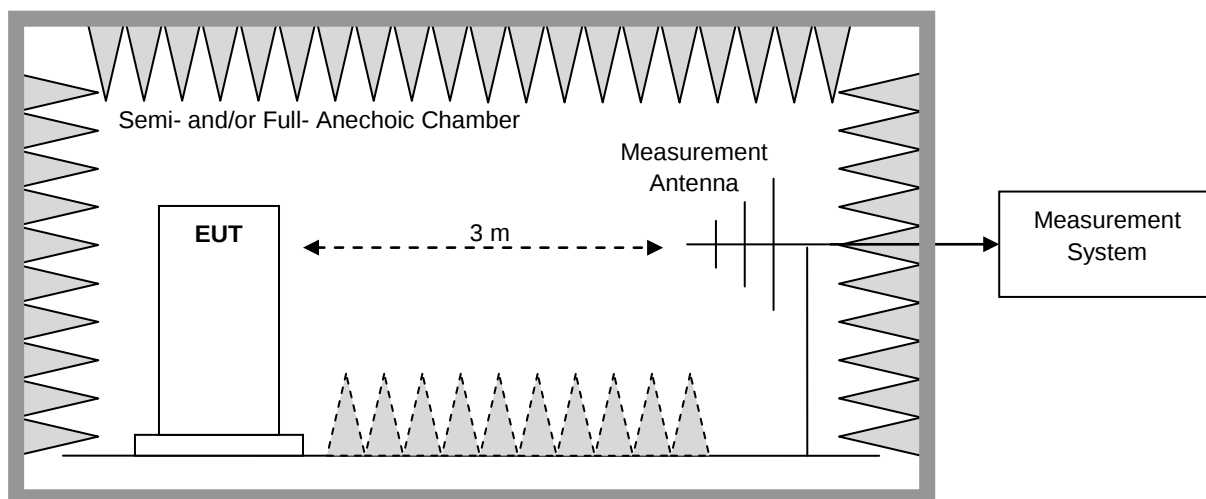
### 4.5.2 Test Setup 2



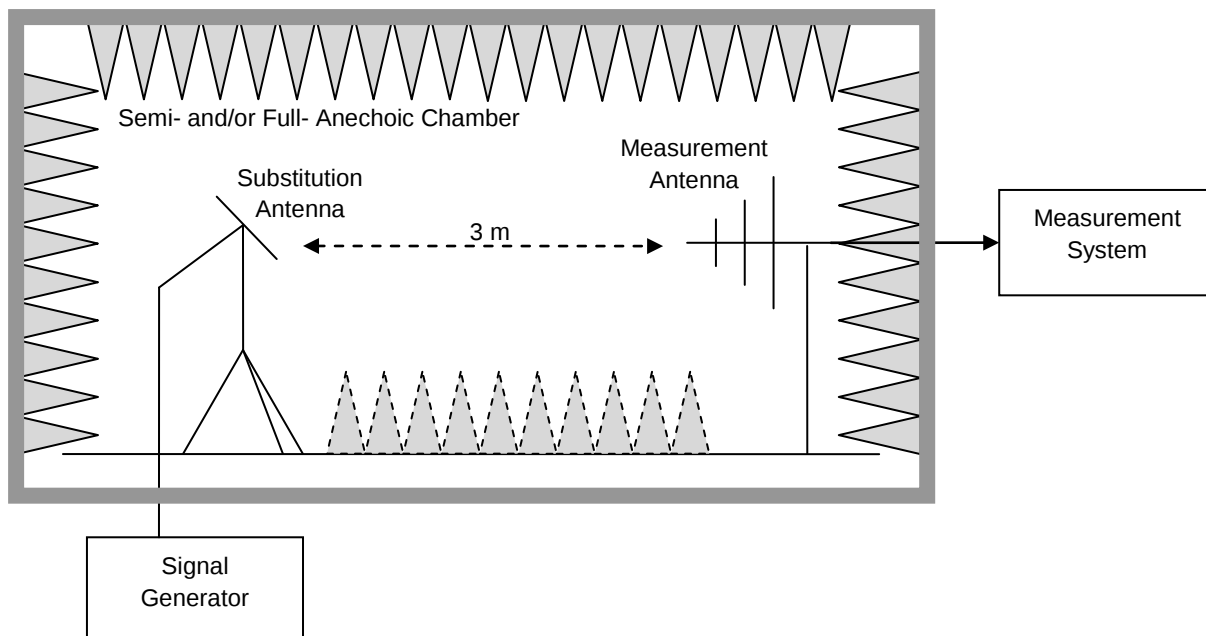
### 4.5.3 Test Setup 3

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

| Test Case                            | Test Conditions  |                                                                                                                                                         |
|--------------------------------------|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                      | Test Mode        | GSM/TM1,GSM/TM2,LTE/TM1,LTE/TM2                                                                                                                         |
| Field Strength of Spurious Radiation | Test Env.        | Ambient Climate & Rated Voltage                                                                                                                         |
|                                      | Test Setup       | Test Seup 3                                                                                                                                             |
|                                      | Test Mode        | GSM/TM1,GSM/TM2,LTE/TM1,LTE/TM2<br>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<br>(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;<br>(2) VL, VN and VH of Rated Voltage at Ambient Climate.                                        |
|                                      | Test Setup       | Test Seup 2                                                                                                                                             |
|                                      | RF Channels (TX) | L, M, H<br>(L= low channel, M= middle channel, H= high channel )                                                                                        |
|                                      | Test Mode        | GSM/TM1,GSM/TM2,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    | 117341         | 2014-02-25 | 2015-02-24 |
| Spectrum Analyzer                               | Agilent      | N9020A    | MY52090652     | 2014-07-11 | 2015-07-10 |
| Universal Radio Communication Tester            | R & S        | CMW500    | 126855         | 2013-08-08 | 2015-08-09 |
| Spectrum Analyzer                               | Agilent      | E4440A    | MY48250119     | 2014-07-11 | 2015-07-10 |
| 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                             | WEISS        | WKL64     | 56246002940010 | 2014-02-25 | 2015-02-24 |
| Temperature Chamber                             | ESPEC        | MW3030    | 06114003       | 2014-05-09 | 2015-05-08 |
| Signal generator                                | Agilent      | E8257D    | MY51500314     | 2014-05-09 | 2015-05-08 |
| Vector Signal Generator                         | R&S          | SMU200A   | 104162         | 2013-10-29 | 2014-10-28 |
| Test receiver                                   | R&S          | ESU26     | 100150         | 2014-05-09 | 2015-05-08 |
| 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:<br>U = 4.6 dB (30 MHz to 1GHz)<br>U = 3.0 dB (above 1 GHz)<br>For 10 m Chamber:<br>U = 4.6 dB (30 MHz to 1GHz)<br>U = 3.0 dB (above 1 GHz) |
| Frequency Stability                  | Frequency Accuracy [ppm] | U = 0.21 ppm                                                                                                                                                |

END