

# FCC RF TEST REPORT

ISSUED BY  
Shenzhen BALUN Technology Co., Ltd.



FOR  
**LTE Digital Mobile Handset**

ISSUED TO  
ZTE Corporation

ZTE Plaza, Keji Road South, Hi-Tech, Industrial Park, Nanshan District,  
Shenzhen, Guangdong, P. R. China



Tested by:

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Date

*Jun. 24. 2016*

Approved by:

*Liao Jianming*  
Liao Jianming  
(Technical director)

Date

*Jun. 24. 2016*

Report No.: BL-SZ1660087-602

EUT Type: LTE Digital Mobile Handset

Model Name: ZTE Blade A511, Blade A511

Brand Name: ZTE

Test Standard: 47 CFR Part 15 Subpart C

FCC ID: SRQ-A511

Test conclusion: Pass

Test Date: Jun. 15, 2016 ~ Jun. 23, 2016

Date of Issue: Jun. 24, 2016

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**Revision History**

| <u>Version</u> | <u>Issue Date</u>    | <u>Revisions Content</u> |
|----------------|----------------------|--------------------------|
| <u>Rev. 01</u> | <u>Jun. 24, 2016</u> | <u>Initial Issue</u>     |
| _____          | _____                | _____                    |

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# 1 ADMINISTRATIVE DATA (GENERAL INFORMATION)

## 1.1 Identification of the Testing Laboratory

|              |                                                                                                                                 |
|--------------|---------------------------------------------------------------------------------------------------------------------------------|
| Company Name | Shenzhen BALUN Technology Co., Ltd.                                                                                             |
| Address      | Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China |
| Phone Number | +86 755 6685 0100                                                                                                               |
| Fax Number   | +86 755 6182 4271                                                                                                               |

## 1.2 Identification of the Responsible Testing Location

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Location             | Shenzhen BALUN Technology Co., Ltd.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Address                   | Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Accreditation Certificate | <p>The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 11524A-1.</p> <p>The laboratory has been listed by US Federal Communications Commission to perform electromagnetic emission measurements. The recognition numbers of test site are 832625.</p> <p>The laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L6791.</p> |
| Description               | All measurement facilities used to collect the measurement data are located at Block B, FL 1, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China 518055                                                                                                                                                                                                                                                                                                                                           |

## 1.3 Laboratory Condition

|                           |                   |
|---------------------------|-------------------|
| Ambient Temperature       | 20 to 25°C        |
| Ambient Relative Humidity | 45% - 55%         |
| Ambient Pressure          | 100 kPa - 102 kPa |

## 1.4 Announce

- (1) The test report reference to the report template version v6.2.
- (2) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
- (3) The test report is invalid if there is any evidence and/or falsification.
- (4) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.
- (5) This document may not be altered or revised in any way unless done so by BALUN and all revisions are duly noted in the revisions section.
- (6) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without

prior written approval from the laboratory.

## 2 PRODUCT INFORMATION

### 2.1 Applicant Information

|           |                                                                                                          |
|-----------|----------------------------------------------------------------------------------------------------------|
| Applicant | ZTE Corporation                                                                                          |
| Address   | ZTE Plaza, Keji Road South, Hi-Tech, Industrial Park, Nanshan District, Shenzhen, Guangdong, P. R. China |

### 2.2 Manufacturer Information

|              |                                                                                                          |
|--------------|----------------------------------------------------------------------------------------------------------|
| Manufacturer | ZTE Corporation                                                                                          |
| Address      | ZTE Plaza, Keji Road South, Hi-Tech, Industrial Park, Nanshan District, Shenzhen, Guangdong, P. R. China |

### 2.3 Factory Information

|         |     |
|---------|-----|
| Factory | N/A |
| Address | N/A |

### 2.4 General Description for Equipment under Test (EUT)

|                                           |                                                                                                                                                                                                                                      |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EUT Type                                  | LTE Digital Mobile Handset                                                                                                                                                                                                           |
| Model Name Under Test                     | ZTE Blade A511                                                                                                                                                                                                                       |
| Series Model Name                         | Blade A511                                                                                                                                                                                                                           |
| Description of Model name differentiation | The equipment model ZTE Blade A511 and Blade A511 are LTE Digital Mobile Handset, the electrical parameters and internal structure of circuit are same, only the model name is different.                                            |
| Hardware Version                          | V1AMB_A                                                                                                                                                                                                                              |
| Software Version                          | A511_ChileMovistar_1.01                                                                                                                                                                                                              |
| Dimensions (Approx.)                      | N/A                                                                                                                                                                                                                                  |
| Weight (Approx.)                          | N/A                                                                                                                                                                                                                                  |
| Network and Wireless connectivity         | 2G Network GSM/GPRS/EDGE 850/1900 MHz<br>3G Network WCDMA/HSDPA/HSUPA Band II/V<br>4G Network FDD LTE Band 4/7/28<br>Bluetooth 3.0, Bluetooth 4.0 Low Energy (BLE)<br>WIFI 802.11b, 802.11g and 802.11n(HT20/40)<br>GPS, FM, GLONASS |

## 2.5 Ancillary Equipment

|                       |                 |                               |
|-----------------------|-----------------|-------------------------------|
| Ancillary Equipment 1 | Battery         |                               |
|                       | Brand Name      | ZTE                           |
|                       | Model No.       | Li3822T43P3h786032            |
|                       | Serial No.      | N/A                           |
|                       | Capacitance     | 2200 mAh                      |
|                       | Rated Voltage   | 3.8 V                         |
|                       | Limited Voltage | 4.35 V                        |
| Ancillary Equipment 2 | Charge          |                               |
|                       | Brand Name      | ZTE                           |
|                       | Model No.       | STC-A22O50I1000USBA-A         |
|                       | Rated Input     | 100~240 V ~, 50~60 Hz, 300 mA |
|                       | Rated Output    | 5 V =, 1000 mA                |
| Ancillary Equipment 3 | USB Data Cable  |                               |
|                       | Length (Approx) | 1.2 m                         |
| Ancillary Equipment 4 | Earphone        |                               |
|                       | Length (Approx) | 51 cm                         |

## 2.6 Technical Information

The requirement for the following technical information of the EUT was tested in this report:

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TX/ RX Operating Range | <p>802.11b/g/n(20 MHz): 2.412 GHz - 2.462 GHz</p> <p><math>f_c = 2412 \text{ MHz} + (N-1)*5 \text{ MHz}</math>, where</p> <ul style="list-style-type: none"> <li>- <math>f_c</math> = "Operating Frequency" in MHz,</li> <li>- N = "Channel Number" with the range from 1 to 11.</li> </ul> <p>802.11n(40 MHz): 2.422 GHz - 2.452 GHz</p> <p><math>f_c = 2412 \text{ MHz} + (N-1)*5 \text{ MHz}</math>, where</p> <ul style="list-style-type: none"> <li>- <math>f_c</math> = "Operating Frequency" in MHz,</li> <li>- N = "Channel Number" with the range from 3 to 9.</li> </ul> |
| Modulation Type        | DSSS, OFDM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Antenna Type           | PIFA Antenna                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Antenna Gain           | -4 dBi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| About the Product      | The equipment is LTE Digital Mobile Handset, it contains WIFI Modules operating at 2.4 GHz ISM band.                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

| Modulation technology | Modulation Type | Transfer Rate (Mbps) | The Frequency Equal to the Transmission Rate of Modulation Signal |
|-----------------------|-----------------|----------------------|-------------------------------------------------------------------|
| DSSS (802.11b)        | DBPSK           | 1                    | 1 MHz                                                             |
|                       | DQPSK           | 2                    |                                                                   |
|                       | CCK             | 5.5/ 11              | 1.375 MHz                                                         |
| OFDM (802.11g)        | BPSK            | 6 / 9                | 1 MHz                                                             |
|                       | QPSK            | 12 / 18              |                                                                   |
|                       | 16QAM           | 24 / 36              |                                                                   |

|                         |       |            |       |
|-------------------------|-------|------------|-------|
|                         | 64QAM | 48 / 54    |       |
| OFDM<br>(802.11n-20MHz) | BPSK  | 6.5        | 1 MHz |
|                         | QPSK  | 13/19.5    |       |
|                         | 16QAM | 26/39      |       |
|                         | 64QAM | 52/58.5/65 |       |
| OFDM<br>(802.11n-40MHz) | BPSK  | 13.5       | 1 MHz |
|                         | QPSK  | 27/40.5    |       |
|                         | 16QAM | 54/81/108  |       |
|                         | 64QAM | 121.5/135  |       |

Note: Preliminary tests were performed in different data rate in above table to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

| Test Items                   | Mode                | Data Rate         | Channel |       |
|------------------------------|---------------------|-------------------|---------|-------|
| Output Power                 | 11b/11g/11n20/11n40 | 1/6/6.5/13.5 Mbps | 1/6/11  | 3/6/9 |
| 6dB Bandwidth                | 11b/11g/11n20/11n40 | 1/6/6.5/13.5 Mbps | 1/6/11  | 3/6/9 |
| Conducted Spurious Emission  | 11b/11g/11n20/11n40 | 1/6/6.5/13.5 Mbps | 1/6/11  | 3/6/9 |
| Conducted Emission           | 11b/11g/11n20/11n40 | 1/6/6.5/13.5 Mbps | 1/6/11  | 3/6/9 |
| Radiated Spurious Emission   | 11b/11g/11n20/11n40 | 1/6/6.5/13.5 Mbps | 1/6/11  | 3/6/9 |
| Band Edge                    | 11b/11g/11n20/11n40 | 1/6/6.5/13.5 Mbps | 1/6/11  | 3/6/9 |
| Power spectral density (PSD) | 11b/11g/11n20/11n40 | 1/6/6.5/13.5 Mbps | 1/6/11  | 3/6/9 |

Note: The above EUT information in section 2.4 and 2.6 was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

## 2.7 Additional Instructions

EUT Software Settings:

During testing. Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

| Power level setup in software |                            |                 |          |
|-------------------------------|----------------------------|-----------------|----------|
| Project Keyword               | Project Keyword is *2366*# |                 |          |
| Mode                          | Channel                    | Frequency (MHz) | Soft Set |
| 11b                           | CH1                        | 2412            | 19       |
| 11g                           | CH1                        | 2412            | 17       |
| 11n (HT20)                    | CH11                       | 2462            | 15       |
| 11n (HT40)                    | CH3                        | 2422            | 15       |

Run Software:



### 3 SUMMARY OF TEST RESULTS

#### 3.1 Test Standards

| No. | Identity                                          | Document Title                                                     |
|-----|---------------------------------------------------|--------------------------------------------------------------------|
| 1   | 47 CFR Part 15,<br>Subpart C<br>(10-1-15 Edition) | Miscellaneous Wireless Communications Services                     |
| 2   | ANSI C63.10-2013                                  | American National Standard for Testing Unlicensed Wireless Devices |

#### 3.2 Verdict

| No. | Description                          | FCC Part No.        | Test Result | Verdict                |
|-----|--------------------------------------|---------------------|-------------|------------------------|
| 1   | Antenna Requirement                  | 15.203<br>15.247(b) | --          | Pass <sup>Note 1</sup> |
| 2   | Output Power                         | 15.247(b)           | ANNEX A.1   | Pass <sup>Note 2</sup> |
| 3   | 6dB Bandwidth                        | 15.247(a)           | ANNEX A.2   | Pass <sup>Note 2</sup> |
| 4   | Conducted Spurious Emission          | 15.247(d)           | ANNEX A.3   | Pass <sup>Note 2</sup> |
| 5   | Band Edge(Authorized-band band-edge) | 15.247(d)           | ANNEX A.4   | Pass <sup>Note 2</sup> |
| 6   | Conducted Emission                   | 15.207              | ANNEX A.5   | Pass                   |
| 7   | Radiated Spurious Emission           | 15.209<br>15.247(d) | ANNEX A.6   | Pass                   |
| 8   | Band Edge(Restricted-band band-edge) | 15.209<br>15.247(d) | ANNEX A.7   | Pass <sup>Note 2</sup> |
| 9   | Power spectral density (PSD)         | 15.247(e)           | ANNEX A.8   | Pass <sup>Note 2</sup> |

Note 1: Please refer to section 5.1

Note 2: Based on the initial report (issued by SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd on Mar. 28, 2016), changed charger and main antenna, So The test item of Antenna Requirement, Output Power, 6dB Bandwidth, Conducted Spurious Emission, Band Edge (Authorized-band band-edge), Band Edge (Restricted-band band-edge) and Power spectral density (PSD) please refer to the Report No. SZ16010163W03 issued by MORLAB on Mar. 28, 2016 and only evaluated CE emission and RSE below 1GHz.

## 4 GENERAL TEST CONFIGURATIONS

### 4.1 Test Environments

During the measurement, the normal environmental conditions were within the listed ranges:

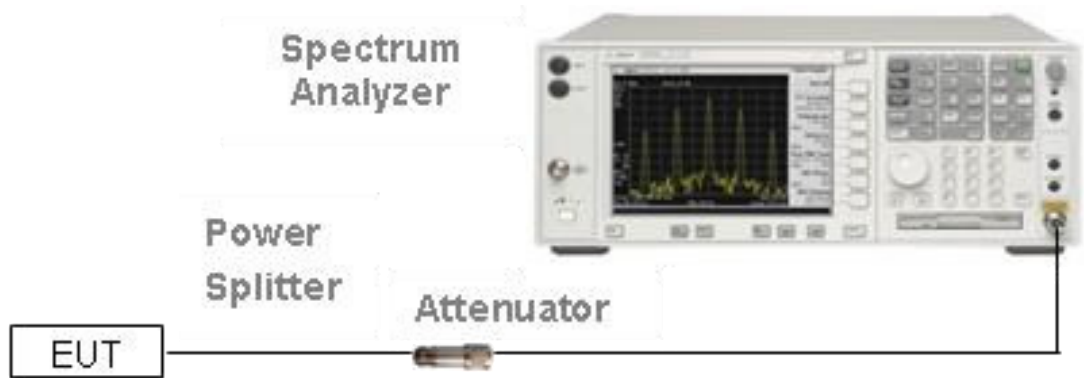
|                            |                         |                |
|----------------------------|-------------------------|----------------|
| Relative Humidity          | 45% - 55%               |                |
| Atmospheric Pressure       | 100 kPa - 102 kPa       |                |
| Temperature                | NT (Normal Temperature) | +22°C to +25°C |
| Working Voltage of the EUT | NV (Normal Voltage)     | 3.8 V          |

### 4.2 Test Equipment List

| Description                       | Manufacturer         | Model      | Serial No. | Cal. Date  | Cal. Due   |
|-----------------------------------|----------------------|------------|------------|------------|------------|
| Spectrum Analyzer                 | ROHDE&SCHWARZ        | FSV-30     | 103118     | 2015.07.16 | 2016.07.15 |
| Vector Signal Generator           | ROHDE&SCHWARZ        | SMBV100A   | 177746     | 2015.07.16 | 2016.07.15 |
| Signal Generator                  | ROHDE&SCHWARZ        | SMB100A    | 260592     | 2015.07.01 | 2016.06.30 |
| Switch Unit with OSP-B157         | ROHDE&SCHWARZ        | OSP120     | 101270     | 2015.07.16 | 2016.07.15 |
| Spectrum Analyzer                 | AGILENT              | E4440A     | MY45304434 | 2015.10.15 | 2016.10.14 |
| EMI Receiver                      | ROHDE&SCHWARZ        | ESRP       | 101036     | 2015.07.14 | 2016.07.13 |
| LISN                              | SCHWARZBECK          | NSLK 8127  | 8127-687   | 2015.07.14 | 2016.07.13 |
| Bluetooth Tester                  | ROHDE&SCHWARZ        | CBT        | 101005     | 2015.07.16 | 2016.07.15 |
| Power Splitter                    | KMW                  | DCPD-LDC   | 1305003215 | 2015.07.01 | 2016.06.30 |
| Power Sensor                      | ROHDE&SCHWARZ        | NRP-Z21    | 103971     | 2015.07.21 | 2016.07.20 |
| Attenuator (20 dB)                | KMW                  | ZA-S1-201  | 110617091  | --         | --         |
| Attenuator (6 dB)                 | KMW                  | ZA-S1-61   | 1305003189 | --         | --         |
| DC Power Supply                   | ROHDE&SCHWARZ        | HMP2020    | 018141664  | 2015.07.17 | 2016.07.16 |
| Temperature Chamber               | ANGELANTIONI SCIENCE | NTH64-40A  | 1310       | 2015.08.07 | 2016.08.06 |
| Test Antenna-Loop(9 kHz-30 MHz)   | SCHWARZBECK          | FMZB 1519  | 1519-037   | 2015.07.22 | 2017.07.21 |
| Test Antenna-Bi-Log(30 MHz-3 GHz) | SCHWARZBECK          | VULB 9163  | 9163-624   | 2015.07.22 | 2017.07.21 |
| Test Antenna-Horn(1-18 GHz)       | SCHWARZBECK          | BBHA 9120D | 9120D-1148 | 2015.07.22 | 2017.07.21 |
| Test Antenna-Horn(15-26.5 GHz)    | SCHWARZBECK          | BBHA 9170  | 9170-305   | 2015.07.22 | 2017.07.21 |
| Anechoic Chamber                  | RAINFORD             | 9m*6m*6m   | N/A        | 2015.02.28 | 2017.02.27 |
| Shielded Enclosure                | ChangNing            | CN-130701  | 130703     | --         | --         |

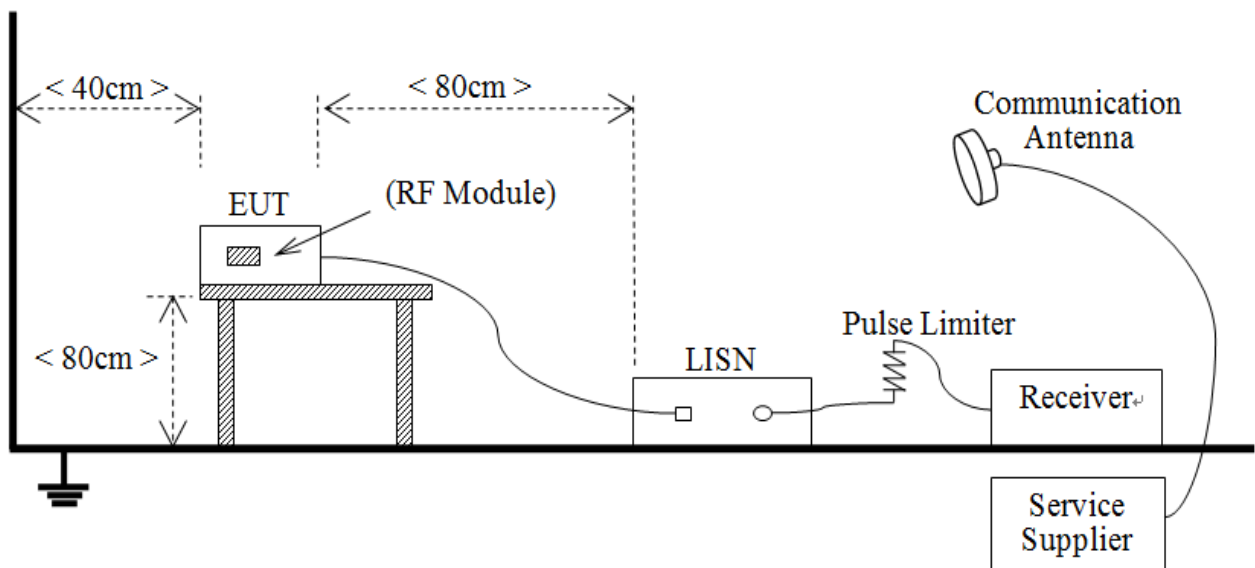
### 4.3 Description of Test Setup

#### 4.3.1 For Antenna Port Test



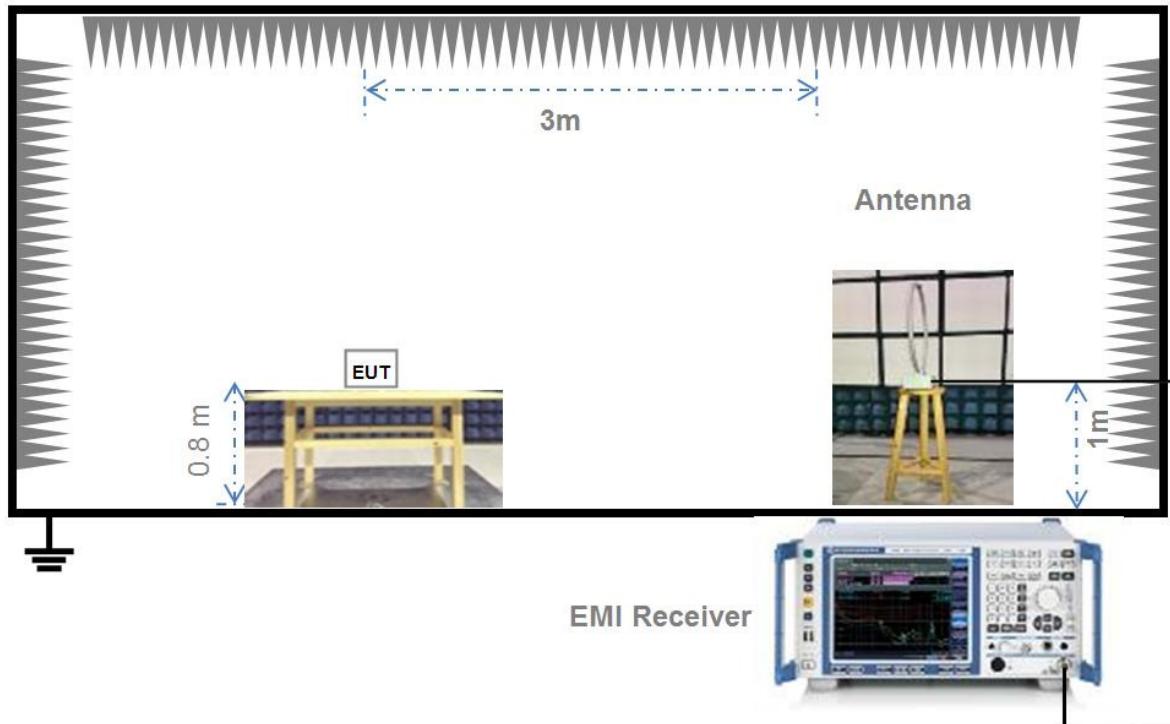
(Diagram 1)

#### 4.3.2 For AC Power Supply Port Test



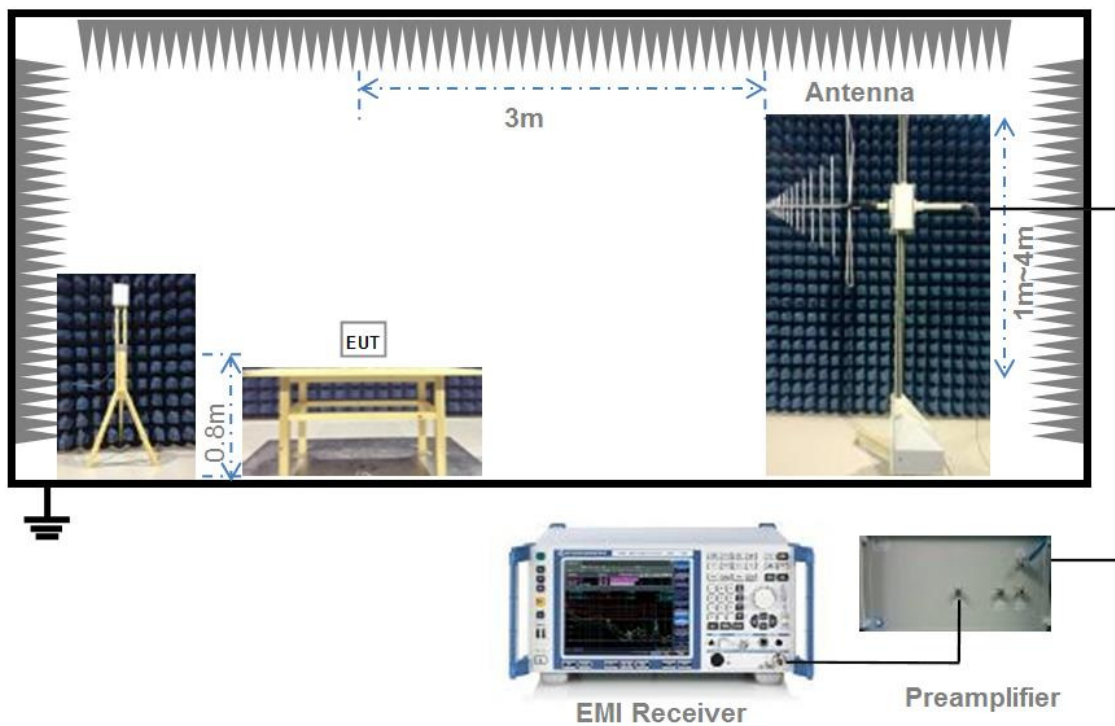
(Diagram 2)

### 4.3.3 For Radiated Test (Below 30 MHz)



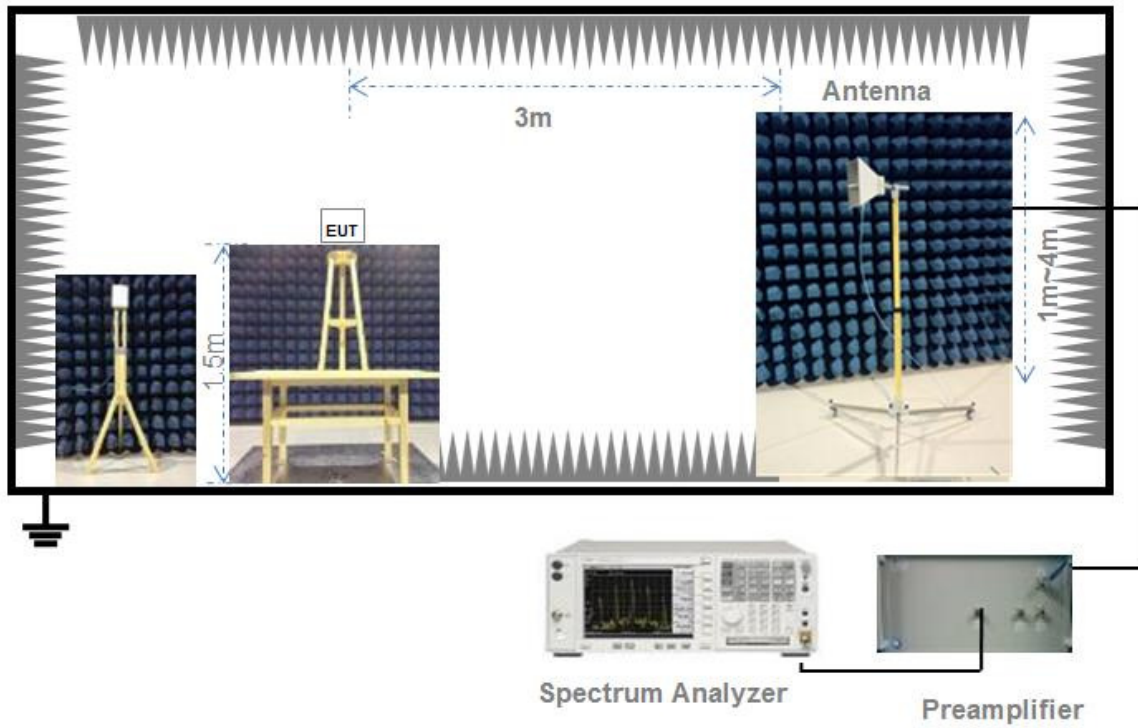
(Diagram 3)

### 4.3.4 For Radiated Test (30 MHz-1 GHz)



(Diagram 4)

#### 4.3.5 For Radiated Test (Above 1 GHz)



(Diagram 5)

## 5 TEST ITEMS

### 5.1 Antenna Requirements

#### 5.1.1 Standard Applicable

FCC §15.203 & 15.247(b)

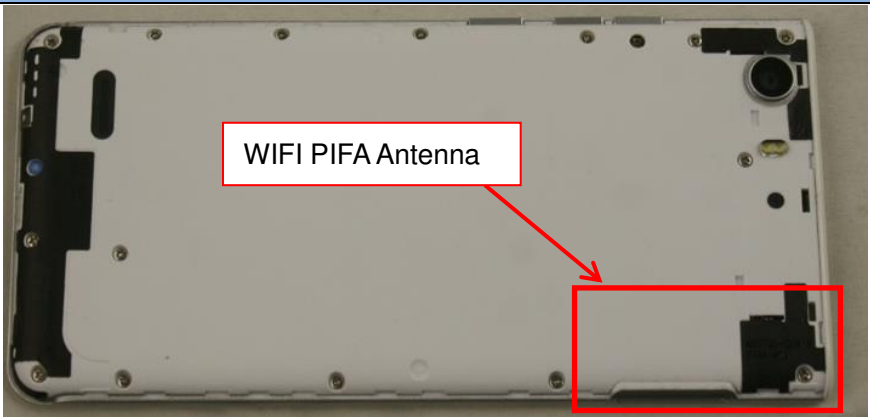
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

#### 5.1.2 Antenna Anti-Replacement Construction

The Antenna Anti-Replacement as following method:

| Protected Method              | Description                            |
|-------------------------------|----------------------------------------|
| The antenna is An embedded-in | An embedded-in antenna design is used. |

| Reference Documents | Item                                                                                 |
|---------------------|--------------------------------------------------------------------------------------|
| Photo               |  |

#### 5.1.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

## 5.2 Output Power

### 5.2.1 Test Limit

FCC § 15.247(b)

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements.

### 5.2.2 Test Setup

See section 4.3.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.2.3 Test Procedure

#### Maximum peak conducted output power

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the *DTS bandwidth* and shall utilize a fast-responding diode detector.

#### Maximum conducted (average) output power (Reporting Only)

a) As an alternative to spectrum analyzer or EMI receiver measurements, measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

- 1) The EUT is configured to transmit continuously, or to transmit with a constant duty factor.
- 2) At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
- 3) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

b) If the transmitter does not transmit continuously, measure the duty cycle (x) of the transmitter output signal as described in Section 6.0.

c) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.

d) Adjust the measurement in dBm by adding  $10\log(1/x)$ , where x is the duty cycle to the measurement result.

#### Measurements of duty cycle

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal.

Set the center frequency of the instrument to the center frequency of the transmission.

Set  $RBW \geq OBW$  if possible; otherwise, set RBW to the largest available value.

Set  $VBW \geq RBW$ . Set detector = peak or average.

The zero-span measurement method shall not be used unless both RBW and VBW are  $> 50/T$  and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if  $T \leq 16.7$  microseconds.)

#### 5.2.4 Test Result

Please refer to ANNEX A.1.

## 5.36dB Bandwidth

### 5.3.1 Limit

FCC §15.247(a)

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW. The 6 dB bandwidth must be greater than 500 kHz.

### 5.3.2 Test Setup

See section 4.3.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.3.3 Test Procedure

Use the following spectrum analyzer settings:

Set RBW = 100 kHz.

Set the video bandwidth (VBW)  $\geq 3$  RBW.

Detector = Peak.

Trace mode = max hold.

Sweep = auto couple.

Allow the trace to stabilize.

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### 5.3.4 Test Result

Please refer to ANNEX A.2.

## 5.4 Conducted Spurious Emission

### 5.4.1 Limit

FCC §15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

### 5.4.2 Test Setup

See section 4.3.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.4.3 Test Procedure

The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

- a) If the maximum peak conducted output power procedure was used to demonstrate compliance as described in 9.1, then the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 20 dBc).
- b) If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc).
- c) In either case, attenuation to levels below the 15.209 general radiated emissions limits is not required.

The following procedures shall be used to demonstrate compliance to these limits. Note that these procedures can be used in either an antenna-port conducted or radiated test set-up. Radiated tests must conform to the test site requirements and utilize maximization procedures defined herein.

#### Reference level measurement

Establish a reference level by using the following procedure:

Set instrument center frequency to DTS channel center frequency.

Set the span to  $\geq 1.5$  times the DTS bandwidth.

Set the RBW = 100 kHz.

Set the VBW  $\geq 3 \times$  RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum PSD level.

### Emission level measurement

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

Set the RBW = 100 kHz.

Set the VBW  $\geq 3 \times$  RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

#### 5.4.4 Test Result

Please refer to ANNEX A.3.

## 5.5 Band Edge (Authorized-band band-edge)

### 5.5.1 Limit

FCC §15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

### 5.5.2 Test Setup

See section 4.3.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.5.3 Test Procedure

The following procedures may be used to determine the peak or average field strength or power of an unwanted emission that is within 2 MHz of the authorized band edge. If a peak detector is utilized, use the procedure described in 13.2.1. Use the procedure described in 13.2.2 when using an average detector and the EUT can be configured to transmit continuously (i.e., duty cycle  $\geq 98\%$ ). Use the procedure described in 13.2.3 when using an average detector and the EUT cannot be configured to transmit continuously but the duty cycle is constant (i.e., duty cycle variations are less than  $\pm 2$  percent). Use the procedure described in 13.2.4 when using an average detector for those cases where the EUT cannot be configured to transmit continuously and the duty cycle is not constant (duty cycle variations equal or exceed 2 percent).

When using a peak detector to measure unwanted emissions at or near the band edge (within 2 MHz of the authorized band), the following integration procedure can be used.

Set instrument center frequency to the frequency of the emission to be measured (must be within 2 MHz of the authorized band edge).

Set span to 2 MHz

RBW = 100 kHz.

VBW  $\geq 3 \times$  RBW.

Detector = peak.

Sweep time = auto.

Trace mode = max hold.

Allow sweep to continue until the trace stabilizes (required measurement time may increase for low duty cycle applications)

Compute the power by integrating the spectrum over 1 MHz using the analyzer's band power measurement function with band limits set equal to the emission frequency (femission)  $\pm 0.5$  MHz. If the instrument does not have a band power function, then sum the amplitude levels (in power units) at 100 kHz intervals extending across the 1 MHz spectrum defined by femission  $\pm 0.5$  MHz.

### 5.5.4 Test Result

Please refer to ANNEX A.4.

## 5.6 Conducted Emission

### 5.6.1 Limit

FCC §15.207

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 $\mu$ H/50 $\Omega$  line impedance stabilization network (LISN).

| Frequency range<br>(MHz) | Conducted Limit (dB $\mu$ V) |          |
|--------------------------|------------------------------|----------|
|                          | Quai-peak                    | Average  |
| 0.15 - 0.50              | 66 to 56                     | 56 to 46 |
| 0.50 - 5                 | 56                           | 46       |
| 0.50 - 30                | 60                           | 50       |

### 5.6.2 Test Setup

See section 4.3.2 for test setup description for the AC power supply port. The photo of test setup please refer to ANNEX B.

### 5.6.3 Test Procedure

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz) for which the device is capable of operation. A device rated for 50/60 Hz operation need not be tested at both frequencies provided the radiated and line conducted emissions are the same at both frequencies.

### 5.6.4 Test Result

Please refer to ANNEX A.5.

## 5.7 Radiated Spurious Emission

### 5.7.1 Limit

FCC §15.209&15.247(c)

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Field Strength ( $\mu\text{V/m}$ ) | Measurement Distance (m) |
|-----------------|------------------------------------|--------------------------|
| 0.009 - 0.490   | $2400/F(\text{kHz})$               | 300                      |
| 0.490 - 1.705   | $24000/F(\text{kHz})$              | 30                       |
| 1.705 - 30.0    | 30                                 | 30                       |
| 30 - 88         | 100                                | 3                        |
| 88 - 216        | 150                                | 3                        |
| 216 - 960       | 200                                | 3                        |
| Above 960       | 500                                | 3                        |

Note:

1. Field Strength ( $\text{dB}\mu\text{V/m}$ ) =  $20 \cdot \log[\text{Field Strength } (\mu\text{V/m})]$ .
2. In the emission tables above, the tighter limit applies at the band edges.
3. For Above 1000 MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
4. For above 1000 MHz, limit field strength of harmonics:  $54\text{dB}\mu\text{V/m}@3\text{m}$  (AV) and  $74\text{dB}\mu\text{V/m}@3\text{m}$  (PK).

### Test Setup

See section 4.3.3-4.3.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.7.2 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from  $0^\circ$  to  $360^\circ$ , and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for  $f \geq 1$  GHz, 100 kHz for  $f < 1$  GHz

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

### 5.7.3 Test Result

Please refer to ANNEX A.6.

## 5.8 Band Edge (Restricted-band band-edge)

### 5.8.1 Limit

FCC §15.209&15.247(d)

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

### 5.8.2 Test Setup

See section 4.3.3 to 4.3.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.8.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for  $f \geq 1$  GHz, 100 kHz for  $f < 1$  GHz

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

### 5.8.4 Test Result

Please refer to ANNEX A.7.

## 5.9 Power Spectral density (PSD)

### 5.9.1 Limit

FCC §15.247(d)

The same method of determining the conducted output power shall be used to determine the power spectral density. If a peak output power is measured, then a peak power spectral density measurement is required. If an average output power is measured, then an average power spectral density measurement should be used.

### 5.9.2 Test Setup

See section 4.3.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.9.3 Test Procedure

Set analyzer center frequency to DTS channel center frequency.

Set the span to 1.5 times the DTS bandwidth.

Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .

Set the VBW  $\geq 3 \text{ RBW}$ .

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### 5.9.4 Test Result

Please refer to ANNEX A.8.

## **ANNEX A TEST RESULT**

### **A.1 Output Power**

The Output power result reference from original test report: Report No. SZ16010163W03 issued by SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd on Mar. 28, 2016, section 2.2.3 Test Result.

### **A.2 Bandwidth**

The Bandwidth result reference from original test report: Report No. SZ16010163W03 issued by SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd on Mar. 28, 2016, section 2.3.3 Test Result.

### **A.3 Conducted Spurious Emissions**

The Conducted Spurious Emissions result reference from original test report: Report No. SZ16010163W03 issued by SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd on Mar. 28, 2016, section 2.4.3 Test Result.

### **A.4 Band Edge (Authorized-band band-edge)**

The Band Edge result reference from original test report: Report No. SZ16010163W03 issued by SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd on Mar. 28, 2016, section 2.4.3 Test Result.

## A.5 Conducted Emissions

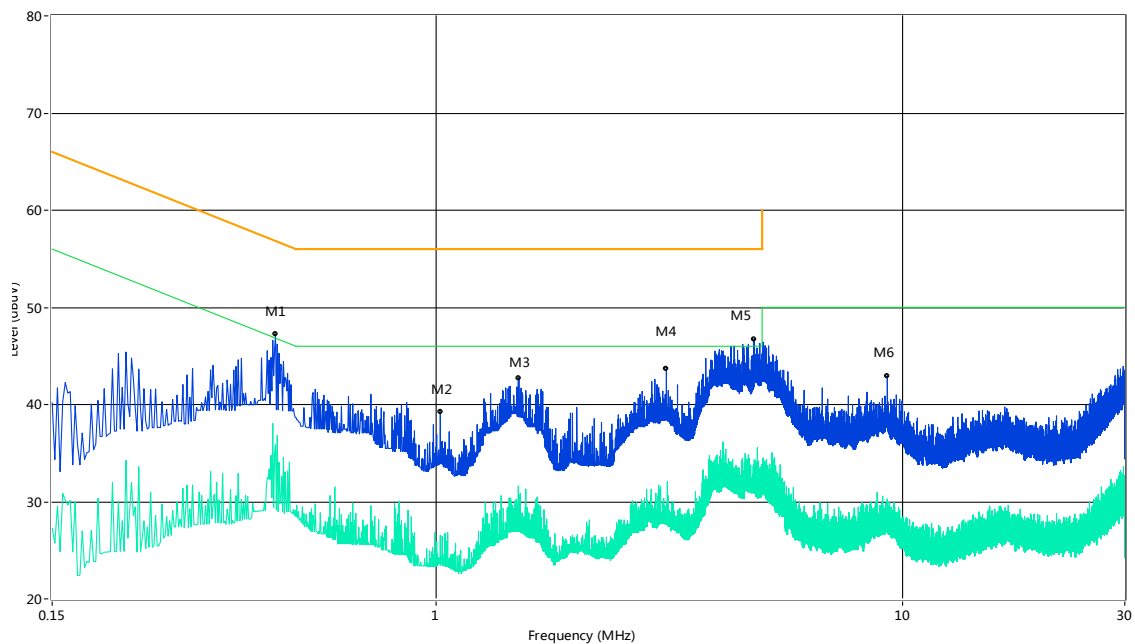
Note 1: The EUT is working in the Normal link mode.

Note 2: Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 60 Hz and 240 VAC, 50 Hz) for which the device is capable of operation. So, The configuration 120 VAC, 60 Hz and 240 VAC, 50 Hz were tested respectively, but only the worst configuration (120 VAC, 60 Hz ) shown here.

### Test Data and Plots

#### PHASE L

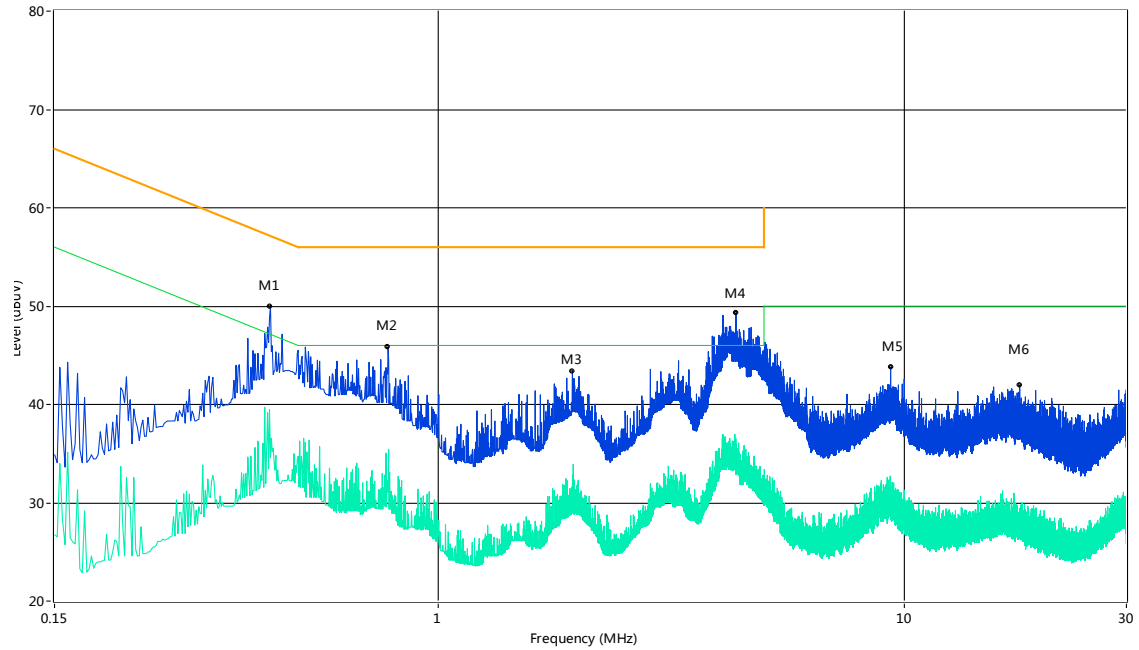
CE Test case\_FCC\_CE\_FCC PART 15\_ Class B



| No. | Frequency (MHz) | Results (dBuV) | Factor (dB) | Limit (dBuV) | Margin (dB) | Detector | Line   | Verdict |
|-----|-----------------|----------------|-------------|--------------|-------------|----------|--------|---------|
| 1   | 0.45            | 47.2           | 11.00       | 57.4         | 10.20       | Peak     | L Line | Pass    |
| 1** | 0.45            | 35.9           | 11.00       | 47.4         | 11.50       | AV       | L Line | Pass    |
| 2   | 1.02            | 39.2           | 11.00       | 56.0         | 16.80       | Peak     | L Line | Pass    |
| 2** | 1.02            | 26.6           | 11.00       | 46.0         | 19.40       | AV       | L Line | Pass    |
| 3   | 1.50            | 42.8           | 11.00       | 56.0         | 13.20       | Peak     | L Line | Pass    |
| 3** | 1.50            | 30.7           | 11.00       | 46.0         | 15.30       | AV       | L Line | Pass    |
| 4   | 3.12            | 43.6           | 11.00       | 56.0         | 12.40       | Peak     | L Line | Pass    |
| 4** | 3.12            | 28.5           | 11.00       | 46.0         | 17.50       | AV       | L Line | Pass    |
| 5   | 4.80            | 46.7           | 11.00       | 56.0         | 9.30        | Peak     | L Line | Pass    |
| 5** | 4.80            | 32.3           | 11.00       | 46.0         | 13.70       | AV       | L Line | Pass    |
| 6   | 9.28            | 42.9           | 11.00       | 60.0         | 17.10       | Peak     | L Line | Pass    |
| 6** | 9.28            | 26.8           | 11.00       | 50.0         | 23.20       | AV       | L Line | Pass    |

## PHASE N

CE Test case\_FCC\_CE\_FCC PART 15\_ Class B



| No. | Frequency (MHz) | Results (dBuV) | Factor (dB) | Limit (dBuV) | Margin (dB) | Detector | Line   | Verdict |
|-----|-----------------|----------------|-------------|--------------|-------------|----------|--------|---------|
| 1   | 0.44            | 50.0           | 11.00       | 57.8         | 7.80        | Peak     | N Line | Pass    |
| 1** | 0.44            | 34.6           | 11.00       | 47.8         | 13.20       | AV       | N Line | Pass    |
| 2   | 0.78            | 45.8           | 11.00       | 56.0         | 10.20       | Peak     | N Line | Pass    |
| 2** | 0.78            | 31.1           | 11.00       | 46.0         | 14.90       | AV       | N Line | Pass    |
| 3   | 1.94            | 43.3           | 11.00       | 56.0         | 12.70       | Peak     | N Line | Pass    |
| 3** | 1.94            | 32.0           | 11.00       | 46.0         | 14.00       | AV       | N Line | Pass    |
| 4   | 4.35            | 49.3           | 11.00       | 56.0         | 6.70        | Peak     | N Line | Pass    |
| 4** | 4.35            | 34.2           | 11.00       | 46.0         | 11.80       | AV       | N Line | Pass    |
| 5   | 9.35            | 43.8           | 11.00       | 60.0         | 16.20       | Peak     | N Line | Pass    |
| 5** | 9.35            | 30.4           | 11.00       | 50.0         | 19.60       | AV       | N Line | Pass    |
| 6   | 17.70           | 42.0           | 11.00       | 60.0         | 18.00       | Peak     | N Line | Pass    |
| 6** | 17.70           | 29.3           | 11.00       | 50.0         | 20.70       | AV       | N Line | Pass    |

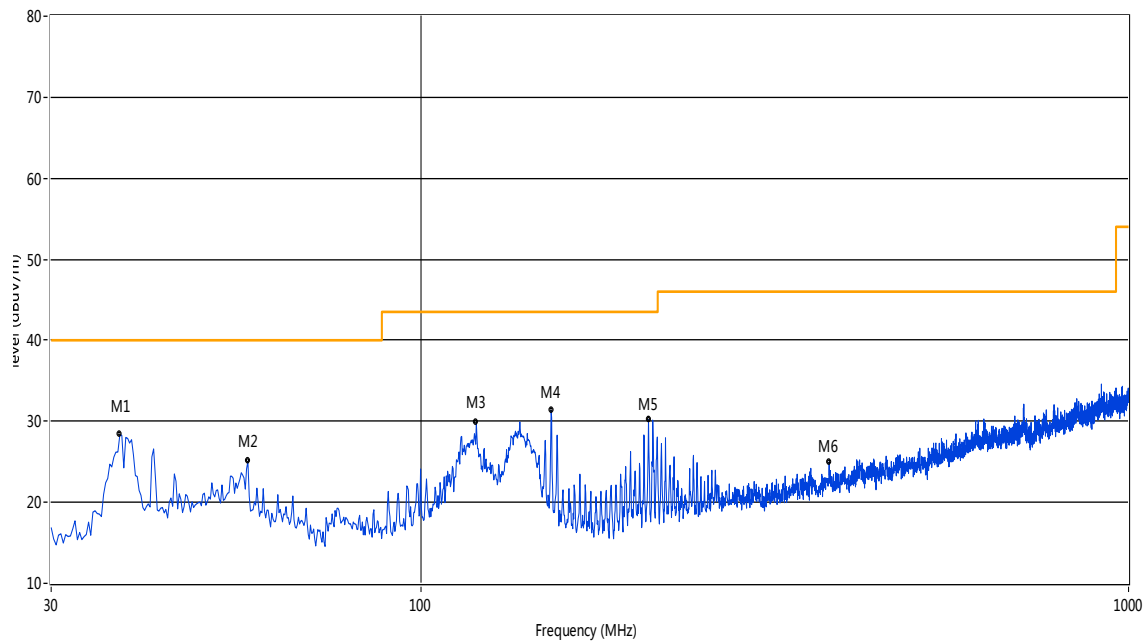
## A.6 Radiated Spurious Emission

Note 1: The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

Note 2: The Radiated Spurious Emissions 1GHz to 25GHz result reference from original test report: Report No. SZ16010163W03 issued by SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd on Mar. 28, 2016, section 2.8.3 Test Result. The 30MHz to 1GHz only test in this report.

### 30 MHz to 1 GHz, ANT H

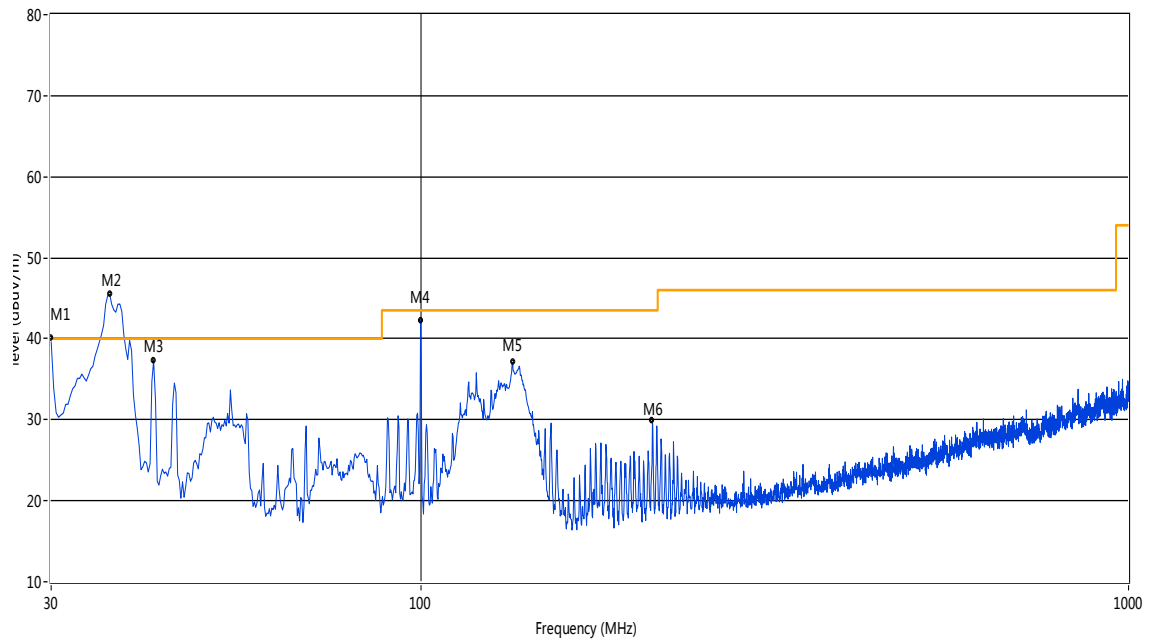
RE Test case\_FCC\_Part 15C\_FCC 15C 30MHz-1GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|------------|---------|
| 1   | 37.52           | 28.36            | -20.48      | 40.0           | 11.64       | Peak     | 146.80    | 100         | Horizontal | Pass    |
| 2   | 56.91           | 25.07            | -19.61      | 40.0           | 14.93       | Peak     | 359.60    | 100         | Horizontal | Pass    |
| 3   | 119.70          | 29.89            | -21.66      | 43.5           | 13.61       | Peak     | 297.90    | 100         | Horizontal | Pass    |
| 4   | 152.67          | 31.36            | -23.43      | 43.5           | 12.14       | Peak     | 307.90    | 100         | Horizontal | Pass    |
| 5   | 209.65          | 30.19            | -20.05      | 43.5           | 13.31       | Peak     | 66.70     | 100         | Horizontal | Pass    |
| 6   | 377.42          | 24.98            | -15.77      | 46.0           | 21.02       | Peak     | 257.30    | 100         | Horizontal | Pass    |

## 30 MHz to 1 GHz, ANT V

RE Test case\_FCC\_Part 15C\_FCC 15C 30MHz-1GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|----------|---------|
| 1   | 30.00           | 39.67            | -21.72      | 40.0           | 0.33        | Peak     | 40.20     | 100         | Vertical | N/A     |
| 1*  | 30.00           | 36.38            | -21.72      | 40.0           | 3.62        | QP       | 40.20     | 100         | Vertical | Pass    |
| 2   | 36.30           | 45.43            | -20.90      | 40.0           | -5.43       | Peak     | 25.00     | 100         | Vertical | N/A     |
| 2*  | 36.30           | 37.10            | -20.90      | 40.0           | 3.10        | QP       | 25.00     | 100         | Vertical | Pass    |
| 3   | 41.88           | 37.30            | -19.06      | 40.0           | 2.70        | Peak     | 65.40     | 100         | Vertical | N/A     |
| 3*  | 41.88           | 36.34            | -19.06      | 40.0           | 3.66        | QP       | 65.40     | 100         | Vertical | Pass    |
| 4   | 99.82           | 42.24            | -20.20      | 43.5           | 1.26        | Peak     | 116.10    | 100         | Vertical | N/A     |
| 4*  | 99.82           | 40.30            | -20.20      | 43.5           | 3.20        | QP       | 116.10    | 100         | Vertical | Pass    |
| 5   | 134.73          | 37.06            | -23.42      | 43.5           | 6.44        | Peak     | 6.20      | 100         | Vertical | Pass    |
| 6   | 212.31          | 29.84            | -20.10      | 43.5           | 13.66       | Peak     | 358.80    | 100         | Vertical | Pass    |

## **A.7 Band Edge (Restricted-band band-edge)**

The Conducted Emissions result reference from original test report: Report No. SZ16010163W03 issued by SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd on Mar. 28, 2016, section 2.6.3 Test Result.

## **A.8 Power Spectral Density (PSD)**

The Power Spectral Density (PSD) result reference from original test report: Report No. SZ16010163W03 issued by MORLAB on Mar. 28, 2016, section 2.5.3 Test Result.

## **ANNEX B TEST SETUP PHOTOS**

Please refer the document “BL-SZ1660087-AR.pdf”.

## **ANNEX C EUT EXTERNAL PHOTOS**

Please refer the document “BL-SZ1660087-AW.pdf”.

## **ANNEX D EUT INTERNAL PHOTOS**

Please refer the document “BL-SZ1660087-AI.pdf”.

--END OF REPORT--