



# EMC TEST REPORT

**Report No.:** SET2016-11151

**Product Name:** LTE USB Modem

**FCC ID:** SRQ-MF831

**Model No. :** MF831

**Applicant:** ZTE CORPORATION

**Address:** ZTE Plaza, Keji Road South, Shenzhen, China

**Received Date:** 2016-06-12

**Tested Date:** 2016-06-12—2016-07-10

**Issued by:** CCIC-SET

**Lab Location:** Electronic Testing Building, Shahe Road, Xili, Nanshan District, Shenzhen, 518055, P. R. China

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## Test Report

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**Manufacturer** ..... : ZTE CORPORATION

**Manufacturer Address** ..... : ZTE Plaza, Keji Road South, Shenzhen, China

**Test Standards** ..... : 47 CFR Part 15 Subpart B: Radio Frequency Devices

**Test Result** ..... : PASS

**Tested by** ..... : Ling Min Xie

LingMin Xie Test Engineer 2016.07.10

**Reviewed by** ..... : Zhu Qi

Zhu Qi Senior Engineer 2016.07.10

**Approved by** ..... : Wu Li'an

Wu Li'an, Manager 2016.07.10

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| Change History |            |                   |
|----------------|------------|-------------------|
| Issue          | Date       | Reason for change |
| 1.0            | 2016.07.10 | First edition     |
|                |            |                   |
|                |            |                   |

## 1. GENERAL INFORMATION

### 1.1 EUT Description

EUT Name ..... : LTE USB Modem

FCC ID ..... : SRQ-MF831

Trade Name..... : ZTE

Brand Name..... : ZTE

Hardware Version..... : dkxA

Software Version ..... : BD\_MF831V1.0.2B18

*Note1:* The EUT is a LTE USB Modem, it supports the following operating frequency band:GSM850/900/1800/1900; WCDMA850/1700/1900/2100; LTE BAND 1,2,4,5,7;

*Note2:* The EUT is equipped with a T-Flash card slot; equipped with a USB port which can be connected to the ancillary equipments.

*Note 3:* The highest operation frequency or processor operate frequency is 1.3 GHz.

*Note 4:* For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

## 1.2 Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart B:

| No. | Identity                         | Document Title          |
|-----|----------------------------------|-------------------------|
| 1   | 47 CFR Part 15<br>Subpart B 2014 | Radio Frequency Devices |

Test detailed items/section required by FCC rules and results are as below:

| No. | Section | Description        | Result |
|-----|---------|--------------------|--------|
| 1   | 15.107  | Conducted Emission | PASS   |
| 2   | 15.109  | Radiated Emission  | PASS   |

NOTE:

(1) The EUT has been tested according to 47 CFR Part 15 Subpart B, Class B. The test procedure is according to ANSI C63.4:2009.

## 1.3 Facilities and Accreditations

### 1.3.1 Facilities

#### **CNAS-Lab Code: L1659**

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. CCIC is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L1659. A 12.8\*6.8\*6.4 (m) fully anechoic chamber was used for the radiated spurious emissions test.

#### **FCC-Registration No.: 406086**

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 406086, valid time is until October 28, 2017.

### 1.3.2 Test Environment Conditions

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

|                             |              |
|-----------------------------|--------------|
| Temperature (°C):           | 15°C - 35°C  |
| Relative Humidity (%):      | 25% -75%     |
| Atmospheric Pressure (kPa): | 86kPa-106kPa |

### 1.3.3 Measurement Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

|                                    |                               |
|------------------------------------|-------------------------------|
| Uncertainty of Conducted Emission: | U <sub>c</sub> = 3.6 dB (k=2) |
| Uncertainty of Radiated Emission:  | U <sub>c</sub> = 4.5 dB (k=2) |

## 2. TEST CONDITIONS SETTING

### 2.1 Test Peripherals

The following is a listing of the EUT and peripherals utilized during the performance of EMC test:

#### Support Equipment:

| Description   | Brand name | Model | Serial No. | FCCID |
|---------------|------------|-------|------------|-------|
| Notebook      | ThinkPad   | E430C | A131101550 | N/A   |
| Micro SD card | SanDisk    | N/A   | N/A        | N/A   |
| Mouse         | Logitech   | M100r | 25011051   | DOC   |

#### Support Cable:

| Description            | Shield Type   | Ferrite Core | Length |
|------------------------|---------------|--------------|--------|
| USB Cable              | shielding     | Yes          | 1.2m   |
| RJ45 Cable             | shielding     | No           | 2m     |
| PC Power adapter Cable | Un- shielding | No           | 1.2m   |
| Mouse Cable            | Un- shielding | No           | 1m     |

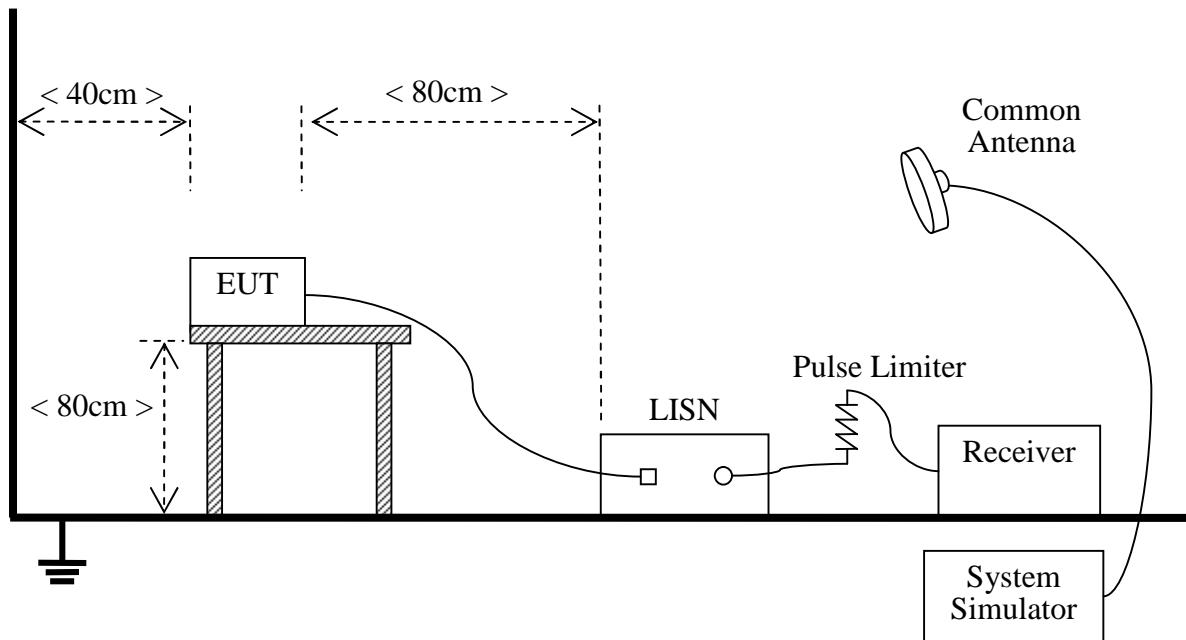
### 2.2 Test Mode

The EUT configuration of the emission tests is TransFlash Card + EUT + PC+Mouse.

### 2.3 Test Setup and Equipments List

#### 2.3.1 Conducted Emission

### A. Test Setup:



The EUT is placed on a 0.8m high insulating table, which stands on the grounded conducting floor, and keeps 0.4m away from the grounded conducting wall. The EUT is connected to the power mains through a LISN which provides  $50\Omega/50\mu\text{H}$  of coupling impedance for the measuring instrument. The Common Antenna is used for the call between the EUT and the System Simulator (SS). A Pulse Limiter is used to protect the measuring instrument. The factors of the whole test system are calibrated to correct the reading.

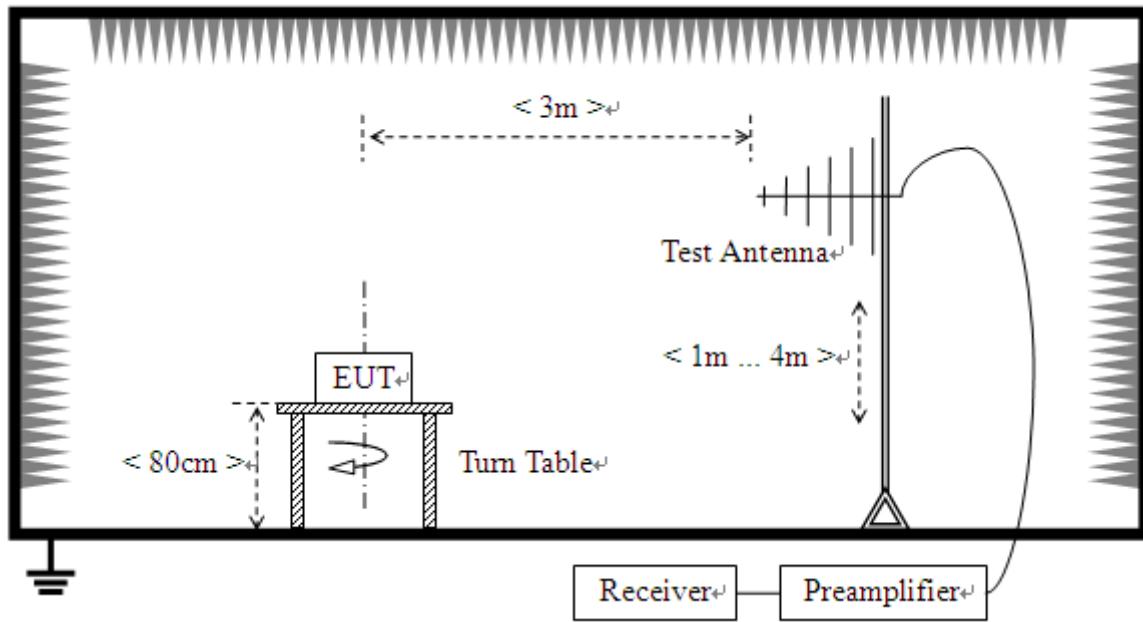
### B. Equipments List:

| Description   | Manufacturer  | Model  | Serial No. | Calibration Date | Calibration Due. Date |
|---------------|---------------|--------|------------|------------------|-----------------------|
| Test Receiver | ROHDE&SCHWARZ | ESCI   | A130901475 | 2015.09.09       | 2016.09.08            |
| LISN          | ROHDE&SCHWARZ | ENV216 | /          | 2016.01.04       | 2017.01.03            |
| Cable         | MATCHING PAD  | W7     | /          | 2016.06.03       | 2017.06.02            |

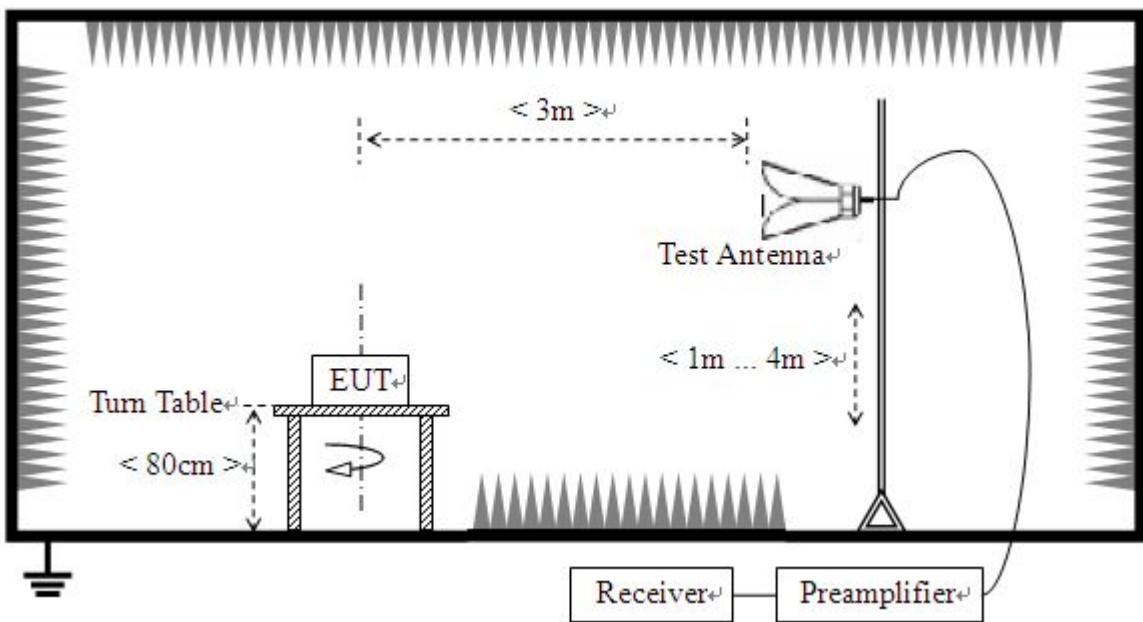
### 2.3.2 Radiated Emission

#### A. Test Setup:

- 1) For radiated emissions from 30MHz to 1GHz



2) For radiated emissions above 1GHz



## B. Test Procedure

The test is performed in a 3m Semi-Anechoic Chamber; the antenna factor, cable loss and so on of the site (factors) is calculated to correct the reading. The EUT is placed on a 0.8m high insulating Turn Table, and keeps 3m away from the Test Antenna, which is mounted on a variable-height antenna master tower.

For the test Antenna:

- 1) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.

#### C. Equipments List:

| Description           | Manufacturer                | Model                       | Serial No. | Calibration Date | Calibration Due. Date |
|-----------------------|-----------------------------|-----------------------------|------------|------------------|-----------------------|
| Test Receiver         | ROHDE&SCHWARZ               | ESIB7                       | A0501375   | 2016.06.04       | 2017.06.03            |
| Test Receiver         | ROHDE&SCHWARZ               | ESIB26                      | A0304218   | 2016.06.04       | 2017.06.03            |
| Semi-Anechoic Chamber | Albatross                   | 9m*6m*6m                    | A0412372   | 2016.05.09       | 2017.05.08            |
| Test Antenna - Bi-Log | HP                          | CBL6111A                    | A9704202   | 2016.06.04       | 2017.06.03            |
| Test Antenna – Horn   | ROHDE&SCHWARZ               | HF906                       | A0304225   | 2016.06.04       | 2017.06.03            |
| Anechoic Chamber      | Albatross                   | SAC-5MAC<br>12.8x6.8x6.4m   | A0304210   | 2016.05.09       | 2017.05.08            |
| Amplifier 1G~18GHz    | ROHDE&SCHWARZ               | MITEQ<br>AFS42-001018<br>00 | A0509366   | 2016.06.04       | 2017.06.03            |
| Amplifier 20M~3GHz    | Compliance Direction System | PAP-0203H                   | A0509377   | 2016.06.04       | 2017.06.03            |
| Cable                 | SUNHNER                     | SUCOFLEX<br>100             | /          | 2016.06.04       | 2017.06.03            |
| Cable                 | SUNHNER                     | SUCOFLEX<br>104             | MY1758/4   | 2016.06.04       | 2017.06.03            |

### 3. 47 CFR PART 15B REQUIREMENTS

#### 3.1 Conducted Emission

##### 3.1.1 Requirement

According to FCC section 15.107, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz 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 (MHz) | Conducted Limit (dB $\mu$ V) |          |
|-----------------------|------------------------------|----------|
|                       | Quasi-peak                   | Average  |
| 0.15 - 0.50           | 66 to 56                     | 56 to 46 |
| 0.50 - 5              | 56                           | 46       |
| 5 - 30                | 60                           | 50       |

**Note:**

- a) The limit subjects to the Class B digital device.
- b) The lower limit shall apply at the band edges.
- c) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

#### 3.1.2 Test Description

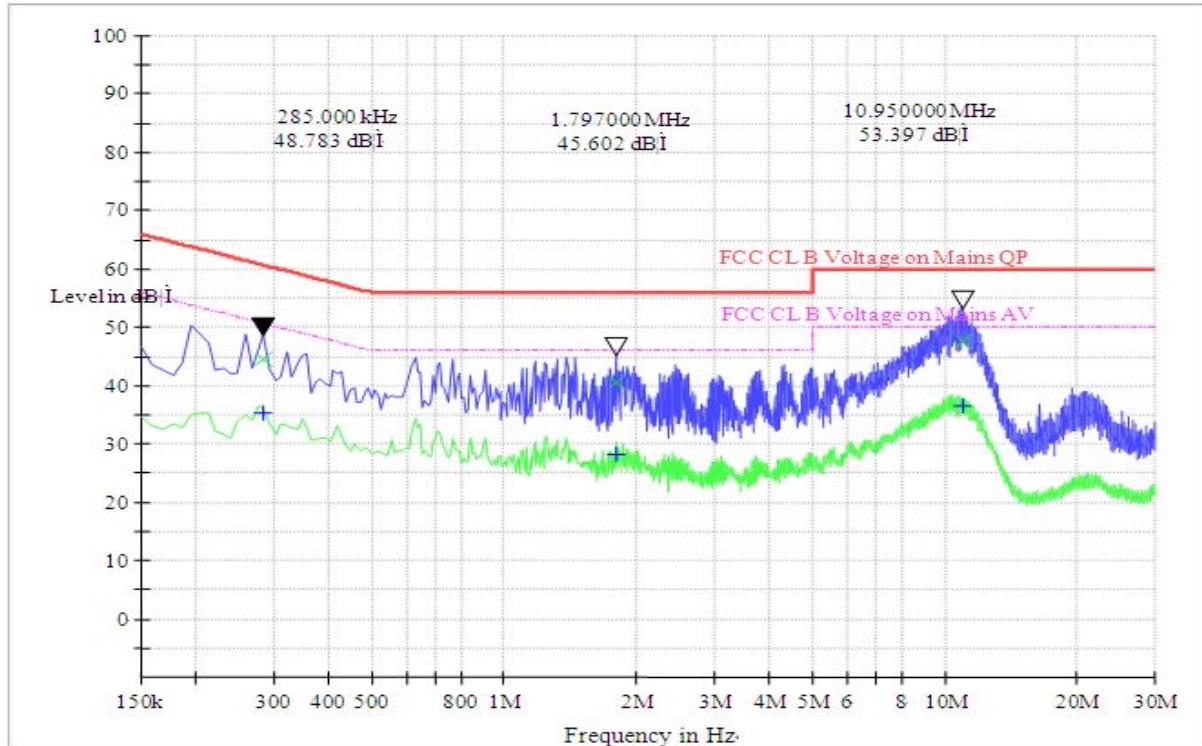
See section 2.3.1 of this report.

#### 3.1.3 Test Result

The maximum conducted interference is searched using Peak (PK), Quasi-peak (QP) and Average (AV) detectors; 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. All test modes are considered, refer to recorded points and plots below.

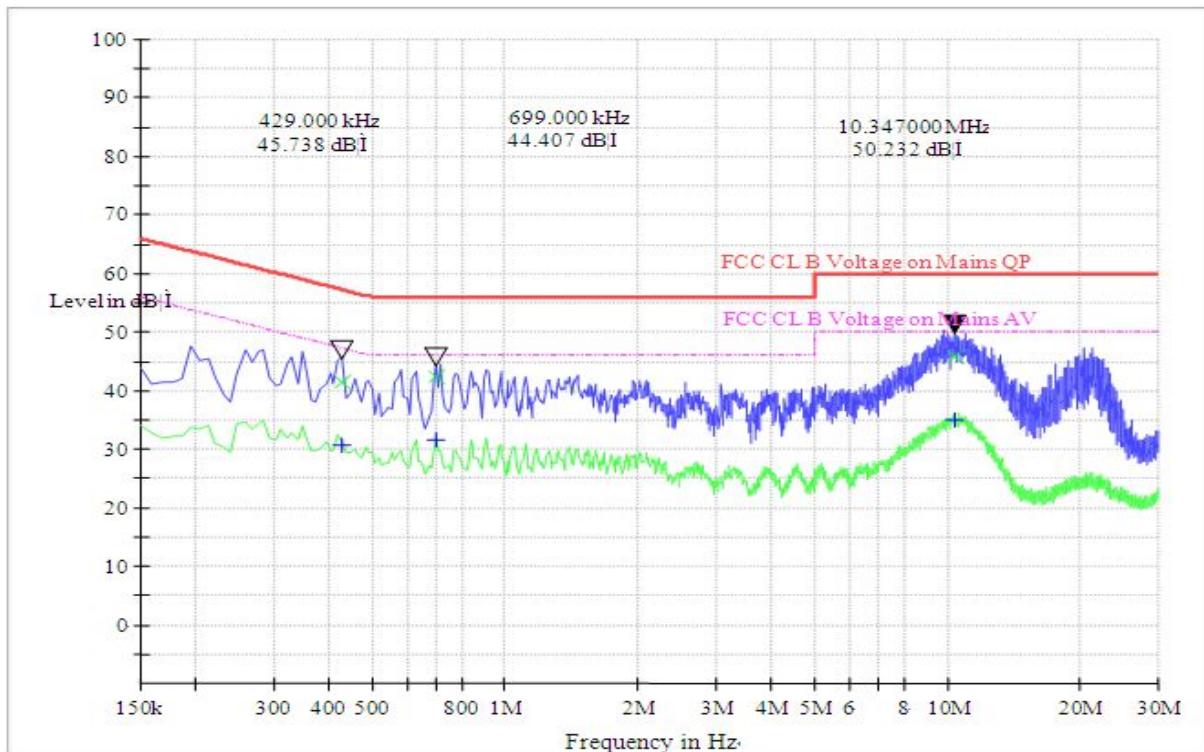
**Note:**

Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a Nominal 120V AC,50/60Hz) 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.

**Test voltage and frequency (120V AC,60Hz)**
**A. Test Plot and Suspicious Points:**


(Plot A: L Phase)

| Conducted Disturbance at Mains Terminals |               |                          |             |                 |               |                          |             |
|--|---------------|--------------------------|-------------|-----------------|---------------|--------------------------|-------------|
| L Test Data                              |               |                          |             |                 |               |                          |             |
| QP                                       |               |                          |             | AV              |               |                          |             |
| Frequency (MHz)                          | Limits (dBµV) | Measurement Value (dBµV) | Margin (dB) | Frequency (MHz) | Limits (dBµV) | Measurement Value (dBµV) | Margin (dB) |
| 0.2850                                   | 60.70         | 44.64                    | 16.06       | 0.2850          | 50.70         | 35.23                    | 15.47       |
| 1.7970                                   | 56.00         | 40.54                    | 15.46       | 1.7970          | 46.00         | 28.10                    | 17.90       |
| 10.9500                                  | 60.00         | 47.76                    | 12.24       | 10.9500         | 50.00         | 36.42                    | 13.58       |



(Plot B: N Phase)

| Conducted Disturbance at Mains Terminals |               |                          |             |                 |               |                          |             |
|--|---------------|--------------------------|-------------|-----------------|---------------|--------------------------|-------------|
| N Test Data                              |               |                          |             |                 |               |                          |             |
| QP                                       |               |                          |             | AV              |               |                          |             |
| Frequency (MHz)                          | Limits (dBµV) | Measurement Value (dBµV) | Margin (dB) | Frequency (MHz) | Limits (dBµV) | Measurement Value (dBµV) | Margin (dB) |
| 0.4290                                   | 57.30         | 41.59                    | 15.71       | 0.4290          | 47.30         | 30.72                    | 16.58       |
| 0.6990                                   | 56.00         | 42.36                    | 13.64       | 0.6990          | 46.00         | 31.55                    | 14.45       |
| 10.3470                                  | 60.00         | 45.63                    | 14.37       | 10.3470         | 50.00         | 35.10                    | 14.90       |

Test Result: PASS

## 3.2 Radiated Emission

### 3.2.1 Requirement

According to FCC section 15.109, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

| Frequency range (MHz) | Field Strength |      | Field Strength Limitation at 3m Measurement Dist |                        |
|-----------------------|----------------|------|--|------------------------|
|                       | $\mu$ V/m      | Dist | (uV/m)   | (dBuV/m)               |
| 0.009 - 0.490         | 2400/F(kHz)    | 300m | 10000* 2400/F(kHz)                               | 20log 2400/F(kHz) + 80 |
| 0.490 - 1.705         | 2400/F(kHz)    | 30m  | 100* 2400/F(kHz)                                 | 20log 2400/F(kHz) + 40 |
| 1.705 - 30.00         | 30             | 30m  | 100*30   | 20log 30 + 40          |
| 30.0 - 88.0           | 100            | 3m   | 100  | 20log 100              |
| 88.0 - 216.0          | 150            | 3m   | 150  | 20log 150              |
| 216.0 - 960.0         | 200            | 3m   | 200  | 20log 200              |
| Above 960.0           | 500            | 3m   | 500  | 20log 500              |

- a) As shown in FCC section 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector. When average radiated emission measurements are specified in this part, including emission measurements below 1000MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules.
- b) Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.
- c) For below 1G :QP detector RBW 120kHz ,VBW 300kHz.
- d) For Above 1G: PK detector RBW 1MHz,VBW 3MHz for PK value ;AV detector RBW 1MHz, VBW 10Hz for AV value.

#### Note:

- 1) The tighter limit shall apply at the boundary between two frequency range.
- 2) Limitation expressed in dBuV/m is calculated by 20log Emission Level(uV/m).
- 3) If measurement is made at 3m distance, then F.S Limitation at 3m distance is adjusted by using the formula of  $Ld1 = Ld2 * (d2/d1)^2$ .

#### Example:

F.S Limit at 30m distance is 30uV/m, then F.S Limitation at 3m distance is adjusted as  
 $Ld1 = Ld2 * (10)^2 = 100 * 30uV/m$ .

### **3.2.2 Test Description**

See section 2.3.2 of this report.

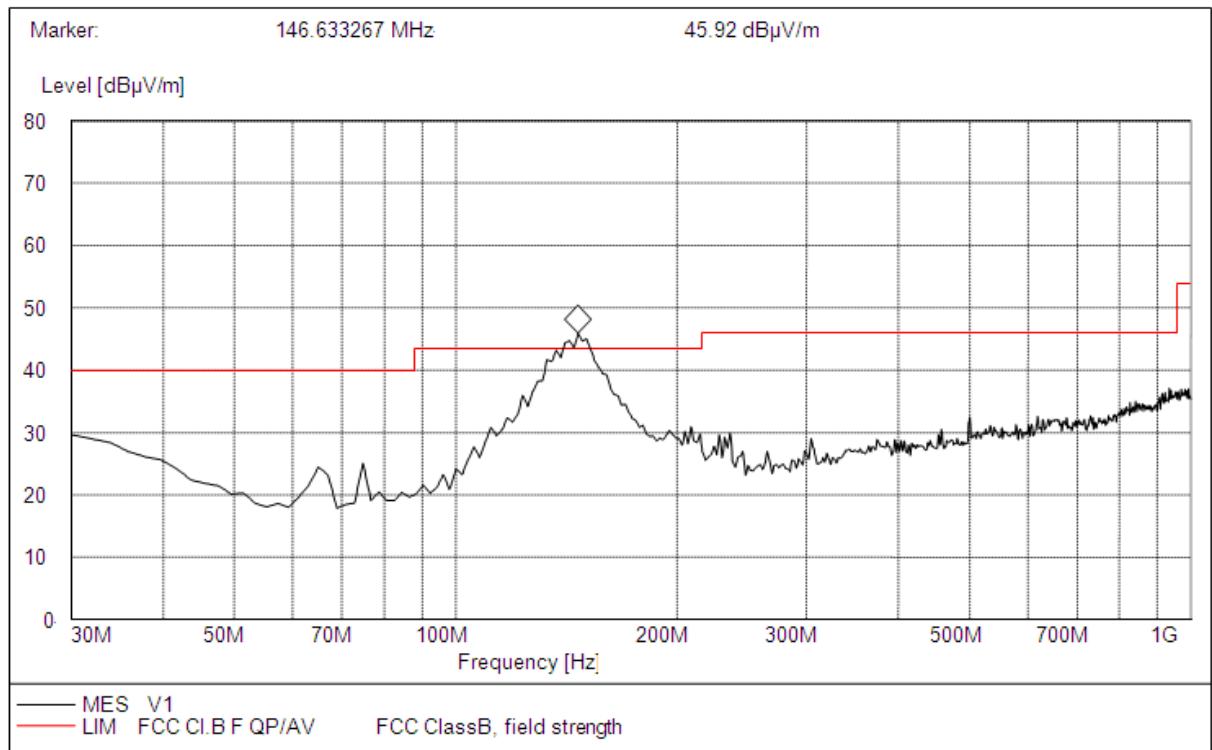
### **3.2.3 Test Result**

The maximum radiated emission is searched using PK, QP and AV detectors; the emission levels more than the limits, and that have narrow margins from the limits will be re-measured with AV and QP detectors. Both the vertical and the horizontal polarizations of the Test Antenna are considered to perform the tests. All test modes are considered, refer to recorded points and plots below.

The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

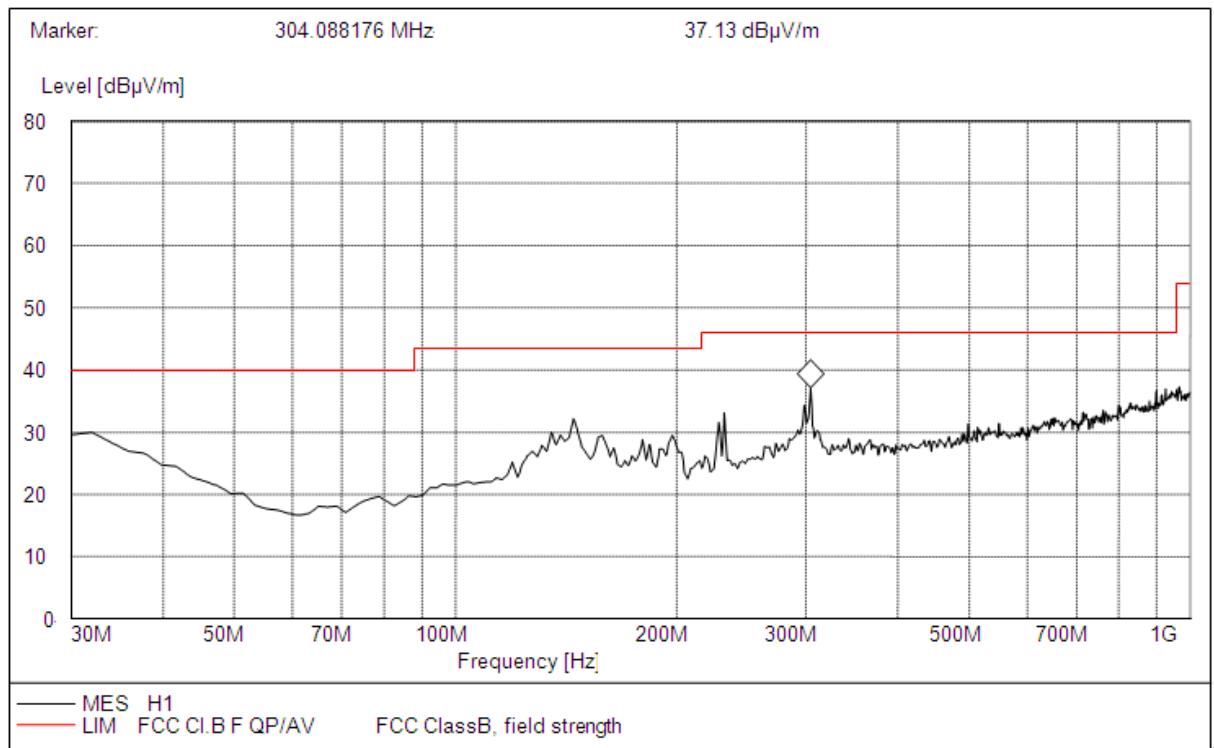
Note: All radiated emission tests were performed in X, Y, Z axis direction, and only the worst axis test condition was recorded in this test report.

## B. Test Plots and Suspicious Points:



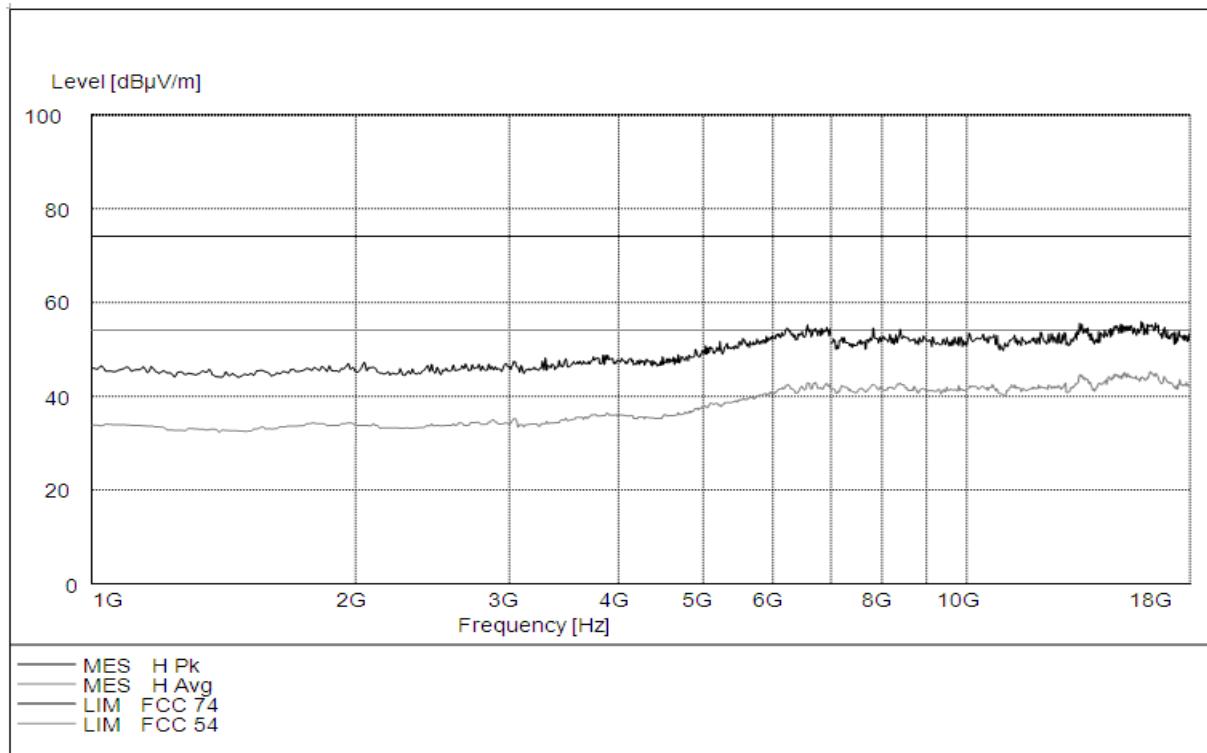
(Plot C: Test Antenna Vertical 30M - 1G)

| Frequency (MHz) | QuasiPeak (dB $\mu$ V/m) | Bandwidth (kHz) | Antenna height (cm) | Limit (dB $\mu$ V/m) | Margin (dB) | Antenna  | Verdict |
|-----------------|--------------------------|-----------------|---------------------|----------------------|-------------|----------|---------|
| 123.31000       | 32.89                    | 120.000         | 228.0               | 40.00                | 7.11        | Vertical | Pass    |
| 148.63000       | 42.86                    | 120.000         | 179.0               | 43.50                | 0.64        | Vertical | Pass    |
| 208.83000       | 28.94                    | 120.000         | 147.0               | 43.50                | 14.56       | Vertical | Pass    |

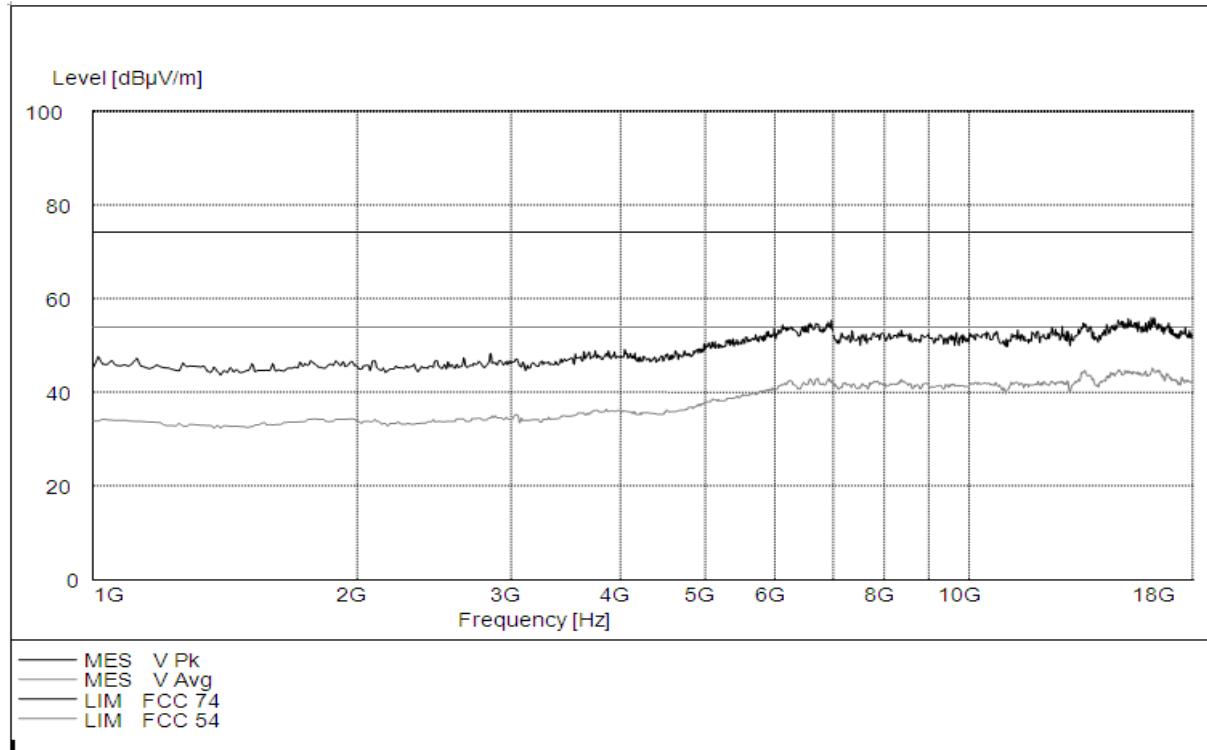


(Plot D: Test Antenna Horizontal 30M - 1G)

| Frequency (MHz) | QuasiPeak (dB $\mu$ V/m) | Bandwidth (kHz) | Antenna height (cm) | Limit (dB $\mu$ V/m) | Margin (dB) | Antenna    | Verdict |
|-----------------|--------------------------|-----------------|---------------------|----------------------|-------------|------------|---------|
| 144.68000       | 27.65                    | 120.000         | 213.0               | 43.50                | 15.85       | Horizontal | Pass    |
| 197.17000       | 26.85                    | 120.000         | 175.0               | 43.50                | 16.65       | Horizontal | Pass    |
| 304.08000       | 35.14                    | 120.000         | 126.0               | 46.00                | 10.86       | Horizontal | Pass    |



(Plot E: Test Antenna Horizontal 1G – 18G)



(Plot F: Test Antenna Vertical 1G – 18G)

**Test Result: PASS**