

FCC

RF

TEST REPORT

ISSUED BY  
Shenzhen BALUN Technology Co., Ltd.



FOR  
**Activity Tracker**

ISSUED TO  
Guangdong Transtek Medical Electronics Co., Ltd.

Zone A, 5/F., Investment Building, No. 12 Huizhan East Rd., Torch  
Development District, Zhongshan, Guangdong, China 528437

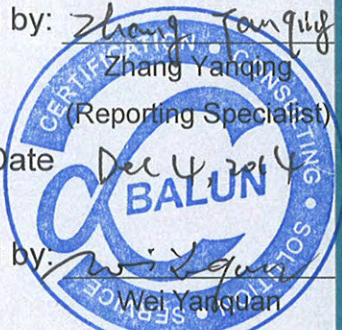


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Date: *Dec 4, 2014*

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Date: *Dec 4, 2014*



Report No.: BL-SZ14B0128-601

EUT Type: Activity Tracker

Model Name: LS407-B

Brand Name: BonBon

Test Standard: 47 CFR Part 15 Subpart C

FCC ID: OU9LS407-B01

Test conclusion: PASS

Test Date: Nov 20, 2014 ~ Dec 2, 2014

Date of Issue: Dec 4, 2014

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### Revision History

|                |                    |                      |
|----------------|--------------------|----------------------|
| Version        | Issue Date         | Revisions            |
| <u>Rev. 01</u> | <u>Dec 4, 2014</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 6683 3402   |
| 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 has met the requirements of the IAS Accreditation Criteria for Testing Laboratories (AC89), has demonstrated compliance with ISO/IEC Standard 17025:2005. The accreditation certificate number is TL-588.</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 Announce

- (1) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
- (2) The test report is invalid if there is any evidence and/or falsification.
- (3) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.
- (4) 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.
- (5) 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

|           |  |
|-----------|--|
| Applicant | Guangdong Transtek Medical Electronics Co., Ltd.   |
| Address   | Zone A, 5/F., Investment Building, No. 12 Huizhan East Rd., Torch Development District, Zhongshan, Guangdong, China 528437 |

### 2.2 Manufacturer

|              |  |
|--------------|--|
| Manufacturer | Guangdong Transtek Medical Electronics Co., Ltd.   |
| Address      | Zone A, 5/F., Investment Building, No. 12 Huizhan East Rd., Torch Development District, Zhongshan, Guangdong, China 528437 |

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

|                                   |   |
|-----------------------------------|---|
| EUT Type                          | Activity Tracker  |
| Model Name                        | LS407-B   |
| Hardware Version                  | V1.0  |
| Software Version                  | V1.0  |
| Network and Wireless connectivity | Bluetooth 4.0 Low Energy (BLE)  |
| About the Product                 | The equipment is Activity Tracker, it contains Bluetooth Module operating at 2.4GHz ISM band. |

### 2.4 Technical Information

|                       |  |
|-----------------------|--|
| Modulation Technology | FHSS   |
| Modulation Type       | GFSK   |
| Transfer Rate         | 1Mbps  |
| Frequency Range       | The frequency range used is 2402MHz - 2480MHz;<br>The frequency block is 2400MHz to 2483.5MHz. |
| Number of channel     | 40 (at intervals of 2MHz)  |
| Tested Channel        | 0 (2402MHz), 19 (2440MHz), 39 (2480MHz).   |
| Antenna Type          | Ceramic Chip Antenna   |
| Antenna Gain          | 0dBi   |

Note: The above EUT information in section 2.3 and 2.4 was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

## 2.5 Ancillary Equipment

| Ancillary Equipment | Battery         |                                       |
|---------------------|-----------------|---------------------------------------|
|                     | Brand Name      | MAXELL                                |
|                     | Model No        | CR2032                                |
|                     | Serial No       | (N/A. marked #1 by test site)         |
|                     | Battery type    | Buckle type lithium manganese battery |
|                     | Capacitance     | 220mAh                                |
|                     | Rated Voltage   | 3.0V                                  |
|                     | Extreme Voltage | N/A                                   |

### 3 SUMMARY OF TEST RESULTS

#### 3.1 Test Standards

| No. | Identity   | Document Title  |
|-----|--|---|
| 1   | 47 CFR Part 15,<br>Subpart C (12-30-13<br>Edition) | Miscellaneous Wireless Communications Services  |
| 2   | KDB Publication 558074<br>D01v03r02                | Guidance for Performing Compliance Measurements on<br>Digital Transmission Systems (DTS) Operating Under §15.247  |
| 3   | ANSI C63.4-2014                                    | American National Standard for Standard for Methods of<br>Measurement of Radio-Noise Emissions from Low-Voltage<br>Electrical and Electronic Equipment in the Range of 9 kHz to 40<br>GHz |
| 4   | ANSI C63.10-2013                                   | American National Standard for Testing Unlicensed Wireless<br>Devices   |

#### 3.2 Verdict

| No.  | Description                  | FCC Part<br>No.     | Test Result | Verdict |
|--|------------------------------|---------------------|-------------|---------|
| 1  | Antenna Requirement          | 15.203<br>15.247(b) | Note 1      | PASS    |
| 2  | Output Power                 | 15.247(b)           | ANNEX A.1   | PASS    |
| 3  | 6dB Bandwidth                | 15.247(a)           | ANNEX A.2   | PASS    |
| 4  | Conducted Spurious Emission  | 15.247(d)           | ANNEX A.3   | PASS    |
| 5  | Conducted Emission           | 15.207              | Note 2      | N/A     |
| 6  | Radiated Spurious Emission   | 15.209<br>15.247(d) | ANNEX A.4   | PASS    |
| 7  | Band Edge                    | 15.209<br>15.247(d) | ANNEX A.5   | PASS    |
| 8  | Power spectral density (PSD) | 15.247(e)           | ANNEX A.6   | PASS    |
| Note 1: Please refer to section 5.1.<br>Note 2: The EUT is powered by buckle type lithium manganese battery, So the Conducted<br>Emission test was not applicable. |                              |                     |             |         |



## 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 (kPa) | 90 - 96                 |                |
| Temperature                | NT (Normal Temperature) | +22°C to +25°C |
| Working Voltage of the EUT | NV (Normal Voltage)     | 3.0V           |

### 4.2 Test Equipment List

| Description                      | Manufacturer         | Model      | Serial No. | Cal. Date  | Cal. Due   |
|----------------------------------|----------------------|------------|------------|------------|------------|
| Spectrum Analyzer                | ROHDE&SCHWARZ        | FSV30      | 103118     | 2014.07.10 | 2015.07.09 |
| Vector Signal Generator          | ROHDE&SCHWARZ        | SMBV100A   | 177746     | 2014.07.09 | 2015.07.08 |
| Signal Generator                 | ROHDE&SCHWARZ        | SMB100A    | 260592     | 2014.07.21 | 2015.07.20 |
| Switch Unit with OSP-B157        | ROHDE&SCHWARZ        | OSP120     | 101270     | 2014.07.23 | 2015.07.22 |
| Spectrum Analyzer                | AGILENT              | E4440A     | MY45304434 | 2014.07.07 | 2015.07.06 |
| Spectrum Analyzer                | ROHDE&SCHWARZ        | FSL3       | 103640/003 | 2014.07.07 | 2015.07.06 |
| Power Splitter                   | KMW                  | DCPD-LDC   | 1305003215 | 2014.07.07 | 2015.07.06 |
| Power Sensor                     | ROHDE&SCHWARZ        | NRP-Z21    | 103971     | 2014.07.07 | 2015.07.06 |
| Attenuator (20dB)                | KMW                  | ZA-S1-201  | 110617091  | --         | --         |
| Attenuator (6dB)                 | KMW                  | ZA-S1-61   | 1305003189 | --         | --         |
| DC Power Supply                  | ROHDE&SCHWARZ        | HMP2020    | 018141664  | 2014.07.07 | 2015.07.06 |
| Temperature Chamber              | ANGELANTIONI SCIENCE | NTH64-40A  | 1310       | 2014.07.07 | 2015.07.06 |
| Test Antenna-Loop(9kHz-30MHz)    | SCHWARZBECK          | FMZB 1519  | 1519-037   | 2013.07.02 | 2015.07.01 |
| Test Antenna-Bi-Log(30MHz-3G Hz) | SCHWARZBECK          | VULB 9163  | 9163-624   | 2013.07.03 | 2015.07.02 |
| Test Antenna-Horn(1-18GHz)       | SCHWARZBECK          | BBHA 9120D | 9120D-1148 | 2013.07.02 | 2015.07.01 |
| Test Antenna-Horn(15-26.5GHz)    | SCHWARZBECK          | BBHA 9170  | 9170-305   | 2013.07.02 | 2015.07.01 |
| Anechoic Chamber                 | RAINFORD             | 9m*6m*6m   | N/A        | 2013.10.07 | 2015.10.06 |

### 4.3 Test Configurations

| Test Configurations (TC) NO. | Description           |                     |
|------------------------------|-----------------------|---------------------|
|                              | Signal Description    | Operating Frequency |
| Transmitter                  |                       |                     |
| TC01                         | FHSS modulation, GFSK | Ch No. 0/ 2402MHz   |
| TC02                         | FHSS modulation, GFSK | Ch No.19/ 2440MHz   |
| TC03                         | FHSS modulation, GFSK | Ch No. 39/ 2480MHz  |

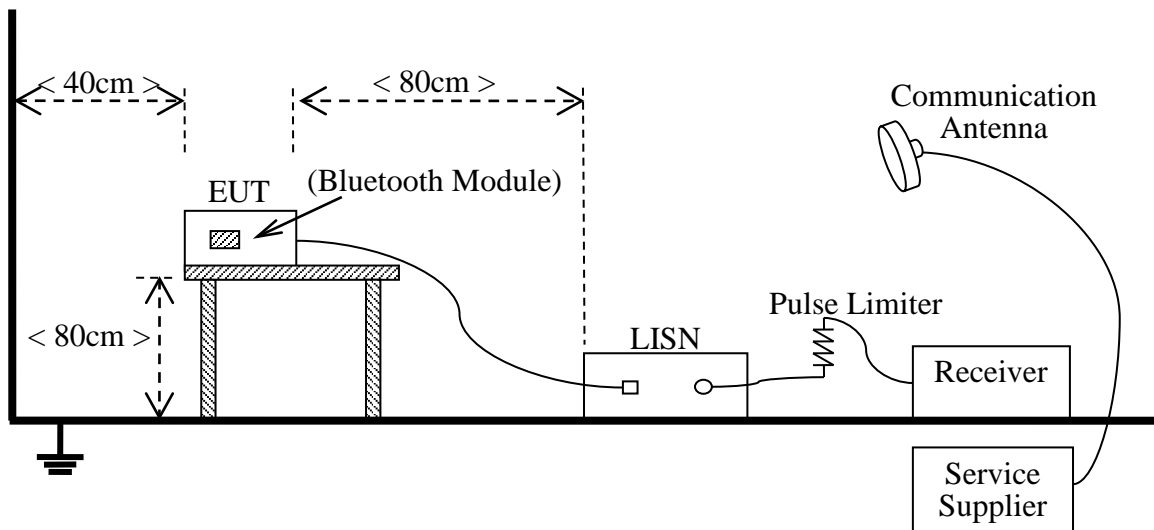
### 4.4 Description of Test Setup

#### 4.4.1 For Antenna Port Test



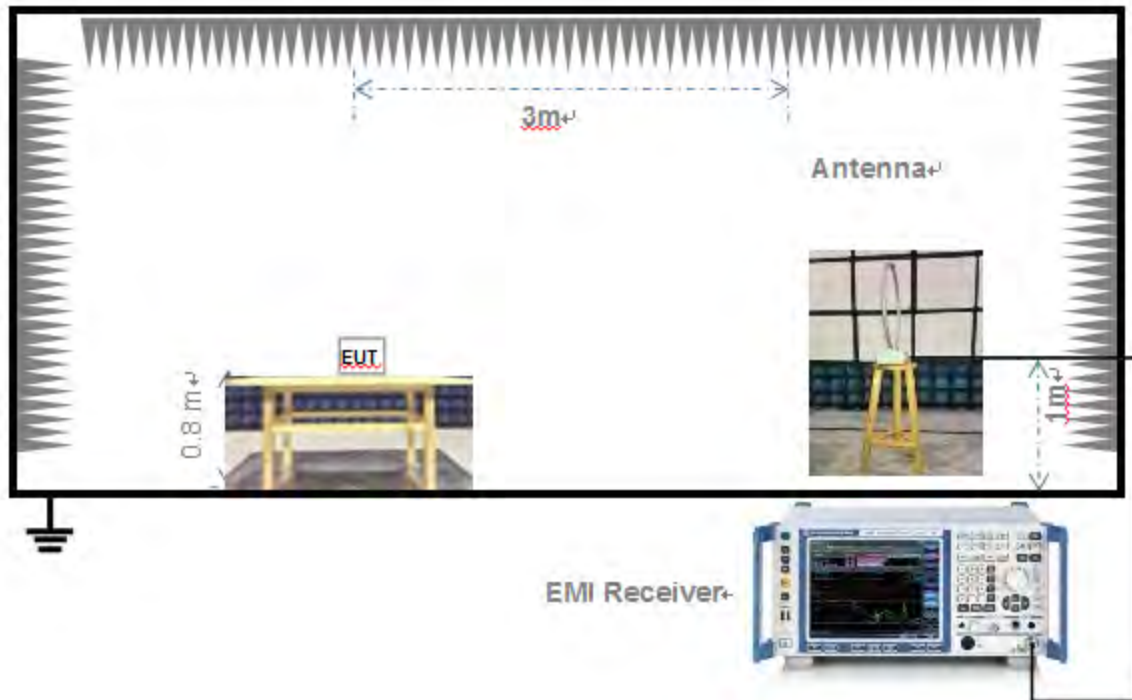
(Diagram 1)

#### 4.4.2 For AC Power Supply Port Test



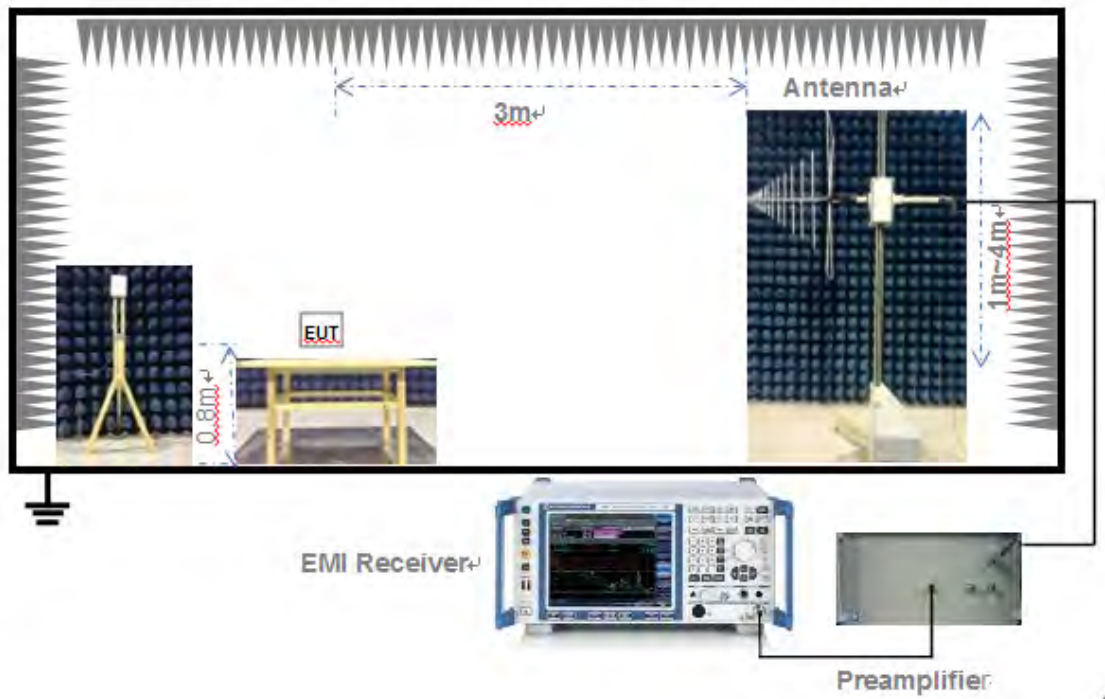
(Diagram 2)

4.4.3 For Radiated Test (Below 30MHz)



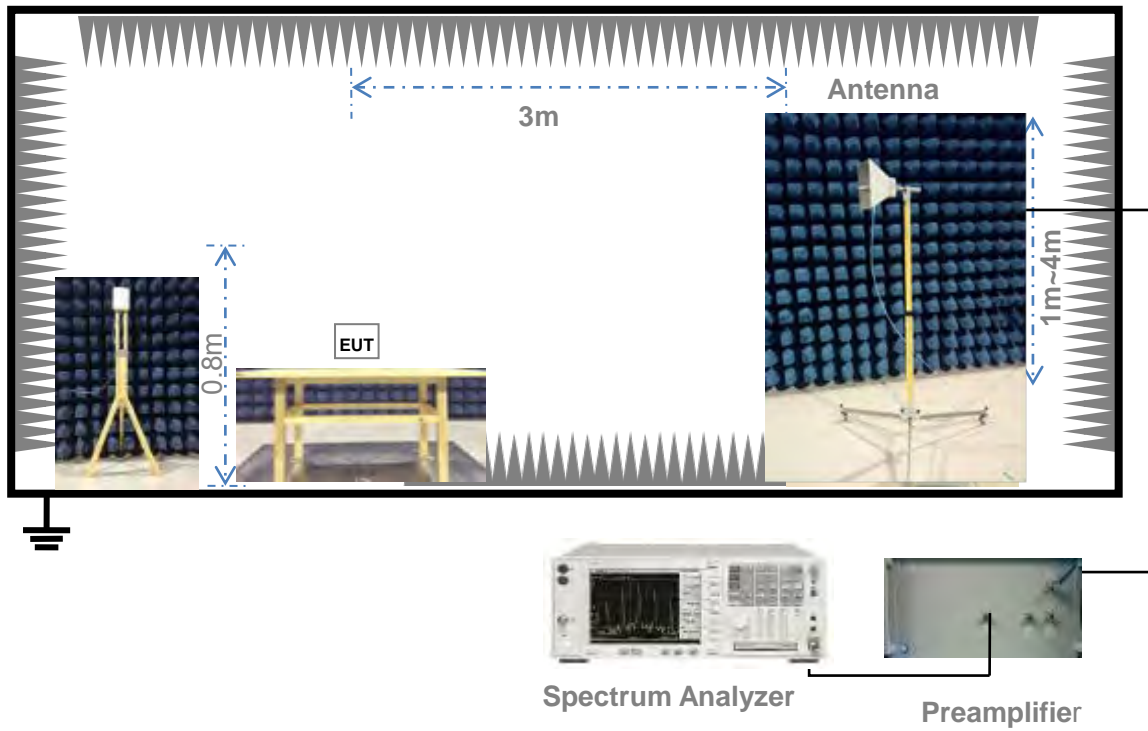
(Diagram 3)

4.4.4 For Radiated Test (30MHz-1GHz)



(Diagram 4)

4.4.5 For Radiated Test (Above 1GHz)



(Diagram 5)

## 4.5 Test Conditions

| Test Case   | Test Conditions |  |                                      |
|---|-----------------|--|--------------------------------------|
|   | Test Env.       | Test Setup <sup>Note 1</sup>                 | Test Configuration <sup>Note 2</sup> |
| Peak Output Power   | NTNV            | Test Setup 1                                 | TC01~TC03                            |
| Occupied Bandwidth  | NTNV            | Test Setup 1                                 | TC01~TC03                            |
| Conducted Spurious Emission   | NTNV            | Test Setup 1                                 | TC01~TC03                            |
| Conducted Emission  | NTNV            | Test Setup 2                                 | TC01~TC03                            |
| Radiated Spurious Emission  | NTNV            | Test Setup 3<br>Test Setup 4<br>Test Setup 5 | TC01~TC03                            |
| Band Edge   | NTNV            | Test Setup 1                                 | TC01, TC03                           |
| Power spectral density (PSD)  | NTNV            | Test Setup 2                                 | TC01~TC03                            |
| Note:<br>1. Please refer to section 4.4 for test setup details.<br>2. Please refer to section 4.3 for test setup details. |                 |  |                                      |

## 4.6 Measurement Results Explanation Example

### 4.6.1 For conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and 10dB attenuator between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and 10dB attenuator factor.

Offset = RF cable loss + attenuator factor.

Following table shows an offset computation example with cable loss 8.5 dB.

Example:

Offset (dB) = RF cable loss (dB) + attenuator factor (dB).

= 8.5 + 10 = 18.5 (dB)

## 5 TEST ITEMS

### 5.1 Antenna Requirements

#### 5.1.1 Standard Applicable

FCC §15.203 & 15.247(b)

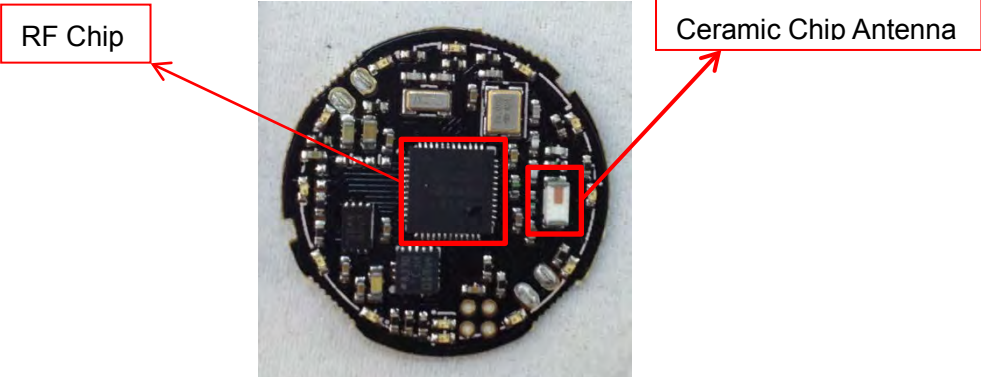
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply 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 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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 5725-5850MHz 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 Procedure

#### Maximum peak conducted output power

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

Set the RBW  $\geq$  DTS bandwidth.

Set VBW  $\geq 3 \times$  RBW.

Set span  $\geq 3 \times$  RBW

Sweep time = auto couple.

Detector = peak.

Trace mode = max hold.

Allow trace to fully stabilize.

Use peak marker function to determine the peak amplitude level.

#### 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.)

## 5.3 6dB 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 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.

## 5.4 Conducted Spurious Emission

### 5.4.1 Limit

FCC §15.247(d)

In any 100kHz 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 20dB below that in the 100kHz 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 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.

## 5.5 Conducted Emission

### 5.5.1 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 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) |          |
|-----------------------|------------------------------|----------|
|                       | Quai-peak                    | Average  |
| 0.15 - 0.50           | 66 to 56                     | 56 to 46 |
| 0.50 - 5              | 56                           | 46       |
| 0.50 - 30             | 60                           | 50       |

### 5.5.2 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.

## 5.6 Radiated Spurious Emission

### 5.6.1 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).

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 ( $\mu\text{V}/\text{m}$ ) | 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 ( $\text{dB}\mu\text{V}/\text{m}$ ) =  $20 \cdot \log[\text{Field Strength } (\mu\text{V}/\text{m})]$ .
2. In the emission tables above, the tighter limit applies at the band edges.
3. For Above 1000MHz, 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 1000MHz, limit field strength of harmonics:  $54\text{dBuV}/\text{m}@3\text{m}$  (AV) and  $74\text{dBuV}/\text{m}@3\text{m}$  (PK).

### 5.6.2 Test Procedure

The measurement frequency range is from 30MHz 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 3dB 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 Band Edge

### 5.7.1 Limit

FCC §15.209&15.247(d)

In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

### 5.7.2 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.

## 5.8 Power Spectral density (PSD)

### 5.8.1 Limit

FCC §15.247(e)

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.

### 5.8.2 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.

# ANNEX A TEST RESULT

## A.1 Output Power

### Duty Cycle

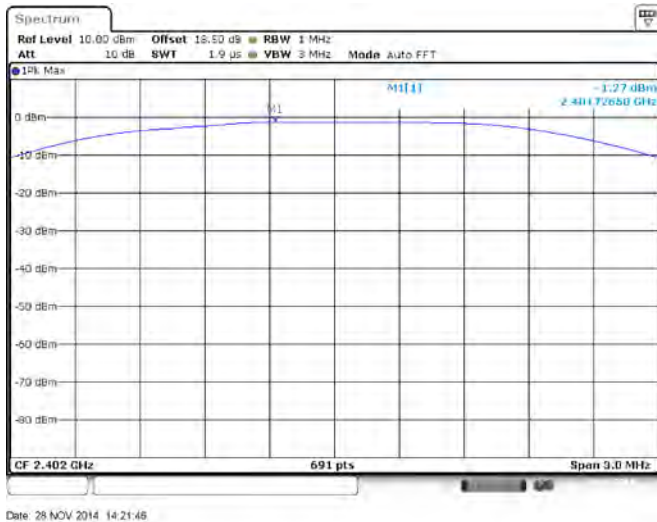
| Band | Duty Cycle(%) | T(ms) | 1/T(kHz) |
|------|---------------|-------|----------|
| GFSK | 20.74         | 0.629 | 1.590    |

### Peak Power Test Data

| Channel | Measured Output Peak Power |      | Limit |      | Verdict |
|---------|----------------------------|------|-------|------|---------|
|         | dBm                        | mW   | dBm   | mW   |         |
| Low     | -1.27                      | 0.75 | 30    | 1000 | PASS    |
| Middle  | -2.97                      | 0.50 |       |      | PASS    |
| High    | -4.95                      | 0.32 |       |      | PASS    |

### Peak Power Test Plots

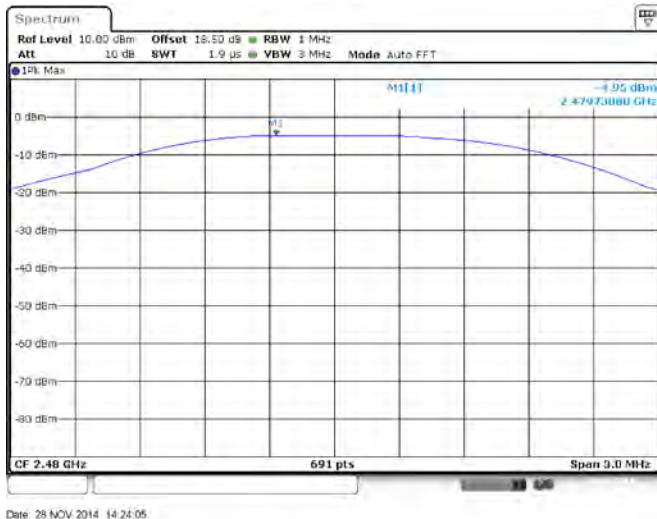
#### LOW CHANNEL



#### MID CHANNEL



#### HIGH CHANNEL



## A.2 Bandwidth

### Test Data

| Channel | 6 dB Bandwidth (kHz) | Limits (kHz) | Verdict |
|---------|----------------------|--------------|---------|
| Low     | 729.400              | $\geq 500$   | PASS    |
| Middle  | 664.300              | $\geq 500$   | PASS    |
| High    | 668.600              | $\geq 500$   | PASS    |

### Test plots

#### LOW CHANNEL



Date: 28 NOV 2014 14:51:43

#### MID CHANNEL



Date: 28 NOV 2014 15:01:50

#### HIGH CHANNEL



Date: 28 NOV 2014 15:06:22

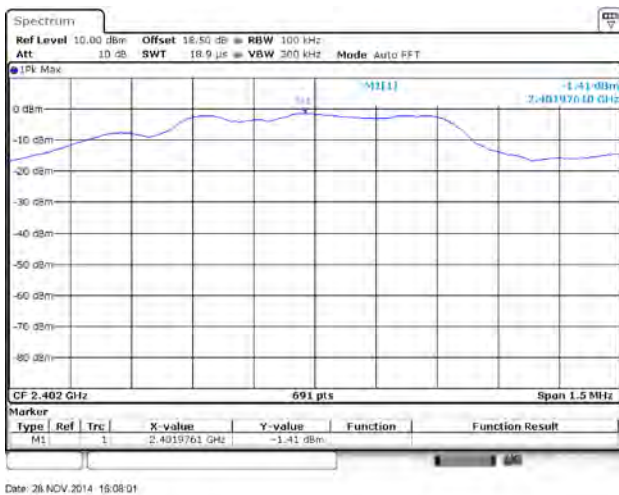
### A.3 Conducted Spurious Emissions

#### Test Data

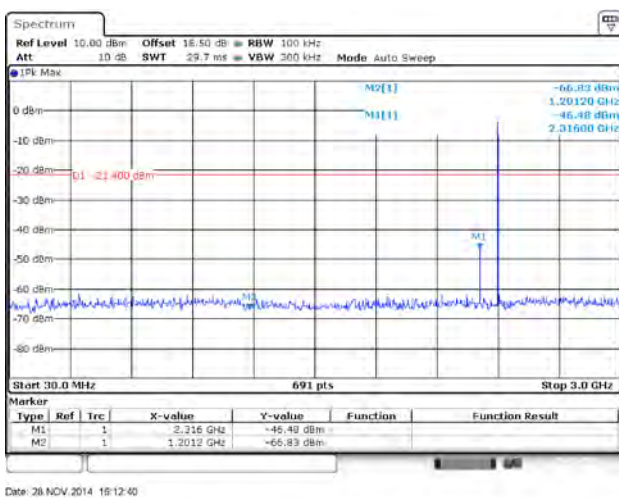
| Channel | Measured Max. Out of Band Emission (dBm) | Limit (dBm)   |                         | Verdict |
|---------|--|---------------|-------------------------|---------|
|         |  | Carrier Level | Calculated 20 dBc Limit |         |
| Low     | -46.48                                   | -1.41         | -21.4                   | PASS    |
| Middle  | -50.86                                   | -3.20         | -23.2                   | PASS    |
| High    | -53.60                                   | -5.09         | -25.1                   | PASS    |

#### Test Plots

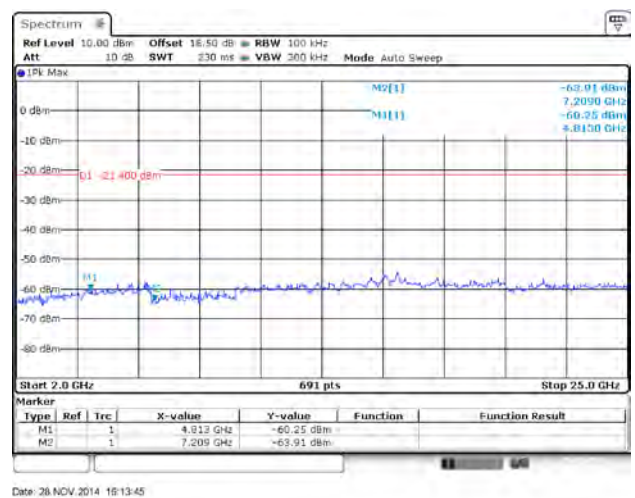
##### LOW CHANNEL CARRIER LEVEL



##### LOW CHANNEL, SPURIOUS 30MHz~3GHz

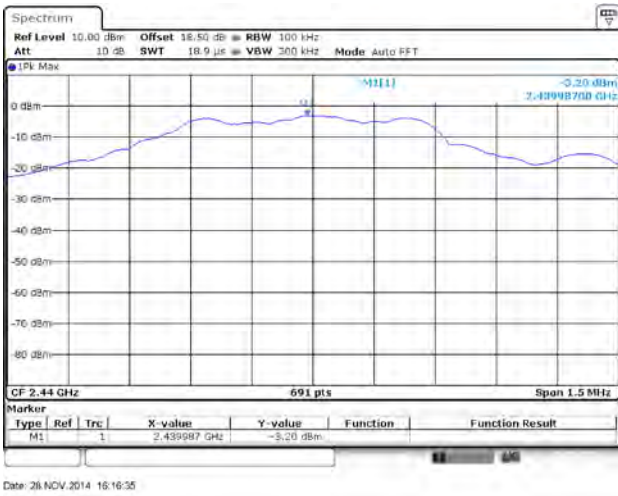


##### LOW CHANNEL, SPURIOUS 2GHz~25GHz

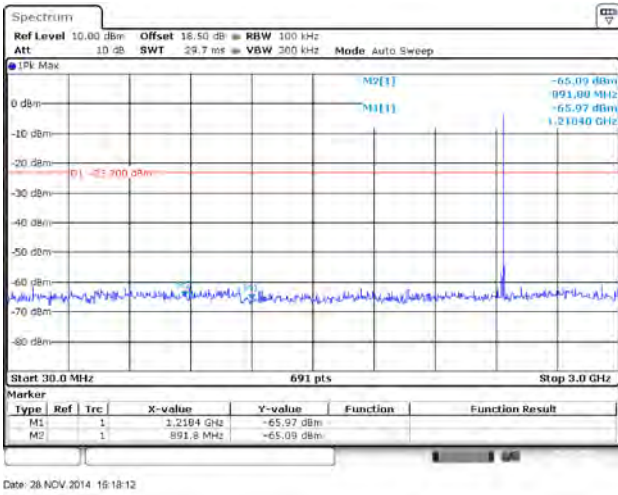




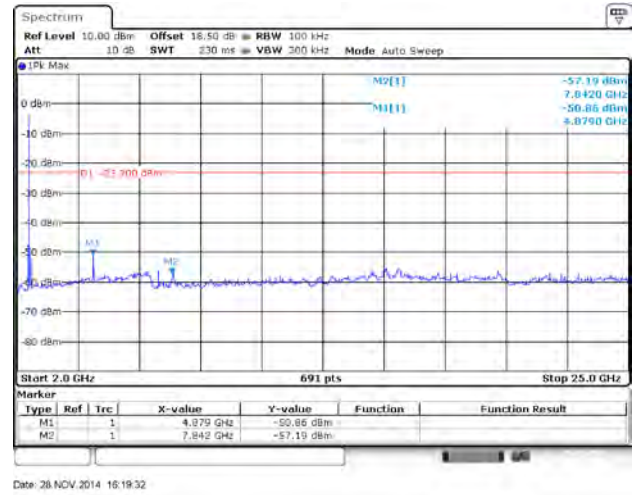
## MID CHANNEL CARRIER LEVEL



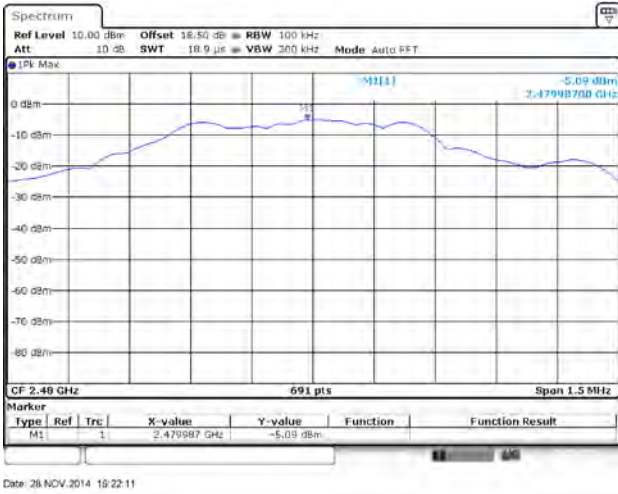
## MID CHANNEL, SPURIOUS 30MHz~3GHz



## MID CHANNEL, SPURIOUS 2GHz~25GHz

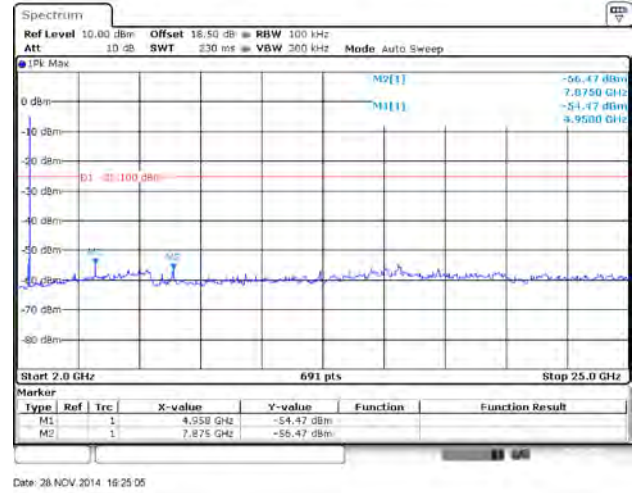
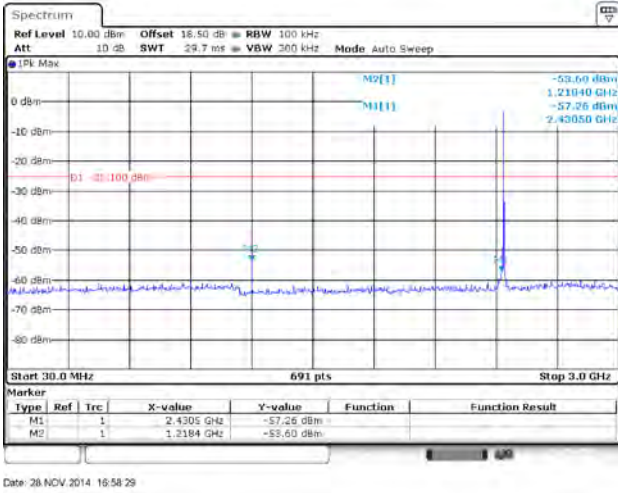


HIGH CHANNEL CARRIER LEVEL



HIGH CHANNEL, SPURIOUS 30MHz~3GHz

HIGH CHANNEL, SPURIOUS 2GHz~25GHz



## A.4 Radiated Emission

Note 1: The symbol of "--" in the table which means not application.

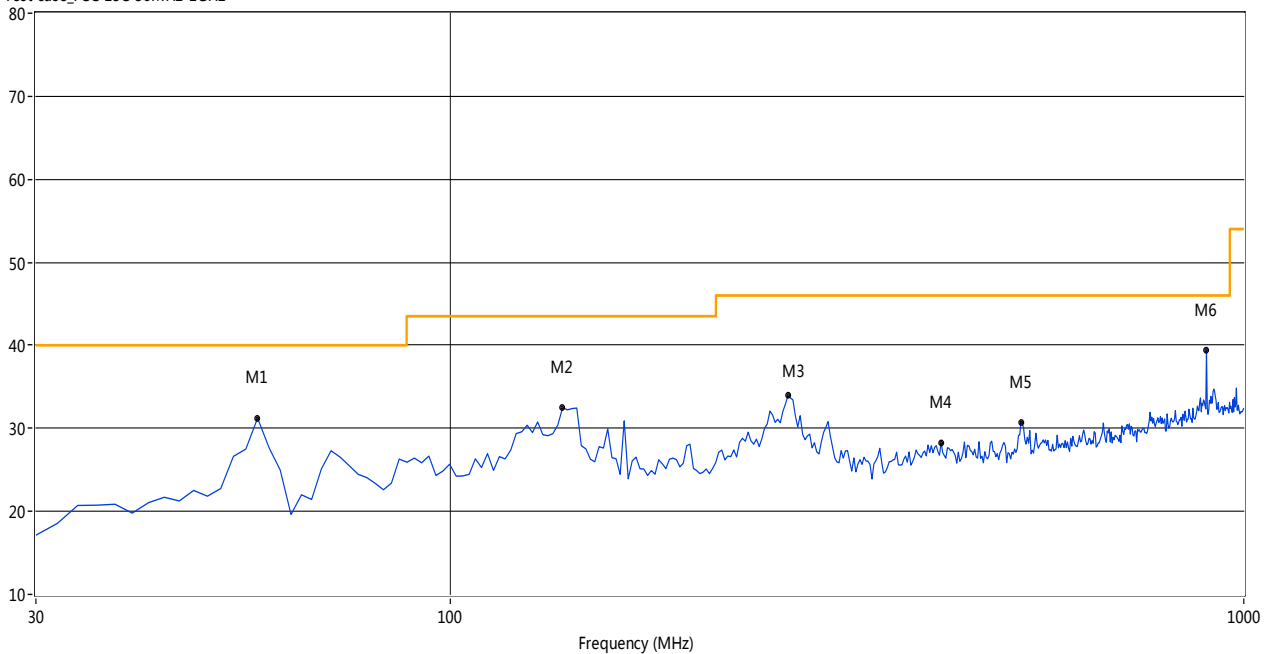
Note 2: For the test data above 1GHz, According the ANSI C63.4-2014, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Note 3: The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

Note 4: All configurations have been tested, only the worst configuration (GFSK Low Channel) shown here.

### 30MHz to 1GHz, ANT V

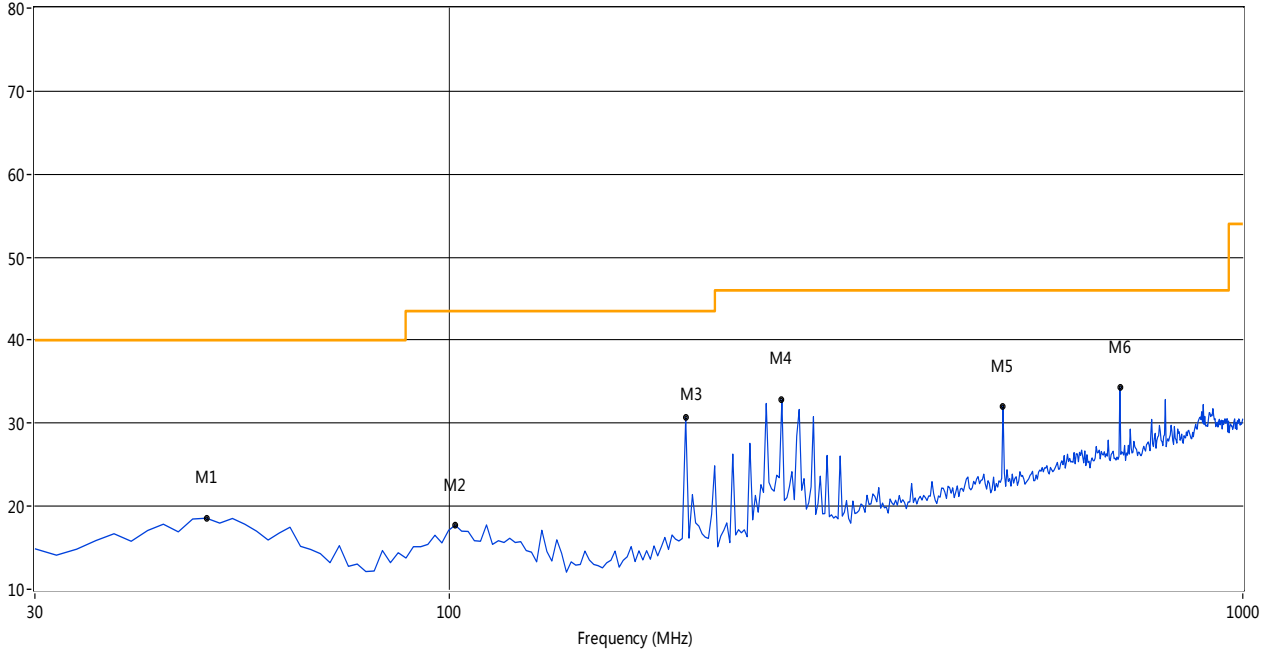
RE Test case\_FCC 15C 30MHz-1GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|----------|---------|
| 1   | 57.11           | 31.23            | -18.90      | 40.0           | 8.77        | Peak     | 227.80    | 100         | Vertical | PASS    |
| 2   | 138.42          | 32.50            | -22.89      | 43.5           | 11.00       | Peak     | 148.10    | 100         | Vertical | PASS    |
| 3   | 266.21          | 33.98            | -18.01      | 46.0           | 12.02       | Peak     | 360.00    | 100         | Vertical | PASS    |
| 4   | 415.29          | 28.27            | -14.37      | 46.0           | 17.73       | Peak     | 0.60      | 100         | Vertical | PASS    |
| 5   | 523.71          | 30.74            | -11.87      | 46.0           | 15.26       | Peak     | 347.80    | 100         | Vertical | PASS    |
| 6   | 897.38          | 39.43            | -3.31       | 46.0           | 6.57        | Peak     | 148.10    | 100         | Vertical | PASS    |

30MHz to 1GHz, ANT H

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

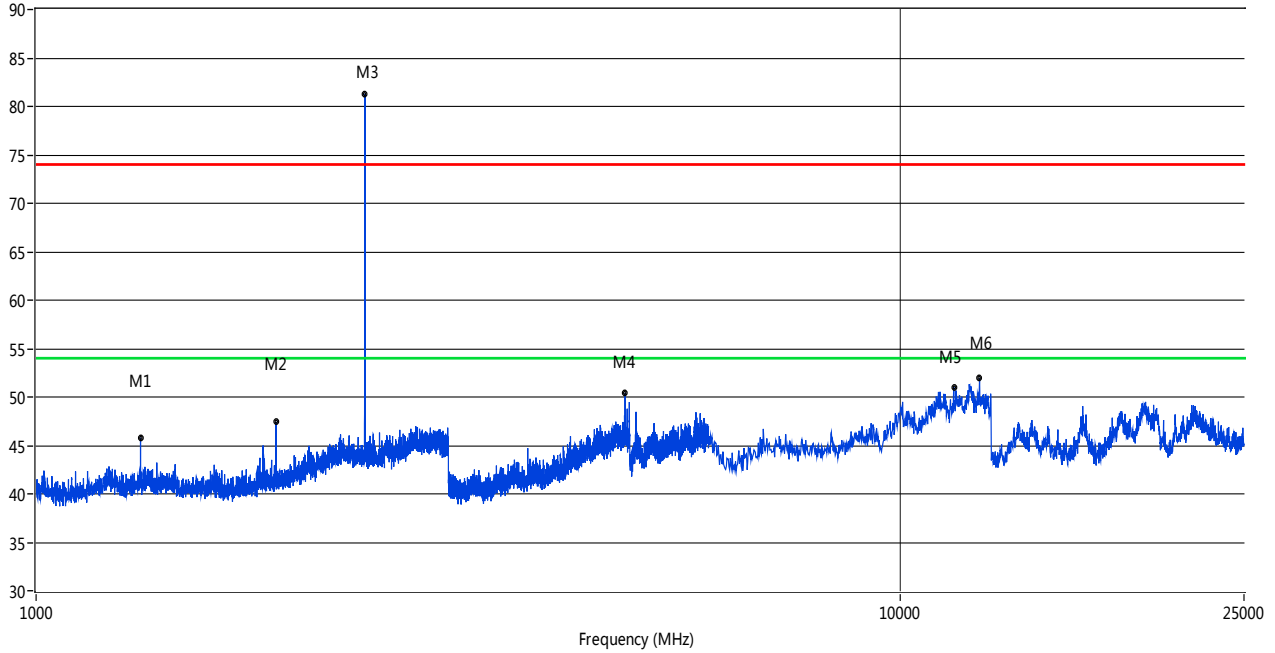


| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|------------|---------|
| 1   | 49.36           | 18.56            | -17.96      | 40.0           | 21.44       | Peak     | 205.20    | 100         | Horizontal | PASS    |
| 2   | 101.64          | 17.72            | -19.56      | 43.5           | 25.78       | Peak     | 67.00     | 100         | Horizontal | PASS    |
| 3   | 198.44          | 40.61            | -19.78      | 43.5           | 2.89        | Peak     | 43.30     | 100         | Horizontal | PASS    |
| 4   | 262.33          | 32.82            | -18.12      | 46.0           | 13.18       | Peak     | 4.20      | 100         | Horizontal | PASS    |
| 5   | 498.54          | 29.52            | -12.43      | 46.0           | 16.48       | Peak     | 320.40    | 100         | Horizontal | PASS    |

Note: The marked spikes near 2400MHz with circle should be ignored because they are Fundamental signal.  
 Test Data and Plots(1GHz ~ 10th Harmonic)

LOW CHANNEL 1GHz to 25GHz, ANT V

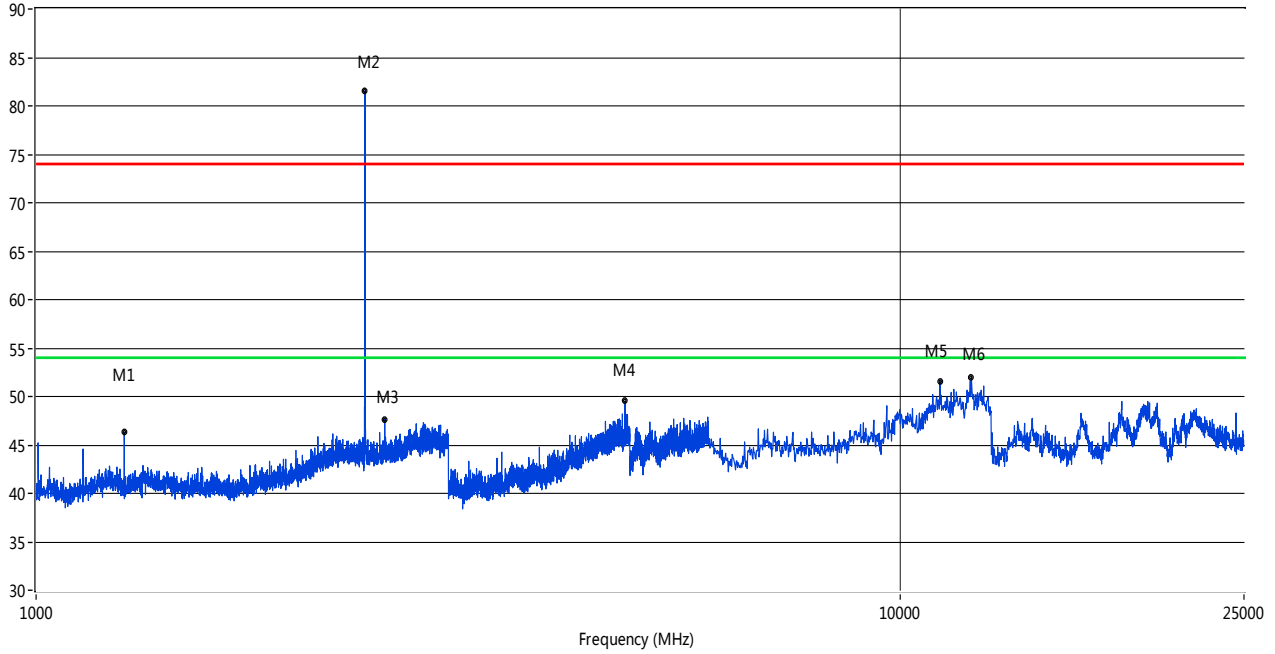
RE Test case\_FCC 15C 1GHz-25GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|----------|---------|
| 1   | 1320.92         | 45.78            | -5.18       | 74.0           | 28.22       | Peak     | 257.50    | 100         | Vertical | PASS    |
| 2   | 1895.28         | 47.44            | -3.32       | 74.0           | 26.56       | Peak     | 6.00      | 100         | Vertical | PASS    |
| 3   | 2402.21         | 81.57            | -1.18       | 74.0           | -7.57       | Peak     | 114.70    | 100         | Vertical | N/A     |
| 4   | 4804.80         | 50.38            | 13.20       | 74.0           | 23.62       | Peak     | 38.40     | 100         | Vertical | PASS    |
| 5   | 11537.02        | 51.04            | 20.17       | 74.0           | 22.96       | Peak     | 5.10      | 100         | Vertical | PASS    |
| 6   | 12356.91        | 51.96            | 20.64       | 74.0           | 22.04       | Peak     | 216.90    | 100         | Vertical | PASS    |

LOW CHANNEL 1GHz to 25GHz, ANT H

RE Test case\_FCC 15C 1GHz-25GHz

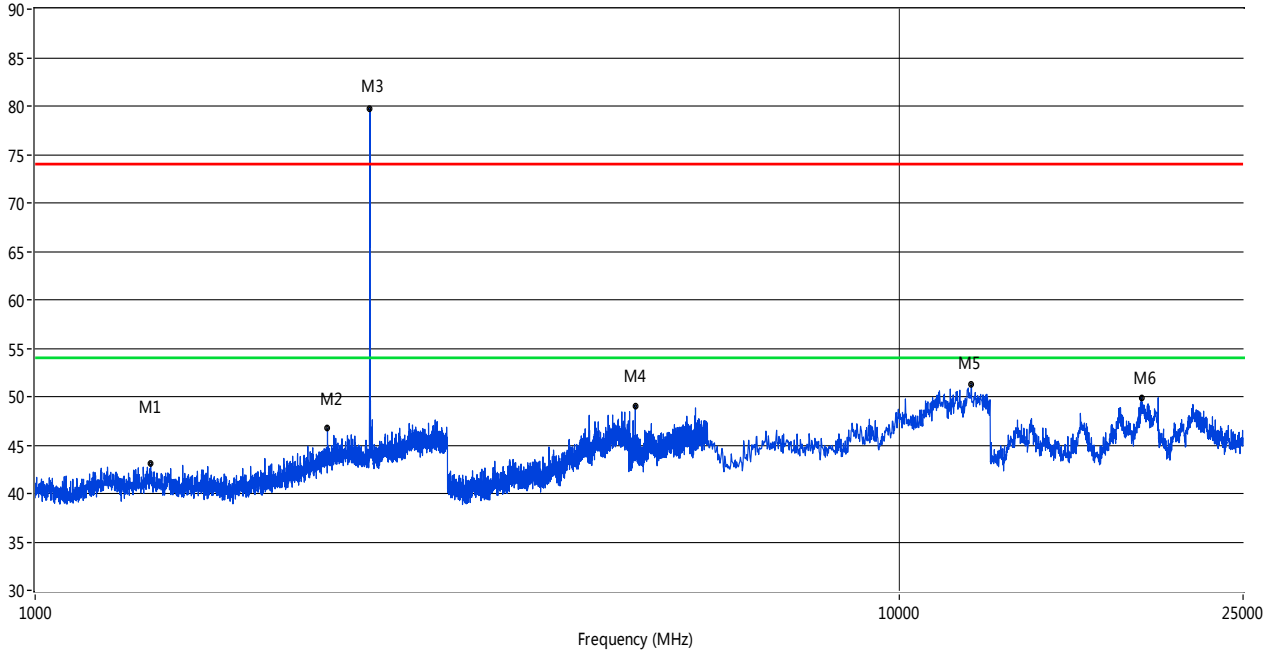


| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|------------|---------|
| 1   | 1264.93         | 46.30            | -5.43       | 74.0           | 27.70       | Peak     | 204.80    | 100         | Horizontal | PASS    |
| 2   | 2402.26         | 81.34            | -1.18       | 74.0           | -7.34       | Peak     | 339.30    | 100         | Horizontal | N/A     |
| 3   | 2532.12         | 47.62            | -0.55       | 74.0           | 26.38       | Peak     | 359.60    | 100         | Horizontal | PASS    |
| 4   | 4804.05         | 49.54            | 13.18       | 74.0           | 24.46       | Peak     | 359.90    | 100         | Horizontal | PASS    |
| 5   | 11121.46        | 51.55            | 20.22       | 74.0           | 22.45       | Peak     | 176.00    | 100         | Horizontal | PASS    |
| 6   | 12087.35        | 51.95            | 20.78       | 74.0           | 22.05       | Peak     | 181.50    | 100         | Horizontal | PASS    |



MID CHANNEL 1GHz to 25GHz, ANT V

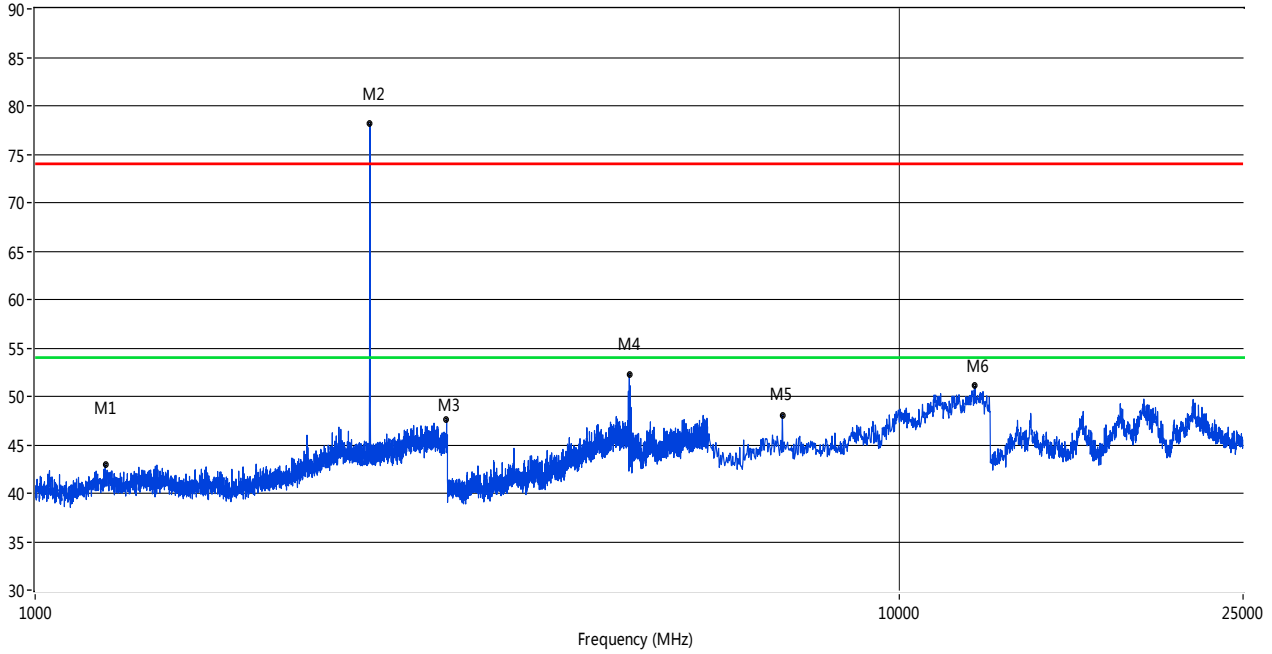
RE Test case\_FCC 15C 1GHz-25GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|----------|---------|
| 1   | 1360.41         | 43.05            | -5.03       | 74.0           | 30.95       | Peak     | 217.50    | 100         | Vertical | PASS    |
| 2   | 2179.20         | 46.73            | -1.04       | 74.0           | 27.27       | Peak     | 178.10    | 100         | Vertical | PASS    |
| 3   | 2440.13         | 79.68            | -0.81       | 74.0           | -5.68       | Peak     | 328.50    | 100         | Vertical | N/A     |
| 4   | 4949.51         | 49.06            | 13.54       | 74.0           | 24.94       | Peak     | 57.00     | 100         | Vertical | PASS    |
| 5   | 12121.05        | 51.28            | 20.75       | 74.0           | 22.72       | Peak     | 180.70    | 100         | Vertical | PASS    |
| 6   | 19059.90        | 49.92            | 13.60       | 74.0           | 24.08       | Peak     | 252.20    | 100         | Vertical | PASS    |

MID CHANNEL 1GHz to 25GHz, ANT H

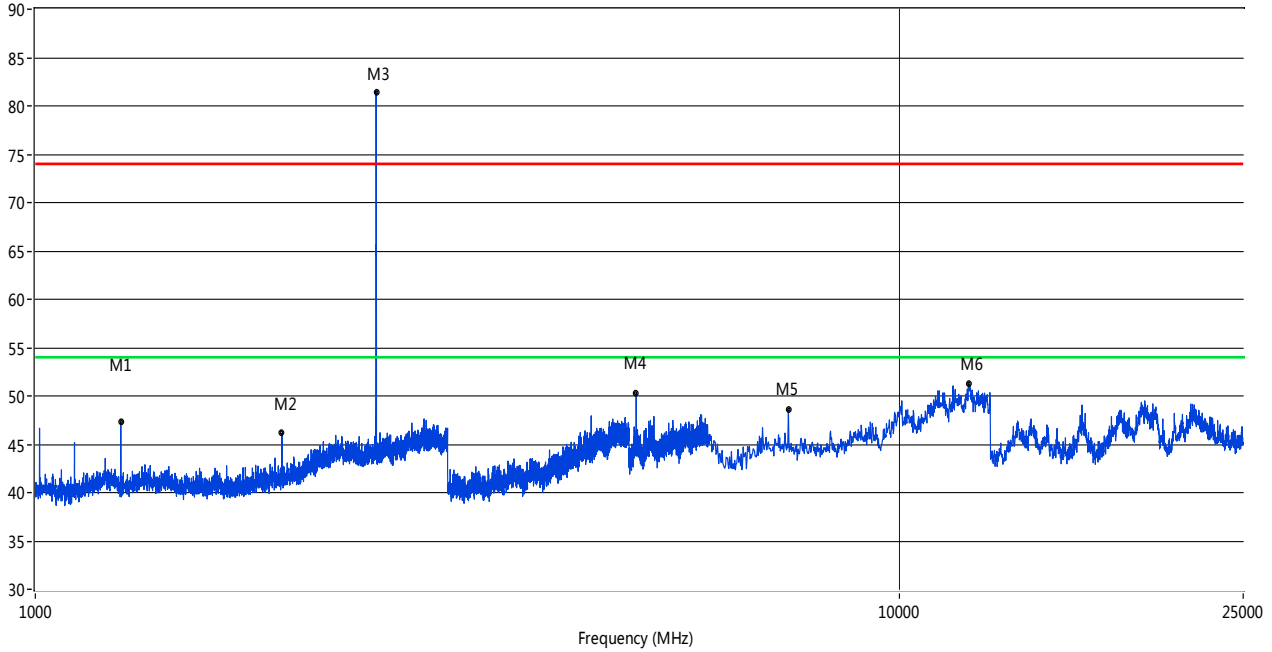
RE Test case\_FCC 15C 1GHz-25GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|------------|---------|
| 1   | 1205.45         | 42.93            | -5.39       | 74.0           | 31.07       | Peak     | 249.70    | 100         | Horizontal | PASS    |
| 2   | 2440.05         | 78.68            | -0.81       | 74.0           | -4.68       | Peak     | 320.90    | 100         | Horizontal | N/A     |
| 3   | 2993.50         | 47.64            | 2.11        | 74.0           | 26.36       | Peak     | 360.00    | 100         | Horizontal | PASS    |
| 4   | 4871.53         | 52.28            | 13.29       | 74.0           | 21.72       | Peak     | 356.30    | 100         | Horizontal | PASS    |
| 5   | 7325.29         | 48.05            | 14.18       | 74.0           | 25.95       | Peak     | 199.20    | 100         | Horizontal | PASS    |
| 6   | 12233.36        | 51.06            | 20.65       | 74.0           | 22.94       | Peak     | 0.30      | 100         | Horizontal | PASS    |

HIGH CHANNEL 1GHz to 25GHz, ANT V

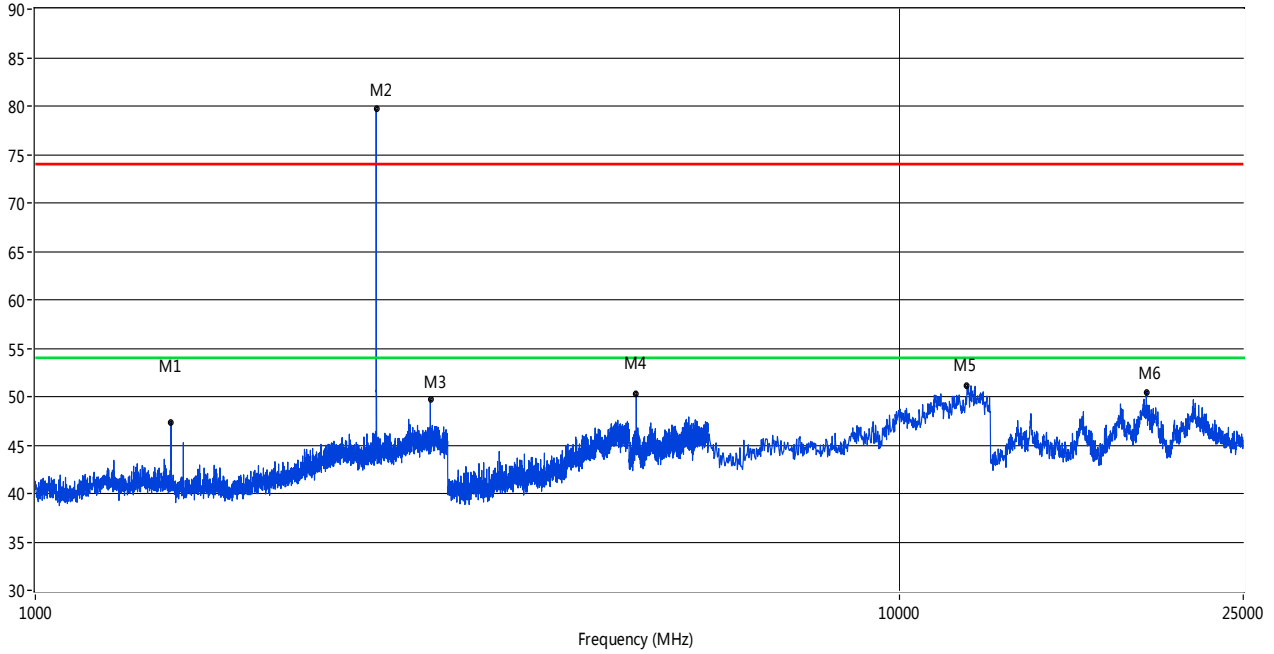
RE Test case\_FCC 15C 1GHz-25GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT      | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|----------|---------|
| 1   | 1255.94         | 47.32            | -5.34       | 74.0           | 26.68       | Peak     | 30.50     | 100         | Vertical | PASS    |
| 2   | 1929.27         | 46.14            | -3.07       | 74.0           | 27.86       | Peak     | 327.60    | 100         | Vertical | PASS    |
| 3   | 2480.13         | 84.09            | -0.73       | 74.0           | -10.09      | Peak     | 344.50    | 100         | Vertical | N/A     |
| 4   | 4960.01         | 53.27            | 13.62       | 74.0           | 20.73       | Peak     | 81.80     | 100         | Vertical | PASS    |
| 5   | 7440.60         | 48.56            | 14.21       | 74.0           | 25.44       | Peak     | 40.50     | 100         | Vertical | PASS    |
| 6   | 12019.97        | 51.32            | 20.86       | 74.0           | 22.68       | Peak     | 93.80     | 100         | Vertical | PASS    |

HIGH CHANNEL 1GHz to 25GHz, ANT H

RE Test case\_FCC 15C 1GHz-25GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT        | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|-----------|-------------|------------|---------|
| 1   | 1435.89         | 47.39            | -5.04       | 74.0           | 26.61       | Peak     | 265.20    | 100         | Horizontal | PASS    |
| 2   | 2480.31         | 88.36            | -0.73       | 74.0           | -14.36      | Peak     | 313.10    | 100         | Horizontal | N/A     |
| 3   | 2865.03         | 47.69            | 1.73        | 74.0           | 26.31       | Peak     | 19.70     | 100         | Horizontal | PASS    |
| 4   | 4960.01         | 50.27            | 13.62       | 74.0           | 23.73       | Peak     | 8.90      | 100         | Horizontal | PASS    |
| 5   | 11975.04        | 51.12            | 20.76       | 74.0           | 22.88       | Peak     | 70.90     | 100         | Horizontal | PASS    |
| 6   | 19309.48        | 50.49            | 13.46       | 74.0           | 23.51       | Peak     | 57.40     | 100         | Horizontal | PASS    |

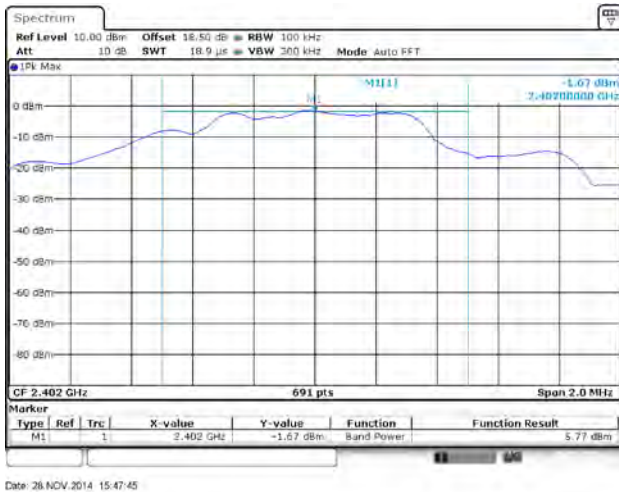
## A.5 Band Edge

### Test Data

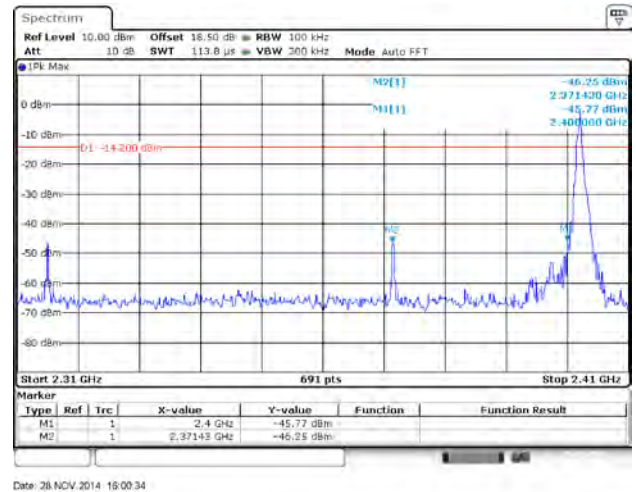
The lowest and highest channels are tested to verify the band edge emissions. Please refer to the following the plots for emissions values.

### Test Plots

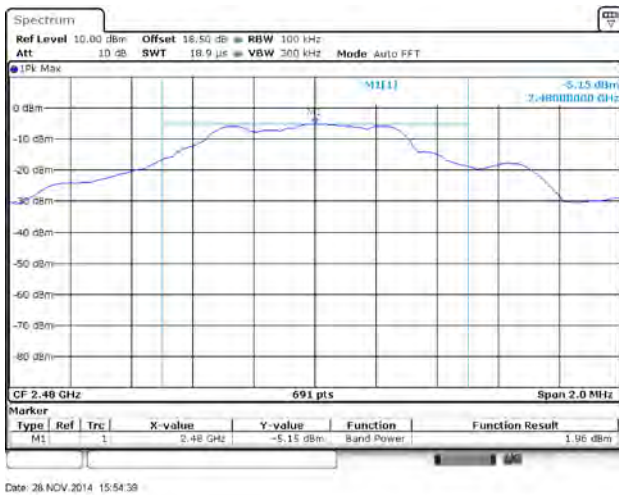
LOW CHANNEL, Reference level



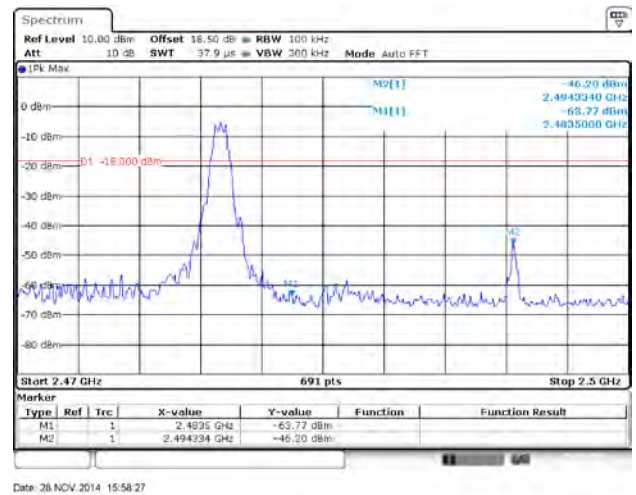
LOW CHANNEL, Band Edge



HIGH CHANNEL, Reference level



HIGH CHANNEL, Band Edge



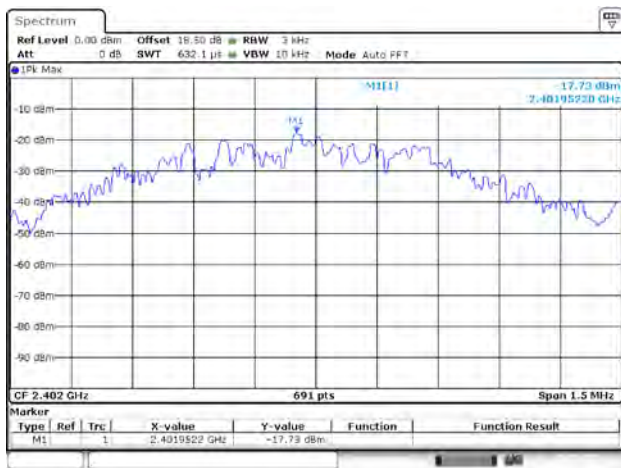
## A.6 Power Spectral Density (PSD)

### Test Data

| Channel | Spectral power density (dBm/3kHz) | Limit (dBm/3kHz) | Verdict |
|---------|-----------------------------------|------------------|---------|
| Low     | -17.73                            | 8                | PASS    |
| Middle  | -18.68                            | 8                | PASS    |
| High    | -20.29                            | 8                | PASS    |

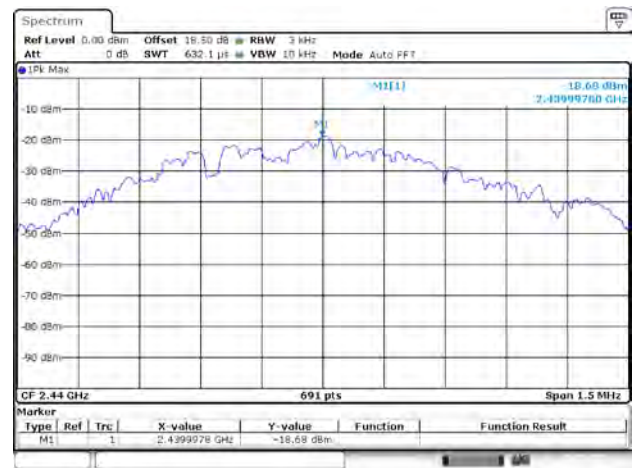
### Test plots

#### LOW CHANNEL



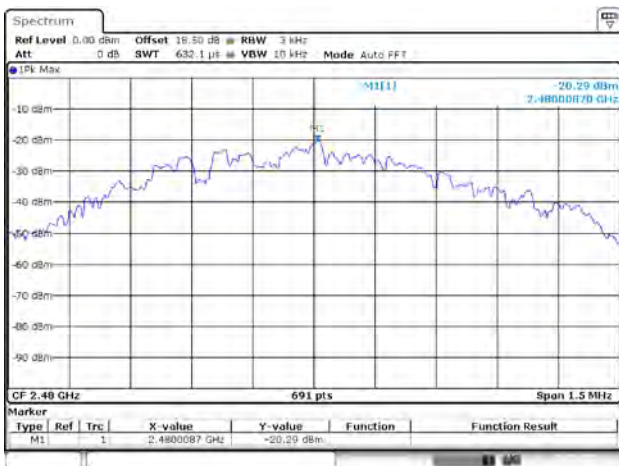
Date: 28 NOV 2014 15:22:35

#### MID CHANNEL



Date: 28 NOV 2014 15:21:21

#### HIGH CHANNEL



Date: 28 NOV 2014 15:19:01

## ANNEX B TEST SETUP PHOTOS

### B.1 Conducted Test Photo

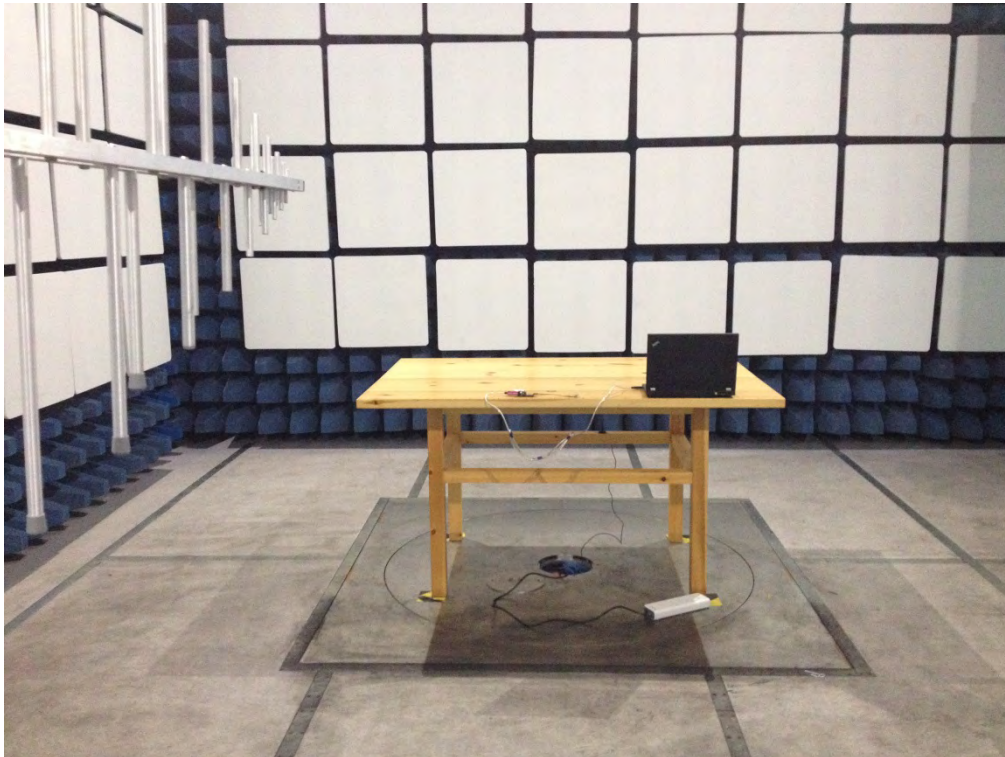




## B.2 Radiated Test Photo

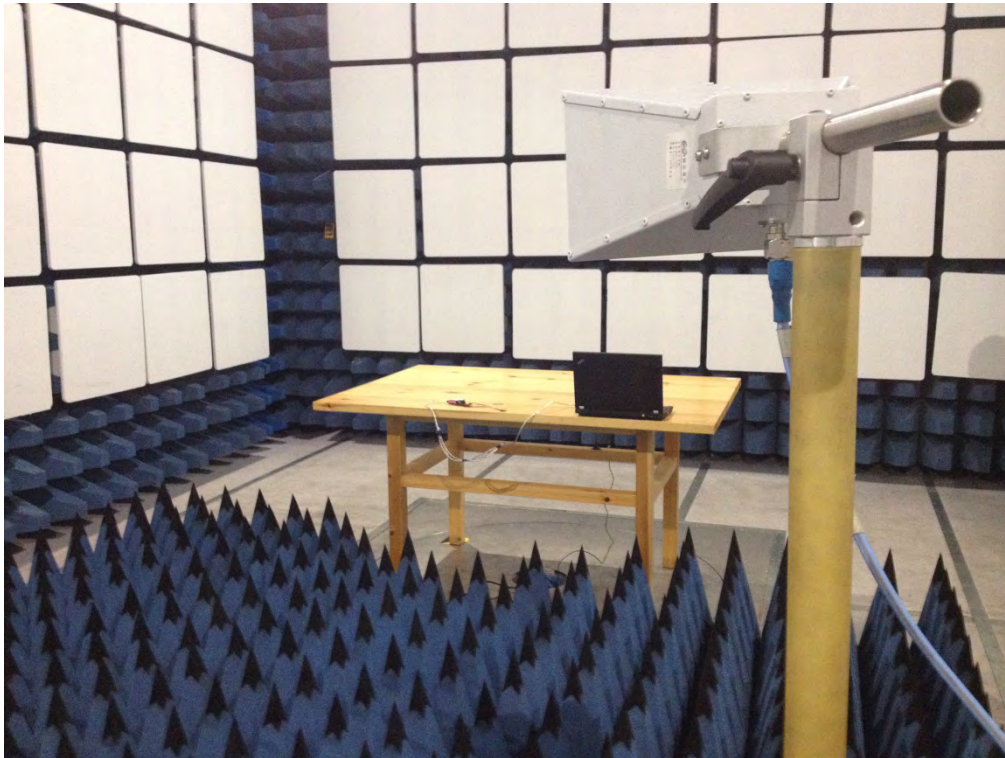


Below 30MHz



30MHz to 1GHz





Above 1GHz

## ANNEX C EUT PHOTOS

### C.1 Appearance of the EUT



THE FRONT OF EUT

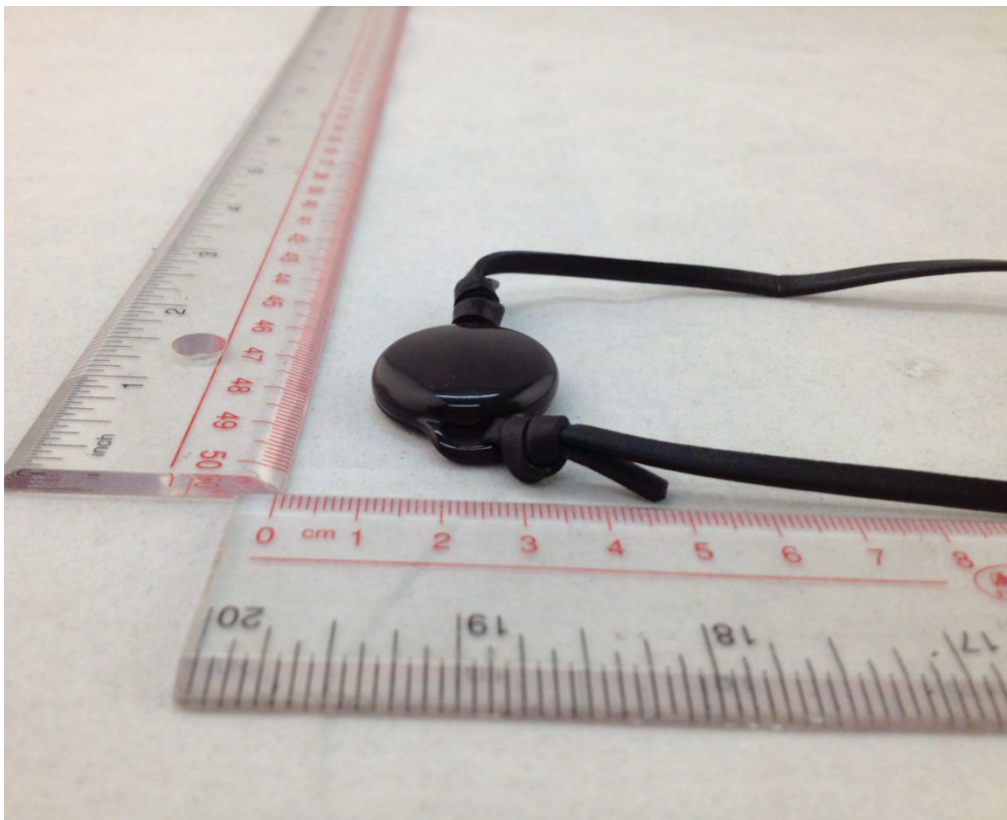


THE BACK OF EUT





THE LEFT OF EUT



THE RIGHT OF EUT



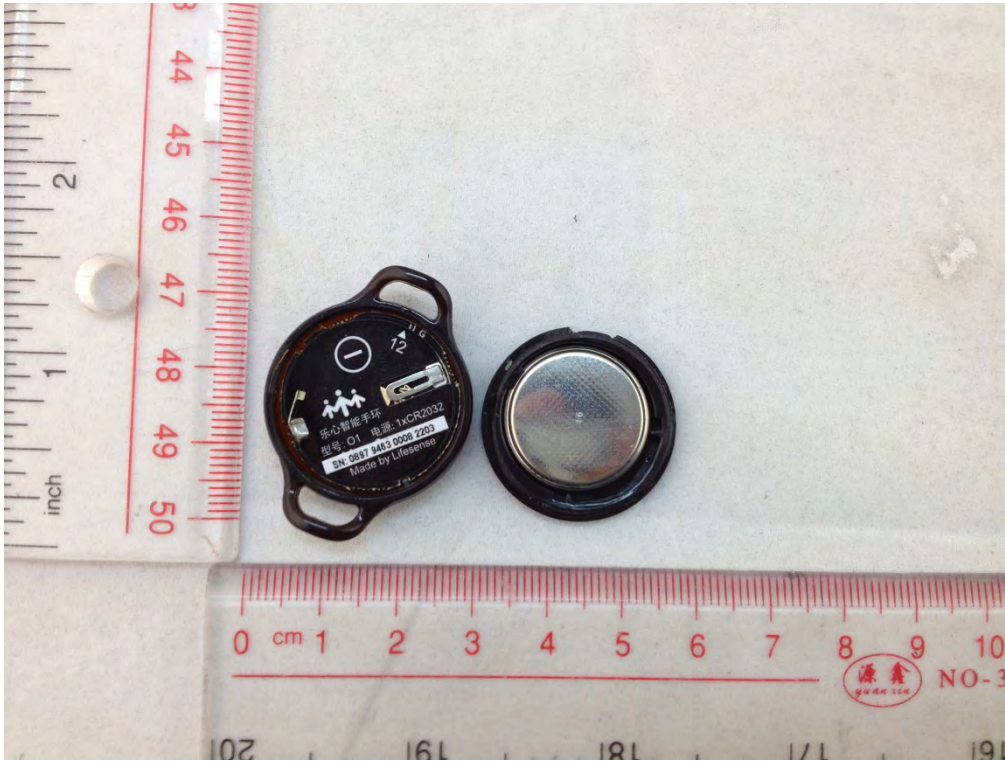
THE UP OF EUT



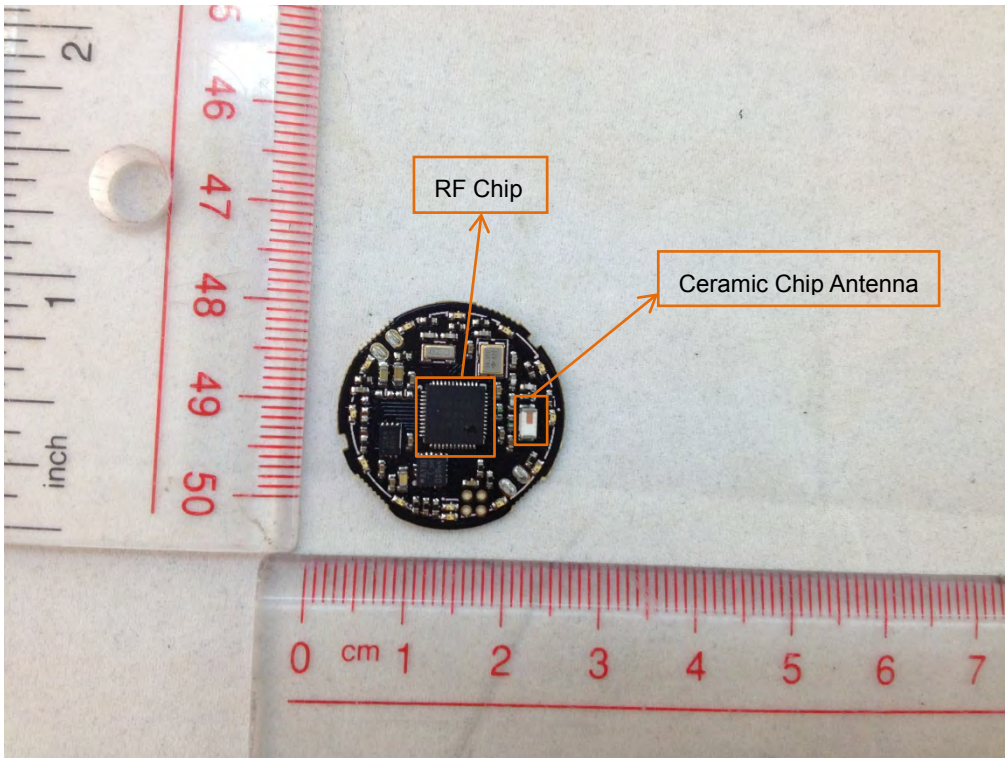
THE DOWN OF EUT



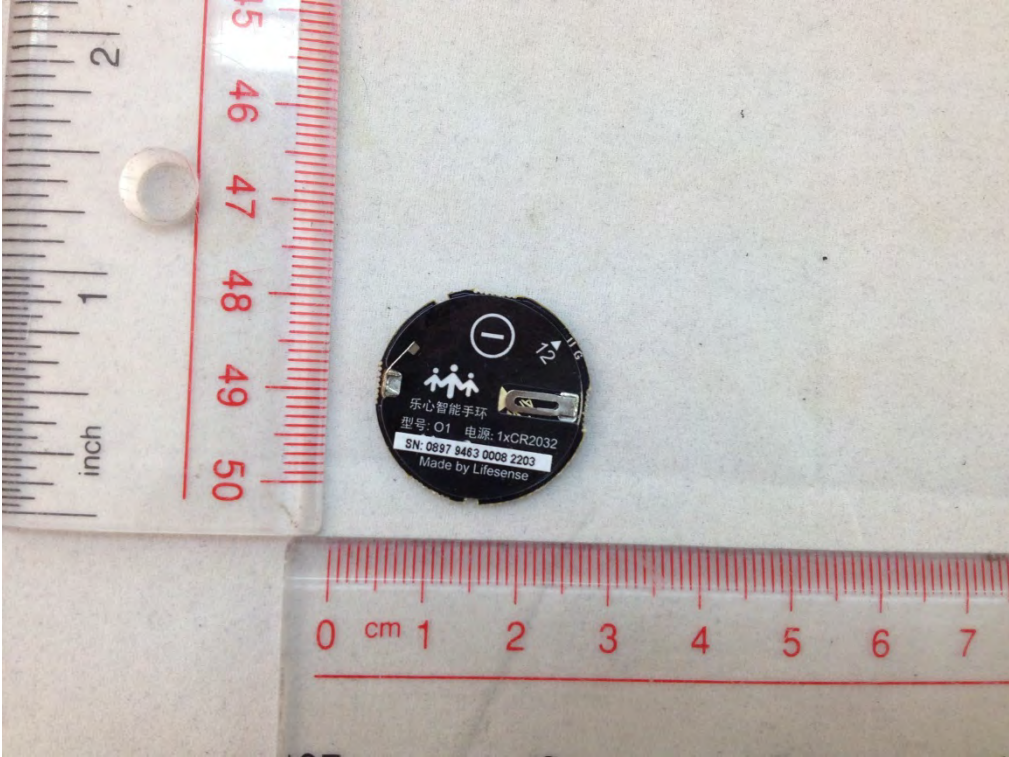
## C.2 Inside of the EUT



EUT UNCOVER VIEW 1



MAIN BOARD TOP VIEW 1



MAIN BOARD BACK VIEW 1



MAIN BOARD BACK VIEW 2

--END OF REPORT--