

# TEST REPORT

**Reference No.**..... : WTS15S1239750E  
**FCC ID** ..... : 2ACQ5SPB411AFOA  
**Applicant**..... : Revogi Innovation Co., Ltd.  
**Address**..... : 2018, Anhui Building, No. 6007, Shennan Boulevard, Shenzhen, Guangdong, China  
**Manufacturer** ..... : SKYRC Technology Co., Ltd.  
**Address**..... : 4/F, Building No. 6, Meitai Industry Park, Guangang South Road, Guihua, Guanlan, 518110, Baoan District, Shenzhen, CHINA  
**Product Name**..... : Smart Meter  
**Model No** ..... : SPB411  
**Brand**..... : Revogi  
**Standards**..... : FCC CFR47 Part 15 Section 15.247:2015  
**Date of Receipt sample** .... : Oct. 10, 2015  
**Date of Test** ..... : Oct. 24 - 28, 2015  
**Date of Issue**..... : Jan. 20, 2016  
**Test Result**..... : **Pass**

**Remarks:**

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

**Prepared By:**

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## 2 Test Summary

| Test Items                                                        | Test Requirement       | Result |
|-------------------------------------------------------------------|------------------------|--------|
| Radiated Emissions                                                | 15.205(a)<br>15.209(a) | PASS   |
| Conducted Emissions                                               | 15.207(a)              | PASS   |
| Bandwidth                                                         | 15.247(a)(2)           | PASS   |
| Maximum Peak Output Power                                         | 15.247(b)(3),(4)       | PASS   |
| Power Spectral Density                                            | 15.247(e)              | PASS   |
| Band Edge                                                         | 15.247(d)              | PASS   |
| Antenna Requirement                                               | 15.203                 | PASS   |
| Maximum Permissible Exposure<br>(Exposure of Humans to RF Fields) | 1.1307(b)(1)           | PASS   |

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## 4 General Information

### 4.1 General Description of E.U.T.

|                        |                                                            |
|------------------------|------------------------------------------------------------|
| Product Name:          | Smart Meter                                                |
| Model No.:             | SPB411                                                     |
| Model Difference:      | :N/A                                                       |
| Operation Frequency:   | :2402MHz ~ 2480MHz, separated by 2MHz,40 channels in total |
| The lowest oscillator: | :32.768kHz                                                 |
| Antenna Gain:          | 0 dBi                                                      |
| Type of modulation:    | :GFSK(BLE only)                                            |

### 4.2 Details of E.U.T.

|                |                              |
|----------------|------------------------------|
| Technical Data | :Ratings 100-120VAC 60Hz 15A |
|----------------|------------------------------|

### 4.3 Channel List

| Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) |
|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|
| 0           | 2402            | 1           | 2404            | 2           | 2406            | 3           | 2408            |
| 4           | 2410            | 5           | 2412            | 6           | 2414            | 7           | 2416            |
| 8           | 2418            | 9           | 2420            | 10          | 2422            | 11          | 2424            |
| 12          | 2426            | 13          | 2428            | 14          | 2430            | 15          | 2432            |
| 16          | 2434            | 17          | 2436            | 18          | 2438            | 19          | 2440            |
| 20          | 2442            | 21          | 2444            | 22          | 2446            | 23          | 2448            |
| 24          | 2450            | 25          | 2452            | 26          | 2454            | 27          | 2456            |
| 28          | 2458            | 29          | 2460            | 30          | 2462            | 31          | 2464            |
| 32          | 2466            | 33          | 2468            | 34          | 2470            | 35          | 2472            |
| 36          | 2474            | 37          | 2476            | 38          | 2478            | 39          | 2480            |

### 4.4 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Table 1 Tests Carried Out Under FCC part 15.247

| Test mode    | Low channel | Middle channel | High channel |
|--------------|-------------|----------------|--------------|
| Transmitting | 2402MHz     | 2440MHz        | 2480MHz      |

#### 4.5 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: 7760A-1**

Waltek Services(Shenzhen) Co., Ltd. Has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration number 7760A-1, October 15, 2015.

- **FCC Test Site 1#– Registration No.: 880581**

Waltek Services(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 880581, April 29, 2014.

- **FCC Test Site 2#– Registration No.: 328995**

Waltek Services(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 328995, December 3, 2014.

## 5 Equipment Used during Test

### 5.1 Equipments List

| Conducted Emissions Test Site 1#                              |                            |                                  |              |                 |                       |                      |
|---------------------------------------------------------------|----------------------------|----------------------------------|--------------|-----------------|-----------------------|----------------------|
| Item                                                          | Equipment                  | Manufacturer                     | Model No.    | Serial No.      | Last Calibration Date | Calibration Due Date |
| 1.                                                            | EMI Test Receiver          | R&S                              | ESCI         | 100947          | Sep.15,2015           | Sep.14,2016          |
| 2.                                                            | LISN                       | R&S                              | ENV216       | 101215          | Sep.15,2015           | Sep.14,2016          |
| 3.                                                            | Cable                      | Top                              | TYPE16(3.5M) | -               | Sep.15,2015           | Sep.14,2016          |
| Conducted Emissions Test Site 2#                              |                            |                                  |              |                 |                       |                      |
| Item                                                          | Equipment                  | Manufacturer                     | Model No.    | Serial No.      | Last Calibration Date | Calibration Due Date |
| 1.                                                            | EMI Test Receiver          | R&S                              | ESCI         | 101155          | Sep.15,2015           | Sep.14,2016          |
| 2.                                                            | LISN                       | SCHWARZBECK                      | NSLK 8128    | 8128-289        | Sep.15,2015           | Sep.14,2016          |
| 3.                                                            | Limiter                    | York                             | MTS-IMP-136  | 261115-001-0024 | Sep.15,2015           | Sep.14,2016          |
| 4.                                                            | Cable                      | LARGE                            | RF300        | -               | Sep.15,2015           | Sep.14,2016          |
| 3m Semi-anechoic Chamber for Radiation Emissions Test site 1# |                            |                                  |              |                 |                       |                      |
| Item                                                          | Equipment                  | Manufacturer                     | Model No.    | Serial No.      | Last Calibration Date | Calibration Due Date |
| 1                                                             | EMC Analyzer               | Agilent                          | E7405A       | MY45114943      | Sep.15,2015           | Sep.14,2016          |
| 2                                                             | Active Loop Antenna        | Beijing Dazhi                    | ZN30900A     | -               | Sep.15,2015           | Sep.14,2016          |
| 3                                                             | Trilog Broadband Antenna   | SCHWARZBECK                      | VULB9163     | 336             | Apr.19,2015           | Apr.18,2016          |
| 4                                                             | Coaxial Cable (below 1GHz) | Top                              | TYPE16(13M)  | -               | Sep.15,2015           | Sep.14,2016          |
| 5                                                             | Broad-band Horn Antenna    | SCHWARZBECK                      | BBHA 9120 D  | 667             | Apr.19,2015           | Apr.18,2016          |
| 6                                                             | Broad-band Horn Antenna    | SCHWARZBECK                      | BBHA 9170    | 335             | Apr.19,2015           | Apr.18,2016          |
| 7                                                             | Broadband Preamplifier     | COMPLIANCE DIRECTION             | PAP-1G18     | 2004            | Mar.17,2015           | Mar.16,2016          |
| 8                                                             | Coaxial Cable (above 1GHz) | Top                              | 1GHz-25GHz   | EW02014-7       | Apr.10,2015           | Apr.09,2016          |
| 3m Semi-anechoic Chamber for Radiation Emissions Test site 2# |                            |                                  |              |                 |                       |                      |
| Item                                                          | Equipment                  | Manufacturer                     | Model No.    | Serial No       | Last Calibration Date | Calibration Due Date |
| 1                                                             | Test Receiver              | R&S                              | ESCI         | 101296          | Sep.15,2015           | Sep.14,2016          |
| 2                                                             | Trilog Broadband Antenna   | SCHWARZBECK                      | VULB9160     | 9160-3325       | Sep.15,2015           | Sep.14,2016          |
| 3                                                             | Amplifier                  | Compliance pirection systems inc | PAP-0203     | 22024           | Sep.15,2015           | Sep.14,2016          |
| 4                                                             | Cable                      | HUBER+SUHNER                     | CBL2         | 525178          | Sep.15,2015           | Sep.14,2016          |

| RF Conducted Testing |                                 |              |           |            |                       |                      |
|----------------------|---------------------------------|--------------|-----------|------------|-----------------------|----------------------|
| Item                 | Equipment                       | Manufacturer | Model No. | Serial No. | Last Calibration Date | Calibration Due Date |
| 1.                   | EMC Analyzer<br>(9k~26.5GHz)    | Agilent      | E7405A    | MY45114943 | Sep.15,2015           | Sep.14,2016          |
| 2.                   | Spectrum Analyzer<br>(9k-6GHz)  | R&S          | FSL6      | 100959     | Sep.15,2015           | Sep.14,2016          |
| 3.                   | Signal Analyzer<br>(9k~26.5GHz) | Agilent      | N9010A    | MY50520207 | Sep.15,2015           | Sep.14,2016          |

## 5.2 Description of Support Units

| Equipment  | permanent assets | Note      |
|------------|------------------|-----------|
| Light Load | Waltek           | Max 1800W |

## 5.3 Measurement Uncertainty

| Parameter                         | Uncertainty                                 |
|-----------------------------------|---------------------------------------------|
| Radio Frequency                   | $\pm 1 \times 10^{-6}$                      |
| RF Power                          | $\pm 1.0$ dB                                |
| RF Power Density                  | $\pm 2.2$ dB                                |
| Radiated Spurious Emissions test  | $\pm 5.03$ dB (Bilog antenna 30M~1000MHz)   |
|                                   | $\pm 4.74$ dB (Horn antenna 1000M~25000MHz) |
| Conducted Spurious Emissions test | $\pm 3.64$ dB (AC mains 150KHz~30MHz)       |

## 5.4 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

## 6 Conducted Emission

|                   |                                                                                                                        |
|-------------------|------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | FCC CFR 47 Part 15 Section 15.207                                                                                      |
| Test Method:      | ANSI C63.10:2013                                                                                                       |
| Test Result:      | PASS                                                                                                                   |
| Frequency Range:  | 150kHz to 30MHz                                                                                                        |
| Class/Severity:   | Class B                                                                                                                |
| Limit:            | 66-56 dB $\mu$ V between 0.15MHz & 0.5MHz<br>56 dB $\mu$ V between 0.5MHz & 5MHz<br>60 dB $\mu$ V between 5MHz & 30MHz |
| Detector:         | Peak for pre-scan (9kHz Resolution Bandwidth)                                                                          |

### 6.1 E.U.T. Operation

Operating Environment :

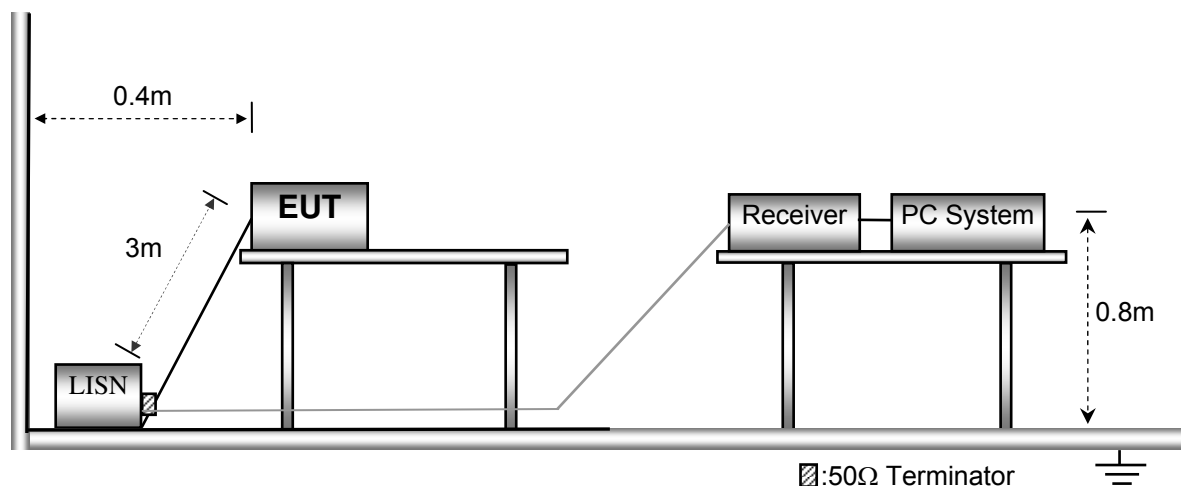
|                       |          |
|-----------------------|----------|
| Temperature:          | 25.5 °C  |
| Humidity:             | 51 % RH  |
| Atmospheric Pressure: | 101.2kPa |

EUT Operation :

The test was performed in Transmitting mode, the test data were shown in the report.

### 6.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2013.

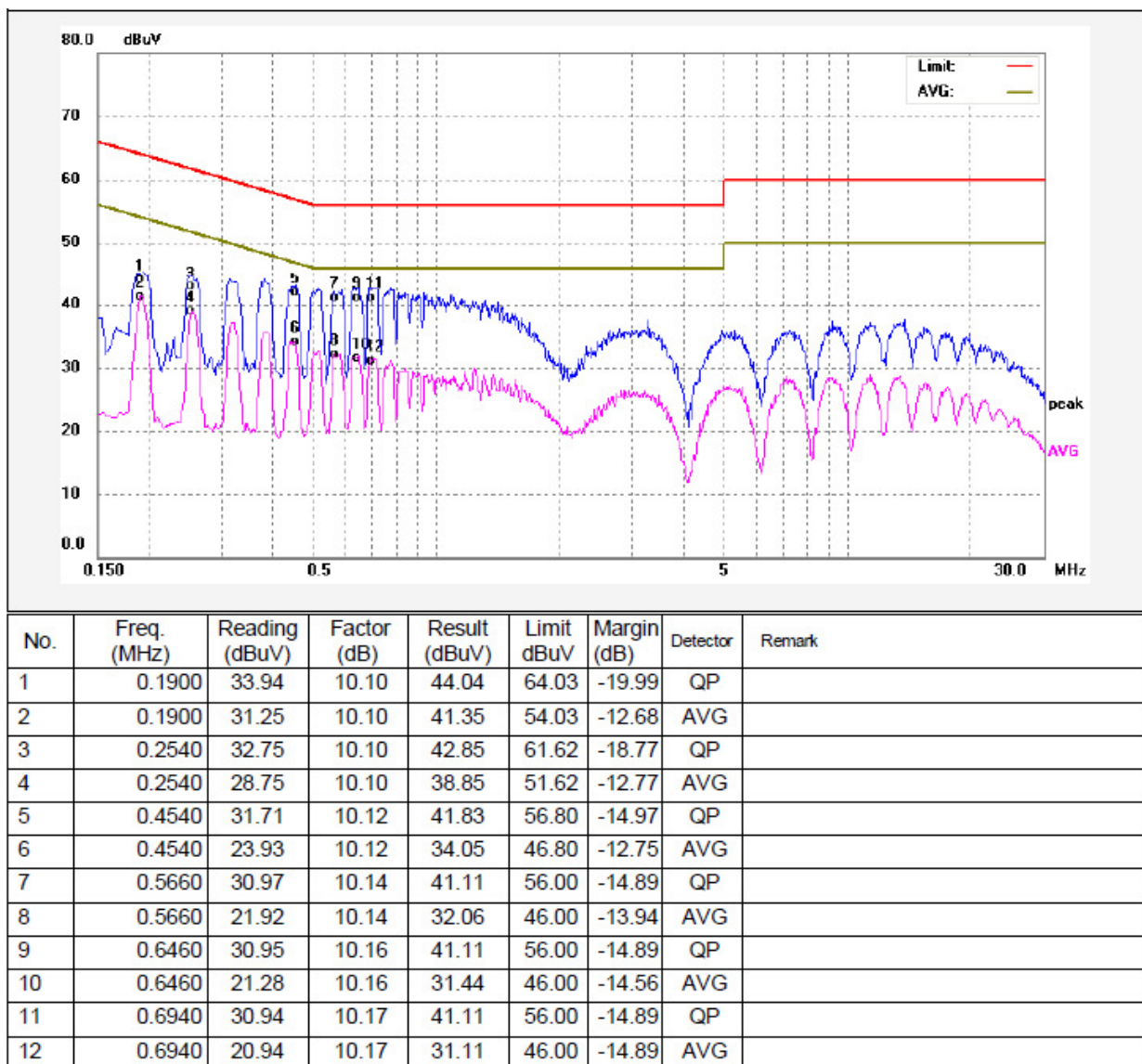


### 6.3 Measurement Description

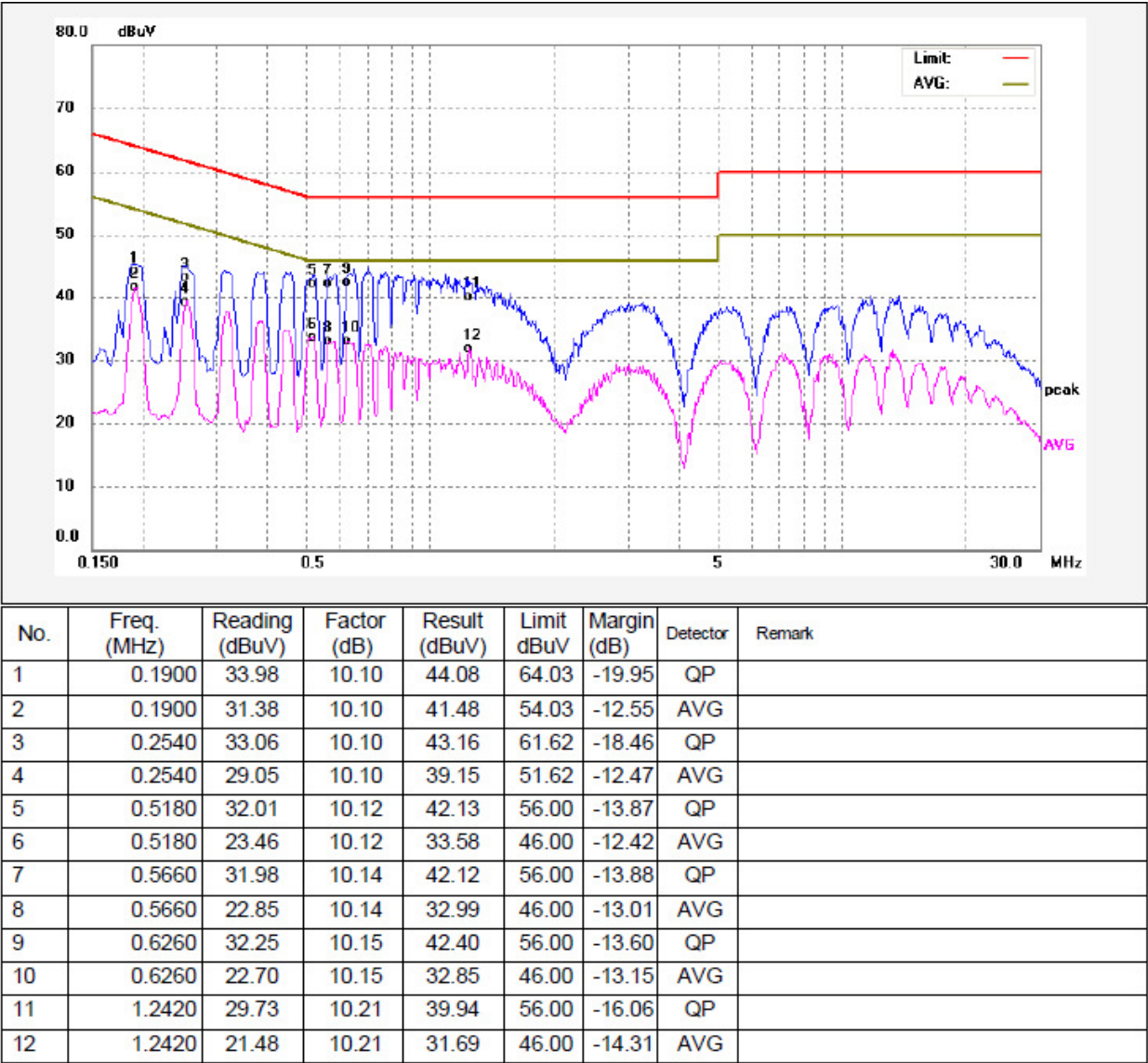
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

## 6.4 Conducted Emission Test Result

Live line:



Neutral line:



## 7 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: 558074 D01 DTS Meas Guidance v03r03 & ANSI C63.10:2013

Test Result: PASS

Measurement Distance: 3m

Limit:

| Frequency<br>(MHz) | Field Strength        |                 | Field Strength Limit at 3m Measurement Dist |                                       |
|--------------------|-----------------------|-----------------|---------------------------------------------|---------------------------------------|
|                    | uV/m                  | Distance<br>(m) | uV/m                                        | dBuV/m                                |
| 0.009 ~ 0.490      | $2400/F(\text{kHz})$  | 300             | $10000 * 2400/F(\text{kHz})$                | $20\log^{(2400/F(\text{kHz}))} + 80$  |
| 0.490 ~ 1.705      | $24000/F(\text{kHz})$ | 30              | $100 * 24000/F(\text{kHz})$                 | $20\log^{(24000/F(\text{kHz}))} + 40$ |
| 1.705 ~ 30         | 30                    | 30              | $100 * 30$                                  | $20\log^{(30)} + 40$                  |
| 30 ~ 88            | 100                   | 3               | 100                                         | $20\log^{(100)}$                      |
| 88 ~ 216           | 150                   | 3               | 150                                         | $20\log^{(150)}$                      |
| 216 ~ 960          | 200                   | 3               | 200                                         | $20\log^{(200)}$                      |
| Above 960          | 500                   | 3               | 500                                         | $20\log^{(500)}$                      |

### 7.1 EUT Operation

Operating Environment:

Temperature: 25.5 °C

Humidity: 51 % RH

Atmospheric Pressure: 1016 mbar

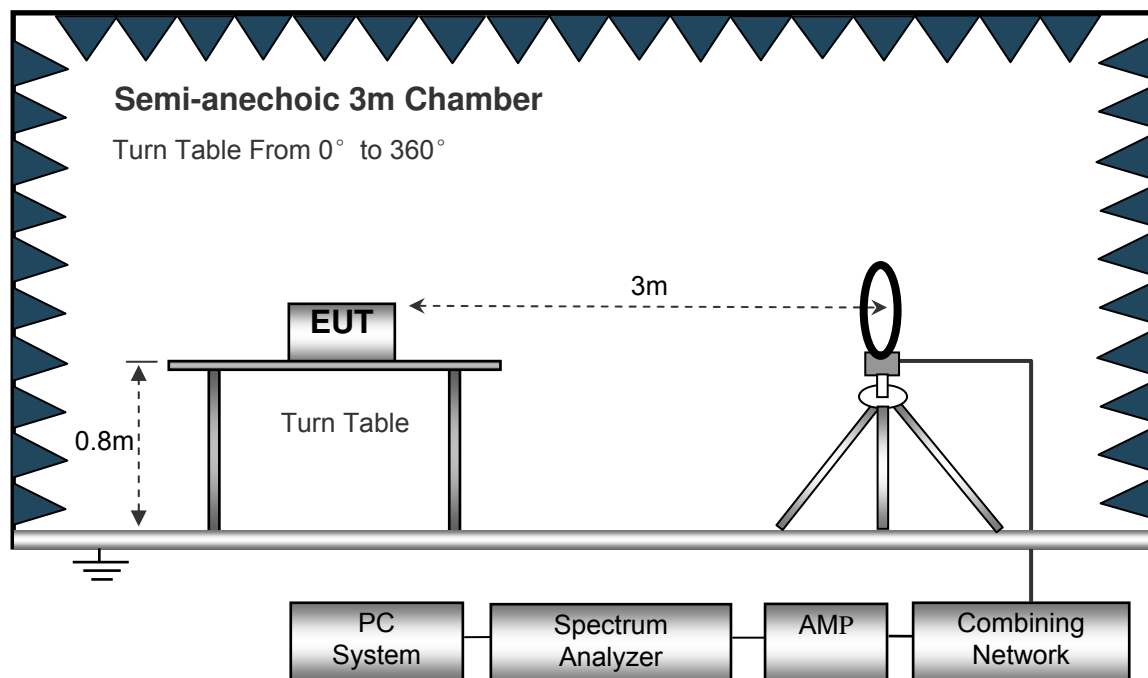
EUT Operation:

The test was performed in transmitting mode, the test data were shown in the report.

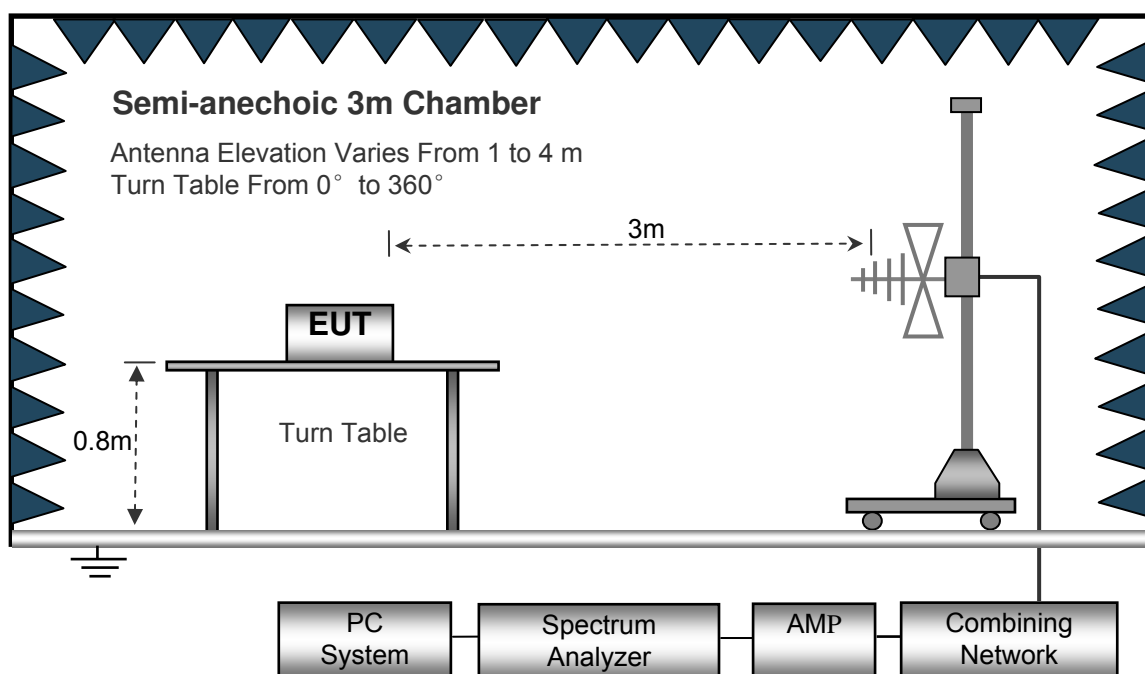
## 7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10: 2013.

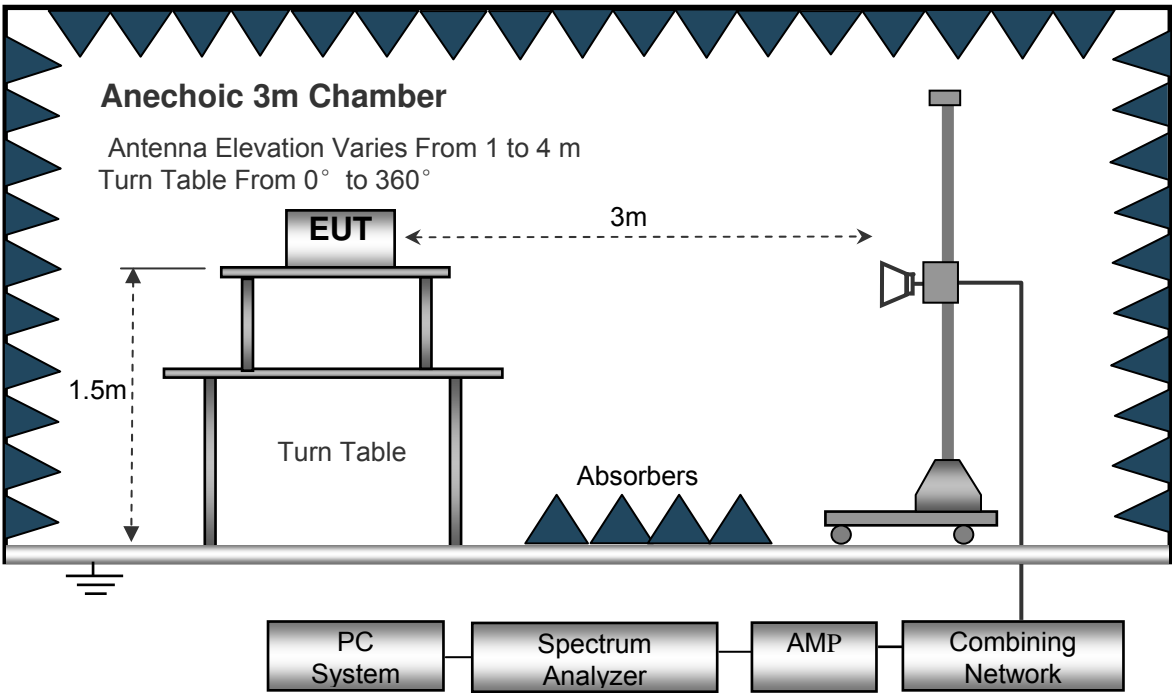
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



### 7.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed ..... Auto  
IF Bandwidth.....10kHz  
Video Bandwidth.....10kHz  
Resolution Bandwidth.....10kHz

30MHz ~ 1GHz

Sweep Speed ..... Auto  
Detector ..... PK  
Resolution Bandwidth.....100kHz  
Video Bandwidth.....300kHz

Above 1GHz

Sweep Speed ..... Auto  
Detector ..... PK  
Resolution Bandwidth.....1MHz  
Video Bandwidth.....3MHz  
Detector ..... Ave.  
Resolution Bandwidth.....1MHz  
Video Bandwidth.....10Hz

## 7.4 Test Procedure

1. The EUT is placed on a turntable. For below 1GHz, the EUT is 0.8m above ground plane; For above 1GHz, the EUT is 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

## 7.5 Summary of Test Results

### Test Frequency: 32.768KHz~ 30MHz

The measurements were more than 20 dB below the limit and not reported.

### Test Frequency: 30MHz ~ 18GHz

| Frequency        | Receiver Reading | Detector    | Turn table Angle | RX Antenna |       | Corrected Factor | Corrected Amplitude | Limit    | Margin |
|------------------|------------------|-------------|------------------|------------|-------|------------------|---------------------|----------|--------|
|                  |                  |             |                  | Height     | Polar |                  |                     |          |        |
| (MHz)            | (dBμV)           | (PK/QP/Ave) | Degree           | (m)        | (H/V) | (dB)             | (dBμV/m)            | (dBμV/m) | (dB)   |
| GFSK Low Channel |                  |             |                  |            |       |                  |                     |          |        |
| 268.20           | 36.55            | QP          | 64               | 1.7        | H     | -13.35           | 23.20               | 46.00    | -22.80 |
| 268.20           | 42.63            | QP          | 33               | 1.6        | V     | -13.35           | 29.28               | 46.00    | -16.72 |
| 4804.00          | 46.72            | PK          | 18               | 1.7        | V     | -1.06            | 45.66               | 74.00    | -28.34 |
| 4804.00          | 44.61            | Ave         | 18               | 1.7        | V     | -1.06            | 43.55               | 54.00    | -10.45 |
| 7206.00          | 40.20            | PK          | 155              | 1.3        | H     | 1.33             | 41.53               | 74.00    | -32.47 |
| 7206.00          | 34.95            | Ave         | 155              | 1.3        | H     | 1.33             | 36.28               | 54.00    | -17.72 |
| 2315.65          | 46.28            | PK          | 219              | 1.4        | V     | -13.19           | 33.09               | 74.00    | -40.91 |
| 2315.65          | 38.03            | Ave         | 219              | 1.4        | V     | -13.19           | 24.84               | 54.00    | -29.16 |
| 2381.49          | 43.82            | PK          | 146              | 1.1        | H     | -13.14           | 30.68               | 74.00    | -43.32 |
| 2381.49          | 37.12            | Ave         | 146              | 1.1        | H     | -13.14           | 23.98               | 54.00    | -30.02 |
| 2489.53          | 43.64            | PK          | 305              | 1.3        | V     | -13.08           | 30.56               | 74.00    | -43.44 |
| 2489.53          | 37.15            | Ave         | 305              | 1.3        | V     | -13.08           | 24.07               | 54.00    | -29.93 |

| Frequency           | Receiver Reading | Detector    | Turn table Angle | RX Antenna |       | Corrected Factor | Corrected Amplitude | Limit    | Margin |
|---------------------|------------------|-------------|------------------|------------|-------|------------------|---------------------|----------|--------|
|                     |                  |             |                  | Height     | Polar |                  |                     |          |        |
| (MHz)               | (dBμV)           | (PK/QP/Ave) | Degree           | (m)        | (H/V) | (dB)             | (dBμV/m)            | (dBμV/m) | (dB)   |
| GFSK Middle Channel |                  |             |                  |            |       |                  |                     |          |        |
| 268.20              | 35.97            | QP          | 16               | 1.4        | H     | -13.35           | 22.62               | 46.00    | -23.38 |
| 268.20              | 42.59            | QP          | 280              | 1.5        | V     | -13.35           | 29.24               | 46.00    | -16.76 |
| 4880.00             | 45.50            | PK          | 110              | 1.2        | V     | -0.62            | 44.88               | 74.00    | -29.12 |
| 4880.00             | 44.00            | Ave         | 110              | 1.2        | V     | -0.62            | 43.38               | 54.00    | -10.62 |
| 7320.00             | 41.55            | PK          | 156              | 1.4        | H     | 2.21             | 43.76               | 74.00    | -30.24 |
| 7320.00             | 34.03            | Ave         | 156              | 1.4        | H     | 2.21             | 36.24               | 54.00    | -17.76 |
| 2318.99             | 46.20            | PK          | 109              | 1.5        | V     | -13.19           | 33.01               | 74.00    | -40.99 |
| 2318.99             | 39.15            | Ave         | 109              | 1.5        | V     | -13.19           | 25.96               | 54.00    | -28.04 |
| 2377.44             | 42.12            | PK          | 301              | 1.5        | H     | -13.14           | 28.98               | 74.00    | -45.02 |
| 2377.44             | 37.61            | Ave         | 301              | 1.5        | H     | -13.14           | 24.47               | 54.00    | -29.53 |
| 2492.81             | 44.09            | PK          | 171              | 1.1        | V     | -13.08           | 31.01               | 74.00    | -42.99 |
| 2492.81             | 38.99            | Ave         | 171              | 1.1        | V     | -13.08           | 25.91               | 54.00    | -28.09 |

| Frequency         | Receiver Reading | Detector    | Turn table Angle | RX Antenna |       | Corrected Factor | Corrected Amplitude | Limit          | Margin |
|-------------------|------------------|-------------|------------------|------------|-------|------------------|---------------------|----------------|--------|
|                   |                  |             |                  | Height     | Polar |                  |                     |                |        |
| (MHz)             | (dB $\mu$ V)     | (PK/QP/Ave) | Degree           | (m)        | (H/V) | (dB)             | (dB $\mu$ V/m)      | (dB $\mu$ V/m) | (dB)   |
| GFSK High Channel |                  |             |                  |            |       |                  |                     |                |        |
| 268.20            | 36.55            | QP          | 229              | 1.4        | H     | -13.35           | 23.20               | 46.00          | -22.80 |
| 268.20            | 43.07            | QP          | 83               | 1.0        | V     | -13.35           | 29.72               | 46.00          | -16.28 |
| 4960.00           | 44.98            | PK          | 63               | 1.2        | V     | -0.24            | 44.74               | 74.00          | -29.26 |
| 4960.00           | 44.15            | Ave         | 63               | 1.2        | V     | -0.24            | 43.91               | 54.00          | -10.09 |
| 7440.00           | 42.13            | PK          | 245              | 1.2        | H     | 2.84             | 44.97               | 74.00          | -29.03 |
| 7440.00           | 34.87            | Ave         | 245              | 1.2        | H     | 2.84             | 37.71               | 54.00          | -16.29 |
| 2343.83           | 46.34            | PK          | 214              | 1.5        | V     | -13.19           | 33.15               | 74.00          | -40.85 |
| 2343.83           | 39.10            | Ave         | 214              | 1.5        | V     | -13.19           | 25.91               | 54.00          | -28.09 |
| 2365.20           | 43.21            | PK          | 220              | 1.4        | H     | -13.14           | 30.07               | 74.00          | -43.93 |
| 2365.20           | 37.20            | Ave         | 220              | 1.4        | H     | -13.14           | 24.06               | 54.00          | -29.94 |
| 2497.18           | 42.35            | PK          | 316              | 1.2        | V     | -13.08           | 29.27               | 74.00          | -44.73 |
| 2497.18           | 38.54            | Ave         | 316              | 1.2        | V     | -13.08           | 25.46               | 54.00          | -28.54 |

**Test Frequency: 18GHz~25GHz**

The measurements were more than 20 dB below the limit and not reported

## 8 Band Edge Measurement

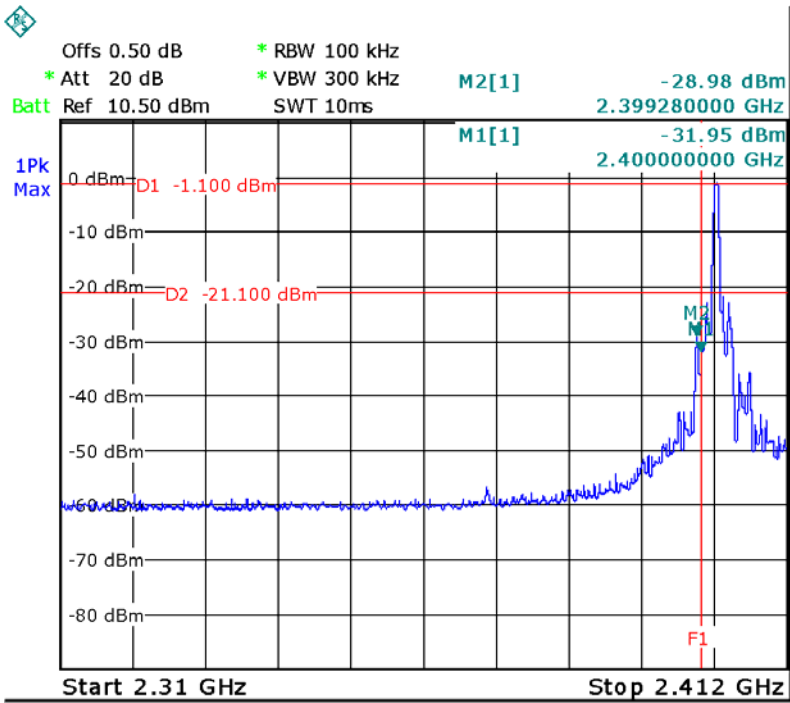
|                   |                                                                                                                                                                                                                         |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) and 15.205(c). |
| Test Method:      | 558074 D01 DTS Meas Guidance v03r03 June 9, 2015                                                                                                                                                                        |
| Test Mode:        | Transmitting                                                                                                                                                                                                            |

### 8.1 Test Produce

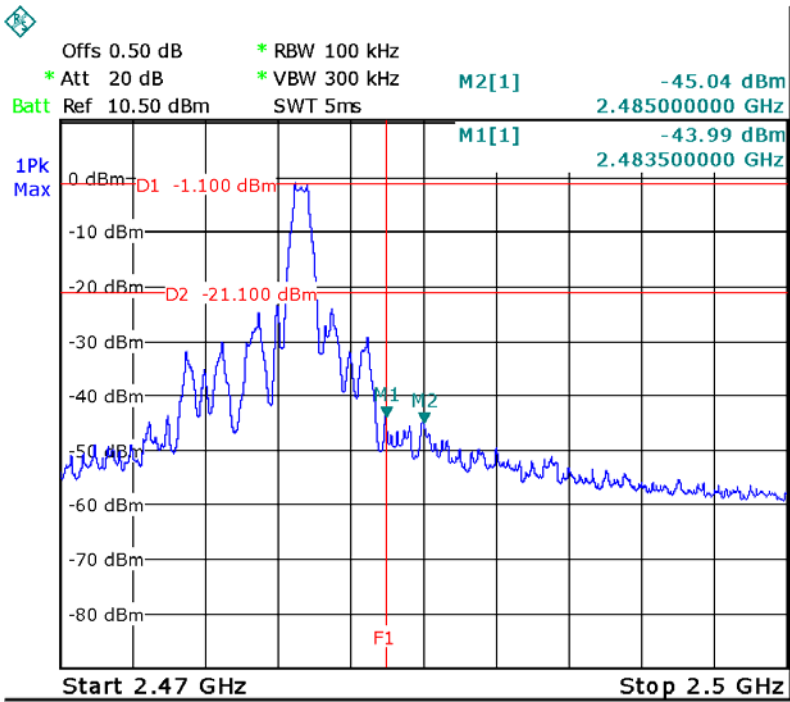
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto  
  
Detector function = peak, Trace = max hold
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

8.2 Test Result

Band edge-left side



Band edge-right side



## 9 Bandwidth Measurement

Test Requirement:

FCC CFR47 Part 15 Section 15.247

Test Method:

558074 D01 DTS Meas Guidance v03r03 June 9, 2015

### 9.1 Test Procedure

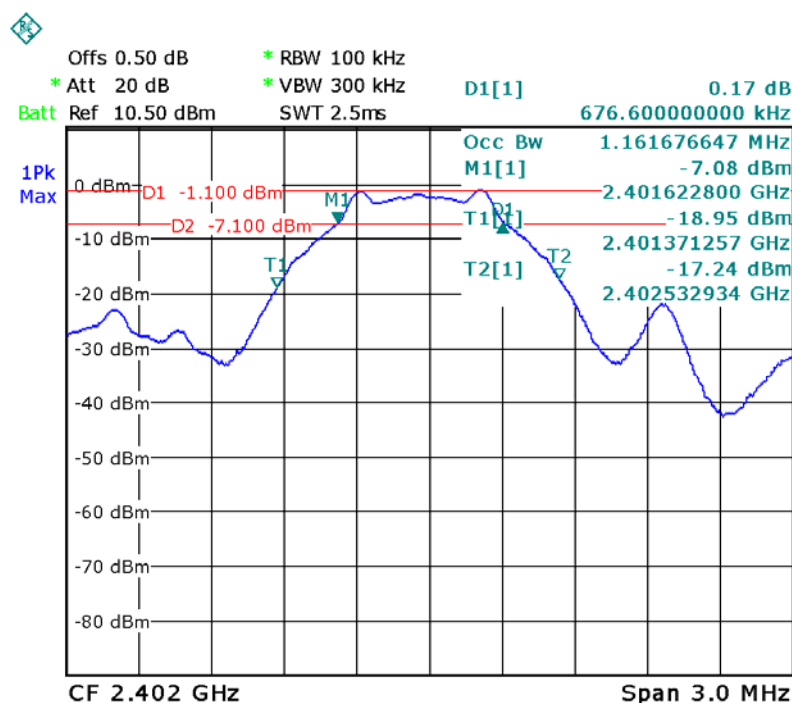
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

### 9.2 Test Result:

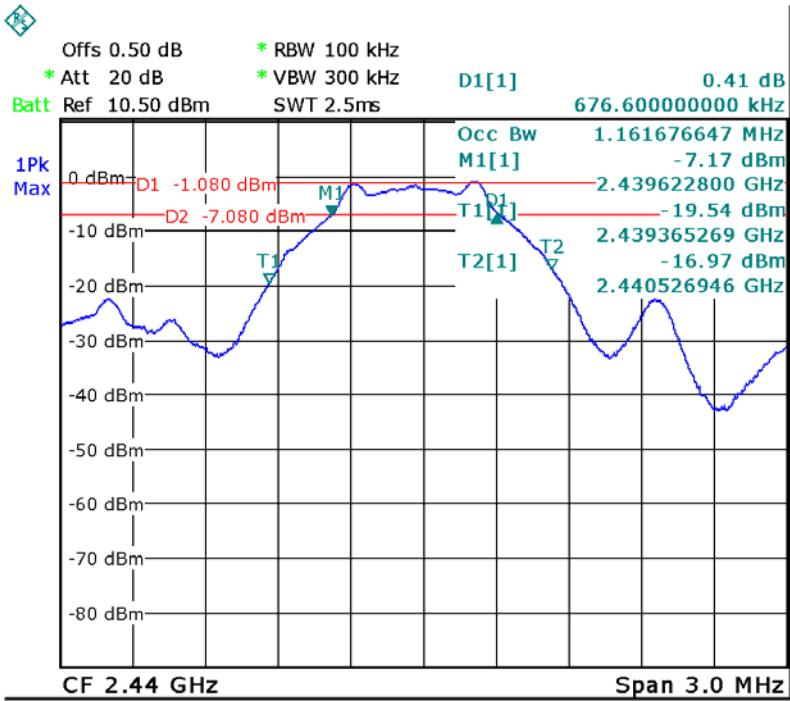
| Operation mode | 6dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|----------------|---------------------|---------------------|
| Low channel    | 0.6766              | 1.1617              |
| Middle channel | 0.6766              | 1.1617              |
| High channel   | 0.6766              | 1.1377              |

Test result plot as follows:

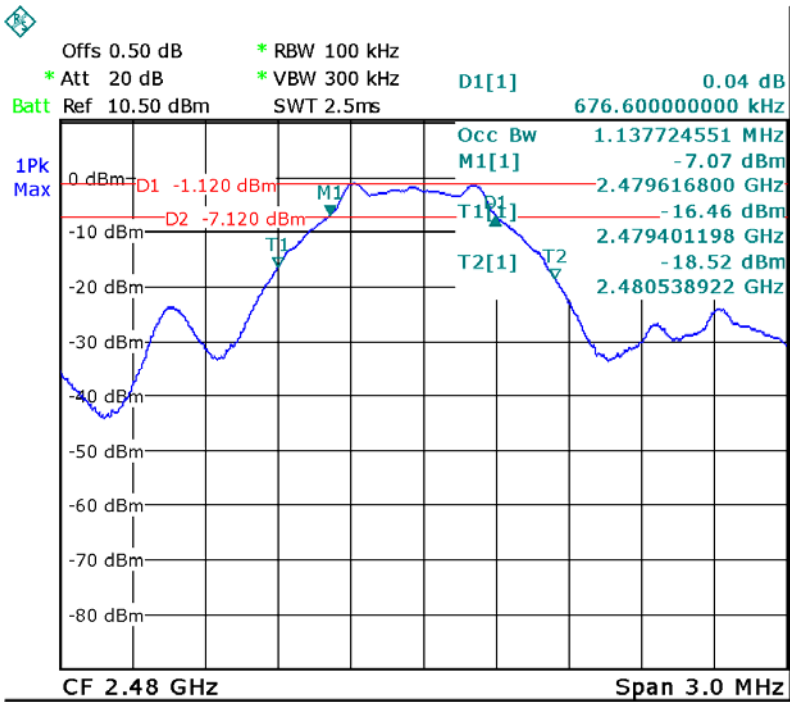
Mode: Low channel



Mode: Middle channel



Mode: High channel



## 10 Maximum Peak Output Power

Test Requirement:

FCC CFR47 Part 15 Section 15.247

Test Method:

558074 D01 DTS Meas Guidance v03r03 June 9, 2015

### 10.1 Test Procedure

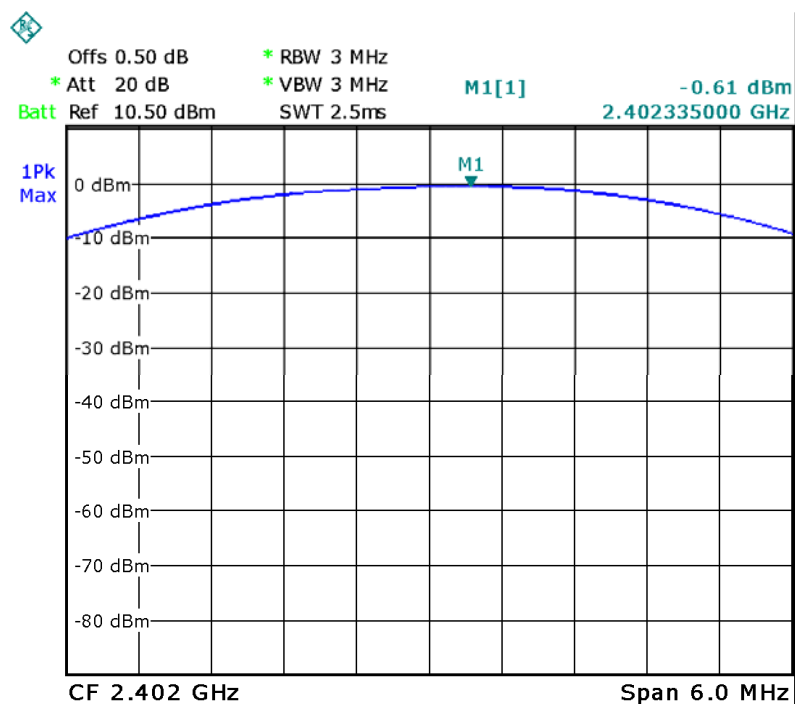
558074 D01 DTS Meas Guidance v03r03 June 9, 2015 section 9.1.1

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3MHz. VBW = 3MHz. Sweep = auto; Detector Function = Peak, Set the span to fully encompass the DTS bandwidth.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

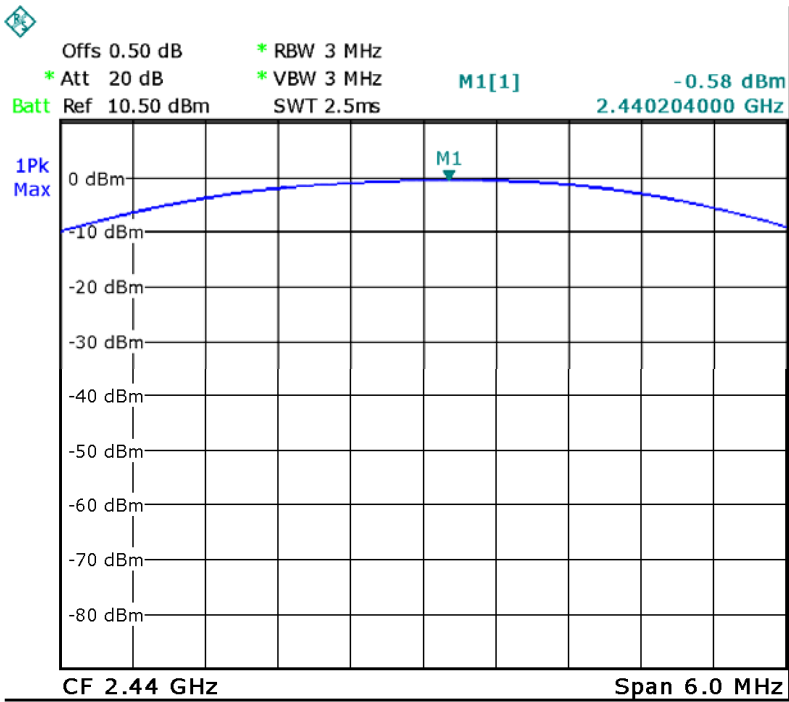
### 10.2 Test Result

| Maximum Peak Output Power (dBm) |                |              |
|---------------------------------|----------------|--------------|
| Low channel                     | Middle channel | High channel |
| -0.61                           | -0.58          | -0.57        |
| Limit : 1W/30dBm                |                |              |

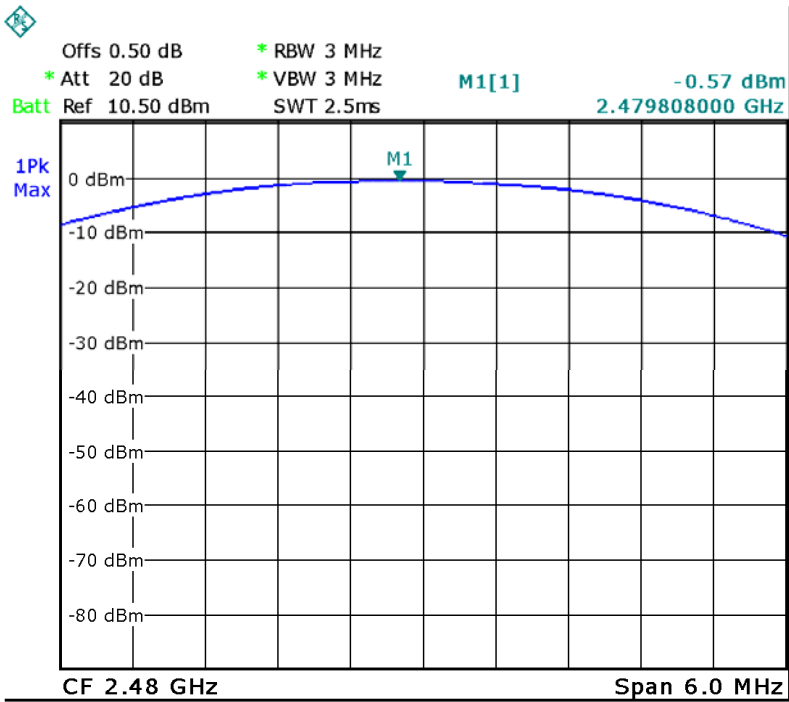
Test mode: Low channel



Test mode :Middle channel



Test mode: High channel



## 11 Power Spectral density

Test Requirement:

FCC CFR47 Part 15 Section 15.247

Test Method:

558074 D01 DTS Meas Guidance v03r03 June 9, 2015

### 11.1 Test Procedure

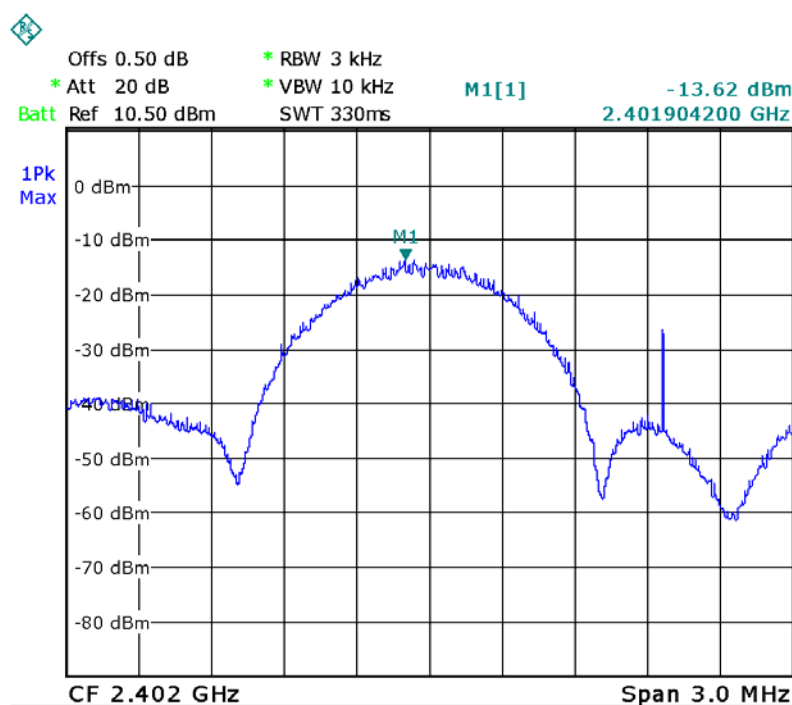
558074 D01 DTS Meas Guidance v03r03 June 9, 2015 section 10.2

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3kHz. VBW = 10kHz , Span = 1.5 times the DTS channel bandwidth(6 dB bandwidth). Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section  
Submit this plot.

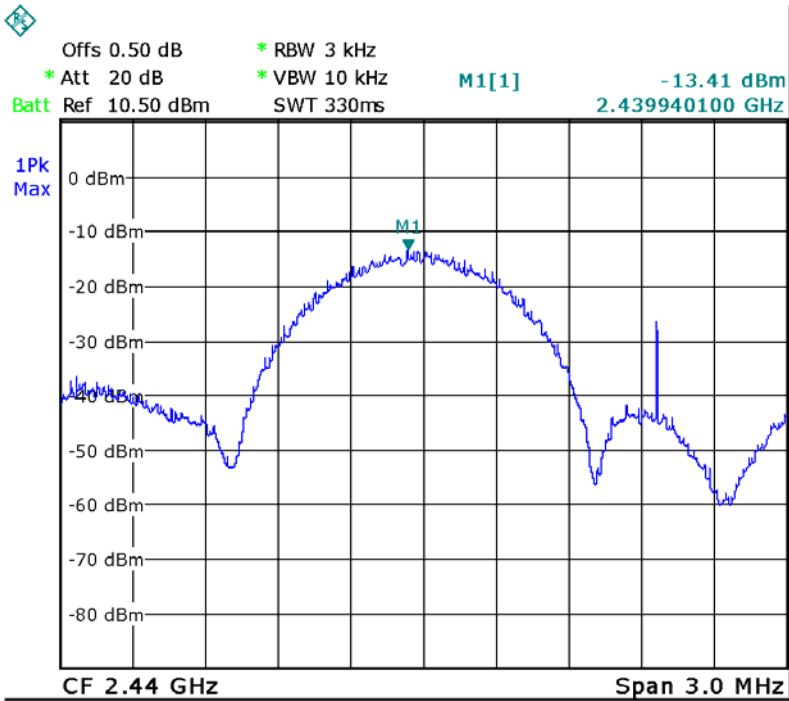
### 11.2 Test Result

| Power Spectral Density |                |              |
|------------------------|----------------|--------------|
| Low channel            | Middle channel | High channel |
| -13.62                 | -13.41         | -12.65       |
| Limit : 8dBm per 3kHz  |                |              |

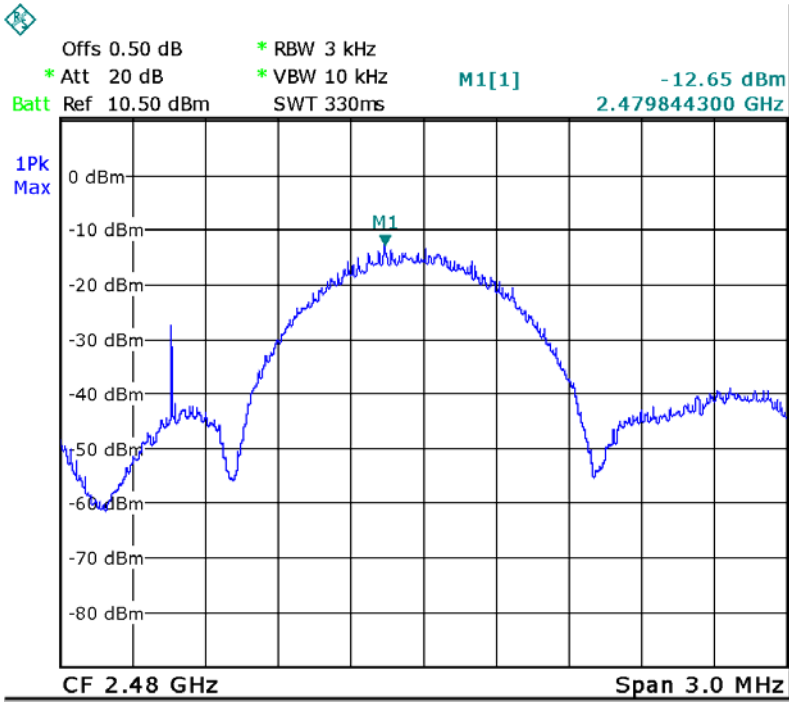
Test mode: Low channel



Test mode: Middle channel



Test mode: High channel



## **12 Antenna Requirement**

According to the FCC Part 15 Paragraph 15.203, 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. This product has a PCB printed antenna, fulfill the requirement of this section.

## 13 RF Exposure

Test Requirement: FCC Part 1.1307

Evaluation Method: FCC Part 2.1091

### 13.1 Requirements

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

### 13.2 The procedures / limit

#### (A) Limits for Occupational / Controlled Exposure

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/ cm <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|------------------------------------------|------------------------------------------------------------------|
| 0.3-3.0               | 614                               | 1.63                              | (100)*                                   | 6                                                                |
| 3.0-30                | 1842 / f                          | 4.89 / f                          | (900 / f)*                               | 6                                                                |
| 30-300                | 61.4                              | 0.163                             | 1.0                                      | 6                                                                |
| 300-1500              |                                   |                                   | F/300                                    | 6                                                                |
| 1500-100,000          |                                   |                                   | 5                                        | 6                                                                |

#### (B) Limits for General Population / Uncontrolled Exposure

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/ cm <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|------------------------------------------|------------------------------------------------------------------|
| 0.3-1.34              | 614                               | 1.63                              | (100)*                                   | 30                                                               |
| 1.34-30               | 824/f                             | 2.19/f                            | (180/f)*                                 | 30                                                               |
| 30-300                | 27.5                              | 0.073                             | 0.2                                      | 30                                                               |
| 300-1500              |                                   |                                   | F/1500                                   | 30                                                               |
| 1500-100,000          |                                   |                                   | 1.0                                      | 30                                                               |

Note: f = frequency in MHz ; \*Plane-wave equivalent power density

### 13.3 MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

**E** = Electric field (V/m)

**P** = Peak RF output power (W)

**G** = EUT Antenna numeric gain (numeric)

**d** = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

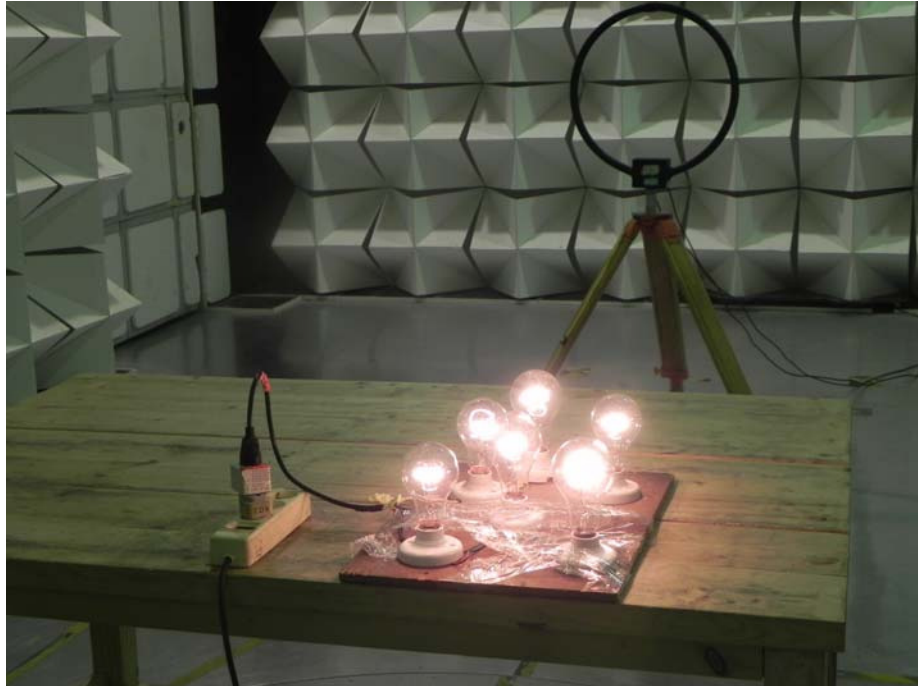
From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

| Antenna Gain<br>(numeric) | Max. Peak Output<br>Power (dBm) | Peak Output Power<br>(mW) | Power Density<br>(mW/cm <sup>2</sup> ) | Limit of Power<br>Density (mW/cm <sup>2</sup> ) |
|---------------------------|---------------------------------|---------------------------|----------------------------------------|-------------------------------------------------|
| 1.000                     | -0.57                           | 0.877                     | 0.0001745                              | 1                                               |

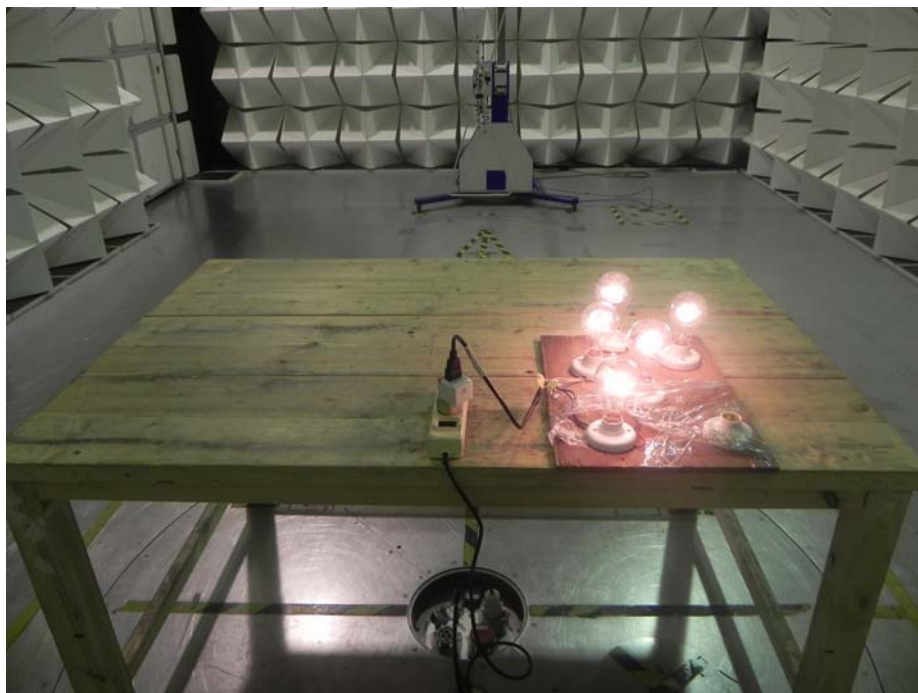
## 14 Photographs –Model SPB411 Test Setup

### 14.1 Photograph – Radiated Emission

Test frequency 32.768KHz to 30MHz Test Site 2#



Test frequency from 30MHz to 1GHz Test Site 2#



Test frequency above 1GHz Test Site 1#  
ON mode



OFF mode

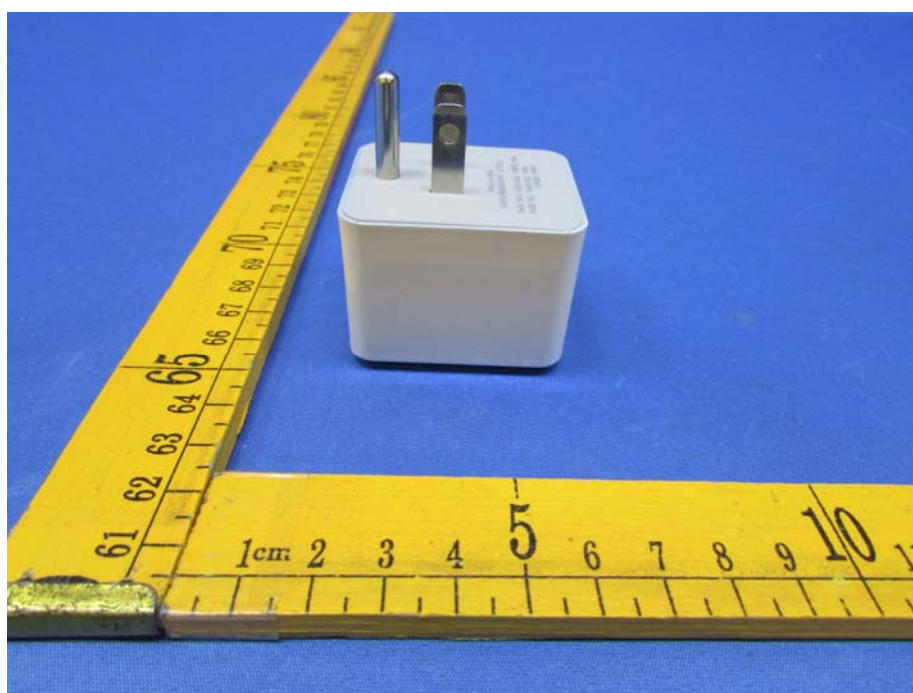


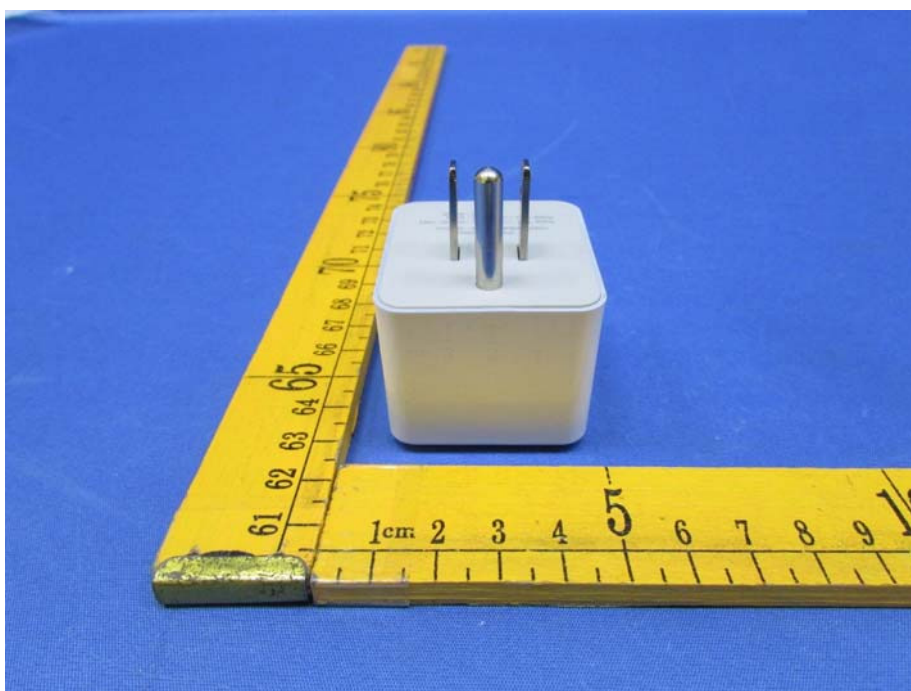
## 14.2 Photograph – Conducted Emission Test Setup at Test Site 1#

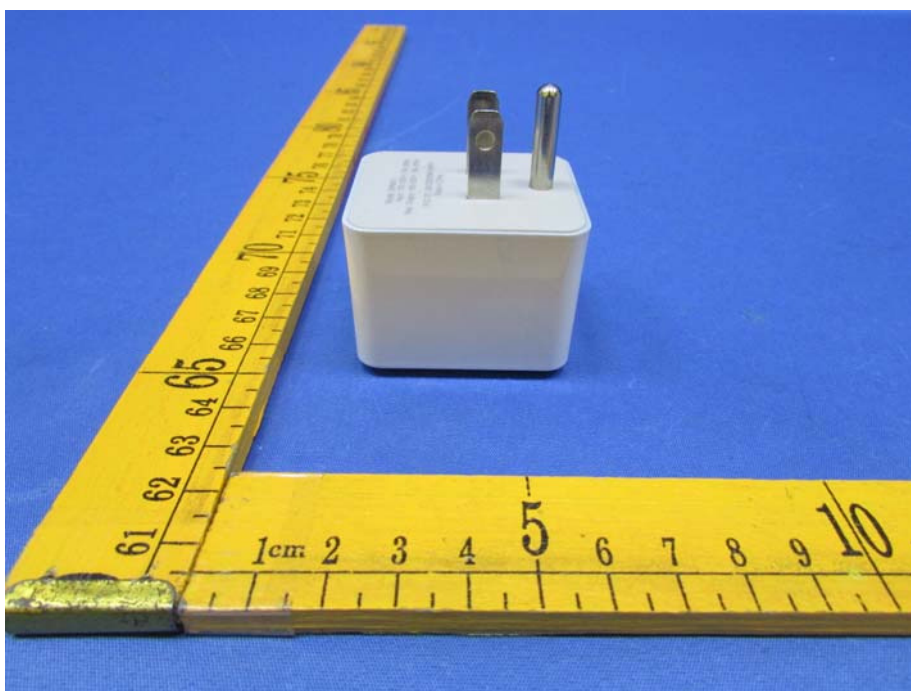


## 15 Photographs - Constructional Details

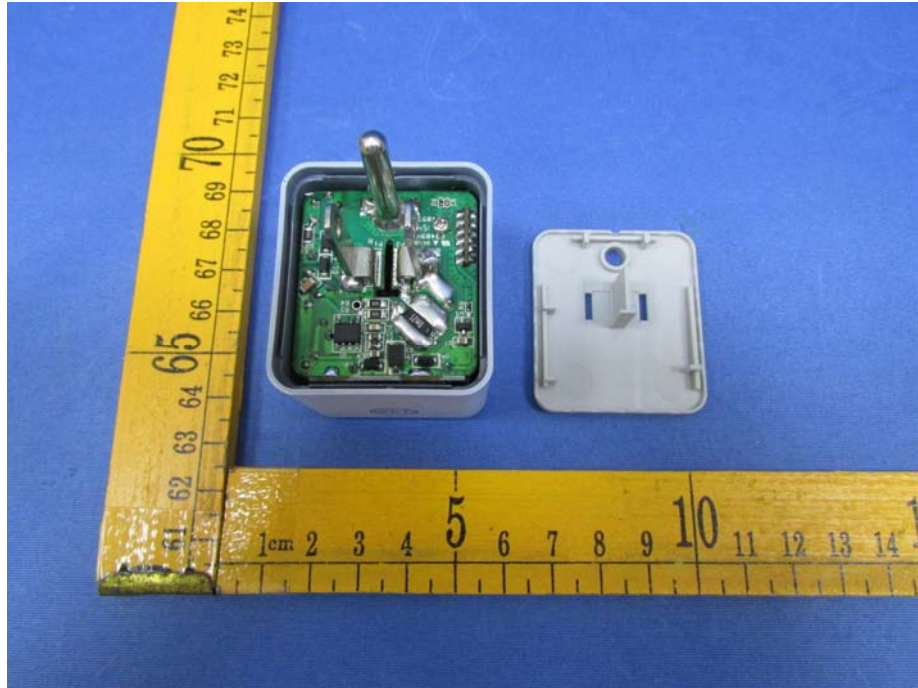
### 15.1 Model SPB411- External Photos

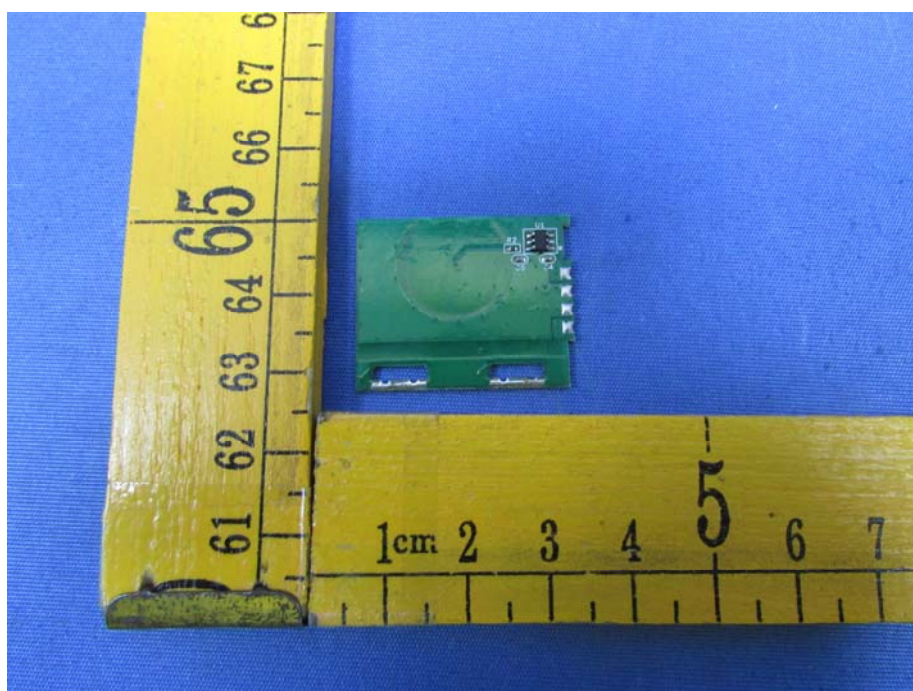
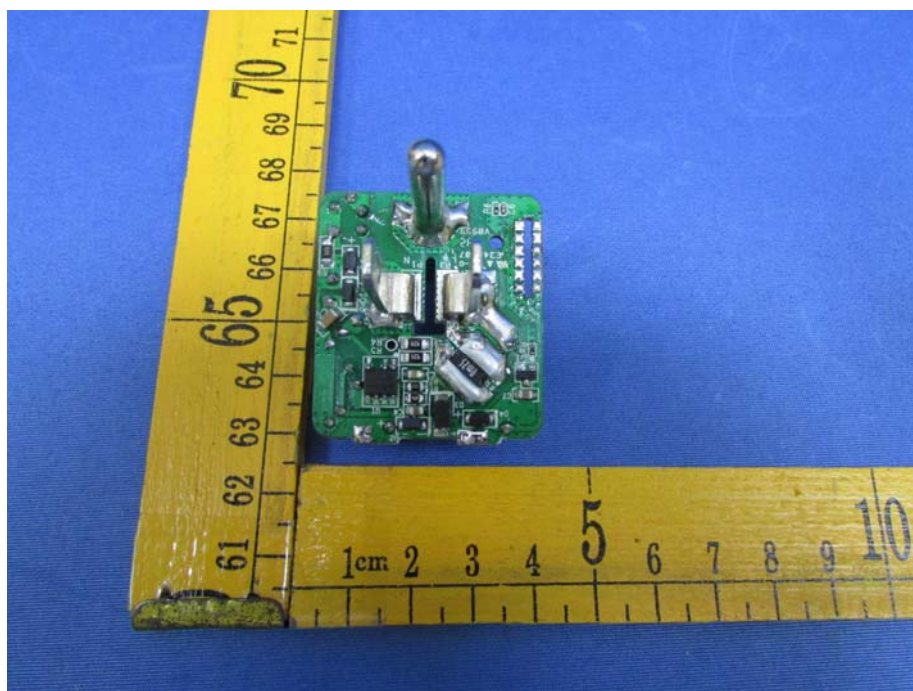


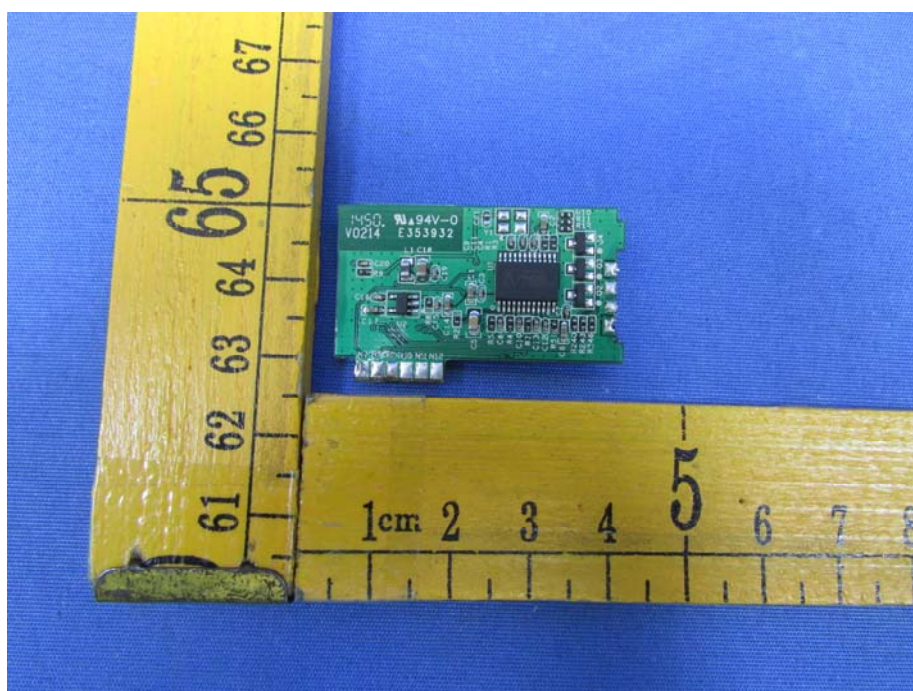
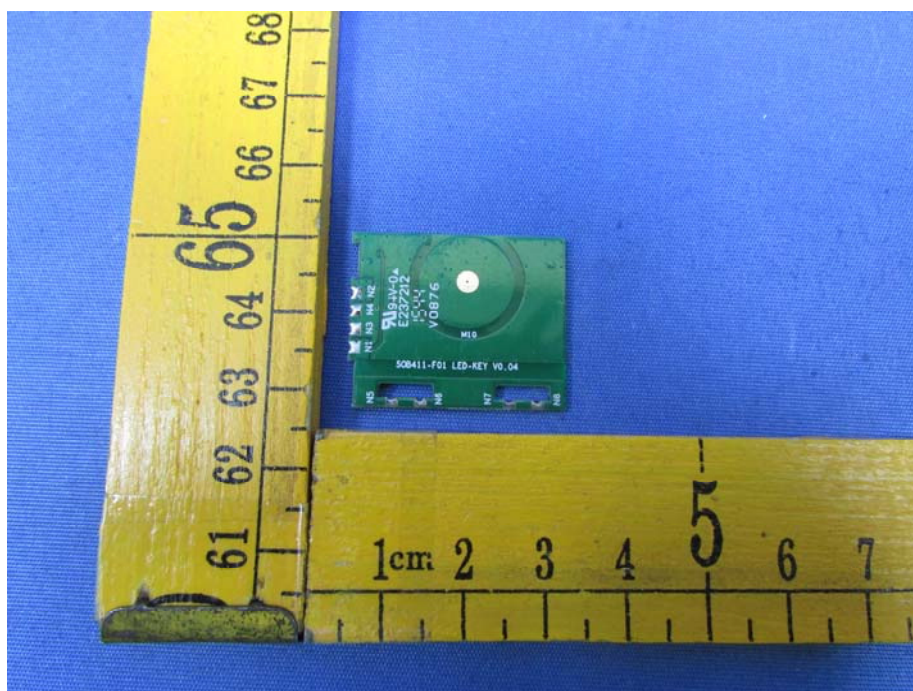


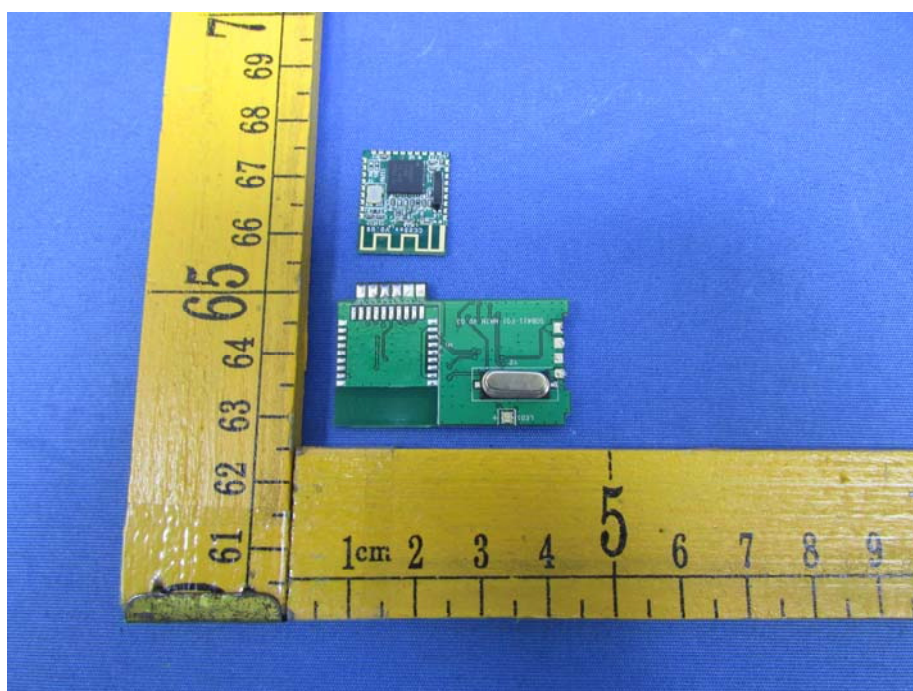
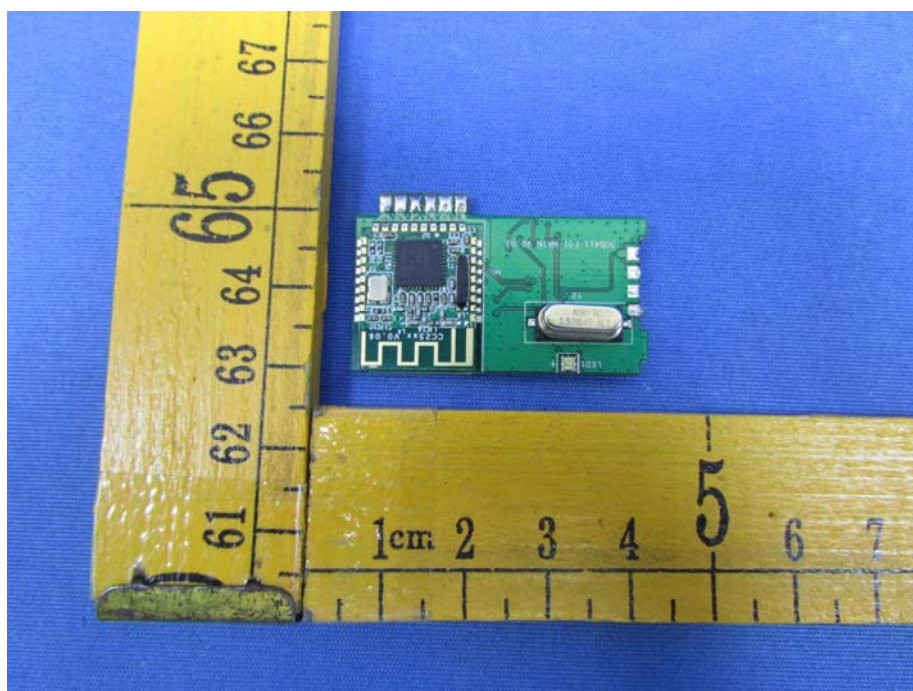


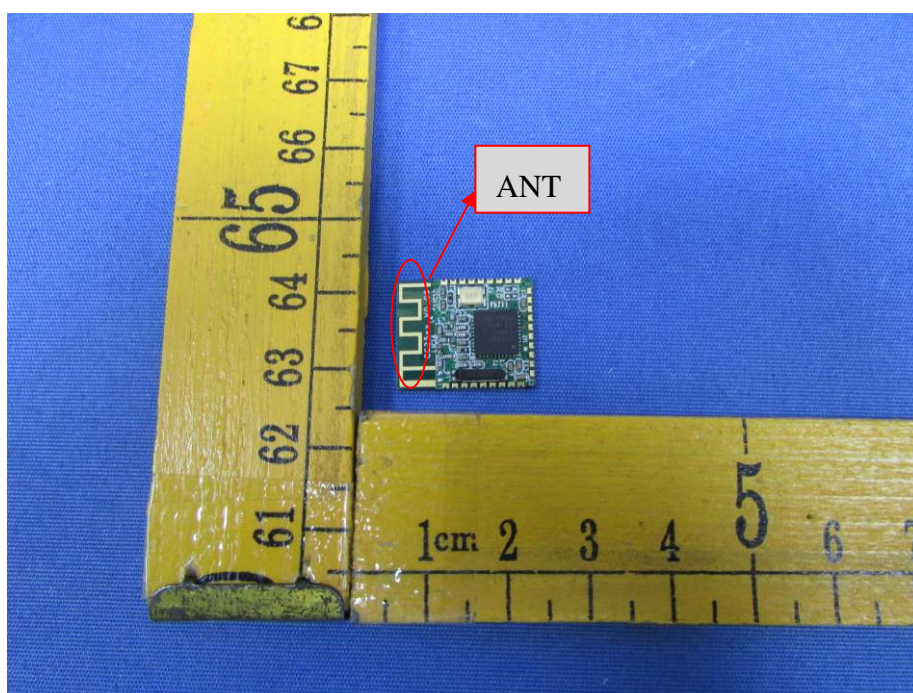
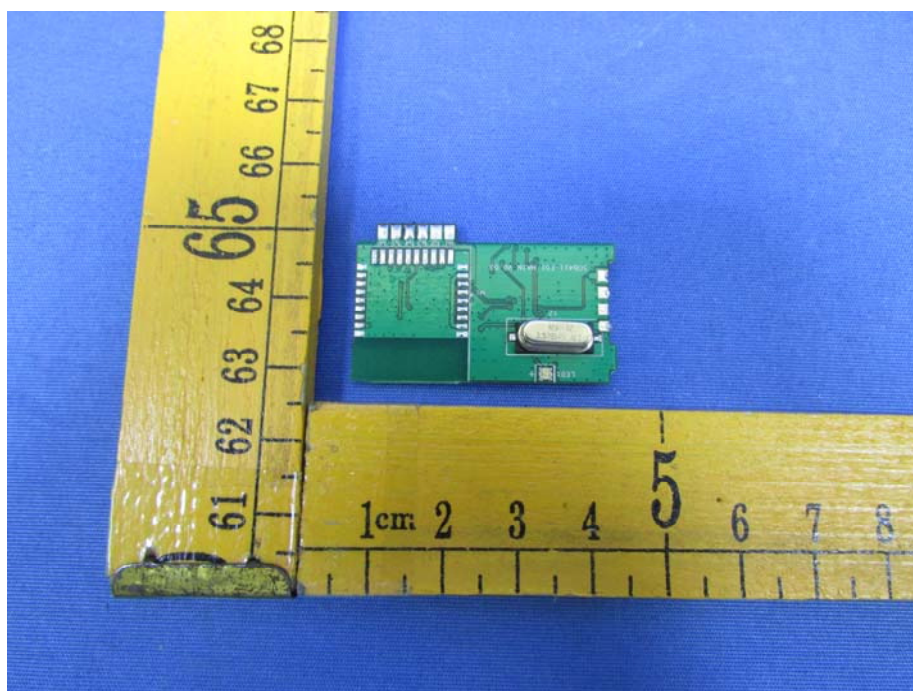
## 15.2 Model SPB411- Internal Photos

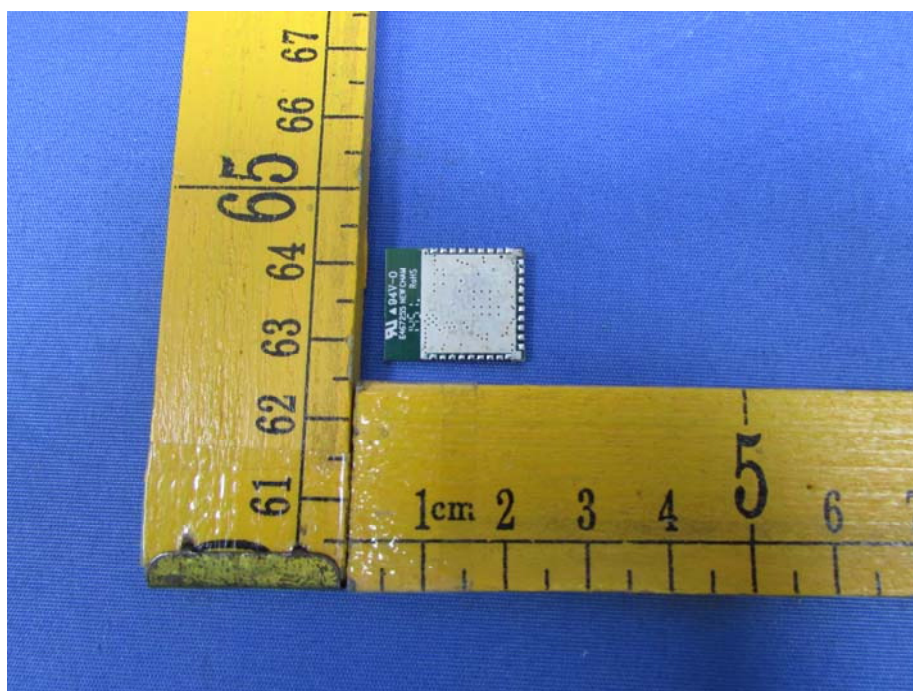












=====End of Report=====