# TEST REPORT

| | | |
|---|---|---|
| **Reference No.** | : | WTS18S05113032W |
| **FCC ID** | : | 2AKSESPGUS-02 |
| **Applicant** | : | Smart iBlue Technology Limited |
| **Address** | : | Unit 12,10/F.,Hong Man Industrial Centre,2 Hong Man Street,Chai Wan,Hong Kong |
| **Manufacturer** | : | Jinhui Electirc Co.,Ltd. |
| **Address** | : | 11Chang Yuan Er Lu,Lu Dong District,523000 Humen,Dong Guan County,PEOPLE'S REPUBLIC OF CHINA |
| **Product Name** | : | Mini Smart Plug(US) |
| **Model No**. | : | SPG-US-02 |
| **Standards** | : | FCC CFR47 Part 15 C Section 15.247:2017 |
| **Date of Receipt sample** | : | 2018-06-21 |
| **Date of Test** | : | 2018-06-21 to2018-06-27 |
| **Date of Issue** | : | 2018-06-28 |
| **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.


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Approved by: Philo Zhong

Philo Zhong / Manager

# 2 Contents

# 3 Report Revision History

| Test report No. | Date of Receipt sample | Date of Test | Date of Issue | Purpose | Comment | Approved |
|---|---|---|---|---|---|---|
| WTS18S05113032W | 2018-06-21 | 2018-06-21 to 2018-06-27 | 2018-06-28 | Original | - | Valid |

# 4 General Information

## 4.1 General Description of E.U.T

| | |
|---|---|
| Product Name: | Mini Smart Plug(US) |
| Model No.: | SPG-US-02 |
| Model Difference: | N/A |
| Operation Frequency: | 2402-2480MHz |
| Antenna Gain: | 2dBi |
| Type of modulation: | GFSK |
| Antenna installation: | Ceramic Antenna |

## 4.2 Details of E.U.T.

Rating(s) : Input: AC 125V 60Hz 15A Max

## 4.3 Channel List

BLE:

| 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

Table 1 Tests Carried Out Under FCC part 15.247

| Test Items | Mode | Data Rate | Channel | TX/RX |
|---|---|---|---|---|
| Maximum Peak Output Power | BLE | 1 Mbps | 0/19/39 | TX |
| Power Spectral Density | BLE | 1 Mbps | 0/19/39 | TX |
| Frequency Range | BLE | 1 Mbps | 0/19/39 | TX |
| Transmitter Spurious Emissions | BLE | 1 Mbps | 0/19/39 | TX |

**Note** :Parameters set by test software during channel & power tests, the software provided by the customer was used to set the operating channels as well as the output power level. The RF output power set is the power expected by the manufacturer and is going to be fixed on the firmware of the final product.

# 5 Equipment Used during Test

## 5.1 Equipments List

| Conducted Emissions at Mains Terminals Disturbance Voltage (Conducted Emission)(843 Shielding room) | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Last Calibration Date** | **Calibration Due Date** |
| 1 | EMI Test Receiver | R&S | ESCI | 100947 | 2017.09.11 | 2018.09.10 |
| 2 | LISN | R&S | ENV216 | 100115 | 2017.09.11 | 2018.09.10 |
| 3 | Cable | Top | TYPE16(3.5M) | - | 2017.09.11 | 2018.09.10 |
| **Conducted Emissions at Mains Terminals Disturbance Voltage (Conducted Emission)** | | | | | | |
| **Item** | **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Last Calibration Date** | **Calibration Due Date** |
| 1 | EMI Test Receiver | R&S | ESCI | 101155 | 2017.09.11 | 2018.09.10 |
| 2 | LISN | SCHWARZBECK | NSLK 8128 | 8128-259 | 2017.09.11 | 2018.09.10 |
| 3 | Limiter | CYBERTEK | EM5010 | 261115-001-0024 | 2017.09.11 | 2018.09.10 |
| 4 | Cable | **Laplace** | RF300 | - | 2017.07.19 | 2018.07.18 |
| **Radiated electromagnetic disturbance(9kHz to 30MHz)** | | | | | | |
| **Item** | **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Last Calibration Date** | **Calibration Due Date** |
| 1 | EMI Test Receiver | R&S | ESCI | 101155 | 2017.09.11 | 2018.09.10 |
| 2 | LARGE LOOP ANTENNA | Laplace | RF300 | 9057 | 2017.07.19 | 2018.07.18 |
| 3 | Cable | **Laplace** | RF300 | - | 2017.07.19 | 2018.07.18 |
| **3m Semi-anechoic Chamber for Radiation** | | | | | | |
| **Item** | **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Last Calibration Date** | **Calibration Due Date** |
| 1 | Spectrum Analyzer | R&S | FSP | 100091 | 2018.04.20 | 2019.04.19 |
| 2 | Amplifier | Agilent | 8447D | 2944A10178 | 2018.01.10 | 2019.01.09 |
| 3 | Active Loop Antenna | Com-Power Corp. | AL-130R | 10160007 | 2018.04.17 | 2019.04.16 |
| 4 | Trilog Broadband Antenna | SCHWARZBECK | VULB9163 | 336 | 2018.05.18 | 2019.05.17 |
| 5 | Coaxial Cable (below 1GHz) | Top | TYPE16(13M) | - | 2017.10.14 | 2018.10.15 |
| 6 | Broad-band Horn Antenna | SCHWARZBECK | BBHA 9120 D | 667 | 2018.05.18 | 2019.05.17 |
| 7 | Broad-band Horn Antenna | SCHWARZBECK | BBHA 9170 | 335 | N/A | N/A |
| 8 | Broadband Preamplifier | COMPLIANCE DIRECTION | PAP-1G18 | 2004 | 2018.04.07 | 2019.04.06 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 9 | Coaxial Cable (above 1GHz) | Top | 1GHz-18GHz | EW02014-7 | 2018.04.07 | 2019.04.06 |
| 10 | Universal Radio Communication Tester | R&S | CMU 200 | 112461 | 2018.04.20 | 2019.04.19 |
| 11 | Universal Radio Communication Tester | R&S | CMW 500 | 127818 | 2018.04.20 | 2019.04.19 |
| 12 | Signal Generater | R&S | SMP22 | 100102 | 2017.09.12 | 2018.09.11 |
| **3m Semi-anechoic Chamber for Radiation(TDK)** | | | | | | |
| **Item** | **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Last Calibration Date** | **Calibration Due Date** |
| 1 | Test Receiver | R&S | ESCI | 101296 | 2018.04.20 | 2019.04.19 |
| 2 | Trilog Broadband Antenna | SCHWARZBECK | VULB9160 | 9160-3325 | 2018.04.19 | 2019.04.18 |
| 3 | Amplifier | ANRITSU | MH648A | M43381 | 2018.04.20 | 2019.04.19 |
| 4 | Cable | HUBER+SUHNER | CBL2 | 525178 | 2018.04.20 | 2019.04.19 |
| **RF Conducted Testing** | | | | | | |
| **Item** | **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Last Calibration Date** | **Calibration Due Date** |
| 1. | EMC Analyzer (9k~26.5GHz) | Agilent | E7405A | MY45114943 | 2017-09-14 | 2018-09-13 |
| 2. | Spectrum Analyzer (9k-6GHz) | R&S | FSL6 | 100959 | 2017-09-12 | 2018-09-11 |
| 3. | Signal Analyzer (9k~26.5GHz) | Agilent | N9010A | MY50520207 | 2017-09-12 | 2018-09-11 |

## 5.2 Measurement Uncertainty

| Parameter | Uncertainty |
|---|---|
| Radio Frequency | ± 1 x $10^{-6}$ |
| RF Power | ± 1.0 dB |
| RF Power Density | ± 2.2 dB |
| Radiated Spurious Emissions test | ± 5.03 dB (30M~1000MHz) |
| | ± 5.47 dB (1000M~25000MHz) |
| Conducted Spurious Emissions test | ± 3.64 dB (AC mains 150KHz~30MHz) |

## 5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by GUANG ZHOU GRG METROLOGY & TEST CO., LTD. address is No.163, Pingyun Rd. West of Huangpu Ave,Tianhe District, Guangzhou, Guang dong, China.

# 6 Test Summary

| Test Items | Test Requirement | Result |
|---|---|---|
| Radiated Emissions | 15.247<br>15.205(a)<br>15.209(a) | C |
| Conducted Emissions | 15.207(a) | C |
| Bandwidth | 15.247(a)(2) | C |
| Maximum Peak Output Power | 15.247(b)(3),(4) | C |
| Power Spectral Density | 15.247(e) | C |
| Band Edge | 15.247(d) | C |
| Antenna Requirement | 15.203 | C |
| Maximum Permissible Exposure<br>(Exposure of Humans to RF Fields) | 1.1307(b)(1) | C |
| Note: C=Compliance; NC=Not Compliance; NT=Not Tested; N/A=Not Applicable. | | |

# 7 Conducted Emission

| | |
|---|---|
| Test Requirement: | FCC CFR 47 Part 15 Section 15.207 |
| Test Method: | ANSI C63.10:2013,ANSI C63.4:2014 |
| Test Result: | PASS |
| Frequency Range: | 150kHz to 30MHz |
| Class/Severity: | Class B |
| Limit: | 66-56 dBμV between 0.15MHz & 0.5MHz |
| | 56 dBμV between 0.5MHz & 5MHz |
| | 60 dBμV between 5MHz & 30MHz |
| Detector: | Peak for pre-scan (9kHz Resolution Bandwidth) |

## 7.1 E.U.T. Operation

Operating Environment **:**

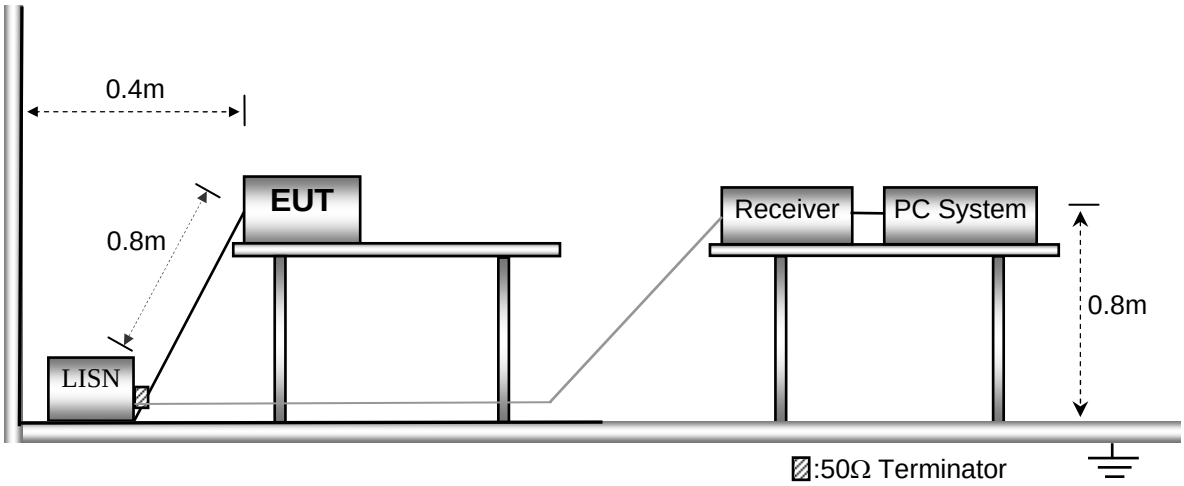
| | |
|---|---|
| Temperature: | 21.5 °C |
| Humidity: | 51.9 % RH |
| Atmospheric Pressure: | 101.2kPa |

EUT Operation **:**

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

## 7.2 EUT Setup

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




## 7.3 Measurement Description

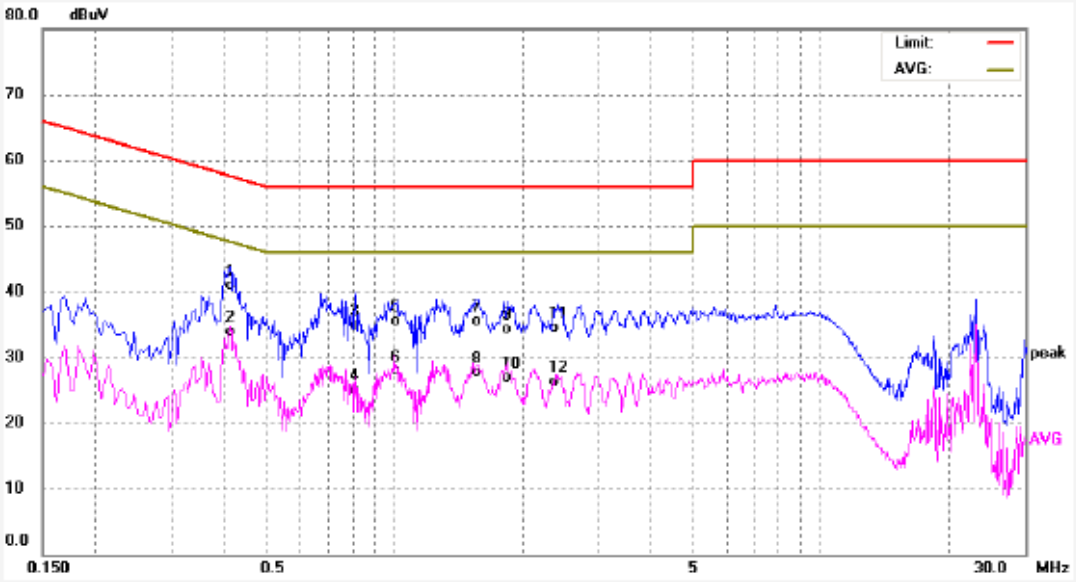
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

## 7.4 Conducted Emission Test Result

An initial pre-scan was performed on the live and neutral lines.

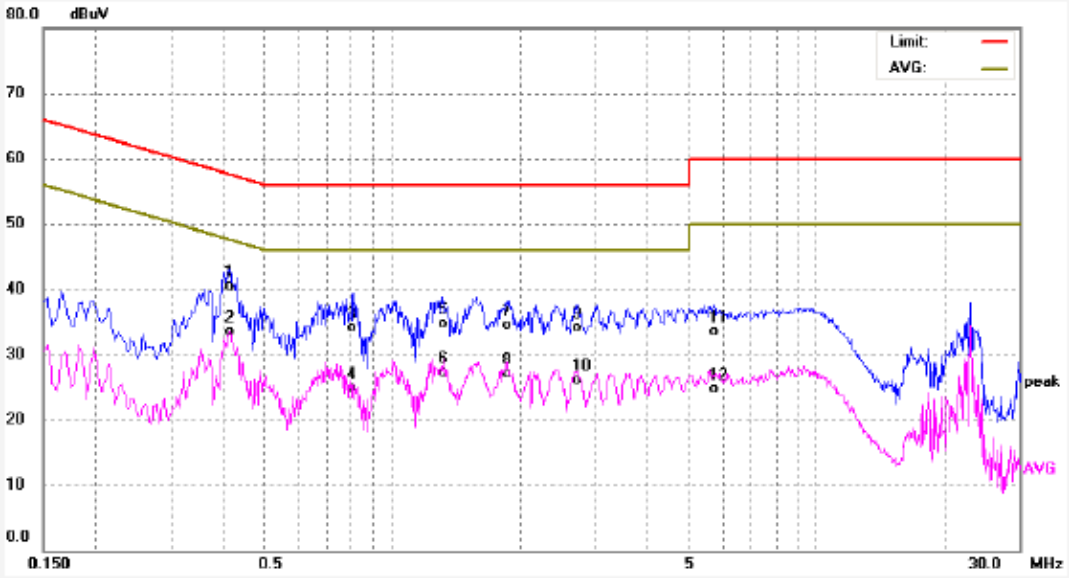
Only the worst case (WIFI transmitting mode) test data were record in the report.

Live line:




| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit dBuV | Margin (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.4140 | 30.86 | 10.04 | 40.90 | 57.57 | -16.67 | QP | |
| 2 | 0.4140 | 23.83 | 10.04 | 33.87 | 47.57 | -13.70 | AVG | |
| 3 | 0.8100 | 24.75 | 10.11 | 34.86 | 56.00 | -21.14 | QP | |
| 4 | 0.8100 | 15.06 | 10.11 | 25.17 | 46.00 | -20.83 | AVG | |
| 5 | 1.0140 | 25.33 | 10.12 | 35.45 | 56.00 | -20.55 | QP | |
| 6 | 1.0140 | 17.70 | 10.12 | 27.82 | 46.00 | -18.18 | AVG | |
| 7 | 1.5780 | 25.36 | 10.16 | 35.52 | 56.00 | -20.48 | QP | |
| 8 | 1.5780 | 17.51 | 10.16 | 27.67 | 46.00 | -18.33 | AVG | |
| 9 | 1.8180 | 24.20 | 10.18 | 34.38 | 56.00 | -21.62 | QP | |
| 10 | 1.8180 | 16.71 | 10.18 | 26.89 | 46.00 | -19.11 | AVG | |
| 11 | 2.4140 | 24.23 | 10.22 | 34.45 | 56.00 | -21.55 | QP | |
| 12 | 2.4140 | 16.16 | 10.22 | 26.38 | 46.00 | -19.62 | AVG | |

Neutral line:




| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit dBuV | Margin (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.4140 | 30.37 | 10.04 | 40.41 | 57.57 | -17.16 | QP | |
| 2 | 0.4140 | 23.52 | 10.04 | 33.56 | 47.57 | -14.01 | AVG | |
| 3 | 0.8139 | 23.99 | 10.11 | 34.10 | 56.00 | -21.90 | QP | |
| 4 | 0.8139 | 14.80 | 10.11 | 24.91 | 46.00 | -21.09 | AVG | |
| 5 | 1.3060 | 24.35 | 10.32 | 34.67 | 56.00 | -21.33 | QP | |
| 6 | 1.3060 | 17.07 | 10.32 | 27.39 | 46.00 | -18.61 | AVG | |
| 7 | 1.8780 | 24.41 | 10.19 | 34.60 | 56.00 | -21.40 | QP | |
| 8 | 1.8780 | 17.00 | 10.19 | 27.19 | 46.00 | -18.81 | AVG | |
| 9 | 2.7220 | 23.85 | 10.23 | 34.08 | 56.00 | -21.92 | QP | |
| 10 | 2.7220 | 15.82 | 10.23 | 26.05 | 46.00 | -19.95 | AVG | |
| 11 | 5.7220 | 23.23 | 10.26 | 33.49 | 60.00 | -26.51 | QP | |
| 12 | 5.7220 | 14.46 | 10.26 | 24.72 | 50.00 | -25.28 | AVG | |

# 8 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: ANSI C63.10:2013,ANSI C63.4:2014

Test Result: PASS

Measurement Distance: 3m

Limit:

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

## 8.1 EUT Operation

Operating Environment **:**

Temperature: 23.5 °C

Humidity: 52.1 % RH

Atmospheric Pressure: 101.2kPa

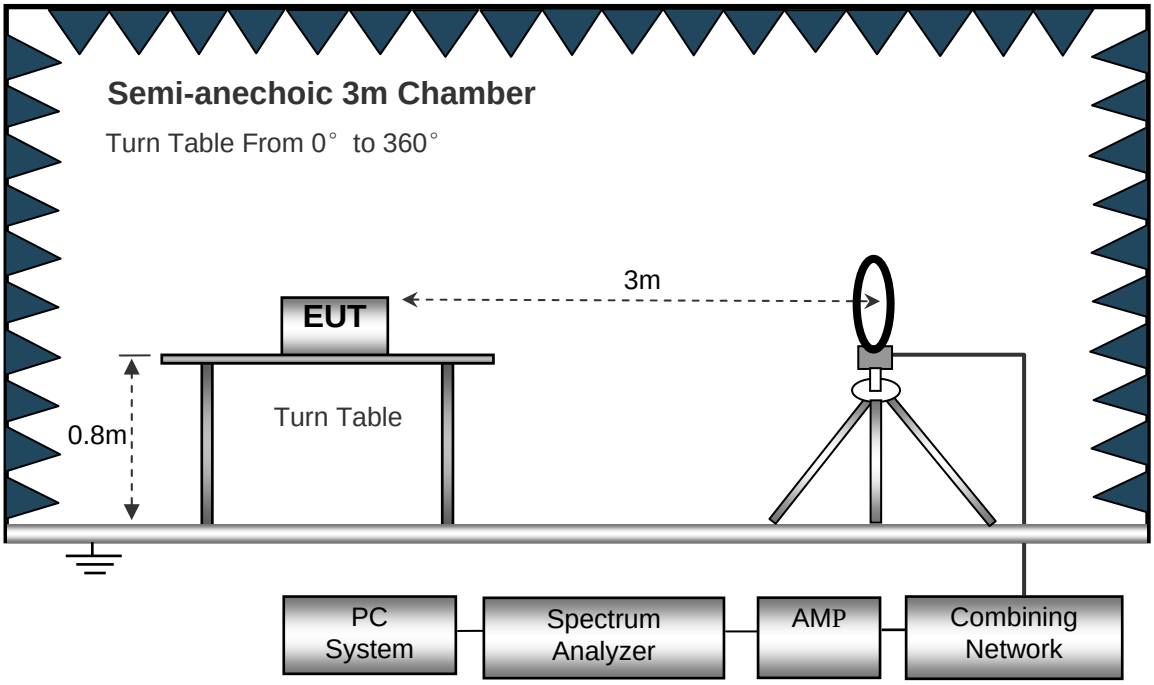
EUT Operation **:**

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

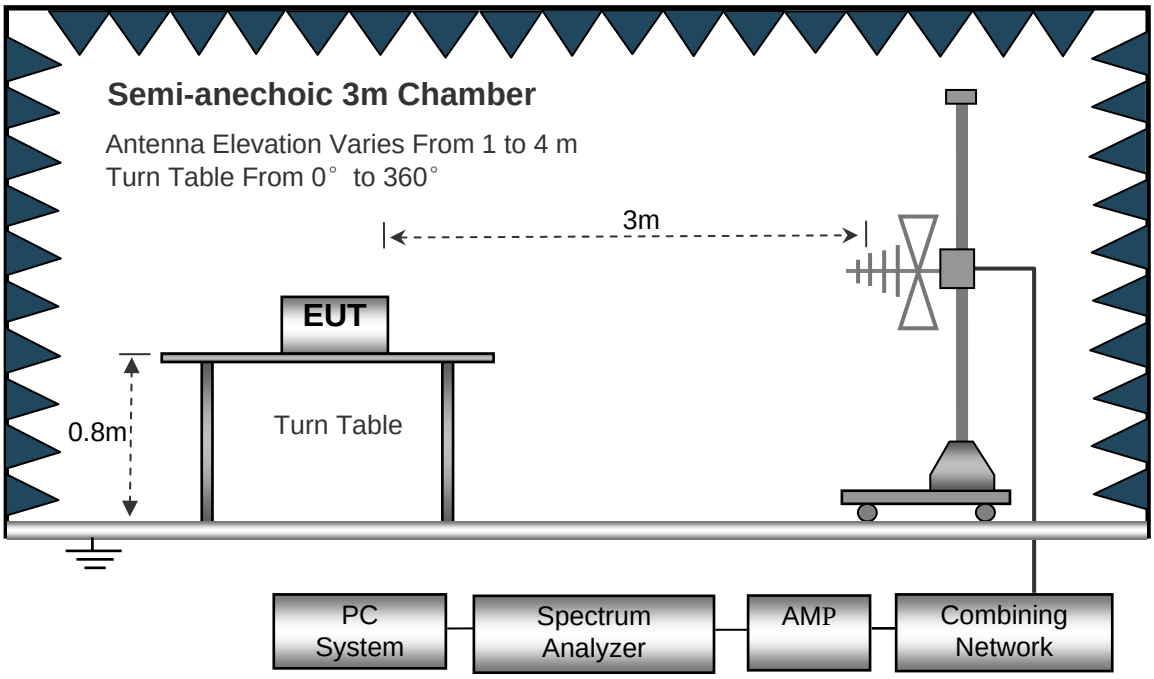
## 8.2 Test Setup

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

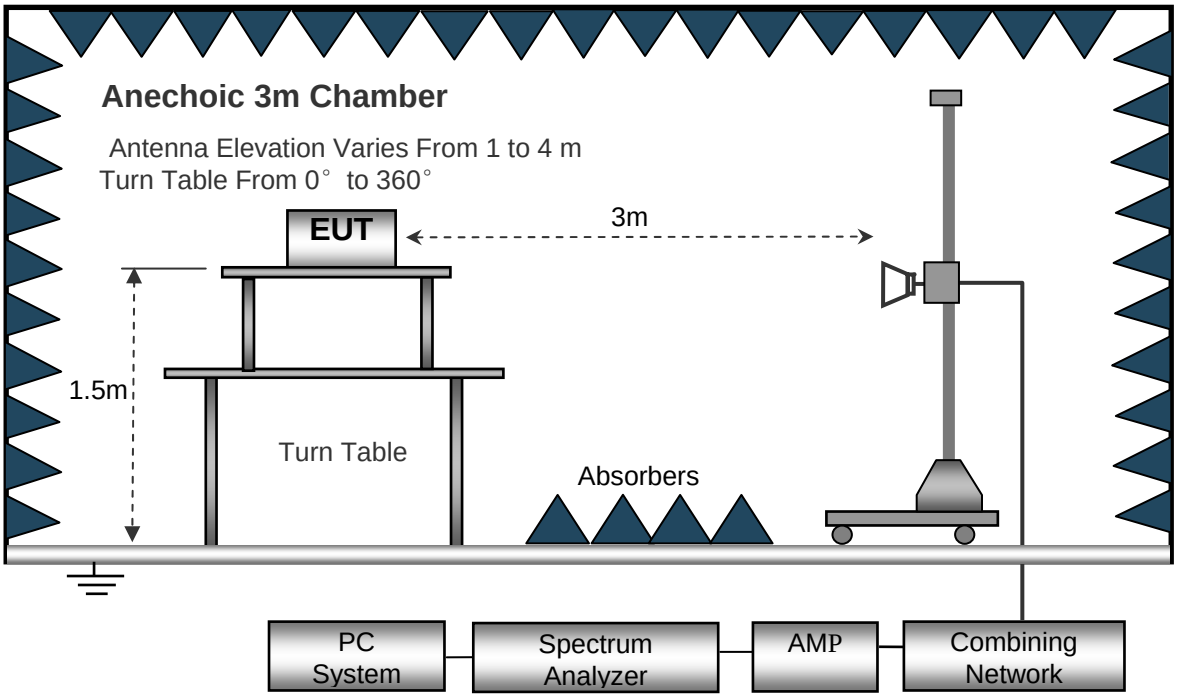
The test setup for emission measurement below 30MHz.




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



The test setup for emission measurement above 1 GHz.




## 8.3 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

## 8.4 Test Procedure

1. The EUT is placed on a turntable. For below 1GHz, the EUT is 0.8m above ground plane; For above1GHz, 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.
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 performed in X,Y and Z axis positioning(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand),the worst condition was tested putting the eut in X axis,so the worst data were shown as follow.
8. A 2.4GHz high –pass filter is used druing radiated emissions above 1GHz measurement.

## 8.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – Limit

## 8.6 Summary of Test Results

**Test Frequency : 12MHz ~ 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/m) | (dBμV/m) | (dBμV/m) | (dB) |
| **GFSK Low Channel 2402MHz** | | | | | | | | | |
| 485.62 | 13.50 | PK | 139 | 1.1 | H | 21.09 | 34.59 | 45.00 | -10.41 |
| 485.62 | 13.35 | PK | 257 | 1.3 | V | 21.09 | 34.44 | 45.00 | -10.56 |
| 4804 | 45.78 | PK | 242 | 1.4 | V | -1.06 | 44.72 | 74.00 | -29.28 |
| 4804 | 44.08 | Ave | 242 | 1.4 | V | -1.06 | 43.02 | 54.00 | -10.98 |
| 7206 | 44.90 | PK | 346 | 1.1 | V | 1.33 | 46.23 | 74.00 | -27.77 |
| 7206 | 44.25 | Ave | 346 | 1.1 | V | 1.33 | 45.58 | 54.00 | -8.42 |

| 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/m) | (dBμV/m) | (dBμV/m) | (dB) |
| **GFSK Middle Channel 2440MHz** | | | | | | | | | |
| 485.62 | 12.93 | PK | 5 | 1.4 | H | 21.09 | 34.02 | 45.00 | -10.98 |
| 485.62 | 12.66 | PK | 288 | 1.5 | V | 21.09 | 33.75 | 45.00 | -11.25 |
| 4880 | 45.65 | PK | 270 | 1.3 | V | -0.62 | 45.03 | 74.00 | -28.97 |
| 4880 | 43.83 | Ave | 270 | 1.3 | V | -0.62 | 43.21 | 54.00 | -10.79 |
| 7320 | 45.55 | PK | 353 | 1.3 | V | 2.21 | 47.76 | 74.00 | -26.24 |
| 7320 | 44.52 | Ave | 353 | 1.3 | V | 2.21 | 46.73 | 54.00 | -7.27 |

| 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/m) | (dBμV/m) | (dBμV/m) | (dB) |
| **GFSK High Channel 2480MHz** | | | | | | | | | |
| 485.62 | 13.32 | PK | 81 | 1.9 | H | 21.09 | 34.41 | 45.00 | -10.59 |
| 485.62 | 14.08 | PK | 242 | 1.8 | V | 21.09 | 35.17 | 45.00 | -9.83 |
| 4960 | 46.13 | PK | 324 | 1.6 | V | -0.24 | 45.89 | 74.00 | -28.11 |
| 4960 | 43.46 | Ave | 324 | 1.6 | V | -0.24 | 43.22 | 54.00 | -10.78 |
| 7440 | 45.17 | PK | 256 | 1.6 | V | 2.84 | 48.01 | 74.00 | -25.99 |
| 7440 | 44.60 | Ave | 256 | 1.6 | V | 2.84 | 47.44 | 54.00 | -6.56 |

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

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

# 9 Band Edge Measurement

| | |
|---|---|
| Test Requirement: | FCC CFR47 Part 15 Section 15.247 |
| Test Method: | 558074 D01 DTS Meas Guidance V04 |
| Test Limit: | Regulation 15.247 (d),In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)). |
| Test Mode: | Transmitting |

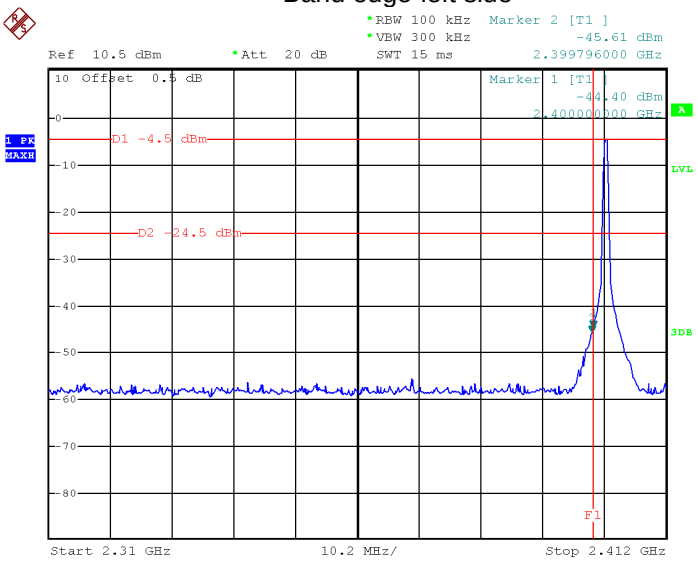
## 9.1 Test Produce

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 RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
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.

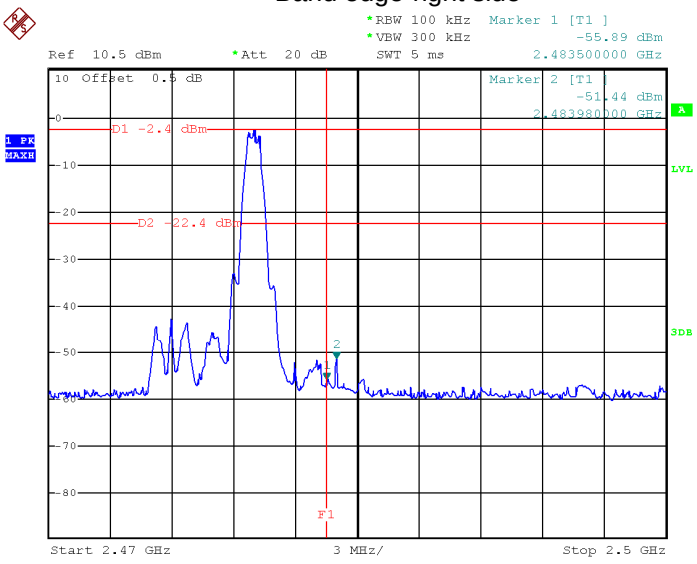
## 9.2 Test Result

Test result plots shown as follows:

Band edge-left side




Band edge-right side



# 10 Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: 558074 D01 DTS Meas Guidance V04

## 10.1 Test Procedure:

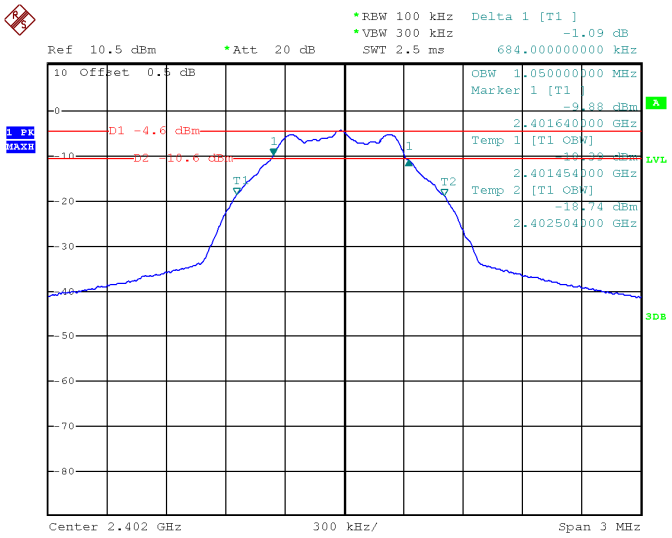
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;

2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

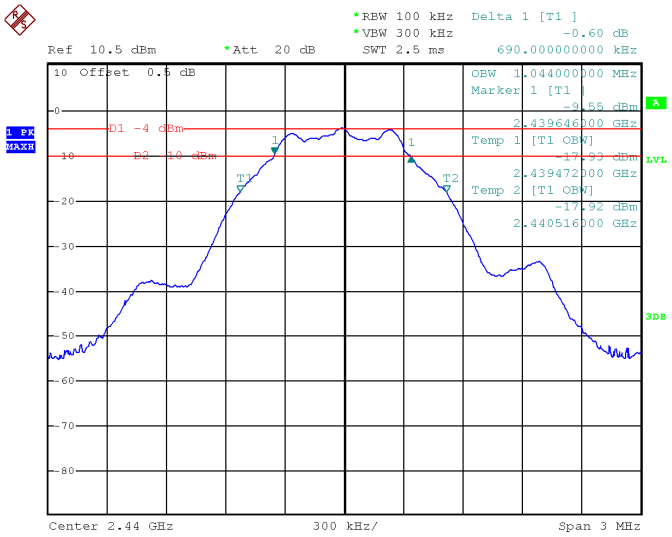
## 10.2 Test Result:

| Operation mode | 6dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|---|---|---|
| Low channel | 0.684 | 1.050 |
| Middle channel | 0.690 | 1.044 |
| High channel | 0.774 | 1.044 |

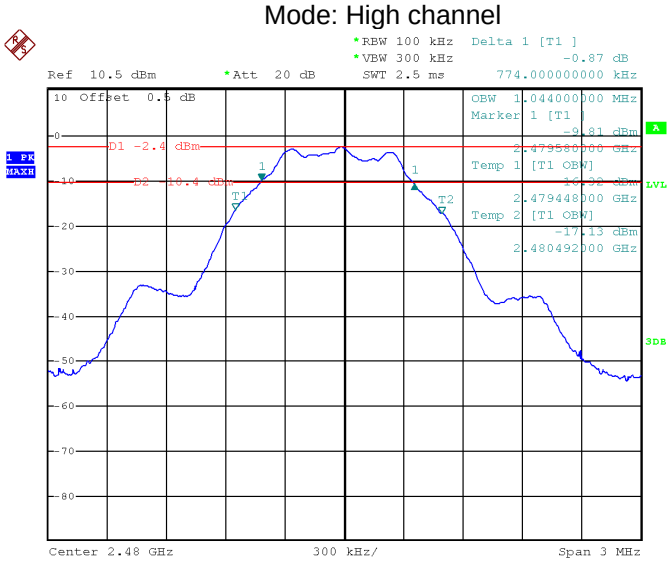
Mode: Low channel




Mode: Middle channel



Mode: High channel



# 11 Maximum Peak Output Power

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: 558074 D01 DTS Meas Guidance V04

## 11.1 Test Procedure:

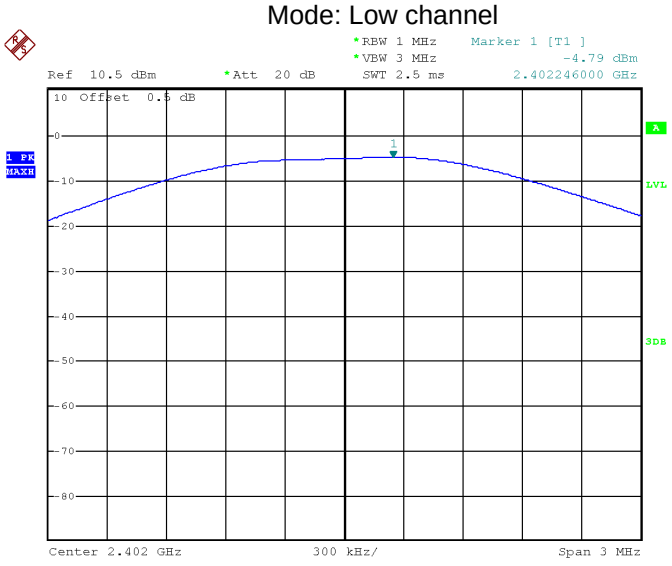
558074 D01 DTS Meas Guidance V04

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 = 1 MHz. VBW = 3 MHz. 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.

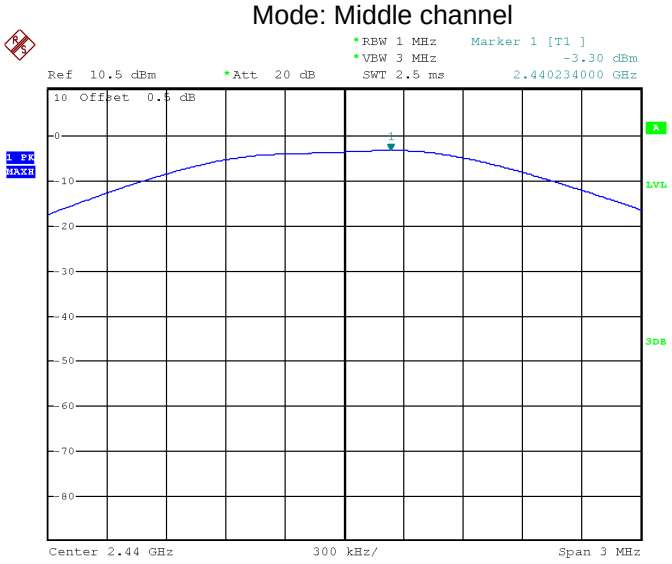
## 11.2 Test Result:

| Maximum Peak Output Power (dBm) | | |
|---|---|---|
| Low channel | Middle channel | High channel |
| -4.79 | -3.30 | -1.89 |
| Limit: 1W/30dBm | | |

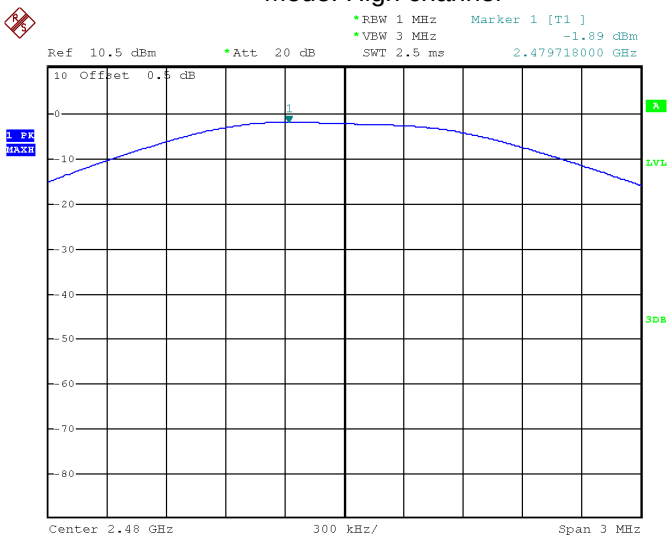
Mode: Low channel



Mode: Middle channel




Mode: High channel



# 12 Power Spectral density

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: 558074 D01 DTS Meas Guidance V04

## 12.1 Test Procedure:

558074 D01 DTS Meas Guidance V04

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

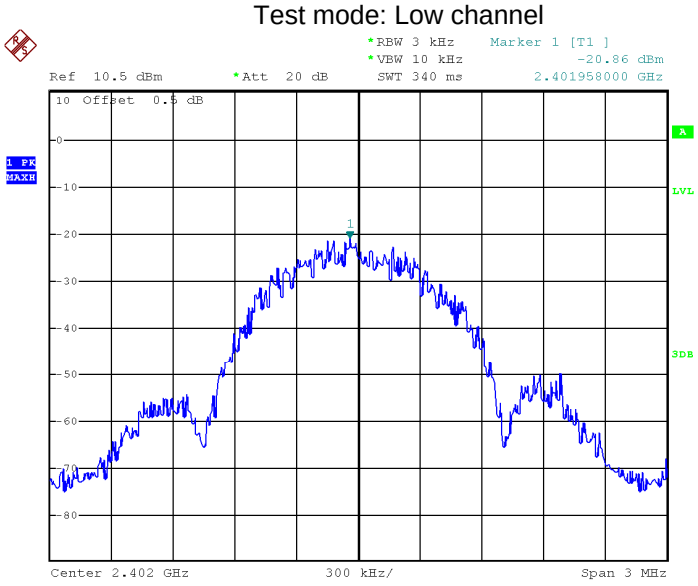
2. Set the spectrum analyzer: RBW = 3kHz. VBW = 10kHz , Span = 1.5 times the DTS channel bandwidth(6 dB bandwidth). Sweep = auto; Detector Function = Peak. Trace = Max hold.

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.

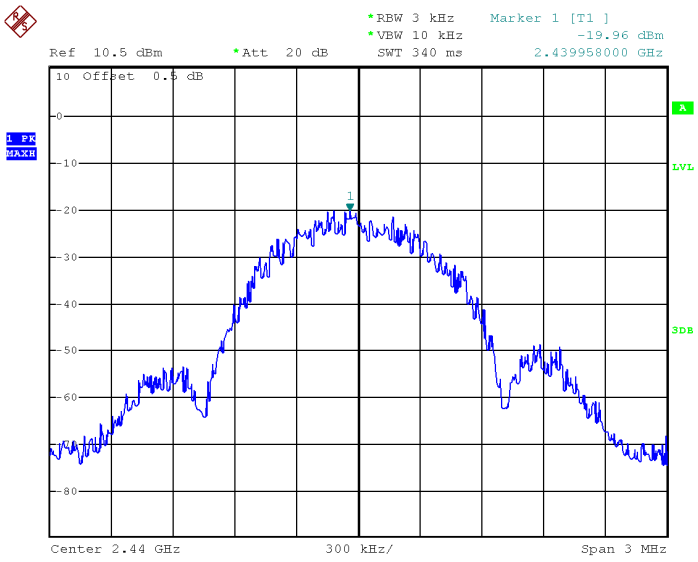
## 12.2 Test Result:

| Power Spectral Density(dBm) | | |
|---|---|---|
| Low channel | Middle channel | High channel |
| -20.86 | -19.96 | -18.15 |
| Limit: 8dBm per 3kHz | | |

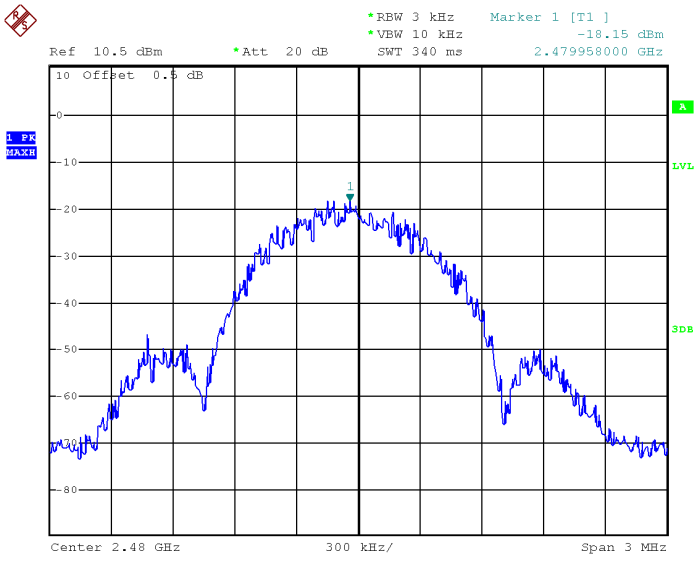
Test mode: Low channel



Test mode: Middle channel




Test mode: High channel



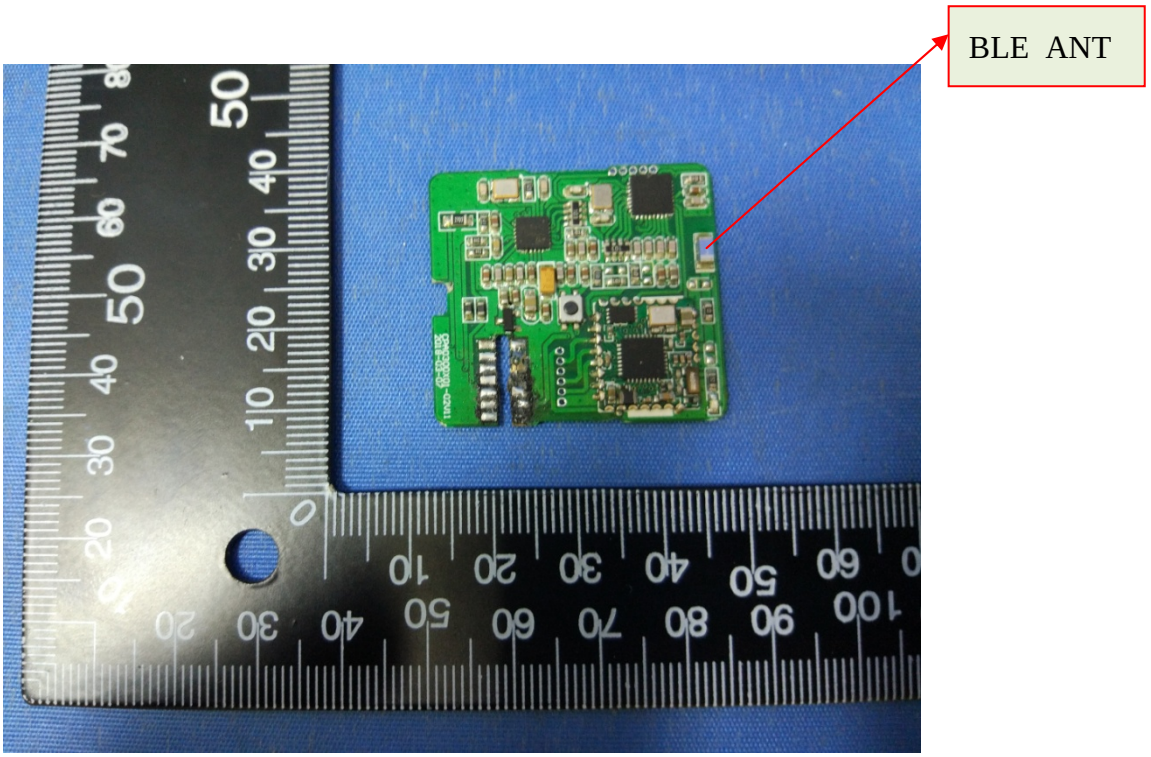
# 13 Antenna Requirement

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.

For intentional device, according to FCC 47 CFR Section 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.

Result:

The EUT has a Ceramic Antenna, meets the requirements of FCC 15.203.



# 14 RF Exposure

Test Requirement: FCC Part 1.1307

Evaluation Method: FCC Part 2.1091

## 14.1 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.

## 14.2 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/ $cm^2$) | Averaging Time $\|E\|^2$,$\|H\|^2$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/ $cm^2$) | Averaging Time $\|E\|^2$,$\|H\|^2$ 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

## 14.3 MPE Calculation Method

E (V/m) $= \frac{\sqrt{30 \times P \times G}}{d}$ Power Density: *Pd* (W/m²) $= \frac{E^2}{377}$

**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.

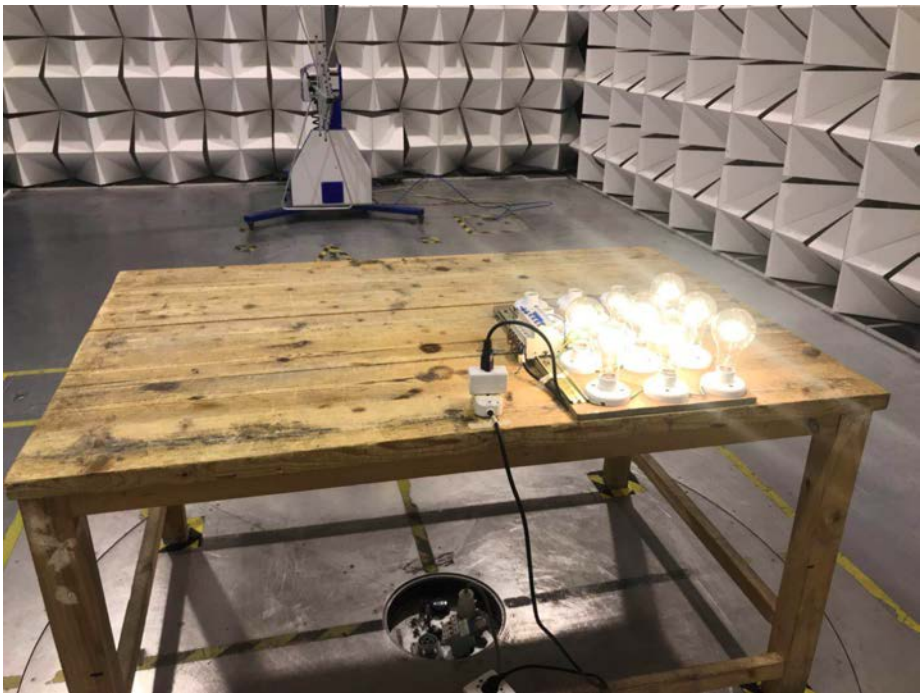
| Antenna Gain (dBi) | Antenna Gain (numeric) | Max. Peak Output Power (dBm) | Peak Output Power (mW) | Power Density (mW/cm2) | Limit of Power Density (mW/cm2) |
|---|---|---|---|---|---|
| 2.00 | 1.585 | -1.89 | 0.65 | 0.000204 | 1 |

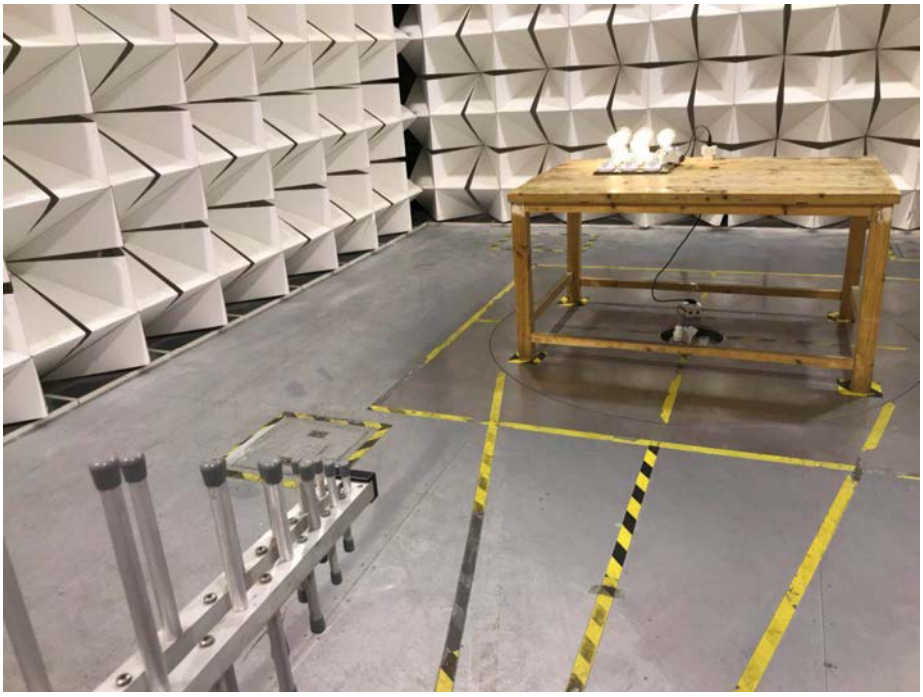
# 15 Photographs – Test Setup Photos

## 15.1 Radiated Emission

Test frequency Below 30MHz

Test frequency from 30MHz to 1GHz



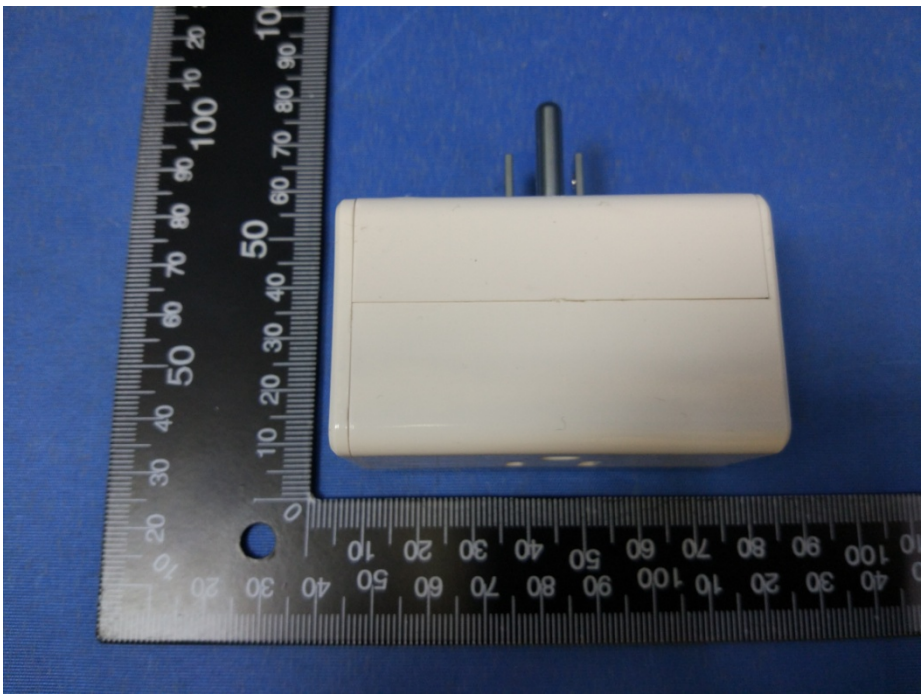


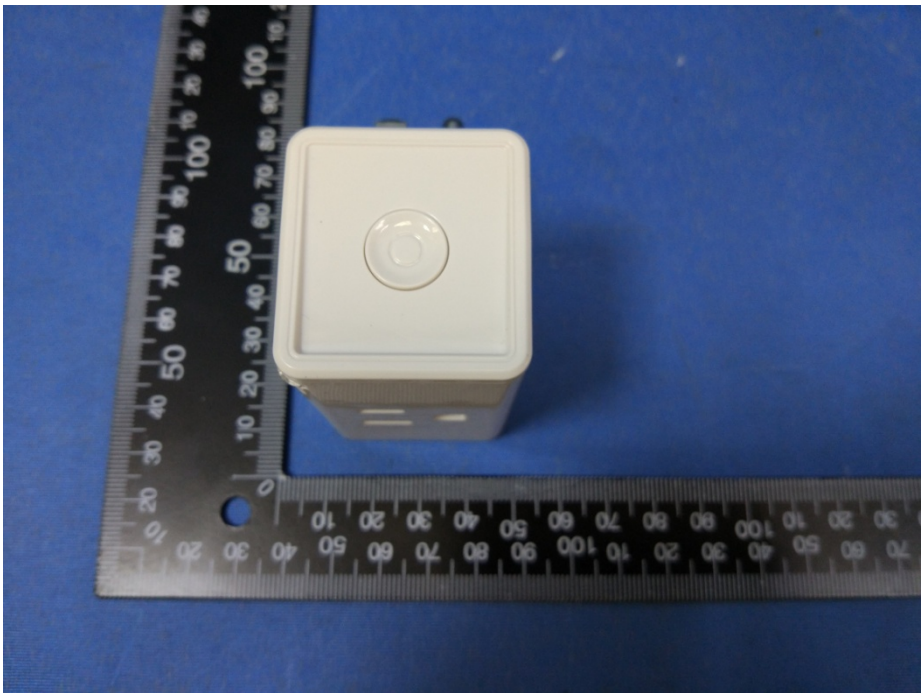
Test frequency above 1GHz

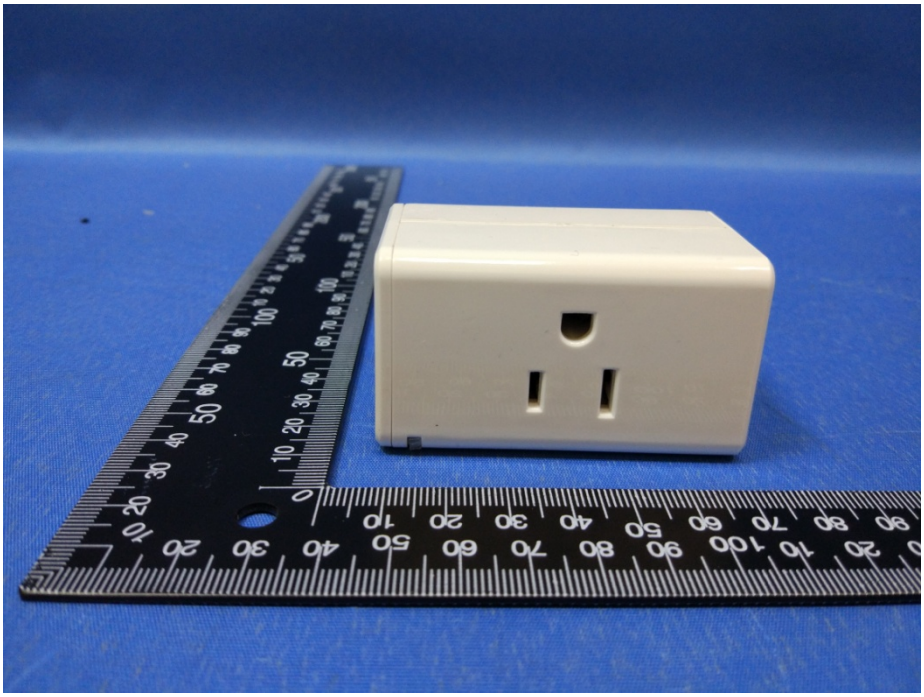
## 15.2 Conducted Emission

# 16 Photographs – Constructional Details

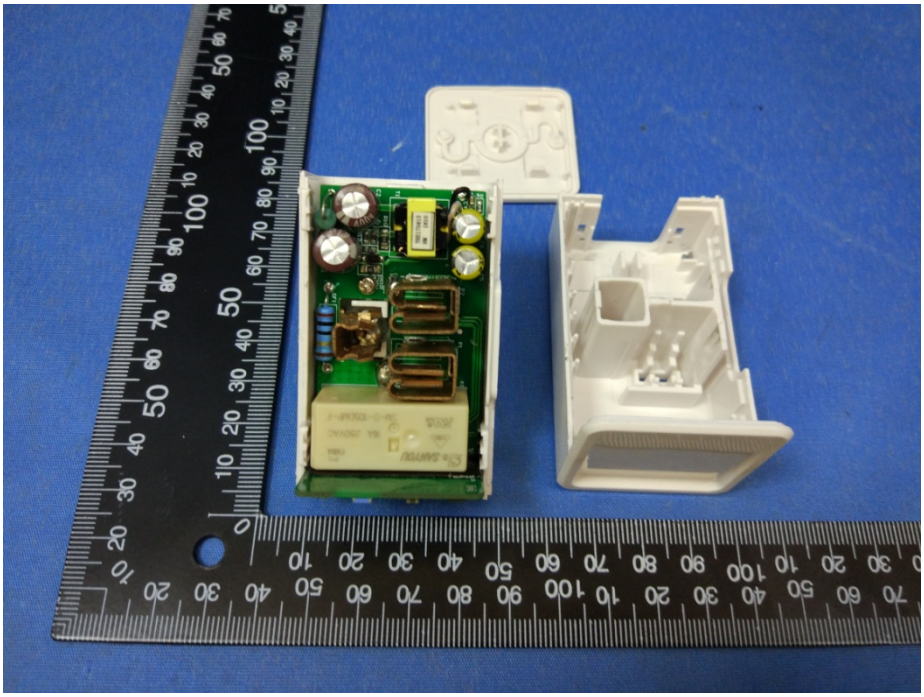
## 16.1 Appearance View

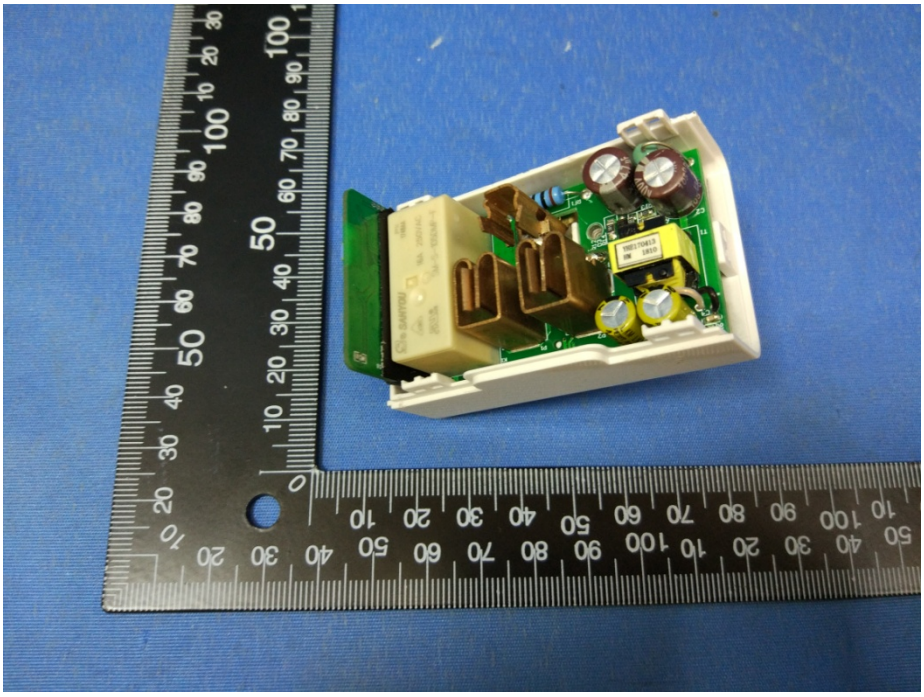


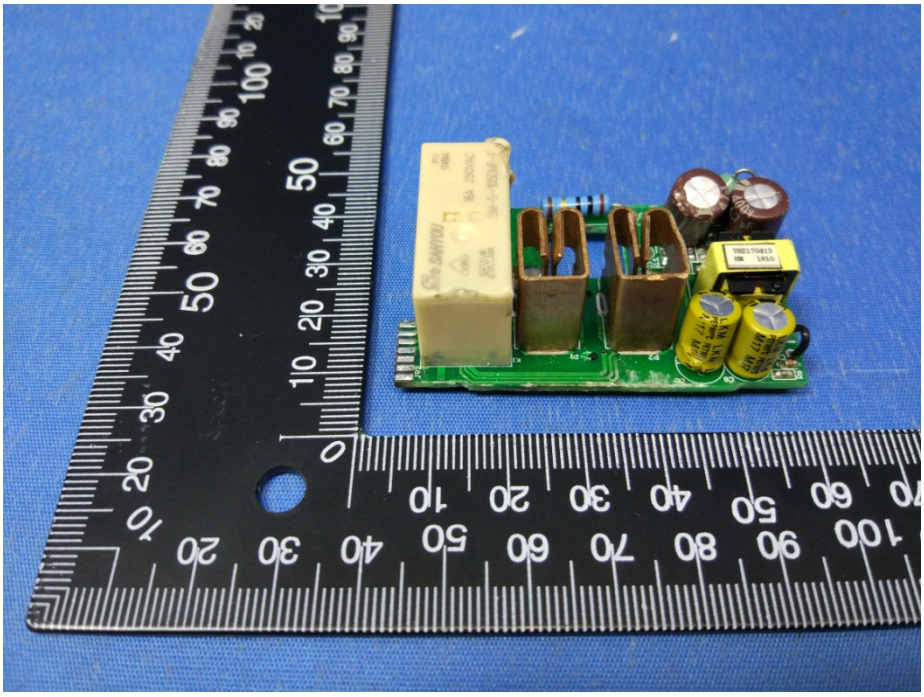


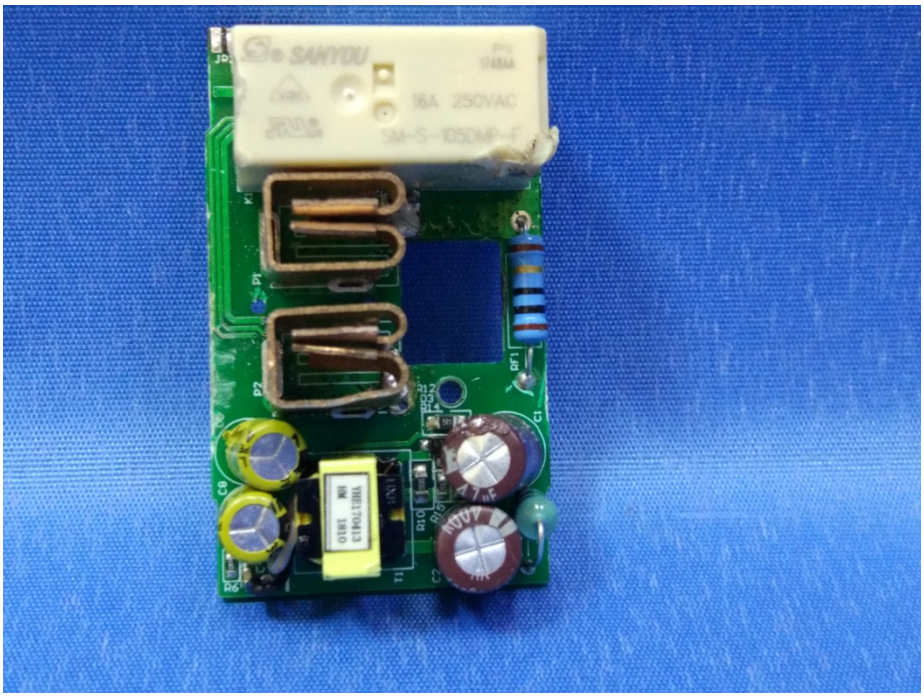


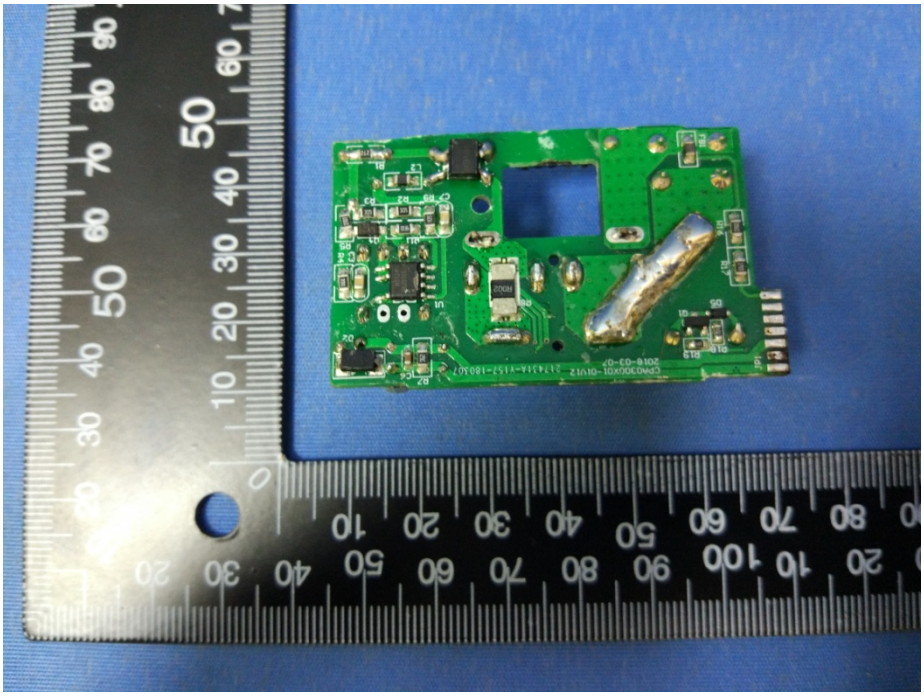
## 16.2 Internal View

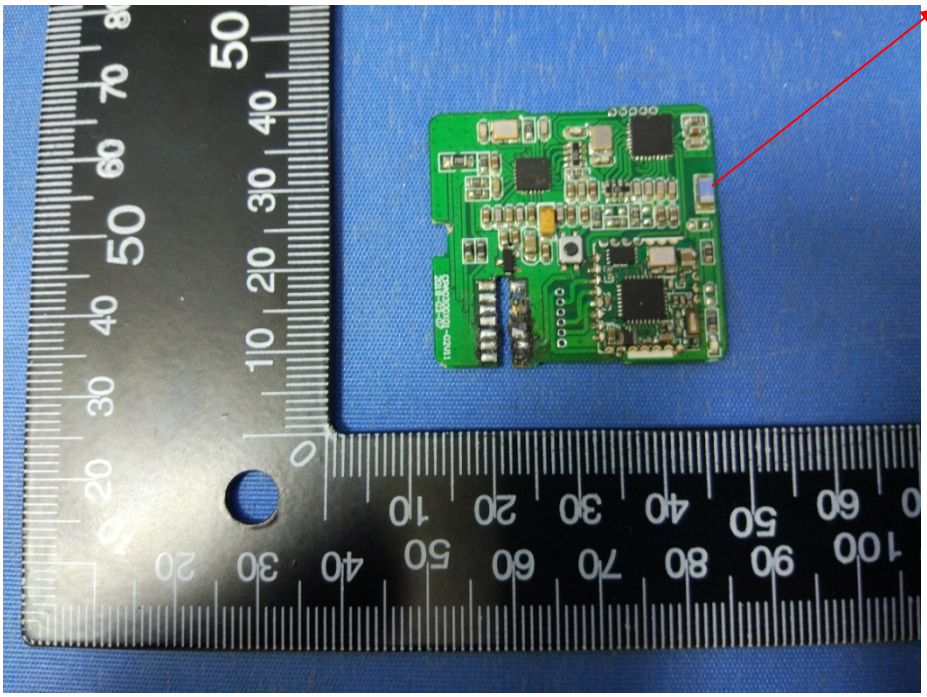


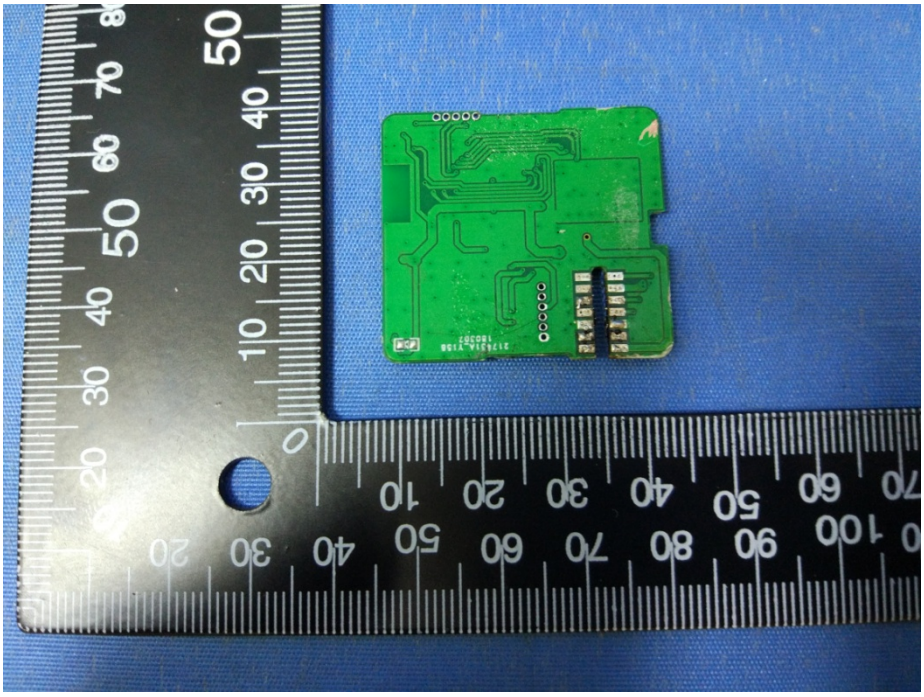


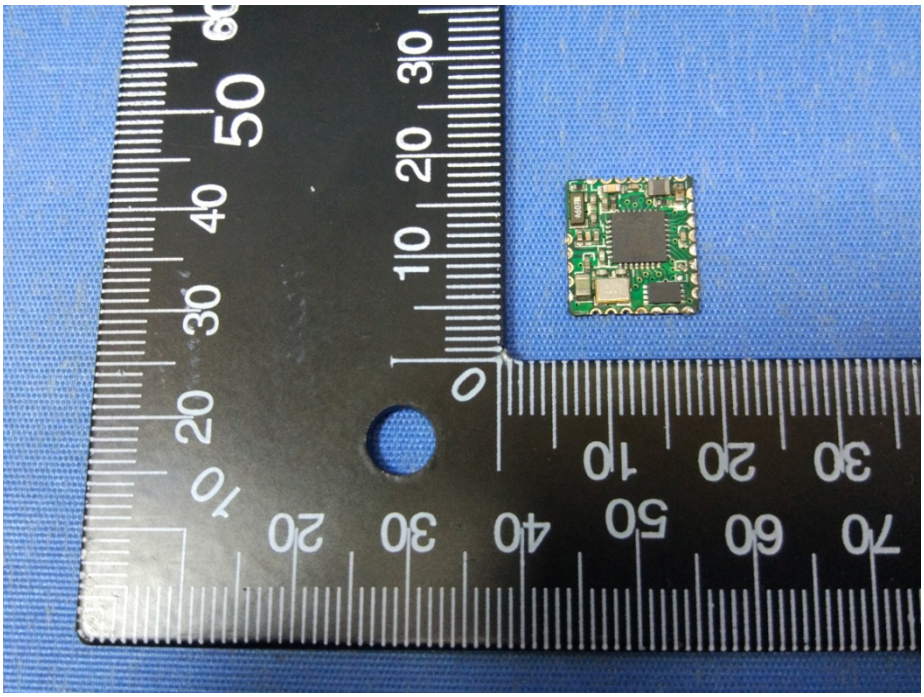


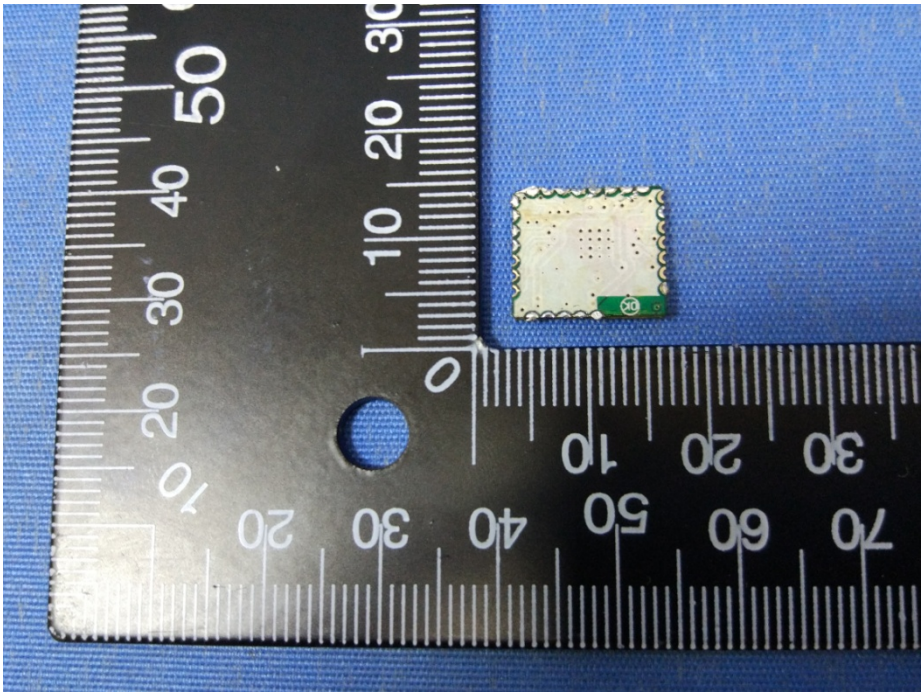

SANYOU
16A 250VAC

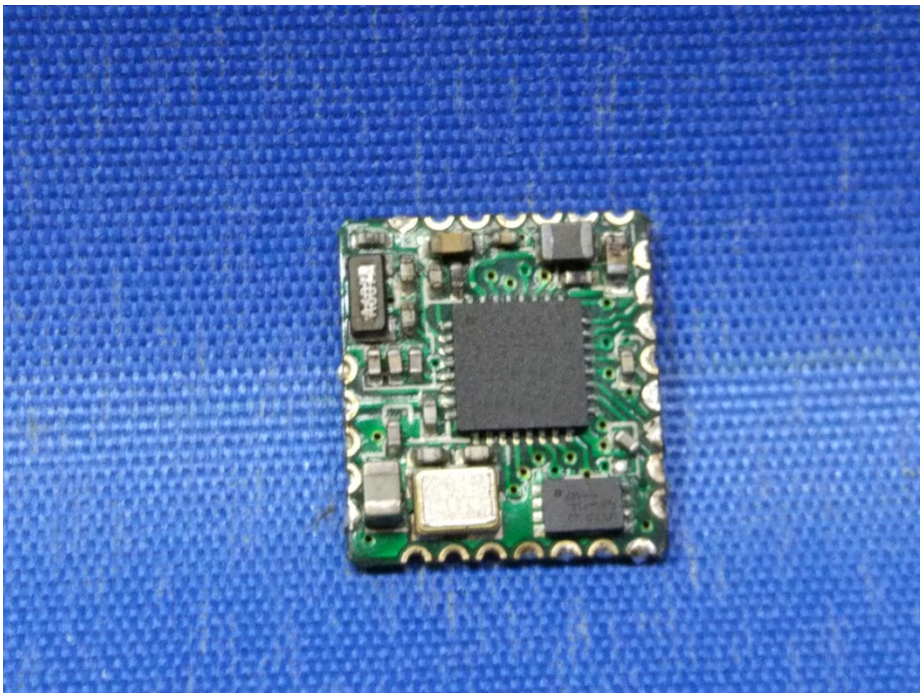



antenna









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