

# TEST REPORT

**Reference No.** ..... : WTS18S08121720W  
**FCC ID**..... : 2AMNH-CONCEPT620  
**Applicant** ..... : Berlin Brands Group Inc  
**Address** ..... : 101 Montgomery Street, Suite 2050 San Francisco, California, United States, 94104  
**Manufacturer** ..... : Shenzhen City Enkor Electronics Ltd.  
**Address** ..... : The 2nd&3rd floor, Building P and building O, Shengguang Ind.park, 148#Donghuan Road, Nandong, Huangpu Shajing street,Bao'an District, Shenzhen, China  
**Product** ..... : Multimedia Speaker System  
**Model(s)**..... : US-10006335, US-10030885, US-10030886, US-10033068, US-10033204, US-10033205, US-10033070, US-10033206, US-10033207  
**Standards** ..... : FCC CFR47 Part 15 Section 15.247: 2018  
**Date of Receipt sample** .... : 2018-08-23  
**Date of Test**..... : 2018-08-23 to 2018-09-07  
**Date of Issue** ..... : 2018-09-07  
**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 Laboratories Introduction

**Waltek Services (Shenzhen) Co., Ltd** is a professional third-party testing and certification laboratory with multi-year product testing and certification experience, established strictly in accordance with ISO/IEC 17025 requirements, and accredited by ILAC (International Laboratory Accreditation Cooperation) member. A2LA (American Association for Laboratory Accreditation, the certification number is 4243.01) of USA, CNAS (China National Accreditation Service for Conformity Assessment, the registration number is L3110) of China. Meanwhile, Waltek has got recognition as registration and accreditation laboratory from EMSD (Electrical and Mechanical Services Department), and American Energy star, FCC(The Federal Communications Commission), CEC(California energy efficiency), ISED (Innovation, Science and Economic Development Canada). It's the strategic partner and data recognition laboratory of international authoritative organizations, such as Intertek(ETL-SEMKO), TÜV Rheinland, TÜV SÜD, etc.



Waltek Services (Shenzhen) Co., Ltd is one of the largest and the most comprehensive third party testing laboratory in China. Our test capability covered four large fields: safety test. ElectroMagnetic Compatibility(EMC), and energy performance, wireless radio. As a professional, comprehensive, justice international test organization, we still keep the scientific and rigorous work attitude to help each client satisfy the international standards and assist their product enter into globe market smoothly.

## 2.1 Test Facility

### A. Accreditations for Conformity Assessment (International)

| Country/Region                                                      | Scope Covered By | Scope              | Note |
|---------------------------------------------------------------------|------------------|--------------------|------|
| USA                                                                 | ISO/IEC 17025    | FCC ID \ DOC \ VOC | 1    |
| Canada                                                              |                  | IC ID \ VOC        | 2    |
| Japan                                                               |                  | MIC-T \ MIC-R      | -    |
| Europe                                                              |                  | EMCD \ RED         | -    |
| Taiwan                                                              |                  | NCC                | -    |
| Hong Kong                                                           |                  | OFCA               | -    |
| Australia                                                           |                  | RCM                | -    |
| India                                                               |                  | WPC                | -    |
| Thailand                                                            |                  | NTC                | -    |
| Singapore                                                           |                  | IDA                | -    |
| Note:                                                               |                  |                    |      |
| 1. FCC Designation No.: CN1201. Test Firm Registration No.: 523476. |                  |                    |      |
| 2. ISED Canada Registration No.: 7760A                              |                  |                    |      |

### B.TCBs and Notify Bodies Recognized Testing Laboratory.

| Recognized Testing Laboratory of ...      | Notify body number |
|-------------------------------------------|--------------------|
| TUV Rheinland                             | Optional.          |
| Intertek                                  |                    |
| TUV SUD                                   |                    |
| SGS                                       |                    |
| Phoenix Testlab GmbH                      | 0700               |
| Element Materials Technology Warwick Ltd. | 0891               |
| Timco Engineering, Inc.                   | 1177               |
| Eurofins Product Service GmbH             | 0681               |

### 3 Contents

|                                            | <b>Page</b> |
|--------------------------------------------|-------------|
| <b>1 COVER PAGE.....</b>                   | <b>1</b>    |
| <b>2 LABORATORIES INTRODUCTION.....</b>    | <b>2</b>    |
| 2.1 TEST FACILITY.....                     | 3           |
| <b>3 CONTENTS.....</b>                     | <b>4</b>    |
| <b>4 REVISION HISTORY .....</b>            | <b>6</b>    |
| <b>5 GENERAL INFORMATION.....</b>          | <b>7</b>    |
| 5.1 GENERAL DESCRIPTION OF E.U.T .....     | 7           |
| 5.2 DETAILS OF E.U.T.....                  | 7           |
| 5.3 CHANNEL LIST.....                      | 7           |
| 5.4 TEST MODE .....                        | 8           |
| <b>6 EQUIPMENT USED DURING TEST .....</b>  | <b>9</b>    |
| 6.1 EQUIPMENTS LIST .....                  | 9           |
| 6.2 MEASUREMENT UNCERTAINTY .....          | 10          |
| 6.3 TEST EQUIPMENT CALIBRATION .....       | 10          |
| <b>7 TEST SUMMARY .....</b>                | <b>11</b>   |
| <b>8 CONDUCTED EMISSION .....</b>          | <b>12</b>   |
| 8.1 E.U.T. OPERATION .....                 | 12          |
| 8.2 EUT SETUP.....                         | 12          |
| 8.3 MEASUREMENT DESCRIPTION .....          | 12          |
| 8.4 CONDUCTED EMISSION TEST RESULT .....   | 13          |
| <b>9 RADIATED EMISSIONS.....</b>           | <b>15</b>   |
| 9.1 EUT OPERATION.....                     | 15          |
| 9.2 TEST SETUP .....                       | 16          |
| 9.3 SPECTRUM ANALYZER SETUP .....          | 17          |
| 9.4 TEST PROCEDURE .....                   | 18          |
| 9.5 SUMMARY OF TEST RESULTS.....           | 19          |
| <b>10 BAND EDGE MEASUREMENT .....</b>      | <b>22</b>   |
| 10.1 TEST PROCEDURE.....                   | 22          |
| 10.2 TEST RESULT: .....                    | 23          |
| <b>11 BANDWIDTH MEASUREMENT.....</b>       | <b>27</b>   |
| 11.1 TEST PROCEDURE:.....                  | 27          |
| 11.2 TEST RESULT: .....                    | 27          |
| <b>12 MAXIMUM PEAK OUTPUT POWER .....</b>  | <b>31</b>   |
| 12.1 TEST PROCEDURE:.....                  | 31          |
| 12.2 TEST RESULT: .....                    | 31          |
| <b>13 HOPPING CHANNEL SEPARATION .....</b> | <b>35</b>   |
| 13.1 TEST PROCEDURE:.....                  | 35          |
| 13.2 TEST RESULT: .....                    | 35          |
| <b>14 NUMBER OF HOPPING FREQUENCY.....</b> | <b>40</b>   |
| 14.1 TEST PROCEDURE:.....                  | 40          |
| 14.2 TEST RESULT: .....                    | 40          |
| <b>15 DWELL TIME .....</b>                 | <b>42</b>   |

|           |                                                   |           |
|-----------|---------------------------------------------------|-----------|
| 15.1      | TEST PROCEDURE:.....                              | 42        |
| 15.2      | TEST RESULT: .....                                | 42        |
| <b>16</b> | <b>ANTENNA REQUIREMENT .....</b>                  | <b>47</b> |
| <b>17</b> | <b>RF EXPOSURE.....</b>                           | <b>48</b> |
| 17.1      | REQUIREMENTS.....                                 | 48        |
| 17.2      | THE PROCEDURES / LIMIT .....                      | 48        |
| 17.3      | MPE CALCULATION METHOD .....                      | 49        |
| <b>18</b> | <b>PHOTOGRAPHS -TEST SETUP PHOTOS .....</b>       | <b>50</b> |
| 18.1      | PHOTOGRAPH-CONDUCTED EMISSIONS TEST SETUP .....   | 50        |
| 18.2      | PHOTOGRAPH-RADIATED EMISSIONS.....                | 50        |
| <b>19</b> | <b>PHOTOGRAPHS – CONSTRUCTIONAL DETAILS .....</b> | <b>53</b> |
| 19.1      | EUT – APPEARANCE VIEW .....                       | 53        |
| 19.2      | INTERNAL PHOTOS .....                             | 58        |

**4 Revision History**

| Test report No. | Date of Receipt sample | Date of Test             | Date of Issue | Purpose  | Comment | Approved |
|-----------------|------------------------|--------------------------|---------------|----------|---------|----------|
| WTS18S08121720W | 2018-08-23             | 2018-08-23 to 2018-09-07 | 2018-09-07    | original | -       | Valid    |

## 5 General Information

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

|                              |                                                                                                                     |
|------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>Product:</b>              | Multimedia Speaker System                                                                                           |
| <b>Model(s):</b>             | US-10006335, US-10030885, US-10030886, US-10033068, US-10033204, US-10033205, US-10033070, US-10033206, US-10033207 |
| <b>Model descriptions:</b>   | Only the model names are different. The model US-10006335 is the tested sample.                                     |
| <b>Operation Frequency:</b>  | 2402-2480MHz, 79(EDR) Channels in total                                                                             |
| <b>RF out Power:</b>         | -0.16dBm                                                                                                            |
| <b>Antenna installation:</b> | PCB Printed Antenna                                                                                                 |
| <b>Antenna Gain:</b>         | 0dBi                                                                                                                |
| <b>Type of Modulation:</b>   | GFSK, Pi/4DQPSK                                                                                                     |

### 5.2 Details of E.U.T

|                 |                     |
|-----------------|---------------------|
| <b>Ratings:</b> | Input: AC 120V 60Hz |
|-----------------|---------------------|

### 5.3 Channel List

| Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) |
|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|
| 1           | 2402            | 2           | 2403            | 3           | 2404            | 4           | 2405            |
| 5           | 2406            | 6           | 2407            | 7           | 2408            | 8           | 2409            |
| 9           | 2410            | 10          | 2411            | 11          | 2412            | 12          | 2413            |
| 13          | 2414            | 14          | 2415            | 15          | 2416            | 16          | 2417            |
| 17          | 2418            | 18          | 2419            | 19          | 2420            | 20          | 2421            |
| 21          | 2422            | 22          | 2423            | 23          | 2424            | 24          | 2425            |
| 25          | 2426            | 26          | 2427            | 27          | 2428            | 28          | 2429            |
| 29          | 2430            | 30          | 2431            | 31          | 2432            | 32          | 2433            |
| 33          | 2434            | 34          | 2435            | 35          | 2436            | 36          | 2437            |
| 37          | 2438            | 38          | 2439            | 39          | 2440            | 40          | 2441            |
| 41          | 2442            | 42          | 2443            | 43          | 2444            | 44          | 2445            |
| 45          | 2446            | 46          | 2447            | 47          | 2448            | 48          | 2449            |
| 49          | 2450            | 50          | 2451            | 51          | 2452            | 52          | 2453            |
| 53          | 2454            | 54          | 2455            | 55          | 2456            | 56          | 2457            |
| 57          | 2458            | 58          | 2459            | 59          | 2460            | 60          | 2461            |
| 61          | 2462            | 62          | 2463            | 63          | 2464            | 64          | 2465            |
| 65          | 2466            | 66          | 2467            | 67          | 2468            | 68          | 2469            |
| 69          | 2470            | 70          | 2471            | 71          | 2472            | 72          | 2473            |
| 73          | 2474            | 74          | 2475            | 75          | 2476            | 76          | 2477            |
| 77          | 2478            | 78          | 2479            | 79          | 2480            | -           | -               |

#### 5.4 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     | 2441MHz        | 2480MHz      |

Table 2 Tests Carried Out Under FCC part 15.207 and 15.209

| Test Item           | Test Mode    |
|---------------------|--------------|
| Radiated Emissions  | Transmitting |
| Conducted Emissions | Transmitting |



## 6 Equipment Used during Test

### 6.1 Equipments List

| Conducted Emissions                                           |                            |                      |             |                 |                       |                      |
|---------------------------------------------------------------|----------------------------|----------------------|-------------|-----------------|-----------------------|----------------------|
| Item                                                          | Equipment                  | Manufacturer         | Model No.   | Serial No.      | Last Calibration Date | Calibration Due Date |
| 1.                                                            | EMI Test Receiver          | R&S                  | ESCI        | 101155          | 2017-09-12            | 2018-09-11           |
| 2.                                                            | LISN                       | SCHWARZBECK          | NSLK 8128   | 8128-289        | 2017-09-12            | 2018-09-11           |
| 3.                                                            | Limiter                    | York                 | MTS-IMP-136 | 261115-001-0024 | 2017-09-12            | 2018-09-11           |
| 4.                                                            | Cable                      | LARGE                | RF300       | -               | 2017-09-12            | 2018-09-11           |
| 3m Semi-anechoic Chamber for Radiation Emissions Test site 1# |                            |                      |             |                 |                       |                      |
| Item                                                          | Equipment                  | Manufacturer         | Model No.   | Serial No.      | Last Calibration Date | Calibration Due Date |
| 1                                                             | Spectrum Analyzer          | R&S                  | FSP         | 100091          | 2017-09-14            | 2018-09-13           |
| 2                                                             | Amplifier                  | Agilent              | 8447D       | 2944A10178      | 2017-10-16            | 2018-10-15           |
| 3                                                             | Active Loop Antenna        | Beijing Dazhi        | ZN30900A    | 0703            | 2018-04-08            | 2019-04-07           |
| 4                                                             | Trilog Broadband Antenna   | SCHWARZBECK          | VULB9163    | 336             | 2017-09-12            | 2018-09-11           |
| 5                                                             | Coaxial Cable (below 1GHz) | Top                  | TYPE16(13M) | -               | 2018-04-08            | 2019-04-07           |
| 6                                                             | Broad-band Horn Antenna    | SCHWARZBECK          | BBHA 9120 D | 667             | 2017-09-14            | 2018-09-13           |
| 7                                                             | Broad-band Horn Antenna    | SCHWARZBECK          | BBHA 9170   | 335             | 2017-09-14            | 2018-09-13           |
| 8                                                             | Broadband Preamplifier     | COMPLIANCE DIRECTION | PAP-1G18    | 2004            | 2018-04-12            | 2019-04-11           |
| 9                                                             | Coaxial Cable (above 1GHz) | Top                  | 1GHz-18GHz  | EW02014-7       | 2018-04-12            | 2019-04-11           |
| 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          | 2018-04-12            | 2019-04-11           |
| 2                                                             | Trilog Broadband Antenna   | SCHWARZBECK          | VULB9160    | 9160-3325       | 2018-04-08            | 2019-04-07           |
| 3                                                             | Amplifier                  | ANRITSU              | MH648A      | M43381          | 2018-04-12            | 2019-04-11           |
| 4                                                             | Cable                      | HUBER+SUHNER         | CBL2        | 525178          | 2018-04-12            | 2019-04-11           |
| 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<br>(9k-6GHz)  | R&S     | FSL6   | 100959     | 2017-09-12 | 2018-09-11 |
| 3 | Signal Analyzer<br>(9k~26.5GHz) | Agilent | N9010A | MY50520207 | 2017-09-12 | 2018-09-11 |

## 6.2 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 (30M~1000MHz)           |
|                                   | $\pm 5.47$ dB (1000M~25000MHz)        |
| Conducted Spurious Emissions test | $\pm 3.64$ dB (AC mains 150KHz~30MHz) |

## 6.3 Test Equipment Calibration

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

## 7 Test Summary

| Test Items                                                                | Test Requirement                 | Result |
|---------------------------------------------------------------------------|----------------------------------|--------|
| Conduct Emission                                                          | 15.207                           | C      |
| Spurious Radiated Emissions                                               | 15.205(a)<br>15.209<br>15.247(d) | C      |
| Band edge                                                                 | 15.247(d)<br>15.205(a)           | C      |
| Bandwidth                                                                 | 15.247(a)(1)                     | C      |
| Maximum Peak Output Power                                                 | 15.247(b)(1)                     | C      |
| Frequency Separation                                                      | 15.247(a)(1)                     | C      |
| Number of Hopping Frequency                                               | 15.247(a)(1)(iii)                | C      |
| Dwell time                                                                | 15.247(a)(1)(iii)                | C      |
| SAR                                                                       | 1.1307(b)(1)                     | C      |
| Antenna Requirement                                                       | 15.203                           | C      |
| Note: C=Compliance; NC=Not Compliance; NT=Not Tested; N/A=Not Applicable. |                                  |        |

## 8 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:

| Frequency (MHz) | Conducted Limit (dB $\mu$ V) |           |
|-----------------|------------------------------|-----------|
|                 | Qsi-peak                     | Average   |
| 0.15 to 0.5     | 66 to 56*                    | 56 to 46* |
| 0.5 to 5.0      | 56                           | 46        |
| 5.0 to 30       | 60                           | 50        |

\*Decreases with the logarithm of the frequency.

### 8.1 E.U.T. Operation

Operating Environment :

Temperature: 22.8 °C

Humidity: 52.6 % RH

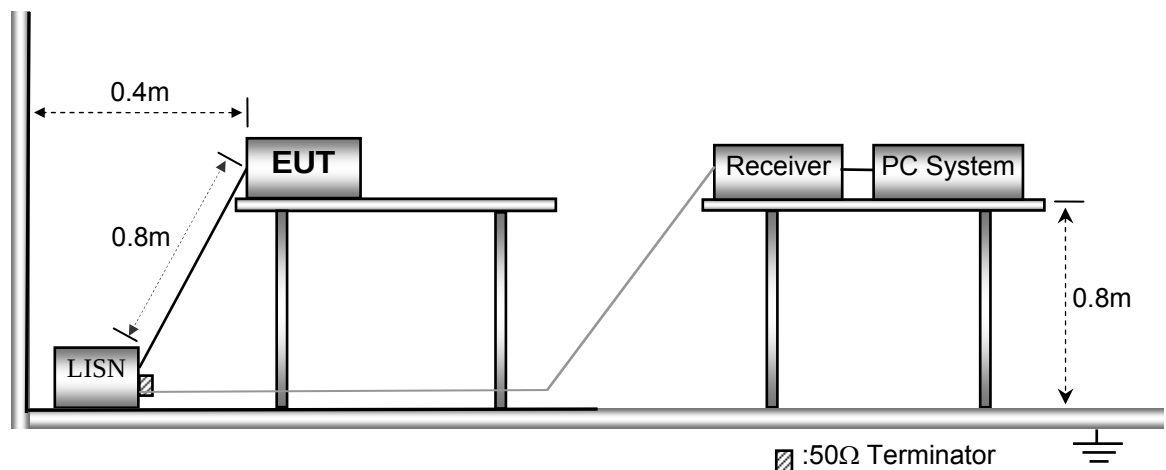
Atmospheric Pressure: 101.2kPa

EUT Operation :

Refer to Section 4.4.

### 8.2 EUT Setup

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



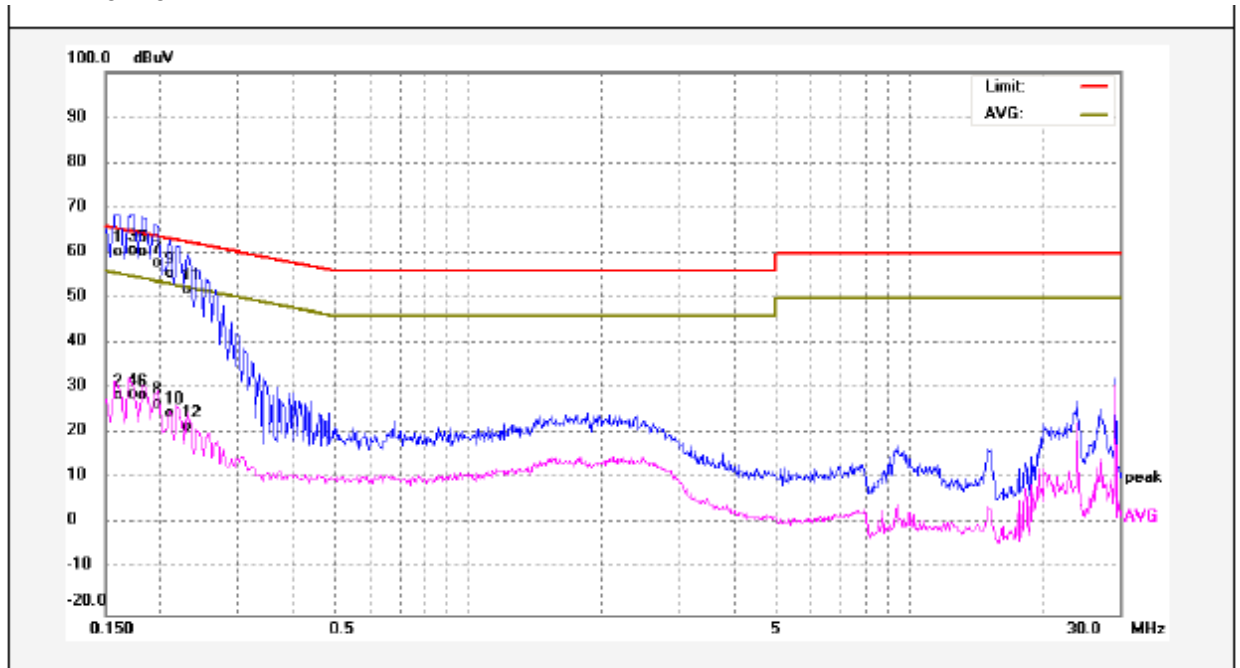
### 8.3 Measurement Description

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.

## 8.4 Conducted Emission Test Result

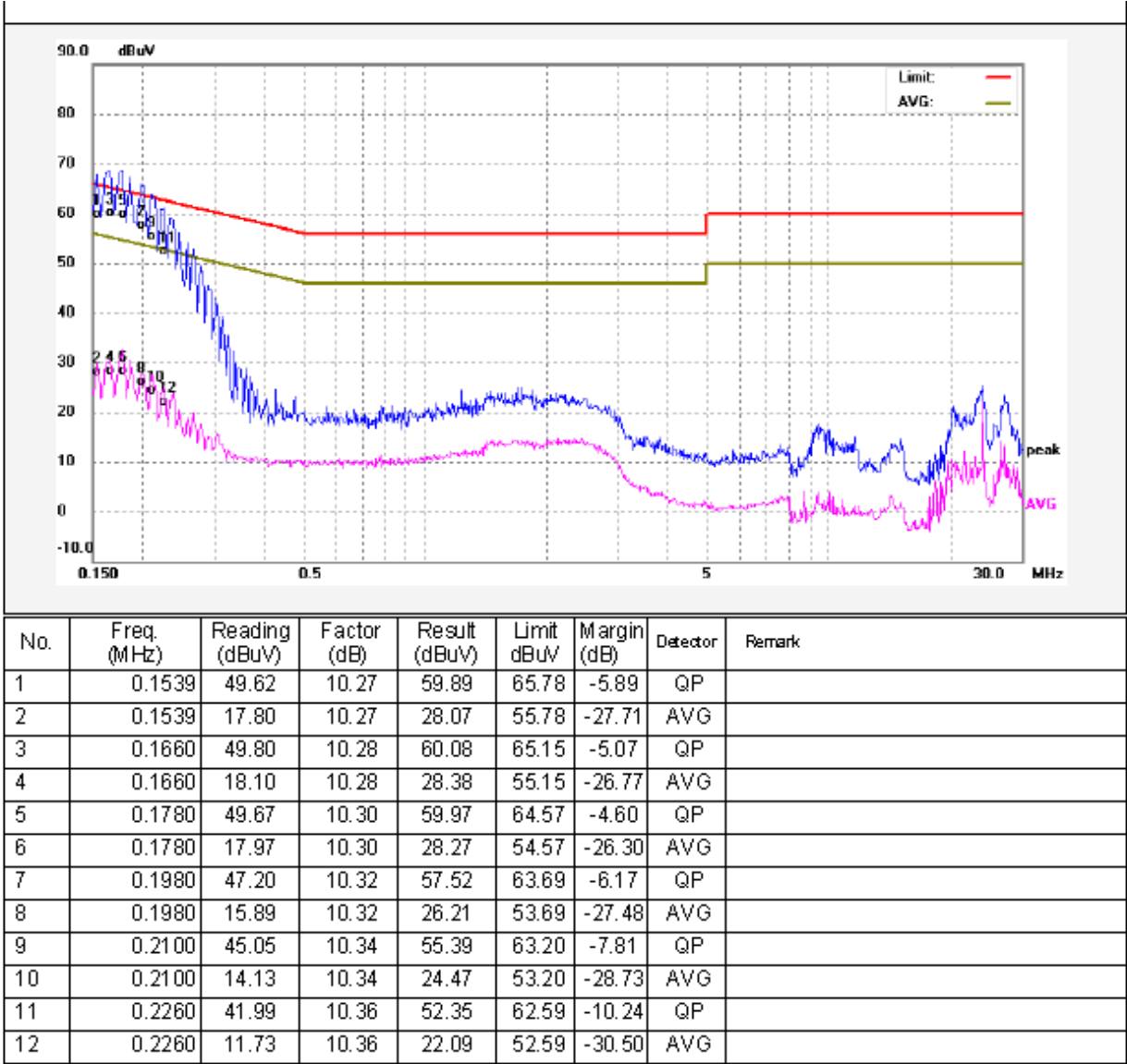
An initial pre-scan was performed on the live and neutral lines.

Live line:



| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit dBuV | Margin (dB) | Detector | Remark |
|-----|-------------|----------------|-------------|---------------|------------|-------------|----------|--------|
| 1   | 0.1620      | 49.88          | 10.28       | 60.16         | 65.36      | -5.20       | QP       |        |
| 2   | 0.1620      | 18.10          | 10.28       | 28.38         | 55.36      | -26.98      | AVG      |        |
| 3   | 0.1740      | 50.38          | 10.29       | 60.67         | 64.76      | -4.09       | QP       |        |
| 4   | 0.1740      | 18.36          | 10.29       | 28.65         | 54.76      | -26.11      | AVG      |        |
| 5   | 0.1819      | 49.88          | 10.30       | 60.18         | 64.39      | -4.21       | QP       |        |
| 6   | 0.1819      | 18.14          | 10.30       | 28.44         | 54.39      | -25.95      | AVG      |        |
| 7   | 0.1945      | 47.54          | 10.32       | 57.86         | 63.84      | -5.98       | QP       |        |
| 8   | 0.1945      | 16.22          | 10.32       | 26.54         | 53.84      | -27.30      | AVG      |        |
| 9   | 0.2100      | 45.21          | 10.34       | 55.55         | 63.20      | -7.65       | QP       |        |
| 10  | 0.2100      | 14.18          | 10.34       | 24.52         | 53.20      | -28.68      | AVG      |        |
| 11  | 0.2300      | 41.45          | 10.36       | 51.81         | 62.45      | -10.64      | QP       |        |
| 12  | 0.2300      | 11.30          | 10.36       | 21.66         | 52.45      | -30.79      | AVG      |        |

Neutral line:



## 9 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: 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                                         | $20\log^{(500)}$                      |

### 9.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 52.1 % RH

Atmospheric Pressure: 101.2kPa

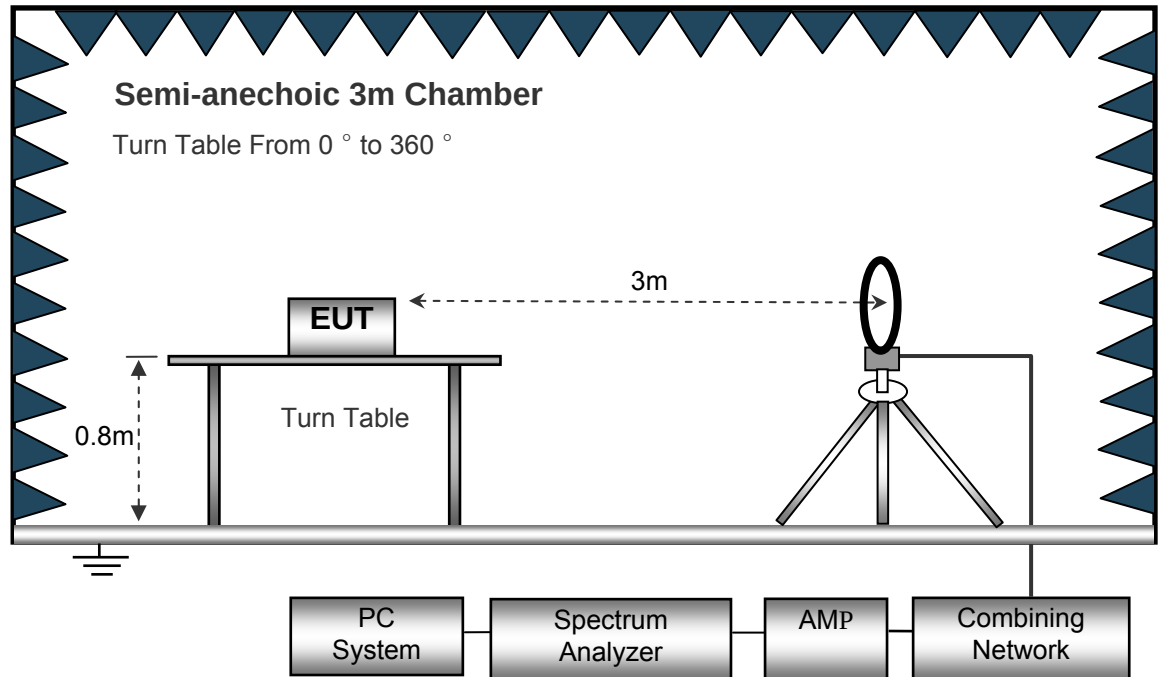
EUT Operation :

Refer to Section 4.4.

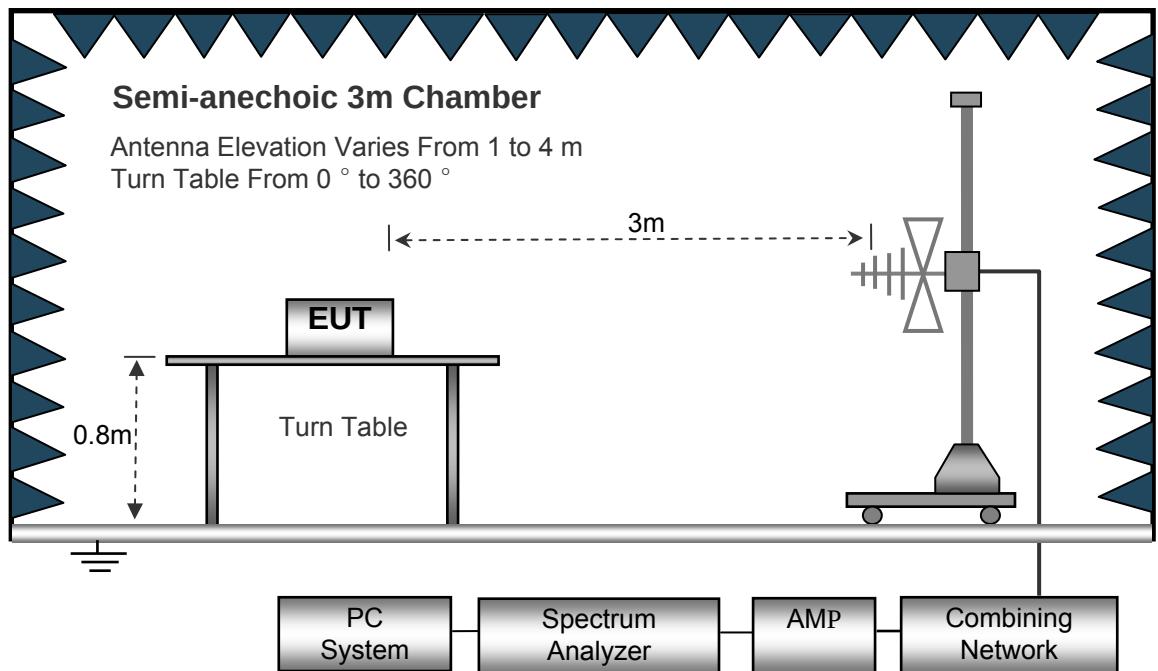
## 9.2 Test Setup

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.

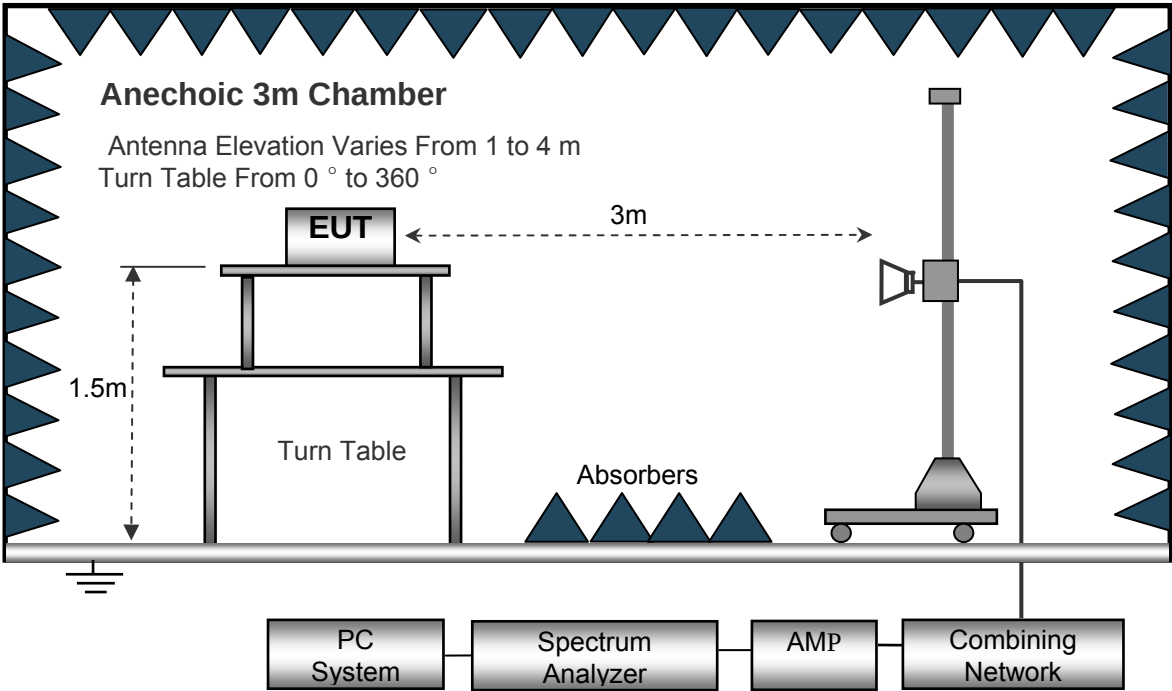


The test setup for emission measurement from 30 MHz to 1 GHz.





The test setup for emission measurement above 1 GHz.



9.3 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

## 9.4 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.

## 9.5 Summary of Test Results

### Test Frequency: 9kHz ~ 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 | FCC Part 15.247/209/205 |        |
|--------------------------|------------------|-------------|------------------|------------|-------|------------------|---------------------|-------------------------|--------|
|                          |                  |             |                  | Height     | Polar |                  |                     | Limit                   | Margin |
| (MHz)                    | (dBμV)           | (PK/QP/Ave) | Degree           | (m)        | (H/V) | (dB)             | (dBμV/m)            | (dBμV/m)                | (dB)   |
| GFSK Low Channel 2402MHz |                  |             |                  |            |       |                  |                     |                         |        |
| 255.46                   | 15.12            | QP          | 162              | 1.9        | H     | 10.54            | 25.66               | 39.46                   | -13.80 |
| 255.46                   | 15.18            | QP          | 171              | 1.8        | V     | 10.54            | 25.72               | 39.46                   | -13.74 |
| 4804.00                  | 46.57            | PK          | 293              | 1.5        | V     | -1.08            | 45.49               | 74.00                   | -28.51 |
| 4804.00                  | 44.11            | Ave         | 293              | 1.5        | V     | -1.08            | 43.03               | 54.00                   | -10.97 |
| 7206.00                  | 54.54            | PK          | 67               | 1.5        | H     | 1.34             | 55.88               | 74.00                   | -18.12 |
| 7206.00                  | 41.82            | Ave         | 67               | 1.5        | H     | 1.34             | 43.16               | 54.00                   | -10.84 |
| 2339.66                  | 48.26            | PK          | 165              | 1.8        | V     | -13.20           | 35.06               | 74.00                   | -38.94 |
| 2339.66                  | 37.35            | Ave         | 165              | 1.8        | V     | -13.20           | 24.15               | 54.00                   | -29.85 |
| 2355.55                  | 49.96            | PK          | 42               | 1.3        | H     | -13.12           | 36.84               | 74.00                   | -37.16 |
| 2355.55                  | 38.92            | Ave         | 42               | 1.3        | H     | -13.12           | 25.80               | 54.00                   | -28.20 |
| 2499.02                  | 49.52            | PK          | 275              | 1.6        | V     | -13.02           | 36.50               | 74.00                   | -37.50 |
| 2499.02                  | 37.70            | Ave         | 275              | 1.6        | V     | -13.02           | 24.68               | 54.00                   | -29.32 |

| Frequency                   | Receiver Reading | Detector    | Turn table Angle | RX Antenna |       | Corrected Factor | Corrected Amplitude | FCC Part 15.247/209/205 |        |
|-----------------------------|------------------|-------------|------------------|------------|-------|------------------|---------------------|-------------------------|--------|
|                             |                  |             |                  | Height     | Polar |                  |                     | Limit                   | Margin |
| (MHz)                       | (dBμV)           | (PK/QP/Ave) | Degree           | (m)        | (H/V) | (dB)             | (dBμV/m)            | (dBμV/m)                | (dB)   |
| GFSK Middle Channel 2441MHz |                  |             |                  |            |       |                  |                     |                         |        |
| 255.46                      | 15.18            | QP          | 84               | 1.9        | H     | 10.54            | 25.72               | 39.46                   | -13.74 |
| 255.46                      | 14.48            | QP          | 99               | 1.2        | V     | 10.54            | 25.02               | 39.46                   | -14.44 |
| 4882.00                     | 40.07            | PK          | 81               | 1.6        | V     | -0.62            | 39.45               | 74.00                   | -34.55 |
| 4882.00                     | 42.70            | Ave         | 81               | 1.6        | V     | -0.62            | 42.08               | 54.00                   | -11.92 |
| 7323.00                     | 52.80            | PK          | 49               | 1.0        | H     | 2.21             | 55.01               | 74.00                   | -18.99 |
| 7323.00                     | 41.46            | Ave         | 49               | 1.0        | H     | 2.21             | 43.67               | 54.00                   | -10.33 |
| 2313.13                     | 45.44            | PK          | 326              | 1.1        | V     | -13.19           | 32.25               | 74.00                   | -41.75 |
| 2313.13                     | 39.07            | Ave         | 326              | 1.1        | V     | -13.19           | 25.88               | 54.00                   | -28.12 |
| 2356.02                     | 45.14            | PK          | 137              | 1.7        | H     | -13.14           | 32.00               | 74.00                   | -42.00 |
| 2356.02                     | 38.12            | Ave         | 137              | 1.7        | H     | -13.14           | 24.98               | 54.00                   | -29.02 |
| 2484.79                     | 49.35            | PK          | 30               | 1.7        | V     | -13.08           | 36.27               | 74.00                   | -37.73 |
| 2484.79                     | 38.99            | Ave         | 30               | 1.7        | V     | -13.08           | 25.91               | 54.00                   | -28.09 |

| Frequency                 | Receiver Reading | Detector    | Turn table Angle | RX Antenna |       | Corrected Factor | Corrected Amplitude | FCC Part 15.247/209/205 |        |
|---------------------------|------------------|-------------|------------------|------------|-------|------------------|---------------------|-------------------------|--------|
|                           |                  |             |                  | Height     | Polar |                  |                     | Limit                   | Margin |
| (MHz)                     | (dBμV)           | (PK/QP/Ave) | Degree           | (m)        | (H/V) | (dB)             | (dBμV/m)            | (dBμV/m)                | (dB)   |
| GFSK High Channel 2480MHz |                  |             |                  |            |       |                  |                     |                         |        |
| 255.46                    | 22.47            | QP          | 261              | 1.6        | H     | 10.54            | 33.01               | 39.46                   | -6.45  |
| 255.46                    | 19.04            | QP          | 137              | 2.0        | V     | 10.54            | 29.58               | 39.46                   | -9.88  |
| 4960.00                   | 54.23            | PK          | 239              | 1.1        | V     | -0.24            | 53.99               | 74.00                   | -20.01 |
| 4960.00                   | 41.24            | Ave         | 239              | 1.1        | V     | -0.24            | 41.00               | 54.00                   | -13.00 |
| 7440.00                   | 51.57            | PK          | 322              | 1.3        | H     | 2.84             | 54.41               | 74.00                   | -19.59 |
| 7440.00                   | 42.31            | Ave         | 322              | 1.3        | H     | 2.84             | 45.15               | 54.00                   | -8.85  |
| 2331.22                   | 45.75            | PK          | 195              | 1.7        | V     | -13.19           | 32.56               | 74.00                   | -41.44 |
| 2331.22                   | 37.80            | Ave         | 195              | 1.7        | V     | -13.19           | 24.61               | 54.00                   | -29.39 |
| 2382.53                   | 43.49            | PK          | 241              | 1.0        | H     | -13.14           | 30.35               | 74.00                   | -43.65 |
| 2382.53                   | 37.97            | Ave         | 241              | 1.0        | H     | -13.14           | 24.83               | 54.00                   | -29.17 |
| 2494.25                   | 43.77            | PK          | 61               | 1.5        | V     | -13.08           | 30.69               | 74.00                   | -43.31 |
| 2494.25                   | 37.63            | Ave         | 61               | 1.5        | V     | -13.08           | 24.55               | 54.00                   | -29.45 |

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

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

## 10 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) (see Section 15.205(c)).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Test Method:      | ANSI C63.10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

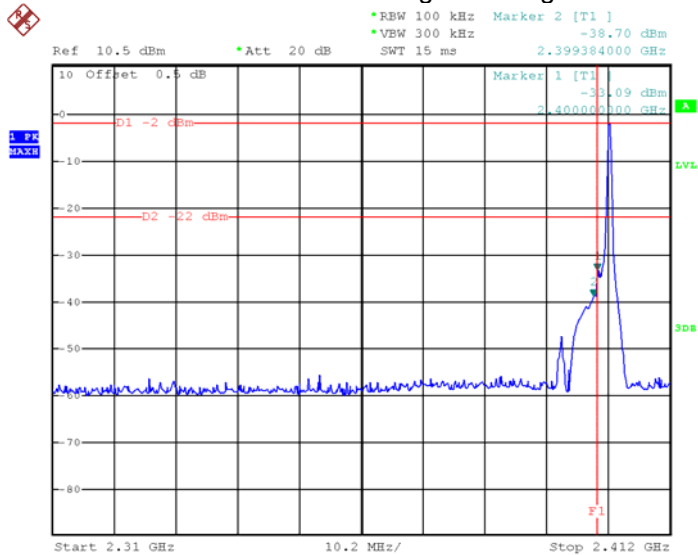
### 10.1 Test Procedure

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, Sweep = auto  
Detector function = peak, Trace = max hold

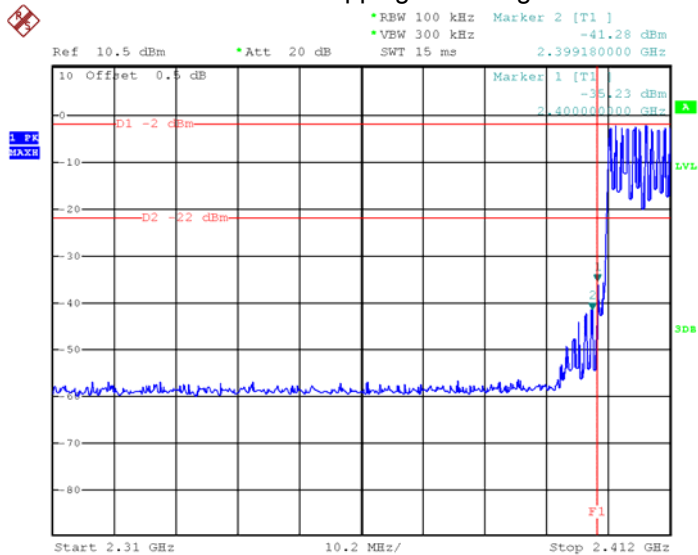
10.2 Test Result:

Test plots

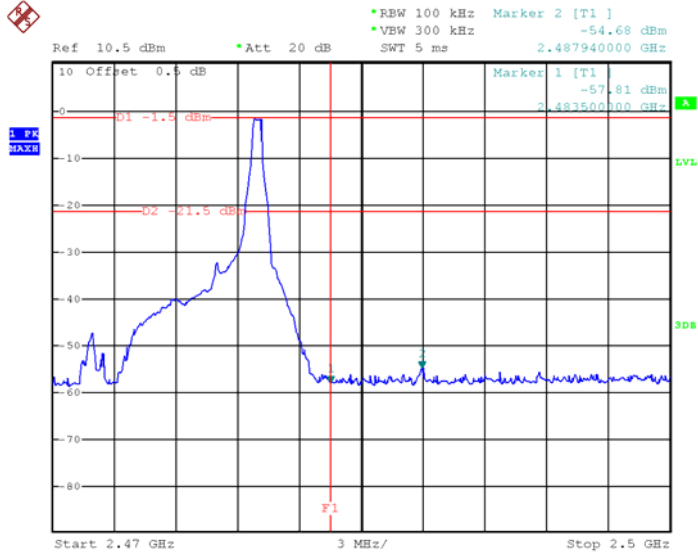
GFSK Transmitting Band edge-left side



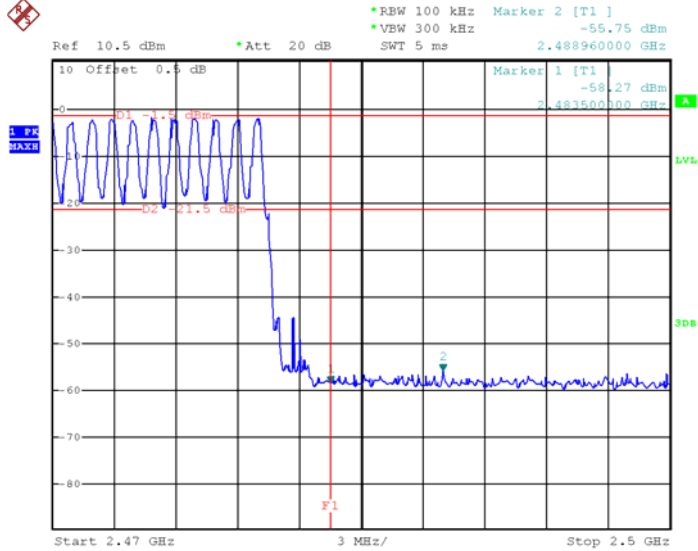
GFSK Hopping Band edge-left side



GFSK Transmitting Band edge-right side

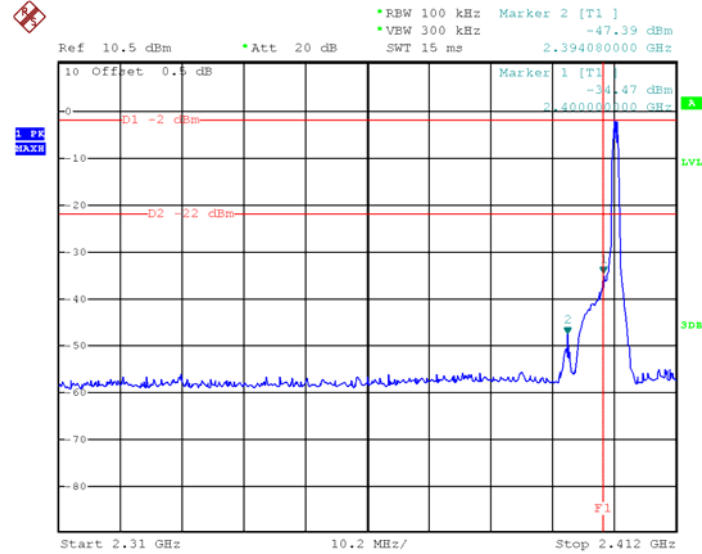


GFSK Hopping Band edge-right side

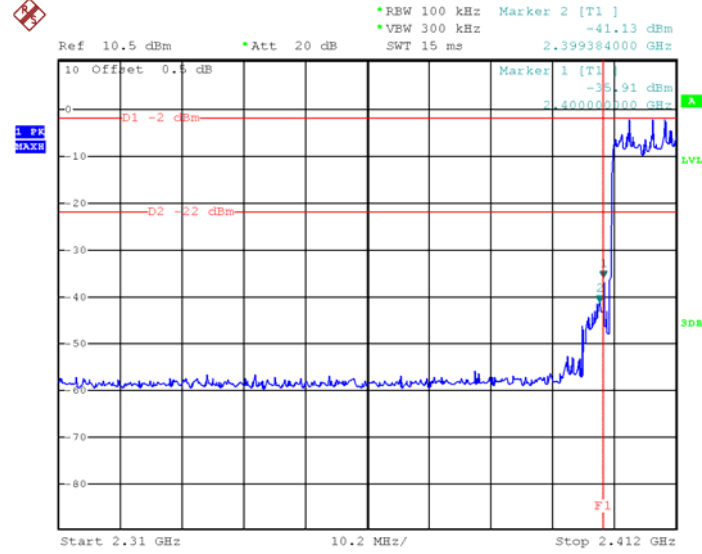




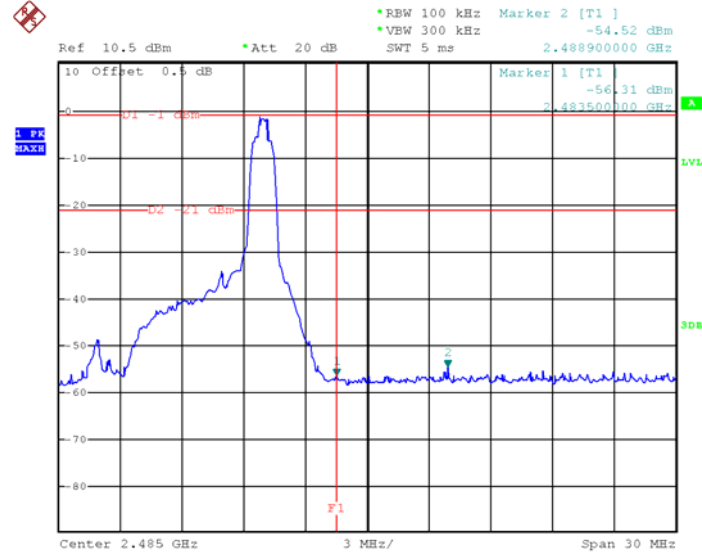
Pi/4 DQPSK Transmitting Band edge-left side



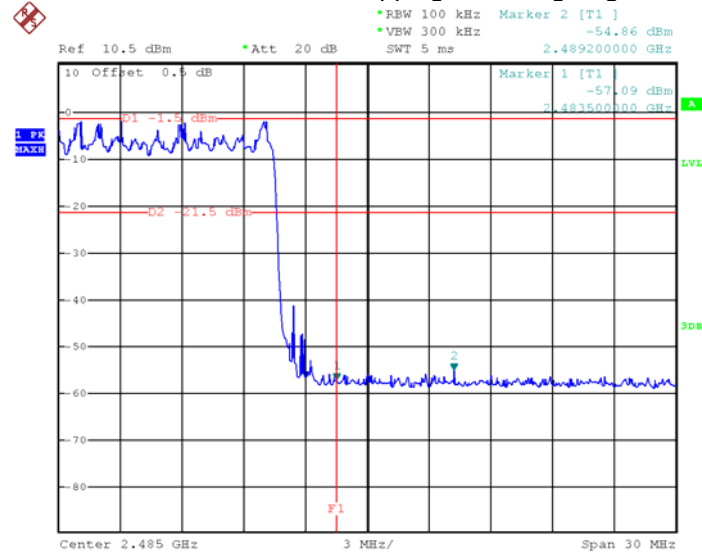
Pi/4 DQPSK Hopping Band edge-left side



Pi/4 DQPSK Transmitting Band edge-right side



Pi/4 DQPSK Hopping Band edge-right side



11 Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247  
Test Method: C63.10: 2013  
Test Mode: Test in fixing operating frequency at low, Middle, high channel.

11.1 Test Procedure:

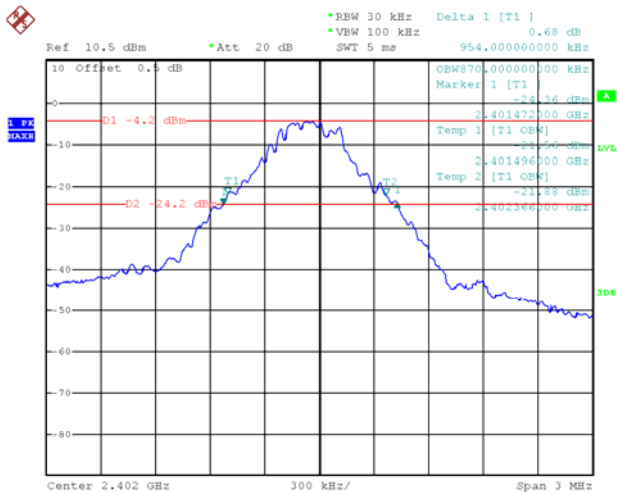
- 1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
- 2. Set the spectrum analyzer: RBW = 30kHz, VBW = 100kHz

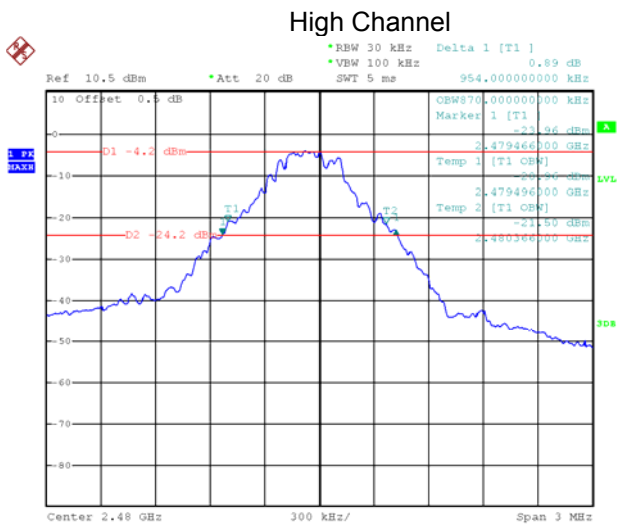
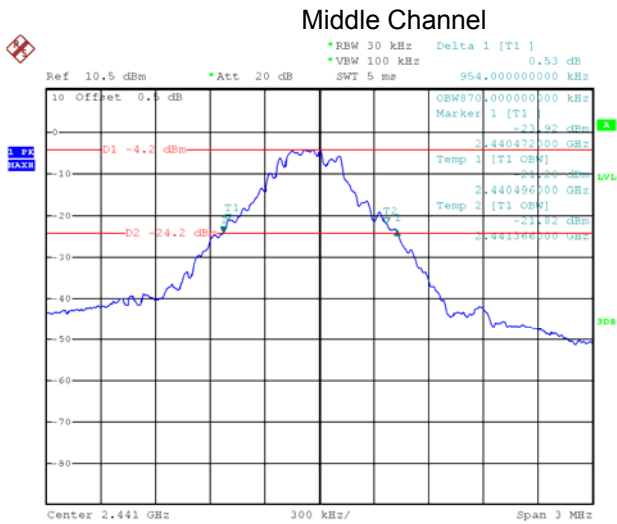
11.2 Test Result:

| Modulation | Test Channel | 20 dB Bandwidth(MHz) | 99% Bandwidth(MHz) |
|------------|--------------|----------------------|--------------------|
| GFSK       | Low          | 0.954                | 0.870              |
| GFSK       | Middle       | 0.954                | 0.870              |
| GFSK       | High         | 0.954                | 0.870              |
| Pi/4 DQPSK | Low          | 1.320                | 1.176              |
| Pi/4 DQPSK | Middle       | 1.320                | 1.170              |
| Pi/4 DQPSK | High         | 1.320                | 1.170              |

Test result plot as follows:

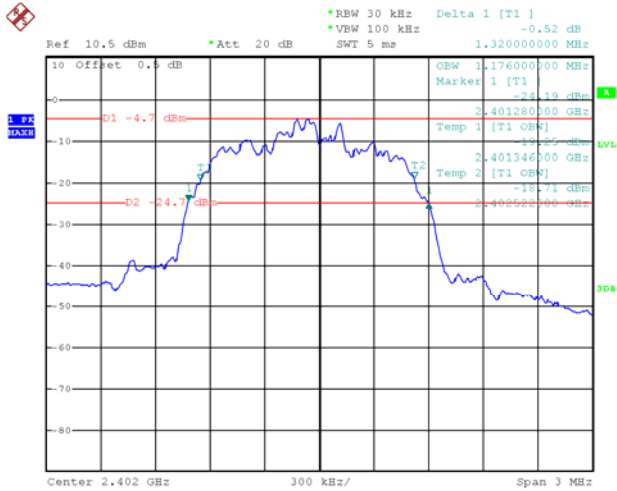
Modulation: GFSK Low Channel



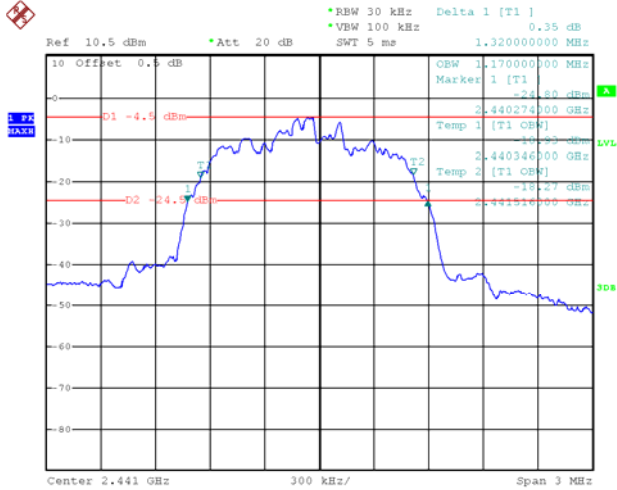


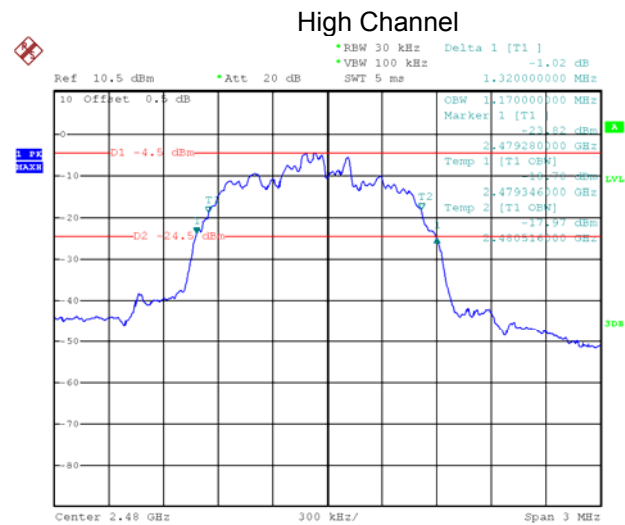
Modulation: Pi/4 DQPSK

Low Channel



Middle Channel





## 12 Maximum Peak Output Power

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | FCC CFR47 Part 15 Section 15.247                                                                                                                                                                                                                                                                                                                                                                                       |
| Test Method:      | C63.10:2013                                                                                                                                                                                                                                                                                                                                                                                                            |
| Test Limit:       | Regulation 15.247 (b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.<br>Refer to the result "Number of Hopping Frequency" of this document. The 1watts (30 dBm) limit applies. |
| Test mode:        | Test in fixing frequency transmitting mode.                                                                                                                                                                                                                                                                                                                                                                            |

### 12.1 Test Procedure:

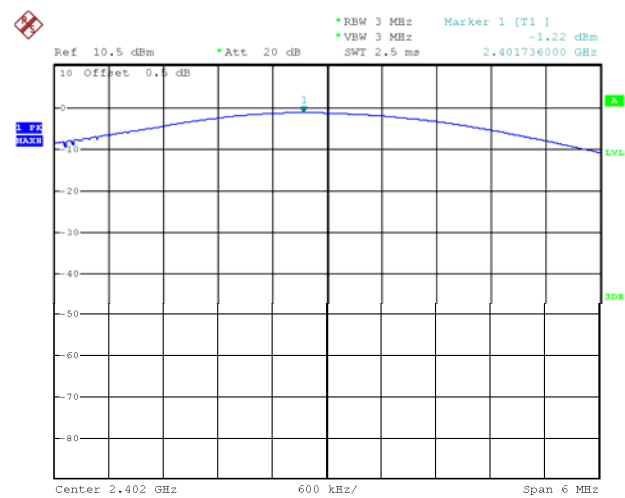
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3 MHz. VBW = 3 MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max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

### 12.2 Test Result:

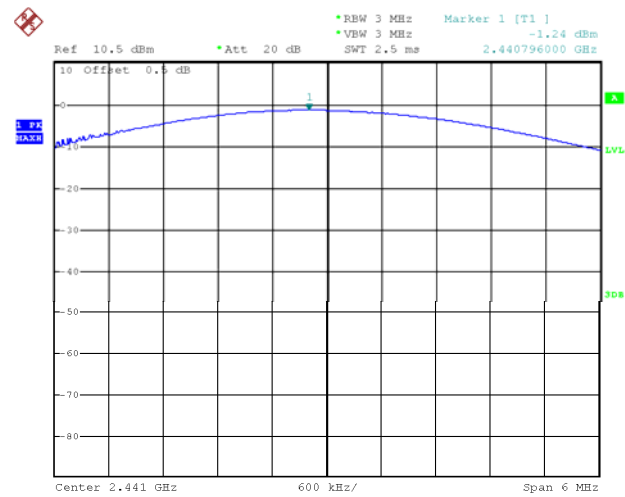
| Test Mode  | Data Rate | Peak Power(dBm) |                |              | Limit (dBm) |
|------------|-----------|-----------------|----------------|--------------|-------------|
|            |           | Low Channel     | Middle Channel | High Channel |             |
| GFSK       | 1Mbps     | -1.22           | -1.24          | -1.11        | 20.97       |
| Pi/4 DQPSK | 2Mbps     | -0.28           | -0.30          | -0.16        | 20.97       |

Test result plot as follows:

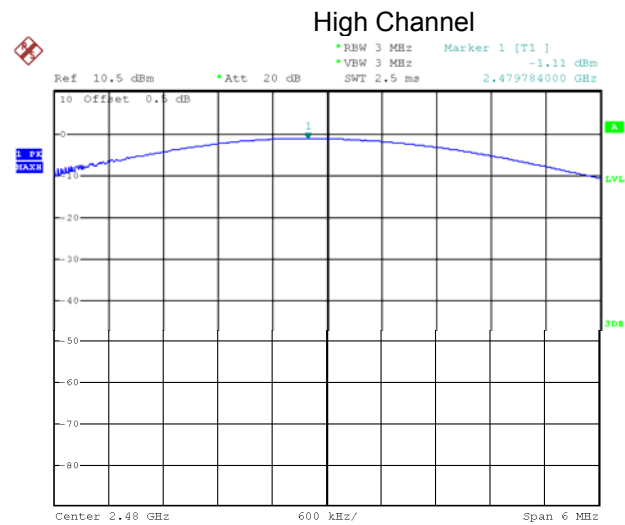
Modulation: GFSK  
Low Channel



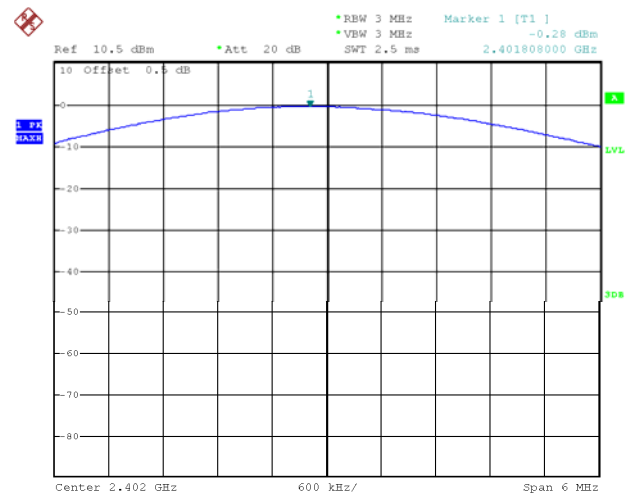
Middle Channel



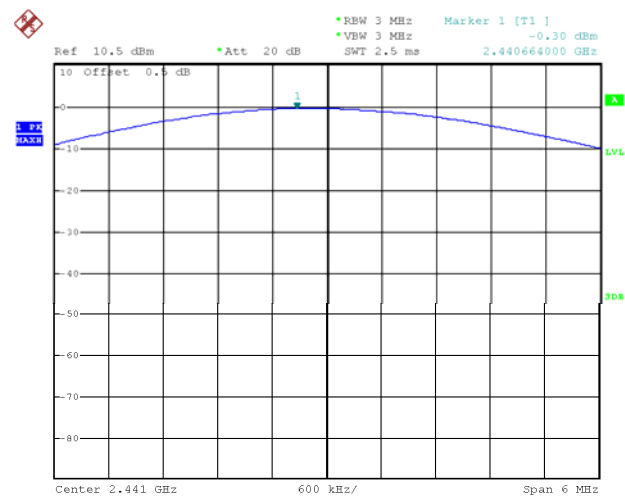




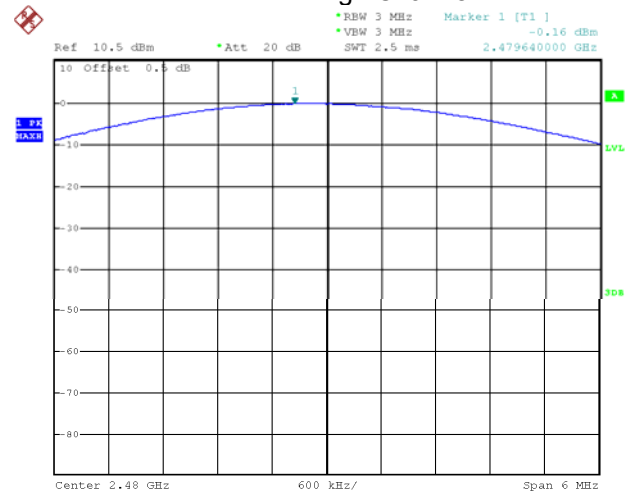
Modulation: Pi/4 DQPSK Low Channel  
Low Channel



Middle Channel



High Channel



## 13 Hopping Channel Separation

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | FCC CFR47 Part 15 Section 15.247                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Test Method:      | C63.10:2013                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Test Limit:       | Regulation 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 1W. |
| Test Mode:        | Test in hopping transmitting operating mode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

### 13.1 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 = 30KHz. VBW = 100KHz , Span = 3MHz. 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.

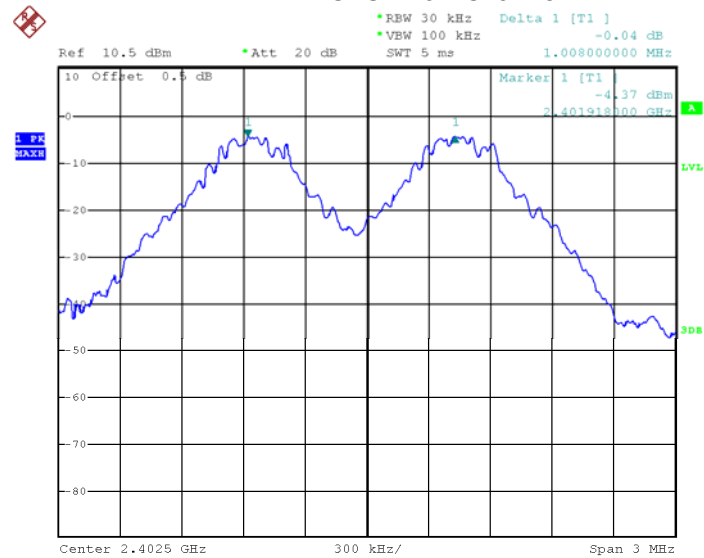
### 13.2 Test Result:

Test result plot as follows:

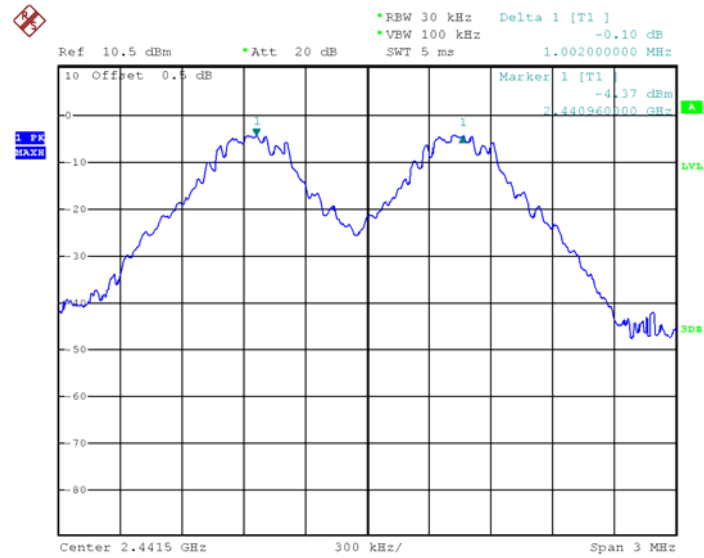
| Modulation | Test Channel | Separation (MHz) | Result |
|------------|--------------|------------------|--------|
| GFSK       | Low          | 1.008 MHz        | PASS   |
| GFSK       | Middle       | 1.002 MHz        | PASS   |
| GFSK       | High         | 1.002 MHz        | PASS   |
| Pi/4 DQPSK | Low          | 1.002 MHz        | PASS   |
| Pi/4 DQPSK | Middle       | 1.020 MHz        | PASS   |
| Pi/4 DQPSK | High         | 1.020 MHz        | PASS   |

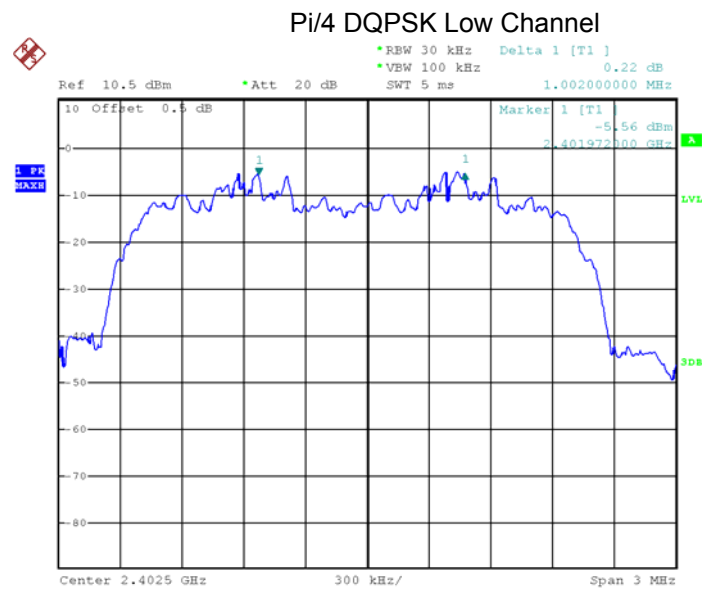
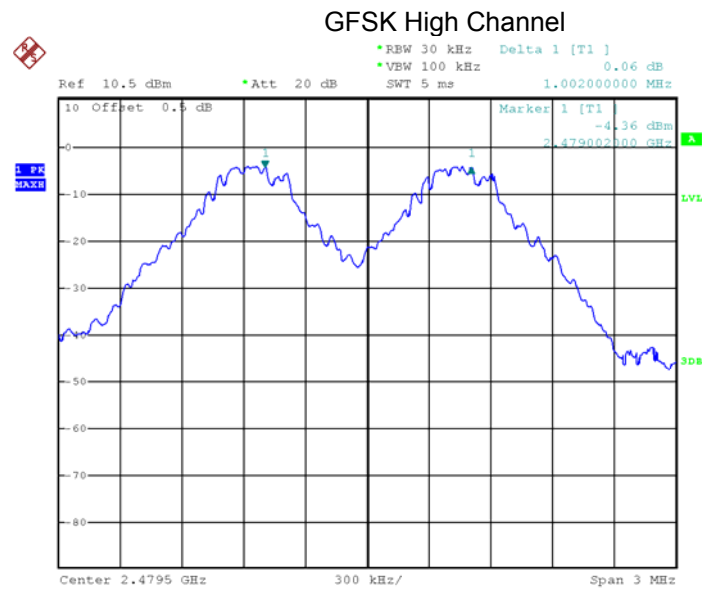
Test plots

GFSK Low Channel

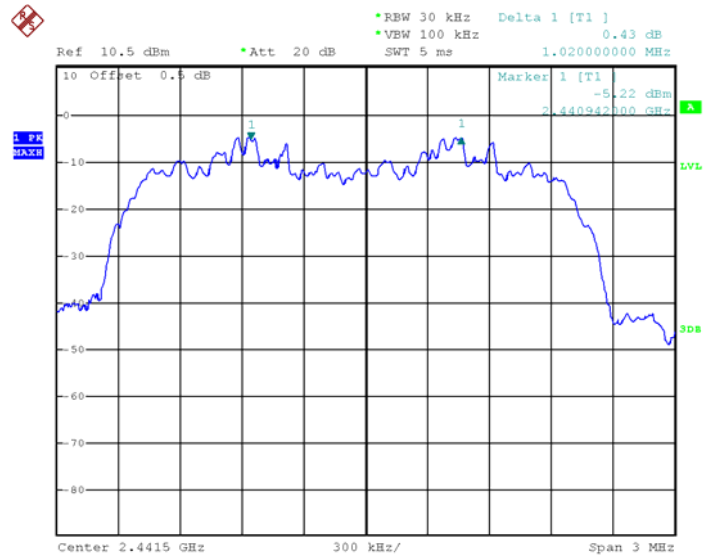


GFSK Middle Channel

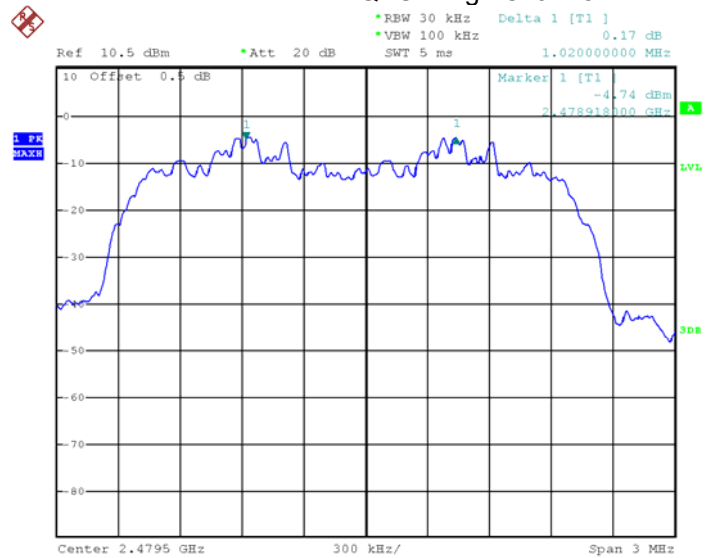




## Pi/4 DQPSK Middle Channel



## Pi/4 DQPSK High Channel





## 14 Number of Hopping Frequency

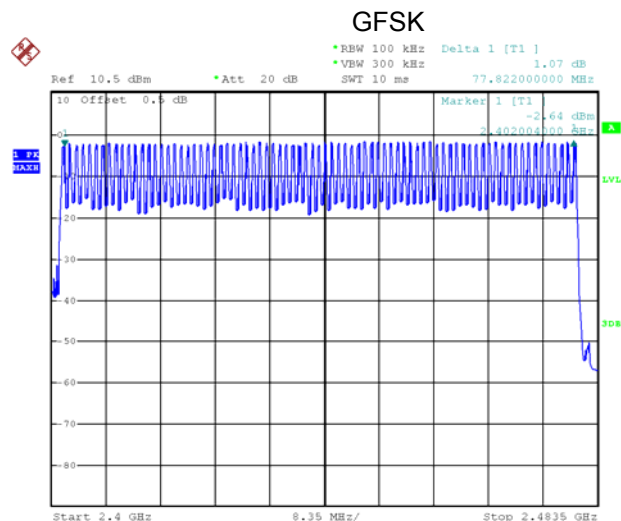
|                   |                                                                                                                     |
|-------------------|---------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | FCC CFR47 Part 15 Section 15.247                                                                                    |
| Test Method:      | C63.10:2013                                                                                                         |
| Test Limit:       | Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. |
| Test Mode:        | Test in hopping transmitting operating mode.                                                                        |

### 14.1 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. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;

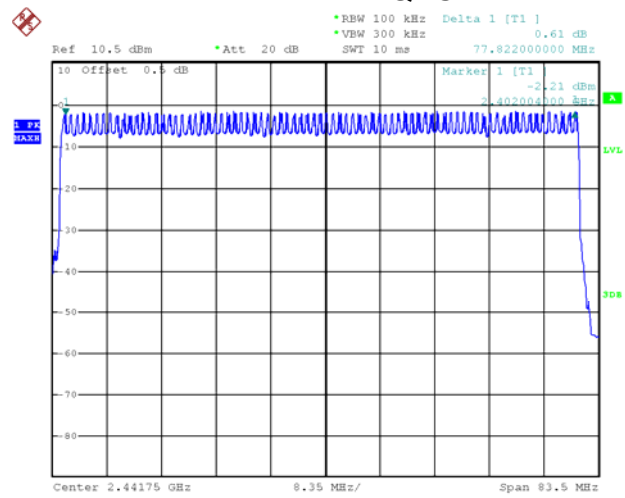
### 14.2 Test Result:

Total Channels are 79 Channels.





## Pi/4 DQPSK



## 15 Dwell Time

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | FCC CFR47 Part 15 Section 15.247                                                                                                                                                                                                                                                                                                                                                                                                             |
| Test Method:      | C63.10:2013                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Test Limit:       | Regulation 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used. |
| Test Mode:        | Test in hopping transmitting operating mode.                                                                                                                                                                                                                                                                                                                                                                                                 |

### 15.1 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 spectrum analyzer span = 0. centred on a hopping channel;
- 3.Set RBW = 1MHz and VBW = 3MHz. Sweep = as necessary to capture the entire dwell time per hopping channel.
- 4.Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

### 15.2 Test Result:

Dwell time = Pulse wide x (Hopping rate / Number of channels) x Period

The test period:  $T = 0.4(s) * 79 = 31.6 (s)$

DH5 Packet permit maximum  $1600 / 79 / 6$  hops per second in each channel (5 time slots RX, 1 time slot TX).

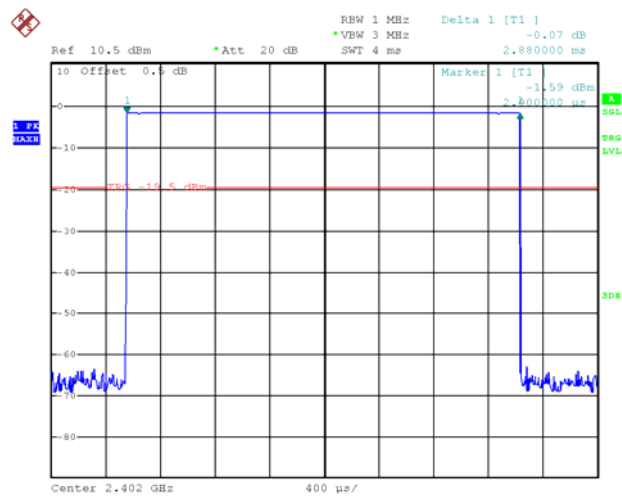
DH3 Packet permit maximum  $1600 / 79 / 4$  hops per second in each channel (3 time slots RX, 1 time slot TX).

DH1 Packet permit maximum  $1600 / 79 / 2$  hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

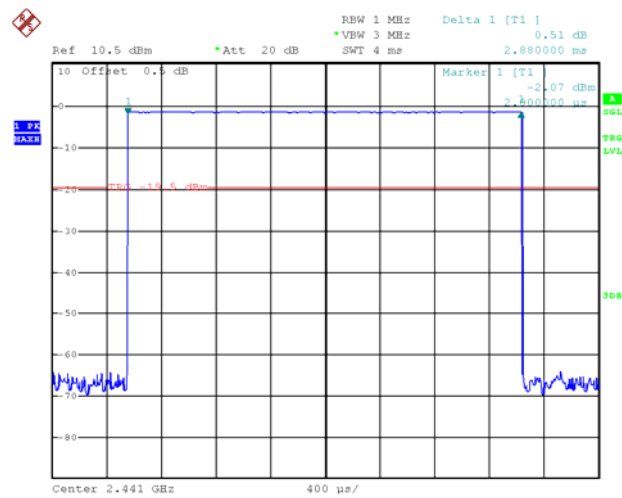
| Data Packet | Dwell Time(s)                    |
|-------------|----------------------------------|
| DH5         | $1600/79/6*31.6*(MkrDelta)/1000$ |
| DH3         | $1600/79/4*31.6*(MkrDelta)/1000$ |
| DH1         | $1600/79/2*31.6*(MkrDelta)/1000$ |
| Remark      | Mkr Delta is single pulse time.  |

| Modulation | Data Packet | Channel | pulse time(ms) | Dwell Time(s) | Limits(s) |
|------------|-------------|---------|----------------|---------------|-----------|
| GFSK       | DH5         | Low     | 2.880          | 0.307         | 0.4       |
|            |             | middle  | 2.880          | 0.307         | 0.4       |
|            |             | High    | 2.880          | 0.307         | 0.4       |
| Pi/4DQPSK  | 2DH5        | Low     | 2.880          | 0.307         | 0.4       |
|            |             | middle  | 2.880          | 0.307         | 0.4       |
|            |             | High    | 2.880          | 0.307         | 0.4       |

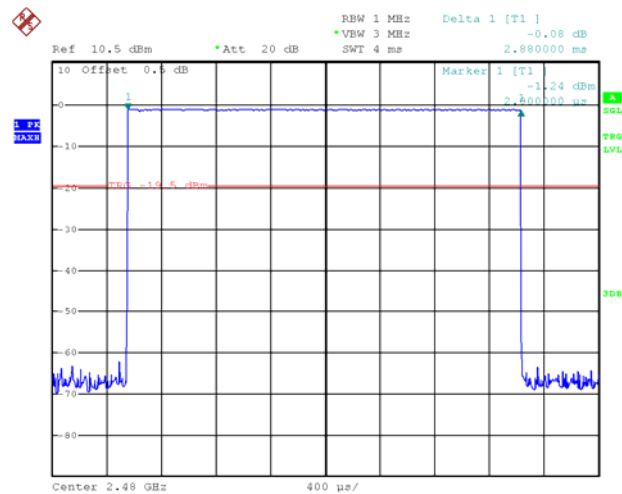
DH5.Low channel



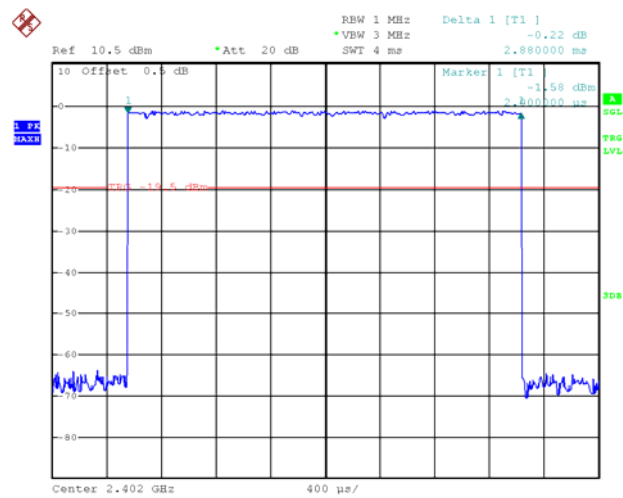
## DH5.Middle channel



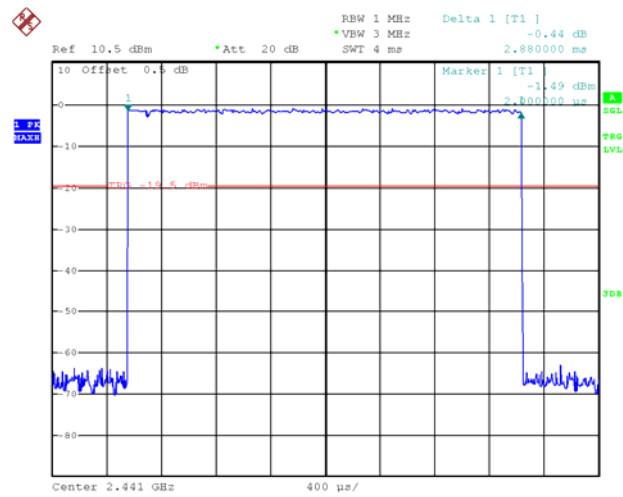
## DH5,High channel



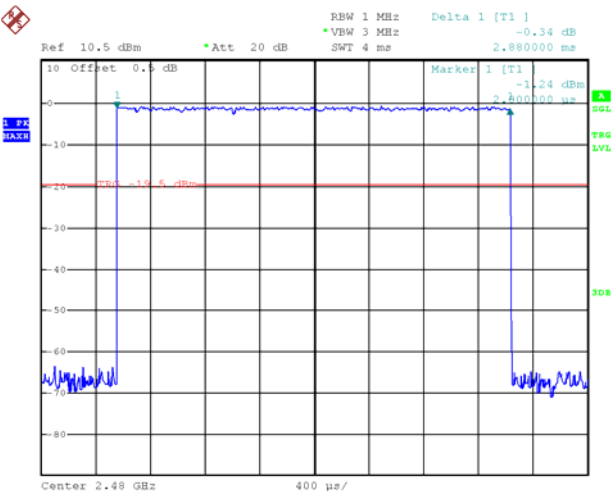
2DH5 Low channel



2DH5.Middle channel



2DH5,High channel



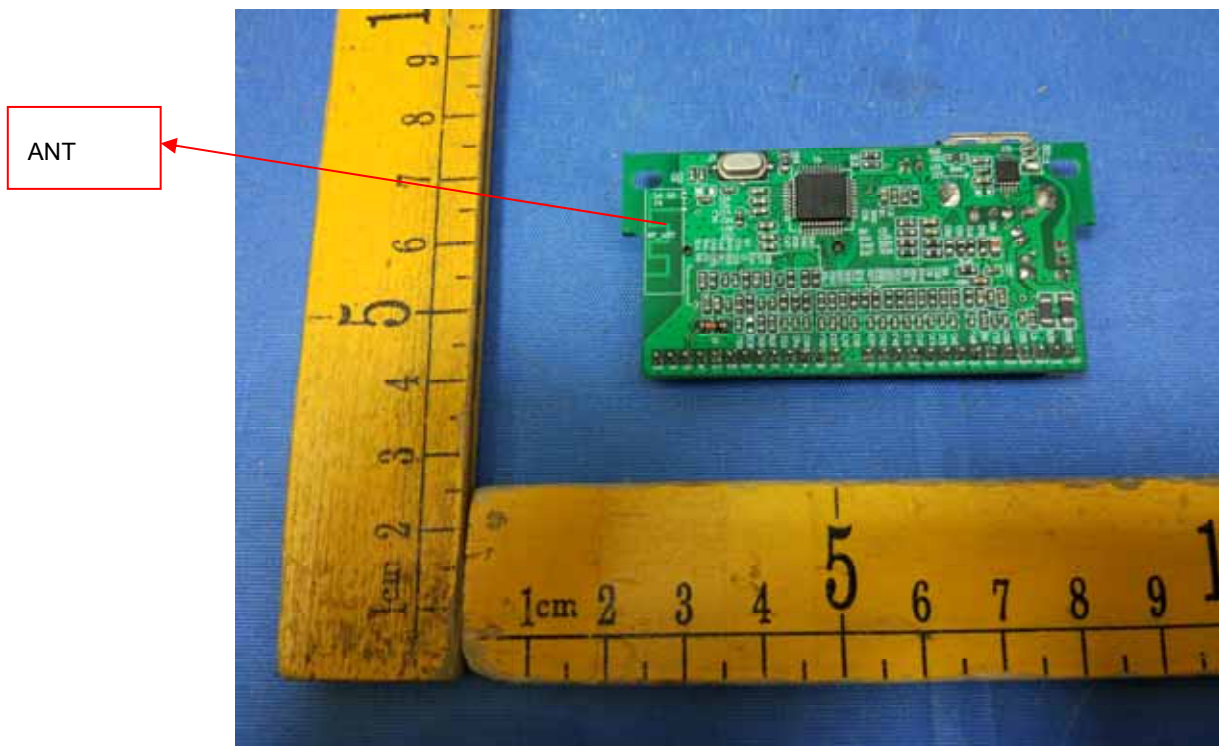
## 16 Antenna Requirement

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 have PCB Printed Antenna, meets the requirements of FCC 15.203.



## 17 RF Exposure

Test Requirement: FCC Part 1.1307  
 Evaluation Method: FCC Part 2.1091

### 17.1 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.

### 17.2 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



### 17.3MPE Calculation Method

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

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

**d** = Separation distance between radiator and human body (m)=0.2m

The formula can be changed to

$$Pd = P_{out} * G / (4 * \pi * R^2)$$

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/cm <sup>2</sup> ) | Limit of Power Density (mW/cm <sup>2</sup> ) |
|--------------------|------------------------|------------------------------|------------------------|-------------------------------------|----------------------------------------------|
| 0                  | 1.000                  | -0.16                        | 0.96                   | 0.0002                              | 1                                            |

Result: Compliance.

No SAR measurement is required.

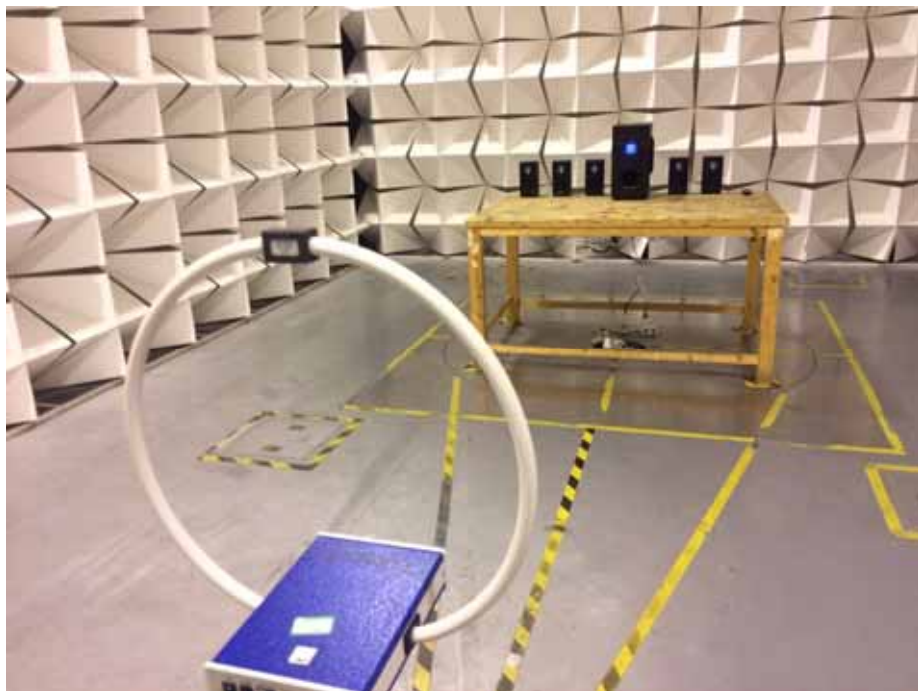
## 18 Photographs -Test Setup Photos

### 18.1 Photograph-Conducted Emissions Test Setup

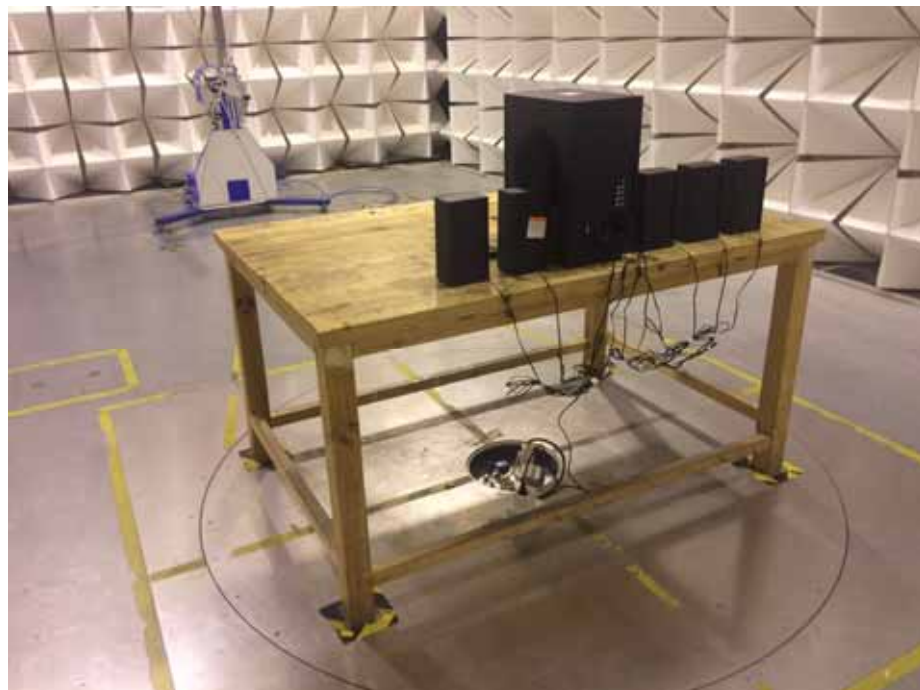
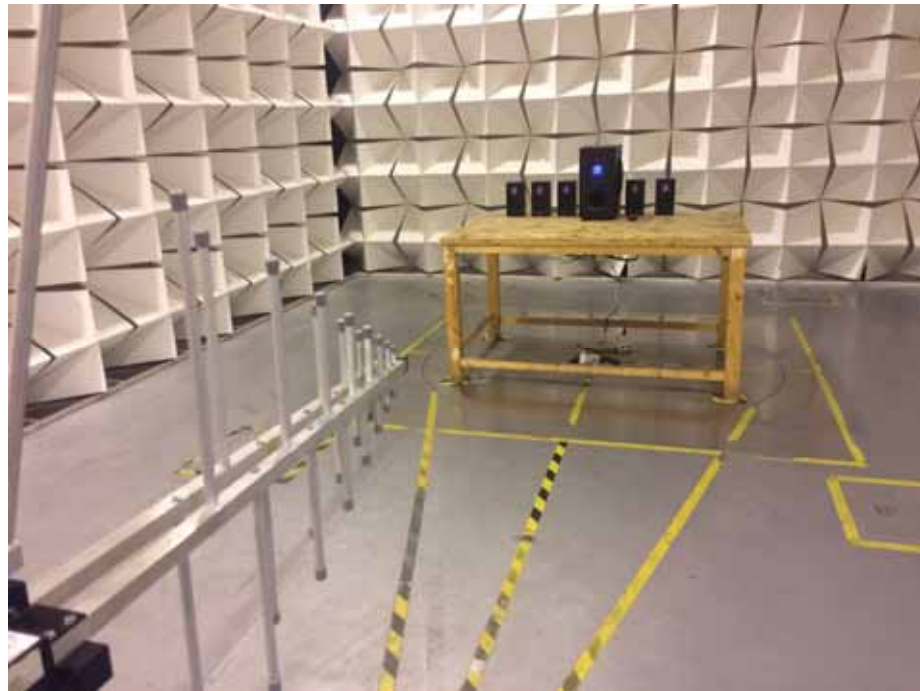


### 18.2 Photograph-Radiated Emissions

Test Frequency Below 30MHz



Test Frequency 30MHz to 1000MHz



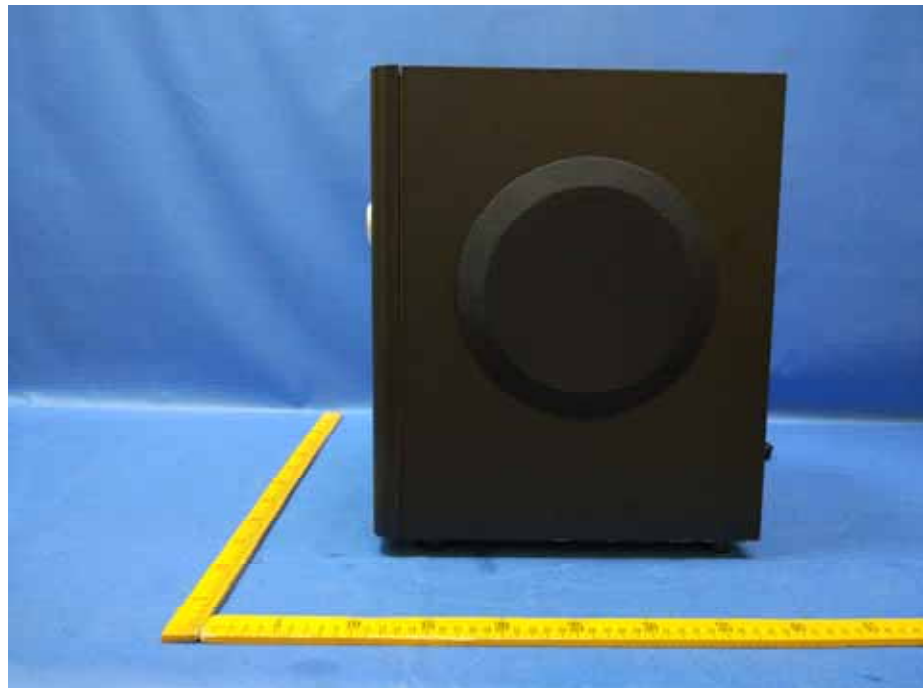
Test Frequency Above 1GHz



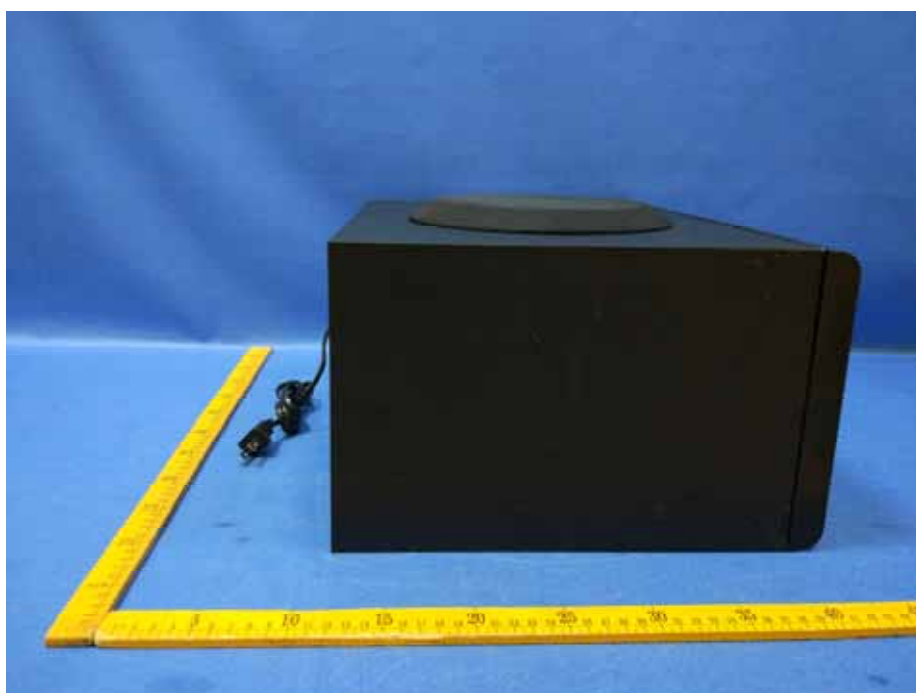
## 19 Photographs – Constructional Details

### 19.1 EUT – Appearance View









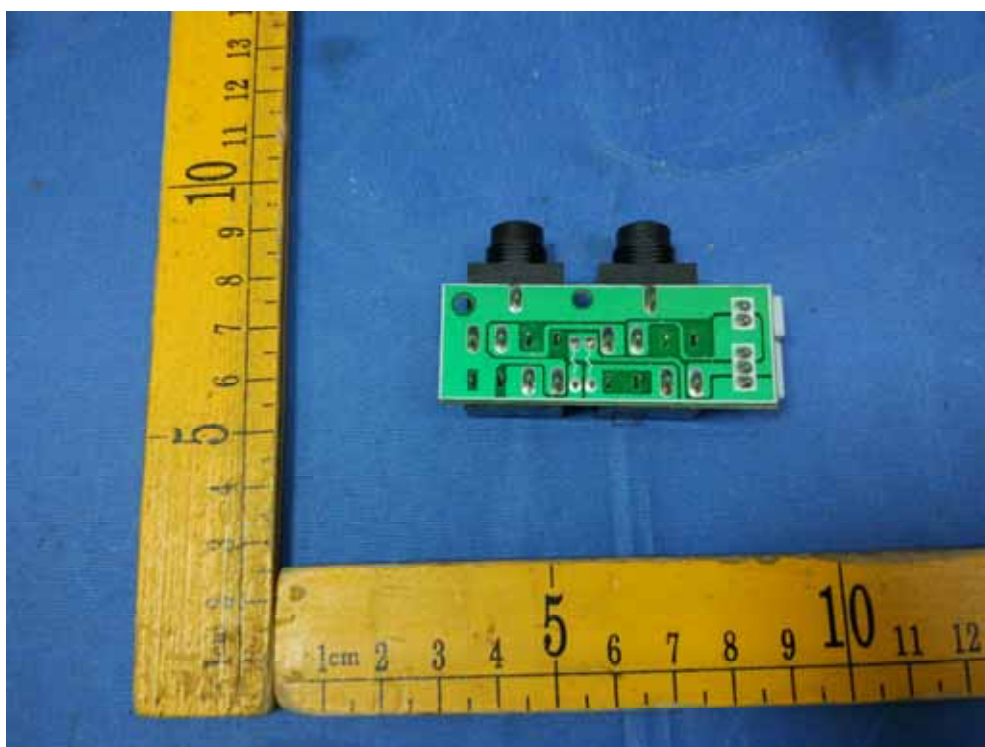






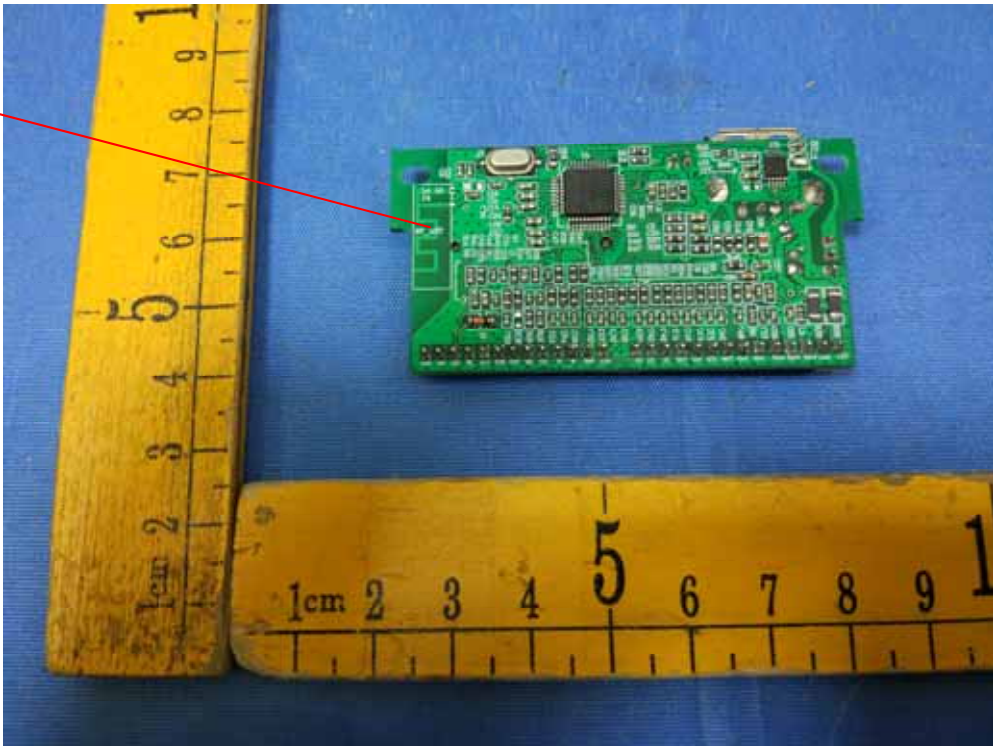
19.2 Internal Photos



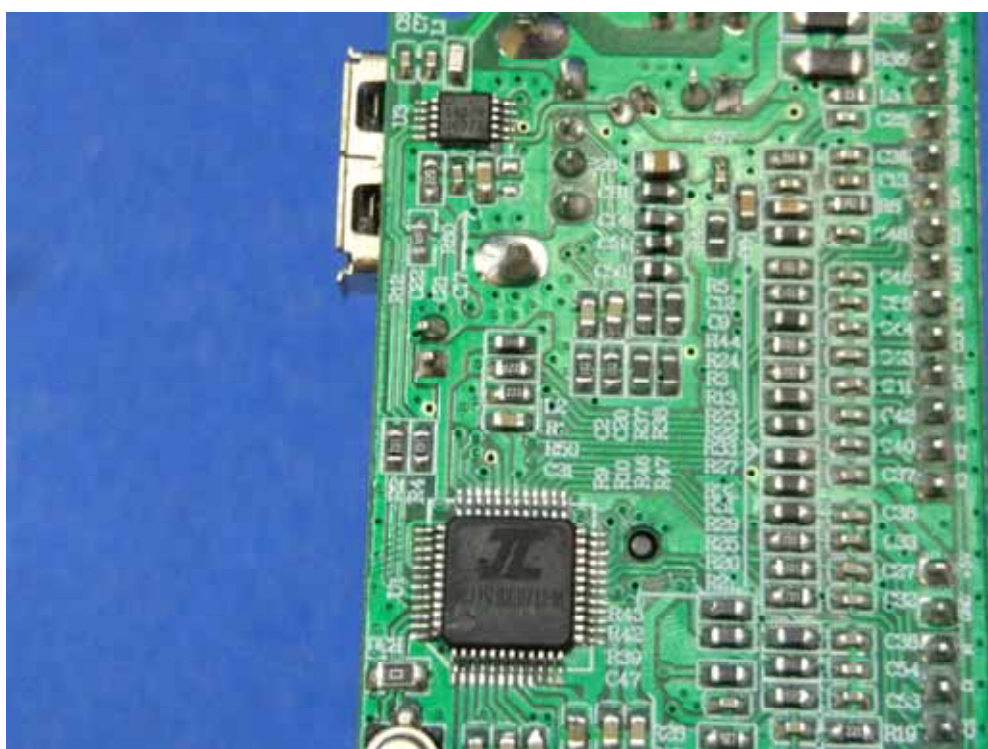
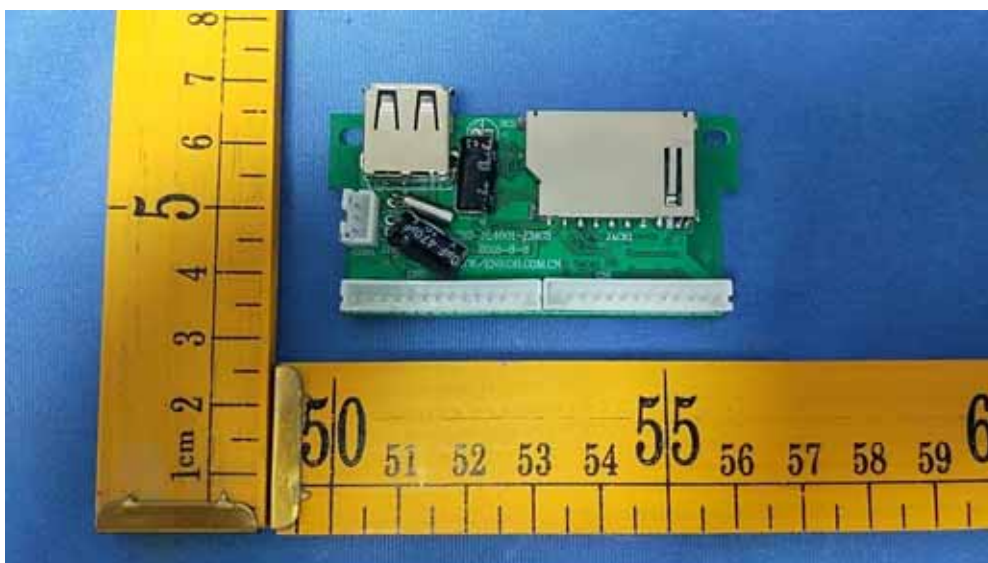




antenna







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