

# TEST REPORT

Reference No..... : WTS17S1299195-1E  
FCC ID ..... : 2ALZL-AA2171  
Applicant..... : Goldwood Sound, Inc.  
Address..... : 9333 Oso Ave. Chatsworth, CA 91311, United States  
Manufacturer ..... : Flyball Electronic (Shenzhen) Co., Ltd.  
Address..... : 5-6 Building, Zhiji Industrial Park, Jinye Road, Kuichong Street,  
LongGang District, Shenzhen, China.  
Product..... : 2.1 CH MULTIMEDIA SPEAKER SYSTEM  
Model(s) ..... : AA2171, AA2170, AA2172  
Brand Name ..... : **Acoustic  
AUDIO**  
by Goldwood  
Standards..... : FCC CFR47 Part 15.247:2017  
Date of Receipt sample .... : 2017-12-22  
Date of Test ..... : 2017-12-23 to 2018-01-08  
Date of Issue..... : 2018-01-09  
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:**

**Waltek Services (Shenzhen) Co., Ltd.**

Address: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China

**Test Site/Test Location:**

**Waltek Services (Shenzhen) Co., Ltd.**

Address: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China

Tel :+86-755-83551033

Fax:+86-755-83552400

Compiled by:

*Robin Zhou*

Robin Zhou / Test Engineer

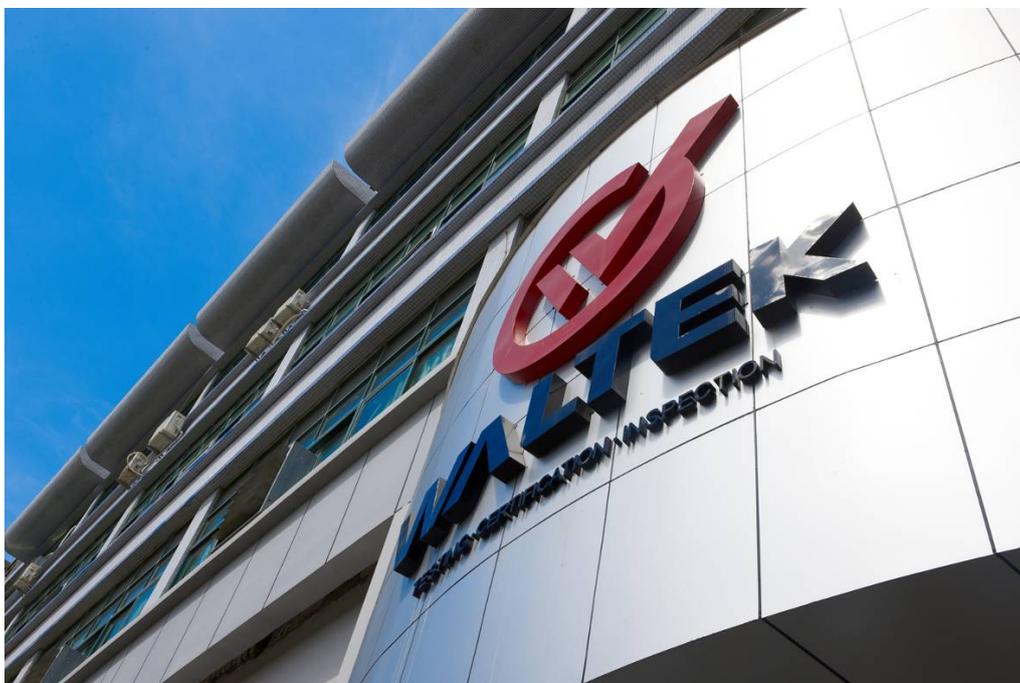
Approved by:



*Philo Zhong*  
Philo Zhong / Manager

## 1 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) of USA, 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), IC(Industry 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. Electro Magnetic 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.

## 1.1 Test Facility

Waltek Services (Shenzhen) Co., Ltd.

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

| Country/Region  | Accreditation Body                        | Scope              | Note |
|---|---|--------------------|------|
| USA   | <b>A2LA</b><br>(Certificate No.: 4243.01) | 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   | <b>International Services</b>             | WPC                | -    |
| Thailand  |   | NTC                | -    |
| Singapore   |   | IDA                | -    |
| Note:   |   |                    |      |
| 1. FCC Designation No.: CN1201. Test Firm Registration No.: 523476. |   |                    |      |
| 2. IC 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               |

## 2 Contents

|   | <b>Page</b> |
|---|-------------|
| <b>COVER PAGE</b> .....                           | <b>1</b>    |
| <b>1 LABORATORIES INTRODUCTION</b> .....          | <b>2</b>    |
| 1.1 TEST FACILITY.....                            | 3           |
| <b>2 CONTENTS</b> .....                           | <b>4</b>    |
| <b>3 REVISION HISTORY</b> .....                   | <b>6</b>    |
| <b>4 GENERAL INFORMATION</b> .....                | <b>7</b>    |
| 4.1 GENERAL DESCRIPTION OF E.U.T.....             | 7           |
| 4.2 DETAILS OF E.U.T.....                         | 7           |
| 4.3 CHANNEL LIST.....                             | 7           |
| 4.4 TEST MODE.....                                | 7           |
| <b>5 EQUIPMENT USED DURING TEST</b> .....         | <b>8</b>    |
| 5.1 EQUIPMENTS LIST.....                          | 8           |
| 5.2 MEASUREMENT UNCERTAINTY.....                  | 9           |
| 5.3 SUBCONTRACTED.....                            | 9           |
| <b>6 TEST SUMMARY</b> .....                       | <b>10</b>   |
| <b>7 CONDUCTED EMISSION</b> .....                 | <b>11</b>   |
| 7.1 E.U.T. OPERATION.....                         | 11          |
| 7.2 EUT SETUP.....                                | 11          |
| 7.3 MEASUREMENT DESCRIPTION.....                  | 11          |
| 7.4 CONDUCTED EMISSION TEST RESULT.....           | 12          |
| <b>8 RADIATED SPURIOUS EMISSIONS</b> .....        | <b>14</b>   |
| 8.1 EUT OPERATION.....                            | 14          |
| 8.2 TEST SETUP.....                               | 15          |
| 8.3 SPECTRUM ANALYZER SETUP.....                  | 16          |
| 8.4 TEST PROCEDURE.....                           | 17          |
| 8.5 CORRECTED AMPLITUDE & MARGIN CALCULATION..... | 17          |
| 8.6 SUMMARY OF TEST RESULTS.....                  | 18          |
| <b>9 BAND EDGE MEASUREMENT</b> .....              | <b>21</b>   |
| 9.1 TEST PROCEDURE.....                           | 21          |
| 9.2 TEST RESULT.....                              | 22          |
| <b>10 BANDWIDTH MEASUREMENT</b> .....             | <b>28</b>   |
| 10.1 TEST PROCEDURE.....                          | 28          |
| 10.2 TEST RESULT.....                             | 28          |
| <b>11 MAXIMUM PEAK OUTPUT POWER</b> .....         | <b>33</b>   |
| 11.1 TEST PROCEDURE.....                          | 33          |
| 11.2 TEST RESULT.....                             | 33          |
| <b>12 HOPPING CHANNEL SEPARATION</b> .....        | <b>39</b>   |
| 12.1 TEST PROCEDURE.....                          | 39          |
| 12.2 TEST RESULT.....                             | 39          |
| <b>13 NUMBER OF HOPPING FREQUENCY</b> .....       | <b>45</b>   |
| 13.1 TEST PROCEDURE.....                          | 45          |
| 13.2 TEST RESULT.....                             | 45          |
| <b>14 DWELL TIME</b> .....                        | <b>47</b>   |
| 14.1 TEST PROCEDURE.....                          | 47          |

|           |  |           |
|-----------|--|-----------|
| 14.2      | TEST RESULT .....                                | 47        |
| <b>15</b> | <b>ANTENNA REQUIREMENT .....</b>                 | <b>53</b> |
| <b>16</b> | <b>FCC ID: 2ALZL-AA2171 RF EXPOSURE.....</b>     | <b>54</b> |
| <b>17</b> | <b>PHOTOGRAPHS-MODEL AA2171 TEST SETUP .....</b> | <b>54</b> |
| <b>18</b> | <b>PHOTOGRAPHS-CONSTRUCTIONAL DETAILS .....</b>  | <b>54</b> |
| 18.1      | MODEL AA2171-EXTERNAL PHOTOS.....                | 54        |
| 18.2      | MODEL AA2171-INTERNAL PHOTOS.....                | 54        |

### 3 Revision History

| Test report No.  | Date of Receipt sample | Date of Test                | Date of Issue | Purpose  | Comment | Approved |
|------------------|------------------------|-----------------------------|---------------|----------|---------|----------|
| WTS17S1299195-1E | 2017-12-22             | 2017-12-23 to<br>2018-01-08 | 2018-01-09    | original | -       | Valid    |

## 4 General Information

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

|                   |   |
|-------------------|---|
| Product           | : 2.1 CH MULTIMEDIA SPEAKER SYSTEM  |
| Model(s)          | : AA2171, AA2170, AA2172  |
| Model Description | : Only the color, model names are different for different market requirement. The model AA2171 is the tested sample |
| Hardware Version  | : V0.0  |
| Software Version  | : V0.0  |

### 4.2 Details of E.U.T

|                      |                              |
|----------------------|------------------------------|
| Operation Frequency  | : 2402~2480MHz               |
| Type of Modulation   | : GFSK, $\pi/4$ DQPSK, 8DPSK |
| Antenna installation | : PCB Printed Antenna        |
| Antenna Gain         | : 0dBi                       |
| Ratings              | : ~120V 60Hz                 |

### 4.3 Channel List

Bluetooth Classic mode

| 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            | -           | -               |

### 4.4 Test Mode

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

| Test mode    | Low channel | Middle channel | High channel |
|--------------|-------------|----------------|--------------|
| Transmitting | 2402MHz     | 2441MHz        | 2480MHz      |

## 5 Equipment Used during Test

### 5.1 Equipments List

| Conducted Emissions                              |   |                      |              |                 |                       |                      |
|--|---|----------------------|--------------|-----------------|-----------------------|----------------------|
| Item   | Equipment                                   | Manufacturer         | Model No.    | Serial No.      | Last Calibration Date | Calibration Due Date |
| 1  | EMI Test Receiver                           | R&S                  | ESCI         | 100947          | 2017-09-12            | 2018-09-11           |
| 2  | LISN  | R&S                  | ENV216       | 100115          | 2017-09-12            | 2018-09-11           |
| 3  | Cable                                       | Top                  | TYPE16(3.5M) | -               | 2017-09-12            | 2018-09-11           |
| 3m Semi-anechoic Chamber for Radiation Emissions |   |                      |              |                 |                       |                      |
| Item   | Equipment                                   | Manufacturer         | Model No.    | Serial No.      | Last Calibration Date | Calibration Due Date |
| 1  | Spectrum Analyzer                           | R&S                  | FSP30        | 100091          | 2017-04-29            | 2018-04-28           |
| 2  | Broad-band Horn Antenna(1-18GHz)            | SCHWARZBECK          | BBHA 9120 D  | 667             | 2017-04-09            | 2018-04-08           |
| 3  | Broadband Preamplifier                      | COMPLIANCE DIRECTION | PAP-1G18     | 2004            | 2017-04-13            | 2018-04-12           |
| 4  | Coaxial Cable (above 1GHz)                  | Top                  | 1GHz-18GHz   | EW02014-7       | 2017-04-13            | 2018-04-12           |
| 5  | Spectrum Analyzer                           | R&S                  | FSP40        | 100501          | 2017-10-20            | 2018-10-19           |
| 6  | Broad-band Horn Antenna(18-40GHz)           | SCHWARZBECK          | BBHA 9170    | BBHA917065<br>1 | 2017-10-25            | 2018-10-24           |
| 7  | Microwave Broadband Preamplifier (18-40GHz) | SCHWARZBECK          | BBV 9721     | 100472          | 2017-10-25            | 2018-10-24           |
| 8  | Cable                                       | Top                  | 18-40GHz     | -               | 2017-10-25            | 2018-10-24           |
| 3m Semi-anechoic Chamber for Radiation Emissions |   |                      |              |                 |                       |                      |
| Item   | Equipment                                   | Manufacturer         | Model No.    | Serial No       | Last Calibration Date | Calibration Due Date |
| 1  | Test Receiver                               | R&S                  | ESCI         | 101296          | 2017-04-13            | 2018-04-12           |
| 2  | Trilog Broadband Antenna                    | SCHWARZBECK          | VULB9160     | 9160-3325       | 2017-04-13            | 2018-04-12           |
| 3  | Active Loop Antenna                         | Beijing Dazhi        | ZN30900A     | -               | 2017-04-09            | 2018-04-08           |
| 4  | Amplifier                                   | ANRITSU              | MH648A       | M43381          | 2017-04-13            | 2018-04-12           |
| 5  | Cable                                       | HUBER+SUHNER         | CBL2         | 525178          | 2017-04-13            | 2018-04-12           |
| 6  | Coaxial Cable (below 1GHz)                  | Top                  | TYPE16(13M)  | -               | 2017-09-12            | 2018-09-11           |
| RF Conducted Testing                             |   |                      |              |                 |                       |                      |
| Item   | Equipment                                   | Manufacturer         | Model No.    | Serial No.      | Last Calibration Date | Calibration Due Date |

|    |                                 |         |        |            |            |            |
|----|---------------------------------|---------|--------|------------|------------|------------|
| 1. | Signal Analyzer<br>(9k~26.5GHz) | Agilent | N9010A | MY50520207 | 2017-09-12 | 2018-09-11 |
| 2  | Spectrum Analyzer               | R&S     | FSL6   | 100959     | 2017-09-12 | 2018-09-11 |

## 5.2 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) |

## 5.3 Subcontracted

Whether parts of tests for the product have been subcontracted to other labs:

Yes       No

If Yes, list the related test items and lab information:

Test Lab: N/A

Lab address: N/A

Test items: N/A

## 6 Test Summary

| Test Items   | Test Requirement                 | Result |
|--|----------------------------------|--------|
| Radiated Spurious Emissions  | 15.205(a)<br>15.209<br>15.247(d) | Pass   |
| Band edge  | 15.247(d)<br>15.205(a)           | Pass   |
| Conduct Emission   | 15.207                           | Pass   |
| Bandwidth  | 15.247(a)(1)                     | Pass   |
| Maximum Peak Output Power  | 15.247(b)(1)                     | Pass   |
| Frequency Separation   | 15.247(a)(1)                     | Pass   |
| Number of Hopping Frequency  | 15.247(a)(1)(iii)                | Pass   |
| Dwell time   | 15.247(a)(1)(iii)                | Pass   |
| Antenna Requirement  | 15.203                           | Pass   |
| RF Exposure  | 1.1307(b)(1)                     | Pass   |
| Note: Pass=Compliance; Fail=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                  |
| Test Result:      | PASS                              |
| Frequency Range:  | 150kHz to 30MHz                   |
| Class/Severity:   | Class B                           |
| Limit:            |                                   |

| Frequency (MHz) | Limit (dB $\mu$ V) |           |
|-----------------|--------------------|-----------|
|                 | Qsi-peak           | Average   |
| 0.15 to 0.5     | 66 to 56*          | 56 to 46* |
| 0.5 to 5        | 50                 | 60        |
| 5 to 30         | 60                 | 50        |

### 7.1 E.U.T. Operation

Operating Environment :

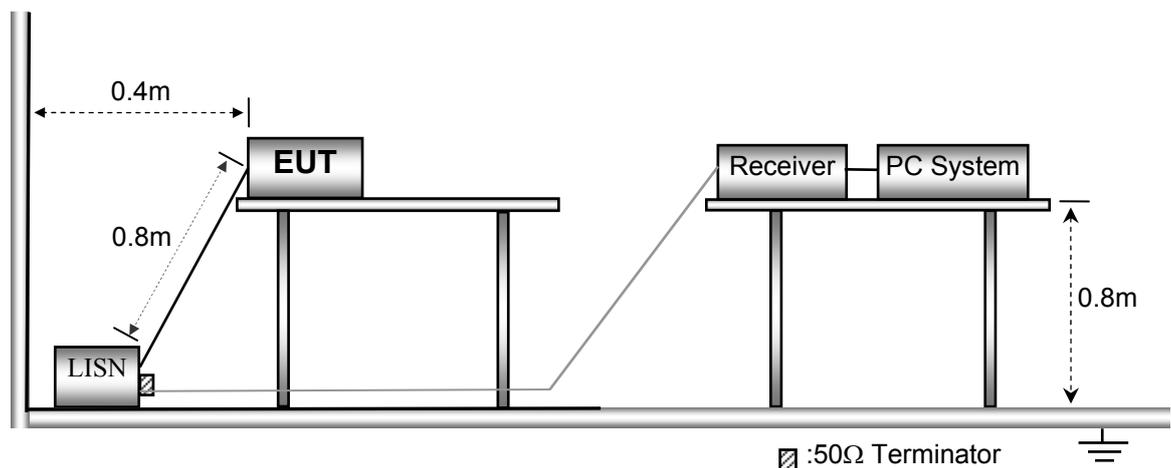
|                       |           |
|-----------------------|-----------|
| Temperature:          | 22.8 °C   |
| Humidity:             | 52.6 % RH |
| Atmospheric Pressure: | 101.2kPa  |

EUT Operation :

The test was performed in Transmitting mode, the worst test data (GFSK modulation Low channel) were shown in the report.

### 7.2 EUT Setup

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



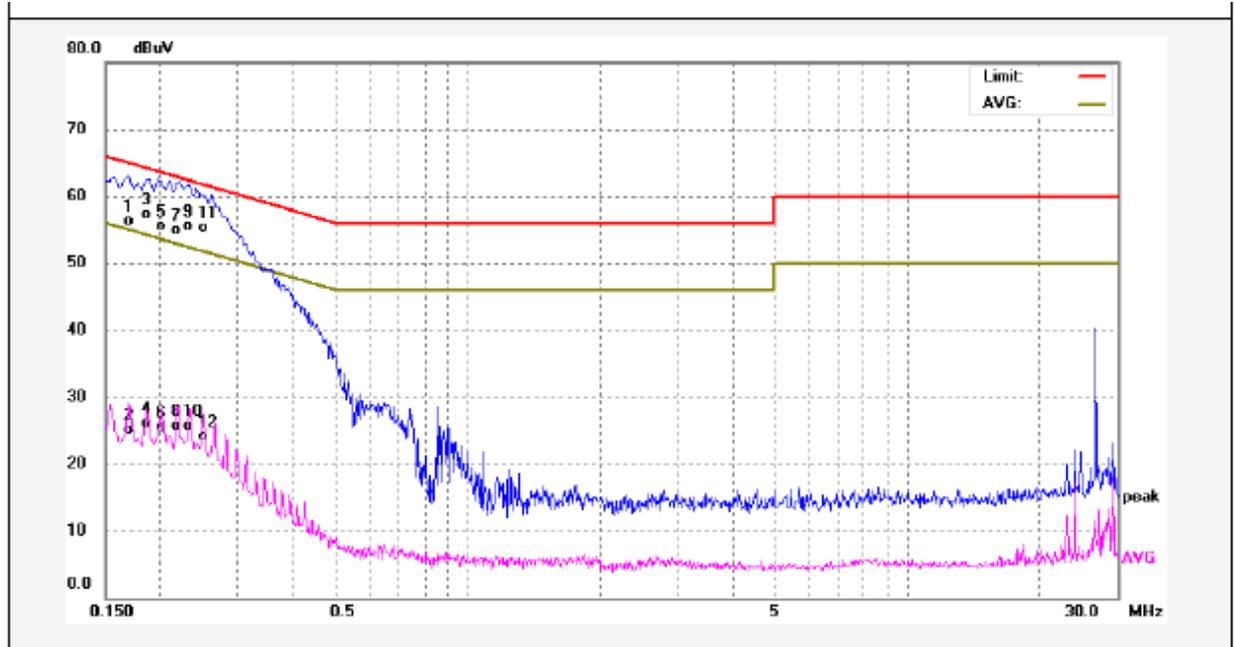
### 7.3 Measurement Description

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

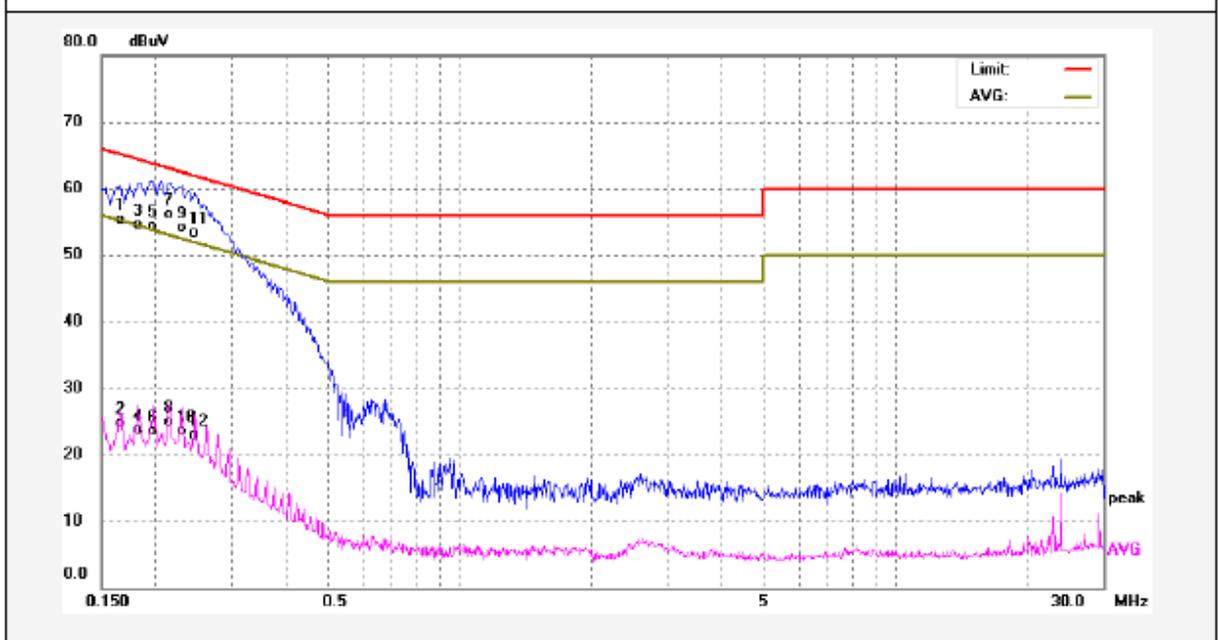
Remark: only the worst data (GFSK modulation Low channel mode) were reported

Live line:



| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit dBuV | Margin (dB) | Detector | Remark |
|-----|-------------|----------------|-------------|---------------|------------|-------------|----------|--------|
| 1   | 0.1700      | 46.71          | 9.64        | 56.35         | 64.96      | -8.61       | QP       |        |
| 2   | 0.1700      | 15.48          | 9.64        | 25.12         | 54.96      | -29.84      | AVG      |        |
| 3   | 0.1860      | 47.72          | 9.63        | 57.35         | 64.21      | -6.86       | QP       |        |
| 4   | 0.1860      | 16.46          | 9.63        | 26.09         | 54.21      | -28.12      | AVG      |        |
| 5   | 0.2020      | 45.90          | 9.62        | 55.52         | 63.52      | -8.00       | QP       |        |
| 6   | 0.2020      | 15.98          | 9.62        | 25.60         | 53.52      | -27.92      | AVG      |        |
| 7   | 0.2180      | 45.33          | 9.63        | 54.96         | 62.89      | -7.93       | QP       |        |
| 8   | 0.2180      | 16.15          | 9.63        | 25.78         | 52.89      | -27.11      | AVG      |        |
| 9   | 0.2340      | 45.96          | 9.63        | 55.59         | 62.30      | -6.71       | QP       |        |
| 10  | 0.2340      | 16.12          | 9.63        | 25.75         | 52.30      | -26.55      | AVG      |        |
| 11  | 0.2500      | 45.57          | 9.64        | 55.21         | 61.75      | -6.54       | QP       |        |
| 12  | 0.2500      | 14.50          | 9.64        | 24.14         | 51.75      | -27.61      | AVG      |        |

Neutral line:



| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit dBuV | Margin (dB) | Detector | Remark |
|-----|-------------|----------------|-------------|---------------|------------|-------------|----------|--------|
| 1   | 0.1660      | 45.62          | 9.64        | 55.26         | 65.15      | -9.89       | QP       |        |
| 2   | 0.1660      | 15.07          | 9.64        | 24.71         | 55.15      | -30.44      | AVG      |        |
| 3   | 0.1819      | 44.91          | 9.63        | 54.54         | 64.39      | -9.85       | QP       |        |
| 4   | 0.1819      | 14.07          | 9.63        | 23.70         | 54.39      | -30.69      | AVG      |        |
| 5   | 0.1980      | 44.69          | 9.62        | 54.31         | 63.69      | -9.38       | QP       |        |
| 6   | 0.1980      | 13.93          | 9.62        | 23.55         | 53.69      | -30.14      | AVG      |        |
| 7   | 0.2140      | 46.48          | 9.63        | 56.11         | 63.04      | -6.93       | QP       |        |
| 8   | 0.2140      | 15.21          | 9.63        | 24.84         | 53.04      | -28.20      | AVG      |        |
| 9   | 0.2300      | 44.55          | 9.63        | 54.18         | 62.45      | -8.27       | QP       |        |
| 10  | 0.2300      | 13.90          | 9.63        | 23.53         | 52.45      | -28.92      | AVG      |        |
| 11  | 0.2460      | 43.71          | 9.64        | 53.35         | 61.89      | -8.54       | QP       |        |
| 12  | 0.2460      | 13.26          | 9.64        | 22.90         | 51.89      | -28.99      | AVG      |        |

## 8 Radiated Spurious 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(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: 51.1 % RH

Atmospheric Pressure: 101.2kPa

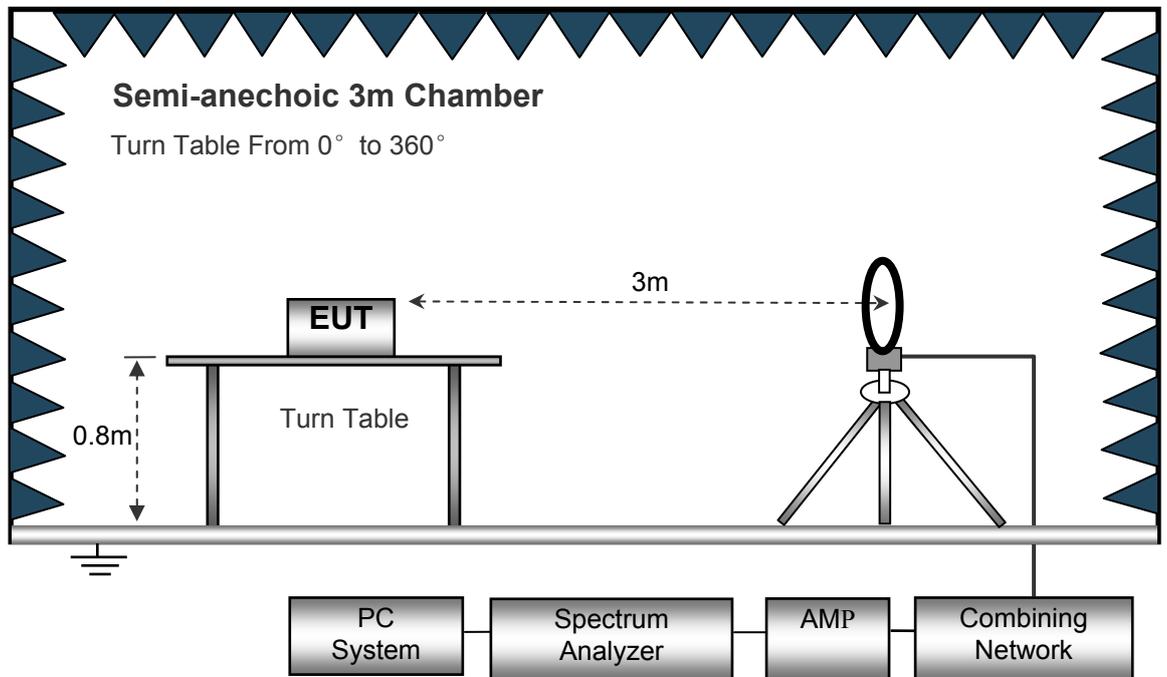
EUT Operation :

The test was performed in Transmitting mode, the worst test data (GFSK modulation) were shown in the report.

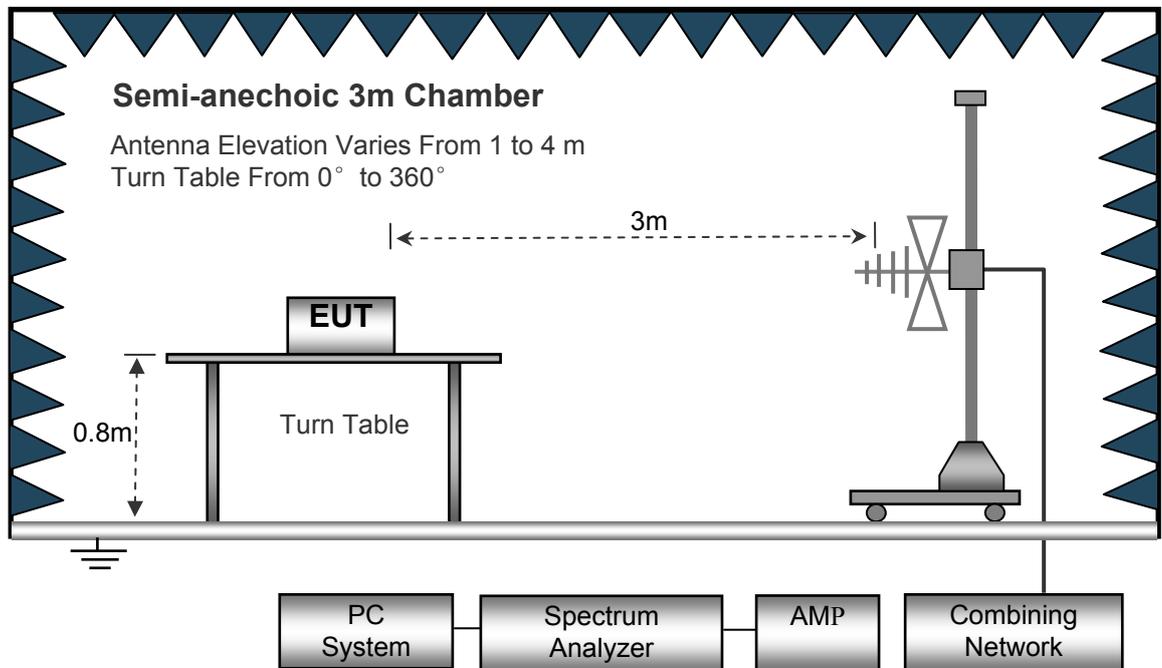
## 8.2 Test Setup

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

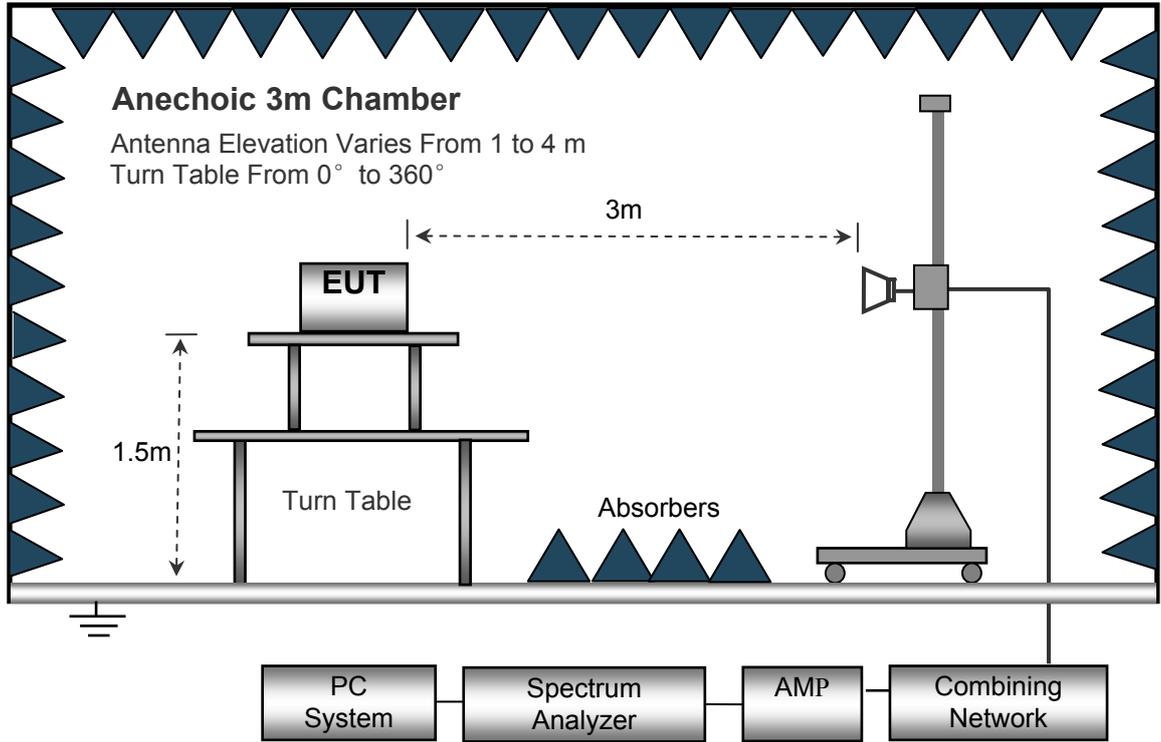
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



### 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, which is 0.8m above ground plane for below 1GHz and 1.5m for above 1GHz.
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 Z position. So the data shown was the Z position only.

## 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:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

## 8.6 Summary of Test Results

### Test Frequency: 9 kHz~30 MHz

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

### Test Frequency: 30 MHz ~ 18 GHz

Remark: only the worst data (GFSK modulation) were reported.

| Frequency                | Receiver Reading | Detector    | Turn table Angle | RX Antenna |       | Corrected Factor | Corrected Amplitude | FCC Part 15.247/209/205 |        |
|--------------------------|------------------|-------------|------------------|------------|-------|------------------|---------------------|-------------------------|--------|
|                          |                  |             |                  | Height     | Polar |                  |                     | Limit                   | Margin |
| (MHz)                    | (dB $\mu$ V)     | (PK/QP/Ave) | Degree           | (m)        | (H/V) | (dB)             | (dB $\mu$ V/m)      | (dB $\mu$ V/m)          | (dB)   |
| GFSK Low Channel 2402MHz |                  |             |                  |            |       |                  |                     |                         |        |
| 96.10                    | 54.02            | QP          | 66               | 1.6        | H     | -18.95           | 35.07               | 43.50                   | -8.43  |
| 96.10                    | 39.87            | QP          | 239              | 1.3        | V     | -18.95           | 20.92               | 43.50                   | -22.58 |
| 4804.00                  | 48.47            | PK          | 135              | 1.7        | V     | -1.06            | 47.41               | 74.00                   | -26.59 |
| 4804.00                  | 42.77            | Ave         | 135              | 1.7        | V     | -1.06            | 41.71               | 54.00                   | -12.29 |
| 7206.00                  | 46.91            | PK          | 300              | 1.1        | H     | 1.33             | 48.24               | 74.00                   | -25.76 |
| 7206.00                  | 39.57            | Ave         | 300              | 1.1        | H     | 1.33             | 40.90               | 54.00                   | -13.10 |
| 2330.85                  | 45.99            | PK          | 324              | 1.3        | V     | -13.19           | 32.80               | 74.00                   | -41.20 |
| 2330.85                  | 38.13            | Ave         | 324              | 1.3        | V     | -13.19           | 24.94               | 54.00                   | -29.06 |
| 2377.86                  | 43.22            | PK          | 263              | 1.8        | H     | -13.14           | 30.08               | 74.00                   | -43.92 |
| 2377.86                  | 36.54            | Ave         | 263              | 1.8        | H     | -13.14           | 23.40               | 54.00                   | -30.60 |
| 2497.81                  | 43.32            | PK          | 242              | 1.9        | V     | -13.08           | 30.24               | 74.00                   | -43.76 |
| 2497.81                  | 37.94            | Ave         | 242              | 1.9        | V     | -13.08           | 24.86               | 54.00                   | -29.14 |

| Frequency                   | Receiver Reading | Detector    | Turn table Angle | RX Antenna |       | Corrected Factor | Corrected Amplitude | FCC Part 15.247/209/205 |        |
|-----------------------------|------------------|-------------|------------------|------------|-------|------------------|---------------------|-------------------------|--------|
|                             |                  |             |                  | Height     | Polar |                  |                     | Limit                   | Margin |
| (MHz)                       | (dB $\mu$ V)     | (PK/QP/Ave) | Degree           | (m)        | (H/V) | (dB)             | (dB $\mu$ V/m)      | (dB $\mu$ V/m)          | (dB)   |
| GFSK Middle Channel 2441MHz |                  |             |                  |            |       |                  |                     |                         |        |
| 96.10                       | 52.82            | QP          | 49               | 1.7        | H     | -18.95           | 33.87               | 43.50                   | -9.63  |
| 96.10                       | 39.87            | QP          | 83               | 1.2        | V     | -18.95           | 20.92               | 43.50                   | -22.58 |
| 4882.00                     | 49.61            | PK          | 241              | 1.2        | V     | -0.62            | 48.99               | 74.00                   | -25.01 |
| 4882.00                     | 44.13            | Ave         | 241              | 1.2        | V     | -0.62            | 43.51               | 54.00                   | -10.49 |
| 7323.00                     | 45.68            | PK          | 101              | 1.6        | H     | 2.21             | 47.89               | 74.00                   | -26.11 |
| 7323.00                     | 38.24            | Ave         | 101              | 1.6        | H     | 2.21             | 40.45               | 54.00                   | -13.55 |
| 2330.12                     | 45.41            | PK          | 96               | 1.5        | V     | -13.19           | 32.22               | 74.00                   | -41.78 |
| 2330.12                     | 39.04            | Ave         | 96               | 1.5        | V     | -13.19           | 25.85               | 54.00                   | -28.15 |
| 2382.07                     | 42.45            | PK          | 228              | 1.4        | H     | -13.14           | 29.31               | 74.00                   | -44.69 |
| 2382.07                     | 36.91            | Ave         | 228              | 1.4        | H     | -13.14           | 23.77               | 54.00                   | -30.23 |
| 2483.64                     | 42.64            | PK          | 14               | 1.9        | V     | -13.08           | 29.56               | 74.00                   | -44.44 |
| 2483.64                     | 38.02            | Ave         | 14               | 1.9        | V     | -13.08           | 24.94               | 54.00                   | -29.06 |

| Frequency                 | Receiver Reading | Detector    | Turn table Angle | RX Antenna |       | Corrected Factor | Corrected Amplitude | FCC Part 15.247/209/205 |        |
|---------------------------|------------------|-------------|------------------|------------|-------|------------------|---------------------|-------------------------|--------|
|                           |                  |             |                  | Height     | Polar |                  |                     | Limit                   | Margin |
| (MHz)                     | (dB $\mu$ V)     | (PK/QP/Ave) | Degree           | (m)        | (H/V) | (dB)             | (dB $\mu$ V/m)      | (dB $\mu$ V/m)          | (dB)   |
| GFSK High Channel 2480MHz |                  |             |                  |            |       |                  |                     |                         |        |
| 96.10                     | 51.37            | QP          | 200              | 1.6        | H     | -18.95           | 32.42               | 43.50                   | -11.08 |
| 96.10                     | 38.63            | QP          | 64               | 1.2        | V     | -18.95           | 19.68               | 43.50                   | -23.82 |
| 4960.00                   | 49.33            | PK          | 301              | 1.3        | V     | -0.24            | 49.09               | 74.00                   | -24.91 |
| 4960.00                   | 44.72            | Ave         | 301              | 1.3        | V     | -0.24            | 44.48               | 54.00                   | -9.52  |
| 7440.00                   | 44.53            | PK          | 247              | 1.6        | H     | 2.84             | 47.37               | 74.00                   | -26.63 |
| 7440.00                   | 39.49            | Ave         | 247              | 1.6        | H     | 2.84             | 42.33               | 54.00                   | -11.67 |
| 2349.22                   | 45.35            | PK          | 318              | 1.1        | V     | -13.19           | 32.16               | 74.00                   | -41.84 |
| 2349.22                   | 37.51            | Ave         | 318              | 1.1        | V     | -13.19           | 24.32               | 54.00                   | -29.68 |
| 2358.34                   | 44.97            | PK          | 151              | 1.5        | H     | -13.14           | 31.83               | 74.00                   | -42.17 |
| 2358.34                   | 38.72            | Ave         | 151              | 1.5        | H     | -13.14           | 25.58               | 54.00                   | -28.42 |
| 2486.27                   | 43.28            | PK          | 90               | 1.9        | V     | -13.08           | 30.20               | 74.00                   | -43.80 |
| 2486.27                   | 36.99            | Ave         | 90               | 1.9        | V     | -13.08           | 23.91               | 54.00                   | -30.09 |

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

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

## 9 Band Edge Measurement

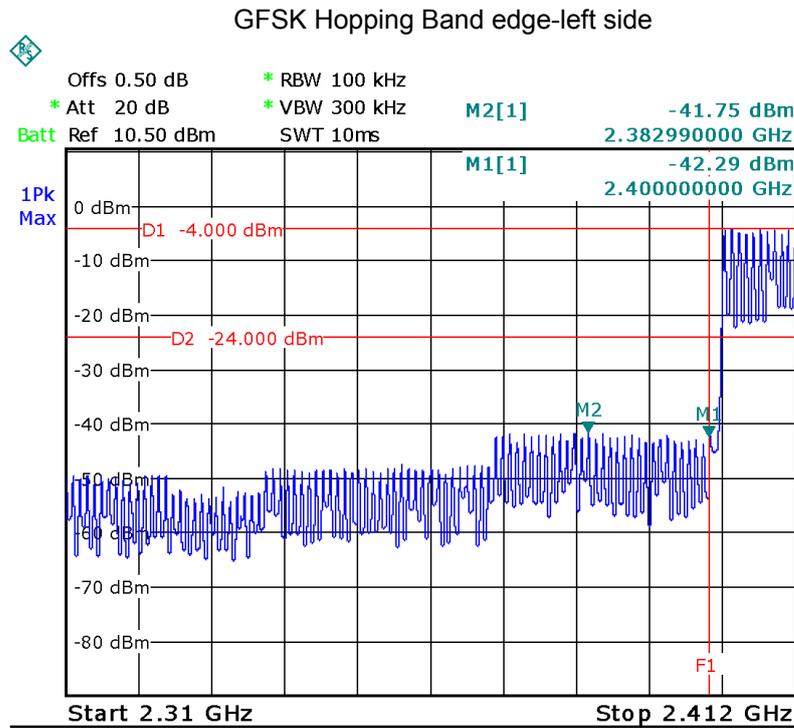
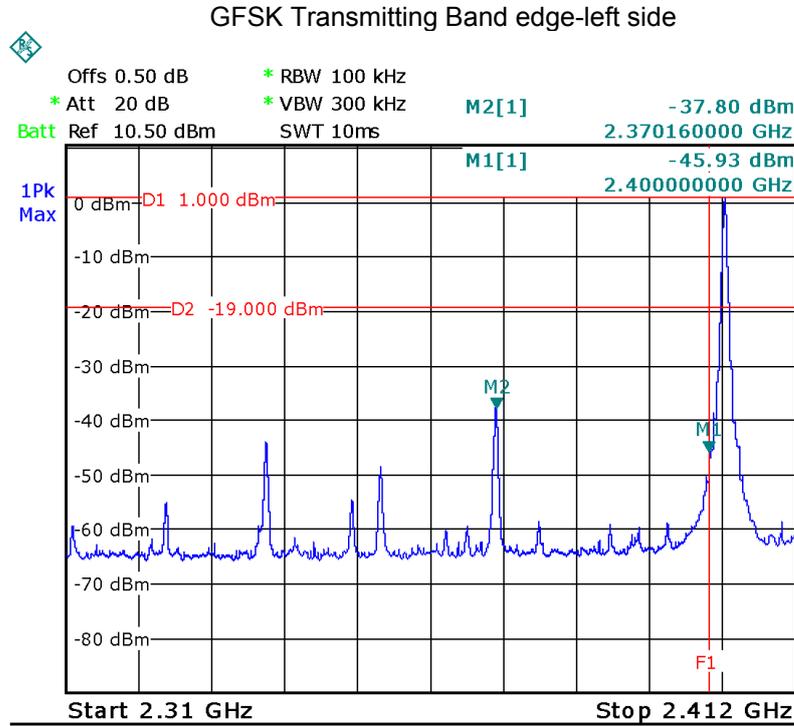
|                   |   |
|-------------------|---|
| Test Requirement: | Section 15.247(d) In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).   |
| Test Method:      | ANSI C63.10:2013  |
| 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 Procedure

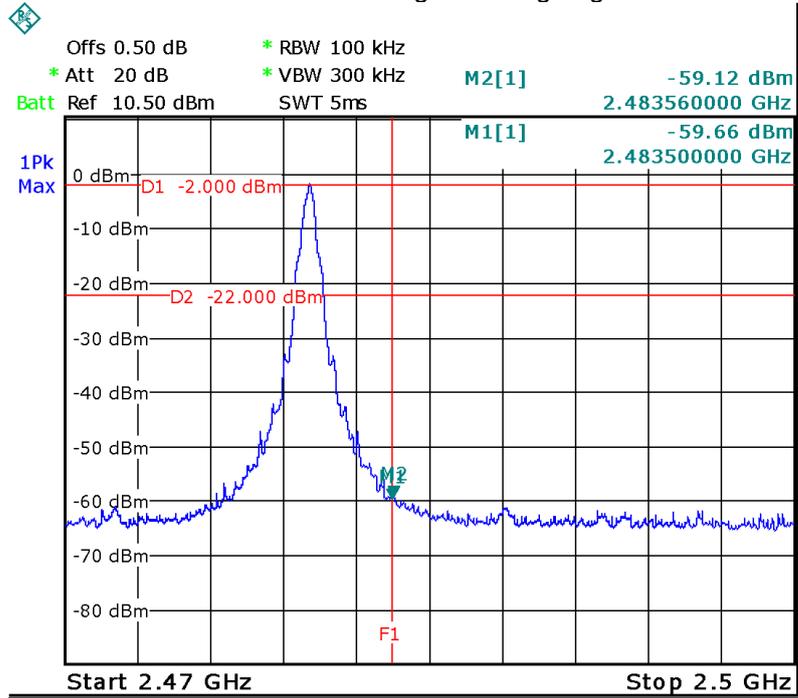
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto  
Detector function = peak, Trace = max hold

## 9.2 Test Result

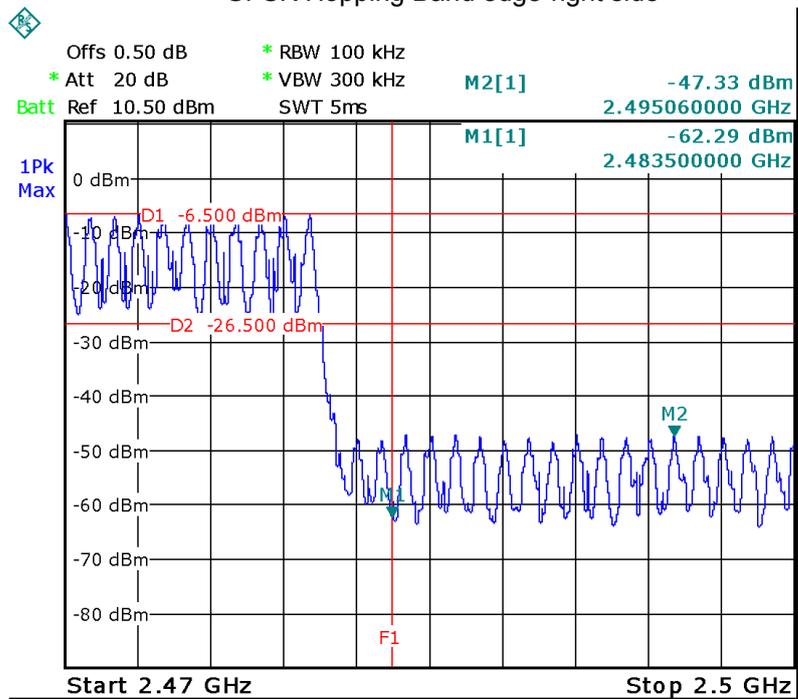
### Test plots

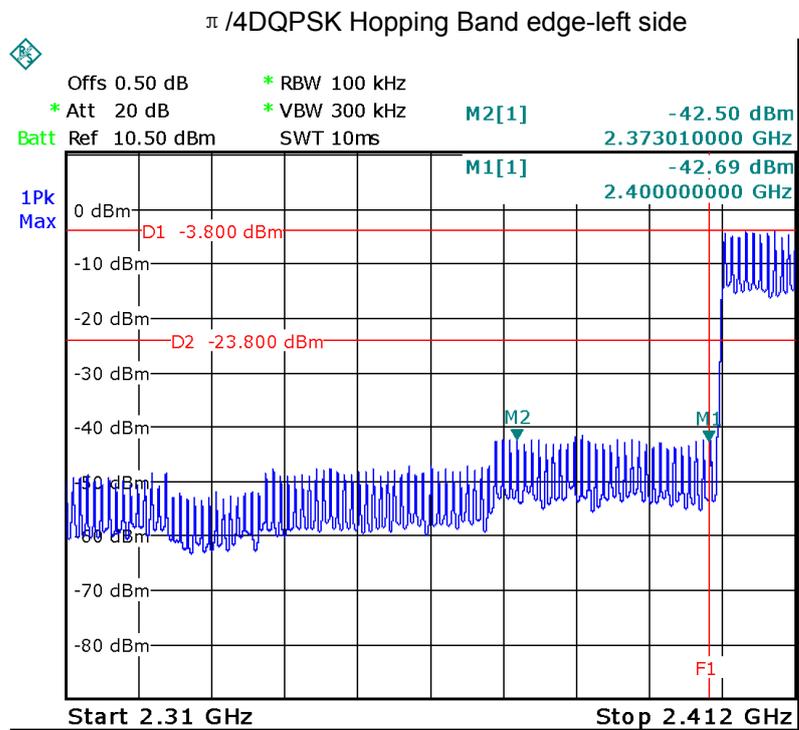
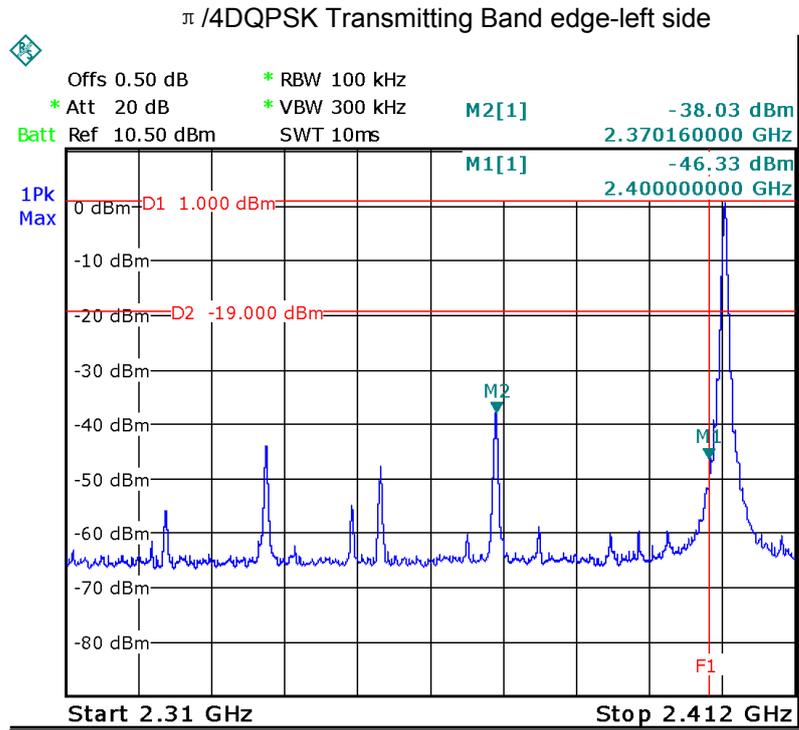


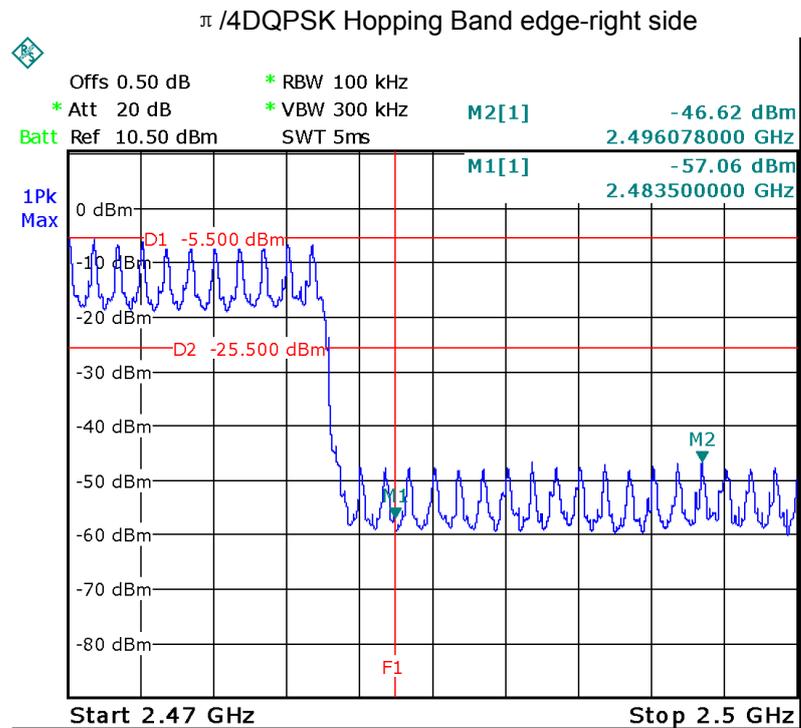
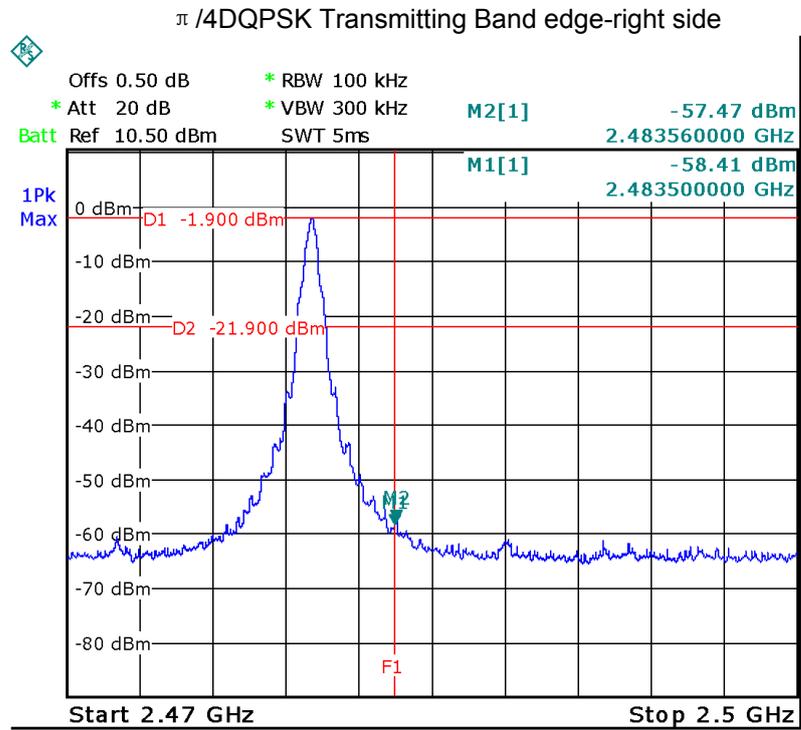
### GFSK Transmitting Band edge-right side

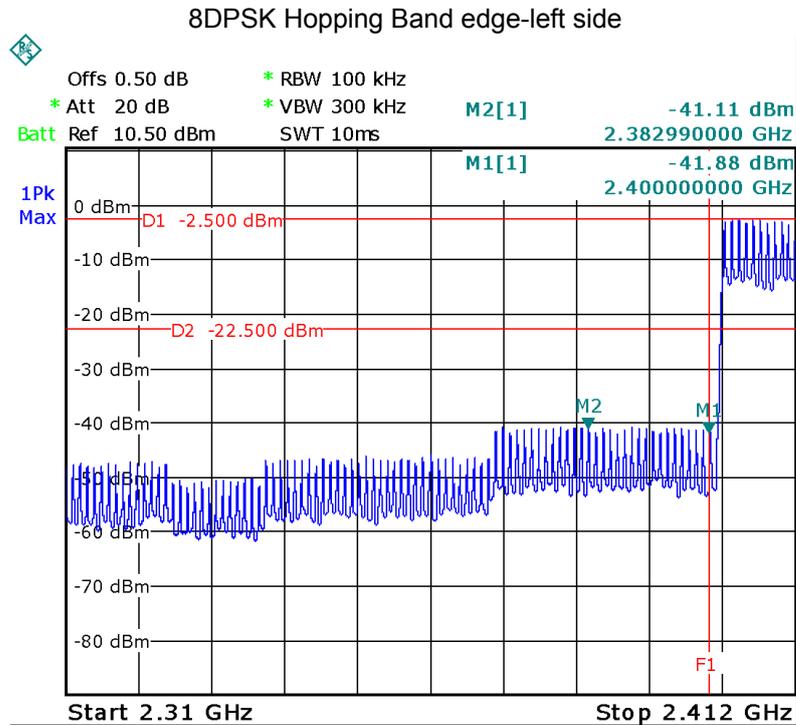
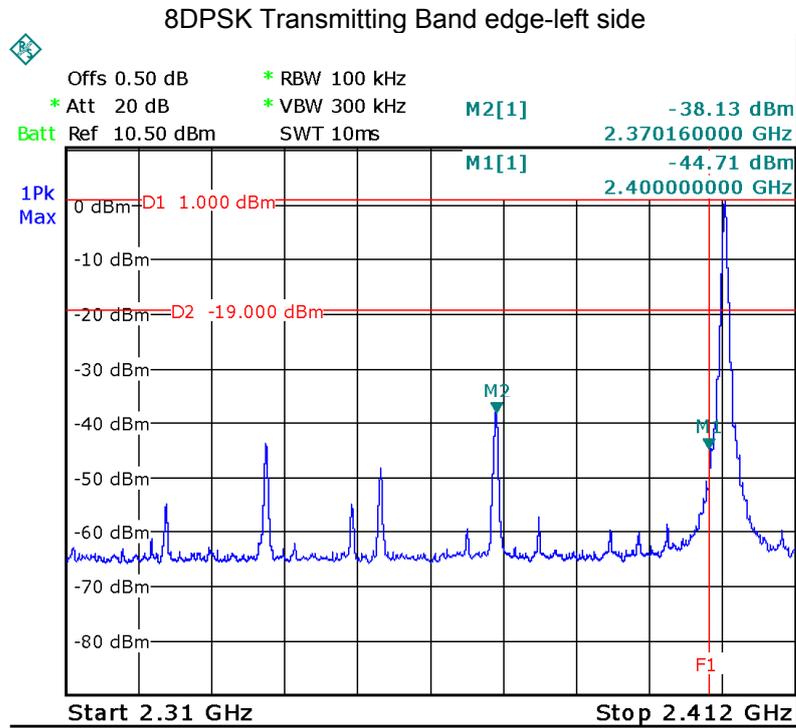


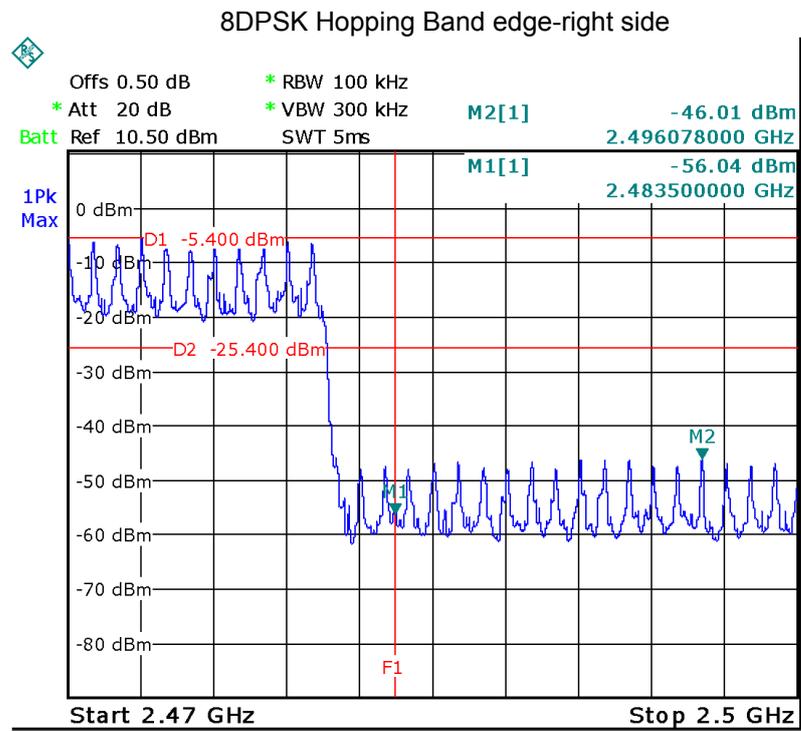
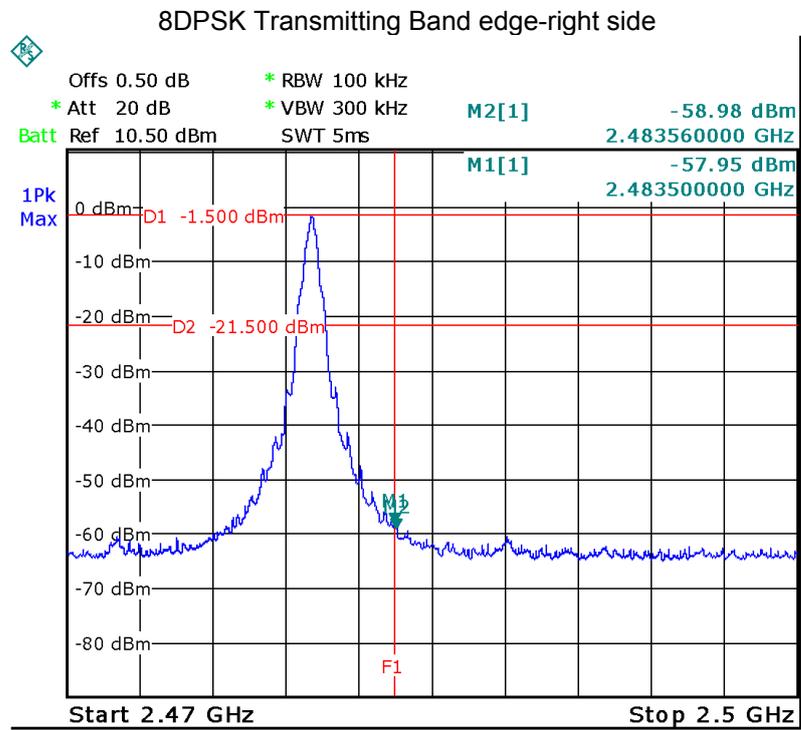
### GFSK Hopping Band edge-right side











## 10 Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: ANSI C63.10:2013

Test Mode: Test in fixing operating frequency at low, Middle, high channel.

### 10.1 Test Procedure

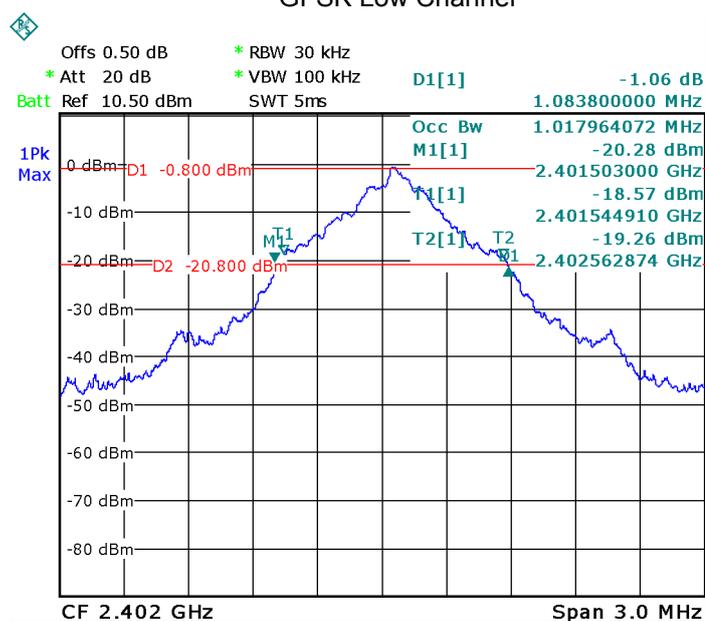
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 30kHz, VBW = 100kHz

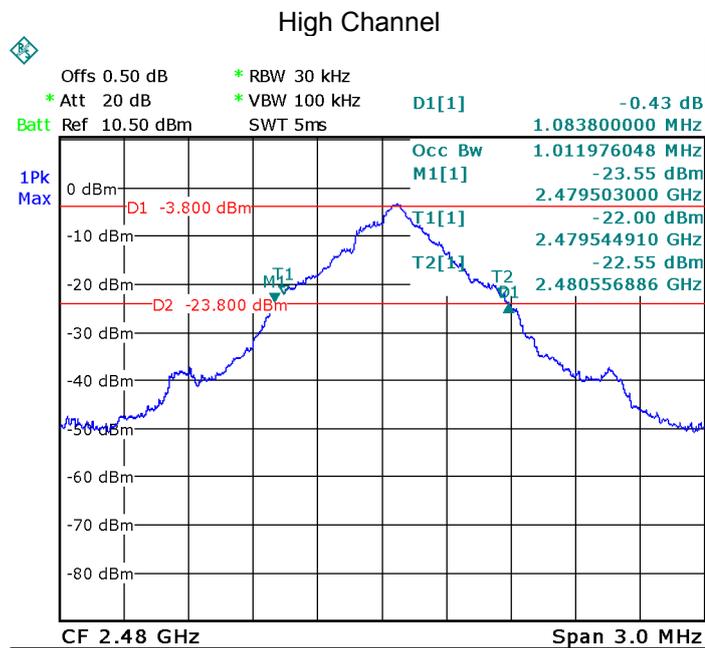
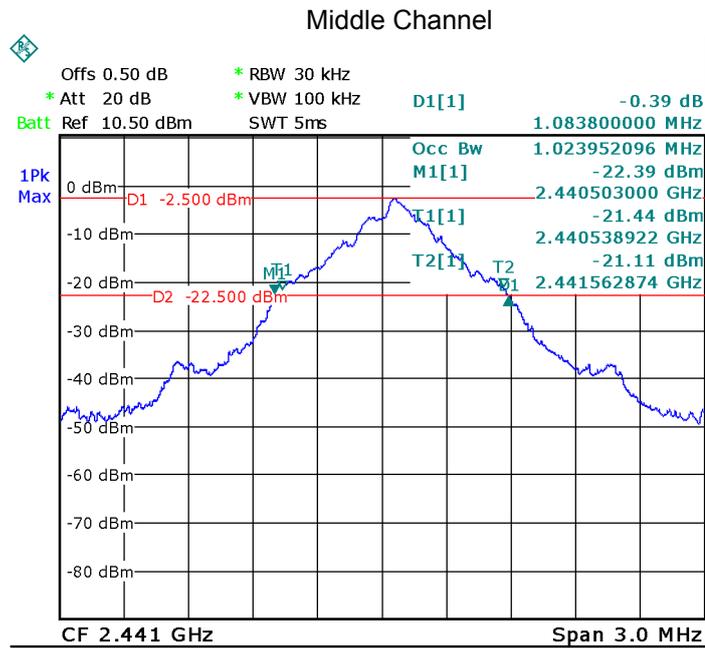
### 10.2 Test Result

| Modulation    | Test Channel | 99% Bandwidth(MHz) | 20dB Bandwidth(MHz) |
|---------------|--------------|--------------------|---------------------|
| GFSK          | Low          | 1.018              | 1.084               |
| GFSK          | Middle       | 1.024              | 1.084               |
| GFSK          | High         | 1.012              | 1.084               |
| $\pi$ /4DQPSK | Low          | 1.114              | 1.126               |
| $\pi$ /4DQPSK | Middle       | 1.120              | 1.126               |
| $\pi$ /4DQPSK | High         | 1.114              | 1.126               |
| 8DPSK         | Low          | 1.108              | 1.066               |
| 8DPSK         | Middle       | 1.102              | 1.066               |
| 8DPSK         | High         | 1.102              | 1.066               |

#### Test plots

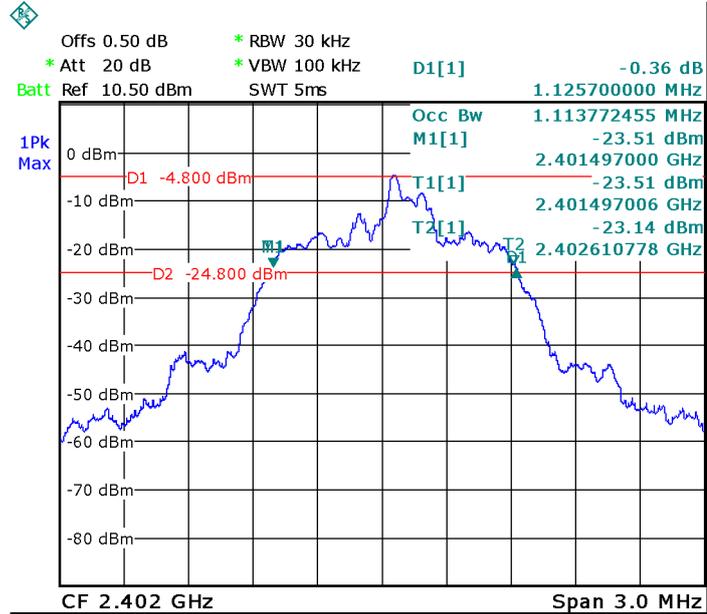
GFSK Low Channel



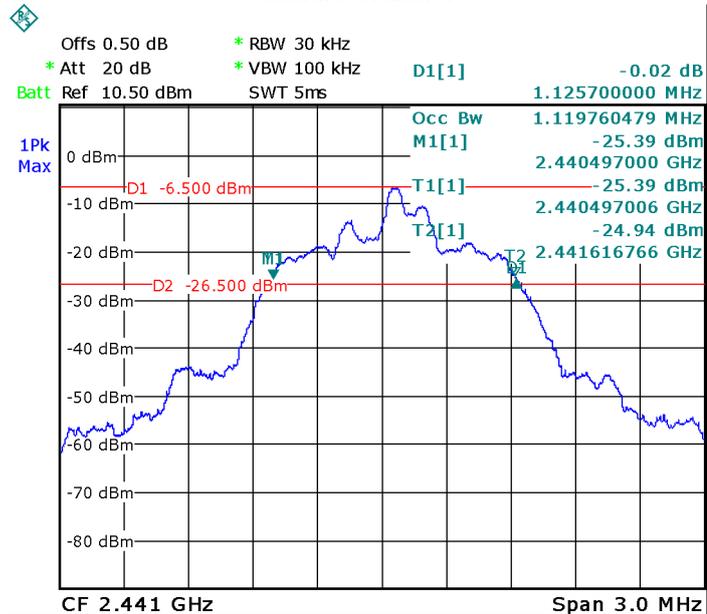


Modulation:  $\pi/4$ DQPSK

Low Channel

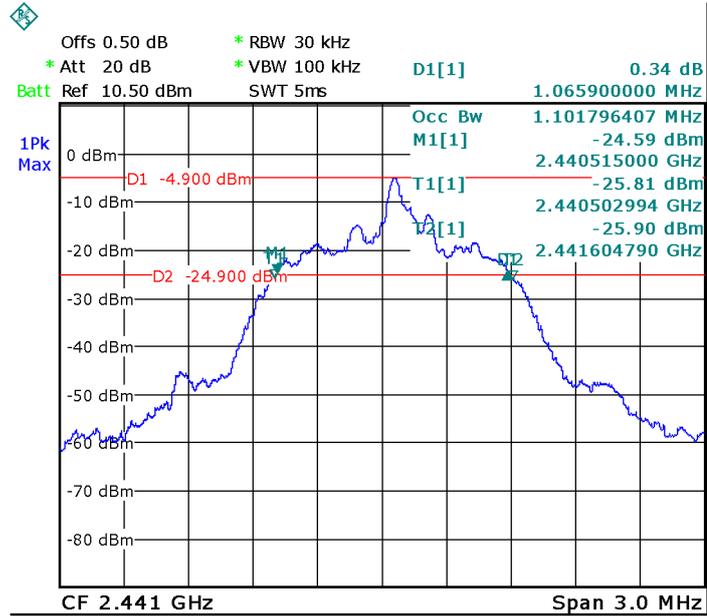


Middle Channel

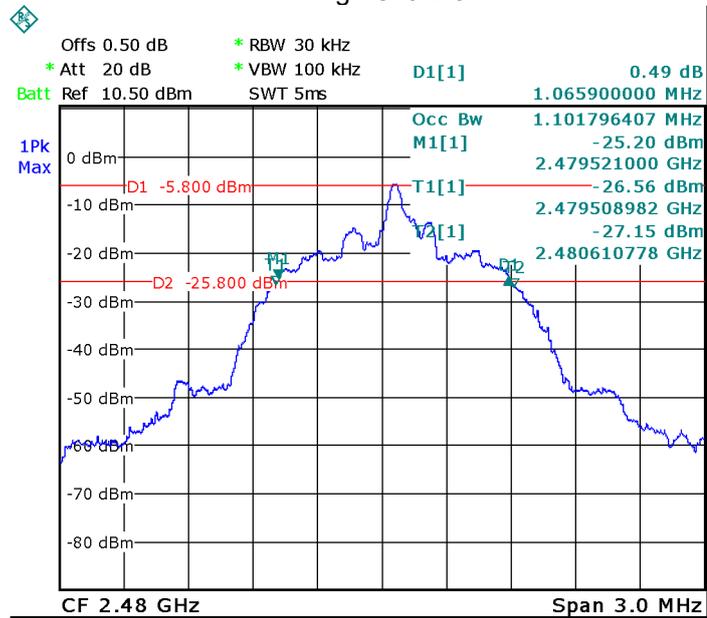




### Middle Channel



### High Channel



## 11 Maximum Peak Output Power

|                   |  |
|-------------------|--|
| Test Requirement: | FCC CFR47 Part 15 Section 15.247   |
| Test Method:      | ANSI 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. |
| Test mode:        | Test in fixing frequency transmitting mode.  |

### 11.1 Test Procedure

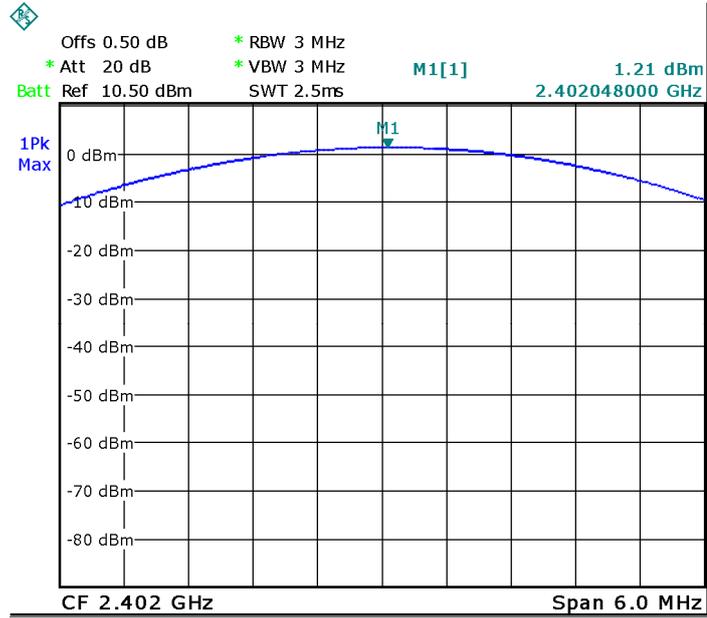
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3MHz. VBW = 3MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

### 11.2 Test Result

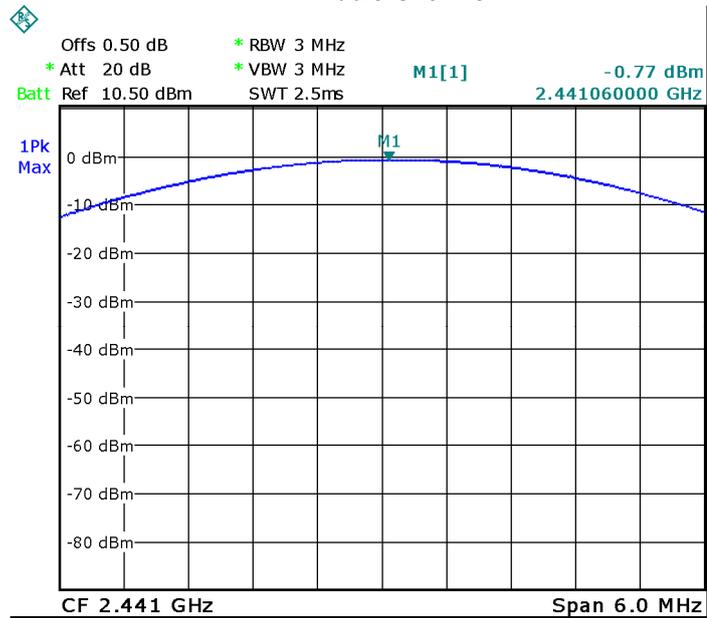
| Modulation    | Test Channel | Output Power (dBm) | Limit (dBm) |
|---------------|--------------|--------------------|-------------|
| GFSK          | Low          | 1.21               | 30          |
| GFSK          | Middle       | -0.77              | 30          |
| GFSK          | High         | -1.64              | 30          |
| $\pi$ /4DQPSK | Low          | 0.91               | 21          |
| $\pi$ /4DQPSK | Middle       | -0.82              | 21          |
| $\pi$ /4DQPSK | High         | -1.57              | 21          |
| 8DPSK         | Low          | 0.99               | 21          |
| 8DPSK         | Middle       | -0.77              | 21          |
| 8DPSK         | High         | -1.62              | 21          |

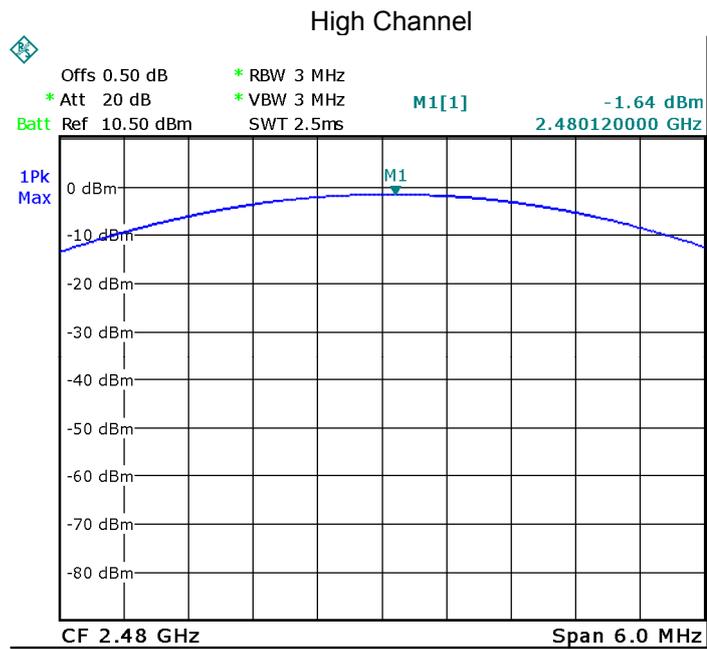
### Test plots

#### GFSK Low Channel

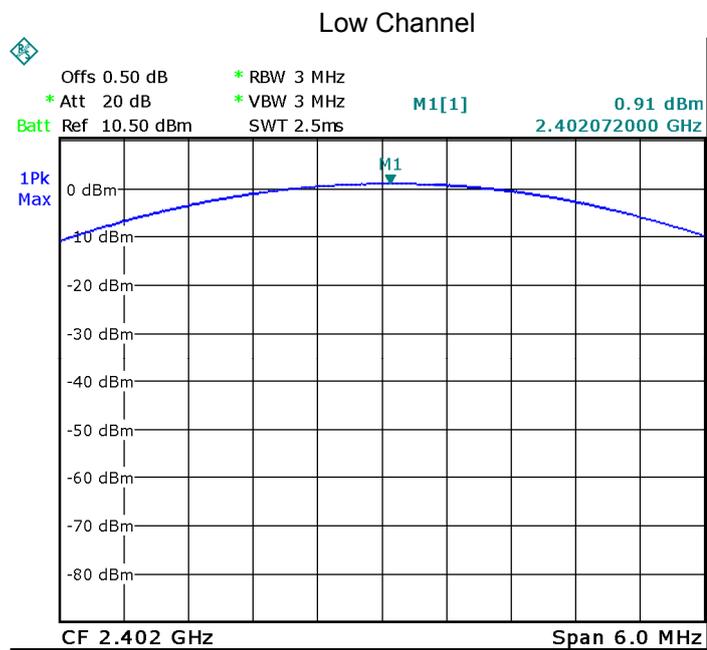


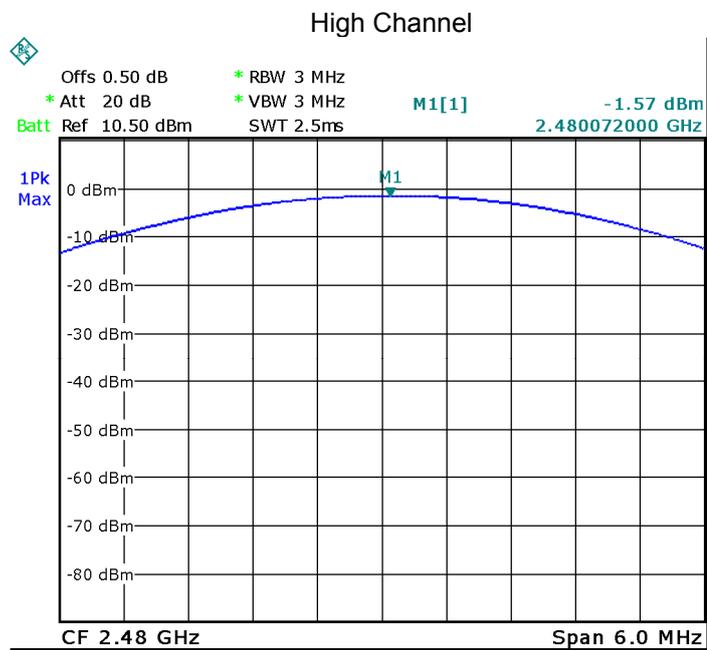
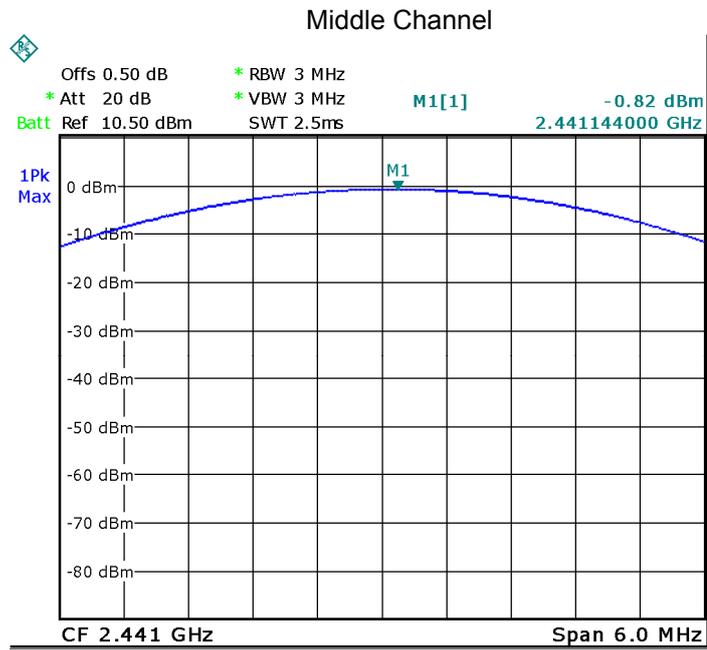
#### Middle Channel





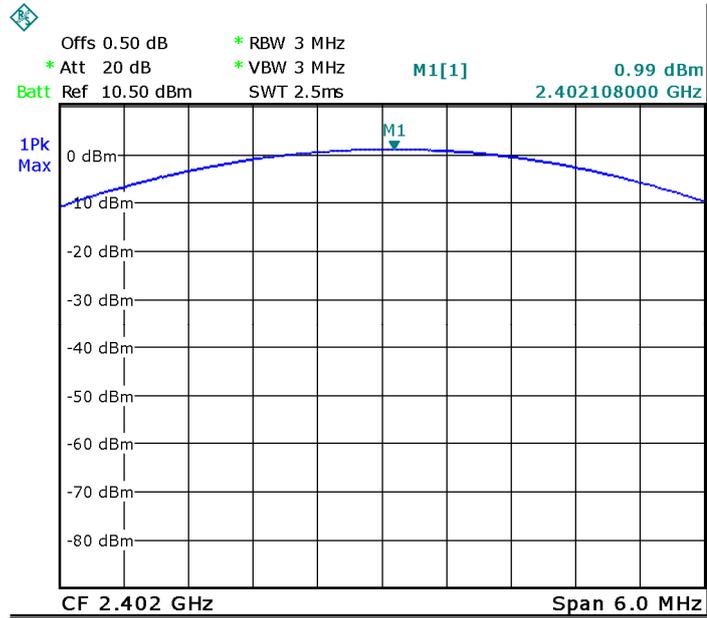
Modulation:  $\pi/4$ DQPSK



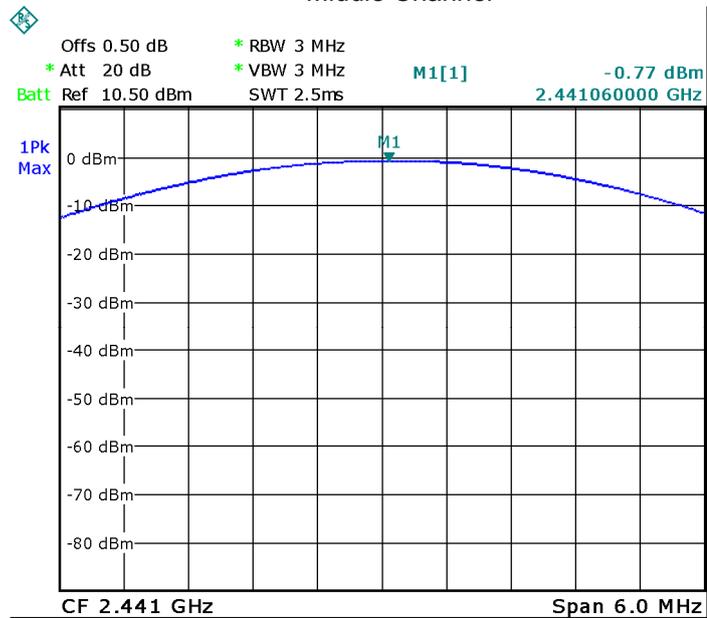


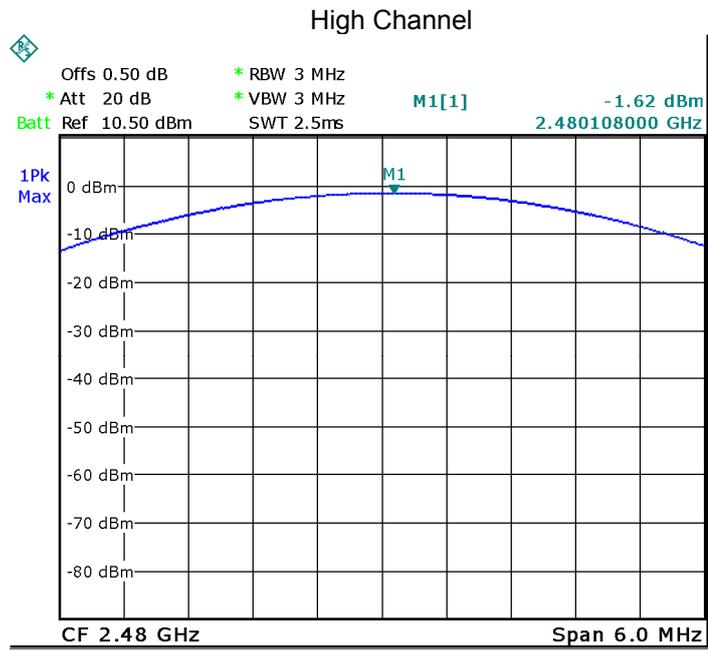
Modulation: 8DPSK

Low Channel



Middle Channel





## 12 Hopping Channel Separation

|                   |  |
|-------------------|--|
| Test Requirement: | FCC CFR47 Part 15 Section 15.247   |
| Test Method:      | ANSI 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 0.125W. |
| Test Mode:        | Test in hopping transmitting operating mode.   |

### 12.1 Test Procedure

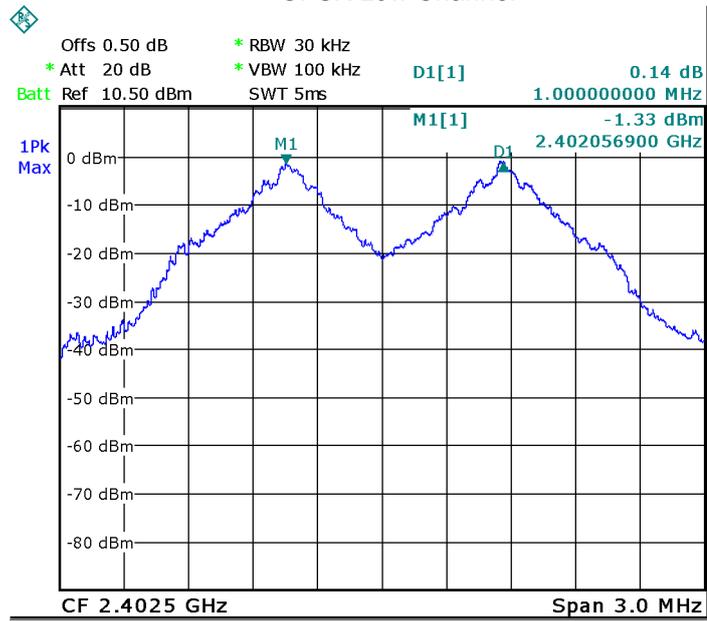
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30kHz. VBW = 100kHz , Span = 3.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to 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

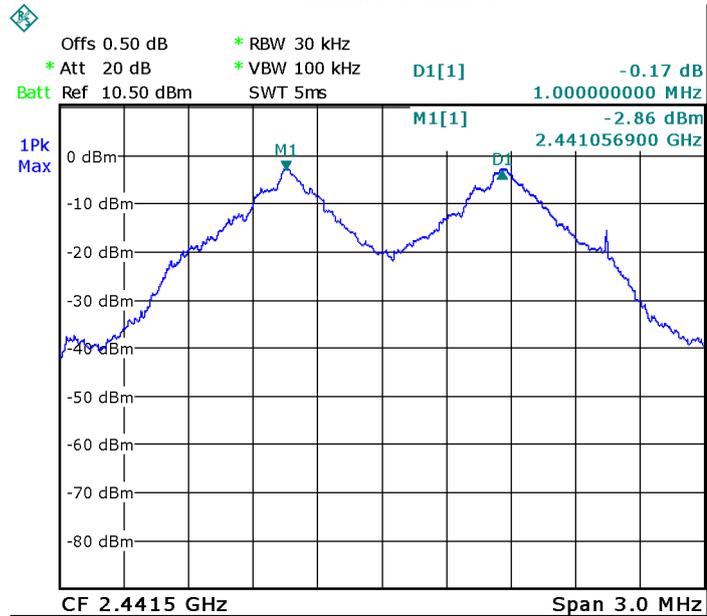
| Modulation    | Test Channel | Separation (MHz) | Result |
|---------------|--------------|------------------|--------|
| GFSK          | Low          | 1.000            | PASS   |
| GFSK          | Middle       | 1.000            | PASS   |
| GFSK          | High         | 1.000            | PASS   |
| $\pi/4$ DQPSK | Low          | 1.000            | PASS   |
| $\pi/4$ DQPSK | Middle       | 1.000            | PASS   |
| $\pi/4$ DQPSK | High         | 1.000            | PASS   |
| 8DPSK         | Low          | 1.000            | PASS   |
| 8DPSK         | Middle       | 1.000            | PASS   |
| 8DPSK         | High         | 1.000            | PASS   |

### Test plots

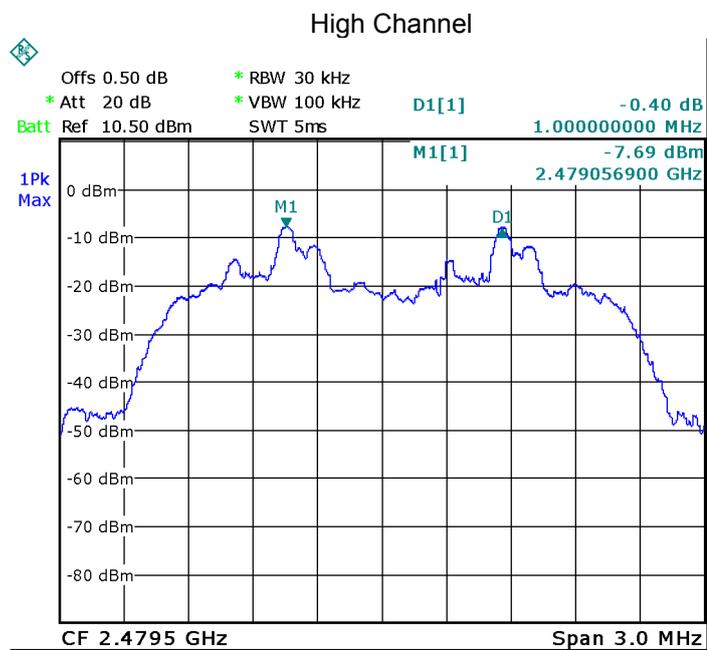
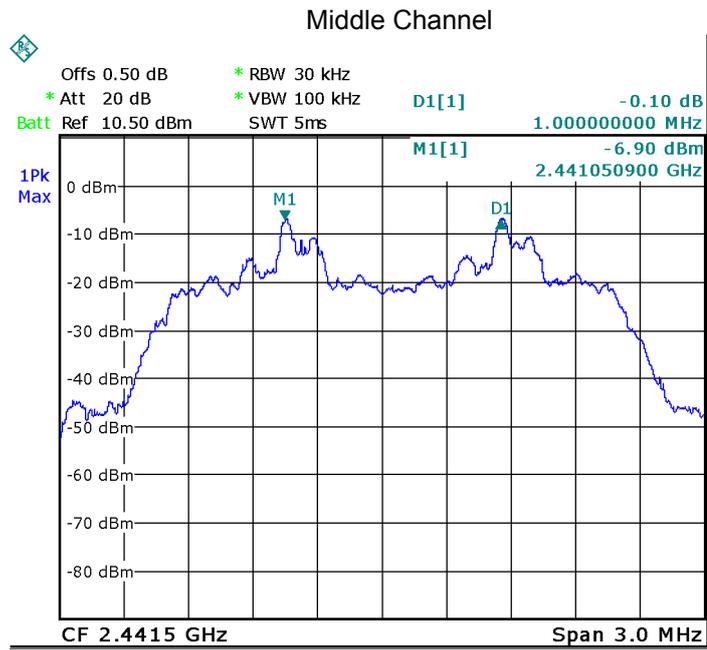
#### GFSK Low Channel



#### Middle Channel

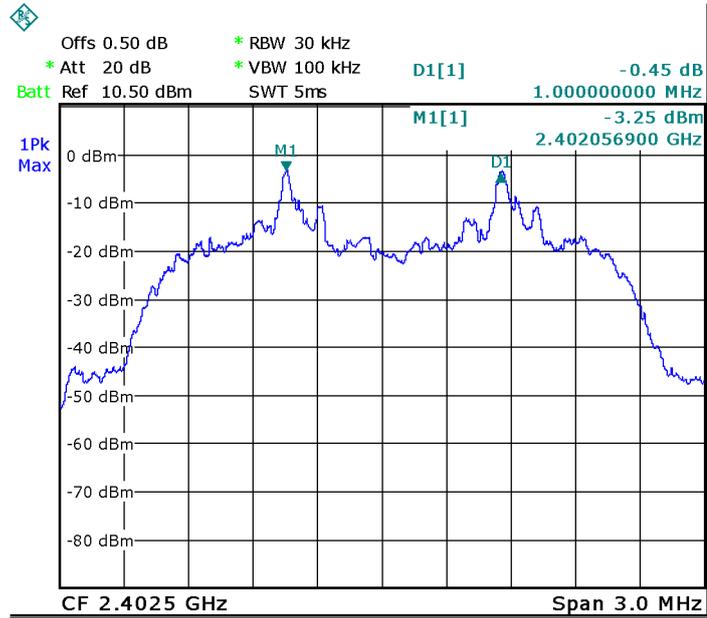




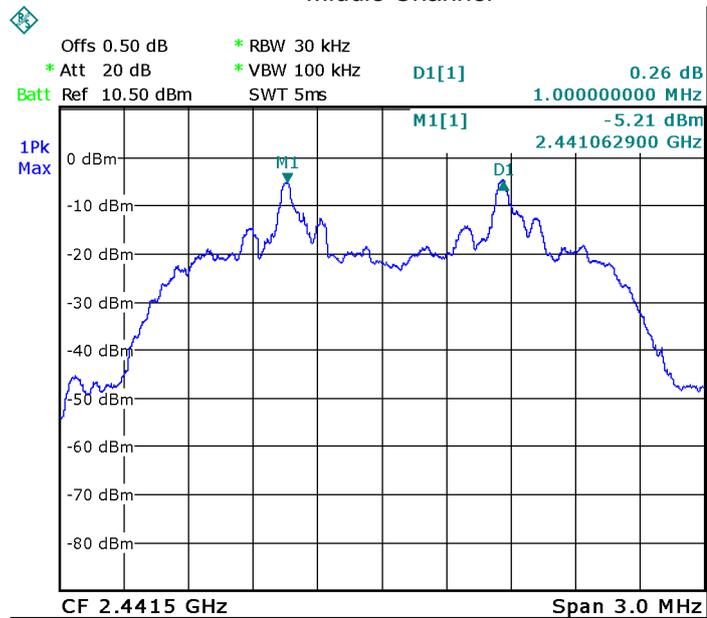


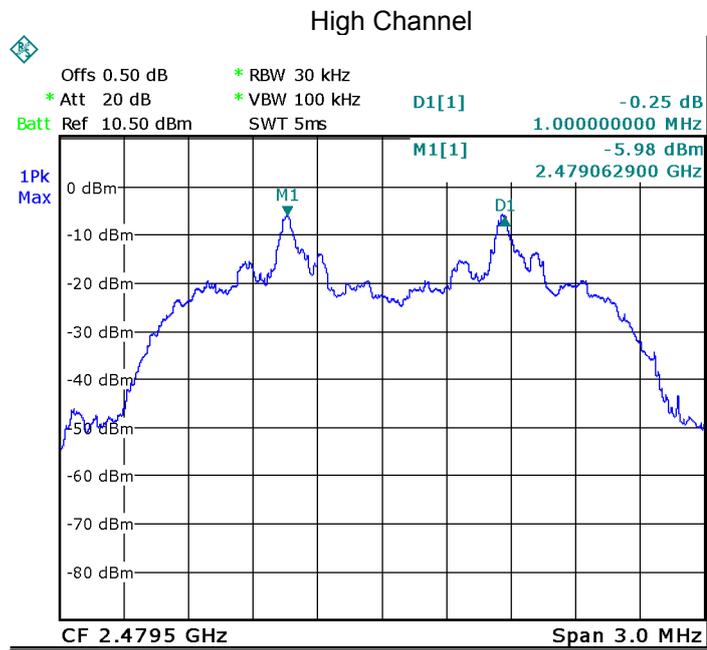
Modulation: 8DPSK

Low Channel



Middle Channel





## 13 Number of Hopping Frequency

|                   |   |
|-------------------|---|
| Test Requirement: | FCC CFR47 Part 15 Section 15.247  |
| Test Method:      | ANSI 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.  |

### 13.1 Test Procedure

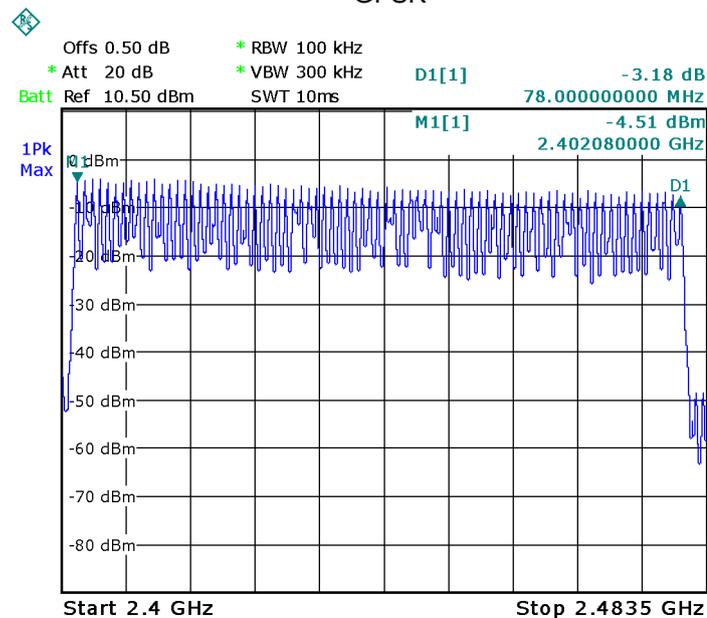
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100 KHz. VBW = 300 KHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up 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;

### 13.2 Test Result

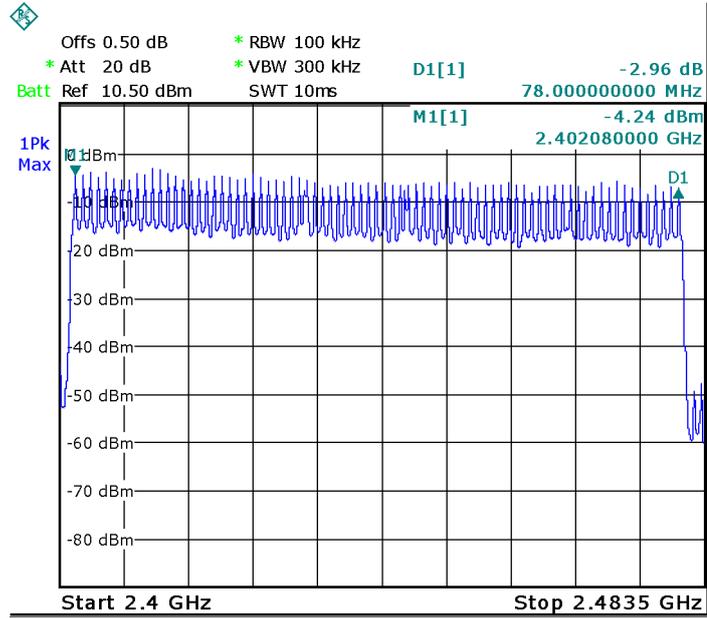
#### Test Plots:

79 Channels in total

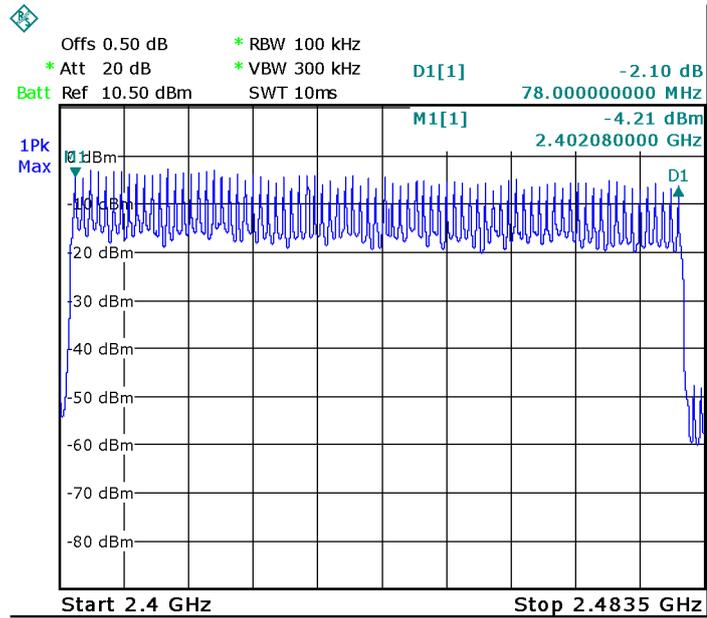
GFSK



Modulation:  $\pi/4$ DQPSK



Modulation: 8DPSK



## 14 Dwell Time

|                   |  |
|-------------------|--|
| Test Requirement: | FCC CFR47 Part 15 Section 15.247   |
| Test Method:      | ANSI 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.   |

### 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 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. Set the EUT for DH5, DH3 and DH1 packet transmitting.
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).

### 14.2 Test Result

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).

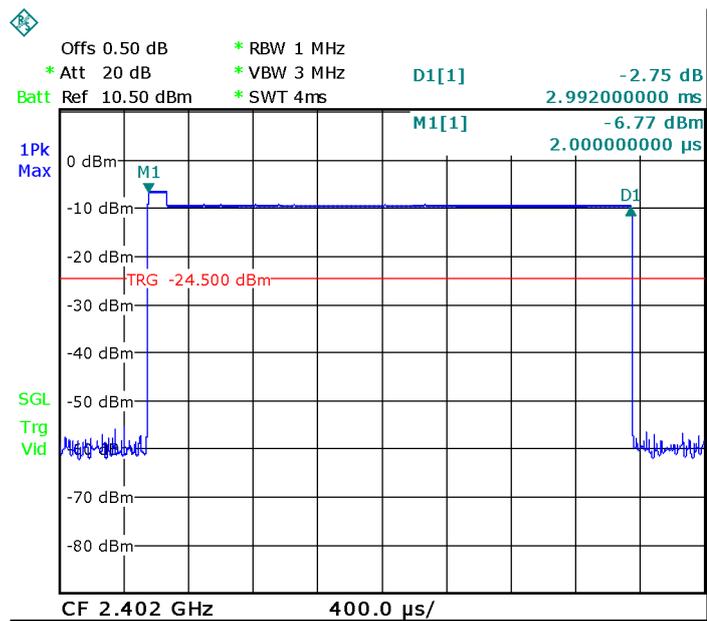
DH1 Packet permit maximum  $1600 / 79 / 2$  hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

| Data Packet                           | Dwell Time(s)                      |
|---------------------------------------|------------------------------------|
| DH5                                   | $1600/79/6*0.4*79*(MkrDelta)/1000$ |
| DH3                                   | $1600/79/4*0.4*79*(MkrDelta)/1000$ |
| DH1                                   | $1600/79/2*0.4*79*(MkrDelta)/1000$ |
| Remark: Mkr Delta is once pulse time. |                                    |

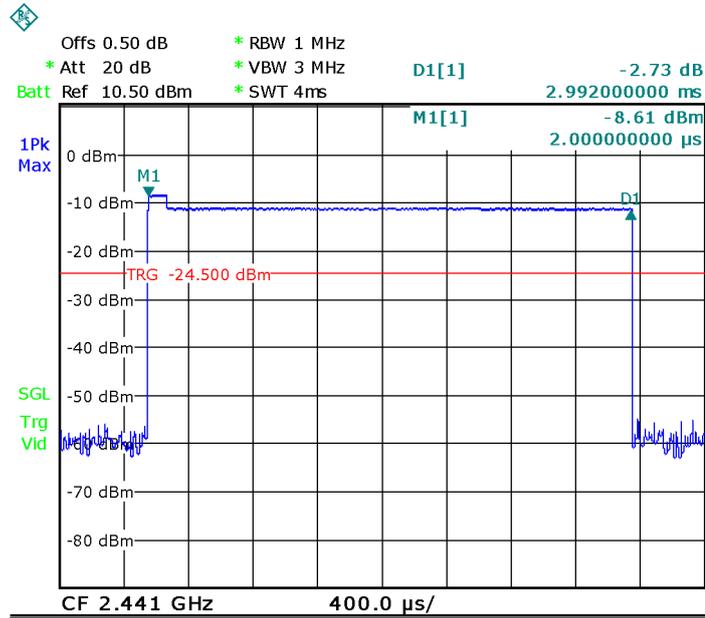
| Modulation | Data Packet | Channel | pulse time(ms) | Dwell Time(s) | Limits(s) |
|------------|-------------|---------|----------------|---------------|-----------|
| GFSK       | DH5         | Low     | 2.992          | 0.319         | 0.4       |
|            |             | middle  | 2.992          | 0.319         | 0.4       |
|            |             | High    | 2.992          | 0.319         | 0.4       |
| π /4DQPSK  | DH5         | Low     | 2.992          | 0.319         | 0.4       |
|            |             | middle  | 2.992          | 0.319         | 0.4       |
|            |             | High    | 2.992          | 0.319         | 0.4       |
| 8DPSK      | DH5         | Low     | 2.992          | 0.319         | 0.4       |
|            |             | middle  | 2.992          | 0.319         | 0.4       |
|            |             | High    | 2.992          | 0.319         | 0.4       |

Remark: Only the worst-case is recorded.

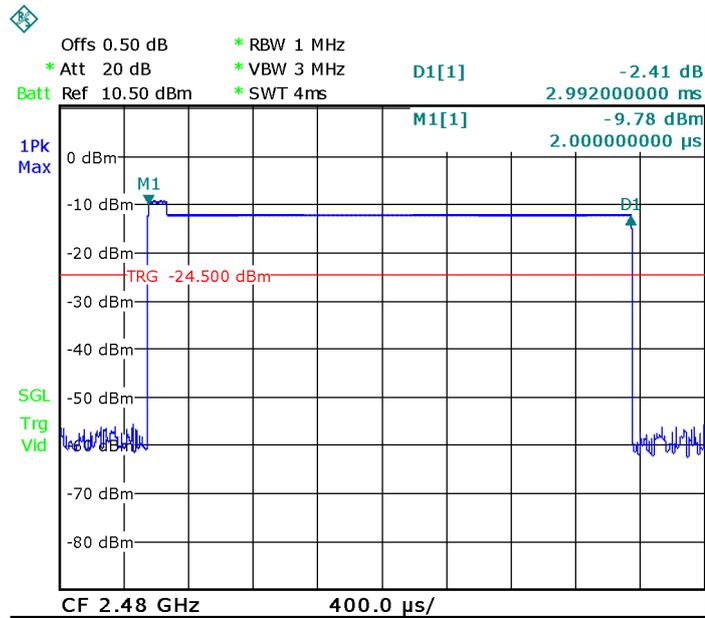
Test Plots  
GFSK DH5 Low Channel



Data Packet:  
DH5.Middle channel



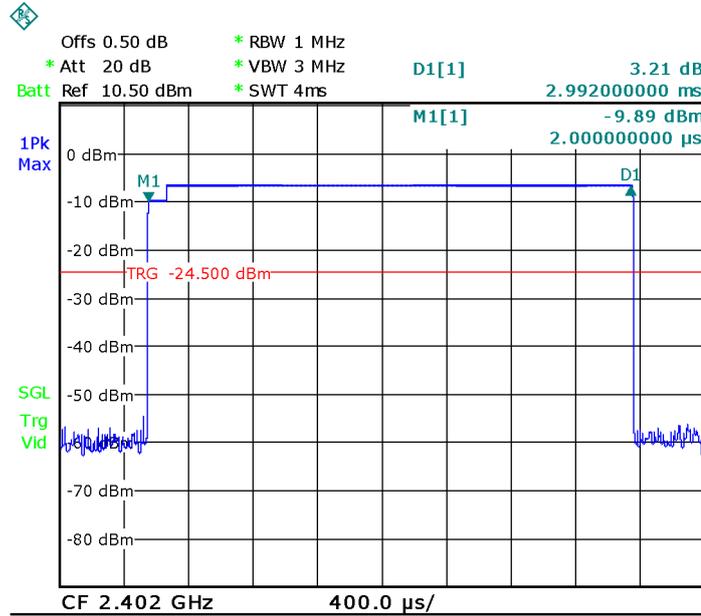
Data Packet:  
DH5, High channel



$\pi/4$ DQPSK

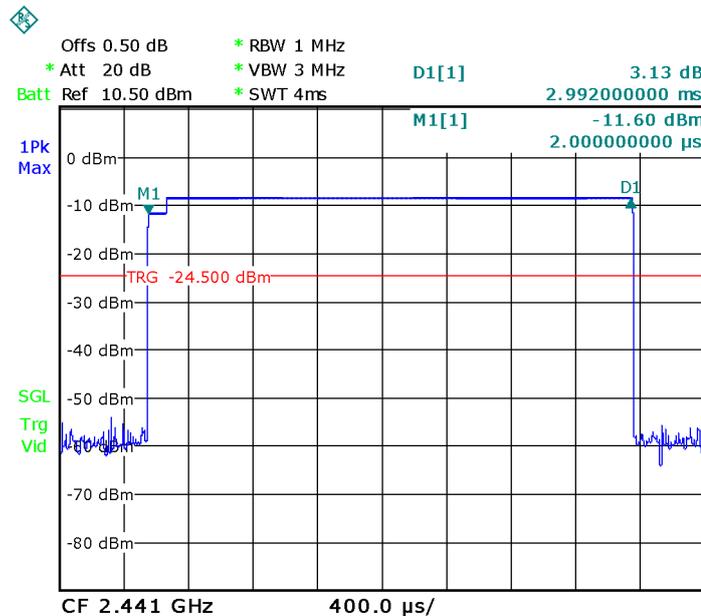
Data Packet:

DH5, Low channel

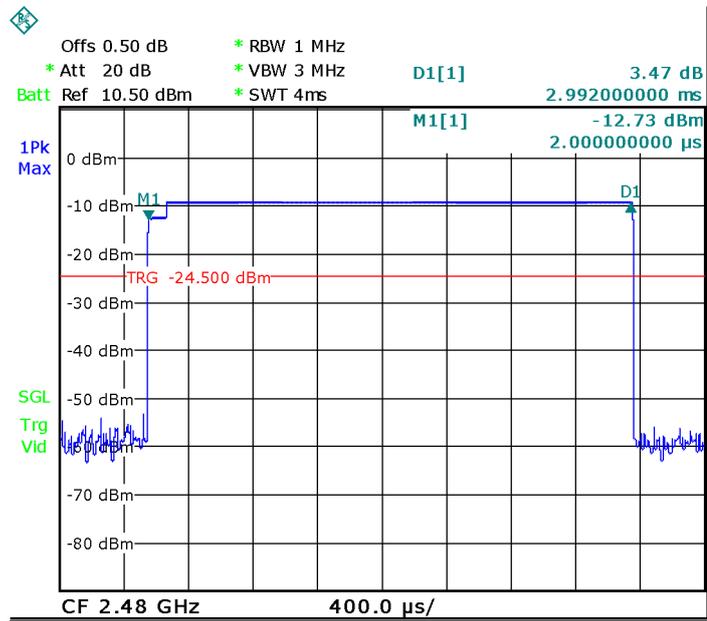


Data Packet:

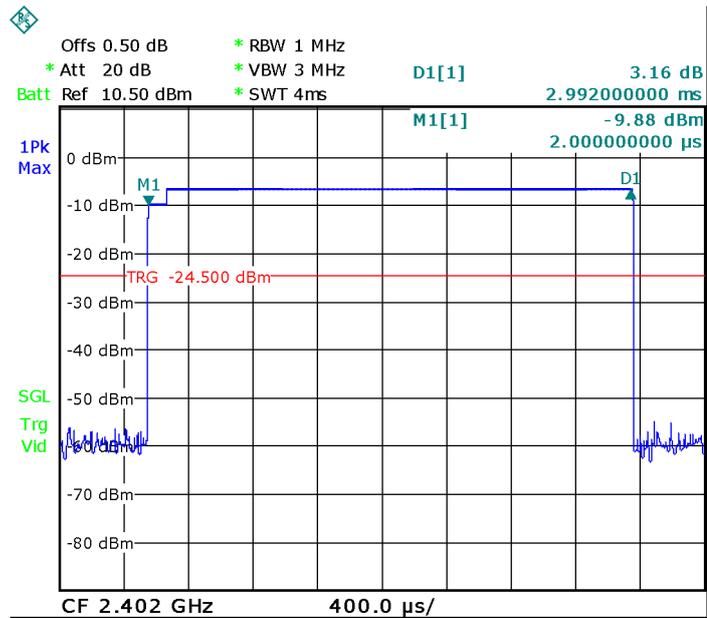
DH5, Middle channel



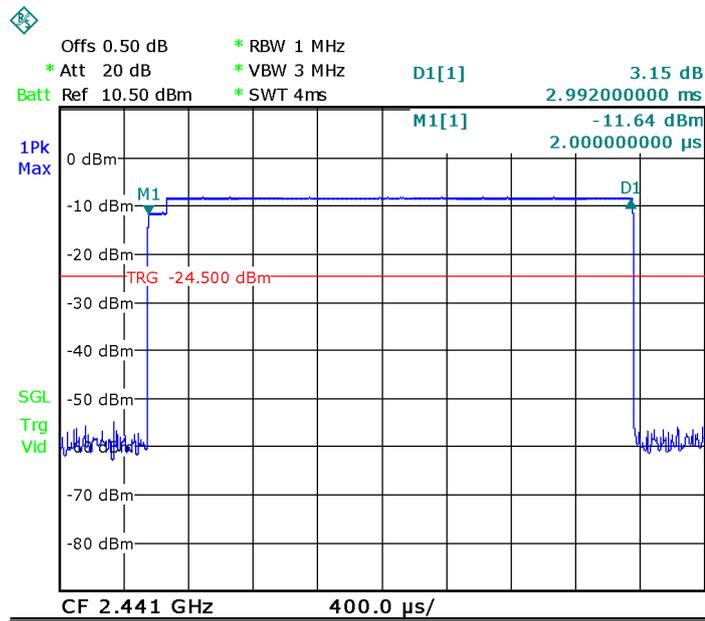
Data Packet:  
DH5, High channel



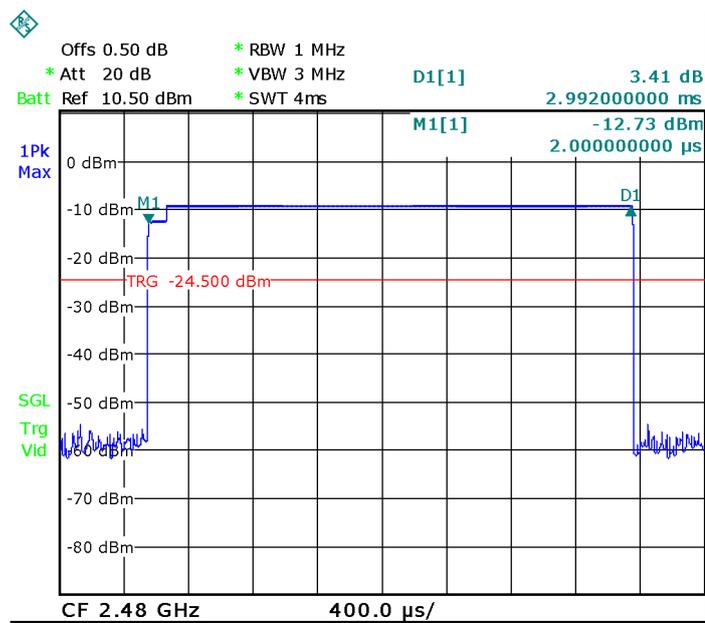
8DPSK  
Data Packet:  
DH5, Low channel



Data Packet:  
DH5, Middle channel



Data Packet:  
DH5, High channel



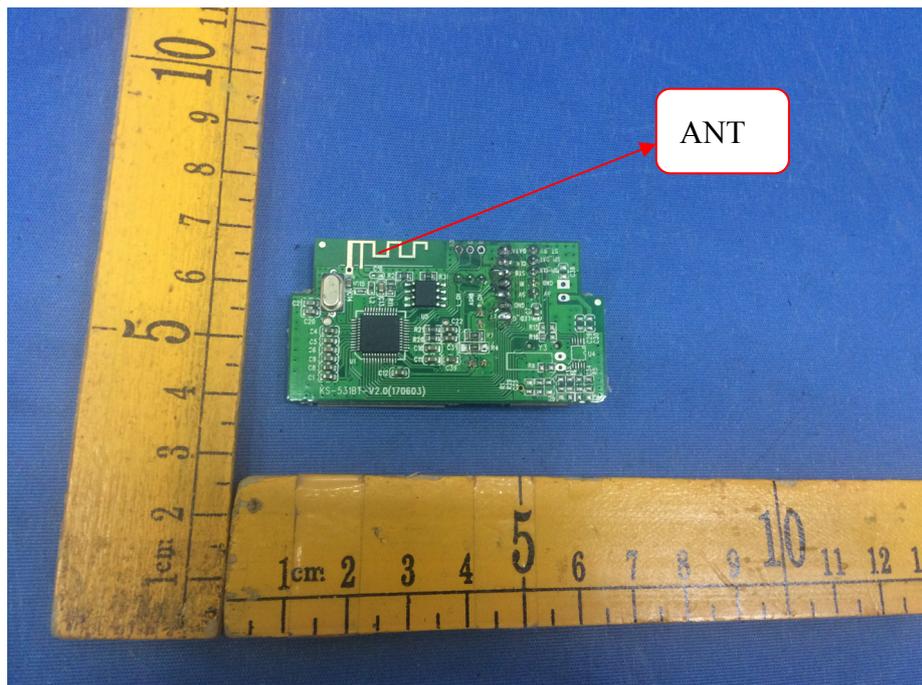
## 15 Antenna Requirement

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 one PCB Printed Antenna, the gain is 0dBi. meets the requirements of FCC 15.203.



## **16 FCC ID: 2ALZL-AA2171 RF Exposure**

Note: Please refer to RF Exposure test report: WTS17S1299195-2E.

## **17 Photographs-Model AA2171 Test Setup**

Note: Please refer to Photos: WTS17S1299195-3E.

## **18 Photographs-Constructional Details**

### **18.1 Model AA2171-External Photos**

Note: Please refer to Photos: WTS17S1299195-3E.

### **18.2 Model AA2171-Internal Photos**

Note: Please refer to Photos: WTS17S1299195-3E.

====End of Report====