



Report No.: PTC19102902102E-FC01

# FCC TEST REPORT

## FCC ID:2AR8A-H702

|                                                                                                                            |   |                      |
|----------------------------------------------------------------------------------------------------------------------------|---|----------------------|
| Product Name                                                                                                               | : | Wireless Earphone    |
| Model Name                                                                                                                 | : | H702                 |
| Brand Name                                                                                                                 | : | N/A                  |
| Report No.                                                                                                                 | : | PTC19102902102E-FC01 |
| <b>Prepared for</b>                                                                                                        |   |                      |
| Shenzhen Gleeman Technology Co., Ltd                                                                                       |   |                      |
| Rm 308, Bldg 2, 1970 Tech Park, Minzhi Street, Longhua District, Shenzhen, China                                           |   |                      |
| <b>Prepared by</b>                                                                                                         |   |                      |
| Dongguan Precise Testing & Certification Corp., Ltd.                                                                       |   |                      |
| Building D, Baoding Technology Park, Guangming Road 2, Guangming Community, Dongcheng District, Dongguan, Guangdong, China |   |                      |
|                                                                                                                            |   |                      |



## 1 TEST RESULT CERTIFICATION

Applicant's name : Shenzhen Gleeman Technology Co., Ltd  
Address : Rm 308, Bldg 2, 1970 Tech Park, Minzhi Street, Longhua District, Shenzhen, China  
Manufacture's name : Dongguan Gleeman Electronic Technology Co.  
Address : F2-3, 6 Qingping Rd, Tang xia Town, Dongguan  
Product name : Wireless Earphone  
Model name : H702  
Standards : FCC CFR47 Part 15 Section 15.247  
Test procedure : ANSI C63.10:2013  
Test Date : Nov 25, 2019 to Nov. 30, 2019  
Date of Issue : Nov. 30, 2019  
Test Result : Pass

This device described above has been tested by PTC, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

This report shall not be reproduced except in full, without the written approval of PTC, this document may be altered or revised by PTC, personal only, and shall be noted in the revision of the document.

Test Engineer:

A handwritten signature in black ink that reads 'Leo Yang'.

Leo Yang / Engineer

Technical Manager:

A handwritten signature in black ink that appears to read 'Chris Du'.

Chris Du / Manager



## Contents

|                                                       | Page      |
|-------------------------------------------------------|-----------|
| <b>1 TEST RESULT CERTIFICATION.....</b>               | <b>2</b>  |
| <b>2 TEST SUMMARY.....</b>                            | <b>5</b>  |
| <b>3 TEST FACILITY.....</b>                           | <b>6</b>  |
| <b>4 GENERAL INFORMATION.....</b>                     | <b>7</b>  |
| 4.1 GENERAL DESCRIPTION OF E.U.T.....                 | 7         |
| 4.2 TEST MODE.....                                    | 8         |
| <b>5 EQUIPMENT DURING TEST.....</b>                   | <b>10</b> |
| 5.1 EQUIPMENTS LIST.....                              | 10        |
| 5.2 MEASUREMENT UNCERTAINTY.....                      | 12        |
| 5.3 DESCRIPTION OF SUPPORT UNITS.....                 | 13        |
| <b>6 CONDUCTED EMISSION.....</b>                      | <b>14</b> |
| 6.1 E.U.T. OPERATION.....                             | 14        |
| 6.2 EUT SETUP.....                                    | 14        |
| 6.3 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)..... | 15        |
| 6.4 MEASUREMENT PROCEDURE:.....                       | 15        |
| 6.5 CONDUCTED EMISSION LIMIT.....                     | 15        |
| 6.6 MEASUREMENT DESCRIPTION.....                      | 15        |
| 6.7 CONDUCTED EMISSION TEST RESULT.....               | 15        |
| <b>7 RADIATED SPURIOUS EMISSIONS.....</b>             | <b>18</b> |
| 7.1 EUT OPERATION.....                                | 18        |
| 7.2 TEST SETUP.....                                   | 19        |
| 7.3 SPECTRUM ANALYZER SETUP.....                      | 20        |
| 7.4 TEST PROCEDURE.....                               | 21        |
| 7.5 SUMMARY OF TEST RESULTS.....                      | 22        |
| <b>8 CONDUCTED BAND EDGE EMISSION.....</b>            | <b>28</b> |
| 8.1 REQUIREMENT.....                                  | 28        |
| 8.2 TEST PROCEDURE.....                               | 28        |
| 8.3 TEST SETUP.....                                   | 28        |
| .....                                                 | 28        |



|                                            |           |
|--------------------------------------------|-----------|
| 8.4 EUT OPERATION CONDITIONS.....          | 29        |
| 8.5 TEST RESULTS.....                      | 29        |
| <b>9 20 DB BANDWIDTH MEASUREMENT.....</b>  | <b>37</b> |
| 9.1 TEST PROCEDURE.....                    | 37        |
| 9.2 TEST RESULT.....                       | 37        |
| <b>10 MAXIMUM PEAK OUTPUT POWER.....</b>   | <b>43</b> |
| 10.1 TEST PROCEDURE.....                   | 43        |
| 10.2 TEST RESULT.....                      | 43        |
| <b>11 HOPPING CHANNEL SEPARATION.....</b>  | <b>50</b> |
| 11.1 TEST PROCEDURE.....                   | 50        |
| 11.2 TEST RESULT.....                      | 51        |
| <b>12 NUMBER OF HOPPING FREQUENCY.....</b> | <b>57</b> |
| 12.1 TEST PROCEDURE.....                   | 57        |
| 12.2 TEST RESULT.....                      | 57        |
| <b>13 DWELL TIME.....</b>                  | <b>58</b> |
| 13.1 TEST PROCEDURE.....                   | 58        |
| 13.2 TEST RESULT.....                      | 58        |
| <b>14 ANTENNA REQUIREMENT.....</b>         | <b>61</b> |
| 14.1 ANTENNA REQUIREMENT.....              | 61        |
| 14.2 RESULT.....                           | 61        |
| <b>15 TEST PHOTOS.....</b>                 | <b>62</b> |
| <b>16 EUT PHOTOS.....</b>                  | <b>64</b> |



## 2 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   |
| 20dB 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   |



### **3 TEST FACILITY**

Dongguan Precise Testing & Certification Corp., Ltd.

Address: Building D, Baoding Technology Park, Guangming Road2, Dongcheng District, Dongguan,  
Guangdong, China

FCC Registration Number: 790290

A2LA Certificate No.: 4408.01

IC Registration Number: 12191A-1



## 4 General Information

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

|                       |   |                                                      |
|-----------------------|---|------------------------------------------------------|
| Product Name          | : | wireless Earphone                                    |
| Model Name            | : | H702                                                 |
| Bluetooth Version     | : | BT 5.0                                               |
| Operating frequency   | : | 2402-2480MHz                                         |
| Additional model name | : | ,N/A                                                 |
| Numbers of Channel    | : | 79 channels For DSS<br>40 channels For DTS           |
| Antenna Type          | : | Circular Metal Antenna                               |
| Antenna Gain          | : | 1.23 dBi                                             |
| Type of Modulation    | : | GFSK, $\pi/4$ -DQPSK, 8DPSK For DSS<br>GFSK, For DTS |
| Power supply          | : | DC 3.7V                                              |
| Hardware Version      | : | N/A                                                  |
| Software Version      | : | N/A                                                  |

## 4.2 Test Mode

The EUT has been tested under its typical operating condition. Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting. Only the worst case data were reported.

The EUT has been associated with peripherals pursuant to ANSI C63.10-2013 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation (9 KHz to the 10th harmonics of the highest fundamental frequency or to 40 GHz, whichever is lower).

The EUT has been tested under TX operating condition.

This EUT is a FHSS system, were conducted to determine the final configuration from all possible combinations. We use software control the EUT, Let EUT hopping on and transmit with highest power, all the modes GFSK,  $\pi/4$ -DQPSK, 8DPSK have been tested. 79 Channels are provided by EUT. The 3 channels of lower, medium and higher were chosen for test.

Channel List:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|---------|-----------------|---------|-----------------|
| 0       | 2402            | 1       | 2403            | 2       | 2404            | 3       | 2405            |
| 4       | 2406            | 5       | 2407            | 6       | 2408            | 7       | 2409            |
| 8       | 2410            | 9       | 2411            | 10      | 2412            | 11      | 2413            |
| 12      | 2414            | 13      | 2415            | 14      | 2416            | 15      | 2417            |
| 16      | 2418            | 17      | 2419            | 18      | 2420            | 19      | 2421            |
| 20      | 2422            | 21      | 2423            | 22      | 2424            | 23      | 2425            |
| 24      | 2426            | 25      | 2427            | 26      | 2428            | 27      | 2429            |
| 28      | 2430            | 29      | 2431            | 30      | 2432            | 31      | 2433            |
| 32      | 2434            | 33      | 2435            | 34      | 2436            | 35      | 2437            |
| 36      | 2438            | 37      | 2439            | 38      | 2440            | 39      | 2441            |
| 40      | 2442            | 41      | 2443            | 42      | 2444            | 43      | 2445            |
| 44      | 2446            | 45      | 2447            | 46      | 2448            | 47      | 2449            |
| 48      | 2450            | 49      | 2451            | 50      | 2452            | 51      | 2453            |
| 52      | 2454            | 53      | 2455            | 54      | 2456            | 55      | 2457            |
| 56      | 2458            | 57      | 2459            | 58      | 2460            | 59      | 2461            |
| 60      | 2462            | 61      | 2463            | 62      | 2464            | 63      | 2465            |
| 64      | 2466            | 65      | 2467            | 66      | 2468            | 67      | 2469            |
| 68      | 2470            | 69      | 2471            | 70      | 2472            | 71      | 2473            |
| 72      | 2474            | 73      | 2475            | 74      | 2476            | 75      | 2477            |
| 76      | 2478            | 77      | 2479            | 78      | 2480            | -       | -               |



Report No.: PTC19102902102E-FC01

| Channel | Frequency(MHz) |
|---------|----------------|
| 0       | 2402           |
| 39      | 2441           |
| 78      | 2480           |



## 5 Equipment During Test

### 5.1 Equipments List

#### RF Conducted Test

| Name of Equipment   | Manufacturer | Model   | Serial No.    | Characteristics | Calibration Due |
|---------------------|--------------|---------|---------------|-----------------|-----------------|
| MXG Signal Analyzer | Agilent      | N9020A  | SER MY5111038 | 10Hz-30GHz      | Aug. 21, 2020   |
| Coaxial Cable       | CDS          | 79254   | 46107086      | 10Hz-30GHz      | Aug. 21, 2020   |
| Power Meter         | Anritsu      | ML2495A | 0949003       | 300MHz-40GHz    | Aug. 28, 2020   |
| Power Sensor        | Anritsu      | MA2411B | 0917017       | 300MHz-40GHz    | Aug. 28, 2020   |

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

#### Radiated Emissions

| Name of Equipment            | Manufacturer  | Model      | Serial No.   | Characteristics | Calibration Due |
|------------------------------|---------------|------------|--------------|-----------------|-----------------|
| EMI Test Receiver            | Rohde&Schwarz | ESCI       | 101417       | 9KHz-3GHz       | Aug. 28, 2020   |
| Loop Antenna                 | Schwarzbeck   | FMZB 1519  | 012          | 9 KHz -30MHz    | Aug. 28, 2020   |
| Bilog Antenna                | SCHWARZBECK   | VULB9160   | 9160-3355    | 25MHz-2GHz      | Aug. 22, 2020   |
| Preamplifier (low frequency) | SCHWARZBECK   | BBV 9475   | 9745-0013    | 1MHz-1GHz       | Aug. 21, 2020   |
| Cable                        | Schwarzbeck   | PLF-100    | 549489       | 9KHz-3GHz       | Aug. 21, 2020   |
| Spectrum Analyzer            | Agilent       | E4407B     | MY45109572   | 9KHz-40GHz      | Aug. 28, 2020   |
| Horn Antenna                 | SCHWARZBECK   | 9120D      | 9120D-1246   | 1GHz-18GHz      | Apr. 13, 2020   |
| Power Amplifier              | LUNAR EM      | LNA1G18-40 | J10100000081 | 1GHz-26.5GHz    | Aug. 21, 2020   |
| Horn Antenna                 | SCHWARZBECK   | BBHA 9170  | 9170-181     | 14GHz-40GHz     | Apr. 13, 2020   |
| Amplifier                    | SCHWARZBECK   | BBV 9721   | 9721-205     | 18GHz-40GHz     | Aug. 21, 2020   |
| Cable                        | H+S           | CBL-26     | N/A          | 1GHz-26.5GHz    | Aug. 21, 2020   |
| RF Cable                     | R&S           | R204       | R21X         | 1GHz-40GHz      | Aug. 21, 2020   |



Report No.: PTC19102902102E-FC01

Conducted Emissions

| Name of Equipment        | Manufacturer  | Model  | Serial No. | Characteristics | Calibration Due |
|--------------------------|---------------|--------|------------|-----------------|-----------------|
| EMI Test Receiver        | Rohde&Schwarz | ESCI   | 101417     | 9KHz-3GHz       | Aug. 28, 2020   |
| Artificial Mains Network | Rohde&Schwarz | ENV216 | 102453     | 9KHz-300MHz     | Aug. 21, 2020   |
| Artificial Mains Network | Rohde&Schwarz | ENV216 | 101342     | 9KHz-300MHz     | Aug. 21, 2020   |



## 5.2 Measurement Uncertainty

| Parameter                          | Uncertainty              |
|------------------------------------|--------------------------|
| RF output power, conducted         | $\pm 1.0\text{dB}$       |
| Power Spectral Density, conducted  | $\pm 2.2\text{dB}$       |
| Radio Frequency                    | $\pm 1 \times 10^{-6}$   |
| Bandwidth                          | $\pm 1.5 \times 10^{-6}$ |
| Time                               | $\pm 2\%$                |
| Duty Cycle                         | $\pm 2\%$                |
| Temperature                        | $\pm 1^{\circ}\text{C}$  |
| Humidity                           | $\pm 5\%$                |
| DC and low frequency voltages      | $\pm 3\%$                |
| Conducted Emissions (150kHz~30MHz) | $\pm 3.64\text{dB}$      |
| Radiated Emission(30MHz~1GHz)      | $\pm 5.03\text{dB}$      |
| Radiated Emission(1GHz~25GHz)      | $\pm 4.74\text{dB}$      |



Report No.: PTC19102902102E-FC01

### 5.3 Description of Support Units

| Equipment | Model No.                                                                   | Series No. |
|-----------|-----------------------------------------------------------------------------|------------|
| Adapter   | Model: PS65B150Y3000S<br>Input: AC120V, 60Hz, 1.5A<br>Output: DC 5V, 3000mA | N/A        |

## 6 Conducted Emission

|                   |                                                 |
|-------------------|-------------------------------------------------|
| Test Requirement: | : FCC CFR 47 Part 15 Section 15.207             |
| Test Method:      | : ANSI C63.10:2013                              |
| Test Result:      | : PASS                                          |
| Frequency Range:  | : 150kHz to 30MHz                               |
| Class/Severity:   | : Class B                                       |
| Detector:         | : Peak for pre-scan (9kHz Resolution Bandwidth) |

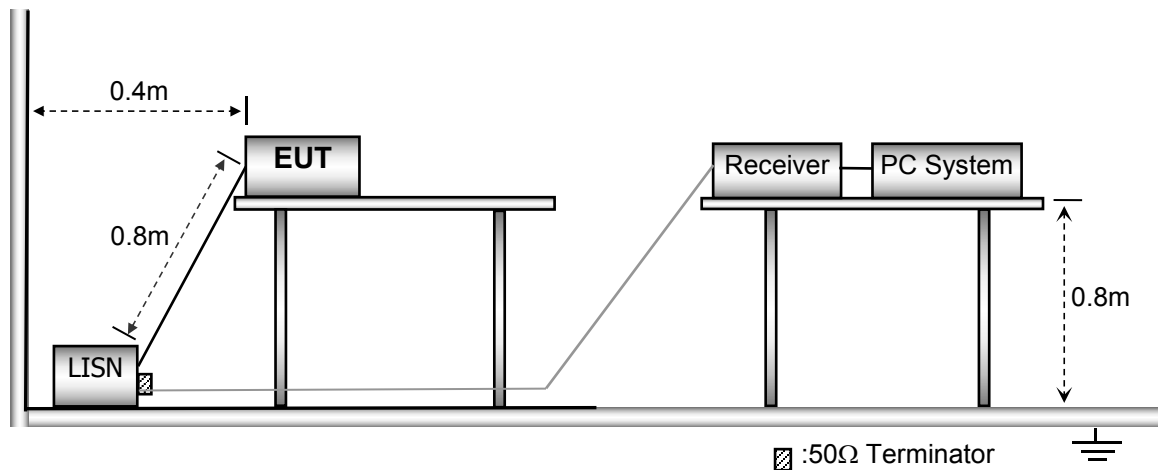
### 6.1 E.U.T. Operation

Operating Environment :

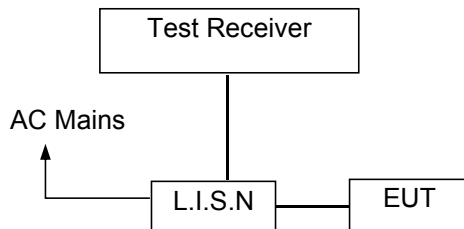
|                       |                |
|-----------------------|----------------|
| Temperature:          | : 23.2°C       |
| Humidity:             | : 51 % RH      |
| Atmospheric Pressure: | : 101.12 kPa   |
| Test Voltage          | : AC 120V/60Hz |

### 6.2 EUT Setup

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



### 6.3 Test SET-UP (Block Diagram of Configuration)



### 6.4 Measurement Procedure:

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured was complete.

### 6.5 Conducted Emission Limit

#### Conducted Emission

| Frequency(MHz) | Quasi-peak | Average |
|----------------|------------|---------|
| 0.15-0.5       | 66-56      | 56-46   |
| 0.5-5.0        | 56         | 46      |
| 5.0-30.0       | 60         | 50      |

#### Note:

1. The lower limit shall apply at the transition frequencies
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

### 6.6 Measurement Description

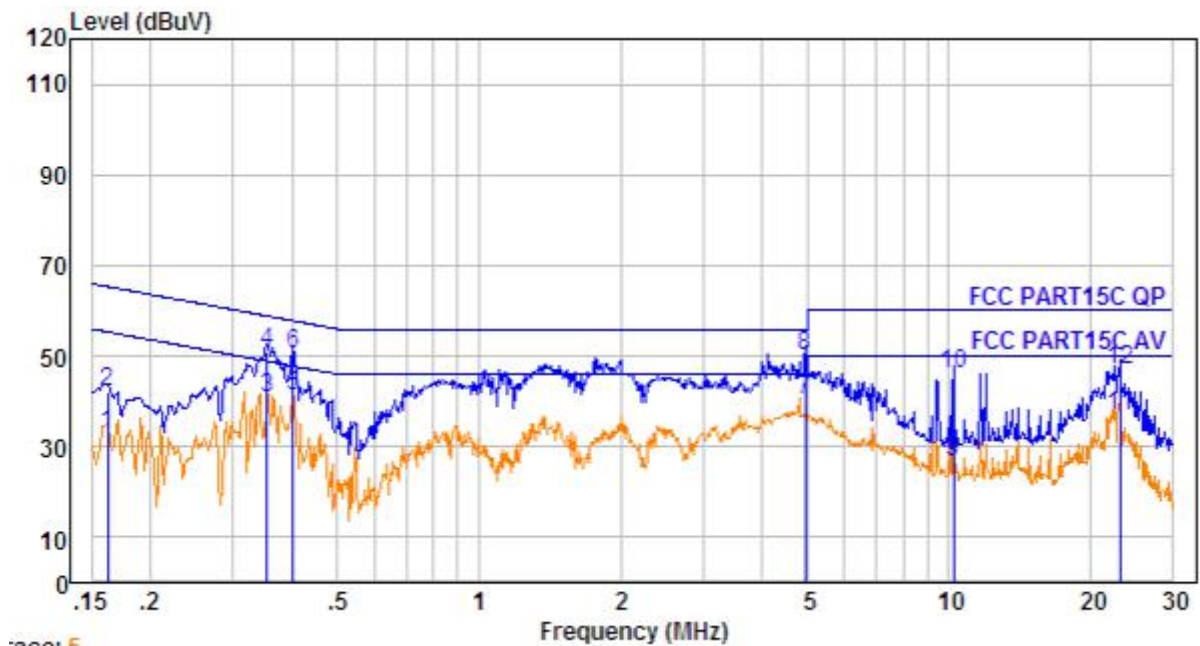
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

### 6.7 Conducted Emission Test Result

Pass

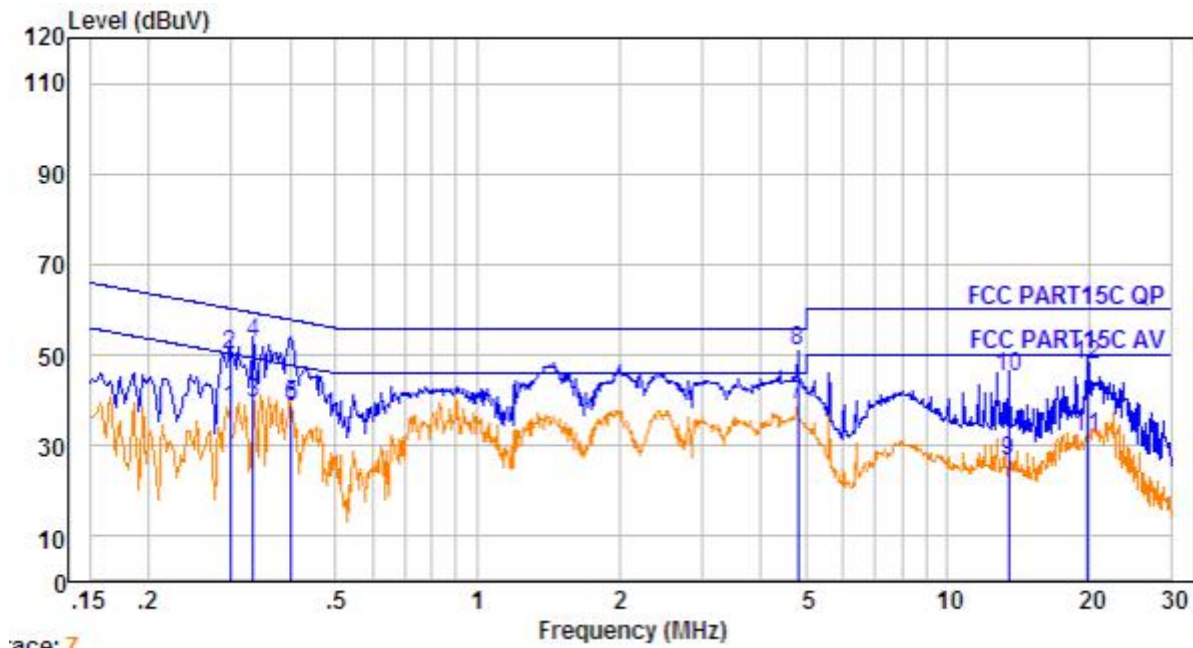
Conducted emission at both 120V & 240V is assessed, and emission at 120V represents the worst case. All the modulation modes were tested the data of the worst mode (GFSK) are recorded in the following pages and the others modulation methods do not exceed the limits.

Line -120V/60Hz:



| No. | Freq<br>MHz | Cable<br>Loss<br>dB | AMN<br>Factor<br>dB | Receiver<br>Reading<br>dBμV | Emission<br>Level<br>dBμV | Limit<br>dBμV | Over<br>Limit<br>dB | Remark  |
|-----|-------------|---------------------|---------------------|-----------------------------|---------------------------|---------------|---------------------|---------|
| 1.  | 0.162       | 0.23                | 9.52                | 23.22                       | 32.97                     | 55.34         | -22.37              | Average |
| 2.  | 0.162       | 0.23                | 9.52                | 32.41                       | 42.16                     | 65.34         | -23.18              | QP      |
| 3.  | 0.354       | 0.39                | 9.71                | 30.51                       | 40.61                     | 48.87         | -8.26               | Average |
| 4.  | 0.354       | 0.39                | 9.71                | 40.63                       | 50.73                     | 58.87         | -8.14               | QP      |
| 5.  | 0.402       | 0.40                | 9.73                | 31.13                       | 41.26                     | 47.81         | -6.55               | Average |
| 6.  | 0.402       | 0.40                | 9.73                | 40.33                       | 50.46                     | 57.81         | -7.35               | QP      |
| 7.  | 4.952       | 0.50                | 9.91                | 29.84                       | 40.25                     | 46.00         | -5.75               | Average |
| 8.  | 4.952       | 0.50                | 9.91                | 39.64                       | 50.05                     | 56.00         | -5.95               | QP      |
| 9.  | 10.233      | 0.56                | 9.96                | 16.19                       | 26.71                     | 50.00         | -23.29              | Average |
| 10. | 10.233      | 0.56                | 9.96                | 35.53                       | 46.05                     | 60.00         | -13.95              | QP      |
| 11. | 23.140      | 0.49                | 9.88                | 26.60                       | 36.97                     | 50.00         | -13.03              | Average |
| 12. | 23.140      | 0.49                | 9.88                | 36.52                       | 46.89                     | 60.00         | -13.11              | QP      |

Neutral -120V/60Hz:



Trace: 7

| No. | Freq<br>MHz | Cable<br>Loss<br>dB | AMN<br>Factor<br>dB | Receiver<br>Reading<br>dBμV | Emission<br>Level<br>dBμV | Limit<br>dBμV | Over<br>Limit<br>dB | Remark  |
|-----|-------------|---------------------|---------------------|-----------------------------|---------------------------|---------------|---------------------|---------|
| 1.  | 0.299       | 0.37                | 9.62                | 27.98                       | 37.97                     | 50.28         | -12.31              | Average |
| 2.  | 0.299       | 0.37                | 9.62                | 40.08                       | 50.07                     | 60.28         | -10.21              | QP      |
| 3.  | 0.334       | 0.38                | 9.62                | 29.20                       | 39.20                     | 49.35         | -10.15              | Average |
| 4.  | 0.334       | 0.38                | 9.62                | 42.65                       | 52.65                     | 59.35         | -6.70               | QP      |
| 5.  | 0.402       | 0.40                | 9.63                | 28.98                       | 39.01                     | 47.81         | -8.80               | Average |
| 6.  | 0.402       | 0.40                | 9.63                | 28.55                       | 38.58                     | 57.81         | -19.23              | QP      |
| 7.  | 4.797       | 0.50                | 9.70                | 28.84                       | 39.04                     | 46.00         | -6.96               | Average |
| 8.  | 4.797       | 0.50                | 9.70                | 40.91                       | 51.11                     | 56.00         | -4.89               | QP      |
| 9.  | 13.479      | 0.56                | 9.83                | 16.29                       | 26.68                     | 50.00         | -23.32              | Average |
| 10. | 13.479      | 0.56                | 9.83                | 34.75                       | 45.14                     | 60.00         | -14.86              | QP      |
| 11. | 19.845      | 0.39                | 9.90                | 21.39                       | 31.68                     | 50.00         | -18.32              | Average |
| 12. | 19.845      | 0.39                | 9.90                | 37.63                       | 47.92                     | 60.00         | -12.08              | QP      |



## 7 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 : See the follow table

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

### 7.1 EUT Operation

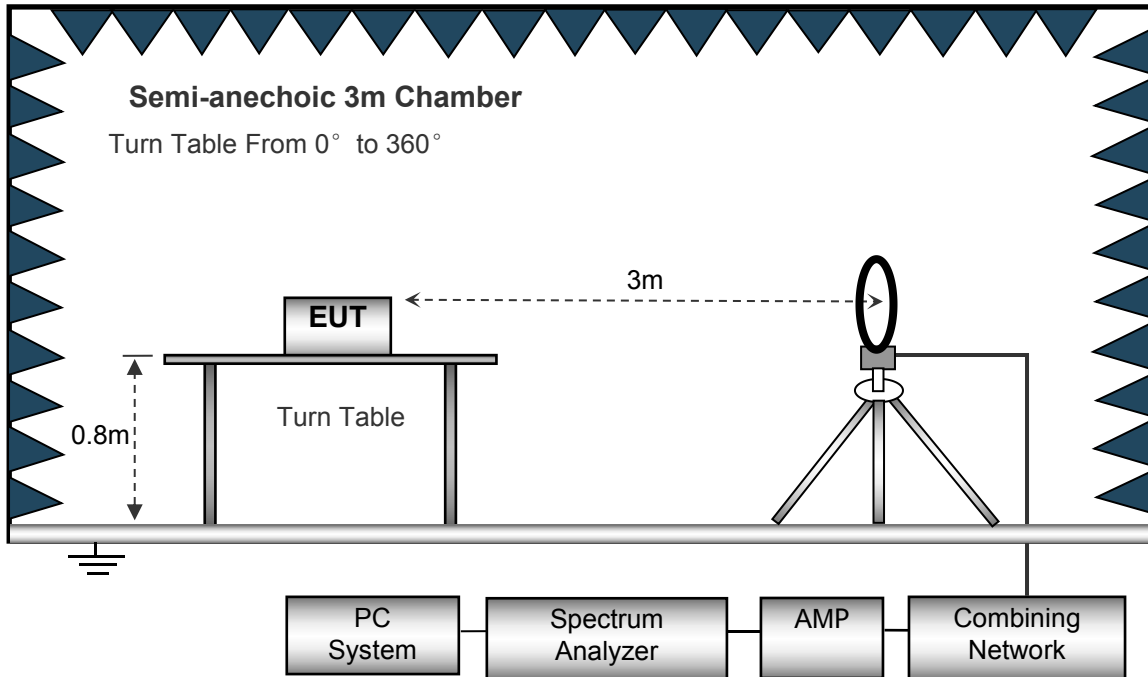
Operating Environment :

Temperature : 23.5 °C  
 Humidity : 51.5% RH  
 Atmospheric Pressure : 100.12kPa  
 Test Voltage : DC 3.7 V

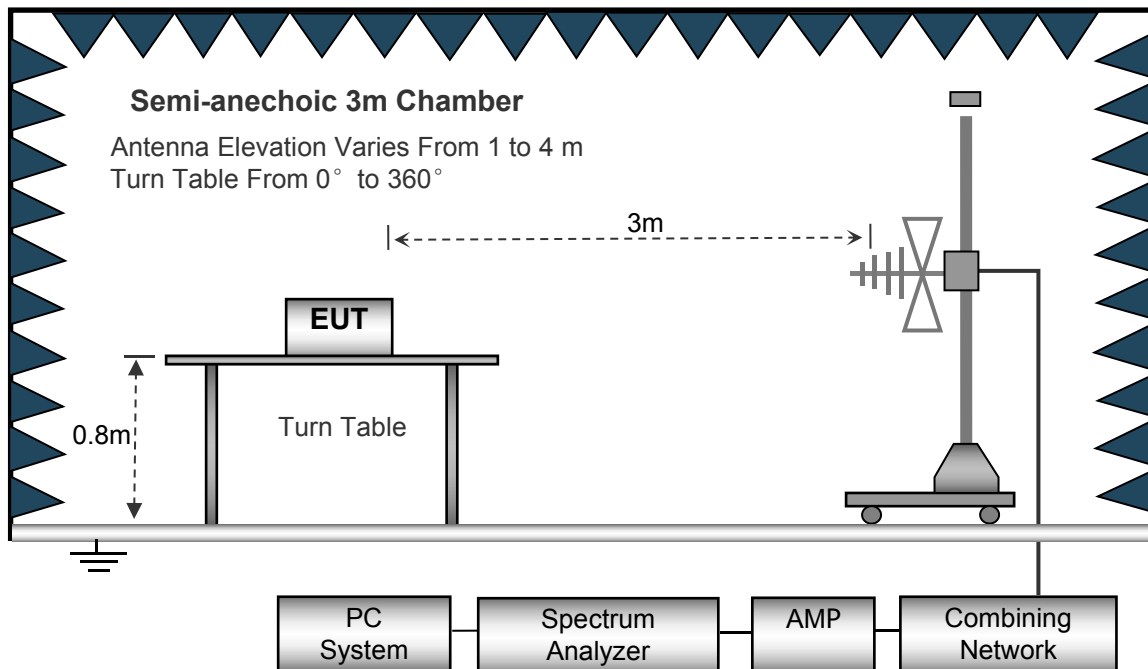
## 7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

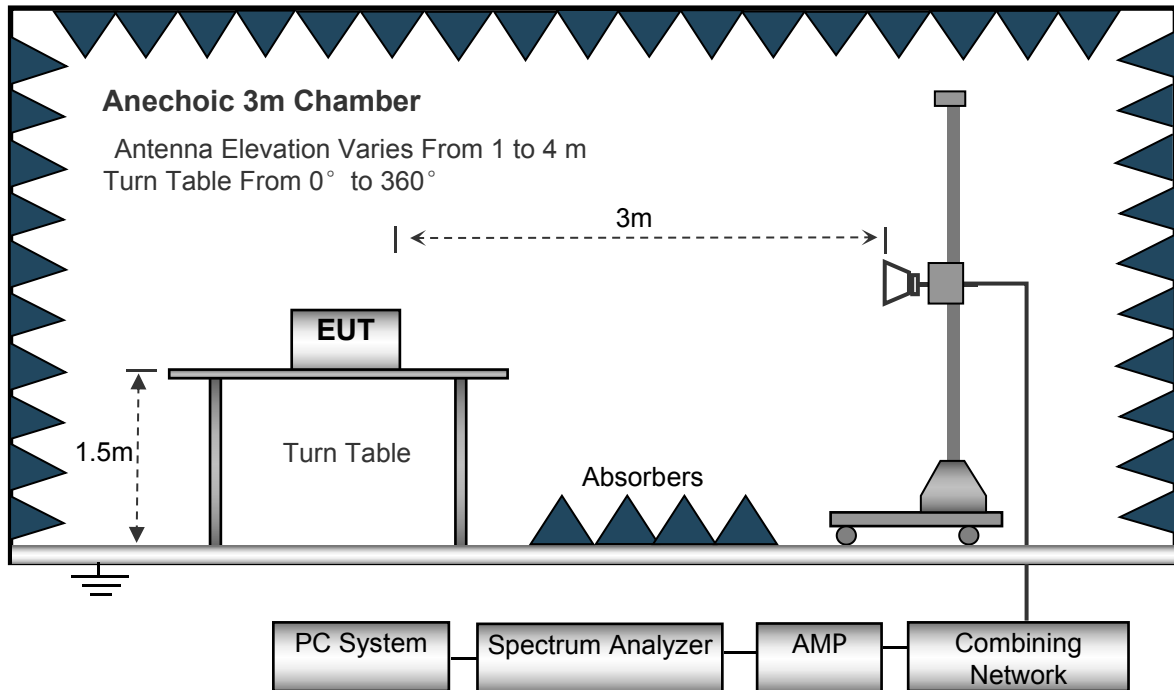
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



### 7.3 Spectrum Analyzer Setup

| Spectrum Parameter                    | Setting                                          |
|---------------------------------------|--------------------------------------------------|
| Attenuation                           | Auto                                             |
| Start Frequency                       | 1000 MHz                                         |
| Stop Frequency                        | 10th carrier harmonic                            |
| RB / VB (emission in restricted band) | 1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average |

| Receiver Parameter     | Setting                          |
|------------------------|----------------------------------|
| Attenuation            | Auto                             |
| Start ~ Stop Frequency | 9kHz~150kHz / RB 200Hz for QP    |
| Start ~ Stop Frequency | 150kHz~30MHz / RB 9kHz for QP    |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB 120kHz for QP |

## 7.4 Test Procedure

1. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10-2013.
2. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane. And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m above ground plane.
3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (From 1m to 4m) and turntable (from 0 degree to 360 degree) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Final measurement (Above 1GHz): The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1MHz. The measurement will be performed in horizontal and vertical polarization of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 degree to 360 degree in order to have the antenna inside the cone of radiation.
7. Test Procedure of measurement (For Above 1GHz):
  - 1) Monitor the frequency range at horizontal polarization and move the antenna over all sides of the EUT(if necessary move the EUT to another orthogonal axis).
  - 2) Change the antenna polarization and repeat 1) with vertical polarization.
  - 3) Make a hardcopy of the spectrum.
  - 4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
  - 5) Change the analyser mode to Clear/ Write and found the cone of emission.
  - 6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3m and the antenna will be still inside the cone of emission.
  - 7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarization and azimuth and the peak and average detector, which causes the maximum emission.
  - 8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.



## 7.5 Summary of Test Results

### Test Frequency: 9KHz-30MHz

| Freq.<br>(MHz) | Ant.Pol.<br>H/V | Emission Level<br>(dBuV/m) | Limit 3m<br>(dBuV/m) | Over<br>(dB) |
|----------------|-----------------|----------------------------|----------------------|--------------|
| --             | --              | --                         | --                   | >20          |

**Note:**

The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

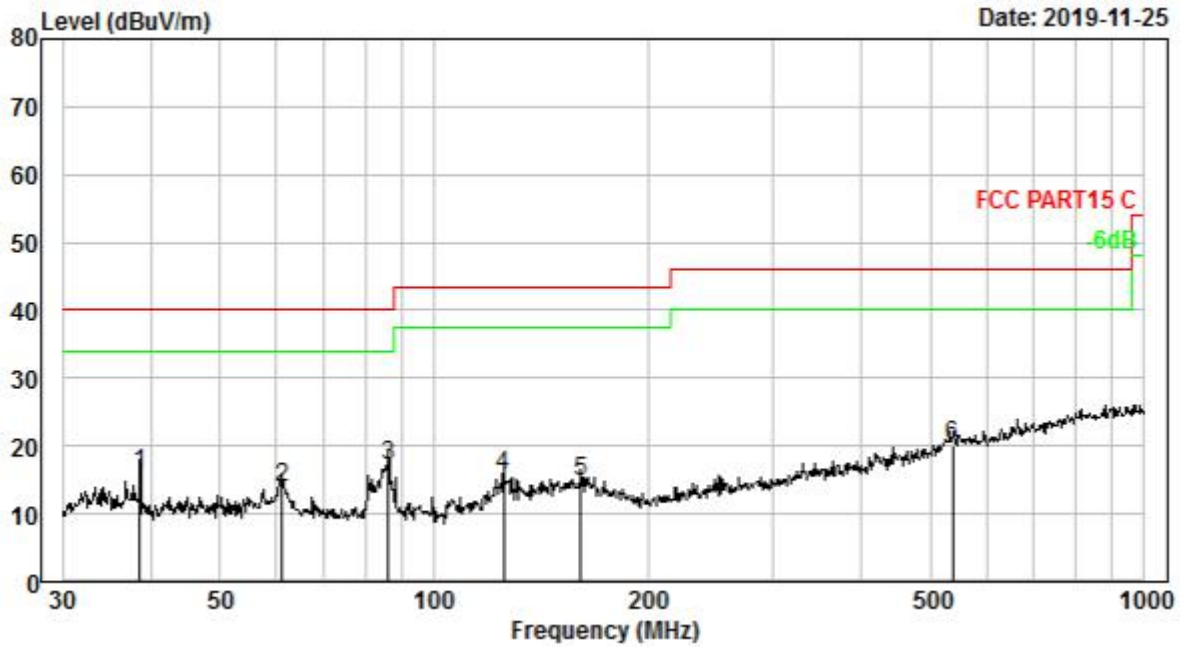
Distance extrapolation factor =  $40 \log(\text{Specific distance} / \text{test distance})$  (dB);

Limit line = Specific limits (dBuV) + distance extrapolation factor.

### Test Frequency: 30MHz ~ 1GHz

Please refer to the following test plots, Low Channel (2402MHz) Worst case GFSK for record:

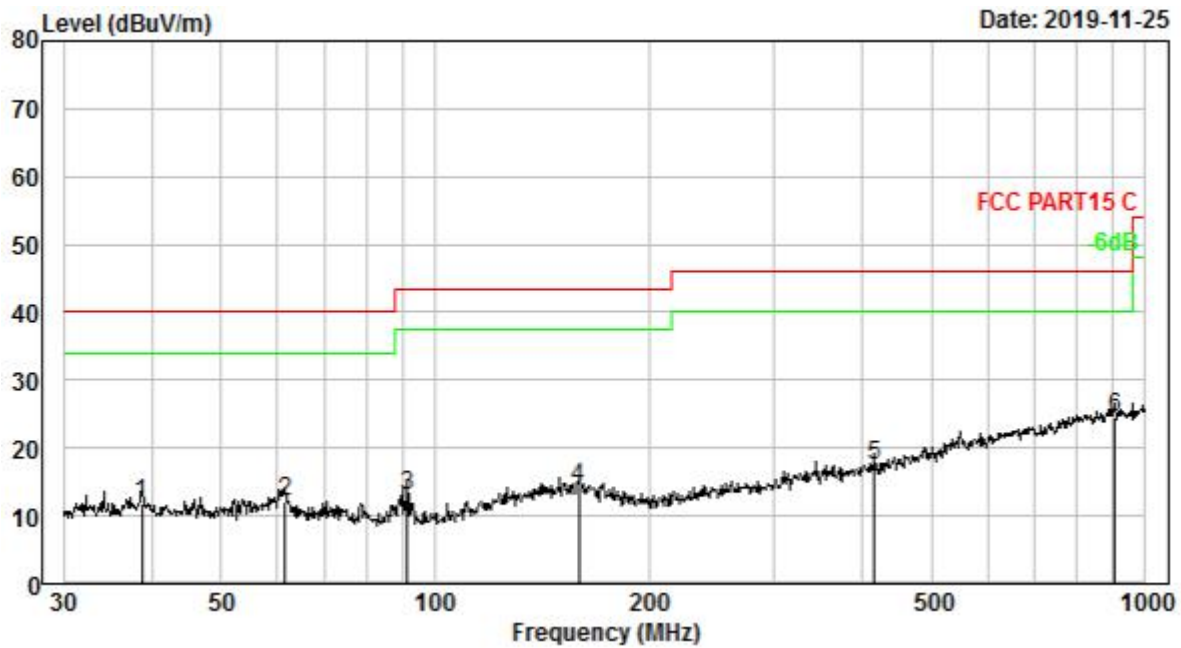
Test plot for Vertical



| No. | Freq<br>MHz | Cable<br>Loss<br>dB | ANT<br>Factor<br>dB/m | Receiver<br>Reading<br>dBuV | Preamp<br>Factor<br>dB | Emission<br>Level<br>dBuV/m | Limit<br>dBuV/m | Over<br>Limit<br>dB | Remark |
|-----|-------------|---------------------|-----------------------|-----------------------------|------------------------|-----------------------------|-----------------|---------------------|--------|
| 1.  | 38.481      | 1.63                | 12.13                 | 32.10                       | 29.91                  | 15.95                       | 40.00           | -24.05              | QP     |
| 2.  | 61.132      | 2.42                | 11.54                 | 29.98                       | 29.94                  | 14.00                       | 40.00           | -26.00              | QP     |
| 3.  | 86.200      | 3.02                | 8.82                  | 35.33                       | 29.98                  | 17.19                       | 40.00           | -22.81              | QP     |
| 4.  | 125.446     | 3.66                | 12.37                 | 29.70                       | 30.01                  | 15.72                       | 43.50           | -27.78              | QP     |
| 5.  | 160.909     | 4.09                | 14.02                 | 26.57                       | 30.02                  | 14.66                       | 43.50           | -28.84              | QP     |
| 6.  | 537.589     | 6.16                | 18.16                 | 26.84                       | 30.94                  | 20.22                       | 46.00           | -25.78              | QP     |

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

## Test plot for Horizontal



| No. | Freq<br>MHz | Cable<br>Loss<br>dB | ANT<br>Factor<br>dB/m | Receiver<br>Reading<br>dBuV | Preamp<br>Factor<br>dB | Emission<br>Level<br>dBuV/m | Limit<br>dBuV/m | Over<br>Limit<br>dB | Remark |
|-----|-------------|---------------------|-----------------------|-----------------------------|------------------------|-----------------------------|-----------------|---------------------|--------|
| 1.  | 38.616      | 1.64                | 12.13                 | 27.98                       | 29.91                  | 11.84                       | 40.00           | -28.16              | QP     |
| 2.  | 61.562      | 2.44                | 11.48                 | 28.08                       | 29.94                  | 12.06                       | 40.00           | -27.94              | QP     |
| 3.  | 91.495      | 3.12                | 9.17                  | 30.66                       | 29.98                  | 12.97                       | 43.50           | -30.53              | QP     |
| 4.  | 159.225     | 4.07                | 14.07                 | 25.91                       | 30.02                  | 14.03                       | 43.50           | -29.47              | QP     |
| 5.  | 416.179     | 5.73                | 15.17                 | 27.14                       | 30.74                  | 17.30                       | 46.00           | -28.70              | QP     |
| 6.  | 906.482     | 7.06                | 22.13                 | 26.27                       | 31.04                  | 24.42                       | 46.00           | -21.58              | QP     |

Remark: Emission Level = Reading + Cable Loss + ANT Factor - AMP Factor



## Test Frequency 1GHz-18GHz

| Low Channel (2402MHz) Worst case GFSK |                      |                    |                 |                    |                         |                |             |                |
|---------------------------------------|----------------------|--------------------|-----------------|--------------------|-------------------------|----------------|-------------|----------------|
| Detector: Peak Value                  |                      |                    |                 |                    |                         |                |             |                |
| Frequency (MHz)                       | Reading Level (dBuV) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Polarity (H/V) |
| 4804                                  | 55.12                | 30.16              | 6.66            | 38.32              | 53.62                   | 74             | -20.38      | V              |
| 4804                                  | 54.86                | 30.16              | 6.66            | 38.32              | 53.36                   | 74             | -20.64      | H              |
| 7206                                  | 55.06                | 30.22              | 6.69            | 38.49              | 53.48                   | 74             | -20.52      | V              |
| 7206                                  | 56.12                | 30.22              | 6.69            | 38.49              | 54.54                   | 74             | -19.46      | H              |
| 9608                                  | 55.89                | 30.59              | 6.72            | 39.15              | 54.05                   | 74             | -19.95      | V              |
| 9608                                  | 54.57                | 30.59              | 6.72            | 39.15              | 52.73                   | 74             | -21.27      | H              |
| Detector: Average Value               |                      |                    |                 |                    |                         |                |             |                |
| 4804                                  | 42.11                | 30.16              | 6.66            | 38.32              | 40.61                   | 54             | -13.39      | V              |
| 4804                                  | 41.98                | 30.16              | 6.66            | 38.32              | 40.48                   | 54             | -13.52      | H              |
| 7206                                  | 41.43                | 30.22              | 6.69            | 38.49              | 39.85                   | 54             | -14.15      | V              |
| 7206                                  | 41.32                | 30.22              | 6.69            | 38.49              | 39.74                   | 54             | -14.26      | H              |
| 9608                                  | 42.03                | 30.59              | 6.72            | 39.15              | 40.19                   | 54             | -13.81      | V              |
| 9608                                  | 41.67                | 30.59              | 6.72            | 39.15              | 39.83                   | 54             | -14.17      | H              |

| Middle Channel (2441MHz) Worst case $\pi/4$ -DQPSK |                      |                    |                 |                    |                         |                |             |                |
|----------------------------------------------------|----------------------|--------------------|-----------------|--------------------|-------------------------|----------------|-------------|----------------|
| Detector: Peak Value                               |                      |                    |                 |                    |                         |                |             |                |
| Frequency (MHz)                                    | Reading Level (dBuV) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Polarity (H/V) |
| 4882                                               | 56.02                | 30.18              | 6.68            | 38.52              | 54.36                   | 74             | -19.64      | V              |
| 4882                                               | 57.11                | 30.18              | 6.68            | 38.52              | 55.45                   | 74             | -18.55      | H              |
| 7323                                               | 56.92                | 30.22              | 6.73            | 39.46              | 54.41                   | 74             | -19.59      | V              |
| 7323                                               | 57.87                | 30.22              | 6.73            | 39.46              | 55.36                   | 74             | -18.64      | H              |
| 9764                                               | 56.04                | 30.54              | 6.81            | 40.71              | 52.68                   | 74             | -21.32      | V              |
| 9764                                               | 57.22                | 30.54              | 6.81            | 40.71              | 53.86                   | 74             | -20.14      | H              |
| Detector: Average Value                            |                      |                    |                 |                    |                         |                |             |                |
| 4882                                               | 43.05                | 30.18              | 6.68            | 38.52              | 41.39                   | 54             | -12.61      | V              |
| 4882                                               | 42.25                | 30.18              | 6.68            | 38.52              | 40.59                   | 54             | -13.41      | H              |
| 7323                                               | 43.86                | 30.22              | 6.73            | 39.46              | 41.35                   | 54             | -12.65      | V              |
| 7323                                               | 42.06                | 30.22              | 6.73            | 39.46              | 39.55                   | 54             | -14.45      | H              |
| 9764                                               | 43.67                | 30.54              | 6.81            | 40.71              | 40.31                   | 54             | -13.69      | V              |
| 9764                                               | 43.02                | 30.54              | 6.81            | 40.71              | 39.66                   | 54             | -14.34      | H              |



| High Channel (2480MHz) Worst case 8DPSK |                            |                       |                       |                       |                               |                   |                |                   |
|-----------------------------------------|----------------------------|-----------------------|-----------------------|-----------------------|-------------------------------|-------------------|----------------|-------------------|
| Detector: Peak Value                    |                            |                       |                       |                       |                               |                   |                |                   |
| Frequency<br>(MHz)                      | Reading<br>Level<br>(dBuV) | Ant. Factor<br>(dB/m) | Cable<br>Loss<br>(dB) | Pre-Amp.<br>Gain (dB) | Emission<br>Level<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Polarity<br>(H/V) |
| 4960                                    | 56.25                      | 30.33                 | 6.75                  | 40.18                 | 53.15                         | 74                | -20.85         | V                 |
| 4960                                    | 57.97                      | 30.33                 | 6.75                  | 40.18                 | 54.87                         | 74                | -19.13         | H                 |
| 7440                                    | 58.04                      | 30.34                 | 6.79                  | 41.23                 | 53.94                         | 74                | -20.06         | V                 |
| 7440                                    | 58.79                      | 30.34                 | 6.79                  | 41.23                 | 54.69                         | 74                | -19.31         | H                 |
| 9920                                    | 57.35                      | 30.68                 | 6.83                  | 42.17                 | 52.69                         | 74                | -21.31         | V                 |
| 9920                                    | 58.11                      | 30.68                 | 6.83                  | 42.17                 | 53.45                         | 74                | -20.55         | H                 |
| Detector: Average Value                 |                            |                       |                       |                       |                               |                   |                |                   |
| 4960                                    | 44.11                      | 30.33                 | 6.75                  | 40.18                 | 41.01                         | 54                | -12.99         | V                 |
| 4960                                    | 43.98                      | 30.33                 | 6.75                  | 40.18                 | 40.88                         | 54                | -13.12         | H                 |
| 7440                                    | 45.03                      | 30.34                 | 6.79                  | 41.23                 | 40.93                         | 54                | -13.07         | V                 |
| 7440                                    | 44.79                      | 30.34                 | 6.79                  | 41.23                 | 40.69                         | 54                | -13.31         | H                 |
| 9920                                    | 45.53                      | 30.68                 | 6.83                  | 42.17                 | 40.87                         | 54                | -13.13         | V                 |
| 9920                                    | 46.11                      | 30.68                 | 6.83                  | 42.17                 | 41.45                         | 54                | -12.55         | H                 |

Note: 1. The testing has been conformed to  $10 \times 2480\text{MHz} = 24800\text{MHz}$ .

2. All other emissions more than 30dB below the limit.
3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.  
 Emission Level = Reading + Factor  
 Margin=Emission Level-Limit



## Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

Bluetooth (GFSK, Pi/4-DQPSK, 8DPSK, Hopping)mode have been tested, and the worst result(GFSK, Hopping) was report as below

| Test Mode: Low Channel 2402MHz |                   |                       |                 |                    |                |                |           |              |            |
|--------------------------------|-------------------|-----------------------|-----------------|--------------------|----------------|----------------|-----------|--------------|------------|
| Frequency (MHz)                | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over (dB) | Polarity H/V | Test Value |
| 2390.00                        | 56.76             | 27.38                 | 6.15            | 36.29              | 54             | 74             | -20       | H            | Peak       |
| 2390.00                        | 43.86             | 27.38                 | 6.15            | 36.29              | 41.1           | 54             | -12.9     | H            | Average    |
| 2390.00                        | 55.79             | 27.43                 | 6.68            | 36.79              | 53.11          | 74             | -20.89    | V            | Peak       |
| 2390.00                        | 42.67             | 27.43                 | 6.68            | 36.79              | 39.99          | 54             | -14.01    | V            | Average    |

| Test Mode: High Channel 2480MHz |                   |                       |                 |                    |                |                |           |              |            |
|---------------------------------|-------------------|-----------------------|-----------------|--------------------|----------------|----------------|-----------|--------------|------------|
| Frequency (MHz)                 | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over (dB) | Polarity H/V | Test Value |
| 2483.50                         | 56.79             | 27.38                 | 6.15            | 36.29              | 54.03          | 74             | -19.97    | H            | Peak       |
| 2483.50                         | 42.11             | 27.38                 | 6.15            | 36.29              | 39.35          | 54             | -14.65    | H            | Average    |
| 2483.50                         | 56.09             | 27.43                 | 6.68            | 36.79              | 53.41          | 74             | -20.59    | V            | Peak       |
| 2483.50                         | 42.25             | 27.43                 | 6.68            | 36.79              | 39.57          | 54             | -14.43    | V            | Average    |

## 8 CONDUCTED BAND EDGE EMISSION

### 8.1 REQUIREMENT

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

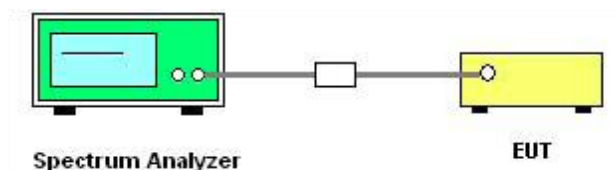
### 8.2 TEST PROCEDURE

| Spectrum Parameter                    | Setting                         |
|---------------------------------------|---------------------------------|
| Detector                              | Peak                            |
| Start/Stop Frequency                  | 30 MHz to 10th carrier harmonic |
| RB / VB (emission in restricted band) | 100 KHz/300 KHz                 |
| Trace-Mode:                           | Max hold                        |

For Band edge

| Spectrum Parameter                    | Setting                                                              |
|---------------------------------------|----------------------------------------------------------------------|
| Detector                              | Peak                                                                 |
| Start/Stop Frequency                  | Lower Band Edge: 2300 – 2403 MHz<br>Upper Band Edge: 2479 – 2500 MHz |
| RB / VB (emission in restricted band) | 100 KHz/300 KHz                                                      |
| Trace-Mode:                           | Max hold                                                             |

### 8.3 TEST SETUP



1. The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100KHz. The video bandwidth is set to 300KHz.
2. The spectrum from 30MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

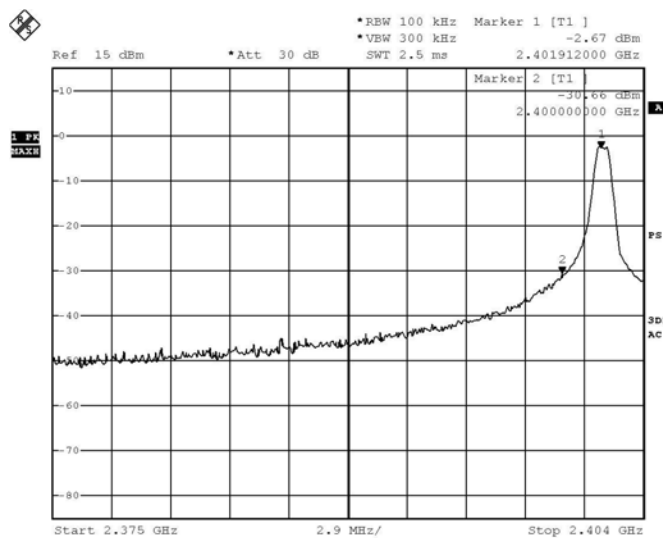
## 8.4 EUT OPERATION CONDITIONS

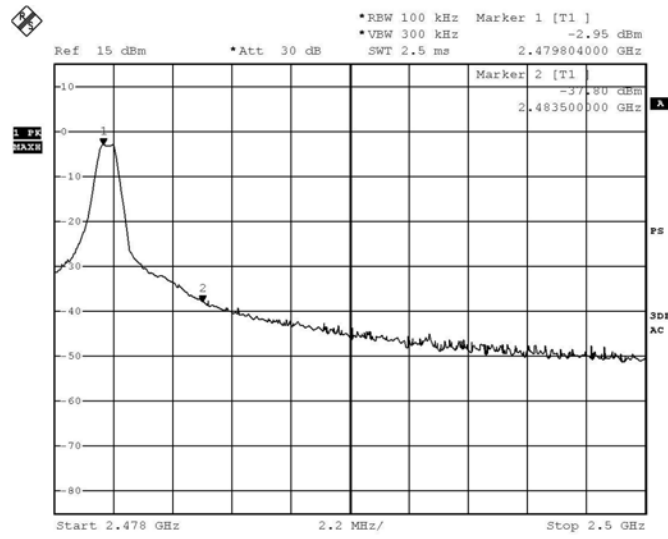
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

## 8.5 TEST RESULTS

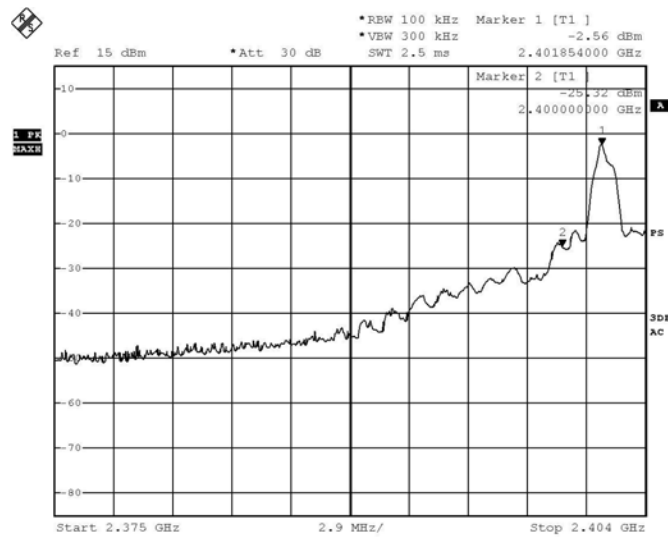
For Non-Hopping Mode:

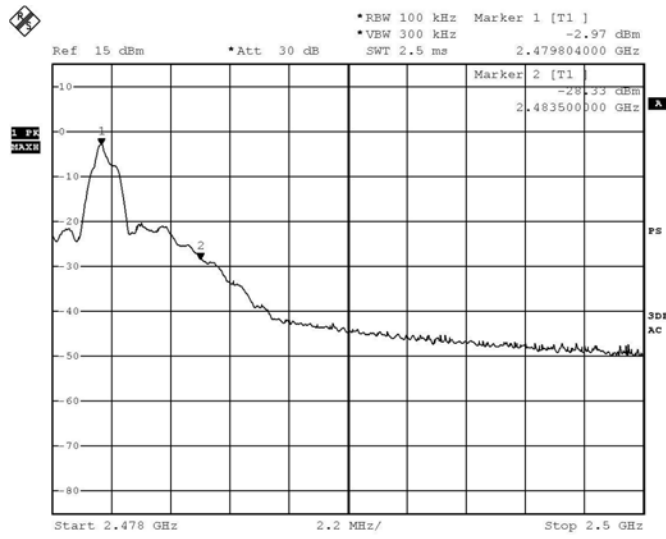
### GFSK



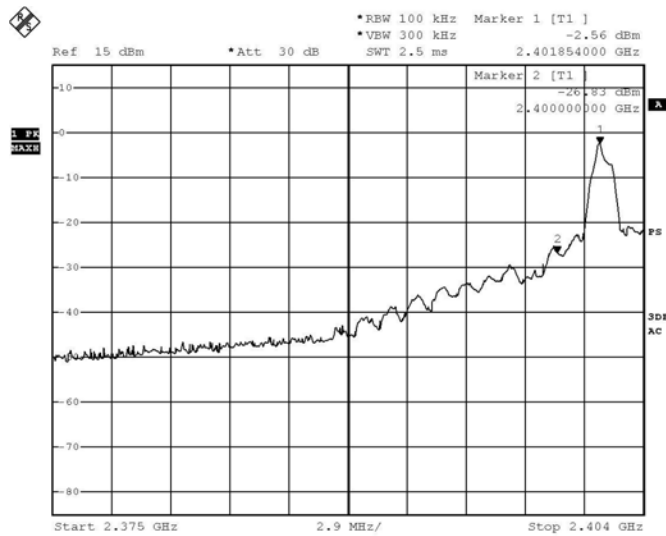


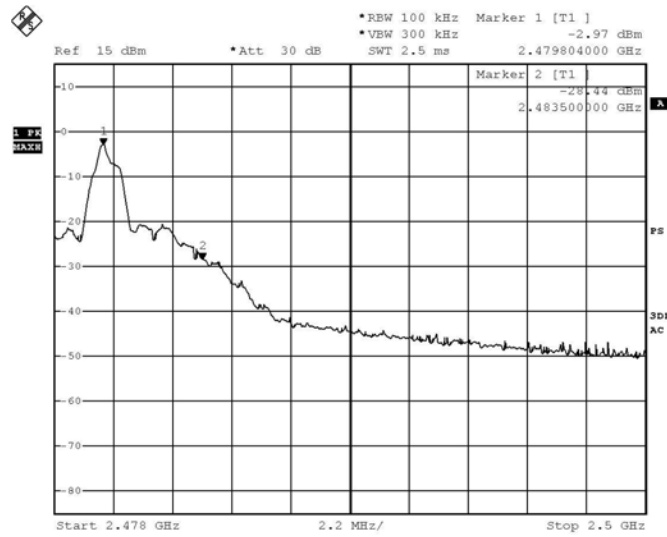
$\pi/4$ DQPSK



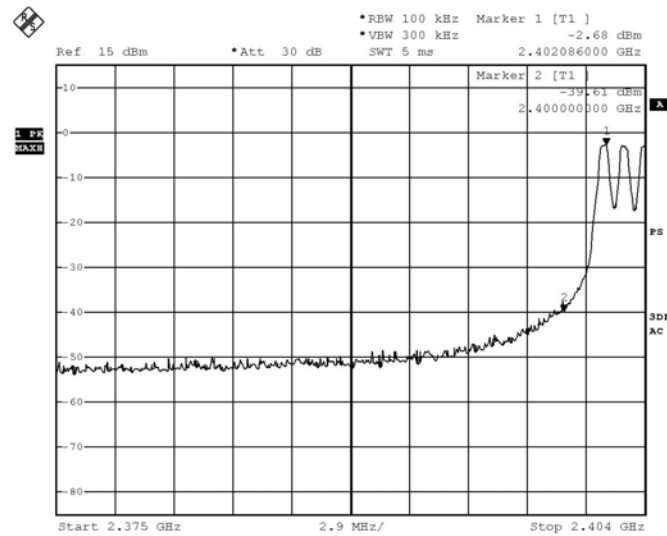


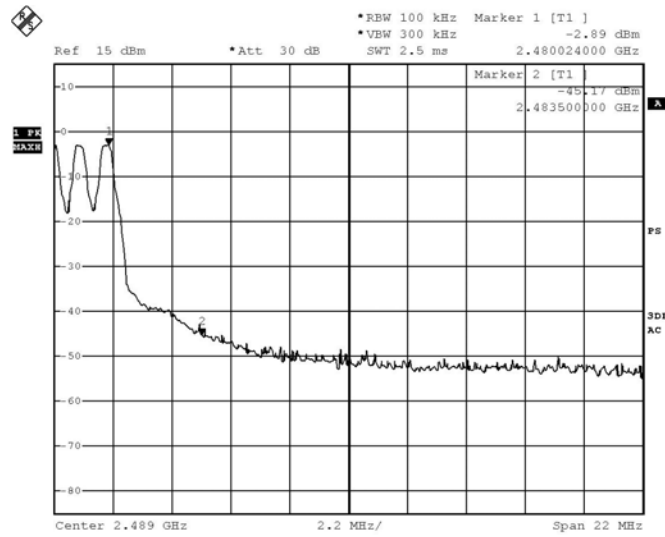
8DPSK



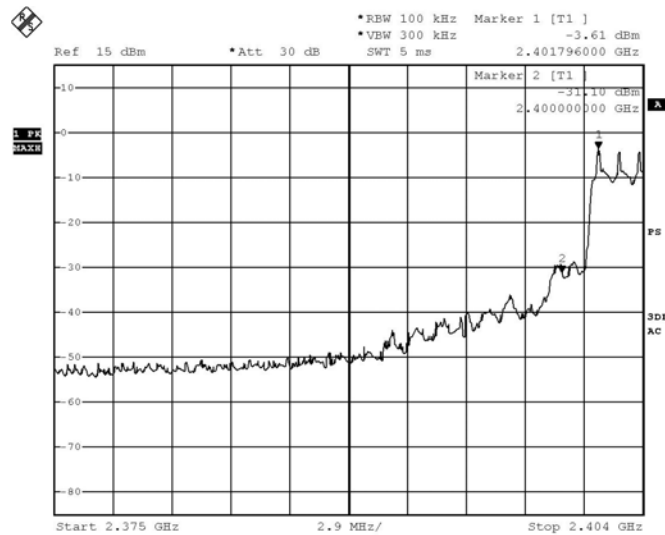


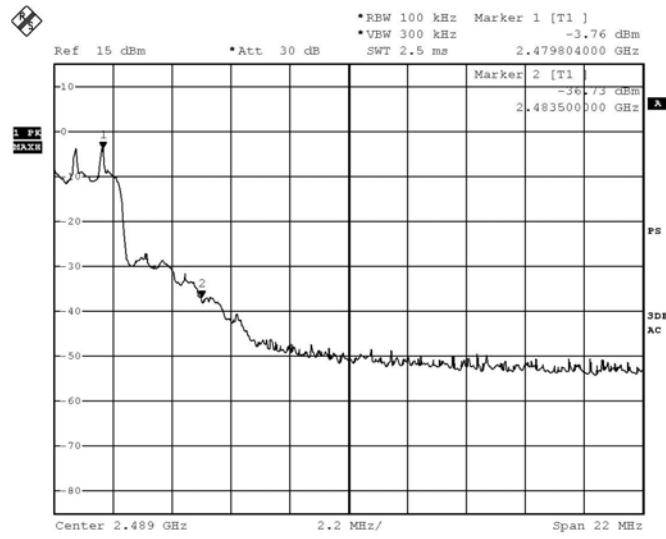
### For Hopping Mode: GFSK



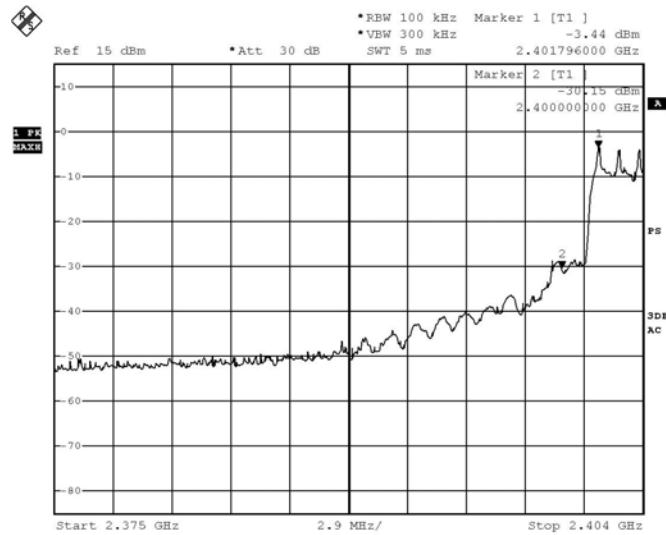


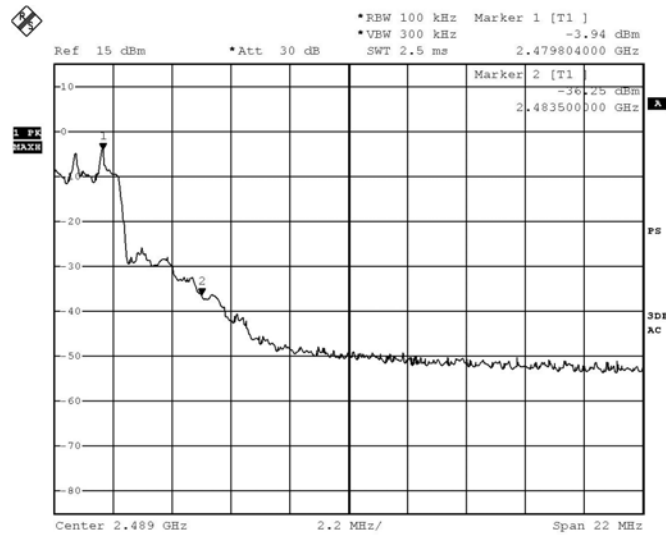
### $\pi/4$ -DQPSK



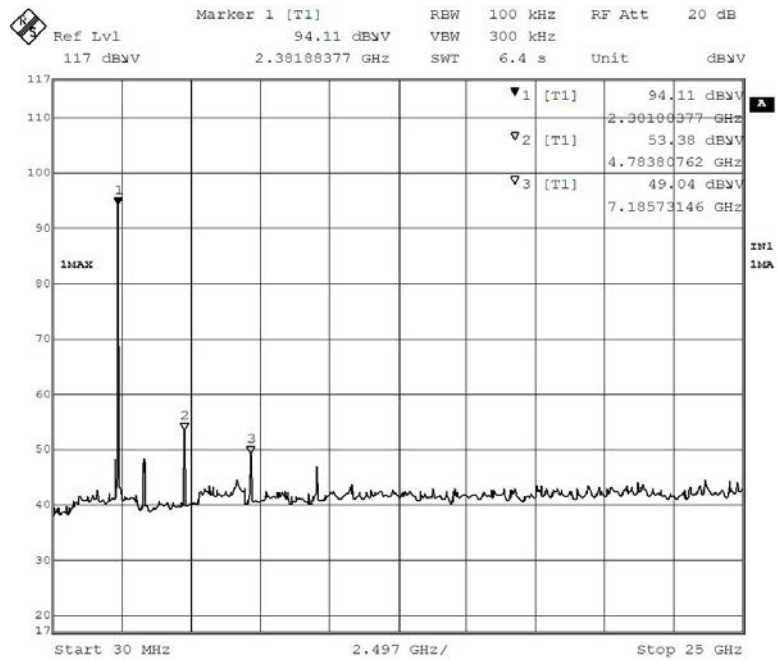


### 8DPSK

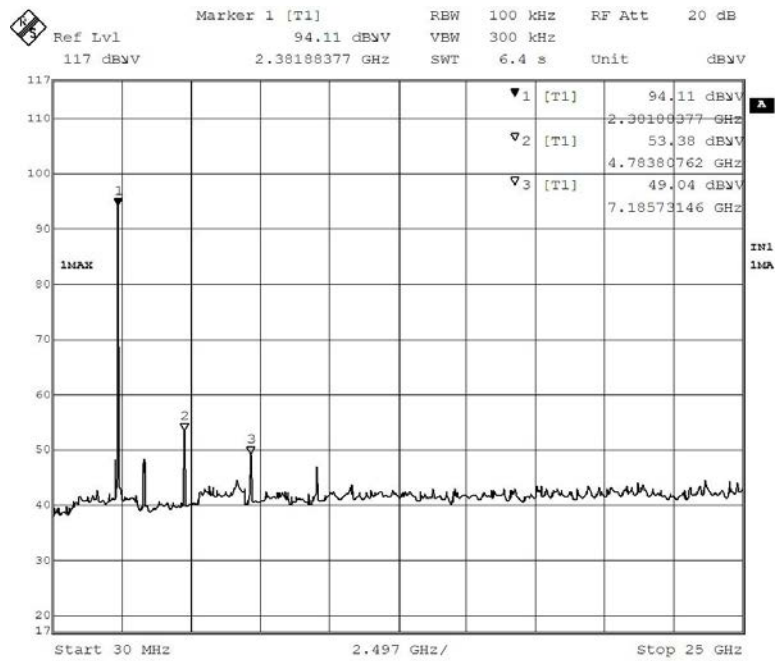




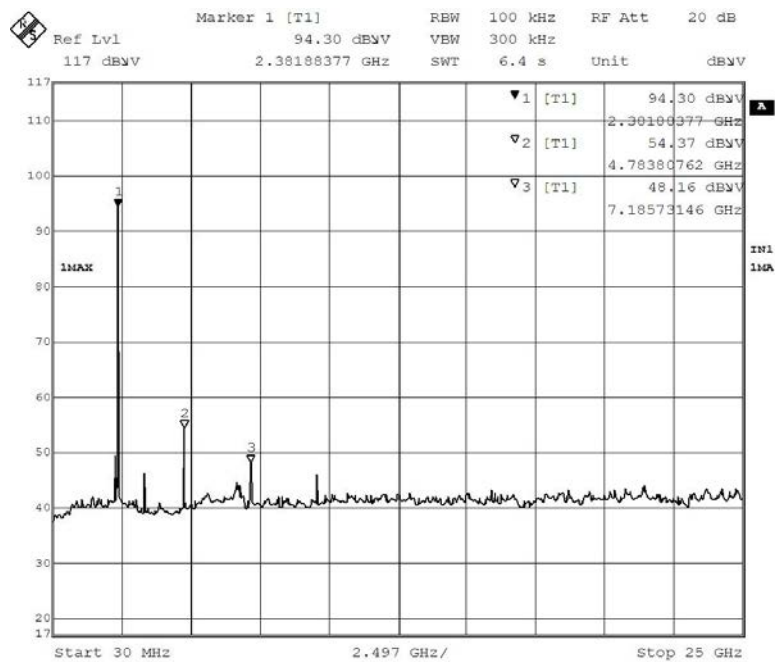
For Conduct spurious emissions: GFSK High Channel Worstcase mode



### $\pi/4$ -DQPSK High Channel Worstcase mode



### 8DPSK High Channel Worstcase mode





## 9 20 dB Bandwidth Measurement

Test Requirement : FCC CFR47 Part 15 Section 15.247

Test Method : ANSI C63.10:2013

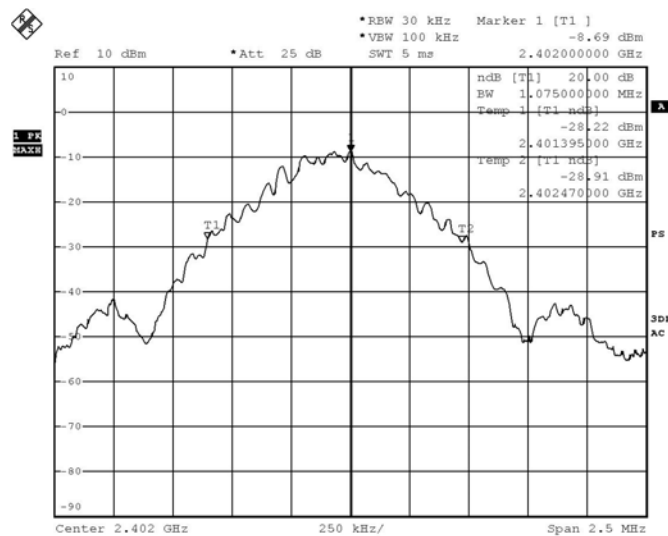
### 9.1 Test Procedure

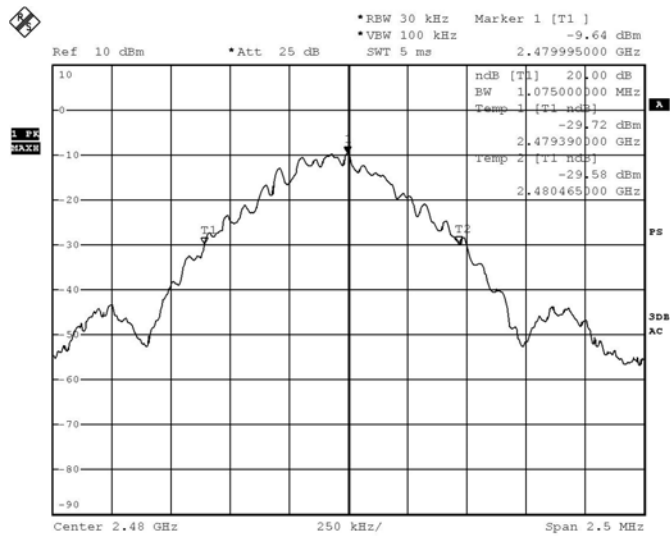
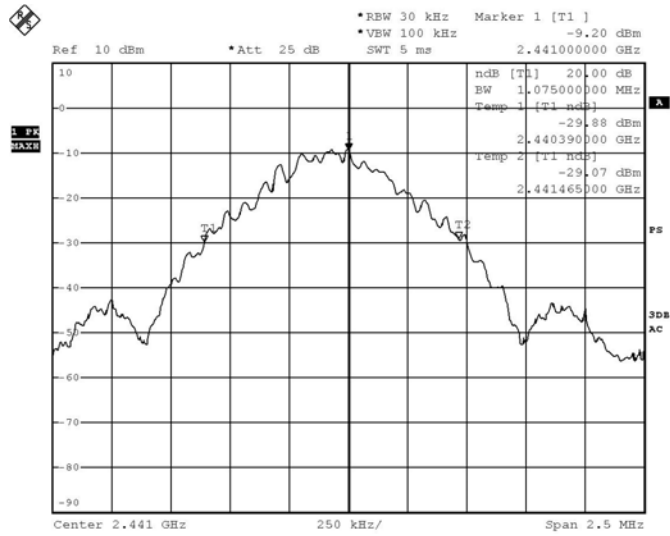
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW =30kHz, VBW = 100kHz

### 9.2 Test Result

Test Mode: CH00 / CH39 / CH78 (GFSK/(1Mbps)Mode)

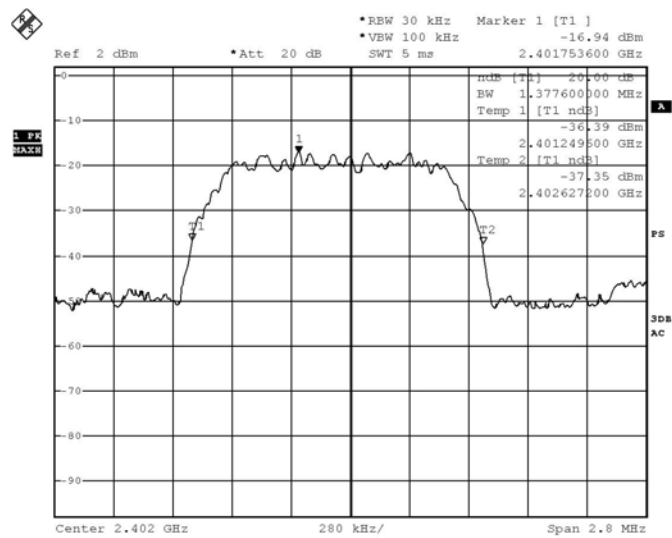
| Channel number | Channel frequency (MHz) | 20dB Down BW(kHz) |
|----------------|-------------------------|-------------------|
| 00             | 2402                    | 1075              |
| 39             | 2441                    | 1075              |
| 78             | 2480                    | 1075              |

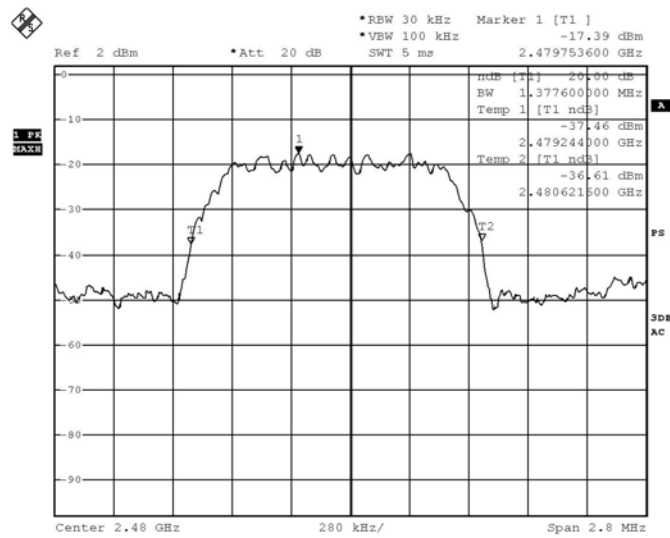
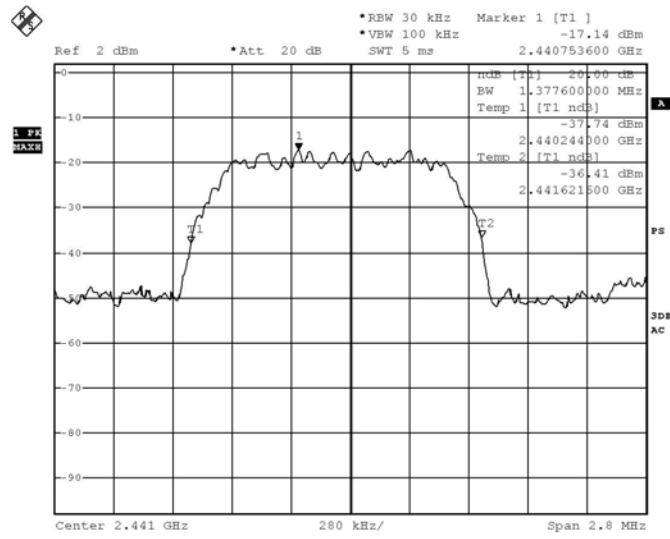




Test Mode: CH00 / CH39 / CH78 ( $\pi/4$ -DQPSK / (2Mbps) Mode)

| Channel number | Channel frequency (MHz) | 20dB Down BW(kHz) |
|----------------|-------------------------|-------------------|
| 00             | 2402                    | 1377.6            |
| 39             | 2441                    | 1377.6            |
| 78             | 2480                    | 1377.6            |

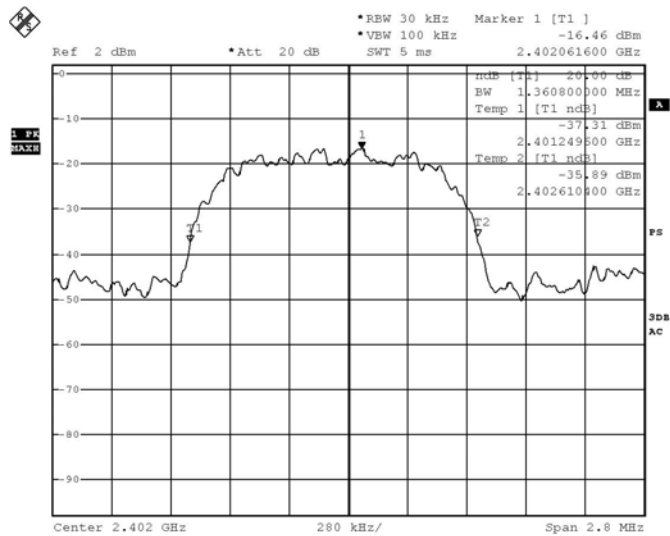


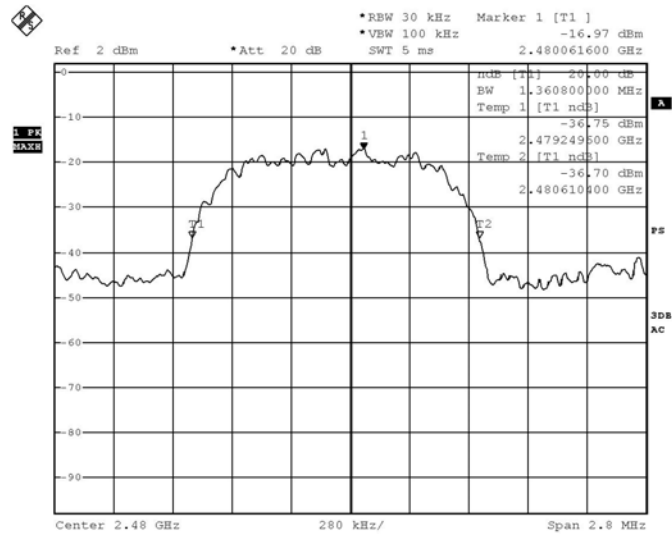
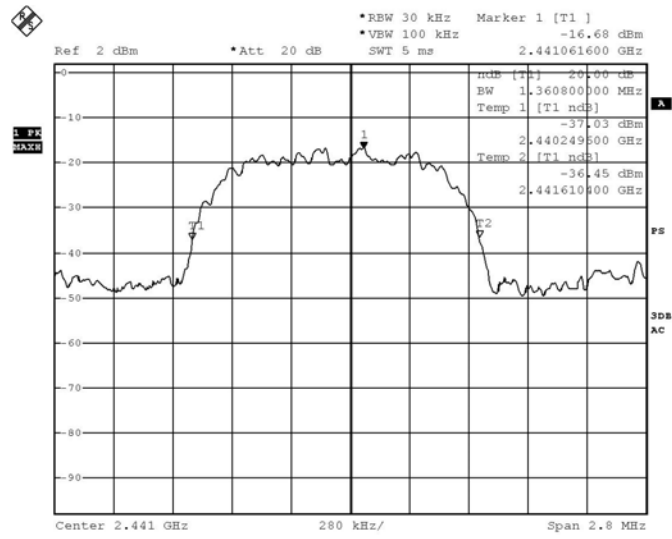




Test Mode: CH00 / CH39 / CH78 (8DPSK(3Mbps)Mode)

| Channel number | Channel frequency (MHz) | 20dB Down BW(kHz) |
|----------------|-------------------------|-------------------|
| 00             | 2402                    | 1360.8            |
| 39             | 2441                    | 1360.8            |
| 78             | 2480                    | 1360.8            |







## 10 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 (30dBm). For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

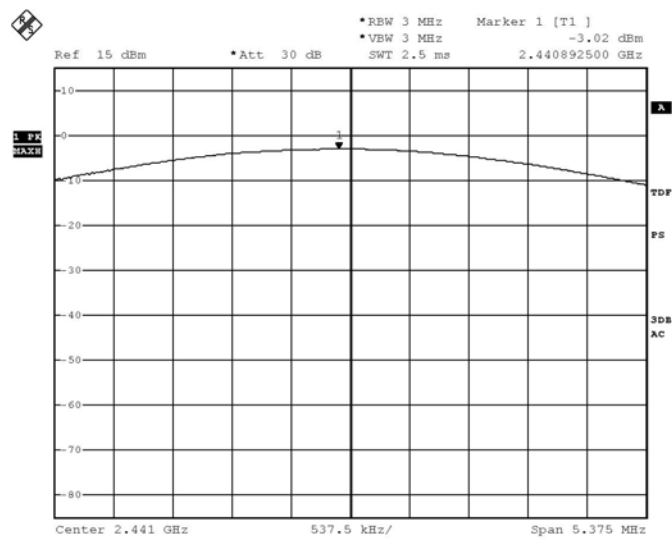
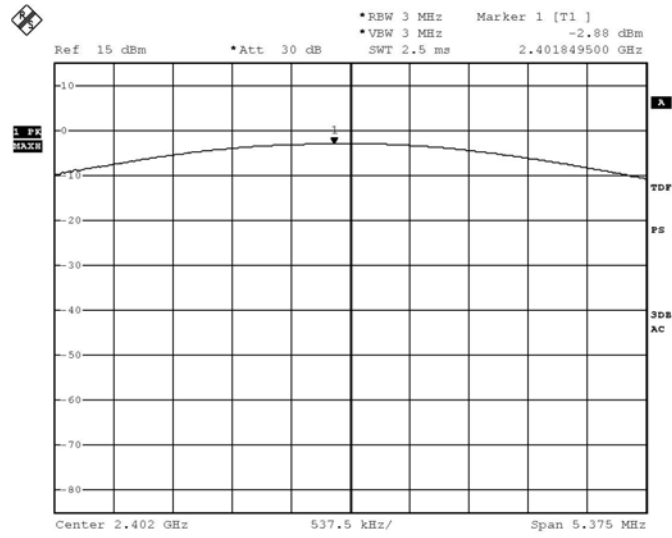
Refer to the result "Number of Hopping Frequency" of this document. The 0.125watts (20.97 dBm) limit applies.

### 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 analyser: RBW = 3 MHz. VBW = 3MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

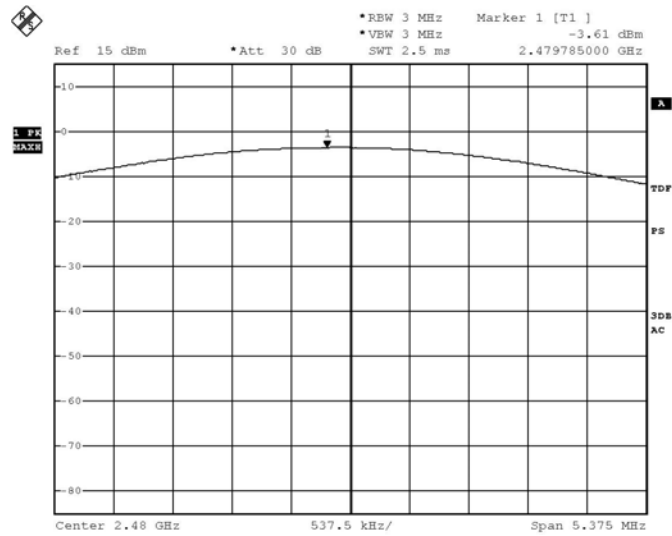
### 10.2 Test Result

| GFSK(1Mbps)  |           |                             |                             |       |           |
|--------------|-----------|-----------------------------|-----------------------------|-------|-----------|
| Test Channel | Frequency | Conducted Output Peak Power | Conducted Output Peak Power | LIMIT | Pass/Fail |
|              | (MHz)     | (dBm)                       | (W)                         | (W)   |           |
| CH00         | 2402      | -2.88                       | 0.000515                    | 0.125 | Pass      |
| CH39         | 2441      | -3.02                       | 0.000499                    | 0.125 | Pass      |
| CH78         | 2480      | -3.61                       | 0.000436                    | 0.125 | Pass      |

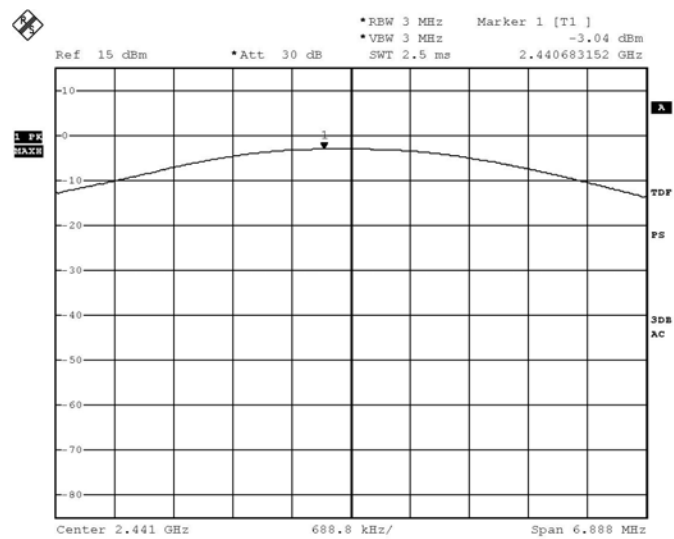
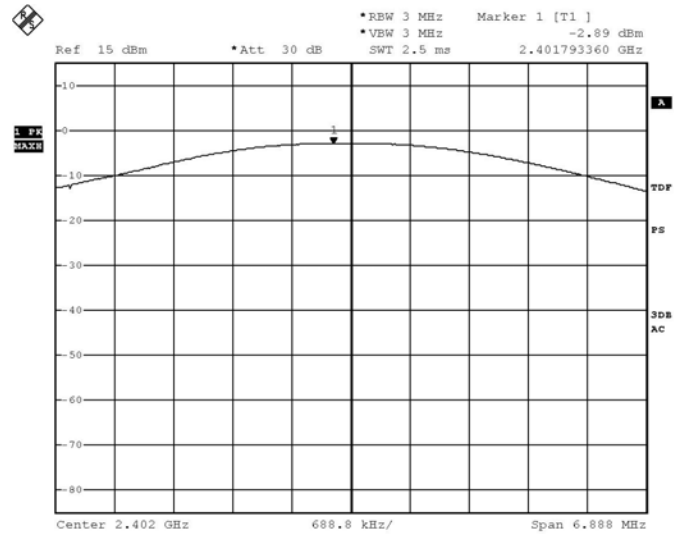


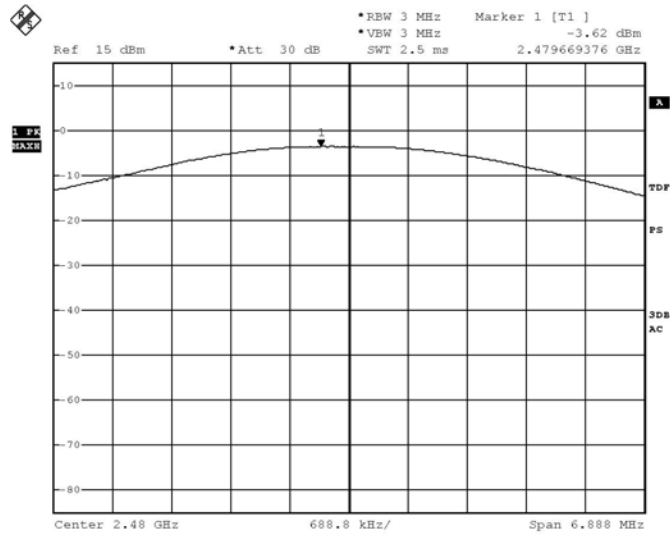


Report No.: PTC19102902102E-FC01

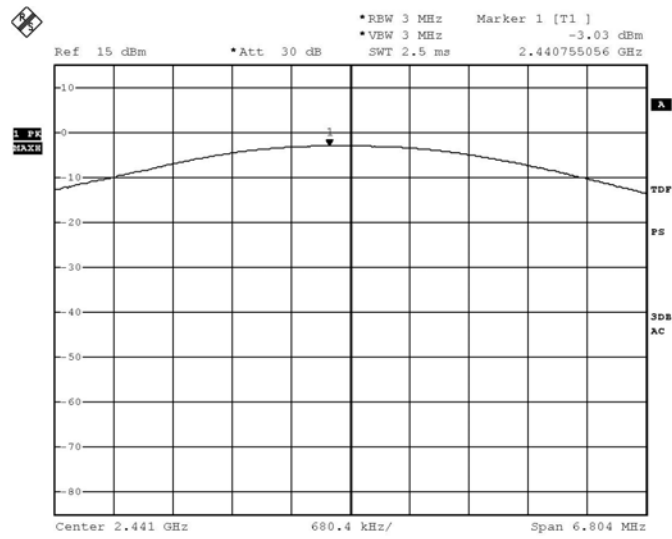
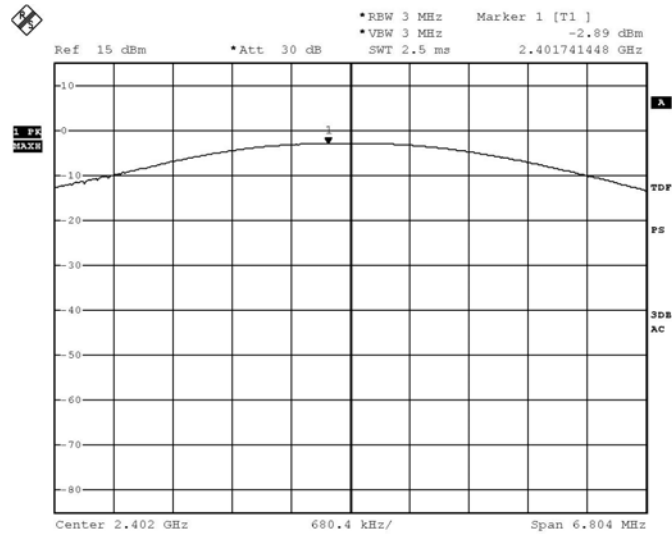


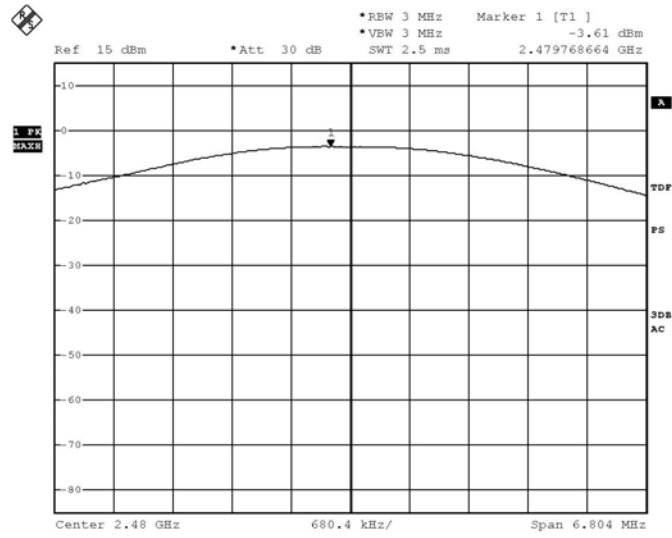
| $\pi/4$ QPSK(2Mbps) |           |                             |                             |       |           |
|---------------------|-----------|-----------------------------|-----------------------------|-------|-----------|
| Test Channel        | Frequency | Conducted Output Peak Power | Conducted Output Peak Power | LIMIT | Pass/Fail |
|                     | (MHz)     | (dBm)                       | (W)                         | (W)   |           |
| CH00                | 2402      | -2.89                       | 0.000514                    | 0.125 | Pass      |
| CH39                | 2441      | -3.04                       | 0.000497                    | 0.125 | Pass      |
| CH78                | 2480      | -3.62                       | 0.000435                    | 0.125 | Pass      |





| 8DPSK(3Mbps) |           |                             |                             |       |           |
|--------------|-----------|-----------------------------|-----------------------------|-------|-----------|
| Test Channel | Frequency | Conducted Output Peak Power | Conducted Output Peak Power | LIMIT | Pass/Fail |
|              | (MHz)     | (dBm)                       | (W)                         | (W)   |           |
| CH00         | 2402      | -2.89                       | 0.000514                    | 0.125 | Pass      |
| CH39         | 2441      | -3.03                       | 0.000498                    | 0.125 | Pass      |
| CH78         | 2480      | -3.61                       | 0.000436                    | 0.125 | Pass      |







## 11 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 2400-2483.5MHz 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        | : Hopping                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

### 11.1 Test Procedure

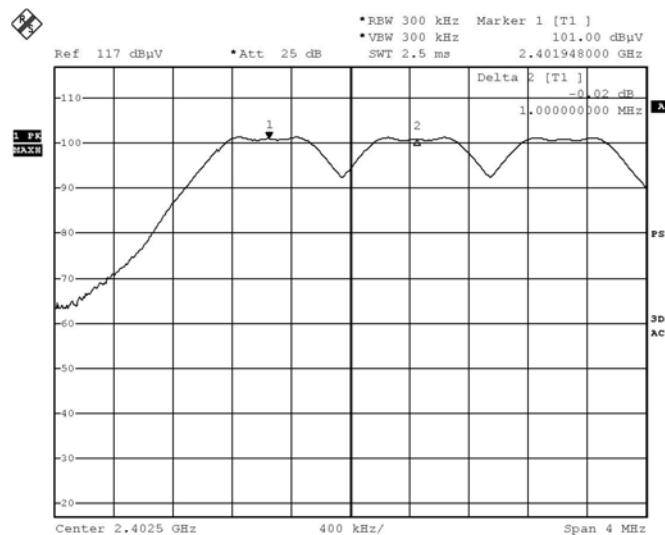
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 300KHz. VBW = 300KHz, Span = 4.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to 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.

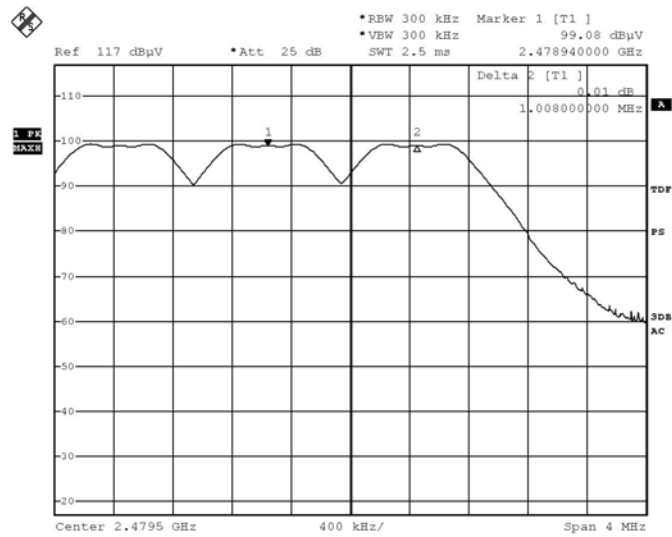
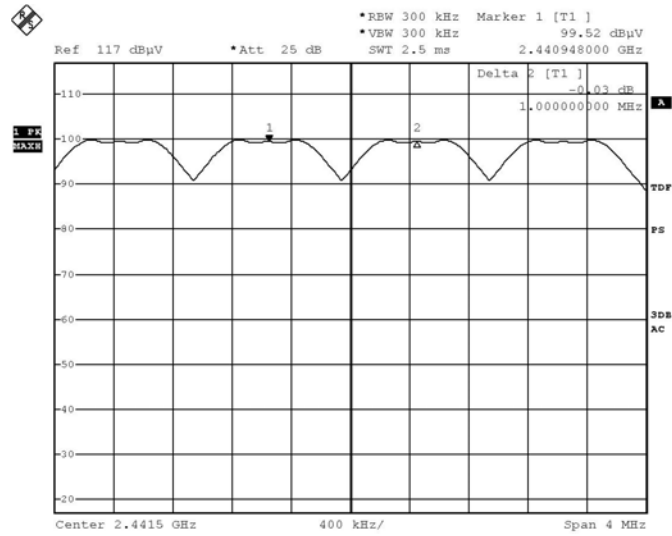


## 11.2 Test Result

|            |                                       |
|------------|---------------------------------------|
| Test Mode: | CH00 / CH39 / CH78 (GFSK(1Mbps) Mode) |
|------------|---------------------------------------|

| Channel number | Channel frequency (MHz) | Separation Read Value (kHz) | Separation Limit<br>2/3* 20dB Down BW(kHz) |
|----------------|-------------------------|-----------------------------|--------------------------------------------|
| 00             | 2402                    | 1000                        | >716.7                                     |
| 39             | 2441                    | 1000                        | >716.7                                     |
| 78             | 2480                    | 1008                        | >716.7                                     |

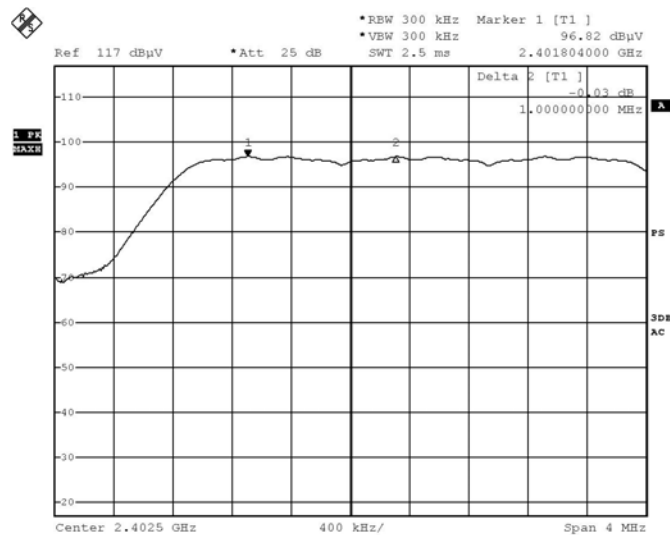


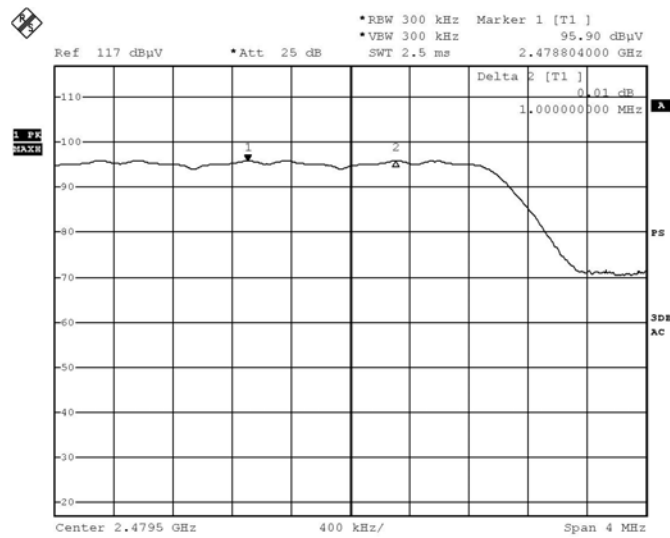
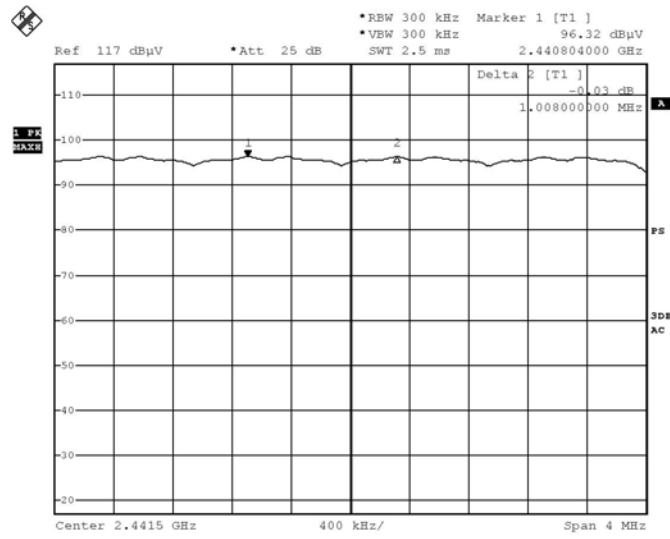




|            |                                                  |
|------------|--------------------------------------------------|
| Test Mode: | CH00 / CH39 / CH78 ( $\pi/4$ -DQPSK(2Mbps) Mode) |
|------------|--------------------------------------------------|

| Channel number | Channel frequency (MHz) | Separation Read Value (kHz) | Separation Limit<br>2/3* 20dB Down BW(kHz) |
|----------------|-------------------------|-----------------------------|--------------------------------------------|
| 00             | 2402                    | 1000                        | >918.4                                     |
| 39             | 2441                    | 1008                        | >918.4                                     |
| 78             | 2480                    | 1000                        | >918.4                                     |

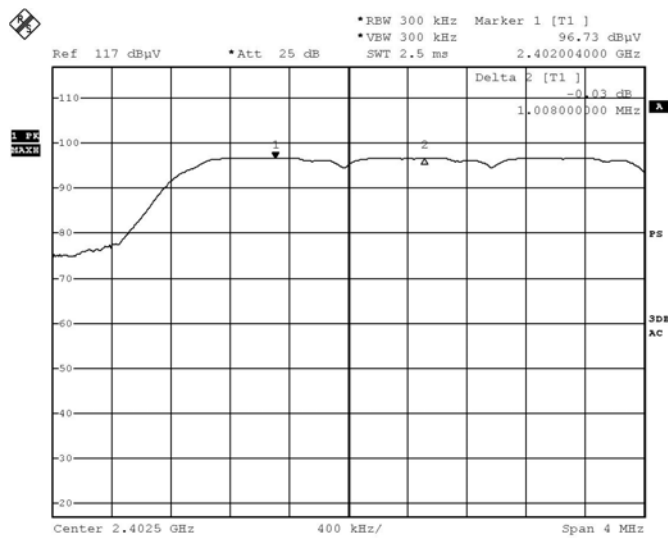


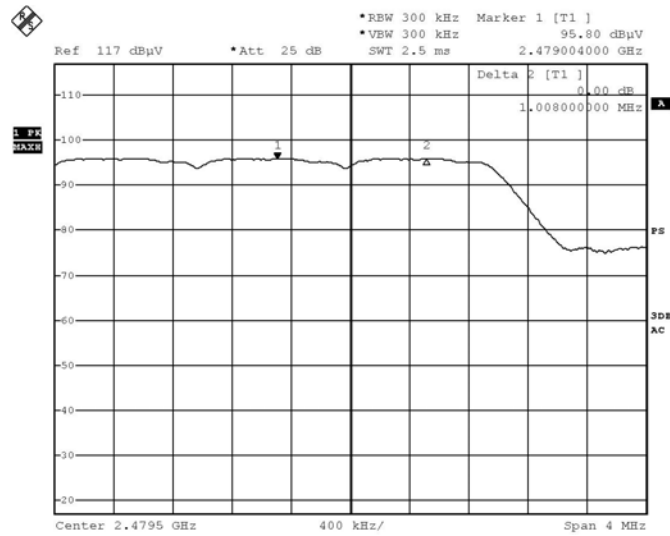
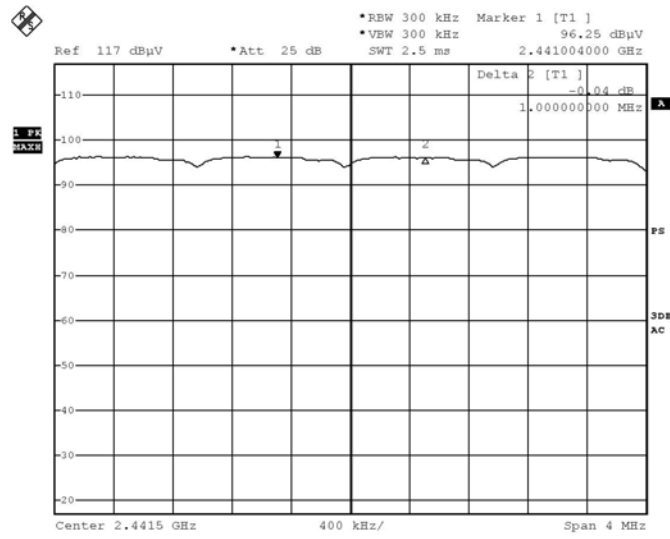




|            |                                       |
|------------|---------------------------------------|
| Test Mode: | CH00 / CH39 / CH78 (8DPSK(3Mbps)Mode) |
|------------|---------------------------------------|

| Channel number | Channel frequency (MHz) | Separation Read Value (kHz) | Separation Limit 2/3 20dB Down BW(kHz) |
|----------------|-------------------------|-----------------------------|----------------------------------------|
| 00             | 2402                    | 1008                        | >907.2                                 |
| 39             | 2441                    | 1000                        | >907.2                                 |
| 78             | 2480                    | 1008                        | >907.2                                 |







## 12 Number of Hopping Frequency

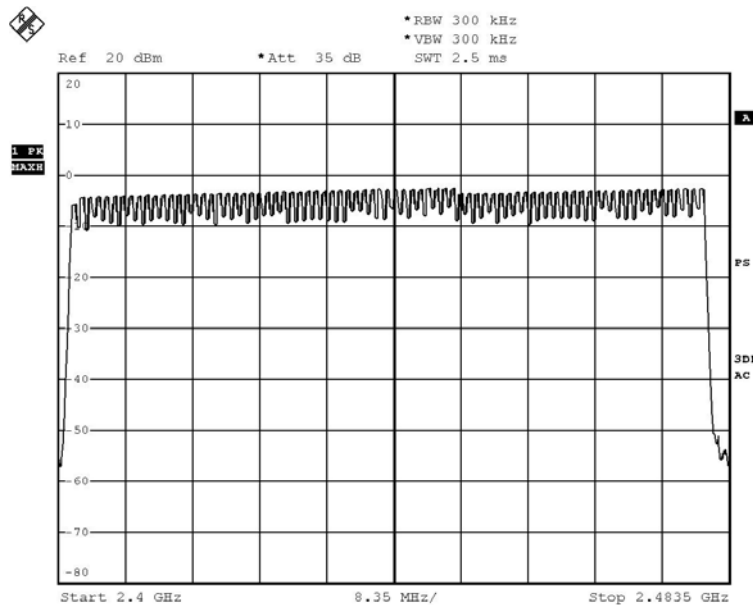
|                  |                                                                                                                       |
|------------------|-----------------------------------------------------------------------------------------------------------------------|
| Test Requirement | : 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        | : Hopping(GFSK)                                                                                                       |

### 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 = 300KHz. 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 = 2.483GHz. Sweep=auto;

### 12.2 Test Result

| Channel Number | Limit     |
|----------------|-----------|
| 79             | $\geq 15$ |





## 13 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. |
| Test Mode        | : The worst case(GFSK) was recorded                                                                                                                                                                                                                                                           |

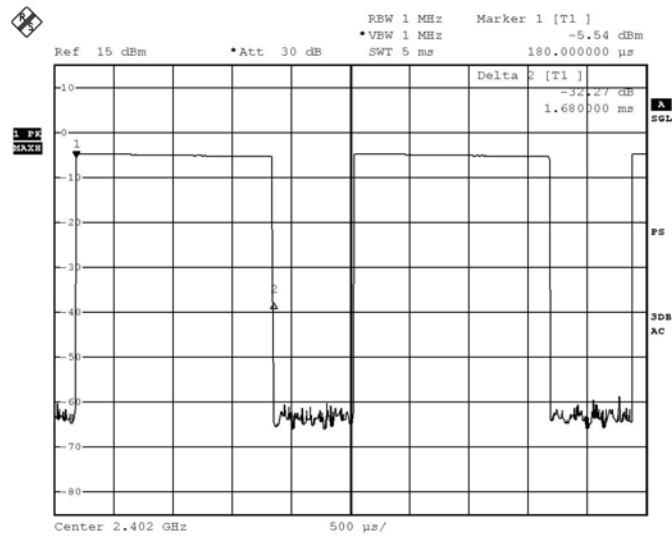
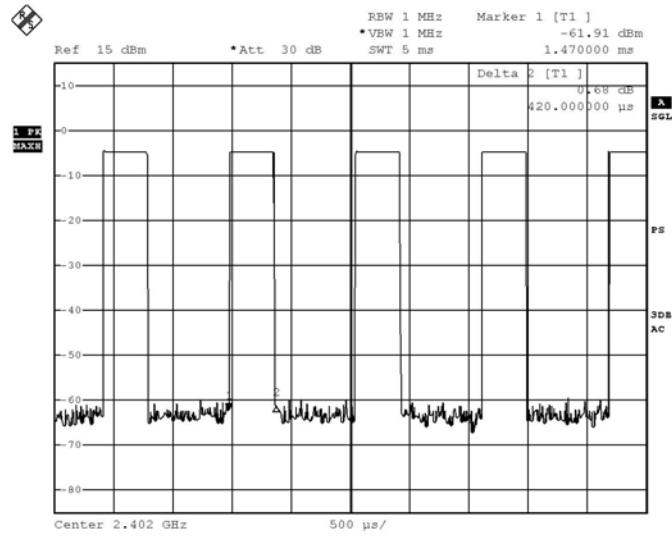
### 13.1 Test Procedure

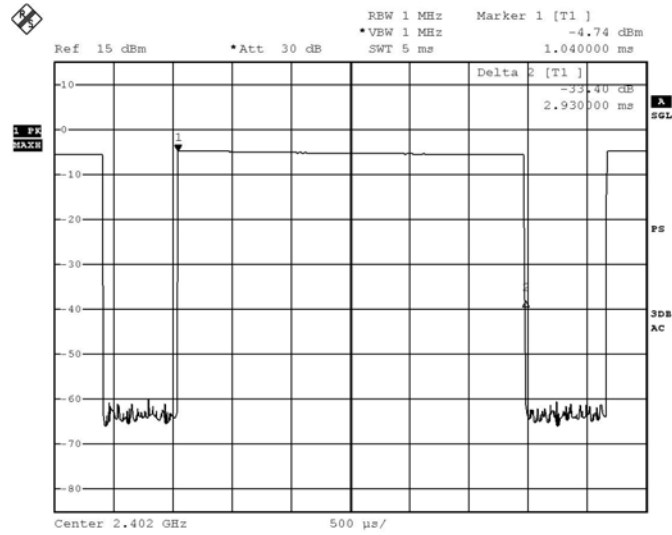
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. Centred on a hopping channel;
3. Set RBW = 1MHz and VBW = 1MHz.Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 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).

### 13.2 Test Result

|            |             |
|------------|-------------|
| Test Mode: | GFSK(1Mbps) |
|------------|-------------|

| Mode | Packet                                                                                                                                                                                                                                                                                                                                                                                                                | Length of transmissions time(sec) | Result (sec) | Limit (sec) |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|--------------|-------------|
| GFSK | DH1                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.420                             | 0.134        | 0.4         |
|      | DH3                                                                                                                                                                                                                                                                                                                                                                                                                   | 1.680                             | 0.267        | 0.4         |
|      | DH5                                                                                                                                                                                                                                                                                                                                                                                                                   | 2.930                             | 0.312        | 0.4         |
|      | Note:<br>The test period= 0.4 Second/channel * 79 channel = 31.6s<br>Calculation Formula: Dwell time=Ton time per hop*Hopping numbers*Period<br>For Example:<br>DH1 time slot= $0.420 \times (1600 / (2 \times 79)) \times 31.6 = 134\text{ms}$<br>DH3 time slot= $1.680 \times (1600 / (4 \times 79)) \times 31.6 = 267\text{ms}$<br>DH5 time slot= $2.930 \times (1600 / (6 \times 79)) \times 31.6 = 312\text{ms}$ |                                   |              |             |







## **14 Antenna Requirement**

### **14.1 Antenna Requirement**

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. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

### **14.2 Result**

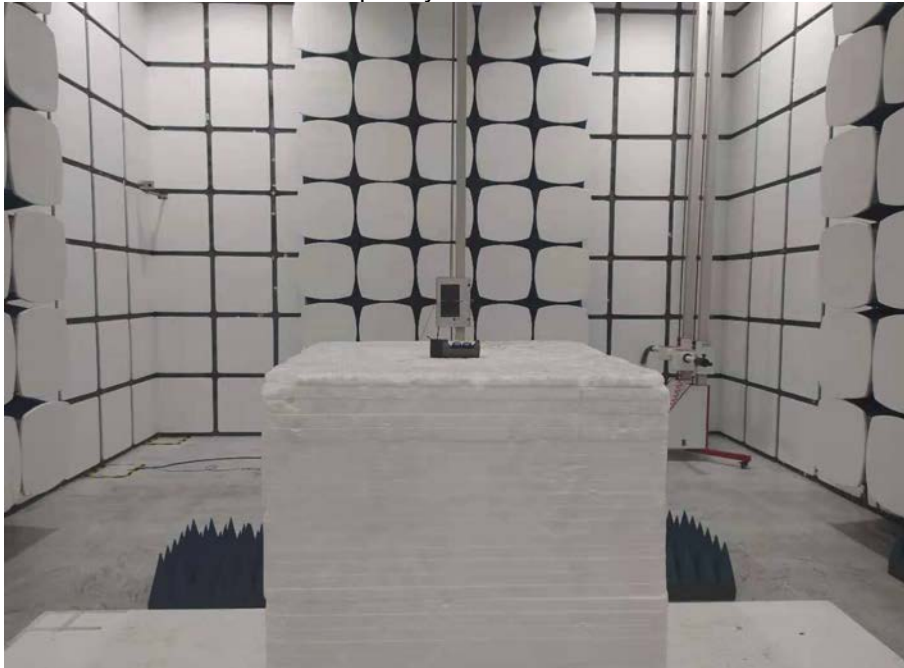
The EUT'S antenna, permanent attached antenna, is Circular Metal Antenna. The antenna's gain is 1.23dBi and meets the requirement.

## 15 TEST PHOTOS

Radiated Spurious Emissions  
Test Frequency From Below 30MHz



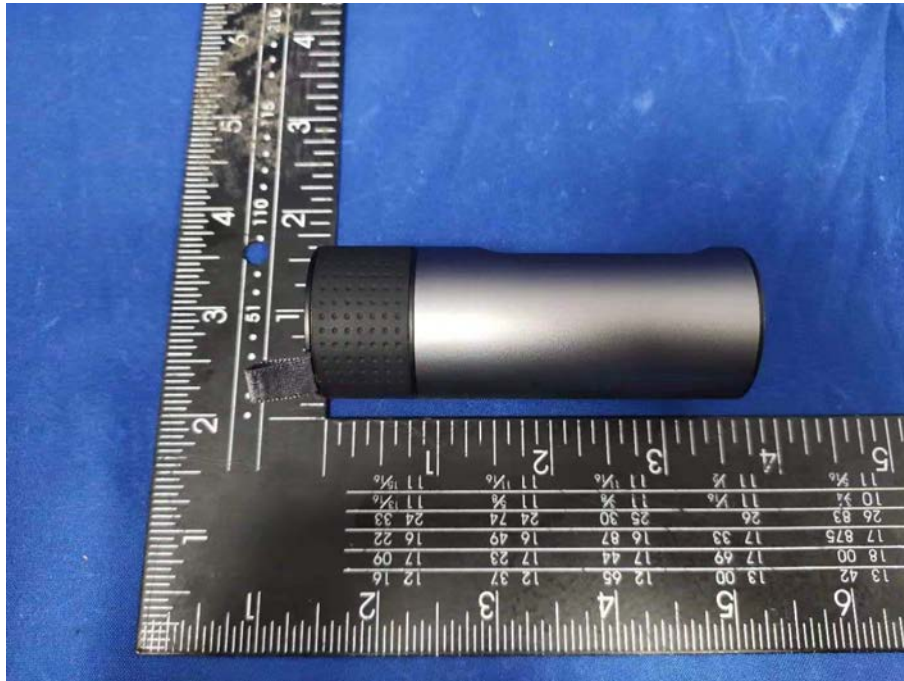
Test frequency from Above 1GHz

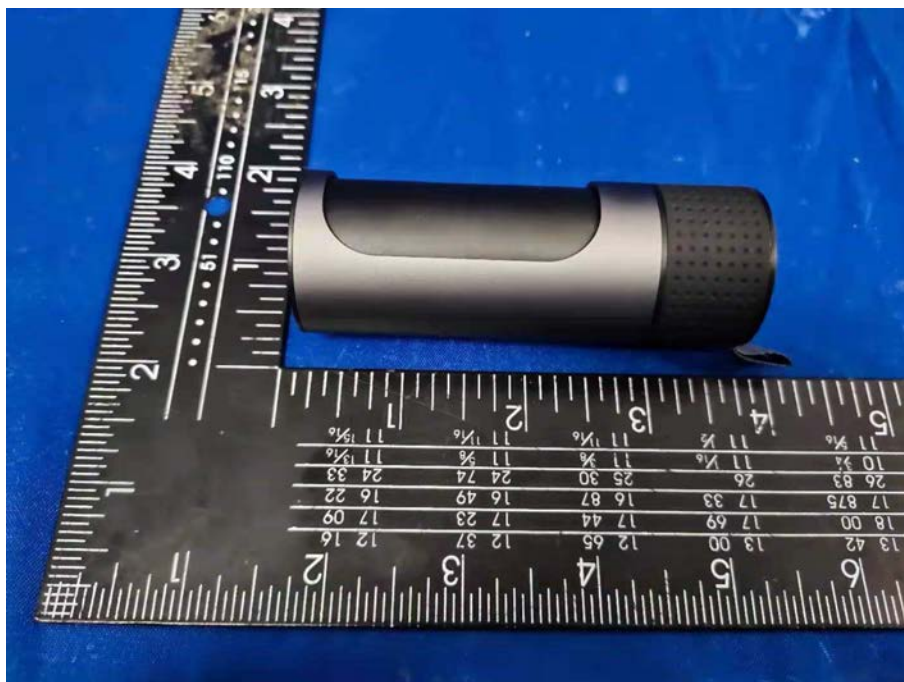
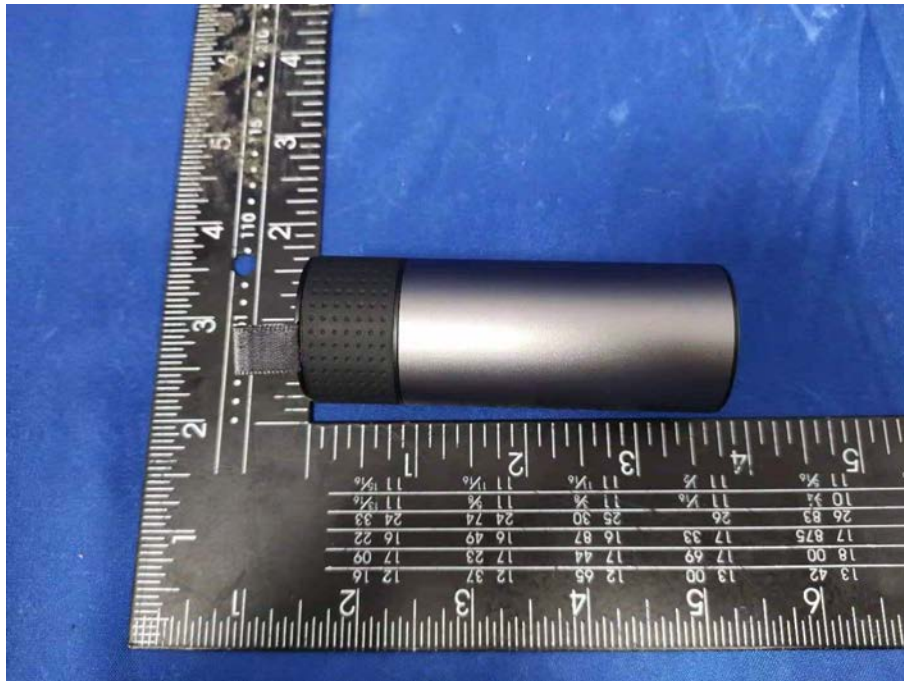


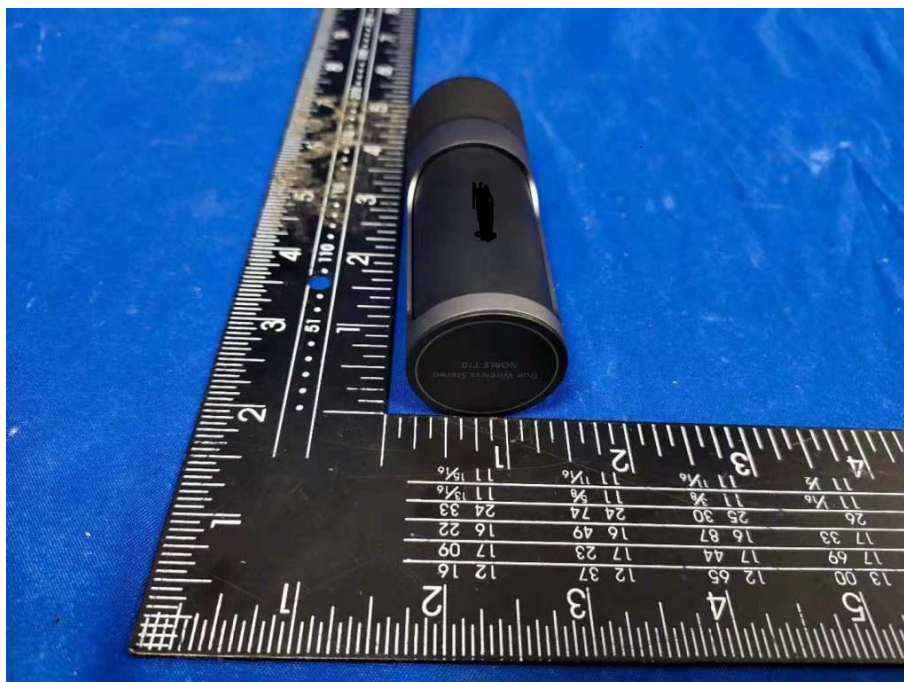
Conducted Emission



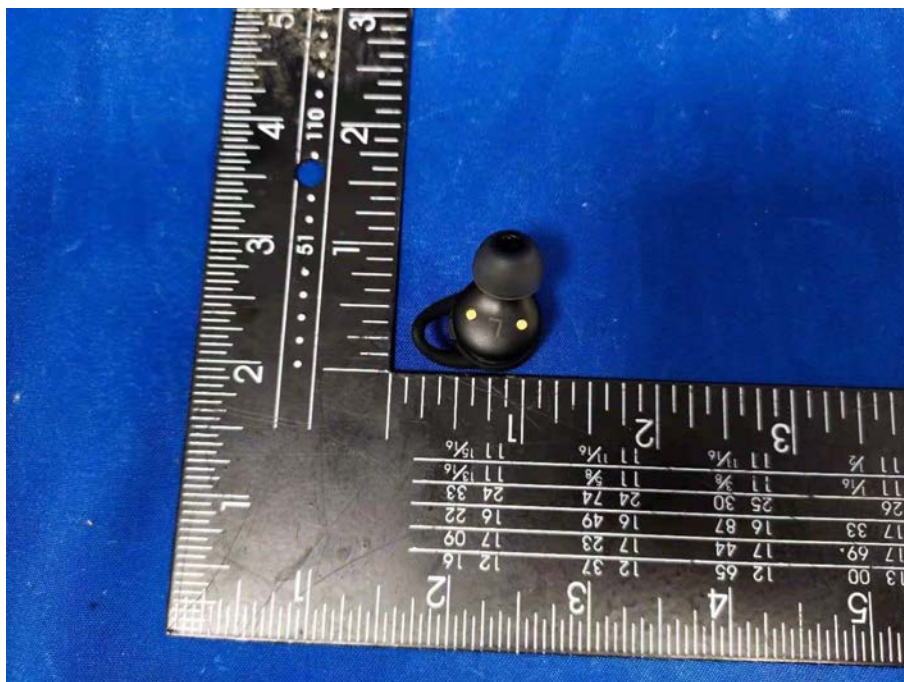
## 16 EUT PHOTOS

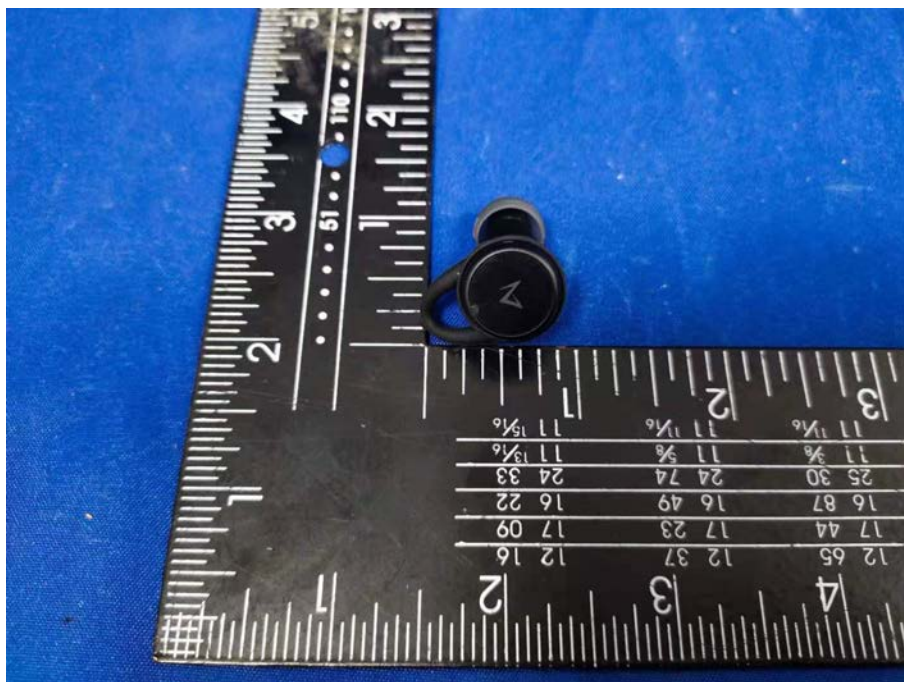
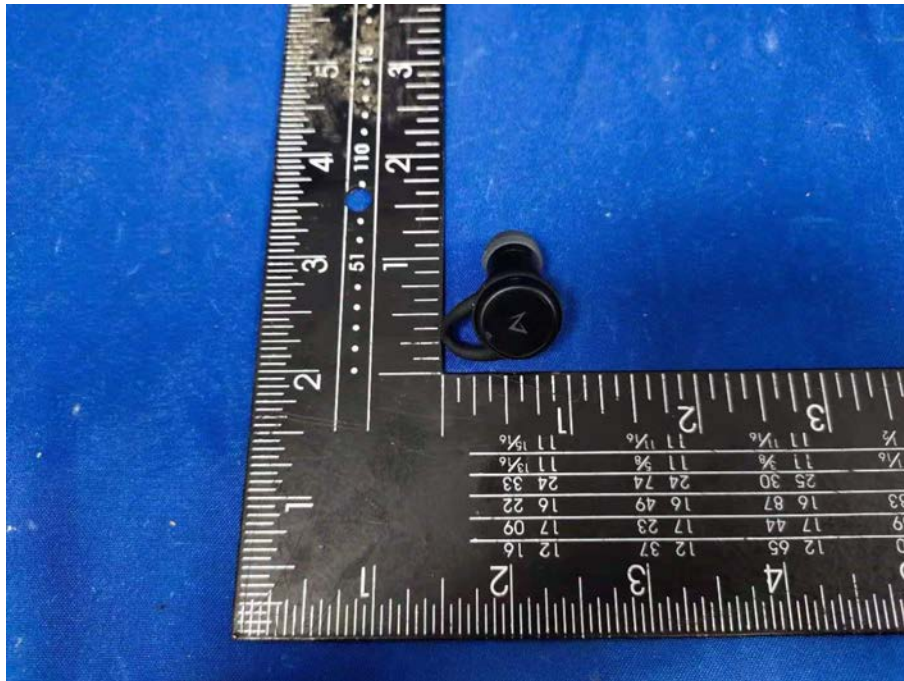


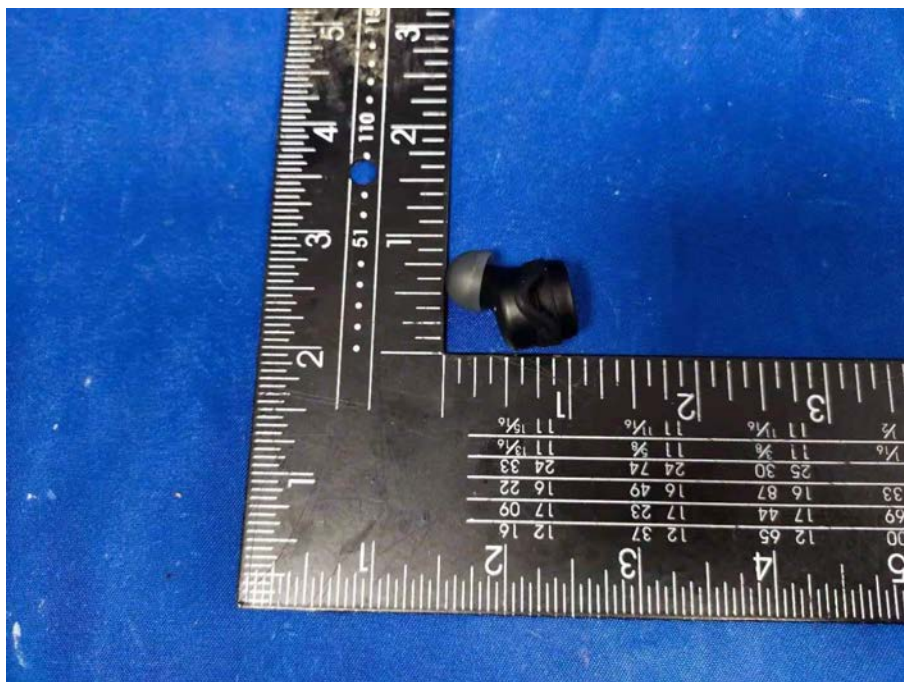


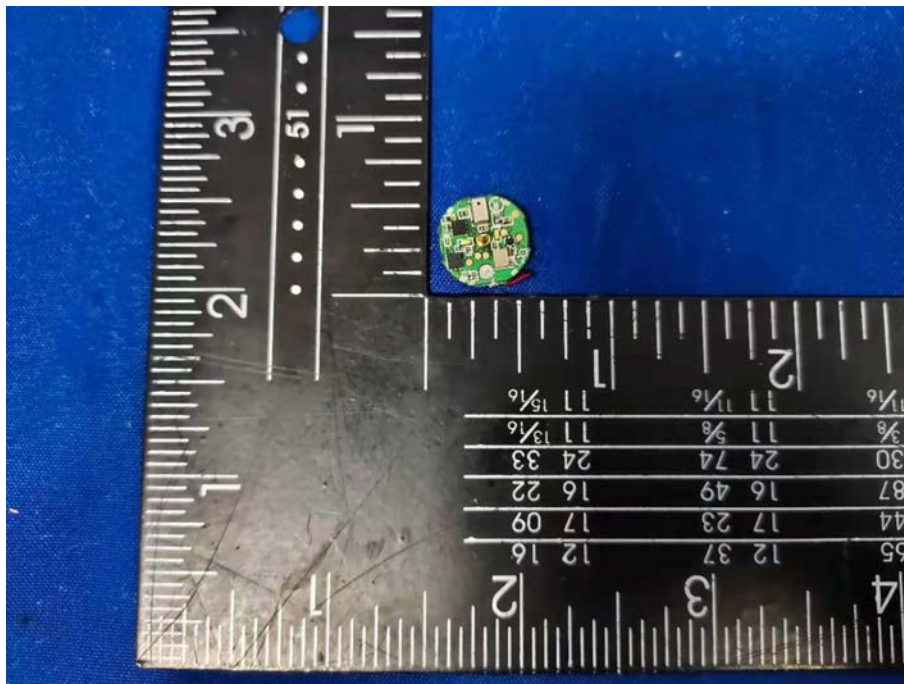
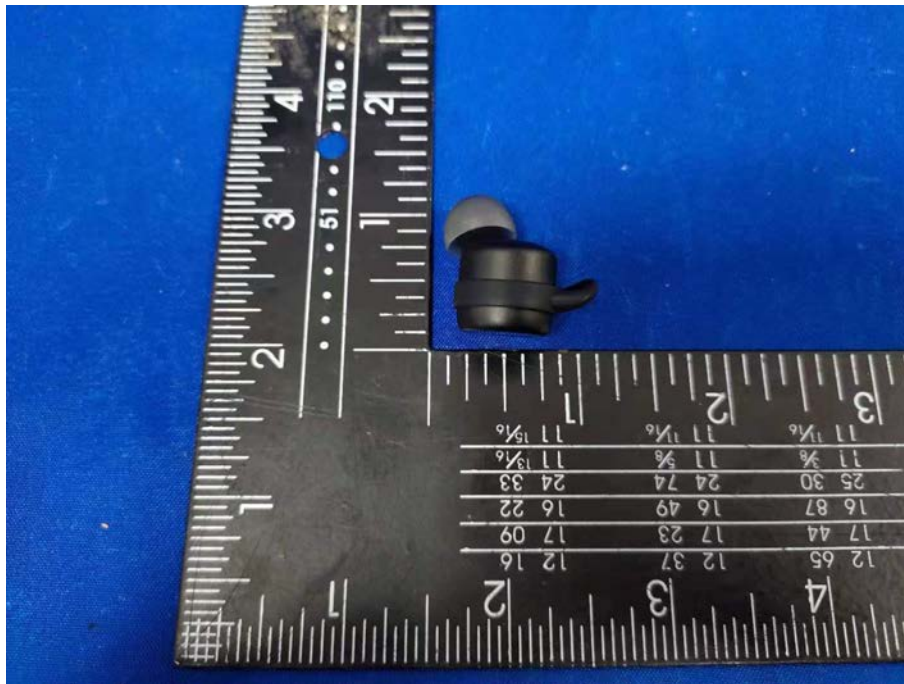


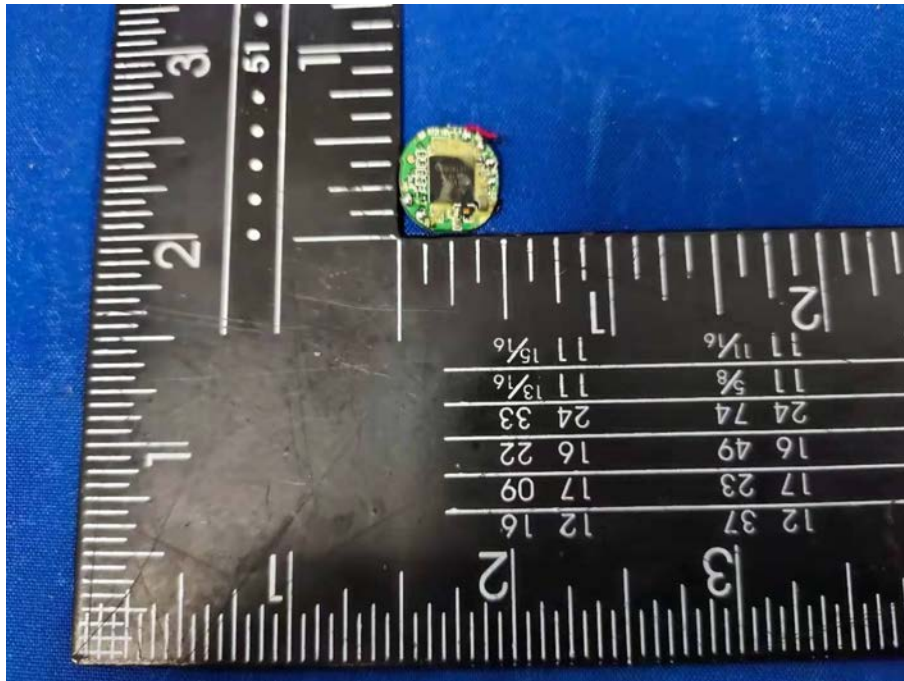












\*\*\*\*\*THE END REPORT\*\*\*\*\*