

# TEST REPORT

**Reference No.**..... : WTS15S1137553E  
**FCC ID** ..... : 2AB7S-NA1610  
**Applicant**..... : Soundmax Electronics Limited  
**Address**..... : 17/F.,Eu Yan Sang Tower, 11-15 Chatham Road South, Tsim Sha Tsui , Kowloon., Hong Kong  
**Manufacturer** ..... : The same as above  
**Address**..... : The same as above  
**Product Name**..... : AV Media Receiver  
**Model No**..... : NA1610,NA1620,NA3500,NA3510,NA3560,NA1611,NA1612  
**Brand**..... : Soundmax ,Nakamichi  
**Standards**..... : FCC CFR47 Part 15 Section 15.247:2014  
**Date of Receipt sample** .... : Nov. 17, 2015  
**Date of Test** ..... : Nov. 17 - 25, 2015  
**Date of Issue**..... : Nov. 25, 2015  
**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  
Tel :+86-755-83551033  
Fax:+86-755-83552400

Compiled by:



Zero Zhou / Test Engineer

Approved by:



Philo Zhong / Manager

## 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                           | N/A    |
| 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   |
| Maximum Permissible Exposure<br>(Exposure of Humans to RF Fields) | 1.1307(b)(1)                     | PASS   |

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## 4 General Information

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

|                        |                                                  |
|------------------------|--------------------------------------------------|
| Product Name:          | AV Media Receiver                                |
| Model No.:             | NA1610,NA1620,NA3500,NA3510,NA3560,NA1611,NA1612 |
| Model Description:     | Only the model names and color are different.    |
| Operation Frequency:   | 2402MHz ~ 2480MHz, 79 channels in total          |
| Type of Modulation:    | GFSK, Pi/4DQPSK, 8DPSK                           |
| The lowest oscillator: | 16MHz                                            |
| Antenna installation:  | PCB printed antenna                              |
| Antenna Gain:          | 0 dBi                                            |
| Remark:                | The model NA1610 is the tested sample.           |

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

|                 |                        |
|-----------------|------------------------|
| Technical Data: | DC 12V by Power Supply |
|-----------------|------------------------|

### 4.3 Channel List

| Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | 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            | -           | -               |

#### 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      |

#### 4.5 Test Facility

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

- **IC – Registration No.: 7760A-1**  
Waltek Services(Shenzhen) Co., Ltd. has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration 7760A-1, October 15, 2015
- **FCC Test Site 1#– Registration No.: 880581**  
Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory `has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 880581, April 29, 2014.
- **FCC Test Site 2#– Registration No.: 328995**  
Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory `has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 328995, December 3, 2014.

## 5 Equipment Used during Test

### 5.1 Equipments List

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

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

## 5.2 Measurement Uncertainty

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

## 5.3 Test Equipment Calibration

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

## 6 Conducted Emission

|                   |                                                                                                                        |
|-------------------|------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | FCC CFR 47 Part 15 Section 15.207                                                                                      |
| Test Method:      | ANSI C63.4:2003                                                                                                        |
| Test Result:      | PASS                                                                                                                   |
| Frequency Range:  | 150kHz to 30MHz                                                                                                        |
| Class/Severity:   | Class B                                                                                                                |
| Limit:            | 66-56 dB $\mu$ V between 0.15MHz & 0.5MHz<br>56 dB $\mu$ V between 0.5MHz & 5MHz<br>60 dB $\mu$ V between 5MHz & 30MHz |
| Detector:         | Peak for pre-scan (9kHz Resolution Bandwidth)                                                                          |

### 6.1 E.U.T. Operation

Operating Environment :

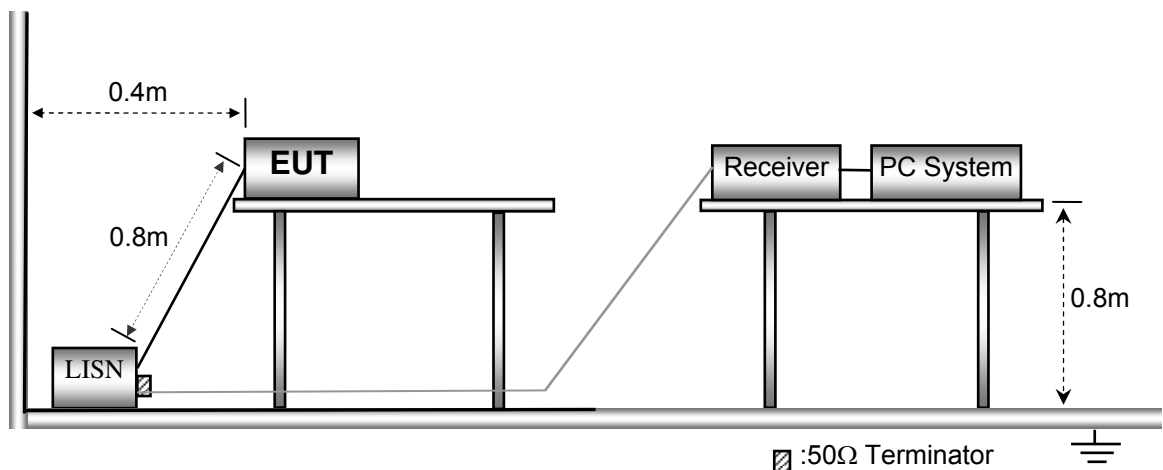
|                       |          |
|-----------------------|----------|
| Temperature:          | 25.5 °C  |
| Humidity:             | 51 % RH  |
| Atmospheric Pressure: | 101.2kPa |

EUT Operation :

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

### 6.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.4:2003.



### 6.3 Measurement Description

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

#### **6.4 Conducted Emission Test Result**

N/A

Note: Not applicable.

## 7 Radiated Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: DA 00-705

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                                         | $20\log^{(500)}$               |

### 7.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 51.1 % RH

Atmospheric Pressure: 101.2kPa

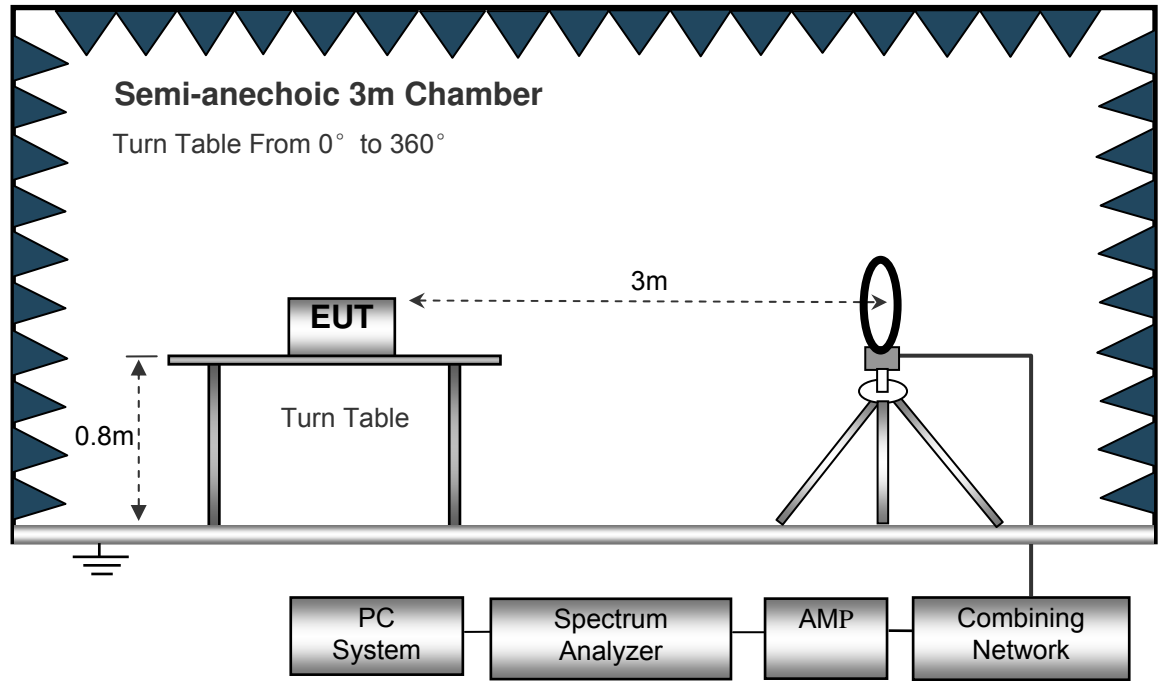
EUT Operation :

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

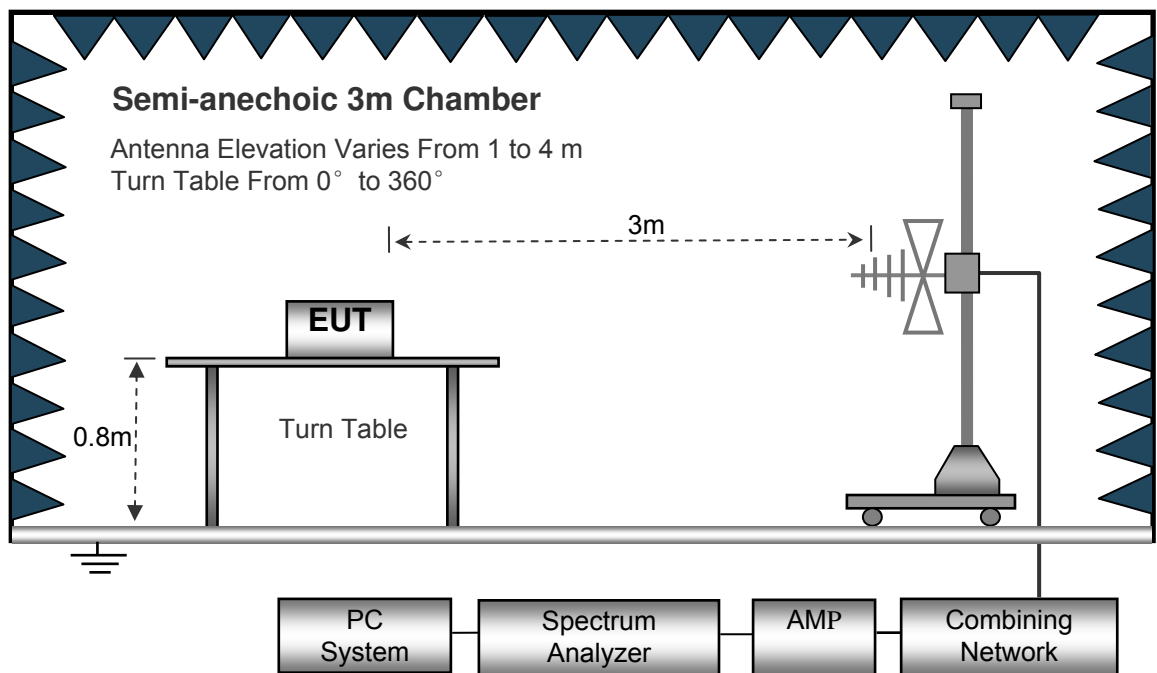
## 7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.

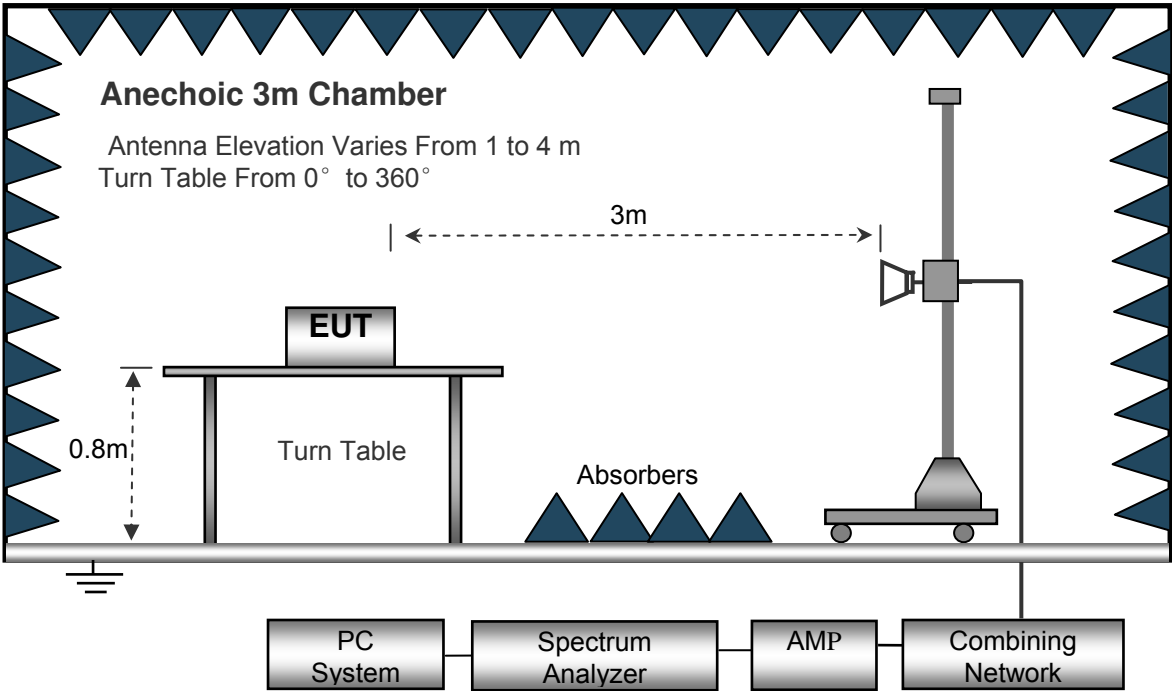
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



7.3 Spectrum Analyzer Setup

- Below 30MHz
- Sweep Speed ..... Auto
  - IF Bandwidth.....10kHz
  - Video Bandwidth.....10kHz
  - Resolution Bandwidth.....10kHz
- 30MHz ~ 1GHz
- Sweep Speed ..... Auto
  - Detector .....PK
  - Resolution Bandwidth.....100kHz
  - Video Bandwidth.....300kHz
- Above 1GHz
- Sweep Speed ..... Auto
  - Detector .....PK
  - Resolution Bandwidth.....1MHz
  - Video Bandwidth.....3MHz
  - Detector .....Ave.
  - Resolution Bandwidth.....1MHz
  - Video Bandwidth.....10Hz

## 7.4 Test Procedure

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

## 7.5 Summary of Test Results

### Test Frequency: 16MHz to 30MHz

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

### Test Frequency: 30MHz ~ 18GHz

| Frequency        | Receiver Reading | Detector    | Turn table Angle | RX Antenna |       | Corrected Factor | Corrected Amplitude | Limit    | Margin |
|------------------|------------------|-------------|------------------|------------|-------|------------------|---------------------|----------|--------|
|                  |                  |             |                  | Height     | Polar |                  |                     |          |        |
| (MHz)            | (dBμV)           | (PK/QP/Ave) | Degree           | (m)        | (H/V) | (dB)             | (dBμV/m)            | (dBμV/m) | (dB)   |
| GFSK Low Channel |                  |             |                  |            |       |                  |                     |          |        |
| 261.97           | 39.72            | QP          | 191              | 1.6        | H     | -13.35           | 26.37               | 46.00    | -19.63 |
| 261.97           | 41.54            | QP          | 127              | 1.1        | V     | -13.35           | 28.19               | 46.00    | -17.81 |
| 4804.00          | 45.38            | PK          | 64               | 1.5        | V     | -1.06            | 44.32               | 74.00    | -29.68 |
| 4804.00          | 42.96            | Ave         | 64               | 1.5        | V     | -1.06            | 41.90               | 54.00    | -12.10 |
| 7206.00          | 40.87            | PK          | 84               | 2.0        | H     | 1.33             | 42.20               | 74.00    | -31.80 |
| 7206.00          | 38.65            | Ave         | 84               | 2.0        | H     | 1.33             | 39.98               | 54.00    | -14.02 |
| 2310.69          | 46.14            | PK          | 240              | 1.0        | V     | -13.19           | 32.95               | 74.00    | -41.05 |
| 2310.69          | 38.48            | Ave         | 240              | 1.0        | V     | -13.19           | 25.29               | 54.00    | -28.71 |
| 2362.43          | 44.03            | PK          | 150              | 1.2        | H     | -13.14           | 30.89               | 74.00    | -43.11 |
| 2362.43          | 38.30            | Ave         | 150              | 1.2        | H     | -13.14           | 25.16               | 54.00    | -28.84 |
| 2494.42          | 43.47            | PK          | 196              | 1.1        | V     | -13.08           | 30.39               | 74.00    | -43.61 |
| 2494.42          | 37.78            | Ave         | 196              | 1.1        | V     | -13.08           | 24.70               | 54.00    | -29.30 |

| Frequency           | Receiver Reading | Detector    | Turn table Angle | RX Antenna |       | Corrected Factor | Corrected Amplitude | Limit    | Margin |
|---------------------|------------------|-------------|------------------|------------|-------|------------------|---------------------|----------|--------|
|                     |                  |             |                  | Height     | Polar |                  |                     |          |        |
| (MHz)               | (dBμV)           | (PK/QP/Ave) | Degree           | (m)        | (H/V) | (dB)             | (dBμV/m)            | (dBμV/m) | (dB)   |
| GFSK Middle Channel |                  |             |                  |            |       |                  |                     |          |        |
| 261.97              | 39.80            | QP          | 250              | 1.9        | H     | -13.35           | 26.45               | 46.00    | -19.55 |
| 261.97              | 41.07            | QP          | 348              | 1.5        | V     | -13.35           | 27.72               | 46.00    | -18.28 |
| 4882.00             | 44.84            | PK          | 77               | 1.4        | V     | -0.62            | 44.22               | 74.00    | -29.78 |
| 4882.00             | 42.12            | Ave         | 77               | 1.4        | V     | -0.62            | 41.50               | 54.00    | -12.50 |
| 7323.00             | 40.78            | PK          | 281              | 1.3        | H     | 2.21             | 42.99               | 74.00    | -31.01 |
| 7323.00             | 37.70            | Ave         | 281              | 1.3        | H     | 2.21             | 39.91               | 54.00    | -14.09 |
| 2336.70             | 46.29            | PK          | 306              | 1.8        | V     | -13.19           | 33.10               | 74.00    | -40.90 |
| 2336.70             | 37.51            | Ave         | 306              | 1.8        | V     | -13.19           | 24.32               | 54.00    | -29.68 |
| 2389.40             | 44.36            | PK          | 214              | 1.4        | H     | -13.14           | 31.22               | 74.00    | -42.78 |
| 2389.40             | 38.11            | Ave         | 214              | 1.4        | H     | -13.14           | 24.97               | 54.00    | -29.03 |
| 2493.00             | 42.23            | PK          | 276              | 1.8        | V     | -13.08           | 29.15               | 74.00    | -44.85 |
| 2493.00             | 38.11            | Ave         | 276              | 1.8        | V     | -13.08           | 25.03               | 54.00    | -28.97 |

| Frequency         | Receiver Reading | Detector    | Turn table Angle | RX Antenna |       | Corrected Factor | Corrected Amplitude | Limit    | Margin |
|-------------------|------------------|-------------|------------------|------------|-------|------------------|---------------------|----------|--------|
|                   |                  |             |                  | Height     | Polar |                  |                     |          |        |
| (MHz)             | (dBμV)           | (PK/QP/Ave) | Degree           | (m)        | (H/V) | (dB)             | (dBμV/m)            | (dBμV/m) | (dB)   |
| GFSK High Channel |                  |             |                  |            |       |                  |                     |          |        |
| 261.97            | 38.60            | QP          | 122              | 1.5        | H     | -13.35           | 25.25               | 46.00    | -20.75 |
| 261.97            | 42.06            | QP          | 101              | 1.5        | V     | -13.35           | 28.71               | 46.00    | -17.29 |
| 4960.00           | 46.32            | PK          | 270              | 1.6        | V     | -0.24            | 46.08               | 74.00    | -27.92 |
| 4960.00           | 41.56            | Ave         | 270              | 1.6        | V     | -0.24            | 41.32               | 54.00    | -12.68 |
| 7440.00           | 41.17            | PK          | 145              | 1.4        | H     | 2.84             | 44.01               | 74.00    | -29.99 |
| 7440.00           | 37.99            | Ave         | 145              | 1.4        | H     | 2.84             | 40.83               | 54.00    | -13.17 |
| 2348.69           | 45.45            | PK          | 22               | 1.1        | V     | -13.19           | 32.26               | 74.00    | -41.74 |
| 2348.69           | 39.87            | Ave         | 22               | 1.1        | V     | -13.19           | 26.68               | 54.00    | -27.32 |
| 2361.04           | 44.70            | PK          | 67               | 1.7        | H     | -13.14           | 31.56               | 74.00    | -42.44 |
| 2361.04           | 37.14            | Ave         | 67               | 1.7        | H     | -13.14           | 24.00               | 54.00    | -30.00 |
| 2487.68           | 44.02            | PK          | 195              | 1.0        | V     | -13.08           | 30.94               | 74.00    | -43.06 |
| 2487.68           | 36.70            | Ave         | 195              | 1.0        | V     | -13.08           | 23.62               | 54.00    | -30.38 |

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

**Test Frequency : 18~25GHz**

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

## 8 Band Edge Measurement

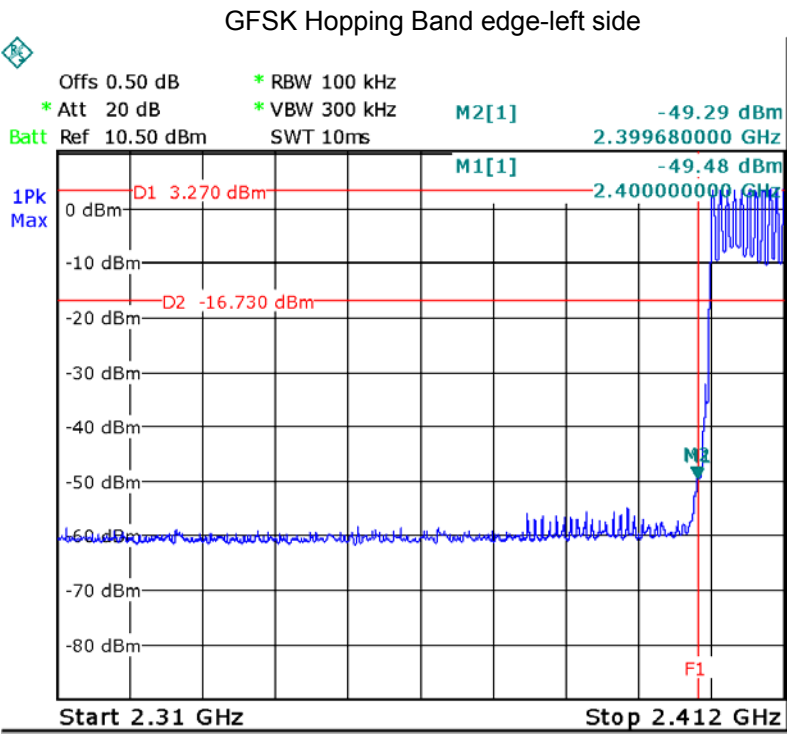
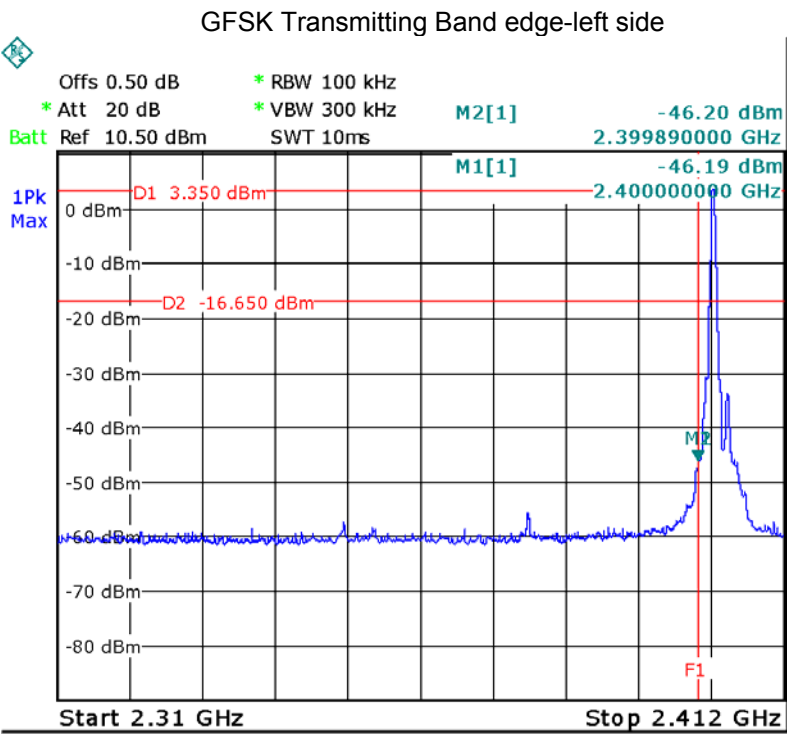
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | Section 15.247(d) In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Test Method:      | DA 00-705                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 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 and Hopping                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

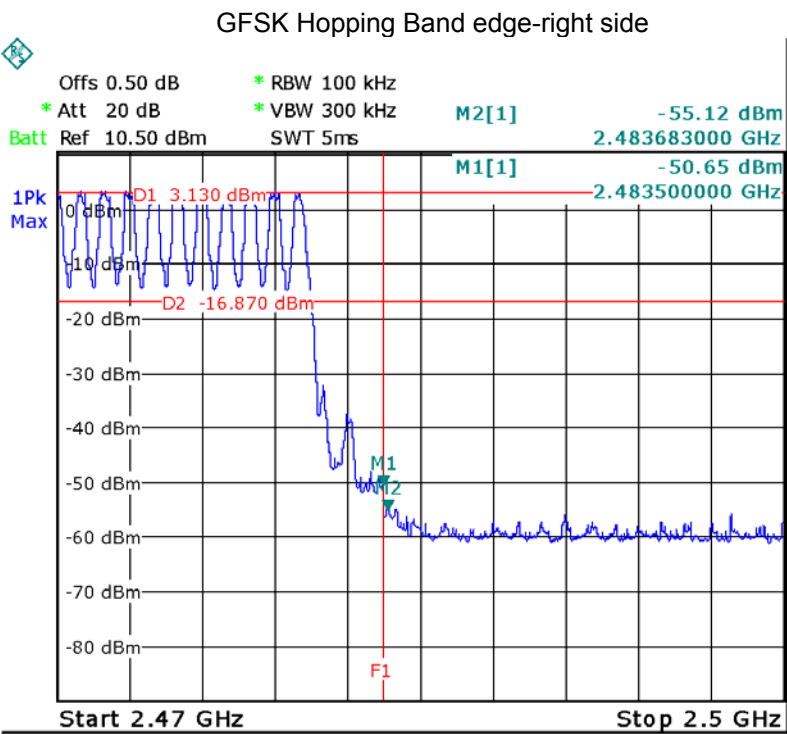
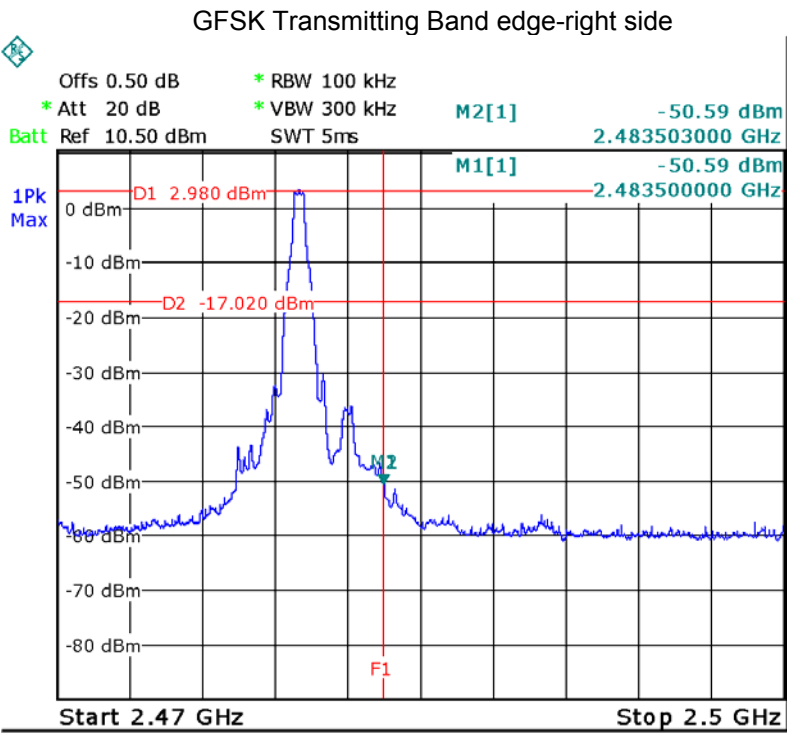
### 8.1 Test Procedure

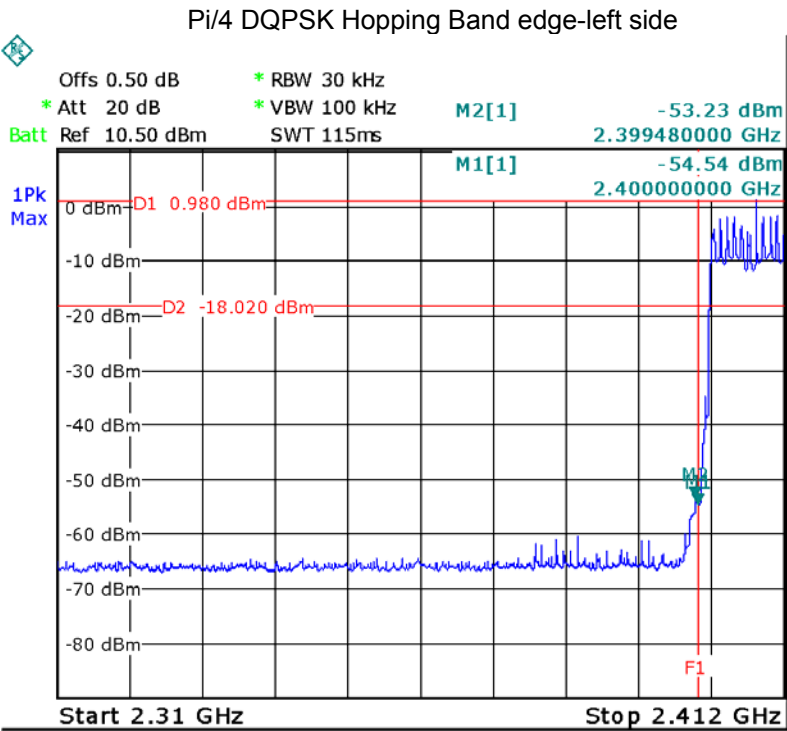
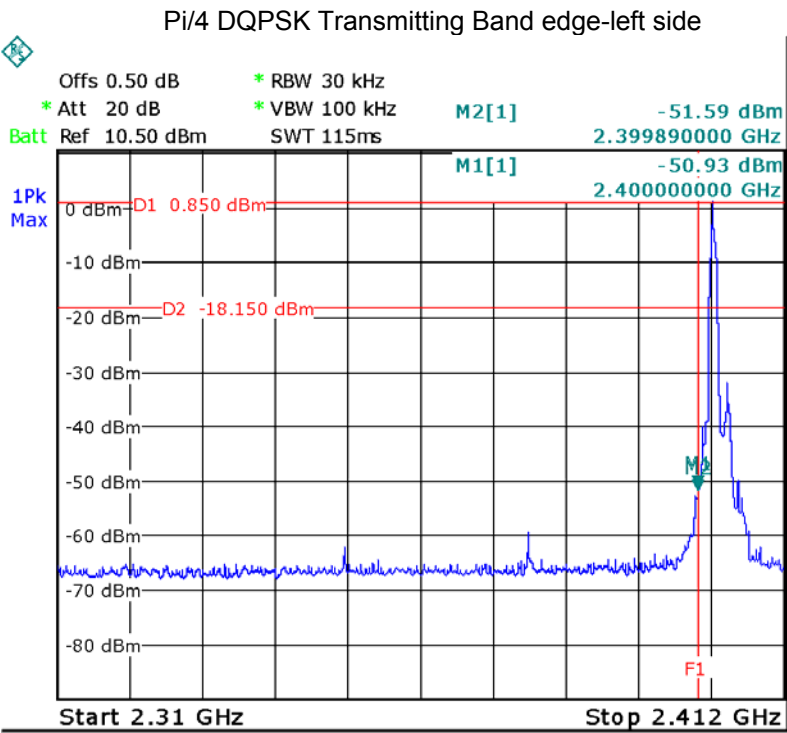
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto  
Detector function = peak, Trace = max hold

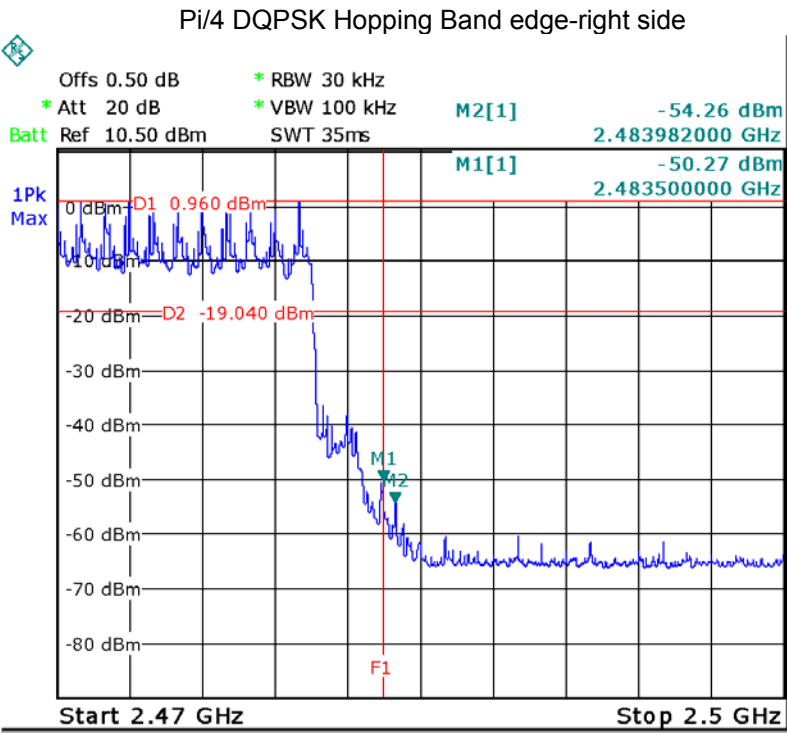
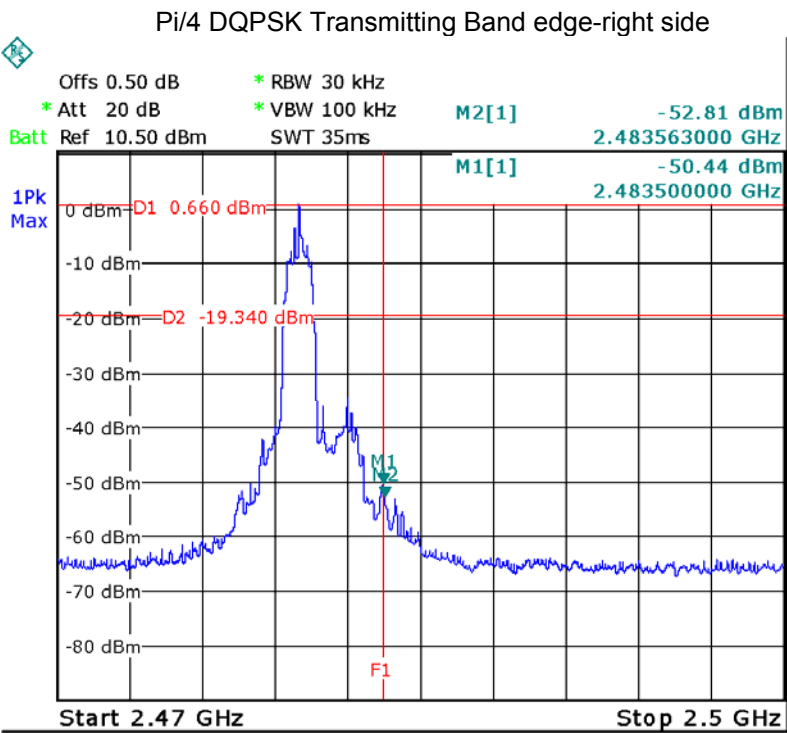
8.2 Test Result

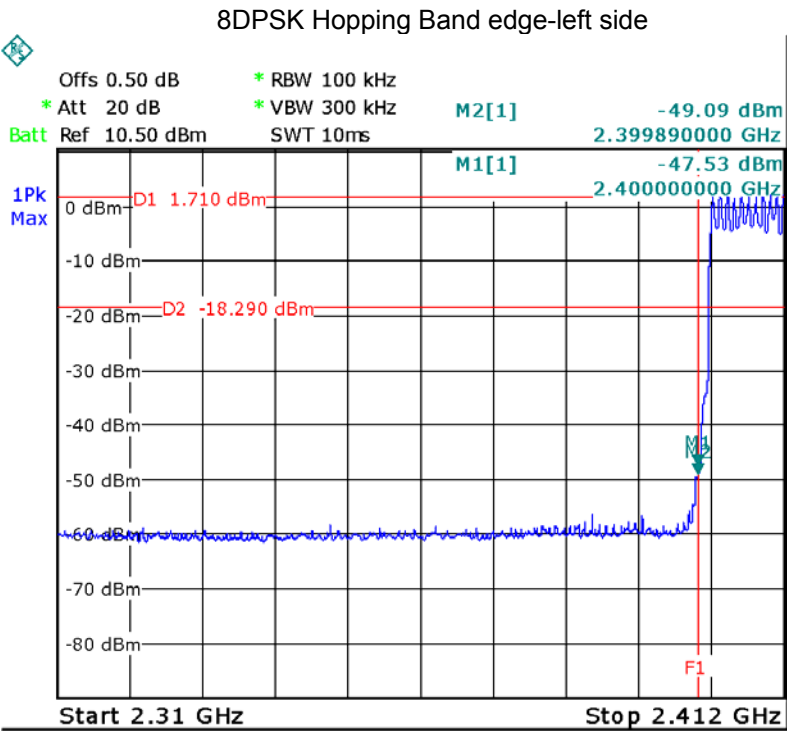
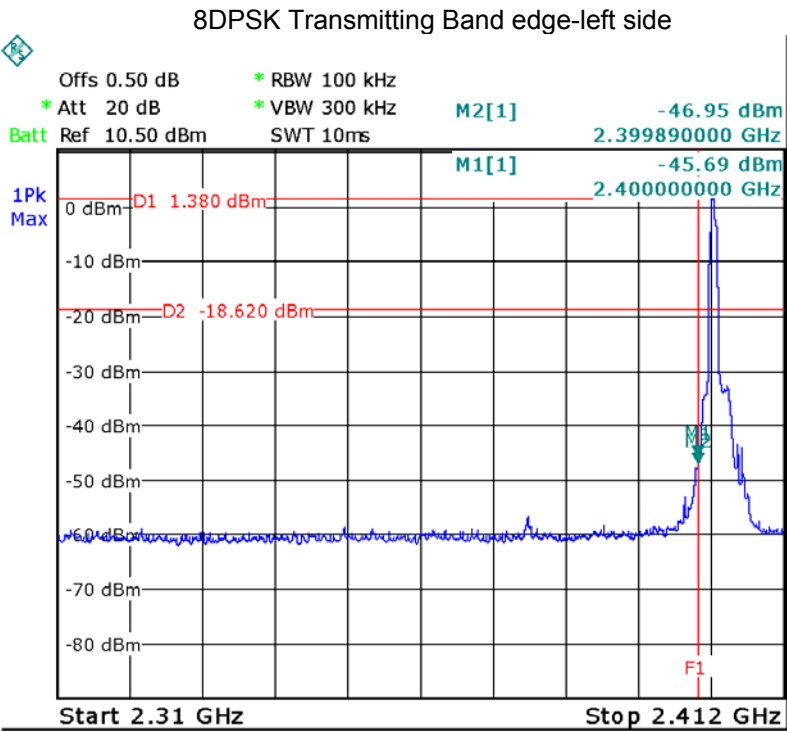
Test plots

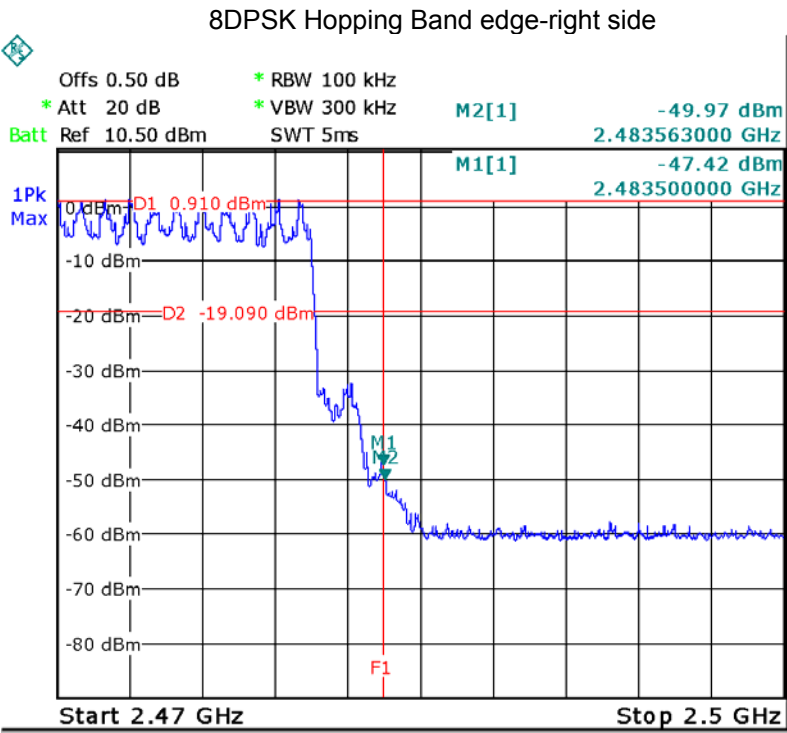
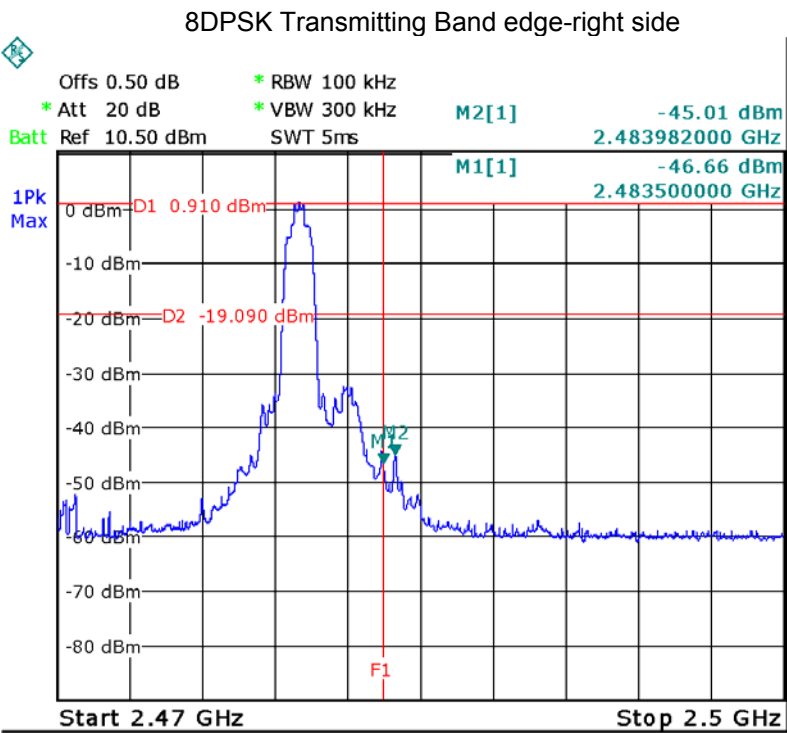












## 9 Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247  
Test Method: DA 00-705  
Test Mode: Test in fixing operating frequency at low, Middle, high channel.

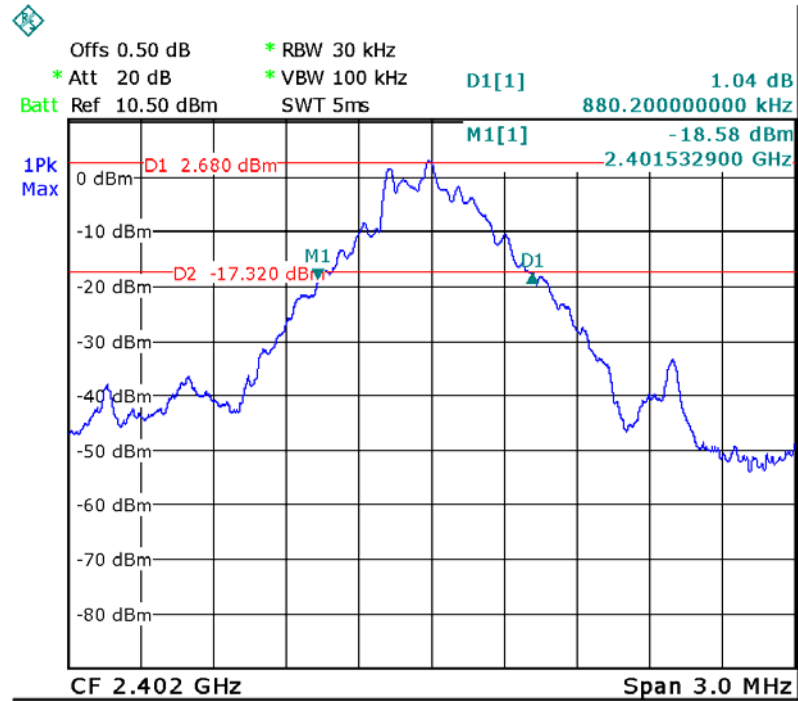
### 9.1 Test Procedure

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

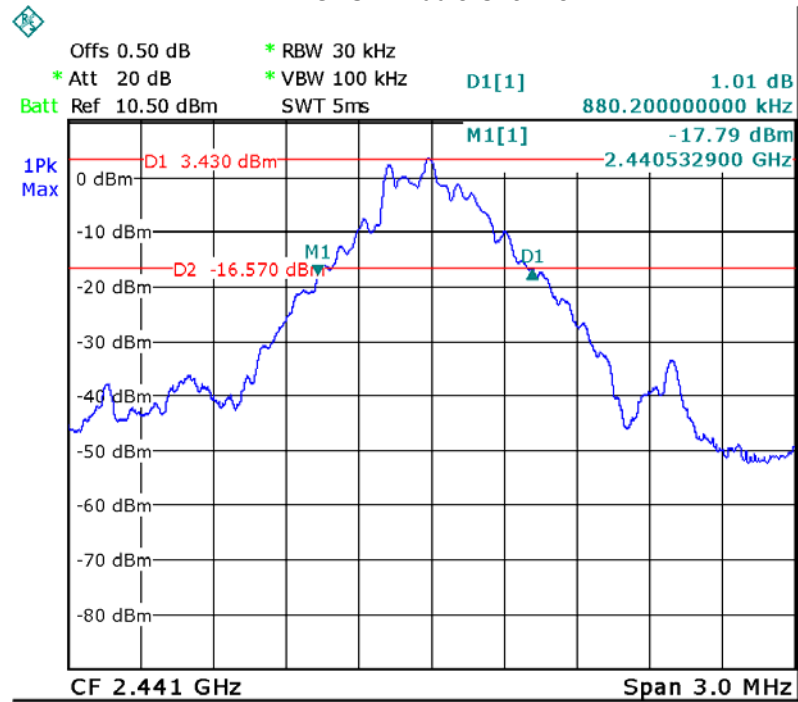
### 9.2 Test Result

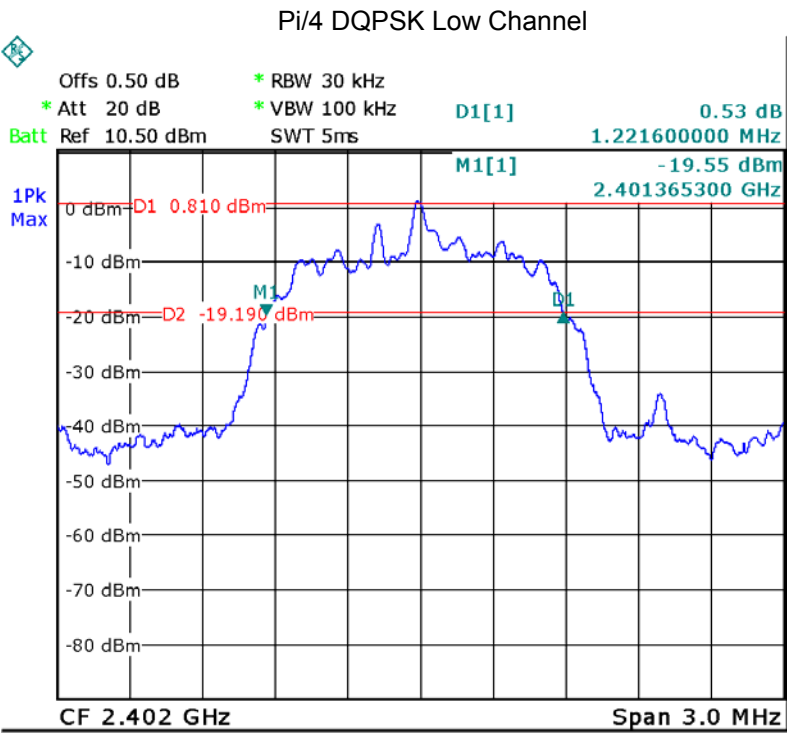
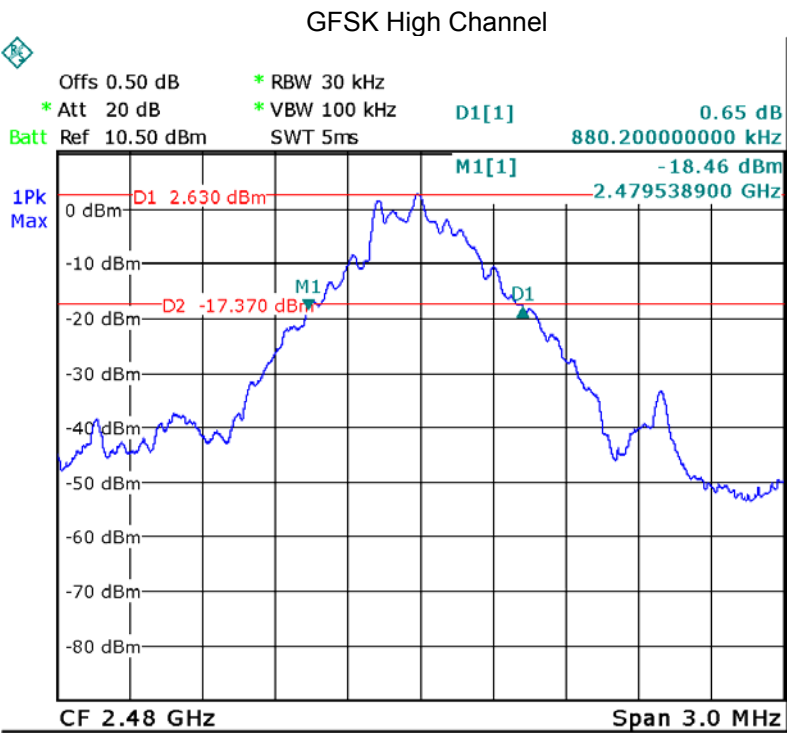
| Modulation | Test Channel | 20 dB Bandwidth |
|------------|--------------|-----------------|
| GFSK       | Low          | 0.880MHz        |
| GFSK       | Middle       | 0.880MHz        |
| GFSK       | High         | 0.880MHz        |
| Pi/4 DQPSK | Low          | 1.222MHz        |
| Pi/4 DQPSK | Middle       | 1.222MHz        |
| Pi/4 DQPSK | High         | 1.222MHz        |
| 8DPSK      | Low          | 1.216 MHz       |
| 8DPSK      | Middle       | 1.216 MHz       |
| 8DPSK      | High         | 1.216 MHz       |

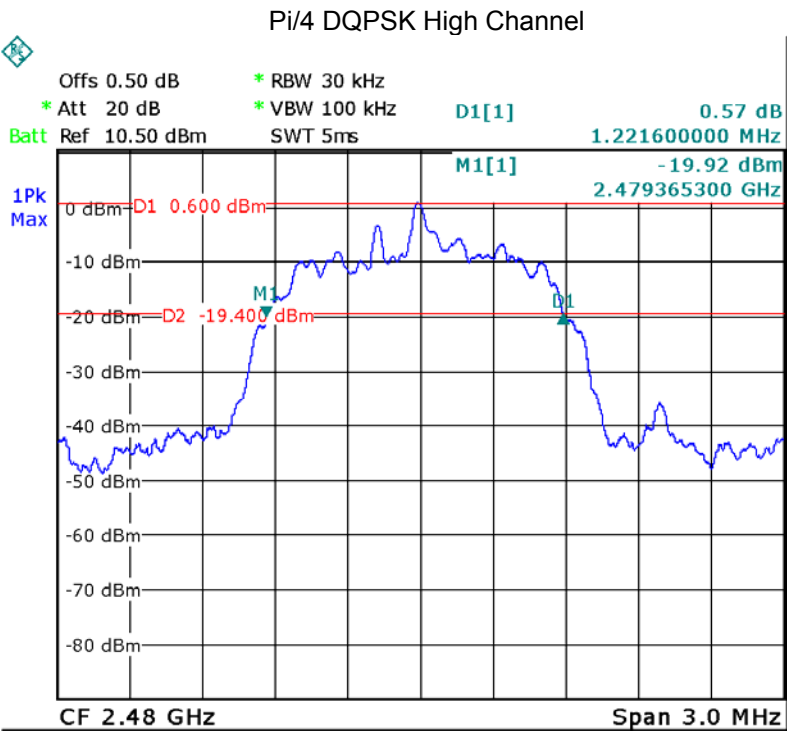
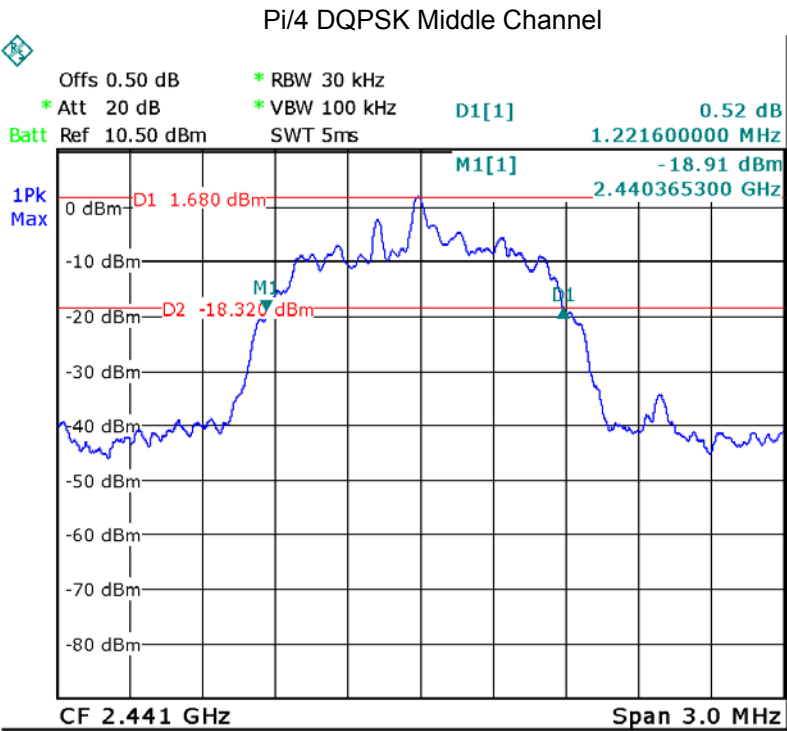
Test plots  
GFSK Low Channel

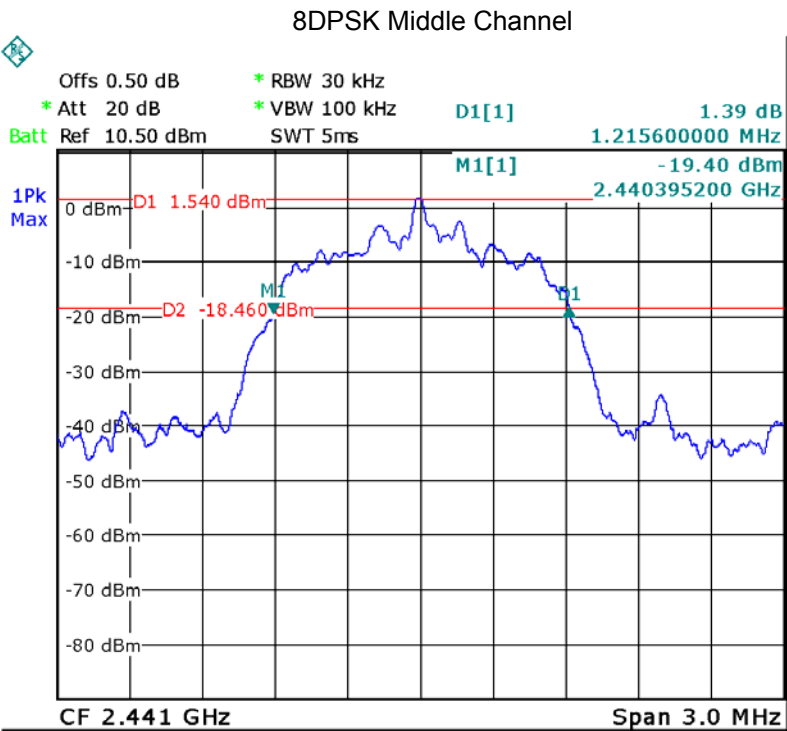
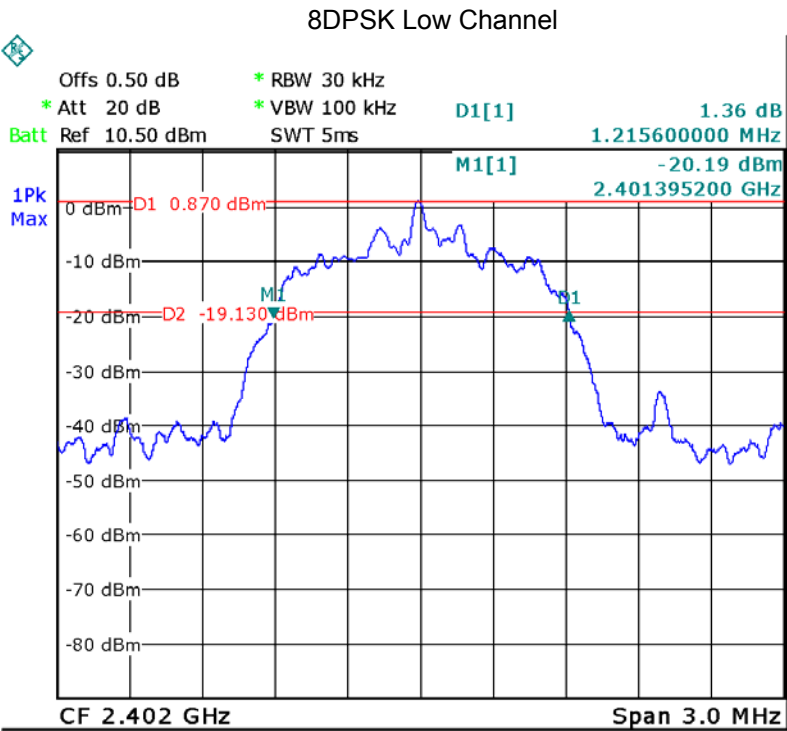


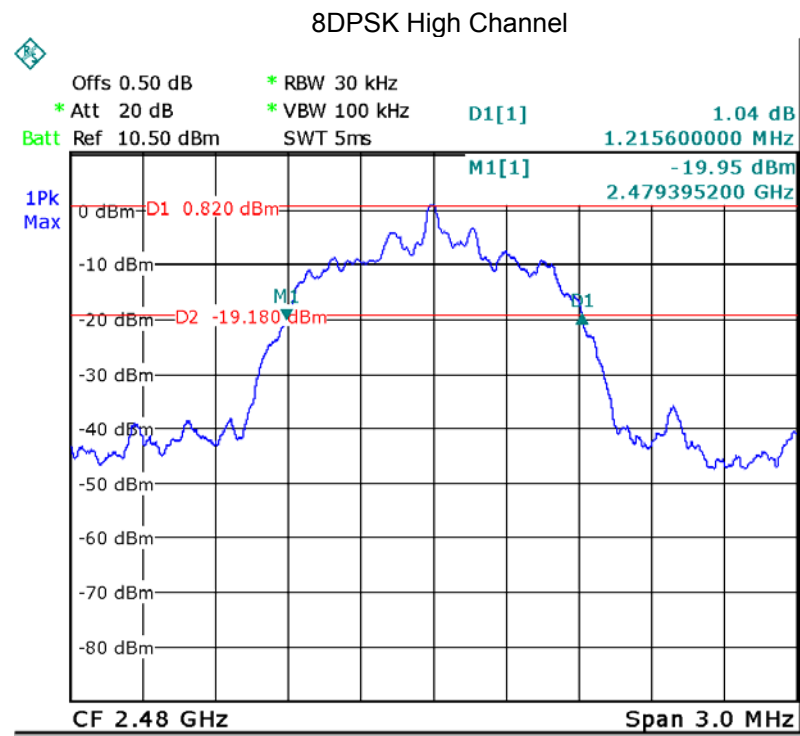
GFSK Middle Channel











## 10 Maximum Peak Output Power

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | FCC CFR47 Part 15 Section 15.247                                                                                                                                                                                                                                                                                                                                                                                              |
| Test Method:      | DA 00-705                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Test Limit:       | Regulation 15.247 (b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.<br>Refer to the result "Number of Hopping Frequency" of this document. The 0.125watts (20.97 dBm) limit applies. |
| Test mode:        | Test in fixing frequency transmitting mode.                                                                                                                                                                                                                                                                                                                                                                                   |

### 10.1 Test Procedure

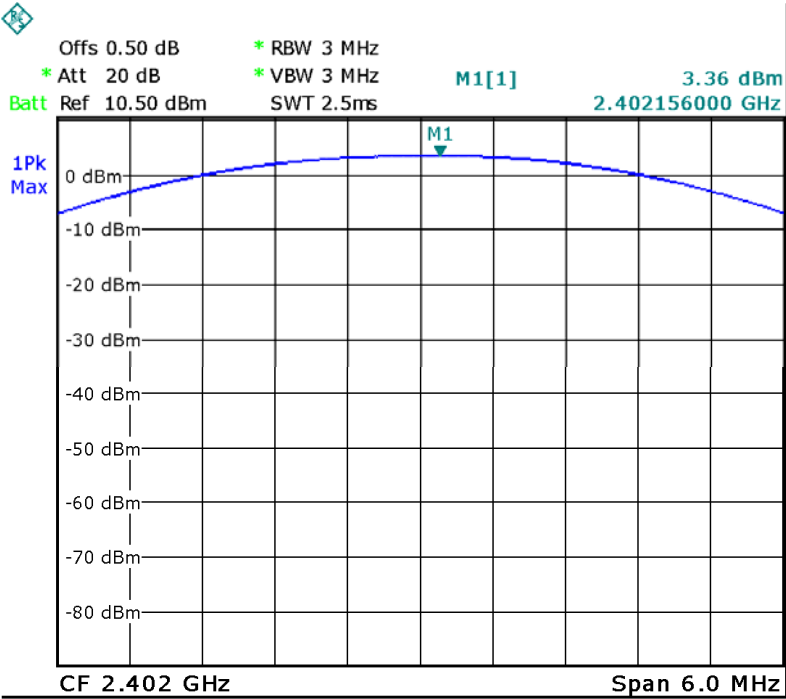
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3 MHz. VBW =3 MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

### 10.2 Test Result

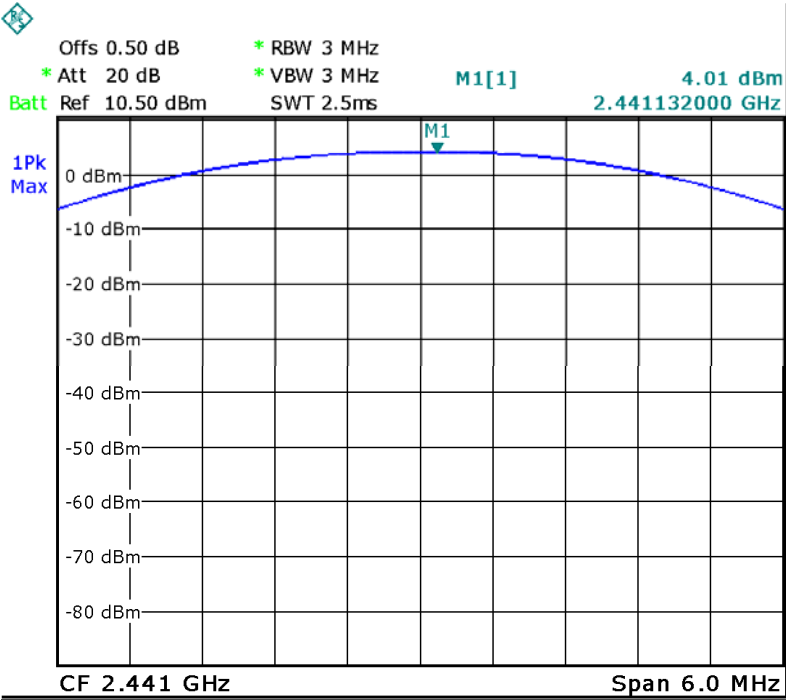
| Test Mode | Data Rate | Peak Power(dBm) |             |      | Limit (dBm) |
|-----------|-----------|-----------------|-------------|------|-------------|
|           |           | CH00            | CH39        | CH78 |             |
| GFSK      | 1Mbps     | 3.36            | <b>4.01</b> | 2.92 | 30          |
| 4*π4DQPSK | 2Mbps     | 2.03            | 2.55        | 1.76 | 20.97       |
| 8DPSK     | 3Mbps     | 2.55            | 3.07        | 2.20 | 20.97       |

Test plots

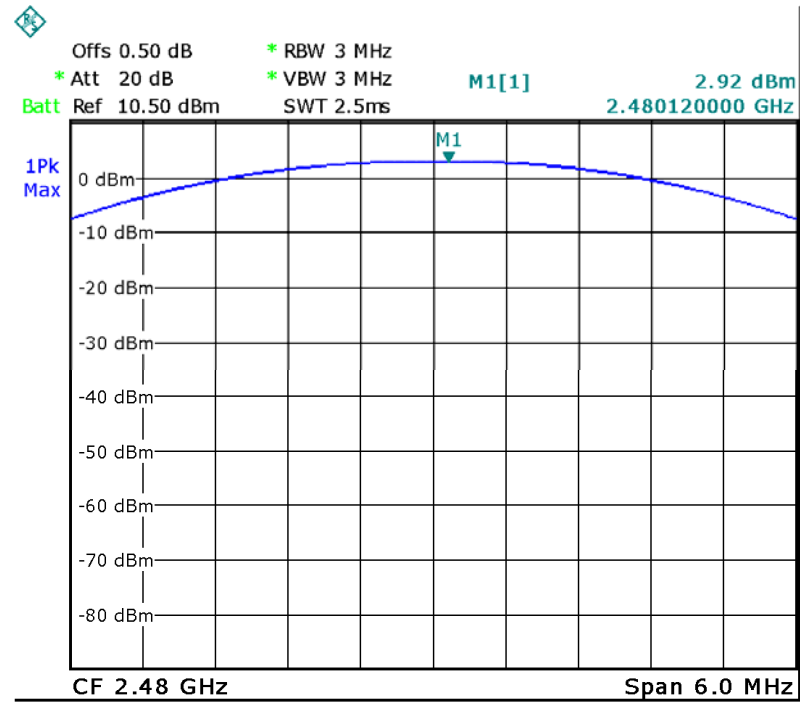
GFSK Low Channel



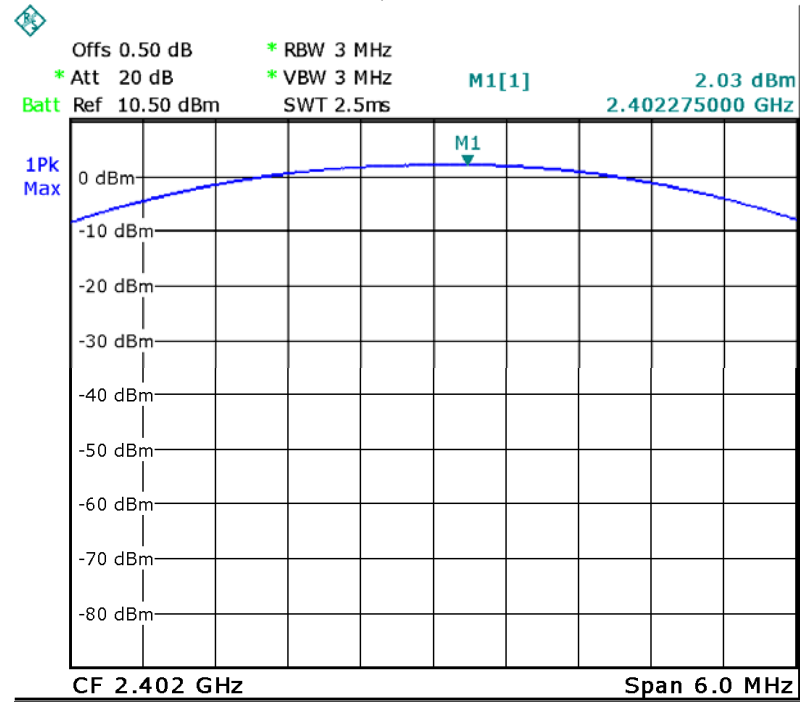
GFSK Middle Channel

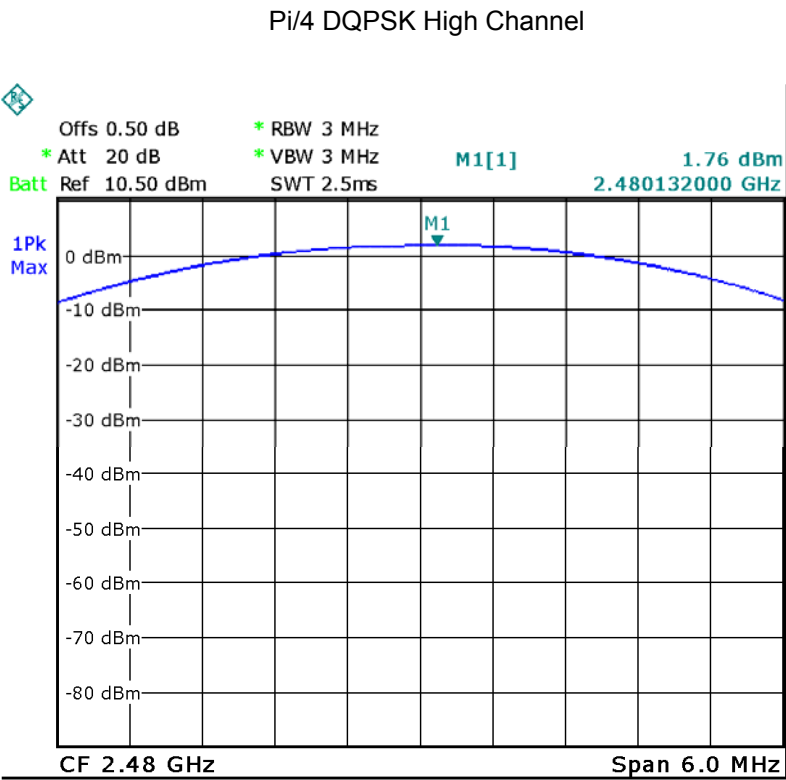
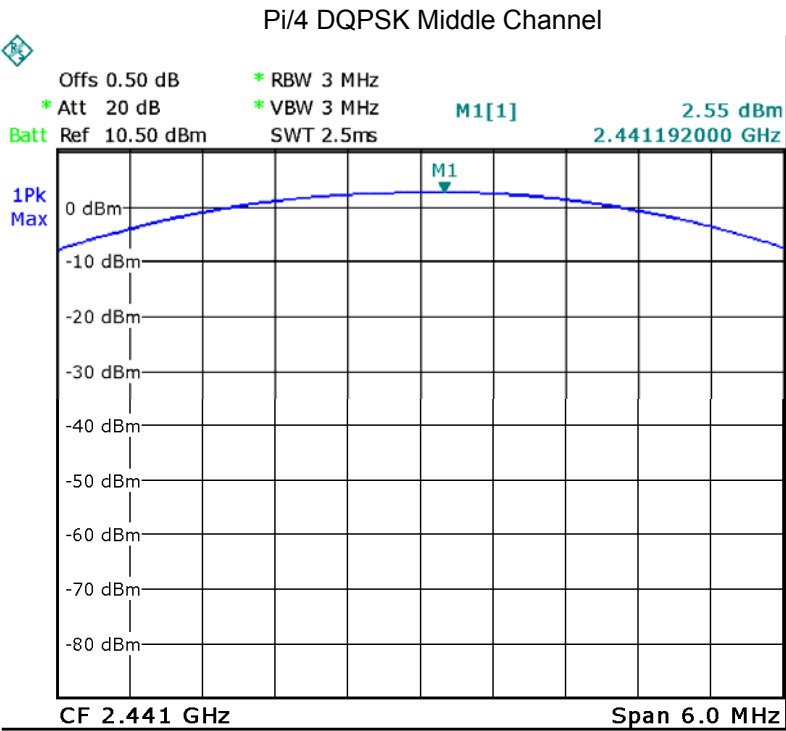


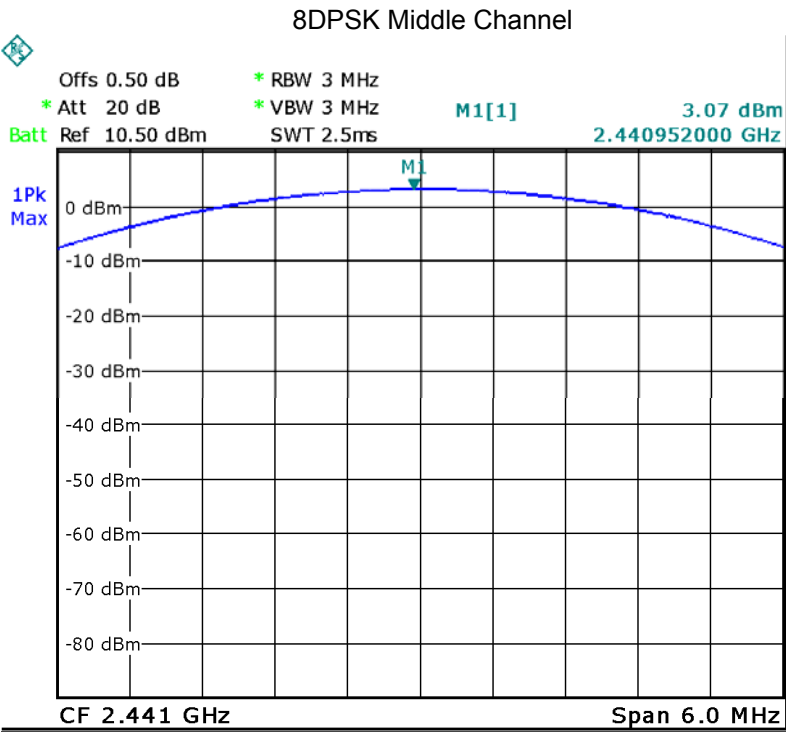
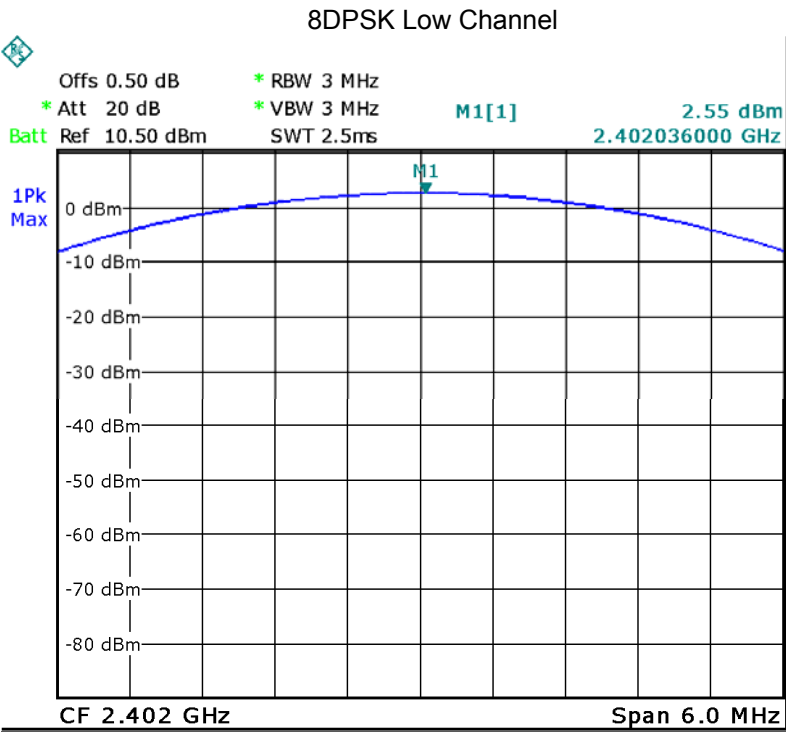
GFSK High Channel



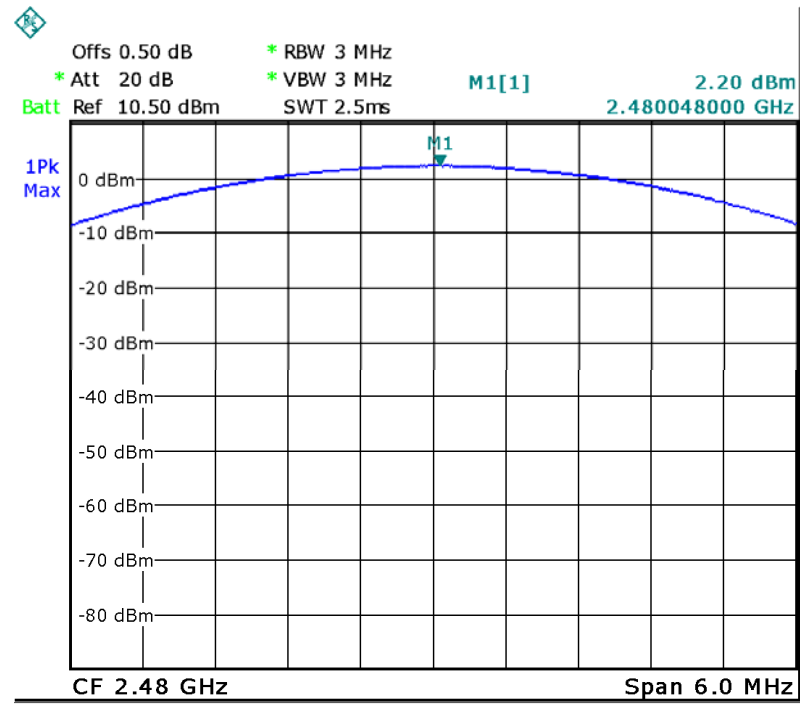
Pi/4 DQPSK Low Channel







8DPSK High Channel



## 11 Hopping Channel Separation

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | FCC CFR47 Part 15 Section 15.247                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Test Method:      | DA 00-705                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 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:        | Test in hopping transmitting operating mode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

### 11.1 Test Procedure

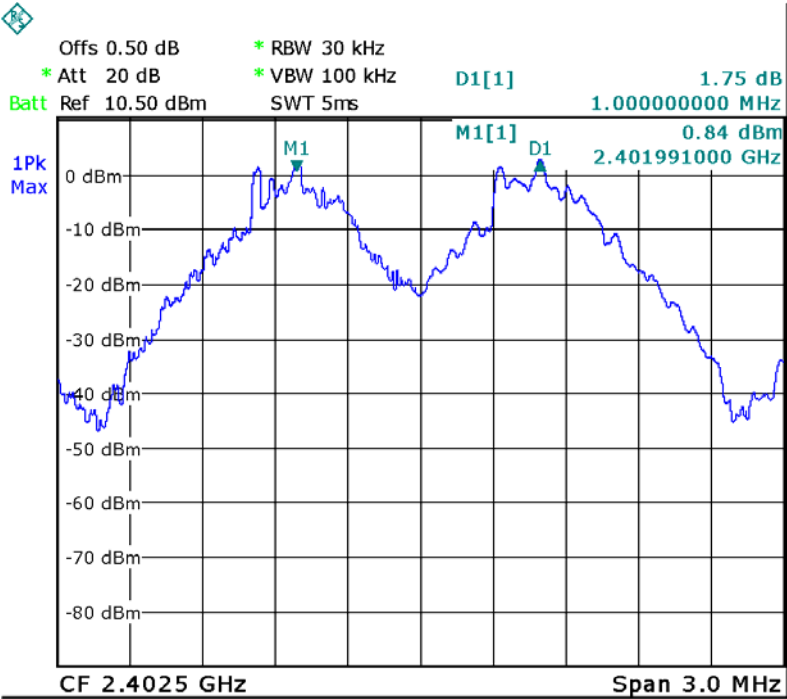
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30KHz. VBW = 100KHz , Span = 3MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

### 11.2 Test Result

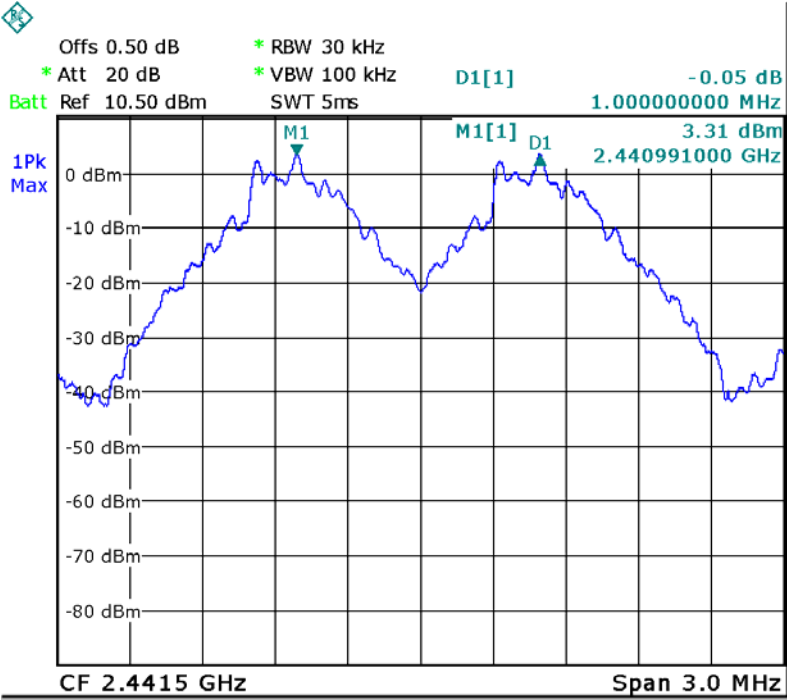
| Modulation | Test Channel | Separation (MHz) | Result |
|------------|--------------|------------------|--------|
| GFSK       | Low          | 1 MHz            | PASS   |
| GFSK       | Middle       | 1 MHz            | PASS   |
| GFSK       | High         | 1 MHz            | PASS   |
| Pi/4 DQPSK | Low          | 1 MHz            | PASS   |
| Pi/4 DQPSK | Middle       | 1 MHz            | PASS   |
| Pi/4 DQPSK | High         | 1 MHz            | PASS   |
| 8DPSK      | Low          | 1 MHz            | PASS   |
| 8DPSK      | Middle       | 1 MHz            | PASS   |
| 8DPSK      | High         | 1 MHz            | PASS   |

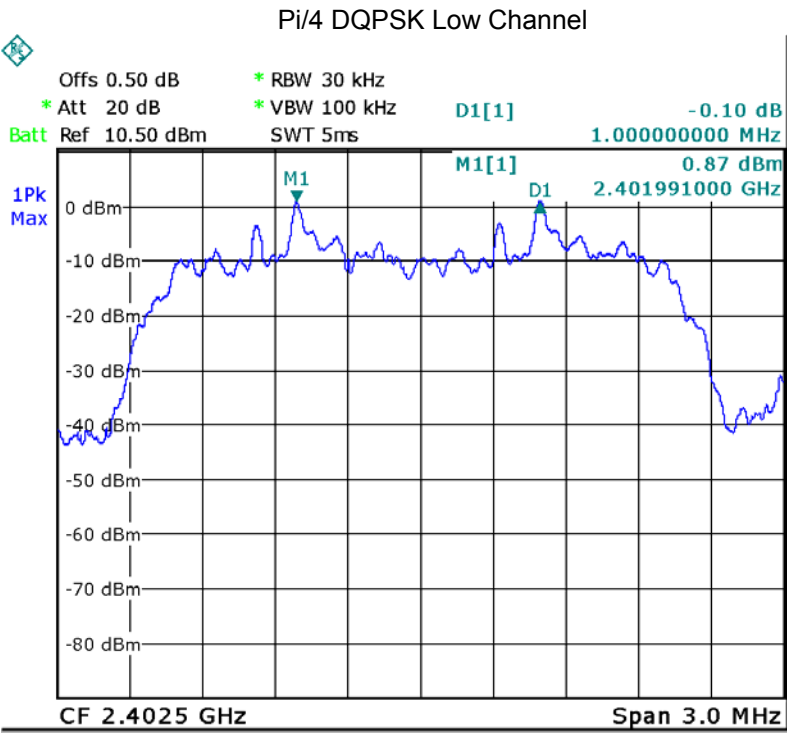
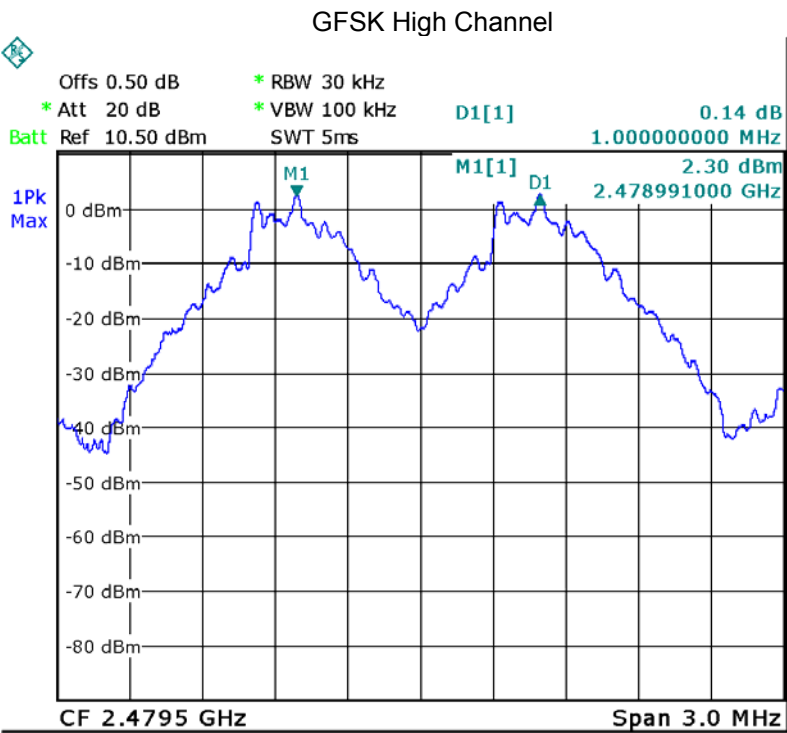
Test plots

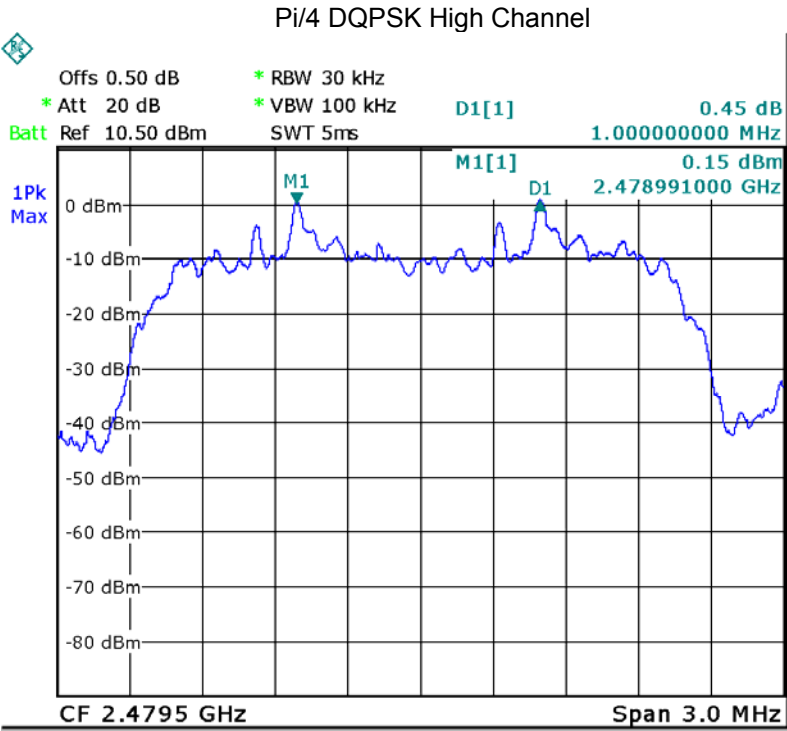
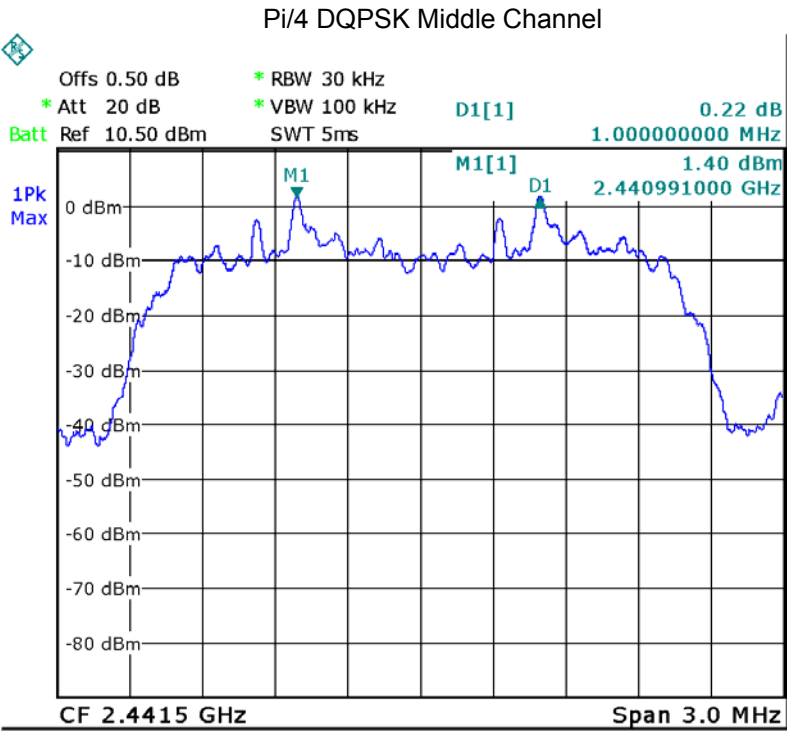
GFSK Low Channel

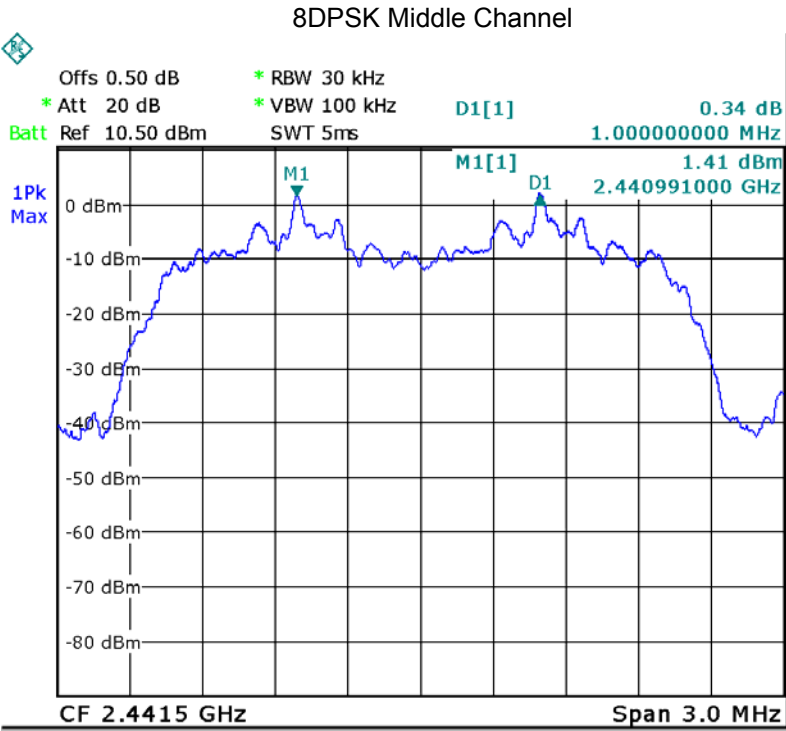
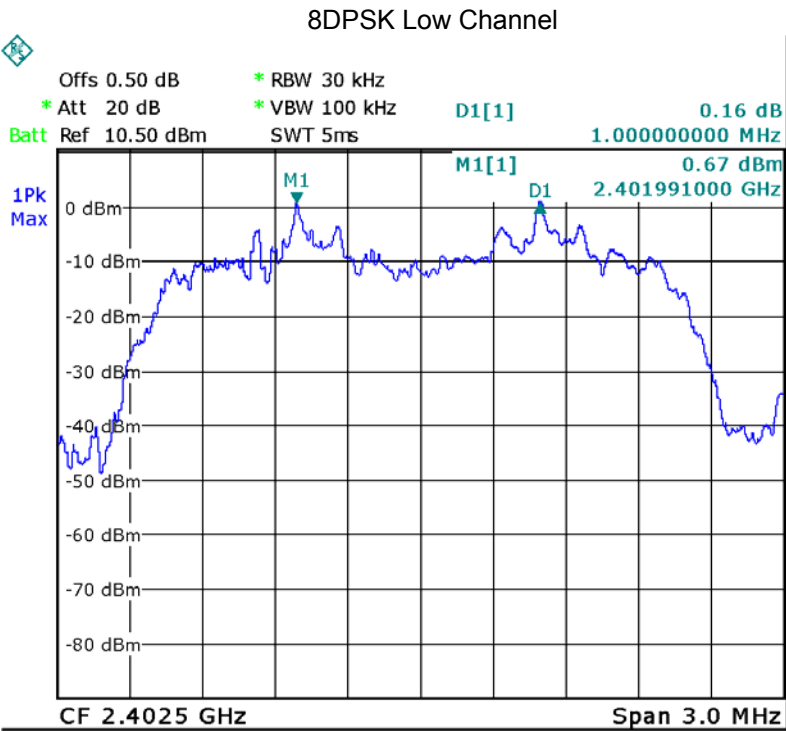


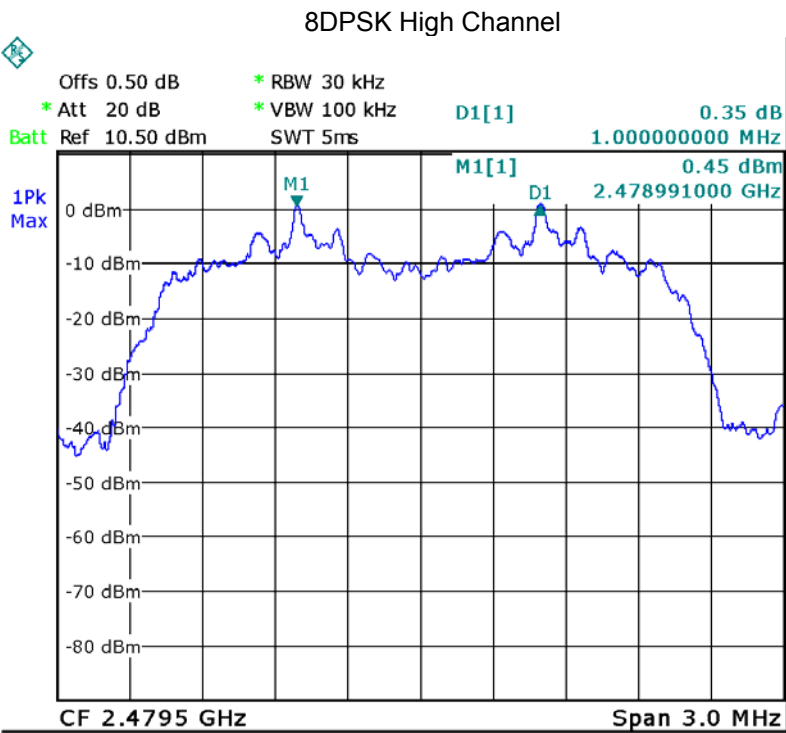
GFSK Middle Channel











## 12 Number of Hopping Frequency

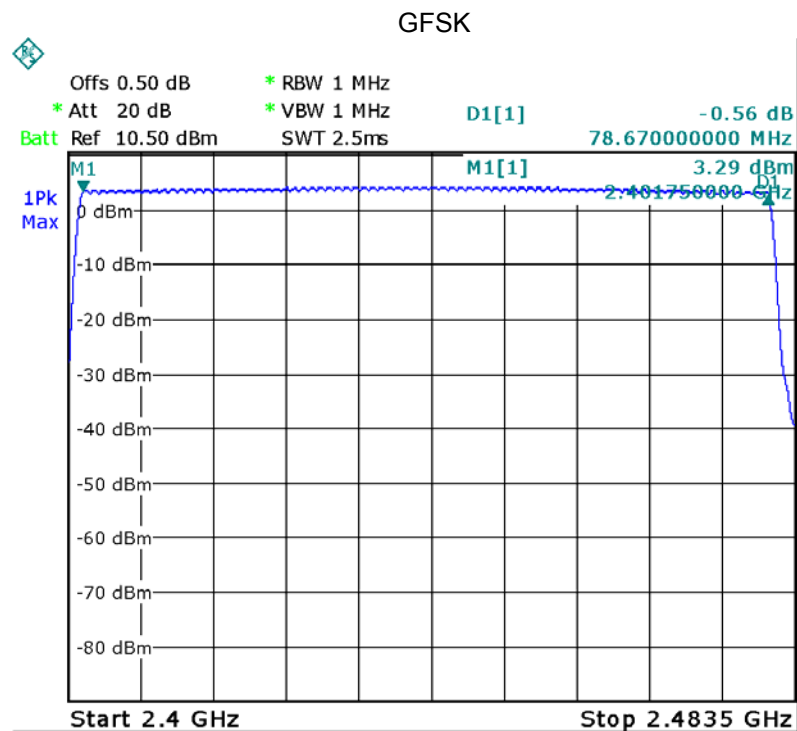
|                   |                                                                                                                     |
|-------------------|---------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | FCC CFR47 Part 15 Section 15.247                                                                                    |
| Test Method:      | DA 00-705                                                                                                           |
| 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.                                                                        |

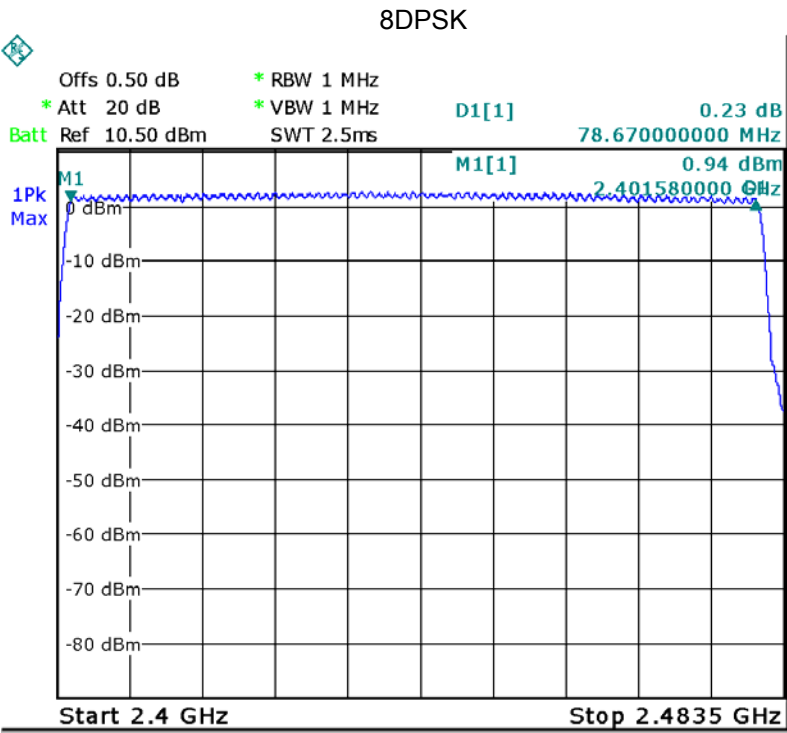
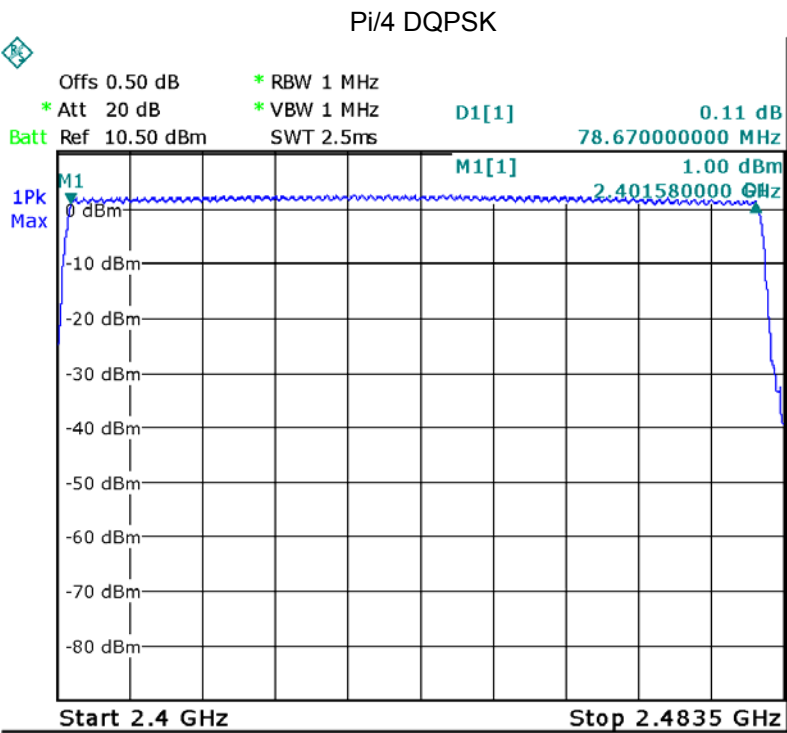
### 12.1 Test Procedure

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 = 1MHz. VBW = 1MHz. 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

Test Plots: 79 Channels in total





## 13 Dwell Time

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | FCC CFR47 Part 15 Section 15.247                                                                                                                                                                                                                                                                                                                                                                                                             |
| Test Method:      | DA 00-705                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 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.                                                                                                                                                                                                                                                                                                                                                                                                 |

### 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 = 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).

### 13.2 Test Result

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

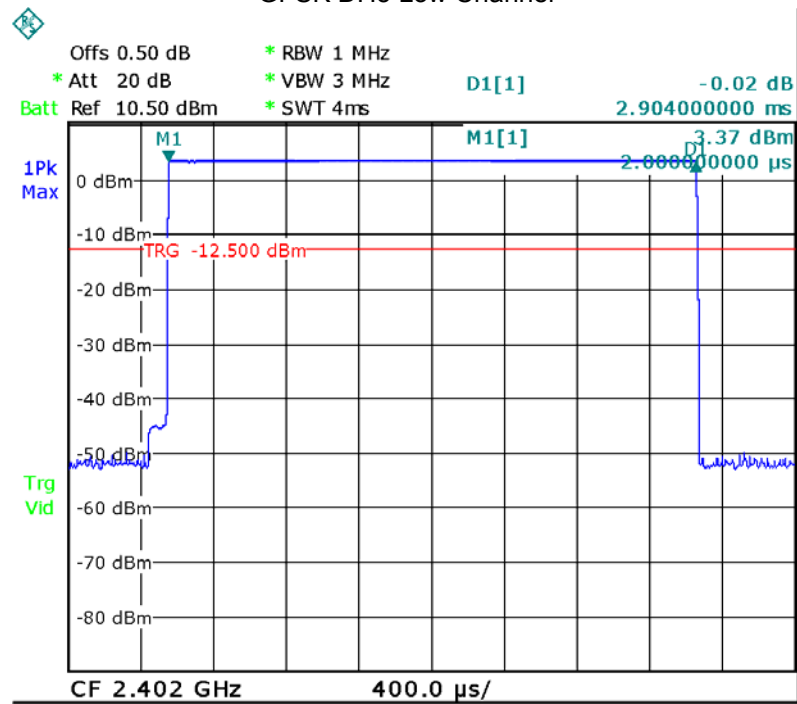
DH3 Packet permit maximum  $1600 / 79 / 4$  hops per second in each channel (3 time slots RX, 1 time slot TX).

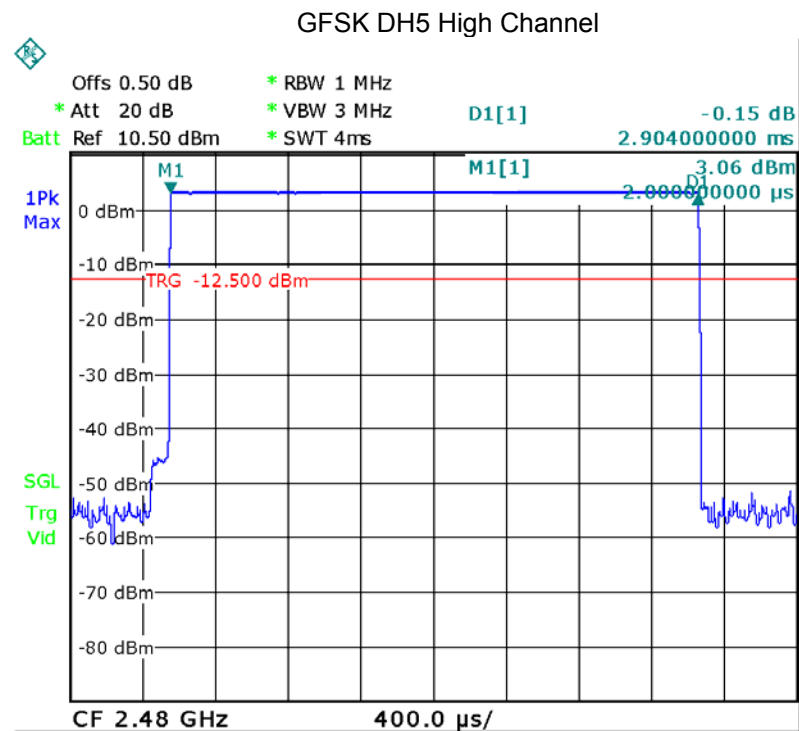
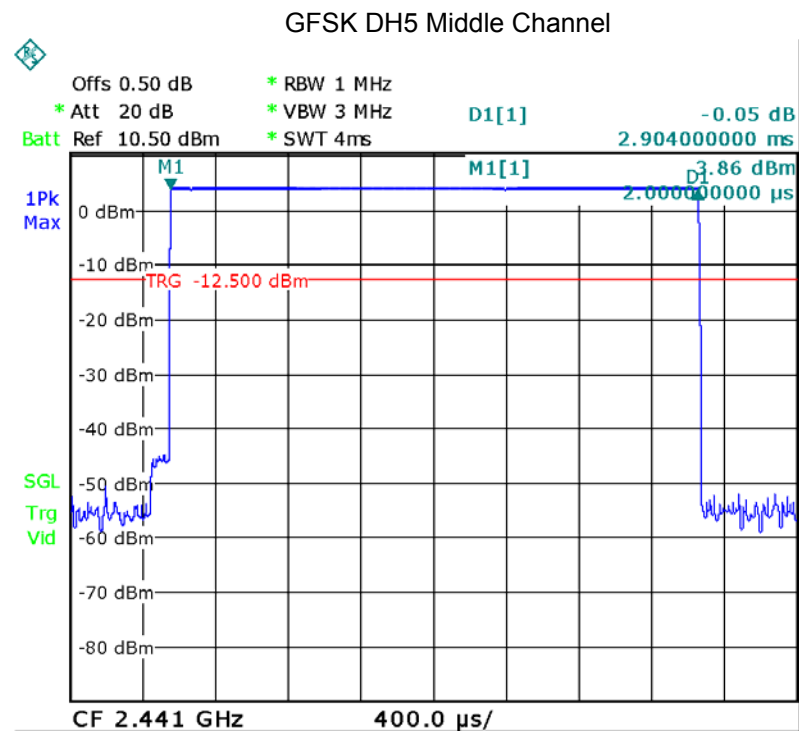
DH1 Packet permit maximum  $1600 / 79 / 2$  hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

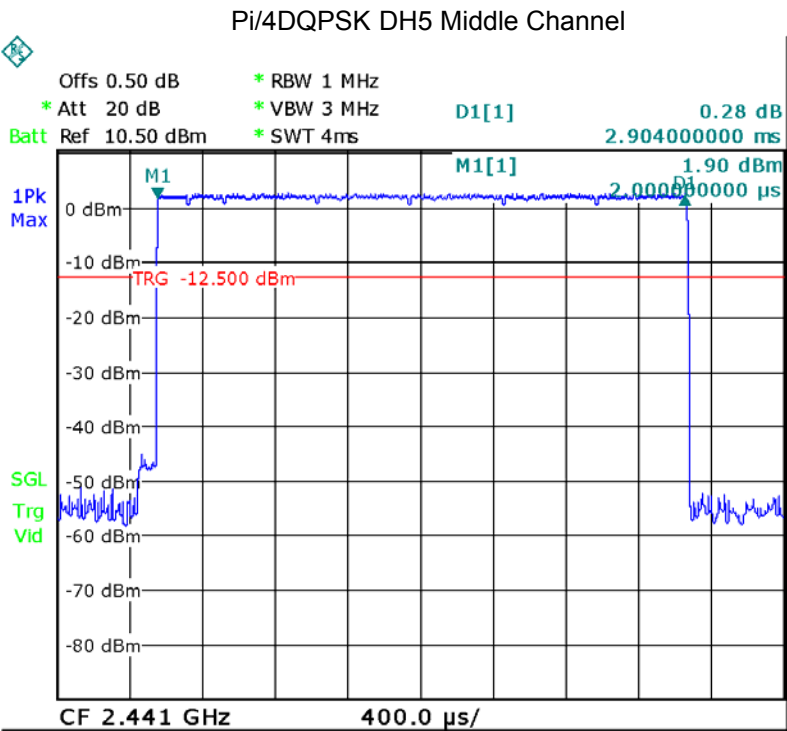
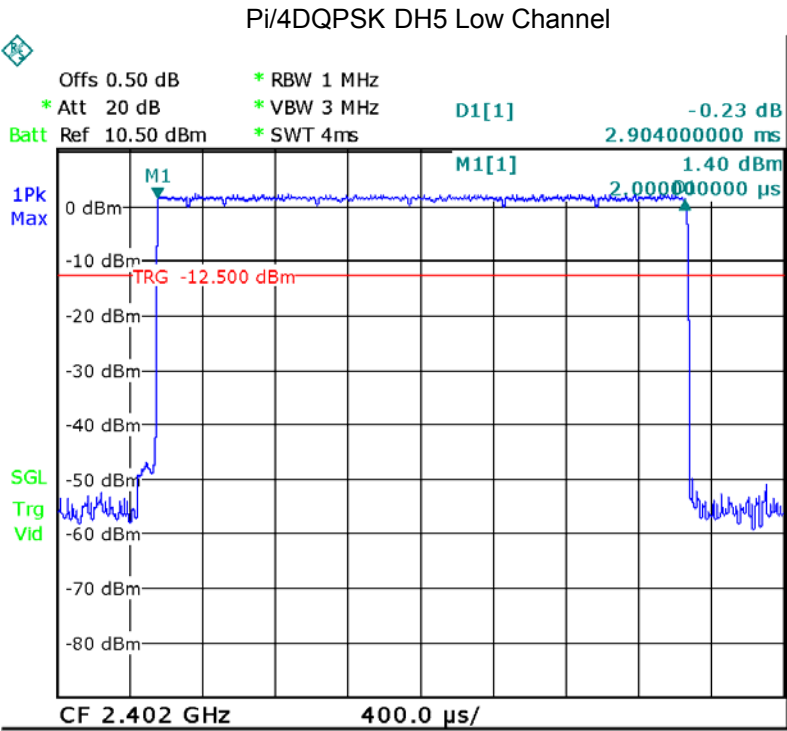
| Data Packet                                                                         | Dwell Time(s)                      |
|-------------------------------------------------------------------------------------|------------------------------------|
| DH5                                                                                 | $1600/79/6*0.4*79*(MkrDelta)/1000$ |
| 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. Only the worst data(DH5) were show as follow. |                                    |

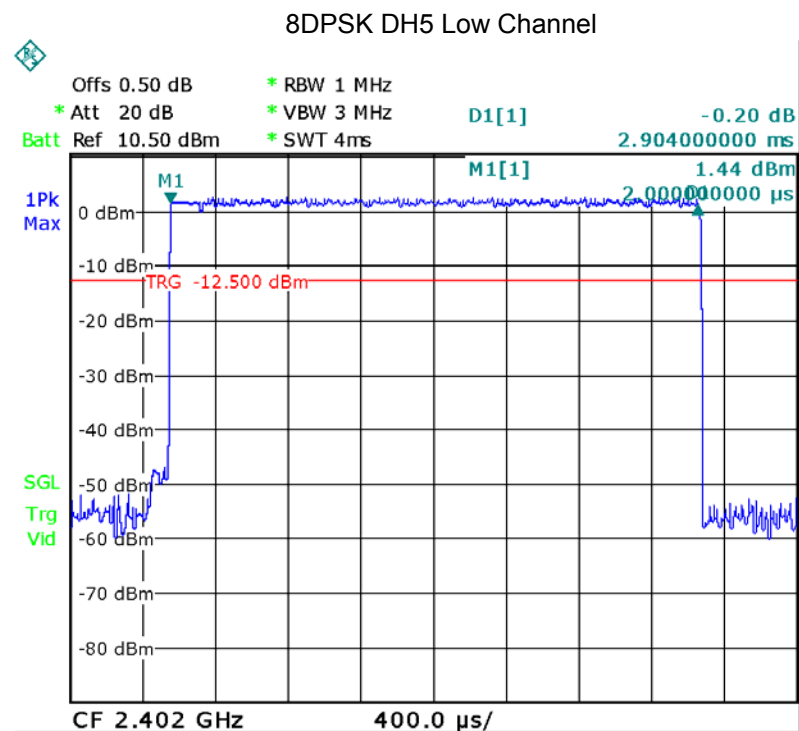
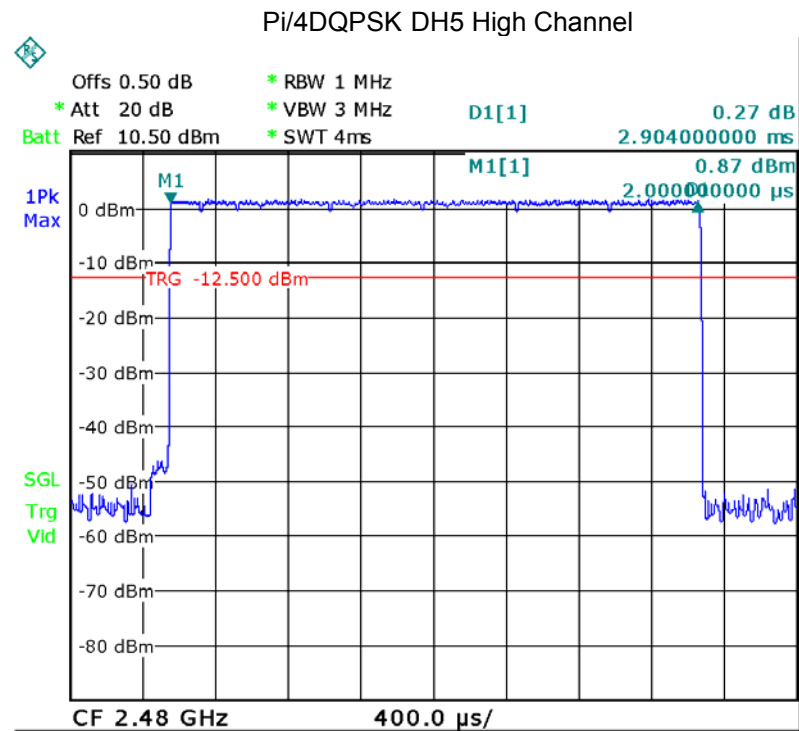
| Modulation | Data Packet | Channel | pulse time(ms) | Dwell Time(s) | Limits(s) |
|------------|-------------|---------|----------------|---------------|-----------|
| GFSK       | DH5         | Low     | 2.904          | 0.310         | 0.4       |
|            |             | middle  | 2.904          | 0.310         | 0.4       |
|            |             | High    | 2.904          | 0.310         | 0.4       |
| Pi/4DQPSK  | DH5         | Low     | 2.904          | 0.310         | 0.4       |
|            |             | middle  | 2.904          | 0.310         | 0.4       |
|            |             | High    | 2.904          | 0.310         | 0.4       |
| 8DPSK      | DH5         | Low     | 2.904          | 0.310         | 0.4       |
|            |             | middle  | 2.904          | 0.310         | 0.4       |
|            |             | High    | 2.904          | 0.310         | 0.4       |

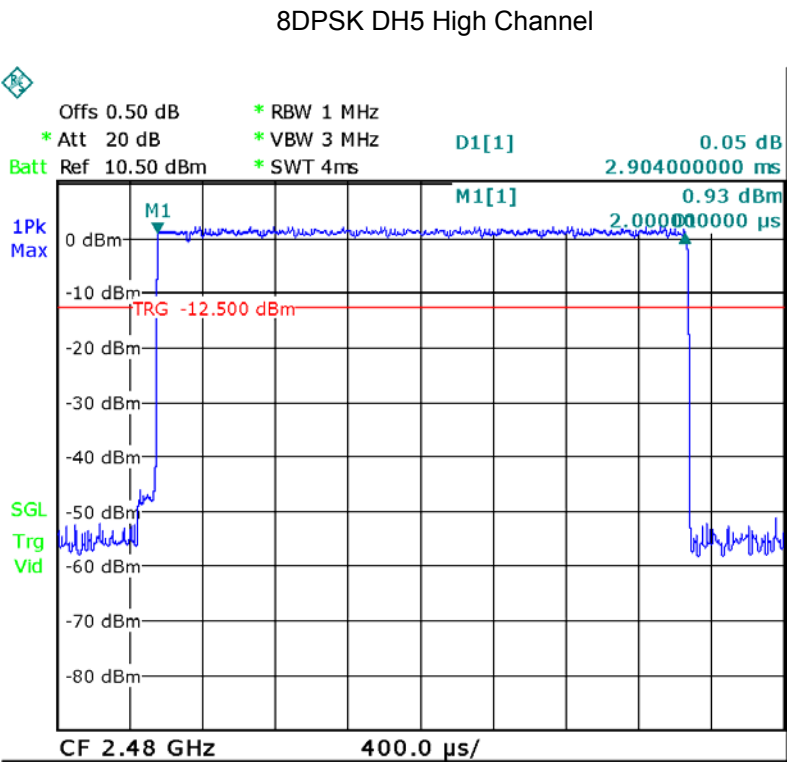
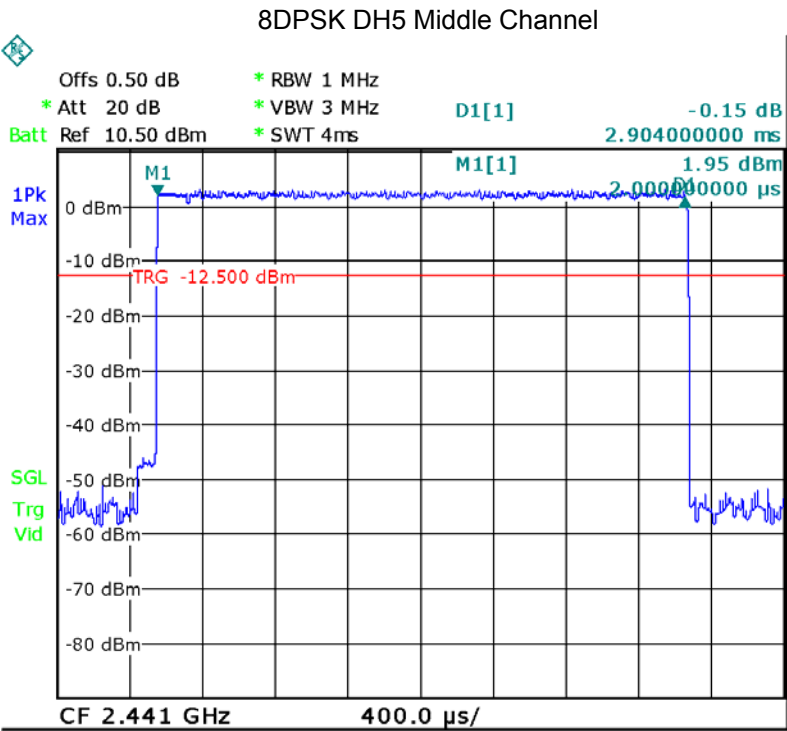
Test Plots  
GFSK DH5 Low Channel











## **14 Antenna Requirement**

According to the FCC Part 15 Paragraph 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. This product has a PCB printed antenna, fulfil the requirement of this section.

## 15 RF Exposure

Test Requirement: FCC Part 1.1307

Evaluation Method: FCC Part 2.1091

### 15.1 Requirements

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

### 15.2 The procedures / limit

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

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

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

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

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

### 15.3 MPE Calculation Method

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

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

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

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

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

The formula can be changed to

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

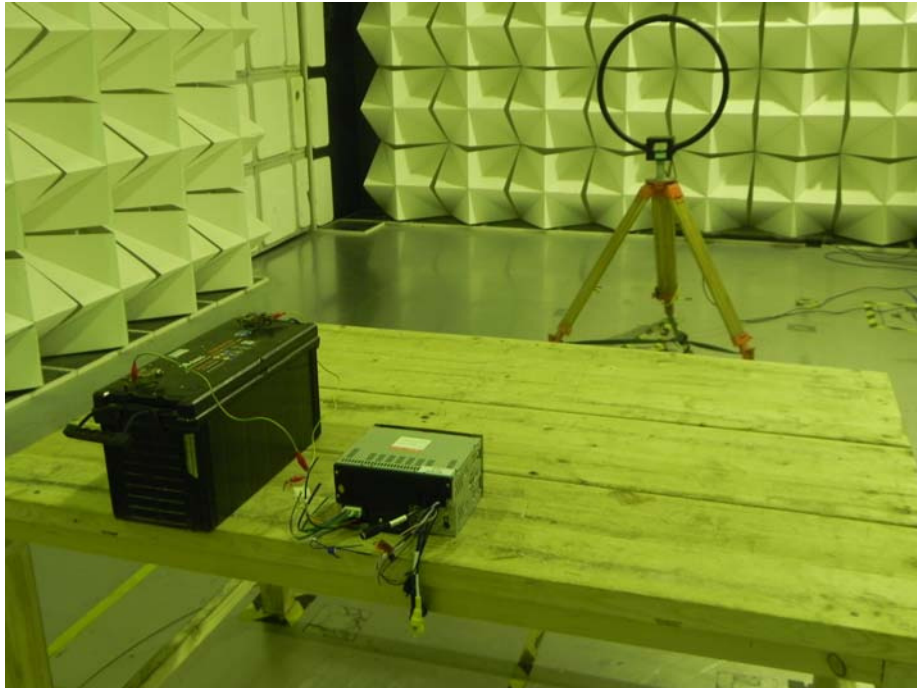
From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

| Antenna Gain (dBm) | Antenna Gain (numeric) | Max. Peak Output Power (dBm) | Peak Output Power (mW) | Power Density (mW/cm <sup>2</sup> ) | Limit of Power Density (mW/cm <sup>2</sup> ) |
|--------------------|------------------------|------------------------------|------------------------|-------------------------------------|----------------------------------------------|
| 0                  | 1.0                    | 4.01                         | 2.52                   | 0.000050                            | 1                                            |

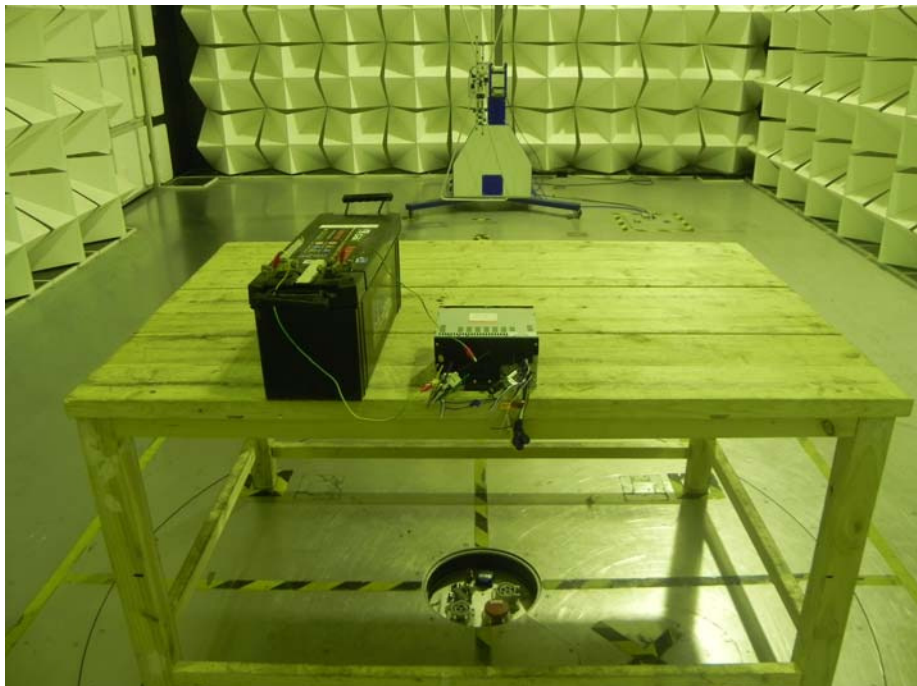
## 16 Photographs – Model NA1610 Test Setup

### 16.1 Photograph – Radiation Spurious Emission Test Setup

Below 30MHz at Test Site 2#



30MHz-1GHz at Test Site 2#

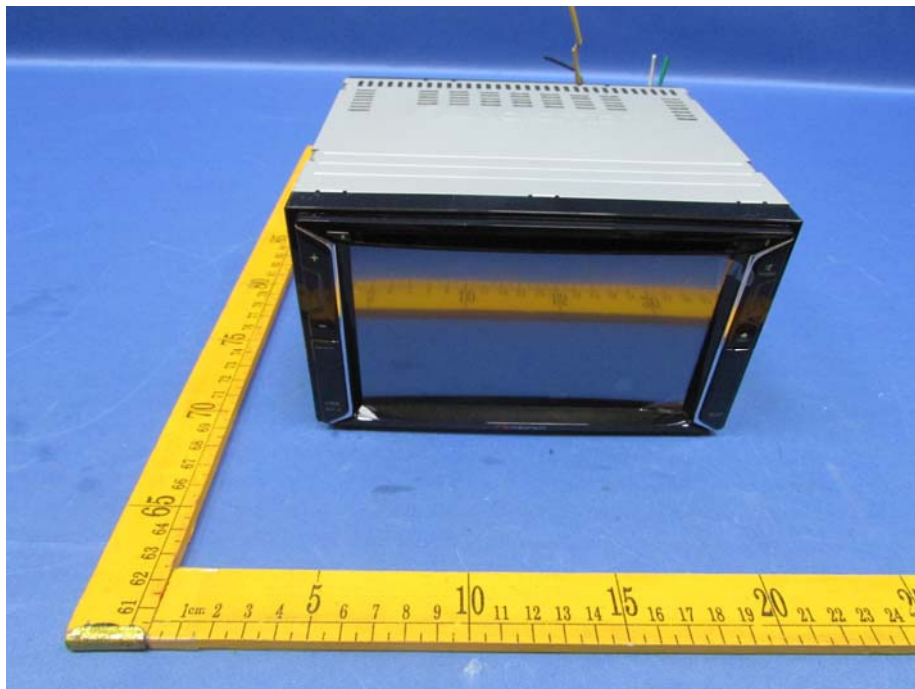


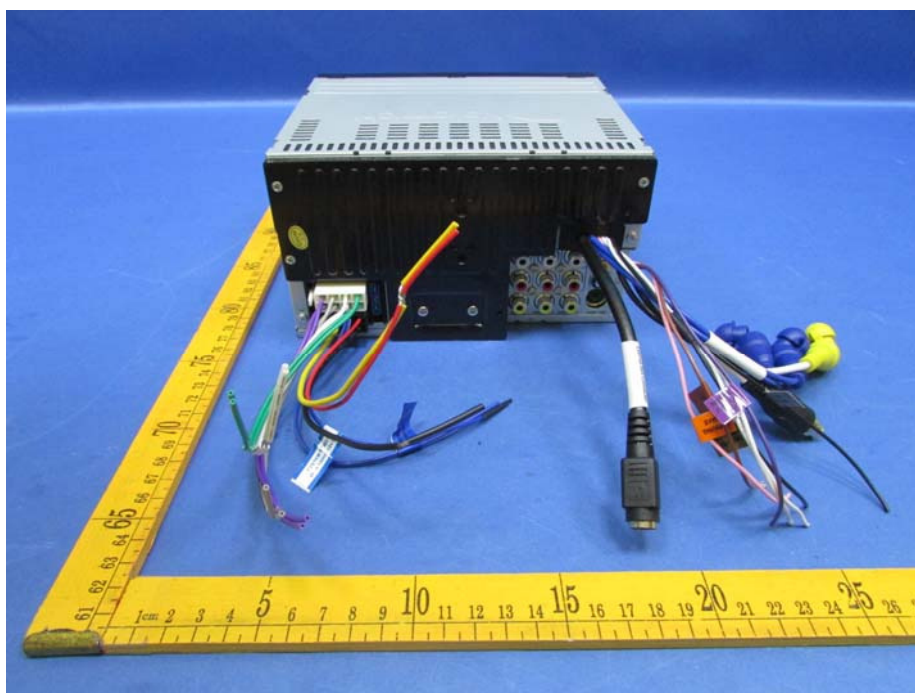
Above 1GHz at Test Site 1#



## 17 Photographs - Constructional Details

### 17.1 Model NA1610 -External Photos

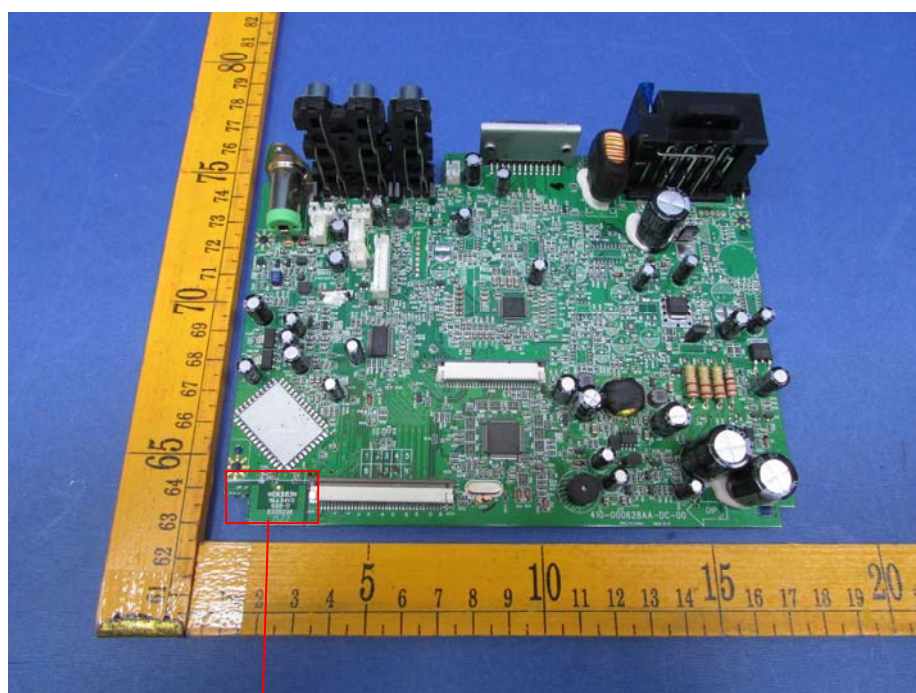




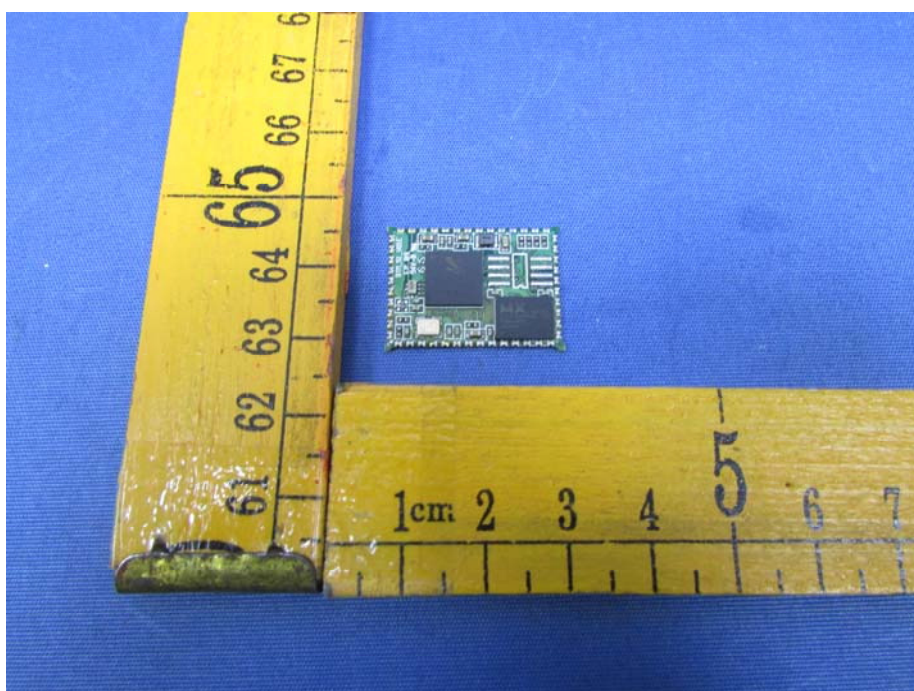


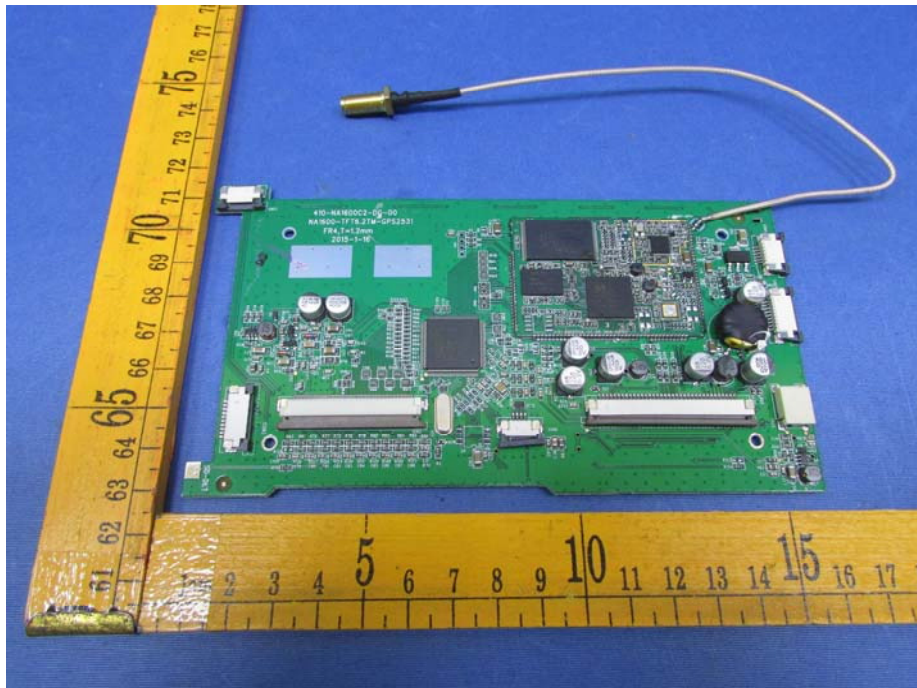
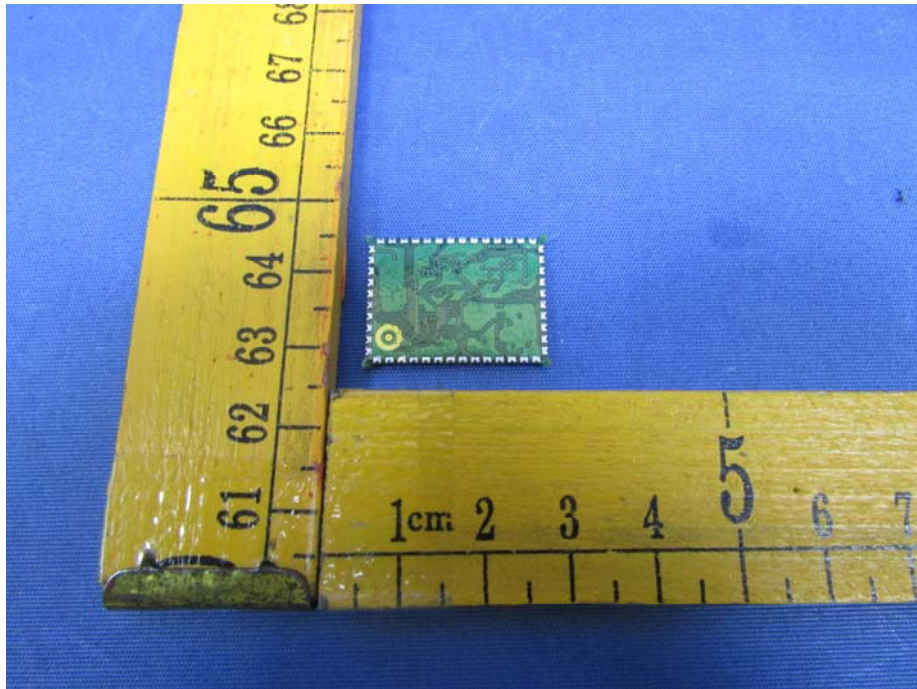
## 17.2 Model NA1610-Internal Photos

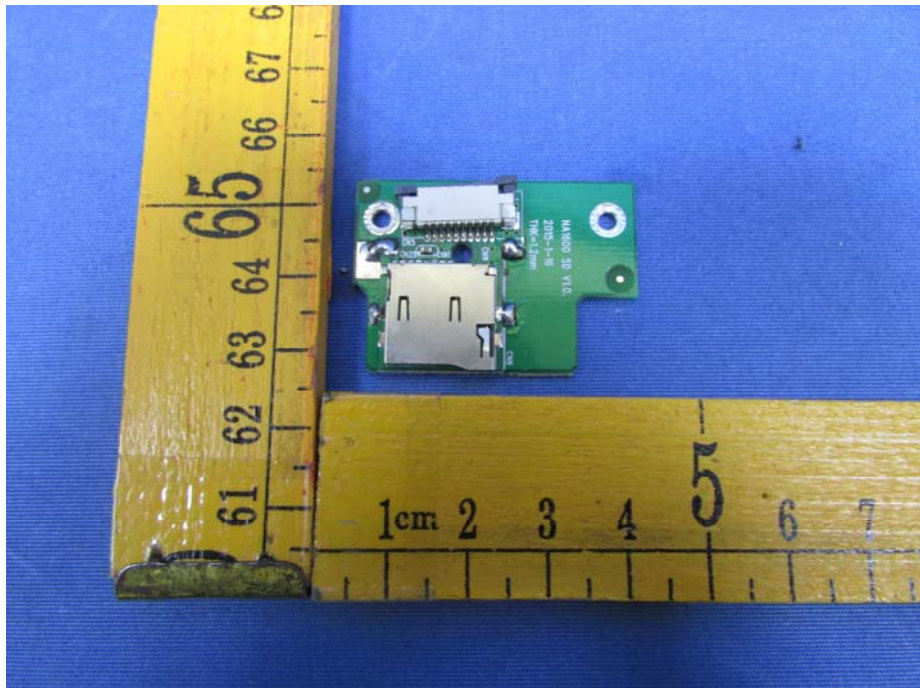
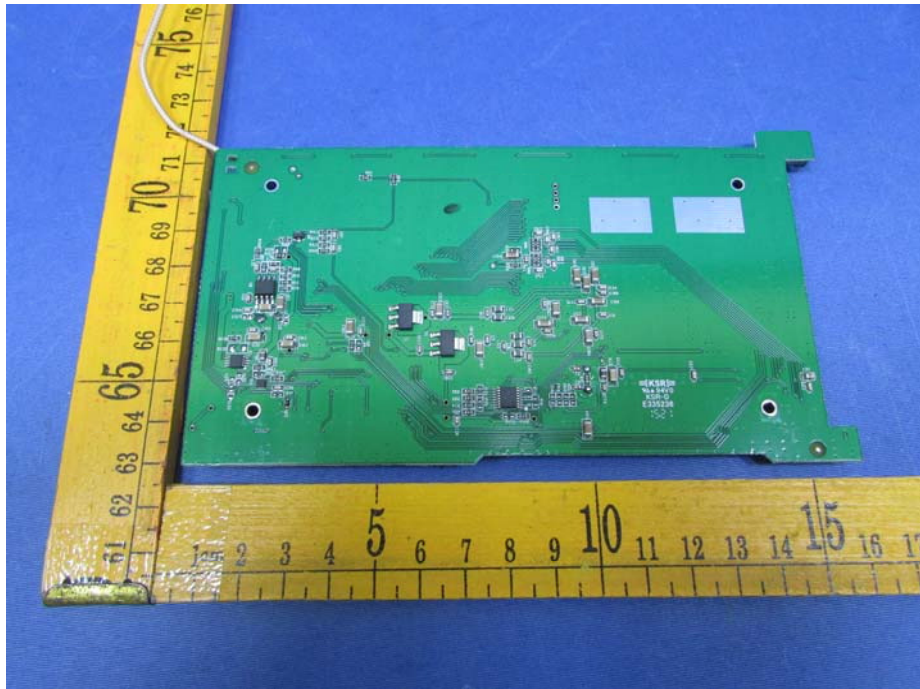


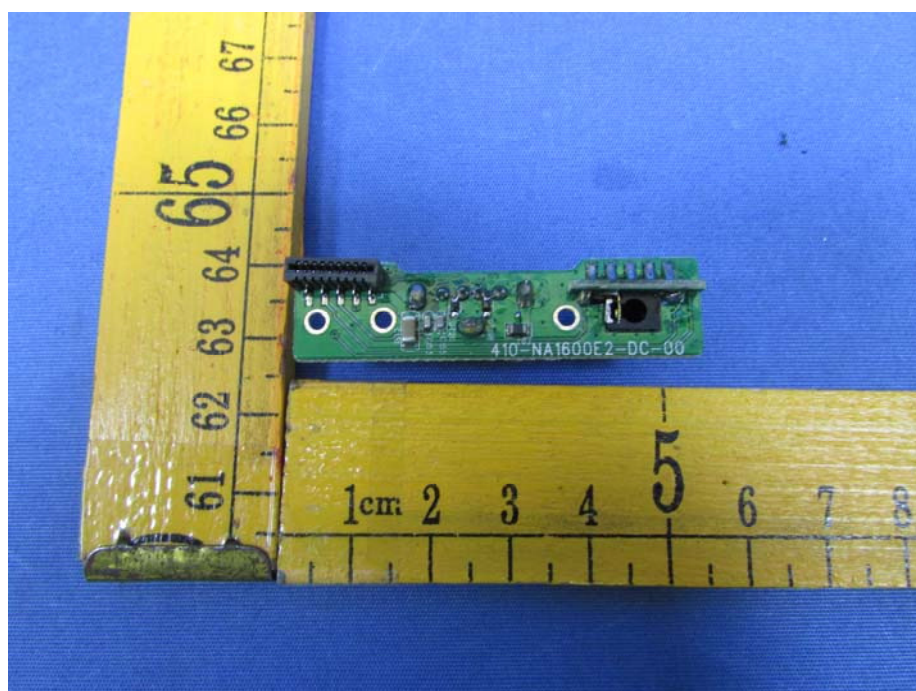
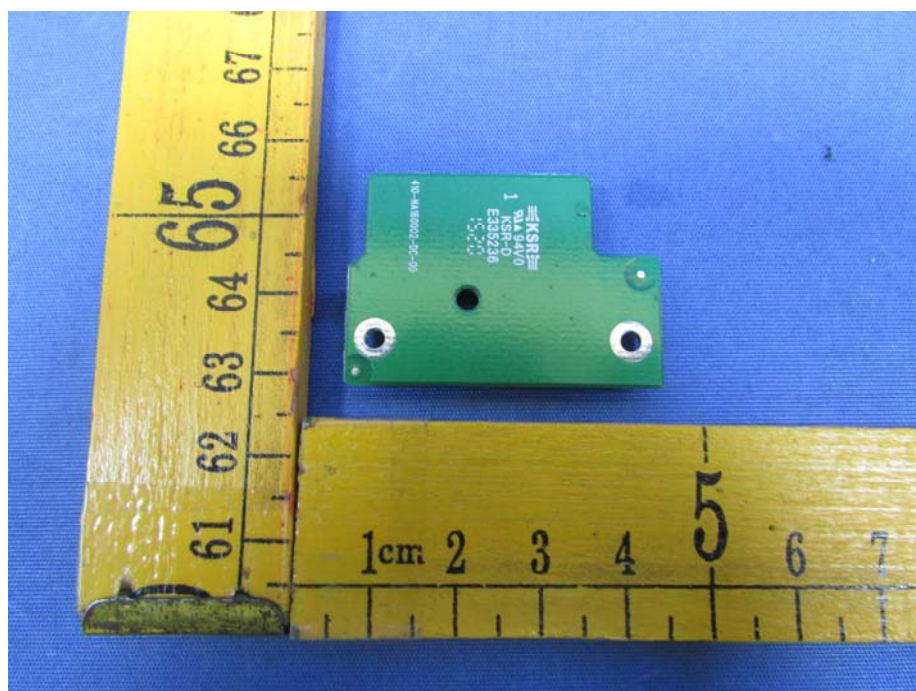


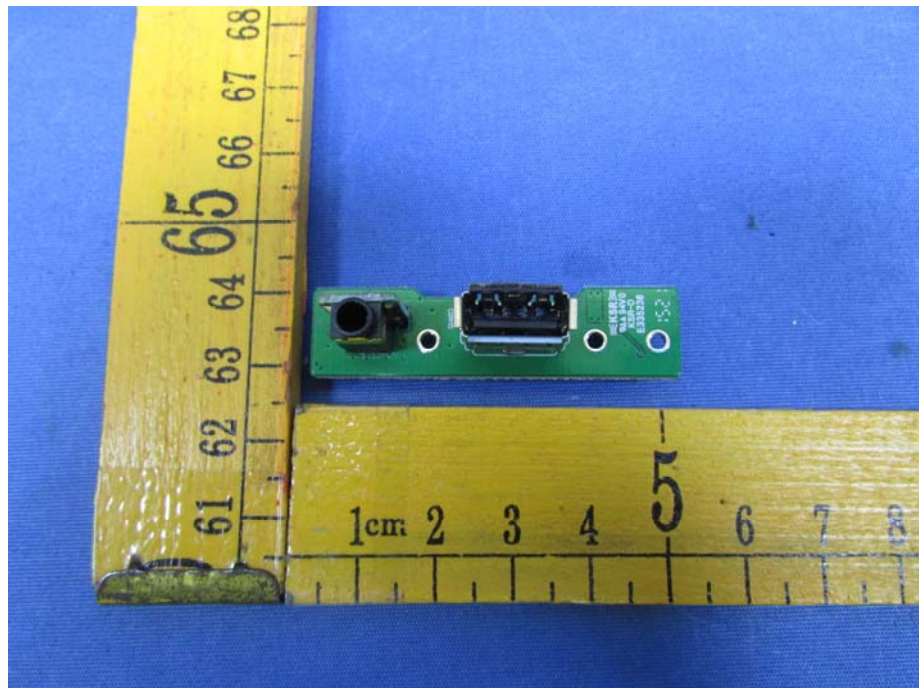
BT ANT.

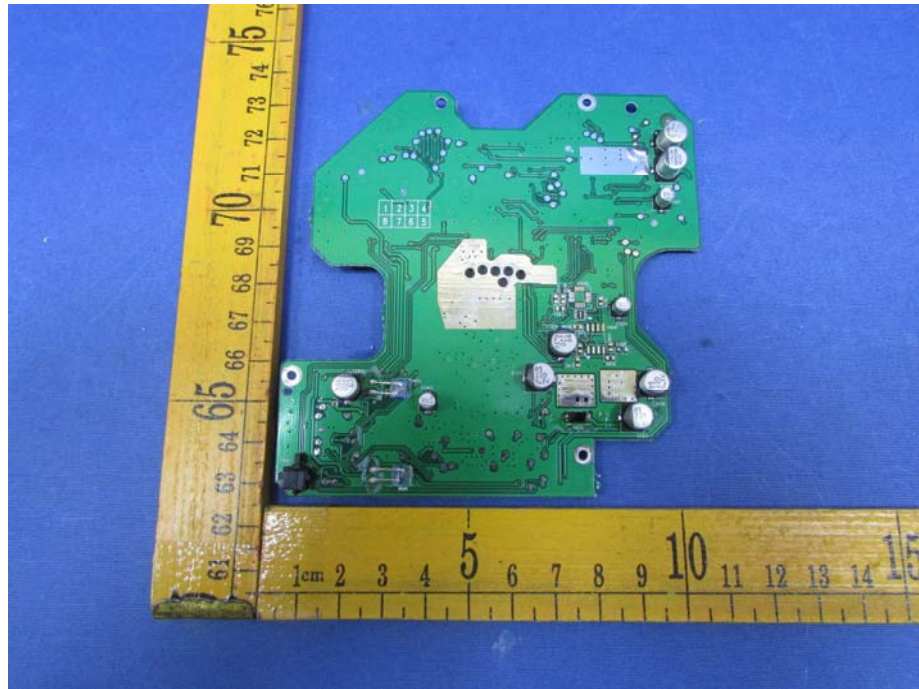












===== End of Report =====