# FCC TEST REPORT
# FCC ID: OIHS711

| | | |
|---|---|---|
| Product | : | Banner |
| Model Name | : | S711 |
| Brand | : | gsedo INDENA 英迪耐 indera 英迪耐 余音 , |
| Report No. | : | PT151104004E-FC01 |

## Prepared for

Shenzhen Leader-Union Technology Co., Ltd

3F, No. 90, Alley 5, Hekan Village, Ban Tian, LongGang District,

Shenzhen City, China

## Prepared by

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## TEST RESULT CERTIFICATION

| | | |
|---|---|---|
| Applicant's name | : | Shenzhen Leader-Union Technology Co., Ltd |
| Address | : | 3F, No. 90, Alley 5, Hekan Village, Ban Tian, LongGang District, Shenzhen City, China |
| Manufacture's name | : | Shenzhen Leader-Union Technology Co., Ltd |
| Address | : | 3F, No. 90, Alley 5, Hekan Village, Ban Tian, LongGang District, Shenzhen City, China |
| Product name | : | Banner |
| Model name | : | S711 |
| Standards | : | FCC CFR47 Part 15 Section 15.247 |
| Test procedure | : | ANSI C63.10:2013,DA 00-705 |
| Test Date | : | Mar.2, 2016 - Mar.18, 2016 |
| Date of Issue | : | Mar. 18, 2016 |
| Test Result | : | Pass |

This device described above has been tested by PTS, 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.

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# 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 |

Remark:

N/A: Not Applicable

# 3 General Information

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

Product Name : Banner

Model Name : S711

Bluetooth Version: : V2.1+EDR

Frequency Range: : 2402-2480MHz, 79Channels

Antenna installation: : PCB Printed Antenna

Antenna Gain: : 0dBi

Type of Modulation : GFSK, Pi/4DQPSK, 8DPSK

The lowest oscillator: : 32.768kHz

Power supply : DC 7.4V Power by battery, DC 5V charging by USB port

## 3.2 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 | - | - |

## 3.3 Test Mode

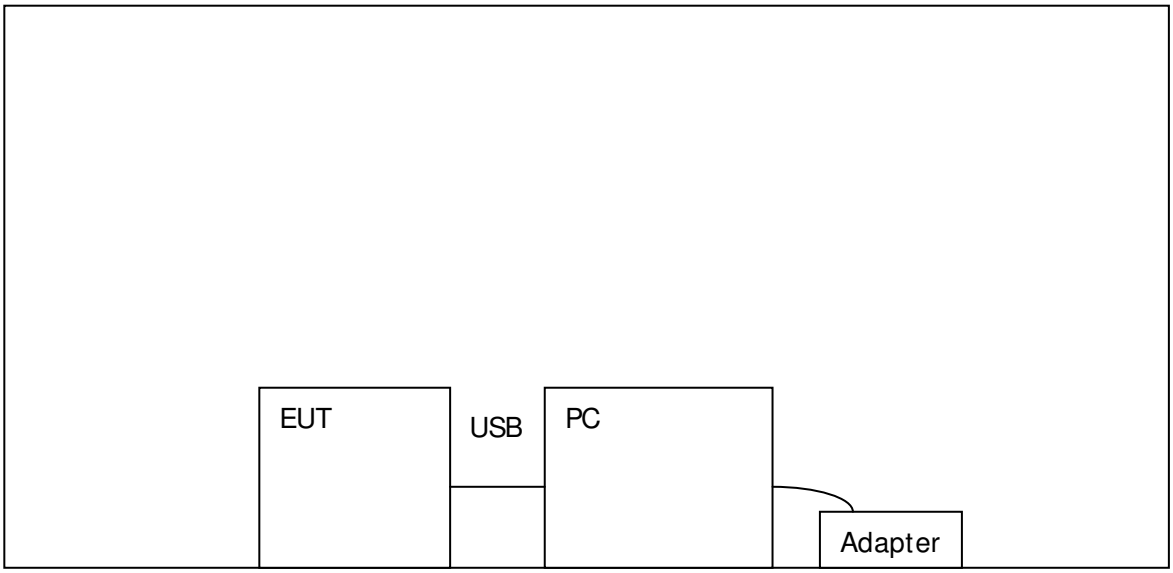
All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

| Modulation | Test mode | Low channel | Middle channel | High channel |
|---|---|---|---|---|
| GFSK | Transmitting | 2402MHz | 2441MHz | 2480MHz |
| Pi/4DQPSK | Transmitting | 2402MHz | 2441MHz | 2480MHz |
| 8DPSK | Transmitting | 2402MHz | 2441MHz | 2480MHz |
| Tests Carried Out Under FCC part 15.207 | | | | |
| Test Item | | Test Mode | | |
| Conduction Emission, 0.15MHz to | | BT Communication | | |

## 3.4 Test Voltage

| Normal Test Voltage | Item |
|---|---|
| 120V 60Hz | Conducted Emission & Radiated Emission |
| 240V 60Hz | Conducted Emission & Radiated Emission |
| Remark: Only the worst case (120V 60Hz) was recorded in the report. | |

## 3.5 Configuration of System



# 4 Equipment During Test

## 4.1 Equipments List

| RF Conducted Test | | | | | | | |
|---|---|---|---|---|---|---|---|
| Item | Kind of Equipment | Manufacturer | Type No. | Serial No. | Last calibration | Calibrated until | Calibration period |
| 1 | EMC Analyzer (9k~26.5GHz) | Agilent | E4407B | MY45109572 | Aug.04, 2015 | Aug.03, 2016 | 1 year |
| 2 | EXA Signal Analyzer | Keysight | N9010A | MY50520207 526B25MPB W7X | Aug.04, 2015 | Aug.03, 2016 | 1 year |
| 3 | EMI Test Receiver | R&S | ESCI | 101155 | July 15, 2015 | July 14, 2016 | 1 year |
| Radiated Emissions | | | | | | | |
| Item | Kind of Equipment | Manufacturer | Type No. | Serial No. | Last calibration | Calibrated until | Calibration period |
| 1 | EMI Test Receiver | Rohde&Schwarz | ESCI | 101417 | July 15, 2015 | July 14, 2016 | 1 year |
| 2 | Trilog Broadband Antenna | SCHWARZBECK | VULB9160 | 9160-3355 | July 15, 2015 | July 14, 2016 | 1 year |
| 3 | Amplifier | EM | EM-30180 | 060538 | July 15, 2015 | July 14, 2016 | 1 year |
| 4 | Horn Antenna | SCHWARZBECK | BBHA9120 D | 9120D-1246 | July 15, 2015 | July 14, 2016 | 1 year |
| Conducted Emissions | | | | | | | |
| Item | Kind of Equipment | Manufacturer | Type No. | Serial No. | Last calibration | Calibrated until | Calibration period |
| 1 | EMI Test Receiver | R&S | ESCI | 101155 | July 15, 2015 | July 14, 2016 | 1 year |
| 2 | LISN | SCHWARZBECK | NSLK 8128 | 8128-289 | July 15, 2015 | July 14, 2016 | 1 year |
| 3 | Cable | LARGE | RF300 | - | July 15, 2015 | July 14, 2016 | 1 year |

## 4.2 Description of Support Units

| Equipment | Manufacturer | Model No. | Series No. |
|---|---|---|---|
| Note Book | Sony | PCG-51111T | X16-96081 |
| AC Adapter | Sony | NSW24063 | SNPA-1900-11SY |
| AC power line(1.0m) | Cold come | JYD-20 | C-2201 |

## 4.3 Measurement Uncertainty

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

# 5 Conducted Emission

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

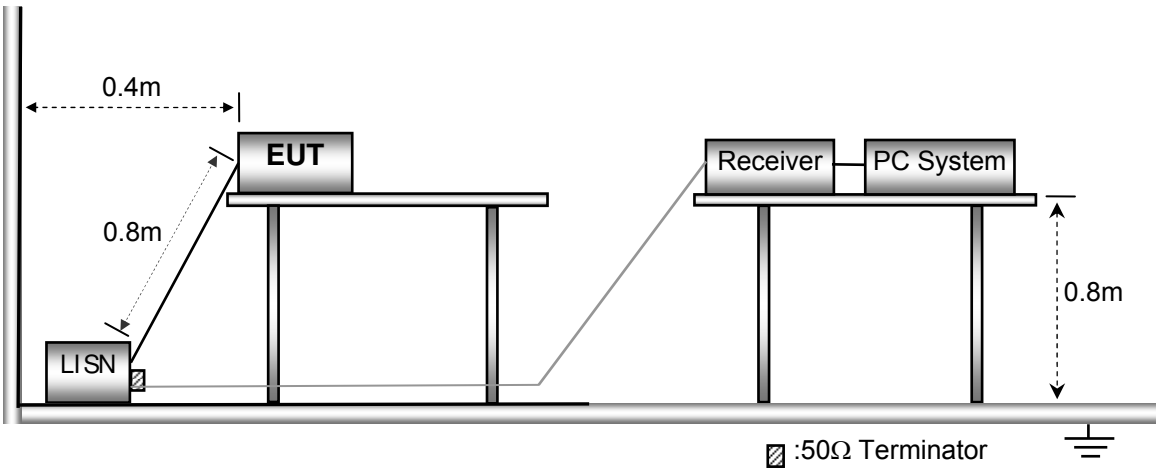
## 5.1 E.U.T. Operation

Operating Environment **:**

| | | |
|---|---|---|
| Temperature: | : | 25.5 °C |
| Humidity: | : | 51 % RH |
| Atmospheric Pressure: | : | 101.2kPa |
| EUT Operation **:** | : | Refer to section 3.3 |

## 5.2 EUT Setup

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

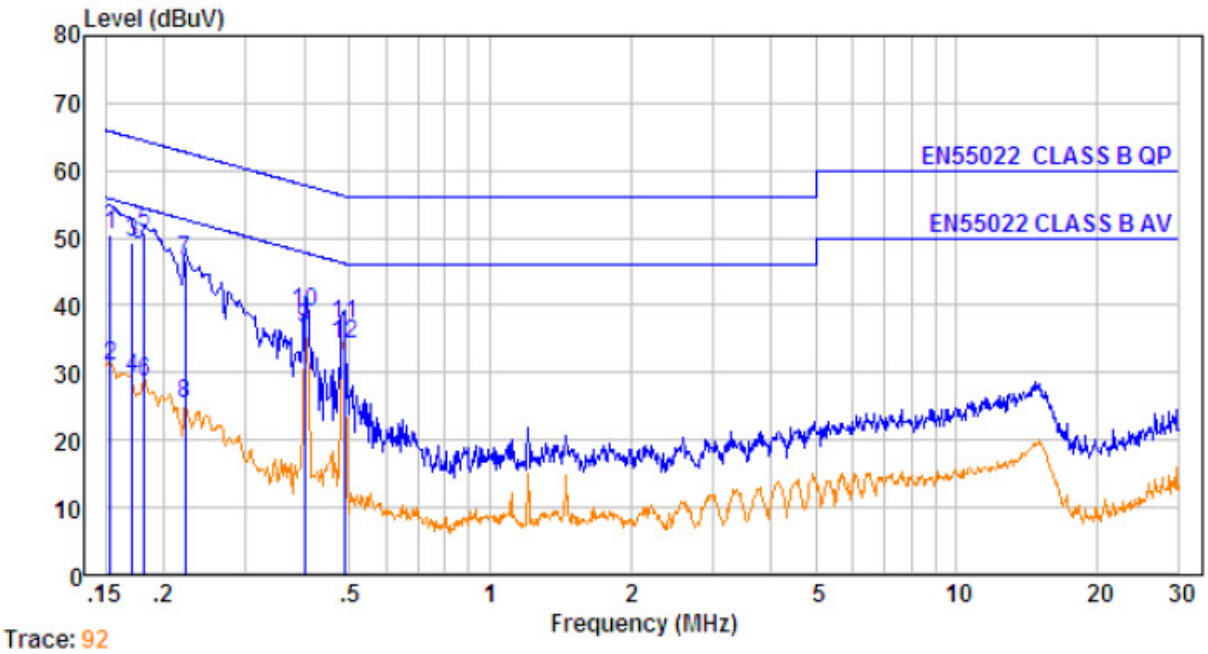


## 5.3 Measurement Description

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.

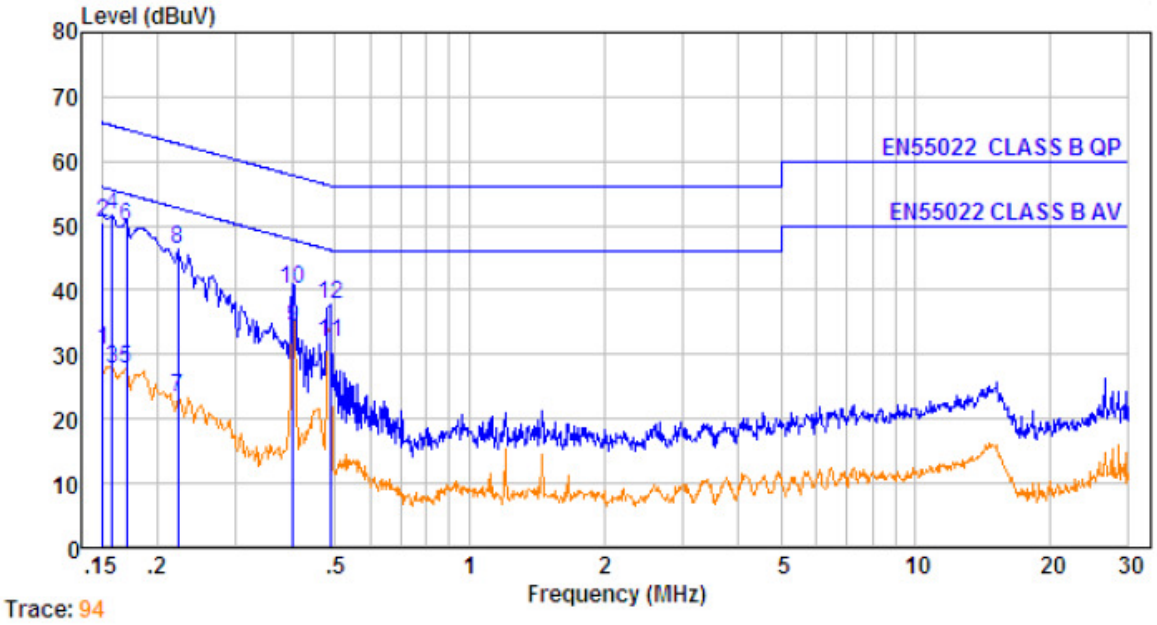
## 5.4 Conducted Emission Test Result

Live line:




| No. | Freq MHz | Cable Loss dB | AMN Factor dB | Receiver Reading dBuV | Emission Level dBuV | Limit dBuV | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 1. | 0.153 | 10.60 | 0.60 | 39.40 | 50.60 | 55.82 | -5.22 | Average |
| 2. | 0.153 | 10.60 | 0.60 | 19.90 | 31.10 | 65.82 | -34.72 | QP |
| 3. | 0.171 | 10.60 | 0.60 | 38.00 | 49.20 | 54.90 | -5.70 | Average |
| 4. | 0.171 | 10.60 | 0.60 | 18.00 | 29.20 | 64.90 | -35.70 | QP |
| 5. | 0.182 | 10.61 | 0.60 | 39.55 | 50.76 | 54.42 | -3.66 | Average |
| 6. | 0.182 | 10.61 | 0.60 | 17.55 | 28.76 | 64.42 | -35.66 | QP |
| 7. | 0.222 | 10.61 | 0.60 | 35.29 | 46.50 | 52.74 | -6.24 | Average |
| 8. | 0.222 | 10.61 | 0.60 | 14.29 | 25.50 | 62.74 | -37.24 | QP |
| 9. | 0.401 | 10.64 | 0.60 | 25.50 | 36.74 | 47.83 | -11.09 | Average |
| 10. | 0.401 | 10.64 | 0.60 | 27.70 | 38.94 | 57.83 | -18.89 | QP |
| 11. | 0.486 | 10.64 | 0.60 | 25.90 | 37.14 | 46.23 | -9.09 | Average |
| 12. | 0.486 | 10.64 | 0.60 | 22.90 | 34.14 | 56.23 | -22.09 | QP |

Neutral line:




| No. | Freq MHz | Cable Loss dB | AMN Factor dB | Receiver Reading dBuV | Emission Level dBuV | Limit dBuV | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 1. | 0.151 | 10.60 | 0.60 | 19.60 | 30.80 | 55.96 | -25.16 | Average |
| 2. | 0.151 | 10.60 | 0.60 | 39.20 | 50.40 | 65.96 | -15.56 | QP |
| 3. | 0.158 | 10.60 | 0.60 | 16.57 | 27.77 | 55.56 | -27.79 | Average |
| 4. | 0.158 | 10.60 | 0.60 | 40.57 | 51.77 | 65.56 | -13.79 | QP |
| 5. | 0.170 | 10.60 | 0.60 | 16.70 | 27.90 | 54.94 | -27.04 | Average |
| 6. | 0.170 | 10.60 | 0.60 | 38.70 | 49.90 | 64.94 | -15.04 | QP |
| 7. | 0.222 | 10.61 | 0.60 | 12.02 | 23.23 | 52.74 | -29.51 | Average |
| 8. | 0.222 | 10.61 | 0.60 | 35.02 | 46.23 | 62.74 | -16.51 | QP |
| 9. | 0.402 | 10.64 | 0.60 | 22.87 | 34.11 | 47.81 | -13.70 | Average |
| 10. | 0.402 | 10.64 | 0.60 | 28.87 | 40.11 | 57.81 | -17.70 | QP |
| 11. | 0.486 | 10.64 | 0.60 | 20.69 | 31.93 | 46.23 | -14.30 | Average |
| 12. | 0.486 | 10.64 | 0.60 | 26.69 | 37.93 | 56.23 | -18.30 | QP |

# 6 Radiated Spurious Emissions

Test Requirement: : FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: : ANSI C63.10:2013,DA 00-705

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

## 6.1 EUT Operation

Operating Environment :

Temperature: : 23.5 °C

Humidity: : 51.1 % RH

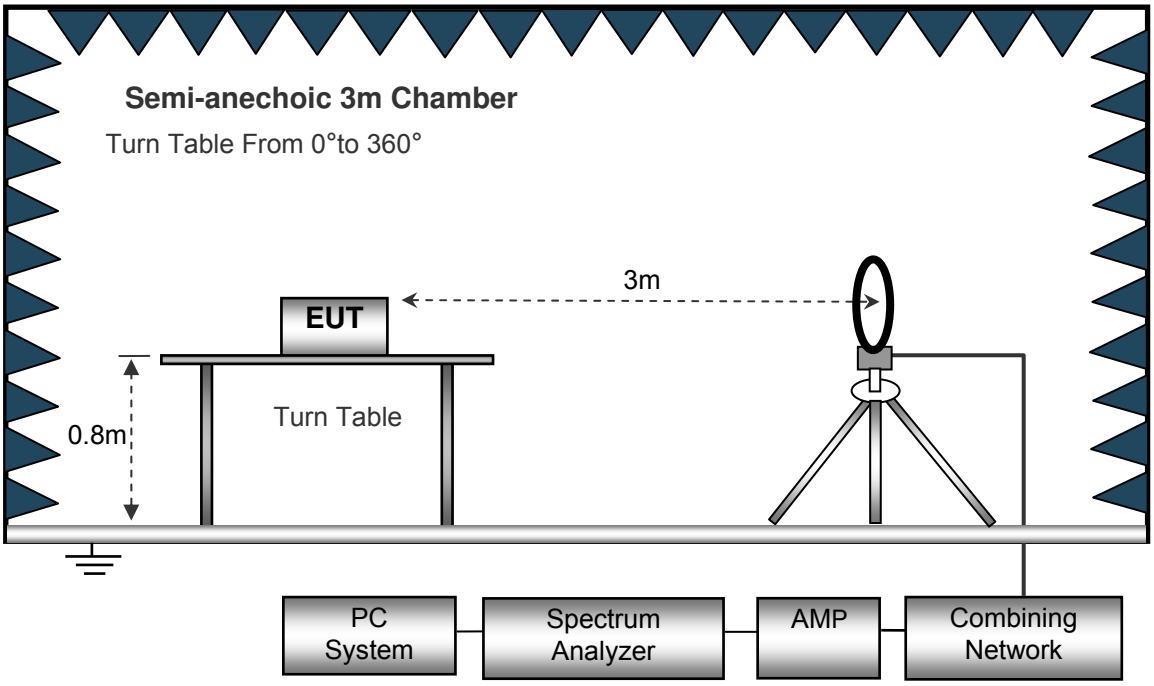
Atmospheric Pressure: : 101.2kPa

EUT Operation : : Refer to section 3.3

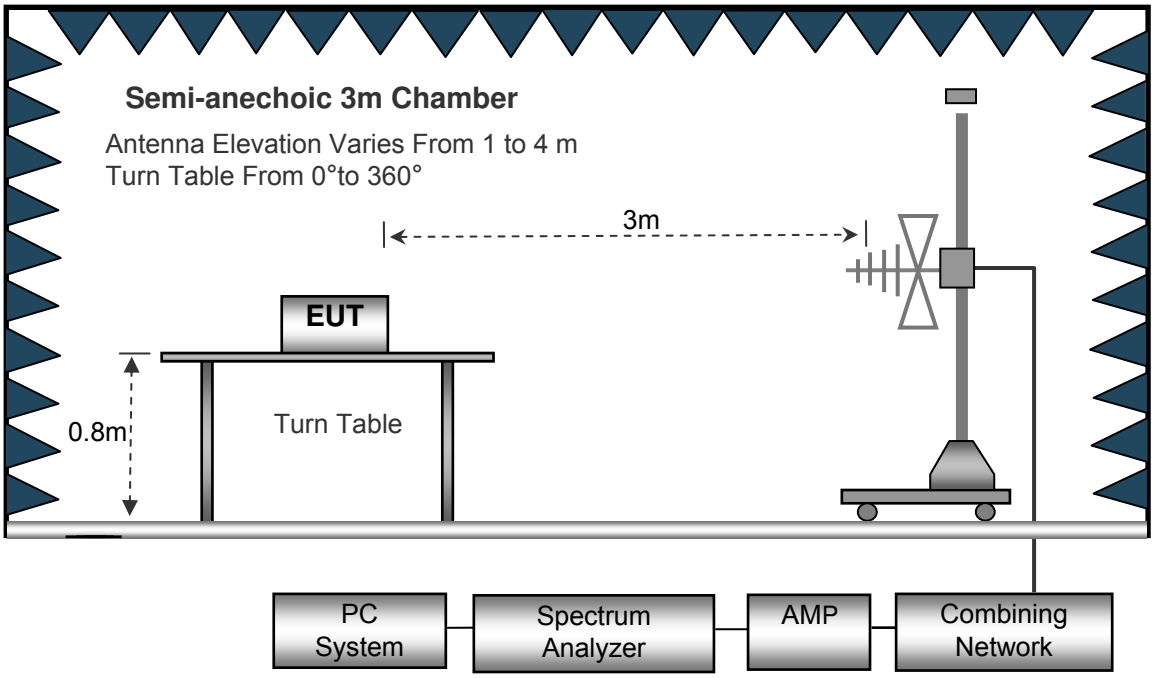
## 6.2 Test Setup

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

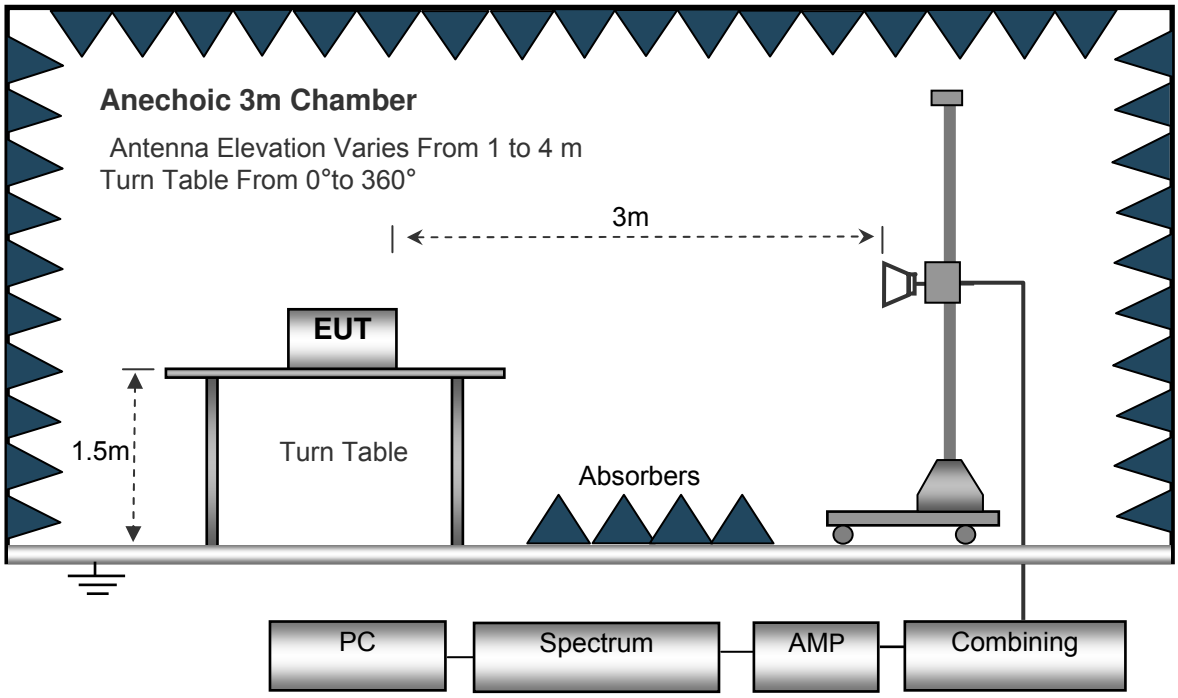
The test setup for emission measurement below 30MHz.




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



The test setup for emission measurement above 1 GHz.




## 6.3 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

## 6.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane for below 1GHz and 1.5m for above 1GHz.

2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.

3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.

5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

6. Repeat above procedures until the measurements for all frequencies are complete.

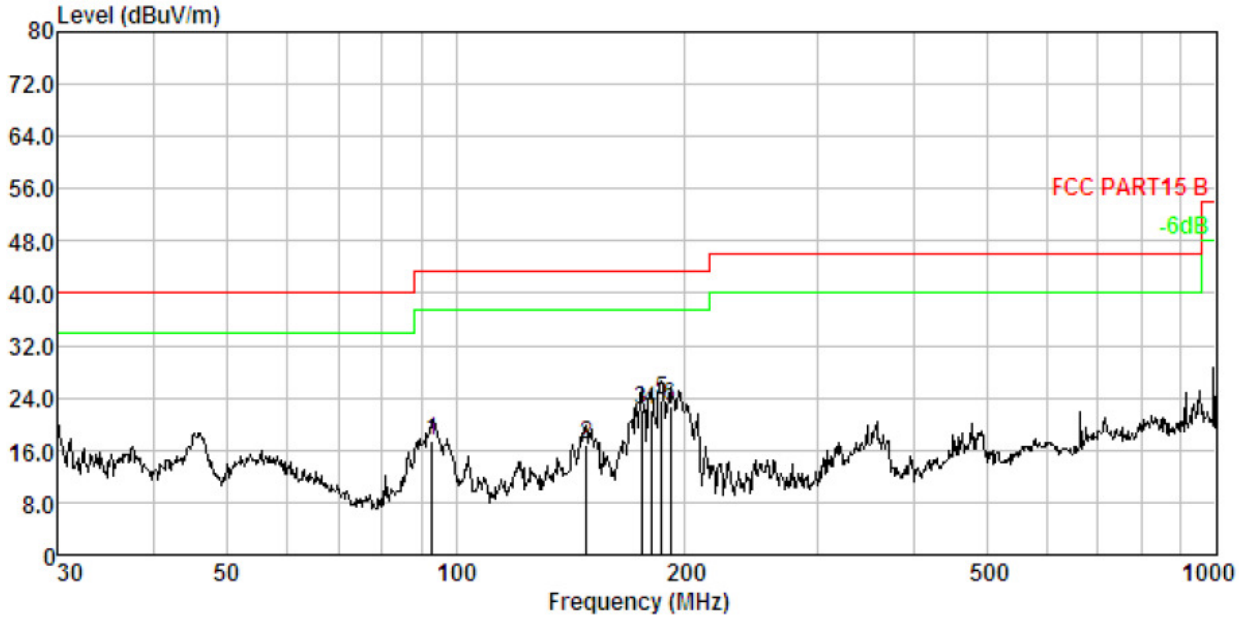
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

## 6.5 Summary of Test Results

Remark : 1. The testing has been conformed to 10*2480 =24800MHz.
2. All other emissions more than 30dB below the limit
3: Only the worst data (GFSK modulation mode) were reported.

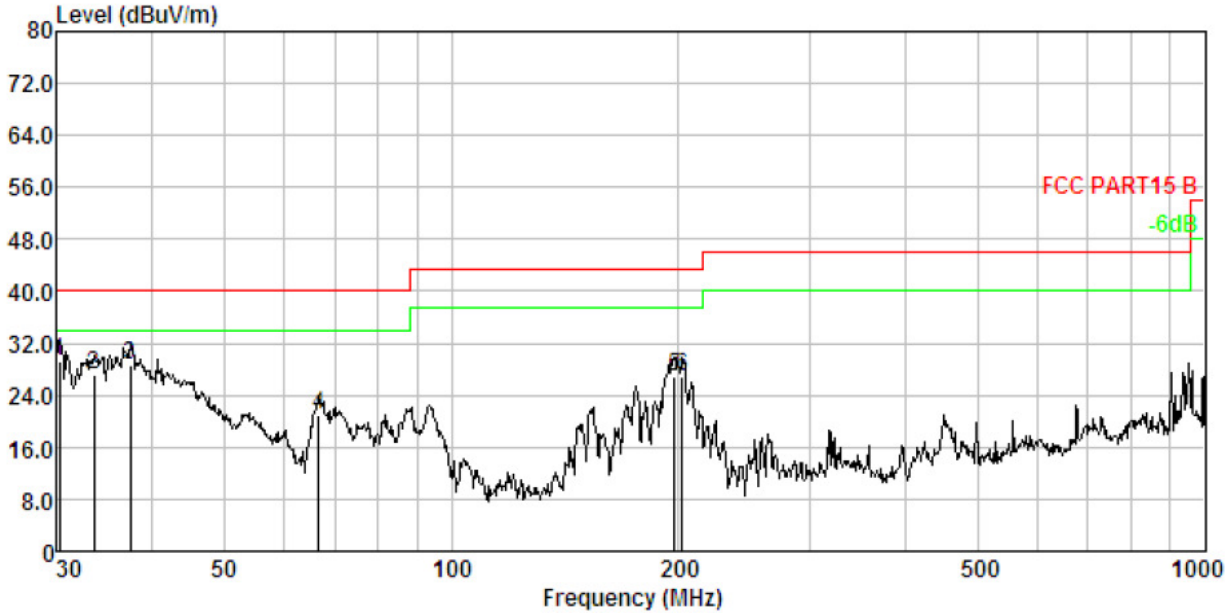
**Test Frequency: 30MHz ~ 1GHz**

Antenna Polarization: Horizontal




| No. | Freq MHz | Cable Loss dB | ANT Factor dB/m | Receiver Reading dBuV | Preamp Factor dB | Emission Level dBuV/m | Limit dBuV/m | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 93.113 | 2.08 | 9.58 | 36.14 | 30.36 | 17.44 | 43.50 | -26.06 | QP |
| 2. | 148.441 | 2.50 | 13.82 | 31.08 | 30.53 | 16.87 | 43.50 | -26.63 | QP |
| 3. | 175.652 | 2.66 | 12.82 | 37.34 | 30.58 | 22.24 | 43.50 | -21.26 | QP |
| 4. | 180.649 | 2.68 | 12.35 | 37.83 | 30.59 | 22.27 | 43.50 | -21.23 | QP |
| 5. | 186.441 | 2.71 | 11.57 | 39.82 | 30.61 | 23.49 | 43.50 | -20.01 | QP |
| 6. | 191.745 | 2.73 | 10.97 | 39.56 | 30.62 | 22.64 | 43.50 | -20.86 | QP |

Antenna Polarization: Vertical




| No. | Freq MHz | Cable Loss dB | ANT Factor dB/m | Receiver Reading dBuV | Preamp Factor dB | Emission Level dBuV/m | Limit dBuV/m | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 30.211 | 1.06 | 13.24 | 44.87 | 29.97 | 29.20 | 40.00 | -10.80 | QP |
| 2. | 33.562 | 1.16 | 13.30 | 42.66 | 30.01 | 27.11 | 40.00 | -12.89 | QP |
| 3. | 37.548 | 1.26 | 13.51 | 44.02 | 30.05 | 28.74 | 40.00 | -11.26 | QP |
| 4. | 66.733 | 1.78 | 11.18 | 38.18 | 30.25 | 20.89 | 40.00 | -19.11 | QP |
| 5. | 197.893 | 2.76 | 10.53 | 44.29 | 30.63 | 26.95 | 43.50 | -16.55 | QP |
| 6. | 202.810 | 2.79 | 10.44 | 44.35 | 30.63 | 26.95 | 43.50 | -16.55 | QP |

**Test Frequency: 1GHz ~ 18GHz**

| Frequency | Receiver Reading | Detector | Corrected Factor | Corrected Amplitude | Limit | Margin |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (PK/QP/Ave) | (dB) | (dBμV/m) | (dBμV/m) | (dB) |
| GFSK Low Channel | | | | | | |
| 4804.00 | 50.54 | PK | -1.06 | 49.48 | 74.00 | -24.52 |
| 4804.00 | 43.73 | Ave | -1.06 | 42.67 | 54.00 | -11.33 |
| 7206.00 | 49.68 | PK | 1.33 | 51.01 | 74.00 | -22.99 |
| 7206.00 | 43.40 | Ave | 1.33 | 44.73 | 54.00 | -9.27 |
| 2320.76 | 45.02 | PK | -13.19 | 31.83 | 74.00 | -42.17 |
| 2320.76 | 39.30 | Ave | -13.19 | 26.11 | 54.00 | -27.89 |
| 2350.12 | 42.91 | PK | -13.14 | 29.77 | 74.00 | -44.23 |
| 2350.12 | 38.12 | Ave | -13.14 | 24.98 | 54.00 | -29.02 |
| 2497.81 | 42.47 | PK | -13.08 | 29.39 | 74.00 | -44.61 |
| 2497.81 | 40.29 | Ave | -13.08 | 27.21 | 54.00 | -26.79 |
| Remark: | | | | | | |
| 1.Corrected Factor=ANT Factor + Cable Loss – Amp Gain | | | | | | |

| Frequency | Receiver Reading | Detector | Corrected Factor | Corrected Amplitude | Limit | Margin |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (PK/QP/Ave) | (dB) | (dBμV/m) | (dBμV/m) | (dB) |
| GFSK Middle Channel | | | | | | |
| 4882.00 | 50.43 | PK | -0.93 | 49.50 | 74.00 | -24.50 |
| 4882.00 | 44.38 | Ave | -0.93 | 43.45 | 54.00 | -10.55 |
| 7323.00 | 49.17 | PK | 1.67 | 50.84 | 74.00 | -23.16 |
| 7323.00 | 43.27 | Ave | 1.67 | 44.94 | 54.00 | -9.06 |
| 2329.90 | 45.48 | PK | -13.19 | 32.29 | 74.00 | -41.71 |
| 2329.90 | 38.31 | Ave | -13.19 | 25.12 | 54.00 | -28.88 |
| 2369.41 | 42.06 | PK | -13.14 | 28.92 | 74.00 | -45.08 |
| 2369.41 | 37.73 | Ave | -13.14 | 24.59 | 54.00 | -29.41 |
| 2496.51 | 41.64 | PK | -13.08 | 28.56 | 74.00 | -45.44 |
| 2496.51 | 40.51 | Ave | -13.08 | 27.43 | 54.00 | -26.57 |
| Remark: | | | | | | |
| 1.Corrected Factor=ANT Factor + Cable Loss – Amp Gain | | | | | | |

.

| Frequency | Receiver Reading | Detector | Corrected Factor | Corrected Amplitude | Limit | Margin |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (PK/QP/Ave) | (dB) | (dBμV/m) | (dBμV/m) | (dB) |
| GFSK High Channel | | | | | | |
| 4960.00 | 49.79 | PK | -0.87 | 48.92 | 74.00 | -25.08 |
| 4960.00 | 43.45 | Ave | -0.87 | 42.58 | 54.00 | -11.42 |
| 7440.00 | 49.30 | PK | 1.84 | 51.14 | 74.00 | -22.86 |
| 7440.00 | 42.47 | Ave | 1.84 | 44.31 | 54.00 | -9.69 |
| 2320.32 | 45.78 | PK | -13.19 | 32.59 | 74.00 | -41.41 |
| 2320.32 | 38.72 | Ave | -13.19 | 25.53 | 54.00 | -28.47 |
| 2354.79 | 41.93 | PK | -13.14 | 28.79 | 74.00 | -45.21 |
| 2354.79 | 38.57 | Ave | -13.14 | 25.43 | 54.00 | -28.57 |
| 2484.51 | 40.72 | PK | -13.08 | 27.64 | 74.00 | -46.36 |
| 2484.51 | 41.29 | Ave | -13.08 | 28.21 | 54.00 | -25.79 |
| Remark: | | | | | | |
| 1.Corrected Factor=ANT Factor + Cable Loss – Amp Gain | | | | | | |

# 7 Band Edge Measurement

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

Test Method : ANSI C63.10:2013,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 : Refer to section 3.3

## 7.1 Test Procedure

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

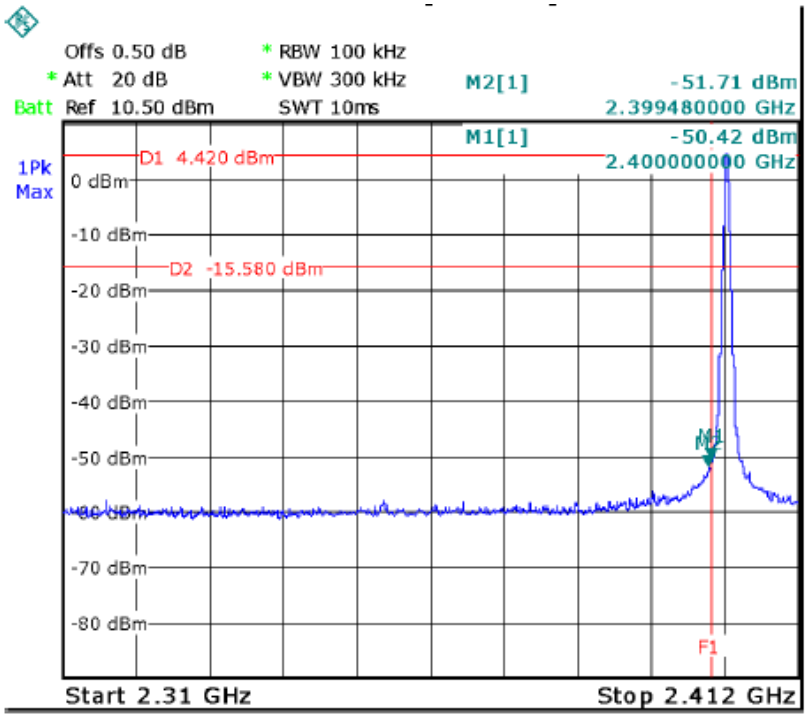
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto

Detector function = peak, Trace = max hold

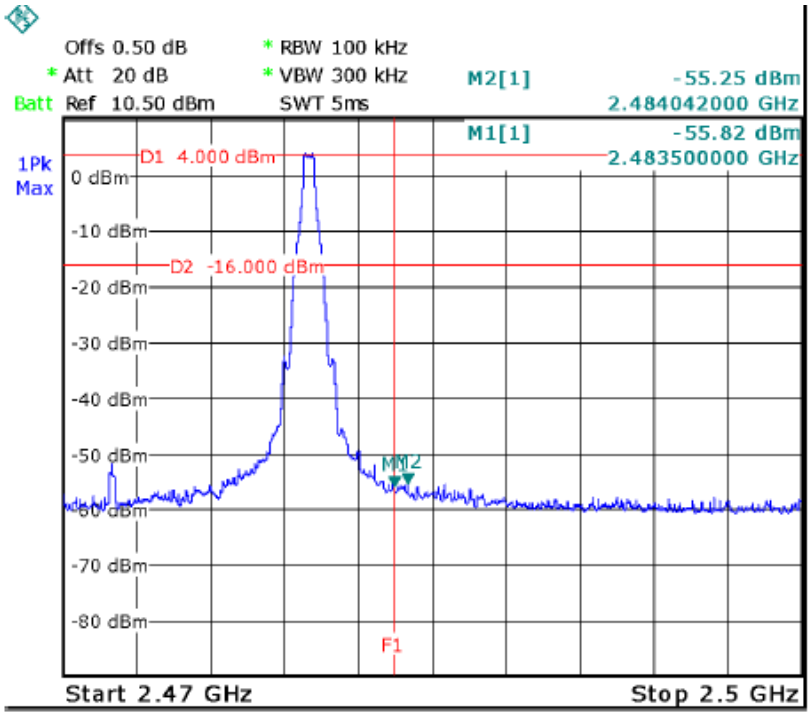
## 7.2 Test Result

| Modulation | Mode | Band edge | Value | Limit | Result |
|---|---|---|---|---|---|
| GFSK | Transmitting | Left | -51.71 | -15.58 | Pass |
| | | Right | -55.25 | -16.00 | Pass |
| | Hopping | Left | -52.93 | -15.20 | Pass |
| | | Right | -56.84 | -16.60 | Pass |
| Pi/4 DQPSK | Transmitting | Left | -50.87 | -16.50 | Pass |
| | | Right | -54.46 | -17.10 | Pass |
| | Hopping | Left | -54.05 | -16.35 | Pass |
| | | Right | -56.65 | -17.45 | Pass |
| 8DPSK | Transmitting | Left | -50.73 | -16.45 | Pass |
| | | Right | -55.03 | -17.25 | Pass |
| | Hopping | Left | -53.17 | -16.30 | Pass |
| | | Right | -56.07 | -17.30 | Pass |
| Remark: | | | | | |
| The limit is 20dB below the maximum peak level, please refer to the display line of the follow plot | | | | | |

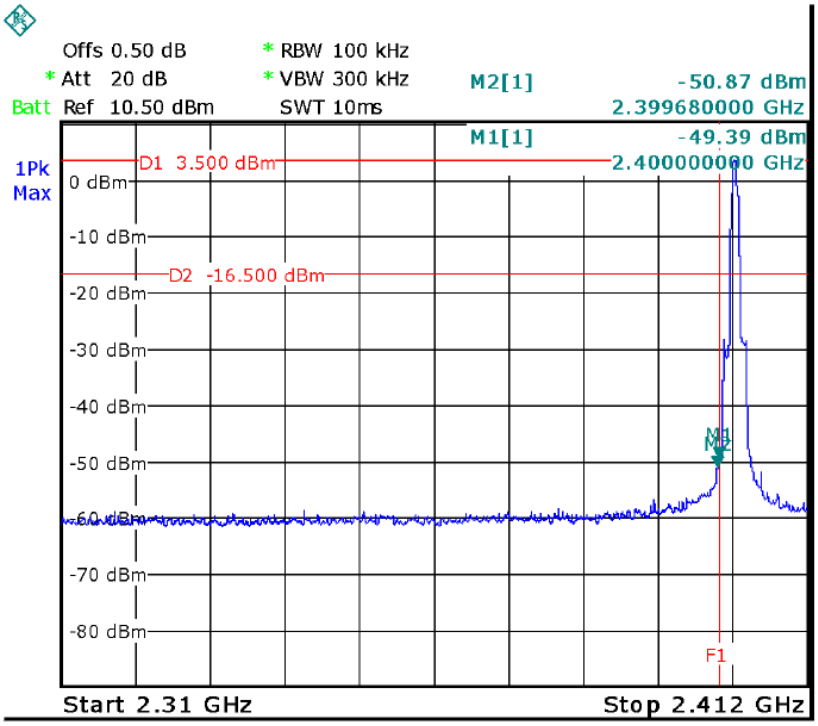
TX in GFSK Band edge-left side



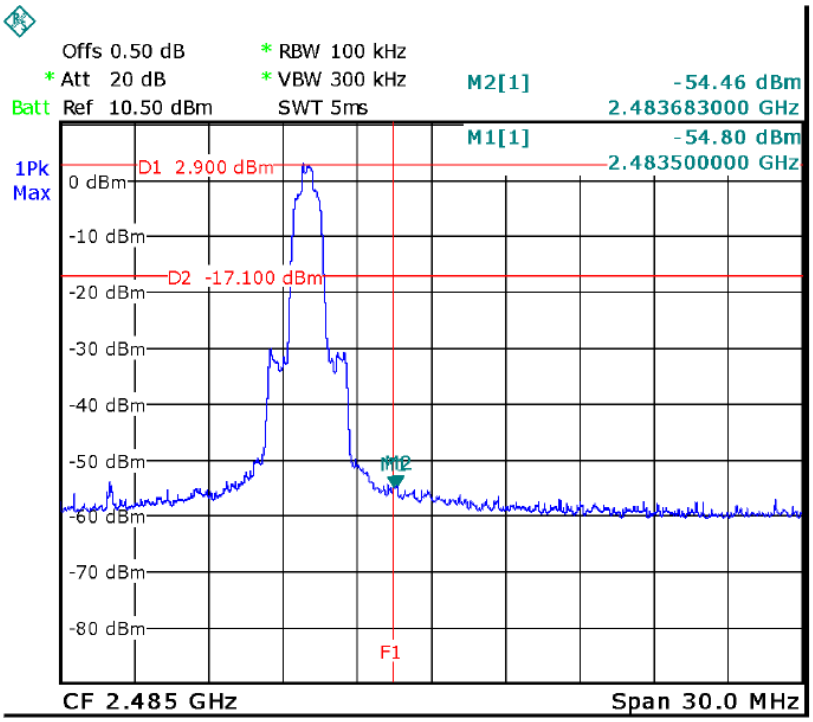

TX in GFSK Band edge-right side



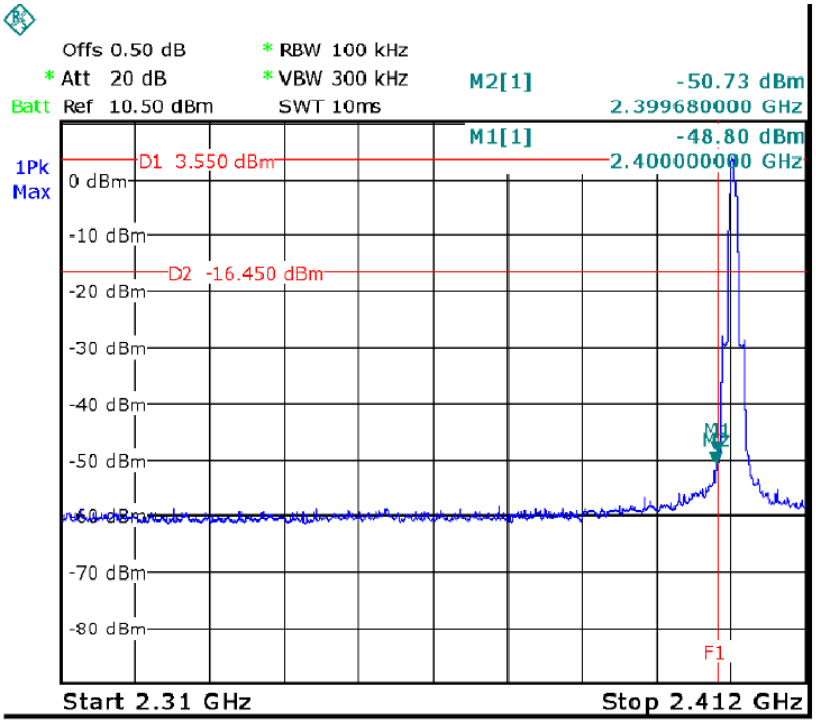
TX in Pi/4 DQPSK Band edge-left side



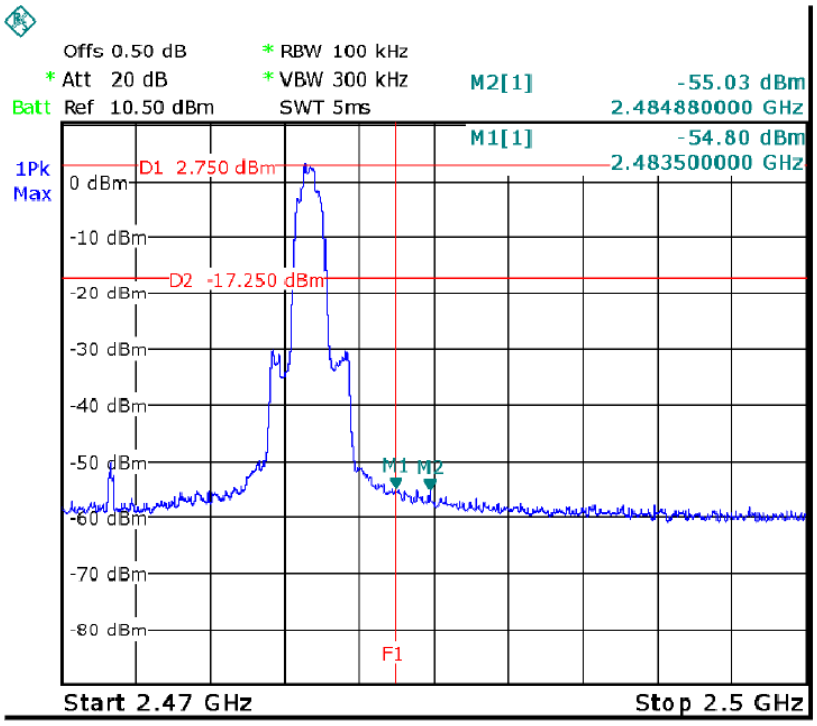

TX in Pi/4 DQPSK Band edge-right side



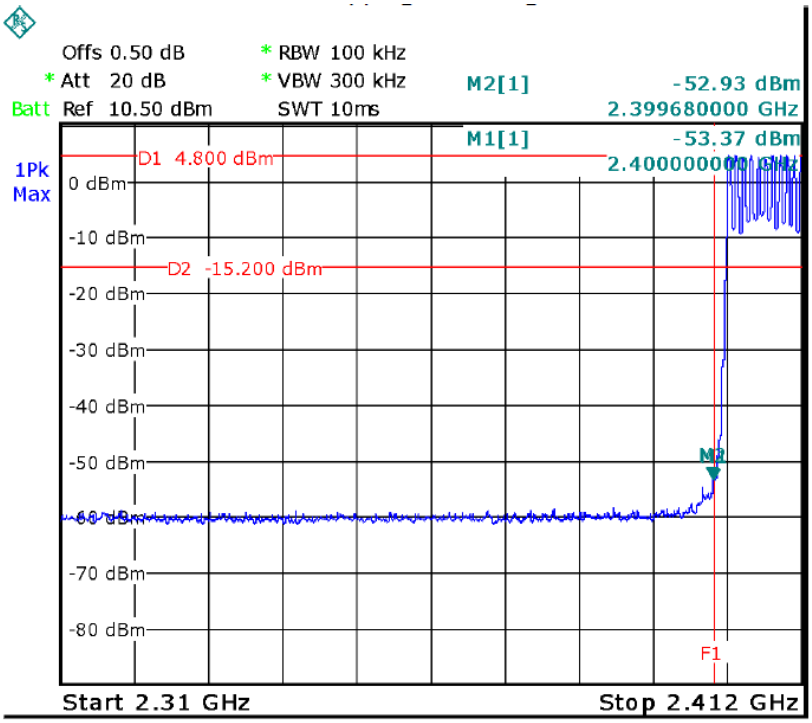
TX in 8DPSK Band edge-left side



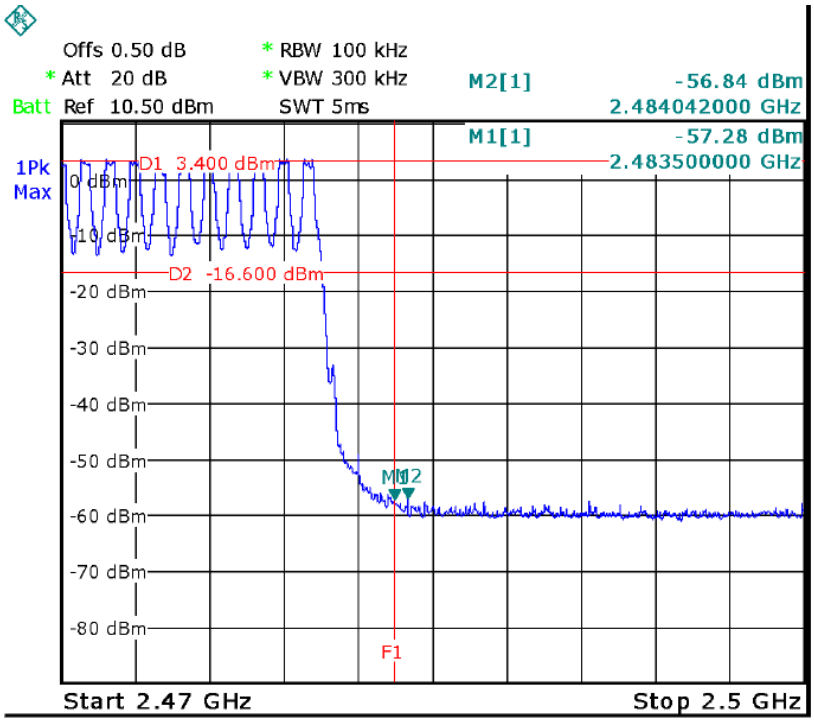

TX in 8DPSK Band edge-right side



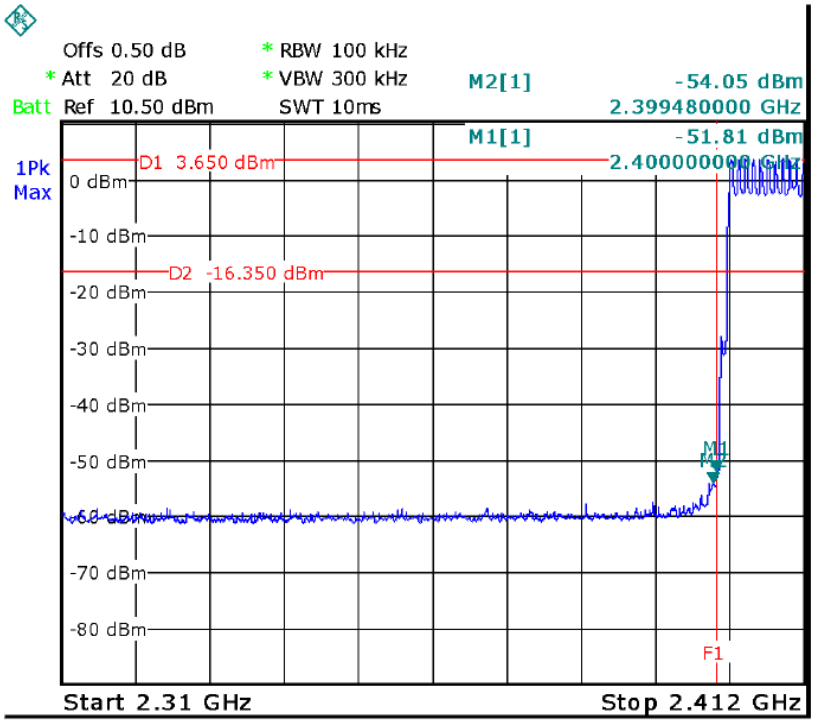
Hopping in GFSK Band edge-left side



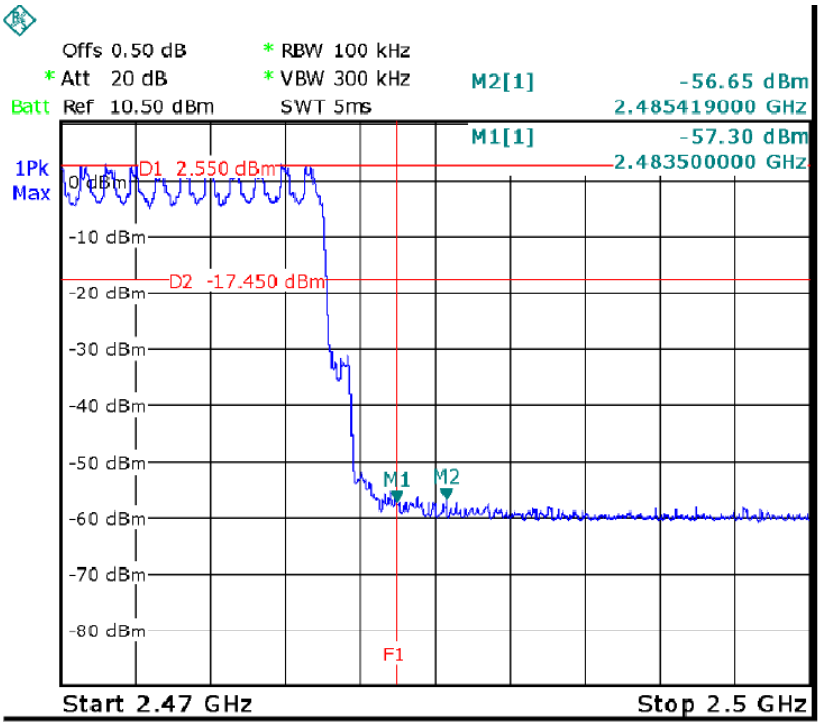

Hopping in GFSK Band edge-right side



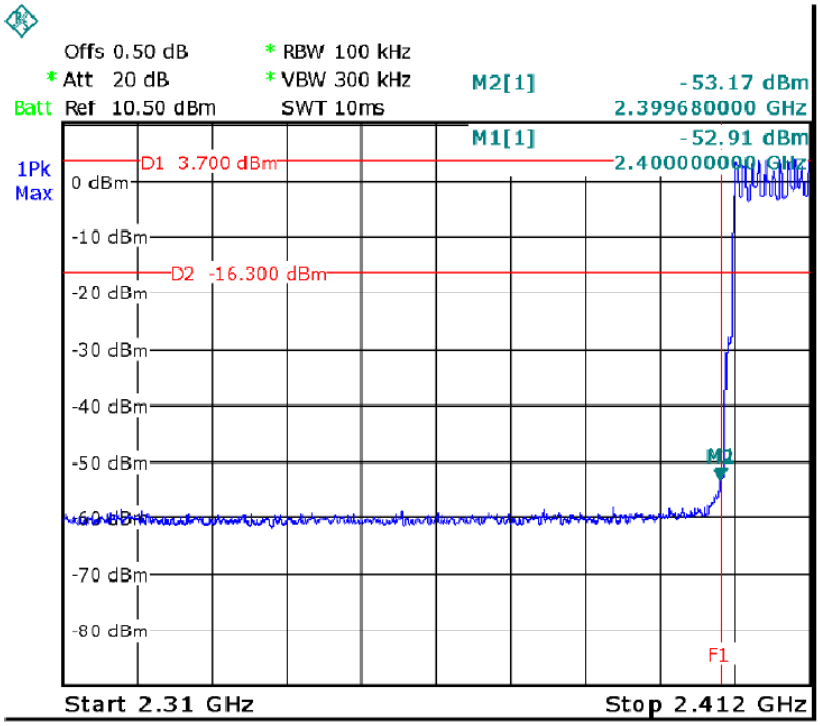
Hopping in Pi/4 DQPSK Band edge-left side



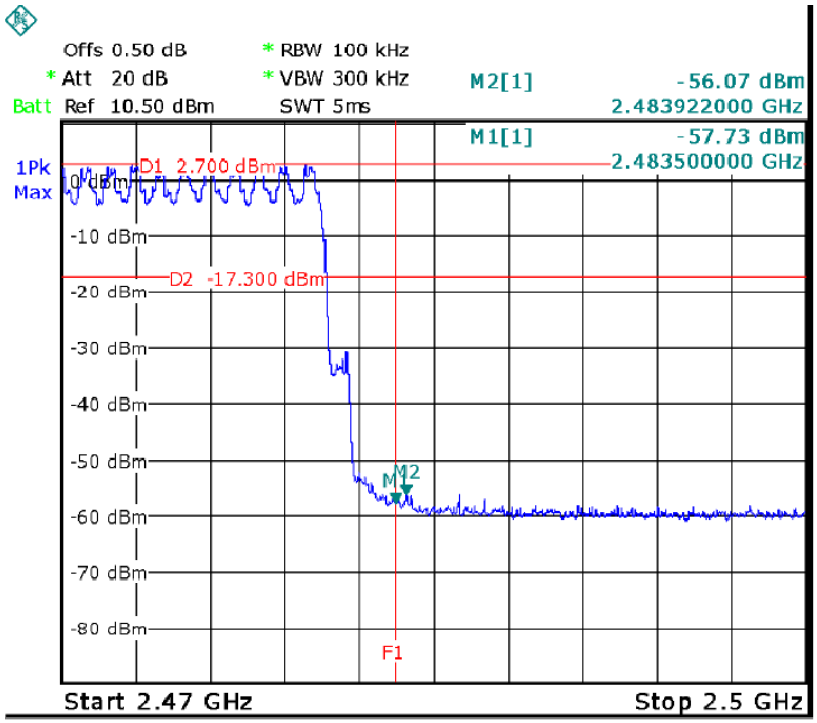

Hopping in Pi/4 DQPSK Band edge-right side



Hopping in 8DPSK Band edge-left side




Hopping in 8DPSK Band edge-right side



# 8 20dB Bandwidth Measurement

| | | |
|---|---|---|
| Test Requirement | : | FCC CFR47 Part 15 Section 15.247 |
| Test Method | : | ANSI C63.10:2013,DA 00-705 |
| Test Mode | : | Refer to section 3.3 |

## 8.1 Test Procedure

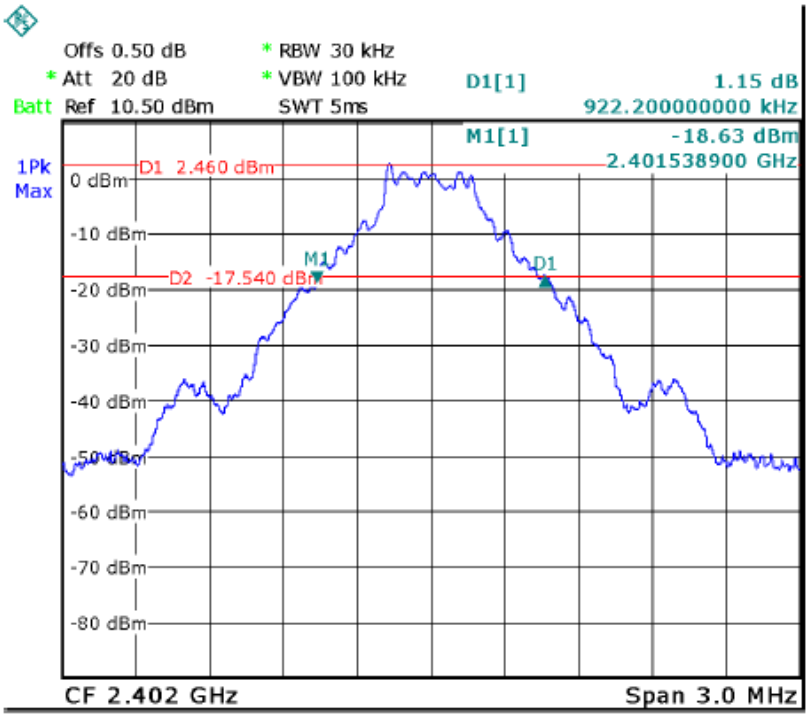
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;

2. Set the spectrum analyzer: RBW = 30kHz, VBW = 100kHz

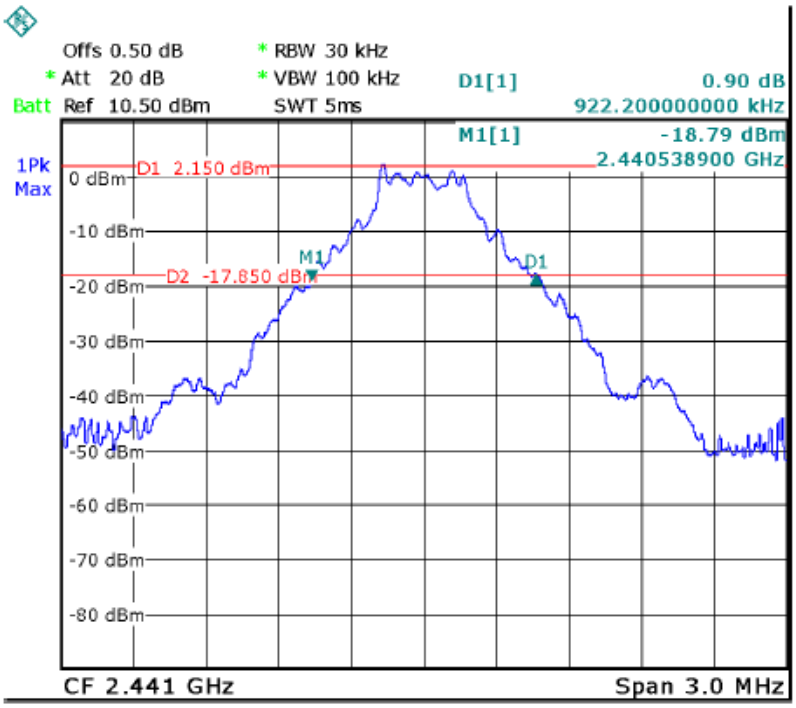
## 8.2 Test Result

| Modulation | Test Channel | Bandwidth |
|---|---|---|
| GFSK | Low | 0.922MHz |
| GFSK | Middle | 0.922MHz |
| GFSK | High | 0.922MHz |
| Pi/4 DQPSK | Low | 1.246MHz |
| Pi/4 DQPSK | Middle | 1.246MHz |
| Pi/4 DQPSK | High | 1.246MHz |
| 8DPSK | Low | 1.264MHz |
| 8DPSK | Middle | 1.264MHz |
| 8DPSK | High | 1.264MHz |

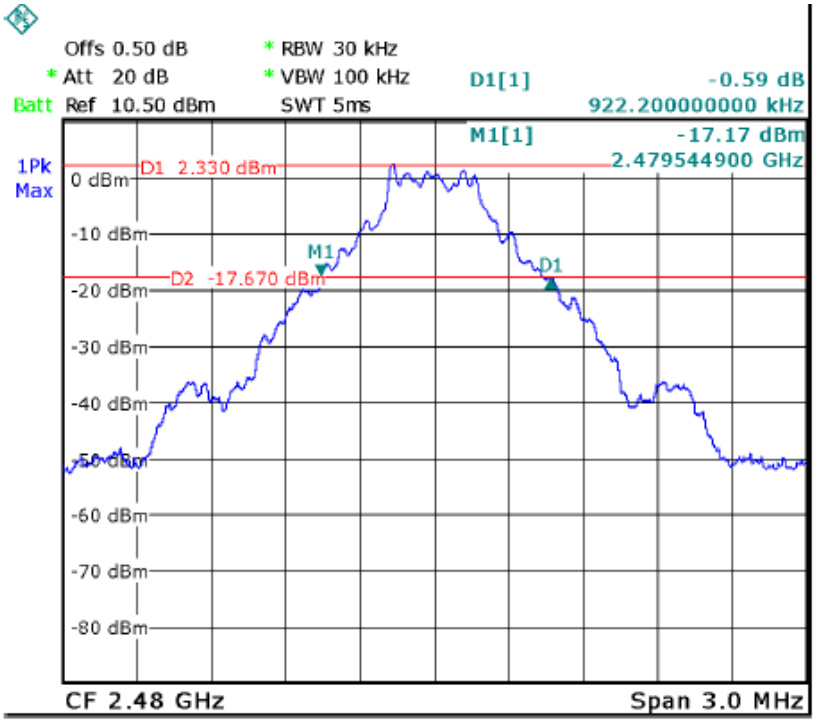
GFSK Low Channel



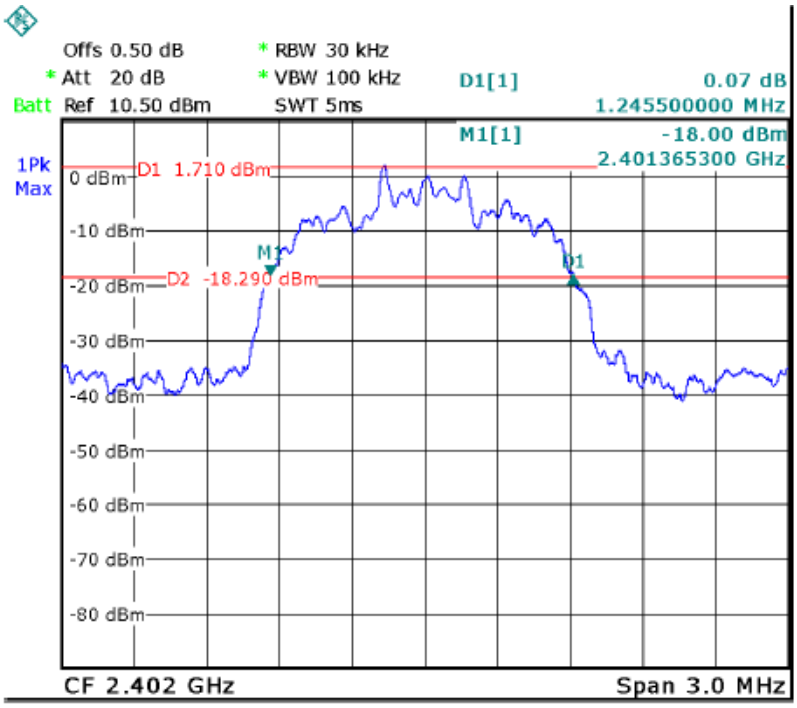

GFSK Middle Channel



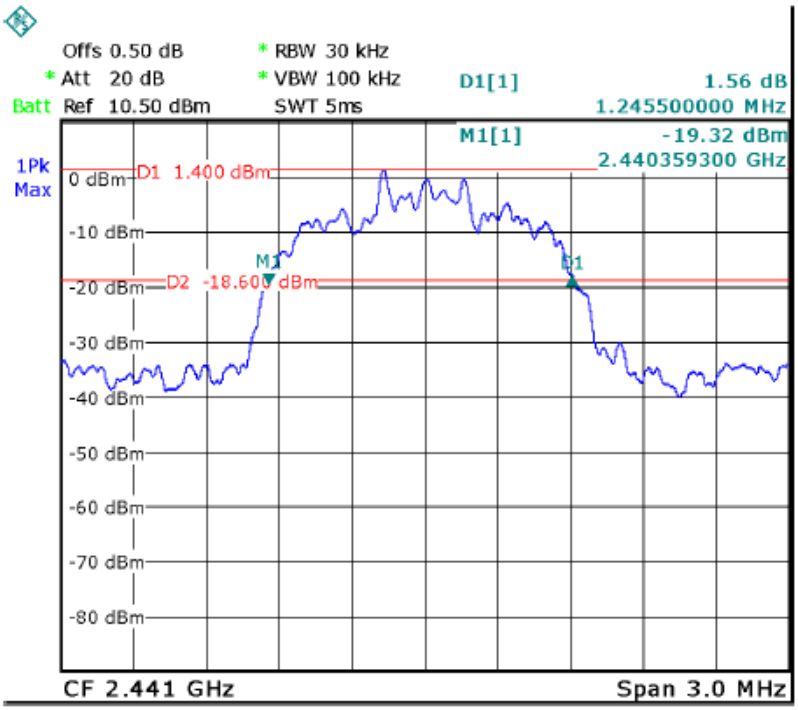
GFSK High Channel



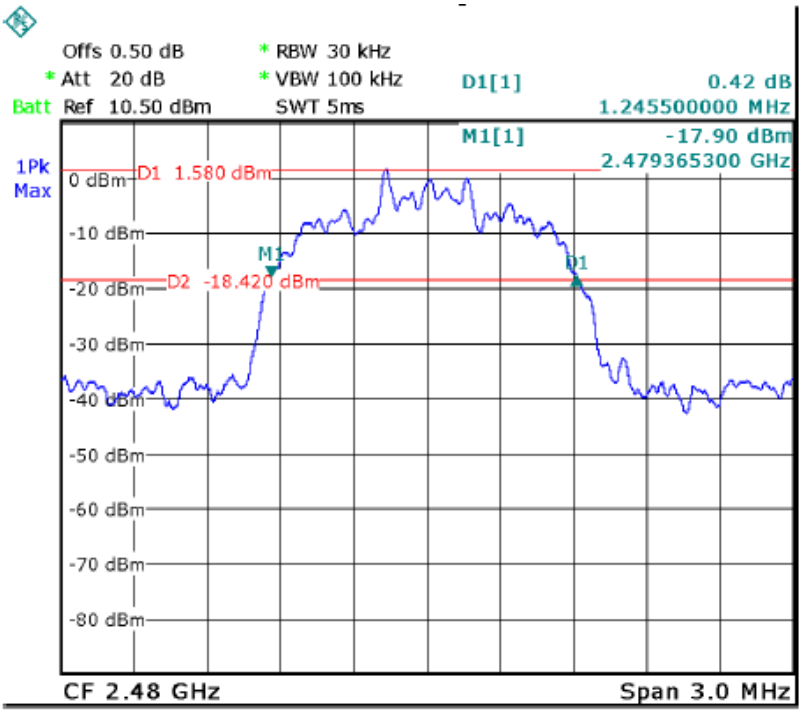

Pi/4DQPSK Low Channel



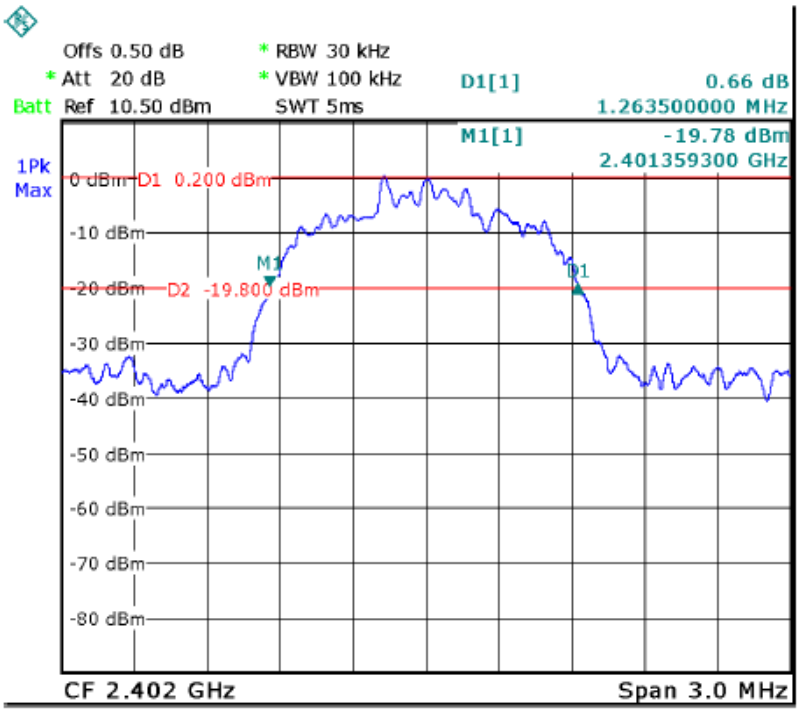
Pi/4DQPSK Middle Channel



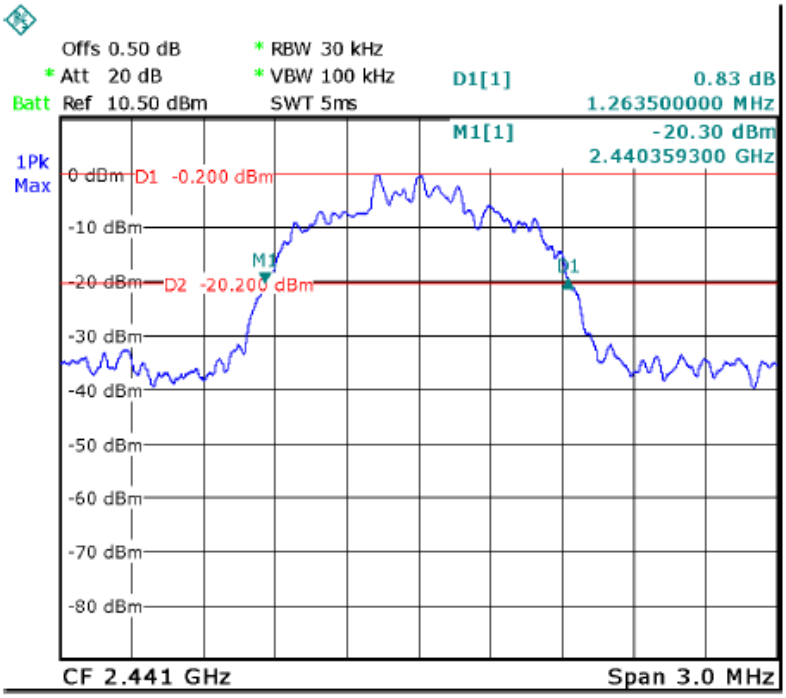

Pi/4DQPSK High Channel



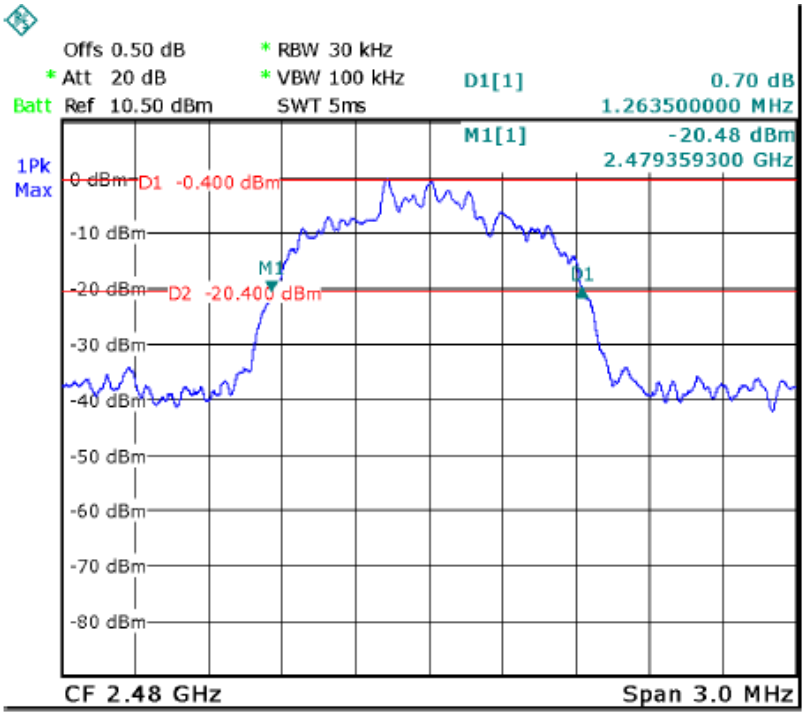
8DPSK Low Channel




8DPSK Middle Channel



8DPSK High Channel



# 9 Maximum Peak Output Power

| | | |
|---|---|---|
| Test Requirement | : | FCC CFR47 Part 15 Section 15.247 |
| Test Method | : | ANSI C63.10:2013,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 | : | Refer to section 3.3 |

## 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.

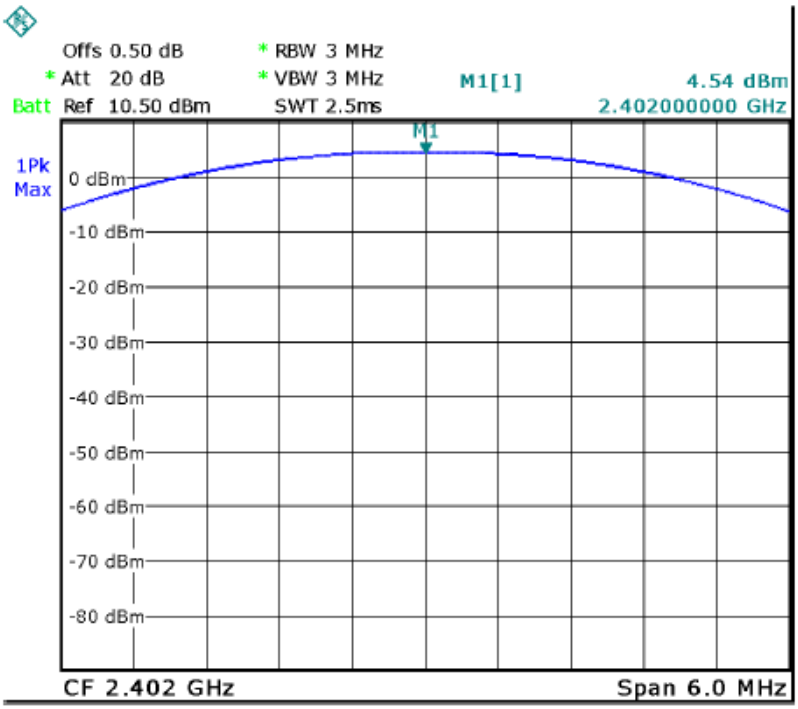
2. Set the spectrum analyser: RBW = 3 MHz. VBW =3 MHz. Sweep = auto; Detector Function = Peak.

3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

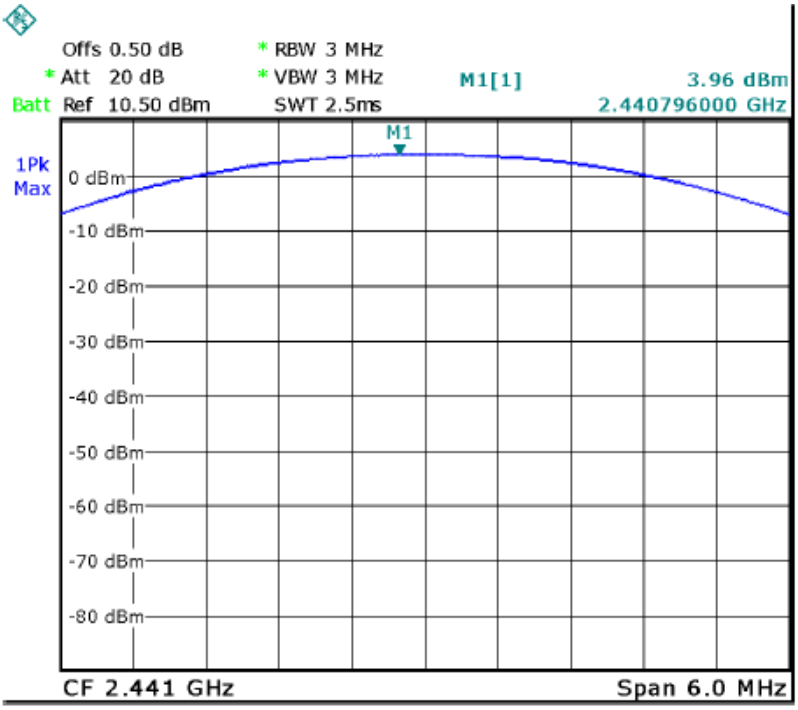
## 9.2 Test Result

| Modulation | Test Channel | Output Power (dBm) | Limit (dBm) |
|---|---|---|---|
| GFSK | Low | 4.54 | 30 |
| GFSK | Middle | 3.96 | 30 |
| GFSK | High | 4.22 | 30 |
| Pi/4 DQPSK | Low | 4.25 | 20.97 |
| Pi/4 DQPSK | Middle | 3.71 | 20.97 |
| Pi/4 DQPSK | High | 3.69 | 20.97 |
| 8DPSK | Low | 4.33 | 20.97 |
| 8DPSK | Middle | 4.09 | 20.97 |
| 8DPSK | High | 3.94 | 20.97 |

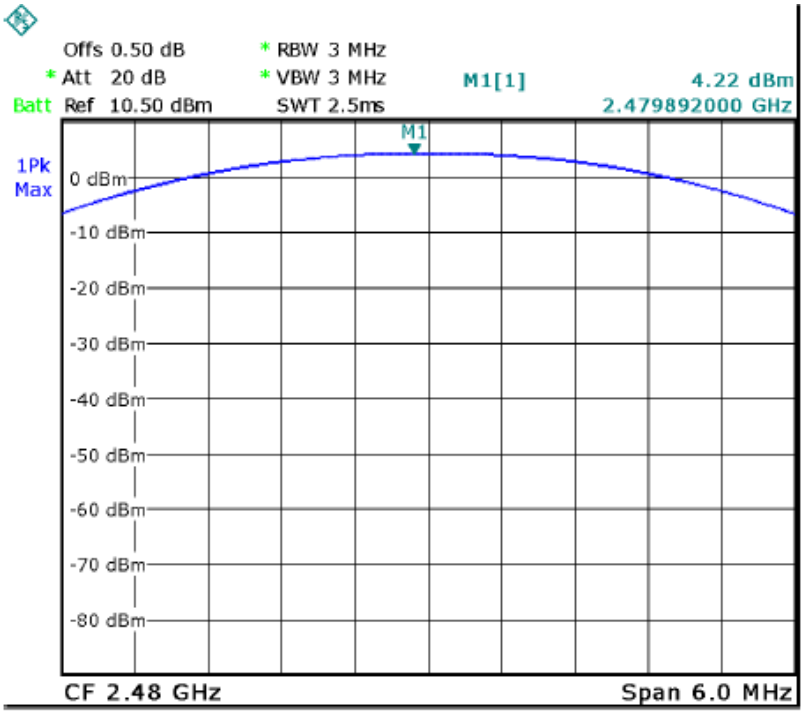
GFSK Low Channel



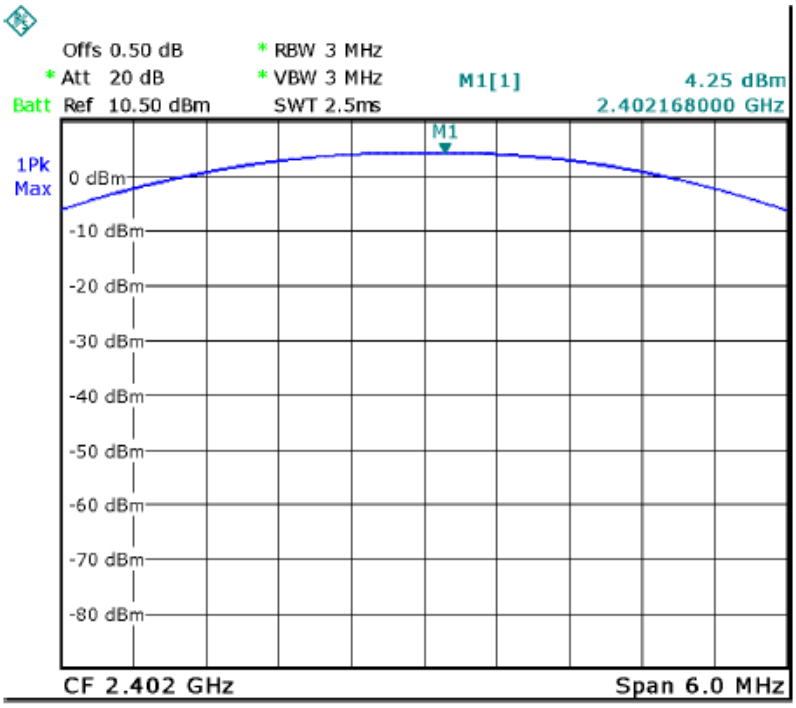

GFSK Middle Channel



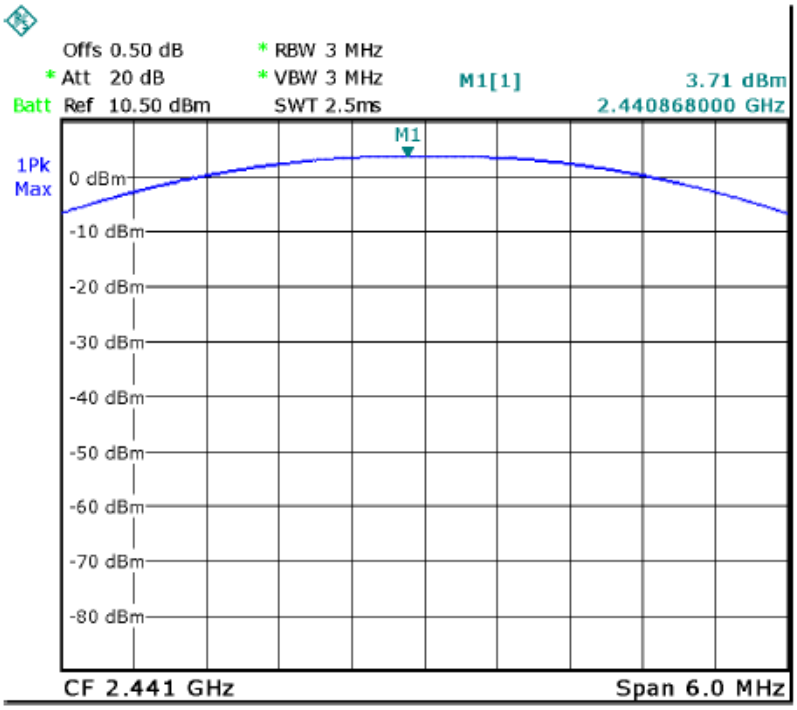
GFSK High Channel



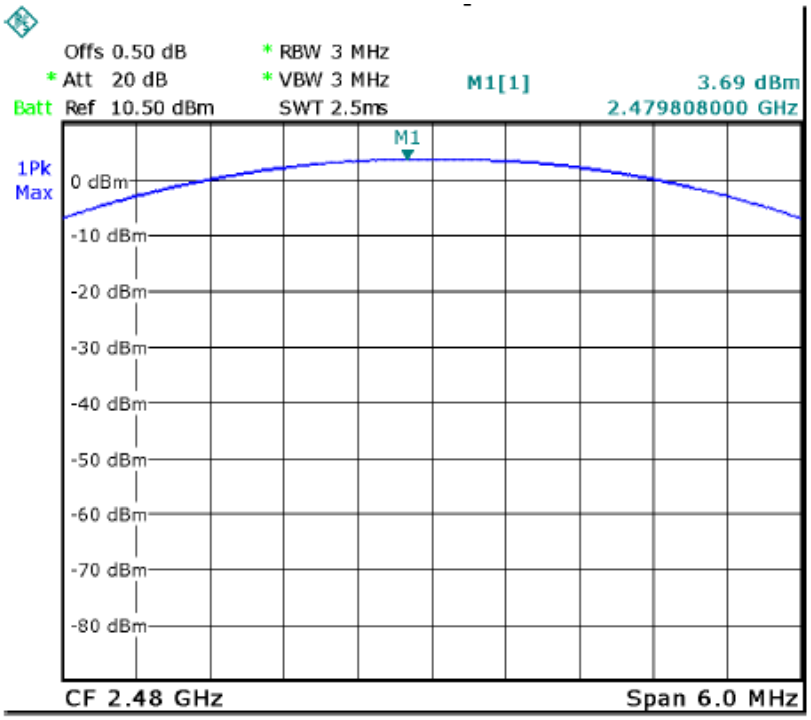

Pi/4DQPSK Low Channel



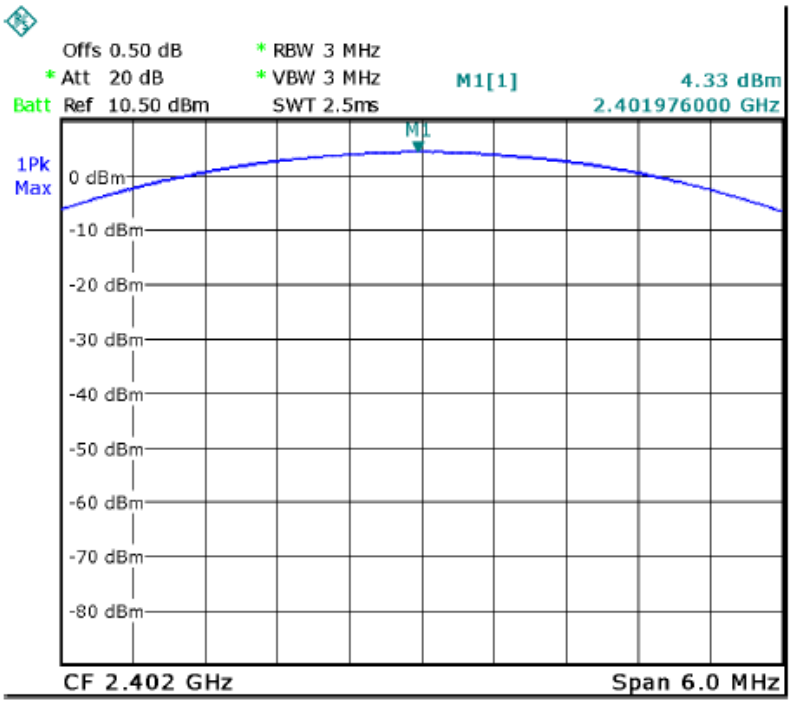
Pi/4DQPSK Middle Channel



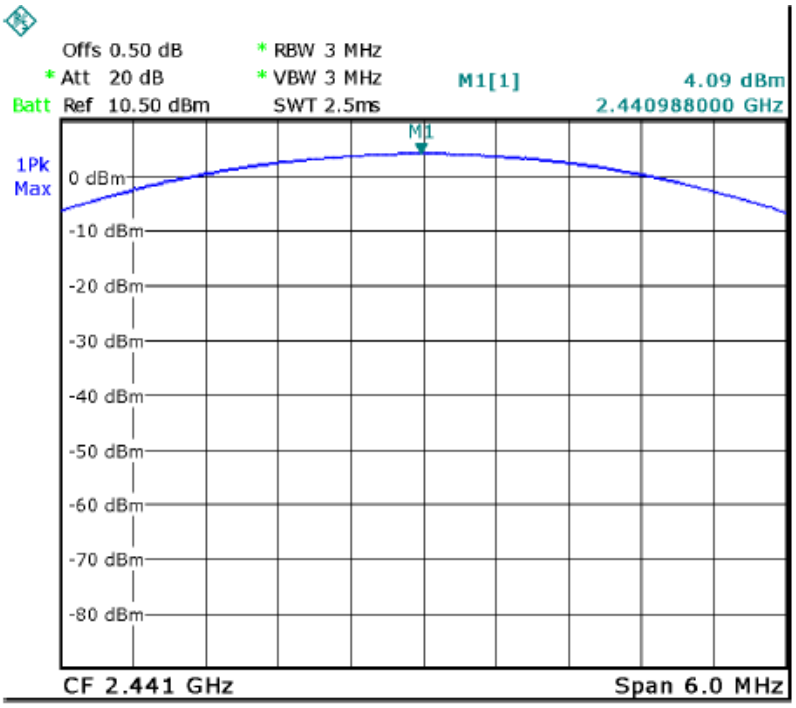

Pi/4DQPSK High Channel



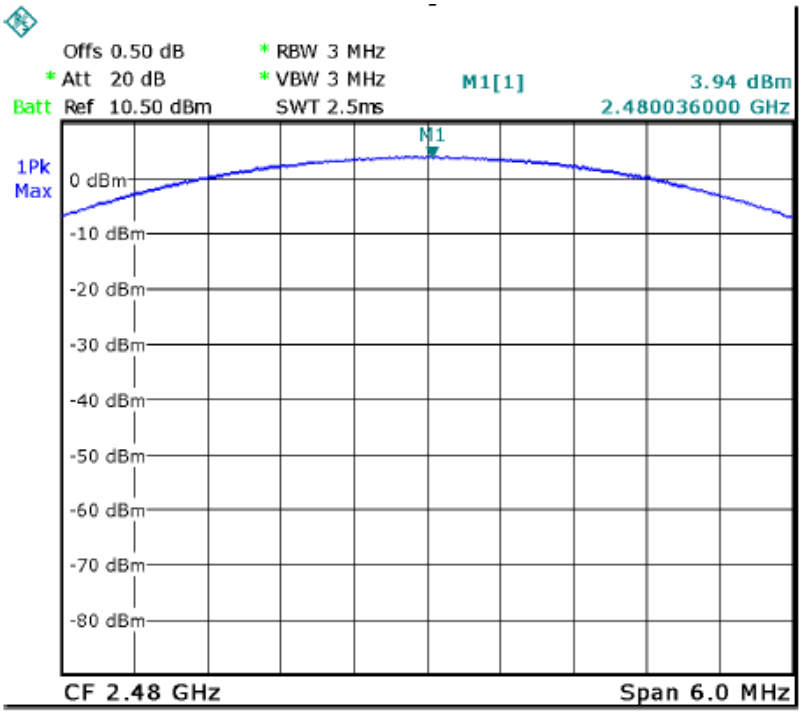
8DPSK Low Channel




8DPSK Middle Channel



8DPSK High Channel



# 10 Hopping Channel Separation

| | | |
|---|---|---|
| Test Requirement | : | FCC CFR47 Part 15 Section 15.247 |
| Test Method | : | ANSI C63.10:2013,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 | : | Hopping |

## 10.1 Test Procedure

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

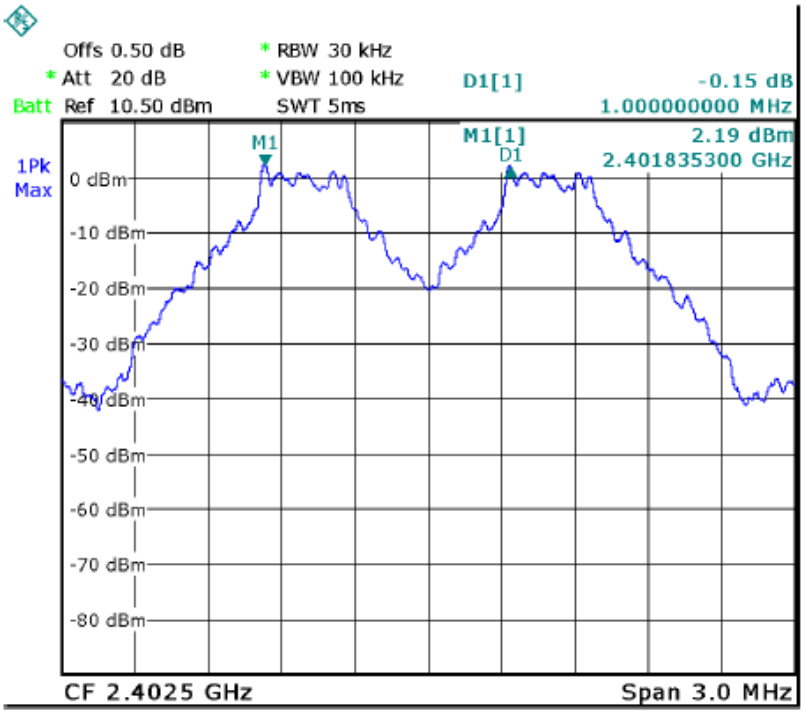
2. Set the spectrum analyzer: RBW = 30KHz. VBW = 100KHz , Span = 3MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

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.

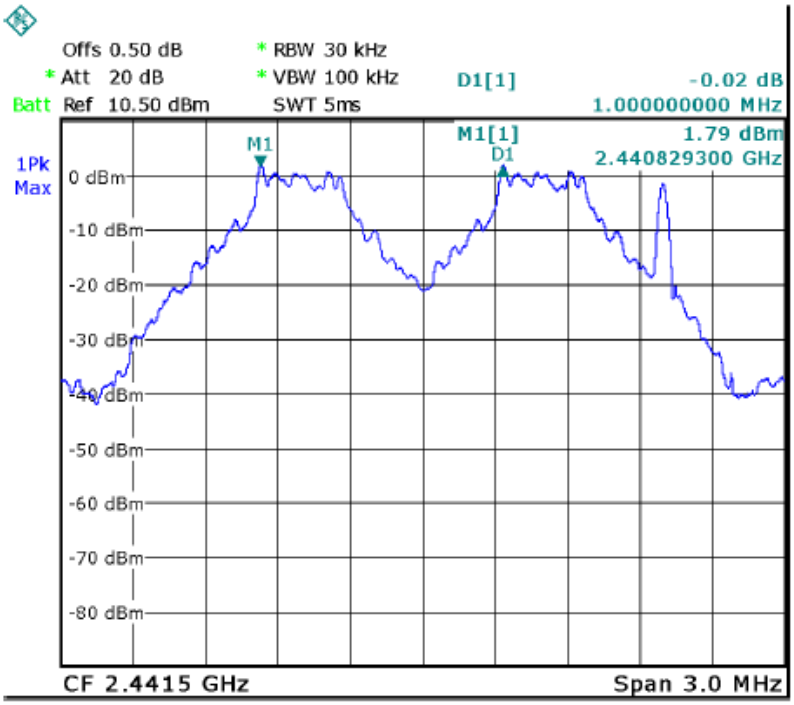
## 10.2 Test Result

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

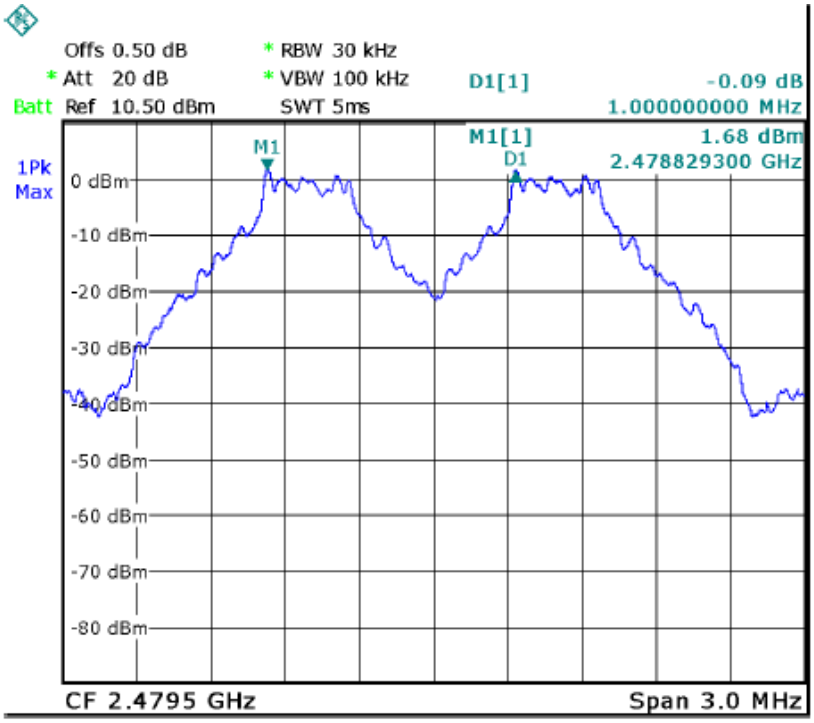
GFSK Low Channel



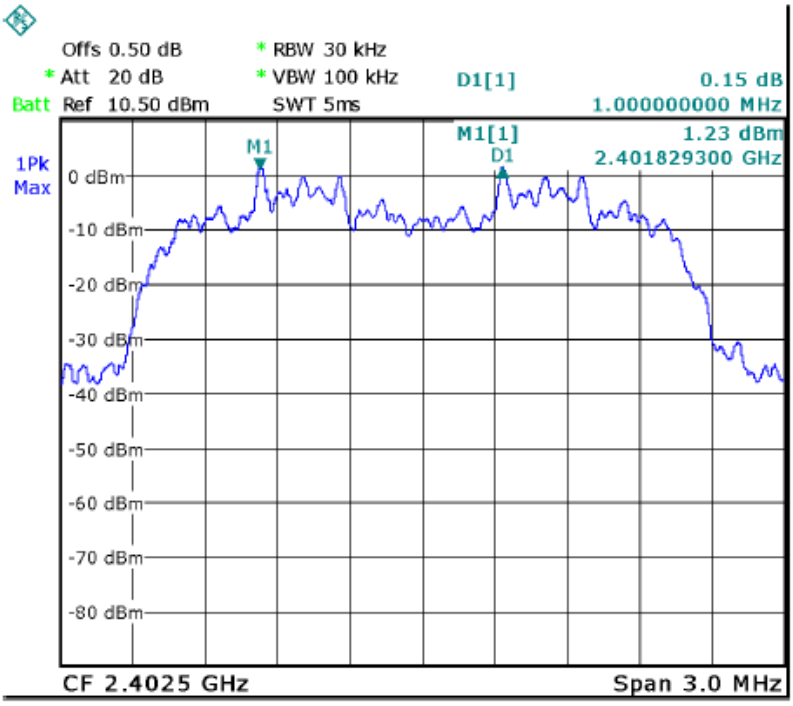

GFSK Middle Channel



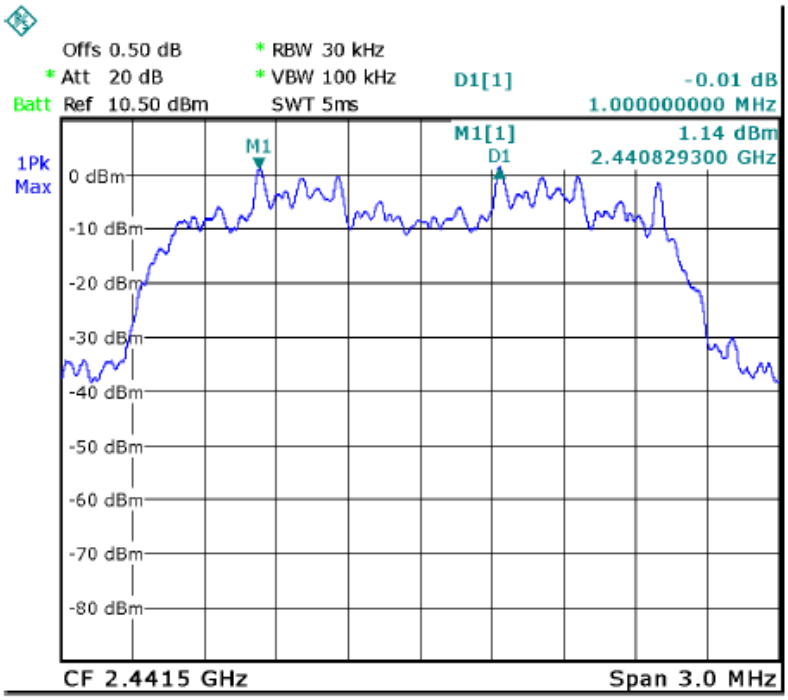
GFSK High Channel



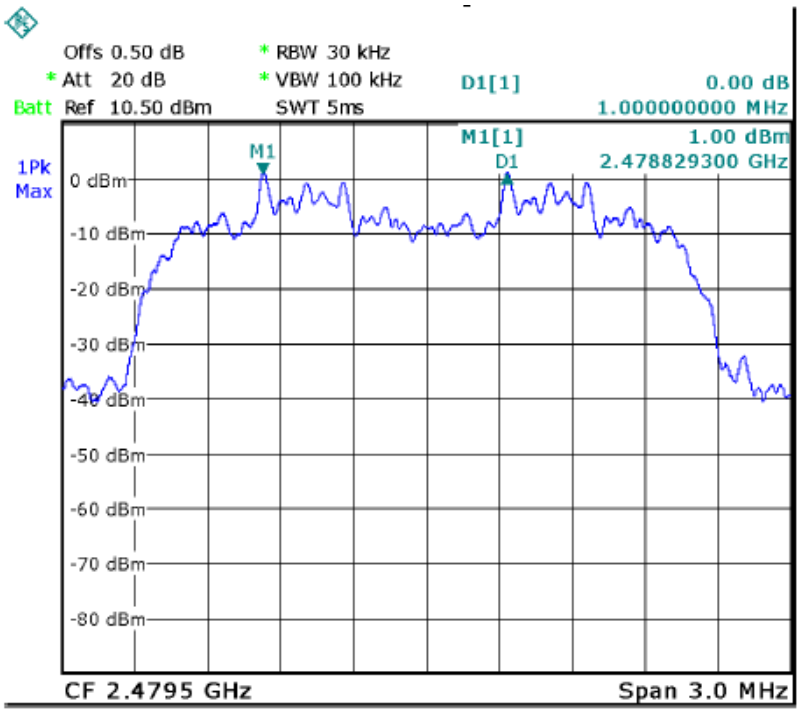

Pi/4DQPSK Low Channel



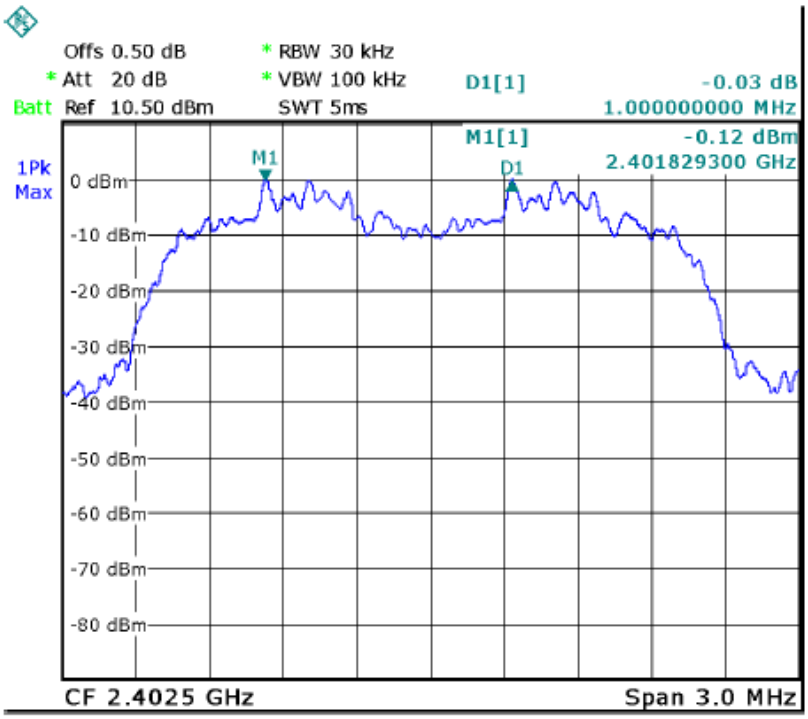
Pi/4DQPSK Middle Channel



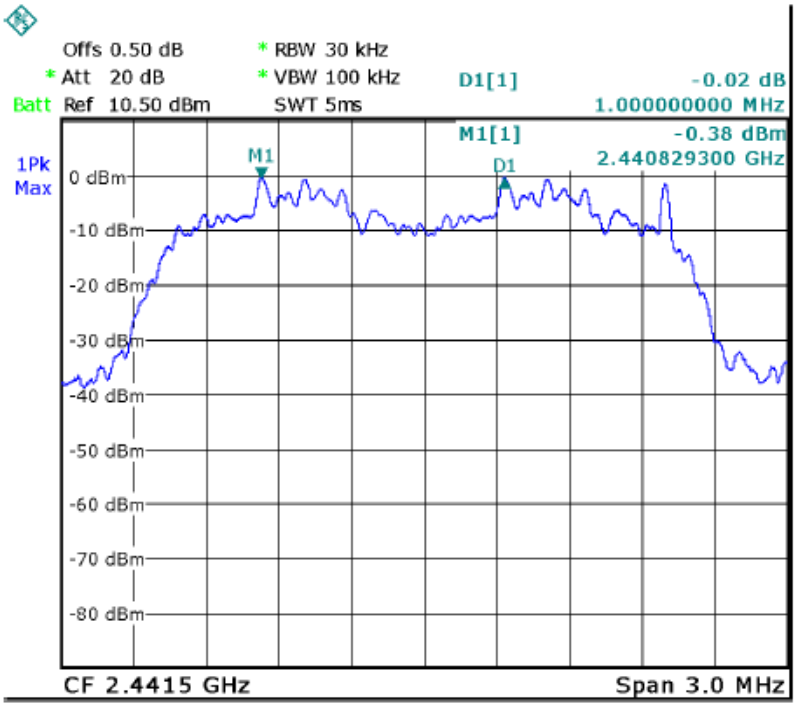

Pi/4DQPSK High Channel



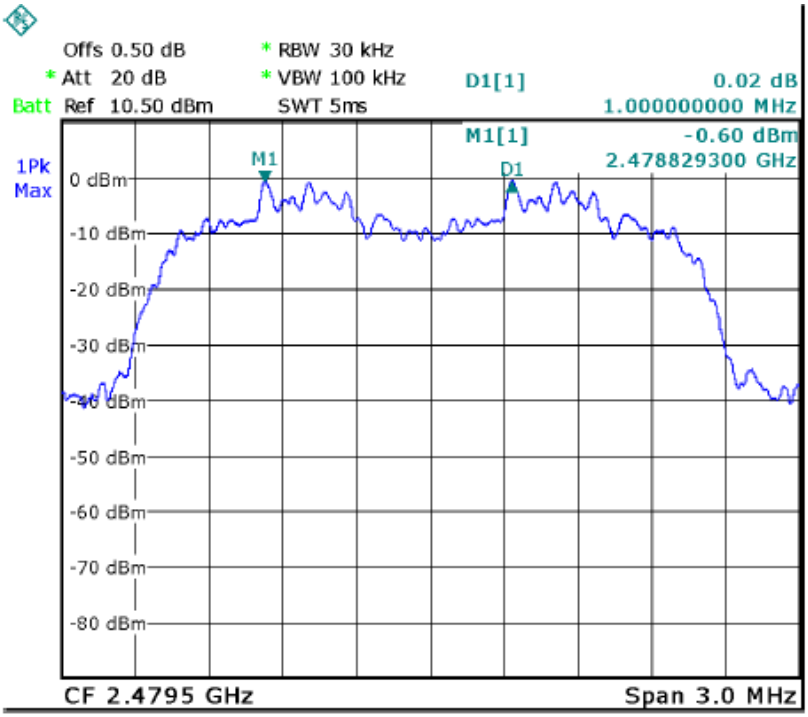
8DPSK Low Channel




8DPSK Middle Channel



8DPSK High Channel



# 11 Number of Hopping Frequency

| | | |
|---|---|---|
| Test Requirement | : | FCC CFR47 Part 15 Section 15.247 |
| Test Method | : | ANSI C63.10:2013,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 | : | Hopping(GFSK) |

## 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.

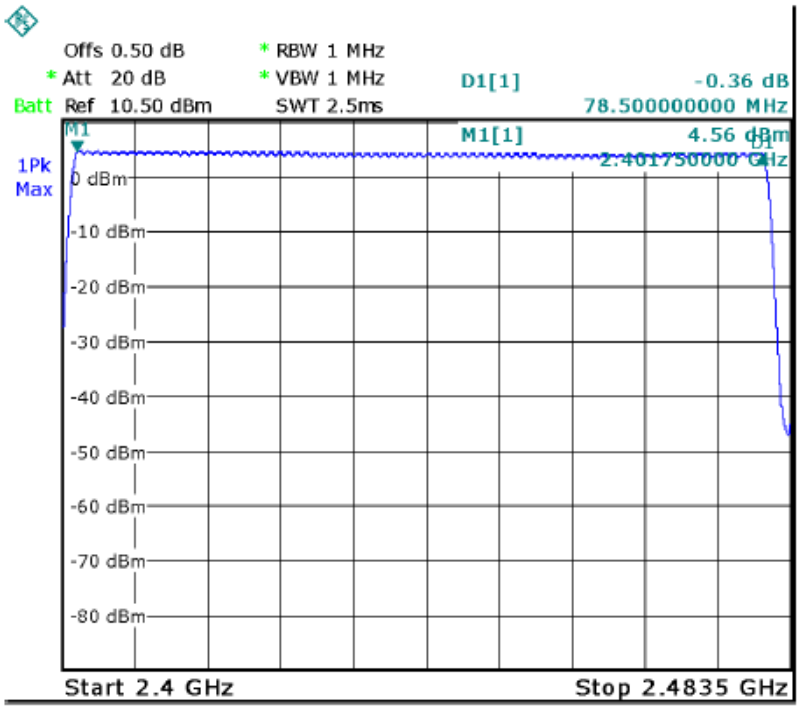
2. Set the spectrum analyzer: RBW = 1MHz. VBW = 1MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

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;

## 11.2 Test Result

| Channel Number | Limit |
|---|---|
| 79 | ⩾15 |



# 12 Dwell Time

| | | |
|---|---|---|
| Test Requirement | : | FCC CFR47 Part 15 Section 15.247 |
| Test Method | : | ANSI C63.10:2013,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. |
| Test Mode | : | Hopping |
| Remark | : | The worst case(8DPSK,3DH5) was recorded |

## 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 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).

## 12.2 Test Result

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

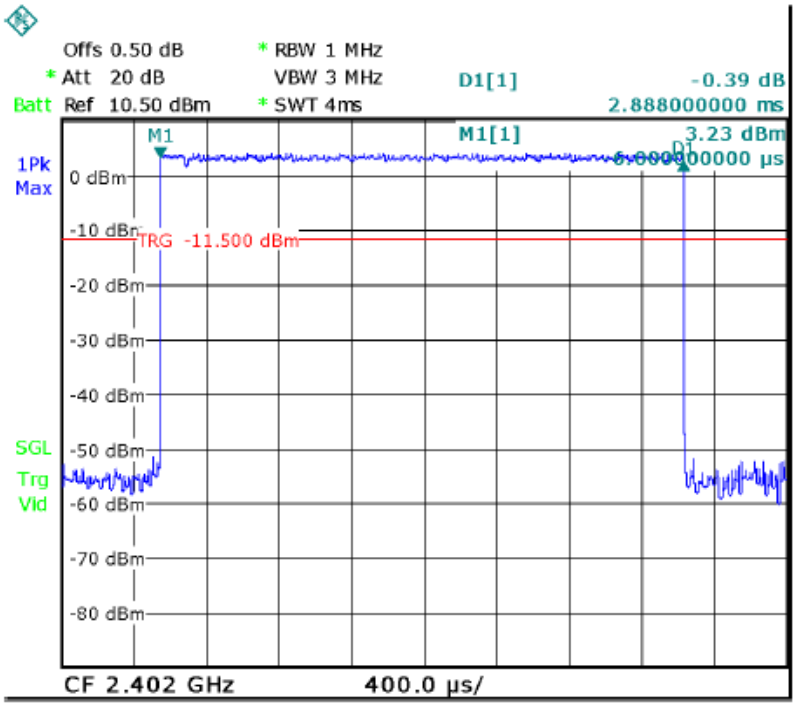
DH3 Packet permit maximum 1600 / 79 / 4 hops per second in each channel (3 time slots RX, 1 time slot TX).

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:

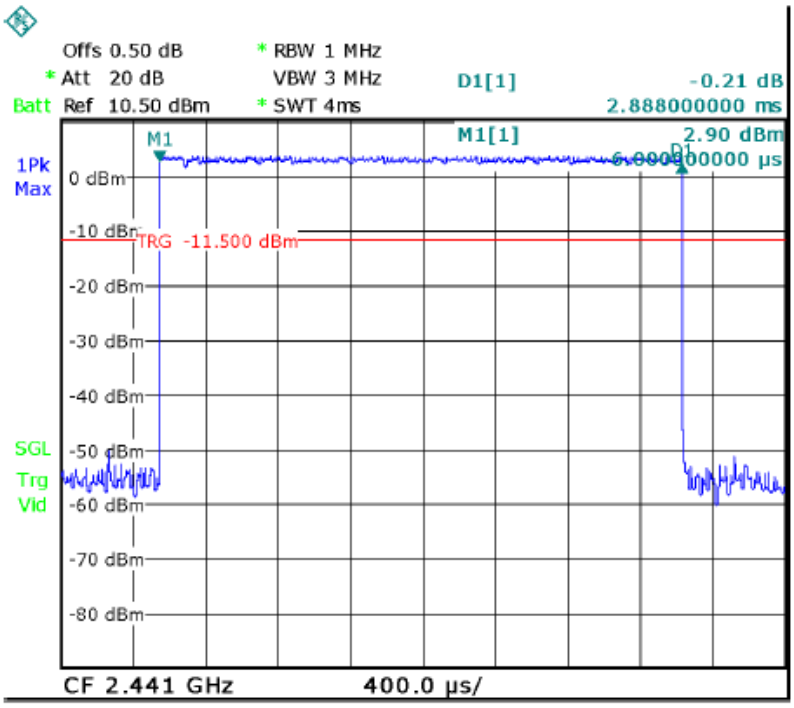
| Data Packet | Dwell Time(s) |
|---|---|
| DH5/2DH5/3DH5 | 1600/79/6*0.4*79*(MkrDelta)/1000 |
| DH3/2DH3/3DH3 | 1600/79/4*0.4*79*(MkrDelta)/1000 |
| DH1/2DH1/3DH1 | 1600/79/2*0.4*79*(MkrDelta)/1000 |
| Remark: Mkr Delta is once pulse time. Only the worst data(DH5) were show as follow. | |

| Modulation | Data Packet | Channel | pulse time(ms) | Dwell Time(s) | Limits(s) |
|---|---|---|---|---|---|
| 8DPSK | 3DH5 | Low | 2.888 | 0.308 | 0.4 |
| | | middle | 2.888 | 0.308 | 0.4 |
| | | High | 2.888 | 0.308 | 0.4 |

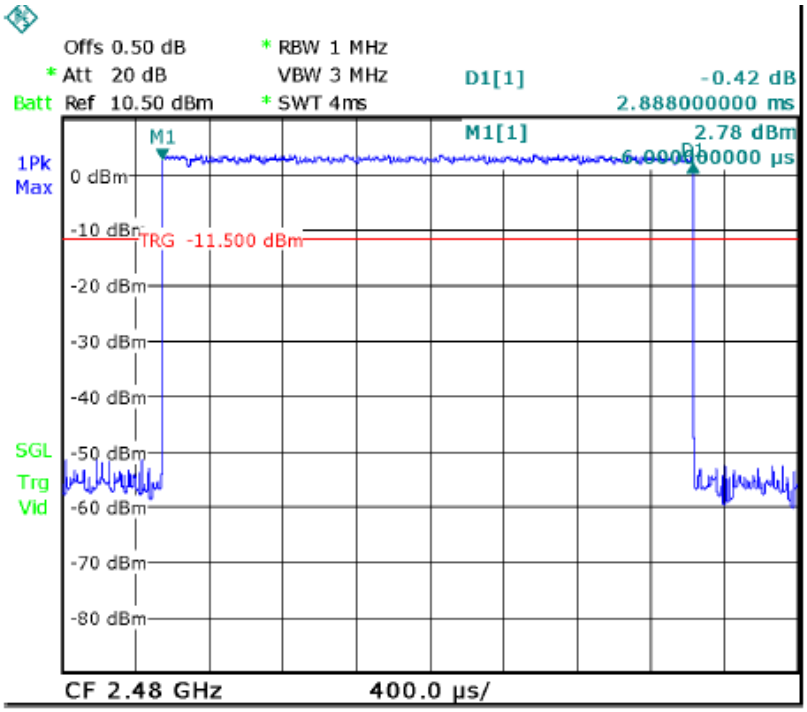
8DPSK Low Channel



8DPSK Middle Channel




8DPSK High Channel

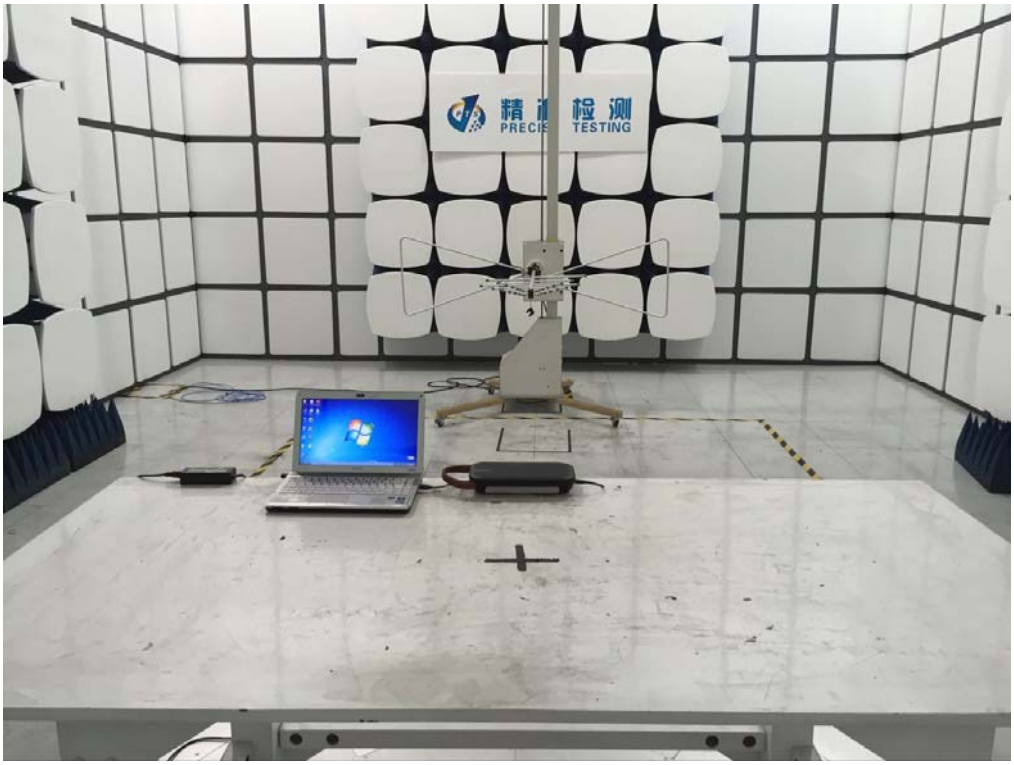


# 13 Antenna Requirement

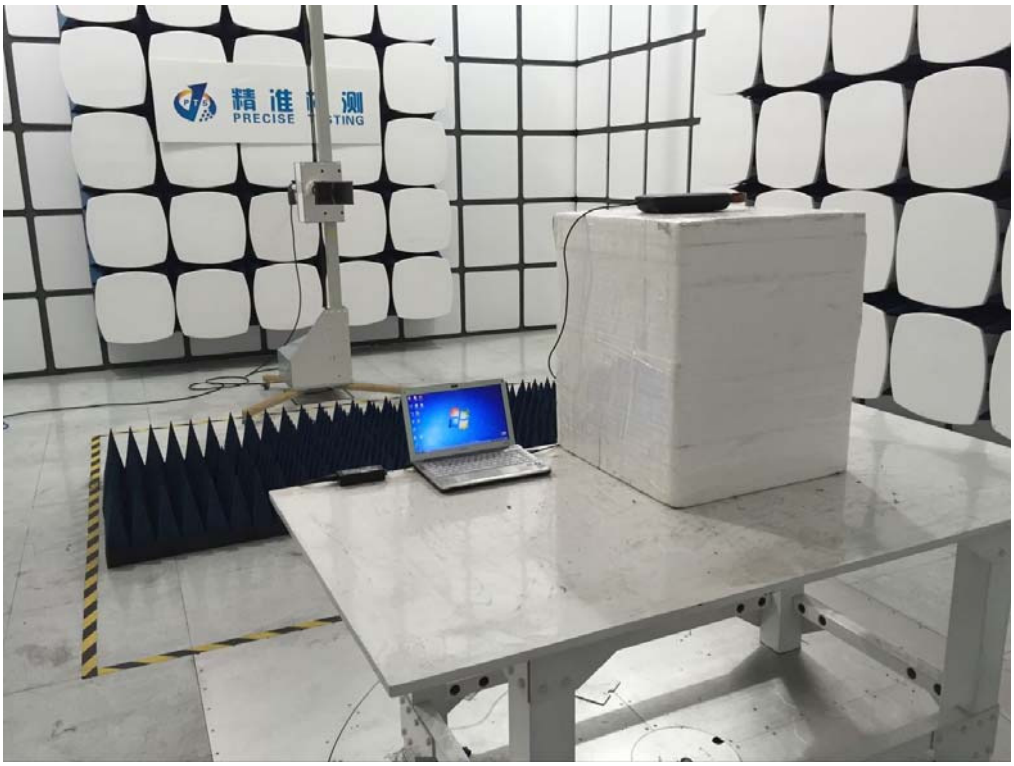
According to the FCC part15.203, a transmitter can only be sold or operated with antennas with which it was approved. This product has a internal permanent antenna, fulfil the requirement of this section.

# 14 Test Setup

Spurious Emissions
From 30MHz-1000MHz




Above 1GHz

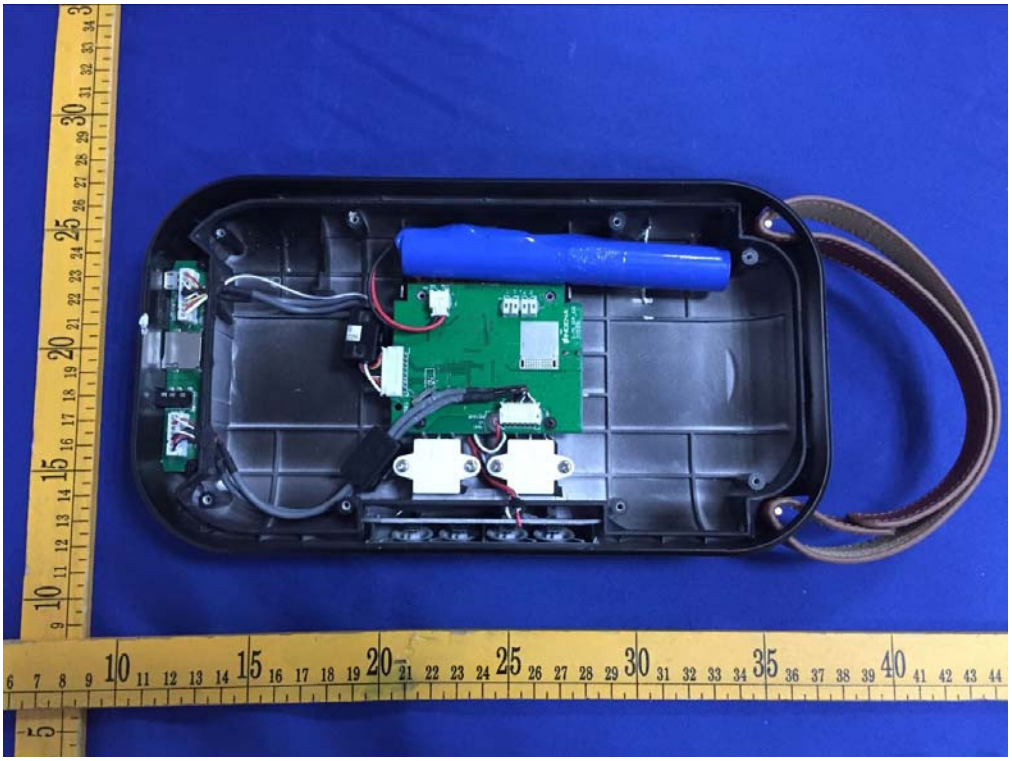


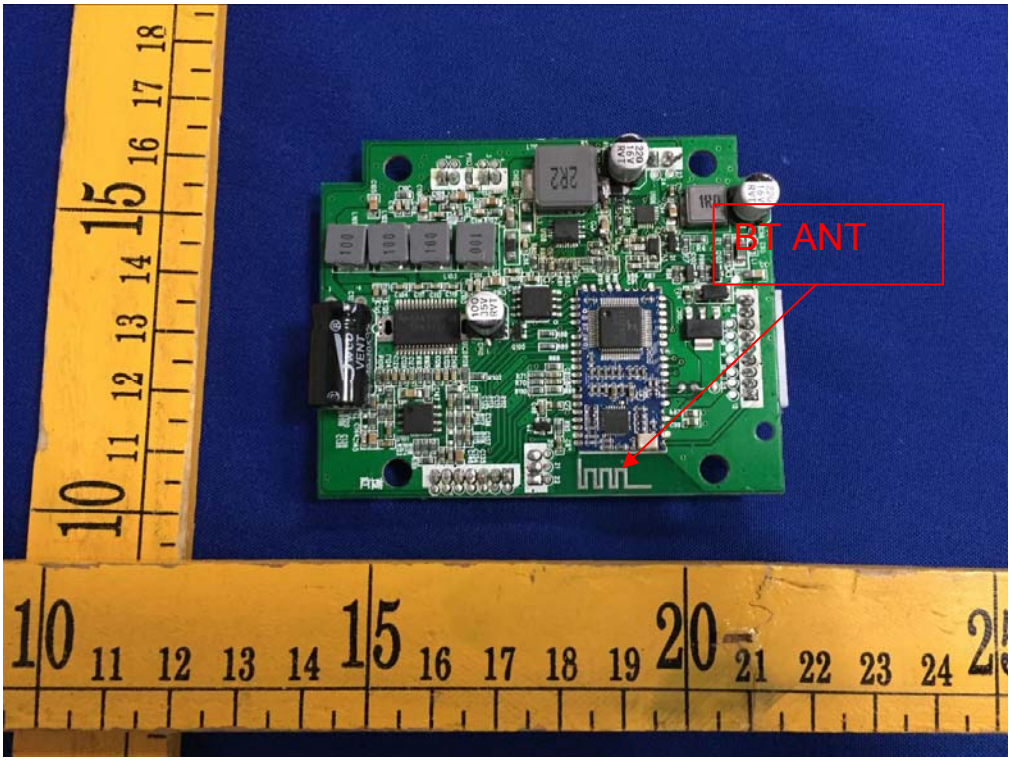
Conducted Emissions

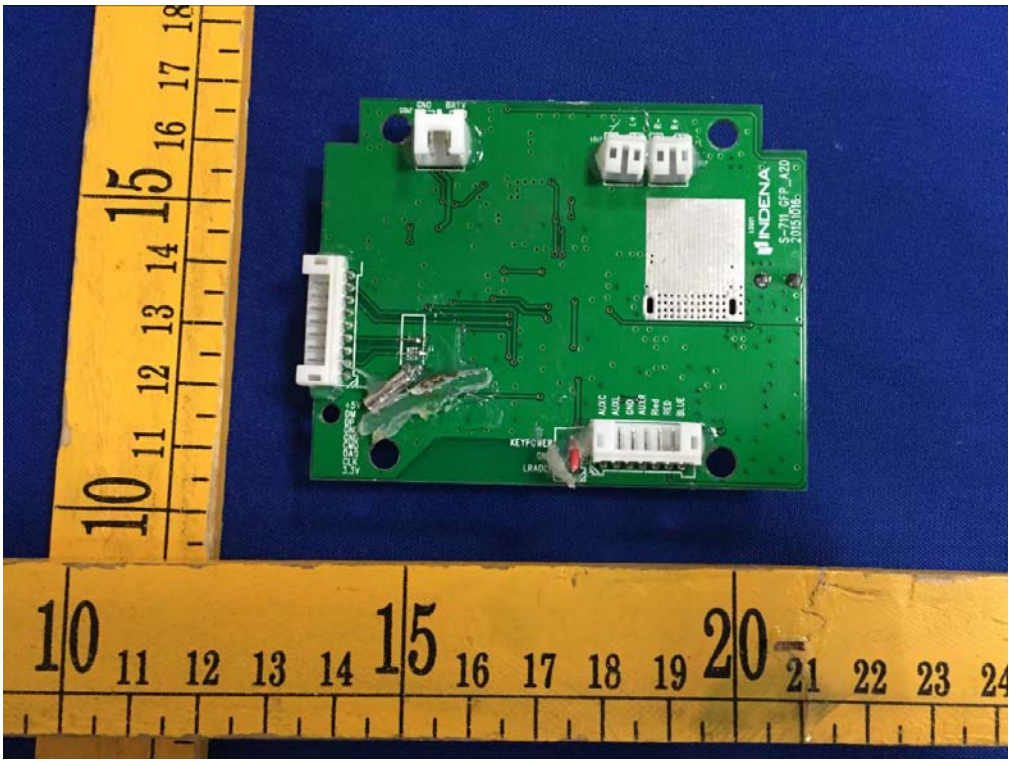
# 15 EUT Photos

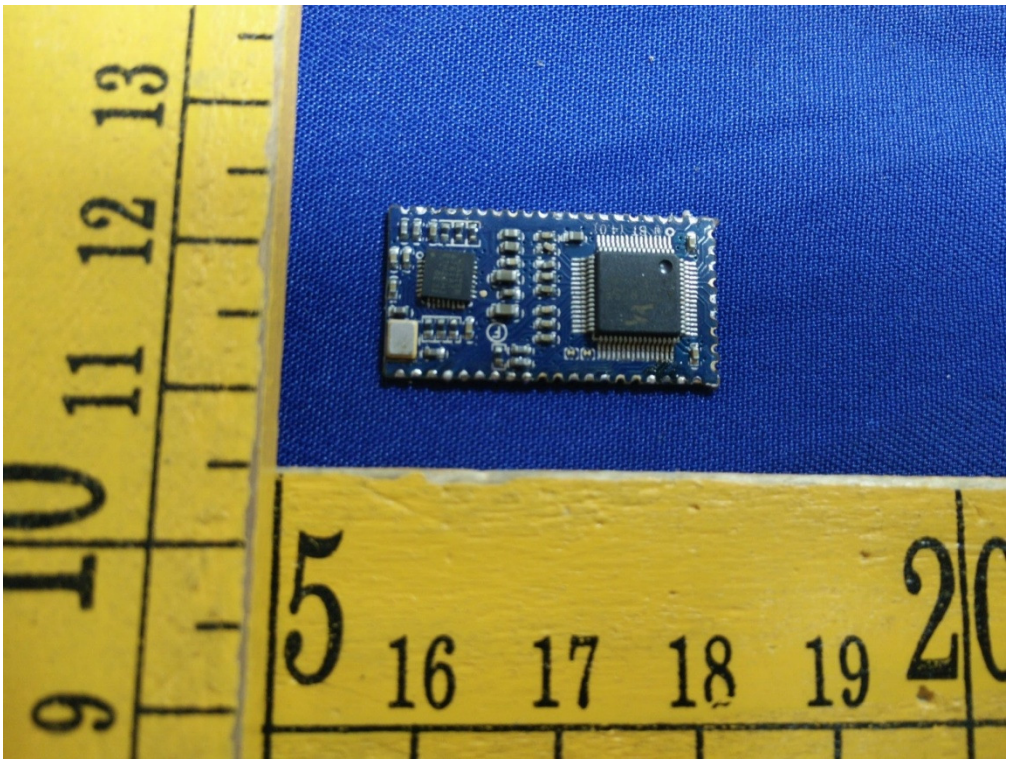
External Photos

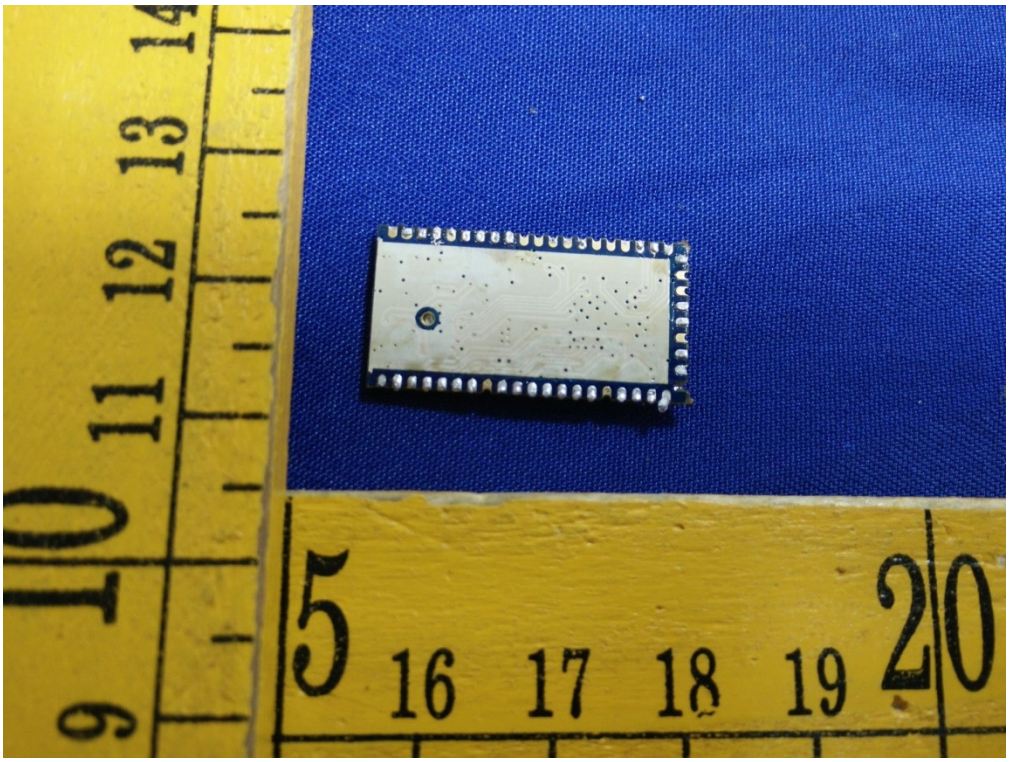
Internal Photos

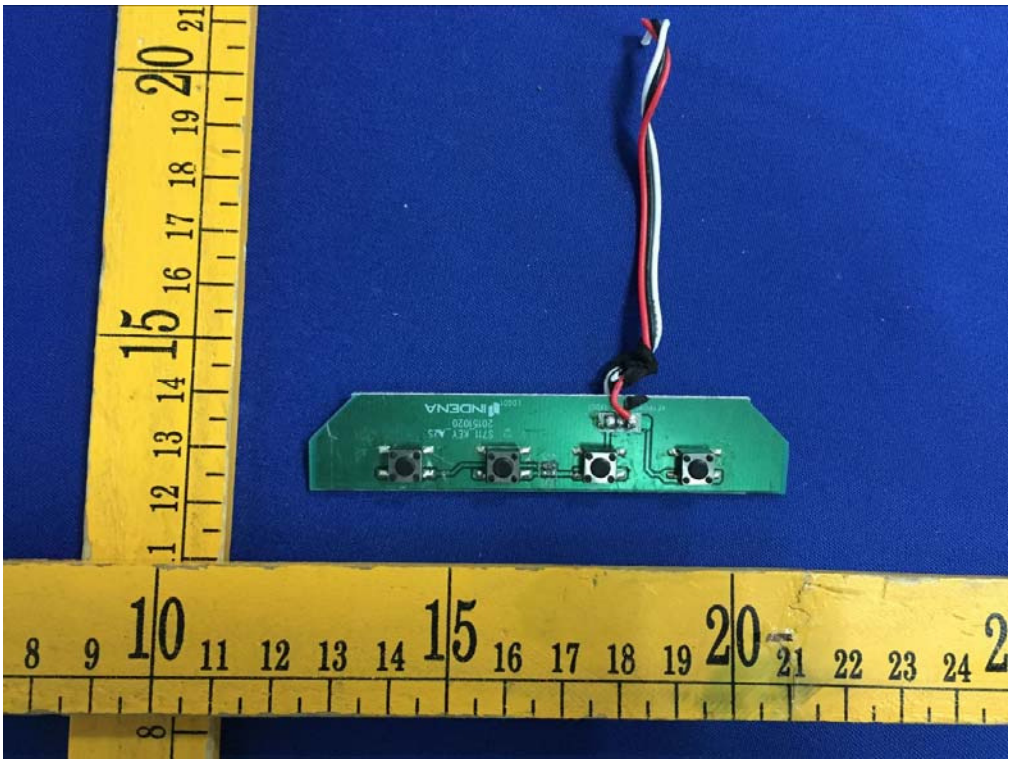


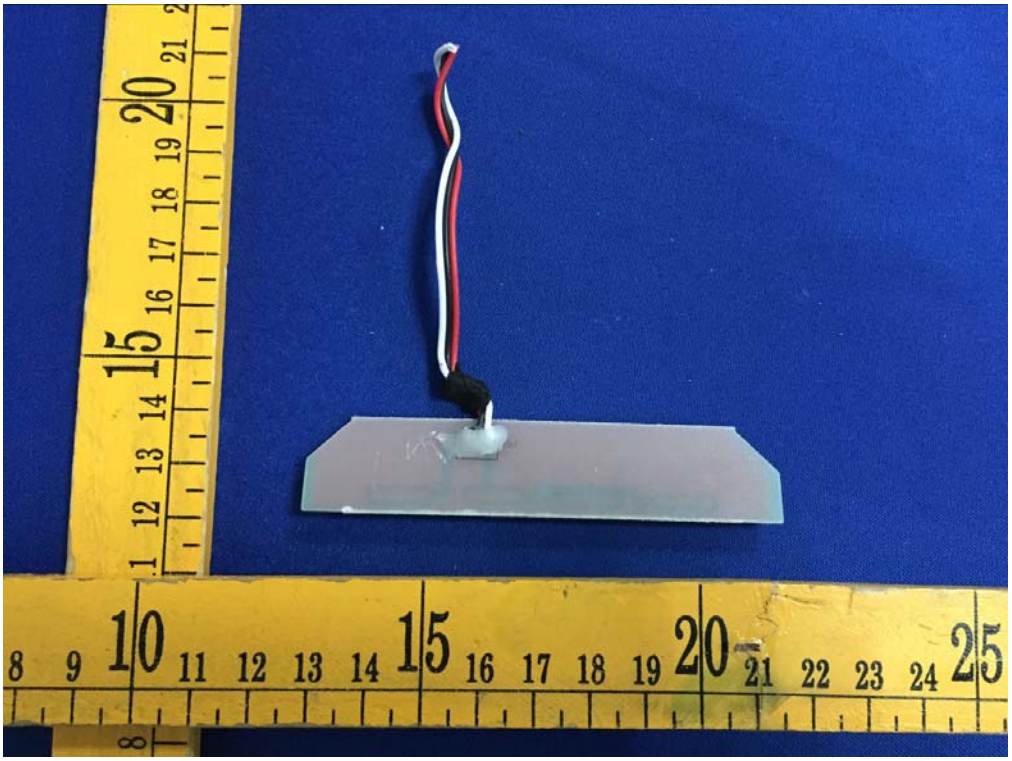

BT ANT

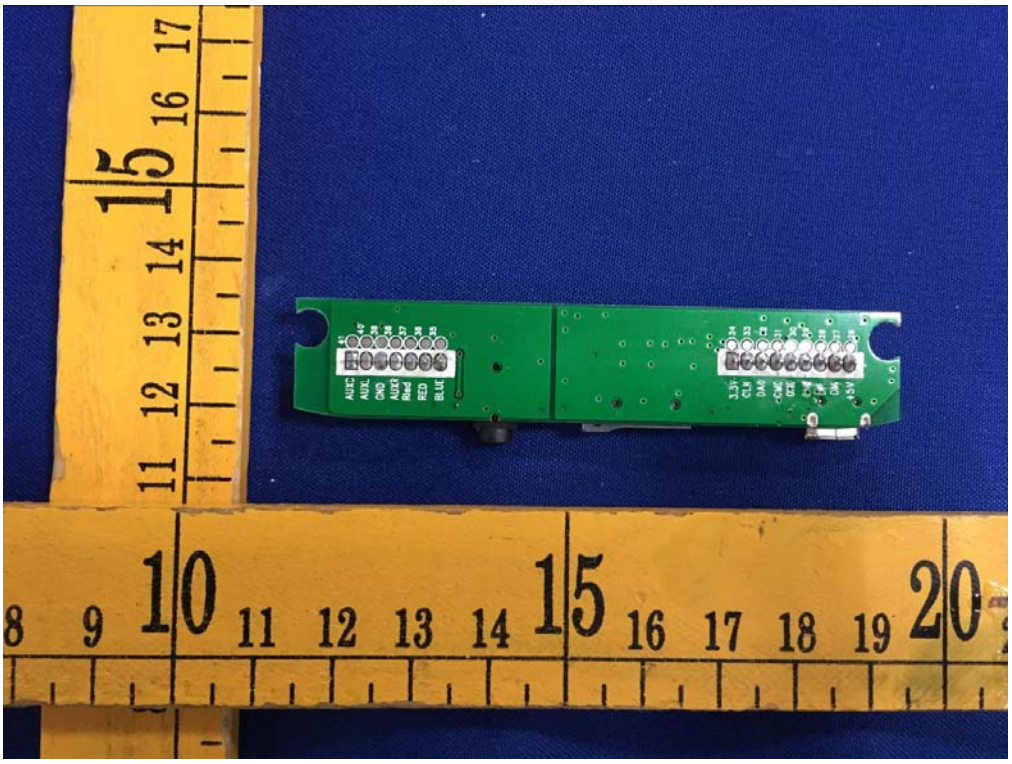


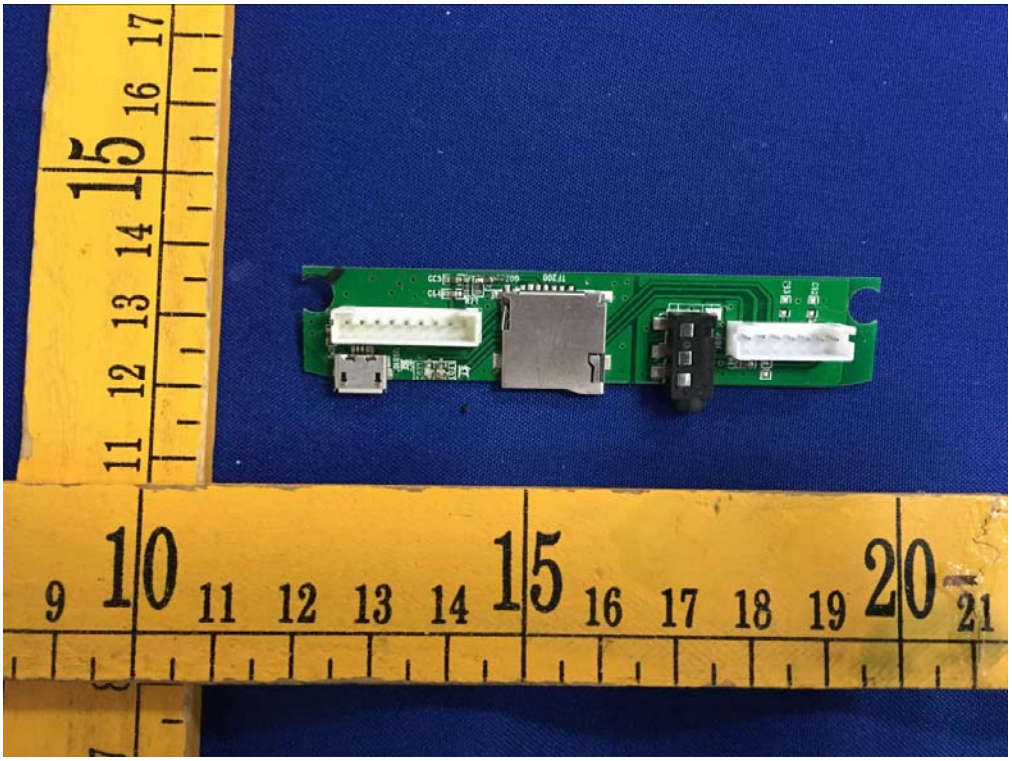












*** * * * * * THE END REPORT* * * * * ***