# FCC TEST REPORT

# FCC ID: 2AIEE–DA149

| | | |
|---|---|---|
| Product Name | : | Wireless Portable Speaker |
| Model Name | : | DA149 |
| Brand Name | : | N/A |
| Report No. | : | PTCHX07170921002E-FC01 |

**Prepared for**

Shenzhen Tomtop Technology Co., Ltd

G Zone 5/f, NO 1 Exchange Square, Huanan City, Pinghu Town, Longgang District Shenzhen, Guangdong Province China

**Prepared by**

Dongguan Precise Testing & Certification Corp., Ltd.

Building D, Baoding Technology Park, Guangming Road 2, Guangming Community, Dongcheng District, Dongguan, Guangdong, China

# 1TEST RESULT CERTIFICATION

| | | |
|---|---|---|
| Applicant's name | : | Shenzhen Tomtop Technology Co., Ltd |
| Address | : | G Zone 5/f, NO 1 Exchange Square, Huanan City, Pinghu Town, Longgang District Shenzhen, Guangdong Province China |
| Manufacture's name | : | SHENZHEN NARUI ELECTRONIC CO., LTD. |
| Address | : | No.6 Building,Ma'an shan Industrial Zone,Hao'San Area,Shajing Sub-District, Bao'an District,Shenzhen city,China |
| Product name | : | Wireless Portable Speaker |
| Model name | : | DA149 |
| Brand Name | : | N/A |
| Standards | : | FCC CFR47 Part 15 Section 15.247 |
| Test procedure | : | ANSI C63.10:2013 |
| Test Date | : | July 09, 2017 to July 11, 2017 |
| Date of Issue | : | July 12, 2017 |
| Test Result | : | Pass |

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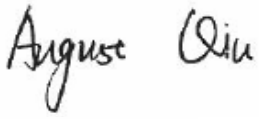
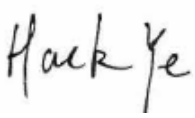
Testing Engineer

August Qiu



Technical Manager

Hack Ye



Authorized Signatory

Chris Du

# Contents

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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 TEST FACILITY

Dongguan Precise Testing & Certification Corp., Ltd.

Building D,Baoding Technology Park,Guangming Road2, Dongcheng District, Dongguan, Guangdong, China, Dongguan, 523129

China

FCC Registration Number: 371540

IC Registration Number: 12191A-1

# 4 General Information

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

| | | |
|---|---|---|
| Product Name | : | Wireless Portable Speaker |
| Model Name | : | DA149 |
| Bluetooth Version | : | BT4.1+EDR |
| Operating frequency | : | 2402-2480MHz |
| Numbers of Channel | : | 79 channels |
| Antenna Type: | : | PCB Print Antenna |
| Antenna Gain: | : | 2dBi |
| Type of Modulation | : | GFSK, Pi/4DQPSK, 8DPSK |
| Power supply | : | DC 3.7V, 2000mAh Battery |
| Hardware Version | : | N/A |
| Software Version | : | 4.1 |

## 4.2 Test Mode

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

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

The EUT has been tested under TX operating condition.

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

Channel List:

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

| **Channel** | **Frequency(MHz)** |
|---|---|
| 1 | 2402 |
| 40 | 2441 |
| 79 | 2480 |

# 5 Equipment During Test

## 5.1 Equipments List

RF Conducted Test

| Name of Equipment | Manufacturer | Model | Serial No. | Calibration Due |
|---|---|---|---|---|
| MXG Signal Analyzer | Agilent | N9020A | MY56070279 | Apr 7,18 |
| MIMO4TX-1 | / | MIMO4TX | TW5451101 | Apr 7,18 |
| MXG Vector Signal Generator | Agilent | N5182A | MY50143410 | Apr 7,18 |
| MXG Analog Signal Generator | KEYSIGHT | N5181B | MY53050432 | Apr 7,18 |

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

Radiated Emissions

| Name of Equipment | Manufacturer | Model | Serial No. | Calibration Due |
|---|---|---|---|---|
| EMI Test Receiver | Rohde&Schwarz | ESCI | 101417 | Sep. 03, 2018 |
| Bilog Antenna | SCHWARZBECK | VULB9160 | 9160-3355 | Aug 31, 2018 |
| Preamplifier (low frequency) | SCHWARZBECK | BBV 9475 | 9745-0013 | Sep. 03, 2018 |
| Spectrum Analyzer | Agilent | E4407B | MY45109572 | Oct. 13, 2017 |
| Horn Antenna | SCHWARZBECK | 9120D | 9120D-1246 | Aug. 31, 2018 |
| LOW NOISE AMPLIFIER | ZHINAN | ZN3380C | 15002 | Sep 03, 2018 |

Conducted Emissions

| Name of Equipment | Manufacturer | Model | Serial No. | Calibration Due |
|---|---|---|---|---|
| EMI Test Receiver | Rohde&Schwarz | ESCI | 101417 | Sep. 03, 2018 |
| Artificial Mains Network | Rohde&Schwarz | L2-16B | 000WX31025 | Sep. 03, 2018 |
| Artificial Mains Network | Rohde&Schwarz | ENV216 | 101342 | Sep. 03, 2018 |

## 5.2 Measurement Uncertainty

| Parameter | Uncertainty |
|---|---|
| RF output power, conducted | ±1.0dB |
| Power Spectral Density, conducted | ±2.2dB |
| Radio Frequency | ± 1 x $10^{-6}$ |
| Bandwidth | ± 1.5 x $10^{-6}$ |
| 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 |
| Remark: The coverage Factor (k=2), and measurement Uncertainty for a level of Confidence of 95% | |

## 5.3 Description of Support Units

| Equipment | Model No. | Series No. |
|---|---|---|
| Adapter | NSA12UH-050200<br>Input: AC 100-240V, 50/60Hz, 0.5A<br>Output: DC 5V, 2A | N/A |

# 6 Conducted Emission

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

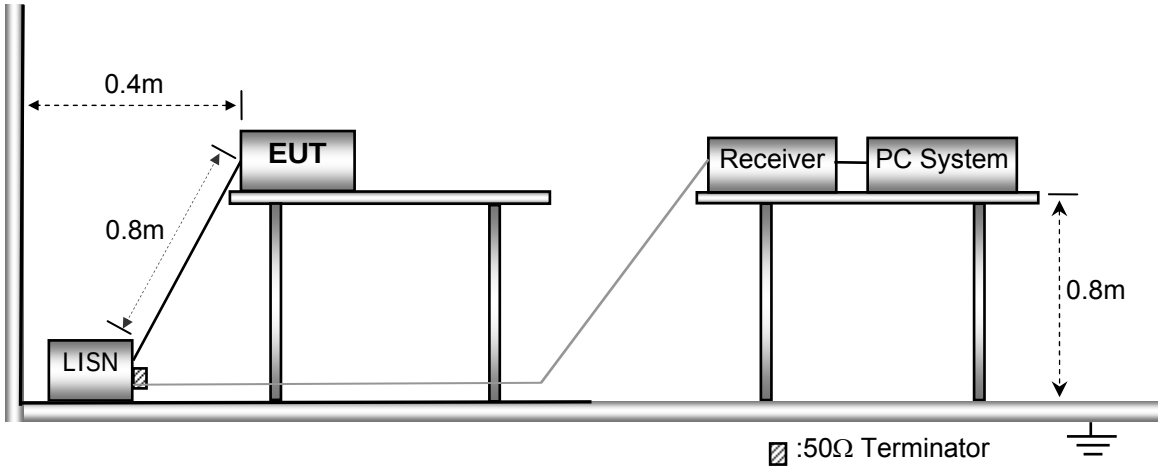
## 6.1 E.U.T. Operation

Operating Environment **:**

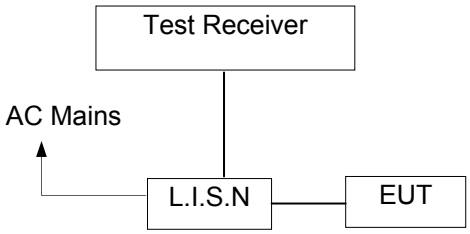
| | | |
|---|---|---|
| Temperature: | : | 25.5 °C |
| Humidity: | : | 51 % RH |
| Atmospheric Pressure: | : | 101.2kPa |
| EUT Operation **:** | : | Refer to section 3.3 |

## 6.2 EUT Setup

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



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




## 6.4 Measurement Procedure:

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

## 6.5 Conducted Emission Limit

**Conducted Emission**

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

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

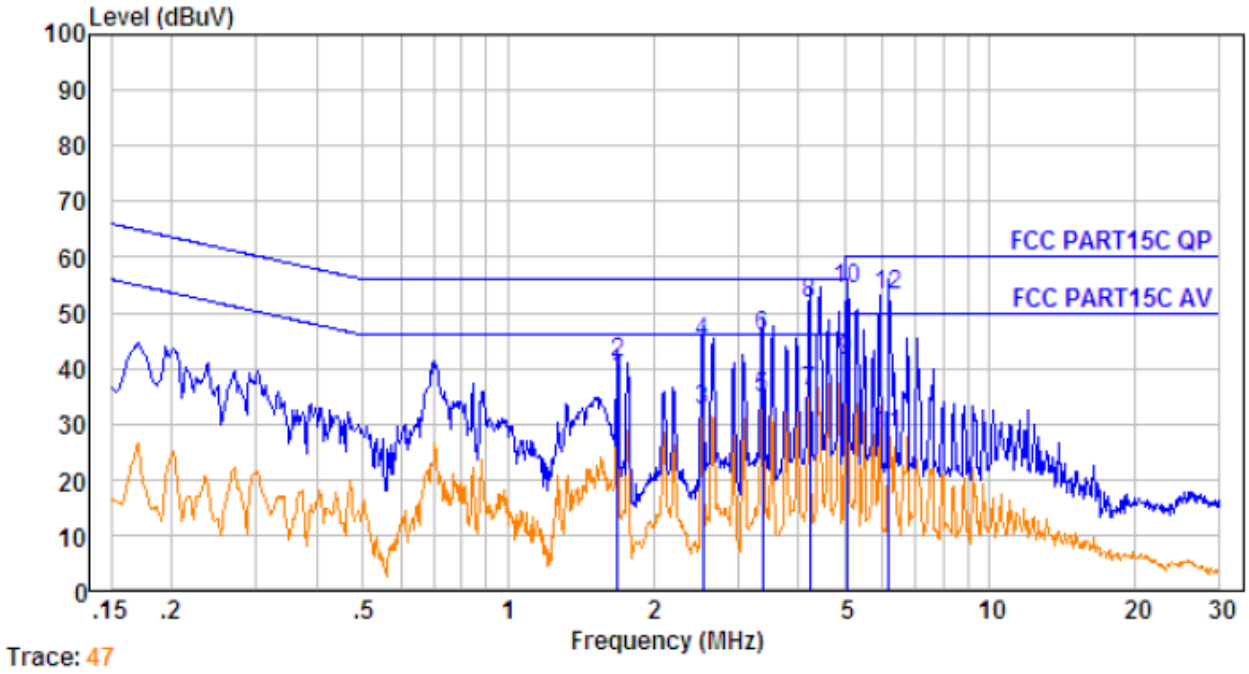
## 6.6 Measurement Description

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

## 6.7 Conducted Emission Test Result

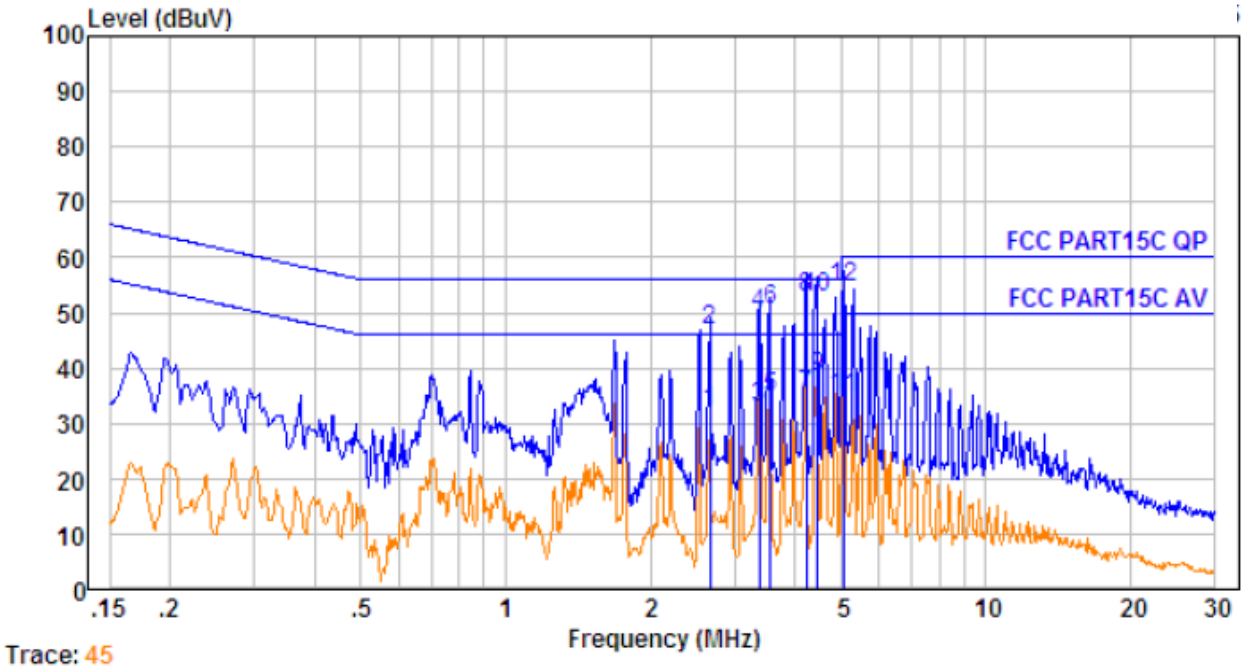
Pass
Please find the following pages.

Line -120V/60Hz:



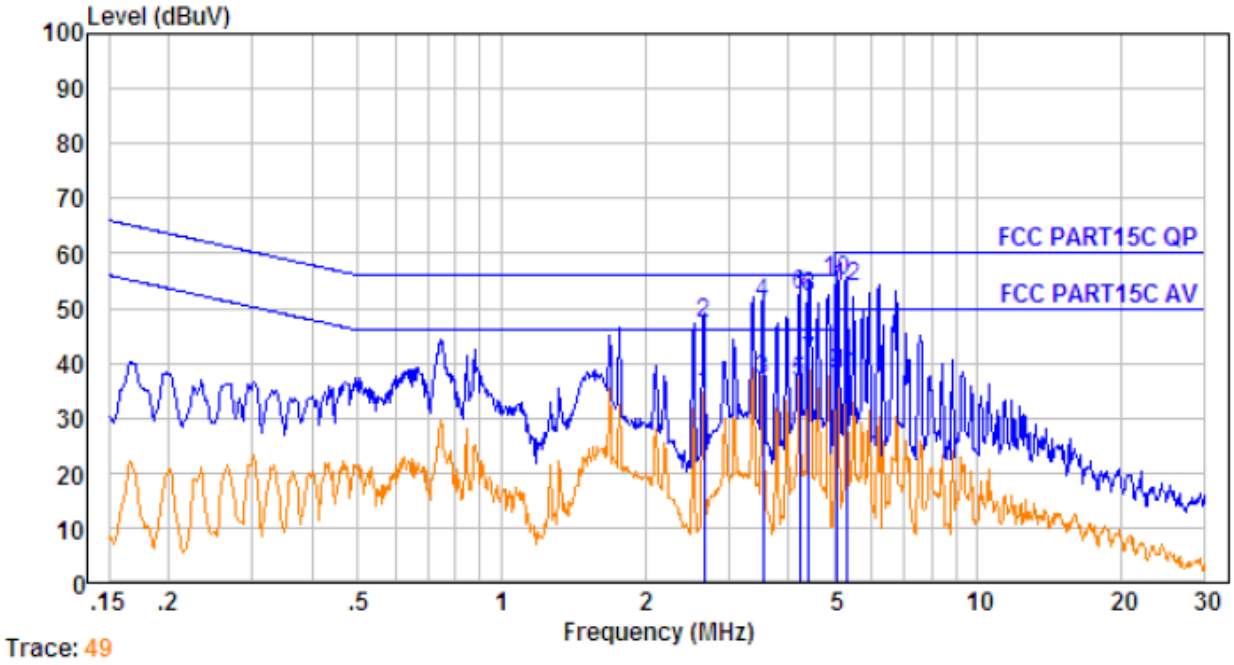

| No. | Freq MHz | Cable Loss dB | AMN Factor dB | Receiver Reading dBuV | Emission Level dBuV | Limit dBuV | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 1. | 1.689 | 0.47 | 0.15 | 37.40 | 38.02 | 46.00 | -7.98 | Average |
| 2. | 1.689 | 0.47 | 0.15 | 40.40 | 41.02 | 56.00 | -14.98 | QP |
| 3. | 2.540 | 0.47 | 0.15 | 32.02 | 32.64 | 46.00 | -13.36 | Average |
| 4. | 2.540 | 0.47 | 0.15 | 44.02 | 44.64 | 56.00 | -11.36 | QP |
| 5. | 3.381 | 0.47 | 0.15 | 34.23 | 34.85 | 46.00 | -11.15 | Average |
| 6. | 3.381 | 0.47 | 0.15 | 45.23 | 45.85 | 56.00 | -10.15 | QP |
| 7. | 4.224 | 0.48 | 0.15 | 35.03 | 35.66 | 46.00 | -10.34 | Average |
| 8. | 4.224 | 0.48 | 0.15 | 51.03 | 51.66 | 56.00 | -4.34 | QP |
| 9. | 5.058 | 0.50 | 0.15 | 40.52 | 41.17 | 50.00 | -8.83 | Average |
| 10. | 5.058 | 0.50 | 0.15 | 53.52 | 54.17 | 60.00 | -5.83 | QP |
| 11. | 6.186 | 0.53 | 0.15 | 27.50 | 28.18 | 50.00 | -21.82 | Average |
| 12. | 6.186 | 0.53 | 0.15 | 52.50 | 53.18 | 60.00 | -6.82 | QP |

Neutral -120V/60Hz:



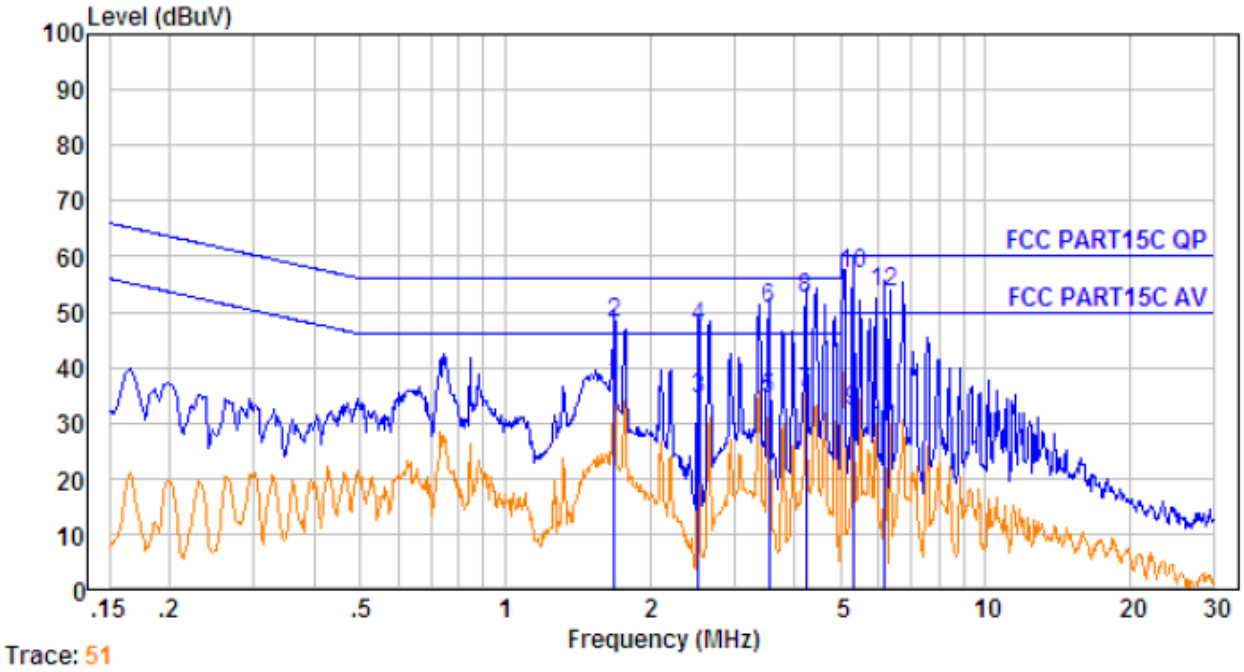

| No. | Freq MHz | Cable Loss dB | AMN Factor dB | Receiver Reading dBuV | Emission Level dBuV | Limit dBuV | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 1. | 2.664 | 0.47 | 0.33 | 31.22 | 32.02 | 46.00 | -13.98 | Average |
| 2. | 2.664 | 0.47 | 0.33 | 46.22 | 47.02 | 56.00 | -8.98 | QP |
| 3. | 3.381 | 0.47 | 0.32 | 32.20 | 32.99 | 46.00 | -13.01 | Average |
| 4. | 3.381 | 0.47 | 0.32 | 49.20 | 49.99 | 56.00 | -6.01 | QP |
| 5. | 3.565 | 0.47 | 0.32 | 33.80 | 34.59 | 46.00 | -11.41 | Average |
| 6. | 3.565 | 0.47 | 0.32 | 49.80 | 50.59 | 56.00 | -5.41 | QP |
| 7. | 4.224 | 0.48 | 0.31 | 34.22 | 35.01 | 46.00 | -10.99 | Average |
| 8. | 4.224 | 0.48 | 0.31 | 52.10 | 52.89 | 56.00 | -3.11 | QP |
| 9. | 4.454 | 0.49 | 0.31 | 37.64 | 38.44 | 46.00 | -7.56 | Average |
| 10. | 4.454 | 0.49 | 0.31 | 51.80 | 52.60 | 56.00 | -3.40 | QP |
| 11. | 5.058 | 0.50 | 0.31 | 33.81 | 34.62 | 50.00 | -15.38 | Average |
| 12. | 5.058 | 0.50 | 0.31 | 53.81 | 54.62 | 60.00 | -5.38 | QP |

Line -240V/60Hz:




| No. | Freq MHz | Cable Loss dB | AMN Factor dB | Receiver Reading dBuV | Emission Level dBuV | Limit dBuV | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 1. | 2.664 | 0.47 | 0.15 | 33.58 | 34.20 | 46.00 | -11.80 | Average |
| 2. | 2.664 | 0.47 | 0.15 | 46.58 | 47.20 | 56.00 | -8.80 | QP |
| 3. | 3.547 | 0.47 | 0.15 | 36.30 | 36.92 | 46.00 | -9.08 | Average |
| 4. | 3.547 | 0.47 | 0.15 | 50.30 | 50.92 | 56.00 | -5.08 | QP |
| 5. | 4.224 | 0.48 | 0.15 | 35.79 | 36.42 | 46.00 | -9.58 | Average |
| 6. | 4.224 | 0.48 | 0.15 | 51.79 | 52.42 | 56.00 | -3.58 | QP |
| 7. | 4.430 | 0.48 | 0.15 | 39.54 | 40.17 | 46.00 | -5.83 | Average |
| 8. | 4.430 | 0.48 | 0.15 | 51.54 | 52.17 | 56.00 | -3.83 | QP |
| 9. | 5.058 | 0.50 | 0.15 | 37.35 | 38.00 | 50.00 | -12.00 | Average |
| 10. | 5.058 | 0.50 | 0.15 | 54.35 | 55.00 | 60.00 | -5.00 | QP |
| 11. | 5.305 | 0.51 | 0.15 | 37.18 | 37.84 | 50.00 | -12.16 | Average |
| 12. | 5.305 | 0.51 | 0.15 | 53.18 | 53.84 | 60.00 | -6.16 | QP |

Neutral -240V/60Hz:




| No. | Freq MHz | Cable Loss dB | AMN Factor dB | Receiver Reading dBuV | Emission Level dBuV | Limit dBuV | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 1. | 1.689 | 0.47 | 0.36 | 36.17 | 37.00 | 46.00 | -9.00 | Average |
| 2. | 1.689 | 0.47 | 0.36 | 47.17 | 48.00 | 56.00 | -8.00 | QP |
| 3. | 2.527 | 0.47 | 0.34 | 33.46 | 34.27 | 46.00 | -11.73 | Average |
| 4. | 2.527 | 0.47 | 0.34 | 46.46 | 47.27 | 56.00 | -8.73 | QP |
| 5. | 3.547 | 0.47 | 0.32 | 33.63 | 34.42 | 46.00 | -11.58 | Average |
| 6. | 3.547 | 0.47 | 0.32 | 49.63 | 50.42 | 56.00 | -5.58 | QP |
| 7. | 4.224 | 0.48 | 0.31 | 34.59 | 35.38 | 46.00 | -10.62 | Average |
| 8. | 4.224 | 0.48 | 0.31 | 51.59 | 52.38 | 56.00 | -3.62 | QP |
| 9. | 5.305 | 0.51 | 0.31 | 31.23 | 32.05 | 50.00 | -17.95 | Average |
| 10. | 5.305 | 0.51 | 0.31 | 55.90 | 56.72 | 60.00 | -3.28 | QP |
| 11. | 6.186 | 0.53 | 0.31 | 27.82 | 28.66 | 50.00 | -21.34 | Average |
| 12. | 6.186 | 0.53 | 0.31 | 52.82 | 53.66 | 60.00 | -6.34 | QP |

# 7 Radiated Spurious Emissions

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

Test Method: : ANSI C63.10:2013

Test Result: : PASS

Measurement Distance: : 3m

Limit: : See the follow table

| Frequency (MHz) | Field Strength | | Field Strength Limit at 3m Measurement Dist | |
|---|---|---|---|---|
| | uV/m | Distance (m) | uV/m | dBuV/m |
| 0.009 ~ 0.490 | 2400/F(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

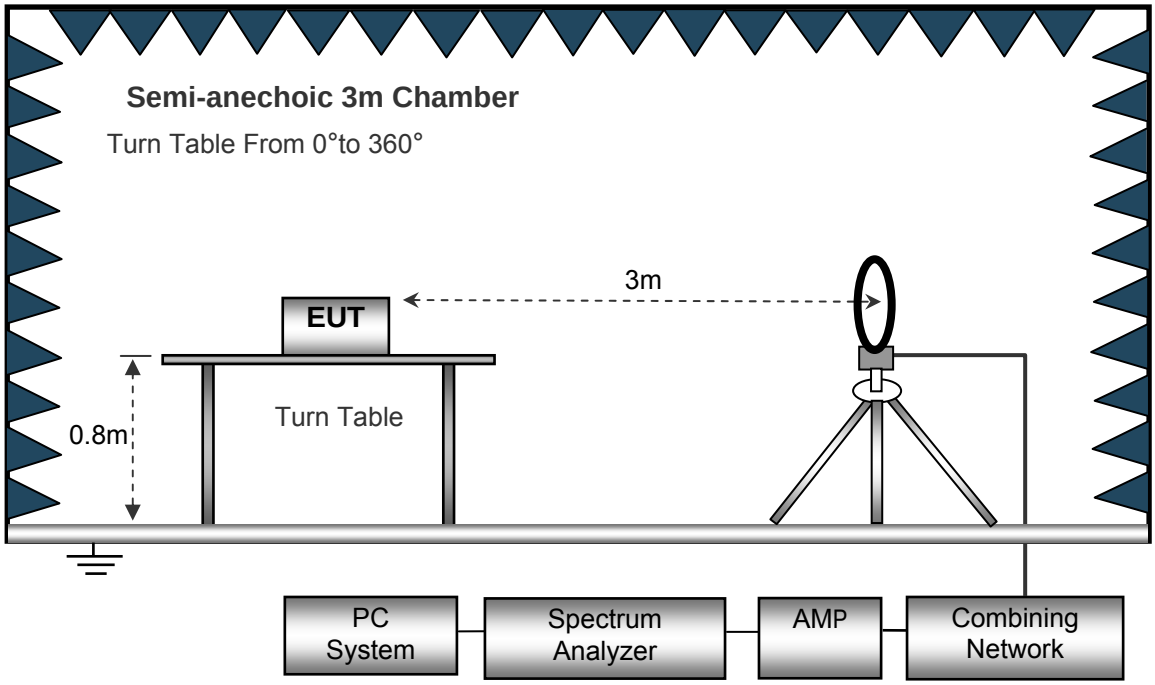
EUT Operation : : Refer to section 3.3

Test Voltage : AC 120V/60Hz

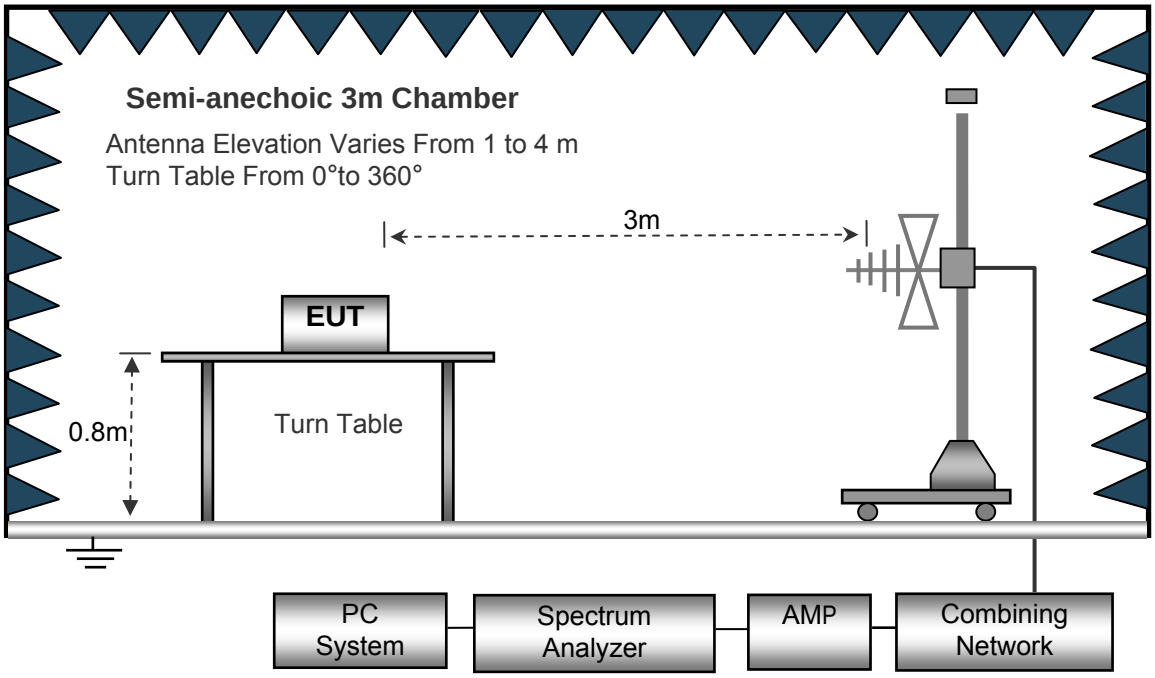
## 7.2 Test Setup

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

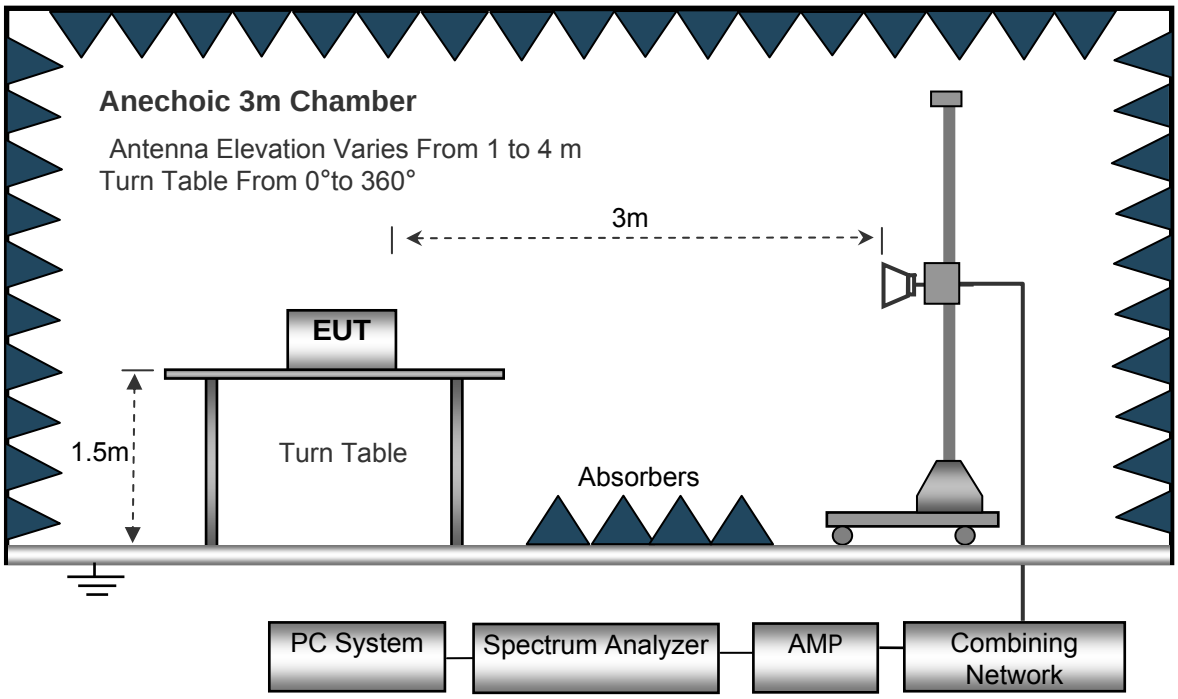
The test setup for emission measurement below 30MHz.




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



The test setup for emission measurement above 1 GHz.




## 7.3 Spectrum Analyzer Setup

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

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

## 7.4 Test Procedure

1. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10-2013.

2. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane. And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m above ground plane.

3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (From 1m to 4m) and turntable (from 0 degree to 360 degree) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.

5. Set to the maximum power setting and enable the EUT transmit continuously.

6. Final measurement (Above 1GHz): The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1MHz. The measurement will be performed in horizontal and vertical polarization of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 degree to 360 degree in order to have the antenna inside the cone of radiation.

7. Test Procedure of measurement (For Above 1GHz):

1) Monitor the frequency range at horizontal polarization and move the antenna over all sides of the EUT(if necessary move the EUT to another orthogonal axis).

2) Change the antenna polarization and repeat 1) with vertical polarization.

3) Make a hardcopy of the spectrum.

4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.

5) Change the analyser mode to Clear/ Write and found the cone of emission.

6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3m and the antenna will be still inside the cone of emission.

7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarization and azimuth and the peak and average detector, which causes the maximum emission.

8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.

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

## 7.5 Summary of Test Results

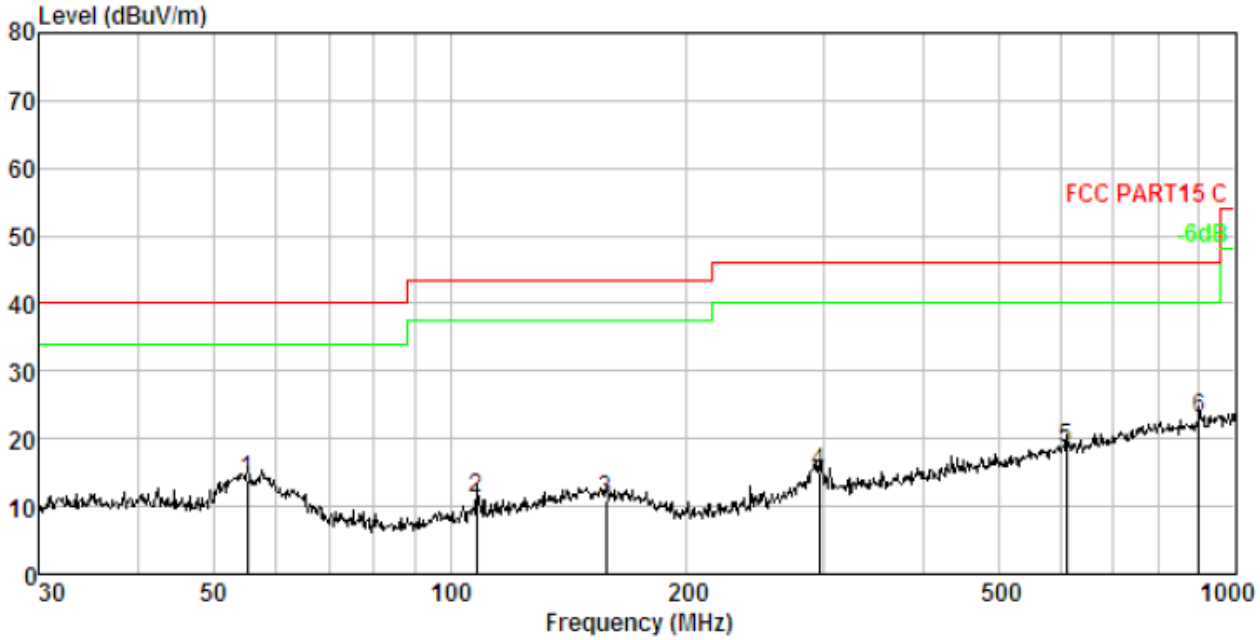
**Test Frequency: Below 30MHz**

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

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

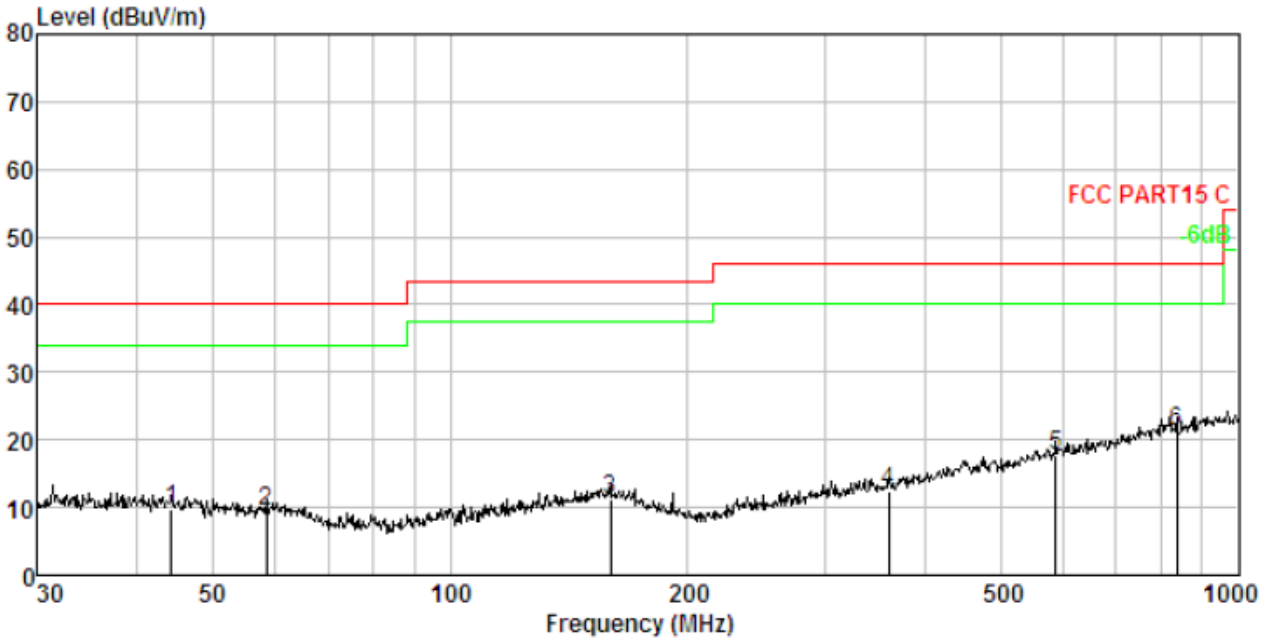
Remark: only the worst data(GFSK modulation mode) were reported.

Test plot for Horizontal: GFSK(2402MHz)



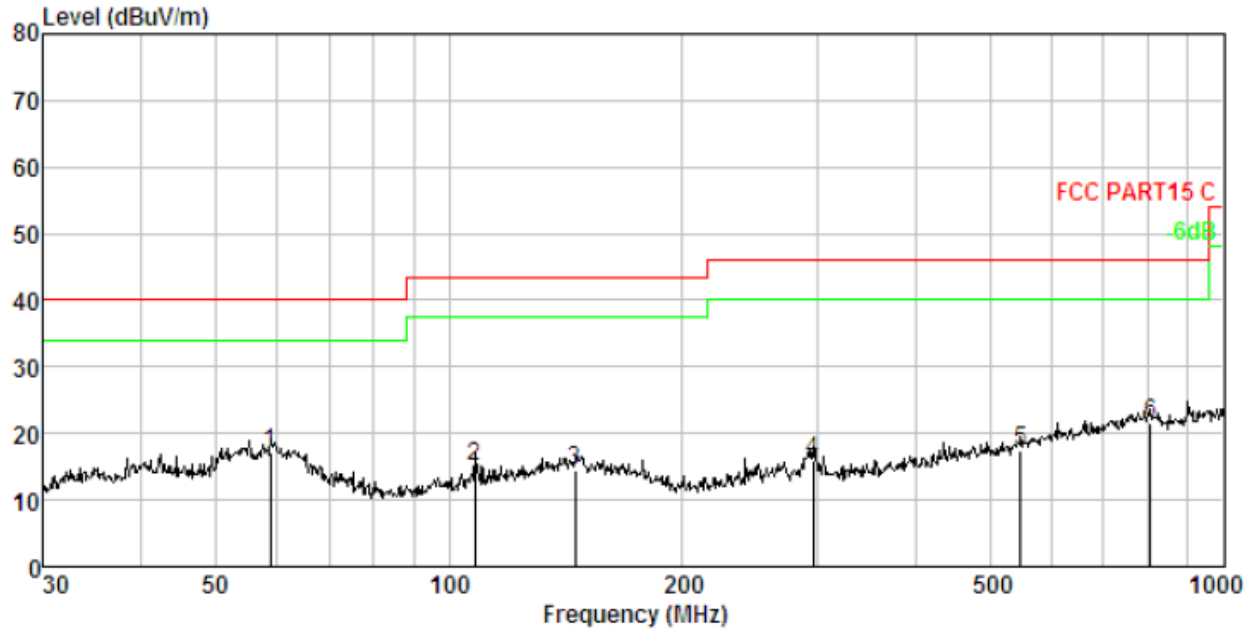

| No. | Freq MHz | Cable Loss dB | ANT Factor dB/m | Receiver Reading dBuV | Preamp Factor dB | Emission Level dBuV/m | Limit dBuV/m | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 55.221 | 1.61 | 11.91 | 30.53 | 30.18 | 13.87 | 40.00 | -26.13 | QP |
| 2. | 107.888 | 2.21 | 10.90 | 28.48 | 30.42 | 11.17 | 43.50 | -32.33 | QP |
| 3. | 158.112 | 2.56 | 13.88 | 25.14 | 30.55 | 11.03 | 43.50 | -32.47 | QP |
| 4. | 295.147 | 3.13 | 13.10 | 29.49 | 30.77 | 14.95 | 46.00 | -31.05 | QP |
| 5. | 609.922 | 3.78 | 19.18 | 26.68 | 31.02 | 18.62 | 46.00 | -27.38 | QP |
| 6. | 900.147 | 4.13 | 22.58 | 27.38 | 31.15 | 22.94 | 46.00 | -23.06 | QP |

Test plot for Vertical: GFSK(2402MHz)



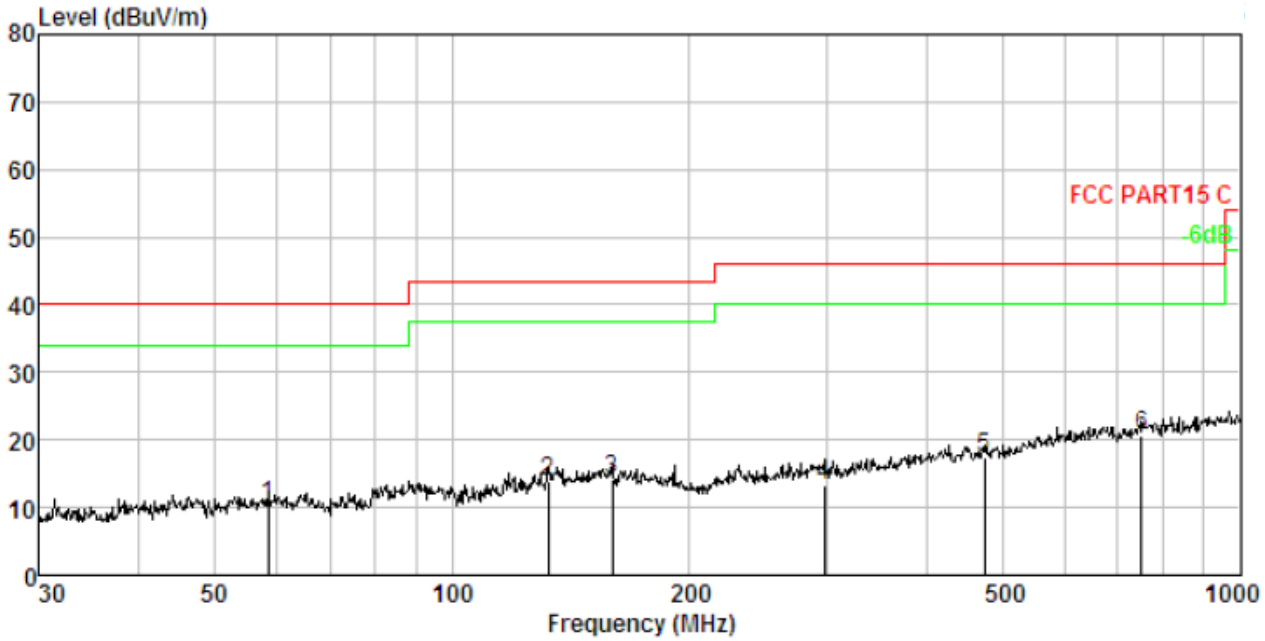

| No. | Freq MHz | Cable Loss dB | ANT Factor dB/m | Receiver Reading dBuV | Preamp Factor dB | Emission Level dBuV/m | Limit dBuV/m | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 44.275 | 1.41 | 13.31 | 25.26 | 30.11 | 9.87 | 40.00 | -30.13 | QP |
| 2. | 58.407 | 1.66 | 12.09 | 25.77 | 30.20 | 9.32 | 40.00 | -30.68 | QP |
| 3. | 159.784 | 2.57 | 13.88 | 25.30 | 30.55 | 11.20 | 43.50 | -32.30 | QP |
| 4. | 360.448 | 3.31 | 14.40 | 25.51 | 30.83 | 12.39 | 46.00 | -33.61 | QP |
| 5. | 586.844 | 3.75 | 18.81 | 26.28 | 31.00 | 17.84 | 46.00 | -28.16 | QP |
| 6. | 836.244 | 4.07 | 21.99 | 26.32 | 31.13 | 21.25 | 46.00 | -24.75 | QP |

Test plot for Horizontal: GFSK(2441MHz)



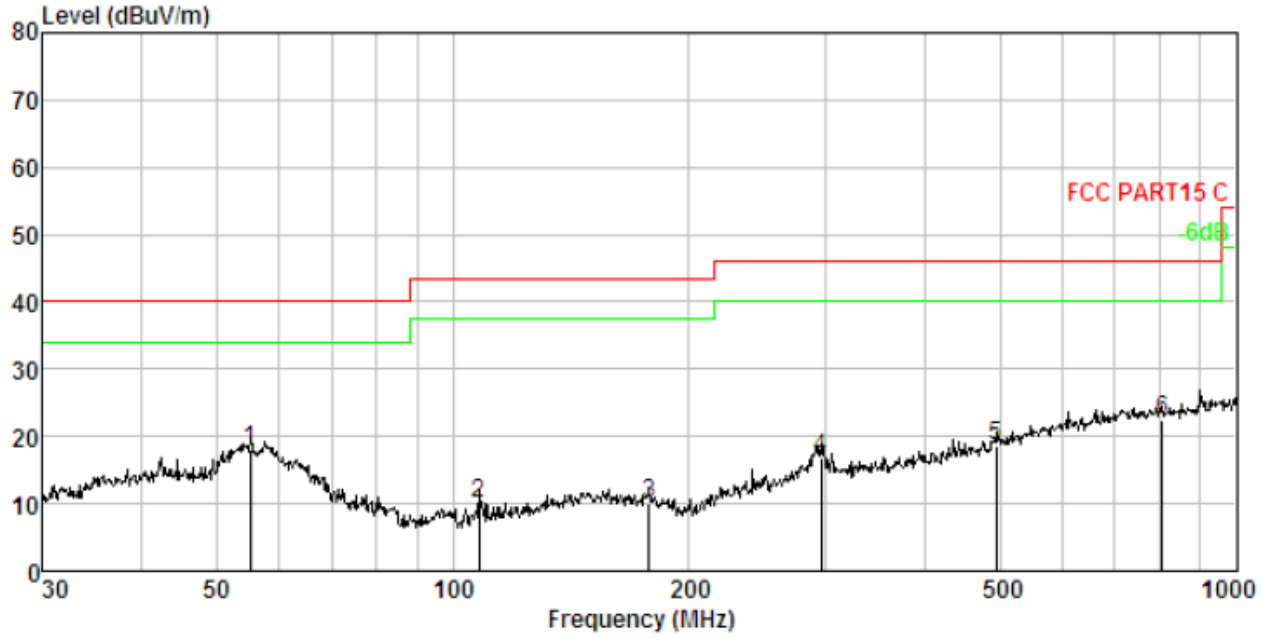

| No. | Freq MHz | Cable Loss dB | ANT Factor dB/m | Receiver Reading dBuV | Preamp Factor dB | Emission Level dBuV/m | Limit dBuV/m | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 58.819 | 1.66 | 12.11 | 33.68 | 30.20 | 17.25 | 40.00 | -22.75 | QP |
| 2. | 107.888 | 2.21 | 10.90 | 32.48 | 30.42 | 15.17 | 43.50 | -28.33 | QP |
| 3. | 145.351 | 2.48 | 13.65 | 28.98 | 30.52 | 14.59 | 43.50 | -28.91 | QP |
| 4. | 295.147 | 3.13 | 13.10 | 30.49 | 30.77 | 15.95 | 46.00 | -30.05 | QP |
| 5. | 547.098 | 3.68 | 17.86 | 26.86 | 30.98 | 17.42 | 46.00 | -28.58 | QP |
| 6. | 804.603 | 4.03 | 21.79 | 26.78 | 31.11 | 21.49 | 46.00 | -24.51 | QP |

Test plot for Vertical: GFSK(2441MHz)



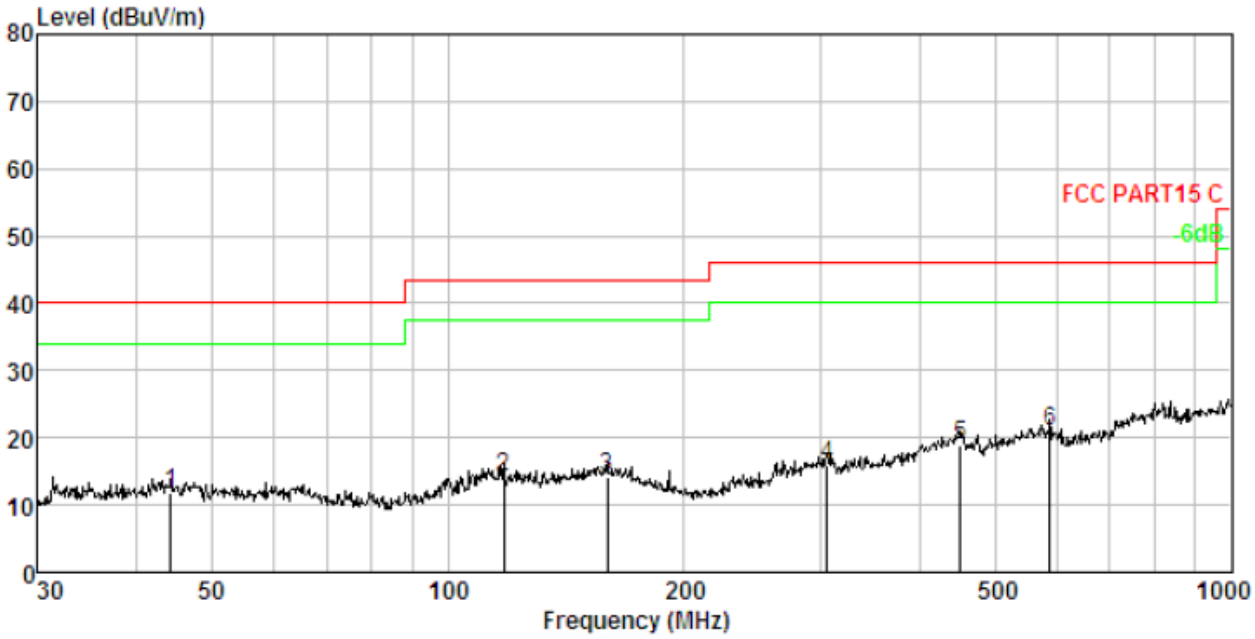

| No. | Freq MHz | Cable Loss dB | ANT Factor dB/m | Receiver Reading dBuV | Preamp Factor dB | Emission Level dBuV/m | Limit dBuV/m | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 58.407 | 1.66 | 12.09 | 26.77 | 30.20 | 10.32 | 40.00 | -29.68 | QP |
| 2. | 132.685 | 2.40 | 12.83 | 29.08 | 30.49 | 13.82 | 43.50 | -29.68 | QP |
| 3. | 159.784 | 2.57 | 13.88 | 28.30 | 30.55 | 14.20 | 43.50 | -29.30 | QP |
| 4. | 297.224 | 3.13 | 13.14 | 27.72 | 30.77 | 13.22 | 46.00 | -32.78 | QP |
| 5. | 473.835 | 3.55 | 16.77 | 27.93 | 30.93 | 17.32 | 46.00 | -28.68 | QP |
| 6. | 750.108 | 3.97 | 21.35 | 26.50 | 31.09 | 20.73 | 46.00 | -25.27 | QP |

Test plot for Horizontal: GFSK(2480MHz)




| 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. | 55.221 | 1.61 | 11.91 | 34.53 | 30.18 | 17.87 | 40.00 | -22.13 | QP |
| 2. | 107.888 | 2.21 | 10.90 | 27.48 | 30.42 | 10.17 | 43.50 | -33.33 | QP |
| 3. | 178.133 | 2.67 | 12.60 | 25.35 | 30.59 | 10.03 | 43.50 | -33.47 | QP |
| 4. | 295.147 | 3.13 | 13.10 | 31.49 | 30.77 | 16.95 | 46.00 | -29.05 | QP |
| 5. | 494.199 | 3.59 | 17.01 | 28.99 | 30.94 | 18.65 | 46.00 | -27.35 | QP |
| 6. | 804.603 | 4.03 | 21.79 | 27.78 | 31.11 | 22.49 | 46.00 | -23.51 | QP |

Test plot for Vertical: GFSK(2480MHz)




| 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. | 44.275 | 1.41 | 13.31 | 27.26 | 30.11 | 11.87 | 40.00 | -28.13 | QP |
| 2. | 117.773 | 2.29 | 11.82 | 30.44 | 30.45 | 14.10 | 43.50 | -29.40 | QP |
| 3. | 159.784 | 2.57 | 13.88 | 28.30 | 30.55 | 14.20 | 43.50 | -29.30 | QP |
| 4. | 304.610 | 3.15 | 13.30 | 30.18 | 30.78 | 15.85 | 46.00 | -30.15 | QP |
| 5. | 451.135 | 3.51 | 16.38 | 29.97 | 30.91 | 18.95 | 46.00 | -27.05 | QP |
| 6. | 586.844 | 3.75 | 18.81 | 29.28 | 31.00 | 20.84 | 46.00 | -25.16 | QP |

**Test Frequency: Above 1000MHz~10th Harmonics:**

GFSK Low Channel (2402MHz)

| Frequency (MHz) | S.A Reading (dBuV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 4804 | 34.69 | AV | V | 30.33 | 6.18 | 29.35 | 41.85 | 54 | -12.15 |
| 4804 | 35.06 | AV | H | 30.33 | 6.18 | 29.35 | 42.22 | 54 | -11.78 |
| 4804 | 41.24 | PK | V | 30.33 | 6.18 | 29.35 | 48.4 | 74 | -25.6 |
| 4804 | 42.07 | PK | H | 30.33 | 6.18 | 29.35 | 49.23 | 74 | -24.77 |
| 17800 | 24.66 | AV | V | 41.33 | 9.73 | 30.35 | 45.37 | 54 | -8.63 |
| 17800 | 23.15 | AV | H | 41.33 | 9.73 | 30.35 | 43.86 | 54 | -10.14 |
| 17800 | 38.04 | PK | V | 41.33 | 9.73 | 30.35 | 58.75 | 74 | -15.25 |
| 17800 | 37.96 | PK | H | 41.33 | 9.73 | 30.35 | 58.67 | 74 | -15.33 |

GFSK Low Channel (2441MHz)

| Frequency (MHz) | S.A Reading (dBuV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 4882 | 35.26 | AV | V | 31.36 | 6.59 | 28.06 | 45.15 | 54 | -8.85 |
| 4882 | 34.01 | AV | H | 31.36 | 6.59 | 28.06 | 43.9 | 54 | -10.1 |
| 4882 | 43.15 | PK | V | 31.36 | 6.59 | 28.06 | 53.04 | 74 | -20.96 |
| 4882 | 42.69 | PK | H | 31.36 | 6.59 | 28.06 | 52.58 | 74 | -21.42 |
| 17811 | 25.72 | AV | V | 40.55 | 9.73 | 30.58 | 45.42 | 54 | -8.58 |
| 17811 | 24.05 | AV | H | 40.55 | 9.73 | 30.58 | 43.75 | 54 | -10.25 |
| 17811 | 39.65 | PK | V | 40.55 | 9.73 | 30.58 | 59.35 | 74 | -14.65 |
| 17811 | 37.45 | PK | H | 40.55 | 9.73 | 30.58 | 57.15 | 74 | -16.85 |

GFSK High Channel (2480MHz)

| Frequency (MHz) | S.A Reading (dBuV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 4960 | 33.22 | AV | V | 31 | 6.03 | 28.43 | 41.82 | 54 | -12.18 |
| 4960 | 34.04 | AV | H | 31 | 6.03 | 28.43 | 42.64 | 54 | -11.36 |
| 4960 | 45.27 | PK | V | 31 | 6.03 | 28.43 | 53.87 | 74 | -20.13 |
| 4960 | 44.15 | PK | H | 31 | 6.03 | 28.43 | 52.75 | 74 | -21.25 |
| 17809 | 24.69 | AV | V | 41.35 | 7.35 | 30.69 | 42.7 | 54 | -11.3 |
| 17809 | 25.37 | AV | H | 41.35 | 7.35 | 30.69 | 43.38 | 54 | -10.62 |
| 17809 | 38.15 | PK | V | 41.35 | 7.35 | 30.69 | 56.16 | 74 | -17.84 |
| 17809 | 36.69 | PK | H | 41.35 | 7.35 | 30.69 | 54.7 | 74 | -19.3 |

## π/4-DQPSK Low Channel (2402MHz)

| Frequency (MHz) | S.A Reading (dBuV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 4804 | 35.15 | AV | V | 29.38 | 5.36 | 30.33 | 39.56 | 54 | -14.44 |
| 4804 | 34.06 | AV | H | 29.38 | 5.36 | 30.33 | 38.47 | 54 | -15.53 |
| 4804 | 40.27 | PK | V | 29.38 | 5.36 | 30.33 | 44.68 | 74 | -29.32 |
| 4804 | 41.66 | PK | H | 29.38 | 5.36 | 30.33 | 46.07 | 74 | -27.93 |
| 17803 | 25.34 | AV | V | 40.72 | 8.76 | 29.75 | 45.07 | 54 | -8.93 |
| 17803 | 24.17 | AV | H | 40.72 | 8.76 | 29.75 | 43.9 | 54 | -10.1 |
| 17803 | 37.92 | PK | V | 40.72 | 8.76 | 29.75 | 57.65 | 74 | -16.35 |
| 17803 | 36.26 | PK | H | 40.72 | 8.76 | 29.75 | 55.99 | 74 | -18.01 |

## π/4-DQPSK Low Channel (2441MHz)

| Frequency (MHz) | S.A Reading (dBuV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 4882 | 34.66 | AV | V | 30.75 | 5.93 | 27.63 | 43.71 | 54 | -10.29 |
| 4882 | 33.26 | AV | H | 30.75 | 5.93 | 27.63 | 42.31 | 54 | -11.69 |
| 4882 | 42.15 | PK | V | 30.75 | 5.93 | 27.63 | 51.2 | 74 | -22.8 |
| 4882 | 40.28 | PK | H | 30.75 | 5.93 | 27.63 | 49.33 | 74 | -24.67 |
| 17804 | 24.59 | AV | V | 39.76 | 8.72 | 39.73 | 33.34 | 54 | -20.66 |
| 17804 | 23.68 | AV | H | 39.76 | 8.72 | 39.73 | 32.43 | 54 | -21.57 |
| 17804 | 38.15 | PK | V | 39.76 | 8.72 | 39.73 | 46.9 | 74 | -27.1 |
| 17804 | 37.56 | PK | H | 39.76 | 8.72 | 39.73 | 46.31 | 74 | -27.69 |

## π/4-DQPSK High Channel (2480MHz)

| Frequency (MHz) | S.A Reading (dBuV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 4960 | 32.66 | AV | V | 29.67 | 7.15 | 27.45 | 42.03 | 54 | -11.97 |
| 4960 | 33.04 | AV | H | 29.67 | 7.15 | 27.45 | 42.41 | 54 | -11.59 |
| 4960 | 44.15 | PK | V | 29.67 | 7.15 | 27.45 | 53.52 | 74 | -20.48 |
| 4960 | 43.25 | PK | H | 29.67 | 7.15 | 27.45 | 52.62 | 74 | -21.38 |
| 17816 | 26.72 | AV | V | 40.33 | 6.39 | 31.69 | 41.75 | 54 | -12.25 |
| 17816 | 24.15 | AV | H | 40.33 | 6.39 | 31.69 | 39.18 | 54 | -14.82 |
| 17816 | 37.05 | PK | V | 40.33 | 6.39 | 31.69 | 52.08 | 74 | -21.92 |
| 17816 | 35.69 | PK | H | 40.33 | 6.39 | 31.69 | 50.72 | 74 | -23.28 |

8DPSK Low Channel (2402MHz)

| Frequency (MHz) | S.A Reading (dBuV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 4804 | 34.66 | AV | V | 30.35 | 5.69 | 29.75 | 40.95 | 54 | -13.05 |
| 4804 | 33.15 | AV | H | 30.35 | 5.69 | 29.75 | 39.44 | 54 | -14.56 |
| 4804 | 39.2 | PK | V | 30.35 | 5.69 | 29.75 | 45.49 | 74 | -28.51 |
| 4804 | 40.35 | PK | H | 30.35 | 5.69 | 29.75 | 46.64 | 74 | -27.36 |
| 17809 | 24.59 | AV | V | 38.72 | 7.36 | 30.11 | 40.56 | 54 | -13.44 |
| 17809 | 25.36 | AV | H | 38.72 | 7.36 | 30.11 | 41.33 | 54 | -12.67 |
| 17809 | 38.04 | PK | V | 38.72 | 7.36 | 30.11 | 54.01 | 74 | -19.99 |
| 17809 | 37.46 | PK | H | 38.72 | 7.36 | 30.11 | 53.43 | 74 | -20.57 |

8DPSK Low Channel (2441MHz)

| Frequency (MHz) | S.A Reading (dBuV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 4882 | 34.21 | AV | V | 29.66 | 6.69 | 26.49 | 44.07 | 54 | -9.93 |
| 4882 | 31.05 | AV | H | 29.66 | 6.69 | 26.49 | 40.91 | 54 | -13.09 |
| 4882 | 40.15 | PK | V | 29.66 | 6.69 | 26.49 | 50.01 | 74 | -23.99 |
| 4882 | 38.06 | PK | H | 29.66 | 6.69 | 26.49 | 47.92 | 74 | -26.08 |
| 17806 | 25.74 | AV | V | 38.25 | 9.43 | 37.69 | 35.73 | 54 | -18.27 |
| 17806 | 23.69 | AV | H | 38.25 | 9.43 | 37.69 | 33.68 | 54 | -20.32 |
| 17806 | 36.25 | PK | V | 38.25 | 9.43 | 37.69 | 46.24 | 74 | -27.76 |
| 17806 | 35.75 | PK | H | 38.25 | 9.43 | 37.69 | 45.74 | 74 | -28.26 |

8DPSK High Channel (2480MHz)

| Frequency (MHz) | S.A Reading (dBuV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 4960 | 31.36 | AV | V | 28.75 | 6.99 | 26.72 | 40.38 | 54 | -13.62 |
| 4960 | 32.05 | AV | H | 28.75 | 6.99 | 26.72 | 41.07 | 54 | -12.93 |
| 4960 | 41.25 | PK | V | 28.75 | 6.99 | 26.72 | 50.27 | 74 | -23.73 |
| 4960 | 42.69 | PK | H | 28.75 | 6.99 | 26.72 | 51.71 | 74 | -22.29 |
| 17811 | 25.14 | AV | V | 39.67 | 7.14 | 30.33 | 41.62 | 54 | -12.38 |
| 17811 | 23.68 | AV | H | 39.67 | 7.14 | 30.33 | 40.16 | 54 | -13.84 |
| 17811 | 38.42 | PK | V | 39.67 | 7.14 | 30.33 | 54.9 | 74 | -19.1 |
| 17811 | 34.69 | PK | H | 39.67 | 7.14 | 30.33 | 51.17 | 74 | -22.83 |

Note: 1. The testing has been conformed to 10*2480MHz=24800MHz.

2. All other emissions more than 30dB below the limit.

3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Emission Level = Reading + Factor
Margin=Emission Level-Limit

# 8 CONDUCTED BAND EDGE EMISSION

## 8.1 REQUIREMENT

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

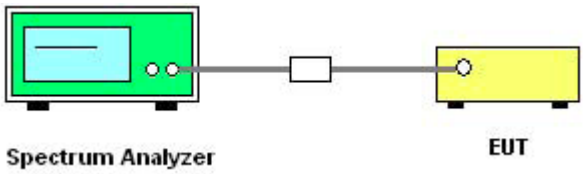
## 8.2 TEST PROCEDURE

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

. For Band edge

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

## 8.3 TEST SETUP




1. The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100KHz. The video bandwidth is set to 300KHz.

2. The spectrum from 30MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

## 8.4 EUT OPERATION CONDITIONS

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

## 8.5 TEST RESULTS

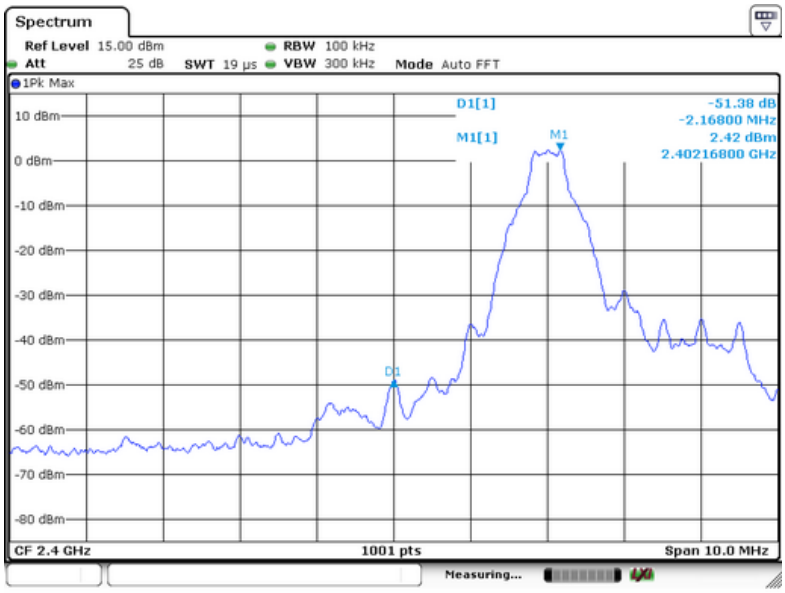
For Non-Hopping Mode:

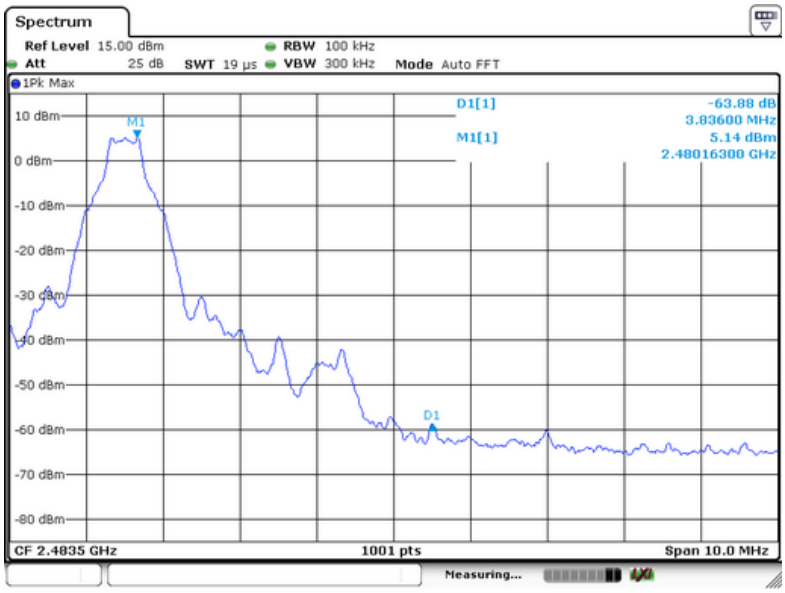
| Frequency(MHz) | Modulation | Peak Power Output (dBm) | Emission Read Value (dBm) | Result of Band edge (dBc) | Band Edge Limit (dBc) |
|---|---|---|---|---|---|
| 2399.99 | GFSK | 2.42 | -48.96 | 51.38 | >20dBc |
| 2399.99 | π/4-DQPSK | -0.92 | -49.81 | 48.89 | >20dBc |
| 2399.99 | 8DPSK | -0.84 | -50.42 | 49.58 | >20dBc |
| 2483.99 | GFSK | 5.14 | -58.74 | 63.88 | >20dBc |
| 2483.53 | π/4-DQPSK | 3.21 | -58.84 | 62.05 | >20dBc |
| 2483.73 | 8DPSK | 3.25 | -58.45 | 61.70 | >20dBc |

Test Plot:

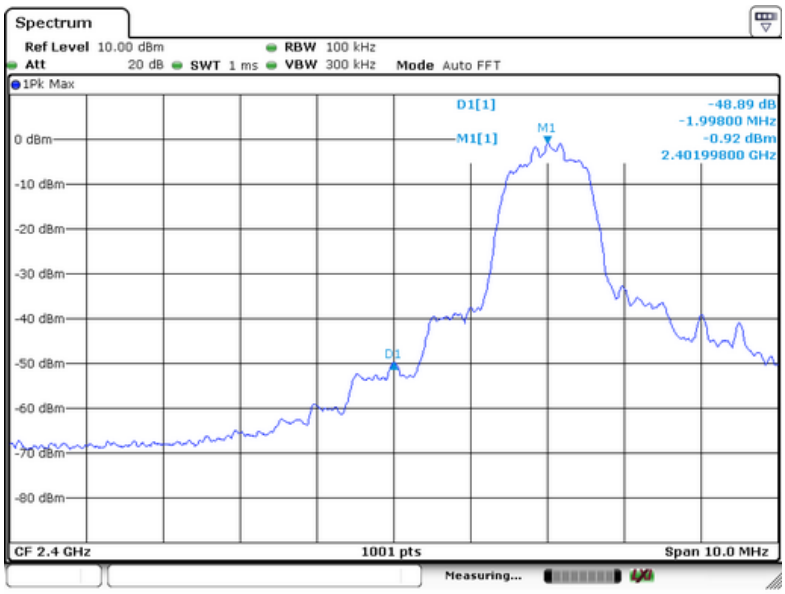
Please refer to the following pages.

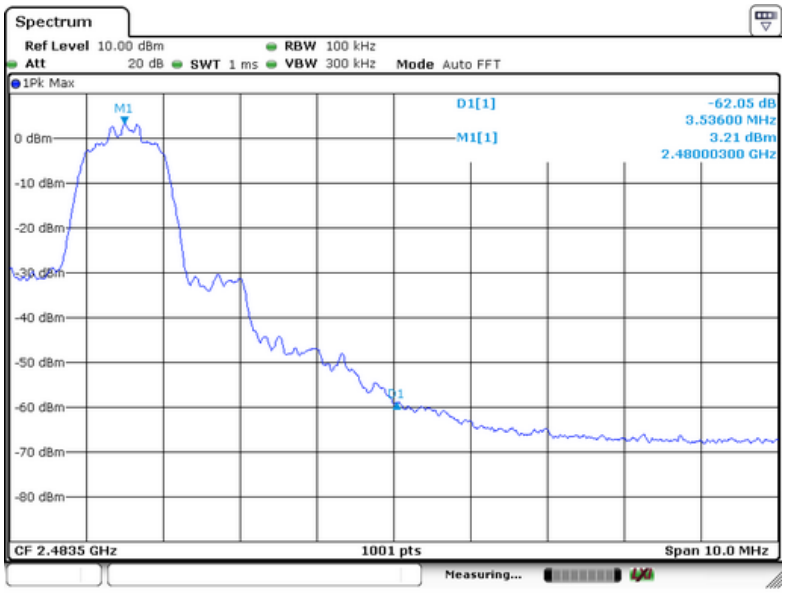
GFSK


Spectrum
Ref Level 15.00 dBm
RBW 100 kHz
Att 25 dB SWT 19 µs VBW 300 kHz Mode Auto FFT
1Pk Max
D1[1] -51.38 dB
-2.16800 MHz
M1[1] 2.42 dBm
2.40216800 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.4 GHz
1001 pts
Span 10.0 MHz
Measuring...

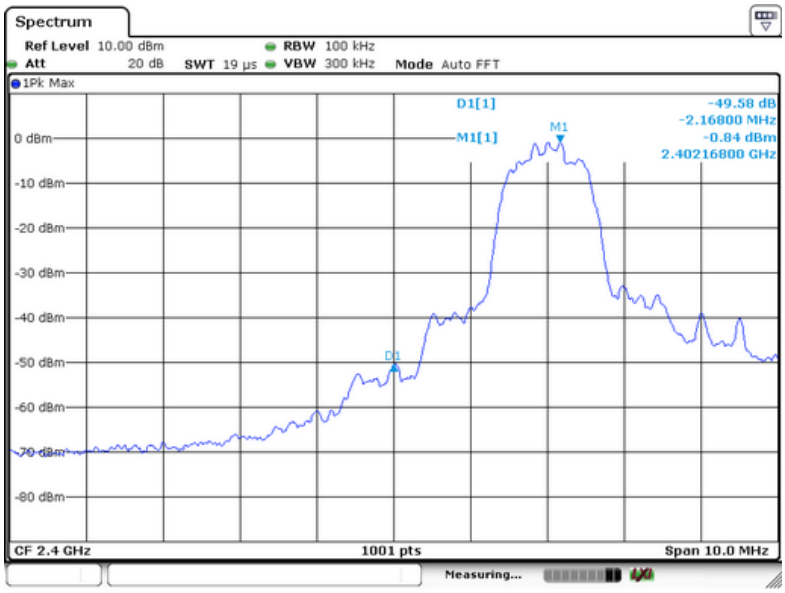

Spectrum
Ref Level 15.00 dBm
RBW 100 kHz
Att 25 dB SWT 19 µs VBW 300 kHz Mode Auto FFT
1Pk Max
D1[1] -63.88 dB
3.83600 MHz
M1[1] 5.14 dBm
2.48016300 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.4835 GHz
1001 pts
Span 10.0 MHz
Measuring...

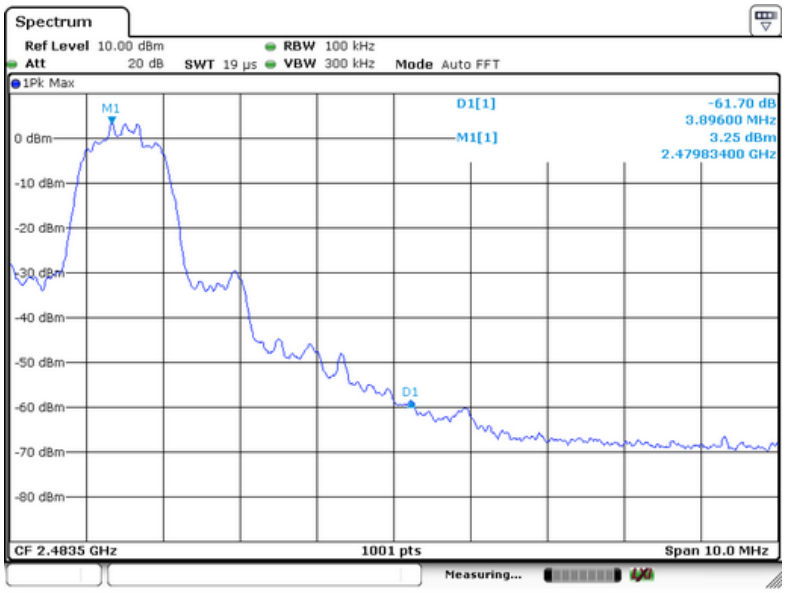
π/4-DQPSK


Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 20 dB SWT 1 ms VBW 300 kHz Mode Auto FFT
1Pk Max
D1[1] -48.89 dB
-1.99800 MHz
M1[1] -0.92 dBm
2.40199800 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.4 GHz
1001 pts
Span 10.0 MHz
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 20 dB SWT 1 ms VBW 300 kHz Mode Auto FFT
1Pk Max
D1[1] -62.05 dB
3.53600 MHz
M1[1] 3.21 dBm
2.48000300 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.4835 GHz
1001 pts
Span 10.0 MHz
Measuring...

8DPSK


Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 20 dB SWT 19 µs VBW 300 kHz Mode Auto FFT
1Pk Max
D1[1] -49.58 dB
-2.16800 MHz
M1[1] -0.84 dBm
2.40216800 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.4 GHz
1001 pts
Span 10.0 MHz
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 20 dB SWT 19 µs VBW 300 kHz Mode Auto FFT
1Pk Max
D1[1] -61.70 dB
3.89600 MHz
M1[1] 3.25 dBm
2.47983400 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.4835 GHz
1001 pts
Span 10.0 MHz
Measuring...

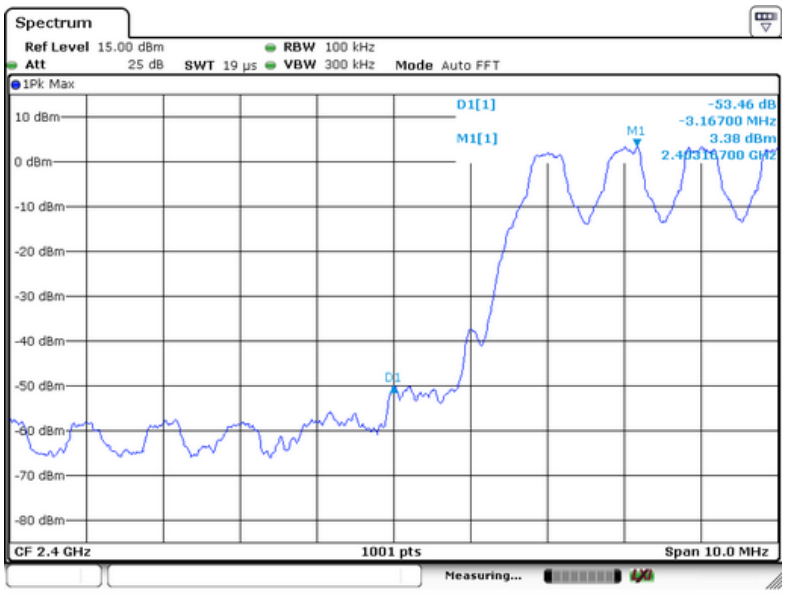
For Hopping Mode:

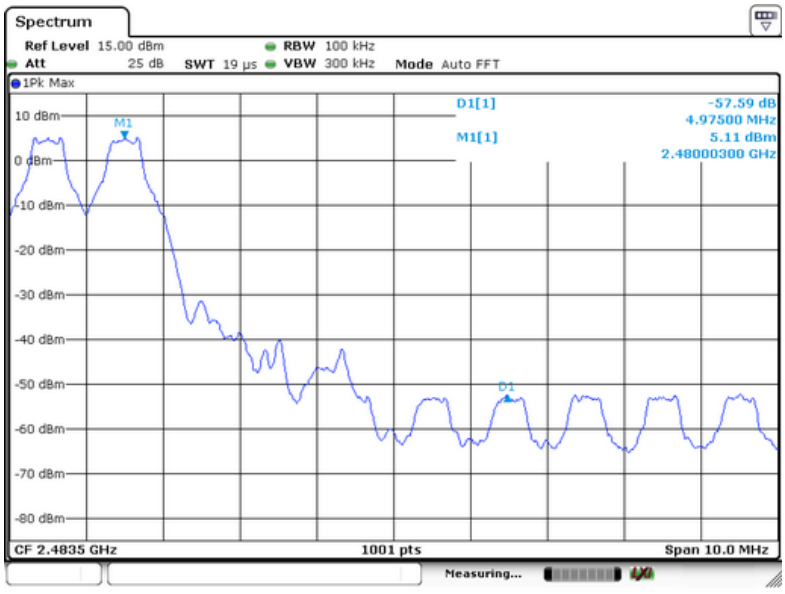
| Frequency(MHz) | Modulation | Peak Power Output (dBm) | Emission Read Value (dBm) | Result of Band edge (dBc) | Band Edge Limit (dBc) |
|---|---|---|---|---|---|
| 2399.99 | GFSK | 3.38 | -50.08 | 53.46 | >20dBc |
| 2399.99 | π/4-DQPSK | 8.47 | -42.26 | 50.73 | >20dBc |
| 2399.99 | 8DPSK | 4.52 | -49.72 | 54.24 | >20dBc |
| 2484.97 | GFSK | 5.11 | -52.48 | 57.59 | >20dBc |
| 2484.99 | π/4-DQPSK | 3.21 | -53.42 | 56.63 | >20dBc |
| 2485.14 | 8DPSK | 3.16 | -53.72 | 56.88 | >20dBc |

Test Plot:

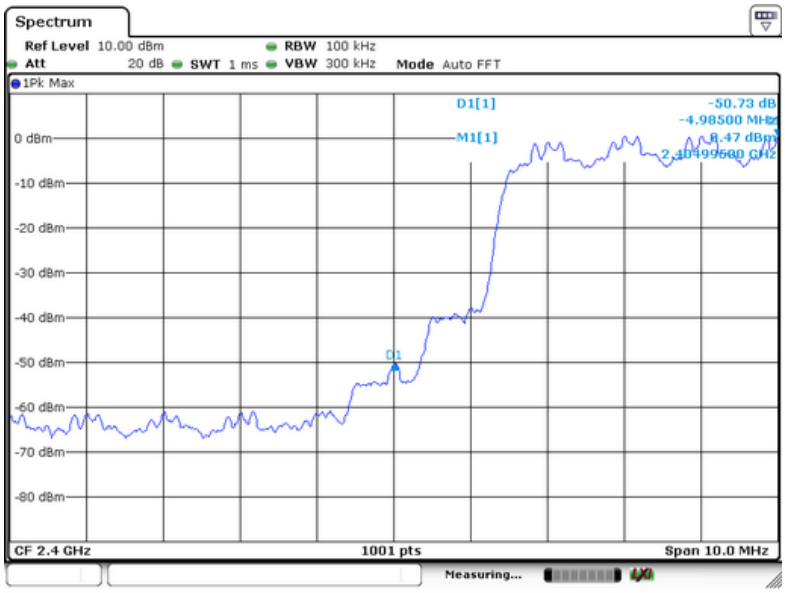
Please refer to the following pages.

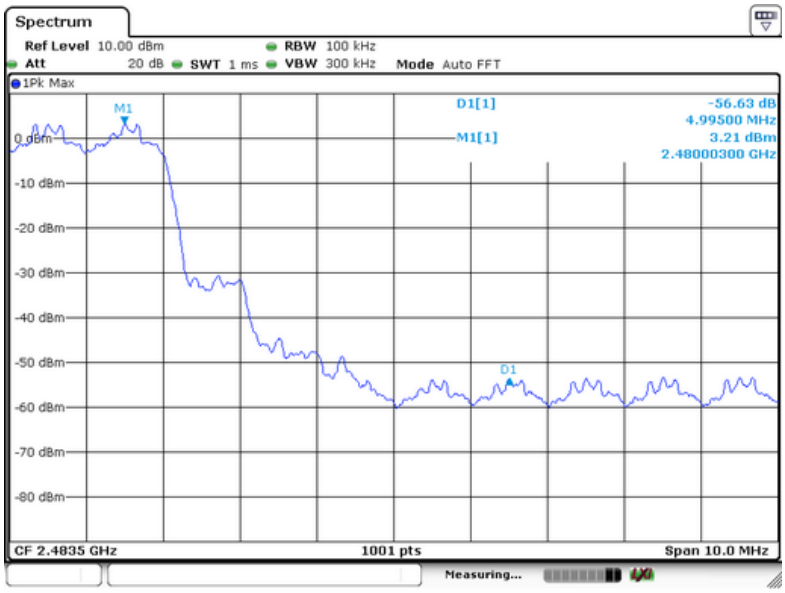
GFSK


Spectrum
Ref Level 15.00 dBm
RBW 100 kHz
Att 25 dB
SWT 19 µs
VBW 300 kHz
Mode Auto FFT
1Pk Max
D1[1]
-53.46 dB
-3.16700 MHz
M1[1]
3.38 dBm
2.40316700 GHz
M1
D1
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.4 GHz
1001 pts
Span 10.0 MHz
Measuring...

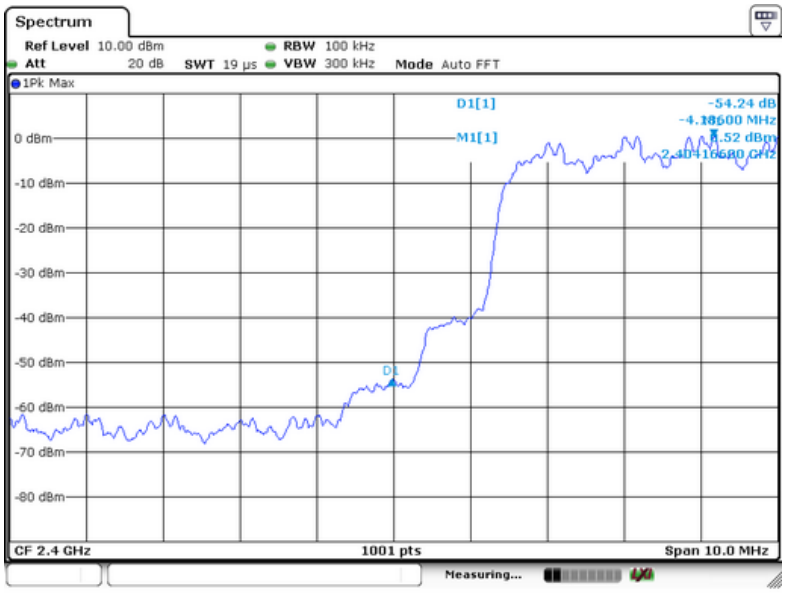

Spectrum
Ref Level 15.00 dBm
RBW 100 kHz
Att 25 dB
SWT 19 µs
VBW 300 kHz
Mode Auto FFT
1Pk Max
D1[1]
-57.59 dB
4.97500 MHz
M1[1]
5.11 dBm
2.48000300 GHz
M1
D1
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.4835 GHz
1001 pts
Span 10.0 MHz
Measuring...

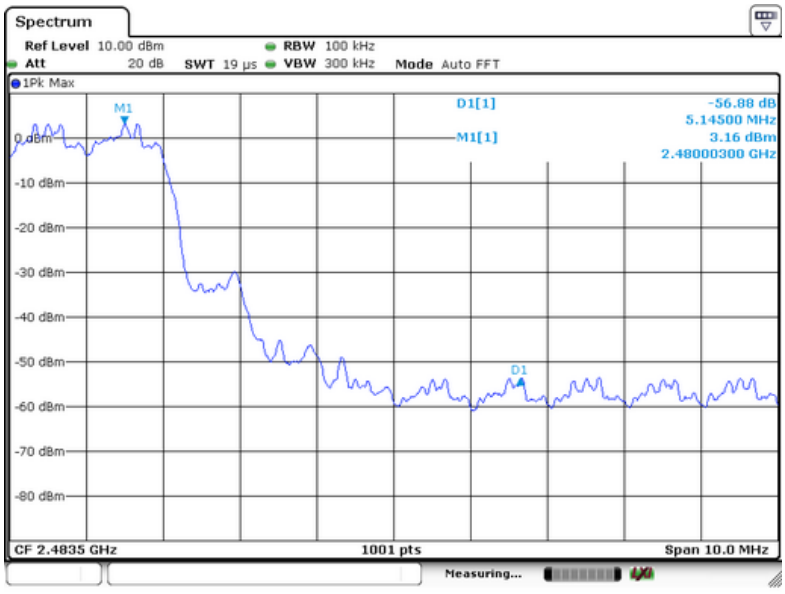
π/4-DQPSK


Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 20 dB SWT 1 ms VBW 300 kHz Mode Auto FFT
1Pk Max
D1[1] -50.73 dB
-4.98500 MHz
M1[1] 8.47 dBm
2.40499500 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
D1
CF 2.4 GHz
1001 pts
Span 10.0 MHz
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 20 dB SWT 1 ms VBW 300 kHz Mode Auto FFT
1Pk Max
M1
D1[1] -56.63 dB
4.99500 MHz
M1[1] 3.21 dBm
2.48000300 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
D1
CF 2.4835 GHz
1001 pts
Span 10.0 MHz
Measuring...

8DPSK


Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 20 dB
SWT 19 µs
VBW 300 kHz
Mode Auto FFT
1Pk Max
D1[1]
-54.24 dB
M1[1]
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
D1
CF 2.4 GHz
1001 pts
Span 10.0 MHz
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 20 dB
SWT 19 µs
VBW 300 kHz
Mode Auto FFT
1Pk Max
M1
D1[1]
-56.88 dB
5.14500 MHz
M1[1]
3.16 dBm
2.48000300 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
D1
CF 2.4835 GHz
1001 pts
Span 10.0 MHz
Measuring...

# 9 20 dB Bandwidth Measurement

Test Requirement : FCC CFR47 Part 15 Section 15.247

Test Method : ANSI C63.10:2013

Test Mode : Refer to section 3.3

## 9.1 Test Procedure

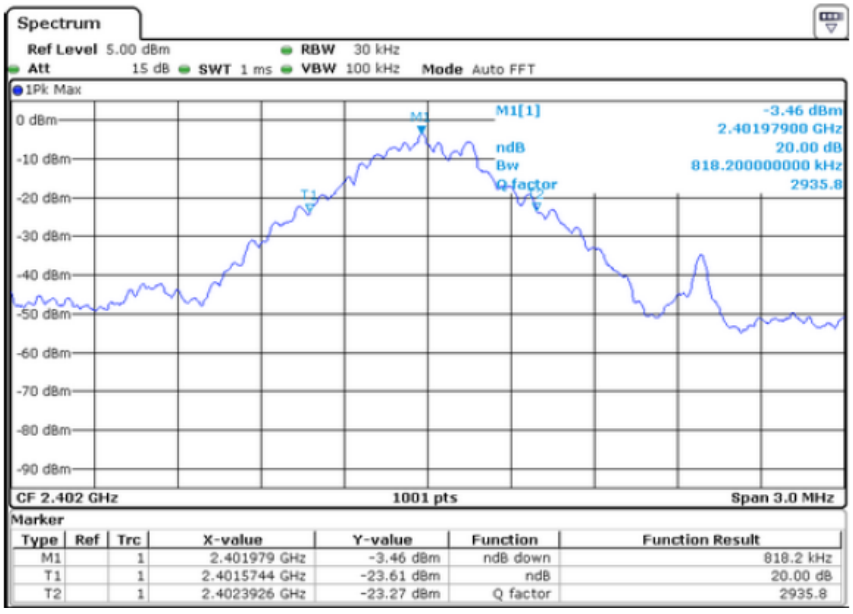
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;

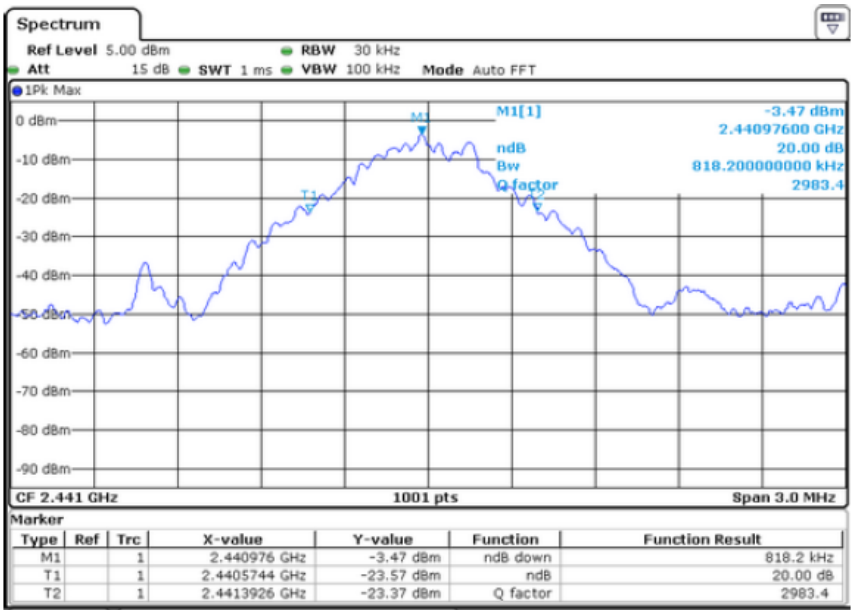
2. Set the spectrum analyzer: RBW = 30kHz, VBW = 100kHz

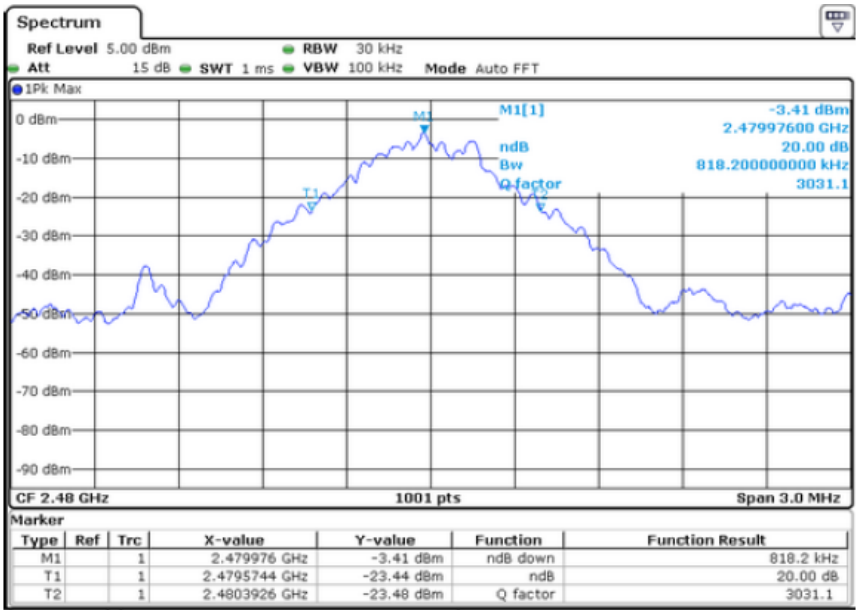
## 9.2 Test Result

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

| Channel number | Channel frequency (MHz) | 20dB Down BW(kHz) |
|---|---|---|
| 00 | 2402 | 818 |
| 39 | 2441 | 818 |
| 78 | 2480 | 818 |

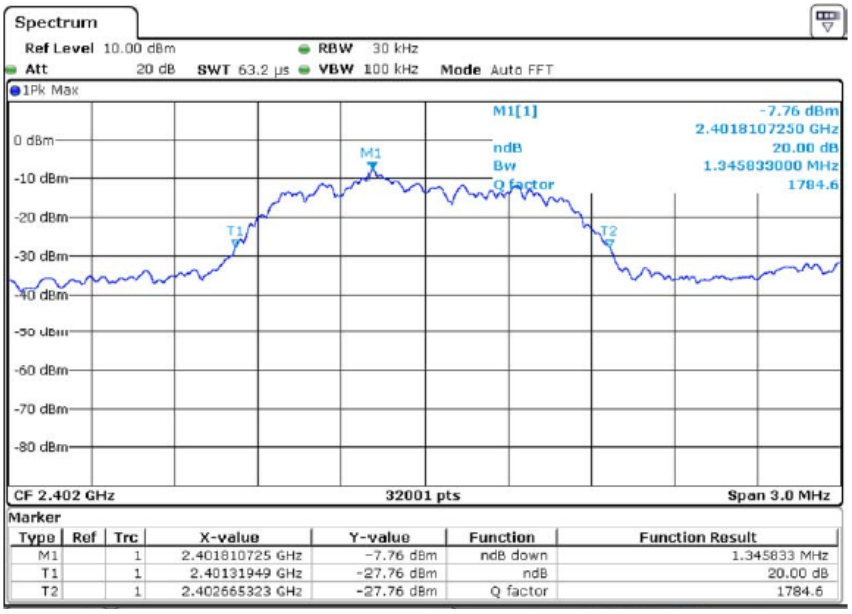

Spectrum
Ref Level 5.00 dBm
RBW 30 kHz
Att 15 dB SWT 1 ms VBW 100 kHz Mode Auto FFT
1Pk Max
M1[1]
-3.46 dBm
2.40197900 GHz
ndB 20.00 dB
Bw 818.200000000 kHz
Q factor 2935.8
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
CF 2.402 GHz
1001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.401979 GHz -3.46 dBm ndB down 818.2 kHz
T1 1 2.4015744 GHz -23.61 dBm ndB 20.00 dB
T2 1 2.4023926 GHz -23.27 dBm Q factor 2935.8

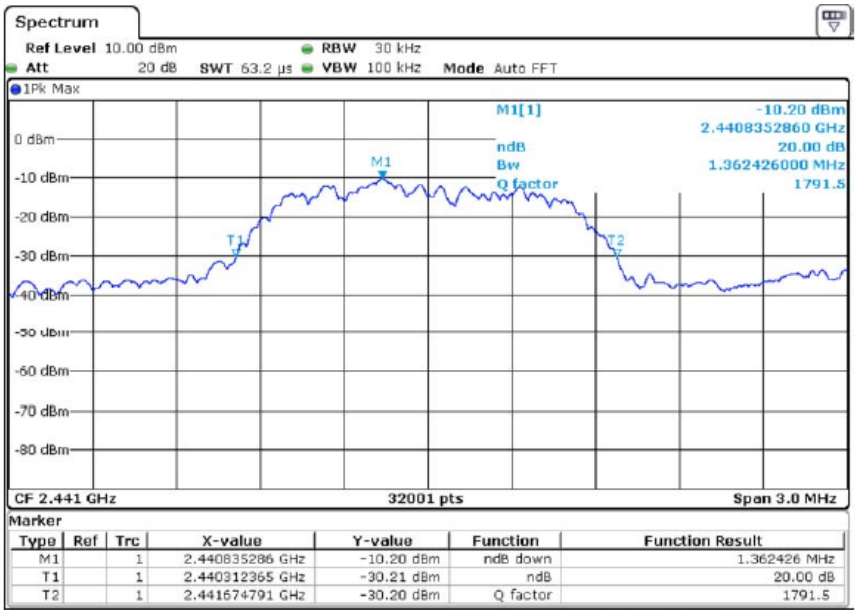

Spectrum
Ref Level 5.00 dBm
RBW 30 kHz
Att 15 dB SWT 1 ms VBW 100 kHz Mode Auto FFT
1Pk Max
M1[1]
-3.47 dBm
2.44097600 GHz
ndB 20.00 dB
Bw 818.200000000 kHz
Q factor 2983.4
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
CF 2.441 GHz
1001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.440976 GHz -3.47 dBm ndB down 818.2 kHz
T1 1 2.4405744 GHz -23.57 dBm ndB 20.00 dB
T2 1 2.4413926 GHz -23.37 dBm Q factor 2983.4

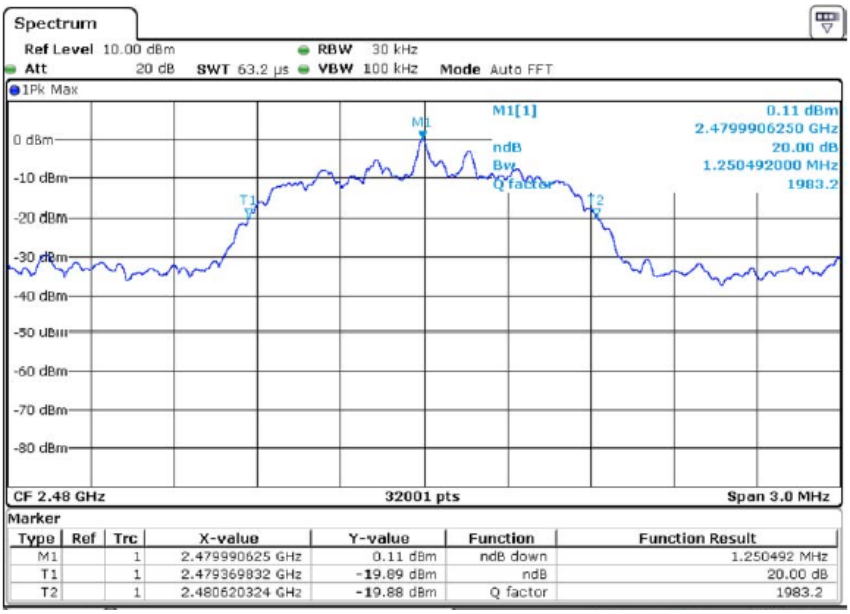



Test Mode: CH00 / CH39 / CH78 (Π/4-DQPSK /(2Mbps)Mode)

| Channel number | Channel frequency (MHz) | 20dB Down BW(kHz) |
|---|---|---|
| 00 | 2402 | 1346 |
| 39 | 2441 | 1362 |
| 78 | 2480 | 1250 |

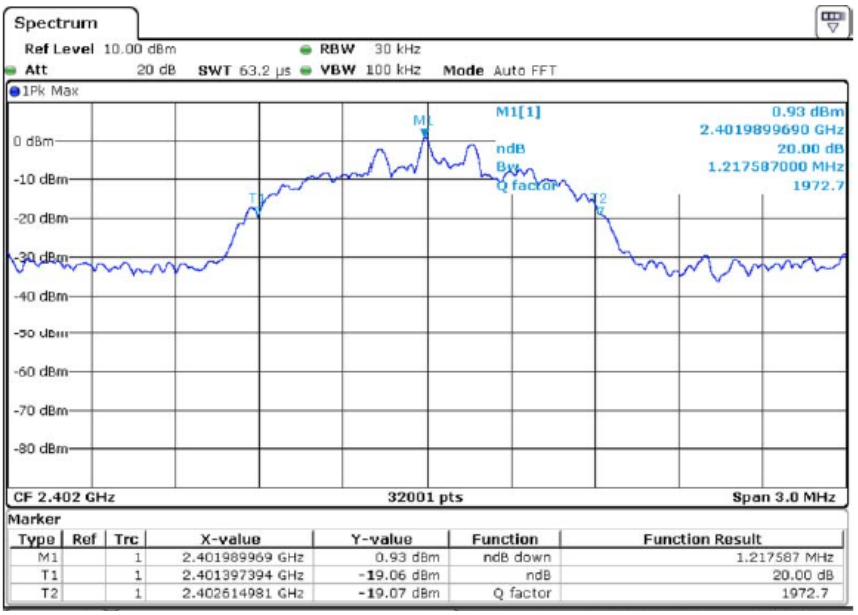

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1[1]
-7.76 dBm
2.4018107250 GHz
ndB 20.00 dB
Bw 1.345833000 MHz
Q factor 1784.6
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
T1
T2
CF 2.402 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.401810725 GHz -7.76 dBm ndB down 1.345833 MHz
T1 1 2.40131949 GHz -27.76 dBm ndB 20.00 dB
T2 1 2.402665323 GHz -27.76 dBm Q factor 1784.6

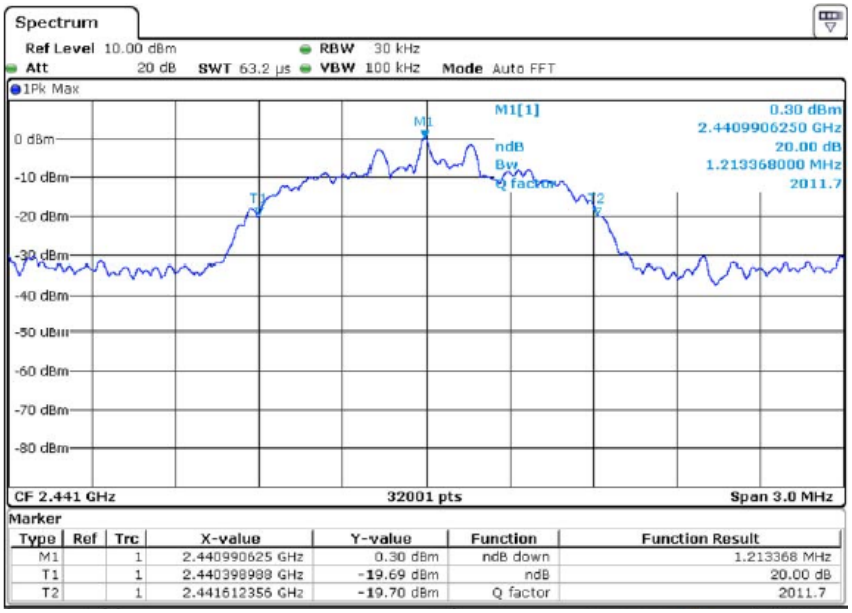

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1[1]
-10.20 dBm
2.4408352860 GHz
ndB 20.00 dB
Bw 1.362426000 MHz
Q factor 1791.5
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
T1
T2
CF 2.441 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.440835286 GHz -10.20 dBm ndB down 1.362426 MHz
T1 1 2.440312365 GHz -30.21 dBm ndB 20.00 dB
T2 1 2.441674791 GHz -30.20 dBm Q factor 1791.5

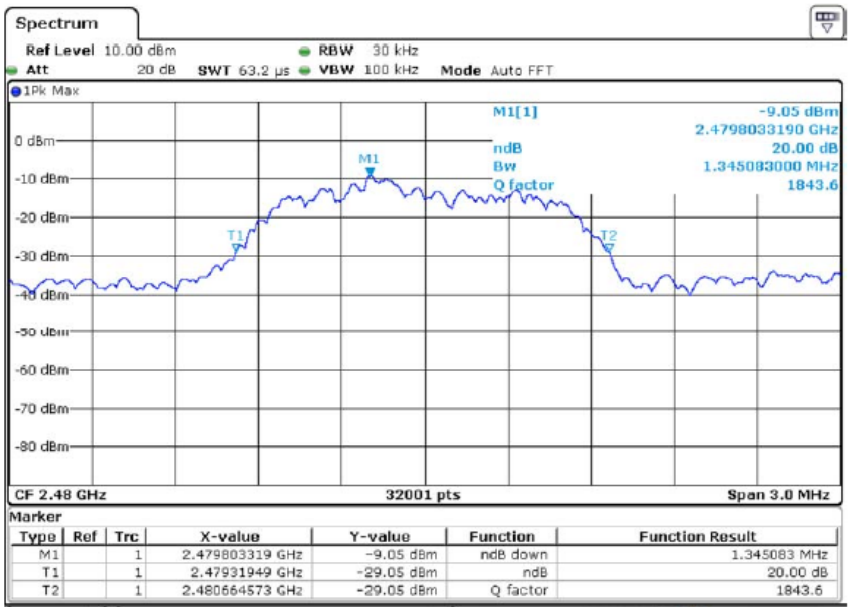



Test Mode: CH00 / CH39 / CH78 (8DPSK(3Mbps)Mode)

| Channel number | Channel frequency (MHz) | 20dB Down BW(kHz) |
|---|---|---|
| 00 | 2402 | 1218 |
| 39 | 2441 | 1213 |
| 78 | 2480 | 1345 |


Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1[1]
0.93 dBm
2.4019899690 GHz
ndB 20.00 dB
Bw 1.217587000 MHz
Q factor 1972.7
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.401989969 GHz 0.93 dBm ndB down 1.217587 MHz
T1 1 2.401397394 GHz -19.06 dBm ndB 20.00 dB
T2 1 2.402614981 GHz -19.07 dBm Q factor 1972.7


Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1[1]
0.30 dBm
2.4409906250 GHz
ndB 20.00 dB
Bw 1.213368000 MHz
Q factor 2011.7
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.440990625 GHz 0.30 dBm ndB down 1.213368 MHz
T1 1 2.440398988 GHz -19.69 dBm ndB 20.00 dB
T2 1 2.441612356 GHz -19.70 dBm Q factor 2011.7


Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1[1]
-9.05 dBm
2.4798033190 GHz
ndB 20.00 dB
Bw 1.345083000 MHz
Q factor 1843.6
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
T1
T2
CF 2.48 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.479803319 GHz -9.05 dBm ndB down 1.345083 MHz
T1 1 2.47931949 GHz -29.05 dBm ndB 20.00 dB
T2 1 2.480664573 GHz -29.05 dBm Q factor 1843.6

# 10 Maximum Peak Output Power

Test Requirement : FCC CFR47 Part 15 Section 15.247

Test Method : ANSI C63.10:2013

Test Limit : Regulation 15.247 (b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt (30dBm). For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
Refer to the result “Number of Hopping Frequency” of this document. The 0.125watts (20.97 dBm) limit applies.

Test Mode : Refer to section 3.3

## 10.1Test Procedure

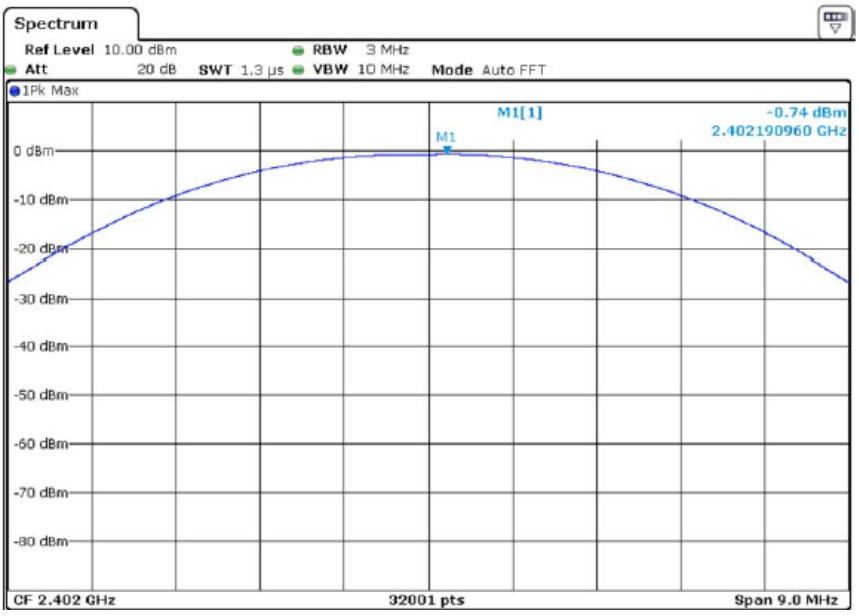
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

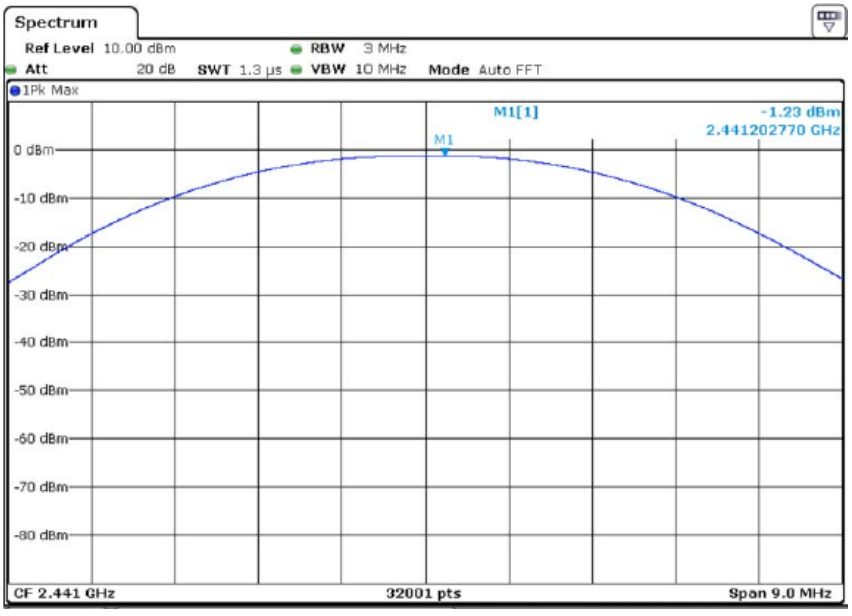
2. Set the spectrum analyser: RBW = 3 MHz. VBW =10MHz. Sweep = auto; Detector Function = Peak.

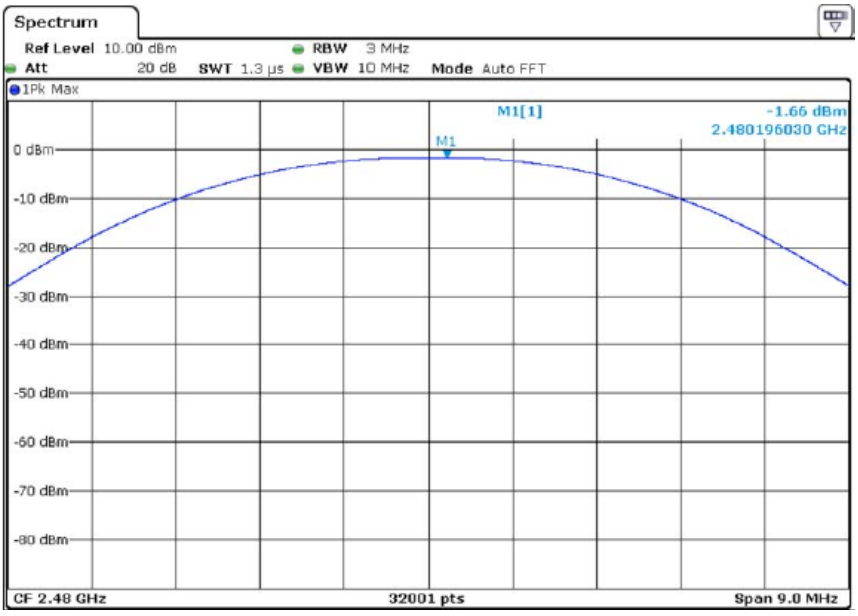
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

## 10.2Test Result

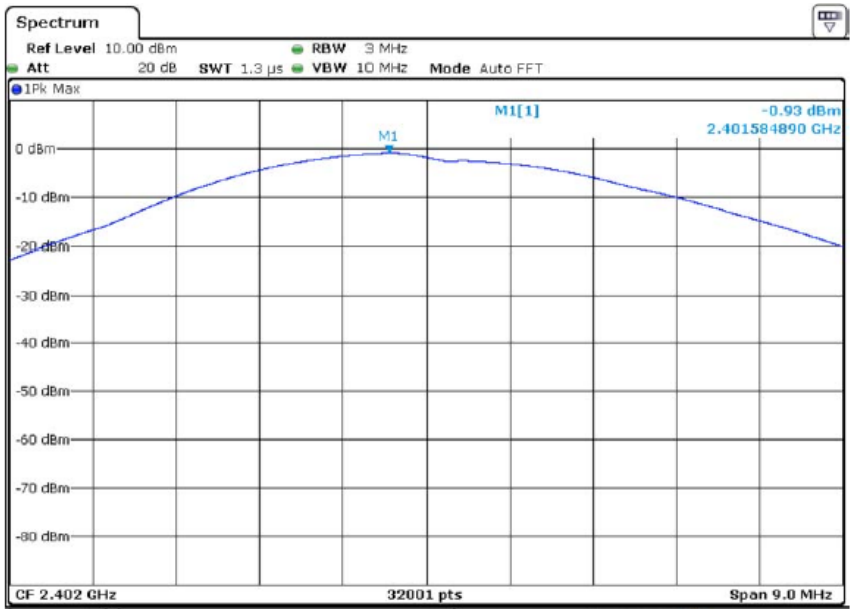
| GFSK(1Mbps) | | | | | |
|---|---|---|---|---|---|
| Test Channel | Frequency | Conducted Output Peak Power | Conducted Output Peak Power | LIMIT | Pass/Fail |
| | (MHz) | (dBm) | (mW) | (mW) | |
| CH00 | 2402 | -0.74 | 0.843 | 1000 | Pass |
| CH39 | 2441 | -1.23 | 0.753 | 1000 | Pass |
| CH78 | 2480 | -1.66 | 0.682 | 1000 | Pass |

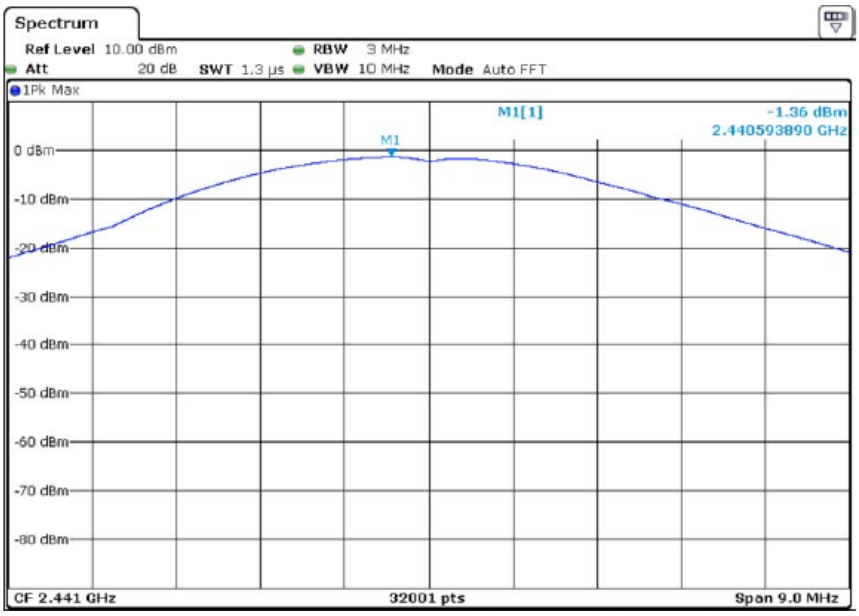

Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 10 MHz
Mode Auto FFT
1Pk Max
M1[1]
-0.74 dBm
2.402190960 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
32001 pts
Span 9.0 MHz

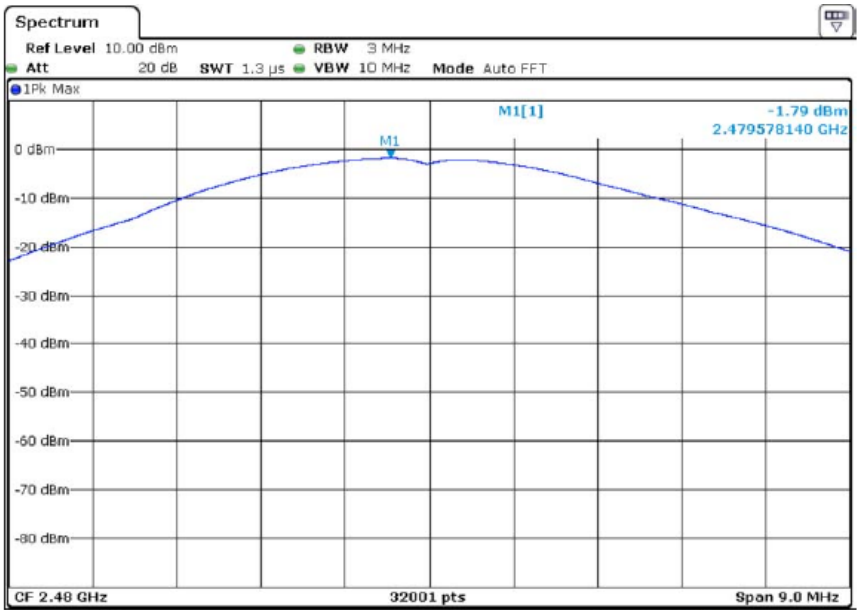

Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 10 MHz
Mode Auto FFT
1Pk Max
M1[1]
-1.23 dBm
2.441202770 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 9.0 MHz



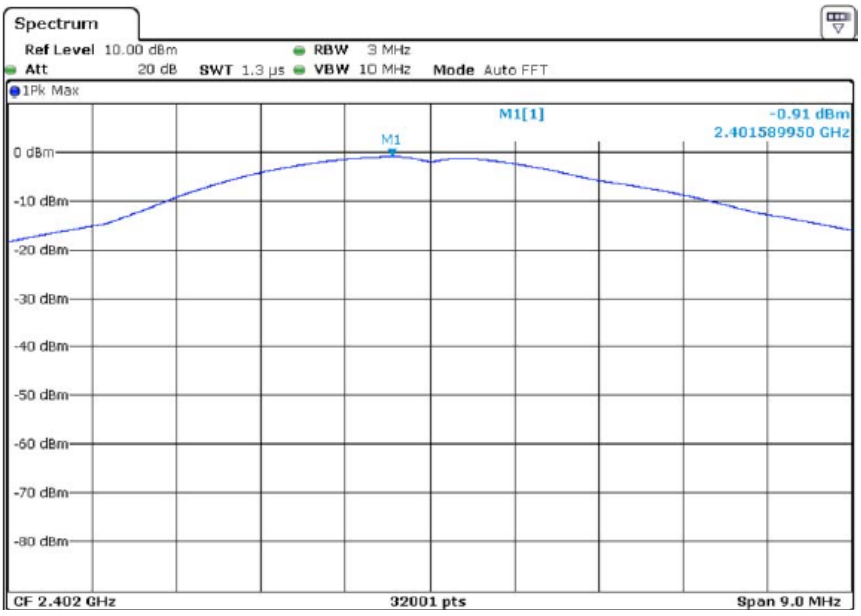

| π/4QPSK(2Mbps) | | | | | |
|---|---|---|---|---|---|
| Test Channel | Frequency | Conducted Output Peak Power | Conducted Output Peak Power | LIMIT | Pass/Fail |
| | (MHz) | (dBm) | (mW) | (mW) | |
| CH00 | 2402 | -0.93 | 0.807 | 125 | Pass |
| CH39 | 2441 | -1.36 | 0.731 | 125 | Pass |
| CH78 | 2480 | -1.79 | 0.662 | 125 | Pass |

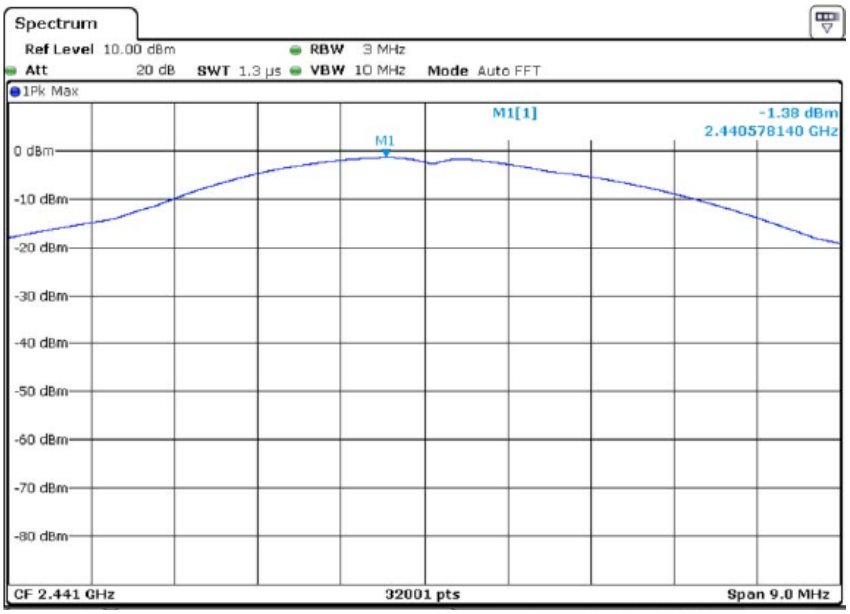

Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB SWT 1.3 µs VBW 10 MHz Mode Auto FFT
1Pk Max
M1[1]
-0.93 dBm
2.401584890 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
32001 pts
Span 9.0 MHz

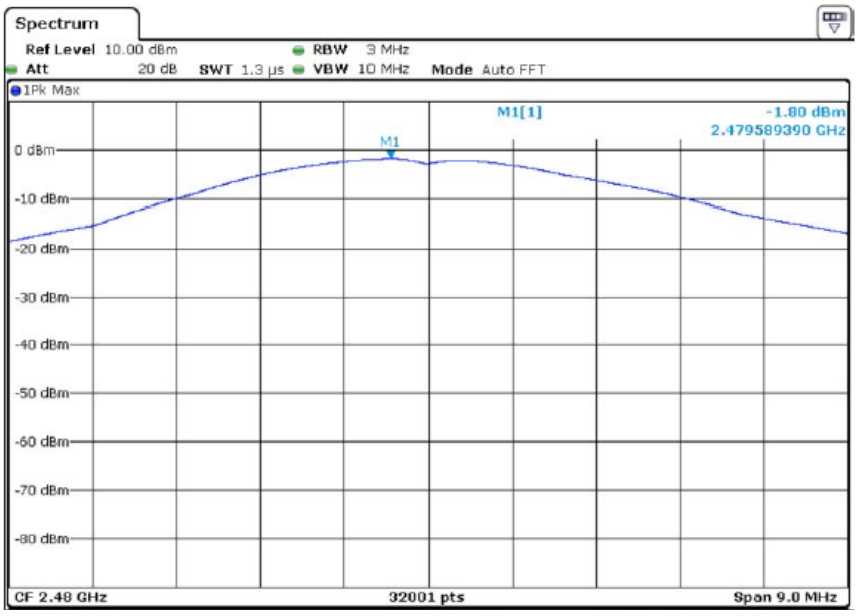

Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB SWT 1.3 µs VBW 10 MHz Mode Auto FFT
1Pk Max
M1[1]
-1.36 dBm
2.440593890 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 9.0 MHz




| 8DPSK(3Mbps) | | | | | |
|---|---|---|---|---|---|
| Test Channel | Frequency | Conducted Output Peak Power | Conducted Output Peak Power | LIMIT | Pass/Fail |
| | (MHz) | (dBm) | (mW) | (mW) | |
| CH00 | 2402 | -0.91 | 0.811 | 125 | Pass |
| CH39 | 2441 | -1.38 | 0.728 | 125 | Pass |
| CH78 | 2480 | -1.80 | 0.661 | 125 | Pass |


Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 10 MHz
Mode Auto FFT
1Pk Max
M1[1]
-0.91 dBm
2.401589950 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
32001 pts
Span 9.0 MHz


Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 10 MHz
Mode Auto FFT
1Pk Max
M1[1]
-1.38 dBm
2.440578140 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 9.0 MHz


Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 10 MHz
Mode Auto FFT
1Pk Max
M1[1]
-1.80 dBm
2.479589390 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
32001 pts
Span 9.0 MHz

# 11 Hopping Channel Separation

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

## 11.1 Test Procedure

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

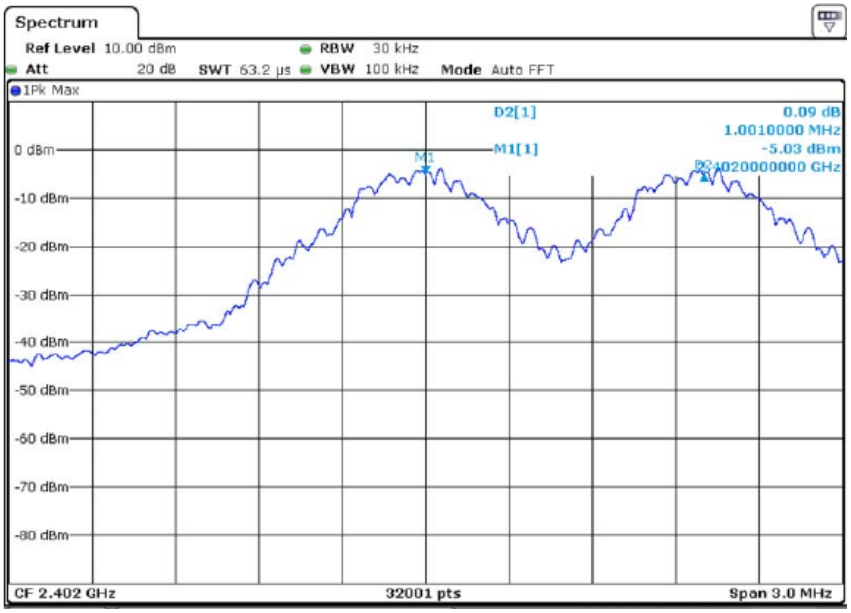
2. Set the spectrum analyzer: RBW = 30KHz. VBW = 100KHz , Span = 3MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

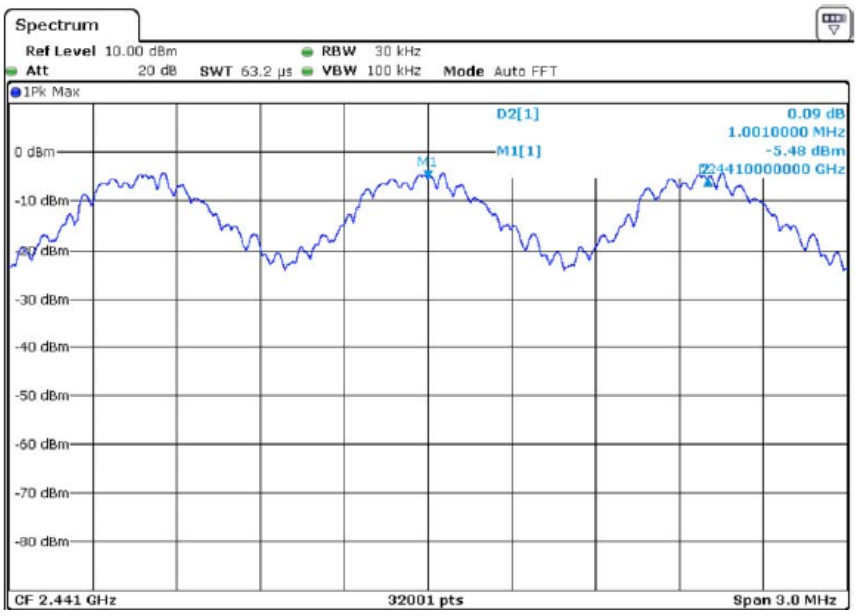
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

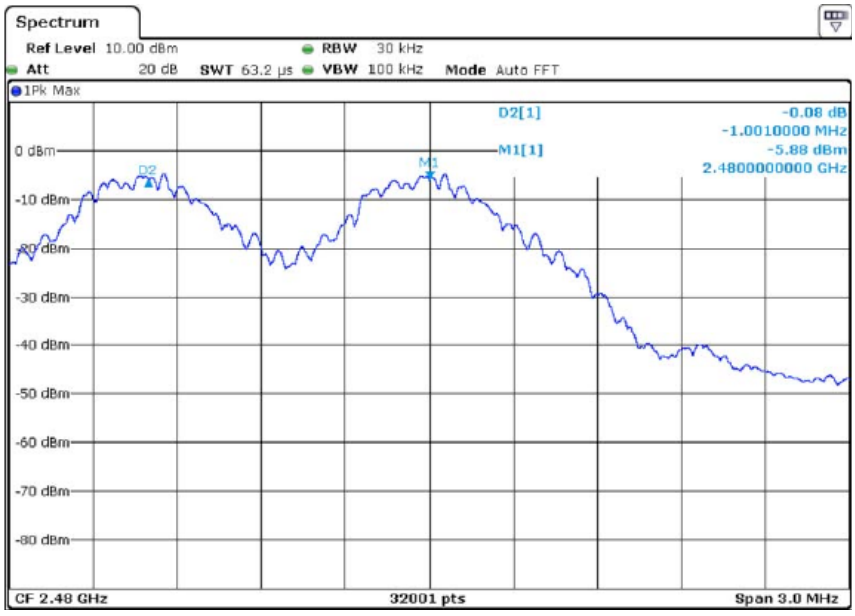
## 11.2 Test Result

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

| Channel number | Channel frequency (MHz) | Separation Read Value (kHz) | Separation Limit<br>2/3 20dB Down BW(kHz) |
|---|---|---|---|
| 00 | 2402 | 1001 | >818 |
| 39 | 2441 | 1001 | >818 |
| 78 | 2480 | 1001 | >818 |

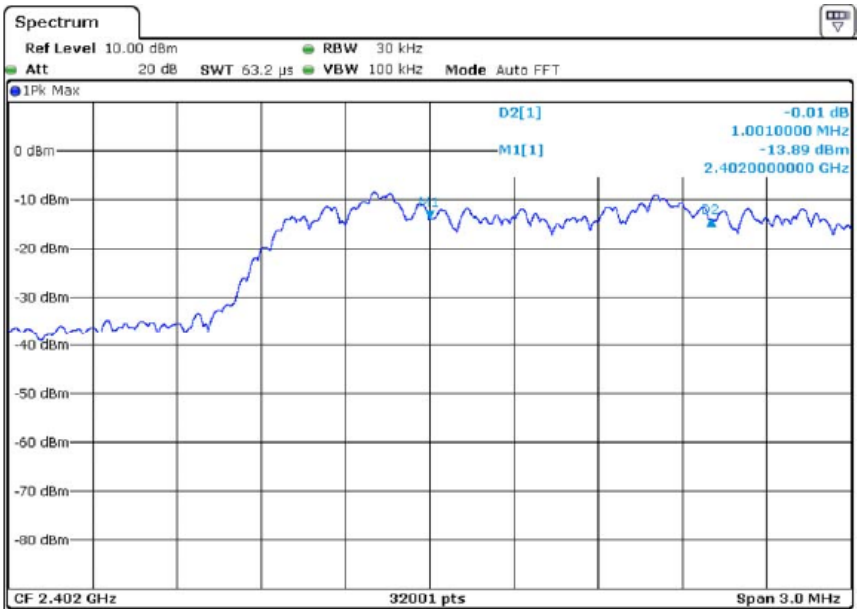


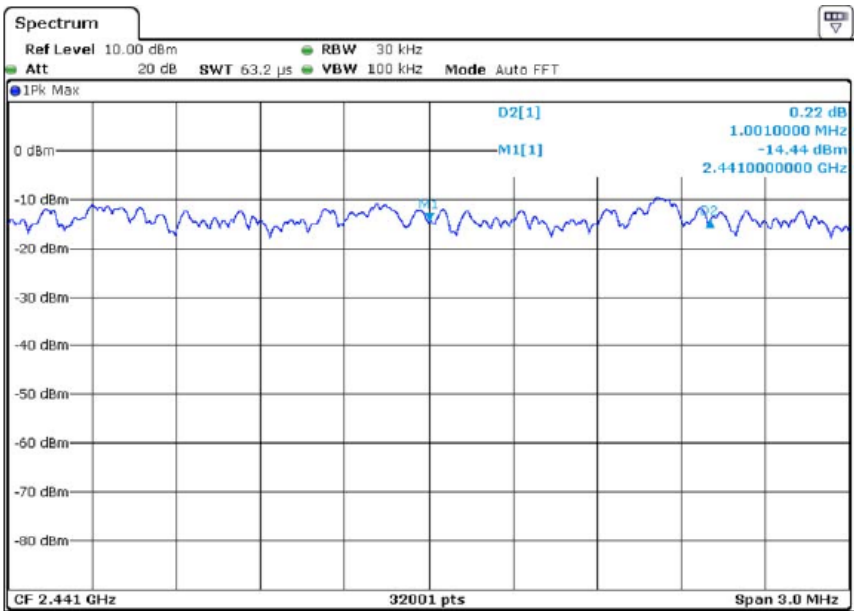

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D2[1]
0.09 dB
1.0010000 MHz
M1[1]
-5.48 dBm
2.4410000000 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 3.0 MHz

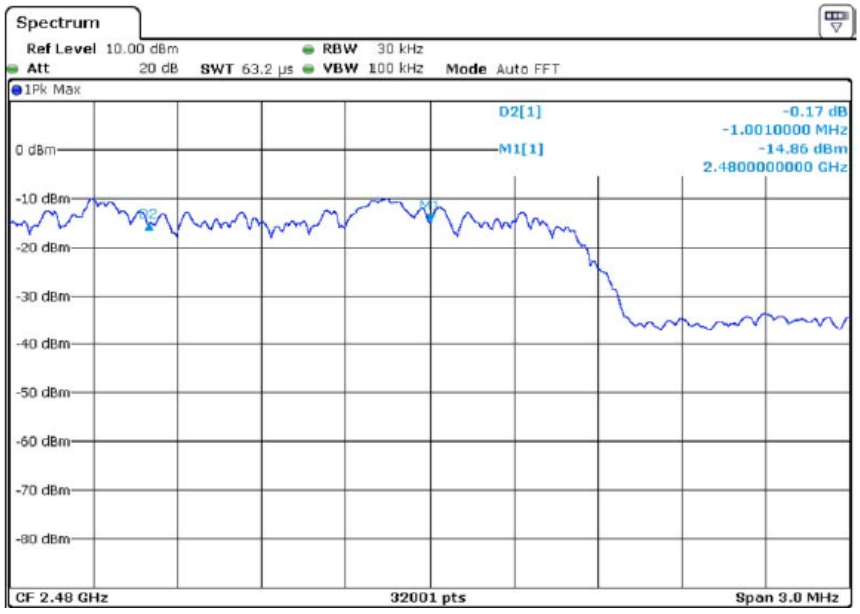

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D2[1]
-0.08 dB
-1.0010000 MHz
M1[1]
-5.88 dBm
2.4800000000 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
32001 pts
Span 3.0 MHz

| Test Mode: | CH00 / CH39 / CH78 (π/4-DQPSK(2Mbps) Mode) |
|---|---|

| Channel number | Channel frequency (MHz) | Separation Read Value (kHz) | Separation Limit<br>2/3 20dB Down BW(kHz) |
|---|---|---|---|
| 00 | 2402 | 1001 | >897 |
| 39 | 2441 | 1001 | >908 |
| 78 | 2480 | 1001 | >833 |

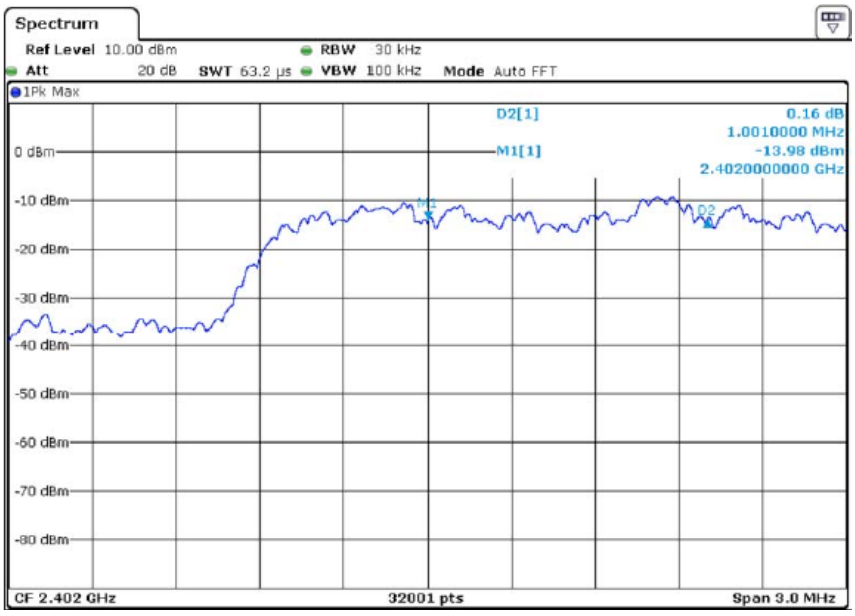


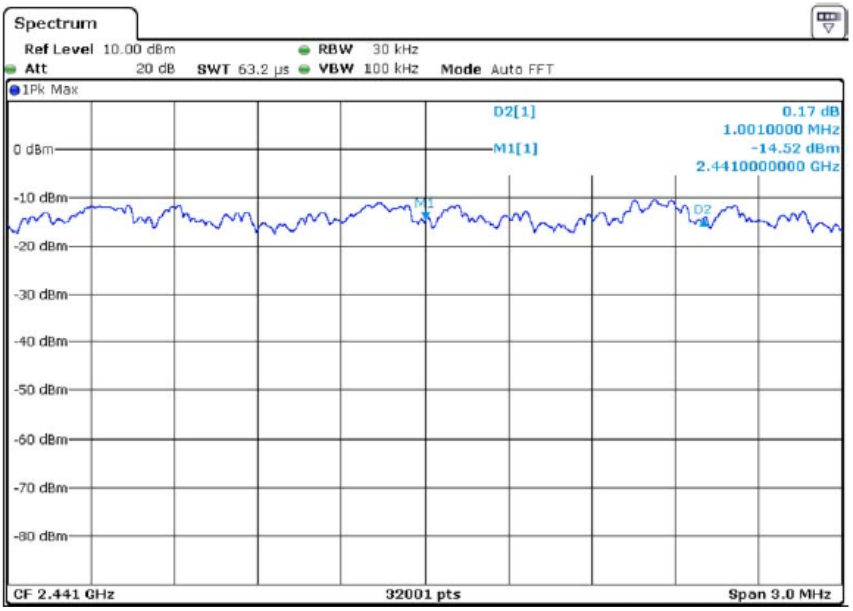

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D2[1]
0.22 dB
1.0010000 MHz
M1[1]
-14.44 dBm
2.4410000000 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 3.0 MHz

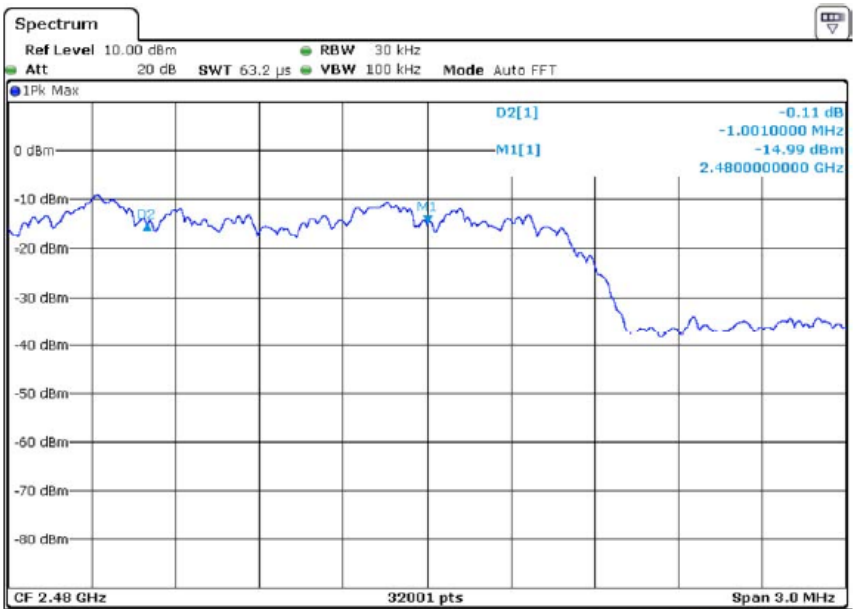

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D2[1]
-0.17 dB
-1.0010000 MHz
M1[1]
-14.86 dBm
2.4800000000 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
32001 pts
Span 3.0 MHz

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

| Channel number | Channel frequency (MHz) | Separation Read Value (kHz) | Separation Limit<br>2/3 20dB Down BW(kHz) |
|---|---|---|---|
| 00 | 2402 | 1001 | >812 |
| 39 | 2441 | 1001 | >809 |
| 78 | 2480 | 1001 | >897 |




Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D2[1]
0.17 dB
1.0010000 MHz
M1[1]
-14.52 dBm
2.4410000000 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 3.0 MHz


Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D2[1]
-0.11 dB
-1.0010000 MHz
M1[1]
-14.99 dBm
2.4800000000 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
32001 pts
Span 3.0 MHz

# 12 Number of Hopping Frequency

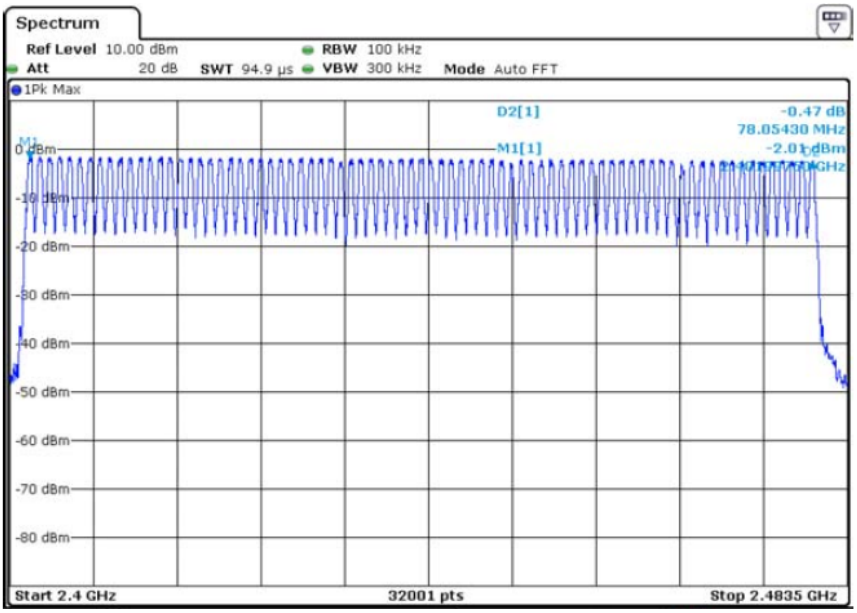
| | | |
|---|---|---|
| Test Requirement | : | FCC CFR47 Part 15 Section 15.247 |
| Test Method | : | ANSI C63.10:2013 |
| Test Limit | : | Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. |
| Test Mode | : | Hopping(GFSK) |

## 12.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100KHz. VBW = 300KHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.483GHz. Sweep=auto;

## 12.2 Test Result

| Channel Number | Limit |
|---|---|
| 79 | ≥15 |



# 13 Dwell Time

| | | |
|---|---|---|
| Test Requirement | : | FCC CFR47 Part 15 Section 15.247 |
| Test Method | : | ANSI C63.10:2013 |
| Test Limit | : | Regulation 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. |
| Test Mode | : | The worst case(GFSK) was recorded |

## 13.1 Test Procedure

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

2. Set spectrum analyzer span = 0.  Centred on a hopping channel;

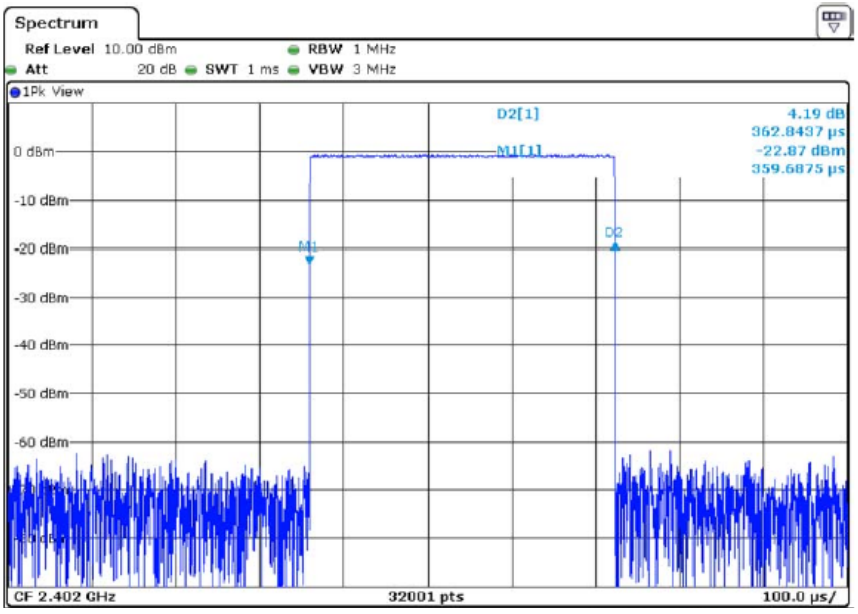
3. Set RBW = 1MHz and VBW = 3MHz.Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 and DH1 packet transmitting.

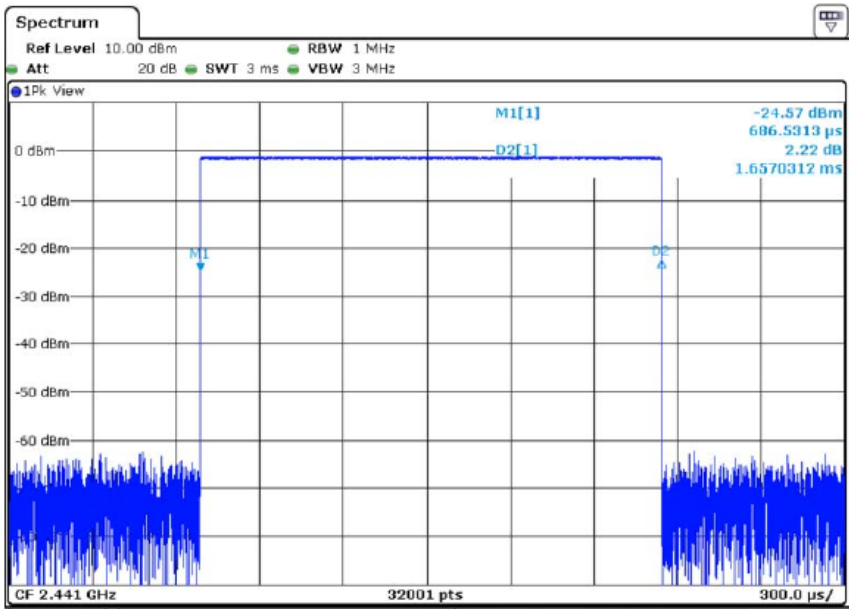
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

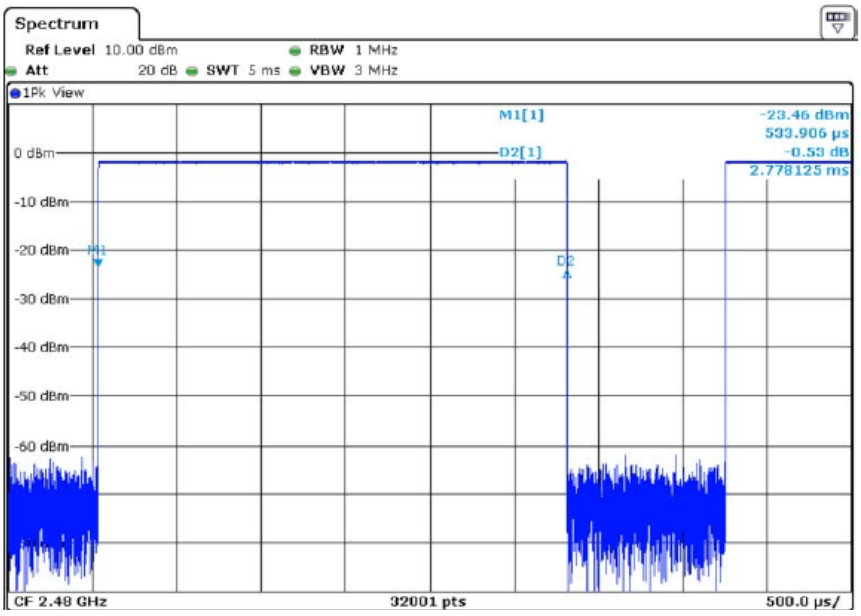
## 13.2 Test Result

| Test Mode: | GFSK(1Mbps) –DH1/DH3/DH5 |
|---|---|

| Mode | Number of transmission in a 31.6( 79 Hopping*0.4) | Length of transmissions time(msec) | Result (msec) | Limit (msec) |
|---|---|---|---|---|
| DH1 | 1600/(2*79) x 31.6 = 320 | 0.359 | 114.88 | 400 |
| DH3 | 1600/(4*79) x 31.6 =160 | 1.657 | 265.12 | 400 |
| DH5 | 1600/(6*79) x 31.6 =106.67 | 2.778 | 296.32 | 400 |


Spectrum
Ref Level 10.00 dBm
RBW 1 MHz
Att 20 dB SWT 1 ms VBW 3 MHz
1Pk View
D2[1] 4.19 dB
362.8437 µs
M1[1] -22.87 dBm
359.6875 µs
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
M1
D2
CF 2.402 GHz
32001 pts
100.0 µs/

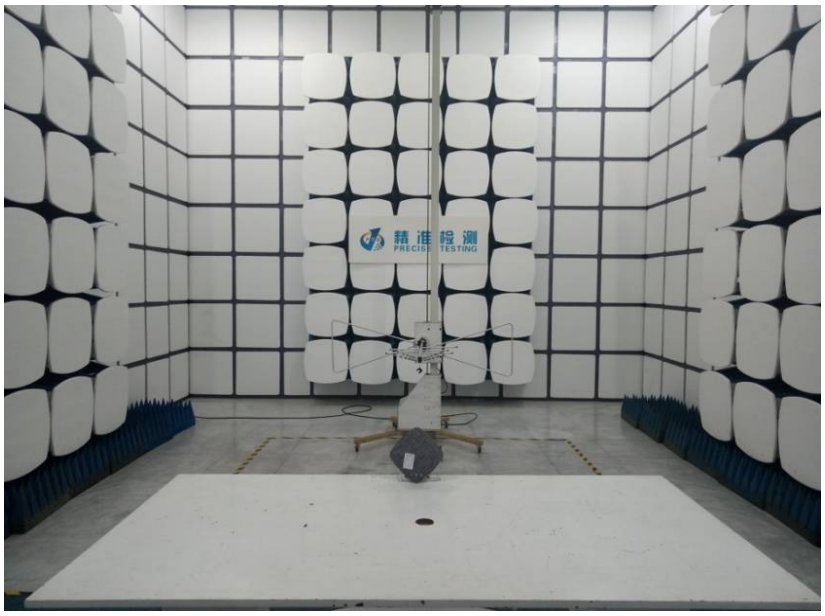

Spectrum
Ref Level 10.00 dBm
RBW 1 MHz
Att 20 dB SWT 3 ms VBW 3 MHz
1Pk View
M1[1] -24.57 dBm
686.5313 µs
D2[1] 2.22 dB
1.6570312 ms
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
M1
D2
CF 2.441 GHz
32001 pts
300.0 µs/


Spectrum
Ref Level 10.00 dBm
RBW 1 MHz
Att 20 dB SWT 5 ms VBW 3 MHz
1Pk View
M1[1] -23.46 dBm
533.906 µs
D2[1] -0.53 dB
2.778125 ms
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
M1
D2
CF 2.48 GHz
32001 pts
500.0 µs/

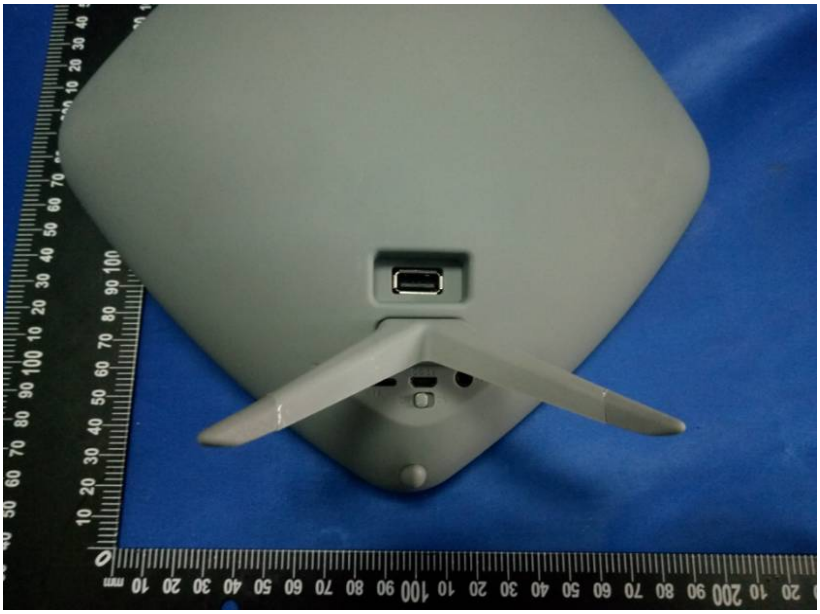
# 14 Antenna Requirement

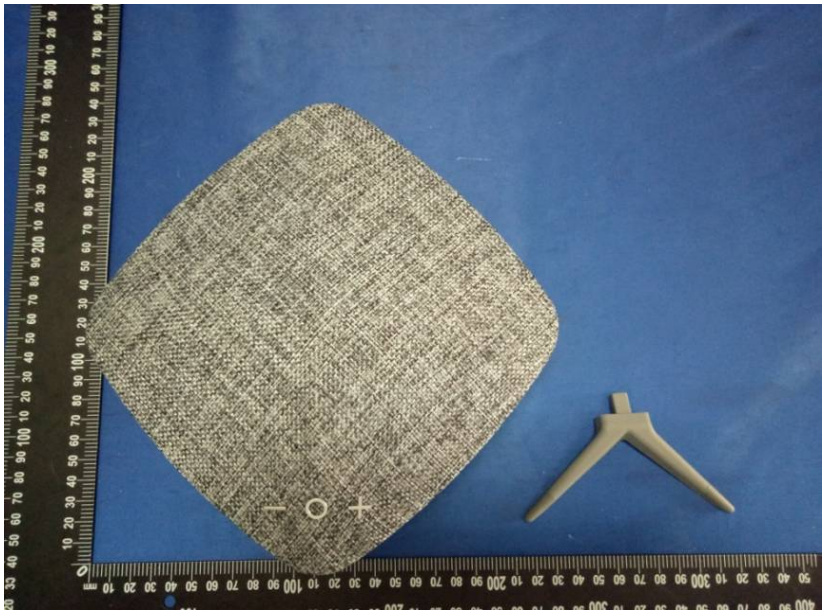
According to the FCC part15.203, a transmitter can only be sold or operated with antennas with which it was approved. This product has an internal PCB Antenna, it meet the requirement of this section.

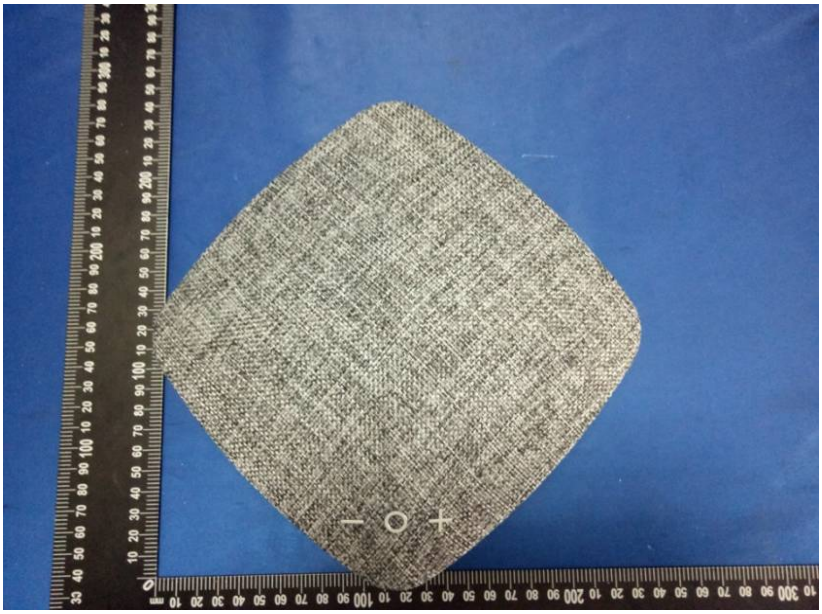
# 15 TEST PHOTOS

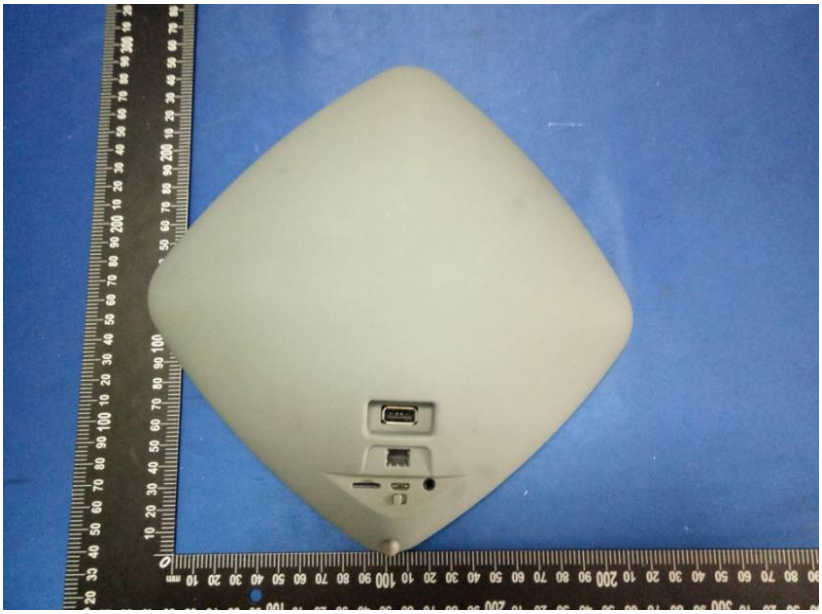


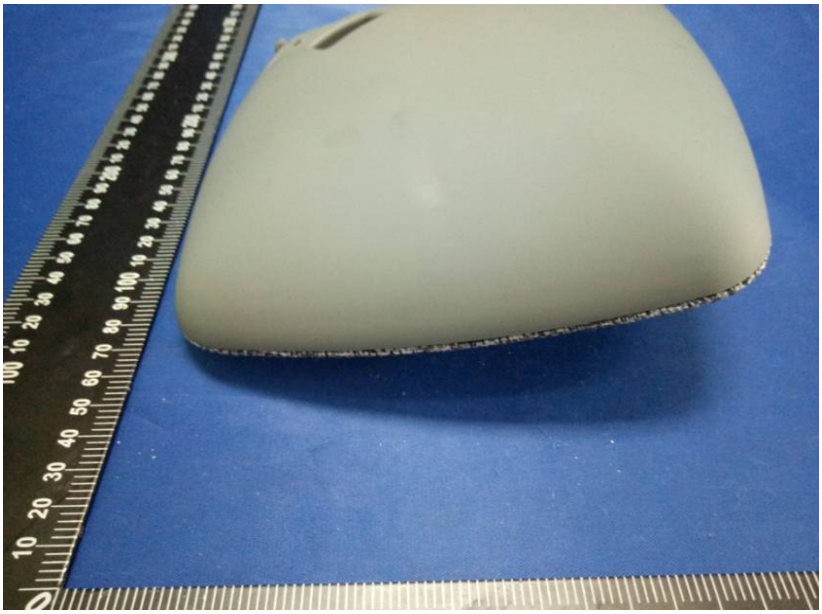
# 16 EUT PHOTOS

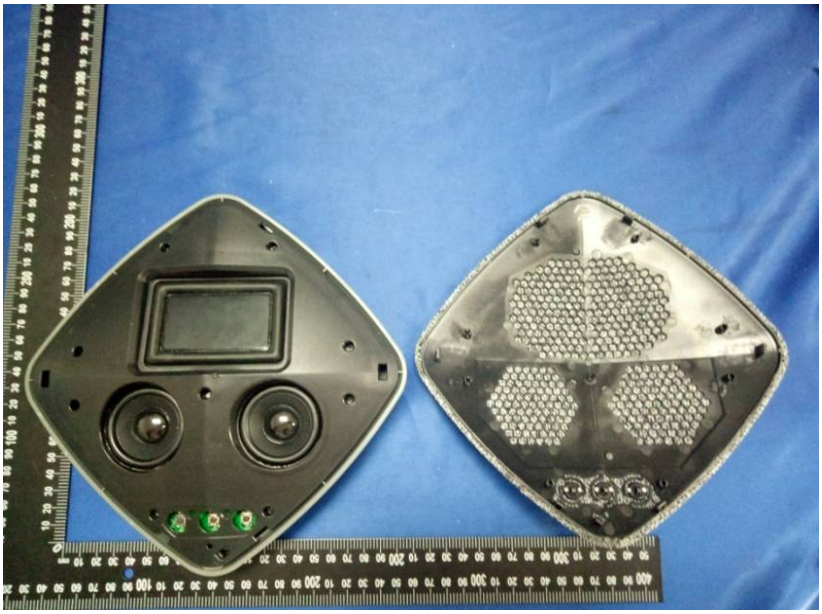


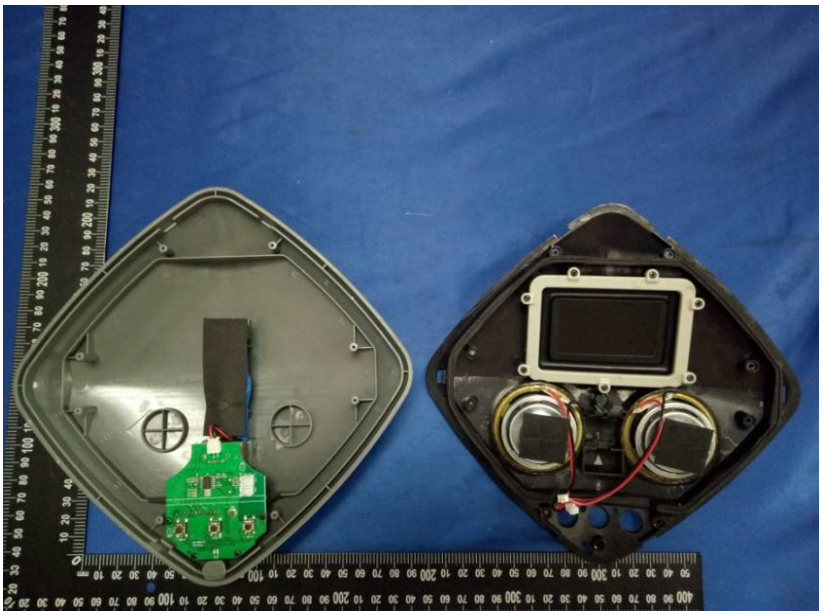


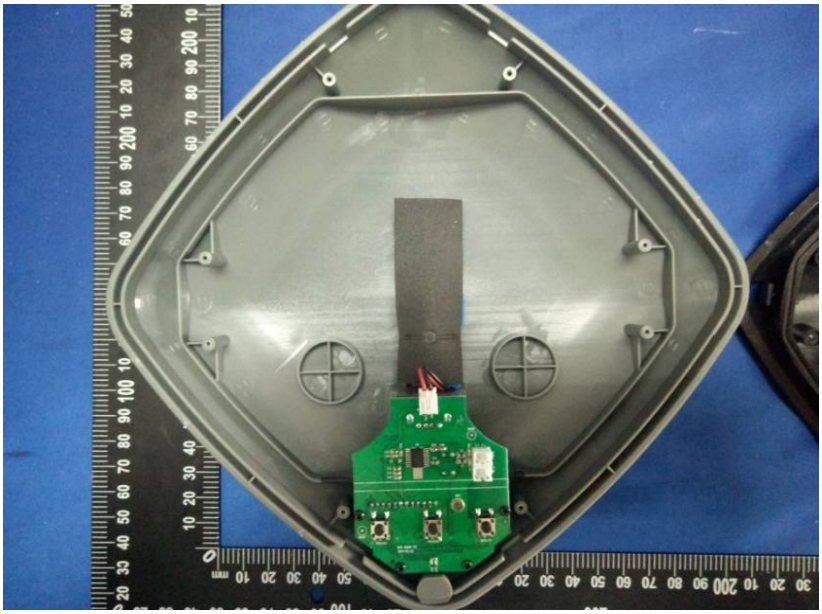


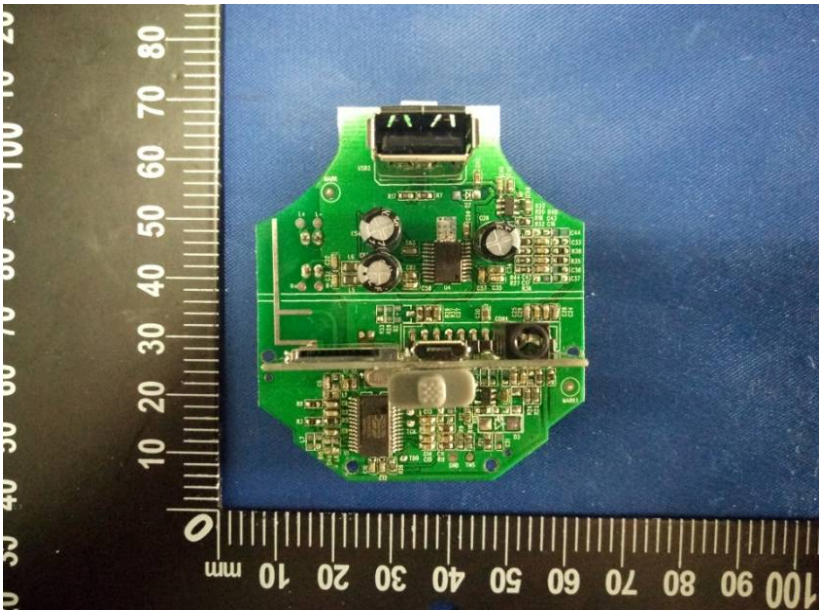


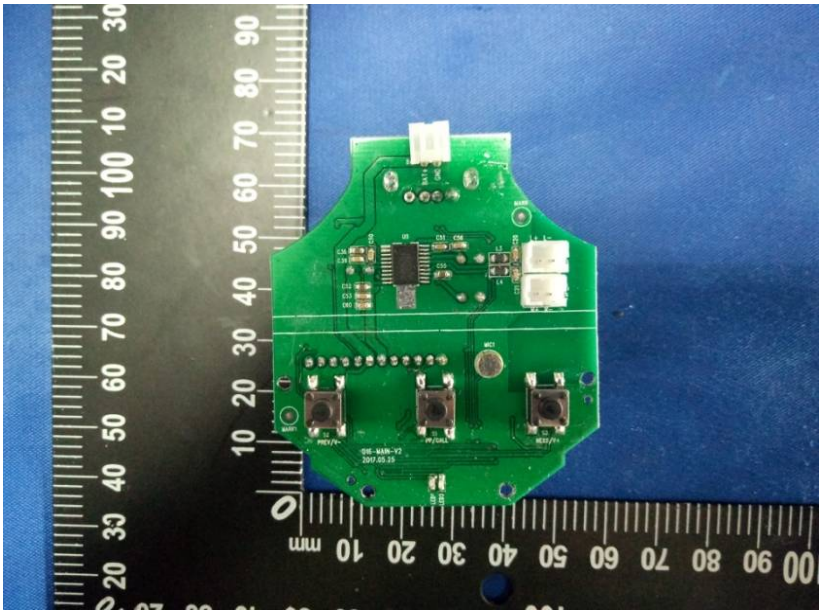


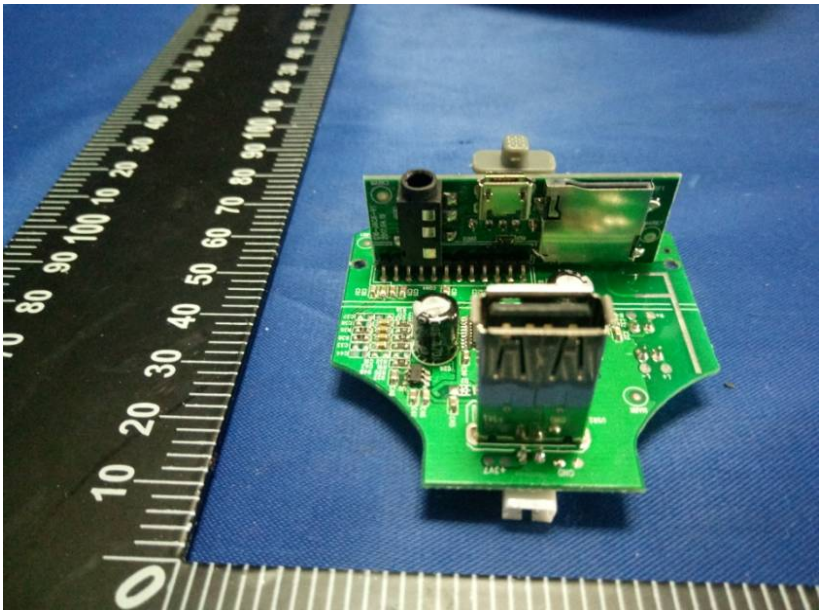


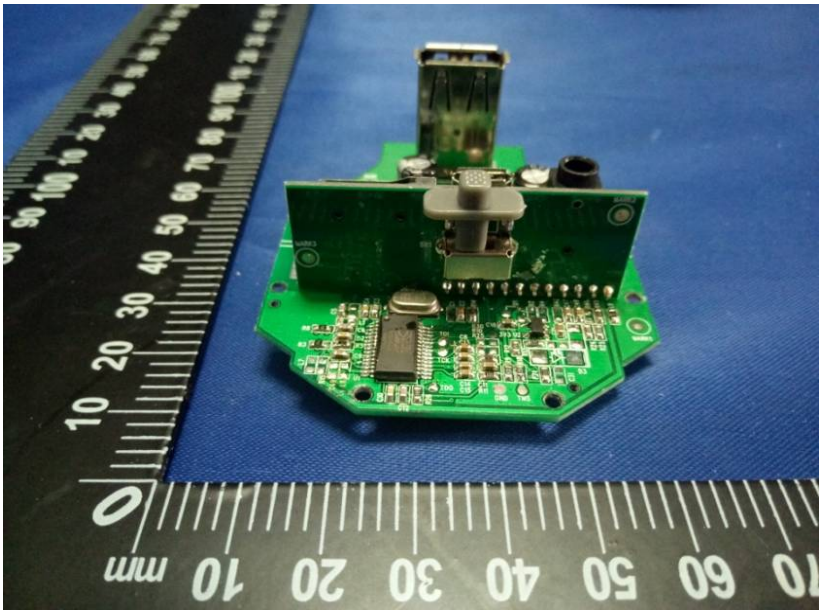


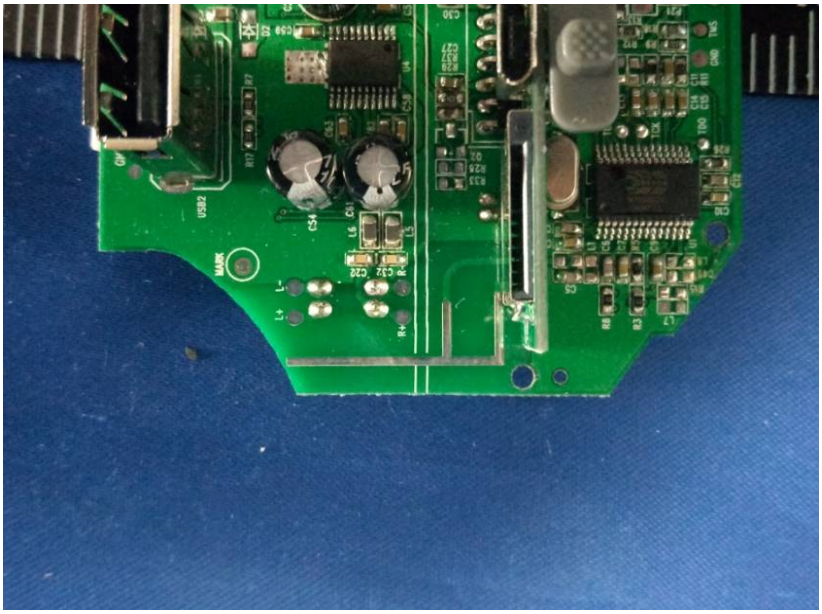


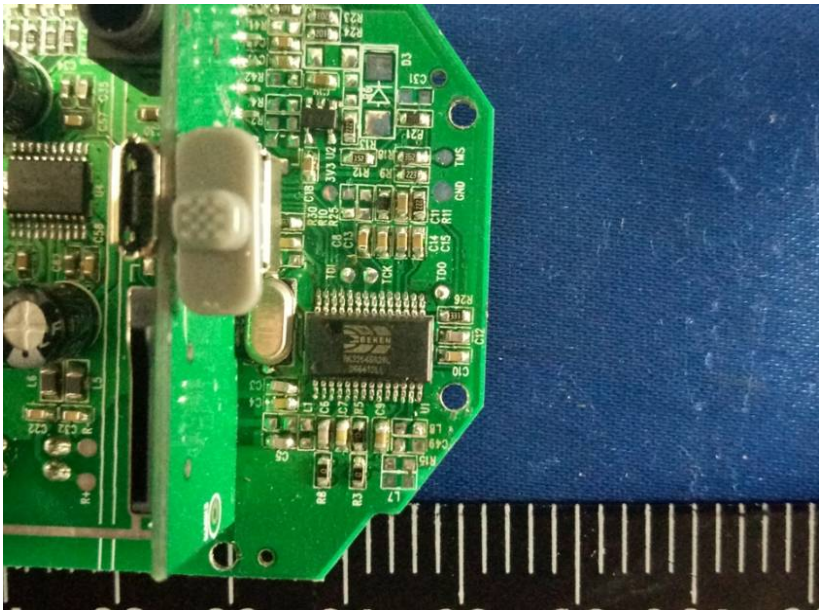












******THE END REPORT******