PRECISE TESTING

# FCC TEST REPORT

# FCC ID: 2AOSW-VISTAR-0002

| | | |
|---|---|---|
| Product Name | : | Bluetooth Speaker |
| Model Name | : | SC-2318BT |
| Brand Name | : | SuperSoinc |
| Report No. | : | PTC18060520801E-FC01 |

**Prepared for**

VISTAR ELECTRIC CO., LIMITED

NO.368 Wushiling, Yangwu, dalang Town, Dongguan City, 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 | : | VISTAR ELECTRIC CO., LIMITED |
| Address | : | NO.368 Wushiling, Yangwu, dalang Town, Dongguan City, Guangdong Province, China |
| Manufacture's name | : | VISTAR ELECTRIC CO., LIMITED |
| Address | : | NO.368 Wushiling, Yangwu, dalang Town, Dongguan City, Guangdong Province, China |
| Product name | : | Bluetooth Speaker |
| Model name | : | SC-2318BT |
| Standards | : | FCC CFR47 Part 15 Section 15.247 |
| Test procedure | : | ANSI C63.10:2013 |
| Test Date | : | June 27, 2018 to July 07, 2018 |
| Date of Issue | : | July 07, 2018 |
| Test Result | : | Pass |

This device described above has been tested by PTC, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.
This report shall not be reproduced except in full, without the written approval of PTC, this document may be altered or revised by PTC, personal only, and shall be noted in the revision of the document.

Test Engineer:

Leo Yang

Leo Yang / Engineer

Technical Manager:

Chris Du / Manager

# Contents

Page

**1 TEST RESULT CERTIFICATION** ..... **2**

**2 TEST SUMMARY** ..... **5**

**3 TEST FACILITY** ..... **6**

**4 GENERAL INFORMATION** ..... **7**

4.1 GENERAL DESCRIPTION OF E.U.T. ..... 7

4.2 TEST MODE ..... 8

**5 EQUIPMENT DURING TEST** ..... **10**

5.1 EQUIPMENTS LIST ..... 10

5.2 MEASUREMENT UNCERTAINTY ..... 12

5.3 DESCRIPTION OF SUPPORT UNITS ..... 13

**6 CONDUCTED EMISSION** ..... **14**

6.1 E.U.T. OPERATION ..... 14

6.2 EUT SETUP ..... 14

6.3 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) ..... 15

6.4 MEASUREMENT PROCEDURE: ..... 15

6.5 CONDUCTED EMISSION LIMIT ..... 15

6.6 MEASUREMENT DESCRIPTION ..... 15

6.7 CONDUCTED EMISSION TEST RESULT ..... 15

**7 RADIATED SPURIOUS EMISSIONS** ..... **18**

7.1 EUT OPERATION ..... 18

7.2 TEST SETUP ..... 19

7.3 SPECTRUM ANALYZER SETUP ..... 20

7.4 TEST PROCEDURE ..... 21

7.5 SUMMARY OF TEST RESULTS ..... 22

**8 CONDUCTED BAND EDGE EMISSION** ..... **27**

8.1 REQUIREMENT ..... 27

8.2 TEST PROCEDURE ..... 27

8.3 TEST SETUP ..... 27

8.4 EUT OPERATION CONDITIONS ..... 28

8.5 TEST RESULTS ..... 28

**9 20 DB BANDWIDTH MEASUREMENT ..... 35**

9.1 TEST PROCEDURE ..... 35

9.2 TEST RESULT ..... 35

**10 MAXIMUM PEAK OUTPUT POWER ..... 41**

10.1 TEST PROCEDURE ..... 41

10.2 TEST RESULT ..... 41

**11 HOPPING CHANNEL SEPARATION ..... 48**

11.1 TEST PROCEDURE ..... 48

11.2 TEST RESULT ..... 49

**12 NUMBER OF HOPPING FREQUENCY ..... 55**

12.1 TEST PROCEDURE ..... 55

12.2 TEST RESULT ..... 55

**13 DWELL TIME ..... 56**

13.1 TEST PROCEDURE ..... 56

13.2 TEST RESULT ..... 56

**14 ANTENNA REQUIREMENT ..... 59**

14.1 ANTENNA REQUIREMENT ..... 59

14.2 RESULT ..... 59

**15 TEST PHOTOS ..... 60**

**16 EUT PHOTOS ..... 62**

## 2 Test Summary

| Test Items | Test Requirement | Result |
|---|---|---|
| Radiated Spurious Emissions | 15.205(a)<br>15.209<br>15.247(d) | PASS |
| Band edge | 15.247(d)<br>15.205(a) | PASS |
| Conduct Emission | 15.207 | PASS |
| 20dB Bandwidth | 15.247(a)(1) | PASS |
| Maximum Peak Output Power | 15.247(b)(1) | PASS |
| Frequency Separation | 15.247(a)(1) | PASS |
| Number of Hopping Frequency | 15.247(a)(1)(iii) | PASS |
| Dwell time | 15.247(a)(1)(iii) | PASS |
| Antenna Requirement | 15.203 | PASS |

# 3 TEST FACILITY

Dongguan Precise Testing & Certification Corp., Ltd.

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

FCC Registration Number: 790290

A2LA Certificate No.: 4408.01

IC Registration Number: 12191A-1

Test Lab: Shenzhen BCTC Testing Co., Ltd.

Address: BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road, Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China

FCC Registered No.: 712850

Test items: Radiated Spurious Emission(18GHz to 25GHz)

# 4 General Information

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

| | | |
|---|---|---|
| Product Name | : | Bluetooth Speaker |
| Model Name | : | SC-2318BT |
| Bluetooth Version | : | BT 4.0+EDR |
| Operating frequency | : | 2402-2480MHz |
| Numbers of Channel | : | 79 channels |
| Antenna Type | : | Internal PCB Antenna |
| Antenna Gain | : | 1.2 dBi |
| Type of Modulation | : | GFSK, Π/4-DQPSK, 8DPSK |
| Power supply | : | DC 7.4V 2000mAh Battery<br>For Adapter<br>Model: THX-090150KE<br>Input: AC 100-240V, 50/60Hz, 0.65A MAX<br>Output: DC 9V, 1.5A |
| Hardware Version | : | VER 1.1 |
| Software Version | : | VER 1.2 |

## 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)** |
|---|---|
| 0 | 2402 |
| 39 | 2441 |
| 78 | 2480 |

# 5 Equipment During Test

## 5.1 Equipments List

RF Conducted Test

| Name of Equipment | Manufacturer | Model | Serial No. | Characteristics | Calibration Due |
|---|---|---|---|---|---|
| MXG Signal Analyzer | Agilent | N9020A | MY56070279 | 10Hz-30GHz | Apr 07, 2019 |
| Coaxial Cable | CDS | 79254 | 46107086 | 10Hz-30GHz | Oct 09, 2018 |
| Antenna Connector | Florida RF Labs | N/A | RF01# | N/A | Aug. 26, 2018 |

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(Test Frequency from 9KHz-18GHz)

| Name of Equipment | Manufacturer | Model | Serial No. | Characteristics | Calibration Due |
|---|---|---|---|---|---|
| EMI Test Receiver | Rohde&Schwarz | ESCI | 101417 | 9KHz-3GHz | Sep. 03, 2018 |
| Loop Antenna | Schwarzbeck | FMZB 1519 | 012 | 9 KHz -30MHz | Aug 31, 2018 |
| Bilog Antenna | SCHWARZBECK | VULB9160 | 9160-3355 | 25MHz-2GHz | Aug 31, 2018 |
| Preamplifier (low frequency) | SCHWARZBECK | BBV 9475 | 9745-0013 | 1MHz-1GHz | Sep. 03, 2018 |
| Cable | Schwarzbeck | PLF-100 | 549489 | 9KHz-3GHz | Sep. 03, 2018 |
| Spectrum Analyzer | Agilent | E4407B | MY45109572 | 9KHz-40GHz | Oct. 13, 2018 |
| Horn Antenna | SCHWARZBECK | 9120D | 9120D-1246 | 1GHz-18GHz | Aug. 31, 2018 |
| Power Amplifier | LUNAR EM | LNA1G18-40 | J10100000081 | 1GHz-26.5GHz | Aug. 31, 2018 |
| Cable | H+S | CBL-26 | N/A | 1GHz-26.5GHz | Sep. 03, 2018 |

Radiated Emission (Test Frequency from 18GHz-25GHz)

| Name of Equipment | Manufacturer | Model | Serial No. | Characteristics | Calibration Due |
|---|---|---|---|---|---|
| Spectrum Analyzer | Agilent | E4407B | MY45109572 | 9KHz-26.5GHz | 2018.08.26 |
| Test Receiver | R&S | ESPI | 101396 | 9KHz-7GHz | 2018.08.26 |
| Horn Antenna | SCHWARZBECK | BBHA 9170 | 9170-181 | 14GHz-40GHz | 2018.09.02 |
| Amplifier | SCHWARZBECK | BBV 9721 | 9721-205 | 18GHz-40GHz | 2018.08.26 |
| RF Cable | R&S | R204 | R21X | 1GHz-40GHz | 2018.08.26 |

Conducted Emissions

| Name of Equipment | Manufacturer | Model | Serial No. | Characteristics | Calibration Due |
|---|---|---|---|---|---|
| EMI Test Receiver | Rohde&Schwarz | ESCI | 101417 | 9KHz-3GHz | Sep. 03, 2018 |
| Artificial Mains Network | Rohde&Schwarz | L2-16B | 000WX31025 | 9KHz-300MHz | Sep. 03, 2018 |
| Artificial Mains Network | Rohde&Schwarz | ENV216 | 101342 | 9KHz-300MHz | 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. |
|---|---|---|
| N/A | N/A | 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) |

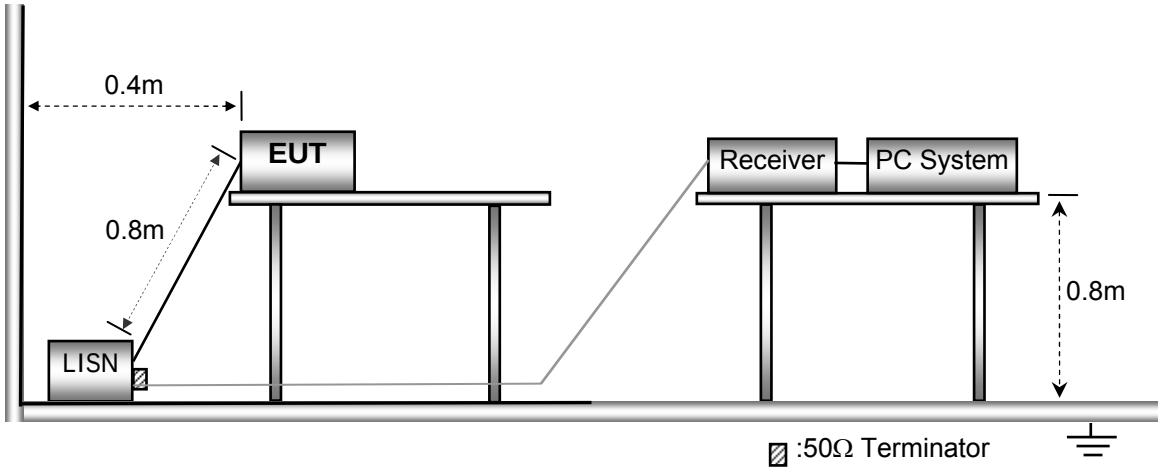
## 6.1 E.U.T. Operation

Operating Environment **:**

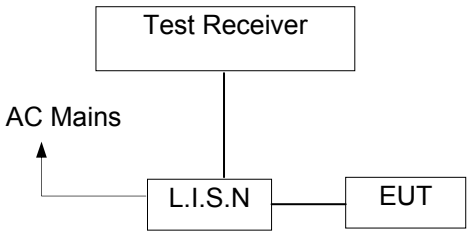
| | | |
|---|---|---|
| Temperature: | : | 25.5 °C |
| Humidity: | : | 51 % RH |
| Atmospheric Pressure: | : | 101.2kPa |
| Test Voltage | : | AC 120V/60Hz |

## 6.2 EUT Setup

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



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




## 6.4 Measurement Procedure:

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

## 6.5 Conducted Emission Limit

**Conducted Emission**

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

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

## 6.6 Measurement Description

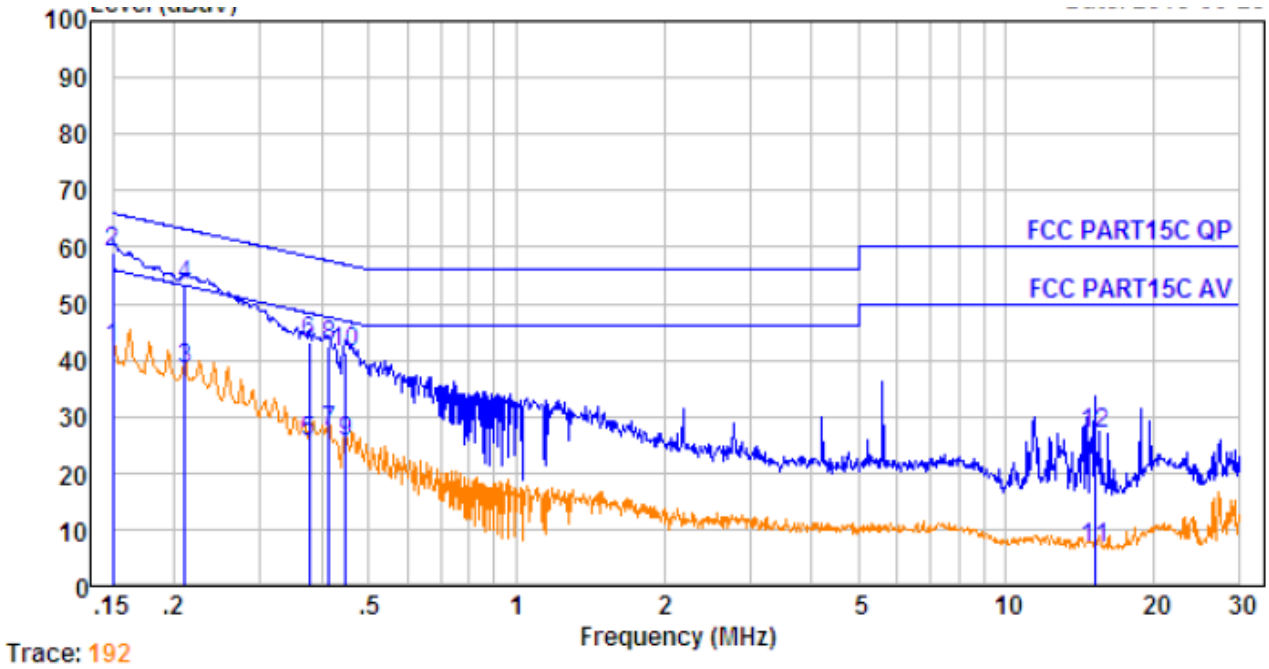
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

## 6.7 Conducted Emission Test Result

Pass.

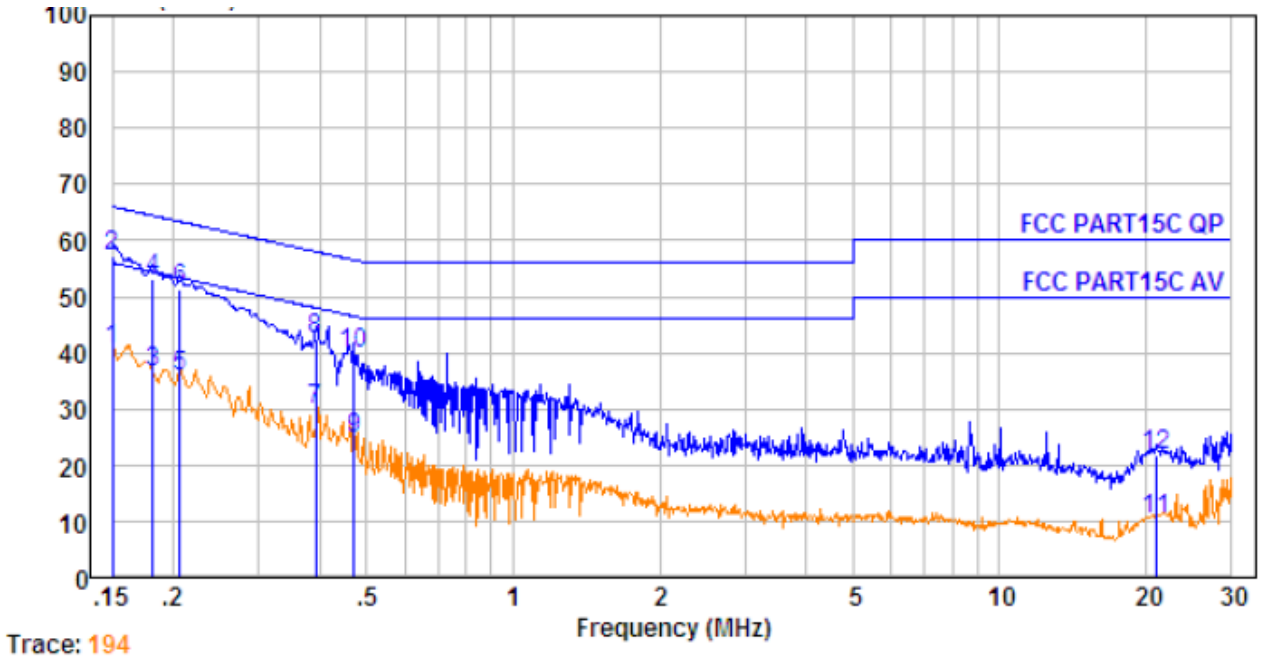
All the modulation modes were tested the data of the worst mode (AC 120V/60Hz, GFSK TX 2402MHz) are recorded in the following pages and the others modulation methods do not exceed the limits.

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. | 0.150 | 0.21 | 9.50 | 32.49 | 42.20 | 56.00 | -13.80 | Average |
| 2. | 0.150 | 0.21 | 9.50 | 49.34 | 59.05 | 66.00 | -6.95 | QP |
| 3. | 0.211 | 0.29 | 9.60 | 28.38 | 38.27 | 53.18 | -14.91 | Average |
| 4. | 0.211 | 0.29 | 9.60 | 43.35 | 53.24 | 63.18 | -9.94 | QP |
| 5. | 0.377 | 0.40 | 9.72 | 15.29 | 25.41 | 48.34 | -22.93 | Average |
| 6. | 0.377 | 0.40 | 9.72 | 33.21 | 43.33 | 58.34 | -15.01 | QP |
| 7. | 0.415 | 0.41 | 9.74 | 17.19 | 27.34 | 47.55 | -20.21 | Average |
| 8. | 0.415 | 0.41 | 9.74 | 32.21 | 42.36 | 57.55 | -15.19 | QP |
| 9. | 0.449 | 0.42 | 9.76 | 15.41 | 25.59 | 46.89 | -21.30 | Average |
| 10. | 0.449 | 0.42 | 9.76 | 31.32 | 41.50 | 56.89 | -15.39 | QP |
| 11. | 15.146 | 0.55 | 10.00 | -3.85 | 6.70 | 50.00 | -43.30 | Average |
| 12. | 15.146 | 0.55 | 10.00 | 16.34 | 26.89 | 60.00 | -33.11 | 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. | 0.150 | 0.21 | 9.53 | 30.70 | 40.44 | 56.00 | -15.56 | Average |
| 2. | 0.150 | 0.21 | 9.53 | 47.34 | 57.08 | 66.00 | -8.92 | QP |
| 3. | 0.182 | 0.25 | 9.59 | 26.80 | 36.64 | 54.42 | -17.78 | Average |
| 4. | 0.182 | 0.25 | 9.59 | 43.22 | 53.06 | 64.42 | -11.36 | QP |
| 5. | 0.206 | 0.29 | 9.63 | 25.86 | 35.78 | 53.36 | -17.58 | Average |
| 6. | 0.206 | 0.29 | 9.63 | 41.25 | 51.17 | 63.36 | -12.19 | QP |
| 7. | 0.393 | 0.40 | 9.76 | 19.55 | 29.71 | 47.99 | -18.28 | Average |
| 8. | 0.393 | 0.40 | 9.76 | 32.34 | 42.50 | 57.99 | -15.49 | QP |
| 9. | 0.471 | 0.42 | 9.80 | 14.34 | 24.56 | 46.49 | -21.93 | Average |
| 10. | 0.471 | 0.42 | 9.80 | 29.55 | 39.77 | 56.49 | -16.72 | QP |
| 11. | 20.924 | 0.42 | 9.98 | 0.08 | 10.48 | 50.00 | -39.52 | Average |
| 12. | 20.924 | 0.42 | 9.98 | 11.55 | 21.95 | 60.00 | -38.05 | 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

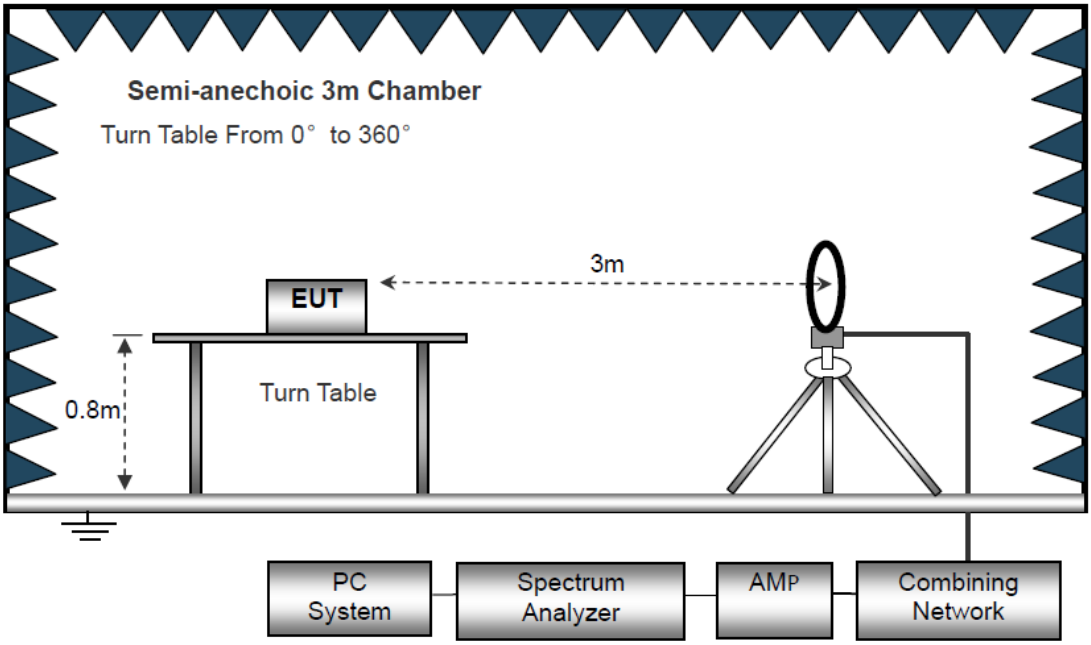
Atmospheric Pressure : 101.2kPa

Test Voltage : AC 120V/60Hz

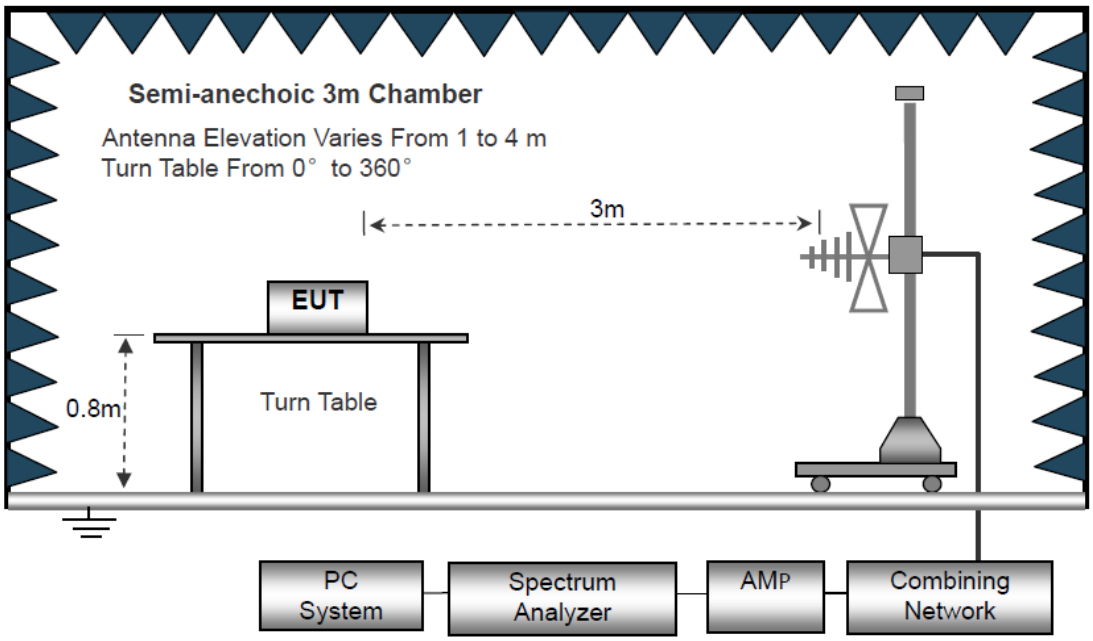
## 7.2 Test Setup

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

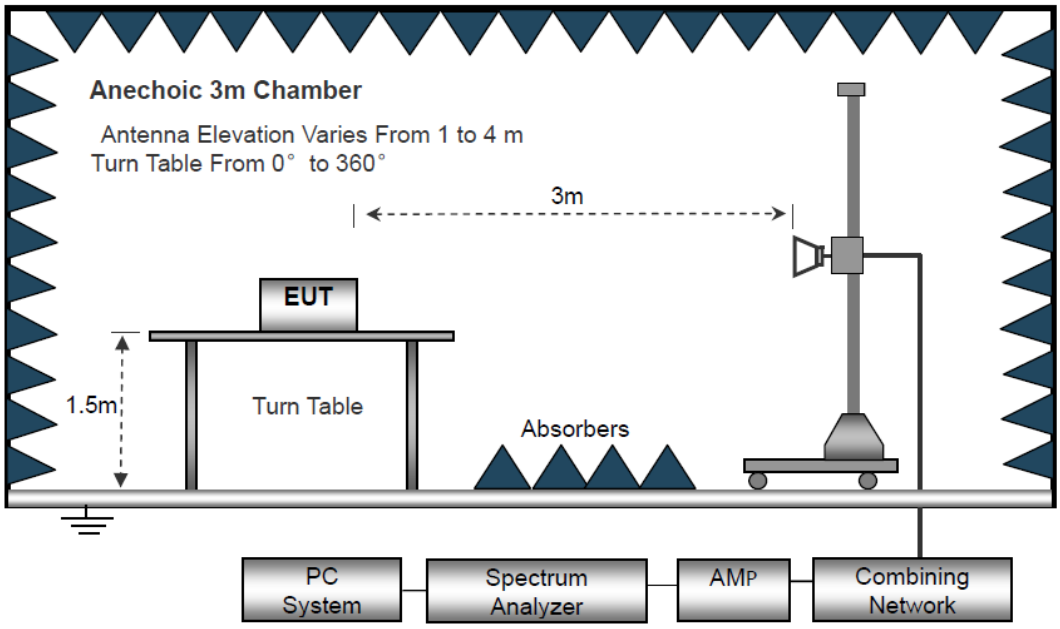
The test setup for emission measurement below 30MHz.




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: 9KHz-30MHz**

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

Note:

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

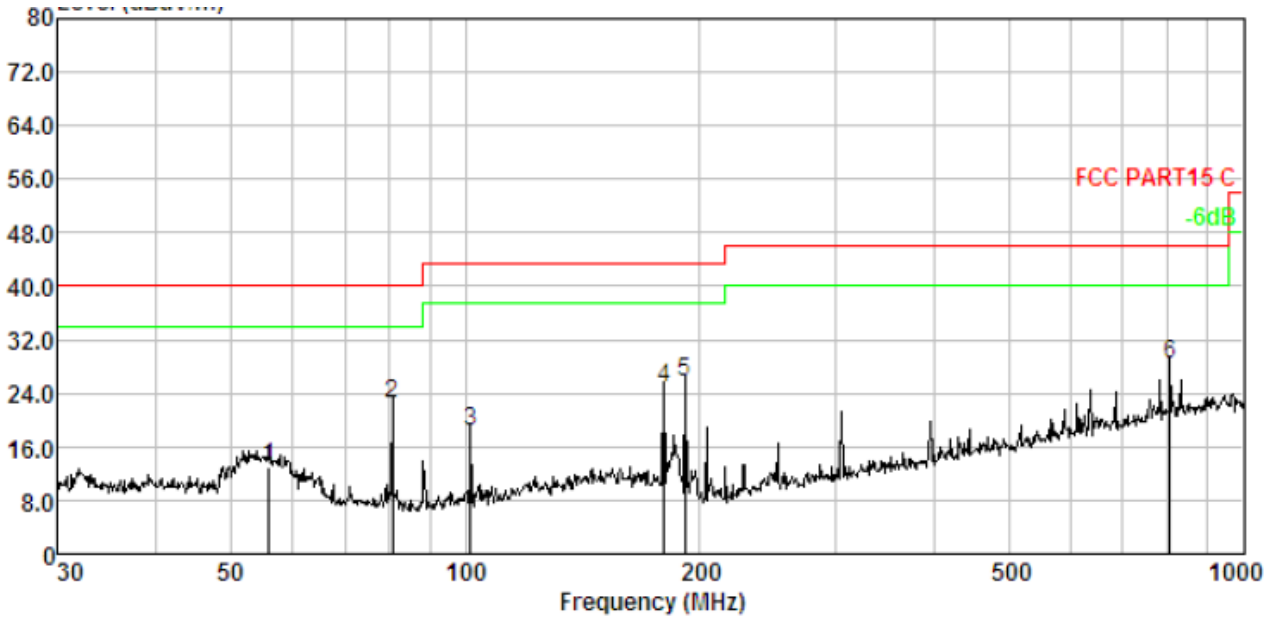
Distance extrapolation factor =40log(Specific distance/ test distance)( dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

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

Please refer to the following test plots:

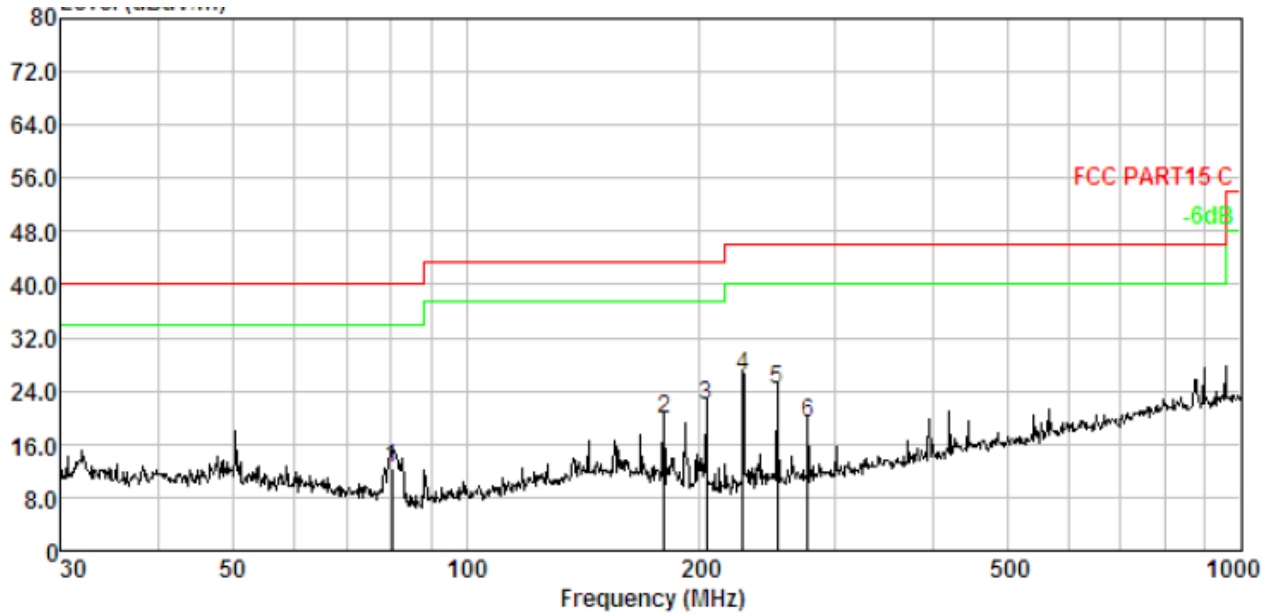
All the modulation modes were tested the data of the worst mode (AC 120V/60Hz, GFSK TX 2402MHz) are recorded in the following pages and the others modulation methods do not exceed the limits.

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. | 56.001 | 1.62 | 11.96 | 29.49 | 30.19 | 12.88 | 40.00 | -27.12 | QP |
| 2. | 80.644 | 1.95 | 8.76 | 42.01 | 30.31 | 22.41 | 40.00 | -17.59 | QP |
| 3. | 101.644 | 2.16 | 10.38 | 36.07 | 30.39 | 18.22 | 43.50 | -25.28 | QP |
| 4. | 180.017 | 2.68 | 12.44 | 40.26 | 30.59 | 24.79 | 43.50 | -18.71 | QP |
| 5. | 191.745 | 2.73 | 10.97 | 42.48 | 30.62 | 25.56 | 43.50 | -17.94 | QP |
| 6. | 804.603 | 4.03 | 21.79 | 33.57 | 31.11 | 28.28 | 46.00 | -17.72 | 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. | 80.081 | 1.94 | 8.77 | 32.04 | 30.31 | 12.44 | 40.00 | -27.56 | QP |
| 2. | 180.017 | 2.68 | 12.44 | 35.35 | 30.59 | 19.88 | 43.50 | -23.62 | QP |
| 3. | 204.238 | 2.79 | 10.46 | 39.21 | 30.64 | 21.82 | 43.50 | -21.68 | QP |
| 4. | 227.691 | 2.89 | 11.14 | 42.79 | 30.68 | 26.14 | 46.00 | -19.86 | QP |
| 5. | 252.063 | 2.98 | 11.97 | 40.04 | 30.71 | 24.28 | 46.00 | -21.72 | QP |
| 6. | 276.124 | 3.06 | 12.68 | 34.09 | 30.74 | 19.09 | 46.00 | -26.91 | QP |

## Test Frequency 1GHz-18GHz

### Low Channel (2402MHz) Worst case GFSK

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 4824 | 28.14 | AV | V | 8.13 | 8.26 | 7.46 | 37.07 | 54 | -16.93 |
| 4824 | 29.35 | AV | H | 8.13 | 8.26 | 7.46 | 38.28 | 54 | -15.72 |
| 4824 | 32.66 | PK | V | 8.13 | 8.26 | 7.46 | 41.59 | 74 | -32.41 |
| 4824 | 35.28 | PK | H | 8.13 | 8.26 | 7.46 | 44.21 | 74 | -29.79 |
| 15447 | 27.46 | AV | V | 9.14 | 9.57 | 8.62 | 37.55 | 54 | -16.45 |
| 15447 | 28.28 | AV | H | 9.14 | 9.57 | 8.62 | 38.37 | 54 | -15.63 |
| 15447 | 30.49 | PK | V | 9.14 | 9.57 | 8.62 | 40.58 | 74 | -33.42 |
| 15447 | 32.58 | PK | H | 9.14 | 9.57 | 8.62 | 42.67 | 74 | -31.33 |

### Middle Channel (2441MHz) Worst case π/4-DQPSK

| 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 | 26.43 | AV | V | 8.24 | 9.47 | 11.05 | 33.09 | 54 | -20.91 |
| 4882 | 28.15 | AV | H | 8.24 | 9.47 | 11.05 | 34.81 | 54 | -19.19 |
| 4882 | 30.26 | PK | V | 8.24 | 9.47 | 11.05 | 36.92 | 74 | -37.08 |
| 4882 | 32.19 | PK | H | 8.24 | 9.47 | 11.05 | 38.85 | 74 | -35.15 |
| 15483 | 28.49 | AV | V | 9.33 | 10.46 | 11.48 | 36.8 | 54 | -17.2 |
| 15483 | 29.35 | AV | H | 9.33 | 10.46 | 11.48 | 37.66 | 54 | -16.34 |
| 15483 | 31.45 | PK | V | 9.33 | 10.46 | 11.48 | 39.76 | 74 | -34.24 |
| 15483 | 32.87 | PK | H | 9.33 | 10.46 | 11.48 | 41.18 | 74 | -32.82 |

### High Channel (2480MHz) Worst case GFSK

| 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 | 25.46 | AV | V | 8.26 | 8.37 | 9.46 | 32.63 | 54 | -21.37 |
| 4960 | 27.35 | AV | H | 8.26 | 8.37 | 9.46 | 34.52 | 54 | -19.48 |
| 4960 | 30.15 | PK | V | 8.26 | 8.37 | 9.46 | 37.32 | 74 | -36.68 |
| 4960 | 32.59 | PK | H | 8.26 | 8.37 | 9.46 | 39.76 | 74 | -34.24 |
| 15386 | 28.43 | AV | V | 9.44 | 9.04 | 11.26 | 35.65 | 54 | -18.35 |
| 15386 | 29.61 | AV | H | 9.44 | 9.04 | 11.26 | 36.83 | 54 | -17.17 |
| 15386 | 31.48 | PK | V | 9.44 | 9.04 | 11.26 | 38.7 | 74 | -35.3 |
| 15386 | 33.68 | PK | H | 9.44 | 9.04 | 11.26 | 40.9 | 74 | -33.1 |

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

## Test Frequency: From 18GHz to 25GHz

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

# 8 CONDUCTED BAND EDGE EMISSION

## 8.1 REQUIREMENT

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

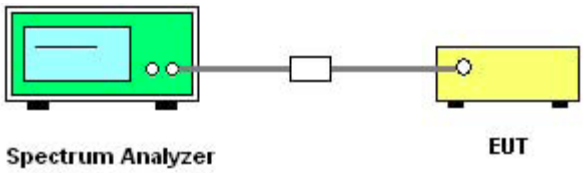
## 8.2 TEST PROCEDURE

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

. For Band edge

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

## 8.3 TEST SETUP




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

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

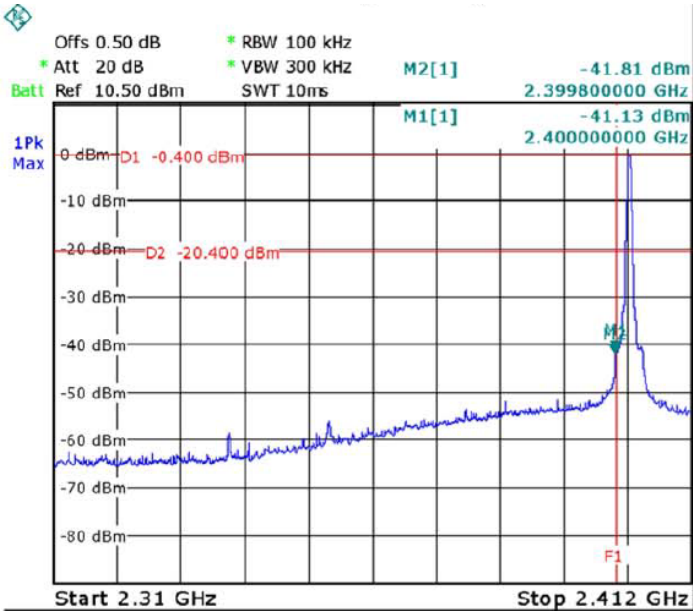
## 8.4 EUT OPERATION CONDITIONS

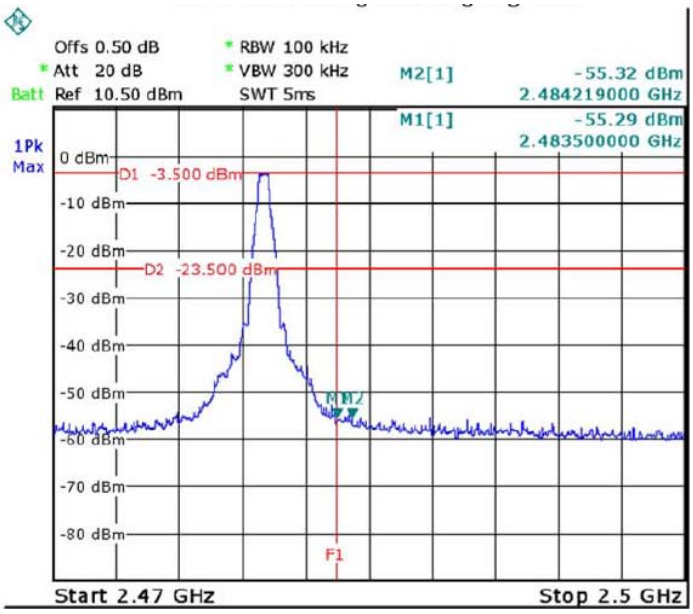
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

## 8.5 TEST RESULTS

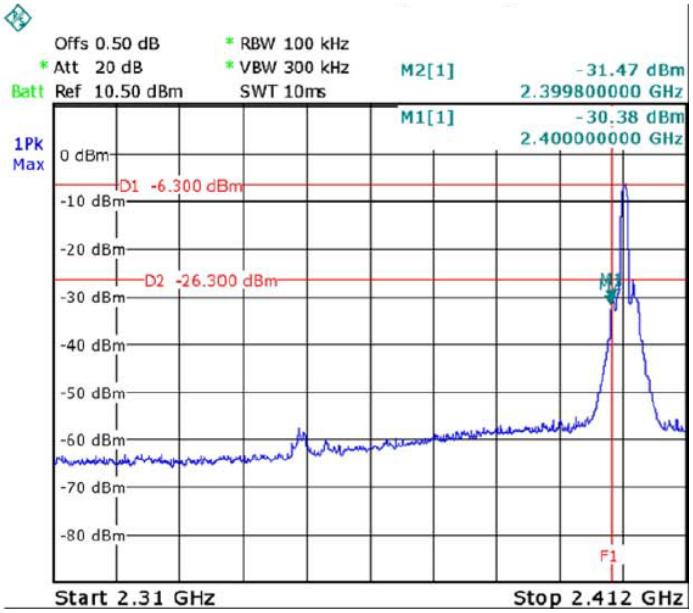
For Non-Hopping Mode:

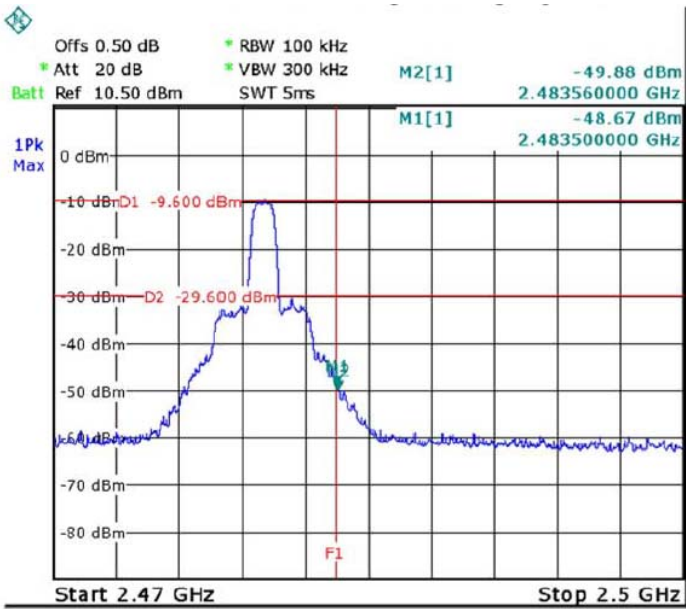
GFSK



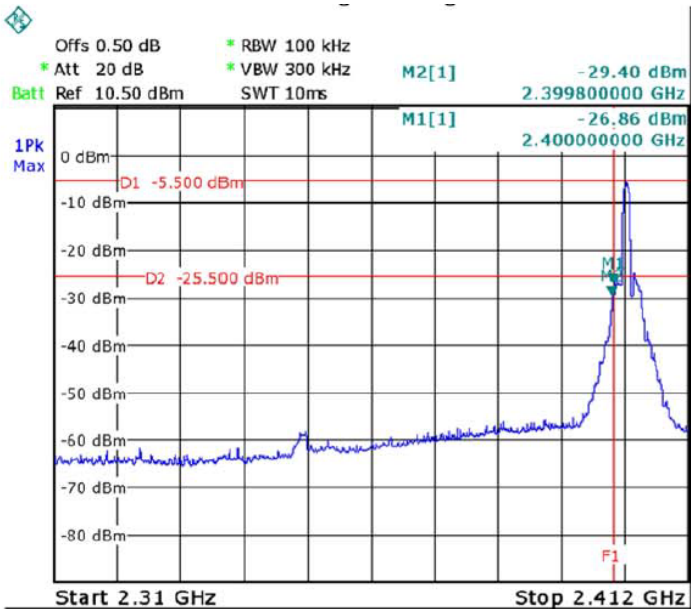

Offs 0.50 dB
* RBW 100 kHz
* Att 20 dB
* VBW 300 kHz
Batt Ref 10.50 dBm
SWT 5ms
M2[1] -55.32 dBm
2.484219000 GHz
M1[1] -55.29 dBm
2.483500000 GHz
1Pk Max
0 dBm
D1 -3.500 dBm
-10 dBm
-20 dBm
D2 -23.500 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
F1
Start 2.47 GHz
Stop 2.5 GHz

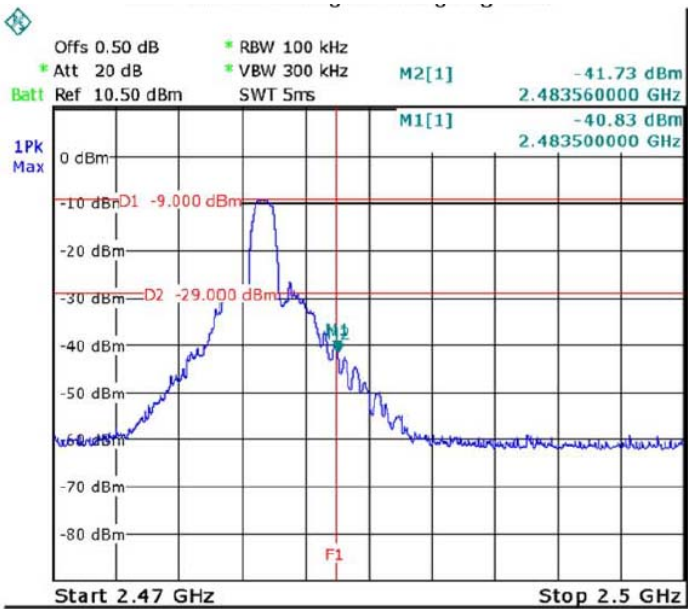
π/4-DQPSK


Offs 0.50 dB
* RBW 100 kHz
* Att 20 dB
* VBW 300 kHz
Batt Ref 10.50 dBm
SWT 10ms
M2[1] -31.47 dBm
2.399800000 GHz
M1[1] -30.38 dBm
2.400000000 GHz
1Pk Max
0 dBm
D1 -6.300 dBm
-10 dBm
-20 dBm
D2 -26.300 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
F1
Start 2.31 GHz
Stop 2.412 GHz


Offs 0.50 dB
* Att 20 dB
Batt Ref 10.50 dBm
* RBW 100 kHz
* VBW 300 kHz
SWT 5ms
M2[1] -49.88 dBm
2.483560000 GHz
M1[1] -48.67 dBm
2.483500000 GHz
1Pk
Max
0 dBm
-10 dBm D1 -9.600 dBm
-20 dBm
-30 dBm D2 -29.600 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
F1
Start 2.47 GHz
Stop 2.5 GHz

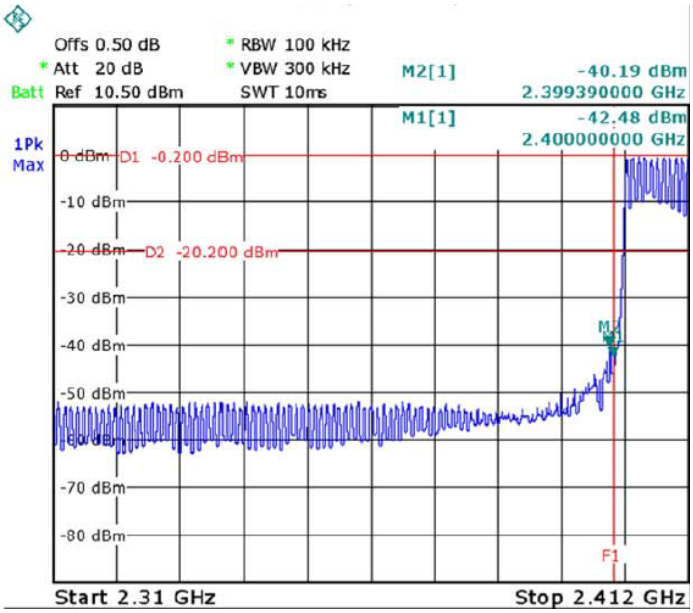
8DPSK

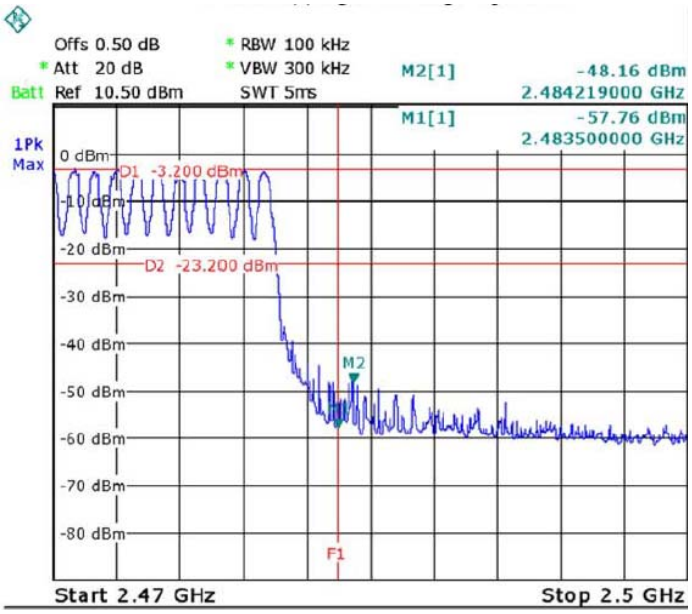

Offs 0.50 dB
* Att 20 dB
Batt Ref 10.50 dBm
* RBW 100 kHz
* VBW 300 kHz
SWT 10ms
M2[1] -29.40 dBm
2.399800000 GHz
M1[1] -26.86 dBm
2.400000000 GHz
1Pk
Max
0 dBm
D1 -5.500 dBm
-10 dBm
-20 dBm
D2 -25.500 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
F1
Start 2.31 GHz
Stop 2.412 GHz



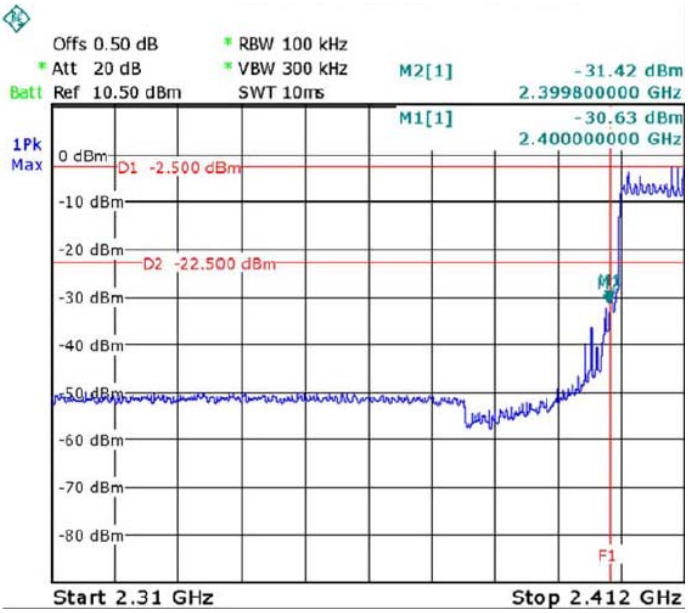

For Hopping Mode:

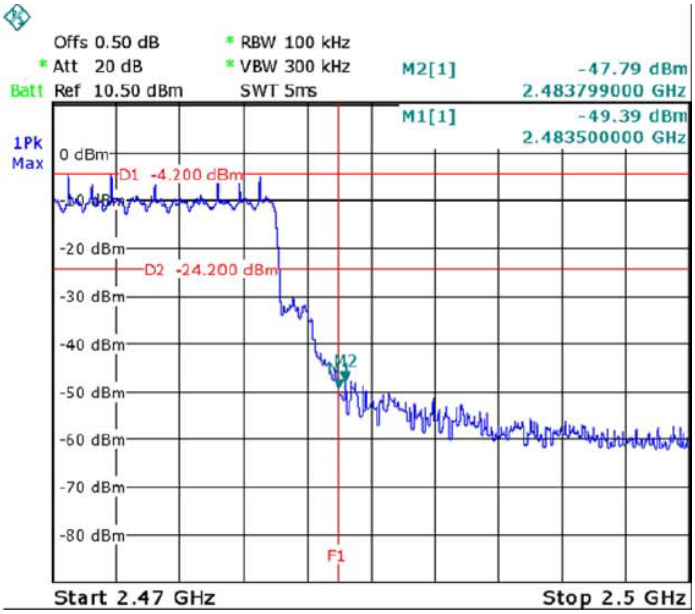
GFSK



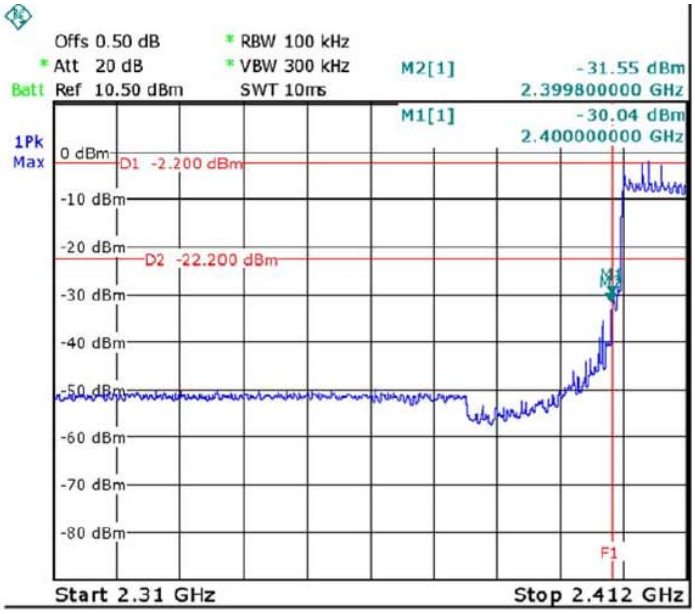

Offs 0.50 dB
* Att 20 dB
Batt Ref 10.50 dBm
* RBW 100 kHz
* VBW 300 kHz
SWT 5ms
M2[1] -48.16 dBm
2.484219000 GHz
M1[1] -57.76 dBm
2.483500000 GHz
1Pk
Max
0 dBm
D1 -3.200 dBm
-10 dBm
-20 dBm
D2 -23.200 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M2
F1
Start 2.47 GHz
Stop 2.5 GHz

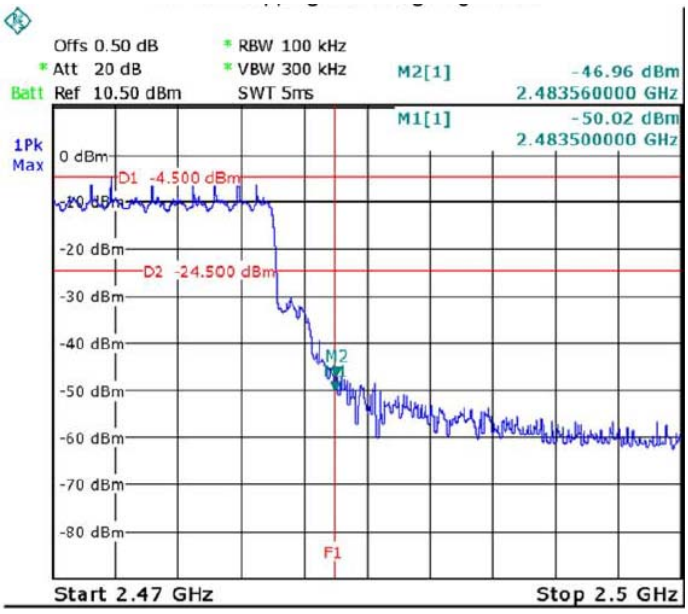
π/4-DQPSK


Offs 0.50 dB
* Att 20 dB
Batt Ref 10.50 dBm
* RBW 100 kHz
* VBW 300 kHz
SWT 10ms
M2[1] -31.42 dBm
2.399800000 GHz
M1[1] -30.63 dBm
2.400000000 GHz
1Pk
Max
0 dBm
D1 -2.500 dBm
-10 dBm
-20 dBm
D2 -22.500 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
F1
Start 2.31 GHz
Stop 2.412 GHz


Offs 0.50 dB
* Att 20 dB
Batt Ref 10.50 dBm
* RBW 100 kHz
* VBW 300 kHz
SWT 5ms
M2[1] -47.79 dBm
2.483799000 GHz
M1[1] -49.39 dBm
2.483500000 GHz
1Pk
Max
0 dBm
D1 -4.200 dBm
-10 dBm
-20 dBm
D2 -24.200 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M2
F1
Start 2.47 GHz
Stop 2.5 GHz

8DPSK


Offs 0.50 dB
* Att 20 dB
Batt Ref 10.50 dBm
* RBW 100 kHz
* VBW 300 kHz
SWT 10ms
M2[1] -31.55 dBm
2.399800000 GHz
M1[1] -30.04 dBm
2.400000000 GHz
1Pk
Max
0 dBm
D1 -2.200 dBm
-10 dBm
-20 dBm
D2 -22.200 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
F1
Start 2.31 GHz
Stop 2.412 GHz


Offs 0.50 dB
* Att 20 dB
Batt Ref 10.50 dBm
* RBW 100 kHz
* VBW 300 kHz
SWT 5ms
M2[1]
-46.96 dBm
2.483560000 GHz
M1[1]
-50.02 dBm
2.483500000 GHz
1Pk
Max
0 dBm
D1 -4.500 dBm
-10 dBm
-20 dBm
D2 -24.500 dBm
-30 dBm
-40 dBm
M2
-50 dBm
-60 dBm
-70 dBm
-80 dBm
F1
Start 2.47 GHz
Stop 2.5 GHz

# 9 20 dB Bandwidth Measurement

Test Requirement : FCC CFR47 Part 15 Section 15.247

Test Method : ANSI C63.10:2013

## 9.1 Test Procedure

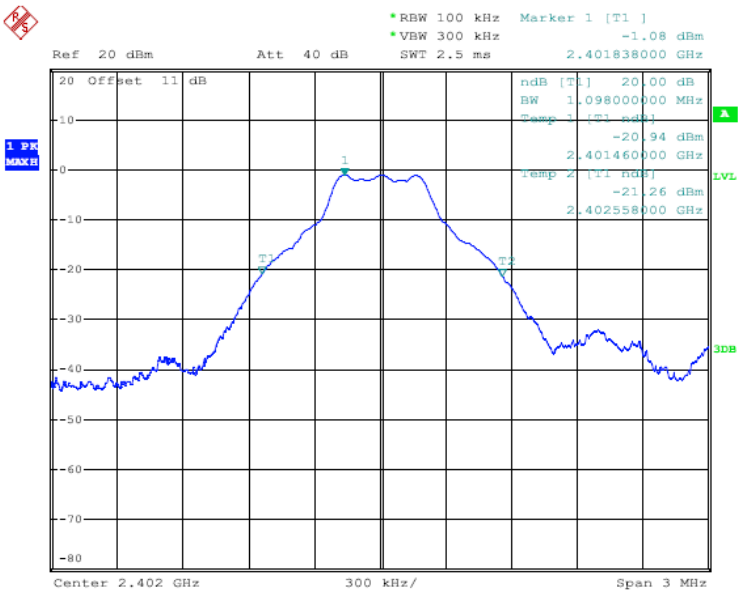
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;

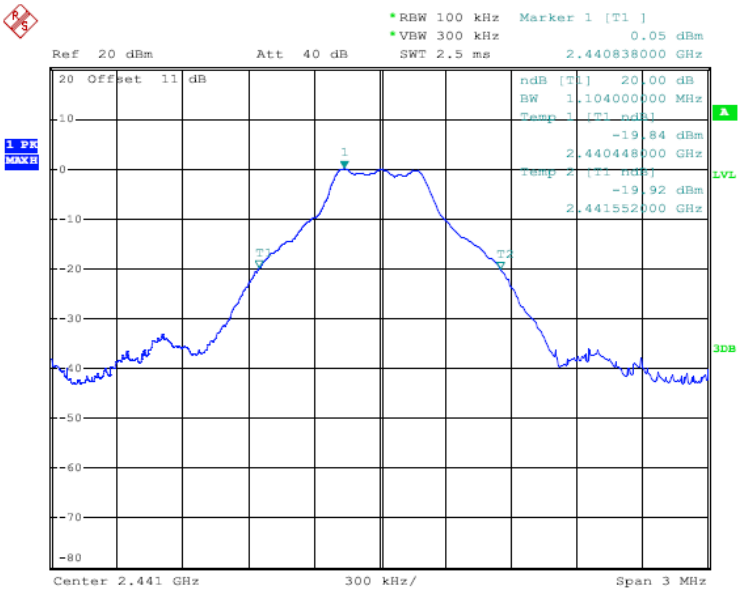
2. Set the spectrum analyzer: RBW =100kHz, VBW = 100kHz

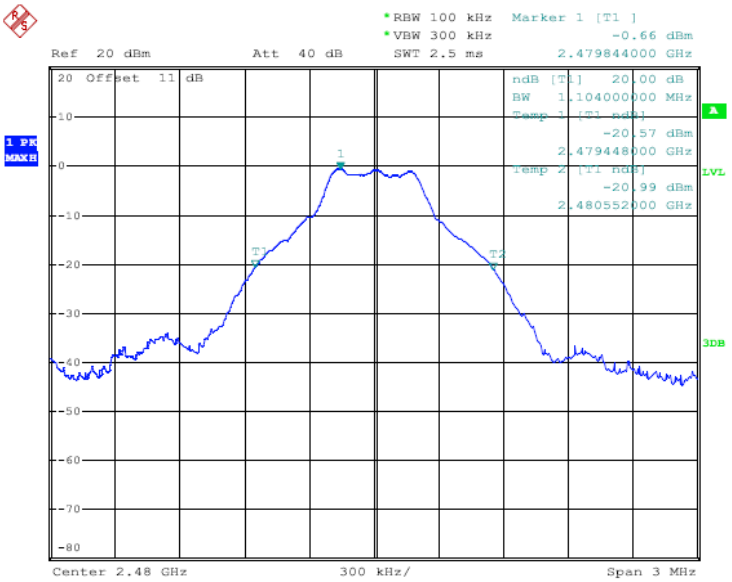
## 9.2 Test Result

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

| Channel number | Channel frequency (MHz) | 20dB Down BW(kHz) |
|---|---|---|
| 00 | 2402 | 1098 |
| 39 | 2441 | 1104 |
| 78 | 2480 | 1104 |

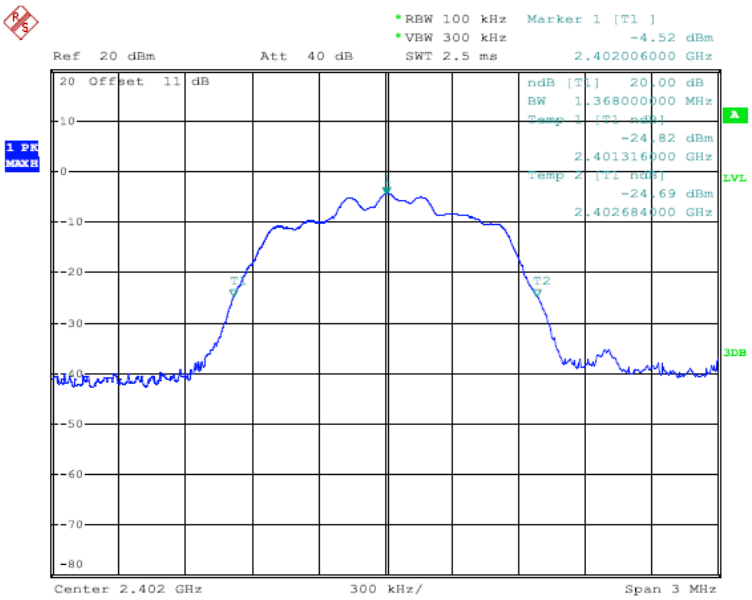


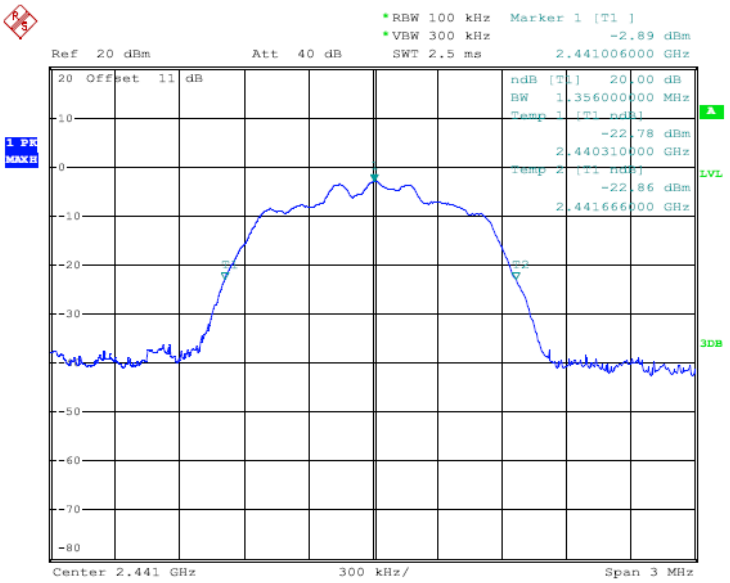

RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms
Marker 1 [T1 ]
0.05 dBm
2.440838000 GHz
Ref 20 dBm
Att 40 dB
20 Offset 11 dB
ndB [T1] 20.00 dB
BW 1.104000000 MHz
-19.84 dBm
2.440448000 GHz
-19.92 dBm
2.441552000 GHz
1 PK MAXH
A
LVL
3DB
Center 2.441 GHz
300 kHz/
Span 3 MHz

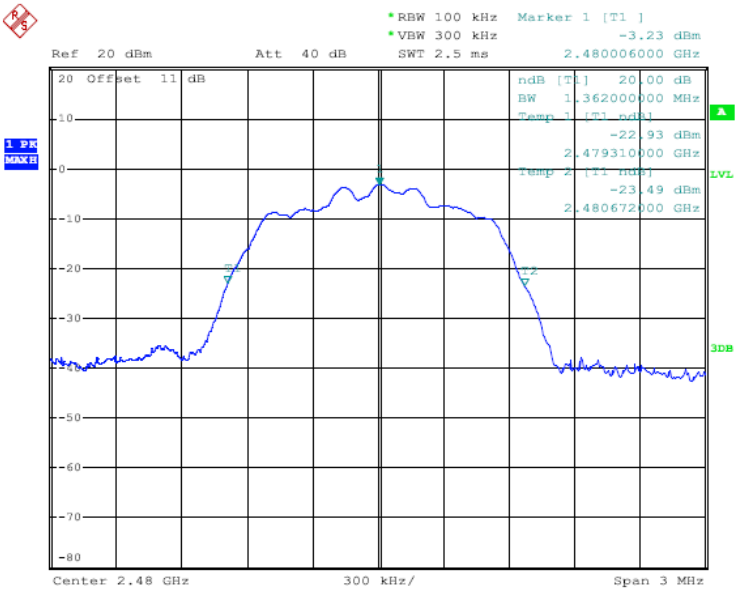

RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms
Marker 1 [T1 ]
-0.66 dBm
2.479844000 GHz
Ref 20 dBm
Att 40 dB
20 Offset 11 dB
ndB [T1] 20.00 dB
BW 1.104000000 MHz
-20.57 dBm
2.479448000 GHz
-20.99 dBm
2.480552000 GHz
1 PK MAXH
A
LVL
3DB
Center 2.48 GHz
300 kHz/
Span 3 MHz

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

| Channel number | Channel frequency (MHz) | 20dB Down BW(kHz) |
|---|---|---|
| 00 | 2402 | 1368 |
| 39 | 2441 | 1356 |
| 78 | 2480 | 1362 |

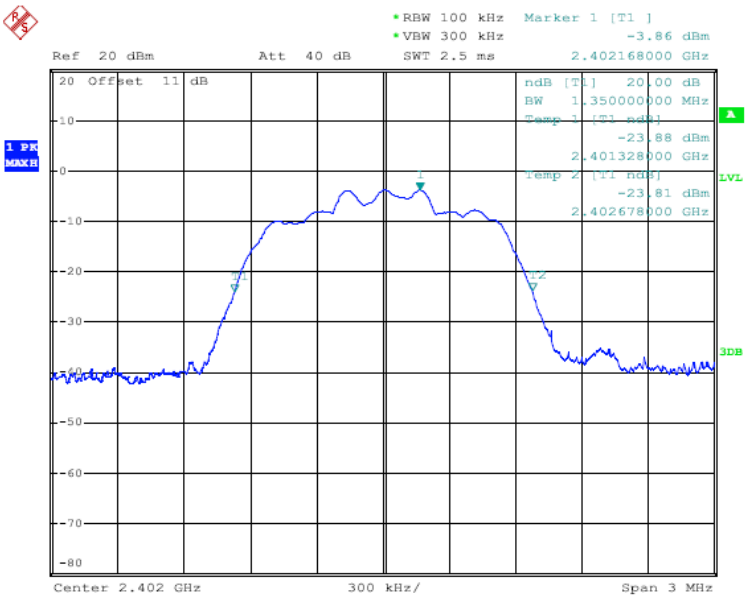


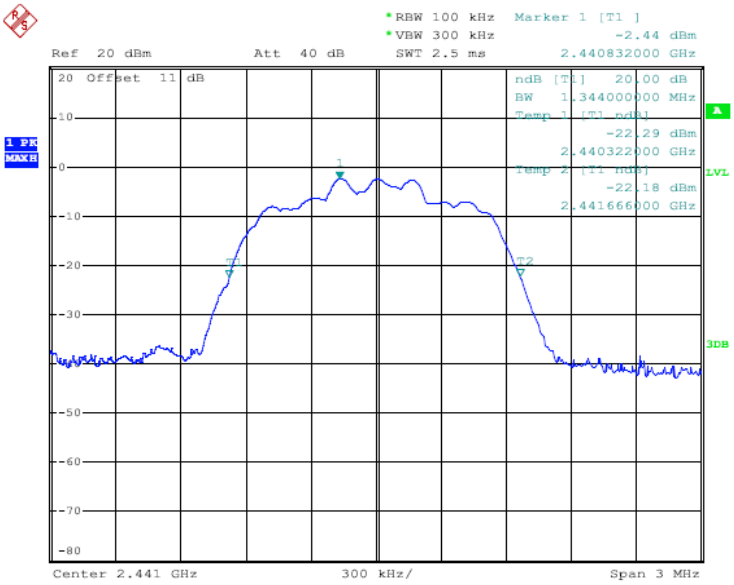

RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms
Marker 1 [T1 ]
-2.89 dBm
2.441006000 GHz
Ref 20 dBm
Att 40 dB
20 Offset 11 dB
ndB [T1] 20.00 dB
BW 1.356000000 MHz
Temp 1 [T1 ndB]
-22.78 dBm
2.440310000 GHz
Temp 2 [T1 ndB]
-22.86 dBm
2.441666000 GHz
1 PK MAXH
A
LVL
3DB
Center 2.441 GHz
300 kHz/
Span 3 MHz

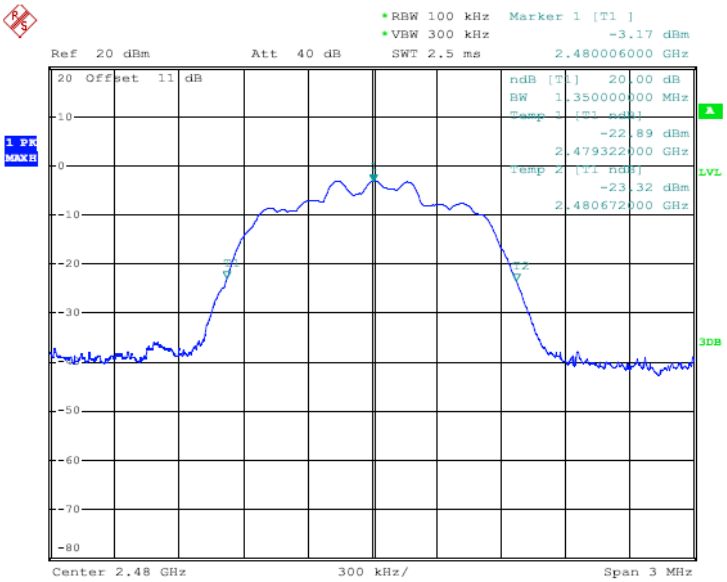

RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms
Marker 1 [T1 ]
-3.23 dBm
2.480006000 GHz
Ref 20 dBm
Att 40 dB
20 Offset 11 dB
ndB [T1] 20.00 dB
BW 1.362000000 MHz
Temp 1 [T1 ndB]
-22.93 dBm
2.479310000 GHz
Temp 2 [T1 ndB]
-23.49 dBm
2.480672000 GHz
1 PK MAXH
A
LVL
3DB
Center 2.48 GHz
300 kHz/
Span 3 MHz

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

| Channel number | Channel frequency (MHz) | 20dB Down BW(kHz) |
|---|---|---|
| 00 | 2402 | 1350 |
| 39 | 2441 | 1344 |
| 78 | 2480 | 1350 |




RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms
Marker 1 [T1 ]
-2.44 dBm
2.440832000 GHz
Ref 20 dBm
Att 40 dB
20 Offset 11 dB
ndB [T1] 20.00 dB
BW 1.344000000 MHz
-22.29 dBm
2.440322000 GHz
-22.18 dBm
2.441666000 GHz
1 PK
MAXH
LVL
3DB
Center 2.441 GHz
300 kHz/
Span 3 MHz


RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms
Marker 1 [T1 ]
-3.17 dBm
2.480006000 GHz
Ref 20 dBm
Att 40 dB
20 Offset 11 dB
ndB [T1] 20.00 dB
BW 1.350000000 MHz
-22.89 dBm
2.479322000 GHz
-23.32 dBm
2.480672000 GHz
1 PK
MAXH
LVL
3DB
Center 2.48 GHz
300 kHz/
Span 3 MHz

# 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 eploying at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt (30dBm). For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

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

## 10.1Test Procedure

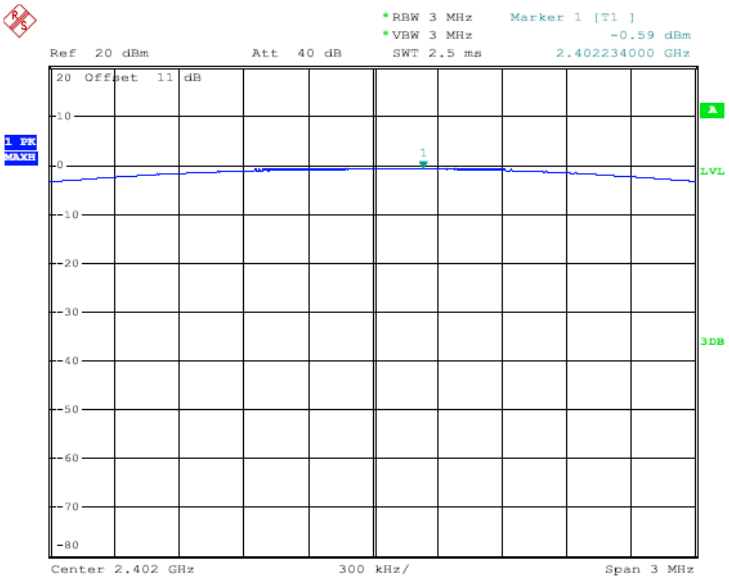
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

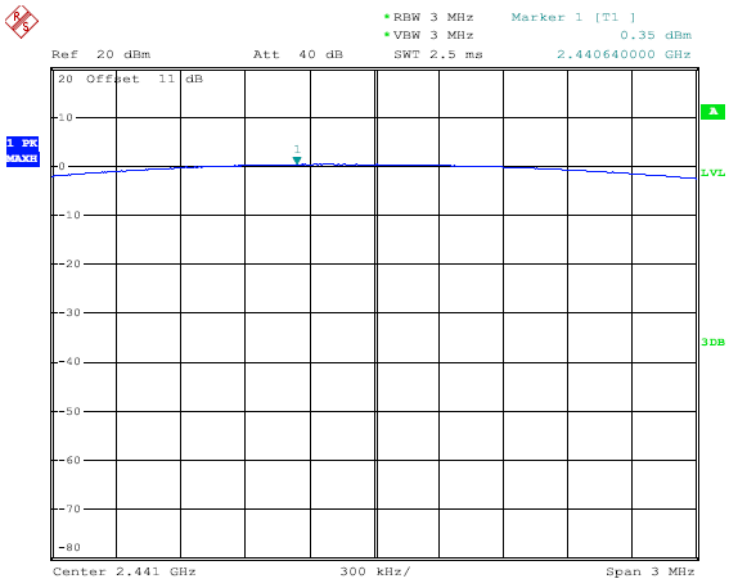
2. Set the spectrum analyser: RBW = 3.0 MHz. VBW =3.0 MHz. Sweep = auto; Detector Function = Peak.

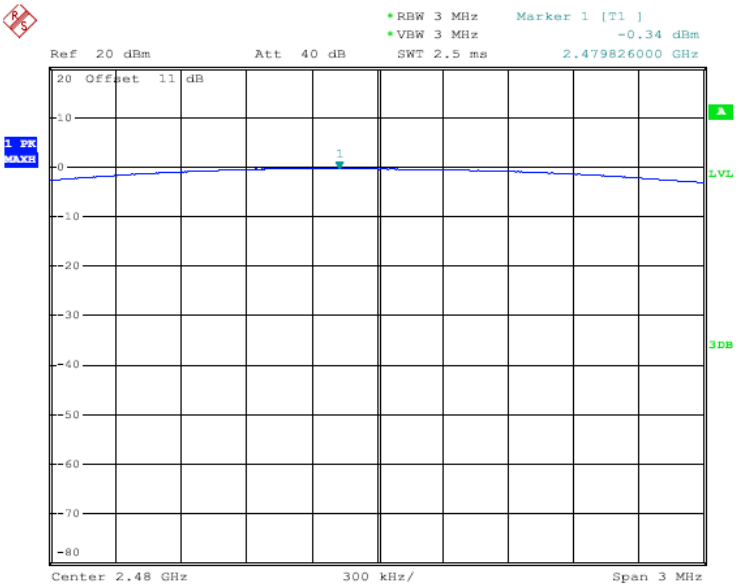
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

## 10.2Test Result

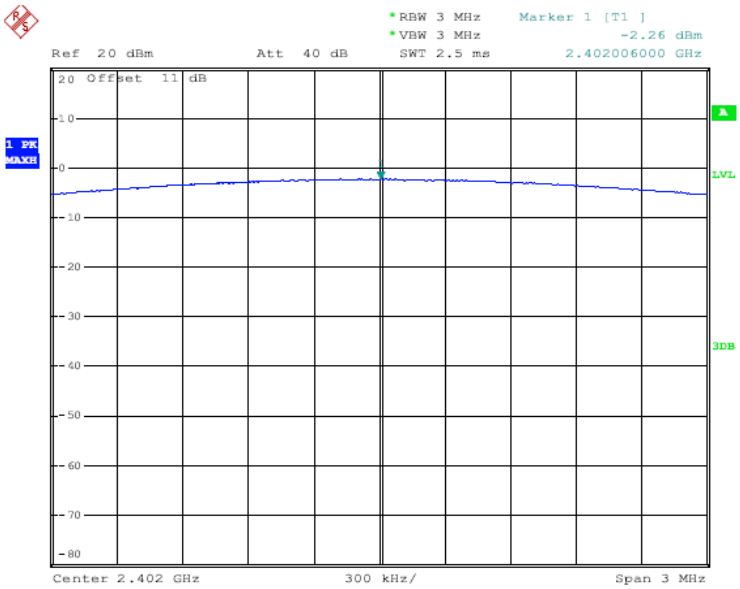
| GFSK(1Mbps) | | | | | |
|---|---|---|---|---|---|
| Test Channel | Frequency | Conducted Output Peak Power | Conducted Output Peak Power | LIMIT | Pass/Fail |
| | (MHz) | (dBm) | (W) | (W) | |
| CH00 | 2402 | -0.59 | 0.00087 | 1 | Pass |
| CH39 | 2441 | 0.35 | 0.00108 | 1 | Pass |
| CH78 | 2480 | -0.34 | 0.00092 | 1 | Pass |

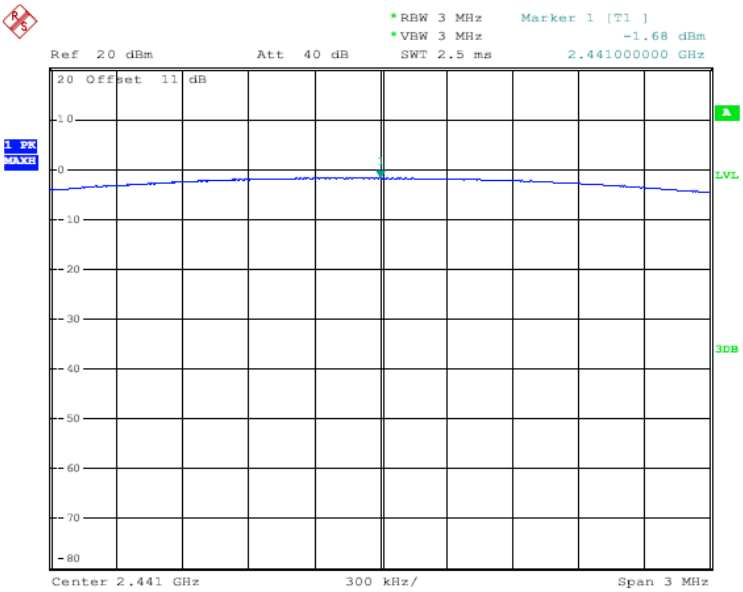

RBW 3 MHz
VBW 3 MHz
SWT 2.5 ms
Marker 1 [T1 ]
-0.59 dBm
2.402234000 GHz
Ref 20 dBm
Att 40 dB
20 Offset 11 dB
1 PK MAXH
A
LVL
3DB
Center 2.402 GHz
300 kHz/
Span 3 MHz

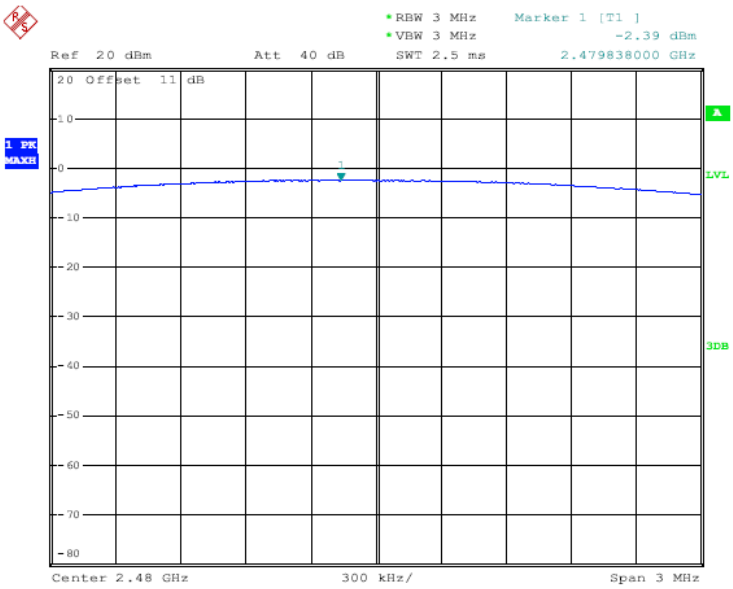

RBW 3 MHz
VBW 3 MHz
SWT 2.5 ms
Marker 1 [T1 ]
0.35 dBm
2.440640000 GHz
Ref 20 dBm
Att 40 dB
20 Offset 11 dB
1 PK MAXH
A
LVL
3DB
Center 2.441 GHz
300 kHz/
Span 3 MHz



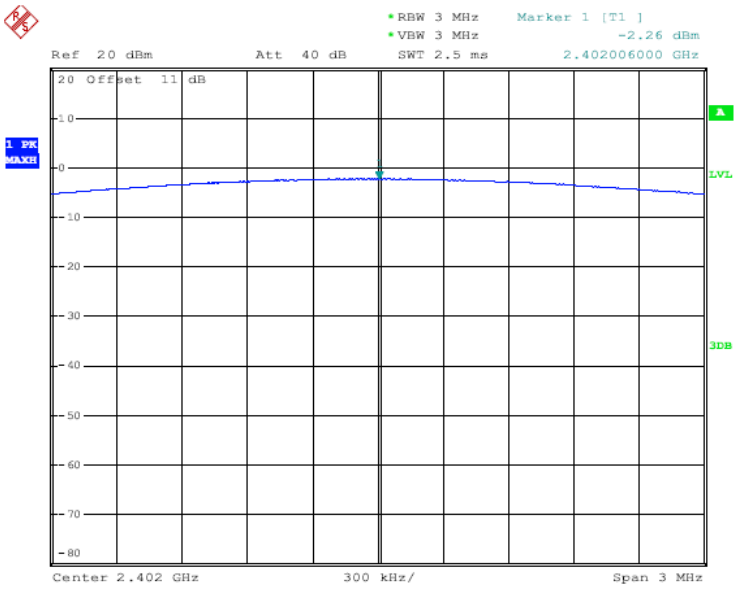

| π/4QPSK(2Mbps) | | | | | |
|---|---|---|---|---|---|
| Test Channel | Frequency | Conducted Output Peak Power | Conducted Output Peak Power | LIMIT | Pass/Fail |
| | (MHz) | (dBm) | (W) | (W) | |
| CH00 | 2402 | -2.26 | 0.00059 | 0.125 | Pass |
| CH39 | 2441 | -1.68 | 0.00068 | 0.125 | Pass |
| CH78 | 2480 | -2.39 | 0.00058 | 0.125 | Pass |

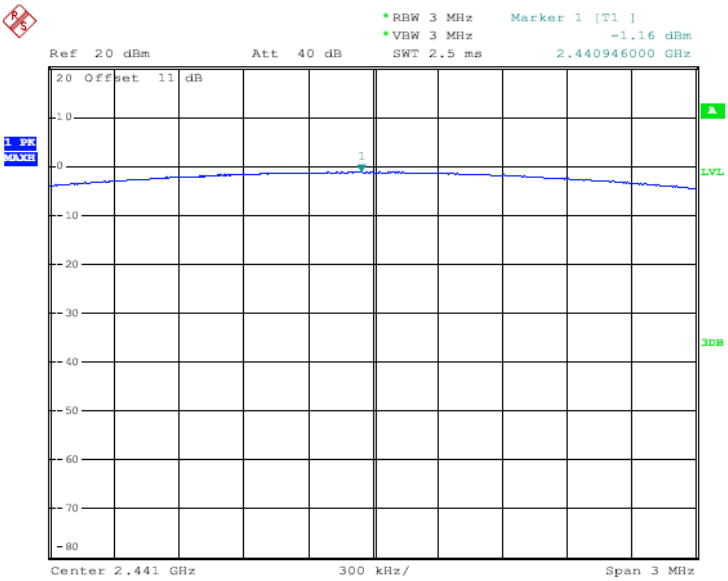

RBW 3 MHz
VBW 3 MHz
SWT 2.5 ms
Marker 1 [T1 ]
-2.26 dBm
2.402006000 GHz
Ref 20 dBm
Att 40 dB
20 Offset 11 dB
1 PK MAXH
A
LVL
3DB
Center 2.402 GHz
300 kHz/
Span 3 MHz

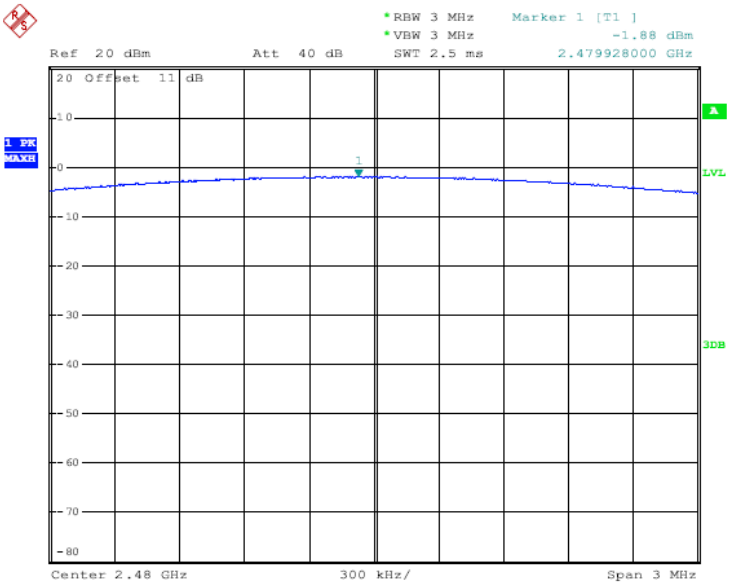

RBW 3 MHz
VBW 3 MHz
SWT 2.5 ms
Marker 1 [T1 ]
-1.68 dBm
2.441000000 GHz
Ref 20 dBm
Att 40 dB
20 Offset 11 dB
1 PK MAXH
A
LVL
3DB
Center 2.441 GHz
300 kHz/
Span 3 MHz




| 8DPSK(3Mbps) | | | | | |
|---|---|---|---|---|---|
| Test Channel | Frequency | Conducted Output Peak Power | Conducted Output Peak Power | LIMIT | Pass/Fail |
| | (MHz) | (dBm) | (W) | (W) | |
| CH00 | 2402 | -2.26 | 0.00059 | 0.125 | Pass |
| CH39 | 2441 | -1.16 | 0.00077 | 0.125 | Pass |
| CH78 | 2480 | -1.88 | 0.00065 | 0.125 | Pass |


RBW 3 MHz
VBW 3 MHz
Marker 1 [T1 ]
-2.26 dBm
2.402006000 GHz
Ref 20 dBm
Att 40 dB
SWT 2.5 ms
20 Offset 11 dB
1 PK MAXH
A
LVL
3DB
Center 2.402 GHz
300 kHz/
Span 3 MHz


RBW 3 MHz
VBW 3 MHz
Marker 1 [T1 ]
-1.16 dBm
2.440946000 GHz
Ref 20 dBm
Att 40 dB
SWT 2.5 ms
20 Offset 11 dB
1 PK MAXH
A
LVL
3DB
Center 2.441 GHz
300 kHz/
Span 3 MHz


RBW 3 MHz
VBW 3 MHz
SWT 2.5 ms
Marker 1 [T1 ]
-1.88 dBm
2.479928000 GHz
Ref 20 dBm
Att 40 dB
20 Offset 11 dB
1 PK
MAXH
A
LVL
3DB
Center 2.48 GHz
300 kHz/
Span 3 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.

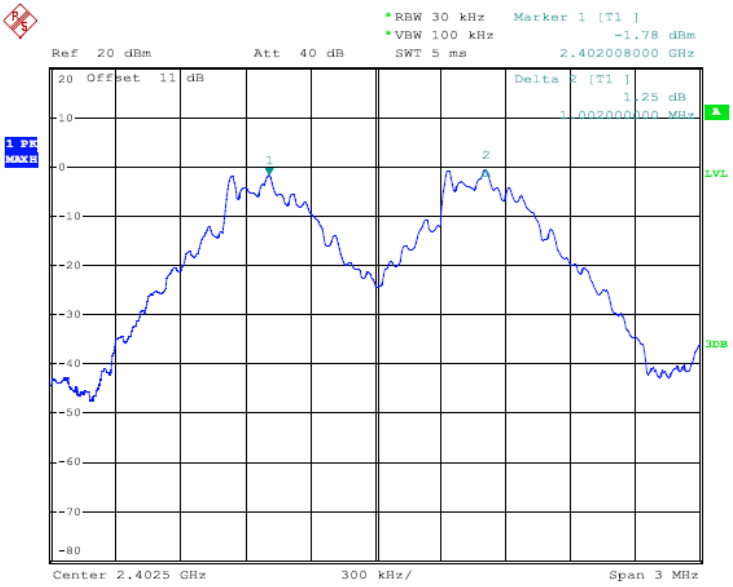
2. Set the spectrum analyzer: RBW = 30KHz. VBW =100KHz, Span = 3.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

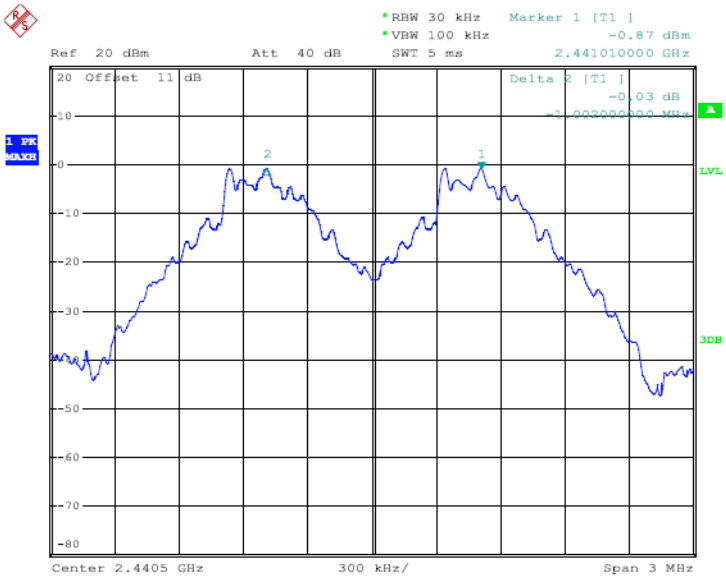
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

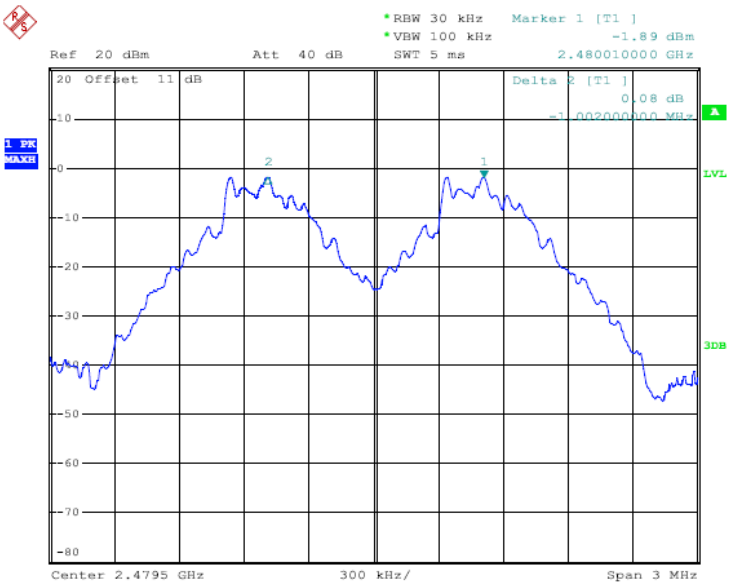
## 11.2 Test Result

| 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 | 1002 | >732 |
| 39 | 2441 | 1002 | >736 |
| 78 | 2480 | 1002 | >736 |

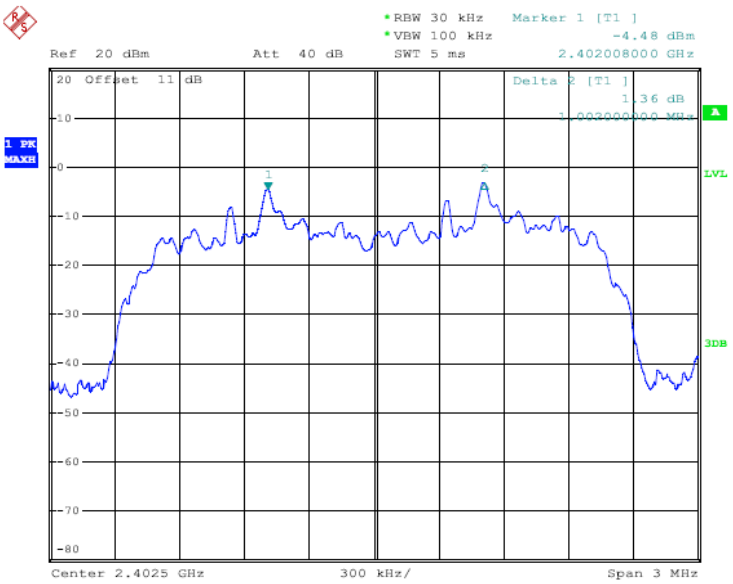


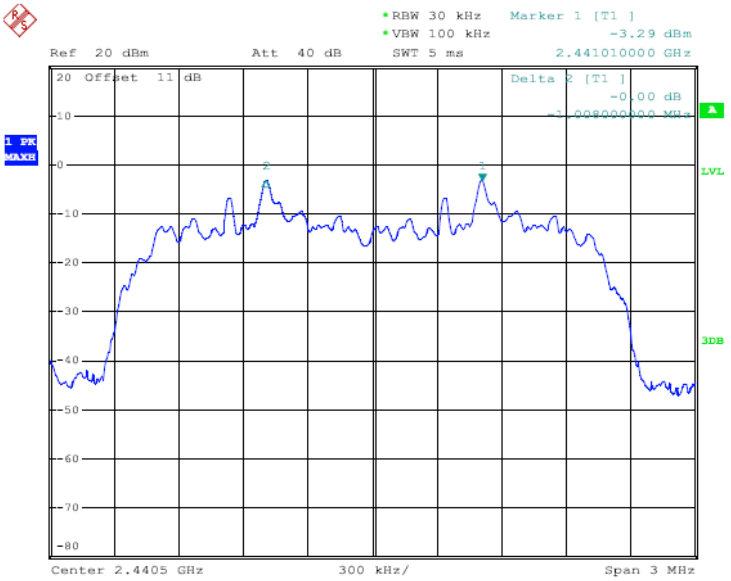

RBW 30 kHz
VBW 100 kHz
SWT 5 ms
Marker 1 [T1 ]
-0.87 dBm
2.441010000 GHz
Ref 20 dBm
Att 40 dB
20 Offset 11 dB
Delta 2 [T1 ]
-0.03 dB
-1.003000000 MHz
1 PK MAXH
LVL
3DB
Center 2.4405 GHz
300 kHz/
Span 3 MHz

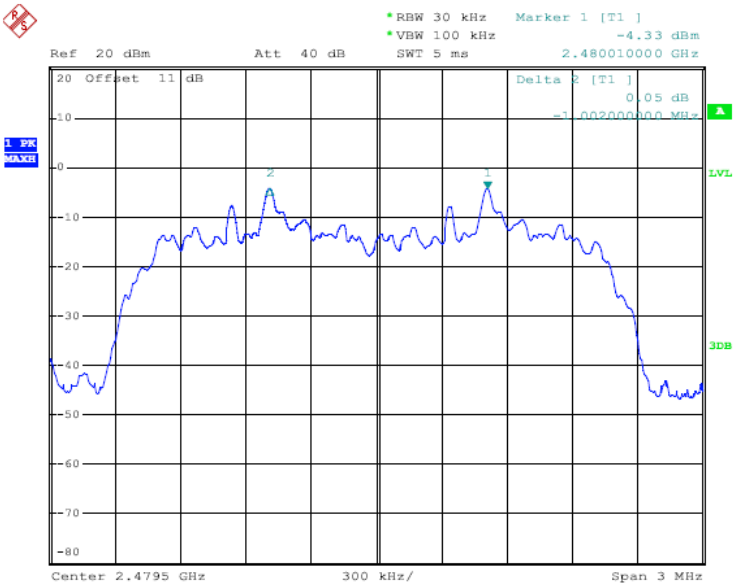

RBW 30 kHz
VBW 100 kHz
SWT 5 ms
Marker 1 [T1 ]
-1.89 dBm
2.480010000 GHz
Ref 20 dBm
Att 40 dB
20 Offset 11 dB
Delta 2 [T1 ]
0.08 dB
-1.002000000 MHz
1 PK MAXH
LVL
3DB
Center 2.4795 GHz
300 kHz/
Span 3 MHz

| 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 | 1002 | >912 |
| 39 | 2441 | 1008 | >904 |
| 78 | 2480 | 1002 | >908 |

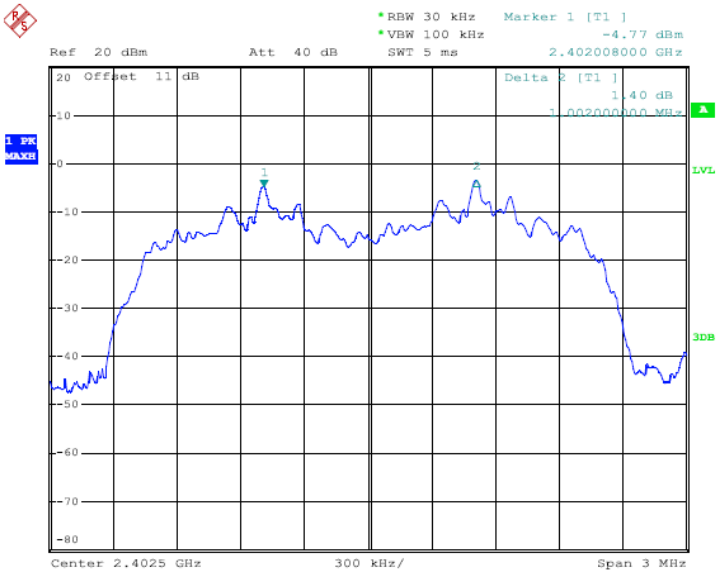


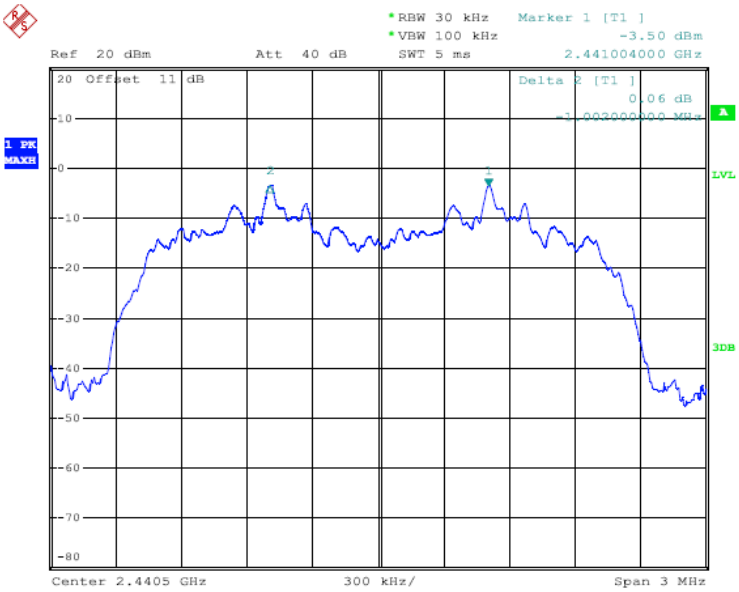

RBW 30 kHz
VBW 100 kHz
SWT 5 ms
Marker 1 [T1 ]
-3.29 dBm
2.441010000 GHz
Ref 20 dBm
Att 40 dB
20 Offset 11 dB
Delta 2 [T1 ]
-0.00 dB
1 PK MAXH
LVL
3DB
Center 2.4405 GHz
300 kHz/
Span 3 MHz

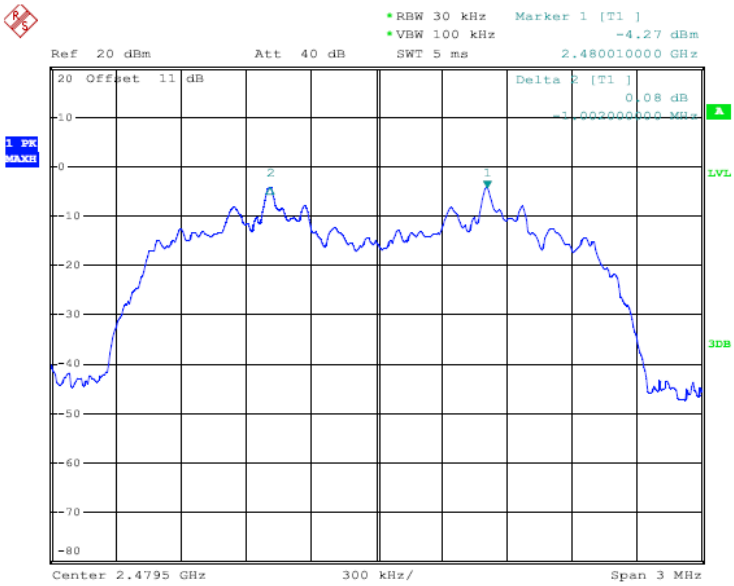

RBW 30 kHz
VBW 100 kHz
SWT 5 ms
Marker 1 [T1 ]
-4.33 dBm
2.480010000 GHz
Ref 20 dBm
Att 40 dB
20 Offset 11 dB
Delta 2 [T1 ]
0.05 dB
1 PK MAXH
LVL
3DB
Center 2.4795 GHz
300 kHz/
Span 3 MHz

| 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 | 1002 | >900 |
| 39 | 2441 | 1002 | >896 |
| 78 | 2480 | 1002 | >900 |




RBW 30 kHz
VBW 100 kHz
SWT 5 ms
Marker 1 [T1 ]
-3.50 dBm
2.441004000 GHz
Ref 20 dBm
Att 40 dB
20 Offset 11 dB
Delta 2 [T1 ]
0.06 dB
-1.003000000 MHz
1 PK MAXH
A
LVL
3DB
Center 2.4405 GHz
300 kHz/
Span 3 MHz


RBW 30 kHz
VBW 100 kHz
SWT 5 ms
Marker 1 [T1 ]
-4.27 dBm
2.480010000 GHz
Ref 20 dBm
Att 40 dB
20 Offset 11 dB
Delta 2 [T1 ]
0.08 dB
-1.003000000 MHz
1 PK MAXH
A
LVL
3DB
Center 2.4795 GHz
300 kHz/
Span 3 MHz

# 12 Number of Hopping Frequency

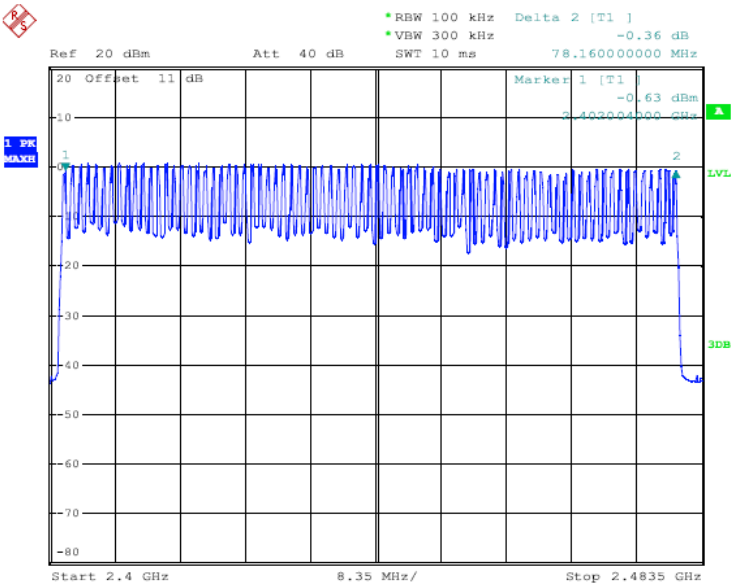
| | | |
|---|---|---|
| Test Requirement | : | FCC CFR47 Part 15 Section 15.247 |
| Test Method | : | ANSI C63.10:2013 |
| Test Limit | : | Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. |
| Test Mode | : | Hopping(GFSK) |

## 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;

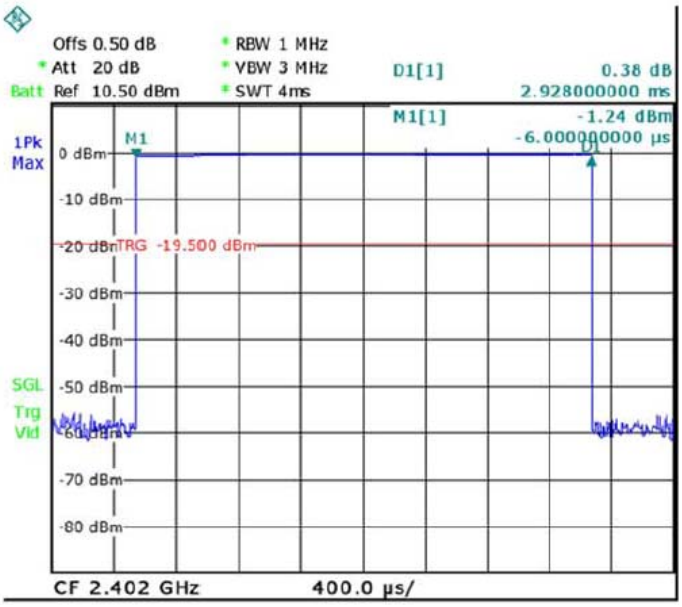
3. Set RBW = 1MHz and VBW = 3MHz.Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 and DH1 packet transmitting.

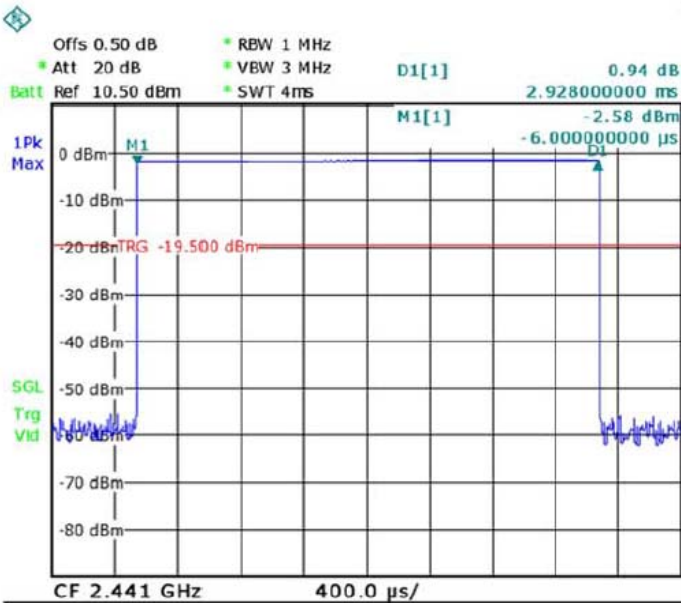
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

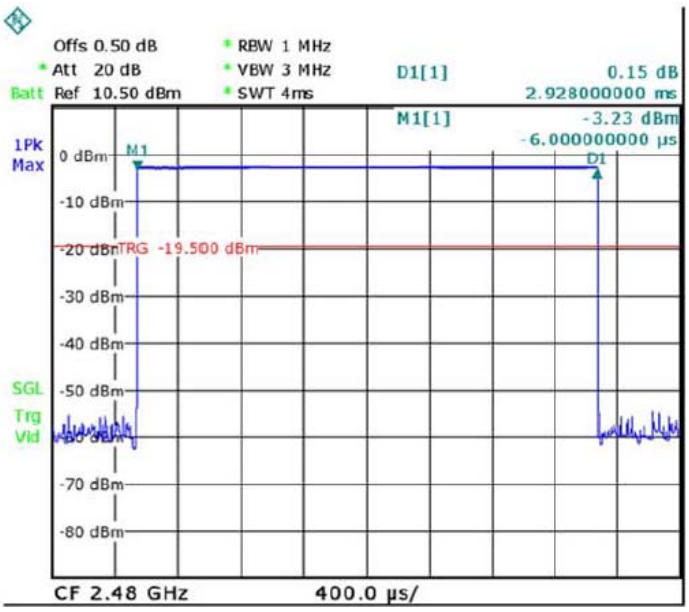
## 13.2 Test Result

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

| Mode | CH | Length of transmissions time(msec) | Result (msec) | Limit (msec) |
|---|---|---|---|---|
| GFSK | Low | 2.928 | 312 | 400 |
| | Middle | 2.928 | 312 | 400 |
| | High | 2.928 | 312 | 400 |
| | Note: Dwell Time= Pulse Time (ms)*1600/6/79*31.6 | | | |


Offs 0.50 dB
* Att 20 dB
Batt Ref 10.50 dBm
* RBW 1 MHz
* VBW 3 MHz
* SWT 4ms
D1[1]
0.38 dB
2.928000000 ms
M1[1]
-1.24 dBm
-6.000000000 µs
1Pk
Max
M1
D1
0 dBm
-10 dBm
-20 dBm
TRG -19.500 dBm
-30 dBm
-40 dBm
SGL
-50 dBm
Trg
Vld
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
400.0 µs/


Offs 0.50 dB
* Att 20 dB
Batt Ref 10.50 dBm
* RBW 1 MHz
* VBW 3 MHz
* SWT 4ms
D1[1]
0.94 dB
2.928000000 ms
M1[1]
-2.58 dBm
-6.000000000 µs
1Pk
Max
M1
D1
0 dBm
-10 dBm
-20 dBm
TRG -19.500 dBm
-30 dBm
-40 dBm
SGL
-50 dBm
Trg
Vld
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
400.0 µs/


Offs 0.50 dB
Att 20 dB
Batt Ref 10.50 dBm
RBW 1 MHz
VBW 3 MHz
SWT 4ms
D1[1]
0.15 dB
2.928000000 ms
M1[1]
-3.23 dBm
-6.000000000 µs
1Pk
Max
0 dBm
M1
D1
-10 dBm
-20 dBm
TRG -19.500 dBm
-30 dBm
-40 dBm
SGL
-50 dBm
Trg
Vld
-70 dBm
-80 dBm
CF 2.48 GHz
400.0 µs/

# 14 Antenna Requirement

## 14.1 Antenna Requirement

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

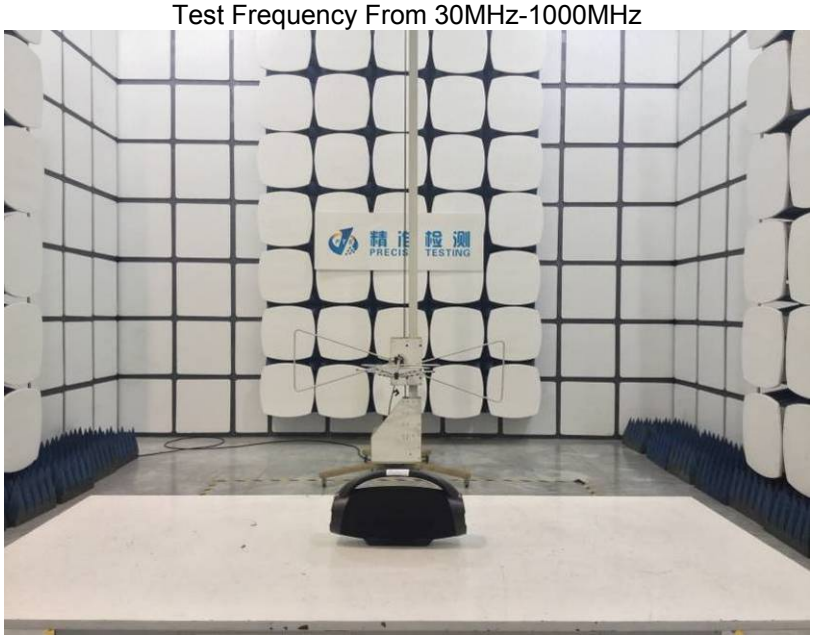
## 14.2 Result

The EUT'S antenna, permanent attached antenna, is Internal PCB Antenna. The antenna's gain is 1.2dBi and meets the requirement.

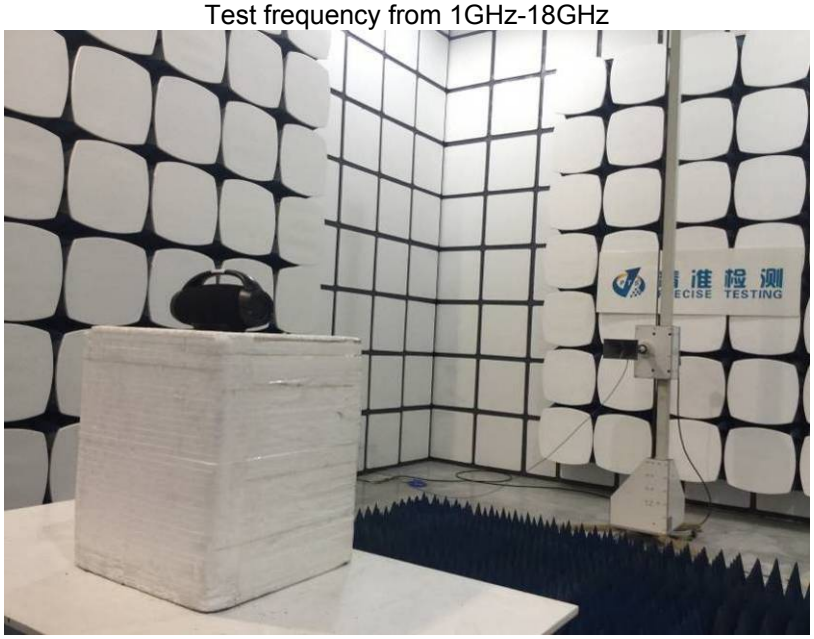
# 15 TEST PHOTOS

Conducted Emissions

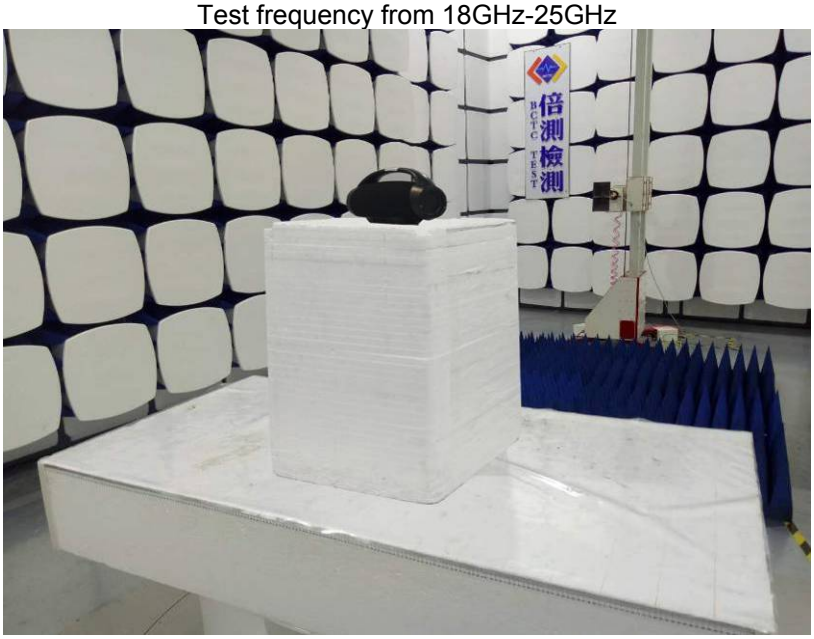
Radiated Spurious Emissions
Test Frequency From 30MHz-1000MHz



Test frequency from 1GHz-18GHz



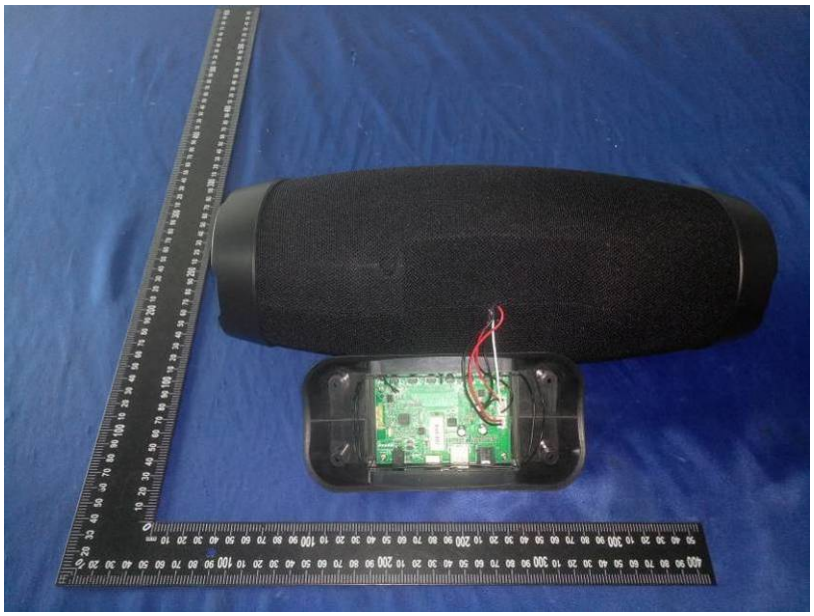

Test frequency from 18GHz-25GHz

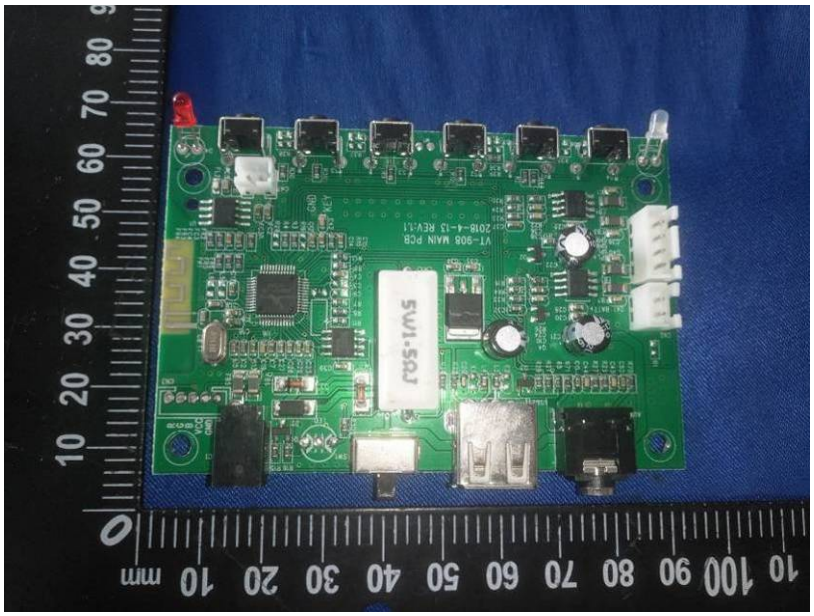


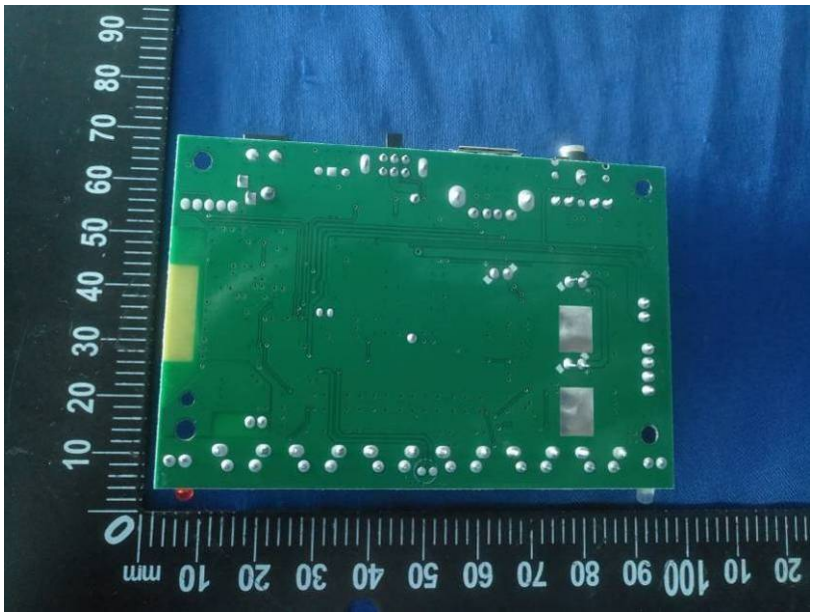
# 16 EUT PHOTOS

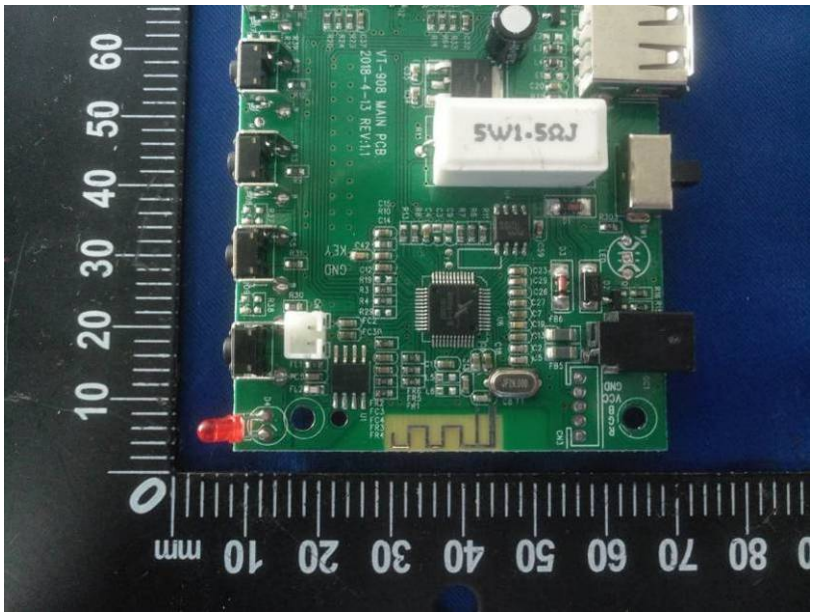
DC 9V
POWER
USB
AUX IN

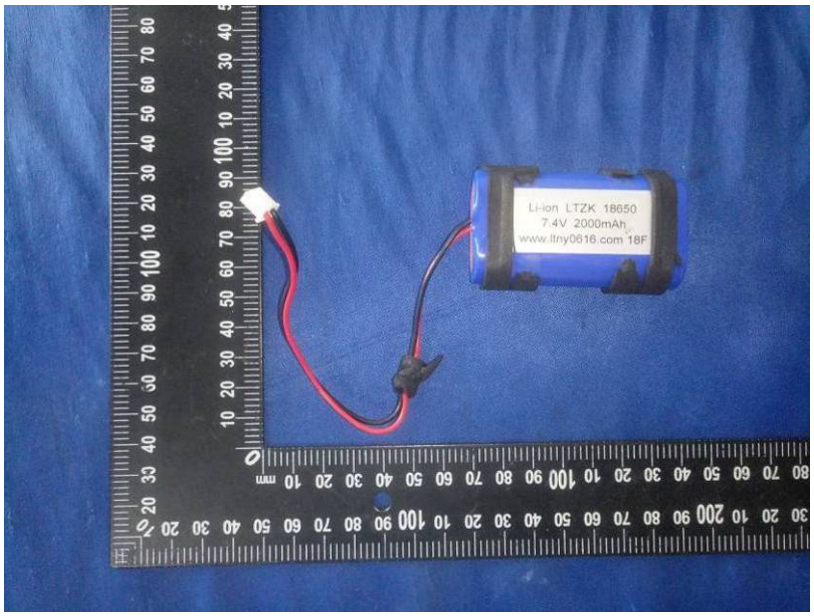
DC 9V
POWER
USB
AUX IN

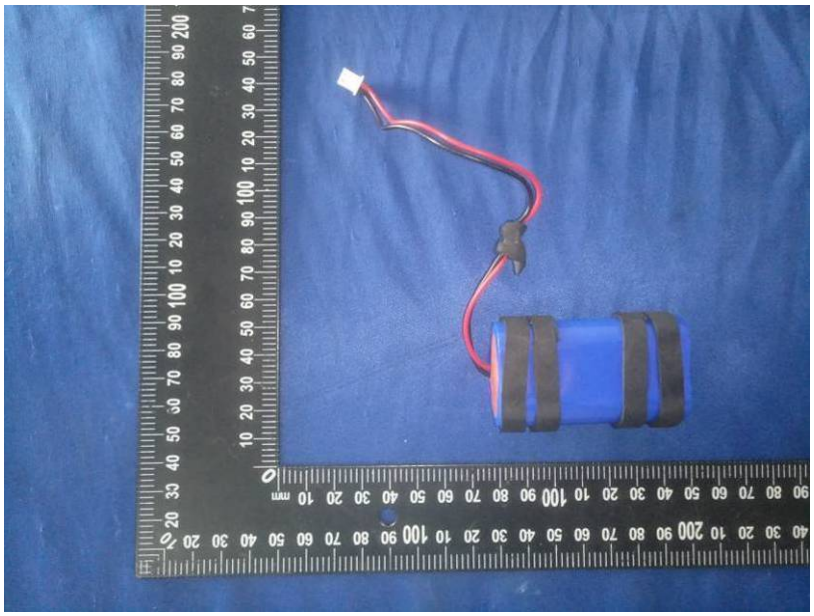



VT-908 MAIN PCB
2018-4-13 REV:1.1
TOS-SJ1
SW1-SJ1




5W1.5ΩJ


Li-ion LTZK 18650
7.4V 2000mAh
www.ltny0616.com 18F



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