# FCC RADIO TEST REPORT

## FCC ID: 2AJRDIT-36

**Product**： Wireless Sports Earbuds

**Trade Name**： ISOtunes

**Model Name**: IT-38(ISOtunes PRO 2.0 + Aware, 85dB)

**Series Model**： IT-36(ISOtunes Sport ADVANCE, 85dB),
IT-39(ISOtunes PRO 2.0 + Aware EN352, 79dB)

**Report No.**： UNIA20102707ER-01

### Prepared for

Haven Technologies, Inc
1025 Pine Hill Way, Carmel, Indiana 46021 USA

### Prepared by

Shenzhen United Testing Technology Co., Ltd.

2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China

# TEST RESULT CERTIFICATION

| | | |
|---|---|---|
| **Applicant's name** | : | Haven Technologies, Inc |
| Address | : | 1025 Pine Hill Way, Carmel, Indiana 46021 USA |
| **Manufacture's Name** | : | ASKA Electronics Co., Ltd |
| Address | : | No.5 Puxin Road, Keyuancheng Industrial Tangxia Town, Dongguan, Guangdong, China |

**Product description**

| | | |
|---|---|---|
| Product name | : | Wireless Sports Earbuds |
| Trade Mark | : | ISOtunes |
| Model and/or type reference | : | IT-36(ISOtunes Sport ADVANCE, 85dB),<br>IT-38(ISOtunes PRO 2.0 + Aware, 85dB),<br>IT-39(ISOtunes PRO 2.0 + Aware EN352, 79dB) |
| **Standards** | : | FCC Rules and Regulations Part 15 Subpart C Section 15.247, ANSI C63.10: 2013 |

This device described above has been tested by Shenzhen United Testing Technology Co., Ltd., 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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| | | |
|---|---|---|
| **Date of Test** | : | |
| Date (s) of performance of tests | : | Oct. 19 ~ 27, 2020 |
| Date of Issue | : | Oct. 28, 2020 |
| Test Result | : | Pass |

Tested by: Kahn yang/Engineer

Reviewer: Sherwin Qian/Supervisor

Approved & Authorized Signer: Liuze/Manager

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# 1. TEST SUMMARY

## 1.1 TEST PROCEDURES AND RESULTS

| DESCRIPTION OF TEST | RESULT |
|---|---|
| CONDUCTED EMISSIONS TEST | COMPLIANT |
| RADIATED EMISSION TEST | COMPLIANT |
| BAND EDGE | COMPLIANT |
| OCCUPIED BANDWIDTH MEASUREMENT | COMPLIANT |
| MAXIMUM PEAK OUTPUT POWER | COMPLIANT |
| FREQUENCY SEPARATION | COMPLIANT |
| CONDUCTED BANDEGE MEASUREMENT | COMPLIANT |
| SPURIOUS RF CONDUCTED EMISSION | COMPLIANT |
| NUMBER OF HOPPING FREQUENCY | COMPLIANT |
| TIME OF OCCUPANCY(DWELL TIME) | COMPLIANT |
| ANTENNA REQUIREMENT | COMPLIANT |

## 1.2 TEST FACILITY

Test Firm : Shenzhen United Testing Technology Co., Ltd.

Address : 2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.The testing quality system of our laboratory meets with ISO/IEC-17025 requirements, which is approved by CNAS. This approval result is accepted by MRA of APLAC.

Our test facility is recognized, certified, or accredited by the following organizations:

CNAS-LAB Code: L6494

The EMC Laboratory has been assessed and in compliance with CNAS-CL01 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of testing Laboratories.

Designation Number: CN1227

Test Firm Registration Number: 674885

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files.

A2LA Certificate Number: 4747.01

## 1.3 MEASUREMENT UNCERTAINTY

Measurement Uncertainty

| | | |
|---|---|---|
| Conducted Emission Expanded Uncertainty | = | 2.23dB, k=2 |
| Radiated emission expanded uncertainty(9kHz-30MHz) | = | 3.08dB, k=2 |
| Radiated emission expanded uncertainty(30MHz-1000MHz) | = | 4.42dB, k=2 |
| Radiated emission expanded uncertainty(Above 1GHz) | = | 4.06dB, k=2 |

# 2. GENERAL INFORMATION

## 2.1 GENERAL DESCRIPTION OF EUT

| | |
|---|---|
| Equipment | Wireless Sports Earbuds |
| Trade Mark | ISOtunes |
| Test Model Name | IT-38(ISOtunes PRO 2.0 + Aware, 85dB) |
| Sample ID | UNIA20102707ER-1# |
| Serial No. | IT-36(ISOtunes Sport ADVANCE, 85dB),<br>IT-39(ISOtunes PRO 2.0 + Aware EN352, 79dB) |
| Model Difference | All models have same circuits diagram, PCB Layout, construction and rated power; Only different is the model name and Appearance color. |
| FCC ID | 2AJRDIT-36 |
| IC | N/A |
| Antenna Type | Internal Antenna |
| Antenna Gain | 2dBi |
| Frequency Range | 2402-2480MHz |
| Number of Channels | 79CH |
| Modulation Type | GFSK, π/4 DQPSK, 8DPSK |
| Power Source | DC 5V from Adapter |
| Battery Information | -550638 3.7V, 150mAh |

Table for auxiliary equipment:

| Equipment Description | Manufacturer | Model | Serial Number |
|---|---|---|---|
| Notebook | Lenovo | Lenovo G475 | GB14477457 |
| Adapter | Lenovo | SC-41 | N/A |

2.2 Carrier Frequency of Channels

| Channel List | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 00 | 2402 | 21 | 2423 | 42 | 2444 | 63 | 2465 |
| 01 | 2403 | 22 | 2424 | 43 | 2445 | 64 | 2466 |
| 02 | 2404 | 23 | 2425 | 44 | 2446 | 65 | 2467 |
| 03 | 2405 | 24 | 2426 | 45 | 2447 | 66 | 2468 |
| 04 | 2406 | 25 | 2427 | 46 | 2448 | 67 | 2469 |
| 05 | 2407 | 26 | 2428 | 47 | 2449 | 68 | 2470 |
| 06 | 2408 | 27 | 2429 | 48 | 2450 | 69 | 2471 |
| 07 | 2409 | 28 | 2430 | 49 | 2451 | 70 | 2472 |
| 08 | 2410 | 29 | 2431 | 50 | 2452 | 71 | 2473 |
| 09 | 2411 | 30 | 2432 | 51 | 2453 | 72 | 2474 |
| 10 | 2412 | 31 | 2433 | 52 | 2454 | 73 | 2475 |
| 11 | 2413 | 32 | 2434 | 53 | 2455 | 74 | 2476 |
| 12 | 2414 | 33 | 2435 | 54 | 2456 | 75 | 2477 |
| 13 | 2415 | 34 | 2436 | 55 | 2457 | 76 | 2478 |
| 14 | 2416 | 35 | 2437 | 56 | 2458 | 77 | 2479 |
| 15 | 2417 | 36 | 2438 | 57 | 2459 | 78 | 2480 |
| 16 | 2418 | 37 | 2439 | 58 | 2460 | | |
| 17 | 2419 | 38 | 2440 | 59 | 2461 | | |
| 18 | 2420 | 39 | 2441 | 60 | 2462 | | |
| 19 | 2421 | 40 | 2442 | 61 | 2463 | | |
| 20 | 2422 | 41 | 2443 | 62 | 2464 | | |

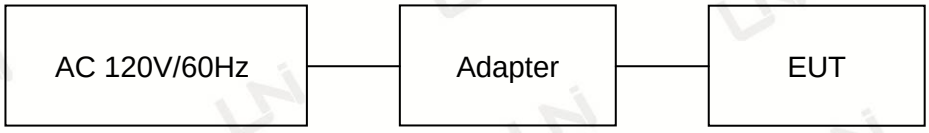
2.3 Operation of EUT during testing

Operating Mode
The mode is used: Transmitting mode
Low Channel: 2402MHz
Middle Channel: 2441MHz
High Channel: 2480MHz
Test SW Version: BlueTest3

2.4 DESCRIPTION OF TEST SETUP

Operation of EUT during Conducted testing:


Operation of EUT during Radiation testing:



## 2.5 MEASUREMENT INSTRUMENTS LIST

| Item | Equipment | Manufacturer | Model No. | Serial No. | Calibrated until |
|---|---|---|---|---|---|
| CONDUCTED EMISSIONS TEST | | | | | |
| 1 | AMN | Schwarzbeck | NNLK8121 | 8121370 | 2021.09.05 |
| 2 | AMN | ETS | 3810/2 | 00020199 | 2021.09.05 |
| 3 | EMI TEST RECEIVER | Rohde&Schwarz | ESCI | 101210 | 2021.09.05 |
| 4 | AAN | TESEQ | T8-Cat6 | 38888 | 2021.09.05 |
| RADIATED EMISSION TEST | | | | | |
| 1 | Horn Antenna | Sunol | DRH-118 | A101415 | 2021.09.05 |
| 2 | BicoNILog Antenna | Sunol | JB1 Antenna | A090215 | 2021.09.05 |
| 3 | PREAMP | HP | 8449B | 3008A00160 | 2021.09.05 |
| 4 | PREAMP | HP | 8447D | 2944A07999 | 2021.09.05 |
| 5 | EMI TEST RECEIVER | Rohde&Schwarz | ESR3 | 101891 | 2021.09.05 |
| 6 | VECTOR Signal Generator | Rohde&Schwarz | SMU200A | 101521 | 2021.09.05 |
| 7 | Signal Generator | Agilent | E4421B | MY4335105 | 2021.09.05 |
| 8 | MXA Signal Analyzer | Agilent | N9020A | MY50510140 | 2021.09.05 |
| 9 | MXA Signal Analyzer | Agilent | N9020A | MY51110104 | 2021.09.05 |
| 10 | ANT Tower&Turn table Controller | Champro | EM 1000 | 60764 | 2021.09.05 |
| 11 | Anechoic Chamber | Taihe Maorui | 9m*6m*6m | 966A0001 | 2021.09.05 |
| 12 | Shielding Room | Taihe Maorui | 6.4m*4m*3m | 643A0001 | 2021.09.05 |
| 13 | RF Power sensor | DARE | RPR3006W | 15I00041SNO88 | 2021.09.05 |
| 14 | RF Power sensor | DARE | RPR3006W | 15I00041SNO89 | 2021.09.05 |
| 15 | RF power divider | Anritsu | K241B | 992289 | 2021.09.05 |
| 16 | Wideband radio communication tester | Rohde&Schwarz | CMW500 | 154987 | 2021.09.05 |
| 17 | Biconical antenna | Schwarzbeck | VHA 9103 | 91032360 | 2021.09.05 |
| 18 | Biconical antenna | Schwarzbeck | VHA 9103 | 91032361 | 2021.09.05 |
| 19 | Broadband Hybrid Antennas | Schwarzbeck | VULB9163 | VULB9163#958 | 2021.09.05 |
| 20 | Horn Antenna | Schwarzbeck | BBHA9120D | 9120D-1680 | 2021.09.05 |
| 21 | Active Receive Loop Antenna | Schwarzbeck | FMZB 1919B | 00023 | 2021.09.05 |
| 22 | Horn Antenna | Schwarzbeck | BBHA 9170 | BBHA9170651 | 2021.09.05 |
| 23 | Microwave Broadband Preamplifier | Schwarzbeck | BBV 9721 | 100472 | 2021.09.05 |
| 24 | Active Loop Antenna | Com-Power | AL-130R | 10160009 | 2021.09.05 |
| 25 | Power Meter | KEYSIGHT | N1911A | MY50520168 | 2021.09.05 |
| 26 | Frequency Meter | VICTOR | VC2000 | 997406086 | 2021.09.05 |
| 27 | DC Power Source | HYELEC | HY5020E | 055161818 | 2021.09.05 |
| Test software | | | | | |
| 1 | E3 | Audix | 6.101223a | N/A | N/A |

# 3. CONDUCTED EMISSIONS TEST

## 3.1 Conducted Power Line Emission Limit

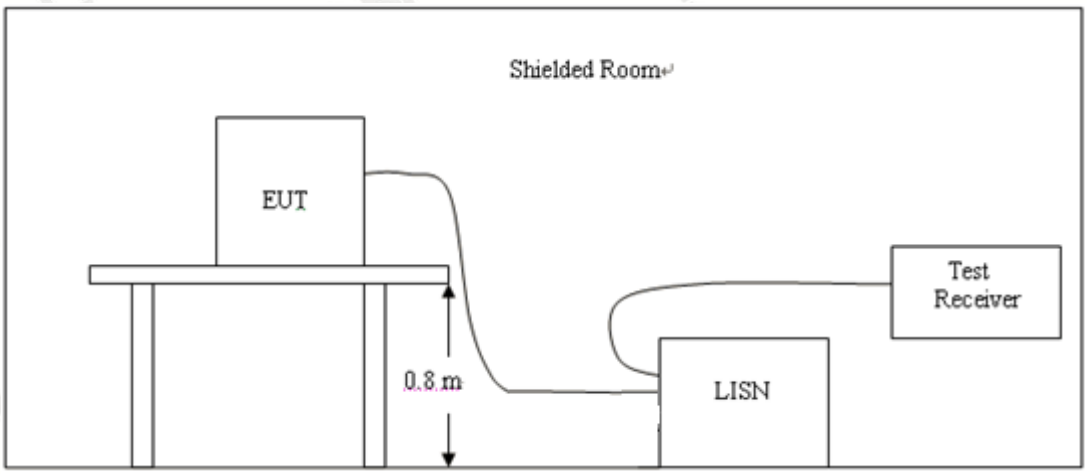
For unintentional device, according to § 15.107(a) & RSS-Gen [8.8] Line Conducted Emission Limits is as following

| Frequency (MHz) | Maximum RF Line Voltage(dBμV) | | | |
|---|---|---|---|---|
| | CLASS A | | CLASS B | |
| | Q.P. | Ave. | Q.P. | Ave. |
| 0.15~0.50 | 79 | 66 | 66~56* | 56~46* |
| 0.50~5.00 | 73 | 60 | 56 | 46 |
| 5.00~30.0 | 73 | 60 | 60 | 50 |

* Decreasing linearly with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

## 3.2 Test Setup




## 3.3 Test Procedure

1, The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10.
2, Support equipment, if needed, was placed as per ANSI C63.10.
3, All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4, If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5, All support equipments received AC power from a second LISN, if any.
6, The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7, Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.

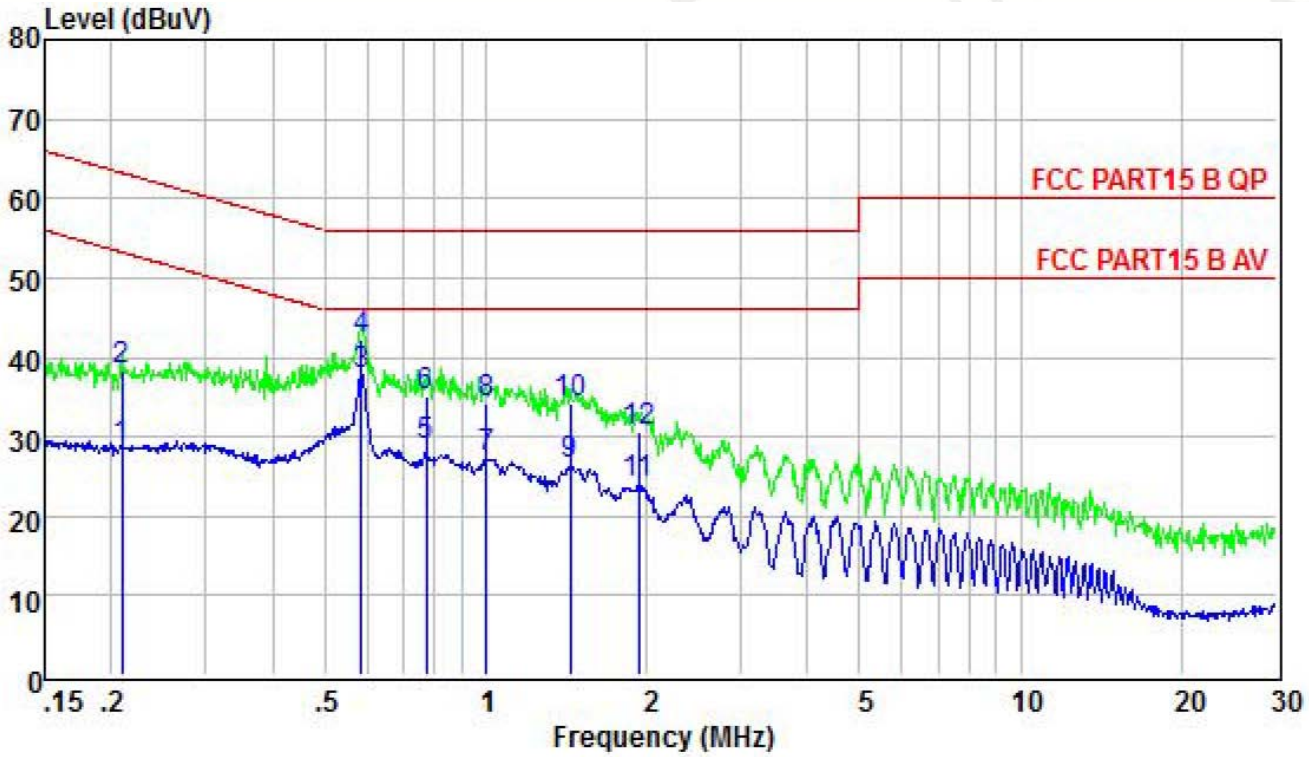
## 3.4 Test Result

Pass

Remark:

1. All modes were tested at AC 120V and 240V, only the worst result of AC 120V was reported.
2. All modes of Low, Middle, and High channel were tested, only the worst result of High Channel was reported as below:

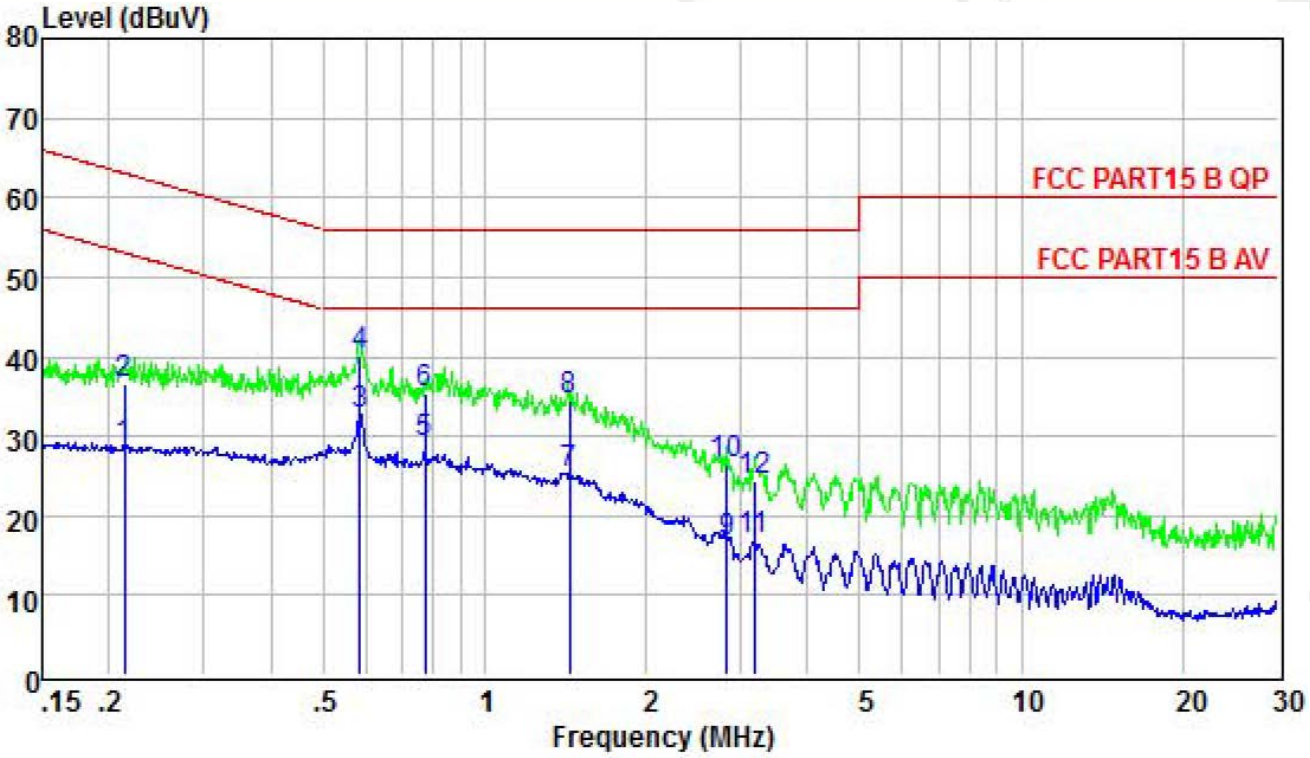
| Temperature: | 26℃ | Relative Humidity: | 48% |
|---|---|---|---|
| Test Date: | Oct. 20, 2020 | Pressure: | 1010hPa |
| Test Voltage: | AC 120V, 60Hz | Phase: | Line |
| Test Mode: | Transmitting mode of GFSK 2480MHz | | |




| | Freq | Level | LISN Factor | Cable Loss | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dB | dBuV | dB | |
| 1 | 0.21 | 28.45 | 9.46 | 0.01 | 53.23 | -24.78 | Average |
| 2 | 0.21 | 38.47 | 9.46 | 0.01 | 63.23 | -24.76 | QP |
| 3 | 0.59 | 37.84 | 9.49 | 0.01 | 46.00 | -8.16 | Average |
| 4 | 0.59 | 42.12 | 9.49 | 0.01 | 56.00 | -13.88 | QP |
| 5 | 0.78 | 28.95 | 9.50 | 0.01 | 46.00 | -17.05 | Average |
| 6 | 0.78 | 34.98 | 9.50 | 0.01 | 56.00 | -21.02 | QP |
| 7 | 1.00 | 27.42 | 9.51 | 0.01 | 46.00 | -18.58 | Average |
| 8 | 1.00 | 34.18 | 9.51 | 0.01 | 56.00 | -21.82 | QP |
| 9 | 1.44 | 26.48 | 9.52 | 0.01 | 46.00 | -19.52 | Average |
| 10 | 1.44 | 34.18 | 9.52 | 0.01 | 56.00 | -21.82 | QP |
| 11 | 1.93 | 24.03 | 9.53 | 0.01 | 46.00 | -21.97 | Average |
| 12 | 1.93 | 30.60 | 9.53 | 0.01 | 56.00 | -25.40 | QP |

Remark: Factor = Insertion Loss + Cable Loss, Result = Reading + Factor, Margin = Result – Limit.

| Temperature: | 26℃ | Relative Humidity: | 48% |
|---|---|---|---|
| Test Date: | Oct. 20, 2020 | Pressure: | 1010hPa |
| Test Voltage: | AC 120V, 60Hz | Phase: | Neutral |
| Test Mode: | Transmitting mode of GFSK 2480MHz | | |




| | Freq | Level | LISN Factor | Cable Loss | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dB | dBuV | dB | |
| 1 | 0.21 | 28.42 | 9.38 | 0.01 | 53.05 | -24.63 | Average |
| 2 | 0.21 | 36.60 | 9.38 | 0.01 | 63.05 | -26.45 | QP |
| 3 | 0.59 | 32.82 | 9.42 | 0.01 | 46.00 | -13.18 | Average |
| 4 | 0.59 | 40.12 | 9.42 | 0.01 | 56.00 | -15.88 | QP |
| 5 | 0.78 | 29.10 | 9.43 | 0.01 | 46.00 | -16.90 | Average |
| 6 | 0.78 | 35.26 | 9.43 | 0.01 | 56.00 | -20.74 | QP |
| 7 | 1.44 | 25.28 | 9.44 | 0.01 | 46.00 | -20.72 | Average |
| 8 | 1.44 | 34.53 | 9.44 | 0.01 | 56.00 | -21.47 | QP |
| 9 | 2.82 | 16.54 | 9.48 | 0.01 | 46.00 | -29.46 | Average |
| 10 | 2.82 | 26.36 | 9.48 | 0.01 | 56.00 | -29.64 | QP |
| 11 | 3.17 | 17.06 | 9.49 | 0.01 | 46.00 | -28.94 | Average |
| 12 | 3.17 | 24.45 | 9.49 | 0.01 | 56.00 | -31.55 | QP |

Remark: Factor = Insertion Loss + Cable Loss, Result = Reading + Factor, Margin = Result – Limit.

# 4. RADIATED EMISSION TEST

## 4.1 Radiation Limit

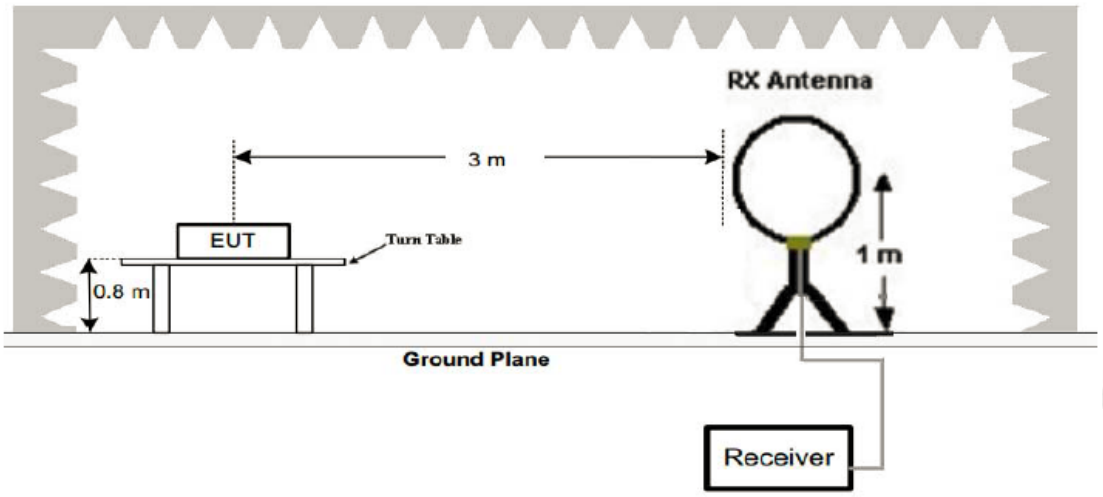
For unintentional device, according to § 15.109(a) & RSS-247 [5.5], except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values：

| Frequency (MHz) | Distance (Meters) | Radiated (dBμV/m) | Radiated (μV/m) |
|---|---|---|---|
| 30-88 | 3 | 40 | 100 |
| 88-216 | 3 | 43.5 | 150 |
| 216-960 | 3 | 46 | 200 |
| Above 960 | 3 | 54 | 500 |

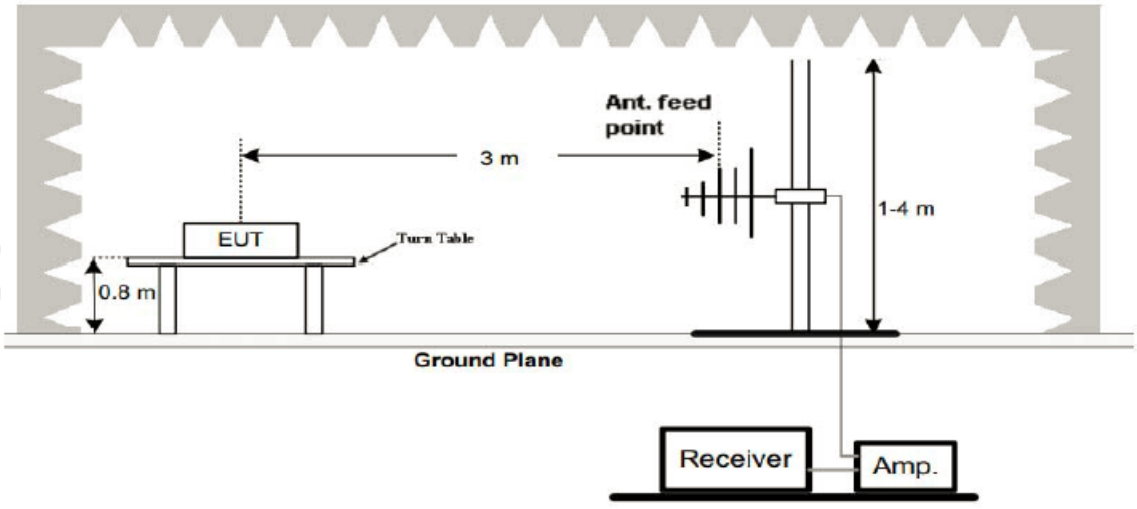
For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

## 4.2 Test Setup

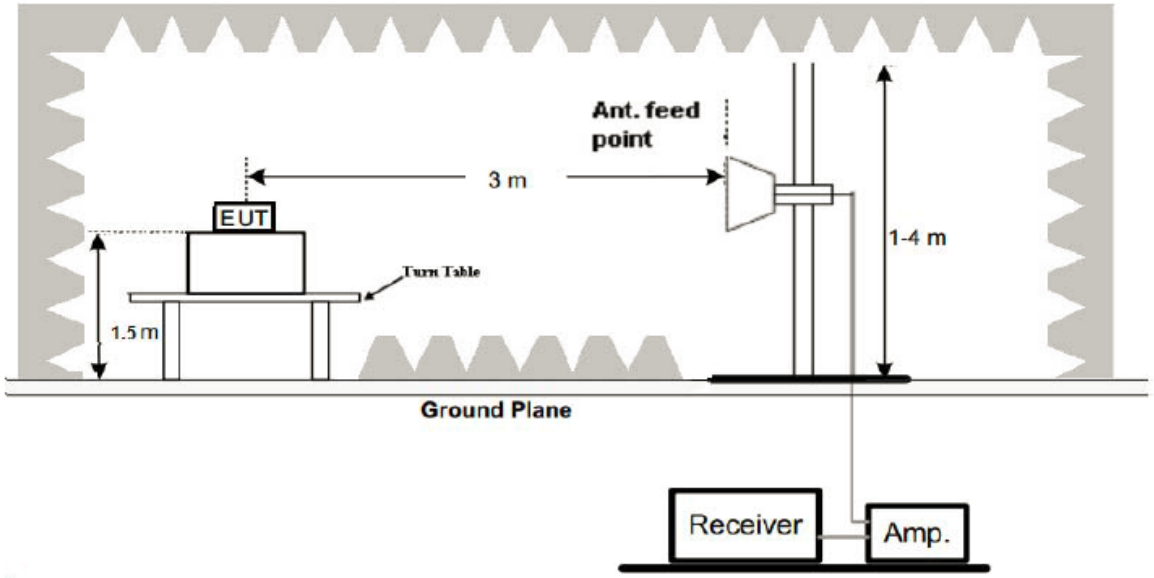
1. Radiated Emission Test-Up Frequency Below 30MHz




2. Radiated Emission Test-Up Frequency 30MHz~1GHz



3. Radiated Emission Test-Up Frequency Above 1GHz




## 4.3 Test Procedure

1. Below 1GHz measurement the EUT is placed on turntable which is 0.8m above ground plane. And above 1GHz measurement EUT was placed on low permittivity and low tangent turn table which is 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The test frequency range from 9KHz to 25GHz per FCC PART 15.33(a).
8. The distance between test antenna and EUT as following table states:

| Test Frequency range | Test Antenna Type | Test Distance |
|---|---|---|
| 9KHz-30MHz | Active Loop Antenna | 3 |
| 30MHz-1GHz | Bilog Antenna | 3 |
| 1GHz-18GHz | Horn Antenna | 3 |
| 18GHz-25GHz | Horn Anternna | 1 |

Note:
For battery operated equipment, the equipment tests shall be performed using a new battery.

## 4.4 Test Result

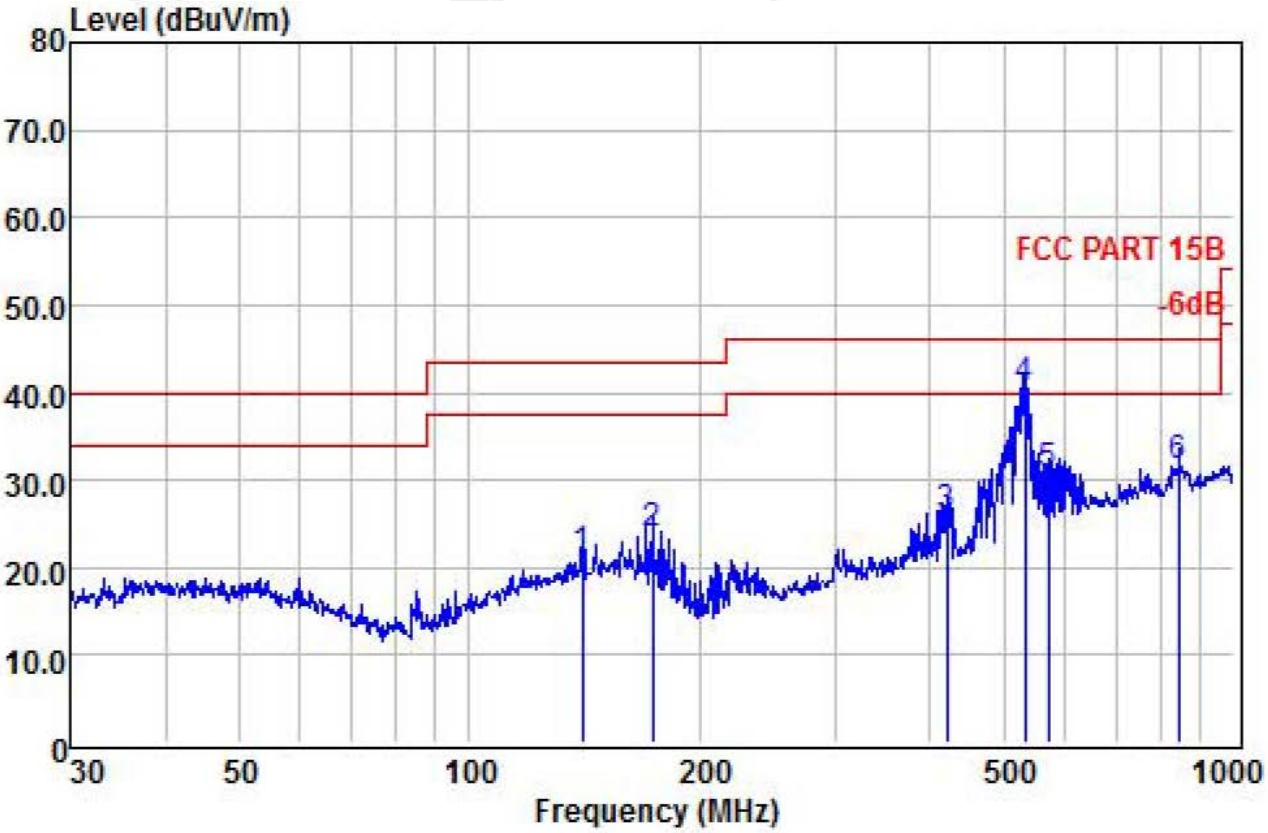
PASS

Remark:

1. All modes of GFSK, π/4 DQPSK, 8DPSK were test at Low, Middle, and High channel, only the worst result of 8DPSK High Channel was reported for below 1GHz test.
2. For BT3.0 above 1GHz test all modes of GFSK, π/4 DQPSK, and 8DPSK were test at Low, Middle, and High channel, only the worst result of GFSK DH5 was reported.
3. By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “Z axis” position was the worst, and test data recorded in this report.
4. Radiated emission test from 9KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9KHz to 30MHz and not recorded in this report.

Below 1GHz Test Results:

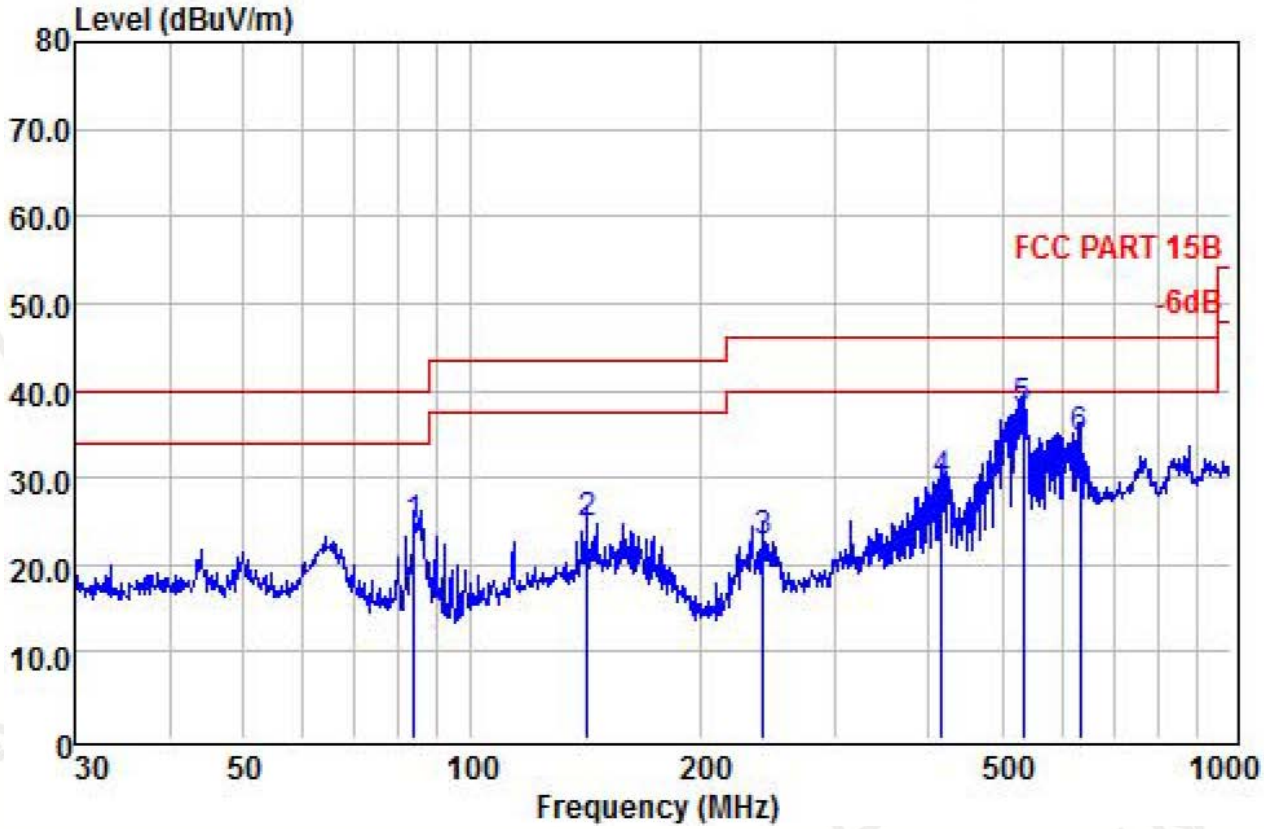
| Temperature: | 22 ℃ | Relative Humidity: | 48% |
|---|---|---|---|
| Test Date: | Oct. 20, 2020 | Pressure: | 1010hPa |
| Test Voltage: | AC 120V, 60Hz | Polarization: | Horizontal |
| Test Mode: | Transmitting mode of GFSK 2480MHz | | |




| | Freq | Read Level | Antenna Factor | Cable Loss | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dBuV/m | dBuV/m | dB | |
| 1 | 140.34 | 5.76 | 14.53 | 0.85 | 21.14 | 43.50 | -22.36 | QP |
| 2 | 173.81 | 9.35 | 13.62 | 0.87 | 23.84 | 43.50 | -19.66 | QP |
| 3 | 420.58 | 8.69 | 15.95 | 1.38 | 26.02 | 46.00 | -19.98 | QP |
| 4 ! | 531.96 | 20.58 | 18.19 | 1.59 | 40.36 | 46.00 | -5.64 | QP |
| 5 | 572.61 | 10.19 | 18.81 | 1.52 | 30.52 | 46.00 | -15.48 | QP |
| 6 | 848.06 | 7.10 | 22.27 | 2.16 | 31.53 | 46.00 | -14.47 | QP |

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit
Factor = Ant. Factor + Cable Loss

| Temperature: | 22 ℃ | Relative Humidity: | 48% |
|---|---|---|---|
| Test Date: | Oct. 20, 2020 | Pressure: | 1010hPa |
| Test Voltage: | AC 120V, 60Hz | Polarization: | Vertical |
| Test Mode: | Transmitting mode of GFSK 2480MHz | | |




| | Freq | Read Level | Antenna Factor | Cable Loss | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dBuV/m | dBuV/m | dB | |
| 1 | 84.11 | 14.57 | 8.86 | 0.86 | 24.29 | 40.00 | -15.71 | QP |
| 2 | 141.83 | 9.07 | 14.62 | 0.85 | 24.54 | 43.50 | -18.96 | QP |
| 3 | 242.53 | 10.76 | 10.98 | 0.87 | 22.61 | 46.00 | -23.39 | QP |
| 4 | 416.18 | 12.12 | 15.90 | 1.36 | 29.38 | 46.00 | -16.62 | QP |
| 5 | 531.96 | 18.06 | 18.19 | 1.59 | 37.84 | 46.00 | -8.16 | QP |
| 6 | 633.91 | 12.81 | 19.93 | 1.65 | 34.39 | 46.00 | -11.61 | QP |

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit
Factor = Ant. Factor + Cable Loss

Remark：
(1) Measuring frequencies from 9 KHz to the 1 GHz, Radiated emission test from 9KHz to 30MHz was verified, and no any emission was found except system noise floor.
(2) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(3) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.

Above 1 GHz Test Results (8DPSK Worst Case):
CH Low (2402MHz)

Horizontal

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 2402 | 111.33 | -5.84 | 105.49 | 114.00 | -8.51 | PK |
| 2402 | 83.36 | -5.84 | 77.52 | 94.00 | -16.48 | AV |
| 4804 | 62.32 | -3.64 | 58.68 | 74.00 | -15.32 | PK |
| 4804 | 51.31 | -3.64 | 47.67 | 54.00 | -6.33 | AV |
| 7206 | 58.25 | -0.95 | 57.30 | 74.00 | -16.70 | PK |
| 7206 | 48.76 | -0.95 | 47.81 | 54.00 | -6.19 | AV |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit | | | | | | |

Vertical

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 2402 | 111.41 | -5.84 | 105.57 | 114.00 | -8.43 | PK |
| 2402 | 81.75 | -5.84 | 75.91 | 94.00 | -18.09 | AV |
| 4804 | 60.37 | -3.64 | 56.73 | 74.00 | -17.27 | PK |
| 4804 | 51.36 | -3.64 | 47.72 | 54.00 | -6.28 | AV |
| 7206 | 56.39 | -0.95 | 55.44 | 74.00 | -18.56 | PK |
| 7206 | 47.53 | -0.95 | 46.58 | 54.00 | -7.42 | AV |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit | | | | | | |

CH Middle (2441MHz)

Horizontal

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 2441 | 112.15 | -5.84 | 106.31 | 114.00 | -7.69 | PK |
| 2441 | 82.35 | -5.84 | 76.51 | 94.00 | -17.49 | AV |
| 4882 | 62.28 | -3.64 | 58.64 | 74.00 | -15.36 | PK |
| 4882 | 52.54 | -3.64 | 48.90 | 54.00 | -5.10 | AV |
| 7323 | 56.47 | -0.95 | 55.52 | 74.00 | -18.48 | PK |
| 7323 | 47.15 | -0.95 | 46.20 | 54.00 | -7.80 | AV |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit | | | | | | |

Vertical

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 2441 | 112.55 | -5.71 | 106.84 | 114.00 | -7.16 | PK |
| 2441 | 82.49 | -5.71 | 76.78 | 94.00 | -17.22 | AV |
| 4882 | 61.37 | -3.51 | 57.86 | 74.00 | -16.14 | PK |
| 4882 | 50.24 | -3.51 | 46.73 | 54.00 | -7.27 | AV |
| 7323 | 56.26 | -0.82 | 55.44 | 74.00 | -18.56 | PK |
| 7323 | 46.74 | -0.82 | 45.92 | 54.00 | -8.08 | AV |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit | | | | | | |

CH High (2480MHz)

Horizontal

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 2480 | 113.39 | -5.65 | 107.74 | 114.00 | -6.26 | PK |
| 2480 | 82.37 | -5.65 | 76.72 | 94.00 | -17.28 | AV |
| 4960 | 61.81 | -3.43 | 58.38 | 74.00 | -15.62 | PK |
| 4960 | 50.35 | -3.43 | 46.92 | 54.00 | -7.08 | AV |
| 7440 | 57.29 | -0.75 | 56.54 | 74.00 | -17.46 | PK |
| 7440 | 46.22 | -0.75 | 45.47 | 54.00 | -8.53 | AV |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit | | | | | | |

Vertical

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 2480 | 113.49 | -5.65 | 107.84 | 114.00 | -6.16 | PK |
| 2480 | 82.15 | -5.65 | 76.50 | 94.00 | -17.50 | AV |
| 4960 | 61.32 | -3.43 | 57.89 | 74.00 | -16.11 | PK |
| 4960 | 50.37 | -3.43 | 46.94 | 54.00 | -7.06 | AV |
| 7440 | 57.12 | -0.75 | 56.37 | 74.00 | -17.63 | PK |
| 7440 | 46.37 | -0.75 | 45.62 | 54.00 | -8.38 | AV |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit | | | | | | |

Remark:
(1) Measuring frequencies from 1 GHz to the 25 GHz.
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) Data of measurement within this frequency range shown “--- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.
(7) All modes of operation were investigated and the worst-case emissions are reported.

# 5. BAND EDGE

## 5.1 Limits

FCC PART 15.247 Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

## 5.2 Test Procedure

The band edge compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW to 1MHz and VBM to 3MHz to measure the peak field strength and set RBW to 1MHz and VBW to 10kHz to measure the average radiated field strength. The conducted RF band edge was measured by using a spectrum analyzer. Set span wide enough to capture the highest in-band emission and the emission at the band edge. Set RBW to 100 KHz and VBW to 300 KHz, to measure the conducted peak band edge.

## 5.3 Test Result

PASS

Remark: All modes of GFSK, π/4 DQPSK, 8DPSK were tested, only the worst result of π/4 DQPSK was reported as below.

Radiated Band Edge Test:

Worst case on π/4DQPSK

Operation Mode: TX CH Low (2402MHz)

Horizontal

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 2310 | 53.42 | -5.81 | 47.61 | 74.00 | -26.39 | PK |
| 2310 | / | -5.81 | / | 54.00 | / | AV |
| 2390 | 53.38 | -5.84 | 47.54 | 74.00 | -26.46 | PK |
| 2390 | / | -5.84 | / | 54.00 | / | AV |
| 2400 | 53.23 | -5.84 | 47.39 | 74.00 | -26.61 | PK |
| 2400 | / | -5.84 | / | 54.00 | / | AV |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 2310 | 52.27 | -5.81 | 46.46 | 74.00 | -27.54 | PK |
| 2310 | / | -5.81 | / | 54.00 | / | AV |
| 2390 | 53.19 | -5.81 | 47.38 | 74.00 | -26.62 | PK |
| 2390 | / | -5.84 | / | 54.00 | / | AV |
| 2400 | 53.26 | -5.84 | 47.42 | 74.00 | -26.58 | PK |
| 2400 | / | -5.84 | / | 54.00 | / | AV |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Operation Mode: TX CH High (2480MHz)

Horizontal

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 2483.5 | 53.57 | -5.65 | 47.92 | 74.00 | -26.08 | PK |
| 2483.5 | / | -5.65 | / | 54.00 | / | AV |
| 2500 | 53.28 | -5.72 | 47.56 | 74.00 | -26.44 | PK |
| 2500 | / | -5.72 | / | 54.00 | / | AV |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 2483.5 | 52.44 | -5.65 | 46.79 | 74.00 | -27.21 | PK |
| 2483.5 | / | -5.65 | / | 54.00 | / | AV |
| 2500 | 53.25 | -5.72 | 47.53 | 74.00 | -26.47 | PK |
| 2500 | / | -5.72 | / | 54.00 | / | AV |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

# 6. OCCUPIED BANDWIDTH MEASUREMENT

## 6.1 Test Setup

Same as Radiated Emission Measurement

## 6.2 Test Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation.
3. Based on ANSI C63.10 section 6.9.2: RBW=30KHz, VBW=100KHz, Span=3MHz.
4. The useful radiated emission from the EUT was detected by the spectrum analyser with peak detector.

## 6.3 Measurement Equipment Used

Same as Radiated Emission Measurement

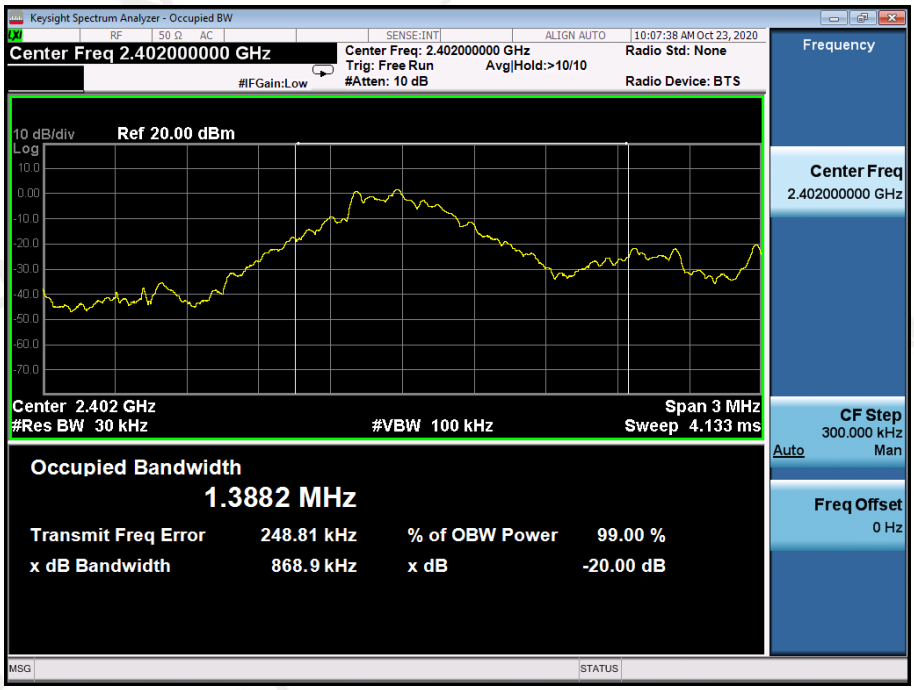
## 6.4 Test Result

PASS

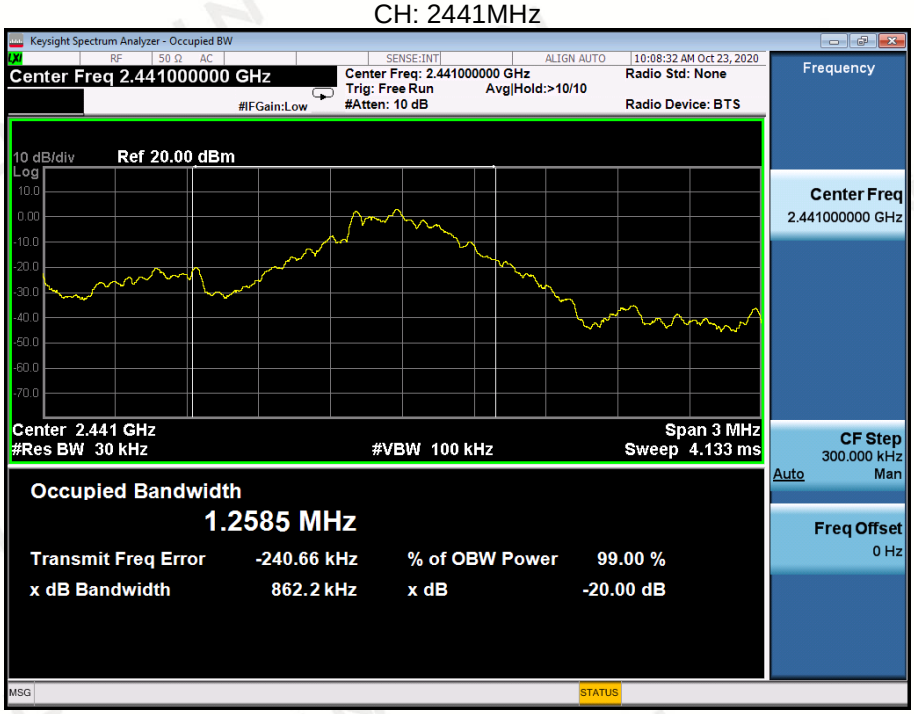
GFSK Modulation:

| Frequency (MHz) | 20dB Bandwidth (MHz) | 99% Bandwidth (MHz) | Result |
|---|---|---|---|
| 2402 | 0.869 | 1.388 | PASS |
| 2441 | 0.862 | 1.259 | PASS |
| 2480 | 0.853 | 1.254 | PASS |

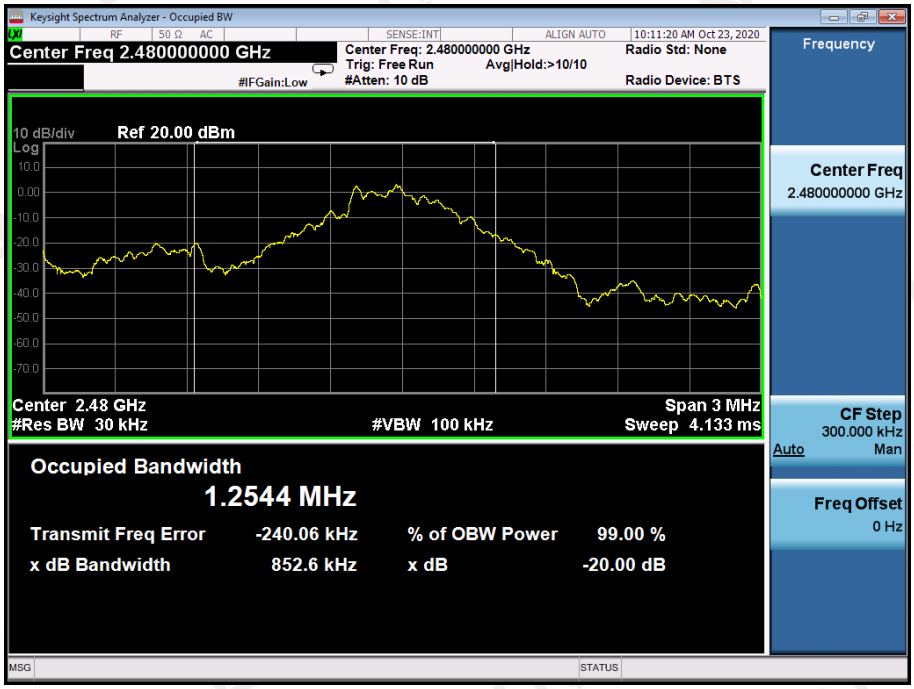
CH: 2402MHz



CH: 2441MHz



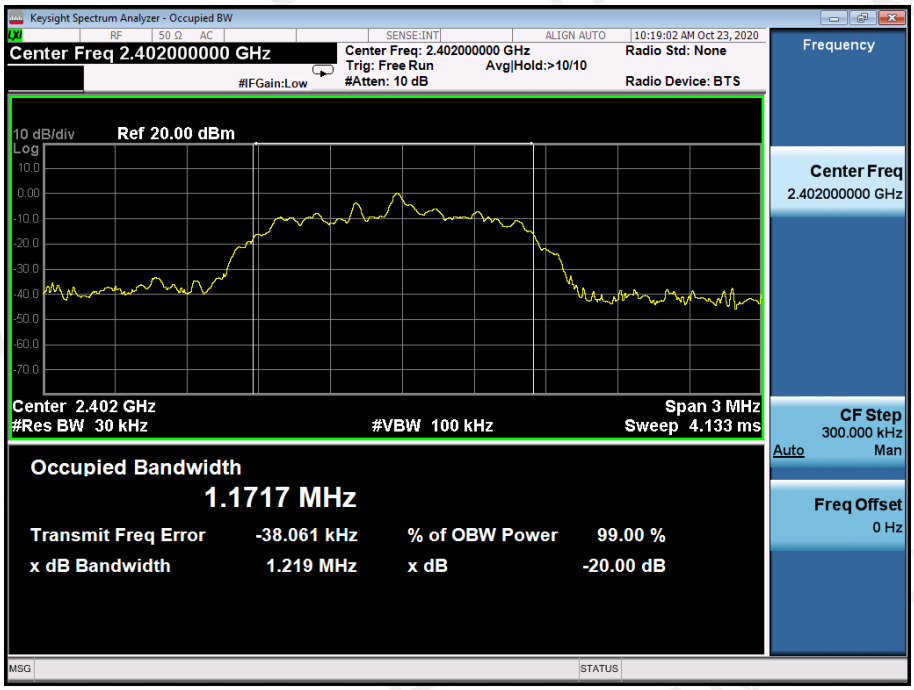

CH: 2480MHz



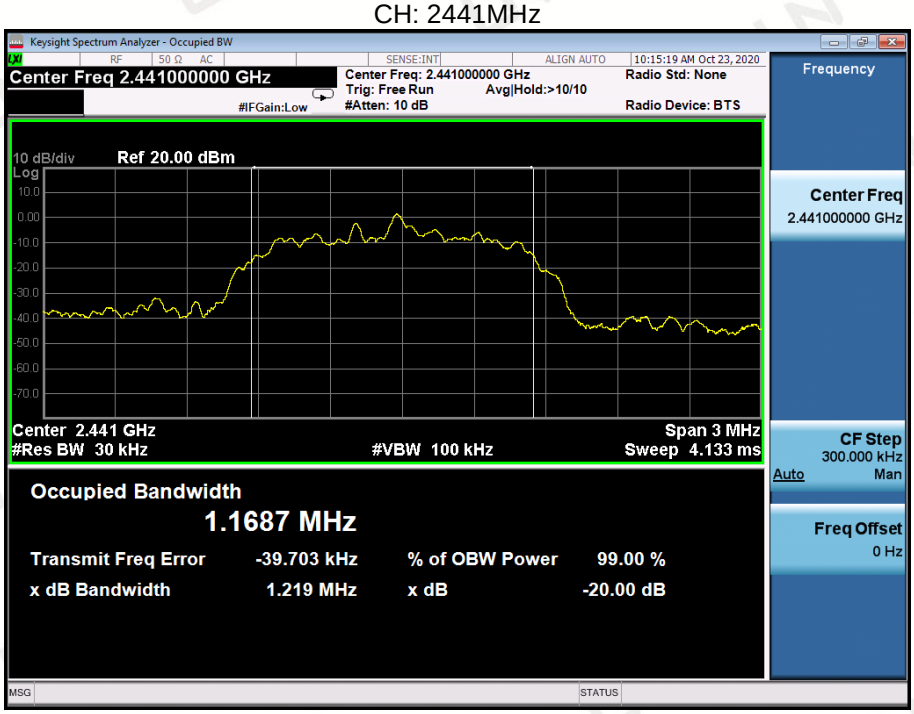
π/4 DQPSK Modulation:

| Frequency (MHz) | 20dB Bandwidth (MHz) | 99% Bandwidth (MHz) | Result |
|---|---|---|---|
| 2402 | 1.219 | 1.172 | PASS |
| 2441 | 1.219 | 1.169 | PASS |
| 2480 | 1.222 | 1.172 | PASS |

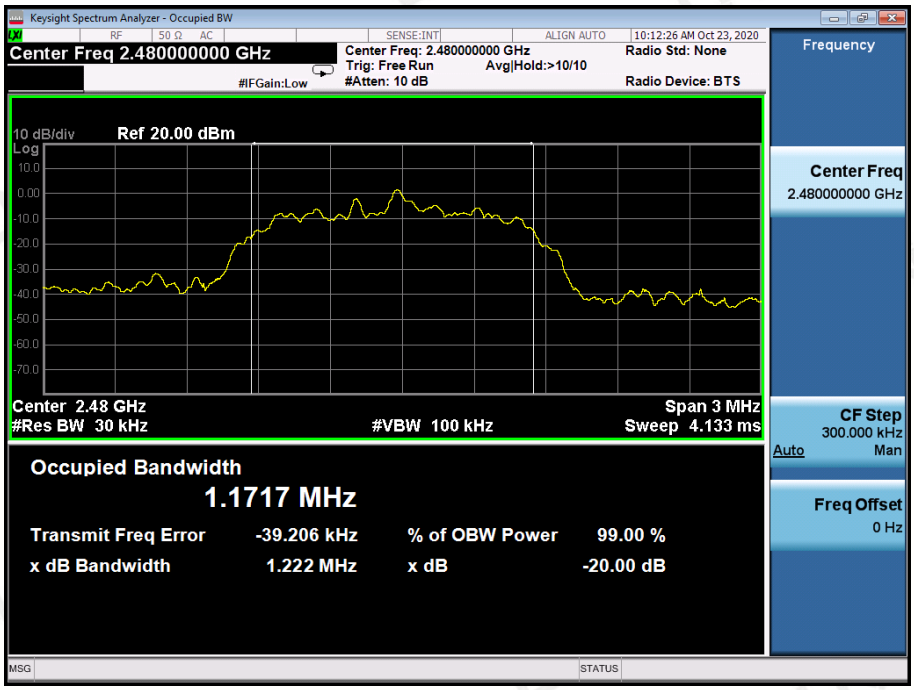
CH: 2402MHz




CH: 2441MHz



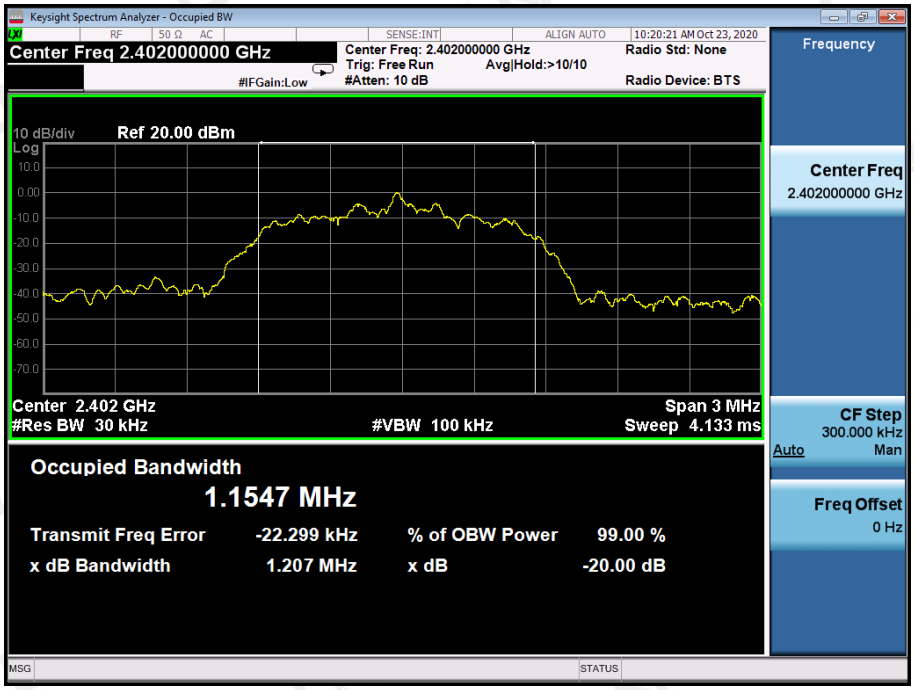
CH: 2480MHz



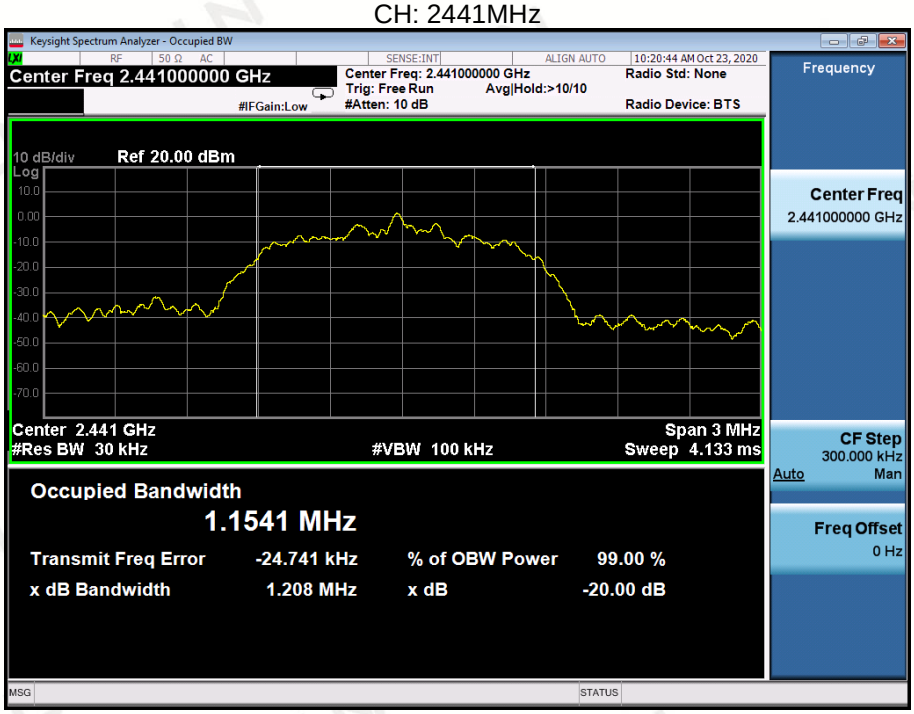

8DPSK Modulation:

| Frequency (MHz) | 20dB Bandwidth (MHz) | 99% Bandwidth (MHz) | Result |
|---|---|---|---|
| 2402 | 1.207 | 1.155 | PASS |
| 2441 | 1.208 | 1.154 | PASS |
| 2480 | 1.209 | 1.150 | PASS |

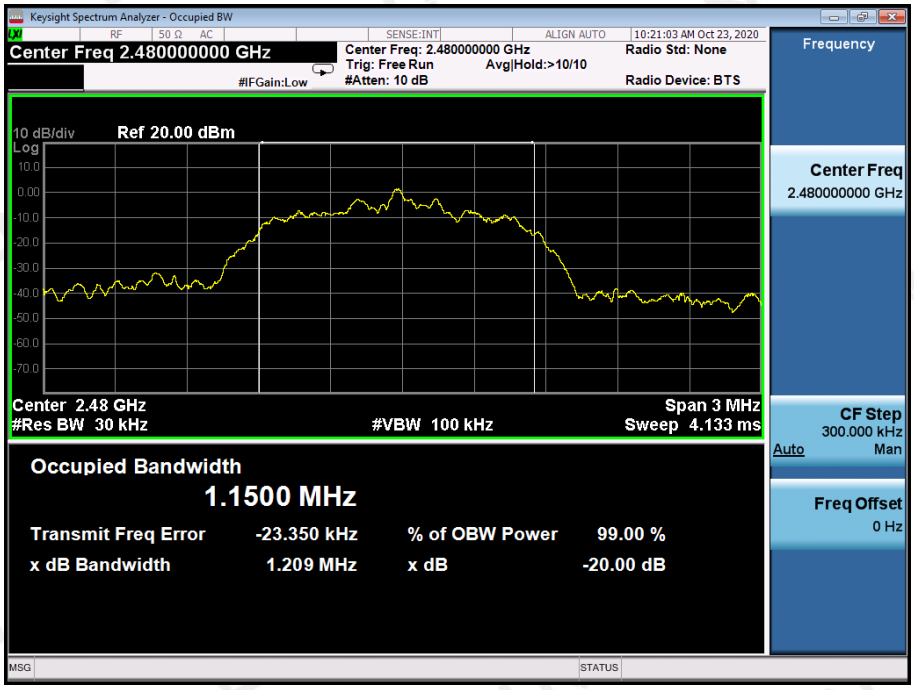
CH: 2402MHz



CH: 2441MHz




CH: 2480MHz



# 7. MAXIMUM PEAK OUTPUT POWER

## 7.1 Test Setup


## 7.2 Test Procedure

According to ANSI C63.10:2013 Maximum peak conducted output power for HFSS devices:
The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the HFSS bandwidth and shall utilize a fast-responding diode detector.
The maximum Average conducted output power may be measured using a wideband RF power meter with a thermocouple derector or equivalent. The power meter shall have a video bandwidth that is greater than or equal to the HFSS bandwidth and shall utilize a fast-responding diode detector.

## 7.3 Limit

For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

## 7.4 Test Result

PASS

| Type | Channel | Peak Output power (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|
| GFSK | Low | 4.051 | 30 | Pass |
| | Mid | 3.952 | | |
| | High | 4.854 | | |
| π/4DQPSK | Low | 3.365 | 21 | Pass |
| | Mid | 3.256 | | |
| | High | 3.185 | | |
| 8DPSK | Low | 3.378 | 21 | Pass |
| | Mid | 3.056 | | |
| | High | 3.189 | | |

# 8. FREQUENCY SEPARATION

## 8.1 Test Setup


## 8.2 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=30KHz and VBW=100KHz.

## 8.3 Limit

According to 15.247(a)(1),frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

## 8.4 Test Result

PASS

| Type/Modulation | CH | CH Frequency (MHz) | CH Separation (MHz) | Limit (MHz) | Result |
|---|---|---|---|---|---|
| CH Separation GFSK | Low Channel | 2402 | 0.992 | 0.869 | pass |
| | Adjacency Channel | 2403 | | | |
| | Mid Channel | 2441 | 1.002 | 0.862 | pass |
| | Adjacency Channel | 2442 | | | |
| | High Channel | 2480 | 0.994 | 0.853 | pass |
| | Adjacency Channel | 2479 | | | |

CH: 2402MHz

CH: 2441MHz


CH: 2480MHz

| Type/Modulation | CH | CH Frequency (MHz) | CH Separation (MHz) | Limit (MHz) | Result |
|---|---|---|---|---|---|
| CH Separation π/4DQPSK | Low Channel | 2402 | 0.992 | 0.813 | pass |
| | Adjacency Channel | 2403 | | | |
| | Mid Channel | 2441 | 1.000 | 0.813 | pass |
| | Adjacency Channel | 2442 | | | |
| | High Channel | 2480 | 0.998 | 0.815 | pass |
| | Adjacency Channel | 2479 | | | |

CH: 2402MHz


CH: 2441MHz

CH: 2480MHz


| Type/Modulation | CH | CH Frequency (MHz) | CH Separation (MHz) | Limit (MHz) | Result |
|---|---|---|---|---|---|
| CH Separation 8DPSK | Low Channel | 2402 | 1.006 | 0.805 | pass |
| | Adjacency Channel | 2403 | | | |
| | Mid Channel | 2441 | 1.002 | 0.805 | pass |
| | Adjacency Channel | 2442 | | | |
| | High Channel | 2480 | 1.006 | 0.806 | pass |
| | Adjacency Channel | 2479 | | | |

CH: 2402MHz

CH: 2441MHz


CH: 2480MHz

# 9. CONDUCTED BANDEGE MEASUREMENT

## 9.1 Test Setup


## 9.2 Test Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as TX operation and connect directly to the spectrum analyzer.
3. Based on FCC Part15 C Section 15.247: RBW=100KHz, VBW=300KHz.
4. Set detected by the spectrum analyzer with peak detector.

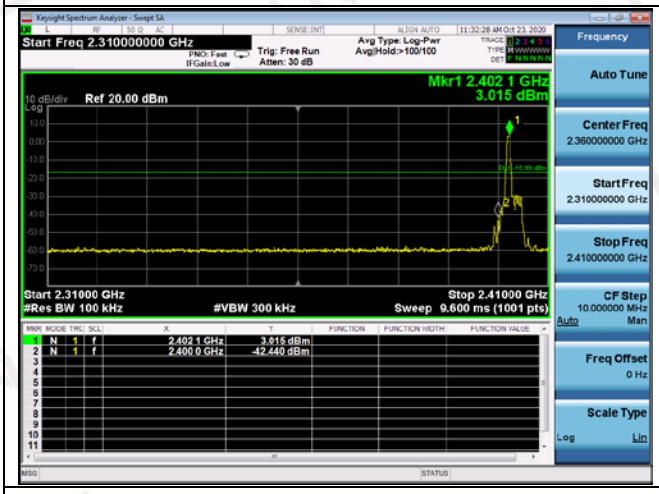
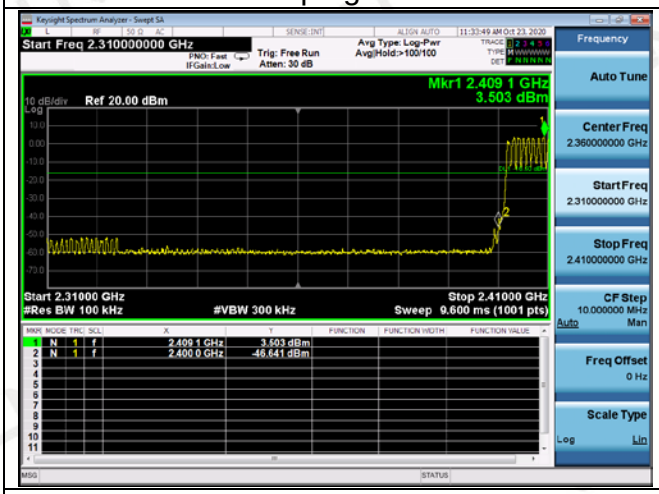
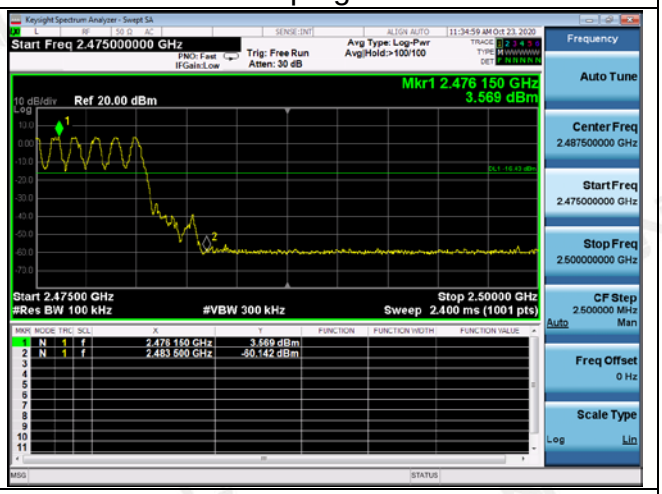
## 9.3 Limit

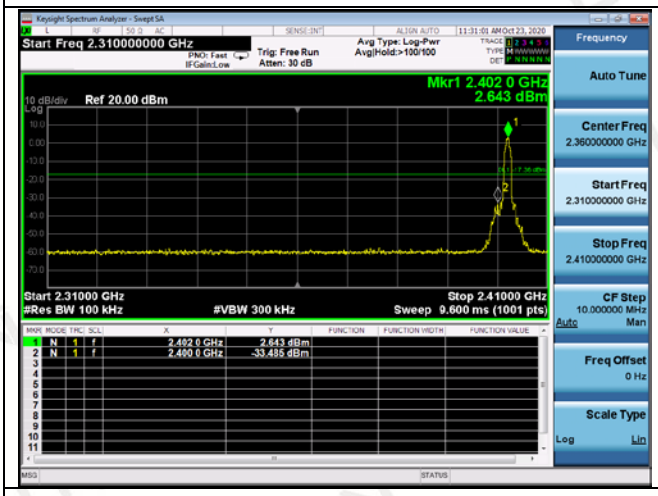
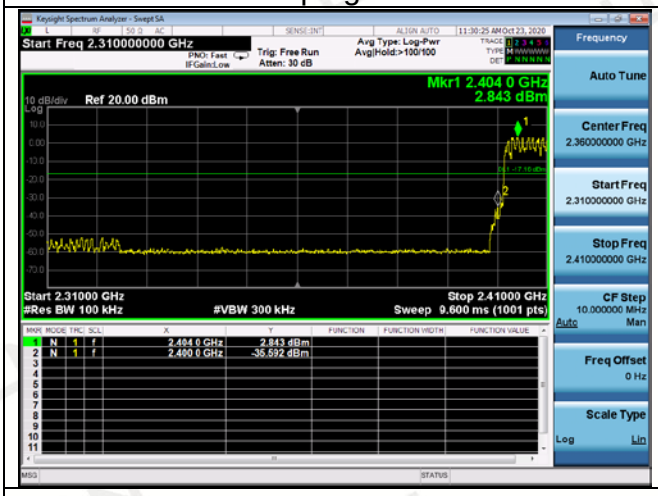
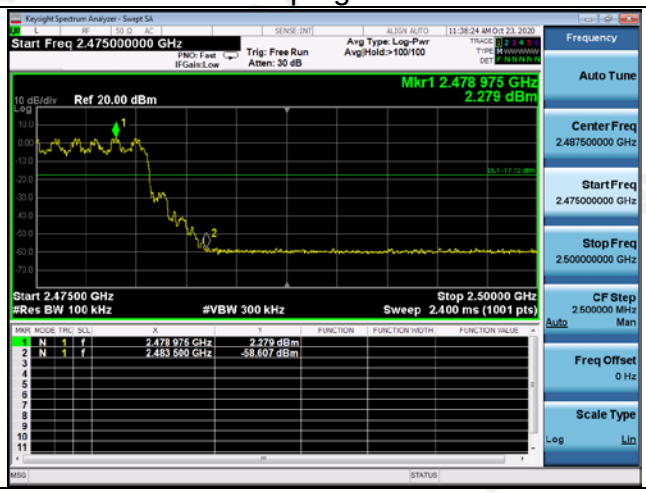
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20dB.

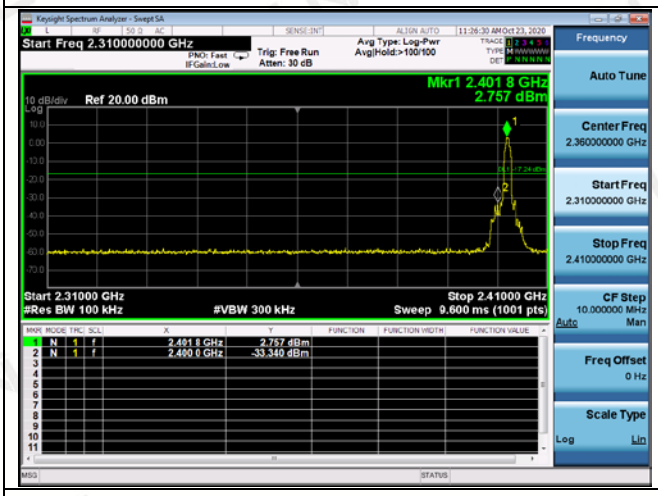
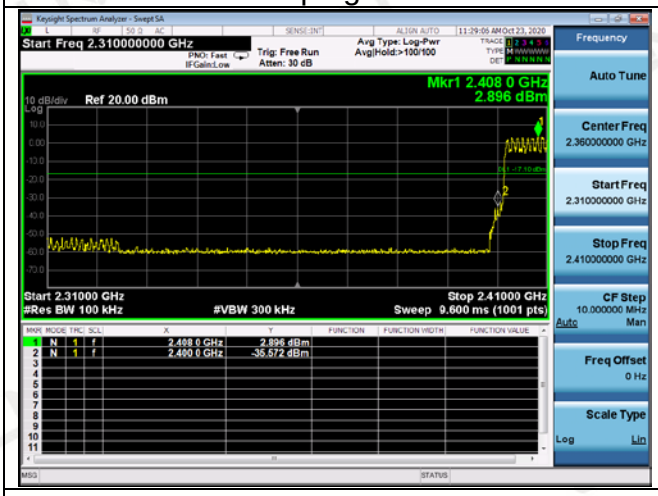
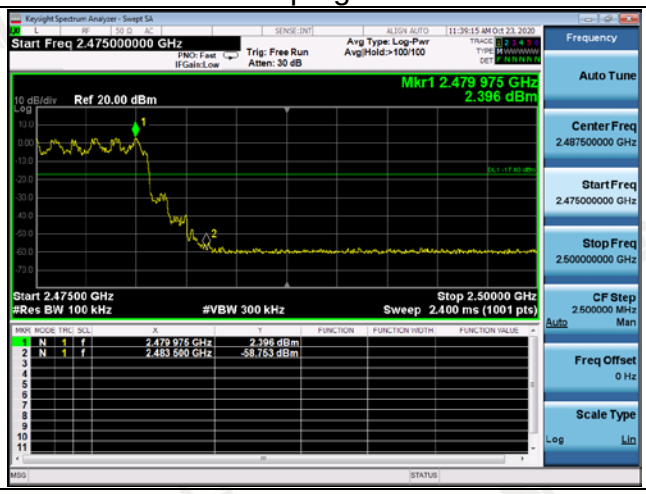
## 9.4 Test Result

PASS

| Modulation | | Frequency Band | Delta Peak to band emission (dBc) | > Limit (dBc) | Result |
|---|---|---|---|---|---|
| GFSK | Non-hopping | Left Band | 45.46 | 20 | Pass |
| | | Right Band | 58.55 | 20 | Pass |
| | hopping | Left Band | 50.14 | 20 | Pass |
| | | Right Band | 63.71 | 20 | Pass |
| π/4DQPSK | Non-hopping | Left Band | 36.13 | 20 | Pass |
| | | Right Band | 59.01 | 20 | Pass |
| | hopping | Left Band | 38.44 | 20 | Pass |
| | | Right Band | 60.89 | 20 | Pass |
| 8DPSK | Non-hopping | Left Band | 36.10 | 20 | Pass |
| | | Right Band | 55.78 | 20 | Pass |
| | hopping | Left Band | 38.47 | 20 | Pass |
| | | Right Band | 61.15 | 20 | Pass |

| GFSK | |
|---|---|
| 2402MHz | 2480MHz |
|  |  |
| Hoping Off | Hoping Off |
|  |  |
| Hoping On | Hoping On |

| π/4DQPSK | |
|---|---|
| 2402MHz | 2480MHz |
|  |  |
| Hoping Off | Hoping Off |
|  |  |
| Hoping On | Hoping On |

| 8DPSK | |
|---|---|
| 2402MHz | 2480MHz |
|  |  |
| Hoping Off | Hoping Off |
|  |  |
| Hoping On | Hoping On |

# 10. SPURIOUS RF CONDUCTED EMISSION

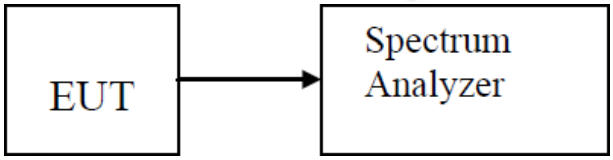
## 10.1 Test Limit

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.
3. For below 30MHz,For 9KHz-150kHz,150K-10MHz,We use the RBW 1KHz,10KHz, So the limit need to calculated by "10lg(BW1/BW2)". for example For9KHz-150kHz,RBW 1KHz, The Limit= the highest emission level-20-10log(100/1)= the highest emission level-40.

## 10.2 Test Procedure

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013, For 9KHz-150kHz, Set RBW=1kHz and VBW= 3KHz; For 150KHz-10MHz, Set RBW=10kHz and VBW= 30KHz:For 10MHz-25GHz ,Set RBW=100kHz and VBW= 300KHz in order to measure the peak field strength, and mwasure frequeny range from 9KHz to 25GHz.

## 10.3 Test Setup



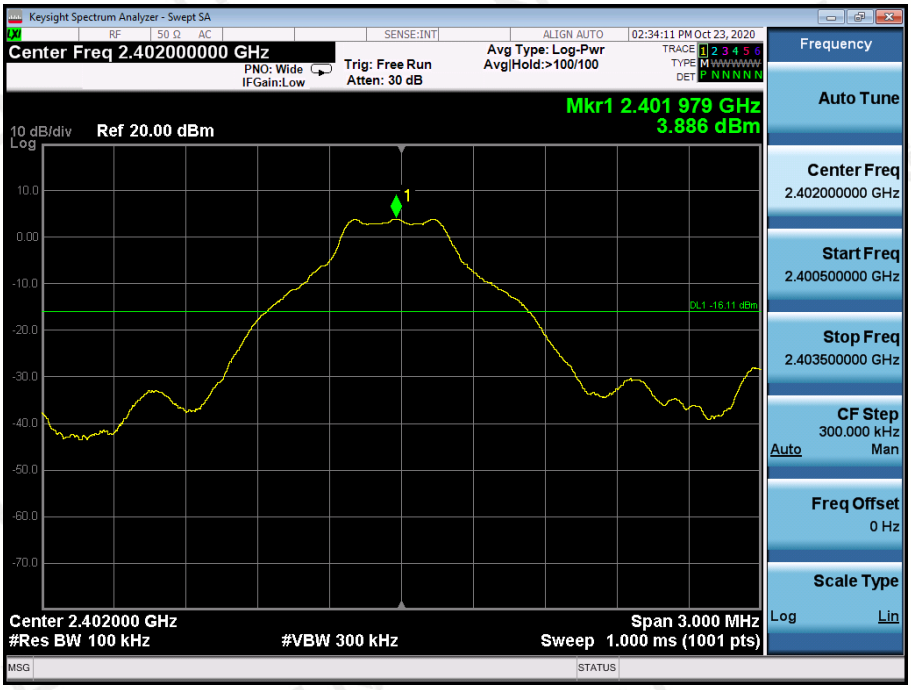

## 10.4 Test Result

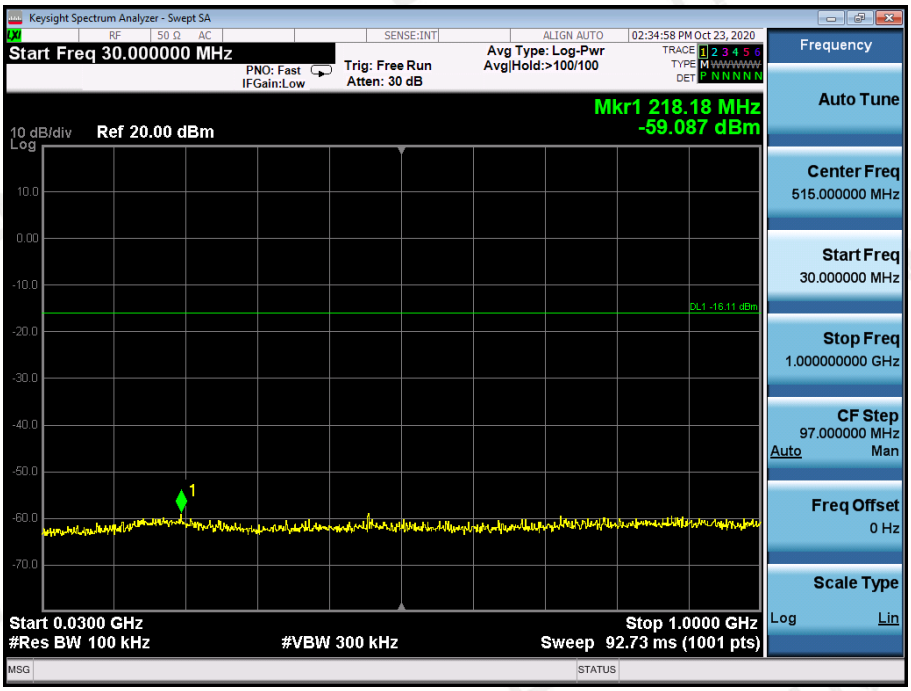
PASS

Remark: All modes of GFSK, π/4 DQPSK, 8DPSK were tested, only the worst result of GFSK was reported as below:

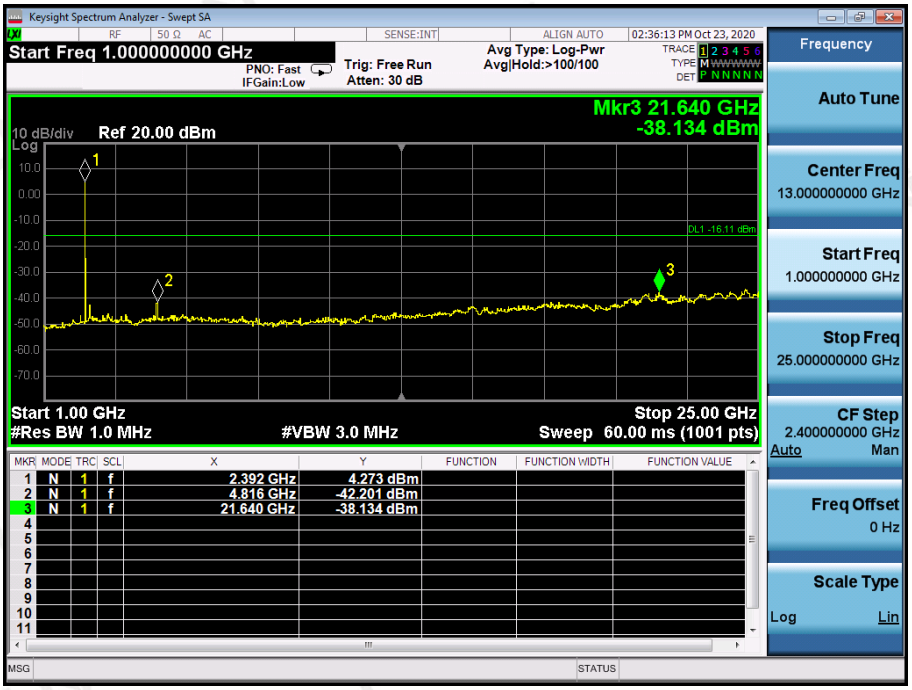
GFSK

CH: 2402MHz



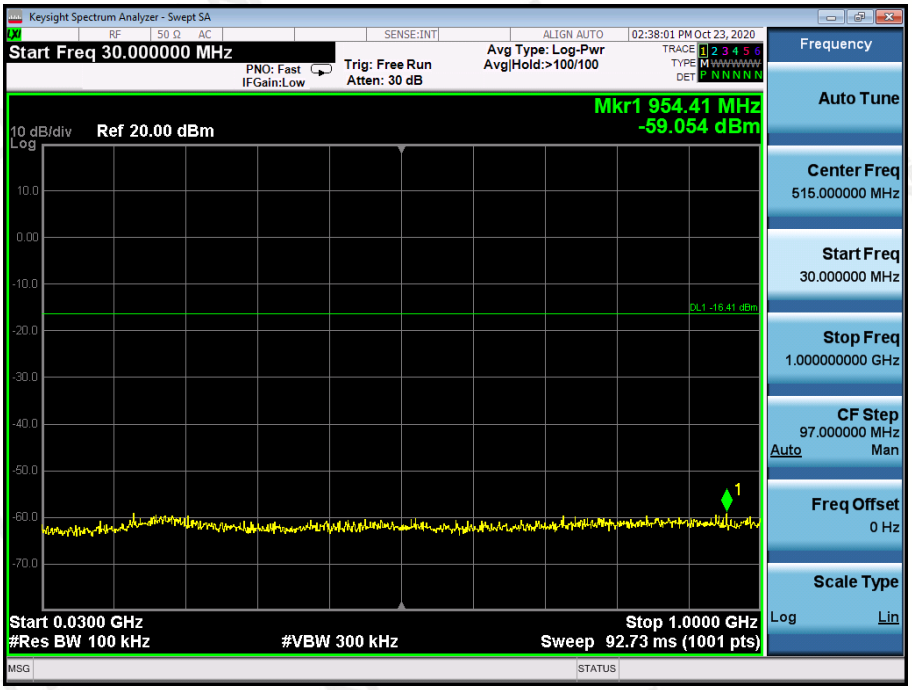




30MHz~1GHz

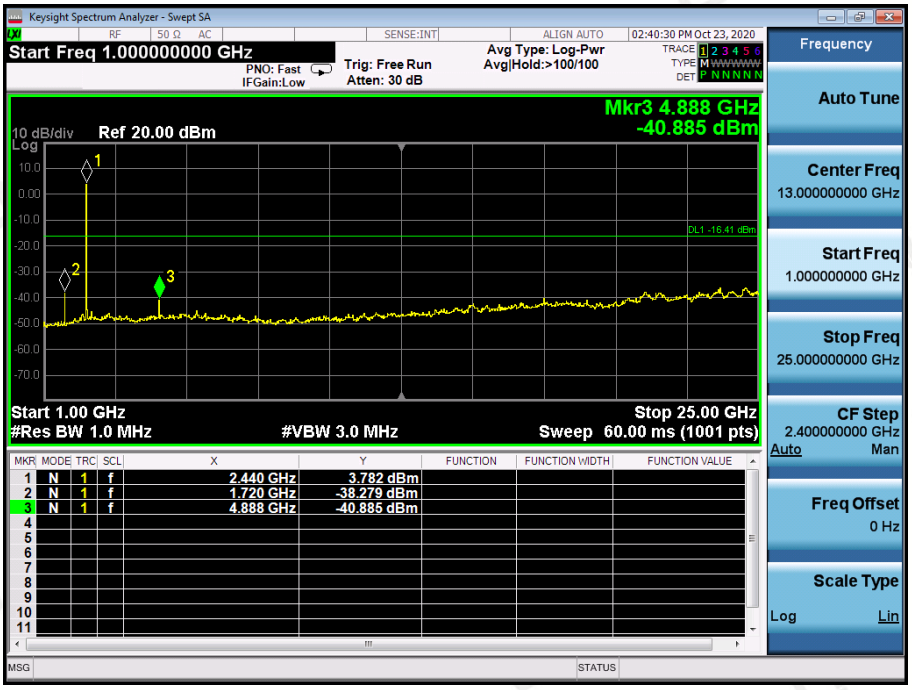



1GHz~25GHz

CH: 2441MHz

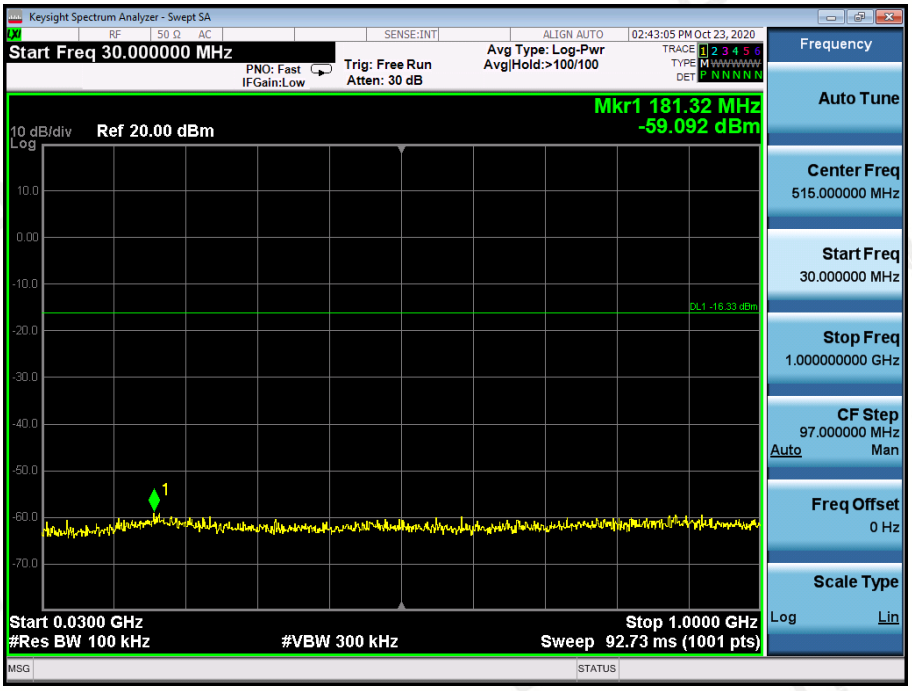



30MHz~1GHz

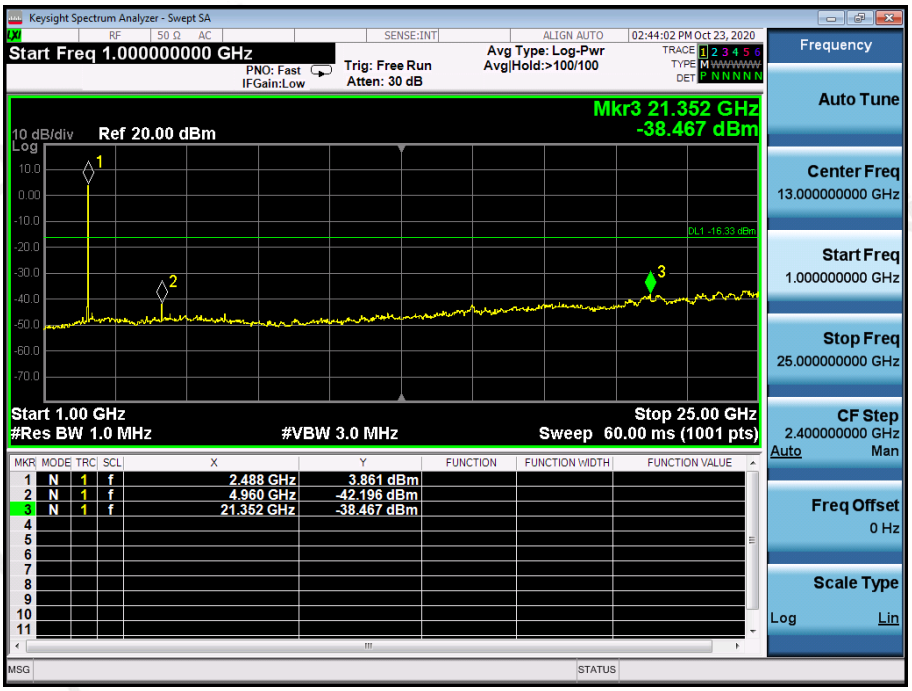



1GHz~25GHz

CH: 2480MHz


30MHz~1GHz


Keysight Spectrum Analyzer - Swept SA
Start Freq 1.000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
02:44:02 PM Oct 23, 2020
Mkr3 21.352 GHz
-38.467 dBm
10 dB/div
Log
Ref 20.00 dBm
DL1 -16.33 dBm
Start 1.00 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 25.00 GHz
Sweep 60.00 ms (1001 pts)
1 N 1 f 2.488 GHz 3.861 dBm
2 N 1 f 4.960 GHz -42.196 dBm
3 N 1 f 21.352 GHz -38.467 dBm
Frequency
Auto Tune
Center Freq
13.000000000 GHz
Start Freq
1.000000000 GHz
Stop Freq
25.000000000 GHz
CF Step
2.400000000 GHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin

1GHz~25GHz

# 11. NUMBER OF HOPPING FREQUENCY

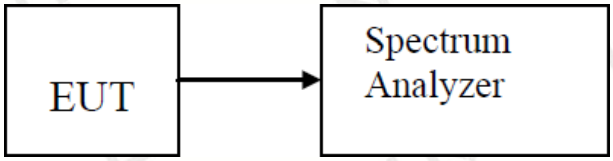
## 11.1 Test Limit

Frequency hopping systems in the 2400–2483.5MHz band shall use at least 15 channels.

## 11.2 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator.Set spectrum analyzer start 2400MHz to 2483.5MHz with RBW=1MHz and VBW=3MHz.

## 11.3 Test Setup

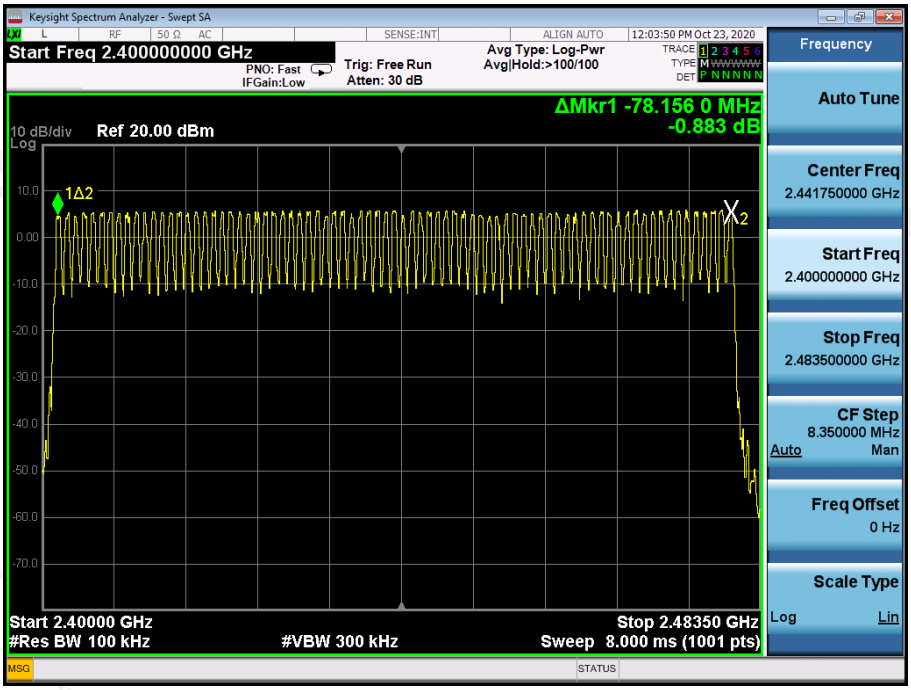



## 11.4 Test Result

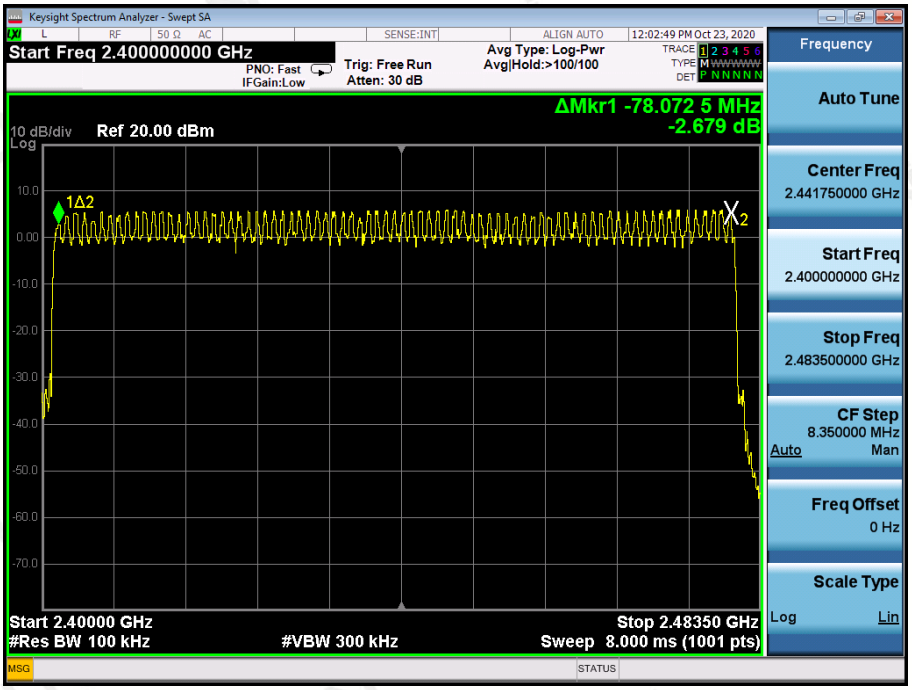
PASS

| Modulation | Number of Hopping Channel | Limit | Result |
|---|---|---|---|
| GFSK | 79 | ≥15 | Pass |
| π/4DQPSK | 79 | | |
| 8DPSK | 79 | | |

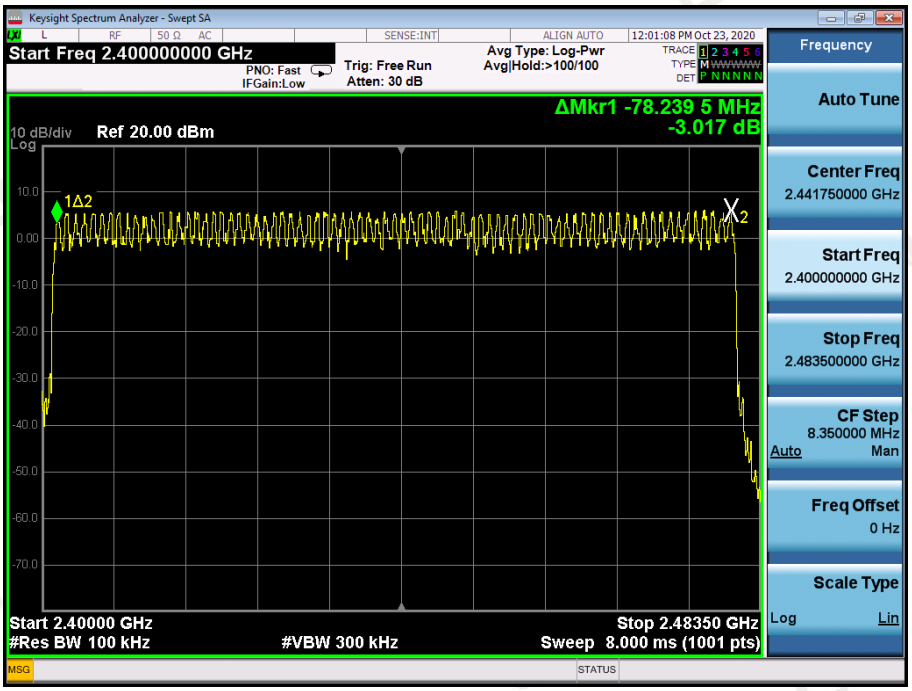
GFSK



π/4DQPSK




8DPSK



# 12. TIME OF OCCUPANCY(DWELL TIME)

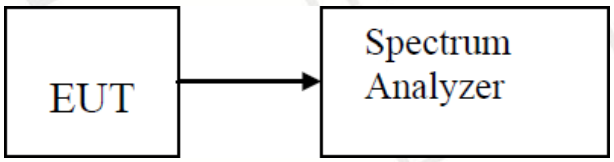
## 12.1 Test Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a pe-riod of 0.4 seconds multiplied by the number of hopping channels employed.

## 12.2 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with RBW=1MHz and VBW=3MHz,Span=0Hz.

## 12.3 Test Setup

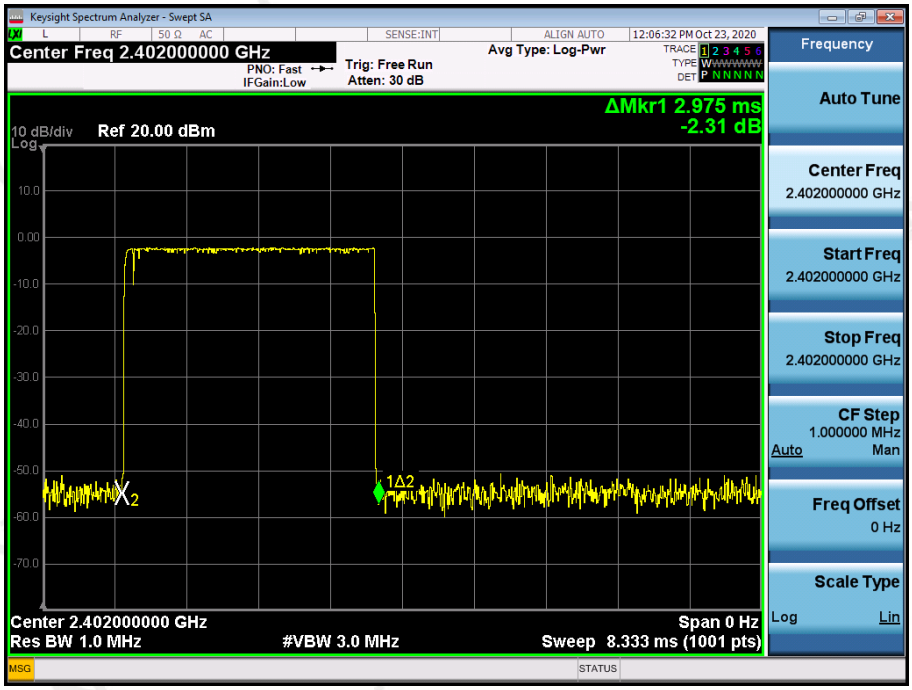



## 12.4 Test Result

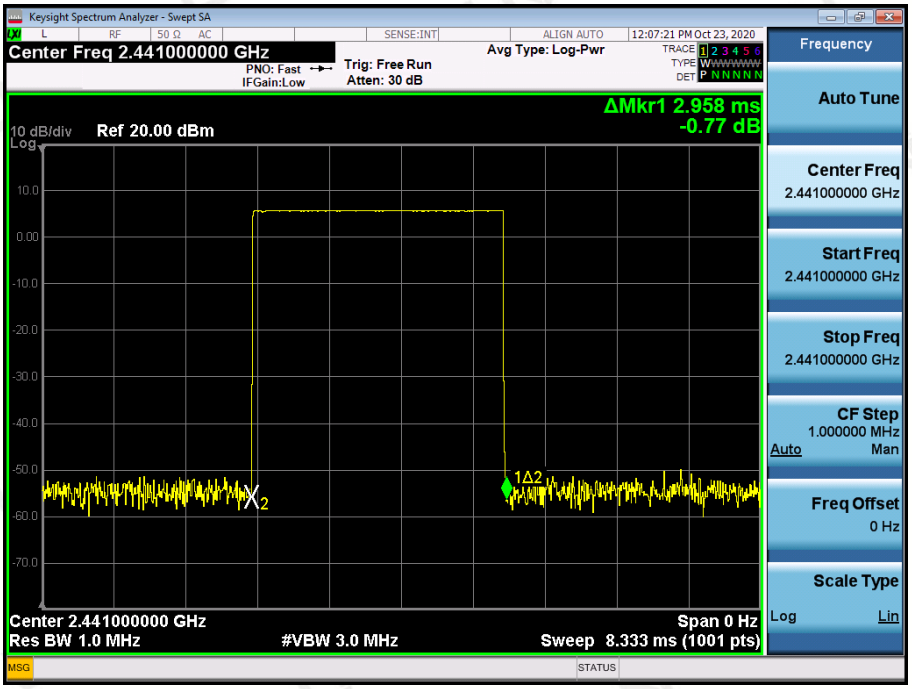
PASS

| Type | Modulation | CH | Pulse time(ms) | Dwell Time(ms) | Limit(ms) | Result |
|---|---|---|---|---|---|---|
| Dwell Time | GFSK | Low | 2.98 | 317.87 | 400 | Pass |
| | | Mid | 2.96 | 315.73 | 400 | Pass |
| | | High | 2.98 | 317.87 | 400 | Pass |

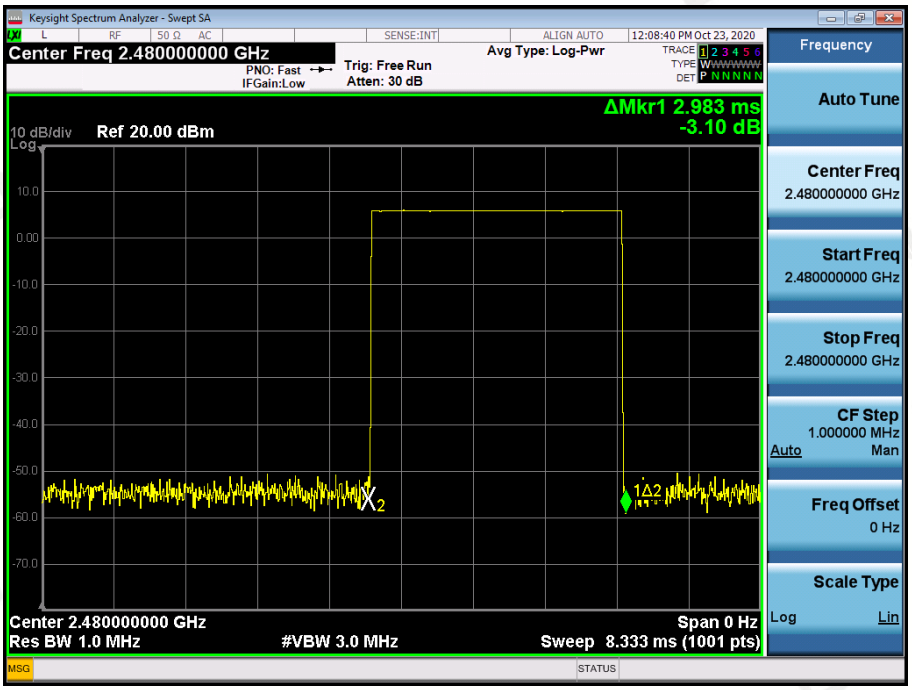
CH: 2402MHz



CH: 2441MHz

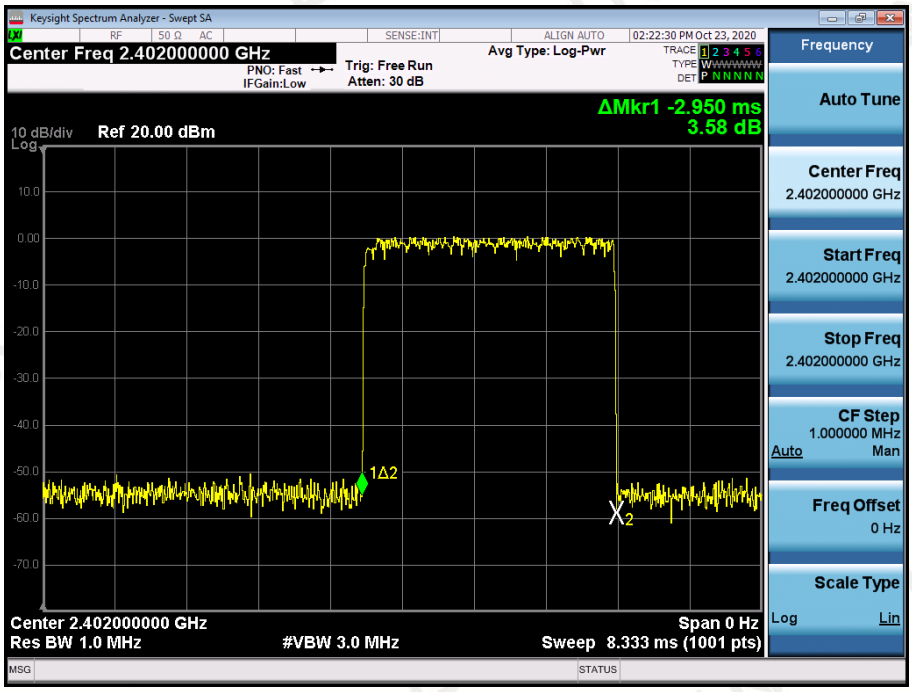



CH: 2480MHz

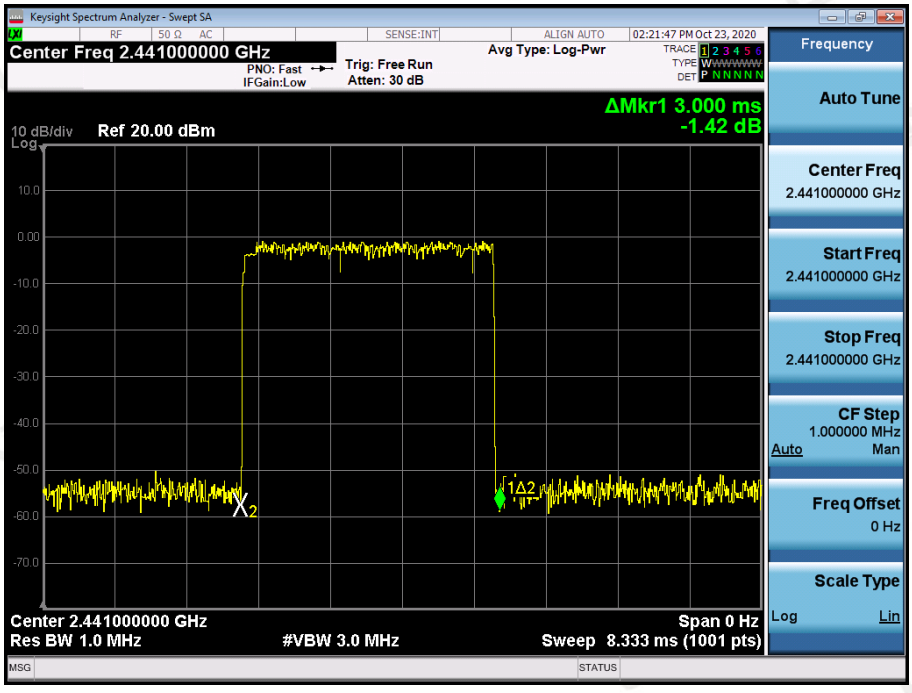


| Type | Modulation | CH | Pulse time(ms) | Dwell Time(ms) | Limit(ms) | Result |
|---|---|---|---|---|---|---|
| Dwell Time | π/4DQPSK | Low | 2.95 | 314.67 | 400 | Pass |
| | | Mid | 3.00 | 320.00 | 400 | Pass |
| | | High | 2.98 | 317.87 | 400 | Pass |

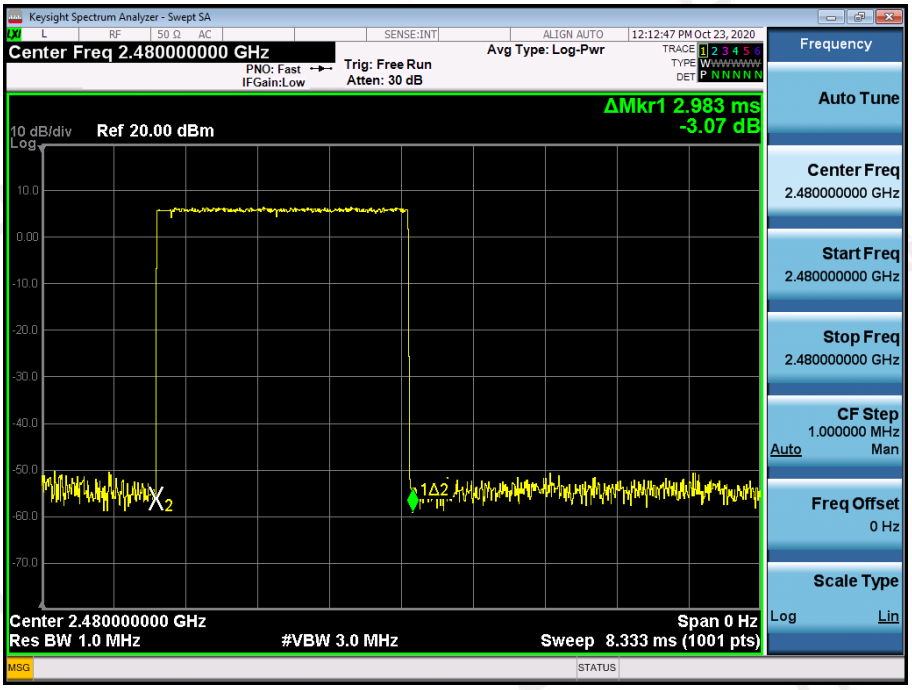
CH: 2402MHz




CH: 2441MHz

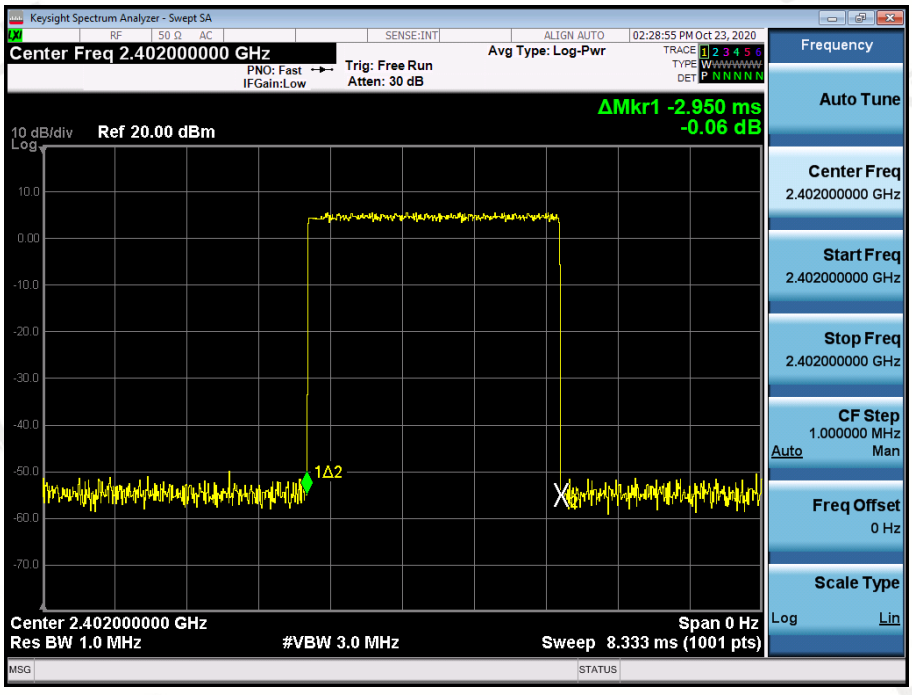


CH: 2480MHz

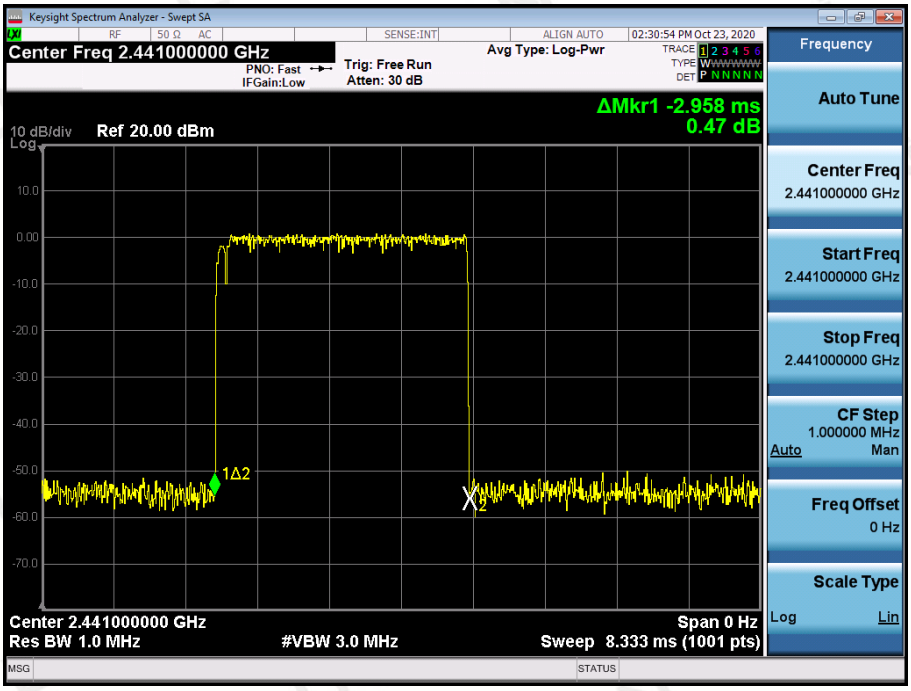



| Type | Modulation | CH | Pulse time(ms) | Dwell Time(ms) | Limit(ms) | Result |
|---|---|---|---|---|---|---|
| Dwell Time | 8DPSK | Low | 2.95 | 314.67 | 400 | Pass |
| | | Mid | 2.96 | 315.73 | 400 | Pass |
| | | High | 2.95 | 314.67 | 400 | Pass |

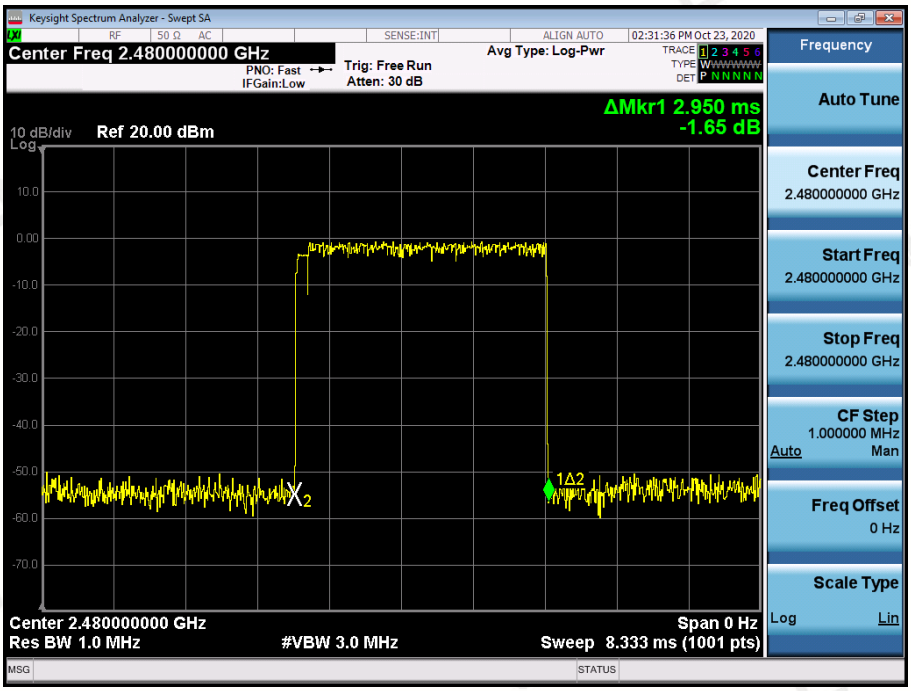
CH: 2402MHz



CH: 2441MHz




CH: 2480MHz



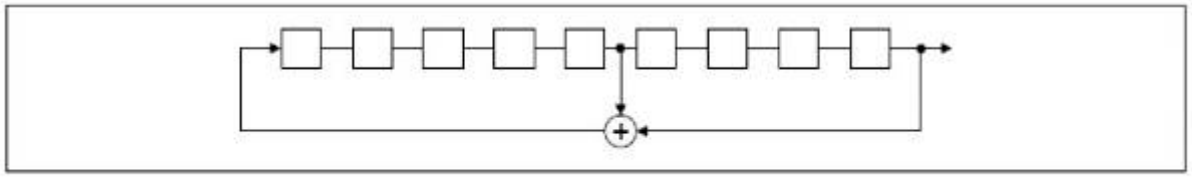
# 13. PSEUDORANDOM FREQUENCY HPPPING SEQUENCE

For 47 CFR Part 15C section 15.247 (a)(1) requirement

Frequency hopping systems shall have hopping channel carrier fre-quencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Al-ternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier fre-quencies
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 125 mW. The system shal l hop
to chan-nel frequencies that are selected at the system hopping rate from a pseudo ran-domly ordered list of hopping fre-quencies. Each frequency must be used equally on the average by each trans-mitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their cor-responding transmitters and shall shift frequencies in synchronization with the transmitted signals.

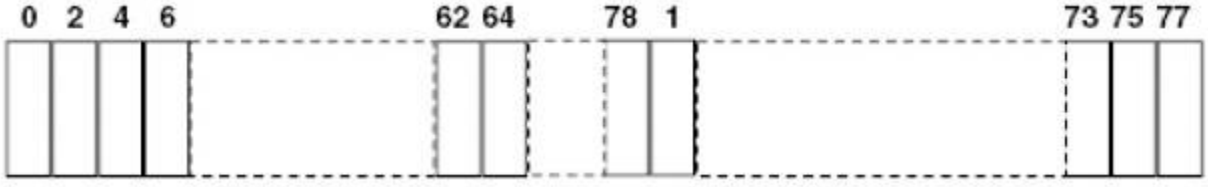
TEUT Pseudorandom Frequency Hopping Sequence Requirement

The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage.And the result is fed back to the input of the frist stage.The sequence begins with the frist one of 9 consecutive ones,for example:the shift register is initialized with nine ones.
Number of shift register stages:9
Length of pseudo-random sequence:29-1=511 bits
Longest sequence of zeros:8(non-inverted signal)



*Linear Feedback Shift Register for Generation of the PRBS sequence*

An explame of pseudorandom frequency hopping sequence as follows:



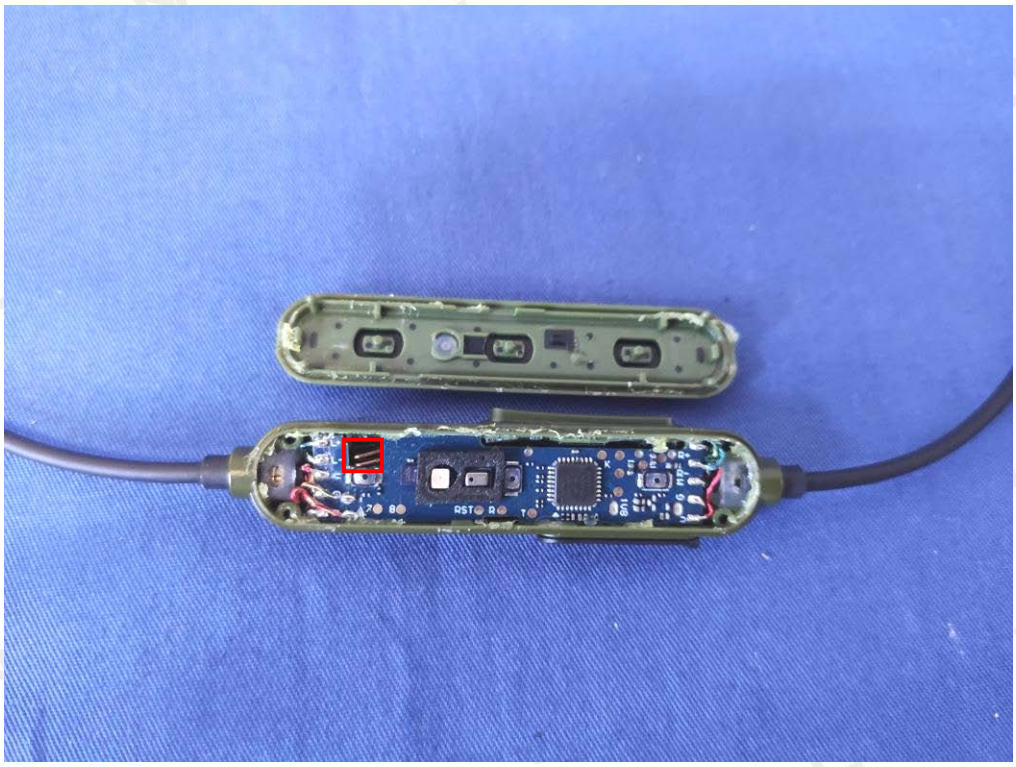

Each frequency used equally one the average by each transmitter.
The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

# 14. ANTENNA REQUIREMENT

Standard Applicable:
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.

Antenna Connected Construction
The antenna used in this product is an Internal Antenna, The directional gains of antenna used for transmitting is 2dBi.

BT ANTENNA:



## 15. PHOTOGRAPH OF TEST

**Radiated Emission**
**(Below 1G)**


**Radiated Emission**
**(Above 1G)**

**Conducted Emission**

***End of Report***