

FCC RADIO TEST REPORT

FCC ID:2A255-ATAC

Product : TAC

Trade Name : NeuroTek

Model Name : Advance TAC & Deluxe TAC

Serial Model : NT-ATAC-1, NT-DTAC-1

Report No. : UNIA21092307ER-61

Prepared for

Neurotek Technologies, LLC.

17116 Journeys End Dr., Odessa, FL, USA 33556

Prepared by

Shenzhen United Testing Technology Co., Ltd.

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TEST RESULT CERTIFICATION

Applicant's name : Neurotek Technologies, LLC.

Address : 17116 Journeys End Dr., Odessa, FL, USA 33556

Manufacture's Name : Outcome Driven Innovation, Inc.

Address : 974 Comercial St, Palo Alto, CA 94303

Product description

Product name : TAC

Trade Mark : NeuroTek

Model and/or type reference : Advance TAC & Deluxe TAC, NT-ATAC-1, NT-DTAC-1

FCC Rules and Regulations Part 15 Subpart C Section 15.247

Standards : 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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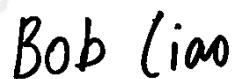
Date of Test :

Date (s) of performance of tests : Jul. 08, 2021 ~ Aug. 27, 2021

Date of Issue : Aug. 27, 2021

Test Result : Pass

Prepared by:



Bob liao/Editor

Reviewer:



Kahn yang/Supervisor

Approved & Authorized Signer:



Liuze/Manager

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1. TEST SUMMARY

1.1 TEST PROCEDURES AND RESULTS

| DESCRIPTION OF TEST STANDARD | RESULT | |
|-----------------------------------|--|-----------|
| Bandwidth | FCC Part 15: 15.247(a)(1) ANSI C63.10: Clause 6.9 | COMPLIANT |
| Carrier Frequency Separation Test | FCC Part 15: 15.247(a)(1) | COMPLIANT |
| Number Of Hopping Frequency | FCC Part 15: 15.247(a)(1)(iii) | COMPLIANT |
| Dwell Time Test | FCC Part 15: 15.247(a)(1)(iii) | COMPLIANT |
| Maximum Output Power | FCC Part 15: 15.247(b)(1) | COMPLIANT |
| Band Edge Emission | FCC Part 15: 15.247(d) | COMPLIANT |
| Radiated Spurious Emissions | FCC Part 15.205 / 15.209 | COMPLIANT |
| Antenna requirement | FCC Part 15: 15.203 | COMPLIANT |
| Conducted Emission | FCC Part 15.207 | 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. This approval result is accepted by MRA of APLAC.

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

A2LA Certificate Number: 4747.01

The EMC Laboratory has been accredited by A2LA, and in compliance with ISO/IEC 17025:2017 General Requirements for testing Laboratories.

FCC Registration Number: 674885

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission.

IC Registration Number: 21947

The EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada.

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 | TAC |
| Trade Mark | NeuroTek |
| Model Name | Advance TAC & Deluxe TAC |
| Serial No. | NT-ATAC-1, NT-DTAC-1 |
| Model Difference | All the model are the same circuit and RF module, except the model name colour button and LCD size. |
| FCC ID | 2A255-ATAC |
| Antenna Type | Chip Antenna |
| Antenna Gain | 0dBi |
| Frequency Range | 2402-2480MHz |
| Number of Channels | 79 |
| Modulation Type | GFSK, $\pi/4$ -DQPSK, 8DPSK |
| Battery | 3.7V, 1100mAh |
| Power Source | DC5V from Adapter or DC3.7V from battery |
| Adapter | Model:YNQX09T050100UL Input:100-240V~ 50/60Hz 0.3A Output: DC 5V 1A |

2.2 Carrier Frequency of Channels

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

2.3 Operation of EUT during testing

Operating Mode

Note: According exploratory test, EUT will have maximum output power in those data rate, so those data rate were used for all test.

The mode is used:

Transmitting mode for TX GFSK, π/4-DQPSK, 8DPSK running at 1,2,3Mbps

Low Channel: 2402MHz

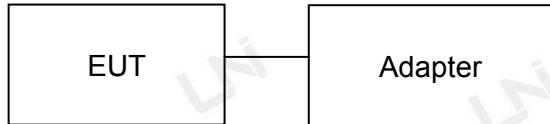
Middle Channel: 2441MHz

High Channel: 2480MHz

After evaluation, the data of the worst-case is Model Advance TAC & Deluxe TAC(Large LCD size).

2.4 DESCRIPTION OF TEST SETUP

Operation of EUT during Conducted testing:



Operation of EUT during Radiation and Above1GHz Radiation testing:



Table for auxiliary equipment:

| Equipment Description | Manufacturer | Model | Calibration Due Date |
|-----------------------|--------------|-----------------|----------------------|
| Adapter | N/A | YNQX09T050100UL | N/A |
| N/A | N/A | N/A | N/A |

2.5 MEASUREMENT INSTRUMENTS LIST

| Item | Equipment | Manufacturer | Model No. | Serial No. | Calibrated until |
|--------------------------|---------------------------------|---------------|-------------|---------------|------------------|
| CONDUCTED EMISSIONS TEST | | | | | |
| 1 | AMN | Schwarzbeck | NNLK8121 | 8121370 | 2021.9.9 |
| 2 | AMN | ETS | 3810/2 | 00020199 | 2021.9.9 |
| 3 | EMI TEST RECEIVER | Rohde&Schwarz | ESCI | 101210 | 2021.9.9 |
| 4 | AAN | TESEQ | T8-Cat6 | 38888 | 2021.9.9 |
| RADIATED EMISSION TEST | | | | | |
| 1 | Horn Antenna | Sunol | DRH-118 | A101415 | 2021.9.9 |
| 2 | BicoNILog Antenna | Sunol | JB1 Antenna | A090215 | 2021.9.9 |
| 3 | PREAMP | HP | 8449B | 3008A00160 | 2021.9.9 |
| 4 | PREAMP | HP | 8447D | 2944A07999 | 2021.9.9 |
| 5 | EMI TEST RECEIVER | Rohde&Schwarz | ESR3 | 101891 | 2021.9.9 |
| 6 | VECTOR Signal Generator | Rohde&Schwarz | SMU200A | 101521 | 2021.9.28 |
| 7 | Signal Generator | Agilent | E4421B | MY4335105 | 2021.9.28 |
| 8 | MXA Signal Analyzer | Agilent | N9020A | MY50510140 | 2021.9.28 |
| 9 | MXA Signal Analyzer | Agilent | N9020A | MY51110104 | 2021.9.9 |
| 10 | ANT Tower&Turn table Controller | Champro | EM 1000 | 60764 | 2021.9.28 |
| 11 | Anechoic Chamber | Taihe Maorui | 9m*6m*6m | 966A0001 | 2021.9.9 |
| 12 | Shielding Room | Taihe Maorui | 6.4m*4m*3m | 643A0001 | 2021.9.9 |
| 13 | RF Power sensor | DARE | RPR3006W | 15I00041SNO88 | 2022.3.14 |

| | | | | | |
|-----|-------------------------------------|---------------|------------|---------------|------------|
| 14 | RF Power sensor | DARE | RPR3006W | 15I00041SNO89 | 2022.3.14 |
| 15 | RF power divider | Anritsu | K241B | 992289 | 2021.9.28 |
| 16 | Wideband radio communication tester | Rohde&Schwarz | CMW500 | 154987 | 2021.9.28 |
| 17 | Biconical antenna | Schwarzbeck | VHA 9103 | 91032360 | 2021.9.8 |
| 18 | Biconical antenna | Schwarzbeck | VHA 9103 | 91032361 | 2021.9.8 |
| 19 | Broadband Hybrid Antennas | Schwarzbeck | VULB9163 | VULB9163#958 | 2021.9.8 |
| 20 | Horn Antenna | Schwarzbeck | BBHA9120D | 9120D-1680 | 2022.1.12 |
| 21 | Active Receive Loop Antenna | Schwarzbeck | FMZB 1919B | 00023 | 2021.9.8 |
| 22 | Horn Antenna | Schwarzbeck | BBHA 9170 | BBHA9170651 | 2022.03.14 |
| 23 | Microwave Broadband Preamplifier | Schwarzbeck | BBV 9721 | 100472 | 2021.9.8 |
| 24 | Active Loop Antenna | Com-Power | AL-130R | 10160009 | 2022.05.10 |
| 25 | Power Meter | KEYSIGHT | N1911A | MY50520168 | 2022.05.10 |
| 26 | Frequency Meter | VICTOR | VC2000 | 997406086 | 2022.05.10 |
| 27 | DC Power Source | HYELEC | HY5020E | 055161818 | 2022.05.10 |
| 24* | Active Loop Antenna | Com-Power | AL-130R | 10160009 | 2022.05.09 |
| 25* | Power Meter | KEYSIGHT | N1911A | MY50520168 | 2022.05.09 |
| 26* | Frequency Meter | VICTOR | VC2000 | 997406086 | 2022.05.09 |
| 27* | DC Power Source | HYELEC | HY5020E | 055161818 | 2022.05.09 |

3. CONDUCTED EMISSIONS TEST

3.1 Conducted Power Line Emission Limit

For unintentional device, according to § 15.207(a) Line Conducted Emission Limits is as following

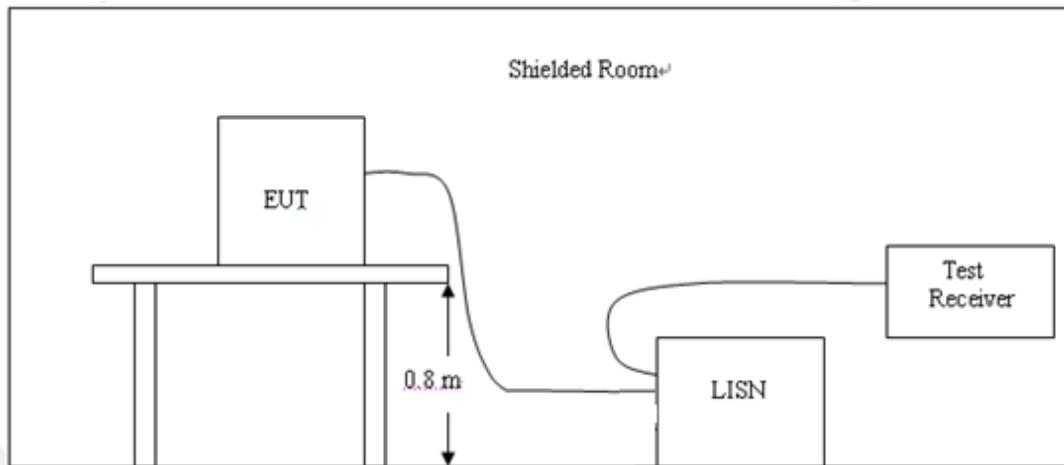
| Frequency (MHz) | Maximum RF Line Voltage(dB V) | | | |
|--------------------|-------------------------------|------|---------|--------|
| | CLASS A | | CLASS B | |
| | Q.P. | Ave. | Q.P. | Ave. |
| 0.15~0.50 | 79 | 66 | 66~56* | 56~46* |
| 0.50~5.00 | 73 | 60 | 56 | 46 |
| 5.00~30.0 | 73 | 60 | 60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

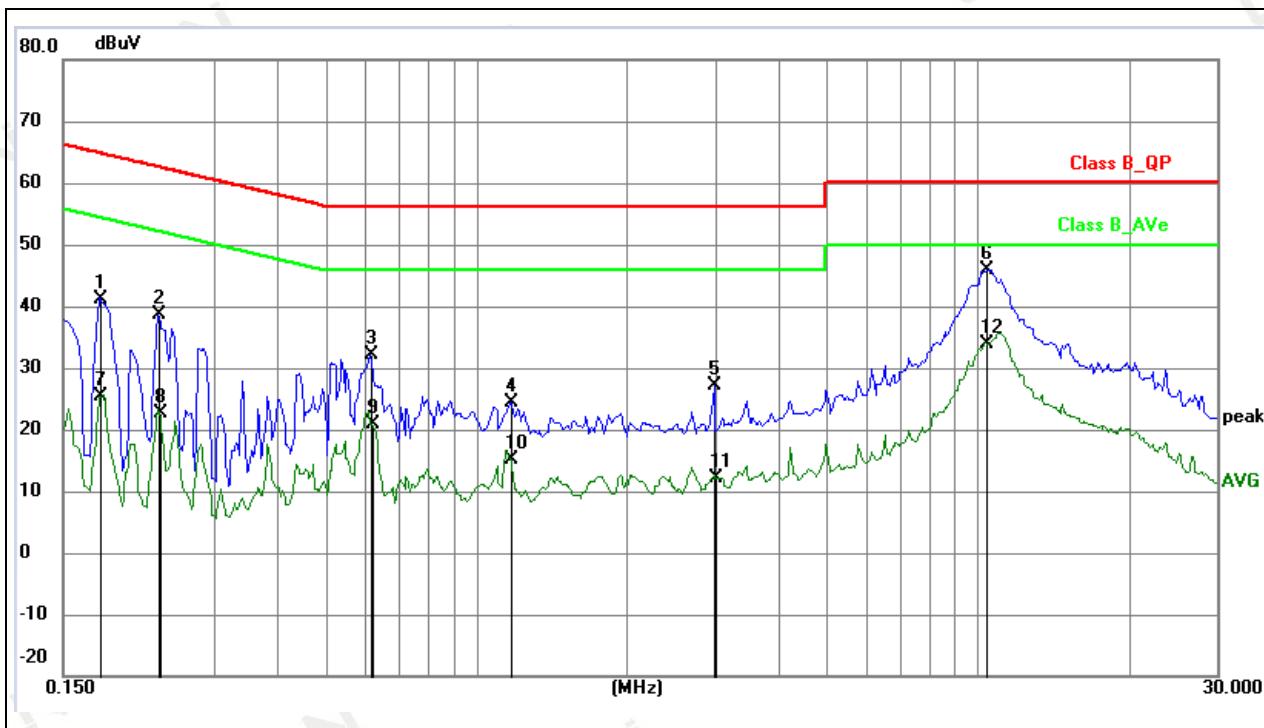
3.4 Test Result

Pass

Remark:

1. All modes were tested at AC 120V and 240V, only the worst result of AC 120V was reported.
2. All modes were tested at Low, Middle, and High channel, only the worst result of 802.11b Low Channel was reported as below:

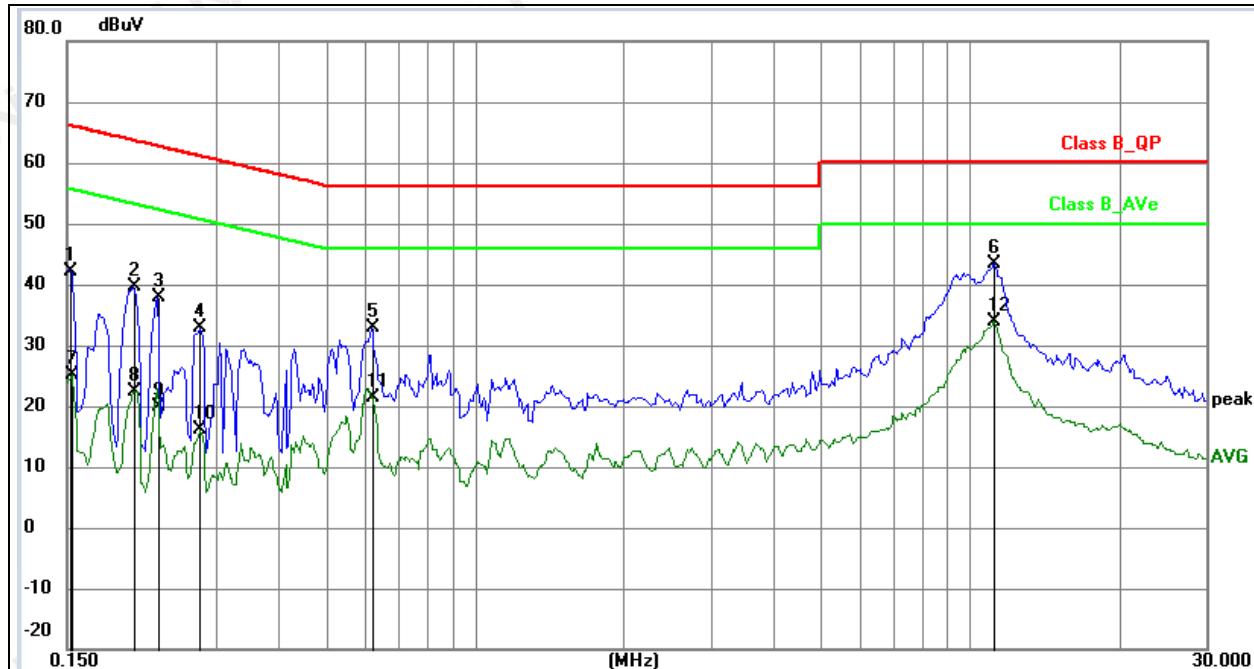
| | | | |
|---------------|------------------------------|--------------------|---------|
| Temperature: | 24°C | Relative Humidity: | 48% |
| Test Date: | 2021-08-02 | Pressure: | 1010hPa |
| Test Voltage: | AC 120V/60Hz for Adapter | Phase: | Line |
| Test Mode: | TX (3Mbps) CH78 (worst case) | | |



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

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | P/F |
|-----|-----------------|----------------|-------------|--------------|--------------|-------------|----------|-----|
| 1 | 0.1777 | 31.43 | 9.77 | 41.20 | 64.59 | -23.39 | peak | P |
| 2 | 0.2319 | 28.86 | 9.75 | 38.61 | 62.38 | -23.77 | peak | P |
| 3 | 0.6141 | 22.30 | 9.78 | 32.08 | 56.00 | -23.92 | peak | P |
| 4 | 1.1718 | 14.63 | 9.79 | 24.42 | 56.00 | -31.58 | peak | P |
| 5 | 2.9853 | 17.23 | 9.84 | 27.07 | 56.00 | -28.93 | peak | P |
| 6 | 10.4334 | 35.81 | 10.18 | 45.99 | 60.00 | -14.01 | peak | P |
| 7 | 0.1777 | 15.60 | 9.77 | 25.37 | 54.59 | -29.22 | AVG | P |
| 8 | 0.2329 | 12.97 | 9.75 | 22.72 | 52.35 | -29.63 | AVG | P |
| 9 | 0.6173 | 10.98 | 9.78 | 20.76 | 46.00 | -25.24 | AVG | P |
| 10 | 1.1719 | 5.31 | 9.79 | 15.10 | 46.00 | -30.90 | AVG | P |
| 11 | 2.9970 | 2.25 | 9.84 | 12.09 | 46.00 | -33.91 | AVG | P |
| 12 | 10.4524 | 23.70 | 10.18 | 33.88 | 50.00 | -16.12 | AVG | P |

| | | | |
|---|--------------------------|--------------------|---------|
| Temperature: | 24°C | Relative Humidity: | 48% |
| Test Date: | 2021-08-02 | Pressure: | 1010hPa |
| Test Voltage: | AC 120V/60Hz for Adapter | Phase: | Neutral |
| Test Mode: TX (3Mbps) CH78 (worst case) | | | |



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

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | P/F |
|-----|-----------------|----------------|-------------|--------------|--------------|-------------|----------|-----|
| 1 | 0.1524 | 32.32 | 9.78 | 42.10 | 65.87 | -23.77 | peak | P |
| 2 | 0.2046 | 29.85 | 9.75 | 39.60 | 63.42 | -23.82 | peak | P |
| 3 | 0.2280 | 28.15 | 9.75 | 37.90 | 62.52 | -24.62 | peak | P |
| 4 | 0.2787 | 23.16 | 9.76 | 32.92 | 60.85 | -27.93 | peak | P |
| 5 | 0.6180 | 23.08 | 9.78 | 32.86 | 56.00 | -23.14 | peak | P |
| 6 | 11.1822 | 33.27 | 10.21 | 43.48 | 60.00 | -16.52 | peak | P |
| 7 | 0.1539 | 15.37 | 9.78 | 25.15 | 55.79 | -30.64 | AVG | P |
| 8 | 0.2050 | 12.66 | 9.75 | 22.41 | 53.41 | -31.00 | AVG | P |
| 9 | 0.2292 | 10.21 | 9.75 | 19.96 | 52.48 | -32.52 | AVG | P |
| 10 | 0.2787 | 6.29 | 9.76 | 16.05 | 50.85 | -34.80 | AVG | P |
| 11 | 0.6205 | 11.53 | 9.78 | 21.31 | 46.00 | -24.69 | AVG | P |
| 12 | 11.1977 | 23.59 | 10.21 | 33.80 | 50.00 | -16.20 | AVG | P |

4 RADIATED EMISSION TEST

4.1 Radiation Limit

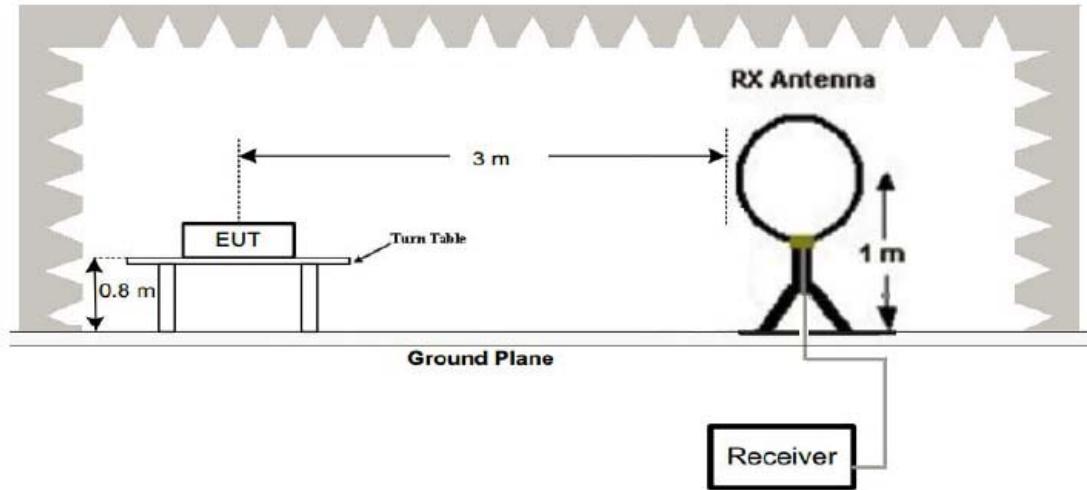
For unintentional device, according to § 15.209(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

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

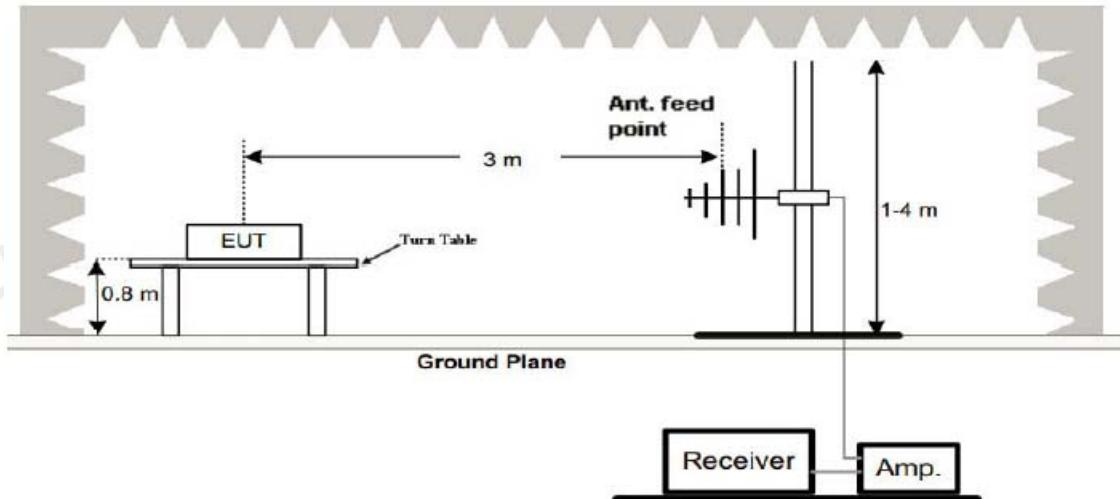
For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

4.2 Test Setup

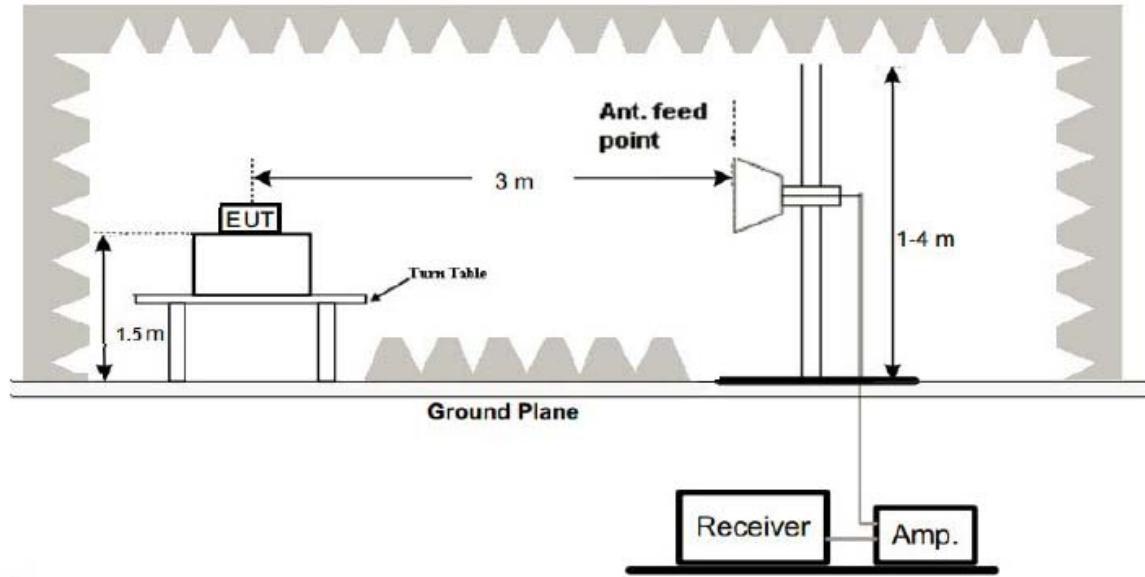
1. Radiated Emission Test-Up Frequency Below 30MHz



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).

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 mode were tested at Low, Middle, and High channel, and only the worst result of GFSK (1Mbps) Low Channel was reported for below 1GHz test.
2. 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.

Below 30M

| | | | |
|---------------|------------------------------|--------------------|------------|
| Temperature: | 22°C | Relative Humidity: | 48% |
| Test Date: | 2021-08-02 | Pressure: | 1010hPa |
| Test Voltage: | DC3.7V from battery | Polarization: | Horizontal |
| Test Mode: | TX (3Mbps) CH78 (worst case) | | |

| Freq. (MHz) | Reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) | State |
|----------------|---------------------|-------------------|----------------|-------|
| -- | -- | -- | -- | P |
| -- | -- | -- | -- | P |

Note:

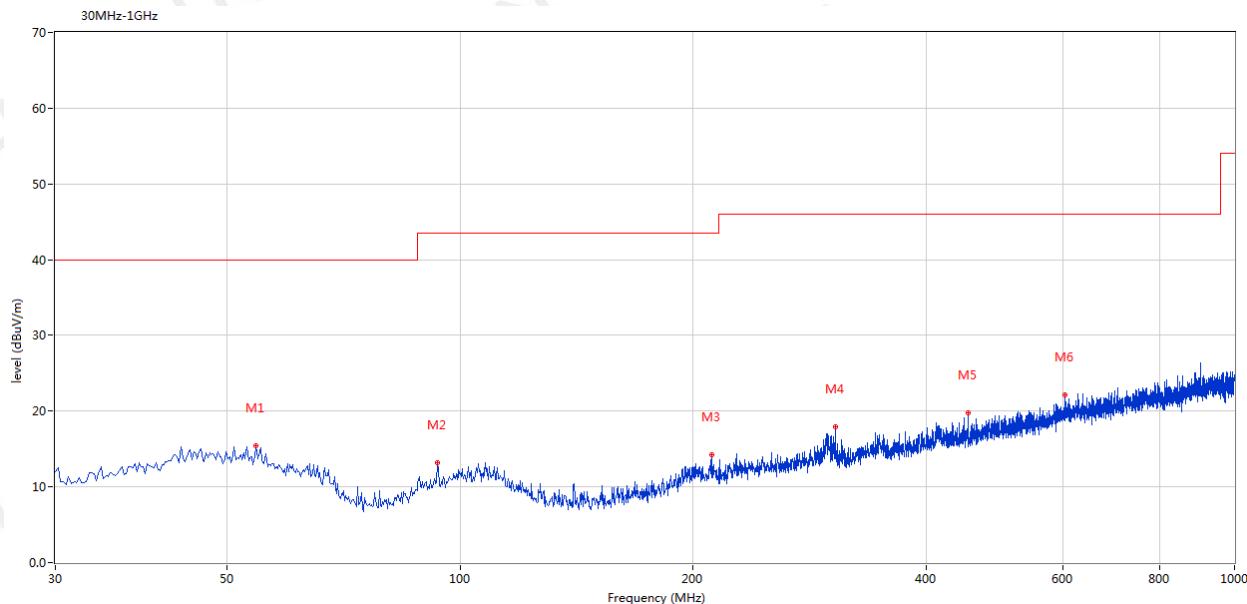
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $20 \log \left(\frac{\text{specific distance}}{\text{test distance}} \right)$ (dB);

Limit line = specific limits(dBuv) + distance extrapolation factor

Below 1GHz Test Results:

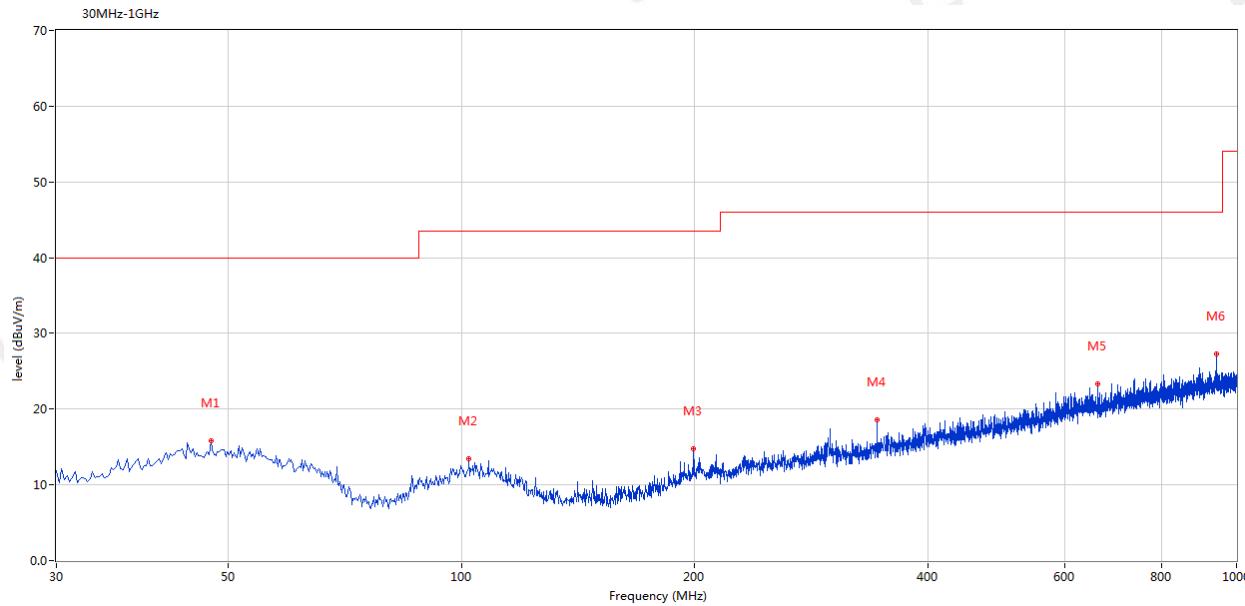
| | | | |
|---------------|------------------------------|--------------------|------------|
| Temperature: | 22°C | Relative Humidity: | 48% |
| Test Date: | 2021-08-02 | Pressure: | 1010hPa |
| Test Voltage: | DC3.7V from battery | Polarization: | Horizontal |
| Test Mode: | TX (3Mbps) CH78 (worst case) | | |



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | ANT | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|------------|---------|
| 1 | 54.486 | 15.42 | -11.66 | 40.0 | -24.58 | Peak | Horizontal | Pass |
| 2 | 93.519 | 13.15 | -14.41 | 43.5 | -30.35 | Peak | Horizontal | Pass |
| 3 | 211.587 | 14.20 | -13.68 | 43.5 | -29.30 | Peak | Horizontal | Pass |
| 4 | 304.926 | 17.96 | -10.95 | 46.0 | -28.04 | Peak | Horizontal | Pass |
| 5 | 453.057 | 19.73 | -7.85 | 46.0 | -26.27 | Peak | Horizontal | Pass |
| 6 | 604.339 | 22.14 | -4.94 | 46.0 | -23.86 | Peak | Horizontal | Pass |

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

| | | | |
|---------------|------------------------------|--------------------|----------|
| Temperature: | 22°C | Relative Humidity: | 48% |
| Test Date: | 2021-08-02 | Pressure: | 1010hPa |
| Test Voltage: | DC3.7V from battery | Polarization: | Vertical |
| Test Mode: | TX (3Mbps) CH78 (worst case) | | |



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | ANT | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|----------|---------|
| 1 | 47.456 | 15.83 | -11.38 | 40.0 | -24.17 | Peak | Vertical | Pass |
| 2 | 102.247 | 13.49 | -13.42 | 43.5 | -30.01 | Peak | Vertical | Pass |
| 3 | 199.223 | 14.77 | -13.50 | 43.5 | -28.73 | Peak | Vertical | Pass |
| 4 | 343.717 | 18.56 | -9.61 | 46.0 | -27.44 | Peak | Vertical | Pass |
| 5 | 662.282 | 23.30 | -4.56 | 46.0 | -22.70 | Peak | Vertical | Pass |
| 6 | 941.572 | 27.31 | -1.81 | 46.0 | -18.69 | Peak | Vertical | Pass |

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

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:

| | | | |
|----------------------|--|--------------------|--------------------------|
| EUT: | TAC | Model Name : | Advance TAC & Deluxe TAC |
| Temperature: | 25 °C | Test Date: | 2021-08-02 |
| Pressure: | 1010 hPa | Relative Humidity: | 60% |
| Test Mode : | 3Mbps | Test Voltage : | DC3.7V from battery |
| Measurement Distance | 3 m | Frequency Range | 1GHz to 25GHz |
| RBW/VBW | 1MHz/1MHz for Peak, 1MHz/10Hz for Average. | | |

| Frequency (MHz) | Meter Reading (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Remark | Comment |
|-----------------------------------|-------------------------------|----------------|----------------------------------|--------------------------|----------------|--------|------------|
| Low Channel (2402 MHz)-Above 1G | | | | | | | |
| 4804.228 | 61.16 | -3.64 | 57.52 | 74.00 | -16.48 | Pk | Vertical |
| 4804.228 | 42.85 | -3.64 | 39.21 | 54.00 | -14.79 | AV | Vertical |
| 7206.451 | 54.77 | -0.95 | 53.82 | 74.00 | -20.18 | Pk | Vertical |
| 7206.451 | 39.96 | -0.95 | 39.01 | 54.00 | -14.99 | AV | Vertical |
| 4804.305 | 60.02 | -3.64 | 56.38 | 74.00 | -17.62 | Pk | Horizontal |
| 4804.305 | 43.15 | -3.64 | 39.51 | 54.00 | -14.49 | AV | Horizontal |
| 7206.377 | 57.11 | -0.95 | 56.16 | 74.00 | -17.84 | Pk | Horizontal |
| 7206.377 | 39.94 | -0.95 | 38.99 | 54.00 | -15.01 | AV | Horizontal |
| Mid Channel (2441 MHz)-Above 1G | | | | | | | |
| 4882.258 | 60.99 | -3.68 | 57.31 | 74.00 | -16.69 | Pk | Vertical |
| 4882.258 | 43.72 | -3.68 | 40.04 | 54.00 | -13.96 | AV | Vertical |
| 7323.014 | 59.36 | -0.82 | 58.54 | 74.00 | -15.46 | Pk | Vertical |
| 7323.014 | 42.51 | -0.82 | 41.69 | 54.00 | -12.31 | AV | Vertical |
| 4882.361 | 59.57 | -3.68 | 55.89 | 74.00 | -18.11 | Pk | Horizontal |
| 4882.361 | 41.33 | -3.68 | 37.65 | 54.00 | -16.35 | AV | Horizontal |
| 7323.211 | 58.03 | -0.82 | 57.21 | 74.00 | -16.79 | Pk | Horizontal |
| 7323.211 | 42.23 | -0.82 | 41.41 | 54.00 | -12.59 | AV | Horizontal |
| High Channel (2480 MHz)- Above 1G | | | | | | | |
| 4960.364 | 61.12 | -3.59 | 57.53 | 74.00 | -16.47 | Pk | Vertical |
| 4960.364 | 43.55 | -3.59 | 39.96 | 54.00 | -14.04 | AV | Vertical |
| 7440.205 | 55.84 | -0.68 | 55.16 | 74.00 | -18.84 | Pk | Vertical |
| 7440.205 | 42.03 | -0.68 | 41.35 | 54.00 | -12.65 | AV | Vertical |
| 4960.251 | 61.06 | -3.59 | 57.47 | 74.00 | -16.53 | Pk | Horizontal |
| 4960.251 | 42.13 | -3.59 | 38.54 | 54.00 | -15.46 | AV | Horizontal |
| 7440.326 | 57.15 | -0.68 | 56.47 | 74.00 | -17.53 | Pk | Horizontal |
| 7440.326 | 42.09 | -0.68 | 41.41 | 54.00 | -12.59 | AV | Horizontal |

Note: Mode 3Mbps is the worst mode.

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.

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

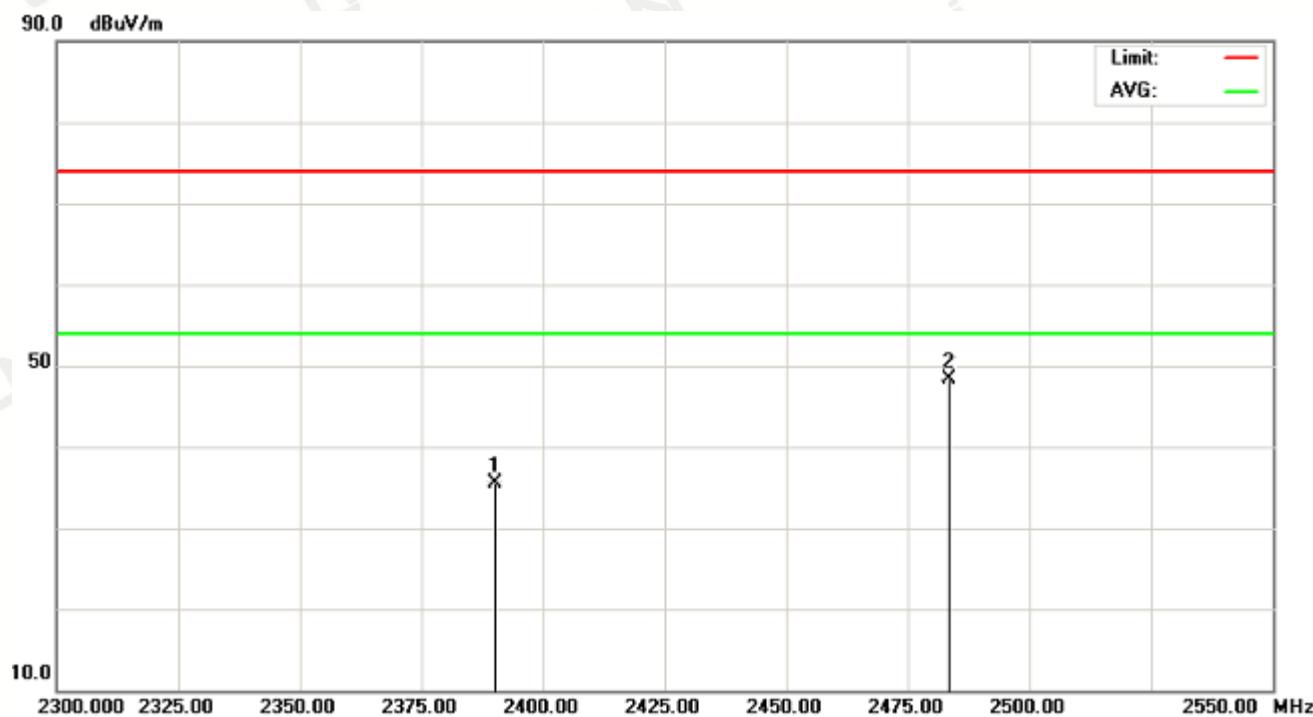
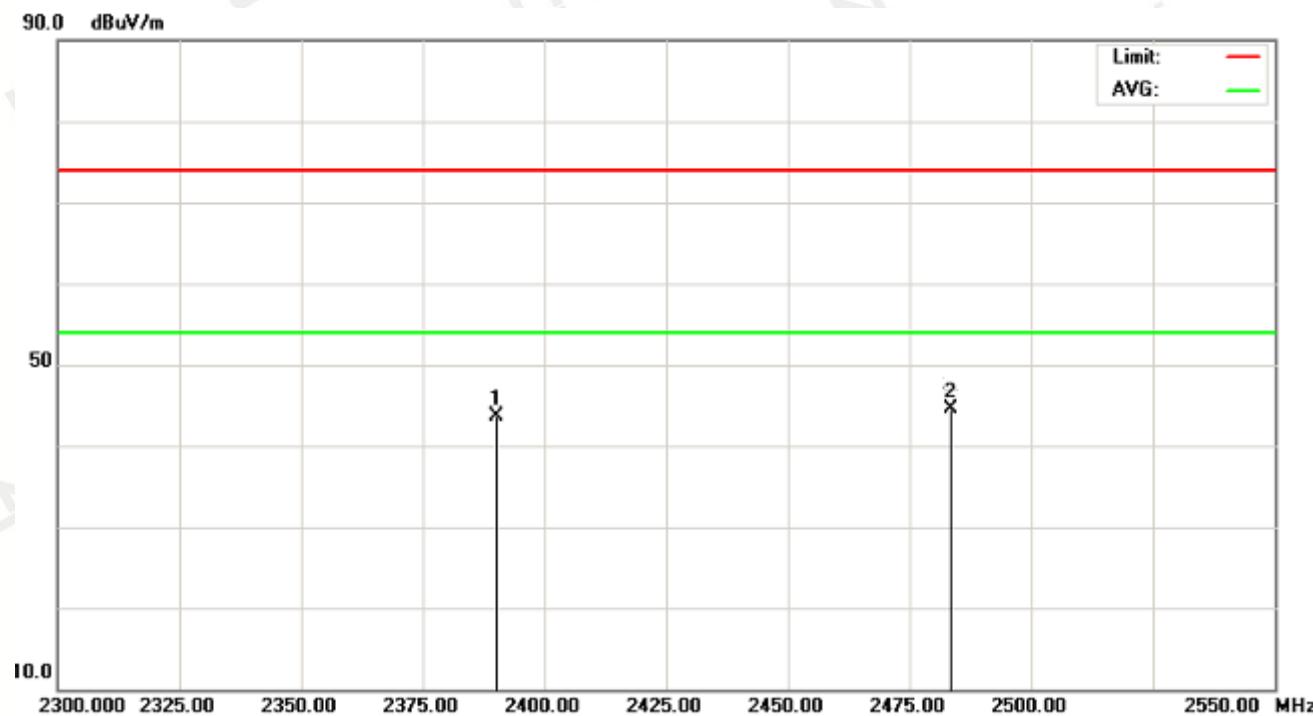
The band edge compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW to 100KHz and VBM to 300KHz to measure the peak field strength and set RBW to 1MHz and VBW to 10Hz 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

Operation Mode: TX 3Mbps Mode(Worst case)

| Freq. (MHz) | Ant.Pol. H/V | Reading | | Ant/CF CF(dB) | Act | | Limit | | Note |
|----------------|-----------------|----------------|--------------|------------------|------------------|----------------|------------------|----------------|------|
| | | Peak (dBuv) | AV (dBuv) | | Peak (dBuv/m) | AV (dBuv/m) | Peak (dBuv/m) | AV (dBuv/m) | |
| 2390.00 | H | 44.02 | -- | -5.79 | 38.23 | -- | 74.00 | 54.00 | CH00 |
| 2390.00 | V | 49.87 | -- | -5.79 | 44.08 | -- | 74.00 | 54.00 | CH00 |
| 2483.50 | H | 53.56 | -- | -4.98 | 48.58 | -- | 74.00 | 54.00 | CH78 |
| 2483.50 | V | 51.89 | -- | -4.98 | 46.91 | -- | 74.00 | 54.00 | CH78 |

Corr.Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Horizontal**Vertical**

6 OCCUPIED BANDWIDTH MEASUREMENT

6.1 Test Limit

| FCC Part15(15.247), Subpart C | | | | |
|-------------------------------|-----------|-------|-----------------------|--------|
| Section | Test Item | Limit | Frequency Range (MHz) | Result |
| 15.247(a)(1) | Bandwidth | N | 2400-2483.5 | PASS |

6.2 Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
2. Spectrum Setting: RBW= 30KHz, VBW=100KHz, Sweep time = Auto, Span=3MHz.

6.3 TEST SETUP



6.4 Test Result

PASS

| Mode | Freq | 20dB | 99%OBW | Conclusion |
|------|-------|-------|--------|------------|
| | (MHz) | (kHz) | (MHz) | |
| GFSK | 2402 | 874.1 | -- | PASS |
| | 2441 | 874.6 | -- | PASS |
| | 2480 | 870.0 | -- | PASS |

| Mode | Freq | 20dB | 99%OBW | Conclusion |
|-------|-------|-------|--------|------------|
| | (MHz) | (MHz) | (MHz) | |
| 8DPSK | 2402 | 1.215 | -- | PASS |
| | 2441 | 1.200 | -- | PASS |
| | 2480 | 1.213 | -- | PASS |

GFSK 2402 MHZ



GFSK 2441 MHZ



GFSK 2480 MHZ



8DPSK 2402 MHZ



8DPSK 2441 MHZ



8DPSK 2480 MHZ



7 CARRIER FREQUENCY SEPARATION TEST

7.1 Test Limit

Section 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 2400-2483.5 MHz 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 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

7.2 Test Procedure

1. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
2. The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were utilised for 20 dB bandwidth measurement.
3. The resolution bandwidth of 300 kHz and the video bandwidth of 1 MHz were utilised for channel separation measurement.

7.3 TEST SETUP



7.4 Test Result

PASS

GFSK

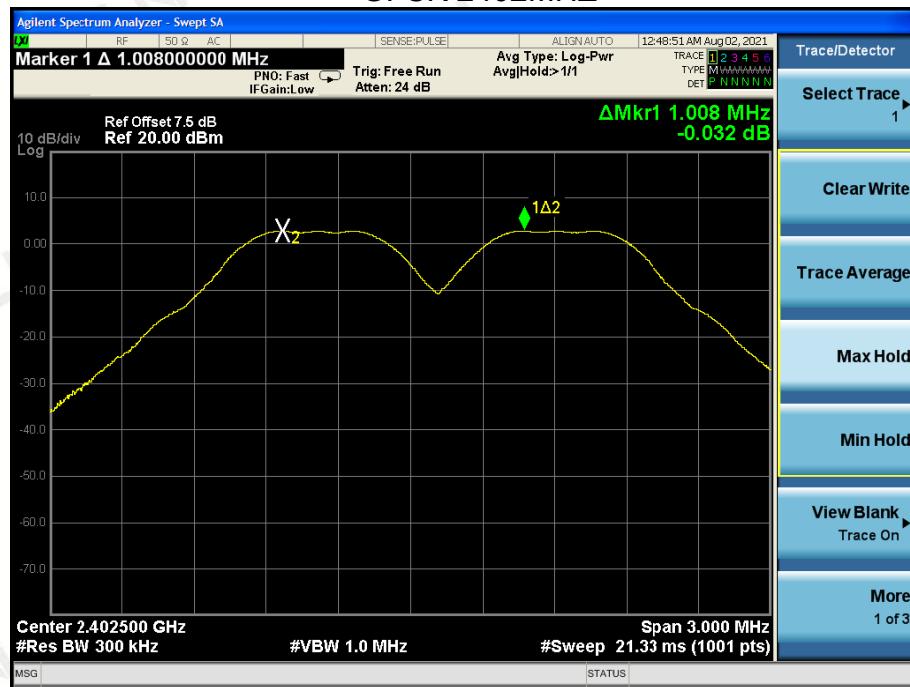
| Channel | Frequency (MHz) | Channel Separation(MHz) | Limit (MHz) | Result |
|---------|-----------------|-------------------------|--------------------------------|--------|
| Low | 2402 | 1.008 | >(25KHz or 2/3*20dB Bandwidth) | PASS |
| Middle | 2441 | 0.993 | >(25KHz or 2/3*20dB Bandwidth) | PASS |
| High | 2480 | 0.993 | >(25KHz or 2/3*20dB Bandwidth) | PASS |

8DPSK

| Channel | Frequency (MHz) | Channel Separation(MHz) | Limit (MHz) | Result |
|---------|-----------------|-------------------------|--------------------------------|--------|
| Low | 2402 | 0.999 | >(25KHz or 2/3*20dB Bandwidth) | PASS |
| Middle | 2441 | 1.005 | >(25KHz or 2/3*20dB Bandwidth) | PASS |
| High | 2480 | 1.008 | >(25KHz or 2/3*20dB Bandwidth) | PASS |

The spectrum analyzer plots are attached as below.

GFSK 2402MHZ



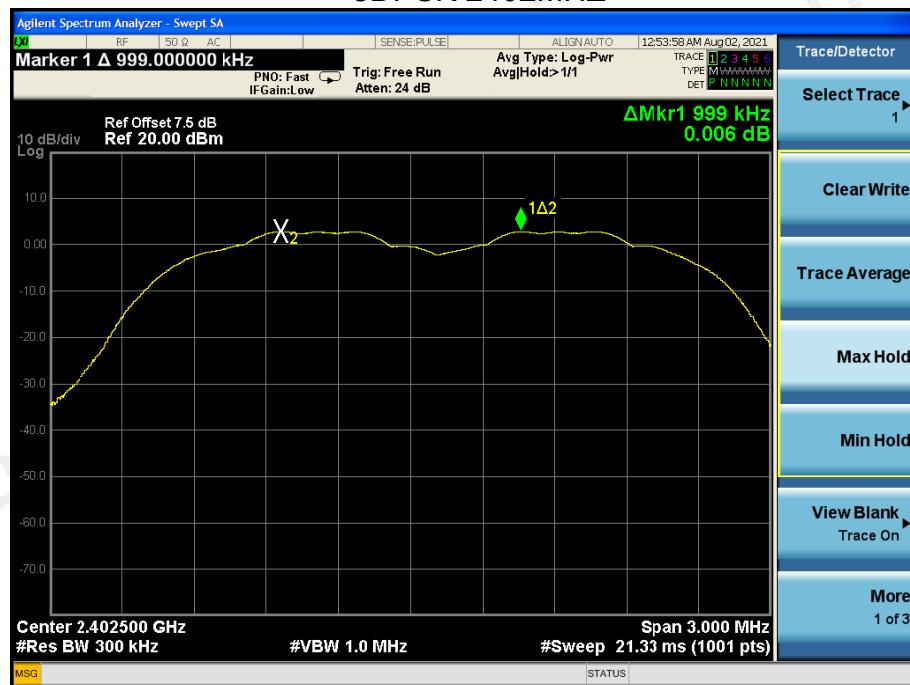
GFSK 2441MHZ



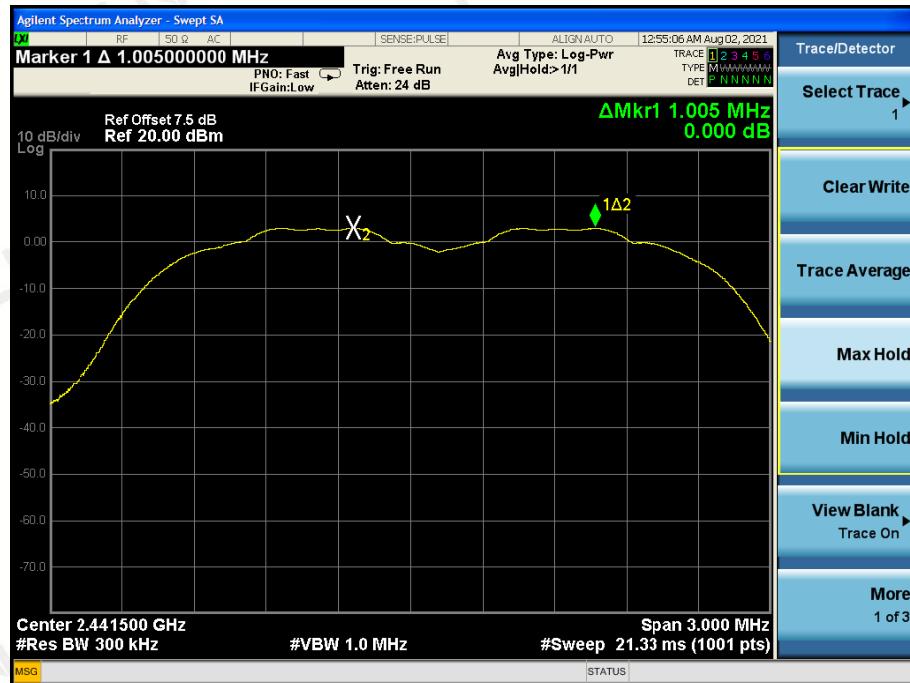
GFSK 2480MHZ



8DPSK 2402MHZ



8DPSK 2441MHZ



8DPSK 2480MHz



8 PEAK OUTPUT POWER TEST

8.1 Test Limit

| FCC Part15(15.247), Subpart C | | | | |
|-------------------------------|-------------------|-----------------|-----------------------|--------|
| Section | Test Item | Limit | Frequency Range (MHz) | Result |
| 15.247(b)(3) | Peak Output Power | 1 watt or 30dBm | 2400-2483.5 | PASS |

8.2 Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
2. Spectrum Setting : RBW=1.5 MHz, VBW= 1.5 MHz, Sweep time = Auto.

8.3 TEST SETUP

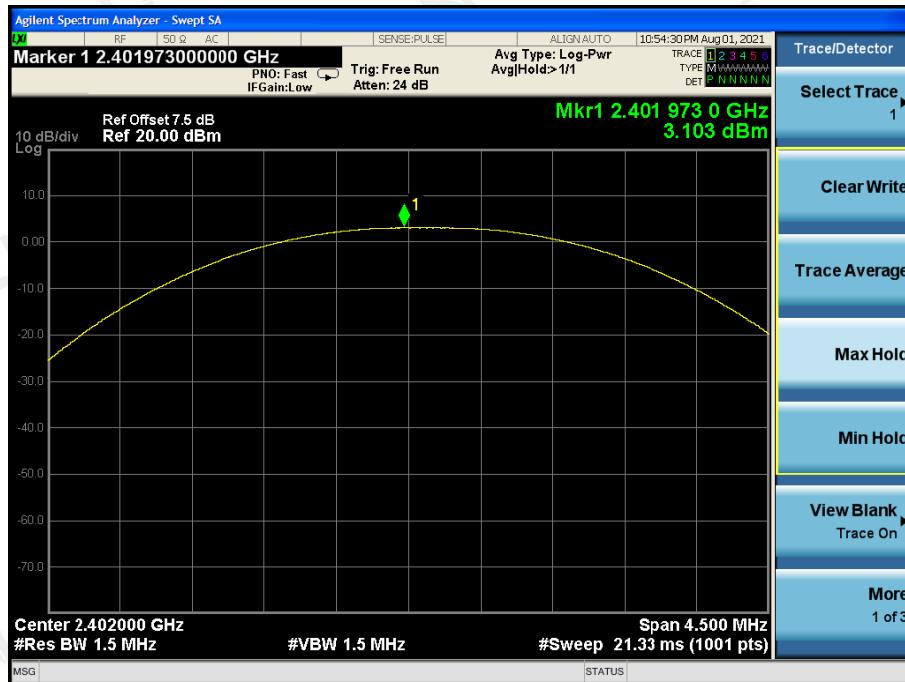


8.4 Test Result

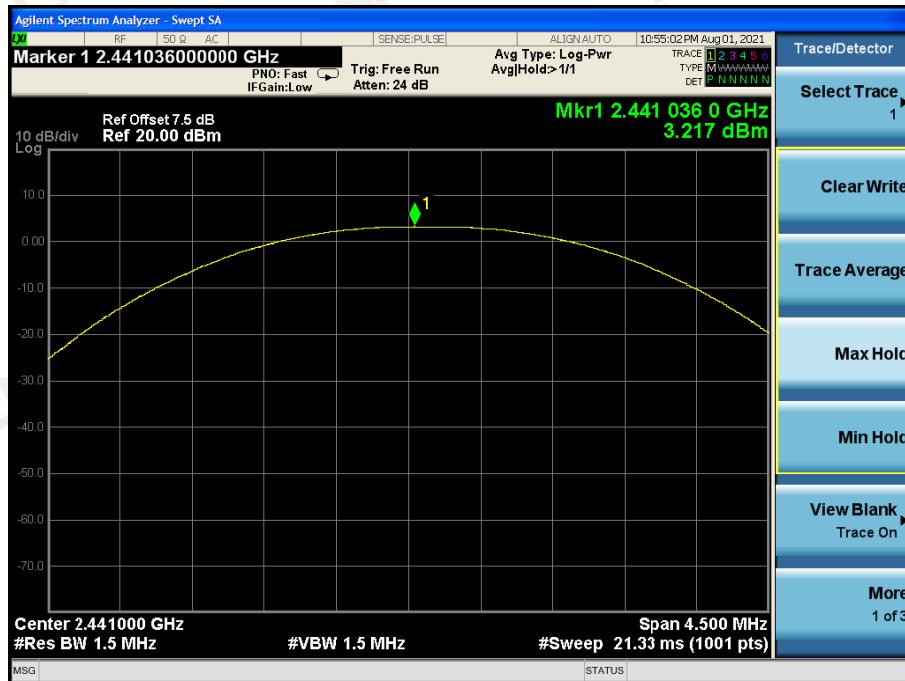
All the test modes completed for test.

| EUT Set Mode | Data Rate (Mbp/s) | Frequency | Result(dBm) |
|----------------|-------------------|------------------|-------------|
| | | (MHz) | Peak |
| GFSK | 1 | 2402 | 3.103 |
| | | 2441 | 3.217 |
| | | 2480 | 3.232 |
| $\pi/4$ -DQPSK | 2 | 2402 | 3.055 |
| | | 2441 | 3.166 |
| | | 2480 | 3.237 |
| 8DPSK | 3 | 2402 | 3.161 |
| | | 2441 | 3.225 |
| | | 2480 | 3.309 |
| Limit: 21dBm | | Conclusion: PASS | |

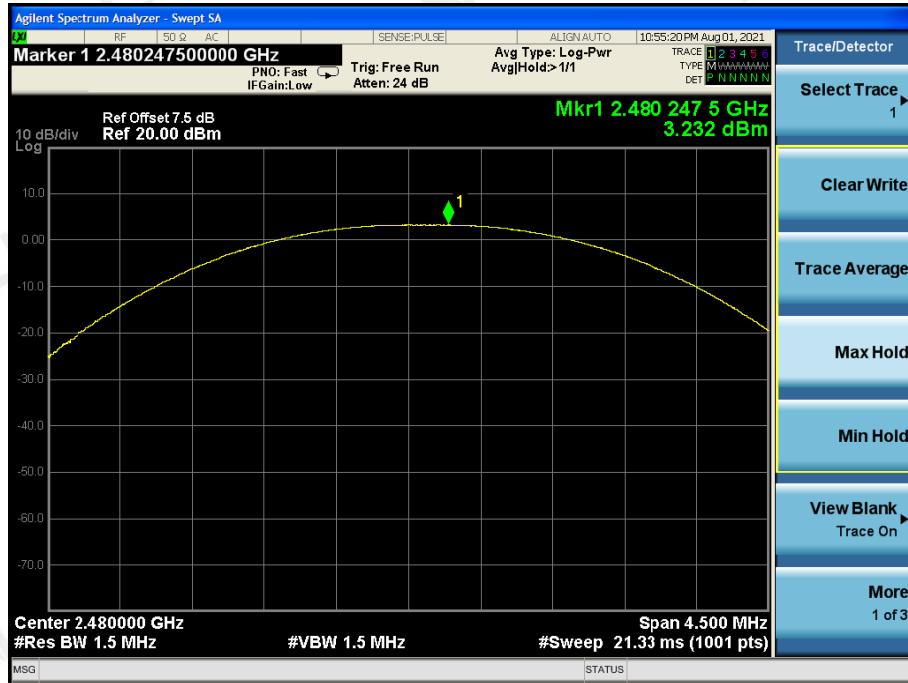
GFSK 2402MHz



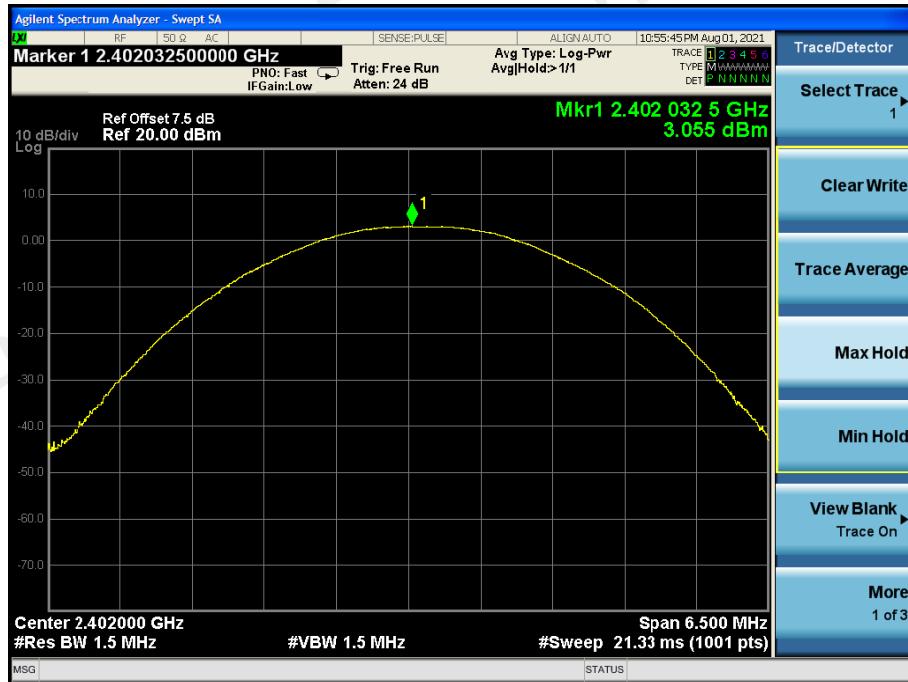
GFSK 2441MHz

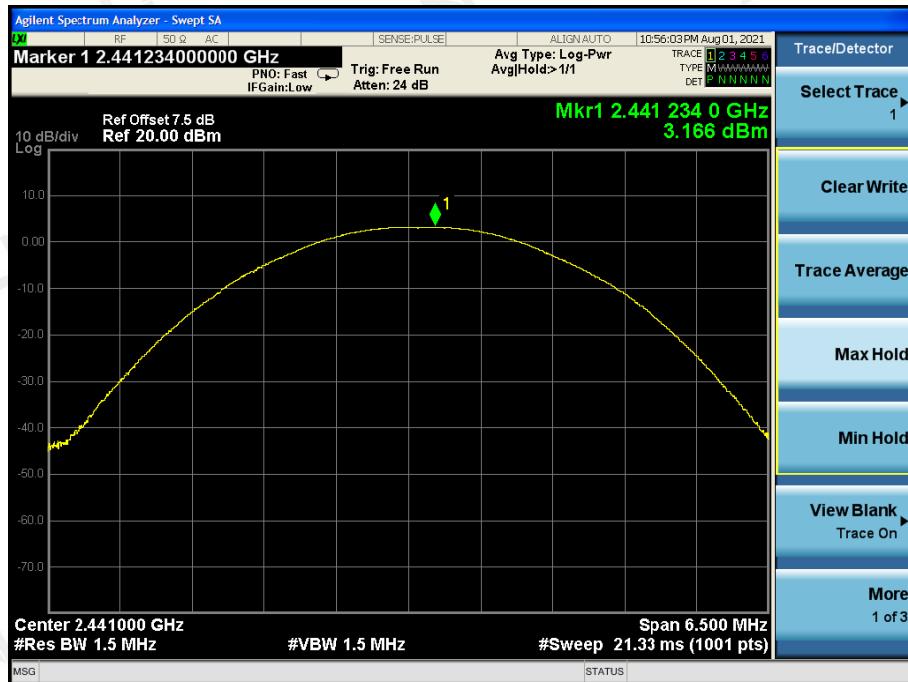
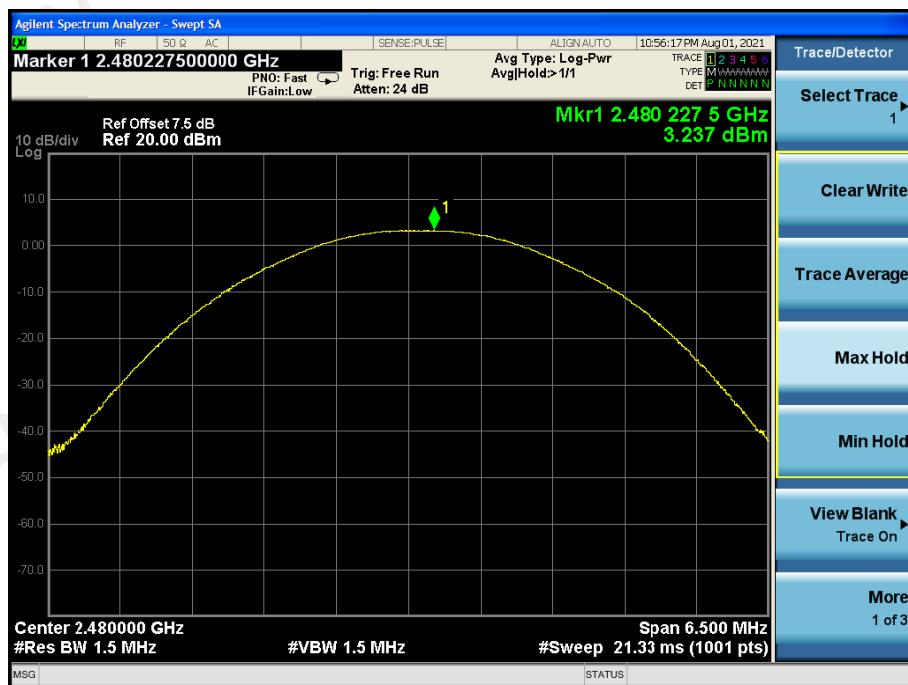


GFSK 2480MHz

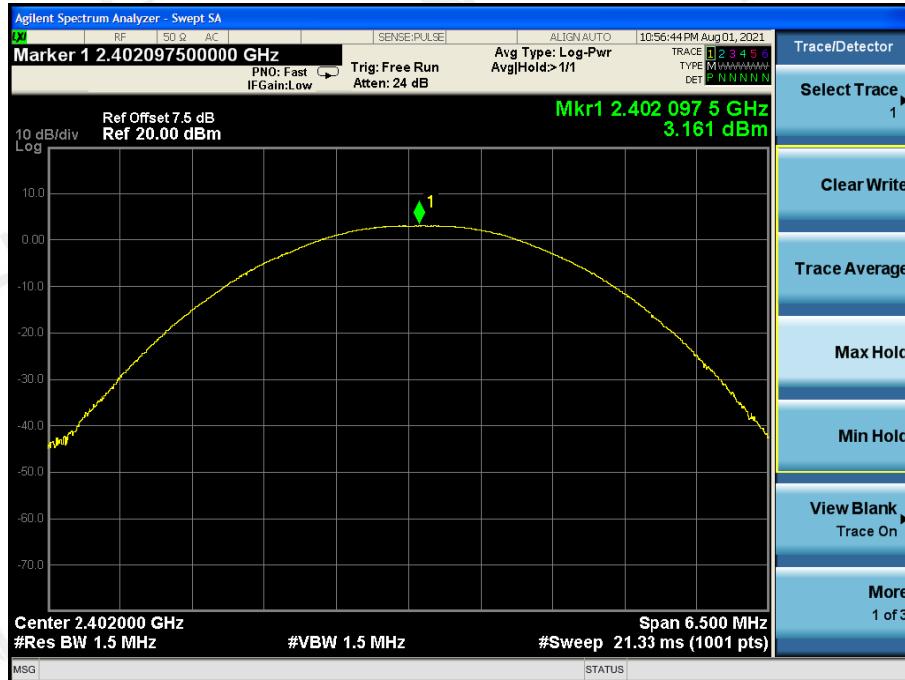


π/4-DQPSK 2402MHz

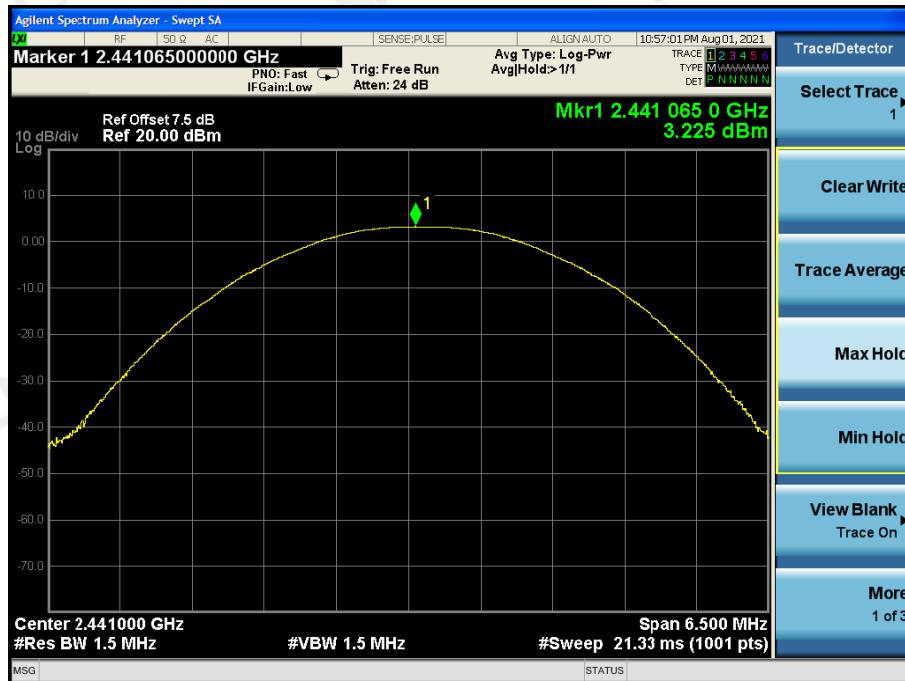


$\pi/4$ -DQPSK 2441MHz $\pi/4$ -DQPSK 2480MHz

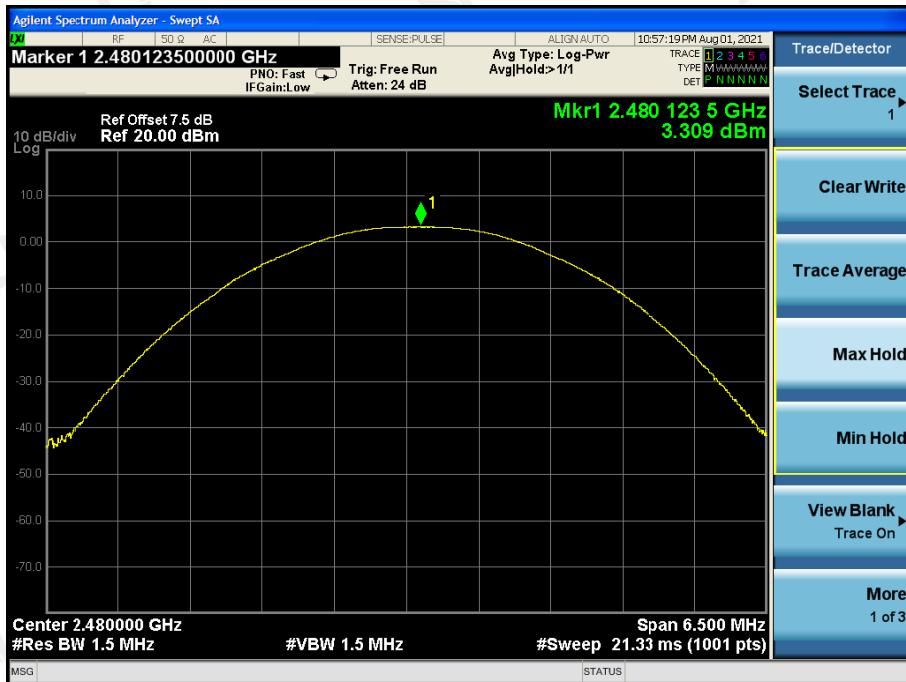
8DPSK 2402MHz



8DPSK 2441MHz



8DPSK 2480MHz



9 NUMBER OF HOPPING FREQUENCY TEST

9.1 Test Limit

Section 15.247(a)(1)(iii): Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

9.2 Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
2. Spectrum Setting : RBW= 300KHz, VBW=1 MHz, Sweep time = Auto.

9.3 Test Setup



9.4 Test Result

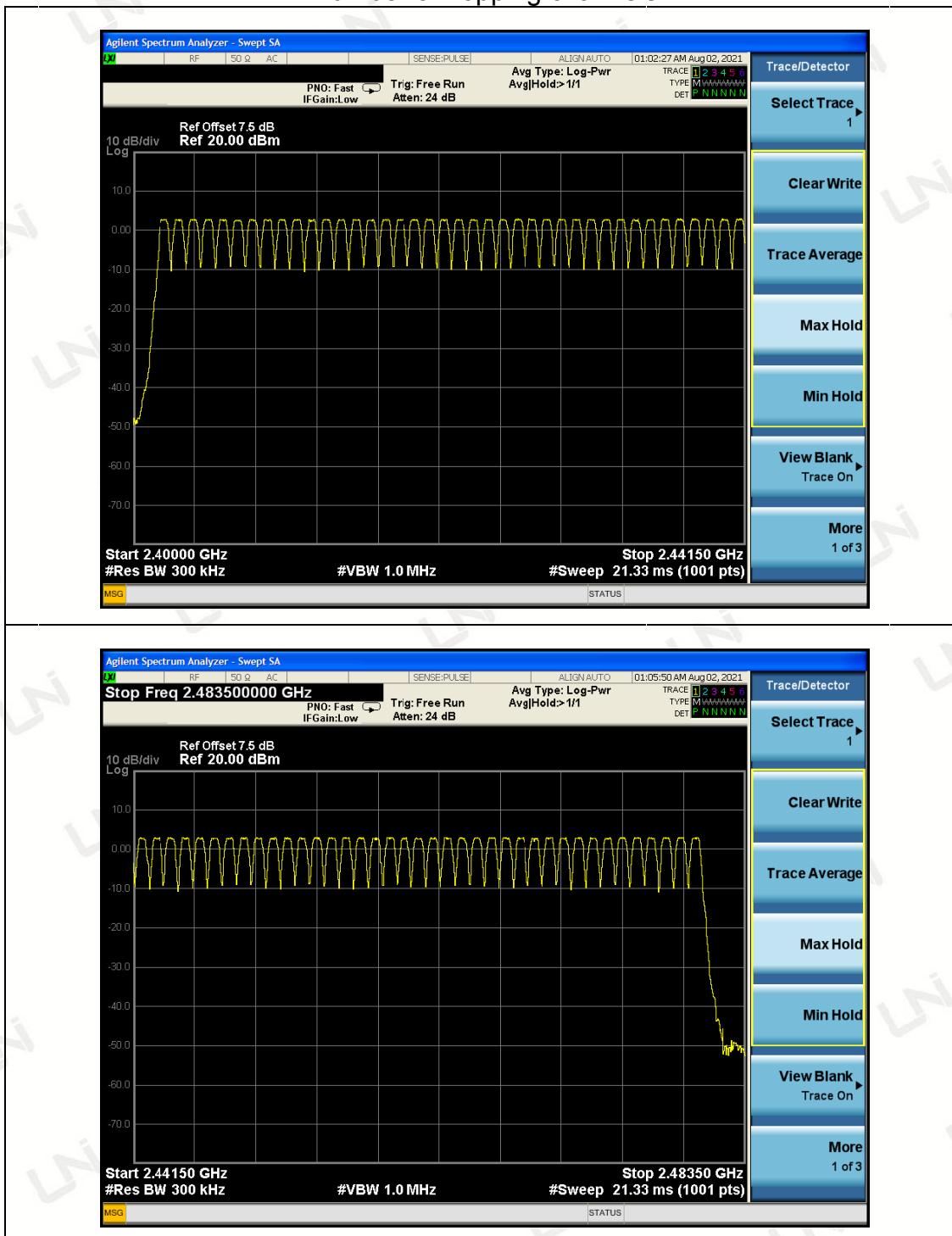
PASS

| Total number of hopping channel | Measurement result(CH) | Limit(CH) |
|---------------------------------|------------------------|-----------|
| | 79 | ≥ 15 |

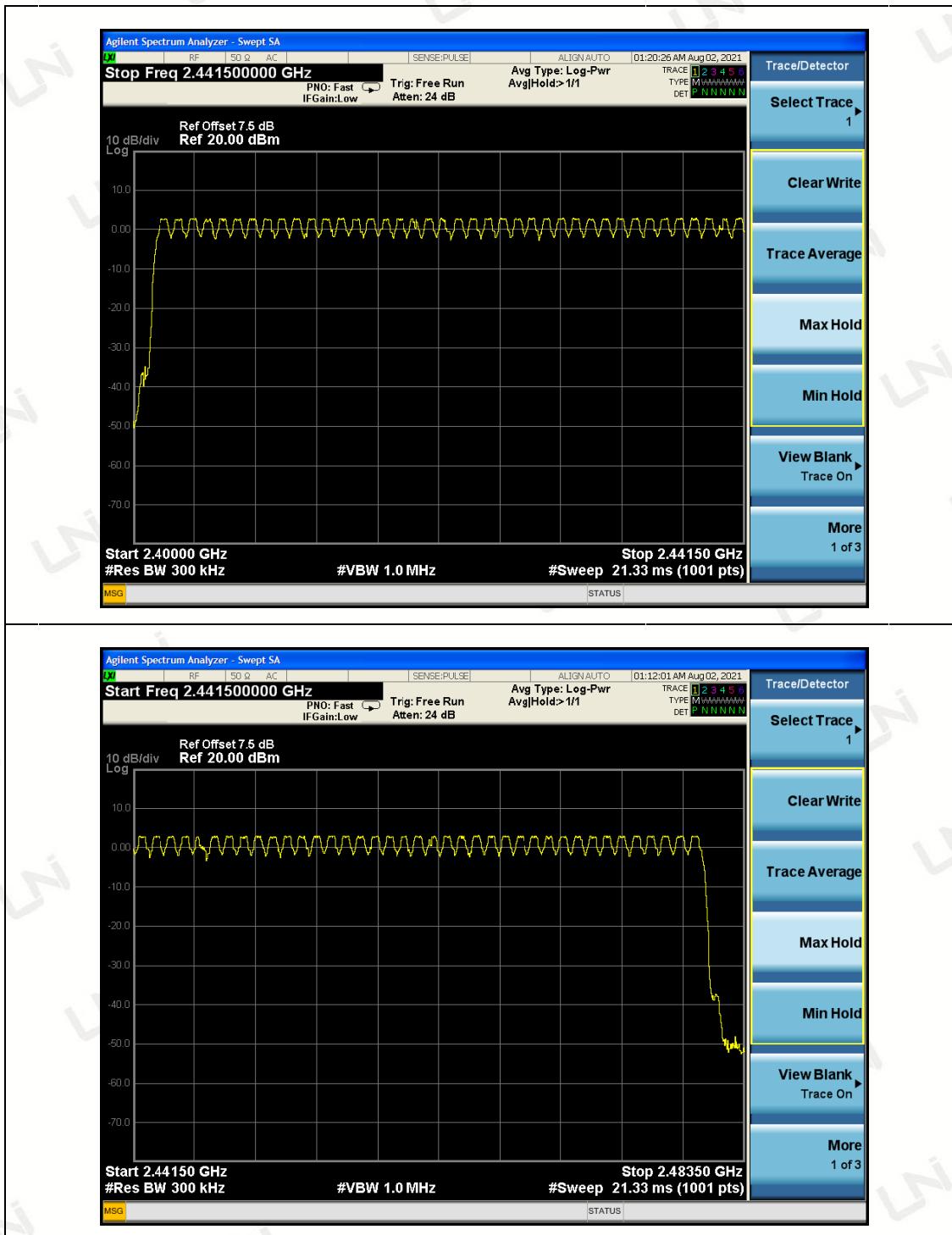
The spectrum analyzer plots are attached as below

GFSK

Number of hopping channels



8DPSK



10 DWELL TIME TEST

10.1 Test Limit

Section 15.247(a)(1)(iii): Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

10.2 Test Procedure

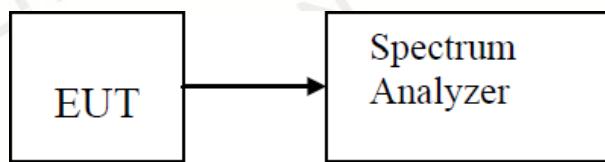
1. The transmitter output (antenna port) was connected to the spectrum analyzer
2. Set RBW of spectrum analyzer to 1MHz and VBW to 1MHz.
3. Use a video trigger with the trigger level set to enable triggering only on full pulses.
4. Sweep Time is more than once pulse time.
5. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
6. Measure the maximum time duration of one single pulse.
7. Set the EUT for DH5, DH3 and DH1 packet transmitting.
8. Measure the maximum time duration of one single pulse.

DH1 Time Slot: Reading * (1600/2)*31.6/(channel number)

DH3 Time Slot: Reading * (1600/4)*31.6/(channel number)

DH5 Time Slot: Reading * (1600/6)*31.6/(channel number)

10.3 Test Setup



10.4 Test Result

PASS

GFSK

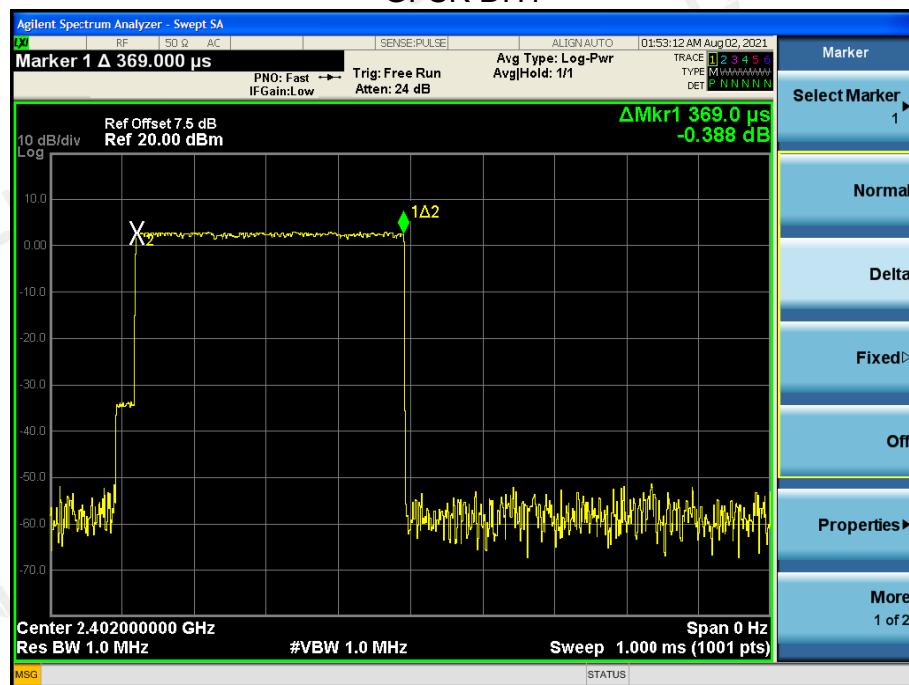
| Mode | Channel Frequency (MHz) | Pulse Time (ms) | Dwell Time (ms) | Limit (ms) |
|------|-------------------------|-----------------|-----------------|------------|
| DH1 | 2402 | 0.369 | 118.080 | 400 |
| DH3 | 2402 | 1.610 | 257.600 | 400 |
| DH5 | 2402 | 2.860 | 305.067 | 400 |

8DPSK

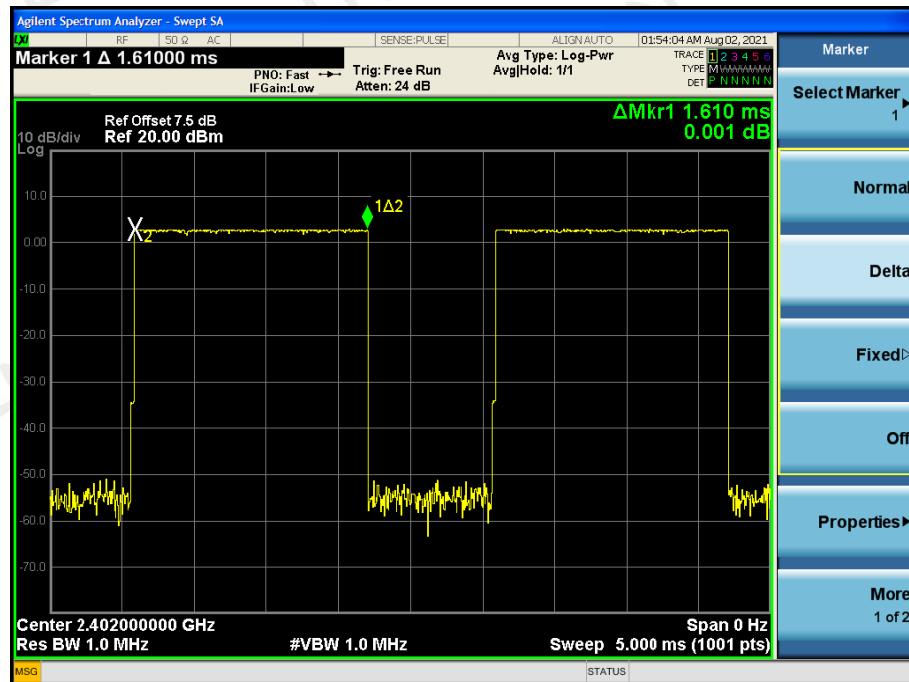
| Mode | Channel Frequency (MHz) | Pulse Time (ms) | Dwell Time (ms) | Limit (ms) |
|------|-------------------------|-----------------|-----------------|------------|
| DH1 | 2402 | 0.376 | 120.320 | 400 |
| DH3 | 2402 | 1.620 | 259.200 | 400 |
| DH5 | 2402 | 2.870 | 306.133 | 400 |

The spectrum analyzer plots are attached as below:

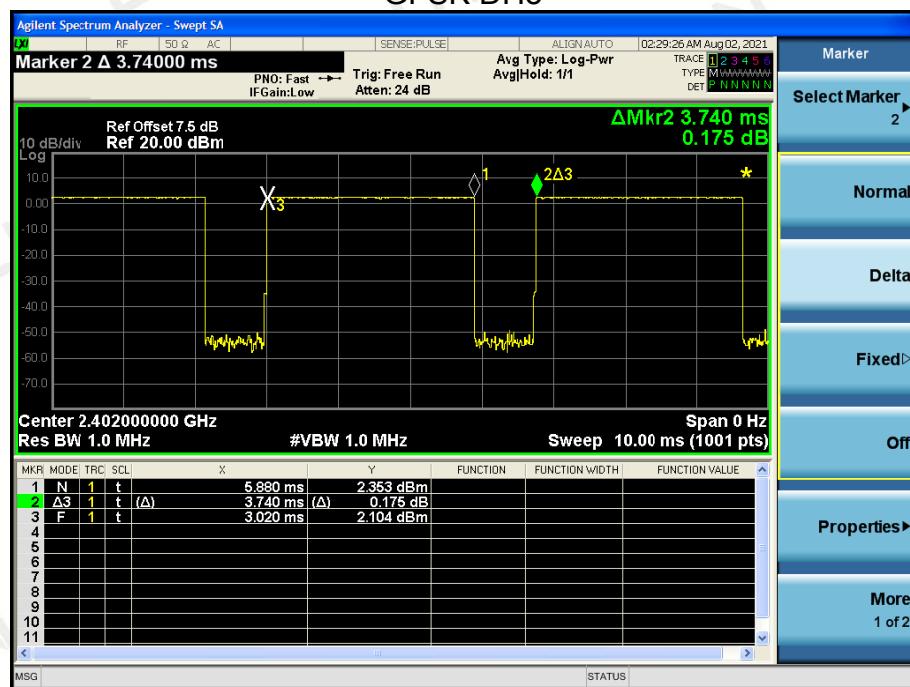
GFSK DH1



GFSK DH3



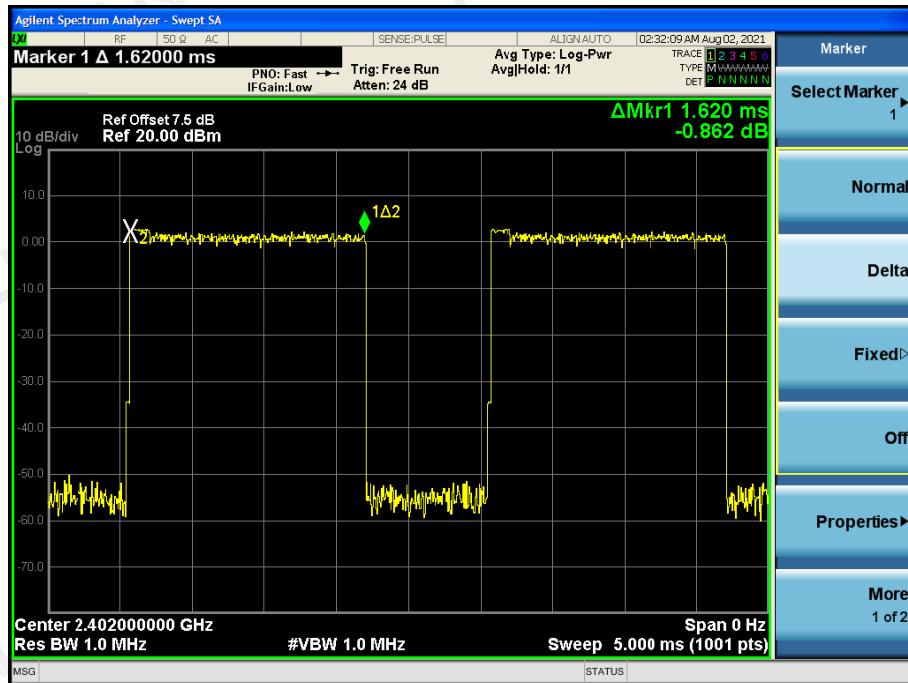
GFSK DH5



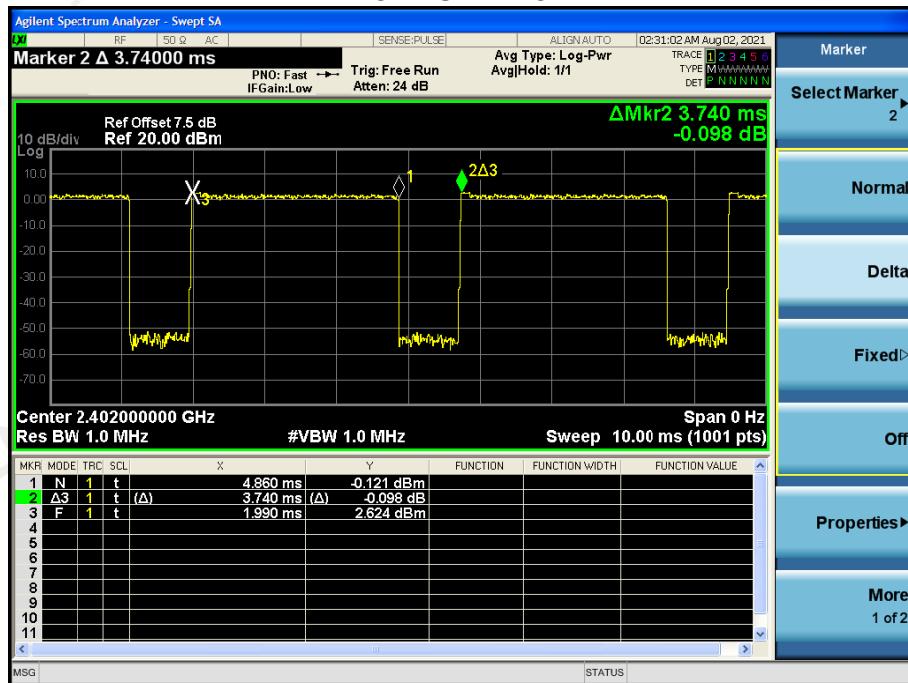
8DPSK DH1



8DPSK DH3



8DPSK DH5



11 OUT OF BAND EMISSIONS TEST

11.1 Test 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 20 dB.

11.2 Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
2. Spectrum Setting : RBW= 100KHz, VBW=300KHz, Sweep time = Auto.

11.3 Test Setup



9.4 Test Result

PASS

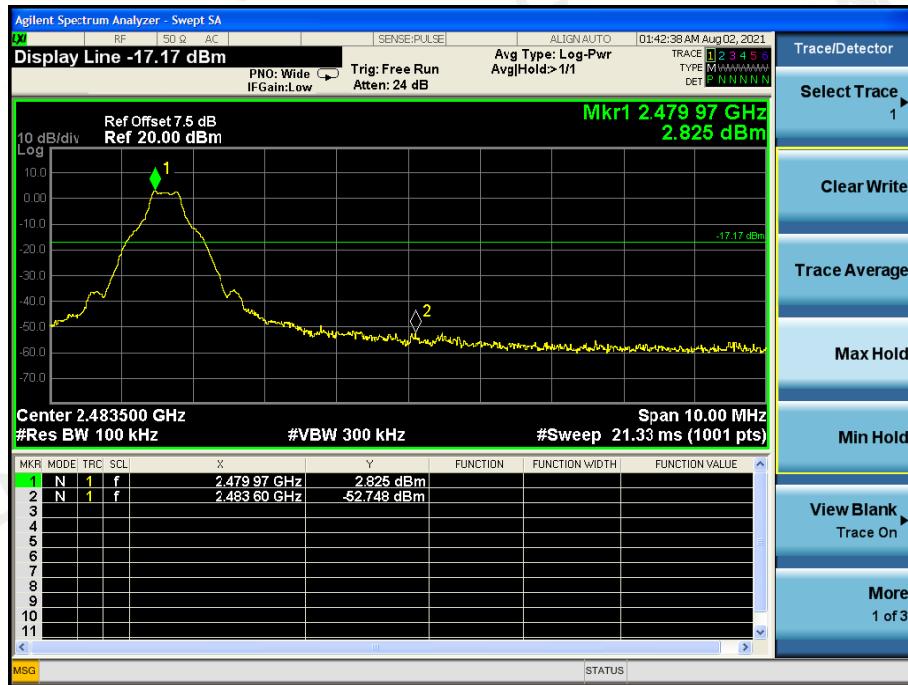
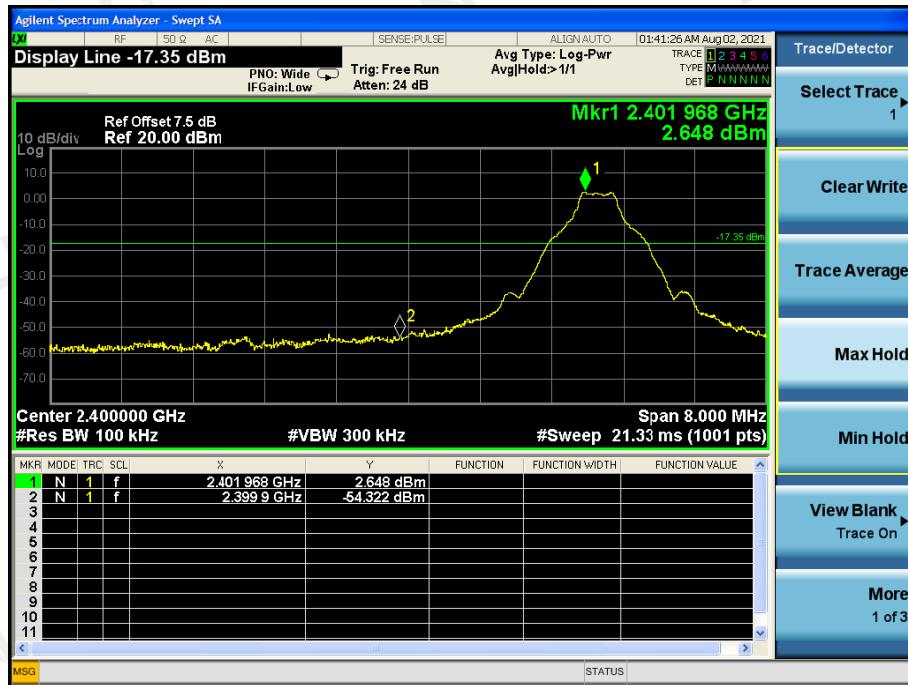
| Frequency Band | Delta Peak to band emission (dBc) | >Limit (dBc) | Result |
|------------------|--------------------------------------|-----------------|--------|
| GFSK Non-hopping | | | |
| 2400 | 56.950 | 20 | Pass |
| 2483.5 | 55.573 | 20 | Pass |

| Frequency Band | Delta Peak to band emission (dBc) | >Limit (dBc) | Result |
|----------------|--------------------------------------|-----------------|--------|
| GFSK hopping | | | |
| 2400 | 58.270 | 20 | Pass |
| 2483.5 | 56.782 | 20 | Pass |

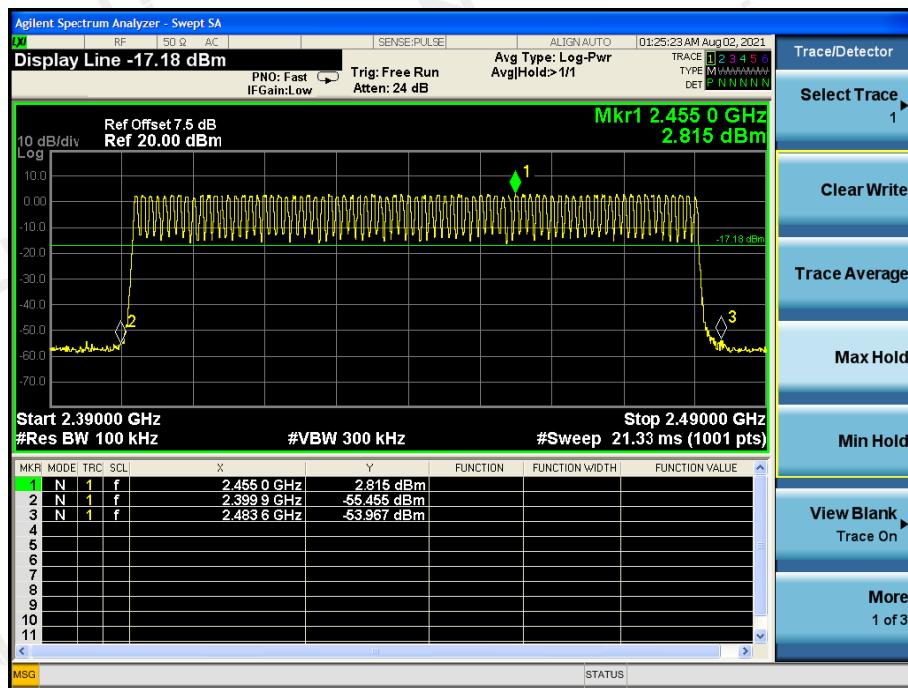
| Frequency Band | Delta Peak to band emission (dBc) | >Limit (dBc) | Result |
|-------------------|--------------------------------------|-----------------|--------|
| 8DPSK Non-hopping | | | |
| 2400 | 56.741 | 20 | Pass |
| 2483.5 | 57.349 | 20 | Pass |

| Frequency Band | Delta Peak to band emission (dBc) | >Limit (dBc) | Result |
|----------------|--------------------------------------|-----------------|--------|
| 8DPSK hopping | | | |
| 2400 | 57.393 | 20 | Pass |
| 2483.5 | 60.318 | 20 | Pass |

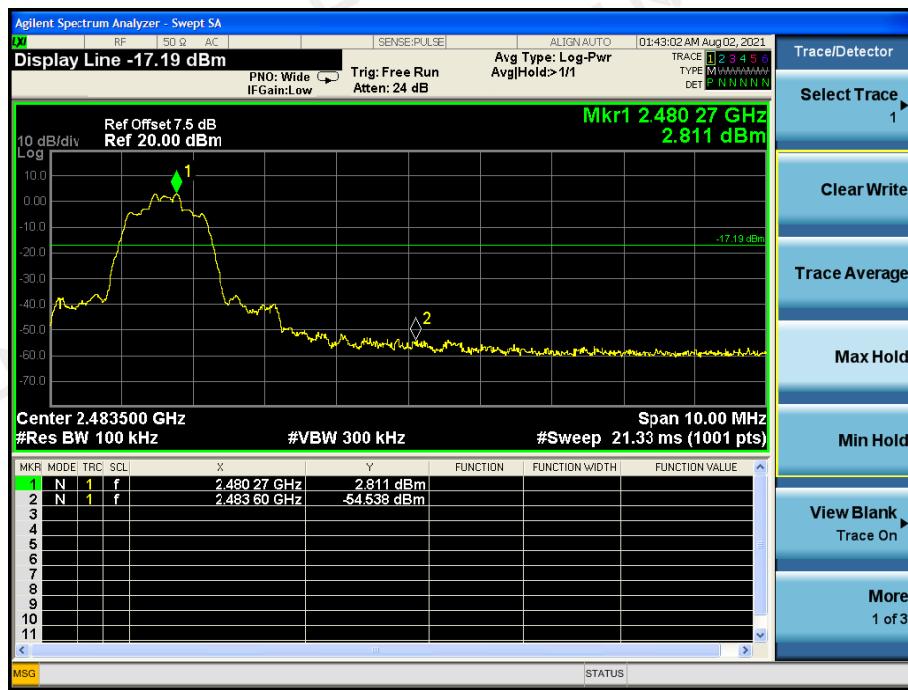
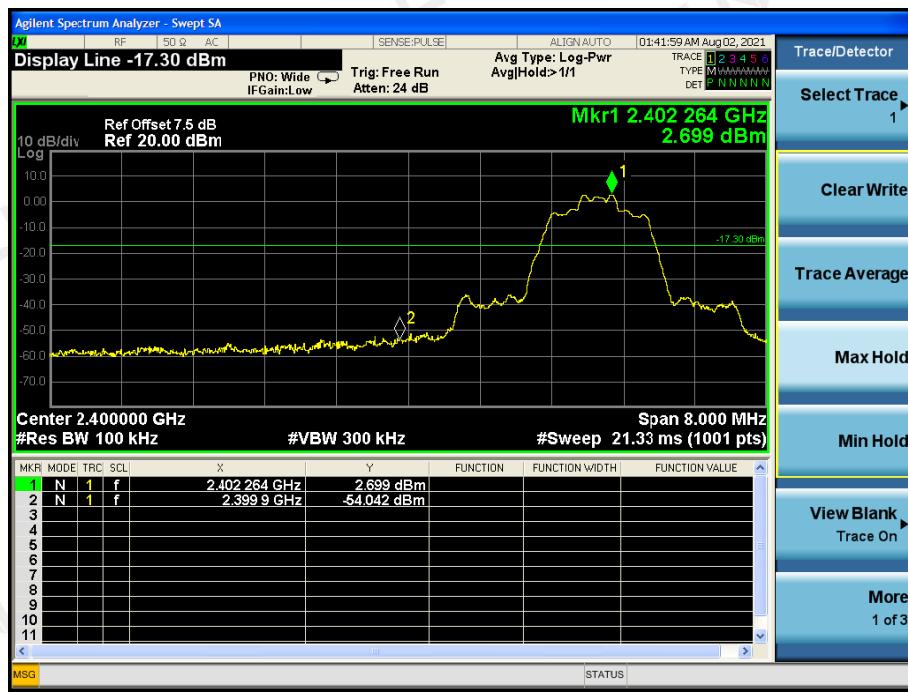
GFSK Non-hopping



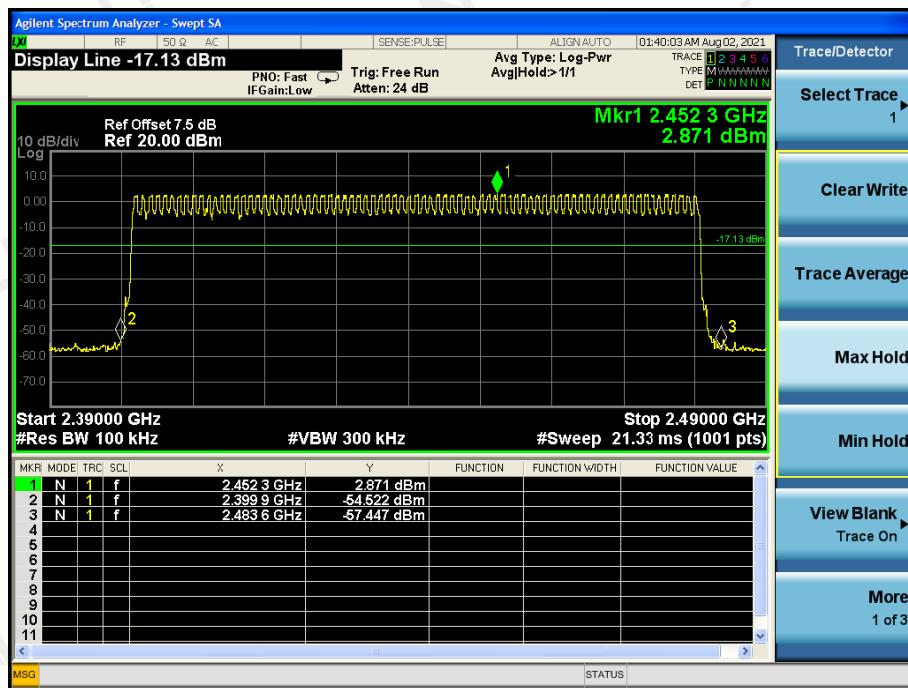
GFSK Hopping



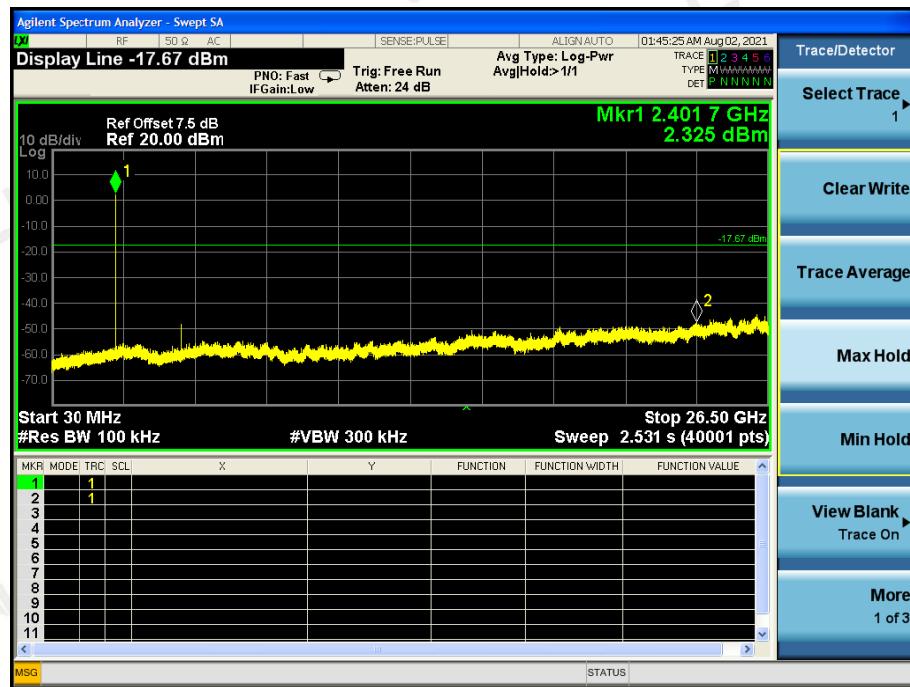
8DPSK Non-hopping



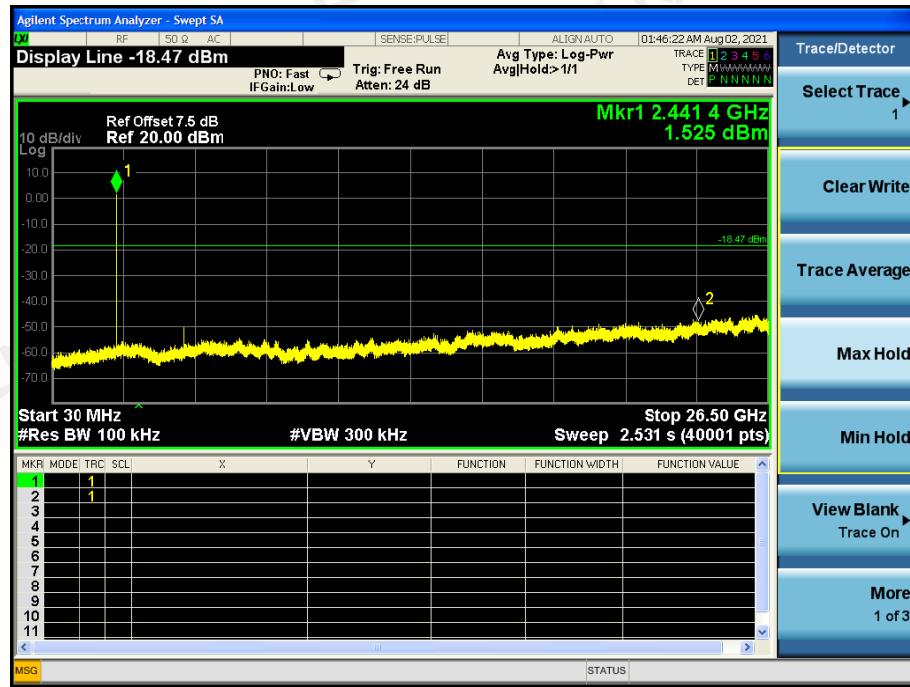
8DPSK Hopping



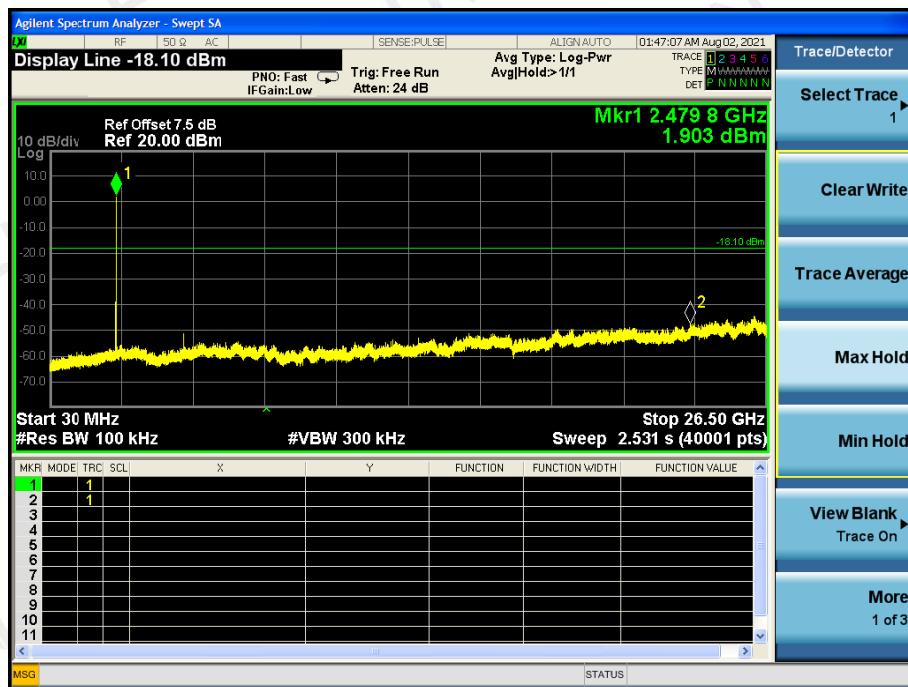
GFSK 2402MHz



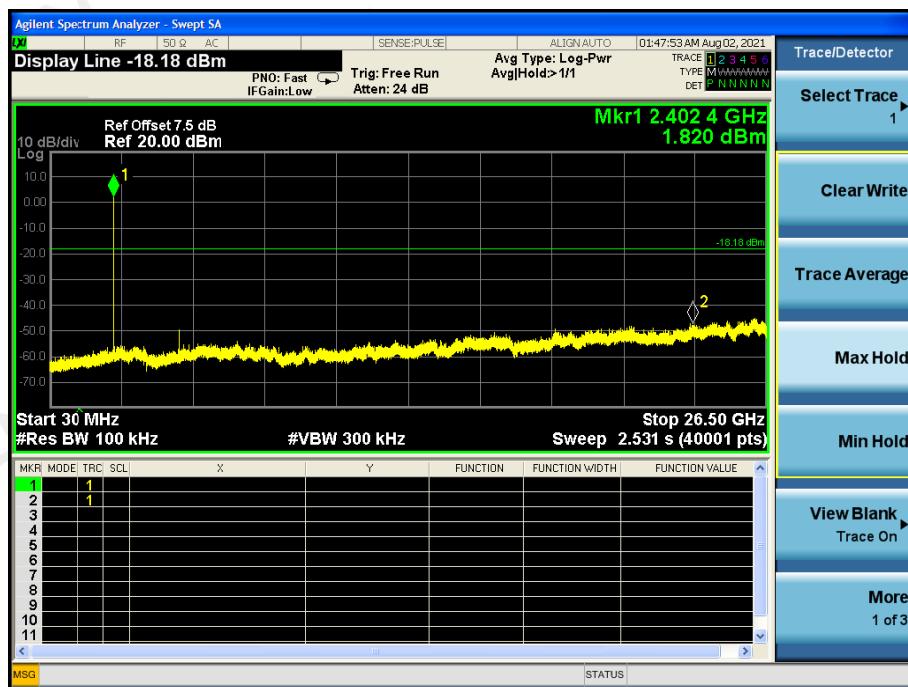
GFSK 2441MHz



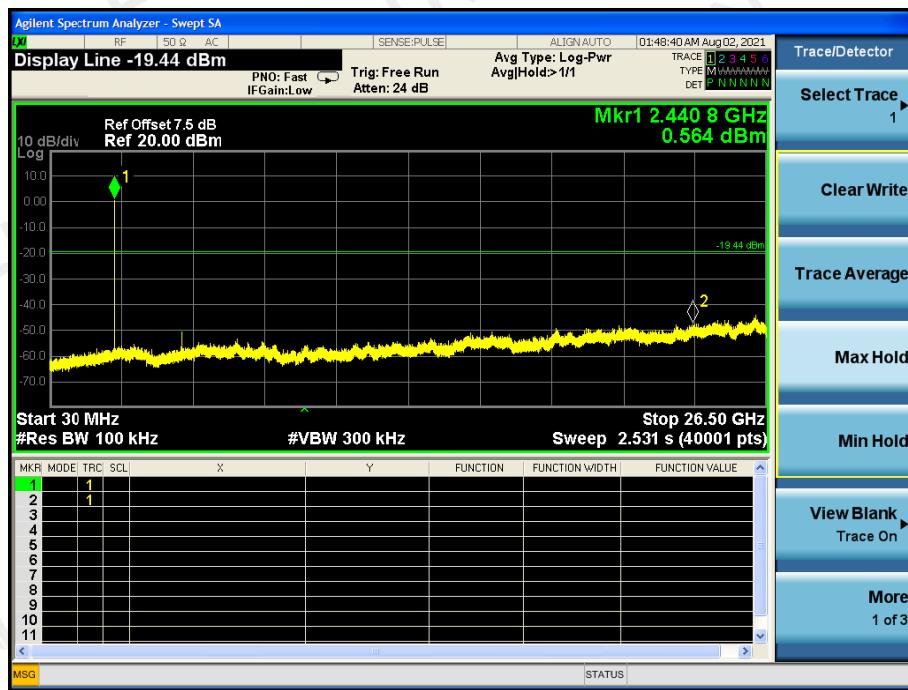
GFSK 2480MHz



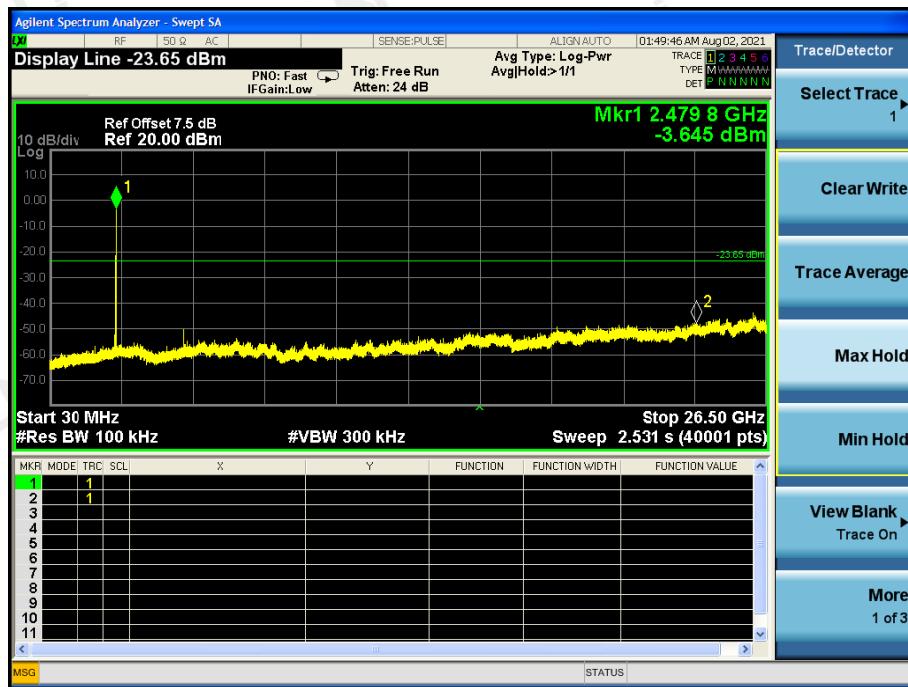
8DPSK 2402MHz



8DPSK 2441MHz



8DPSK 2480MHz



12 ANTENNA REQUIREMENT

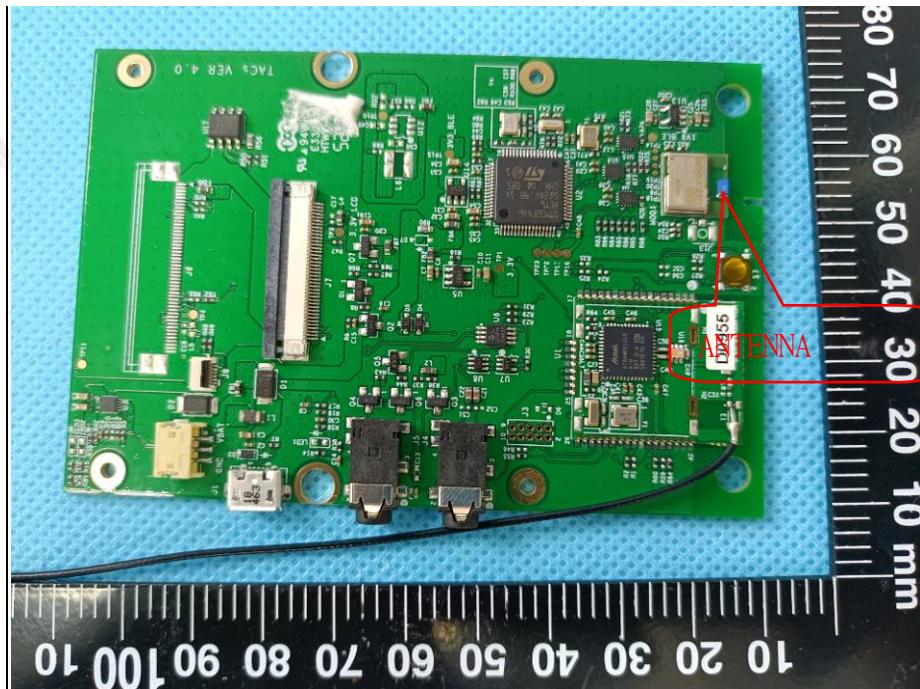
Standard Applicable:

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

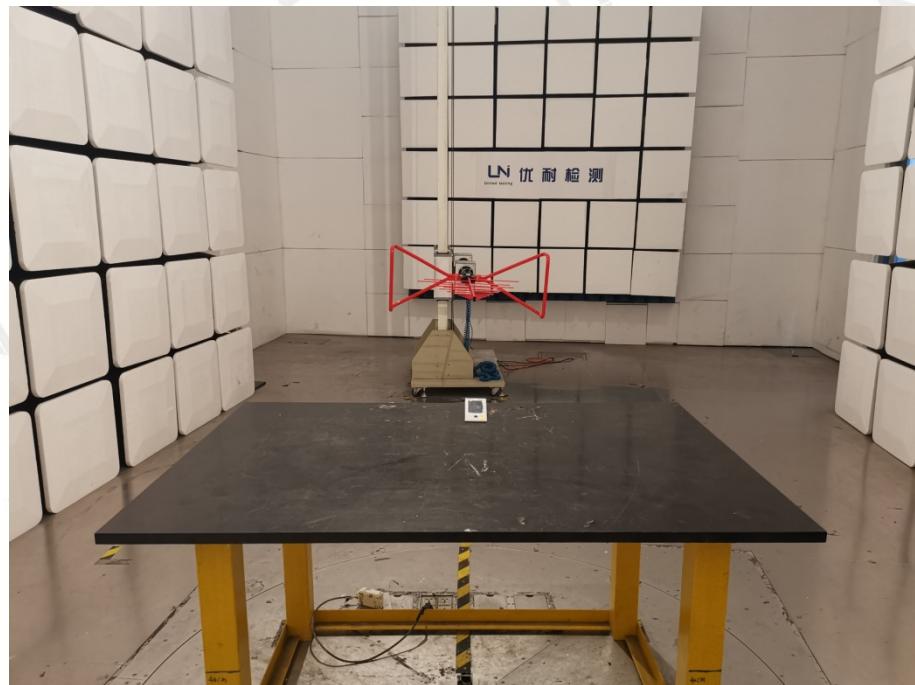
The antenna used in this product is a Chip Antenna, The directional gains of antenna used for transmitting is 0dBi.

ANTENNA:

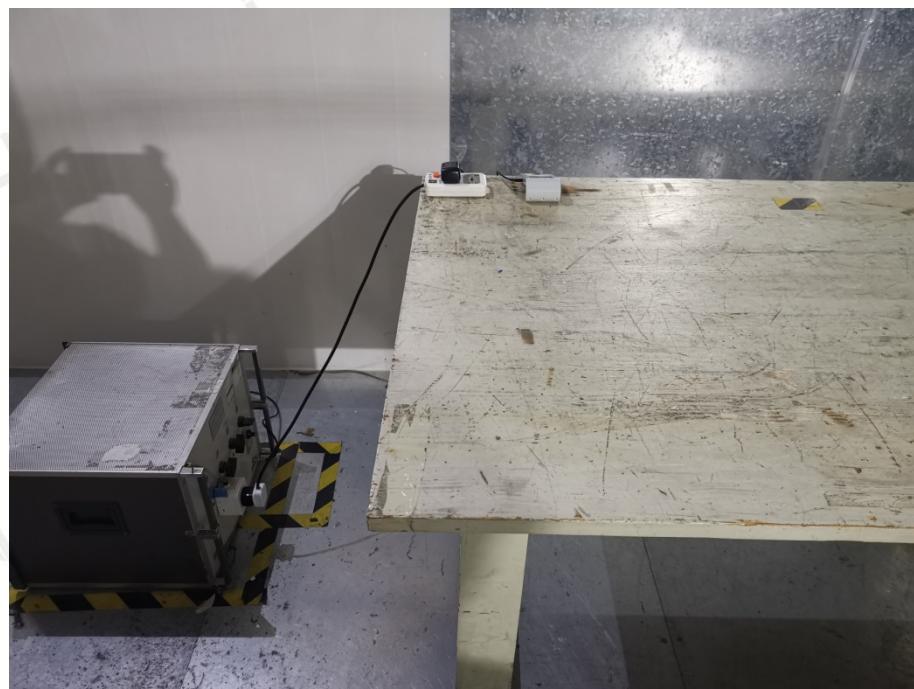


13 PHOTO OF TEST

13.1 RADIATED EMISSION



13.2 CONDUCTED EMISSION



End of Report