



# TEST Report

**Applicant:** Shenzhen seven star technology co.,LTD

**Address of Applicant:** 5/f, building 3,no.17 industrial road, sha jing, baoan district, shenzhen, China

**Manufacturer :** Shenzhen seven star technology co.,LTD

**Address of Manufacturer :** 5/f, building 3,no.17 industrial road, sha jing, baoan district, shenzhen, China

**Equipment Under Test (EUT)**

Product Name: Portable Mini Printer

Model No.: X5

Series model: X1, X2, X3, X6, X 7, X8, X9

Trade Mark: 书包郎

FCC ID: 2A5WI-X5

**Applicable standards:** FCC CFR Title 47 Part 15 Subpart C Section 15.247

**Date of sample receipt:** Mar.10,2022

**Date of Test:** Mar.10,2022- Mar.25,2022

**Date of report issued:** Mar.25,2022

**Test Result :** PASS \*

\* In the configuration tested, the EUT complied with the standards specified above.



Report No.: HTT202203179F01

## 1. Version

| Version No. | Date        | Description |
|-------------|-------------|-------------|
| 00          | Mar.25,2022 | Original    |
|             |             |             |
|             |             |             |
|             |             |             |
|             |             |             |

Tested/ Prepared By Ervin Xu Date: Mar.25,2022  
Project Engineer

Check By: Bruce Zhu Date: Mar.25,2022  
Reviewer

Approved By : Kevin Yang Date: Mar.25,2022  
Authorized Signature



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### 3. Test Summary

| Test Item                        | Section in CFR 47  | Result |
|----------------------------------|--------------------|--------|
| Antenna Requirement              | 15.203/15.247 (c)  | Pass   |
| AC Power Line Conducted Emission | 15.207             | Pass   |
| Conducted Peak Output Power      | 15.247 (b)(1)      | Pass   |
| 20dB Occupied Bandwidth          | 15.247 (a)(1)      | Pass   |
| Carrier Frequencies Separation   | 15.247 (a)(1)      | Pass   |
| Hopping Channel Number           | 15.247 (a)(1)(iii) | Pass   |
| Dwell Time                       | 15.247 (a)(1)(iii) | Pass   |
| Radiated Emission                | 15.205/15.209      | Pass   |
| Band Edge                        | 15.247(d)          | Pass   |

**Remarks:**

1. Pass: The EUT complies with the essential requirements in the standard.
2. Test according to ANSI C63.10:2013

#### Measurement Uncertainty

| Test Item                     | Frequency Range | Measurement Uncertainty | Notes |
|-------------------------------|-----------------|-------------------------|-------|
| Radiated Emission             | 9k~30MHz        | 3.17 dB                 | (1)   |
| Radiated Emission             | 30~1000MHz      | 3.45 dB                 | (1)   |
| Radiated Emission             | 1~6GHz          | 3.54 dB                 | (1)   |
| Radiated Emission             | >6GHz           | 4.89dB                  | (1)   |
| Conducted Disturbance         | 0.15~30MHz      | 2.66 dB                 | (1)   |
| RF power, conducted           | /               | 0.16 dB                 | (1)   |
| Spurious emissions, conducted | /               | 0.21dB                  | (1)   |

Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.



## 4. General Information

### 4.1. General Description of EUT

|                                                                           |                                                                                     |
|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Product Name:                                                             | Portable Mini Printer                                                               |
| Model No.:                                                                | X5                                                                                  |
| Series model:                                                             | X1, X2, X3, X6, X 7, X8, X9                                                         |
| Model Difference                                                          | All the model are the same circuit and RF module, except the model name and colour. |
| Operation Frequency:                                                      | 2402MHz~2480MHz                                                                     |
| Channel numbers:                                                          | 79                                                                                  |
| Channel separation:                                                       | 1MHz                                                                                |
| Modulation type:                                                          | GFSK, $\pi/4$ -DQPSK, 8QPSK                                                         |
| Antenna Type:                                                             | PCB Antenna                                                                         |
| Antenna gain:                                                             | 1.0dBi                                                                              |
| Power supply:                                                             | DC 3.7V/800mAh Form Battery and DC 5V From External Circuit                         |
| Adapter Information<br>(auxiliary test equipment<br>supplied by test Lab) | N/A                                                                                 |



| Operation Frequency each of channel |           |         |           |         |           |         |           |
|-------------------------------------|-----------|---------|-----------|---------|-----------|---------|-----------|
| Channel                             | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 1                                   | 2402MHz   | 21      | 2422MHz   | 41      | 2442MHz   | 61      | 2462MHz   |
| 2                                   | 2403MHz   | 22      | 2423MHz   | 42      | 2443MHz   | 62      | 2463MHz   |
| 3                                   | 2404MHz   | 23      | 2424MHz   | 43      | 2444MHz   | 63      | 2464MHz   |
| 4                                   | 2405MHz   | 24      | 2425MHz   | 44      | 2445MHz   | 64      | 2465MHz   |
| 5                                   | 2406MHz   | 25      | 2426MHz   | 45      | 2446MHz   | 65      | 2466MHz   |
| 6                                   | 2407MHz   | 26      | 2427MHz   | 46      | 2447MHz   | 66      | 2467MHz   |
| 7                                   | 2408MHz   | 27      | 2428MHz   | 47      | 2448MHz   | 67      | 2468MHz   |
| 8                                   | 2409MHz   | 28      | 2429MHz   | 48      | 2449MHz   | 68      | 2469MHz   |
| 9                                   | 2410MHz   | 29      | 2430MHz   | 49      | 2450MHz   | 69      | 2470MHz   |
| 10                                  | 2411MHz   | 30      | 2431MHz   | 50      | 2451MHz   | 70      | 2471MHz   |
| 11                                  | 2412MHz   | 31      | 2432MHz   | 51      | 2452MHz   | 71      | 2472MHz   |
| 12                                  | 2413MHz   | 32      | 2433MHz   | 52      | 2453MHz   | 72      | 2473MHz   |
| 13                                  | 2414MHz   | 33      | 2434MHz   | 53      | 2454MHz   | 73      | 2474MHz   |
| 14                                  | 2415MHz   | 34      | 2435MHz   | 54      | 2455MHz   | 74      | 2475MHz   |
| 15                                  | 2416MHz   | 35      | 2436MHz   | 55      | 2456MHz   | 75      | 2476MHz   |
| 16                                  | 2417MHz   | 36      | 2437MHz   | 56      | 2457MHz   | 76      | 2477MHz   |
| 17                                  | 2418MHz   | 37      | 2438MHz   | 57      | 2458MHz   | 77      | 2478MHz   |
| 18                                  | 2419MHz   | 38      | 2439MHz   | 58      | 2459MHz   | 78      | 2479MHz   |
| 19                                  | 2420MHz   | 39      | 2440MHz   | 59      | 2460MHz   | 79      | 2480MHz   |
| 20                                  | 2421MHz   | 40      | 2441MHz   | 60      | 2461MHz   |         |           |

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

| Channel             | Frequency |
|---------------------|-----------|
| The lowest channel  | 2402MHz   |
| The middle channel  | 2441MHz   |
| The Highest channel | 2480MHz   |



#### 4.2. Test mode

|                                                                                                                                                                                                                                              |                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| Transmitting mode                                                                                                                                                                                                                            | Keep the EUT in continuously transmitting mode. |
| <i>Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.</i> |                                                 |

#### 4.3. Description of Support Units

|       |
|-------|
| None. |
|-------|

#### 4.4. Deviation from Standards

|       |
|-------|
| None. |
|-------|

#### 4.5. Abnormalities from Standard Conditions

|       |
|-------|
| None. |
|-------|

#### 4.6. Test Facility

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>The test facility is recognized, certified, or accredited by the following organizations:</p> <p><b>FCC-Registration No.: 779513 Designation Number: CN1319</b><br/>Shenzhen HTT Technology Co.,Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.</p> <p><b>A2LA-Lab Cert. No.: 6435.01</b><br/>Shenzhen HTT Technology Co.,Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.</p> <p>The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010.</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### 4.7. Test Location

|                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| All tests were performed at:                                                                                                                                                                                                                             |
| <p>Shenzhen HTT Technology Co.,Ltd.<br/>1F, Building B, Huafeng International Robotics Industrial Park, Hangcheng Road,Nanchang Community, Xixiang Street, Bao'an District, Shenzhen, Guangdong, China<br/>Tel: 0755-23595200<br/>Fax: 0755-23595201</p> |

#### 4.8. Additional Instructions

|                   |                                                                                                                     |
|-------------------|---------------------------------------------------------------------------------------------------------------------|
| Test Software     | Special AT test command provided by manufacturer to Keep the EUT in continuously transmitting mode and hopping mode |
| Power level setup | Default                                                                                                             |

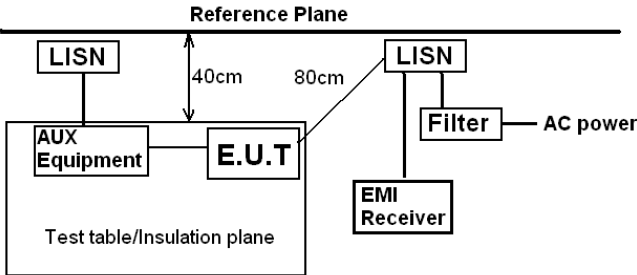


## 5. Test Instruments list

| Item | Test Equipment                  | Manufacturer                        | Model No.          | Inventory No. | Cal.Date (mm-dd-yy) | Cal.Due date (mm-dd-yy) |
|------|---------------------------------|-------------------------------------|--------------------|---------------|---------------------|-------------------------|
| 1    | 3m Semi- Anechoic Chamber       | Shenzhen C.R.T technology co., LTD  | 9*6*6              | HTT-E028      | Aug. 10 2020        | Aug. 09 2024            |
| 2    | Control Room                    | Shenzhen C.R.T technology co., LTD  | 4.8*3.5*3.0        | HTT-E030      | Aug. 10 2020        | Aug. 09 2024            |
| 3    | EMI Test Receiver               | Rohde&Schwar                        | ESCI7              | HTT-E022      | May 21 2021         | May 20 2022             |
| 4    | Spectrum Analyzer               | Rohde&Schwar                        | FSP                | HTT-E037      | May 21 2021         | May 20 2022             |
| 5    | Coaxial Cable                   | ZDecl                               | ZT26-NJ-NJ-0.6M    | HTT-E018      | May 21 2021         | May 20 2022             |
| 6    | Coaxial Cable                   | ZDecl                               | ZT26-NJ-SMAJ-2M    | HTT-E019      | May 21 2021         | May 20 2022             |
| 7    | Coaxial Cable                   | ZDecl                               | ZT26-NJ-SMAJ-0.6M  | HTT-E020      | May 21 2021         | May 20 2022             |
| 8    | Coaxial Cable                   | ZDecl                               | ZT26-NJ-SMAJ-8.5M  | HTT-E021      | May 21 2021         | May 20 2022             |
| 9    | Composite logarithmic antenna   | Schwarzbeck                         | VULB 9168          | HTT-E017      | Aug. 22 2021        | Aug. 21 2022            |
| 10   | Horn Antenna                    | Schwarzbeck                         | BBHA9120D          | HTT-E016      | Aug. 22 2021        | Aug. 21 2022            |
| 11   | Loop Antenna                    | Zhinan                              | ZN30900C           | HTT-E039      | Aug. 22 2021        | Aug. 21 2022            |
| 12   | Horn Antenna                    | Beijing Hangwei Dayang              | OBH100400          | HTT-E040      | Aug. 22 2021        | Aug. 21 2022            |
| 13   | low frequency Amplifier         | Sonoma Instrument                   | 310                | HTT-E015      | May 21 2021         | May 20 2022             |
| 14   | high-frequency Amplifier        | HP                                  | 8449B              | HTT-E014      | May 21 2021         | May 20 2022             |
| 15   | Variable frequency power supply | Shenzhen Anbiao Instrument Co., Ltd | ANB-10VA           | HTT-082       | May 21 2021         | May 20 2022             |
| 16   | EMI Test Receiver               | Rohde & Schwarz                     | ESCS30             | HTT-E004      | May 21 2021         | May 20 2022             |
| 17   | Artificial Mains                | Rohde & Schwarz                     | ESH3-Z5            | HTT-E006      | May 21 2021         | May 20 2022             |
| 18   | Artificial Mains                | Rohde & Schwarz                     | ENV-216            | HTT-E038      | May 21 2021         | May 20 2022             |
| 19   | Cable Line                      | Robinson                            | Z302S-NJ-BNCJ-1.5M | HTT-E001      | May 21 2021         | May 20 2022             |
| 20   | Attenuator                      | Robinson                            | 6810.17A           | HTT-E007      | May 21 2021         | May 20 2022             |
| 21   | Variable frequency power supply | Shenzhen Yanghong Electric Co., Ltd | YF-650 (5KVA)      | HTT-E032      | May 21 2021         | May 20 2022             |
| 22   | Control Room                    | Shenzhen C.R.T technology co., LTD  | 8*4*3.5            | HTT-E029      | May 21 2021         | May 20 2022             |
| 23   | DC power supply                 | Agilent                             | E3632A             | HTT-E023      | May 21 2021         | May 20 2022             |
| 24   | EMI Test Receiver               | Agilent                             | N9020A             | HTT-E024      | May 21 2021         | May 20 2022             |
| 25   | Analog signal generator         | Agilent                             | N5181A             | HTT-E025      | May 21 2021         | May 20 2022             |
| 26   | Vector signal generator         | Agilent                             | N5182A             | HTT-E026      | May 21 2021         | May 20 2022             |
| 27   | Power sensor                    | Keysight                            | U2021XA            | HTT-E027      | May 21 2021         | May 20 2022             |
| 28   | Temperature and humidity meter  | Shenzhen Anbiao Instrument Co., Ltd | TH10R              | HTT-074       | May 21 2021         | May 20 2022             |

## 6. Test results and Measurement Data

### 6.1. Conducted Emissions

|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |       |              |     |           |          |  |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------|-----|-----------|----------|--|
| Test Requirement:                                | FCC Part15 C Section 15.207                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |              |     |           |          |  |
| Test Method:                                     | ANSI C63.10:2013                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |              |     |           |          |  |
| Test Frequency Range:                            | 150KHz to 30MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |       |              |     |           |          |  |
| Class / Severity:                                | Class B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |       |              |     |           |          |  |
| Receiver setup:                                  | RBW=9KHz, VBW=30KHz, Sweep time=auto                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |       |              |     |           |          |  |
| Limit:                                           | Frequency range (MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       | Limit (dBuV) |     |           |          |  |
|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |       | Quasi-peak   |     | Average   |          |  |
|                                                  | 0.15-0.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       | 66 to 56*    |     | 56 to 46* |          |  |
|                                                  | 0.5-5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       | 56           |     | 46        |          |  |
|                                                  | 5-30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |       | 60           |     | 50        |          |  |
| * Decreases with the logarithm of the frequency. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |       |              |     |           |          |  |
| Test setup:                                      | <div><p style="text-align: center;"><b>Reference Plane</b></p><p>Remark:<br/>E.U.T: Equipment Under Test<br/>LISN: Line Impedance Stabilization Network<br/>Test table height=0.8m</p></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |       |              |     |           |          |  |
| Test procedure:                                  | <div><div>1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.</div><div>2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).</div><div>3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement.</div></div> |       |              |     |           |          |  |
| Test Instruments:                                | Refer to section 6.0 for details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |              |     |           |          |  |
| Test mode:                                       | Refer to section 5.2 for details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |              |     |           |          |  |
| Test environment:                                | Temp.:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 25 °C | Humid.:      | 52% | Press.:   | 1012mbar |  |
| Test voltage:                                    | AC 120V, 60Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |              |     |           |          |  |
| Test results:                                    | Pass                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |       |              |     |           |          |  |

Remark: Both high and low voltages have been tested to show only the worst low voltage test data.

### Measurement data:

Line:

100.0 dBuV



| No. | Mk. | Freq.   | Reading | Correct | Measure- | Limit | Over   |          |
|-----|-----|---------|---------|---------|----------|-------|--------|----------|
|     |     | MHz     | Level   | Factor  | ment     |       |        | Detector |
|     |     |         | dBuV    | dB      | dBuV     | dBuV  | dB     |          |
| 1   |     | 0.2007  | 19.80   | 10.20   | 30.00    | 63.58 | -33.58 | QP       |
| 2   |     | 0.2007  | 7.30    | 10.20   | 17.50    | 53.58 | -36.08 | AVG      |
| 3   |     | 0.5868  | 14.46   | 10.48   | 24.94    | 56.00 | -31.06 | QP       |
| 4   |     | 0.5868  | 3.23    | 10.48   | 13.71    | 46.00 | -32.29 | AVG      |
| 5   |     | 1.5072  | 13.27   | 10.81   | 24.08    | 56.00 | -31.92 | QP       |
| 6   |     | 1.5072  | 0.56    | 10.81   | 11.37    | 46.00 | -34.63 | AVG      |
| 7   |     | 4.4625  | 10.61   | 10.88   | 21.49    | 56.00 | -34.51 | QP       |
| 8   |     | 4.4625  | 1.66    | 10.88   | 12.54    | 46.00 | -33.46 | AVG      |
| 9   |     | 8.3228  | 13.65   | 11.18   | 24.83    | 60.00 | -35.17 | QP       |
| 10  |     | 8.3228  | 5.57    | 11.18   | 16.75    | 50.00 | -33.25 | AVG      |
| 11  | *   | 12.3522 | 17.77   | 11.83   | 29.60    | 60.00 | -30.40 | QP       |
| 12  |     | 12.3522 | 7.64    | 11.83   | 19.47    | 50.00 | -30.53 | AVG      |

Neutral:  
100.0 dBuV

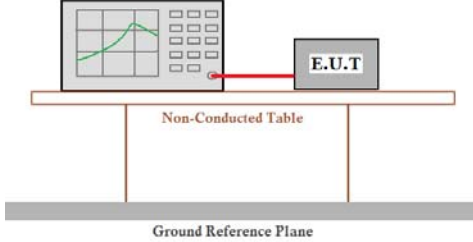


| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|
| 1   |     | 0.1796       | 21.63                    | 10.23                   | 31.86                    | 64.50         | -32.64     | QP       |
| 2   |     | 0.1796       | 6.95                     | 10.23                   | 17.18                    | 54.50         | -37.32     | AVG      |
| 3   | *   | 0.5907       | 18.47                    | 10.48                   | 28.95                    | 56.00         | -27.05     | QP       |
| 4   |     | 0.5907       | 4.48                     | 10.48                   | 14.96                    | 46.00         | -31.04     | AVG      |
| 5   |     | 1.0743       | 11.53                    | 10.80                   | 22.33                    | 56.00         | -33.67     | QP       |
| 6   |     | 1.0743       | 2.05                     | 10.80                   | 12.85                    | 46.00         | -33.15     | AVG      |
| 7   |     | 2.5807       | 11.65                    | 10.84                   | 22.49                    | 56.00         | -33.51     | QP       |
| 8   |     | 2.5807       | 0.52                     | 10.84                   | 11.36                    | 46.00         | -34.64     | AVG      |
| 9   |     | 6.3345       | 12.73                    | 10.92                   | 23.65                    | 60.00         | -36.35     | QP       |
| 10  |     | 6.3345       | 3.90                     | 10.92                   | 14.82                    | 50.00         | -35.18     | AVG      |
| 11  |     | 12.0596      | 16.41                    | 11.79                   | 28.20                    | 60.00         | -31.80     | QP       |
| 12  |     | 12.0596      | 6.48                     | 11.79                   | 18.27                    | 50.00         | -31.73     | AVG      |

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.

## 6.2. Conducted Peak Output Power

|                   |                                                                                                                                                                                       |       |         |     |         |          |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------|-----|---------|----------|
| Test Requirement: | FCC Part15 C Section 15.247 (b)(3)                                                                                                                                                    |       |         |     |         |          |
| Test Method:      | ANSI C63.10:2013                                                                                                                                                                      |       |         |     |         |          |
| Limit:            | 30dBm(for GFSK),20.97dBm(for EDR)                                                                                                                                                     |       |         |     |         |          |
| Test setup:       | <p>Power sensor and Spectrum analyzer</p>  <p>Non-Conducted Table</p> <p>Ground Reference Plane</p> |       |         |     |         |          |
| Test Instruments: | Refer to section 6.0 for details                                                                                                                                                      |       |         |     |         |          |
| Test mode:        | Refer to section 5.2 for details                                                                                                                                                      |       |         |     |         |          |
| Test results:     | Pass                                                                                                                                                                                  |       |         |     |         |          |
| Test environment: | Temp.:                                                                                                                                                                                | 25 °C | Humid.: | 52% | Press.: | 1012mbar |

### Measurement Data

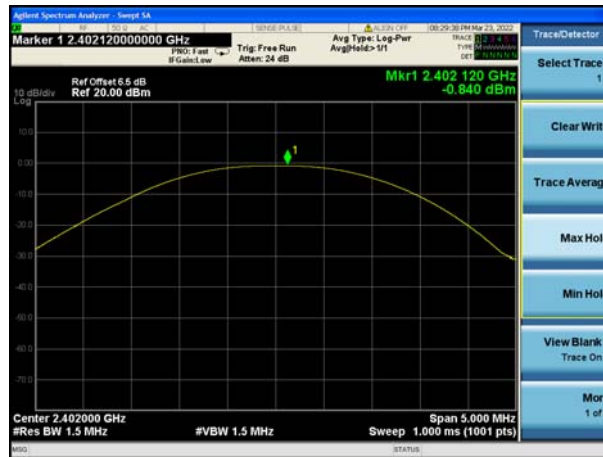
| Mode           | Test channel | Peak Output Power (dBm) | Limit (dBm) | Result |
|----------------|--------------|-------------------------|-------------|--------|
| GFSK           | Lowest       | -0.840                  | 30.00       | Pass   |
|                | Middle       | -1.265                  |             |        |
|                | Highest      | -2.321                  |             |        |
| $\pi/4$ -DQPSK | Lowest       | 1.389                   | 20.97       | Pass   |
|                | Middle       | 1.071                   |             |        |
|                | Highest      | -0.097                  |             |        |
| 8QPSK          | Lowest       | 2.161                   | 20.97       | Pass   |
|                | Middle       | 1.899                   |             |        |
|                | Highest      | 0.697                   |             |        |



Report No.: HTT202203179F01

Test plot as follows:

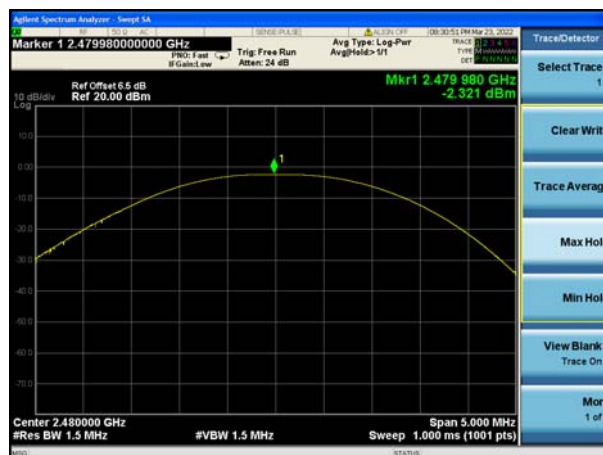
|            |           |
|------------|-----------|
| Test mode: | GFSK mode |
|------------|-----------|



Lowest channel



Middle channel



Highest channel



Report No.: HTT202203179F01

Test mode:

$\pi/4$ -DQPSK mode



Lowest channel



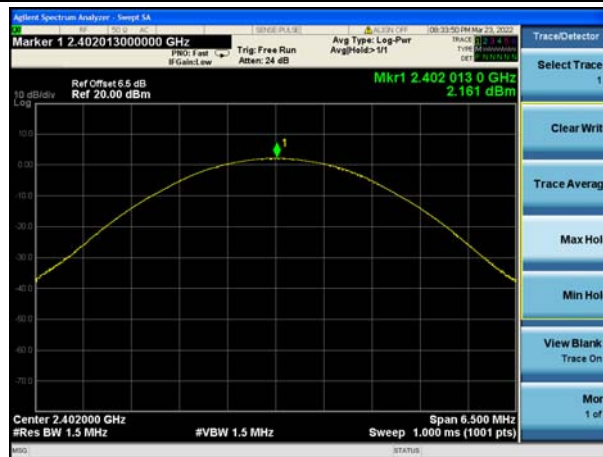
Middle channel



Highest channel



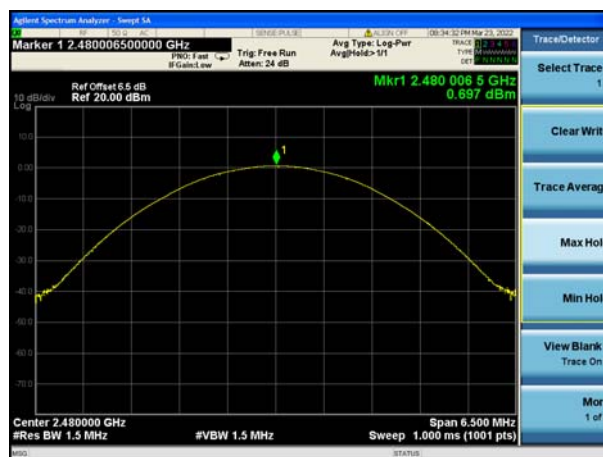
|            |            |
|------------|------------|
| Test mode: | 8QPSK mode |
|------------|------------|



Lowest channel

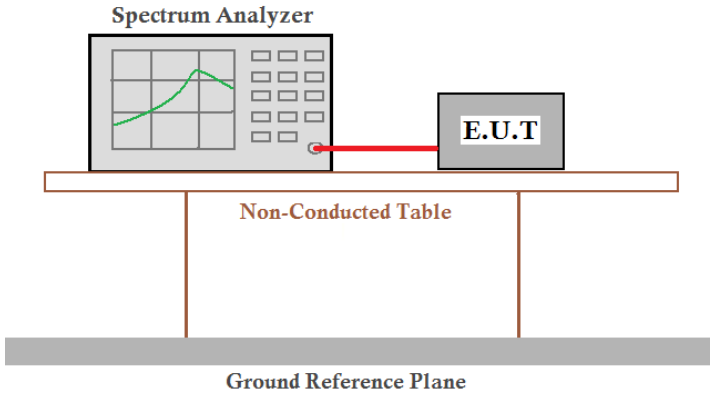


Middle channel



Highest channel

### 6.3. 20dB Emission Bandwidth

|                   |                                                                                    |       |         |     |         |          |
|-------------------|------------------------------------------------------------------------------------|-------|---------|-----|---------|----------|
| Test Requirement: | FCC Part15 C Section 15.247 (a)(2)                                                 |       |         |     |         |          |
| Test Method:      | ANSI C63.10:2013                                                                   |       |         |     |         |          |
| Limit:            | N/A                                                                                |       |         |     |         |          |
| Test setup:       |  |       |         |     |         |          |
| Test Instruments: | Refer to section 6.0 for details                                                   |       |         |     |         |          |
| Test mode:        | Refer to section 5.2 for details                                                   |       |         |     |         |          |
| Test results:     | Pass                                                                               |       |         |     |         |          |
| Test environment: | Temp.:                                                                             | 25 °C | Humid.: | 52% | Press.: | 1012mbar |

### Measurement Data

| Mode  | Test channel | 20dB Emission Bandwidth (MHz) | Result |
|-------|--------------|-------------------------------|--------|
| GFSK  | Lowest       | 0.884                         | Pass   |
|       | Middle       | 0.883                         |        |
|       | Highest      | 0.882                         |        |
| 8QPSK | Lowest       | 1.251                         | Pass   |
|       | Middle       | 1.245                         |        |
|       | Highest      | 1.223                         |        |



Report No.: HTT202203179F01

Test plot as follows:

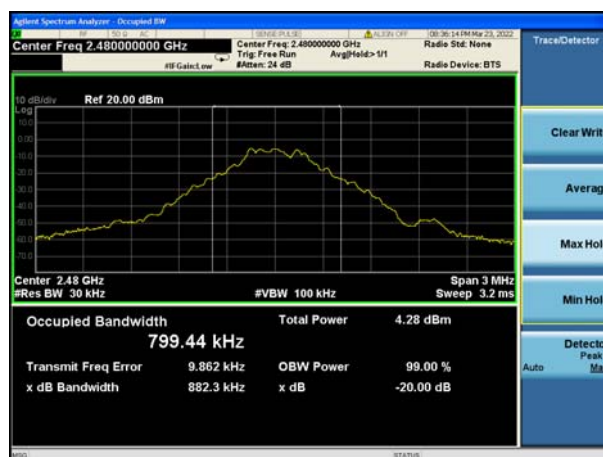
|            |           |
|------------|-----------|
| Test mode: | GFSK mode |
|------------|-----------|



Lowest channel



Middle channel



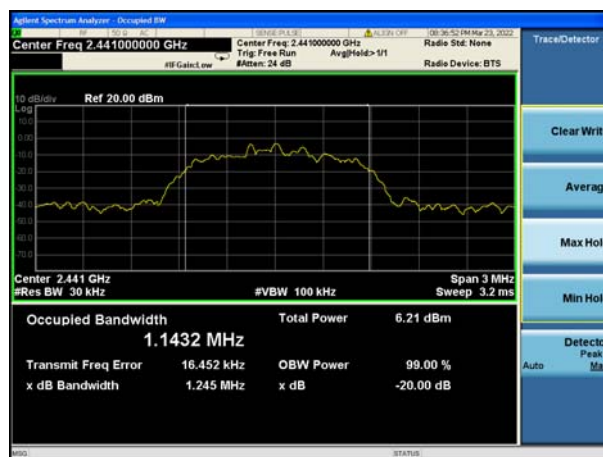
Highest channel



|            |            |
|------------|------------|
| Test mode: | 8QPSK mode |
|------------|------------|



Lowest channel

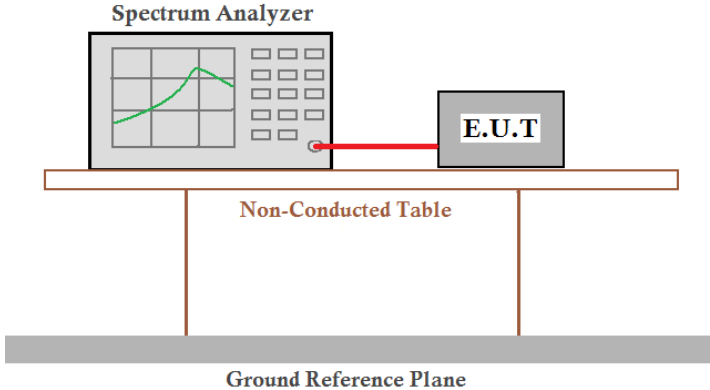


Middle channel



Highest channel

#### 6.4. Frequencies Separation

|                   |                                                                                                                                                                                                                                                                                                                |       |         |     |         |          |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------|-----|---------|----------|
| Test Requirement: | FCC Part15 C Section 15.247 (a)(1)                                                                                                                                                                                                                                                                             |       |         |     |         |          |
| Test Method:      | ANSI C63.10:2013                                                                                                                                                                                                                                                                                               |       |         |     |         |          |
| Receiver setup:   | RBW=300KHz, VBW=1MHz, detector=Peak                                                                                                                                                                                                                                                                            |       |         |     |         |          |
| Limit:            | GFSK: 20dB bandwidth<br>8QPSK : 0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)                                                                                                                                                                                                                   |       |         |     |         |          |
| Test setup:       |  <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.</p> |       |         |     |         |          |
| Test Instruments: | Refer to section 6.0 for details                                                                                                                                                                                                                                                                               |       |         |     |         |          |
| Test mode:        | Refer to section 5.2 for details                                                                                                                                                                                                                                                                               |       |         |     |         |          |
| Test results:     | Pass                                                                                                                                                                                                                                                                                                           |       |         |     |         |          |
| Test environment: | Temp.:                                                                                                                                                                                                                                                                                                         | 25 °C | Humid.: | 52% | Press.: | 1012mbar |

#### Measurement Data

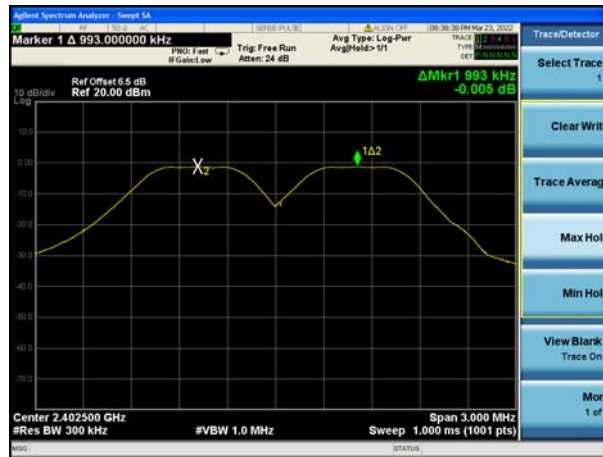
| Mode  | Test channel | Frequencies Separation (MHz) | Limit (kHz)                 | Result |
|-------|--------------|------------------------------|-----------------------------|--------|
| GFSK  | Low          | 0.993                        | 20dB bandwidth              | Pass   |
|       | Middle       | 1.011                        |                             |        |
|       | High         | 1.002                        |                             |        |
| 8QPSK | Low          | 1.014                        | 25KHz or 2/3*20dB bandwidth | Pass   |
|       | Middle       | 1.005                        |                             |        |
|       | High         | 1.005                        |                             |        |



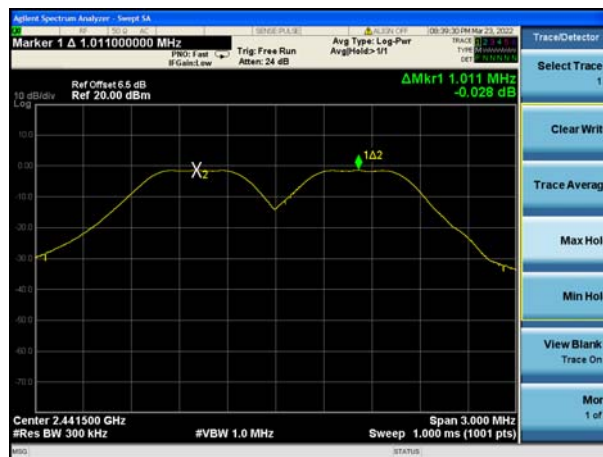
Report No.: HTT202203179F01

Test plot as follows:

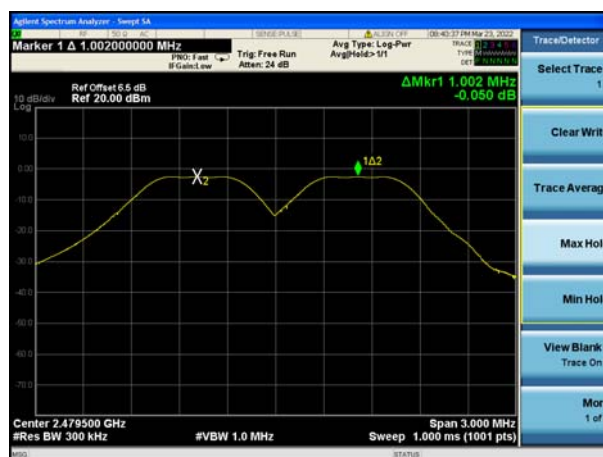
|            |           |
|------------|-----------|
| Test mode: | GFSK mode |
|------------|-----------|



Lowest channel



Middle channel



Highest channel



Report No.: HTT202203179F01

|            |            |
|------------|------------|
| Test mode: | 8QPSK mode |
|------------|------------|



Lowest channel

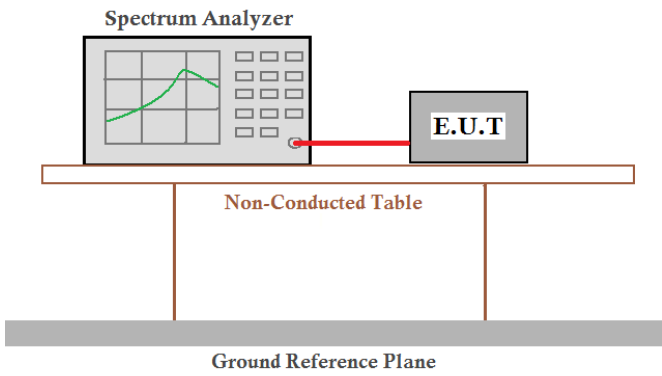


Middle channel



Highest channel

## 6.5. Hopping Channel Number

|                   |                                                                                    |       |         |     |         |          |
|-------------------|------------------------------------------------------------------------------------|-------|---------|-----|---------|----------|
| Test Requirement: | FCC Part15 C Section 15.247 (a)(1)(iii)                                            |       |         |     |         |          |
| Test Method:      | ANSI C63.10:2013                                                                   |       |         |     |         |          |
| Receiver setup:   | RBW=300kHz, VBW=1MHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak             |       |         |     |         |          |
| Limit:            | 15 channels                                                                        |       |         |     |         |          |
| Test setup:       |  |       |         |     |         |          |
| Test Instruments: | Refer to section 6.0 for details                                                   |       |         |     |         |          |
| Test mode:        | Refer to section 5.2 for details                                                   |       |         |     |         |          |
| Test results:     | Pass                                                                               |       |         |     |         |          |
| Test environment: | Temp.:                                                                             | 25 °C | Humid.: | 52% | Press.: | 1012mbar |

### Measurement Data:

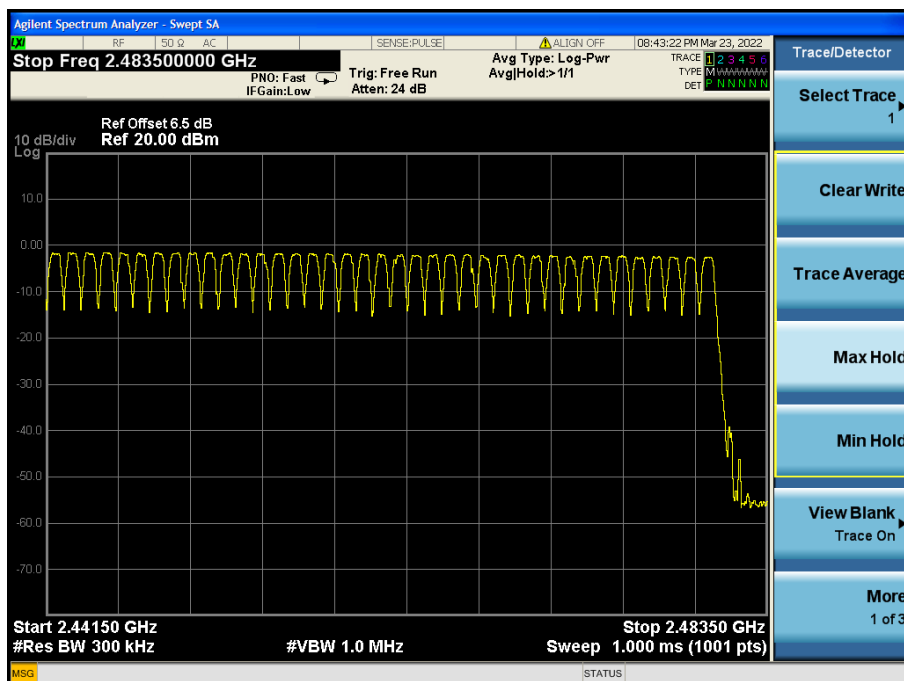
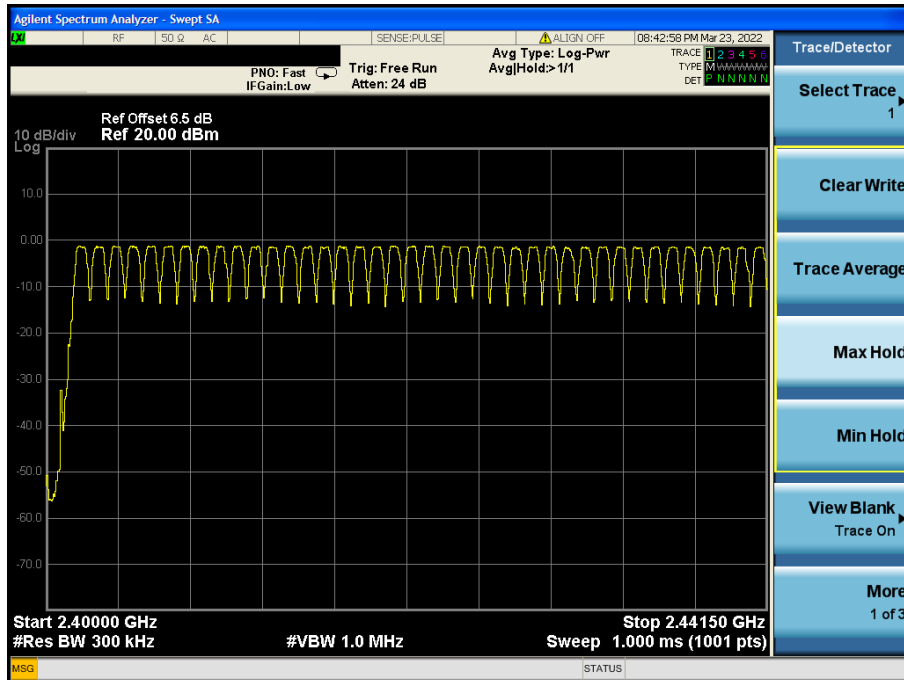
| Mode  | Hopping channel numbers | Limit | Result |
|-------|-------------------------|-------|--------|
| GFSK  | 79                      | ≥15   | Pass   |
| 8QPSK | 79                      |       | Pass   |



Report No.: HTT202203179F01

Test plot as follows:

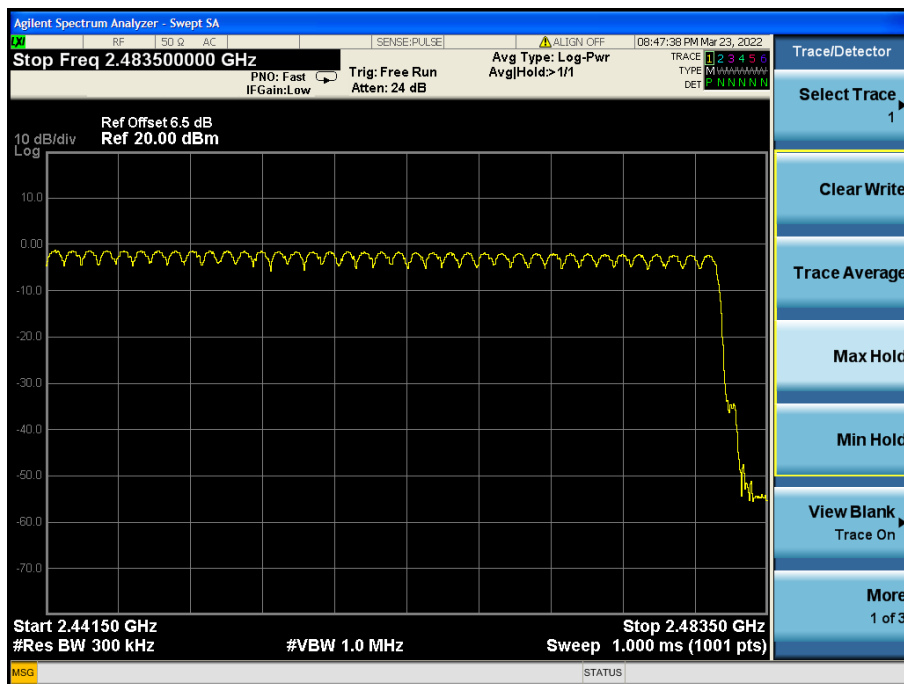
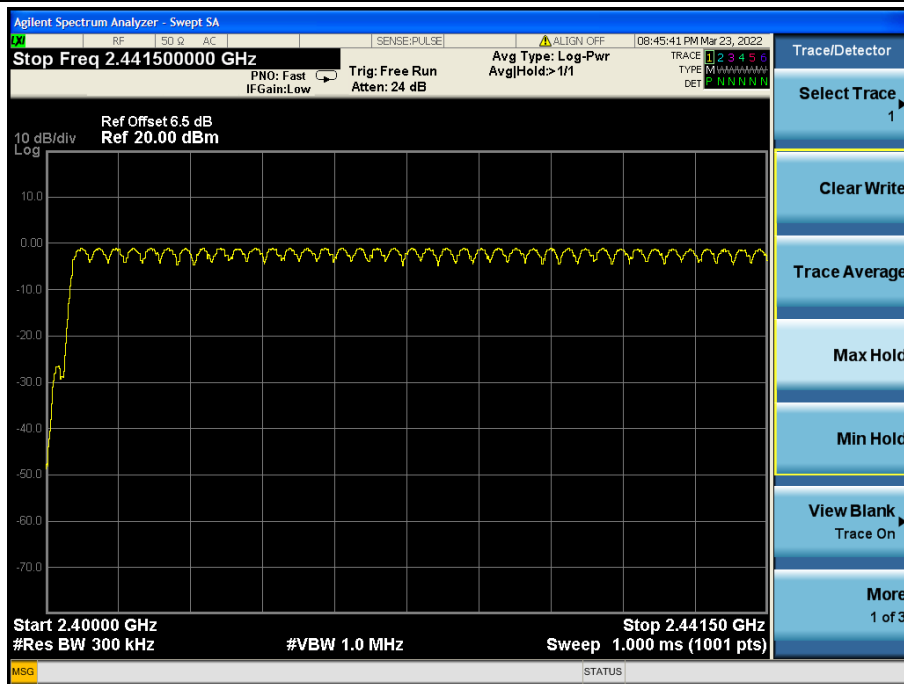
|            |      |
|------------|------|
| Test mode: | GFSK |
|------------|------|



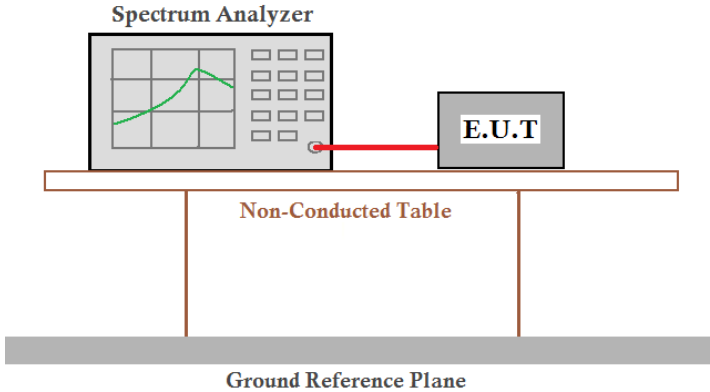


Report No.: HTT202203179F01

Test mode: 8QPSK



## 6.6. Dwell Time

|                   |                                                                                                                                                                                                                                                                                                                                                                                   |       |         |     |         |          |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------|-----|---------|----------|
| Test Requirement: | FCC Part15 C Section 15.247 (a)(1)(iii)                                                                                                                                                                                                                                                                                                                                           |       |         |     |         |          |
| Test Method:      | ANSI C63.10:2013                                                                                                                                                                                                                                                                                                                                                                  |       |         |     |         |          |
| Receiver setup:   | RBW=1MHz, VBW=1MHz, Span=0Hz, Detector=Peak                                                                                                                                                                                                                                                                                                                                       |       |         |     |         |          |
| Limit:            | 0.4 Second                                                                                                                                                                                                                                                                                                                                                                        |       |         |     |         |          |
| Test setup:       |  <p>The diagram illustrates the test setup for Dwell Time measurement. A Spectrum Analyzer is connected via a red cable to an E.U.T (Equipment Under Test). Both are placed on a Non-Conducted Table, which is supported by two vertical legs. Below the table is a Ground Reference Plane.</p> |       |         |     |         |          |
| Test Instruments: | Refer to section 6.0 for details                                                                                                                                                                                                                                                                                                                                                  |       |         |     |         |          |
| Test mode:        | Refer to section 5.2 for details                                                                                                                                                                                                                                                                                                                                                  |       |         |     |         |          |
| Test results:     | Pass                                                                                                                                                                                                                                                                                                                                                                              |       |         |     |         |          |
| Test environment: | Temp.:                                                                                                                                                                                                                                                                                                                                                                            | 25 °C | Humid.: | 52% | Press.: | 1012mbar |

**Measurement Data****GFSK mode:**

| Frequency | Packet | Pulse time<br>(ms) | Dwell time(ms) | Limit(ms) | Result |
|-----------|--------|--------------------|----------------|-----------|--------|
| Hopping   | DH1    | 0.381              | 122            | 400       | Pass   |
| Hopping   | DH3    | 1.635              | 262            | 400       | Pass   |
| Hopping   | DH5    | 2.885              | 308            | 400       | Pass   |

Note: We have tested all mode at high, middle and low channel, and recorded worst case at Low channel.

Dwell time = Pulse time (ms)  $\times$  (1600  $\div$  2  $\div$  79)  $\times$  31.6 Second for DH1

Dwell time = Pulse time (ms)  $\times$  (1600  $\div$  4  $\div$  79)  $\times$  31.6 Second for DH3

Dwell time = Pulse time (ms)  $\times$  (1600  $\div$  6  $\div$  79)  $\times$  31.6 Second for DH5

**8QPSK mode:**

| Frequency | Packet | Pulse time<br>(ms) | Dwell time(ms) | Limit(ms) | Result |
|-----------|--------|--------------------|----------------|-----------|--------|
| Hopping   | 3DH1   | 0.393              | 126            | 400       | Pass   |
| Hopping   | 3DH3   | 1.644              | 263            | 400       | Pass   |
| Hopping   | 3DH5   | 2.890              | 308            | 400       | Pass   |

Note: We have tested all mode at high, middle and low channel, and recorded worst case at Low channel.

Dwell time = Pulse time (ms)  $\times$  (1600  $\div$  2  $\div$  79)  $\times$  31.6 Second for 3-DH1

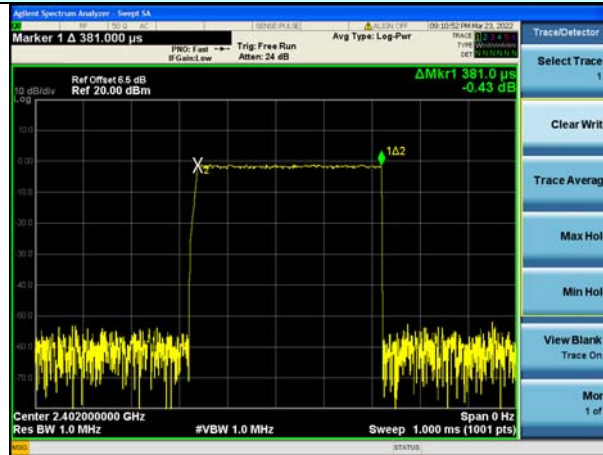
Dwell time = Pulse time (ms)  $\times$  (1600  $\div$  4  $\div$  79)  $\times$  31.6 Second for 3-DH3

Dwell time = Pulse time (ms)  $\times$  (1600  $\div$  6  $\div$  79)  $\times$  31.6 Second for 3-DH5

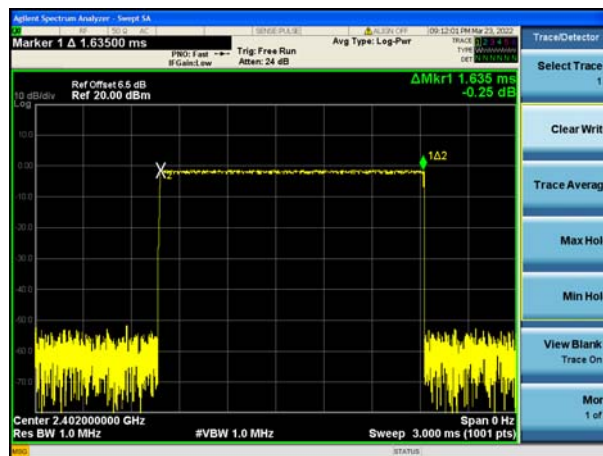


Test plot as follows:

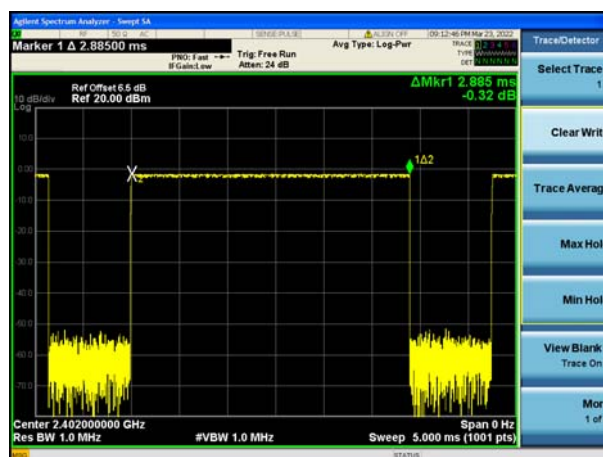
GFSK mode



DH1

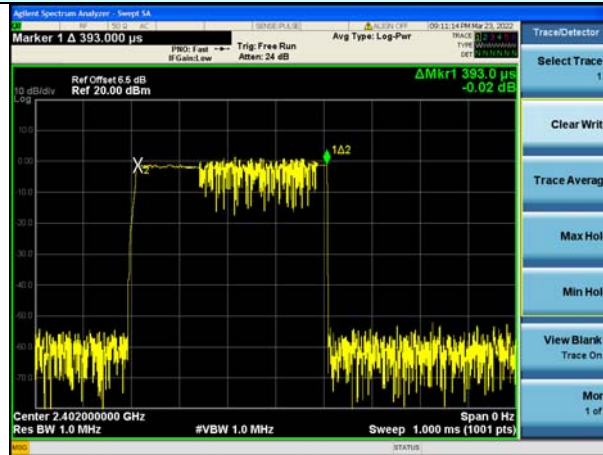


DH3



DH5

## 8QPSK mode



3DH1



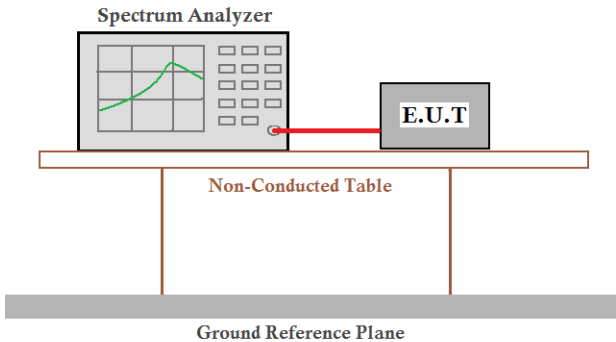
3DH3



3DH5

## 6.7. Band Edge

### 6.7.1. Conducted Emission Method

|                   |                                                                                                                                                                                                                                                                                                                                                                                         |       |         |     |         |          |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------|-----|---------|----------|
| Test Requirement: | FCC Part15 C Section 15.247 (d)                                                                                                                                                                                                                                                                                                                                                         |       |         |     |         |          |
| Test Method:      | ANSI C63.10:2013                                                                                                                                                                                                                                                                                                                                                                        |       |         |     |         |          |
| Receiver setup:   | RBW=100kHz, VBW=300kHz, Detector=Peak                                                                                                                                                                                                                                                                                                                                                   |       |         |     |         |          |
| Limit:            | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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. |       |         |     |         |          |
| Test setup:       |  <p>The diagram illustrates the test setup for conducted emission measurement. A Spectrum Analyzer is connected via a red cable to an E.U.T (Equipment Under Test). Both are placed on a Non-Conducted Table, which is supported by a Ground Reference Plane.</p>                                    |       |         |     |         |          |
| Test Instruments: | Refer to section 6.0 for details                                                                                                                                                                                                                                                                                                                                                        |       |         |     |         |          |
| Test mode:        | Refer to section 5.2 for details                                                                                                                                                                                                                                                                                                                                                        |       |         |     |         |          |
| Test results:     | Pass                                                                                                                                                                                                                                                                                                                                                                                    |       |         |     |         |          |
| Test environment: | Temp.:                                                                                                                                                                                                                                                                                                                                                                                  | 25 °C | Humid.: | 52% | Press.: | 1012mbar |



| Frequency Band   | Delta Peak to band emission<br>(dBc) | >Limit<br>(dBc) | Result |
|------------------|--------------------------------------|-----------------|--------|
| GFSK Non-hopping |                                      |                 |        |
| 2400             | 47.95                                | 20              | Pass   |
| 2483.5           | 56.77                                | 20              | Pass   |

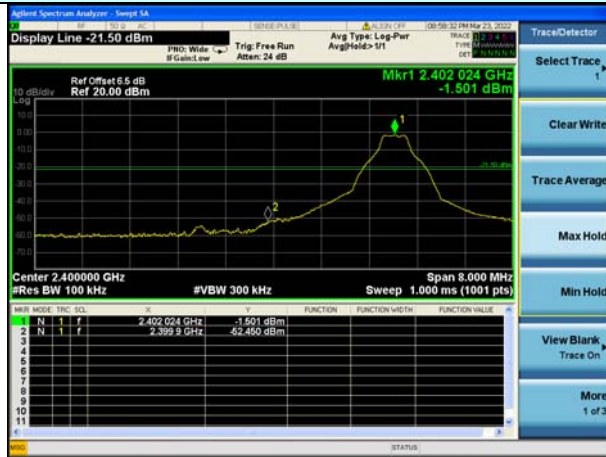
| Frequency Band | Delta Peak to band emission<br>(dBc) | >Limit<br>(dBc) | Result |
|----------------|--------------------------------------|-----------------|--------|
| GFSK hopping   |                                      |                 |        |
| 2400           | 58.96                                | 20              | Pass   |
| 2483.5         | 58.43                                | 20              | Pass   |

| Frequency Band    | Delta Peak to band emission<br>(dBc) | >Limit<br>(dBc) | Result |
|-------------------|--------------------------------------|-----------------|--------|
| 8QPSK Non-hopping |                                      |                 |        |
| 2400              | 50.54                                | 20              | Pass   |
| 2483.5            | 58.20                                | 20              | Pass   |

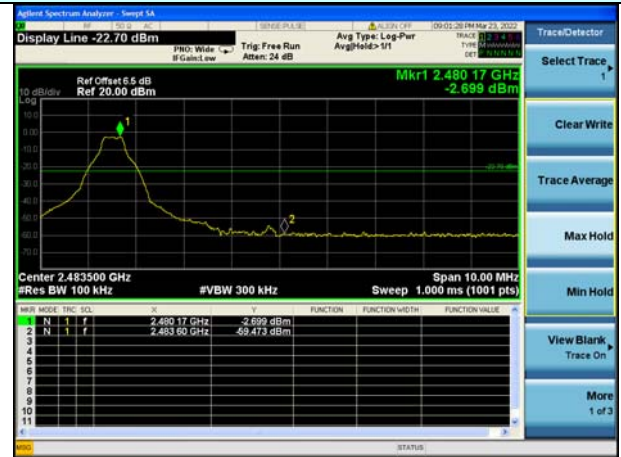
| Frequency Band | Delta Peak to band emission<br>(dBc) | >Limit<br>(dBc) | Result |
|----------------|--------------------------------------|-----------------|--------|
| 8QPSK hopping  |                                      |                 |        |
| 2400           | 50.71                                | 20              | Pass   |
| 2483.5         | 57.84                                | 20              | Pass   |

Test plot as follows:  
GFSK Mode:

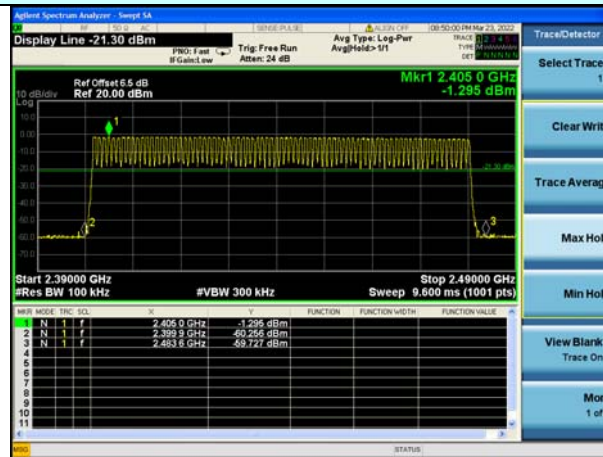
| Lowest channel | Highest channel |
|----------------|-----------------|
|----------------|-----------------|



No-hopping mode



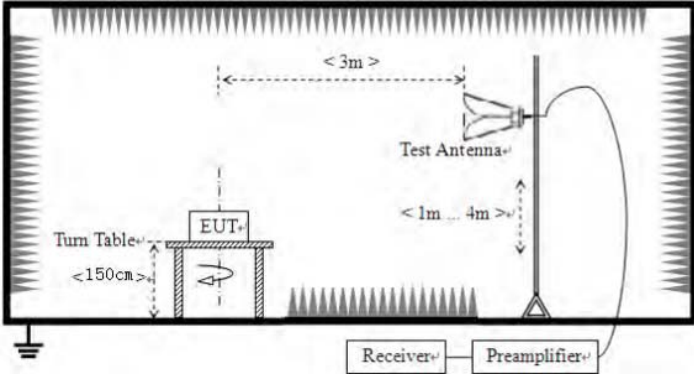
No-hopping mode



Hopping mode



### 6.7.2. Radiated Emission Method

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |          |         |                    |         |               |  |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------|--------------------|---------|---------------|--|
| Test Requirement:     | FCC Part15 C Section 15.209 and 15.205                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |          |         |                    |         |               |  |
| Test Method:          | ANSI C63.10:2013                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |          |         |                    |         |               |  |
| Test Frequency Range: | All of the restrict bands were tested, only the worst band's (2310MHz to 2500MHz) data was showed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |          |         |                    |         |               |  |
| Test site:            | Measurement Distance: 3m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |          |         |                    |         |               |  |
| Receiver setup:       | Frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Detector |         | RBW                | VBW     | Remark        |  |
|                       | Above 1GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Peak     |         | 1MHz               | 3MHz    | Peak Value    |  |
|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Peak     |         | 1MHz               | 10Hz    | Average Value |  |
| Limit:                | Frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |          |         | Limit (dBuV/m @3m) |         | Remark        |  |
|                       | Above 1GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |          |         | 54.00              |         | Average Value |  |
|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |          |         | 74.00              |         | Peak Value    |  |
| Test setup:           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |          |         |                    |         |               |  |
| Test Procedure:       | <div>1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.</div> <div>2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</div> <div>3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.</div> <div>4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.</div> <div>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</div> <div>6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</div> |          |         |                    |         |               |  |
| Test Instruments:     | Refer to section 6.0 for details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |          |         |                    |         |               |  |
| Test mode:            | Refer to section 5.2 for details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |          |         |                    |         |               |  |
| Test results:         | Pass                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |          |         |                    |         |               |  |
| Test environment:     | Temp.:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 25 °C    | Humid.: | 52%                | Press.: | 1012mbar      |  |



Report No.: HTT202203179F01

#### Measurement Data

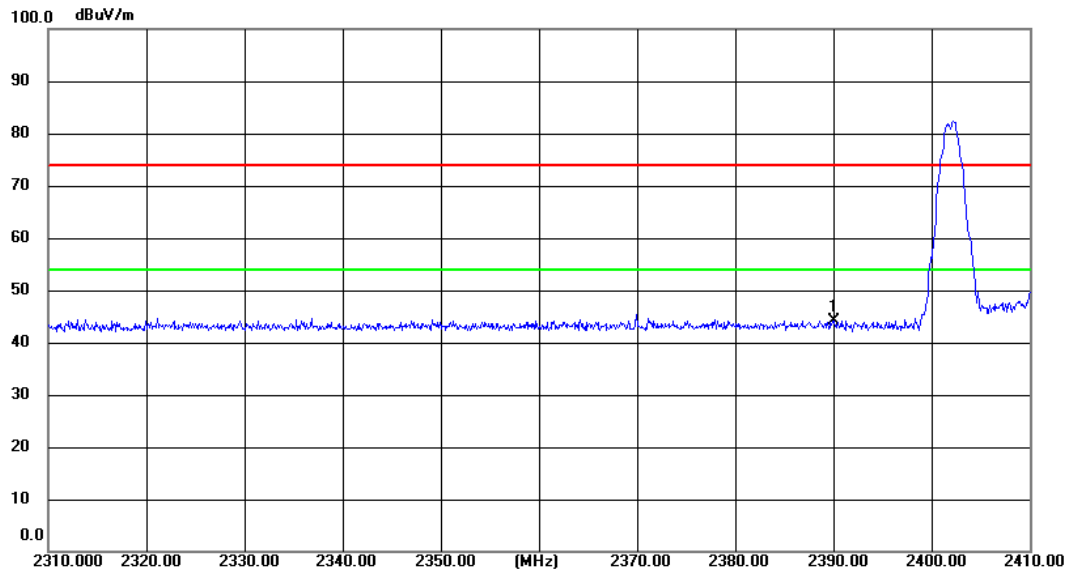
Remark: GFSK, Pi/4 DQPSK, 8QPSK all have been tested, only worse case 8QPSK is reported.

Operation Mode: 8QPSK TX Low channel

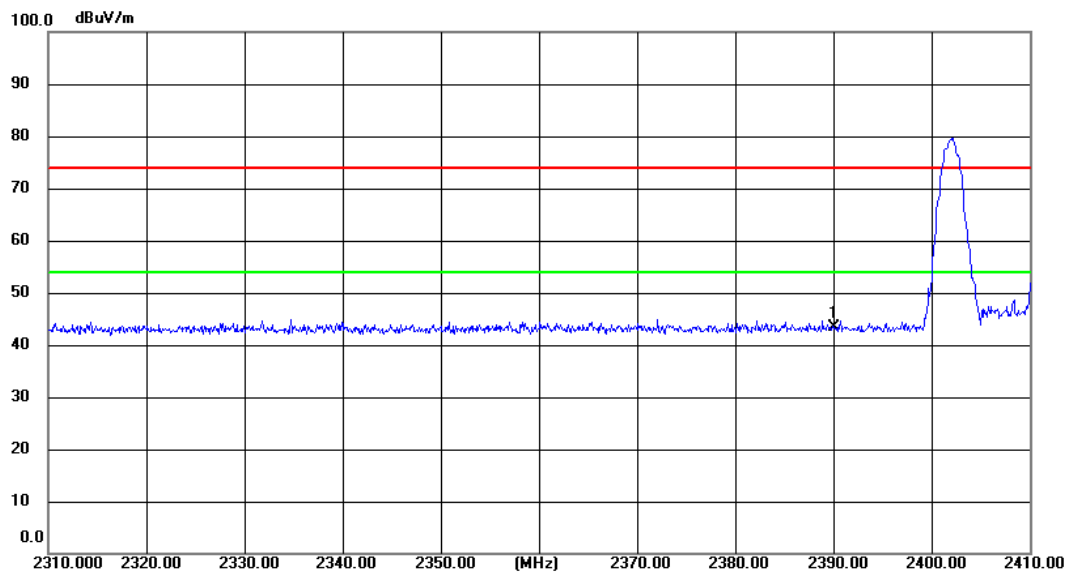
| Freq.<br>(MHz) | Ant.Pol.<br>H/V | Reading        |              | Ant/CF<br>CF(dB) | Act              |                | Limit            |                | Note |
|----------------|-----------------|----------------|--------------|------------------|------------------|----------------|------------------|----------------|------|
|                |                 | Peak<br>(dBuv) | AV<br>(dBuv) |                  | Peak<br>(dBuv/m) | AV<br>(dBuv/m) | Peak<br>(dBuv/m) | AV<br>(dBuv/m) |      |
| 2390.00        | H               | 49.89          | --           | -5.79            | 44.10            | --             | 74.00            | 54.00          | CH00 |
| 2390.00        | V               | 49.25          | --           | -5.79            | 43.46            | --             | 74.00            | 54.00          | CH00 |
| 2483.50        | H               | 48.50          | --           | -4.98            | 43.52            | --             | 74.00            | 54.00          | CH78 |
| 2483.50        | V               | 48.89          | --           | -4.98            | 43.91            | --             | 74.00            | 54.00          | CH78 |

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

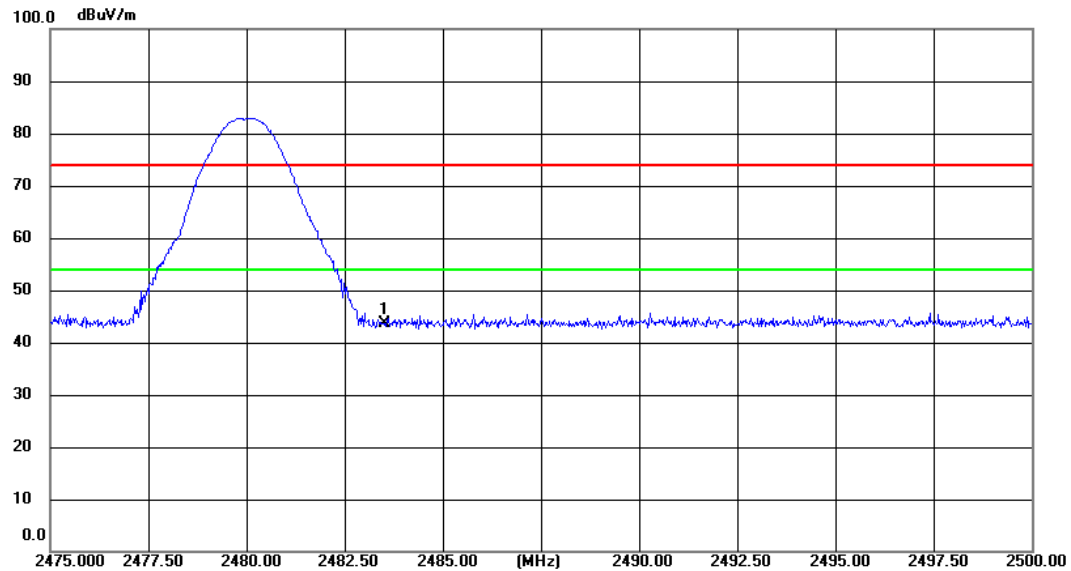
### Horizontal



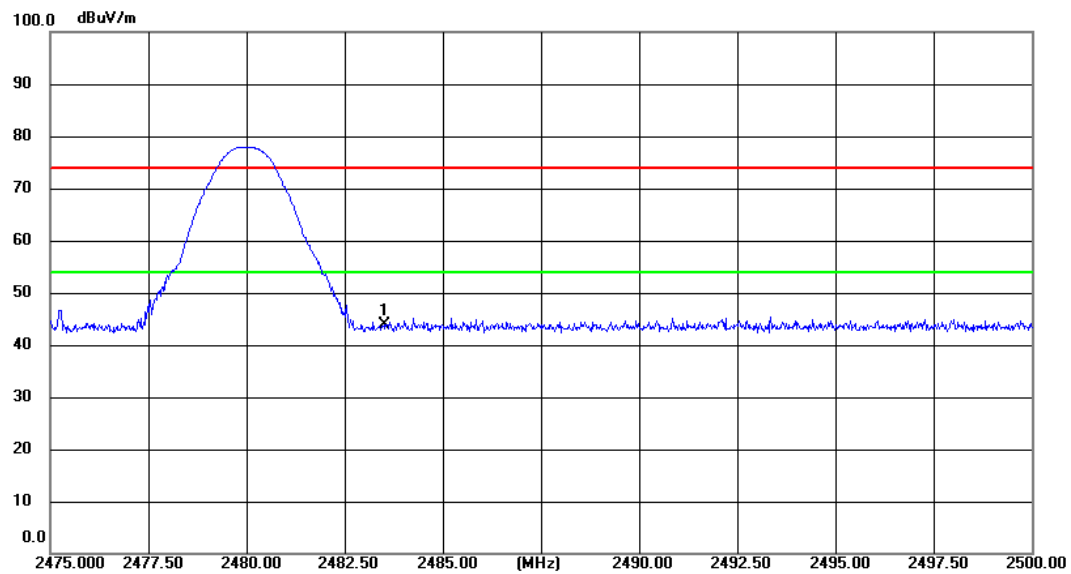
### Vertical



### Horizontal

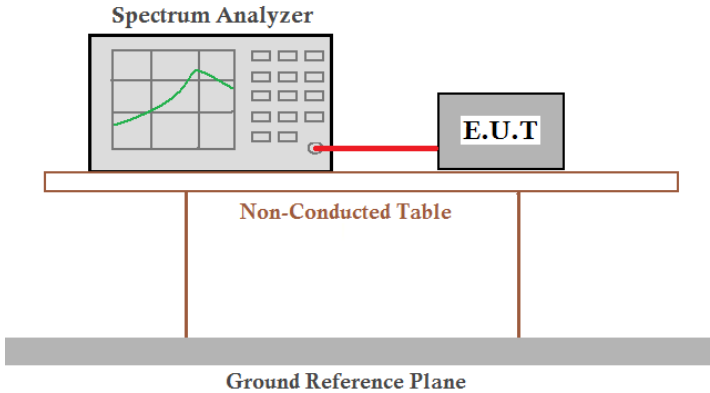


### Vertical



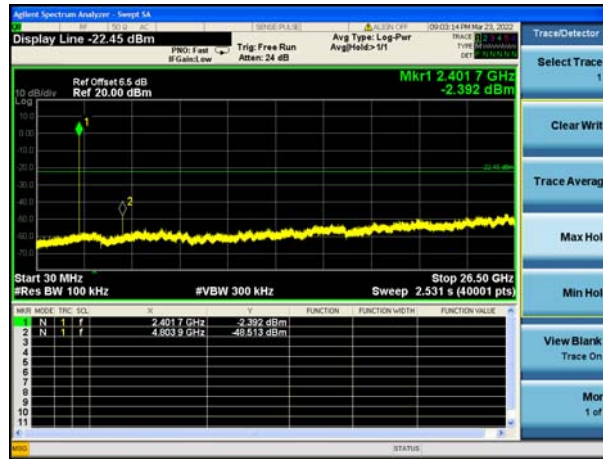
## 6.8. Spurious Emission

### 6.8.1. Conducted Emission Method

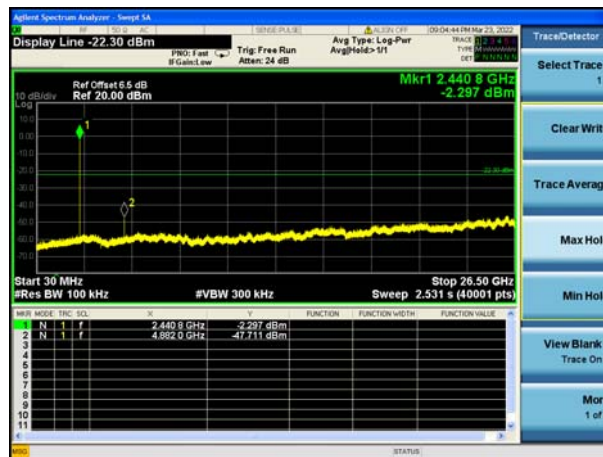
|                   |                                                                                                                                                                                                                                                                                                                                                                                         |       |         |     |         |          |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------|-----|---------|----------|
| Test Requirement: | FCC Part15 C Section 15.247 (d)                                                                                                                                                                                                                                                                                                                                                         |       |         |     |         |          |
| Test Method:      | ANSI C63.10:2013                                                                                                                                                                                                                                                                                                                                                                        |       |         |     |         |          |
| Limit:            | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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. |       |         |     |         |          |
| Test setup:       |  <p>The diagram illustrates the test setup for conducted emission measurement. A Spectrum Analyzer is connected via a red cable to an E.U.T (Equipment Under Test). Both are placed on a Non-Conducted Table, which is supported by a Ground Reference Plane.</p>                                    |       |         |     |         |          |
| Test Instruments: | Refer to section 6.0 for details                                                                                                                                                                                                                                                                                                                                                        |       |         |     |         |          |
| Test mode:        | Refer to section 5.2 for details                                                                                                                                                                                                                                                                                                                                                        |       |         |     |         |          |
| Test results:     | Pass                                                                                                                                                                                                                                                                                                                                                                                    |       |         |     |         |          |
| Test environment: | Temp.:                                                                                                                                                                                                                                                                                                                                                                                  | 25 °C | Humid.: | 52% | Press.: | 1012mbar |



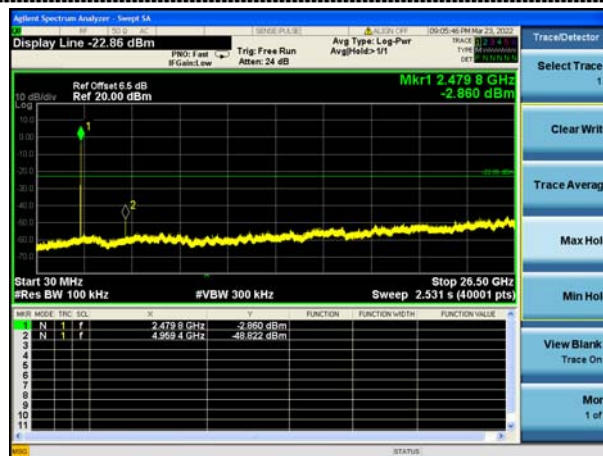
### GFSK



### CH00

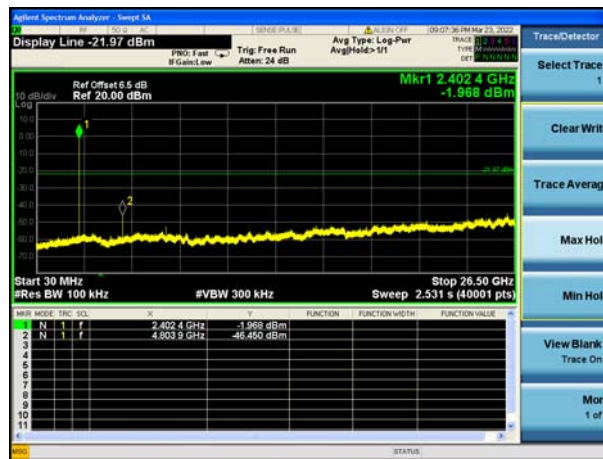


### CH39

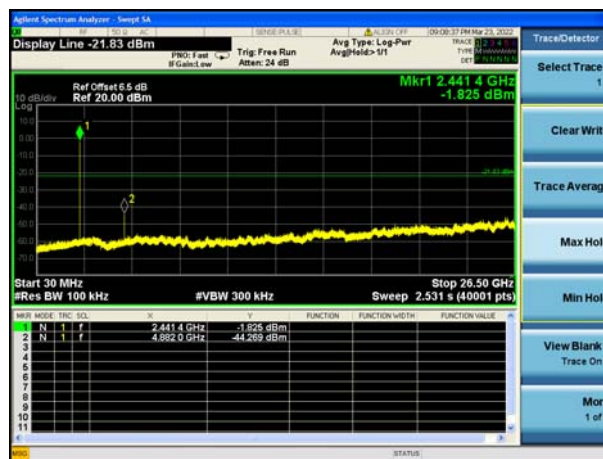


### CH78

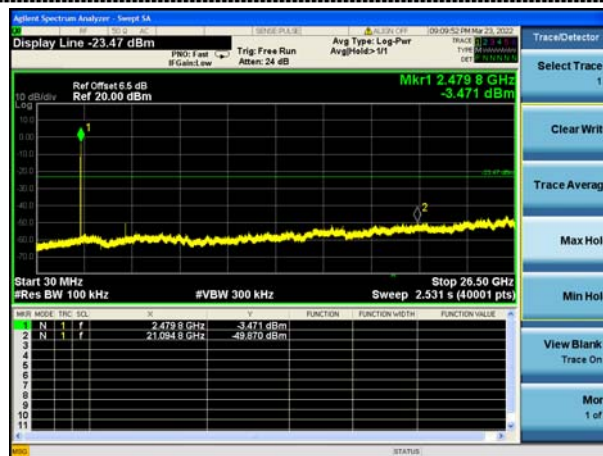
## 8QPSK



## CH00

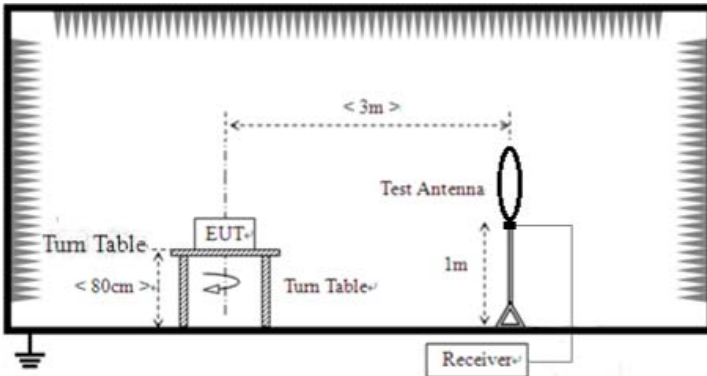


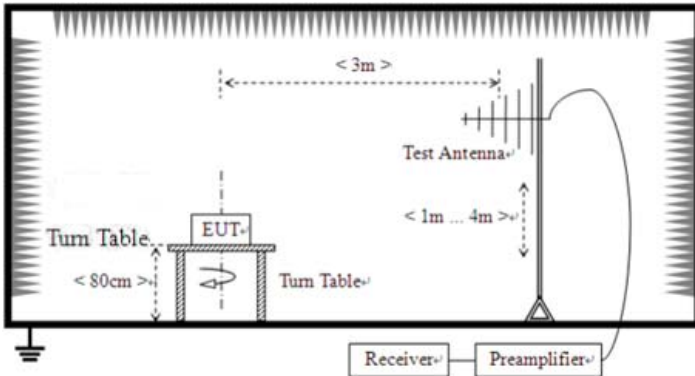
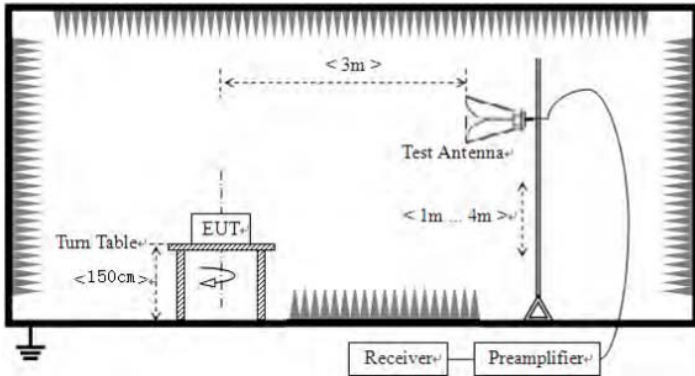
## CH39



## CH78

### 6.8.2. Radiated Emission Method

|                       |                                                                                      |              |         |                      |            |
|-----------------------|--------------------------------------------------------------------------------------|--------------|---------|----------------------|------------|
| Test Requirement:     | FCC Part15 C Section 15.209                                                          |              |         |                      |            |
| Test Method:          | ANSI C63.10:2013                                                                     |              |         |                      |            |
| Test Frequency Range: | 9kHz to 25GHz                                                                        |              |         |                      |            |
| Test site:            | Measurement Distance: 3m                                                             |              |         |                      |            |
| Receiver setup:       | Frequency                                                                            | Detector     | RBW     | VBW                  | Value      |
|                       | 9KHz-150KHz                                                                          | Quasi-peak   | 200Hz   | 600Hz                | Quasi-peak |
|                       | 150KHz-30MHz                                                                         | Quasi-peak   | 9KHz    | 30KHz                | Quasi-peak |
|                       | 30MHz-1GHz                                                                           | Quasi-peak   | 120KHz  | 300KHz               | Quasi-peak |
|                       | Above 1GHz                                                                           | Peak         | 1MHz    | 3MHz                 | Peak       |
|                       |                                                                                      | Peak         | 1MHz    | 10Hz                 | Average    |
| Limit:                | Frequency                                                                            | Limit (uV/m) | Value   | Measurement Distance |            |
|                       | 0.009MHz-0.490MHz                                                                    | 2400/F(KHz)  | QP      | 300m                 |            |
|                       | 0.490MHz-1.705MHz                                                                    | 24000/F(KHz) | QP      | 30m                  |            |
|                       | 1.705MHz-30MHz                                                                       | 30           | QP      | 30m                  |            |
|                       | 30MHz-88MHz                                                                          | 100          | QP      | 3m                   |            |
|                       | 88MHz-216MHz                                                                         | 150          | QP      |                      |            |
|                       | 216MHz-960MHz                                                                        | 200          | QP      |                      |            |
|                       | 960MHz-1GHz                                                                          | 500          | QP      |                      |            |
|                       | Above 1GHz                                                                           | 500          | Average |                      |            |
|                       |                                                                                      | 5000         | Peak    |                      |            |
| Test setup:           | For radiated emissions from 9kHz to 30MHz                                            |              |         |                      |            |
|                       |  |              |         |                      |            |

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                   | <p>For radiated emissions from 30MHz to1GHz</p>  <p>For radiated emissions above 1GHz</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Test Procedure:   | <ol style="list-style-type: none"><li>1. The EUT was placed on the top of a rotating table (0.8m for below 1G and 1.5m for above 1G) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.</li><li>2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</li><li>3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.</li><li>4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.</li><li>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</li><li>6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</li></ol> |
| Test Instruments: | Refer to section 6.0 for details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Test mode:        | Refer to section 5.2 for details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Test environment: | Temp.: 25 °C    Humid.: 52%    Press.: 1012mbar                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |



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|               |         |
|---------------|---------|
| Test voltage: | DC 3.7V |
| Test results: | Pass    |

**Measurement data:**

*Remarks:*

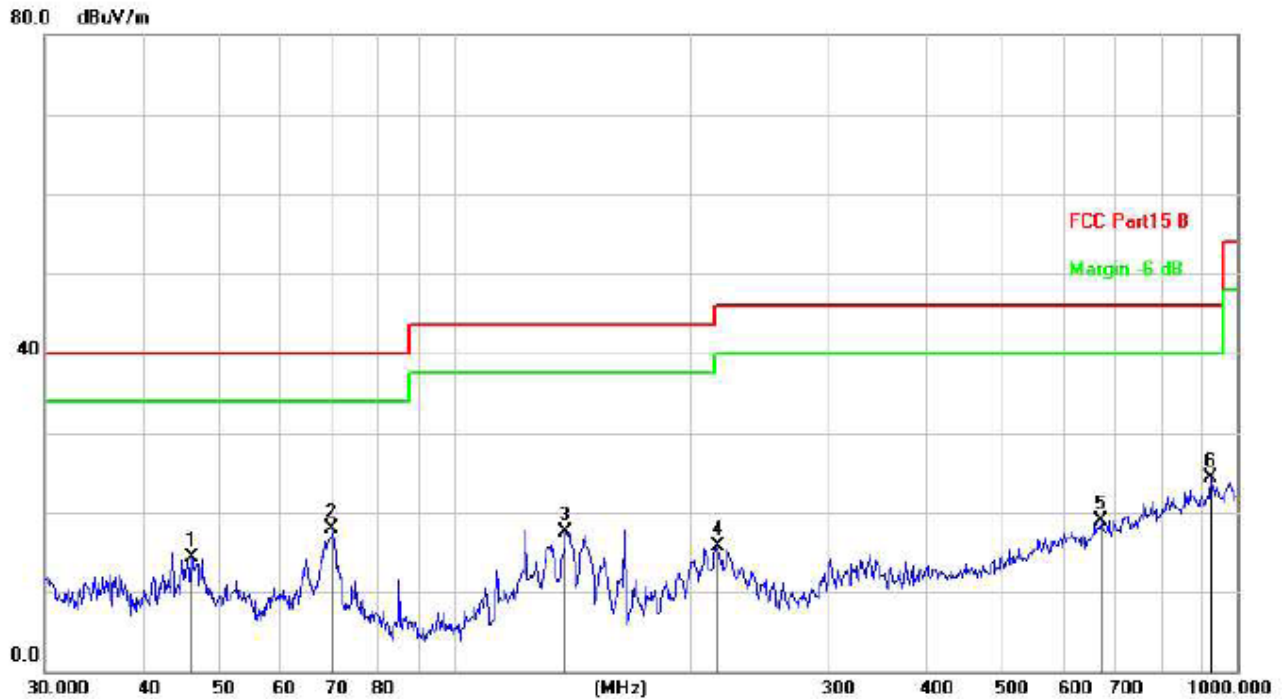
1. *During the test, pre-scan the GFSK,  $\pi/4$ -DQPSK, 8QPSK modulation, and found the 8QPSK modulation which it is worse case.*
2. *Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.*

■ **9kHz~30MHz**

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

### For 30MHz-1GHz

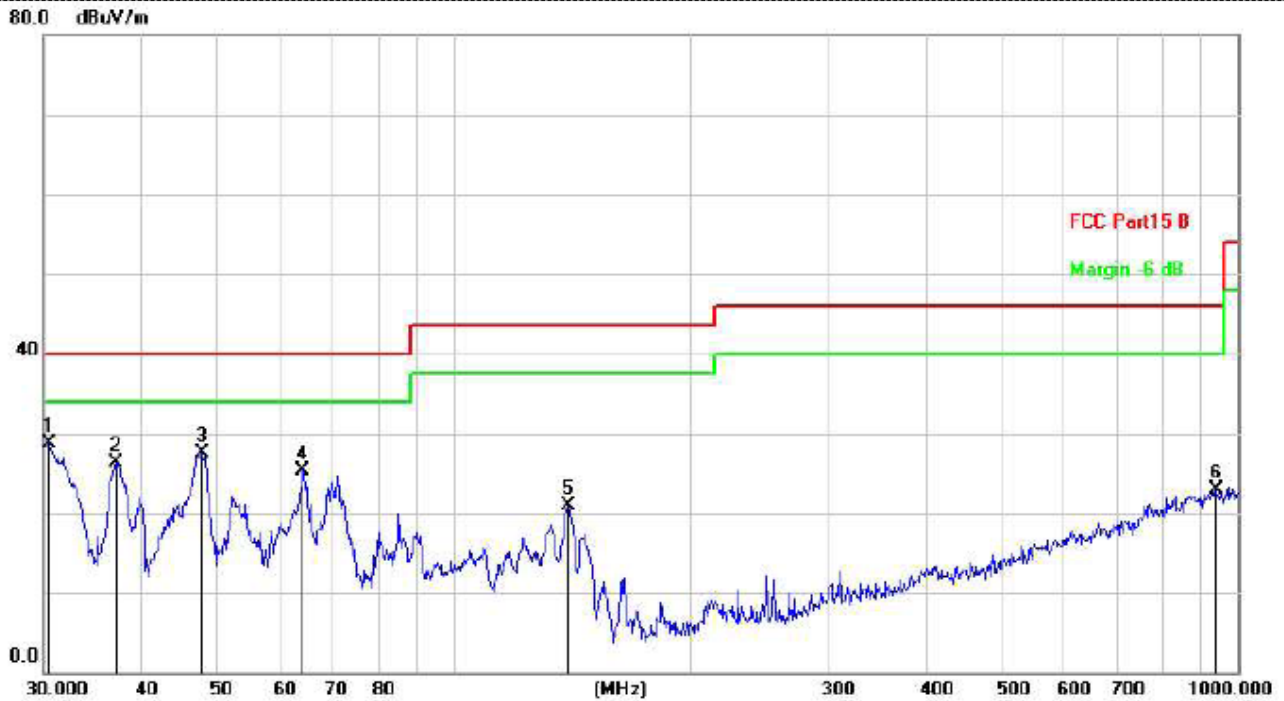
#### Horizontal



| No. | Mk. | Freq.    | Reading | Correct | Measure- | Limit | Over   |          |
|-----|-----|----------|---------|---------|----------|-------|--------|----------|
|     |     | MHz      | Level   | Factor  | ment     |       |        |          |
|     |     |          | dBuV    | dB      | dBuV/m   | dB/m  | dB     | Detector |
| 1   |     | 46.1779  | 31.49   | -17.21  | 14.28    | 40.00 | -25.72 | QP       |
| 2   |     | 69.8450  | 37.80   | -19.94  | 17.86    | 40.00 | -22.14 | QP       |
| 3   |     | 138.8735 | 35.48   | -17.97  | 17.51    | 43.50 | -25.99 | QP       |
| 4   |     | 216.7828 | 35.72   | -20.01  | 15.71    | 46.00 | -30.29 | QP       |
| 5   |     | 670.4893 | 28.38   | -9.40   | 18.98    | 46.00 | -27.02 | QP       |
| 6   | *   | 925.7563 | 28.94   | -4.66   | 24.28    | 46.00 | -21.72 | QP       |

Final Level =Receiver Read level + Correct Factor

### Vertical



| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measurement | Limit | Over   |          |
|-----|-----|----------|---------------|----------------|-------------|-------|--------|----------|
|     |     | MHz      | dBuV          | dB             | dBuV/m      | dB/m  | dB     | Detector |
| 1   | *   | 30.5306  | 47.24         | -18.54         | 28.70       | 40.00 | -11.30 | QP       |
| 2   |     | 37.1550  | 44.13         | -17.79         | 26.34       | 40.00 | -13.66 | QP       |
| 3   |     | 47.8260  | 44.88         | -17.29         | 27.59       | 40.00 | -12.41 | QP       |
| 4   |     | 64.2074  | 44.28         | -18.90         | 25.38       | 40.00 | -14.62 | QP       |
| 5   |     | 139.8508 | 38.67         | -17.84         | 20.83       | 43.50 | -22.67 | QP       |
| 6   |     | 938.8326 | 27.84         | -5.00          | 22.84       | 46.00 | -23.16 | QP       |

Final Level =Receiver Read level + Correct Factor

**For 1GHz to 25GHz**

Remark: For test above 1GHz GFSK , Pi/4 DQPSK and 8QPSK were test at Low, Middle, and High channel; only the worst result of 8QPSK was reported as below:

**CH Low (2402MHz)****Horizontal:**

| Frequency | Meter Reading | Antenna Factor | Cable Loss | Preamplifier Factor | Emission Level | Limits   | Margin | Detector Type |
|-----------|---------------|----------------|------------|---------------------|----------------|----------|--------|---------------|
| (MHz)     | (dBμV)        | (dB/m)         | (dB)       | (dB)                | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 4804      | 50.02         | 31.40          | 8.18       | 31.50               | 58.10          | 74.00    | -15.90 | peak          |
| 4804      | 34.56         | 31.40          | 8.18       | 31.50               | 42.64          | 54.00    | -11.36 | AVG           |
| 7206      | 40.05         | 35.80          | 10.83      | 31.40               | 55.28          | 74.00    | -18.72 | peak          |
| 7206      | 24.08         | 35.80          | 10.83      | 31.40               | 39.31          | 54.00    | -14.69 | AVG           |
| ---       | ---           |                |            | ---                 | ---            | ---      | ---    | ---           |
| ---       | ---           |                |            | ---                 | ---            | ---      | ---    | ---           |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

**Vertical:**

| Frequency | Meter Reading | Antenna Factor | Cable Loss | Preamplifier Factor | Emission Level | Limits   | Margin | Detector Type |
|-----------|---------------|----------------|------------|---------------------|----------------|----------|--------|---------------|
| (MHz)     | (dBμV)        | (dB/m)         | (dB)       | (dB)                | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 4804      | 50.52         | 31.40          | 8.18       | 31.50               | 58.60          | 74.00    | -15.40 | peak          |
| 4804      | 34.76         | 31.40          | 8.18       | 31.50               | 42.84          | 54.00    | -11.16 | AVG           |
| 7206      | 41.12         | 35.80          | 10.83      | 31.40               | 56.35          | 74.00    | -17.65 | peak          |
| 7206      | 25.52         | 35.80          | 10.83      | 31.40               | 40.75          | 54.00    | -13.25 | AVG           |
| ---       | ---           |                |            | ---                 | ---            | ---      | ---    | ---           |
| ---       | ---           |                |            | ---                 | ---            | ---      | ---    | ---           |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.



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### CH Middle (2441MHz)

#### Horizontal:

| Frequency | Meter Reading | Antenna Factor | Cable Loss | Preamp Factor | Emission Level | Limits   | Margin | Detector Type |
|-----------|---------------|----------------|------------|---------------|----------------|----------|--------|---------------|
| (MHz)     | (dBμV)        | (dB/m)         | (dB)       | (dB)          | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 4882      | 50.13         | 31.40          | 9.17       | 32.10         | 58.60          | 74.00    | -15.40 | peak          |
| 4882      | 35.47         | 31.40          | 9.17       | 32.10         | 43.94          | 54.00    | -10.06 | AVG           |
| 7323      | 40.52         | 35.80          | 10.83      | 31.40         | 55.75          | 74.00    | -18.25 | peak          |
| 7323      | 25.58         | 35.80          | 10.83      | 31.40         | 40.81          | 54.00    | -13.19 | AVG           |
| ---       | ---           |                |            | ---           | ---            | ---      | ---    | ---           |
| ---       | ---           |                |            | ---           | ---            | ---      | ---    | ---           |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

#### Vertical:

| Frequency | Meter Reading | Antenna Factor | Cable Loss | Preamp Factor | Emission Level | Limits   | Margin | Detector Type |
|-----------|---------------|----------------|------------|---------------|----------------|----------|--------|---------------|
| (MHz)     | (dBμV)        | (dB/m)         | (dB)       | (dB)          | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 4882      | 50.85         | 31.40          | 9.17       | 32.10         | 59.32          | 74.00    | -14.68 | peak          |
| 4882      | 35.42         | 31.40          | 9.17       | 32.10         | 43.89          | 54.00    | -10.11 | AVG           |
| 7323      | 40.39         | 35.80          | 10.83      | 31.40         | 55.62          | 74.00    | -18.38 | peak          |
| 7323      | 25.07         | 35.80          | 10.83      | 31.40         | 40.30          | 54.00    | -13.70 | AVG           |
| ---       | ---           |                |            | ---           | ---            | ---      | ---    | ---           |
| ---       | ---           |                |            | ---           | ---            | ---      | ---    | ---           |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.



## CH High (2480MHz)

## Horizontal:

| Frequency | Meter Reading | Antenna Factor | Cable Loss | Preamp Factor | Emission Level | Limits   | Margin | Detector Type |
|-----------|---------------|----------------|------------|---------------|----------------|----------|--------|---------------|
| (MHz)     | (dBμV)        | (dB/m)         | (dB)       | (dB)          | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 4960      | 50.13         | 31.40          | 9.17       | 32.10         | 58.6           | 74       | -15.4  | peak          |
| 4960      | 35.52         | 31.40          | 9.17       | 32.10         | 43.99          | 54       | -10.01 | AVG           |
| 7440      | 40.26         | 35.80          | 10.83      | 31.40         | 55.49          | 74       | -18.51 | peak          |
| 7440      | 25.57         | 35.80          | 10.83      | 31.40         | 40.8           | 54       | -13.2  | AVG           |
| ---       | ---           |                |            | ---           | ---            | ---      | ---    | ---           |
| ---       | ---           |                |            | ---           | ---            | ---      | ---    | ---           |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

## Vertical:

| Frequency | Meter Reading | Antenna Factor | Cable Loss | Preamp Factor | Emission Level | Limits   | Margin | Detector Type |
|-----------|---------------|----------------|------------|---------------|----------------|----------|--------|---------------|
| (MHz)     | (dBμV)        | (dB/m)         | (dB)       | (dB)          | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 4960      | 50.13         | 31.40          | 9.17       | 32.10         | 58.6           | 74       | -15.4  | peak          |
| 4960      | 34.12         | 31.40          | 9.17       | 32.10         | 42.59          | 54       | -11.41 | AVG           |
| 7440      | 39.23         | 35.80          | 10.83      | 31.40         | 54.46          | 74       | -19.54 | peak          |
| 7440      | 24.47         | 35.80          | 10.83      | 31.40         | 39.7           | 54       | -14.3  | AVG           |
| ---       | ---           |                |            | ---           | ---            | ---      | ---    | ---           |
| ---       | ---           |                |            | ---           | ---            | ---      | ---    | ---           |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

## Remark:

(1) 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.

(2) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed.



## 7. Test Setup Photo

Reference to the **appendix I** for details.

## 8. EUT Constructional Details

Reference to the **appendix II** for details.

-----End-----