

# Radio Test Report

Report No.:CTA231102005W01

Issued for

SHENZHEN REOSTUDIO TECHNOLOGY CO.,LTD

Room 213-214, Internet of Things Demonstration Park, No. 6  
Minhuan Road, Longhua District, Shenzhen, China

Product Name: Keyboard

Brand Name: **NuPhy<sup>®</sup>**

Model Name: Air75 V2

Series Model(s): N/A

FCC ID: 2A542AIR75PRO

Test Standards: FCC Part15.247

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Shenzhen CTA Testing Technology Co., Ltd.

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China

**TEST REPORT**

**Applicant's Name** .....: SHENZHEN REOSTUDIO TECHNOLOGY CO.,LTD  
**Address** .....: Room 213-214, Internet of Things Demonstration Park, No. 6  
Minhuan Road, Longhua District, Shenzhen, China  
**Manufacturer's Name**.....: SHENZHEN ARBITER TECHNOLOGY CO.,LTD  
**Address** .....: Floor 2, 3 and 4, Bldg. A, Meisheng Industrial Park, Chongqing Rd.,  
Fuhai St., Baoan Dist., Shenzhen, Guangdong, China

**Product Description**

**Product Name** .....: Keyboard  
**Brand Name** .....: **NuPhy®**  
**Model Name** .....: Air75 V2  
**Series Model(s)** .....: N/A  
**Test Standards** .....: FCC Part 15.247  
**Test Procedure**.....: ANSI C63.10-2013

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

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**Date of Test**.....:

**Date of receipt of test item** .....: 12 Sept. 2023  
**Date (s) of performance of tests** .....: 12 Sept. 2023 ~ 03 Nov. 2023  
**Date of Issue** .....: 03 Nov. 2023  
**Test Result** .....: **Pass**

Testing Engineer :



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(Zoey Cao)

Technical Manager :



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(Amy Wen)

Authorized Signatory :



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(Eric Wang)

## Table of Contents

## Page

**1. SUMMARY OF TEST RESULTS****6**

## 1.1 TEST FACTORY

7

## 1.2 MEASUREMENT UNCERTAINTY

7

**2. GENERAL INFORMATION****8**

## 2.1 GENERAL DESCRIPTION OF THE EUT

8

## 2.2 DESCRIPTION OF THE TEST MODES

10

## 2.3 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

10

## 2.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

11

## 2.5 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

12

## 2.6 EQUIPMENTS LIST FOR ALL TEST ITEMS

13

## 3.1 CONDUCTED EMISSION MEASUREMENT

15

## 3.2 RADIATED EMISSION MEASUREMENT

19

**4. CONDUCTED SPURIOUS & BAND EDGE EMISSION****30**

## 4.1 LIMIT

30

## 4.2 TEST PROCEDURE

30

## 4.3 TEST SETUP

31

## 4.4 EUT OPERATION CONDITIONS

31

## 4.5 TEST RESULTS

31

**5. NUMBER OF HOPPING CHANNEL****32**

## 5.1 LIMIT

32

## 5.2 TEST PROCEDURE

32

## 5.3 TEST SETUP

32

## 5.4 EUT OPERATION CONDITIONS

32

## 5.5 TEST RESULTS

32

**6. BANDWIDTH TEST****33**

## 6.1 LIMIT

33

## 6.2 TEST PROCEDURE

33

## 6.3 DEVIATION FROM STANDARD

33

## 6.4 TEST SETUP

33

## 6.5 EUT OPERATION CONDITIONS

33

## 6.6 TEST RESULTS

33

**7. PEAK OUTPUT POWER TEST****34**

## 7.1 LIMIT

34

## FCC PART 15.247,SUBPART C

34

## Table of Contents

## Page

|                                                   |           |
|---------------------------------------------------|-----------|
| 7.2 TEST PROCEDURE                                | 34        |
| 7.3 TEST SETUP                                    | 34        |
| 7.4 EUT OPERATION CONDITIONS                      | 34        |
| 7.5 TEST RESULTS                                  | 34        |
| <b>8. ANTENNA REQUIREMENT</b>                     | <b>35</b> |
| 8.1 STANDARD REQUIREMENT                          | 35        |
| 8.2 EUT ANTENNA                                   | 35        |
| <b>9. AVERAGE TIME OF OCCUPANCY</b>               | <b>36</b> |
| 9.1 LIMIT                                         | 36        |
| 9.2 TEST PROCEDURE                                | 36        |
| 9.3 TEST SETUP                                    | 36        |
| 9.4 EUT OPERATION CONDITIONS                      | 36        |
| 9.5 TEST RESULTS                                  | 36        |
| <b>10. HOPPING CHANNEL SEPARATION MEASUREMENT</b> | <b>37</b> |
| 10.1 LIMIT                                        | 37        |
| 10.2 TEST PROCEDURE                               | 37        |
| 10.3 TEST SETUP                                   | 37        |
| 10.4 EUT OPERATION CONDITIONS                     | 37        |
| 10.5 TEST RESULTS                                 | 37        |
| <b>APPENDIX 1-TEST DATA</b>                       | <b>38</b> |
| 1. MAXIMUM AVERAGE CONDUCTED OUTPUT POWER         | 38        |
| 2. MAXIMUM PEAK CONDUCTED OUTPUT POWER            | 41        |
| 3. -20DB BANDWIDTH                                | 44        |
| 4. CARRIER FREQUENCIES SEPARATION                 | 47        |
| 5. NUMBER OF HOPPING CHANNEL                      | 50        |
| 6. BAND EDGE                                      | 52        |
| 7. BAND EDGE(HOPPING)                             | 55        |
| 8. CONDUCTED RF SPURIOUS EMISSION                 | 58        |
| 9. DWELL TIME                                     | 62        |
| <b>APPENDIX 2-PHOTOS OF TEST SETUP</b>            | <b>65</b> |

**Revision History**

| Rev. | Issue Date   | Report No.      | Effect Page | Contents      |
|------|--------------|-----------------|-------------|---------------|
| 00   | 03 Nov. 2023 | CTA231102005W01 | ALL         | Initial Issue |
|      |              |                 |             |               |

## 1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:  
KDB 558074 D01 15.247 Meas Guidance v05r02.

| FCC Part 15.247, Subpart C    |                                         |          |        |
|-------------------------------|-----------------------------------------|----------|--------|
| Standard Section              | Test Item                               | Judgment | Remark |
| 15.207                        | Conducted Emission                      | PASS     | --     |
| 15.247(a)(1)                  | Hopping Channel Separation              | PASS     | --     |
| 15.247(a)(1)&(b)(1)           | Output Power                            | PASS     | --     |
| 15.209                        | Radiated Spurious Emission              | PASS     | --     |
| 15.247(d)                     | Conducted Spurious & Band Edge Emission | PASS     | --     |
| 15.247(a)(1)(iii)             | Number of Hopping Frequency             | PASS     | --     |
| 15.247(a)(1)(iii)             | Dwell Time                              | PASS     | --     |
| 15.247(a)(1)                  | Bandwidth                               | PASS     | --     |
| 15.205                        | Restricted bands of operation           | PASS     | --     |
| Part 15.247(d)/part 15.209(a) | Band Edge Emission                      | PASS     | --     |
| 15.203                        | Antenna Requirement                     | PASS     | --     |

## NOTE:

(1) 'N/A' denotes test is not applicable in this Test Report.

(2) All tests are according to ANSI C63.10-2013.

## 1.1 TEST FACTORY

Shenzhen CTA Testing Technology Co., Ltd.

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China

FCC test Firm Registration Number: 517856

IC test Firm Registration Number: 27890

A2LA Certificate No.: 6534.01

IC CAB ID: CN0127

## 1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement  $y \pm U$ , where expanded uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95 %.

| Test                                     | Range       | Measurement Uncertainty |
|------------------------------------------|-------------|-------------------------|
| Radiated Emission                        | 30~1000MHz  | 4.06 dB                 |
| Radiated Emission                        | 1~18GHz     | 5.14 dB                 |
| Radiated Emission                        | 18-40GHz    | 5.38 dB                 |
| Conducted Disturbance                    | 0.15~30MHz  | 2.14 dB                 |
| Output Peak power                        | 30MHz~18GHz | 0.55 dB                 |
| Power spectral density                   | /           | 0.57 dB                 |
| Spectrum bandwidth                       | /           | 1.1%                    |
| Radiated spurious emission (30MHz-1GHz)  | 30~1000MHz  | 4.10 dB                 |
| Radiated spurious emission (1GHz-18GHz)  | 1~18GHz     | 4.32 dB                 |
| Radiated spurious emission (18GHz-40GHz) | 18-40GHz    | 5.54 dB                 |

## 2. GENERAL INFORMATION

## 2.1 GENERAL DESCRIPTION OF THE EUT

|                         |                                                                       |              |
|-------------------------|-----------------------------------------------------------------------|--------------|
| Product Name            | Keyboard                                                              |              |
| Brand Name              | <b>NuPhy®</b>                                                         |              |
| Model Name              | Air75 V2                                                              |              |
| Series Model(s)         | N/A                                                                   |              |
| Model Difference        | N/A                                                                   |              |
| Product Description     | The EUT is a Keyboard                                                 |              |
|                         | Operation Frequency:                                                  | 2402-2480MHz |
|                         | Modulation Type:                                                      | GFSK         |
|                         | Number of Channel:                                                    | 40CH         |
|                         | Antenna Type:                                                         | PCB          |
|                         | Antenna Gain (dBi):                                                   | 0 dBi        |
| Channel List            | Please refer to the Note 3.                                           |              |
| Rating                  | Input: DC 5V                                                          |              |
| Battery                 | Rated Voltage:3.8V<br>Charge Limit Voltage:4.35V<br>Capacity: 4000mAh |              |
| Hardware version number | F2 Pro-BT926-B-V1.0                                                   |              |
| Software version number | 0xdf8f9e5b                                                            |              |
| Connecting I/O Port(s)  | Please refer to the Note 1.                                           |              |

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User Manual.

2.

| Channel List |                 |         |                 |         |                 |         |                 |
|--------------|-----------------|---------|-----------------|---------|-----------------|---------|-----------------|
| Channel      | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 00           | 2402            | 10      | 2422            | 20      | 2442            | 30      | 2462            |
| 01           | 2404            | 11      | 2424            | 21      | 2444            | 31      | 2464            |
| 02           | 2406            | 12      | 2426            | 22      | 2446            | 32      | 2466            |
| 03           | 2408            | 13      | 2428            | 23      | 2448            | 33      | 2468            |
| 04           | 2410            | 14      | 2430            | 24      | 2450            | 34      | 2470            |
| 05           | 2412            | 15      | 2432            | 25      | 2452            | 35      | 2472            |
| 06           | 2414            | 16      | 2434            | 26      | 2454            | 36      | 2474            |
| 07           | 2416            | 17      | 2436            | 27      | 2456            | 37      | 2476            |
| 08           | 2418            | 18      | 2438            | 28      | 2458            | 38      | 2478            |
| 09           | 2420            | 19      | 2440            | 29      | 2460            | 39      | 2480            |

3. Table for Filed Antenna

| Ant. | Brand                    | Model Name | Antenna Type | Connector | Gain (dBi) | NOTE     |
|------|--------------------------|------------|--------------|-----------|------------|----------|
| 1    | <b>NuPhy<sup>®</sup></b> | Air75 V2   | PCB          | N/A       | 0 dBi      | 2.4G ANT |

Note:.. The antenna information refer the manufacturer provide report, applicable only to the tested sample identified in the report. Due to the incorrect antenna information, a series of problems such as the accuracy of the test results will be borne by the customer.

## 2.2 DESCRIPTION OF THE TEST MODES

Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

| Worst Mode | Description      | Data Rate |
|------------|------------------|-----------|
| Mode 1     | TX CH00(2402MHz) | GFSK      |
| Mode 2     | TX CH19(2440MHz) | GFSK      |
| Mode 3     | TX CH39(2480MHz) | GFSK      |
| Mode 4     | Hopping          | GFSK      |

Note:

- (1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported.
- (2) We have be tested for all avaiable U.S. voltage and frequencies(For 120V,50/60Hz and 240V, 50/60Hz) for which the device is capable of operation, and the worst case of 120V /60Hz is shown in the report.
- (3) The battery is fully-charged during the radited and RF conducted test.

### AC Conducted Emission

| Test Case             |                    |
|-----------------------|--------------------|
| AC Conducted Emission | Mode 5: Keeping TX |

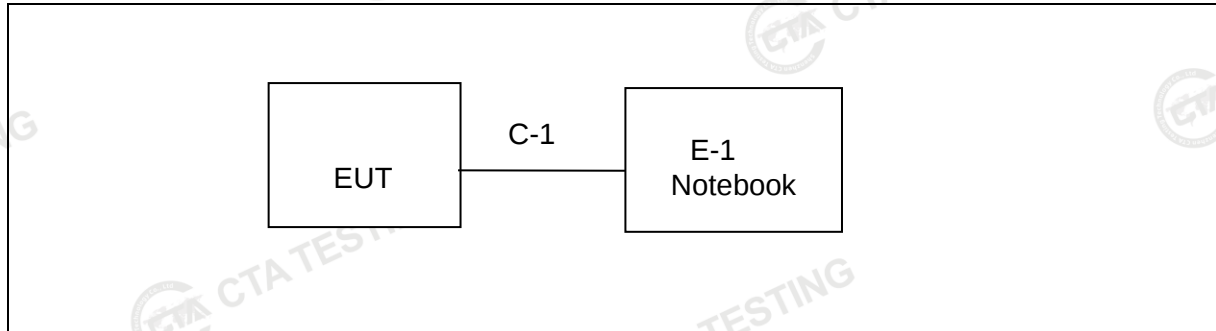
## 2.3 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of FHSS.

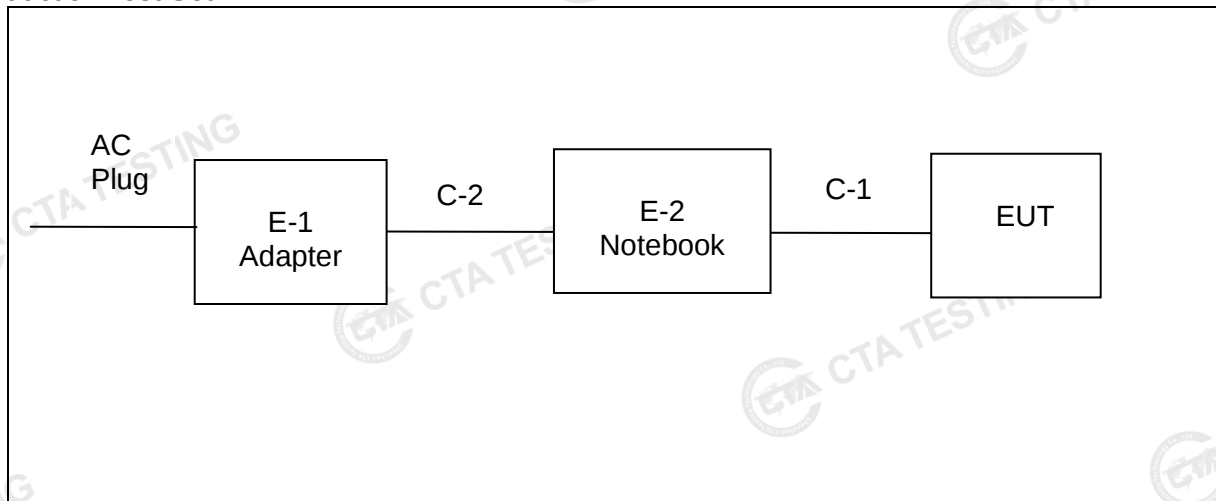
| RF Function | Type | Mode Or Modulation type | ANT Gain(dBi) | Power Class | Software For Testing       |
|-------------|------|-------------------------|---------------|-------------|----------------------------|
| 2.4G        | 2.4G | GFSK                    | 0             | 3           | nrfconnect-setup-4.2.0-x64 |

## 2.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

## Radiation Test Set



## Conduction Test Set



## 2.5 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

### Necessary accessories

| Item | Equipment | Mfr/Brand | Model/Type No. | Length | Note |
|------|-----------|-----------|----------------|--------|------|
|      |           |           |                |        |      |

### Support units

| Item | Equipment        | Mfr/Brand | Model/Type No. | Length | Note |
|------|------------------|-----------|----------------|--------|------|
|      | Notebook Adapter | LENOVO    | ADLX45DLC3A    | N/A    | N/A  |
|      | Notebook         | LENOVO    | Think Pad E470 | N/A    | N/A  |
|      | USB Cable        | N/A       | N/A            | 150cm  | NO   |

Note:

- (1) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
- (2) "YES" is means "with core"; "NO" is means "without core".

## 2.6 EQUIPMENTS LIST FOR ALL TEST ITEMS

| Test Equipment                      | Manufacturer           | Model No.   | Equipment No. | Calibration Date | Calibration Due Date |
|-------------------------------------|------------------------|-------------|---------------|------------------|----------------------|
| LISN                                | R&S                    | ENV216      | CTA-308       | 2023/08/02       | 2024/08/01           |
| LISN                                | R&S                    | ENV216      | CTA-314       | 2023/08/02       | 2024/08/01           |
| EMI Test Receiver                   | R&S                    | ESPI        | CTA-307       | 2023/08/02       | 2024/08/01           |
| EMI Test Receiver                   | R&S                    | ESCI        | CTA-306       | 2023/08/02       | 2024/08/01           |
| Spectrum Analyzer                   | Agilent                | N9020A      | CTA-301       | 2023/08/02       | 2024/08/01           |
| Spectrum Analyzer                   | R&S                    | FSP         | CTA-337       | 2023/08/02       | 2024/08/01           |
| Vector Signal generator             | Agilent                | N5182A      | CTA-305       | 2023/08/02       | 2024/08/01           |
| Analog Signal Generator             | R&S                    | SML03       | CTA-304       | 2023/08/02       | 2024/08/01           |
| WIDEBAND RADIO COMMUNICATION TESTER | CMW500                 | R&S         | CTA-302       | 2023/08/02       | 2024/08/01           |
| Temperature and humidity meter      | Chigo                  | ZG-7020     | CTA-326       | 2023/08/02       | 2024/08/01           |
| Ultra-Broadband Antenna             | Schwarzbeck            | VULB9163    | CTA-310       | 2023/10/17       | 2024/10/16           |
| Horn Antenna                        | Schwarzbeck            | BBHA 9120D  | CTA-309       | 2023/10/13       | 2024/10/12           |
| Loop Antenna                        | Zhinan                 | ZN30900C    | CTA-311       | 2023/10/17       | 2024/10/16           |
| Horn Antenna                        | Beijing Hangwei Dayang | OBH100400   | CTA-336       | 2021/08/07       | 2024/08/06           |
| Amplifier                           | Schwarzbeck            | BBV 9745    | CTA-312       | 2023/08/02       | 2024/08/01           |
| Amplifier                           | Taiwan chengyi         | EMC051845B  | CTA-313       | 2023/08/02       | 2024/08/01           |
| Directional coupler                 | NARDA                  | 4226-10     | CTA-303       | 2023/08/02       | 2024/08/01           |
| High-Pass Filter                    | XingBo                 | XBLBQ-GTA18 | CTA-402       | 2023/08/02       | 2024/08/01           |
| High-Pass Filter                    | XingBo                 | XBLBQ-GTA27 | CTA-403       | 2023/08/02       | 2024/08/01           |
| Automated filter bank               | Tonscend               | JS0806-F    | CTA-404       | 2023/08/02       | 2024/08/01           |
| Power Sensor                        | Agilent                | U2021XA     | CTA-405       | 2023/08/02       | 2024/08/01           |
| Amplifier                           | Schwarzbeck            | BBV9719     | CTA-406       | 2023/08/02       | 2024/08/01           |

| Test Equipment    | Manufacturer | Model No.   | Version number | Calibration Date | Calibration Due Date |
|-------------------|--------------|-------------|----------------|------------------|----------------------|
| EMI Test Software | Tonscend     | TS®JS32-RE  | 5.0.0.2        | N/A              | N/A                  |
| EMI Test Software | Tonscend     | TS®JS32-CE  | 5.0.0.1        | N/A              | N/A                  |
| RF Test Software  | Tonscend     | TS®JS1120-3 | 3.1.65         | N/A              | N/A                  |
| RF Test Software  | Tonscend     | TS®JS1120   | 3.1.46         | N/A              | N/A                  |

### 3. EMC EMISSION TEST

#### 3.1 CONDUCTED EMISSION MEASUREMENT

##### 3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table.

| FREQUENCY (MHz) | Conducted Emission limit (dBuV) |           |
|-----------------|---------------------------------|-----------|
|                 | Quasi-peak                      | Average   |
| 0.15 -0.5       | 66 - 56 *                       | 56 - 46 * |
| 0.50 -5.0       | 56.00                           | 46.00     |
| 5.0 -30.0       | 60.00                           | 50.00     |

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of “ \* ” marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

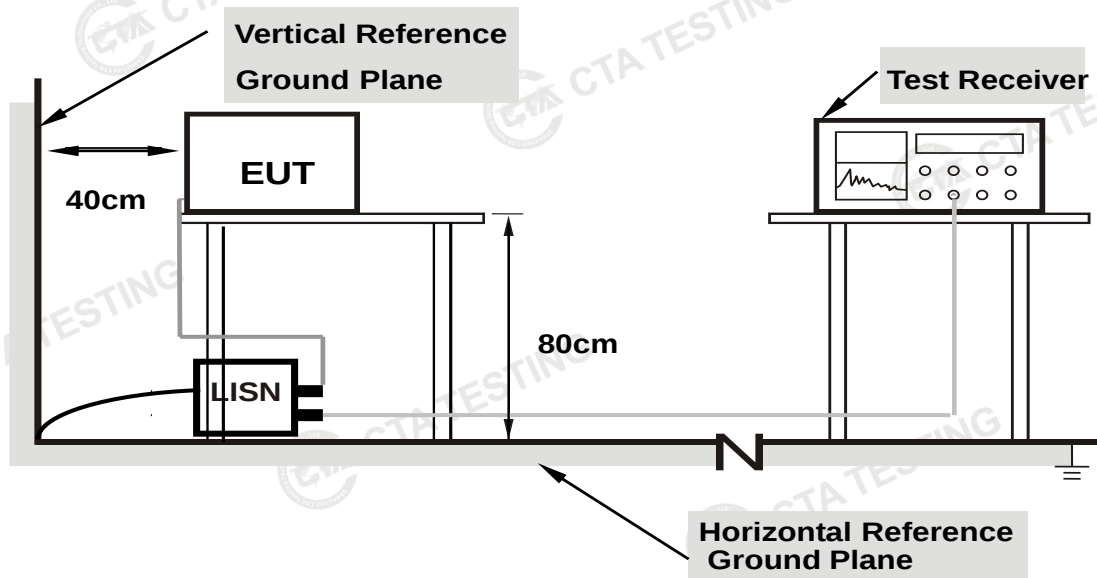
The following table is the setting of the receiver

| Receiver Parameters | Setting  |
|---------------------|----------|
| Attenuation         | 10 dB    |
| Start Frequency     | 0.15 MHz |
| Stop Frequency      | 30 MHz   |
| IF Bandwidth        | 9 kHz    |

### 3.1.2 TEST PROCEDURE

- The EUT is 0.8 m from the horizontal ground plane and 0.4 m from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments are powered from additional LISN(s). The LISN provides 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- LISN is at least 80 cm from the nearest part of EUT chassis.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

### 3.1.3 TEST SETUP



**Note: 1. Support units were connected to second LISN.**

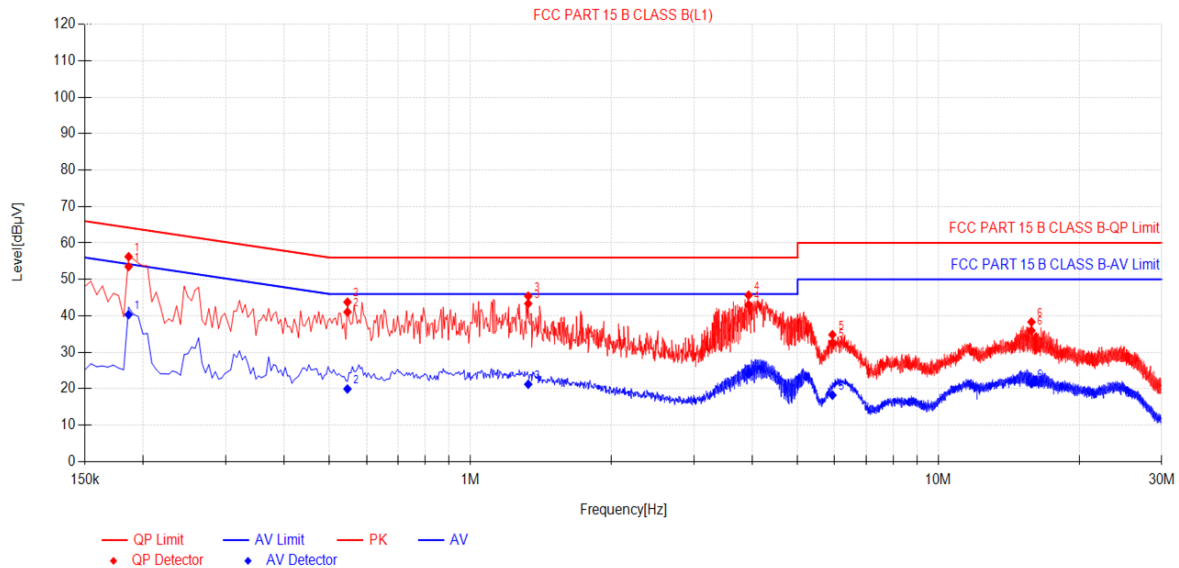
**2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes support units.**

### 3.1.4 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

## 3.1.5 TEST RESULT

|               |              |                    |       |
|---------------|--------------|--------------------|-------|
| Temperature:  | 26.2(C)      | Relative Humidity: | 54%RH |
| Test Voltage: | AC 120V/60Hz | Phase:             | L     |
| Test Mode:    | Mode 5       |                    |       |



## Final Data List

| NO. | Freq. [MHz] | Factor [dB] | QP Reading[dB μV] | QP Value [dBμV] | QP Limit [dBμV] | QP Margin [dB] | AV Reading [dBμV] | AV Value [dBμV] | AV Limit [dBμV] | AV Margin [dB] | Verdict |
|-----|-------------|-------------|-------------------|-----------------|-----------------|----------------|-------------------|-----------------|-----------------|----------------|---------|
| 1   | 0.186       | 10.03       | 43.48             | 53.51           | 64.21           | 10.70          | 30.30             | 40.33           | 54.21           | 13.88          | PASS    |
| 2   | 0.546       | 10.03       | 31.01             | 41.04           | 56.00           | 14.96          | 9.91              | 19.94           | 46.00           | 26.06          | PASS    |
| 3   | 1.329       | 9.90        | 33.46             | 43.36           | 56.00           | 12.64          | 11.32             | 21.22           | 46.00           | 24.78          | PASS    |
| 4   | 3.93        | 9.92        | 33.12             | 43.04           | 56.00           | 12.96          | 14.12             | 24.04           | 46.00           | 21.96          | PASS    |
| 5   | 5.937       | 10.13       | 22.45             | 32.58           | 60.00           | 27.42          | 8.11              | 18.24           | 50.00           | 31.76          | PASS    |
| 6   | 15.8055     | 10.33       | 25.61             | 35.94           | 60.00           | 24.06          | 11.07             | 21.40           | 50.00           | 28.60          | PASS    |

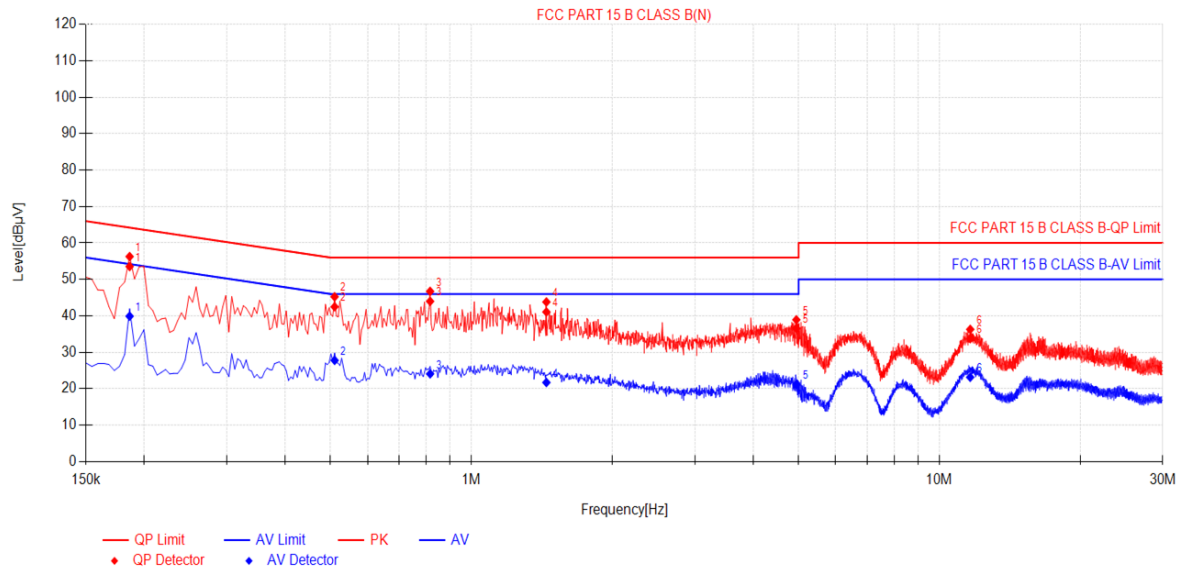
Note:1). QP Value (dBμV) = QP Reading (dBμV) + Factor (dB)

2). Factor (dB) = insertion loss of LISN (dB) + Cable loss (dB)

3). QPMargin(dB) = QP Limit (dBμV) - QP Value (dBμV)

4). AVMargin(dB) = AV Limit (dBμV) - AV Value (dBμV)

|               |              |                    |       |
|---------------|--------------|--------------------|-------|
| Temperature:  | 26.2(C)      | Relative Humidity: | 54%RH |
| Test Voltage: | AC 120V/60Hz | Phase:             | N     |
| Test Mode:    | Mode 5       |                    |       |



### Final Data List

| NO. | Freq. [MHz] | Factor [dB] | QP Reading[dB μV] | QP Value [dBμV] | QP Limit [dBμV] | QP Margin [dB] | AV Reading [dBμV] | AV Value [dBμV] | AV Limit [dBμV] | AV Margin [dB] | Verdict |
|-----|-------------|-------------|-------------------|-----------------|-----------------|----------------|-------------------|-----------------|-----------------|----------------|---------|
| 1   | 0.188       | 10.01       | 43.52             | 53.53           | 64.21           | 10.68          | 29.90             | 39.91           | 54.21           | 14.30          | PASS    |
| 2   | 0.51        | 10.02       | 32.48             | 42.50           | 56.00           | 13.50          | 17.76             | 27.78           | 46.00           | 18.22          | PASS    |
| 3   | 0.816       | 10.14       | 33.84             | 43.98           | 56.00           | 12.02          | 13.94             | 24.08           | 46.00           | 21.92          | PASS    |
| 4   | 1.446       | 10.14       | 30.93             | 41.07           | 56.00           | 14.93          | 11.58             | 21.72           | 46.00           | 24.28          | PASS    |
| 5   | 4.947       | 10.08       | 26.50             | 36.58           | 56.00           | 19.42          | 11.05             | 21.13           | 46.00           | 24.87          | PASS    |
| 6   | 11.6385     | 10.41       | 23.32             | 33.73           | 60.00           | 26.27          | 12.74             | 23.15           | 50.00           | 26.85          | PASS    |

Note:1). QP Value (dBμV) = QP Reading (dBμV) + Factor (dB)

2). Factor (dB) = insertion loss of LISN (dB) + Cable loss (dB)

3). QPMargin(dB) = QP Limit (dBμV) - QP Value (dBμV)

4). AVMargin(dB) = AV Limit (dBμV) - AV Value (dBμV)

### 3.2 RADIATED EMISSION MEASUREMENT

#### 3.2.1 RADIATED EMISSION LIMITS

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205(a)&209(a) limit in the table and according to ANSI C63.10-2013 below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009MHz - 1000MHz)

| Frequencies<br>(MHz) | Field Strength<br>(micorvolts/meter) | Measurement Distance<br>(meters) |
|----------------------|--------------------------------------|----------------------------------|
| 0.009~0.490          | 2400/F(KHz)                          | 300                              |
| 0.490~1.705          | 24000/F(KHz)                         | 30                               |
| 1.705~30.0           | 30                                   | 30                               |
| 30~88                | 100                                  | 3                                |
| 88~216               | 150                                  | 3                                |
| 216~960              | 200                                  | 3                                |
| Above 960            | 500                                  | 3                                |

LIMITS OF RADIATED EMISSION MEASUREMENT (1000MHz-25GHz)

| FREQUENCY (MHz) | (dBuV/m) (at 3M) |         |
|-----------------|------------------|---------|
|                 | PEAK             | AVERAGE |
| Above 1000      | 74               | 54      |

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

#### LIMITS OF RESTRICTED FREQUENCY BANDS

| FREQUENCY (MHz)   | FREQUENCY (MHz)     | FREQUENCY (MHz) | FREQUENCY (GHz) |
|-------------------|---------------------|-----------------|-----------------|
| 0.090-0.110       | 16.42-16.423        | 399.9-410       | 4.5-5.15        |
| 0.495-0.505       | 16.69475-16.69525   | 608-614         | 5.35-5.46       |
| 2.1735-2.1905     | 16.80425-16.80475   | 960-1240        | 7.25-7.75       |
| 4.125-4.128       | 25.5-25.67          | 1300-1427       | 8.025-8.5       |
| 4.17725-4.17775   | 37.5-38.25          | 1435-1626.5     | 9.0-9.2         |
| 4.20725-4.20775   | 73-74.6             | 1645.5-1646.5   | 9.3-9.5         |
| 6.215-6.218       | 74.8-75.2           | 1660-1710       | 10.6-12.7       |
| 6.26775-6.26825   | 108-121.94          | 1718.8-1722.2   | 13.25-13.4      |
| 6.31175-6.31225   | 123-138             | 2200-2300       | 14.47-14.5      |
| 8.291-8.294       | 149.9-150.05        | 2310-2390       | 15.35-16.2      |
| 8.362-8.366       | 156.52475-156.52525 | 2483.5-2500     | 17.7-21.4       |
| 8.37625-8.38675   | 156.7-156.9         | 2690-2900       | 22.01-23.12     |
| 8.41425-8.41475   | 162.0125-167.17     | 3260-3267       | 23.6-24.0       |
| 12.29-12.293      | 167.72-173.2        | 3332-3339       | 31.2-31.8       |
| 12.51975-12.52025 | 240-285             | 3345.8-3358     | 36.43-36.5      |
| 12.57675-12.57725 | 322-335.4           | 3600-4400       | Above 38.6      |
| 13.36-13.41       |                     |                 |                 |

## For Radiated Emission

| Spectrum Parameter                    | Setting                                                                                                                         |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Attenuation                           | Auto                                                                                                                            |
| Detector                              | Peak/QP/AV                                                                                                                      |
| Start Frequency                       | 9 KHz/150KHz(Peak/QP/AV)                                                                                                        |
| Stop Frequency                        | 150KHz/30MHz(Peak/QP/AV)                                                                                                        |
| RB / VB (emission in restricted band) | 200Hz (From 9kHz to 0.15MHz)/<br>9KHz (From 0.15MHz to 30MHz);<br>200Hz (From 9kHz to 0.15MHz)/<br>9KHz (From 0.15MHz to 30MHz) |

| Spectrum Parameter                    | Setting            |
|---------------------------------------|--------------------|
| Attenuation                           | Auto               |
| Detector                              | Peak/QP            |
| Start Frequency                       | 30 MHz(Peak/QP)    |
| Stop Frequency                        | 1000 MHz (Peak/QP) |
| RB / VB (emission in restricted band) | 120 KHz / 300 KHz  |

| Spectrum Parameter                    | Setting                                   |
|---------------------------------------|-------------------------------------------|
| Attenuation                           | Auto                                      |
| Detector                              | Peak/AV                                   |
| Start Frequency                       | 1000 MHz(Peak/AV)                         |
| Stop Frequency                        | 10th carrier hamonic(Peak/AV)             |
| RB / VB (emission in restricted band) | 1 MHz / 3 MHz(Peak)<br>1 MHz/1/T MHz(AVG) |

## For Restricted band

| Spectrum Parameter   | Setting                                                                |
|----------------------|------------------------------------------------------------------------|
| Detector             | Peak/AV                                                                |
| Start/Stop Frequency | Lower Band Edge: 2310 to 2430 MHz<br>Upper Band Edge: 2445 to 2500 MHz |
| RB / VB              | 1 MHz / 3 MHz(Peak)<br>1 MHz/1/T MHz(AVG)                              |

| Receiver Parameter     | Setting                              |
|------------------------|--------------------------------------|
| Start ~ Stop Frequency | 9kHz~90kHz / RB 200Hz for PK & AV    |
| Start ~ Stop Frequency | 90kHz~110kHz / RB 200Hz for QP       |
| Start ~ Stop Frequency | 110kHz~490kHz / RB 200Hz for PK & AV |
| Start ~ Stop Frequency | 490kHz~30MHz / RB 9kHz for QP        |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB 120kHz for QP     |

### 3.2.2 TEST PROCEDURE

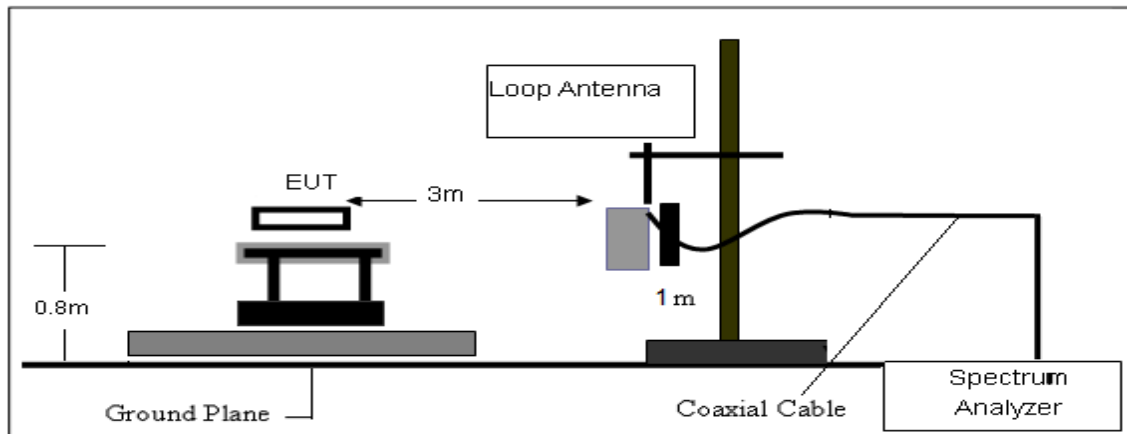
- The measuring distance at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz, and above 1GHz.
- The EUT was placed on the top of a rotating table 0.8 m (above 1GHz is 1.5 m) above the ground at a 3 m anechoic chamber test site. The table was rotated 360 degree to determine the position of the highest radiation.
- The height of the equipment shall be 0.8 m (above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. Horizontal and vertical polarization of the antenna are set to make the measurement.
- The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and QuasiPeak detector mode will be re-measured.
- If the Peak Mode measured value is compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and no additional QP Mode measurement was performed.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

#### Note:

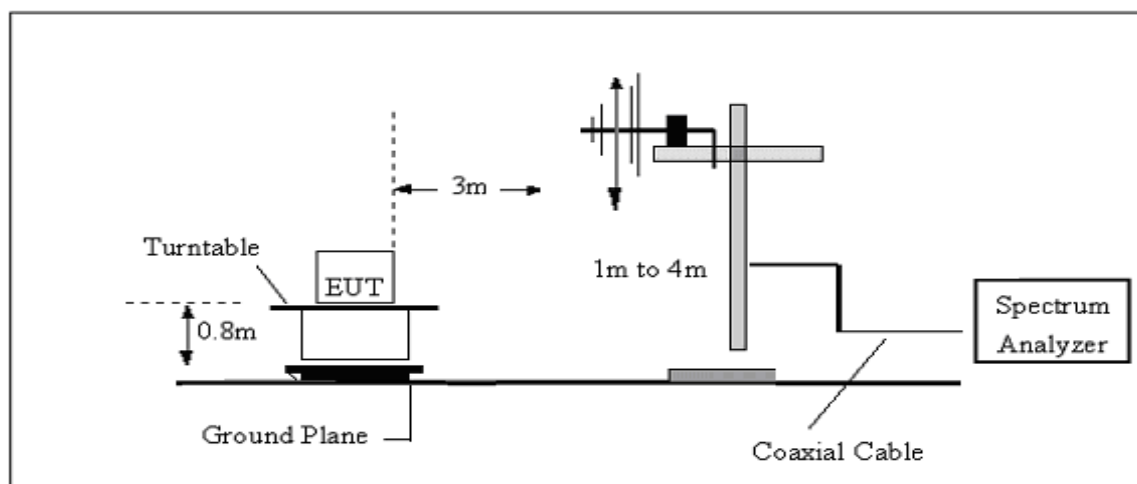
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

### 3.2.3 TEST SETUP

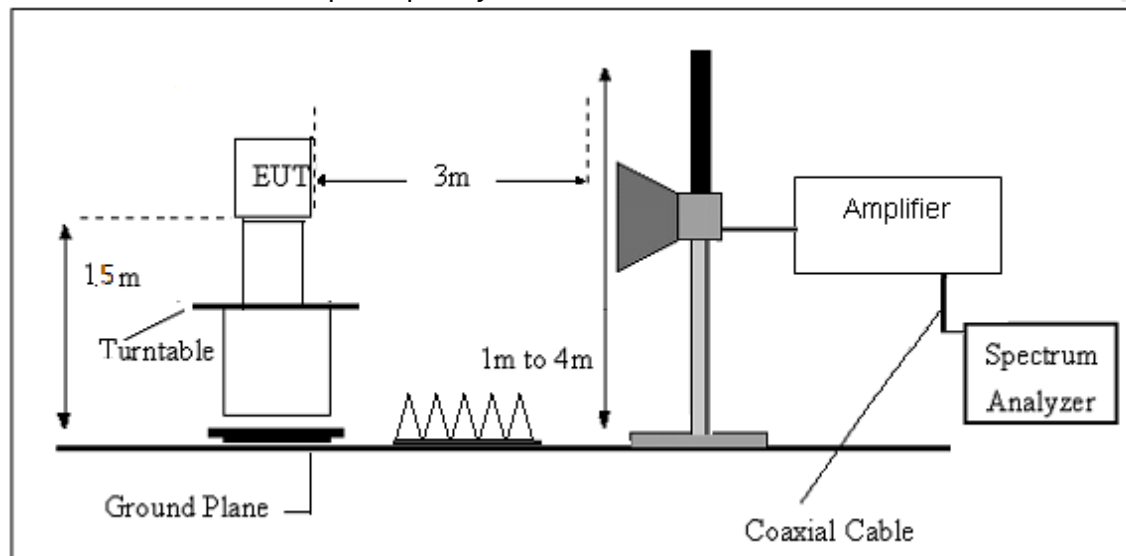
#### (A) Radiated Emission Test-Up Frequency Below 30MHz



#### (B) Radiated Emission Test-Up Frequency 30MHz~1GHz



#### (C) Radiated Emission Test-Up Frequency Above 1GHz



### 3.2.4 EUT OPERATING CONDITIONS

Please refer to section 3.1.4 of this report.

### 3.2.5 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where

FS = Field Strength

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

For example

| Frequency<br>(MHz) | FS<br>(dBμV/m) | RA<br>(dBμV/m) | AF<br>(dB) | CL<br>(dB) | AG<br>(dB) | Factor<br>(dB) |
|--------------------|----------------|----------------|------------|------------|------------|----------------|
| 300                | 40             | 58.1           | 12.2       | 1.6        | 31.9       | -18.1          |

$$\text{Factor} = AF + CL - AG$$

## 3.2.6 TEST RESULT

9KHz-30MHz

|               |         |                    |       |
|---------------|---------|--------------------|-------|
| Temperature:  | 23.1(C) | Relative Humidity: | 60%RH |
| Test Voltage: | DC 3.8V | Polarization:      | --    |
| Test Mode:    | TX Mode |                    |       |

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

## Note:

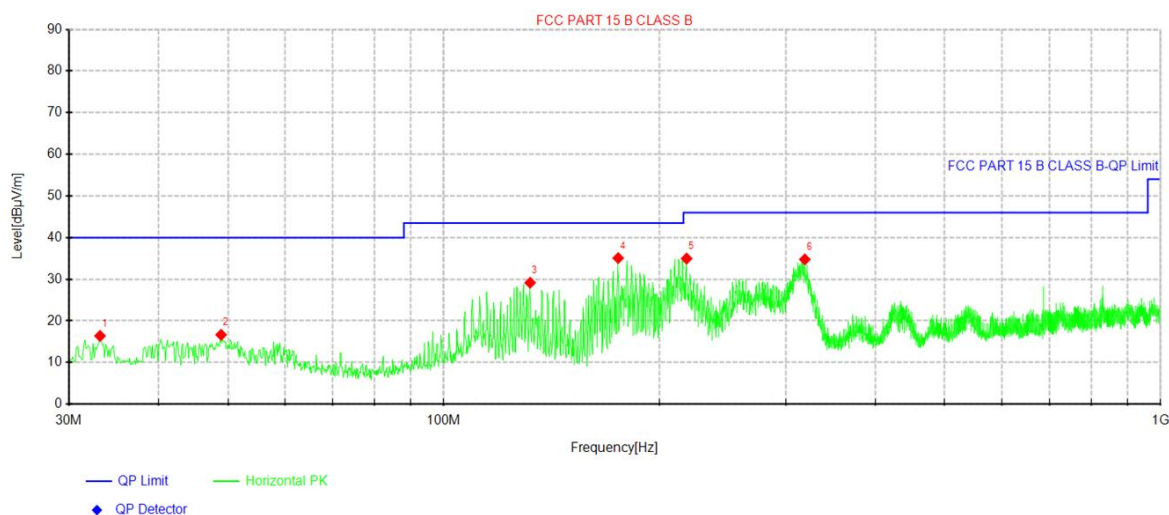
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =  $40 \log (\text{specific distance/test distance})$ (dB);

Limit line = specific limits(dBuV) + distance extrapolation factor.

(30MHz - 1000MHz)

|               |                               |                    |            |
|---------------|-------------------------------|--------------------|------------|
| Temperature:  | 23.1(C)                       | Relative Humidity: | 60%RH      |
| Test Voltage: | DC 3.8V                       | Phase:             | Horizontal |
| Test Mode:    | Mode 1/2/3 (Mode 2worst mode) |                    |            |



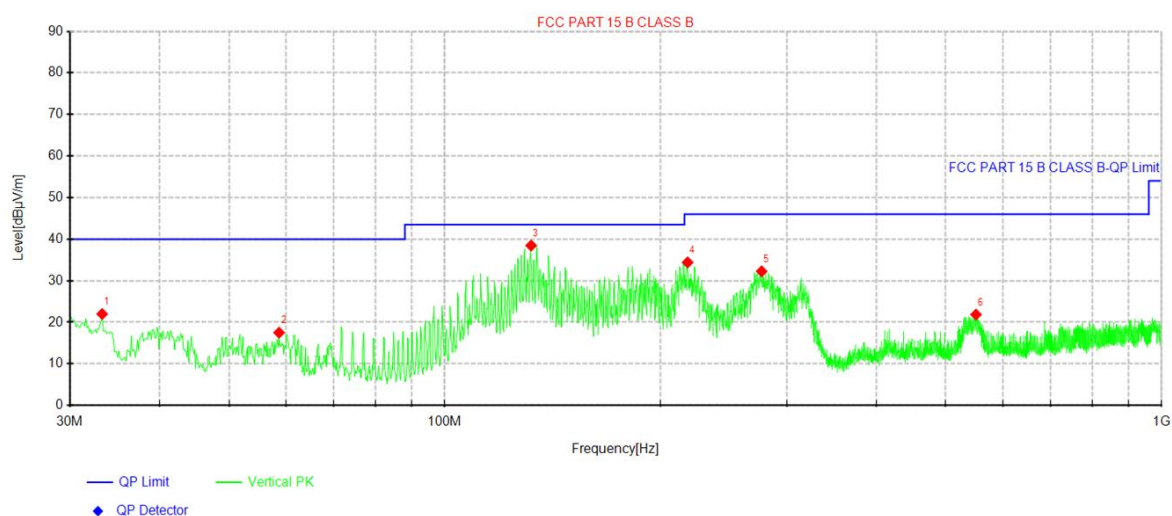
| Suspected Data List |             |                |                |               |                |             |             |           |            |
|---------------------|-------------|----------------|----------------|---------------|----------------|-------------|-------------|-----------|------------|
| NO.                 | Freq. [MHz] | Reading [dBμV] | Level [dBμV/m] | Factor [dB/m] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity   |
| 1                   | 33.1525     | 34.58          | 16.39          | -18.19        | 40.00          | 23.61       | 100         | 267       | Horizontal |
| 2                   | 48.915      | 32.80          | 16.66          | -16.14        | 40.00          | 23.34       | 100         | 359       | Horizontal |
| 3                   | 131.971     | 50.57          | 29.16          | -21.41        | 43.50          | 14.34       | 100         | 299       | Horizontal |
| 4                   | 175.136     | 55.86          | 35.08          | -20.78        | 43.50          | 8.42        | 100         | 75        | Horizontal |
| 5                   | 218.18      | 53.82          | 34.96          | -18.86        | 46.00          | 11.04       | 100         | 86        | Horizontal |
| 6                   | 318.938     | 51.69          | 34.76          | -16.93        | 46.00          | 11.24       | 100         | 86        | Horizontal |

Note:1). Level (dBμV/m) = Reading (dBμV) + Factor (dB/m)

2). Factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin (dB) = Limit (dBμV/m) - Level (dBμV/m)

|               |                                |                    |          |
|---------------|--------------------------------|--------------------|----------|
| Temperature:  | 23.1(C)                        | Relative Humidity: | 60%RH    |
| Test Voltage: | DC 3.8V                        | Phase:             | Vertical |
| Test Mode:    | Mode 1/2/3 (Mode 2 worst mode) |                    |          |



| Suspected Data List |             |                |                |               |                |             |             |           |          |
|---------------------|-------------|----------------|----------------|---------------|----------------|-------------|-------------|-----------|----------|
| NO.                 | Freq. [MHz] | Reading [dBμV] | Level [dBμV/m] | Factor [dB/m] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity |
| 1                   | 33.2738     | 40.15          | 21.99          | -18.16        | 40.00          | 18.01       | 100         | 241       | Vertical |
| 2                   | 58.7362     | 35.44          | 17.50          | -17.94        | 40.00          | 22.50       | 100         | 101       | Vertical |
| 3                   | 131.971     | 59.87          | 38.46          | -21.41        | 43.50          | 5.04        | 100         | 253       | Vertical |
| 4                   | 218.18      | 53.27          | 34.41          | -18.86        | 46.00          | 11.59       | 100         | 27        | Vertical |
| 5                   | 276.743     | 49.96          | 32.26          | -17.70        | 46.00          | 13.74       | 100         | 123       | Vertical |
| 6                   | 550.89      | 35.50          | 21.85          | -13.65        | 46.00          | 24.15       | 100         | 263       | Vertical |

Note:1). Level (dBμV/m) = Reading (dBμV) + Factor (dB/m)

2). Factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin (dB) = Limit (dBμV/m) - Level (dBμV/m)

## For 1GHz to 25GHz

## GFSK (above 1GHz)

| Frequency(MHz): |                         |    | 2402           |             | Polarity:        |                       | HORIZONTAL        |                    |                          |
|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 4804            | 60.59                   | PK | 74             | 13.41       | 64.86            | 32.33                 | 5.12              | 41.72              | -4.27                    |
| 4804            | 43.38                   | AV | 54             | 10.62       | 47.65            | 32.33                 | 5.12              | 41.72              | -4.27                    |
| 7206            | 52.08                   | PK | 74             | 21.92       | 52.60            | 36.6                  | 6.49              | 43.61              | -0.52                    |
| 7206            | 41.08                   | AV | 54             | 12.92       | 41.60            | 36.6                  | 6.49              | 43.61              | -0.52                    |

| Frequency(MHz): |                         |    | 2402           |             | Polarity:        |                       | VERTICAL          |                    |                          |
|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 4804            | 61.85                   | PK | 74             | 12.15       | 66.12            | 32.33                 | 5.12              | 41.72              | -4.27                    |
| 4804            | 43.59                   | AV | 54             | 10.41       | 47.86            | 32.33                 | 5.12              | 41.72              | -4.27                    |
| 7206            | 51.01                   | PK | 74             | 22.99       | 51.53            | 36.6                  | 6.49              | 43.61              | -0.52                    |
| 7206            | 41.36                   | AV | 54             | 12.64       | 41.88            | 36.6                  | 6.49              | 43.61              | -0.52                    |

| Frequency(MHz): |                         |    | 2440           |             | Polarity:        |                       | HORIZONTAL        |                    |                          |
|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 4880            | 60.42                   | PK | 74             | 13.58       | 64.30            | 32.6                  | 5.34              | 41.82              | -3.88                    |
| 4880            | 43.02                   | AV | 54             | 10.98       | 46.90            | 32.6                  | 5.34              | 41.82              | -3.88                    |
| 7320            | 51.09                   | PK | 74             | 22.91       | 51.20            | 36.8                  | 6.81              | 43.72              | -0.11                    |
| 7320            | 41.07                   | AV | 54             | 12.93       | 41.18            | 36.8                  | 6.81              | 43.72              | -0.11                    |

| Frequency(MHz): |                         |    | 2440           |             | Polarity:        |                       | VERTICAL          |                    |                          |
|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 4880            | 60.64                   | PK | 74             | 13.36       | 64.52            | 32.6                  | 5.34              | 41.82              | -3.88                    |
| 4880            | 43.41                   | AV | 54             | 10.59       | 47.29            | 32.6                  | 5.34              | 41.82              | -3.88                    |
| 7320            | 51.24                   | PK | 74             | 22.76       | 51.35            | 36.8                  | 6.81              | 43.72              | -0.11                    |
| 7320            | 41.22                   | AV | 54             | 12.78       | 41.33            | 36.8                  | 6.81              | 43.72              | -0.11                    |

| Frequency(MHz): |                         |    | 2480           |             | Polarity:        |                       | HORIZONTAL        |                    |                          |
|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 4960            | 61.32                   | PK | 74             | 12.68       | 64.40            | 32.73                 | 5.66              | 41.47              | -3.08                    |
| 4960            | 44.32                   | AV | 54             | 9.68        | 47.40            | 32.73                 | 5.66              | 41.47              | -3.08                    |
| 7440            | 51.89                   | PK | 74             | 22.11       | 51.44            | 37.04                 | 7.25              | 43.84              | 0.45                     |
| 7440            | 41.42                   | AV | 54             | 12.58       | 40.97            | 37.04                 | 7.25              | 43.84              | 0.45                     |

| Frequency(MHz): |                         |    | 2480           |             | Polarity:        |                       | VERTICAL          |                    |                          |
|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 4960            | 60.58                   | PK | 74             | 13.42       | 63.66            | 32.73                 | 5.66              | 41.47              | -3.08                    |
| 4960            | 45.26                   | AV | 54             | 8.74        | 48.34            | 32.73                 | 5.66              | 41.47              | -3.08                    |
| 7440            | 52.84                   | PK | 74             | 21.16       | 52.39            | 37.04                 | 7.25              | 43.84              | 0.45                     |
| 7440            | 41.10                   | AV | 54             | 12.90       | 40.65            | 37.04                 | 7.25              | 43.84              | 0.45                     |

## REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier
3. Margin value = Limit value - Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

## 3.2.6 TEST RESULTS(BAND EDGE REQUIREMENTS)

## GFSK

| Frequency(MHz): |                         |    | 2402           |             | Polarity:        |                       | HORIZONTAL        |                    |                          |
|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 2390            | 60.77                   | PK | 74             | 13.23       | 71.19            | 27.42                 | 4.31              | 42.15              | -10.42                   |
| 2390            | 44.81                   | AV | 54             | 9.19        | 55.23            | 27.42                 | 4.31              | 42.15              | -10.42                   |
| Frequency(MHz): |                         |    | 2402           |             | Polarity:        |                       | VERTICAL          |                    |                          |
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 2390.00         | 60.73                   | PK | 74             | 13.27       | 71.15            | 27.42                 | 4.31              | 42.15              | -10.42                   |
| 2390.00         | 44.35                   | AV | 54             | 9.65        | 54.77            | 27.42                 | 4.31              | 42.15              | -10.42                   |
| Frequency(MHz): |                         |    | 2480           |             | Polarity:        |                       | HORIZONTAL        |                    |                          |
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 2483.50         | 60.80                   | PK | 74             | 13.20       | 70.91            | 27.7                  | 4.47              | 42.28              | -10.11                   |
| 2483.50         | 43.74                   | AV | 54             | 10.26       | 53.85            | 27.7                  | 4.47              | 42.28              | -10.11                   |
| Frequency(MHz): |                         |    | 2480           |             | Polarity:        |                       | VERTICAL          |                    |                          |
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 2483.50         | 61.23                   | PK | 74             | 12.77       | 71.34            | 27.7                  | 4.47              | 42.28              | -10.11                   |
| 2483.50         | 44.51                   | AV | 54             | 9.49        | 54.62            | 27.7                  | 4.47              | 42.28              | -10.11                   |

## REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)- Pre-amplifier
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

#### 4. CONDUCTED SPURIOUS & BAND EDGE EMISSION

##### 4.1 LIMIT

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

##### 4.2 TEST PROCEDURE

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

For Band edge

| Spectrum Parameter                    | Setting                                                                |
|---------------------------------------|------------------------------------------------------------------------|
| Detector                              | Peak                                                                   |
| Start/Stop Frequency                  | Lower Band Edge: 2300 to 2432 MHz<br>Upper Band Edge: 2442 to 2500 MHz |
| RB / VB (emission in restricted band) | 100 KHz/300 KHz                                                        |
| Trace-Mode:                           | Max hold                                                               |

For Hopping Band edge

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

#### 4.3 TEST SETUP



The EUT is connected to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

#### 4.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

#### 4.5 TEST RESULTS

Note: The test data please refer to APPENDIX 1.

## 5. NUMBER OF HOPPING CHANNEL

### 5.1 LIMIT

| FCC Part 15.247, Subpart C |                           |           |                       |        |
|----------------------------|---------------------------|-----------|-----------------------|--------|
| Section                    | Test Item                 | Limit     | Frequency Range (MHz) | Result |
| 15.247 (a)(1)(iii)         | Number of Hopping Channel | $\geq 15$ | 2400-2483.5           | PASS   |

| Spectrum Parameters | Setting                     |
|---------------------|-----------------------------|
| Attenuation         | Auto                        |
| Span Frequency      | > Operating Frequency Range |
| RB                  | 300KHz                      |
| VB                  | 300KHz                      |
| Detector            | Peak                        |
| Trace               | Max Hold                    |
| Sweep Time          | Auto                        |

### 5.2 TEST PROCEDURE

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

### 5.3 TEST SETUP



### 5.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

### 5.5 TEST RESULTS

Note: The test data please refer to APPENDIX 1.

## 6. BANDWIDTH TEST

### 6.1 LIMIT

| FCC Part15.247,Subpart C |           |       |                       |        |
|--------------------------|-----------|-------|-----------------------|--------|
| Section                  | Test Item | Limit | Frequency Range (MHz) | Result |
| 15.247(a)(1)             | Bandwidth | N/A   | 2400-2483.5           | PASS   |

| Spectrum Parameter | Setting                                                 |
|--------------------|---------------------------------------------------------|
| Attenuation        | Auto                                                    |
| Span Frequency     | > Measurement Bandwidth or Channel Separation           |
| RB                 | 30 kHz (20dB Bandwidth) / 30 kHz (Channel Separation)   |
| VB                 | 100 kHz (20dB Bandwidth) / 100 kHz (Channel Separation) |
| Detector           | Peak                                                    |
| Trace              | Max Hold                                                |
| Sweep Time         | Auto                                                    |

### 6.2 TEST PROCEDURE

The EUT was directly connected to the spectrum analyzer and antenna output port as show

- in the block diagram below.
- Spectrum Setting: RBW= 30KHz, VBW=100KHz, Sweep time = Auto.

### 6.3 DEVIATION FROM STANDARD

No deviation.

### 6.4 TEST SETUP



### 6.5 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

### 6.6 TEST RESULTS

Note: The test data please refer to APPENDIX 1.

## 7. PEAK OUTPUT POWER TEST

### 7.1 LIMIT

#### FCC PART 15.247, SUBPART C

| Section                 | Test Item    | Limit                                                                                                                     | Frequency Range (MHz) | Result |
|-------------------------|--------------|---------------------------------------------------------------------------------------------------------------------------|-----------------------|--------|
| 15.247<br>(a)(1)&(b)(1) | Output Power | 1 W or 0.125W                                                                                                             | 2400-2483.5           | PASS   |
|                         |              | if channel separation > 2/3 bandwidth provided the systems operate with an output power no greater than 125 mW (20.97dBm) |                       |        |

### 7.2 TEST PROCEDURE

This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test:

a) Use the following spectrum analyzer settings:

- 1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
- 2) RBW > 20 dB bandwidth of the emission being measured.
- 3) VBW  $\geq$  RBW.
- 4) Sweep: Auto.
- 5) Detector function: Peak.
- 6) Trace: Max hold.

b) Allow trace to stabilize.

c) Use the marker-to-peak function to set the marker to the peak of the emission.

d) The indicated level is the peak output power, after any corrections for external attenuators and cables.

e) A plot of the test results and setup description shall be included in the test report.

NOTE—A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.

PKPM1 Peak power meter method:

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DSS bandwidth and shall use a fast-responding diode detector.

### 7.3 TEST SETUP



### 7.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

### 7.5 TEST RESULTS

Note: The test data please refer to APPENDIX 1.

## 8. ANTENNA REQUIREMENT

### 8.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

### 8.2 EUT ANTENNA

The EUT antenna is PCB Antenna. It comply with the standard requirement.

## 9. AVERAGE TIME OF OCCUPANCY

### 9.1 LIMIT

| FCC Part 15.247, Subpart C |                           |        |                       |        |
|----------------------------|---------------------------|--------|-----------------------|--------|
| Section                    | Test Item                 | Limit  | Frequency Range (MHz) | Result |
| 15.247 (a)(1)(iii)         | Average Time of Occupancy | 0.4sec | 2400-2483.5           | PASS   |

### 9.2 TEST PROCEDURE

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

### 9.3 TEST SETUP



### 9.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

### 9.5 TEST RESULTS

Note: The test data please refer to APPENDIX 1.

## 10. HOPPING CHANNEL SEPARATION MEASUREMENT

### 10.1 LIMIT

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

| Spectrum Parameter | Setting                                                 |
|--------------------|---------------------------------------------------------|
| Attenuation        | Auto                                                    |
| Span Frequency     | > 20 dB Bandwidth or Channel Separation                 |
| RB                 | 30 kHz (20dB Bandwidth) / 30 kHz (Channel Separation)   |
| VB                 | 100 kHz (20dB Bandwidth) / 100 kHz (Channel Separation) |
| Detector           | Peak                                                    |
| Trace              | Max Hold                                                |
| Sweep Time         | Auto                                                    |

### 10.2 TEST PROCEDURE

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

### 10.3 TEST SETUP



### 10.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

### 10.5 TEST RESULTS

Note: The test data please refer to APPENDIX 1.

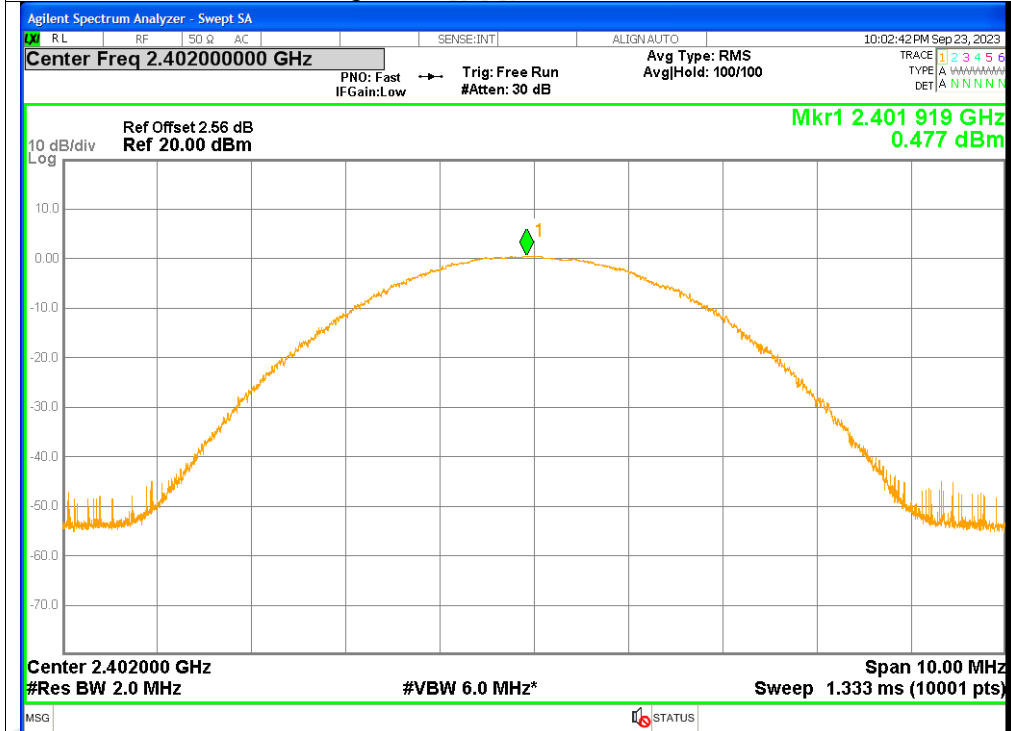
## APPENDIX 1-TEST DATA

**1. Maximum Average Conducted Output Power**

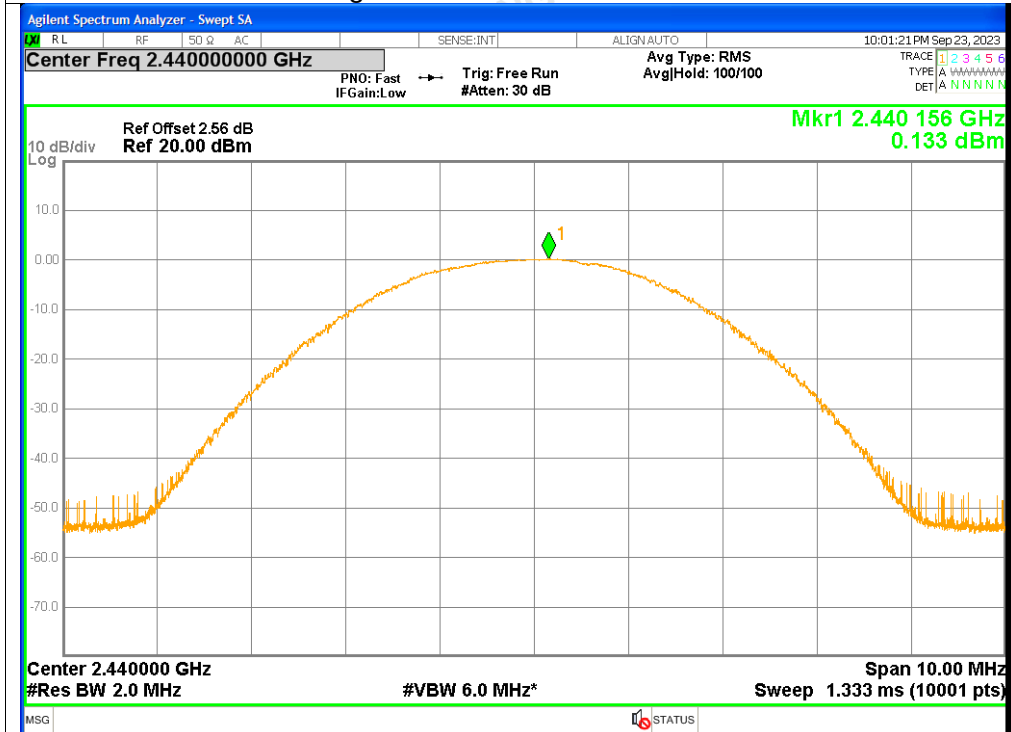
| Condition | Mode | Frequency (MHz) | Conducted Power (dBm) | Total Power (dBm) | Limit (dBm) | Verdict |
|-----------|------|-----------------|-----------------------|-------------------|-------------|---------|
| NVNT      | 2.4G | 2402            | 0.48                  | 0.48              | <=20.97     | Pass    |
| NVNT      | 2.4G | 2440            | 0.13                  | 0.13              | <=20.97     | Pass    |
| NVNT      | 2.4G | 2480            | -0.01                 | -0.01             | <=20.97     | Pass    |

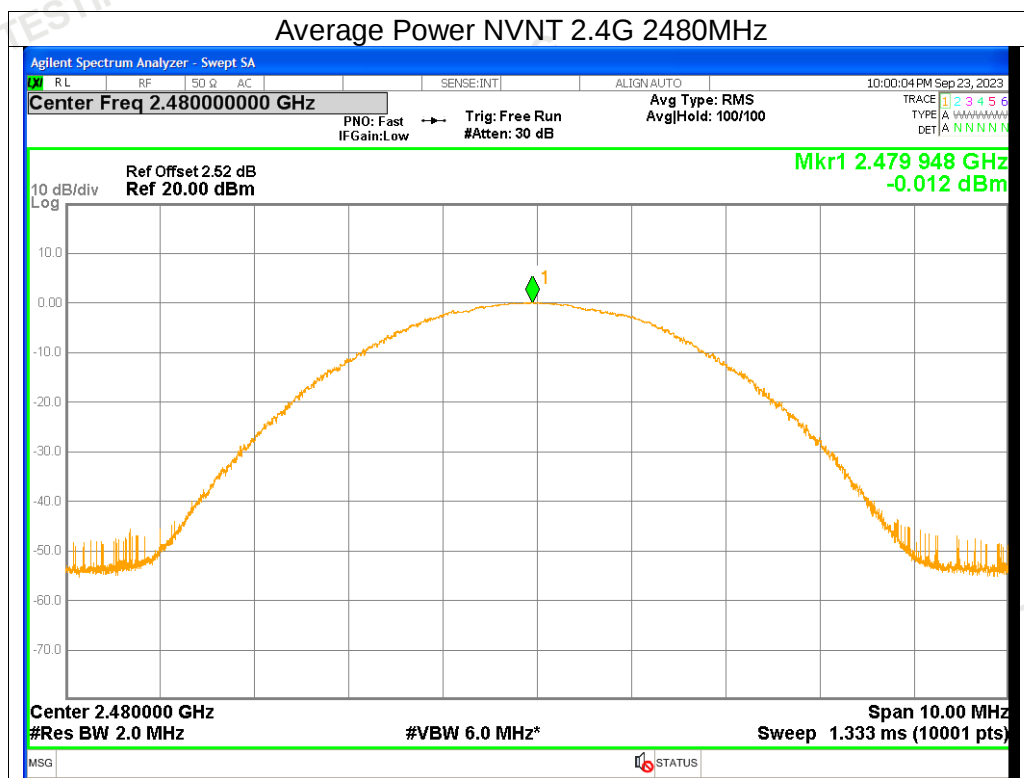
### Test Graphs

#### Average Power NVNT 2.4G 2402MHz



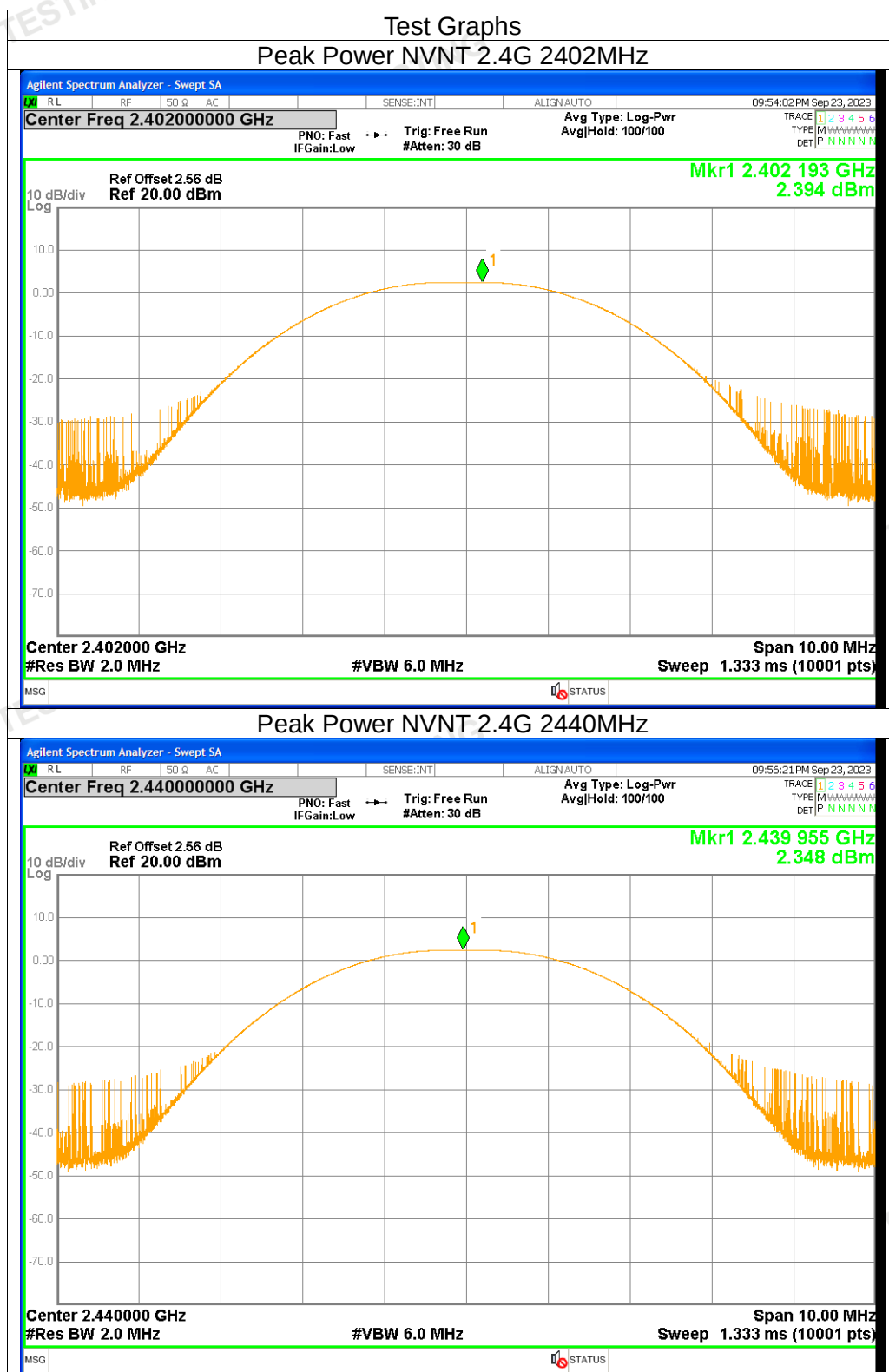
#### Average Power NVNT 2.4G 2440MHz

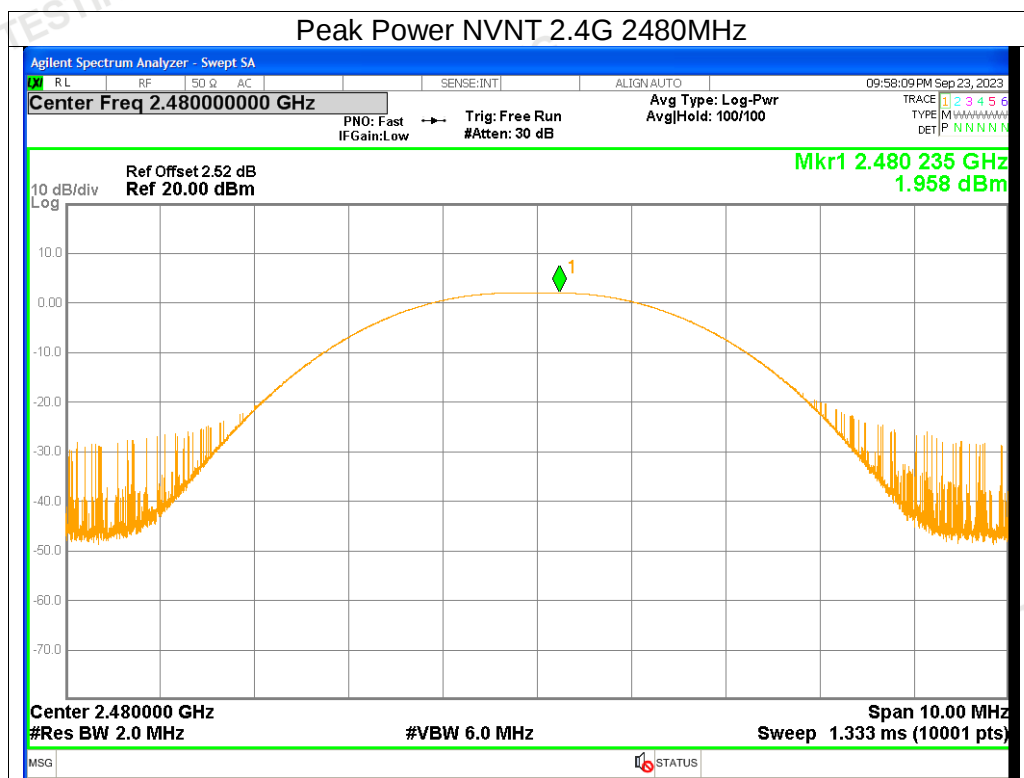




## 2. Maximum Peak Conducted Output Power

| Condition | Mode | Frequency (MHz) | Conducted Power (dBm) | Limit (dBm)  | Verdict |
|-----------|------|-----------------|-----------------------|--------------|---------|
| NVNT      | 2.4G | 2402            | 2.39                  | $\leq 20.97$ | Pass    |
| NVNT      | 2.4G | 2440            | 2.35                  | $\leq 20.97$ | Pass    |
| NVNT      | 2.4G | 2480            | 1.96                  | $\leq 20.97$ | Pass    |



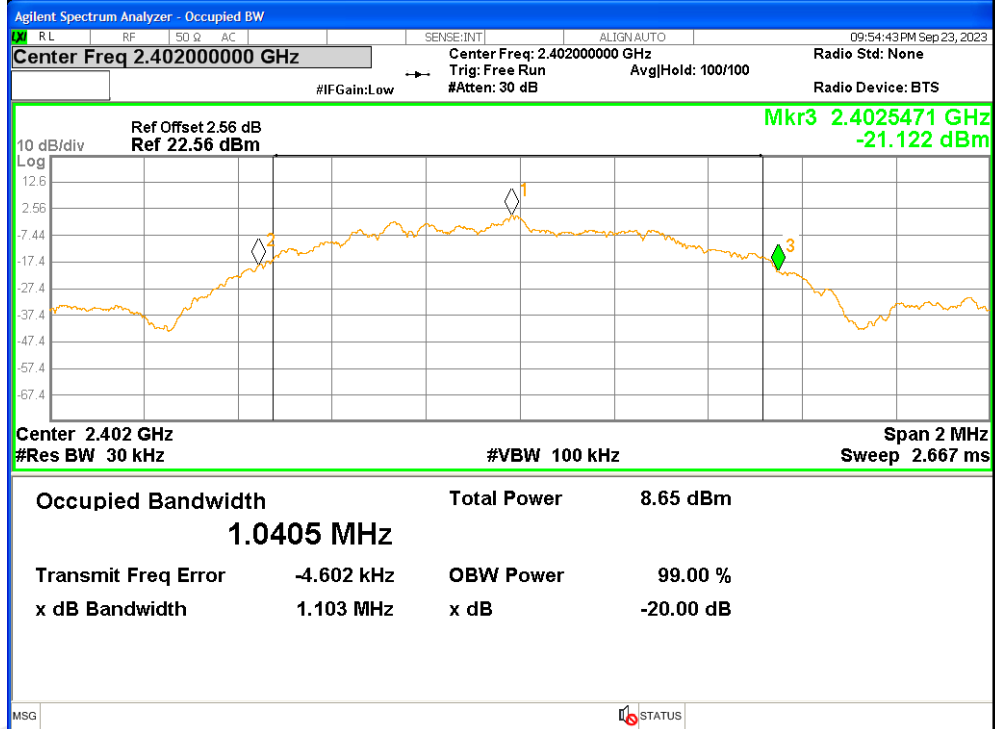


### 3. -20dB Bandwidth

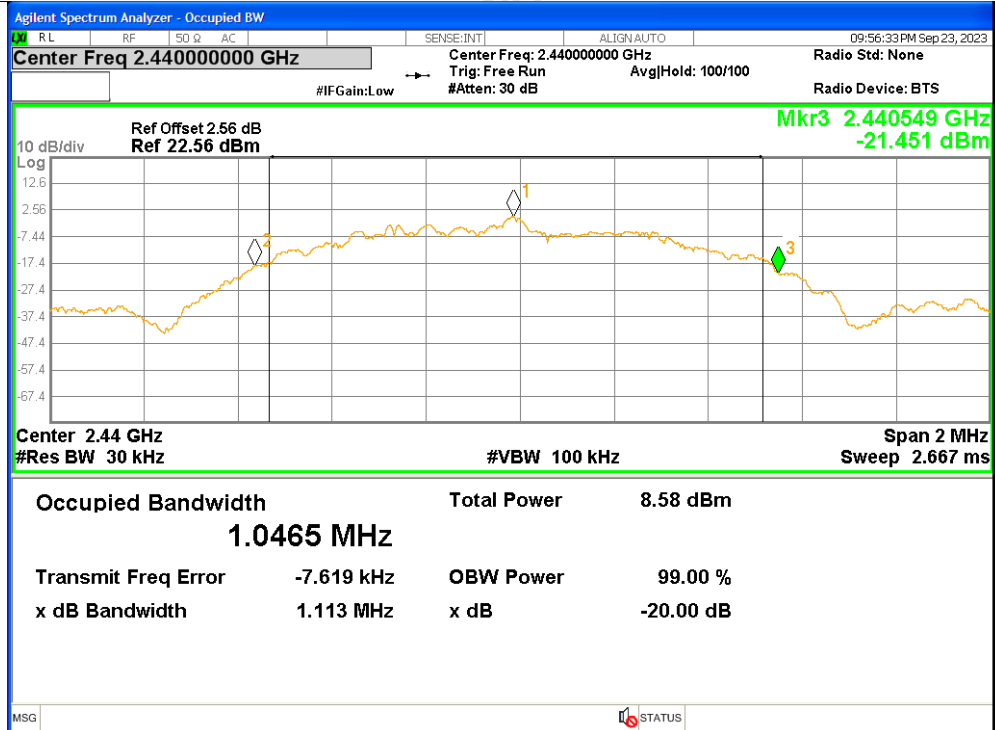
| Condition | Mode | Frequency (MHz) | -20 dB Bandwidth (MHz) | Verdict |
|-----------|------|-----------------|------------------------|---------|
| NVNT      | 2.4G | 2402            | 1.1034                 | Pass    |
| NVNT      | 2.4G | 2440            | 1.1133                 | Pass    |
| NVNT      | 2.4G | 2480            | 1.1196                 | Pass    |

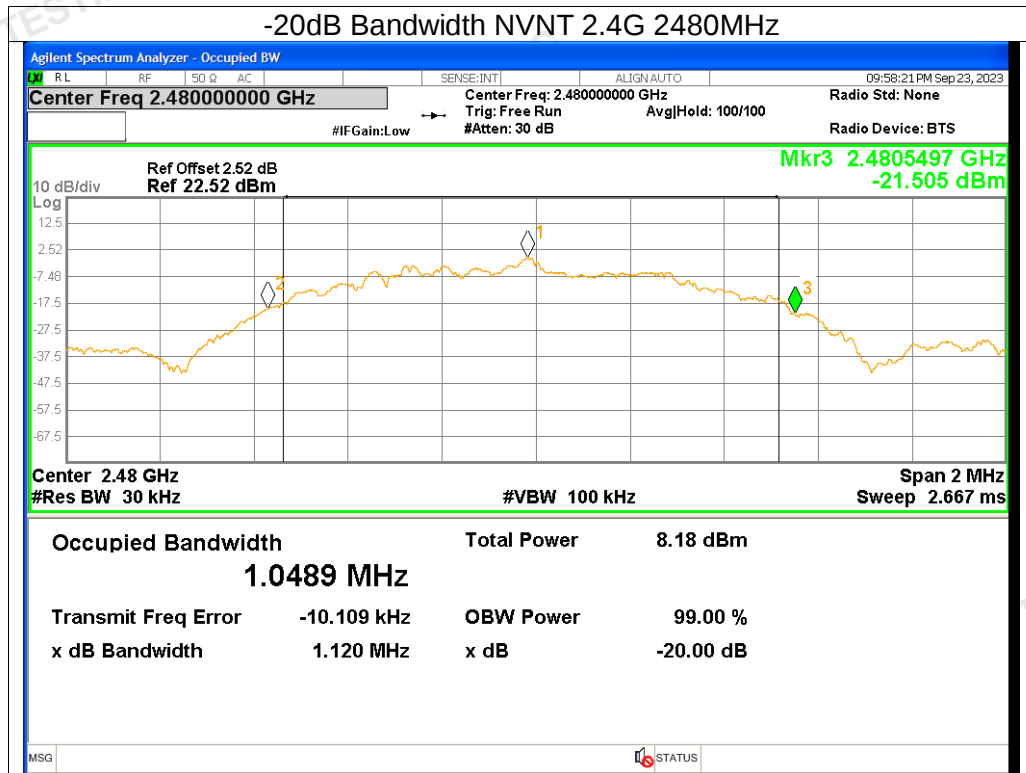
## Test Graphs

## -20dB Bandwidth NVNT 2.4G 2402MHz



## -20dB Bandwidth NVNT 2.4G 2440MHz

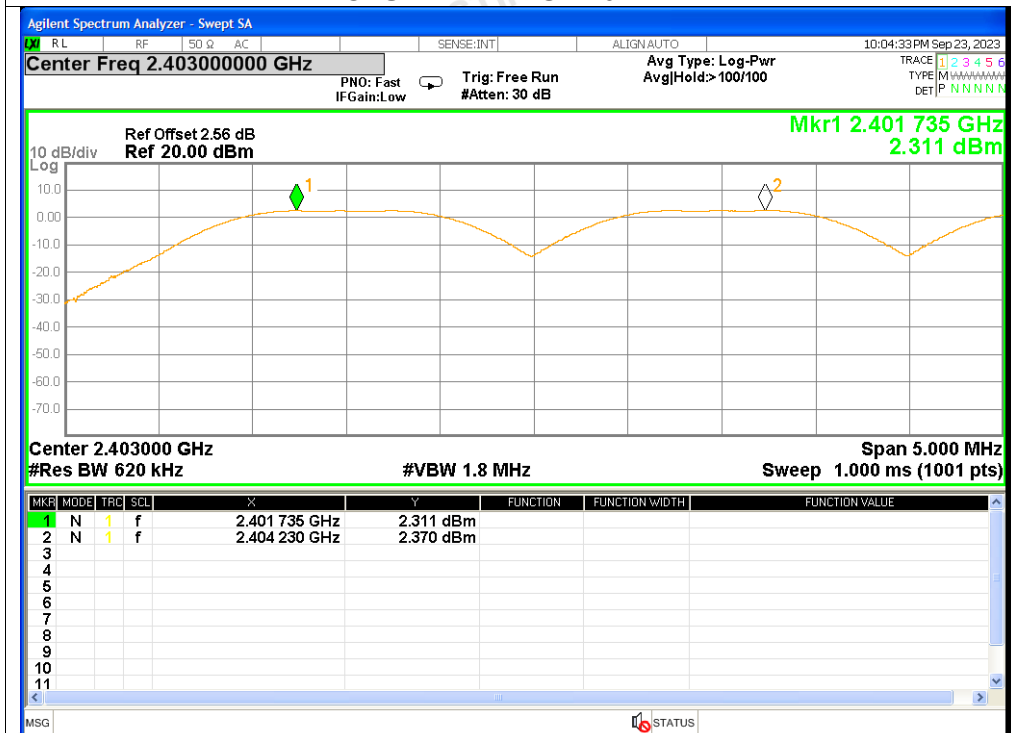




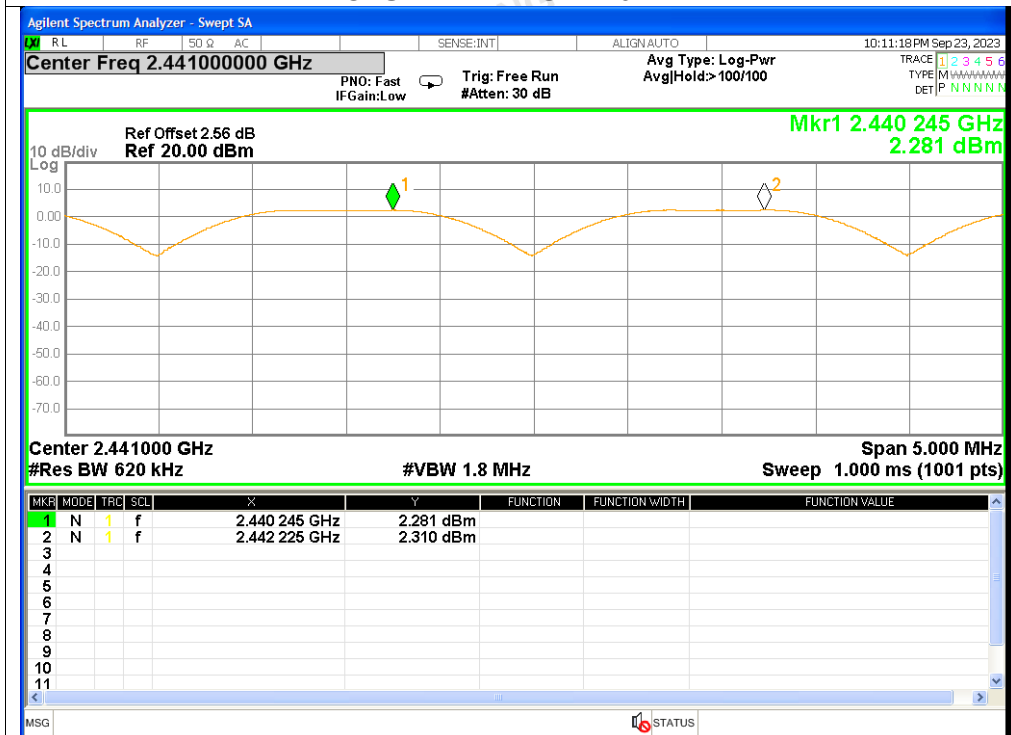
#### 4. Carrier Frequencies Separation

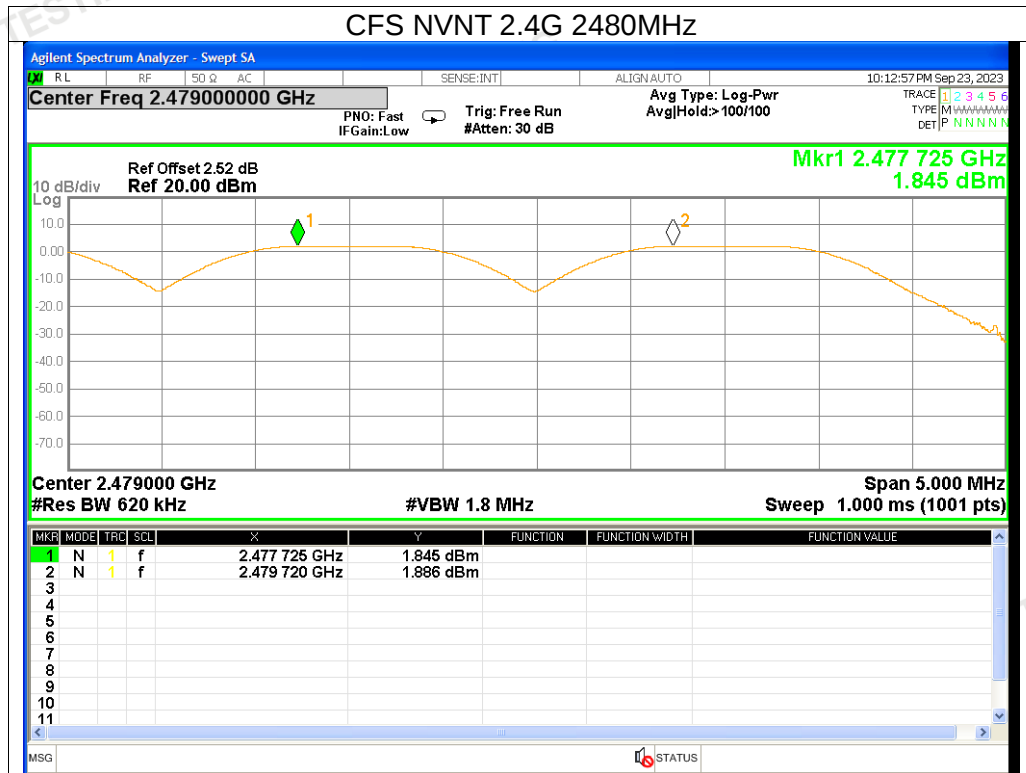
| Condition | Mode | Hopping Freq1 (MHz) | Hopping Freq2 (MHz) | HFS (MHz) | Limit (MHz)  | Verdict |
|-----------|------|---------------------|---------------------|-----------|--------------|---------|
| NVNT      | 2.4G | 2401.735            | 2404.23             | 2.495     | $\geq 0.736$ | Pass    |
| NVNT      | 2.4G | 2440.245            | 2442.225            | 1.98      | $\geq 0.742$ | Pass    |
| NVNT      | 2.4G | 2477.725            | 2479.72             | 1.995     | $\geq 0.746$ | Pass    |

## Test Graphs



CFS NVNT 2.4G 2440MHz

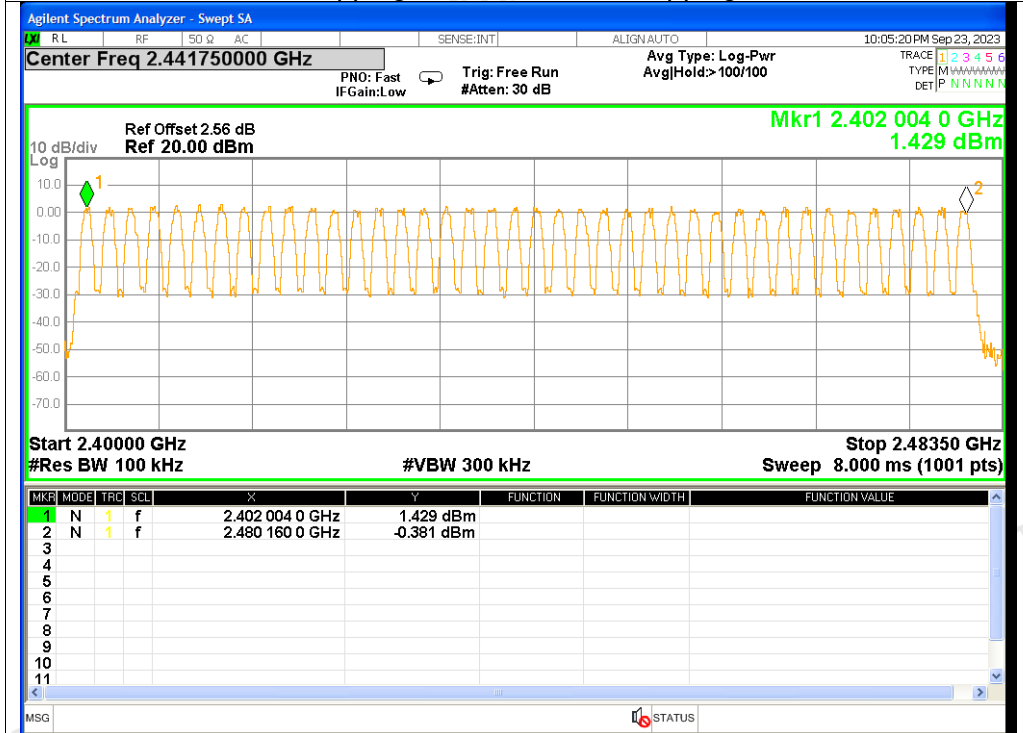




## 5. Number of Hopping Channel

| Condition | Mode | Hopping Number | Limit     | Verdict |
|-----------|------|----------------|-----------|---------|
| NVNT      | 2.4G | 40             | $\geq 15$ | Pass    |

| Test Graphs                   |
|-------------------------------|
| Hopping No. NVNT 2.4G Hopping |



## 6. Band Edge

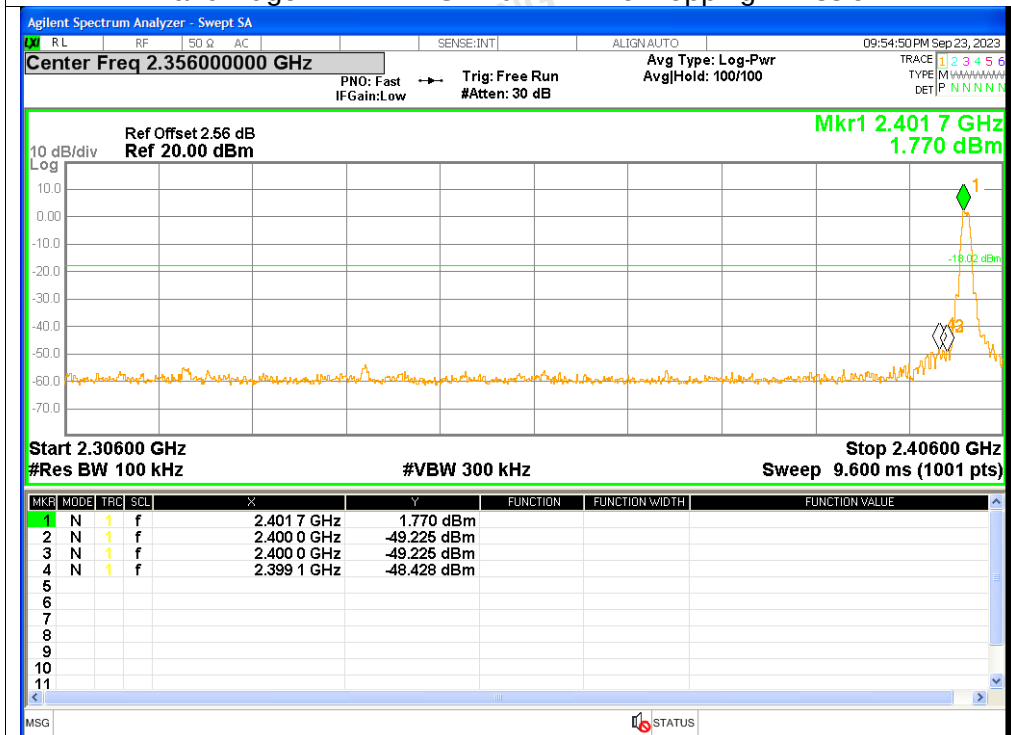
| Condition | Mode | Frequency (MHz) | Hopping Mode | Max Value (dBc) | Limit (dBc) | Verdict |
|-----------|------|-----------------|--------------|-----------------|-------------|---------|
| NVNT      | 2.4G | 2402            | No-Hopping   | -50.41          | $\leq -20$  | Pass    |
| NVNT      | 2.4G | 2480            | No-Hopping   | -53.51          | $\leq -20$  | Pass    |

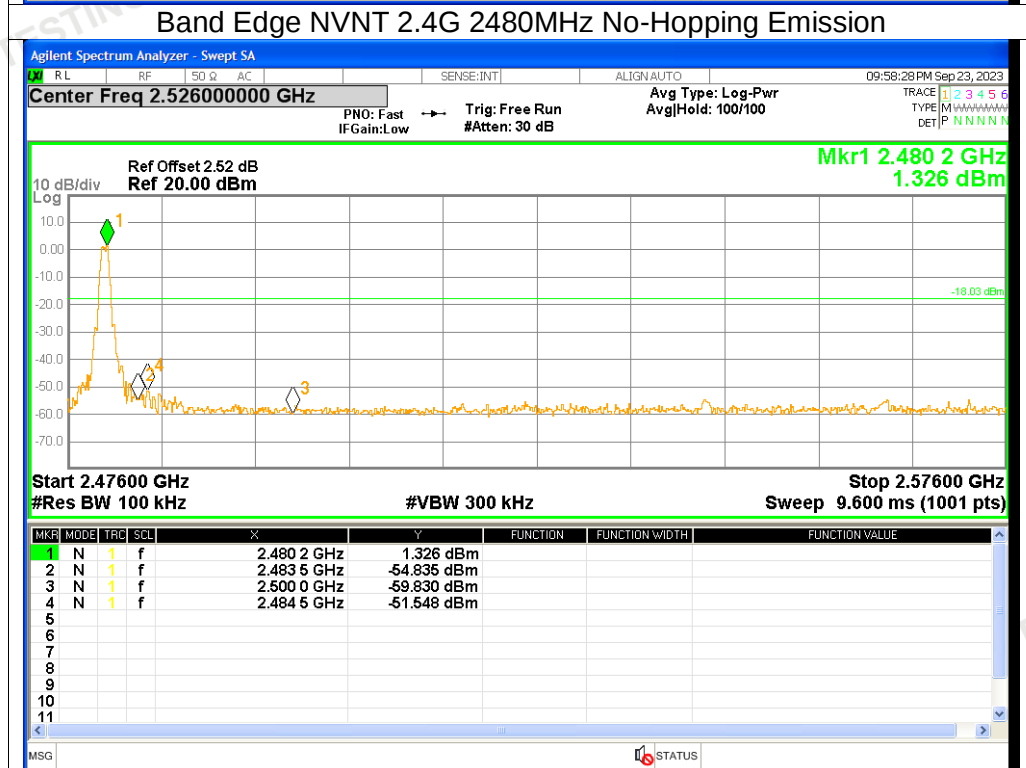
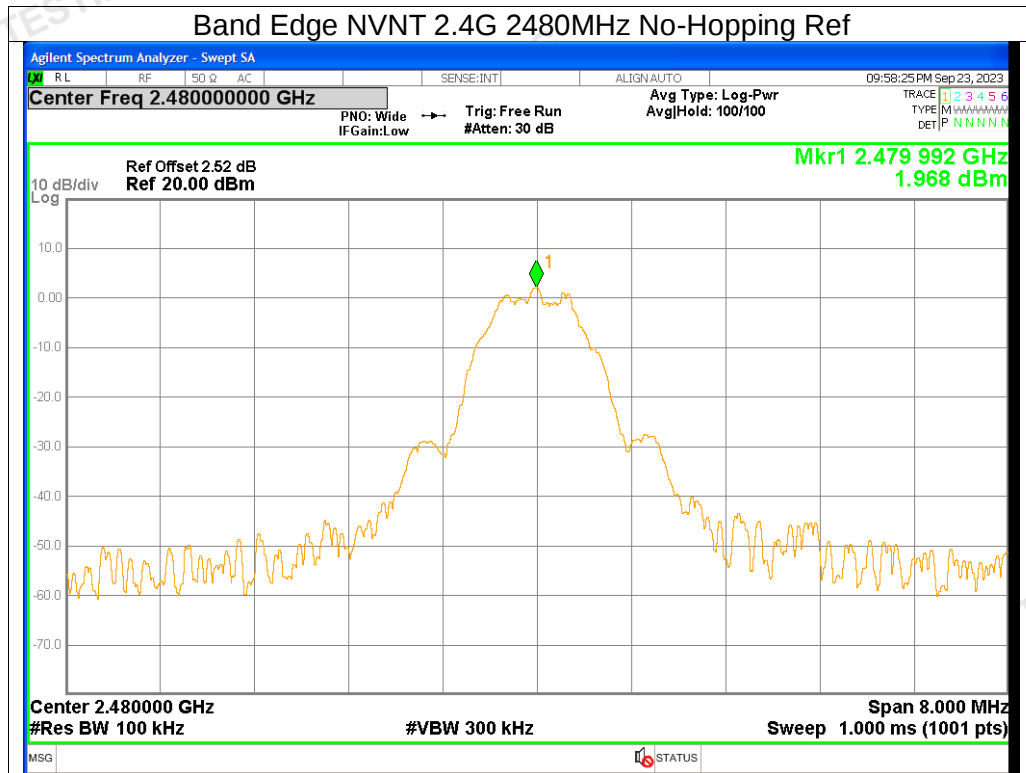
## Test Graphs

Band Edge NVNT 2.4G 2402MHz No-Hopping Ref



## Band Edge NVNT 2.4G 2402MHz No-Hopping Emission

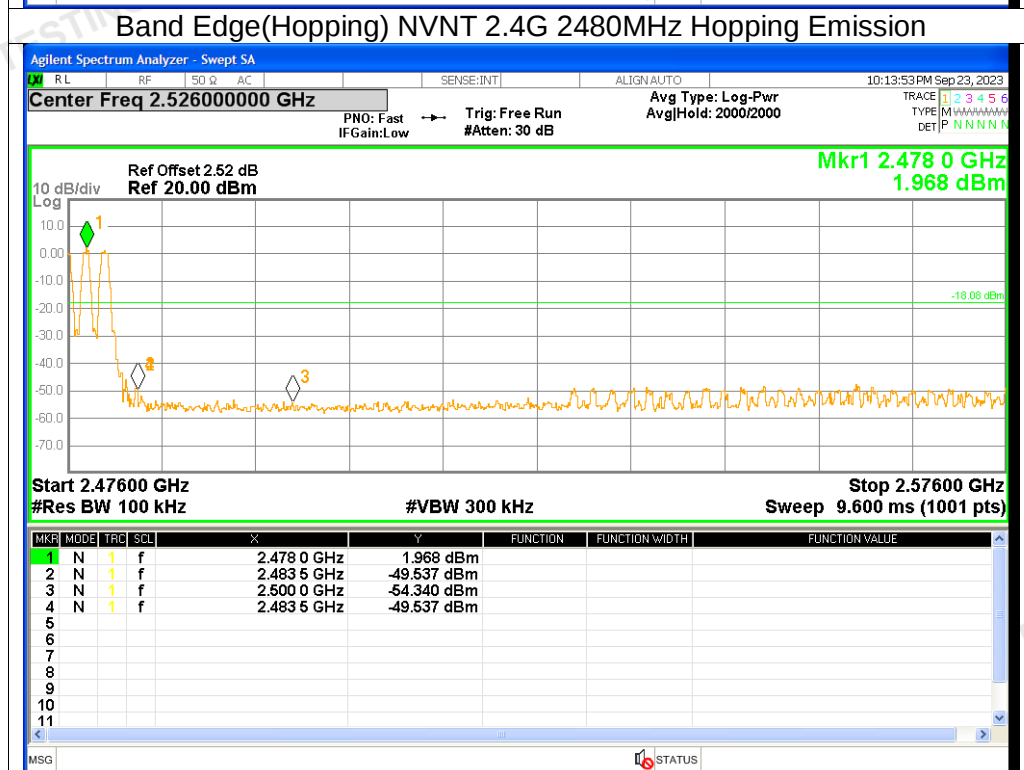
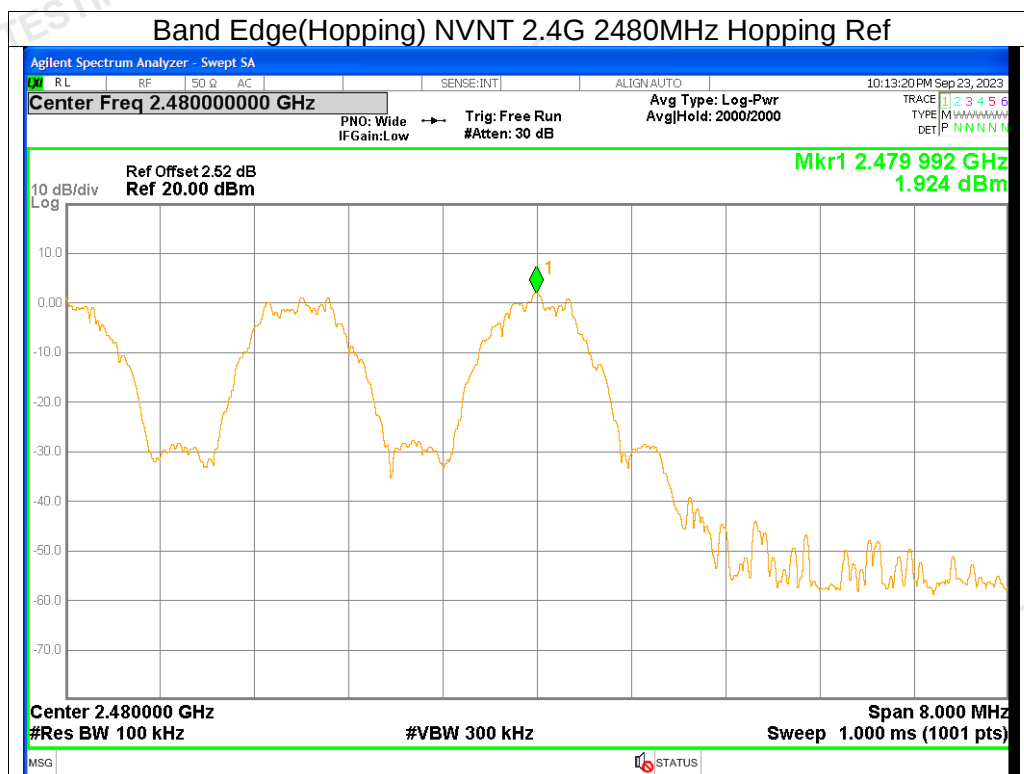




## 7. Band Edge(Hopping)

| Condition | Mode | Frequency (MHz) | Hopping Mode | Max Value (dBc) | Limit (dBc) | Verdict |
|-----------|------|-----------------|--------------|-----------------|-------------|---------|
| NVNT      | 2.4G | 2402            | Hopping      | -49.87          | <=-20       | Pass    |
| NVNT      | 2.4G | 2480            | Hopping      | -51.45          | <=-20       | Pass    |



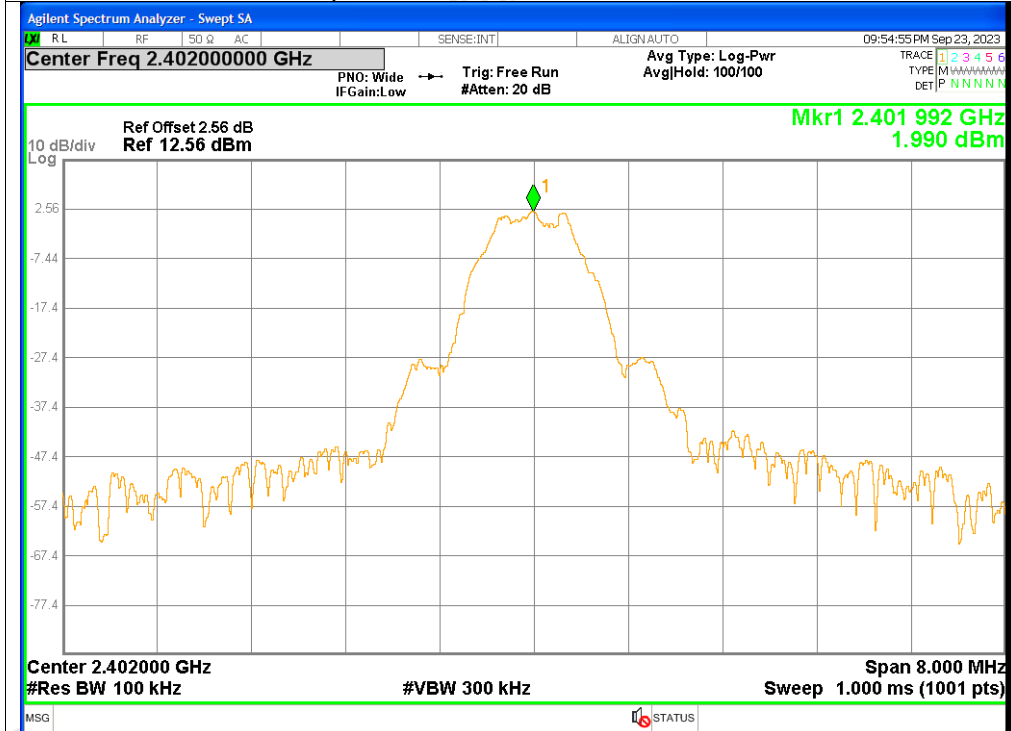


## 8. Conducted RF Spurious Emission

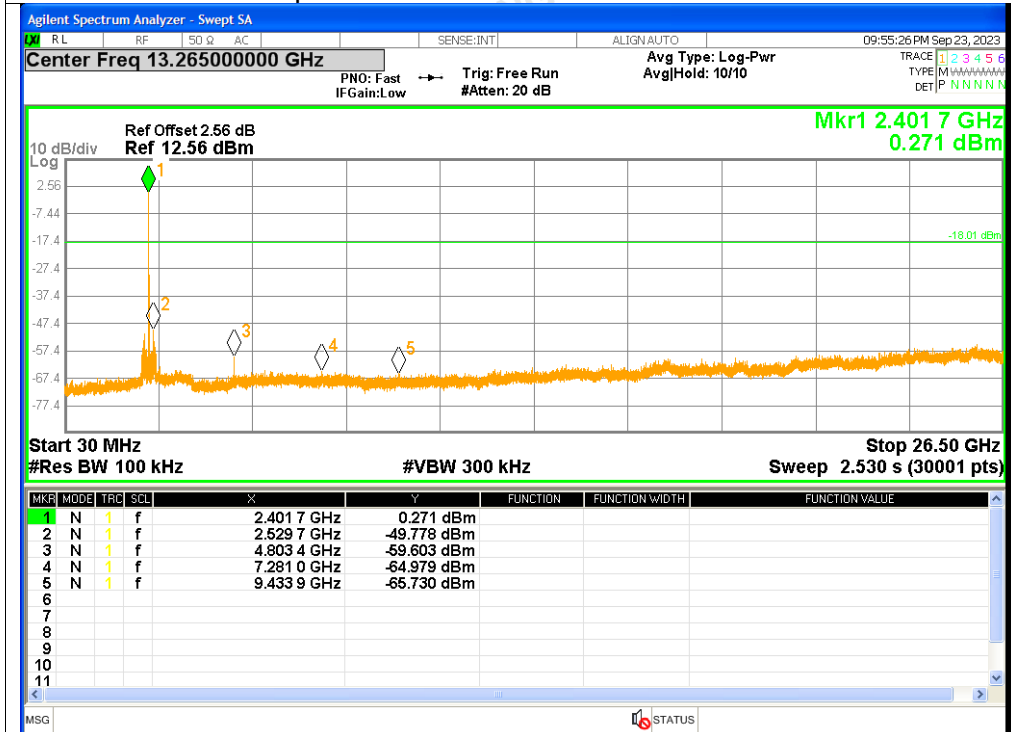
| Condition | Mode | Frequency (MHz) | Max Value (dBc) | Limit (dBc) | Verdict |
|-----------|------|-----------------|-----------------|-------------|---------|
| NVNT      | 2.4G | 2402            | -51.76          | <=-20       | Pass    |
| NVNT      | 2.4G | 2440            | -51.29          | <=-20       | Pass    |
| NVNT      | 2.4G | 2480            | -52.57          | <=-20       | Pass    |

## Test Graphs

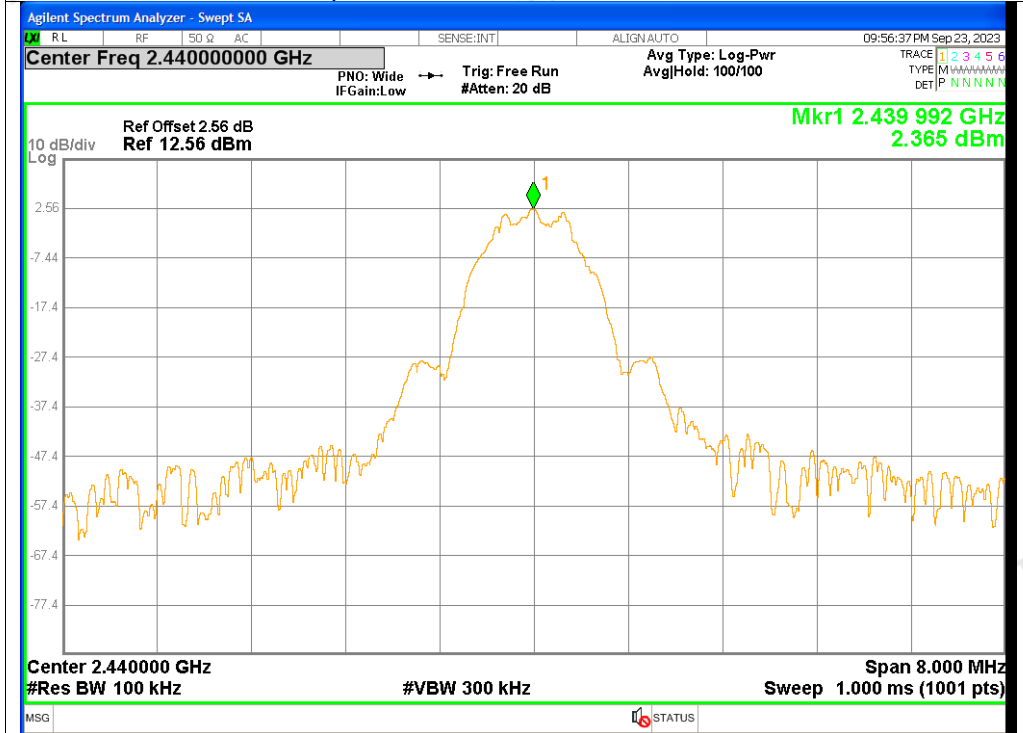
## Tx. Spurious NVNT 2.4G 2402MHz Ref



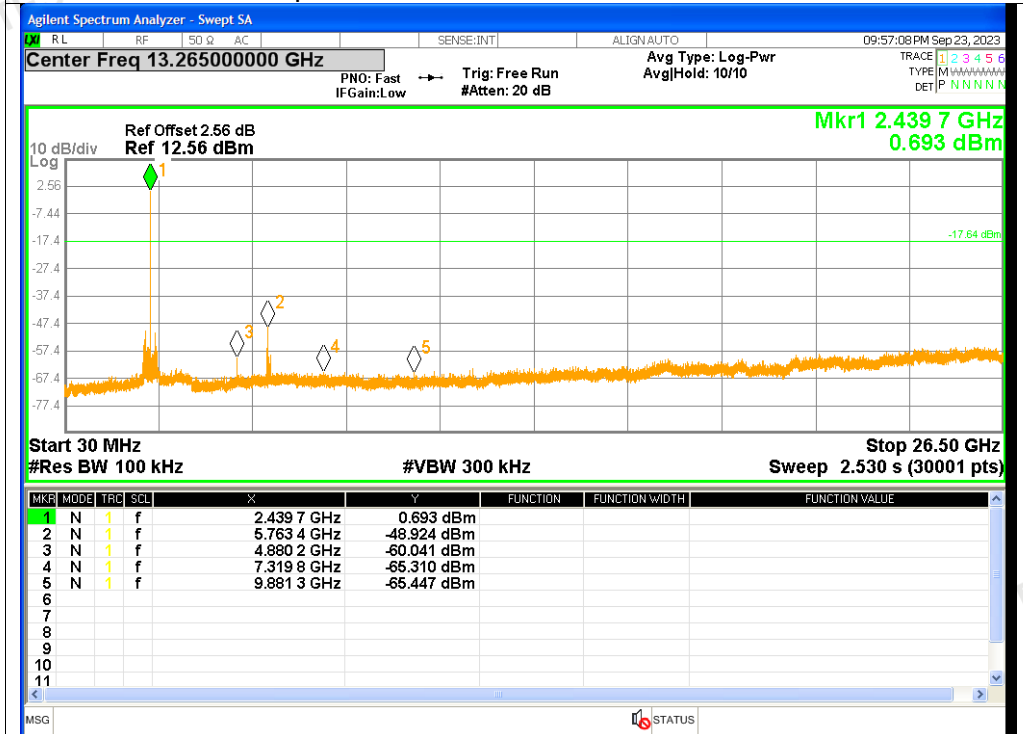
## Tx. Spurious NVNT 2.4G 2402MHz Emission



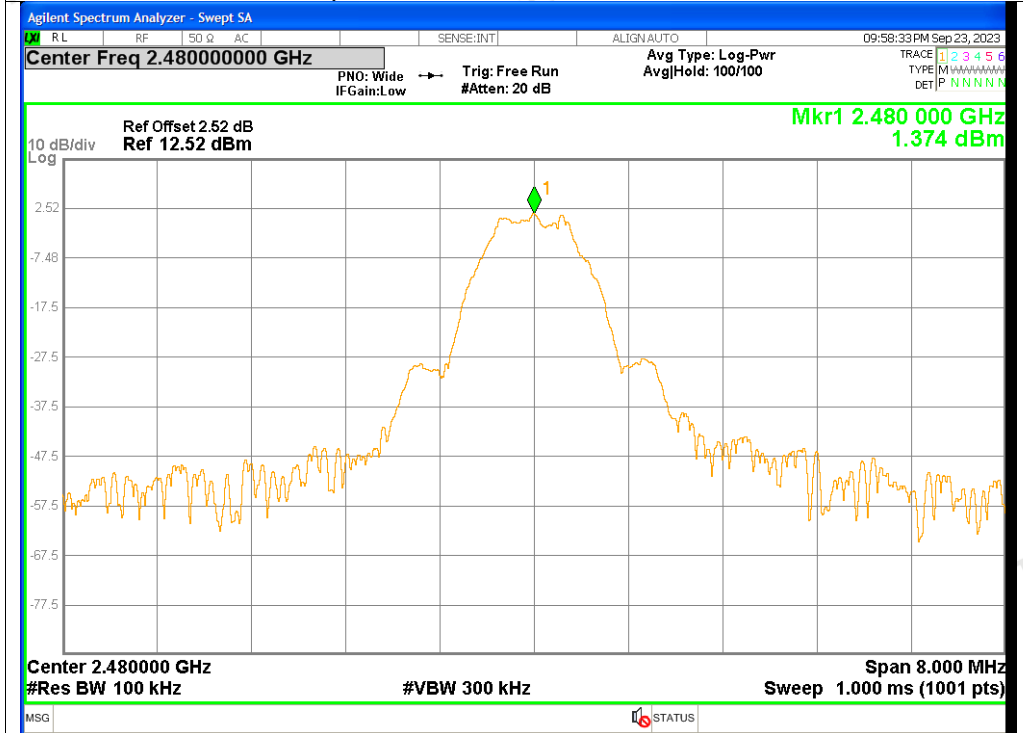
## Tx. Spurious NVNT 2.4G 2440MHz Ref



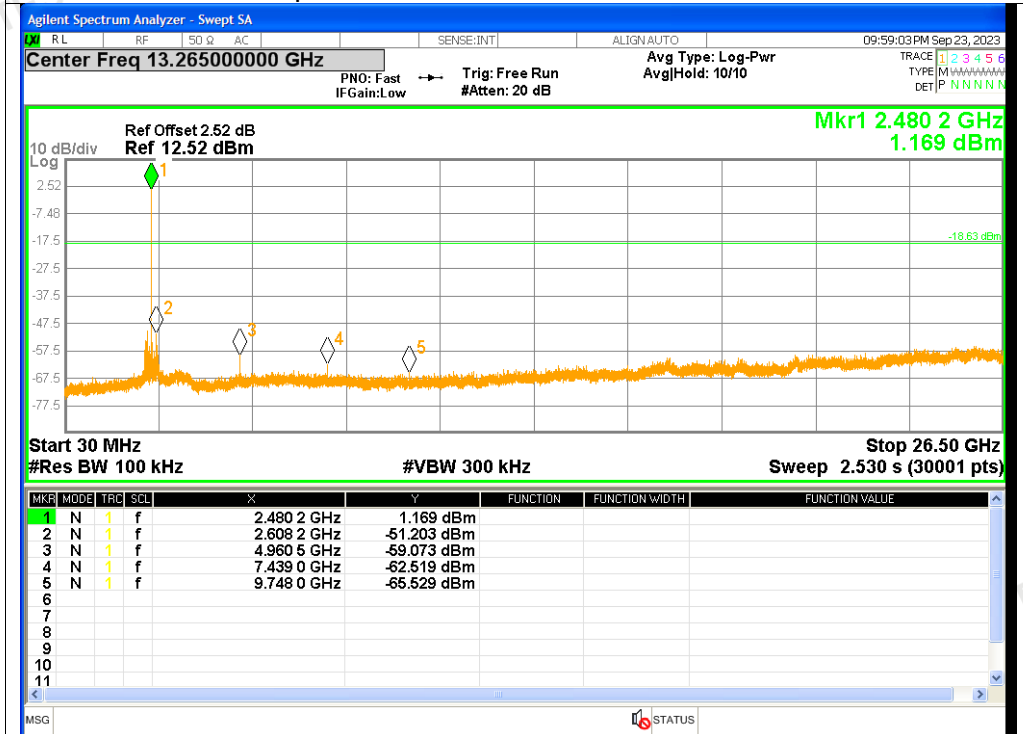
## Tx. Spurious NVNT 2.4G 2440MHz Emission



## Tx. Spurious NVNT 2.4G 2480MHz Ref



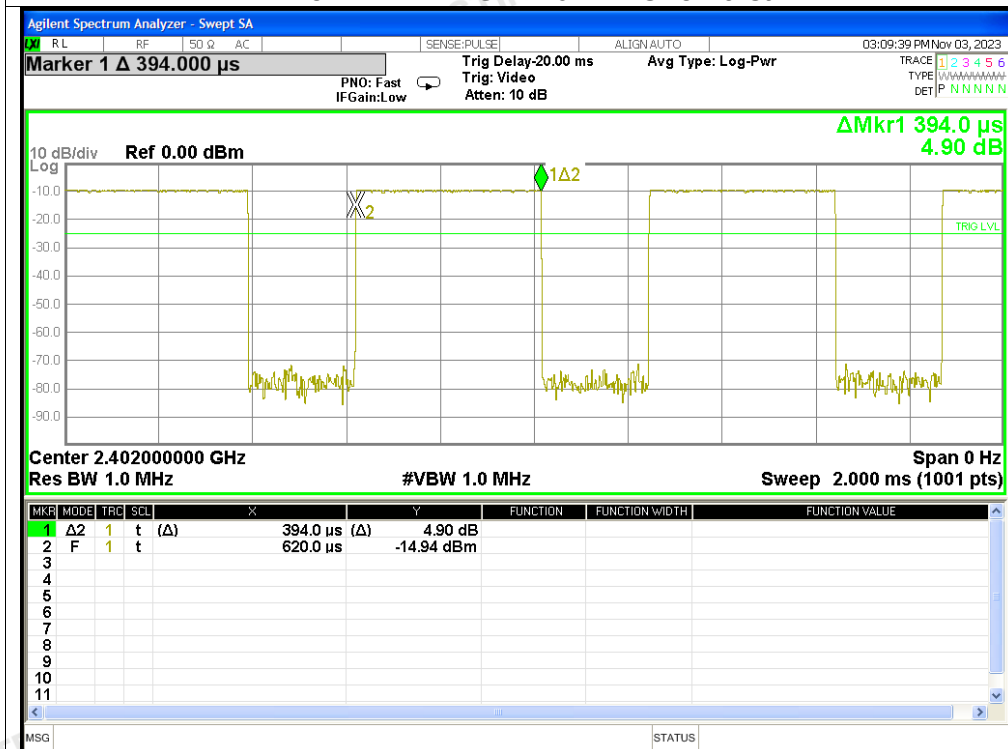
## Tx. Spurious NVNT 2.4G 2480MHz Emission



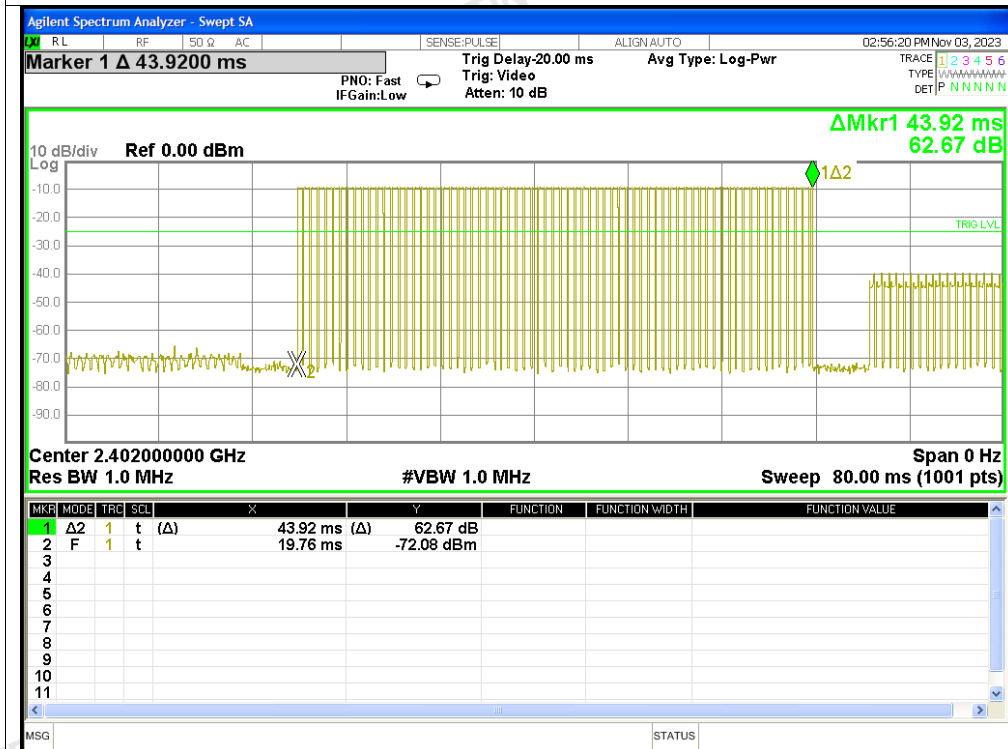
## 9. Dwell Time

| Condition | Mode | Frequency (MHz) | One Pulse Time (ms) | Pulse Time Number | Total Pulse Time (ms) | Total Dwell Time (ms) | Burst Count | Period Time (ms) | Limit (ms) | Verdict |
|-----------|------|-----------------|---------------------|-------------------|-----------------------|-----------------------|-------------|------------------|------------|---------|
| NVNT      | 2.4G | 2440            | 0.394               | 70                | 27.58                 | 220.64                | 8           | 16000            | <=400      | Pass    |

| Test Graphs                       |
|-----------------------------------|
| Dwell NVNT 2.4G 2440MHz One Burst |



## Dwell NVNT 2.4G 2440MHz Total Pulse Time



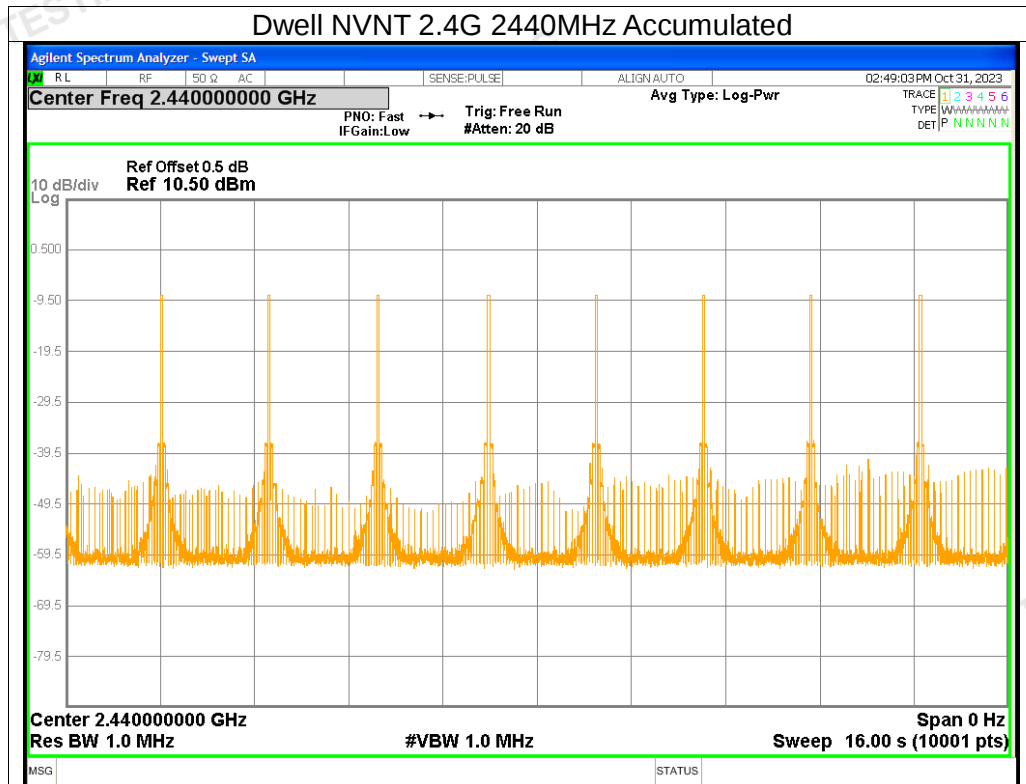
**Note:**

Figure 1 is the time of a single pulse

Figure 2 is a complete cycle,

Figure 3 is number of cycles Accumulated

**Formula of calculation:**

single pulse\* complete cycle(number)\* cycles

Accumulated(number)= $0.394 \times 70 \times 8 = 220.64 \text{ ms} < 400 \text{ ms}$

## APPENDIX 2-PHOTOS OF TEST SETUP

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

\*\*\*\*\*END OF THE REPORT\*\*\*\*\*