

# RF TEST REPORT

For

**Dongguan Miaomiao Electronics Technology Co., Ltd.**

**Product Name: Bluetooth speaker**

**Test Model(s): MM-836**

**Report Reference No.** : DACE250305010RL001

**FCC ID** : 2BN4IMM-836

**Applicant's Name** : Dongguan Miaomiao Electronics Technology Co., Ltd.

**Address** : 401, Bld 9, No 69, Fengqing Rd, Fenggang Town, Dongguan City,  
Guangdong Province, China

**Testing Laboratory** : Shenzhen DACE Testing Technology Co., Ltd.

**Address** : 102, Building H1, & 1/F., Building H, Hongfa Science & Technology Park,  
Tangtou Community, Shiyan Subdistrict, Bao'an District, Shenzhen,  
Guangdong, China

**Test Specification Standard** : 47 CFR Part 15.247

**Date of Receipt** : March 5, 2025

**Date of Test** : March 5, 2025 to March 12, 2025

**Data of Issue** : March 12, 2025

**Result** : Pass

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000003175

## Apply for company information

|                                |   |                                                                                         |
|--------------------------------|---|-----------------------------------------------------------------------------------------|
| Applicant's Name               | : | Dongguan Miaomiao Electronics Technology Co., Ltd.                                      |
| Address                        | : | 401, Bld 9, No 69, Fengqing Rd, Fenggang Town, Dongguan City, Guangdong Province, China |
| Product Name                   | : | Bluetooth speaker                                                                       |
| Test Model(s)                  | : | MM-836                                                                                  |
| Series Model(s)                | : | IVSP2080                                                                                |
| Test Specification Standard(s) | : | 47 CFR Part 15.247                                                                      |

### NOTE1:

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

Compiled by:

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March 12, 2025

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March 12, 2025



Approved by:

*Tom Chen*Tom Chen / Manager

March 12, 2025

## Revision History Of Report

| Version | Description | REPORT No.         | Issue Date     |
|---------|-------------|--------------------|----------------|
| V1.0    | Original    | DACE250305010RL001 | March 12, 2025 |
|         |             |                    |                |
|         |             |                    |                |
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|         |             |                    |                |

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# 1 TEST SUMMARY

## 1.1 Test Standards

The tests were performed according to following standards:

**47 CFR Part 15.247:** Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

## 1.2 Summary of Test Result

| Item                                        | Method                                                                        | Requirement                      | Result |
|---------------------------------------------|-------------------------------------------------------------------------------|----------------------------------|--------|
| Antenna requirement                         | /                                                                             | 47 CFR 15.203                    | Pass   |
| Conducted Emission at AC power line         | ANSI C63.10-2020 section 6.2                                                  | 47 CFR 15.207(a)                 | Pass   |
| 20dB Bandwidth                              | ANSI C63.10-2020, section 7.8.6<br>KDB 558074 D01 15.247 Meas Guidance v05r02 | 47 CFR 15.247(a)(1)              | Pass   |
| Maximum Conducted Output Power              | ANSI C63.10-2020, section 7.8.5<br>KDB 558074 D01 15.247 Meas Guidance v05r02 | 47 CFR 15.247(b)(1)              | Pass   |
| Channel Separation                          | ANSI C63.10-2020, section 7.8.2<br>KDB 558074 D01 15.247 Meas Guidance v05r02 | 47 CFR 15.247(a)(1)              | Pass   |
| Number of Hopping Frequencies               | ANSI C63.10-2020, section 7.8.3<br>KDB 558074 D01 15.247 Meas Guidance v05r02 | 47 CFR 15.247(a)(1)(iii)         | Pass   |
| Dwell Time                                  | ANSI C63.10-2020, section 7.8.4<br>KDB 558074 D01 15.247 Meas Guidance v05r02 | 47 CFR 15.247(a)(1)(iii)         | Pass   |
| Emissions in non-restricted frequency bands | ANSI C63.10-2020 section 7.8.7<br>KDB 558074 D01 15.247 Meas Guidance v05r02  | 47 CFR 15.247(d), 15.209, 15.205 | Pass   |
| Band edge emissions (Radiated)              | ANSI C63.10-2020 section 6.10<br>KDB 558074 D01 15.247 Meas Guidance v05r02   | 47 CFR 15.247(d), 15.209, 15.205 | Pass   |
| Emissions in frequency bands (below 1GHz)   | ANSI C63.10-2020 section 6.6.4<br>KDB 558074 D01 15.247 Meas Guidance v05r02  | 47 CFR 15.247(d), 15.209, 15.205 | Pass   |
| Emissions in frequency bands (above 1GHz)   | ANSI C63.10-2020 section 6.6.4<br>KDB 558074 D01 15.247 Meas Guidance v05r02  | 47 CFR 15.247(d), 15.209, 15.205 | Pass   |

Note: 1.N/A -this device(EUT) is not applicable to this testing item  
2. RF-conducted test results including cable loss.

## 2 GENERAL INFORMATION

### 2.1 Client Information

**Applicant's Name** : Dongguan Miaomiao Electronics Technology Co., Ltd.  
**Address** : 401, Bld 9, No 69, Fengqing Rd, Fenggang Town, Dongguan City, Guangdong Province, China

**Manufacturer** : Dongguan Miaomiao Electronics Technology Co., Ltd.  
**Address** : 401, Bld 9, No 69, Fengqing Rd, Fenggang Town, Dongguan City, Guangdong Province, China

### 2.2 Description of Device (EUT)

|                       |                                                                                                                                                                                                                                                                                     |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Name:         | Bluetooth speaker                                                                                                                                                                                                                                                                   |
| Sample No:            | Q250304017                                                                                                                                                                                                                                                                          |
| Model/Type reference: | MM-836                                                                                                                                                                                                                                                                              |
| Series Model:         | IVSP2080                                                                                                                                                                                                                                                                            |
| Model difference:     | There are two models of the product, Only the model is different due to market customer demand, and other electrical structures of these models are the same(eg:PCB, BOM ), and these differences will not affect RF&EMC performance. Therefore, the selected test model is:MM-836. |
| Trade Mark:           | N/A                                                                                                                                                                                                                                                                                 |
| Product Description:  | Bluetooth speaker                                                                                                                                                                                                                                                                   |
| Power Supply:         | DC3.7V from battery; charging from type-C port                                                                                                                                                                                                                                      |
| Operation Frequency:  | 2402MHz to 2480MHz                                                                                                                                                                                                                                                                  |
| Number of Channels:   | 79                                                                                                                                                                                                                                                                                  |
| Modulation Type:      | GFSK, $\pi/4$ DQPSK,                                                                                                                                                                                                                                                                |
| Antenna Type:         | PCB ANTENNA                                                                                                                                                                                                                                                                         |
| Antenna Gain:         | -0.58dBi                                                                                                                                                                                                                                                                            |
| Hardware Version:     | V2                                                                                                                                                                                                                                                                                  |
| Software Version:     | V1.0.2.2                                                                                                                                                                                                                                                                            |

| 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 | /  | /       |

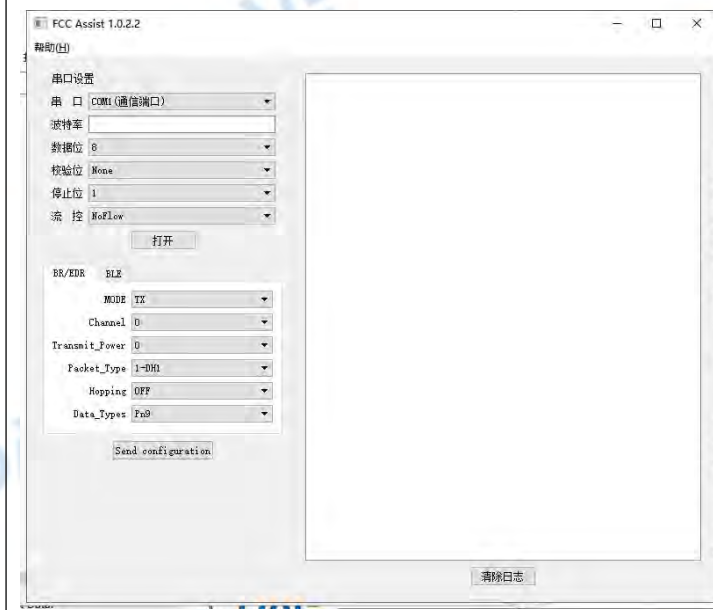
the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

| Test channel    | Frequency (MHz) |
|-----------------|-----------------|
| Lowest channel  | 2402MHz         |
| Middle channel  | 2441MHz         |
| Highest channel | 2480MHz         |

## 2.3 Description of Test Modes

| No  | Title                      | Description                                                                                                                   |
|-----|----------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| TM1 | TX-GFSK (Non-Hopping)      | Keep the EUT in continuously transmitting mode (non-hopping) with GFSK modulation at lowest, middle and highest channel.      |
| TM2 | TX-Pi/4DQPSK (Non-Hopping) | Keep the EUT in continuously transmitting mode (non-hopping) with Pi/4DQPSK modulation at lowest, middle and highest channel. |
| TM3 | TX-GFSK (Hopping)          | Keep the EUT in continuously transmitting mode (hopping) with GFSK modulation,.                                               |
| TM4 | TX-Pi/4DQPSK (Hopping)     | Keep the EUT in continuously transmitting mode (hopping) with Pi/4DQPSK modulation.                                           |

Test software:





## 2.4 Description of Support Units

| Title   | Manufacturer | Model No.     | Serial No.     |
|---------|--------------|---------------|----------------|
| Adapter | PHOTON       | ATXC-069AC65B | Provide by lab |

## 2.5 Equipments Used During The Test

| Conducted Emission at AC power line |                 |                                                  |                                   |            |              |
|-------------------------------------|-----------------|--------------------------------------------------|-----------------------------------|------------|--------------|
| Equipment                           | Manufacturer    | Model No                                         | Inventory No                      | Cal Date   | Cal Due Date |
| Cable                               | SCHWARZ BECK    | /                                                | /                                 | 2024-05-20 | 2025-05-19   |
| Pulse Limiter                       | SCHWARZ BECK    | VTSD 9561-F<br>Pulse limiter 10dB<br>Attenuation | 561-G071                          | 2024-12-06 | 2025-12-05   |
| 50ΩCoaxial Switch                   | Anritsu         | MP59B                                            | M20531                            | /          | /            |
| Test Receiver                       | Rohde & Schwarz | ESPI TEST<br>RECEIVER                            | ID:1164.6607K<br>03-102109-<br>MH | 2024-06-12 | 2025-06-11   |
| L.I.S.N                             | R&S             | ESH3-Z5                                          | 831.5518.52                       | 2023-12-12 | 2025-12-11   |
| L.I.S.N                             | SCHWARZ BECK    | NSLK 8126                                        | 05055                             | 2024-06-14 | 2025-06-13   |
| Pulse Limiter                       | CYBERTEK        | EM5010A                                          | /                                 | 2024-09-27 | 2025-09-26   |
| EMI test software                   | EZ -EMC         | EZ                                               | V1.1.42                           | /          | /            |

### Number of Hopping Frequencies

### Dwell Time

### Emissions in non-restricted frequency bands

### 20dB Bandwidth

### Maximum Conducted Output Power

### Channel Separation

| Equipment                                 | Manufacturer                                               | Model No | Inventory No | Cal Date   | Cal Due Date |
|-------------------------------------------|------------------------------------------------------------|----------|--------------|------------|--------------|
| RF Test Software                          | Tachoy<br>Information<br>Technology(she<br>nzhen) Co.,Ltd. | RTS-01   | V1.0.0       | /          | /            |
| RF Sensor Unit                            | Tachoy<br>Information<br>Technology(she<br>nzhen) Co.,Ltd. | TR1029-2 | 000001       | /          | /            |
| Wideband radio<br>communication<br>tester | R&S                                                        | CMW500   | 113410       | 2024-06-12 | 2025-06-11   |
| Vector Signal<br>Generator                | Keysight                                                   | N5181A   | MY50143455   | 2024-12-06 | 2025-12-05   |
| Signal Generator                          | Keysight                                                   | N5182A   | MY48180415   | 2024-12-06 | 2025-12-05   |
| Spectrum Analyzer                         | Keysight                                                   | N9020A   | MY53420323   | 2024-12-06 | 2025-12-05   |

**Band edge emissions (Radiated)****Emissions in frequency bands (below 1GHz)****Emissions in frequency bands (above 1GHz)**

| Equipment                           | Manufacturer   | Model No         | Inventory No               | Cal Date   | Cal Due Date |
|-------------------------------------|----------------|------------------|----------------------------|------------|--------------|
| EMI Test software                   | Farad          | EZ -EMC          | V1.1.42                    | /          | /            |
| Positioning Controller              | MF             | MF-7802          | /                          | /          | /            |
| Amplifier(18-40G)                   | COM-POWER      | AH-1840          | 10100008-1                 | 2023-05-19 | 2025-05-18   |
| Horn antenna                        | COM-POWER      | AH-1840 (18-40G) | 10100008                   | 2023-05-19 | 2025-05-18   |
| Loop antenna                        | ZHINAN         | ZN30900C         | ZN30900C                   | 2024-06-14 | 2026-06-13   |
| Cable(LF)#2                         | Schwarzbeck    | /                | /                          | 2024-12-19 | 2025-12-18   |
| Cable(LF)#1                         | Schwarzbeck    | /                | /                          | 2024-12-19 | 2025-12-18   |
| Cable(HF)#2                         | Schwarzbeck    | AK9515E          | 96250                      | 2024-05-20 | 2025-05-19   |
| Cable(HF)#1                         | Schwarzbeck    | SYV-50-3-1       | /                          | 2024-05-20 | 2025-05-19   |
| Power amplifier(LF)                 | Schwarzbeck    | BBV9743          | 9743-151                   | 2024-06-12 | 2025-06-11   |
| Power amplifier(HF)                 | Schwarzbeck    | BBV9718          | 9718-282                   | 2024-06-12 | 2025-06-11   |
| Wideband radio communication tester | R&S            | CMW500           | 113410                     | 2024-06-12 | 2025-06-11   |
| Spectrum Analyzer                   | R&S            | FSP30            | 1321.3008K40<br>-101729-jR | 2024-06-12 | 2025-06-11   |
| Test Receiver                       | R&S            | ESCI 3           | 1166.5950K03<br>-101431-Jq | 2024-06-13 | 2025-06-12   |
| Horn Antenna                        | Sunol Sciences | DRH-118          | A091114                    | 2023-05-13 | 2025-05-12   |
| Broadband Antenna                   | Sunol Sciences | JB6 Antenna      | A090414                    | 2024-09-28 | 2026-09-27   |

**2.6 Statement Of The Measurement Uncertainty**

| Test Item                                                                                                                                         | Measurement Uncertainty |
|---------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| Conducted Disturbance (0.15~30MHz)                                                                                                                | ±3.41dB                 |
| Occupied Bandwidth                                                                                                                                | ±3.63%                  |
| RF conducted power                                                                                                                                | ±0.733dB                |
| Duty cycle                                                                                                                                        | ±3.1%                   |
| Conducted Spurious emissions                                                                                                                      | ±1.98dB                 |
| Radiated Emission (Above 1GHz)                                                                                                                    | ±5.46dB                 |
| Radiated Emission (Below 1GHz)                                                                                                                    | ±5.79dB                 |
| Note: (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2. |                         |

## 2.7 Identification of Testing Laboratory

|               |                                                                                                                                                            |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Company Name: | Shenzhen DACE Testing Technology Co., Ltd.                                                                                                                 |
| Address:      | 102, Building H1, & 1/F., Building H, Hongfa Science & Technology Park, Tangtou Community, Shiyan Subdistrict, Bao'an District, Shenzhen, Guangdong, China |
| Phone Number: | +86-13267178997                                                                                                                                            |
| Fax Number:   | 86-755-29113252                                                                                                                                            |

### Identification of the Responsible Testing Location

|                                |                                                                                                                                                            |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Company Name:                  | Shenzhen DACE Testing Technology Co., Ltd.                                                                                                                 |
| Address:                       | 102, Building H1, & 1/F., Building H, Hongfa Science & Technology Park, Tangtou Community, Shiyan Subdistrict, Bao'an District, Shenzhen, Guangdong, China |
| Phone Number:                  | +86-13267178997                                                                                                                                            |
| Fax Number:                    | 86-755-29113252                                                                                                                                            |
| FCC Registration Number:       | 0032847402                                                                                                                                                 |
| Designation Number:            | CN1342                                                                                                                                                     |
| Test Firm Registration Number: | 778666                                                                                                                                                     |
| A2LA Certificate Number:       | 6270.01                                                                                                                                                    |

## 2.8 Announcement

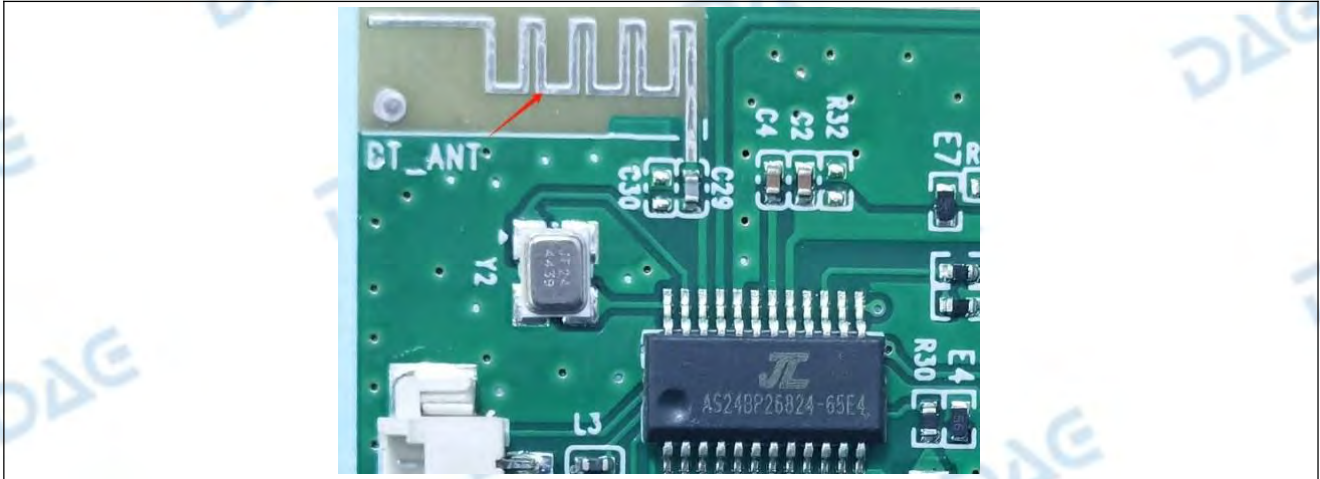
- (1) The test report reference to the report template version v0.
- (2) The test report is invalid if not marked with the signatures of the persons responsible for preparing, reviewing and approving the test report.
- (3) The test report is invalid if there is any evidence and/or falsification.
- (4) This document may not be altered or revised in any way unless done so by DACE and all revisions are duly noted in the revisions section.
- (5) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.
- (6) We hereby declare that the laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant. the laboratory is not responsible for the accuracy of the information provided by the client(item 2.2). When the information provided by the customer may affect the effectiveness of the results, the responsibility lies with the customer, and the laboratory does not assume any responsibility.

### 3 Evaluation Results (Evaluation)

#### 3.1 Antenna requirement

|                   |                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | Refer to 47 CFR Part 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

##### 3.1.1 Conclusion:

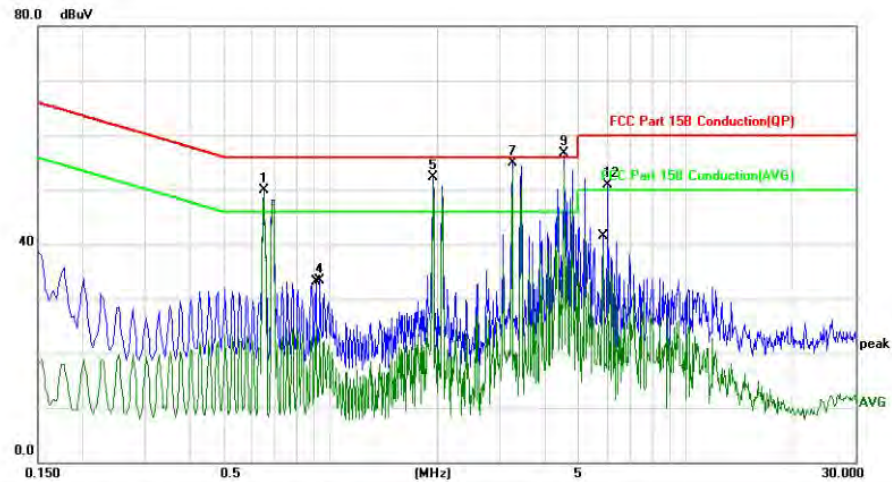






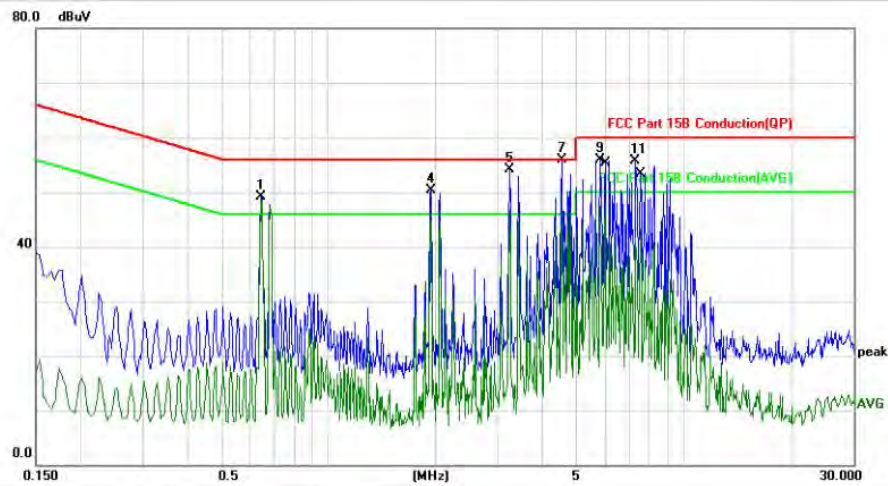
#### 4.1.3 Test Data:

TM1 / Line: Line / Band: 2400-2483.5 MHz / BW: 1 / CH: L



| 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 | Comment |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|---------|
| 1   |     | 0.6500       | 39.91                    | 10.07                   | 49.98                    | 56.00         | -6.02      | peak     |         |
| 2   | X   | 0.6500       | 39.46                    | 10.07                   | 49.53                    | 46.00         | 3.53       | AVG      |         |
| 3   |     | 0.9100       | 14.55                    | 10.08                   | 24.63                    | 46.00         | -21.37     | AVG      |         |
| 4   |     | 0.9340       | 23.32                    | 10.08                   | 33.40                    | 56.00         | -22.60     | peak     |         |
| 5   |     | 1.9460       | 42.36                    | 10.00                   | 52.36                    | 56.00         | -3.64      | peak     |         |
| 6   | X   | 1.9460       | 40.92                    | 10.00                   | 50.92                    | 46.00         | 4.92       | AVG      |         |
| 7   |     | 3.2420       | 44.78                    | 10.08                   | 54.86                    | 56.00         | -1.14      | peak     |         |
| 8   | X   | 3.2420       | 43.38                    | 10.08                   | 53.46                    | 46.00         | 7.46       | AVG      |         |
| 9   | X   | 4.5420       | 46.46                    | 10.18                   | 56.64                    | 56.00         | 0.64       | peak     |         |
| 10  | *   | 4.5420       | 43.43                    | 10.18                   | 53.61                    | 46.00         | 7.61       | AVG      |         |
| 11  |     | 5.8380       | 28.70                    | 10.21                   | 38.91                    | 50.00         | -11.09     | AVG      |         |
| 12  |     | 6.0300       | 40.61                    | 10.22                   | 50.83                    | 60.00         | -9.17      | peak     |         |

TM1 / Line: Neutral / Band: 2400-2483.5 MHz / BW: 1 / CH: L



| 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 | Comment |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|---------|
| 1   |     | 0.6460       | 39.05                    | 10.07                   | 49.12                    | 56.00         | -6.88      | peak     |         |
| 2   | X   | 0.6500       | 38.46                    | 10.07                   | 48.53                    | 46.00         | 2.53       | AVG      |         |
| 3   |     | 1.9380       | 34.93                    | 10.00                   | 44.93                    | 46.00         | -1.07      | AVG      |         |
| 4   |     | 1.9420       | 40.35                    | 10.00                   | 50.35                    | 56.00         | -5.65      | peak     |         |
| 5   |     | 3.2340       | 44.04                    | 10.08                   | 54.12                    | 56.00         | -1.88      | peak     |         |
| 6   | X   | 3.2340       | 36.61                    | 10.08                   | 46.69                    | 46.00         | 0.69       | AVG      |         |
| 7   |     | 4.5300       | 45.67                    | 10.18                   | 55.85                    | 56.00         | -0.15      | peak     |         |
| 8   | *   | 4.5300       | 39.30                    | 10.18                   | 49.48                    | 46.00         | 3.48       | AVG      |         |
| 9   |     | 5.8300       | 45.74                    | 10.21                   | 55.95                    | 60.00         | -4.05      | peak     |         |
| 10  |     | 6.0140       | 37.69                    | 10.22                   | 47.91                    | 50.00         | -2.09      | AVG      |         |
| 11  |     | 7.3100       | 45.51                    | 10.24                   | 55.75                    | 60.00         | -4.25      | peak     |         |
| 12  |     | 7.5540       | 33.05                    | 10.25                   | 43.30                    | 50.00         | -6.70      | AVG      |         |

#### NOTE:

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.
3. Measurement Level = Reading level + Correct Factor, Over=Limit- Measurement



## 4.2 20dB Bandwidth

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | 47 CFR 15.247(a)(1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Test Limit:       | Refer to 47 CFR 15.215(c), intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Test Method:      | ANSI C63.10-2020, section 7.8.6, For occupied bandwidth measurements, use the procedure in 6.9.3. Frequency hopping shall be disabled for this test.<br>KDB 558074 D01 15.247 Meas Guidance v05r02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Procedure:        | <p>The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power bandwidth:</p> <p>a) The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.</p> <p>b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be at least three times the RBW, unless otherwise specified by the applicable requirement.</p> <p>c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than <math>[10 \log (OBW/RBW)]</math> below the reference level. Specific guidance is given in 4.1.6.2.</p> <p>d) Step a) through step c) might require iteration to adjust within the specified range.</p> <p>e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max-hold mode (until the trace stabilizes) shall be used.</p> <p>f) Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.</p> <p>g) If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.</p> <p>h) The occupied bandwidth shall be reported by providing spectral plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).</p> |

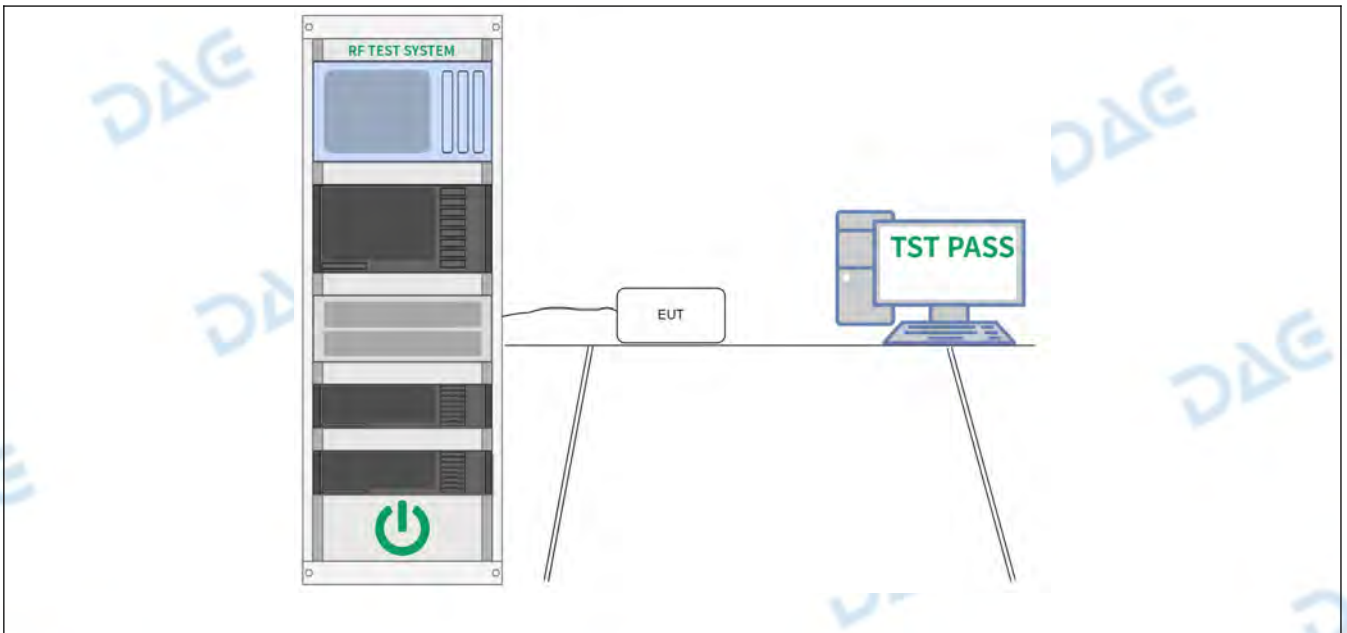
### 4.2.1 E.U.T. Operation:

|                        |          |           |      |                       |         |
|------------------------|----------|-----------|------|-----------------------|---------|
| Operating Environment: |          |           |      |                       |         |
| Temperature:           | 22.4 °C  | Humidity: | 52 % | Atmospheric Pressure: | 102 kPa |
| Pretest mode:          | TM1, TM2 |           |      |                       |         |
| Final test mode:       | TM1, TM2 |           |      |                       |         |

### 4.2.2 Test Setup Diagram:

|  |
|--|
|  |
|--|





#### 4.2.3 Test Data:

Please Refer to Appendix for Details.

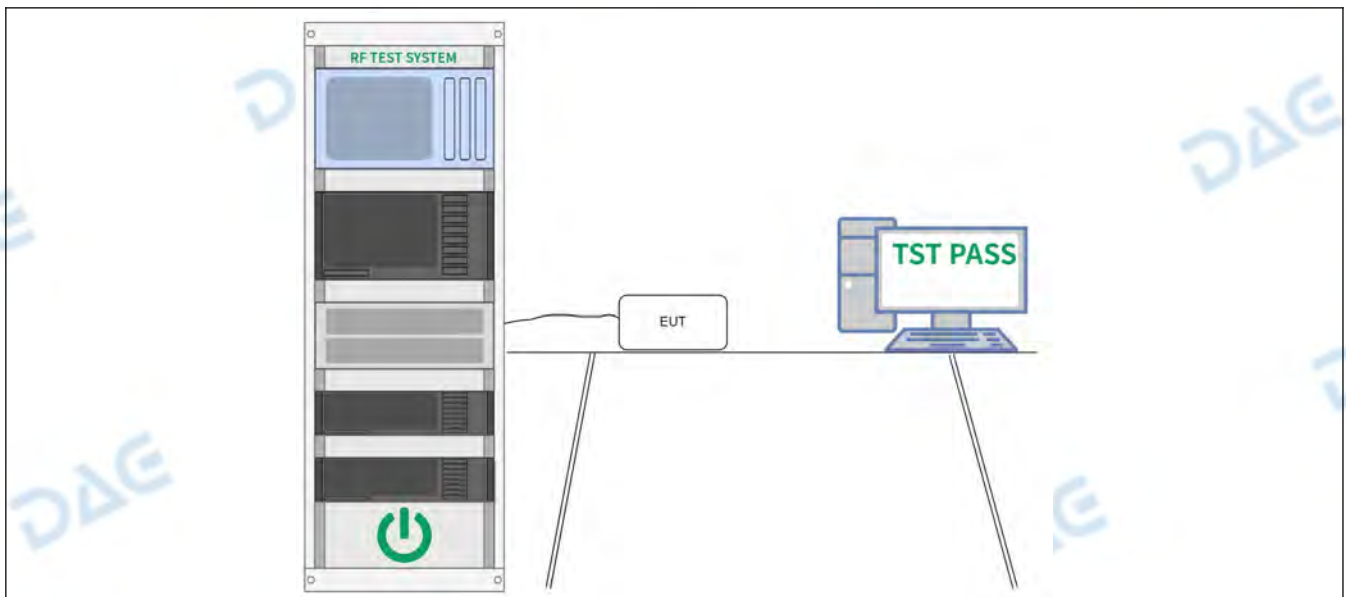
### 4.3 Maximum Conducted Output Power

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | 47 CFR 15.247(b)(1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Test Limit:       | Refer to 47 CFR 15.247(b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Test Method:      | ANSI C63.10-2020, section 7.8.5<br>KDB 558074 D01 15.247 Meas Guidance v05r02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 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. Frequency hopping shall be disabled for this test. Use the following spectrum analyzer settings:<br>a) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.<br>b) RBW > 20 dB bandwidth of the emission being measured.<br>c) VBW ≥ RBW.<br>d) Sweep: No faster than coupled (auto) time.<br>e) Detector function: Peak.<br>f) Trace: Max-hold.<br>g) Allow trace to stabilize.<br>h) Use the marker-to-peak function to set the marker to the peak of the emission.<br>i) The indicated level is the peak output power, after any corrections for external attenuators and cables.<br>j) A spectral plot of the test results and setup description shall be included in the test report. |

#### 4.3.1 E.U.T. Operation:

|                        |          |           |      |                       |         |
|------------------------|----------|-----------|------|-----------------------|---------|
| Operating Environment: |          |           |      |                       |         |
| Temperature:           | 22.4 °C  | Humidity: | 52 % | Atmospheric Pressure: | 102 kPa |
| Pretest mode:          | TM1, TM2 |           |      |                       |         |
| Final test mode:       | TM1, TM2 |           |      |                       |         |

#### 4.3.2 Test Setup Diagram:



#### 4.3.3 Test Data:

Please Refer to Appendix for Details.

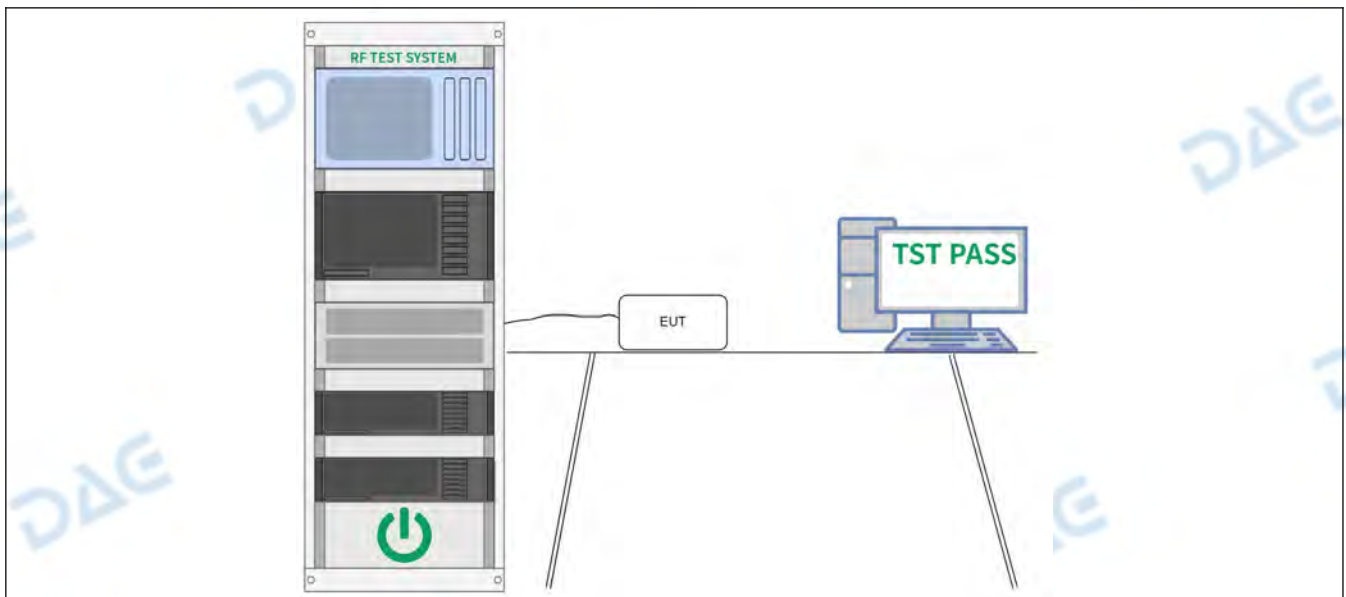
#### 4.4 Channel Separation

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | 47 CFR 15.247(a)(1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Test Limit:       | Refer to 47 CFR 15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.                                                                                                                                                                                                                                                                                                                                                                   |
| Test Method:      | ANSI C63.10-2020, section 7.8.2<br>KDB 558074 D01 15.247 Meas Guidance v05r02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Procedure:        | <p>The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:</p> <ul style="list-style-type: none"> <li>a) Span: Wide enough to capture the peaks of two adjacent channels.</li> <li>b) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.</li> <li>c) Video (or average) bandwidth (VBW) <math>\geq</math> RBW.</li> <li>d) Sweep: No faster than coupled (auto) time.</li> <li>e) Detector function: Peak.</li> <li>f) Trace: Max-hold.</li> <li>g) Allow the trace to stabilize.</li> </ul> <p>Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Compliance of an EUT with the appropriate regulatory limit shall be determined. A spectral plot of the data shall be included in the test report.</p> |

##### 4.4.1 E.U.T. Operation:

|                        |          |           |      |                       |         |
|------------------------|----------|-----------|------|-----------------------|---------|
| Operating Environment: |          |           |      |                       |         |
| Temperature:           | 22.4 °C  | Humidity: | 52 % | Atmospheric Pressure: | 102 kPa |
| Pretest mode:          | TM3, TM4 |           |      |                       |         |
| Final test mode:       | TM3, TM4 |           |      |                       |         |

##### 4.4.2 Test Setup Diagram:



##### 4.4.3 Test Data:

Please Refer to Appendix for Details.

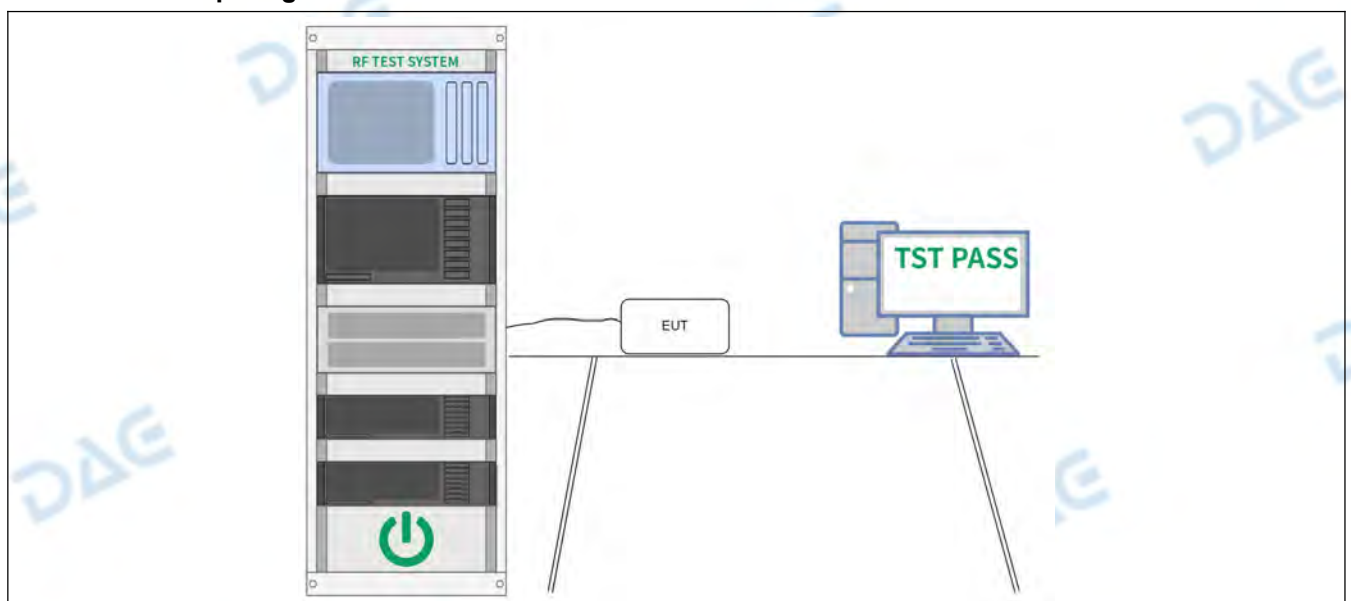
#### 4.5 Number of Hopping Frequencies

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | 47 CFR 15.247(a)(1)(iii)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Test Limit:       | Refer to 47 CFR 15.247(a)(1)(iii), Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Test Method:      | ANSI C63.10-2020, section 7.8.3<br>KDB 558074 D01 15.247 Meas Guidance v05r02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Procedure:        | The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:<br>a) Span: The frequency band of operation. Depending on the number of channels the device supports, it could be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.<br>b) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.<br>c) VBW $\geq$ RBW.<br>d) Sweep: No faster than coupled (auto) time.<br>e) Detector function: Peak.<br>f) Trace: Max-hold.<br>g) Allow the trace to stabilize.<br>It might prove necessary to break the span up into subranges to show clearly all of the hopping frequencies. Compliance of an EUT with the appropriate regulatory limit shall be determined for the number of hopping channels. A spectral plot of the data shall be included in the test report. |

##### 4.5.1 E.U.T. Operation:

|                        |          |           |      |                       |         |
|------------------------|----------|-----------|------|-----------------------|---------|
| Operating Environment: |          |           |      |                       |         |
| Temperature:           | 22.4 °C  | Humidity: | 52 % | Atmospheric Pressure: | 102 kPa |
| Pretest mode:          | TM3, TM4 |           |      |                       |         |
| Final test mode:       | TM3, TM4 |           |      |                       |         |

##### 4.5.2 Test Setup Diagram:



##### 4.5.3 Test Data:

Please Refer to Appendix for Details.



#### 4.6 Dwell Time

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | 47 CFR 15.247(a)(1)(iii)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Test Limit:       | Refer to 47 CFR 15.247(a)(1)(iii), Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Test Method:      | ANSI C63.10-2020, section 7.8.4<br>KDB 558074 D01 15.247 Meas Guidance v05r02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Procedure:        | <p>The dwell time per hop on a channel is the time from the start of the first transmission to the end of the last transmission for that hop. If the device has a single transmission per hop then the dwell time is the duration of that transmission. If the device has a multiple transmissions per hop then the dwell time is measured from the start of the first transmission to the end of the last transmission.</p> <p>The time of occupancy is the total time that the device dwells on a channel over an observation period specified in the regulatory requirement. To determine the time of occupancy the spectrum analyzer will be configured to measure both the dwell time per hop and the number of times the device transmits on a specific channel in a given period.</p> <p>The EUT shall have its hopping function enabled. Compliance with the requirements shall be made with the minimum and with the maximum number of channels enabled. If the dwell time per channel does not vary with the number of channels then compliance with the requirements may be based on the minimum number of channels. If the device supports different dwell times per channel (example Bluetooth devices can dwell on a channel for 1, 3 or 5 time slots) then measurements can be limited to the longest dwell time with the minimum number of channels.</p> <p>Use the following spectrum analyzer settings to determine the dwell time per hop:</p> <ul style="list-style-type: none"> <li>a) Span: Zero span, centered on a hopping channel.</li> <li>b) RBW shall be <math>\leq</math> channel spacing and where possible RBW should be set <math>\gg 1/T</math>, where T is the expected transmission time per hop.</li> <li>c) Sweep time: Set so that the start of the first transmission and end of the last transmission for the hop are clearly captured. Setting the sweep time to be slightly longer than the hopping period per channel (hopping period = <math>1/\text{hopping rate}</math>) should achieve this.</li> <li>d) Use a video trigger, where possible with a trigger delay, so that the start of the transmission is clearly observed. The trigger level might need adjustment to reduce the chance of triggering when the system hops on an adjacent channel.</li> <li>e) Detector function: Peak.</li> <li>f) Trace: Clear-write, single sweep.</li> <li>g) Place markers at the start of the first transmission on the channel and at the end of the last transmission. The dwell time per hop is the time between these two markers.</li> </ul> <p>To determine the number of hops on a channel in the regulatory observation period repeat the measurement using a longer sweep time. When the device uses a single hopping sequence the period of measurement should be sufficient to capture at least 2 hops. When the device uses a dynamic hopping sequence, or the sequence varies, the period of measurement may need to capture multiple hops to better determine the average time of occupancy. Count the number of hops on the channel across the sweep time.</p> <p>The average number of hops on the same channel within the regulatory observation</p> |

period is calculated from the number of hops on the channel divided by the spectrum analyzer sweep time multiplied by the regulatory observation period. For example, if three hops are counted with an analyzer sweep time of 500 ms and the regulatory observation period is 10 s, then the number of hops in that ten seconds is  $3 / 0.5 \times 10$ , or 60 hops.

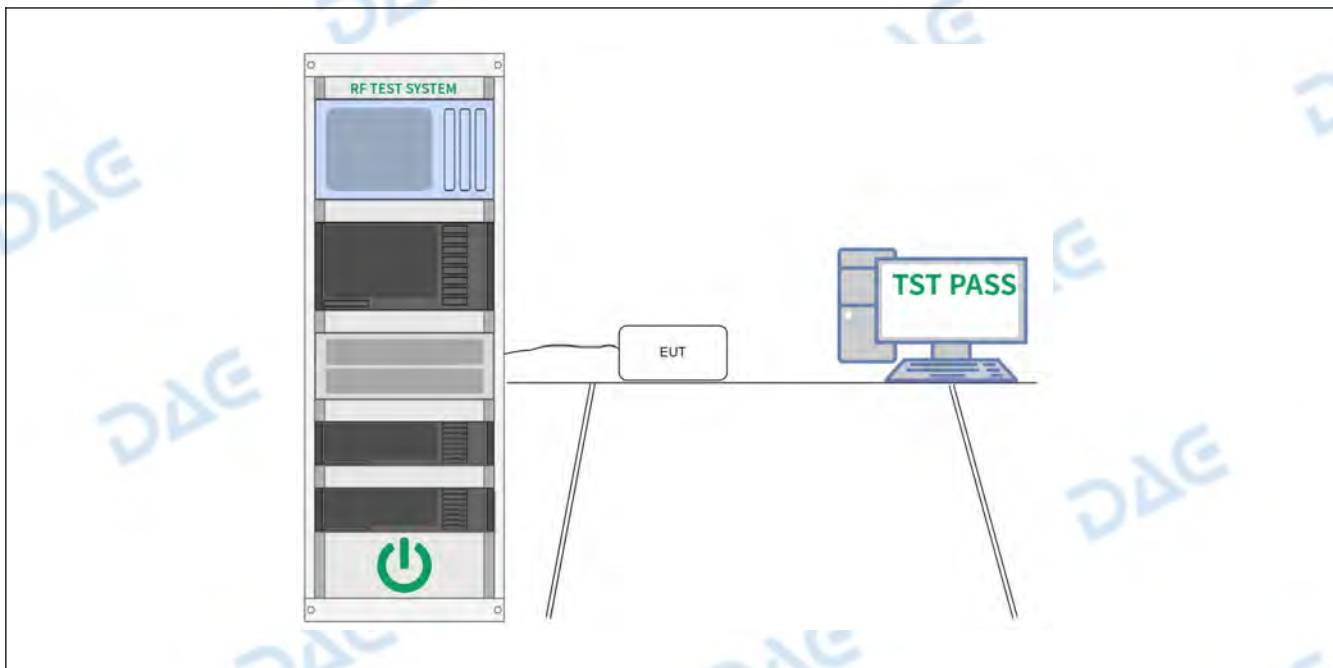
The average time of occupancy is calculated by multiplying the dwell time per hop by the number of hops in the observation period.

#### 4.6.1 E.U.T. Operation:

Operating Environment:

|                  |          |           |      |                       |         |
|------------------|----------|-----------|------|-----------------------|---------|
| Temperature:     | 22.4 °C  | Humidity: | 52 % | Atmospheric Pressure: | 102 kPa |
| Pretest mode:    | TM3, TM4 |           |      |                       |         |
| Final test mode: | TM3, TM4 |           |      |                       |         |

#### 4.6.2 Test Setup Diagram:



#### 4.6.3 Test Data:

Please Refer to Appendix for Details.

#### 4.7 Emissions in non-restricted frequency bands

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | 47 CFR 15.247(d), 15.209, 15.205                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Test Limit:       | Refer to 47 CFR 15.247(d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Test Method:      | ANSI C63.10-2020 section 7.8.7<br>KDB 558074 D01 15.247 Meas Guidance v05r02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Procedure:        | <p><b>7.8.7.1 General considerations</b></p> <p>To demonstrate compliance with the relative out-of-band emissions requirements conducted spurious emissions shall be measured for the transmit frequencies, per 5.5 and 5.6, and at the maximum transmit powers. Frequency hopping shall be disabled for this test with the exception of measurements at the allocated band-edges which shall be repeated with hopping enabled.</p> <p>Connect the primary antenna port through an attenuator to the spectrum analyzer input; in the results, account for all losses between the unlicensed wireless device output and the spectrum analyzer. The frequency range of testing shall span 30 MHz to 10 times the operating frequency and this may be done in a single sweep or, to aid resolution, across a number of sweeps. The resolution bandwidth shall be 100 kHz, video bandwidth 300 kHz, and a coupled sweep time with a peak detector.</p> <p>The limit is based on the highest in-band level across all channels measured using the same instrument settings (resolution bandwidth of 100 kHz, video bandwidth of 300 kHz, and a coupled sweep time with a peak detector). To help clearly demonstrate compliance a display line may be set at the required offset (typically 20 dB) below the highest in-band level. Where the highest in-band level is not clearly identified in the out-of-band measurements a separate spectral plot showing the in-band level shall be provided.</p> <p>When conducted measurements cannot be made (for example a device with integrated, non-removable antenna) radiated measurements shall be used. The reference level for determining the limit shall be established by maximizing the field strength from the highest power channel and measuring using the resolution and video bandwidth settings and peak detector as described above. The field strength limit for spurious emissions outside of restricted-bands shall then be set at the required offset (typically 20 dB) below the highest in-band level. Radiated measurements will follow the standards measurement procedures described in Clause 6 with the exception that the resolution bandwidth shall be 100 kHz, video bandwidth 300 kHz, and a coupled sweep time with a peak detector. Note that use of wider measurement bandwidths are acceptable for measuring the spurious emissions provided that the peak detector is used and that the measured value of spurious emissions are compared to the highest in-band level measured with the 100 kHz / 300 kHz bandwidth settings to determine compliance.</p> <p><b>7.8.7.2 Band-edges</b></p> <p>Compliance with a relative limit at the band-edges (e.g., -20 dBc) shall be made on the lowest and on the highest channels with frequency hopping disabled and repeated with frequency hopping enabled. For the latter test the hopping sequence shall include the lowest and highest channels.</p> |

For measurements with the hopping disabled the analyzer screen shall clearly show compliance with the requirement within 10 MHz of the allocated band-edge.

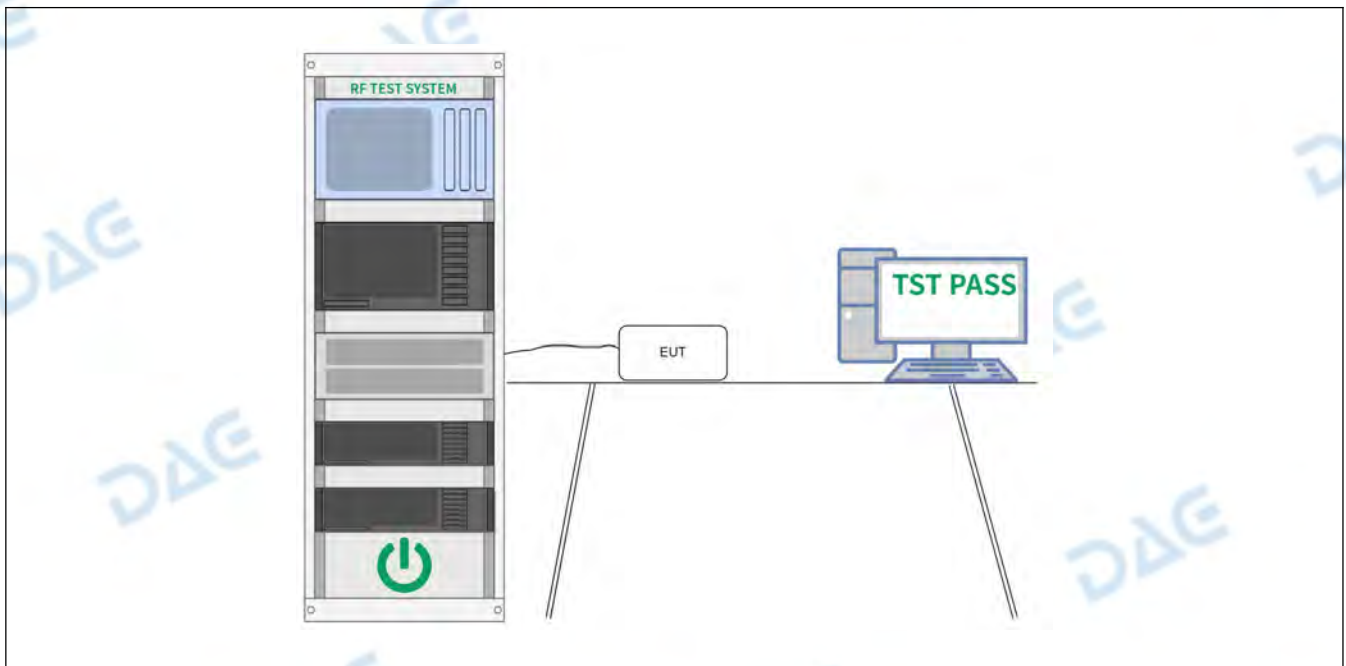
For measurements with the hopping enabled the analyzer screen shall clearly show compliance with the requirement within 10 MHz of both of the allocated band-edges. This could require separate spectral plots for each band-edge.

#### 4.7.1 E.U.T. Operation:

Operating Environment:

|                  |          |           |      |                       |         |
|------------------|----------|-----------|------|-----------------------|---------|
| Temperature:     | 22.4 °C  | Humidity: | 52 % | Atmospheric Pressure: | 102 kPa |
| Pretest mode:    | TM1, TM2 |           |      |                       |         |
| Final test mode: | TM1, TM2 |           |      |                       |         |

#### 4.7.2 Test Setup Diagram:



#### 4.7.3 Test Data:

Please Refer to Appendix for Details.



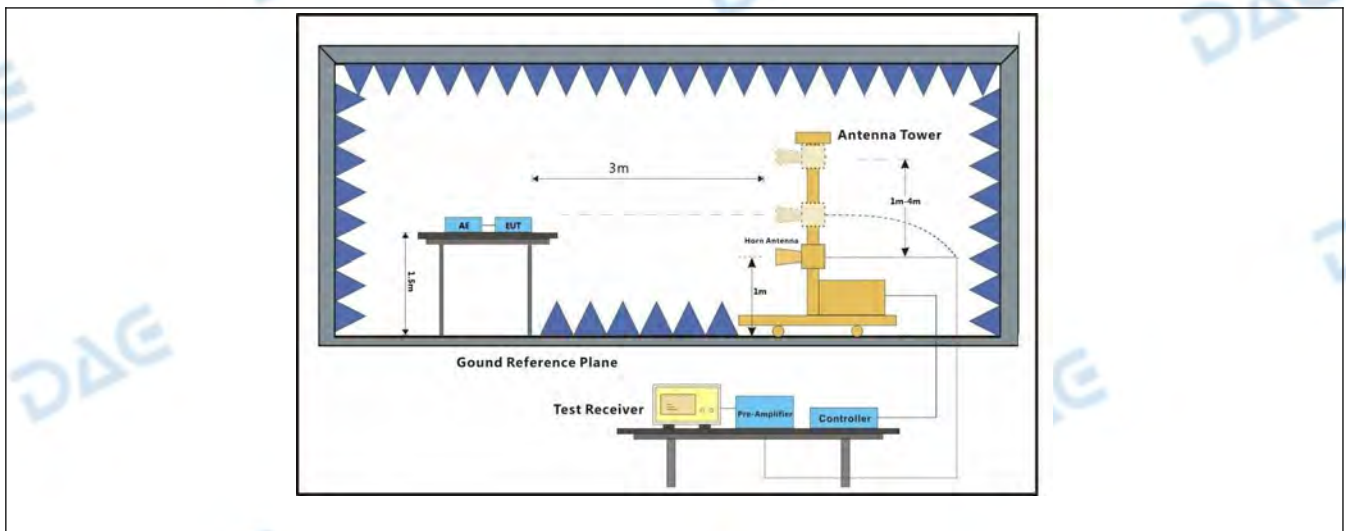
#### 4.8 Band edge emissions (Radiated)

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                         |                                   |                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------------------------|
| Test Requirement:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Refer to 47 CFR 15.247(d), In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)). |                                   |                               |
| Test Limit:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Frequency (MHz)                                                                                                                                                                                                         | Field strength (microvolts/meter) | Measurement distance (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                             |
| <p>** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.</p> <p>In the emission table above, the tighter limit applies at the band edges.</p> <p>The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.</p> |                                                                                                                                                                                                                         |                                   |                               |
| Test Method:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ANSI C63.10-2020 section 6.10<br>KDB 558074 D01 15.247 Meas Guidance v05r02                                                                                                                                             |                                   |                               |
| Procedure:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ANSI C63.10-2020 section 6.10.5.2                                                                                                                                                                                       |                                   |                               |

##### 4.8.1 E.U.T. Operation:

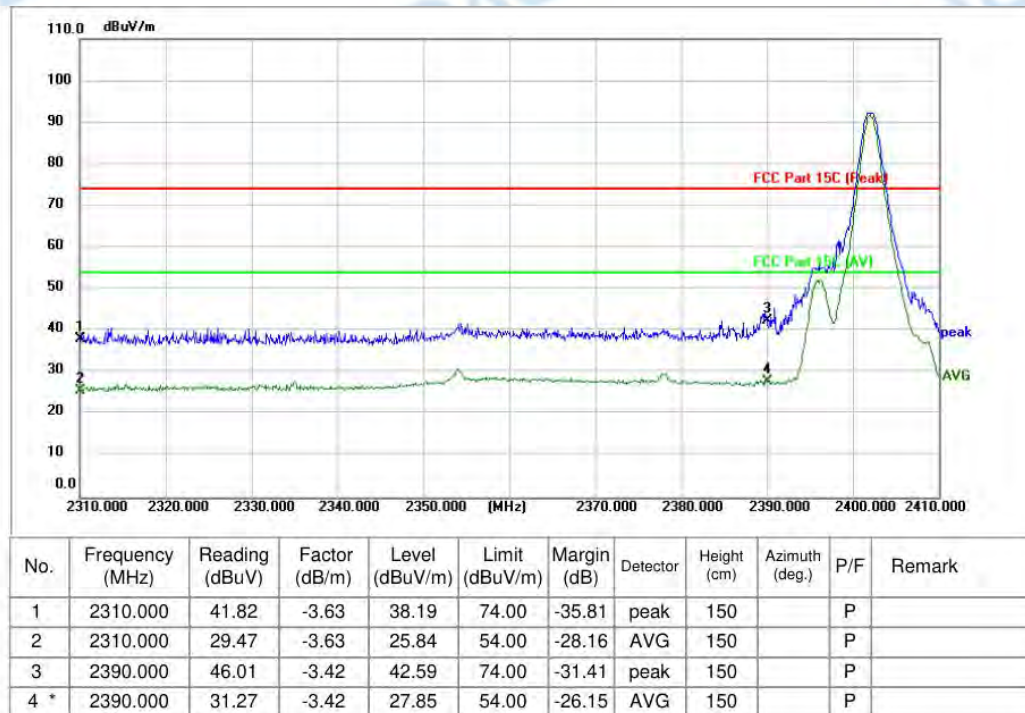
|                        |         |           |      |                       |         |
|------------------------|---------|-----------|------|-----------------------|---------|
| Operating Environment: |         |           |      |                       |         |
| Temperature:           | 22.4 °C | Humidity: | 52 % | Atmospheric Pressure: | 102 kPa |
| Pretest mode:          |         | TM1, TM2  |      |                       |         |
| Final test mode:       |         | TM1       |      |                       |         |

##### 4.8.2 Test Setup Diagram:

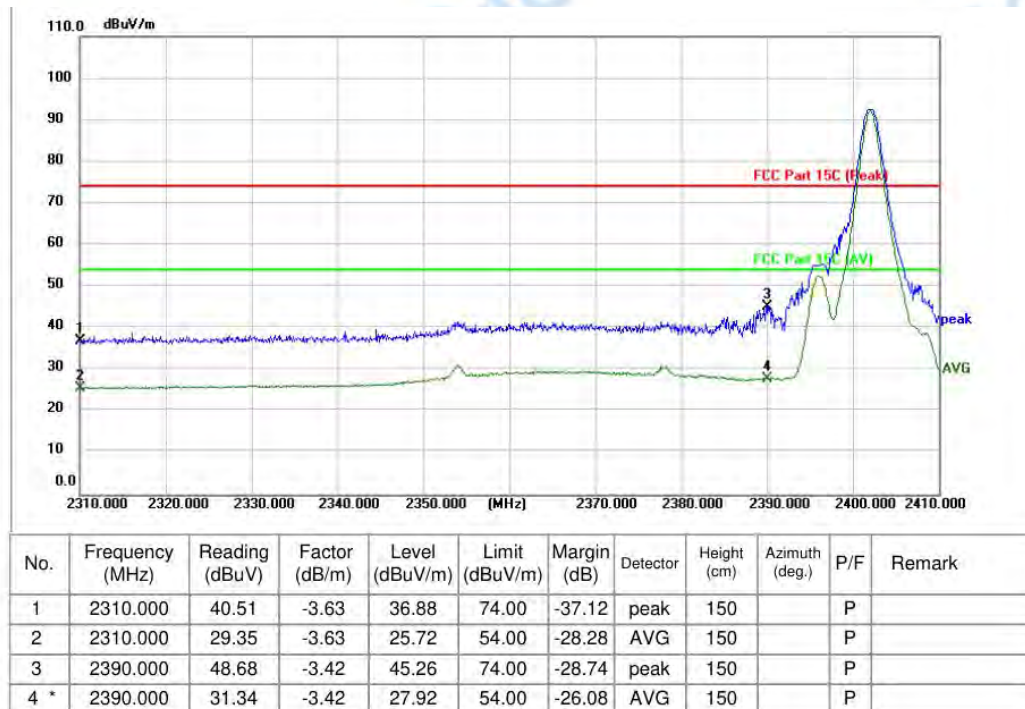


### 4.8.3 Test Data:

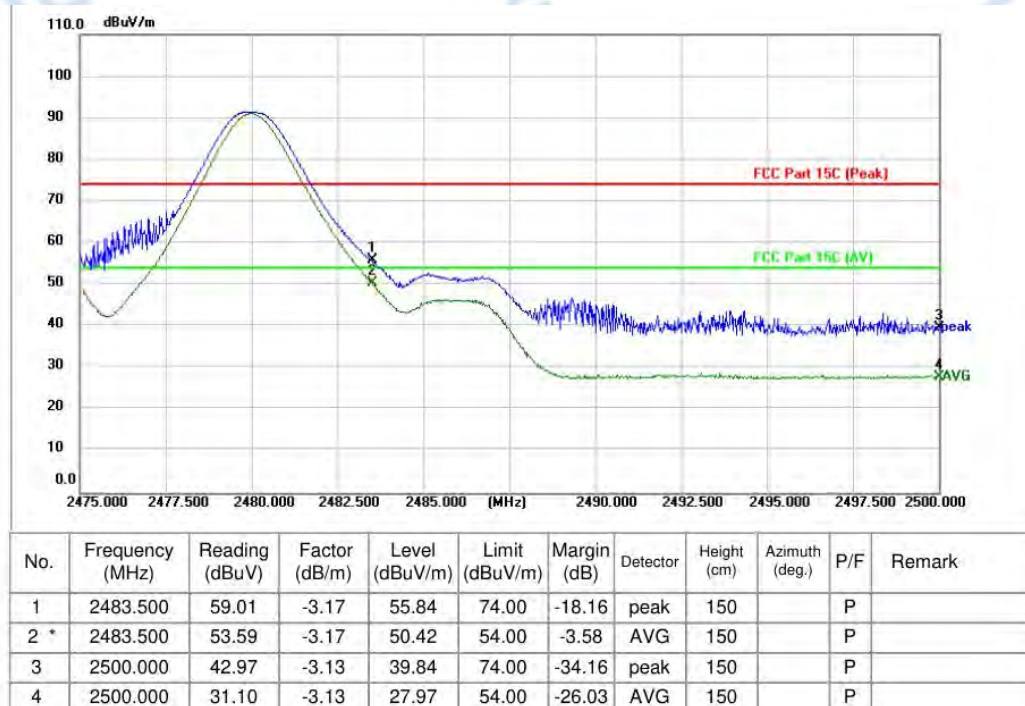
TM1 / Polarization: Vertical / Band: 2400-2483.5 MHz / BW: 1 / CH: L



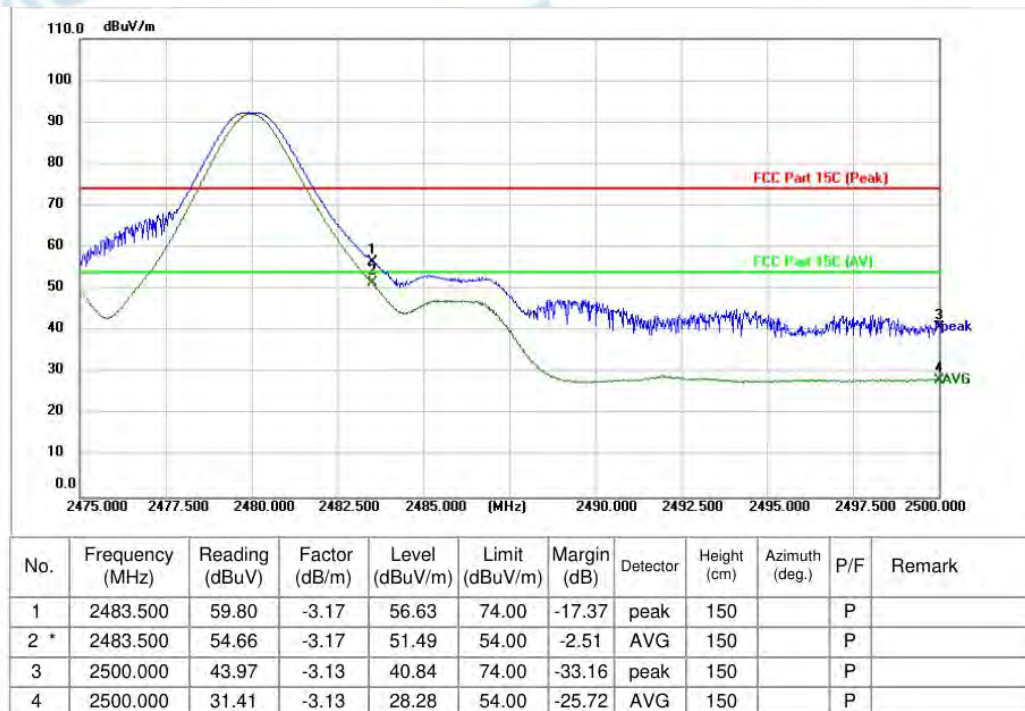
TM1 / Polarization: Horizontal / Band: 2400-2483.5 MHz / BW: 1 / CH: L



TM1 / Polarization: Vertical / Band: 2400-2483.5 MHz / BW: 1 / CH: H



TM1 / Polarization: Vertical / Band: 2400-2483.5 MHz / BW: 1 / CH: H



Remark: Margin = Level - Limit, Level = Test receiver reading + correction factor

The test software will only record the worst test angle and height, and only the worst case will be recorded in the test report.



#### 4.9 Emissions in frequency bands (below 1GHz)

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                   |                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------------------------|
| Test Requirement:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Refer to 47 CFR 15.247(d), In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                   |                               |
| Test Limit:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Frequency (MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Field strength (microvolts/meter) | Measurement distance (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                             |
| <p>** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.</p> <p>In the emission table above, the tighter limit applies at the band edges.</p> <p>The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                   |                               |
| Test Method:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ANSI C63.10-2020 section 6.6.4<br>KDB 558074 D01 15.247 Meas Guidance v05r02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                               |
| Procedure:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p>a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.</p> <p>b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.</p> <p>c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</p> <p>d. 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.</p> <p>e. 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.</p> <p>f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</p> <p>g. 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.</p> <p>h. Test the EUT in the lowest channel, the middle channel, the Highest channel.</p> <p>i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.</p> <p>j. Repeat above procedures until all frequencies measured was complete.</p> <p>Remark:</p> <p>1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.</p> |                                   |                               |



2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:  
 Final Test Level = Receiver Reading + Antenna Factor + Cable Factor + Preamplifier Factor

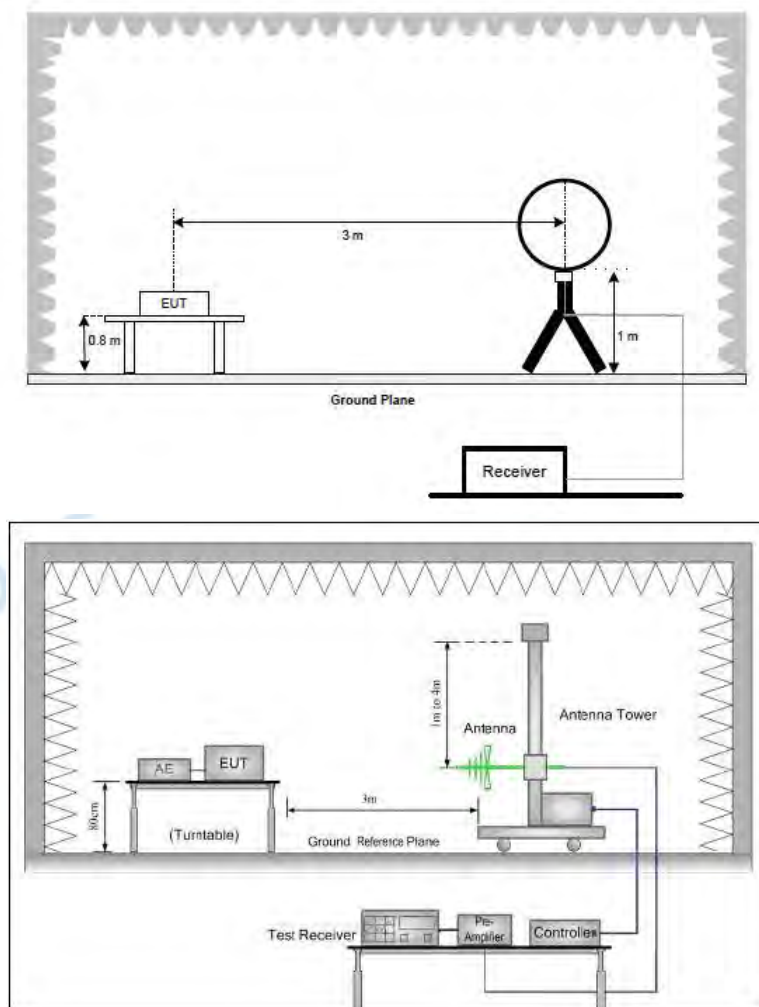
3) Scan from 9kHz to 25GHz, the disturbance above 12.75GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported. Fundamental frequency is blocked by filter, and only spurious emission is shown.

#### 4.9.1 E.U.T. Operation:

Operating Environment:

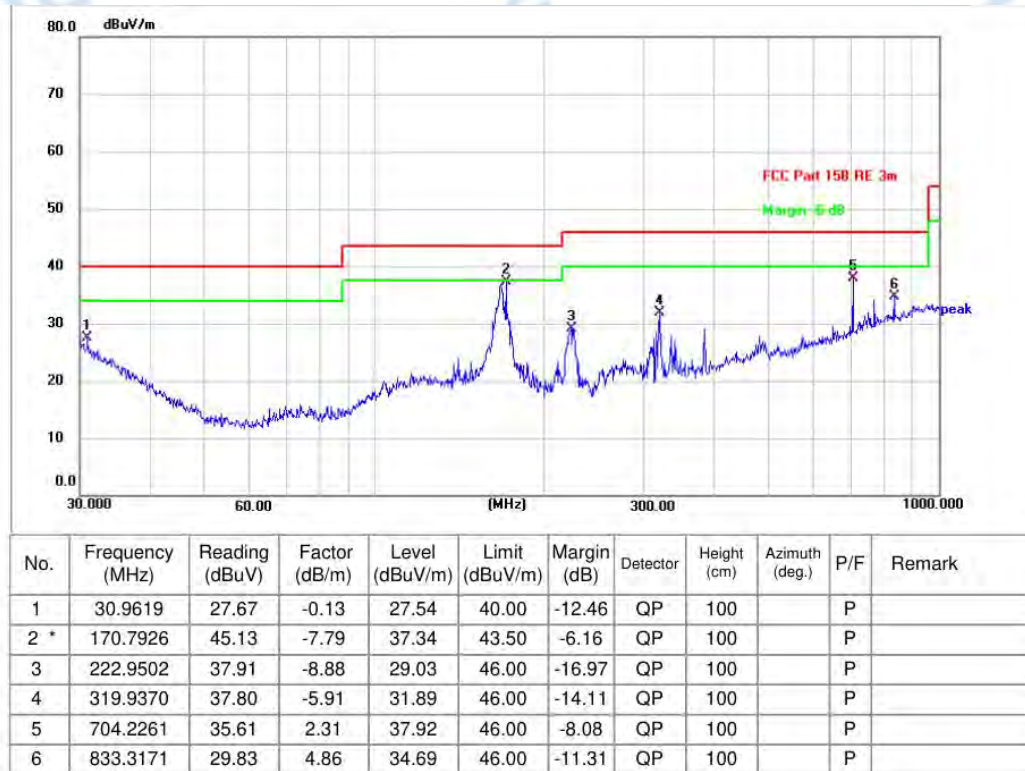
|                  |          |           |      |                       |         |
|------------------|----------|-----------|------|-----------------------|---------|
| Temperature:     | 22.4 °C  | Humidity: | 52 % | Atmospheric Pressure: | 102 kPa |
| Pretest mode:    | TM1, TM2 |           |      |                       |         |
| Final test mode: | TM1      |           |      |                       |         |

#### 4.9.2 Test Setup Diagram:

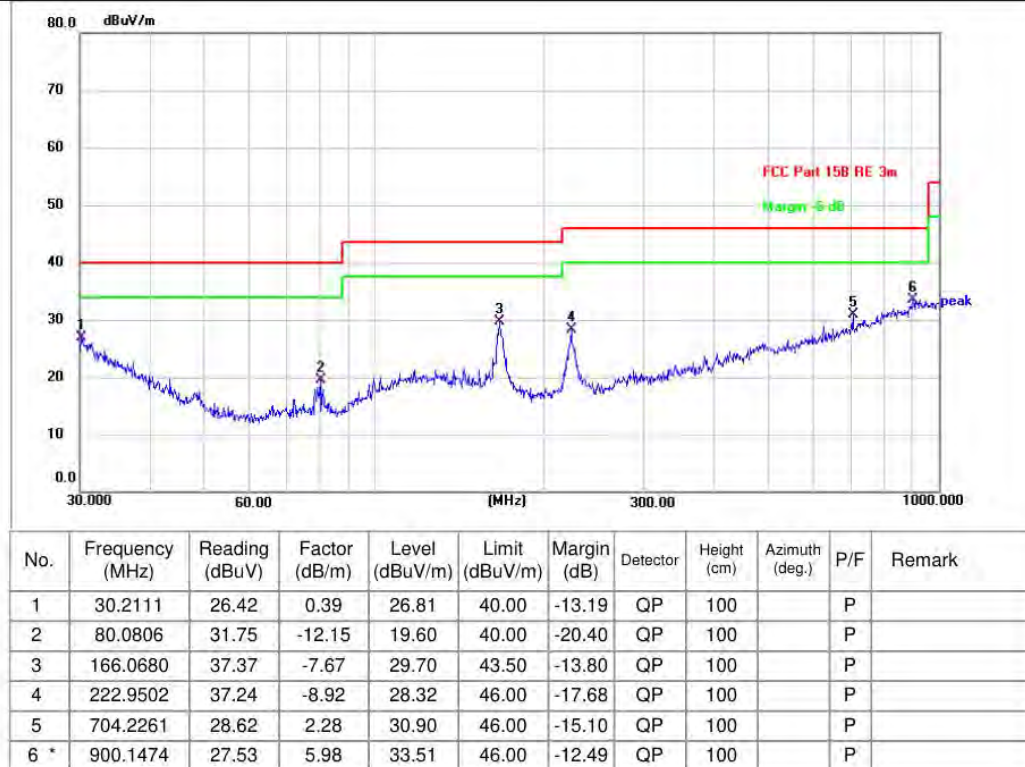


#### 4.9.3 Test Data:

TM1 / Polarization: Horizontal / Band: 2400-2483.5 MHz / BW: 1 / CH: L



TM1 / Polarization: Vertical / Band: 2400-2483.5 MHz / BW: 1 / CH: L



Remark: Margin=Level - Limit, Level=Test receiver reading + correction factor

The test software will only record the worst test angle and height, and only the worst case will be recorded in the test report.

#### 4.10 Emissions in frequency bands (above 1GHz)

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                   |                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------------------------|
| Test Requirement:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                               |
| Test Limit:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Frequency (MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Field strength (microvolts/meter) | Measurement distance (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                             |
| <p>** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.</p> <p>In the emission table above, the tighter limit applies at the band edges.</p> <p>The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                   |                               |
| Test Method:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ANSI C63.10-2020 section 6.6.4<br>KDB 558074 D01 15.247 Meas Guidance v05r02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                               |
| Procedure:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p>a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.</p> <p>b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.</p> <p>c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</p> <p>d. 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.</p> <p>e. 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.</p> <p>f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</p> <p>g. 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.</p> <p>h. Test the EUT in the lowest channel, the middle channel, the Highest channel.</p> <p>i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.</p> <p>j. Repeat above procedures until all frequencies measured was complete.</p> <p>Remark:</p> <p>1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.</p> |                                   |                               |



2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:  
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor + Preamplifier Factor

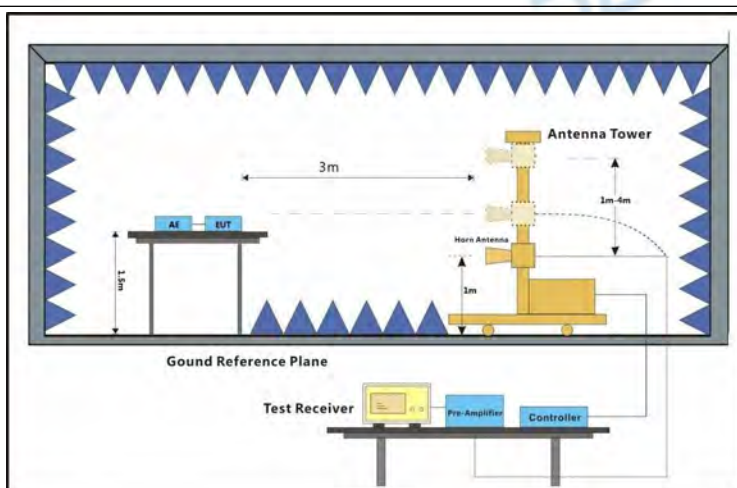
3) Scan from 9kHz to 25GHz, the disturbance above 12.75GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported. Fundamental frequency is blocked by filter, and only spurious emission is shown.

#### 4.10.1 E.U.T. Operation:

Operating Environment:

|                  |          |           |      |                       |         |
|------------------|----------|-----------|------|-----------------------|---------|
| Temperature:     | 22.4 °C  | Humidity: | 52 % | Atmospheric Pressure: | 102 kPa |
| Pretest mode:    | TM1, TM2 |           |      |                       |         |
| Final test mode: | TM1, TM2 |           |      |                       |         |

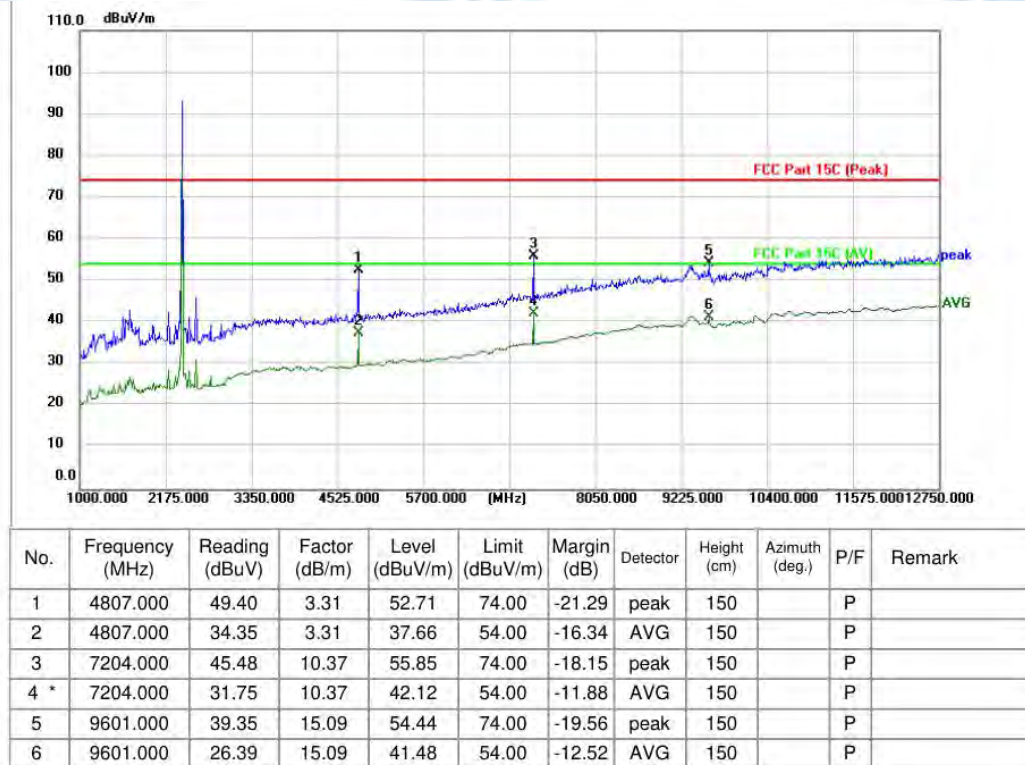
#### 4.10.2 Test Setup Diagram:



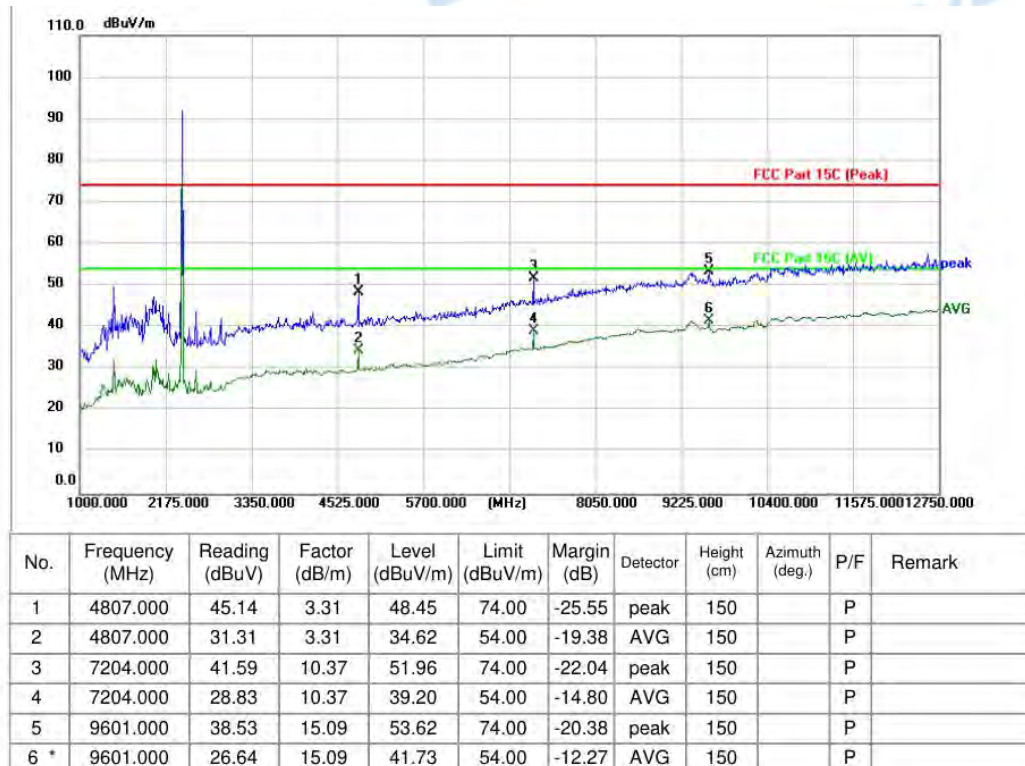


#### 4.10.3 Test Data:

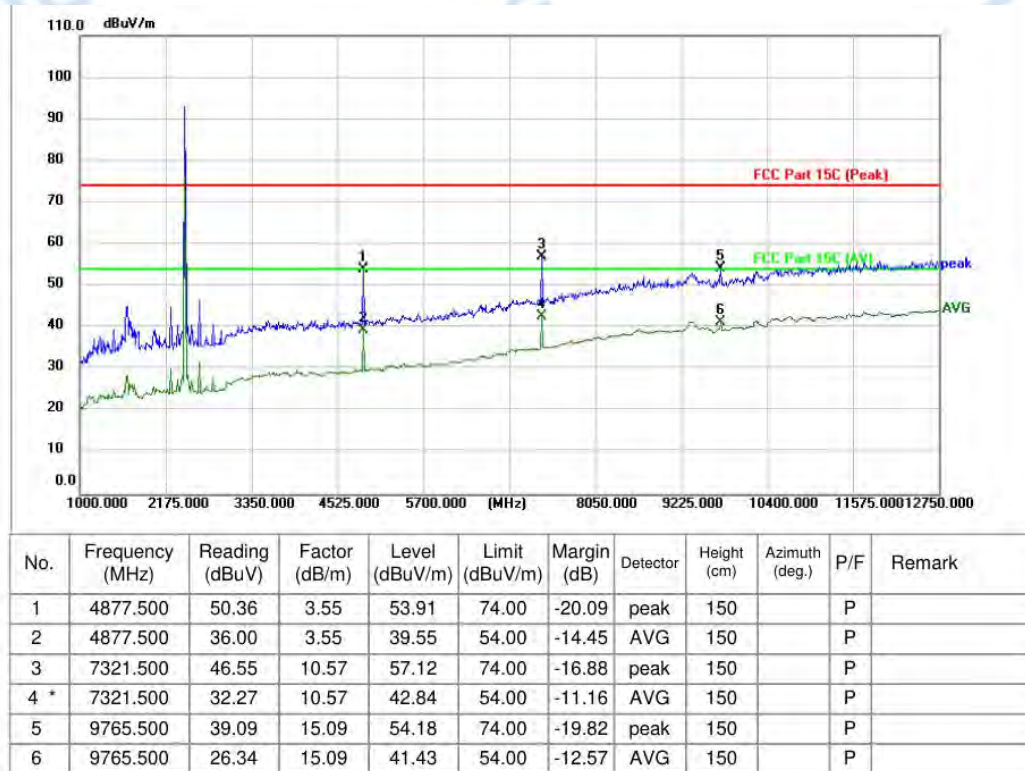
TM1 / Polarization: Horizontal / Band: 2400-2483.5 MHz / BW: 1 / CH: L



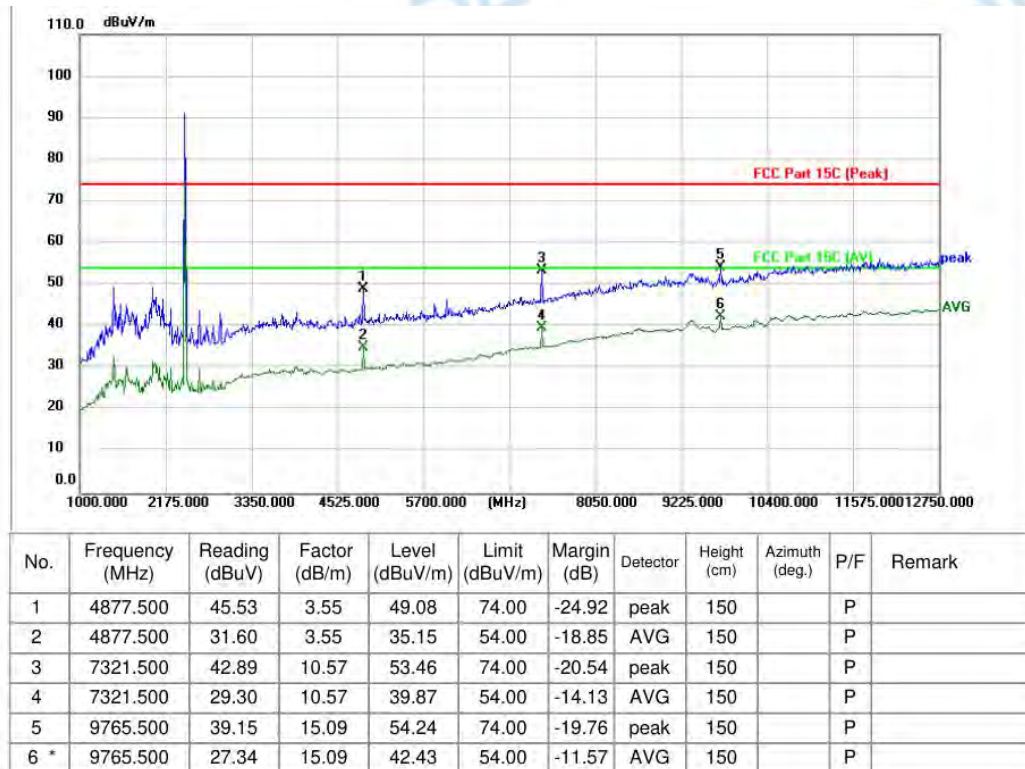
TM1 / Polarization: Vertical / Band: 2400-2483.5 MHz / BW: 1 / CH: L



TM1 / Polarization: Horizontal / Band: 2400-2483.5 MHz / BW: 1 / CH: M

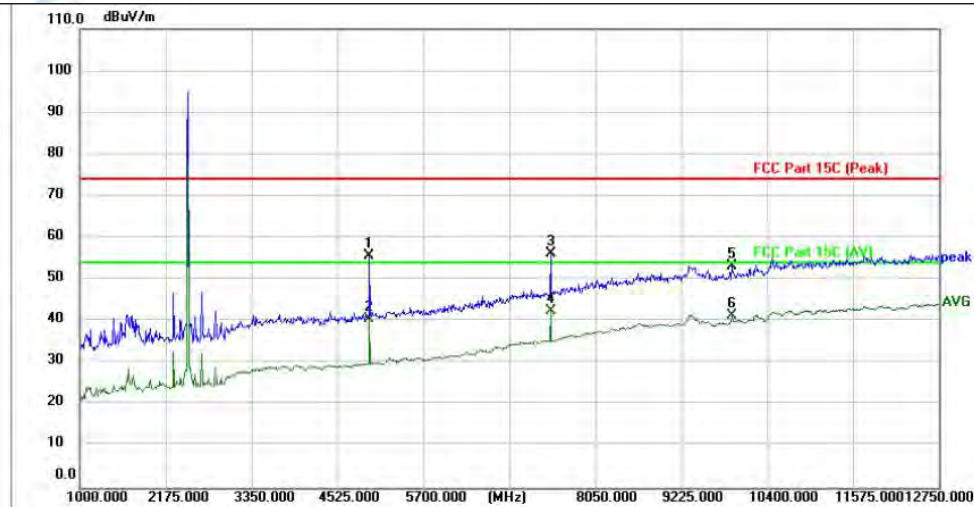


TM1 / Polarization: Vertical / Band: 2400-2483.5 MHz / BW: 1 / CH: M



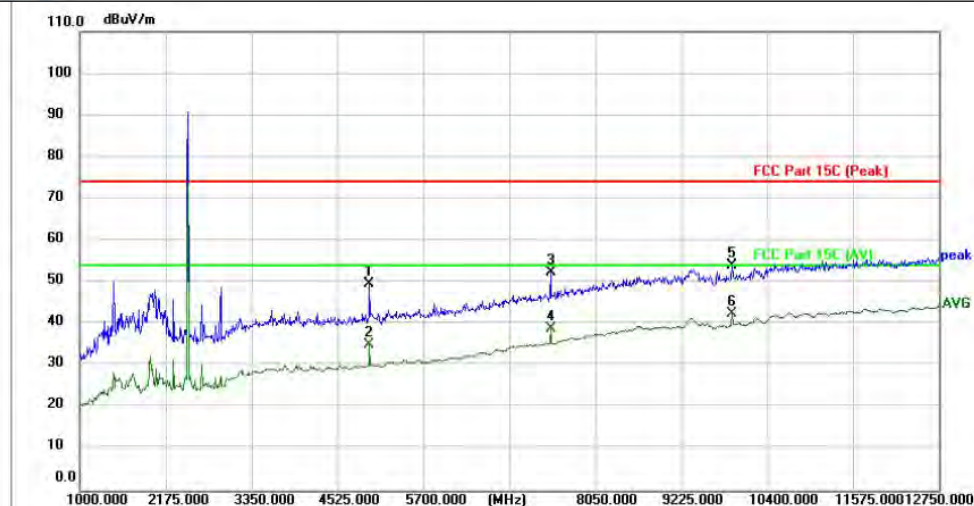


TM1 / Polarization: Horizontal / Band: 2400-2483.5 MHz / BW: 1 / CH: H



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg.) | P/F | Remark |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|----------|-------------|----------------|-----|--------|
| 1   | 4959.750        | 51.87          | 3.83          | 55.70          | 74.00          | -18.30      | peak     | 150         |                | P   |        |
| 2   | 4959.750        | 36.67          | 3.83          | 40.50          | 54.00          | -13.50      | AVG      | 150         |                | P   |        |
| 3   | 7439.000        | 45.53          | 10.78         | 56.31          | 74.00          | -17.69      | peak     | 150         |                | P   |        |
| 4 * | 7439.000        | 31.76          | 10.78         | 42.54          | 54.00          | -11.46      | AVG      | 150         |                | P   |        |
| 5   | 9918.250        | 38.04          | 15.08         | 53.12          | 74.00          | -20.88      | peak     | 150         |                | P   |        |
| 6   | 9918.250        | 26.30          | 15.08         | 41.38          | 54.00          | -12.62      | AVG      | 150         |                | P   |        |

TM1 / Polarization: Vertical / Band: 2400-2483.5 MHz / BW: 1 / CH: H



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg.) | P/F | Remark |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|----------|-------------|----------------|-----|--------|
| 1   | 4959.750        | 45.77          | 3.83          | 49.60          | 74.00          | -24.40      | peak     | 150         |                | P   |        |
| 2   | 4959.750        | 31.28          | 3.83          | 35.11          | 54.00          | -18.89      | AVG      | 150         |                | P   |        |
| 3   | 7439.000        | 41.52          | 10.78         | 52.30          | 74.00          | -21.70      | peak     | 150         |                | P   |        |
| 4   | 7439.000        | 28.24          | 10.78         | 39.02          | 54.00          | -14.98      | AVG      | 150         |                | P   |        |
| 5   | 9918.250        | 39.08          | 15.08         | 54.16          | 74.00          | -19.84      | peak     | 150         |                | P   |        |
| 6 * | 9918.250        | 27.34          | 15.08         | 42.42          | 54.00          | -11.58      | AVG      | 150         |                | P   |        |

Remark: Margin = Level - Limit, Level = Test receiver reading + correction factor

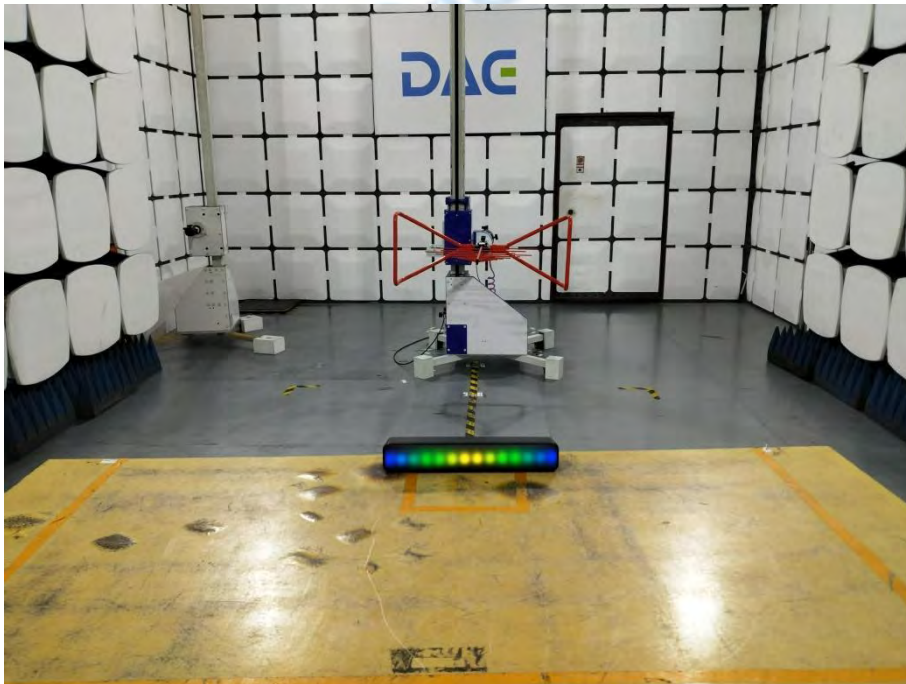
The test software will only record the worst test angle and height, and only the worst case will be recorded in the test report.

## 5 TEST SETUP PHOTOS

Conducted Emission at AC power line

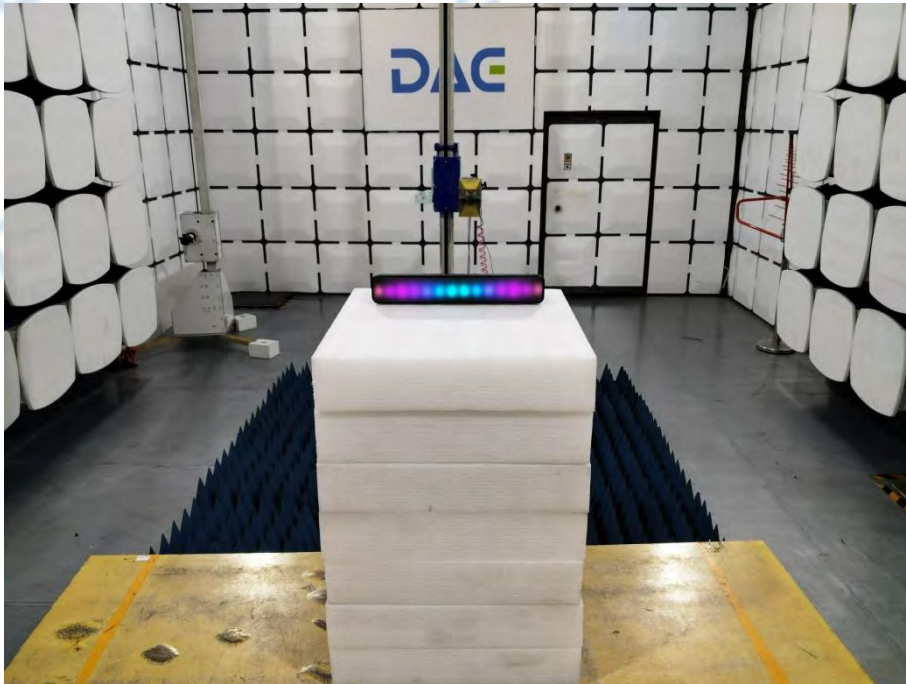


Emissions in frequency bands (below 1GHz)



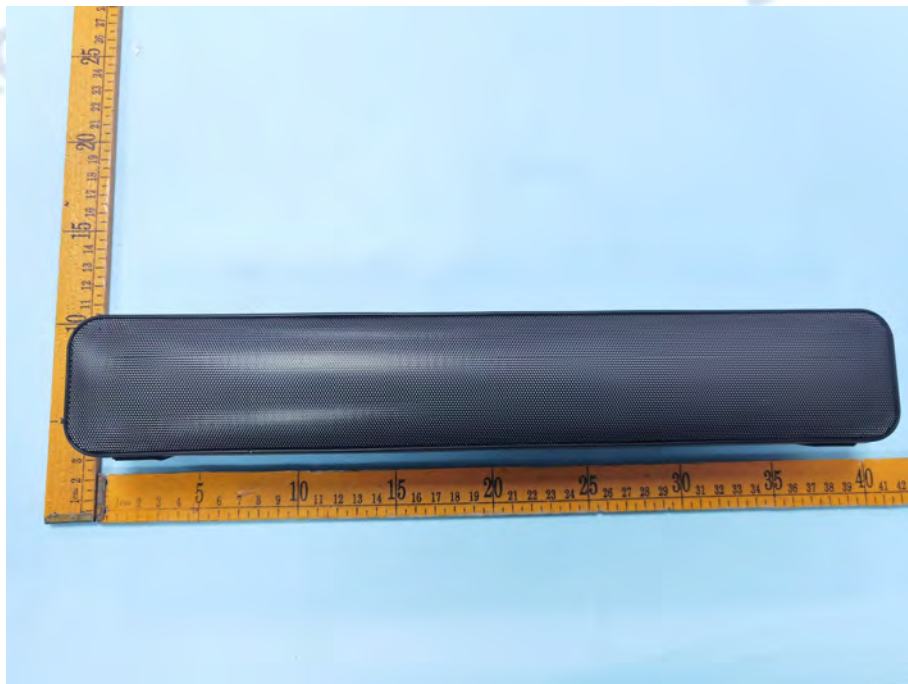


**Emissions in frequency bands (above 1GHz)**



## 6 PHOTOS OF THE EUT

**External**







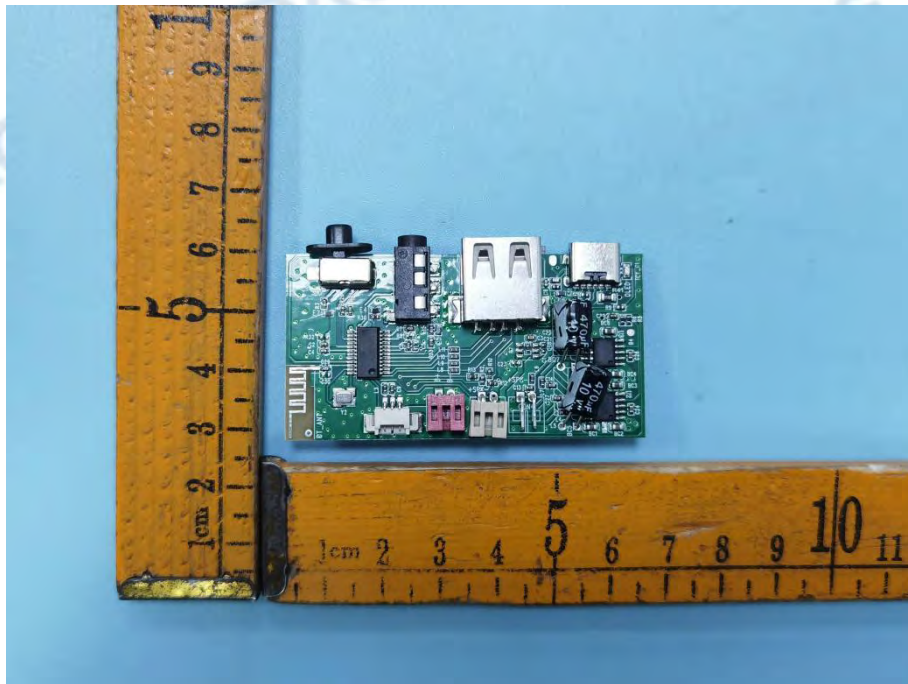


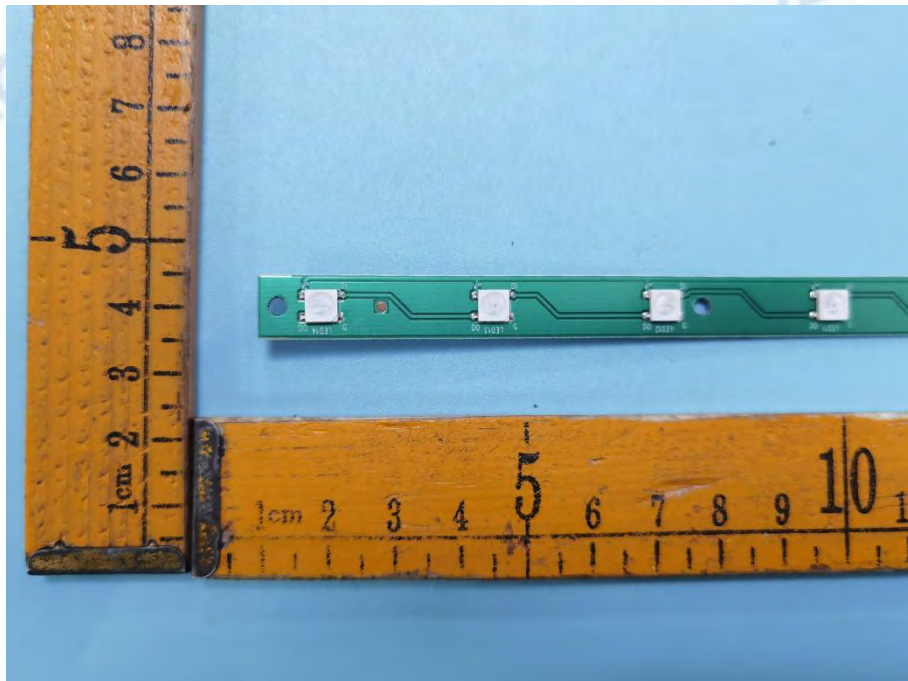
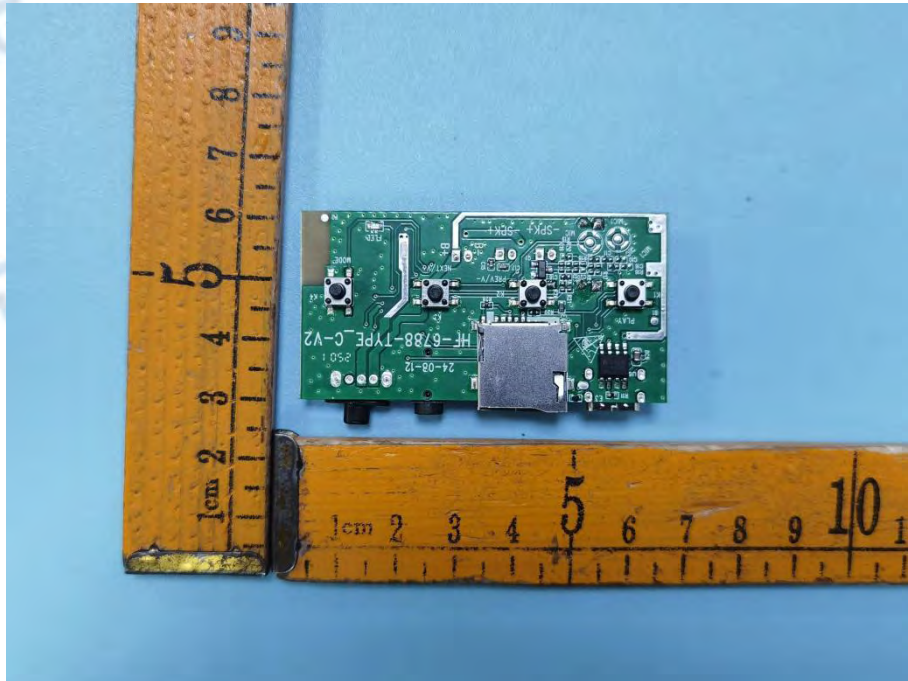


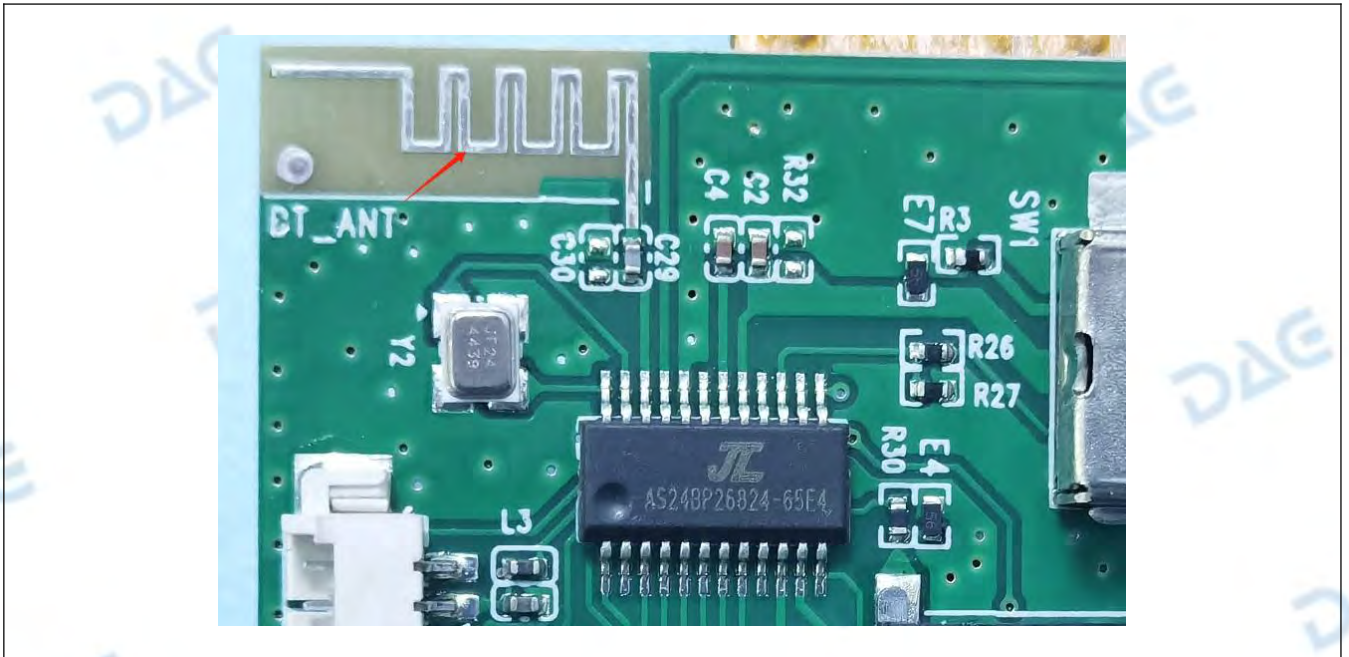
**Internal**













# Appendix

## 1. -20dB Bandwidth

| Condition | Antenna | Modulation | Frequency (MHz) | -20dB BW(MHz) | if larger than CFS |
|-----------|---------|------------|-----------------|---------------|--------------------|
| NVNT      | ANT1    | 1-DH5      | 2402.00         | 1.062         | Yes                |
| NVNT      | ANT1    | 1-DH5      | 2441.00         | 1.060         | Yes                |
| NVNT      | ANT1    | 1-DH5      | 2480.00         | 1.047         | Yes                |
| NVNT      | ANT1    | 2-DH5      | 2402.00         | 1.335         | Yes                |
| NVNT      | ANT1    | 2-DH5      | 2441.00         | 1.340         | Yes                |
| NVNT      | ANT1    | 2-DH5      | 2480.00         | 1.343         | Yes                |

-20dB\_Bandwidth\_NVNT\_ANT1\_1-DH5\_2402\_00



### -20dB\_Bandwidth\_NVNT\_ANT1\_1-DH5\_2441\_00



### -20dB\_Bandwidth\_NVNT\_ANT1\_1-DH5\_2480\_00



### -20dB\_Bandwidth\_NVNT\_ANT1\_2-DH5\_2402\_00



### -20dB\_Bandwidth\_NVNT\_ANT1\_2-DH5\_2441\_00





-20dB\_Bandwidth\_NVNT\_ANT1\_2-DH5\_2480\_00



## 2. 99% Occupied Bandwidth

| Condition | Antenna | Modulation | Frequency (MHz) | 99% BW (MHz) |
|-----------|---------|------------|-----------------|--------------|
| NVNT      | ANT1    | 1-DH5      | 2402.00         | 0.942        |
| NVNT      | ANT1    | 1-DH5      | 2441.00         | 0.955        |
| NVNT      | ANT1    | 1-DH5      | 2480.00         | 0.960        |
| NVNT      | ANT1    | 2-DH5      | 2402.00         | 1.214        |
| NVNT      | ANT1    | 2-DH5      | 2441.00         | 1.226        |
| NVNT      | ANT1    | 2-DH5      | 2480.00         | 1.231        |

99%\_Occupied\_Bandwidth\_NVNT\_ANT1\_1-DH5\_2402\_00



### 99%\_Occupied\_Bandwidth\_NVNT\_ANT1\_1-DH5\_2441\_00



### 99%\_Occupied\_Bandwidth\_NVNT\_ANT1\_1-DH5\_2480\_00

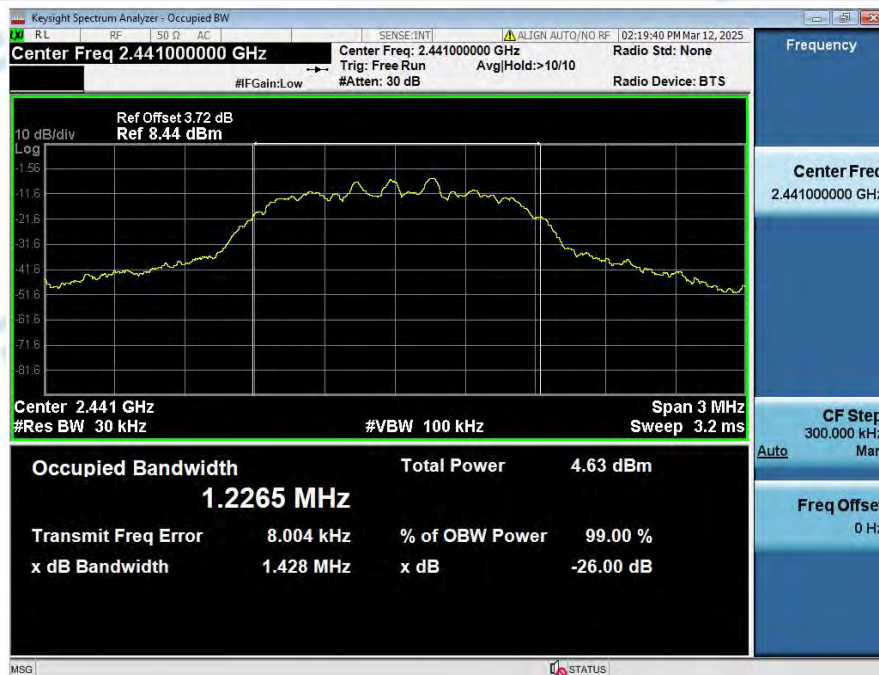




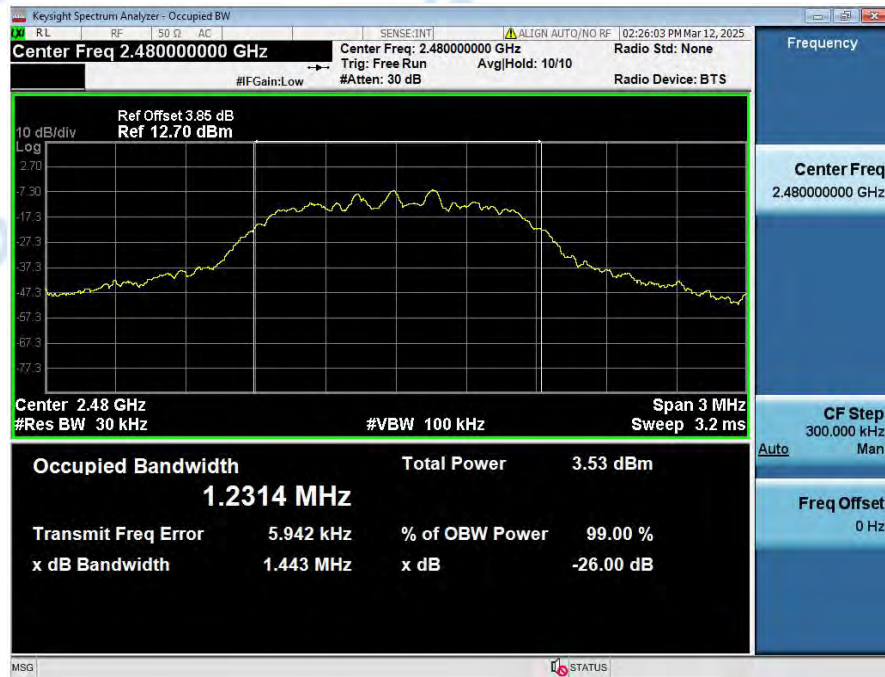
### 99%\_Occupied\_Bandwidth\_NVNT\_ANT1\_2-DH5\_2402\_00



### 99%\_Occupied\_Bandwidth\_NVNT\_ANT1\_2-DH5\_2441\_00



### 99%\_Occupied\_Bandwidth\_NVNT\_ANT1\_2-DH5\_2480\_00



### 3. Peak Output Power

| Condition | Antenna | Modulation | Frequency (MHz) | Max. Conducted Power(dBm) | Max. Conducted Power(mW) | Limit(mW) | Result |
|-----------|---------|------------|-----------------|---------------------------|--------------------------|-----------|--------|
| NVNT      | ANT1    | 1-DH5      | 2402.00         | -1.42                     | 0.72                     | 125       | Pass   |
| NVNT      | ANT1    | 1-DH5      | 2441.00         | -1.46                     | 0.71                     | 125       | Pass   |
| NVNT      | ANT1    | 1-DH5      | 2480.00         | -2.91                     | 0.51                     | 125       | Pass   |
| NVNT      | ANT1    | 2-DH5      | 2402.00         | -2.14                     | 0.61                     | 125       | Pass   |
| NVNT      | ANT1    | 2-DH5      | 2441.00         | -2.28                     | 0.59                     | 125       | Pass   |
| NVNT      | ANT1    | 2-DH5      | 2480.00         | -3.61                     | 0.44                     | 125       | Pass   |

Peak\_Output\_Power\_NVNT\_ANT1\_1-DH5\_2402\_00





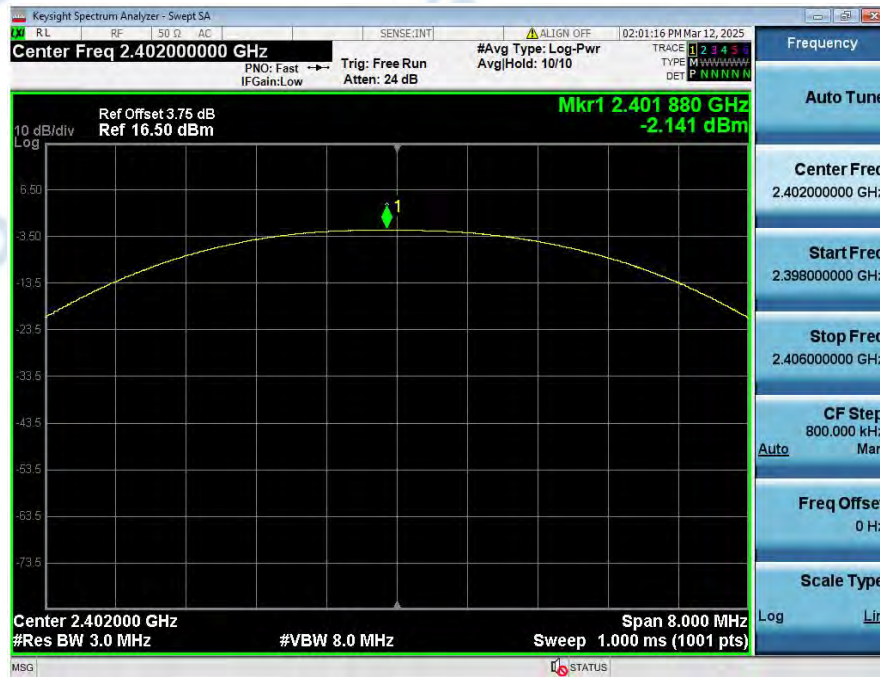
### Peak\_Output\_Power\_NVNT\_ANT1\_1-DH5\_2441\_00



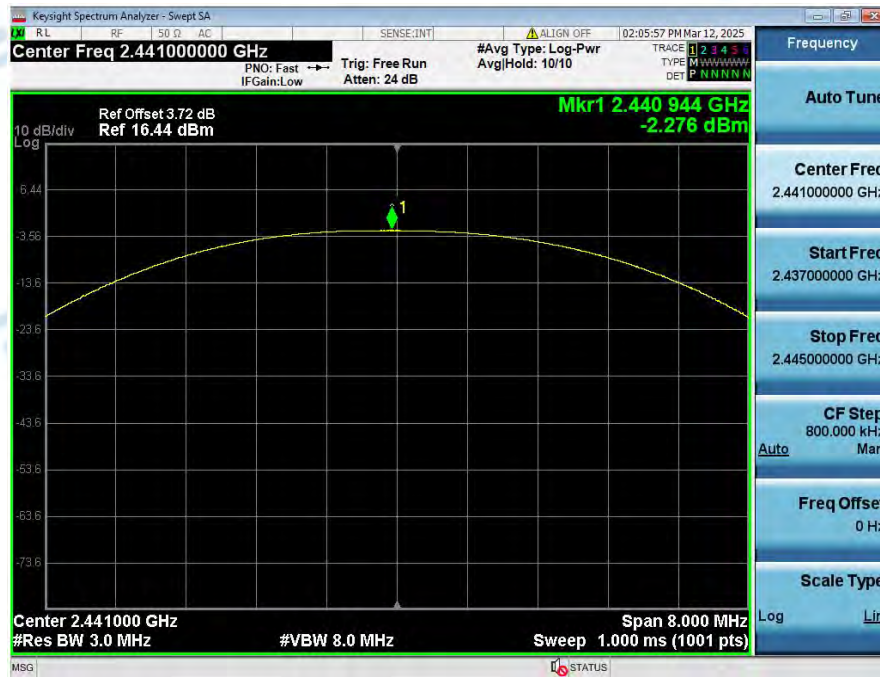
### Peak\_Output\_Power\_NVNT\_ANT1\_1-DH5\_2480\_00



### Peak\_Output\_Power\_NVNT\_ANT1\_2-DH5\_2402\_00



### Peak\_Output\_Power\_NVNT\_ANT1\_2-DH5\_2441\_00



Peak\_Output\_Power\_NVNT\_ANT1\_2-DH5\_2480\_00

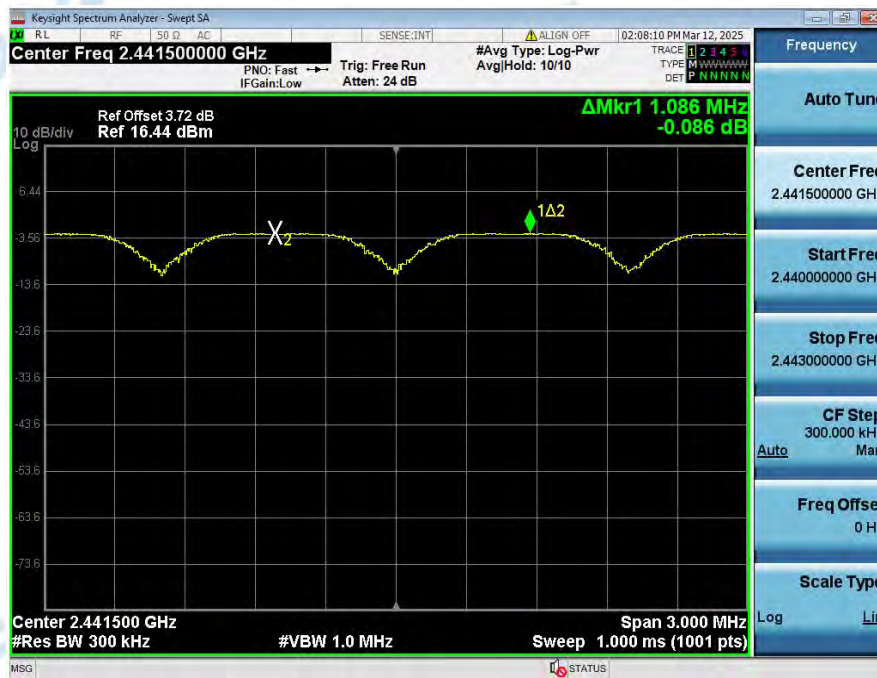




#### 4. Carrier Frequencies Separation (Hopping)

| Condition | Antenna | Modulation | Frequency(MHz) | Hopping NO.0 (MHz) | Hopping NO.1 (MHz) | Carrier Frequencies Separation(MHz) | Limit(MHz) | Result |
|-----------|---------|------------|----------------|--------------------|--------------------|-------------------------------------|------------|--------|
| NVNT      | ANT1    | 1-DH5      | 2441.00        | 2440.984           | 2442.070           | 1.09                                | 0.707      | Pass   |
| NVNT      | ANT1    | 2-DH5      | 2441.00        | 2441.083           | 2442.106           | 1.02                                | 0.893      | Pass   |

Carrier\_Frequencies\_Separation\_(Hopping)\_NVNT\_ANT1\_1-DH5\_Hopping



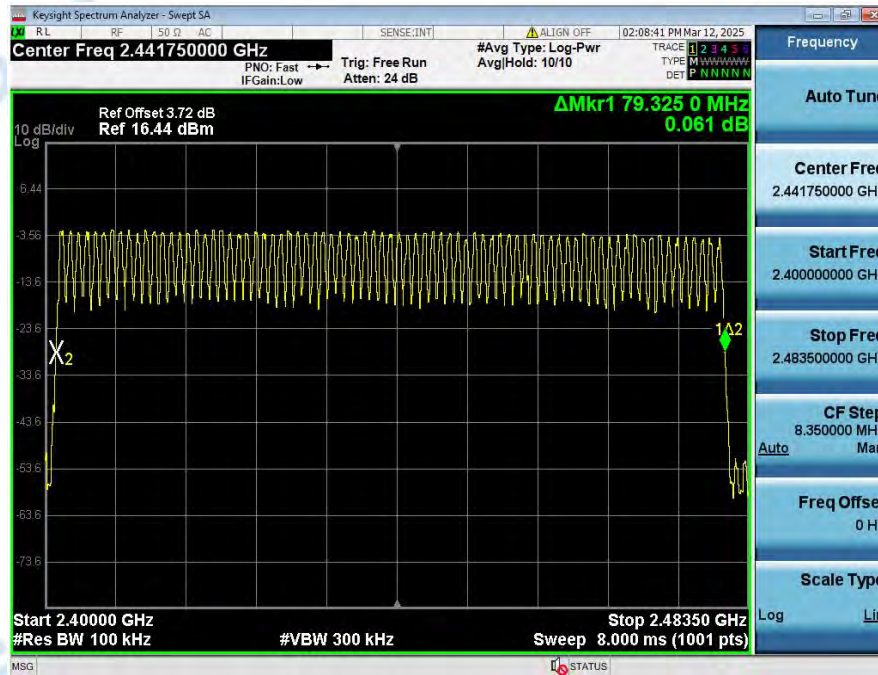
Carrier\_Frequencies\_Separation\_(Hopping)\_NVNT\_ANT1\_2-DH5\_Hopping



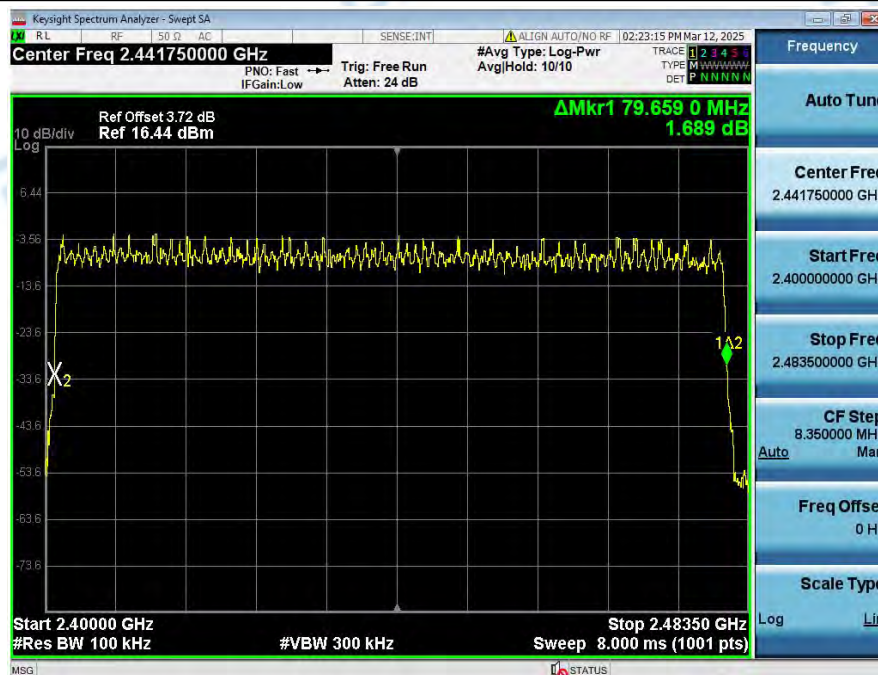
## 5. Number of Hopping Channel (Hopping)

| Condition | Antenna | Modulation | Hopping Num | Limit | Result |
|-----------|---------|------------|-------------|-------|--------|
| NVNT      | ANT1    | 1-DH5      | 79          | 15    | Pass   |
| NVNT      | ANT1    | 2-DH5      | 79          | 15    | Pass   |

Number\_of\_Hopping\_Channel\_(Hopping)\_NVNT\_ANT1\_1-DH5\_Hopping



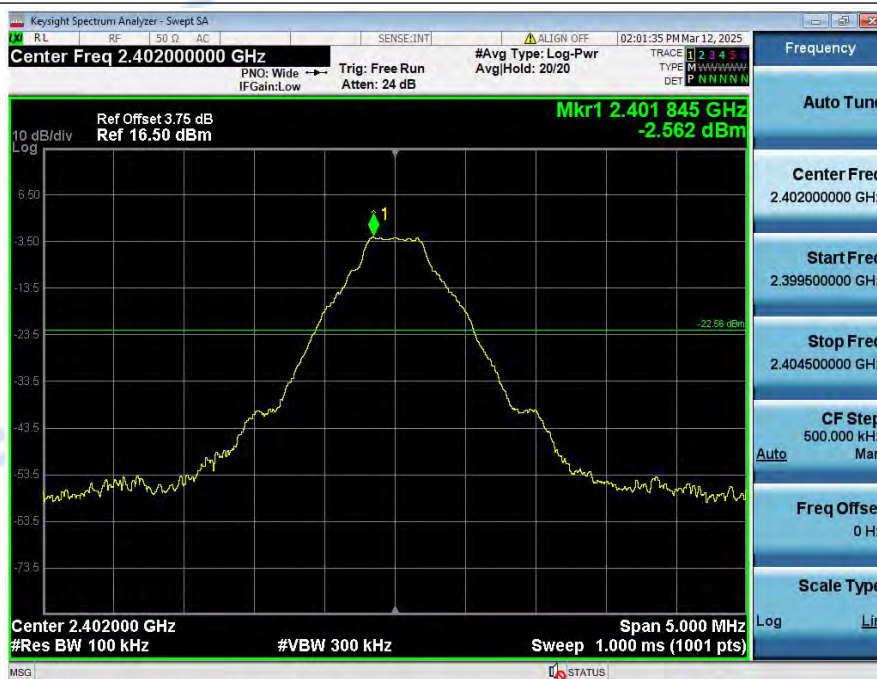
Number\_of\_Hopping\_Channel\_(Hopping)\_NVNT\_ANT1\_2-DH5\_Hopping



## 6. Bandedge

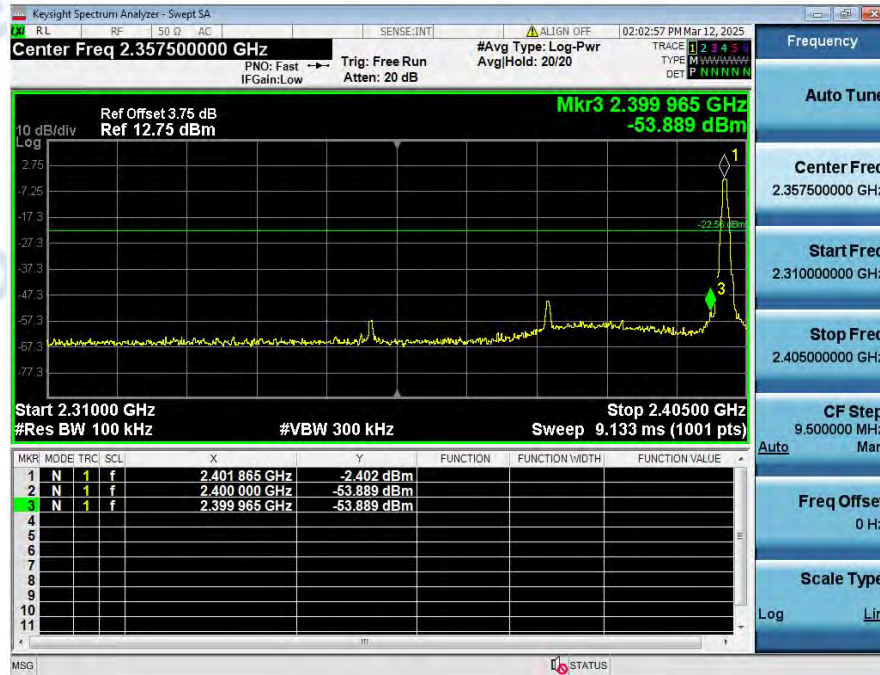
| Condition | Antenna | Modulation | TX Mode     | Ref_level(dBm) | Bandedge MAX.Value | Limit   | Result |
|-----------|---------|------------|-------------|----------------|--------------------|---------|--------|
| NVNT      | ANT1    | 1-DH5      | 2402.00     | -2.562         | -53.889            | -22.562 | Pass   |
| NVNT      | ANT1    | 1-DH5      | Hopping_LCH | -2.281         | -50.050            | -22.281 | Pass   |
| NVNT      | ANT1    | 1-DH5      | 2480.00     | -3.990         | -60.313            | -23.990 | Pass   |
| NVNT      | ANT1    | 1-DH5      | Hopping_HCH | -2.185         | -51.070            | -22.185 | Pass   |
| NVNT      | ANT1    | 2-DH5      | 2402.00     | -2.441         | -52.852            | -22.441 | Pass   |
| NVNT      | ANT1    | 2-DH5      | Hopping_LCH | -2.470         | -50.938            | -22.470 | Pass   |
| NVNT      | ANT1    | 2-DH5      | 2480.00     | -3.781         | -59.138            | -23.781 | Pass   |
| NVNT      | ANT1    | 2-DH5      | Hopping_HCH | -2.148         | -51.693            | -22.148 | Pass   |

1\_Reference\_Level\_NVNT\_ANT1\_1-DH5\_2402\_00





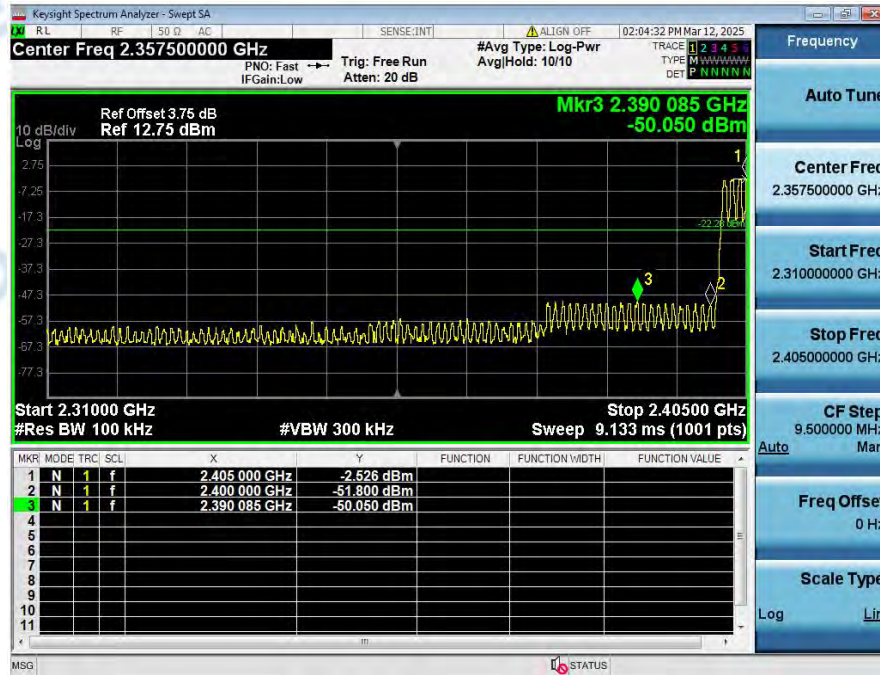
## 2\_Bandedge\_NVNT\_ANT1\_1-DH5\_2402\_00



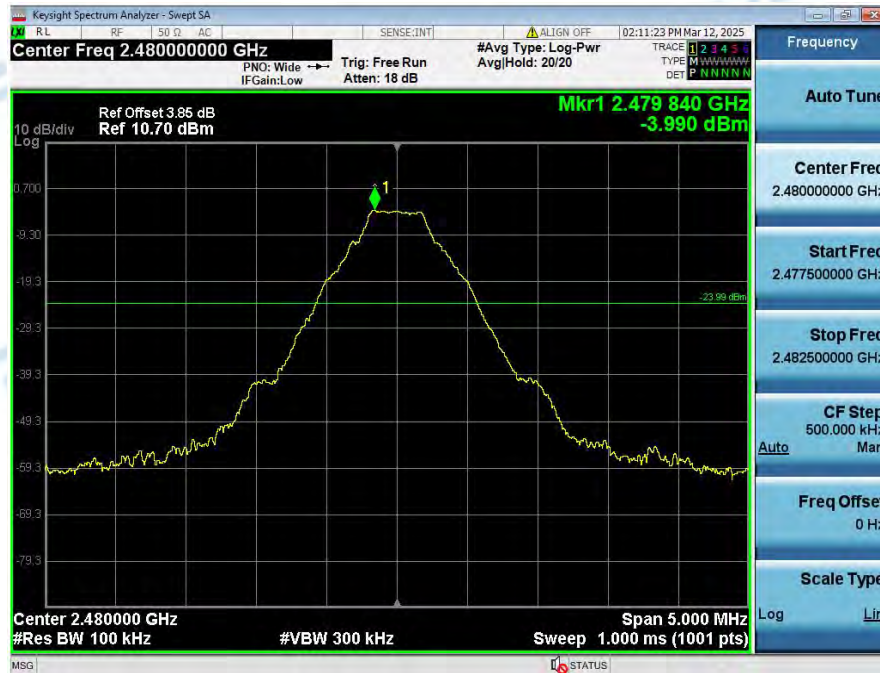
## 1\_Reference\_Level\_Hopping\_NVNT\_ANT1\_1-DH5\_Hopping



## 2\_Band\_Edge\_(Hopping)\_NVNT\_ANT1\_1-DH5\_Hopping

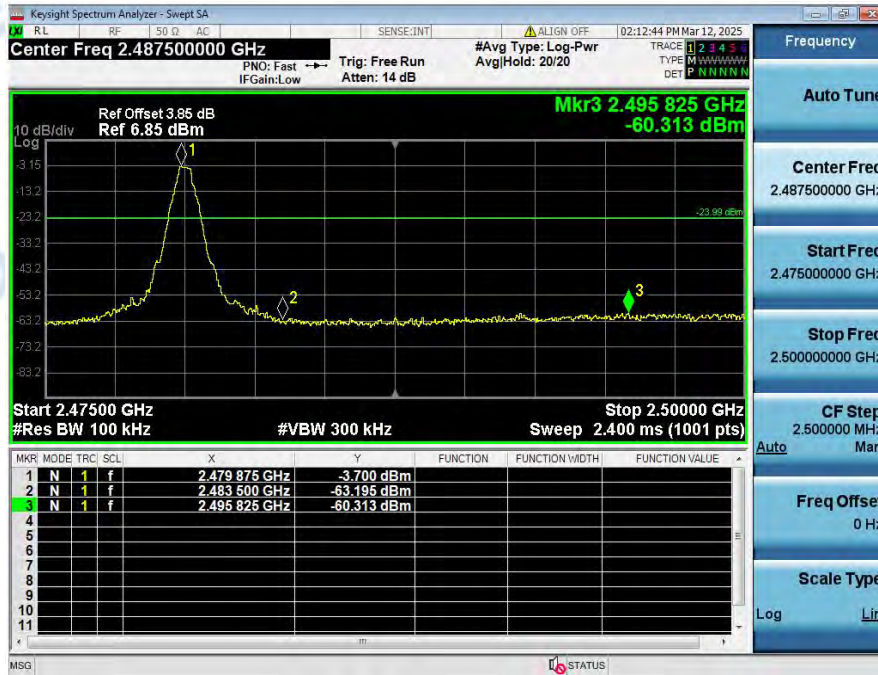


## 1\_Reference\_Level\_NVNT\_ANT1\_1-DH5\_2480\_00

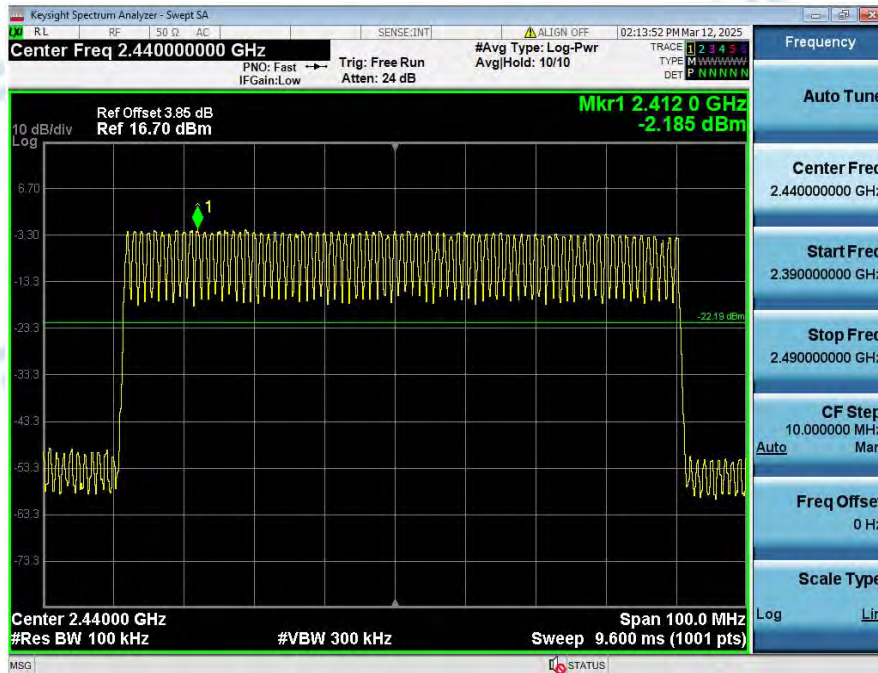




## 2\_Bandedge\_NVNT\_ANT1\_1-DH5\_2480\_00

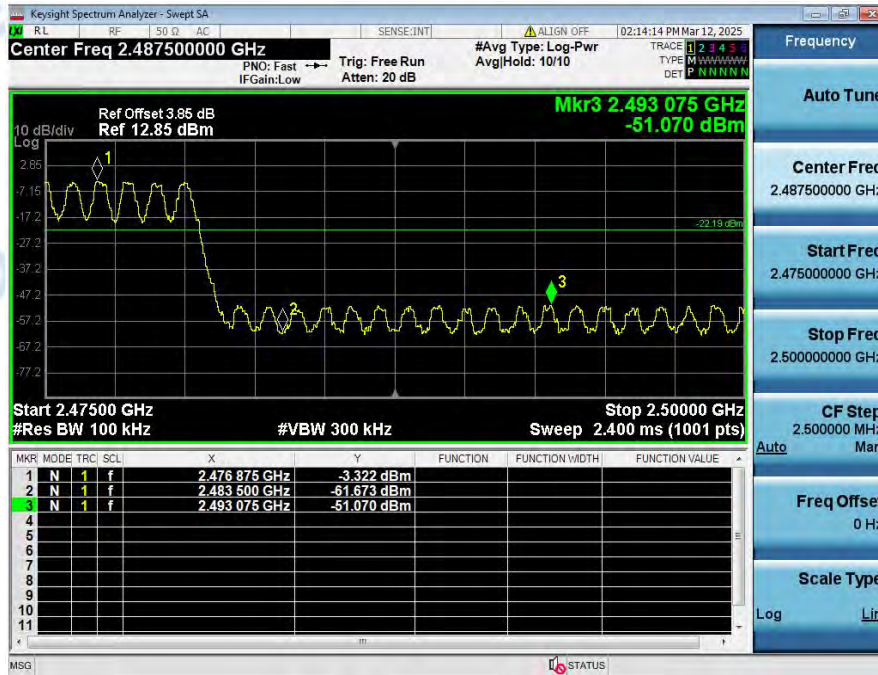


## 1\_Reference\_Level\_Hopping\_NVNT\_ANT1\_1-DH5\_Hopping





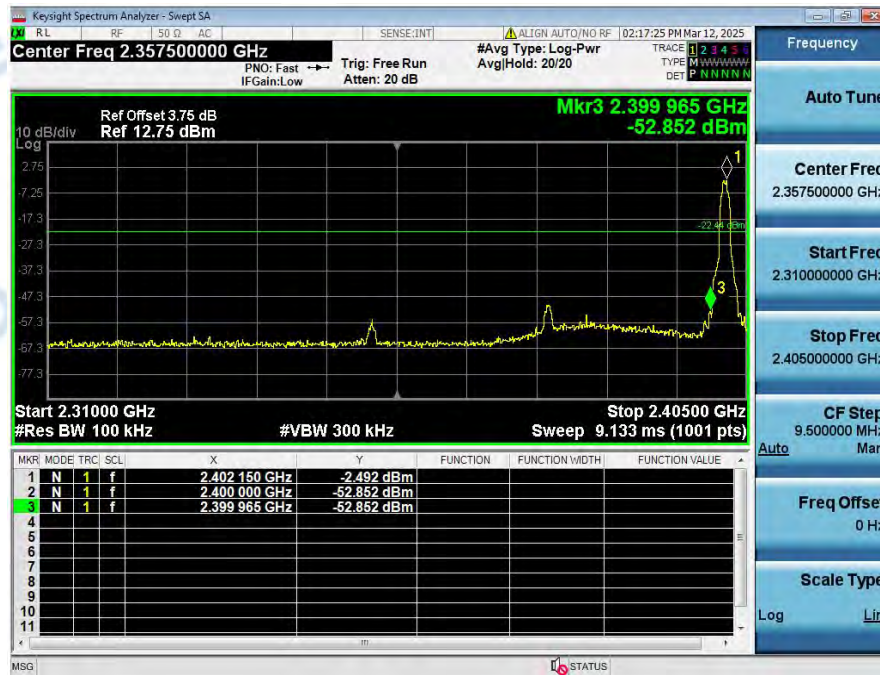
## 2\_Band\_Edge\_(Hopping)\_NVNT\_ANT1\_1-DH5\_Hopping



## 1\_Reference\_Level\_NVNT\_ANT1\_2-DH5\_2402\_00



## 2\_Bandedge\_NVNT\_ANT1\_2-DH5\_2402\_00

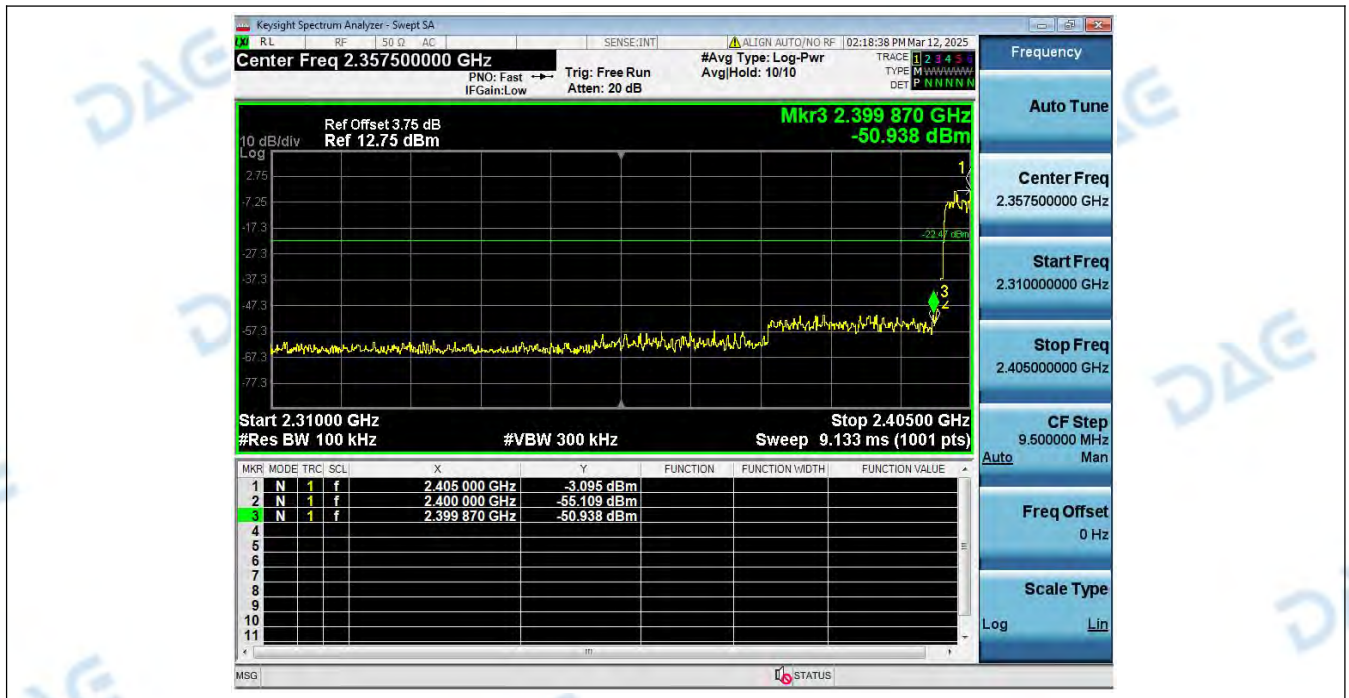


### 1\_Reference\_Level\_Hopping\_NVNT\_ANT1\_2-DH5\_Hopping



### 2\_Band\_Edge\_(Hopping)\_NVNT\_ANT1\_2-DH5\_Hopping



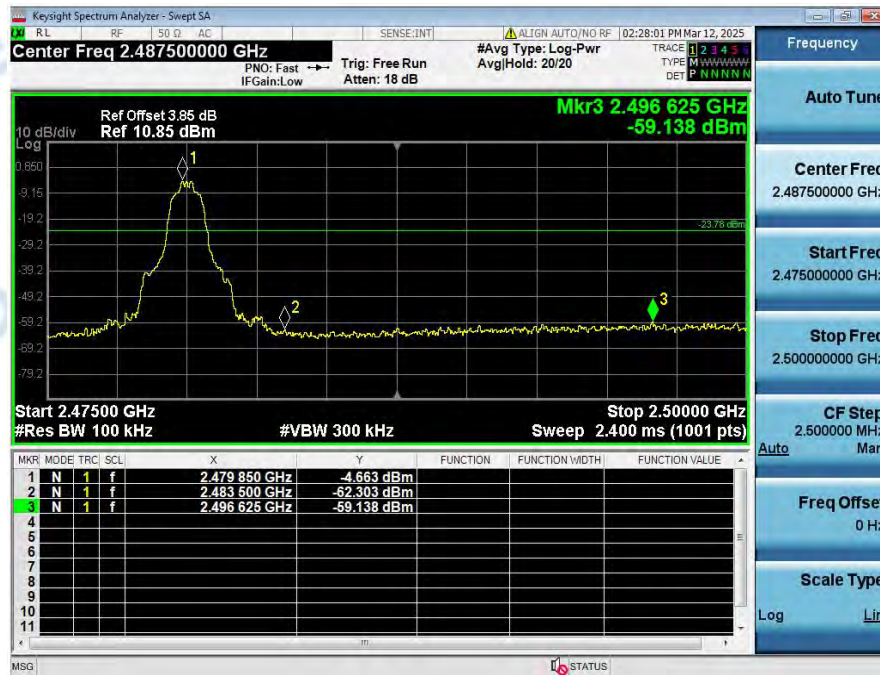


### 1\_Reference\_Level\_NVNT\_ANT1\_2-DH5\_2480\_00

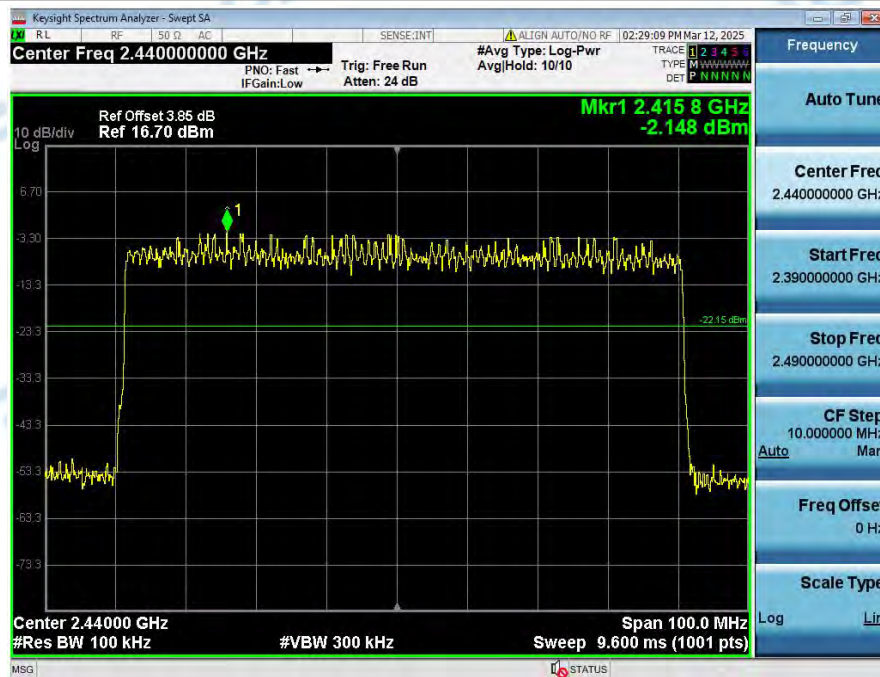


### 2\_Bandedge\_NVNT\_ANT1\_2-DH5\_2480\_00

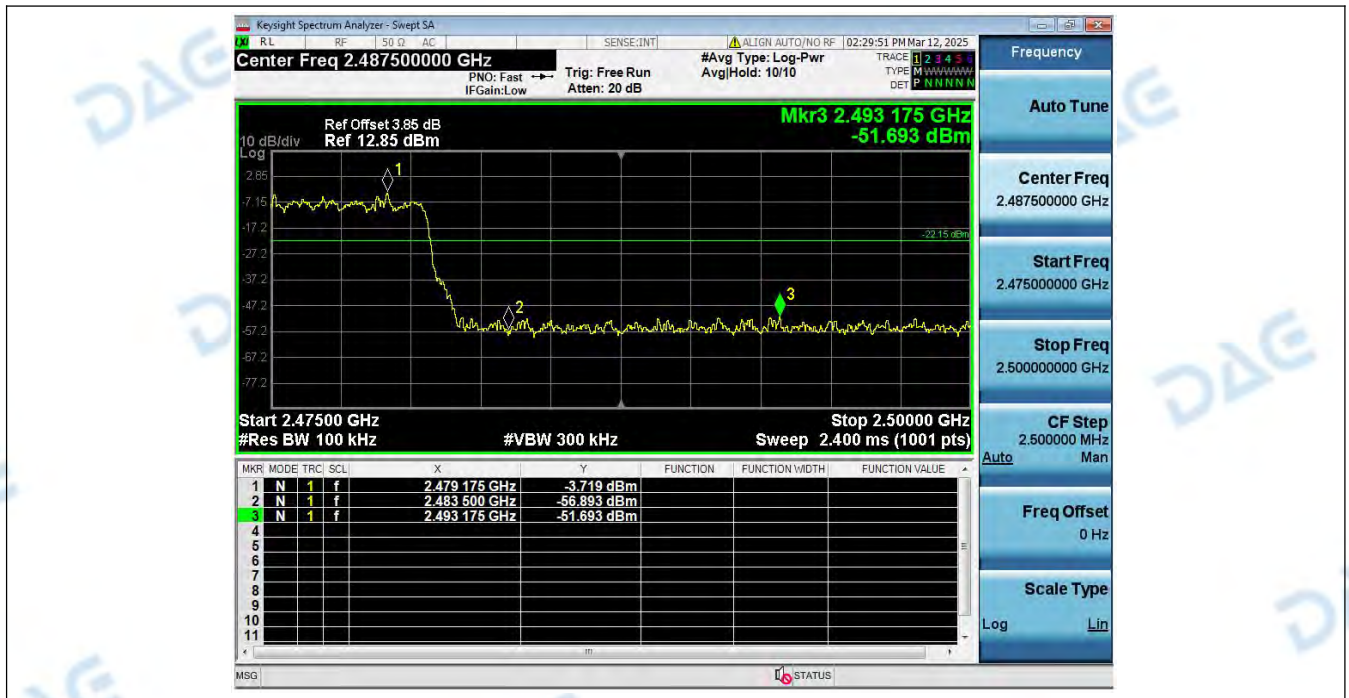




### 1\_Reference\_Level\_Hopping\_NVNT\_ANT1\_2-DH5\_Hopping



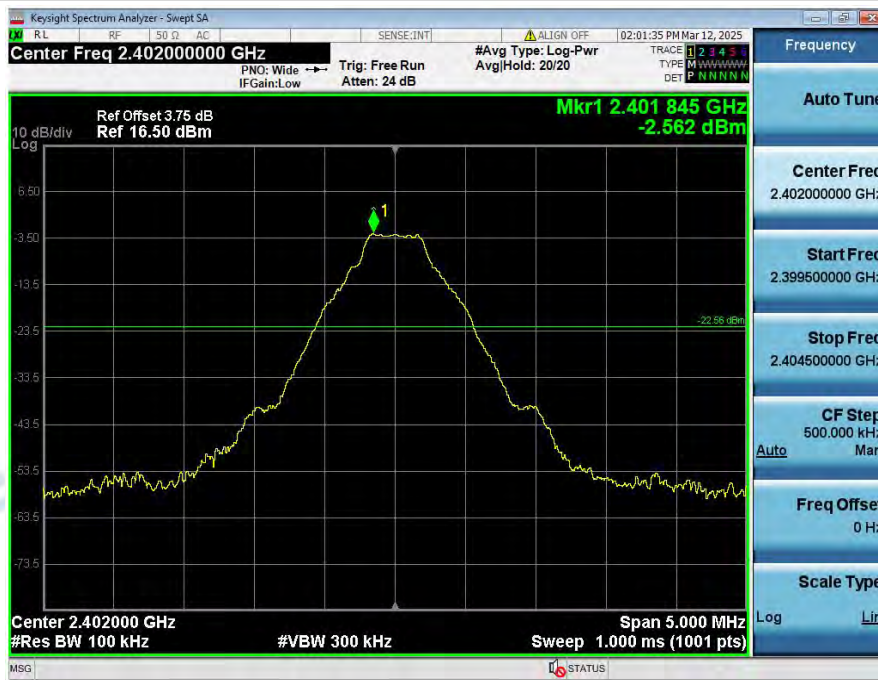
### 2\_Band\_Edge\_(Hopping)\_NVNT\_ANT1\_2-DH5\_Hopping



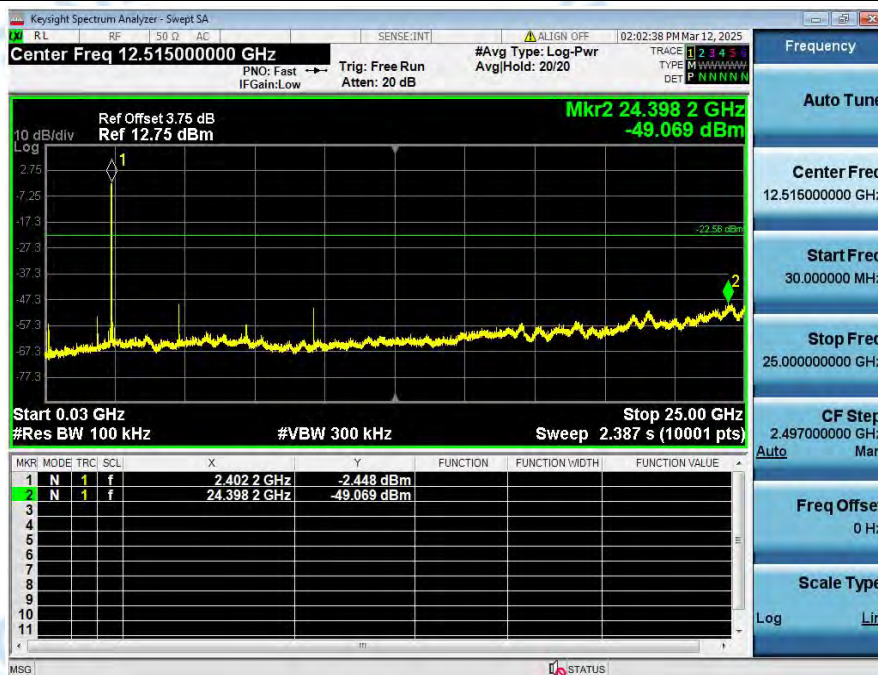
## 7. Spurious Emissions

| Condition | Antenna | Modulation | TX Mode | Ref_level(dBm) | Spurious MAX.Value(dBm) | Limit   | Result |
|-----------|---------|------------|---------|----------------|-------------------------|---------|--------|
| NVNT      | ANT1    | 1-DH5      | 2402.00 | -2.562         | -49.069                 | -22.562 | Pass   |
| NVNT      | ANT1    | 1-DH5      | 2441.00 | -2.715         | -47.610                 | -22.715 | Pass   |
| NVNT      | ANT1    | 1-DH5      | 2480.00 | -3.990         | -48.758                 | -23.990 | Pass   |
| NVNT      | ANT1    | 2-DH5      | 2402.00 | -2.441         | -48.735                 | -22.441 | Pass   |
| NVNT      | ANT1    | 2-DH5      | 2441.00 | -2.660         | -48.911                 | -22.660 | Pass   |
| NVNT      | ANT1    | 2-DH5      | 2480.00 | -3.781         | -49.772                 | -23.781 | Pass   |

1\_Reference\_Level\_NVNT\_ANT1\_1-DH5\_2402\_00

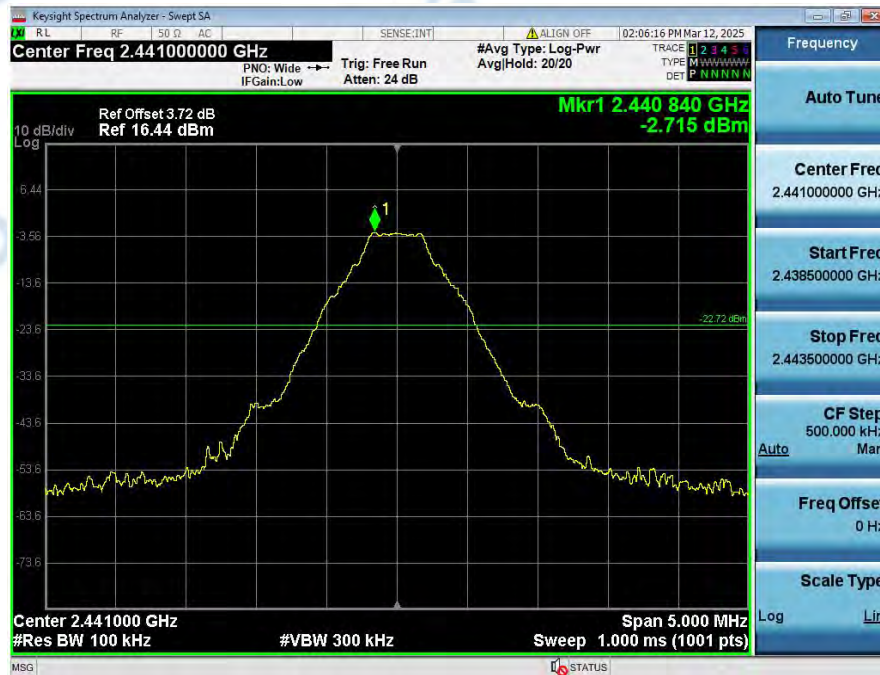


2\_Spurious\_Emissions\_NVNT\_ANT1\_1-DH5\_2402\_00





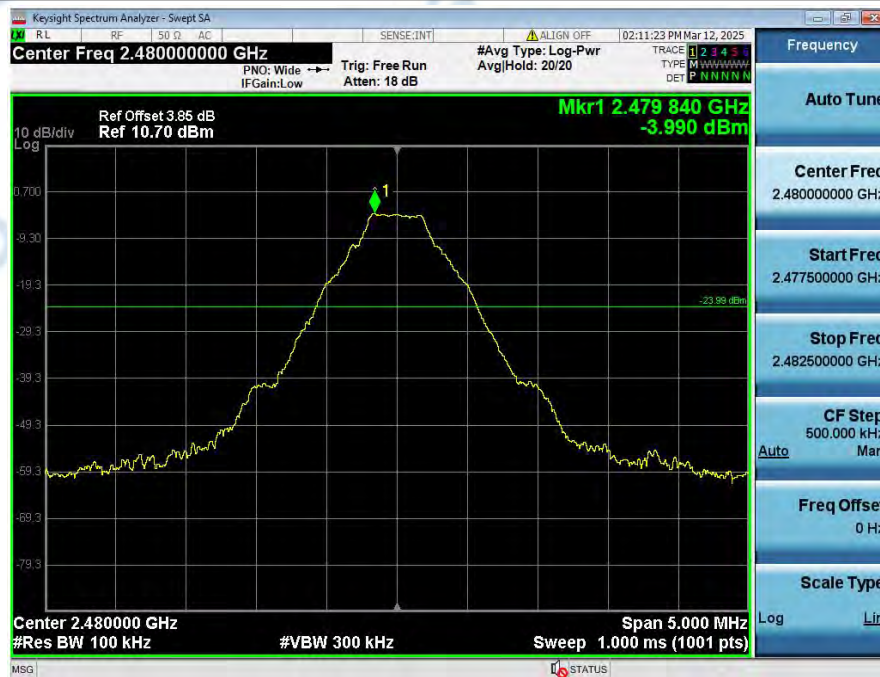
### 1\_Reference\_Level\_NVNT\_ANT1\_1-DH5\_2441\_00



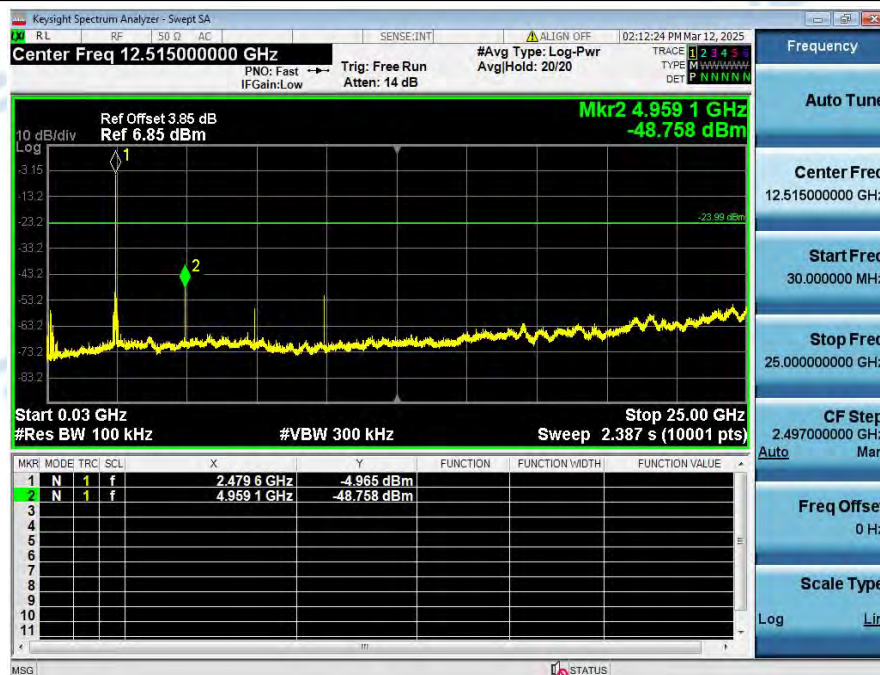
### 2\_Spurious\_Emissions\_NVNT\_ANT1\_1-DH5\_2441\_00



### 1\_Reference\_Level\_NVNT\_ANT1\_1-DH5\_2480\_00



### 2\_Spurious\_Emissions\_NVNT\_ANT1\_1-DH5\_2480\_00

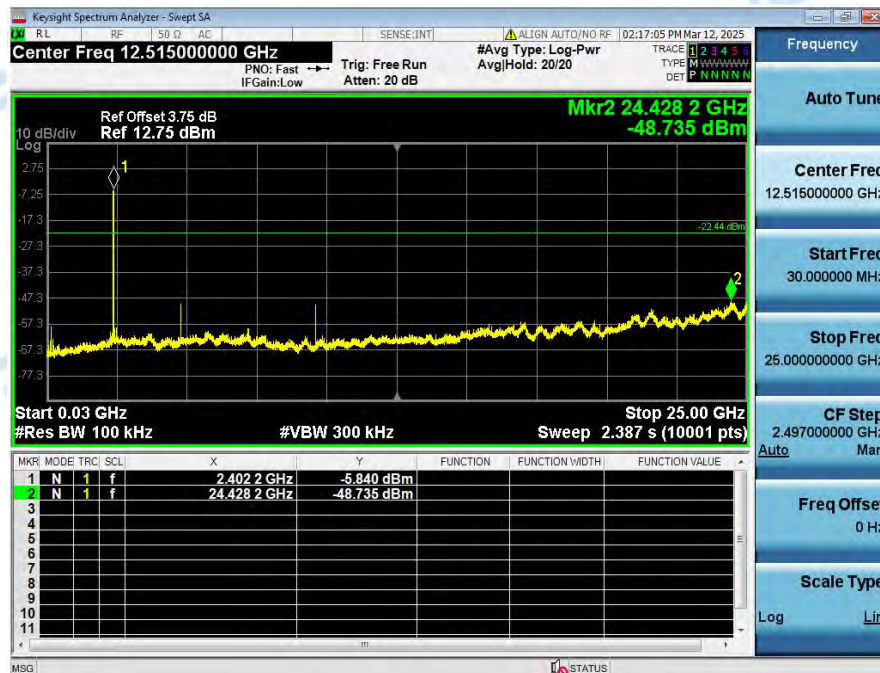




### 1\_Reference\_Level\_NVNT\_ANT1\_2-DH5\_2402\_00



### 2\_Spurious\_Emissions\_NVNT\_ANT1\_2-DH5\_2402\_00

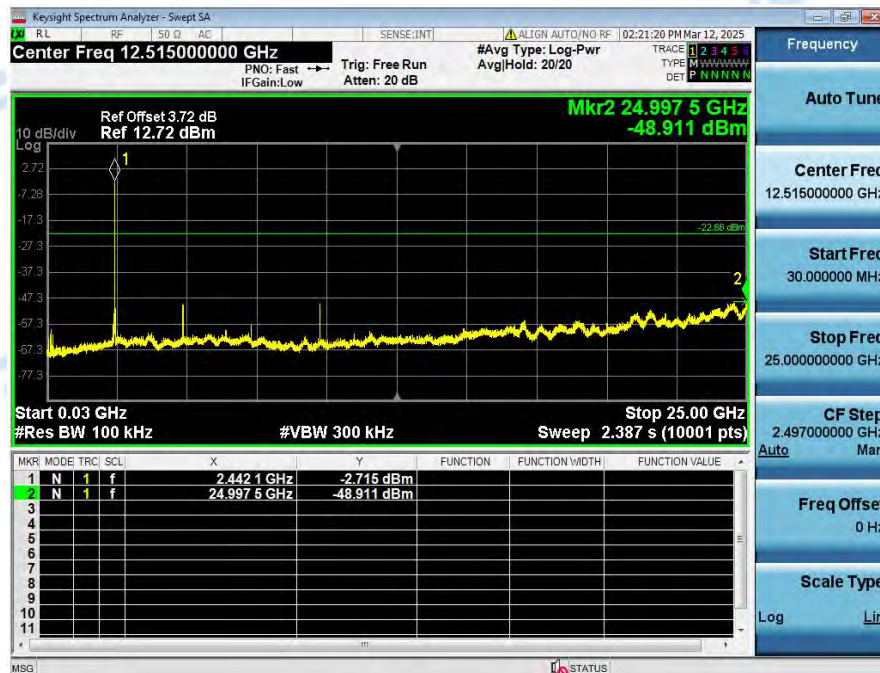




### 1\_Reference\_Level\_NVNT\_ANT1\_2-DH5\_2441\_00



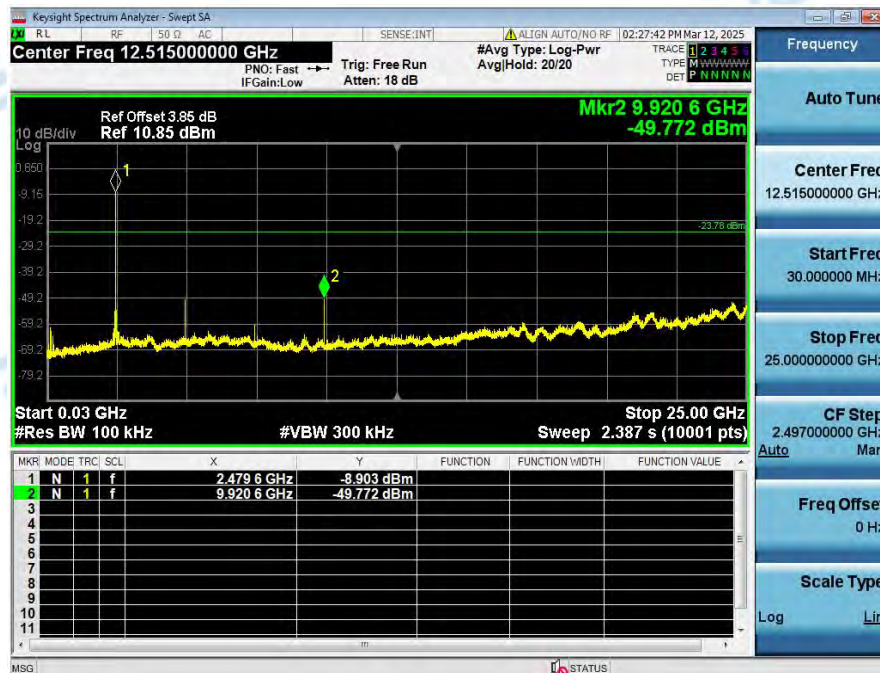
### 2\_Spurious\_Emissions\_NVNT\_ANT1\_2-DH5\_2441\_00



### 1\_Reference\_Level\_NVNT\_ANT1\_2-DH5\_2480\_00



### 2\_Spurious\_Emissions\_NVNT\_ANT1\_2-DH5\_2480\_00





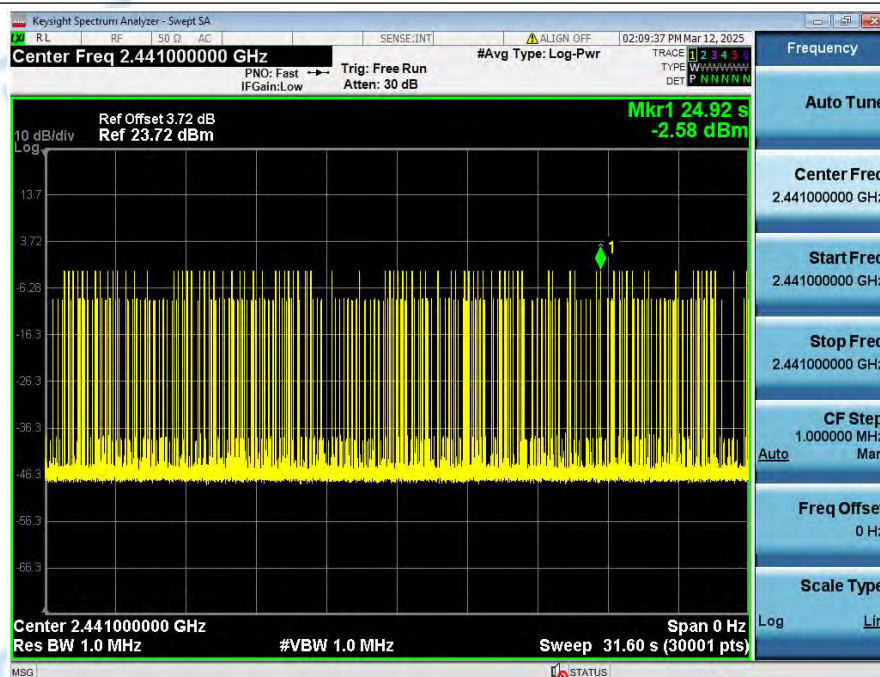
## 8. Dwell Time (Hopping)

| Condition | Antenna | Packet Type | Pulse Time(ms) | Hops   | Dwell Time(ms) | Limit(s) | Result |
|-----------|---------|-------------|----------------|--------|----------------|----------|--------|
| NVNT      | ANT1    | 1-DH5       | 2.890          | 115.00 | 332.350        | 0.40     | Pass   |
| NVNT      | ANT1    | 2-DH5       | 2.890          | 115.00 | 332.350        | 0.40     | Pass   |
| NVNT      | ANT1    | 1-DH1       | 0.390          | 320.00 | 124.800        | 0.40     | Pass   |
| NVNT      | ANT1    | 1-DH3       | 1.640          | 157.00 | 257.480        | 0.40     | Pass   |
| NVNT      | ANT1    | 2-DH1       | 0.390          | 320.00 | 124.800        | 0.40     | Pass   |
| NVNT      | ANT1    | 2-DH3       | 1.640          | 165.00 | 270.600        | 0.40     | Pass   |

Dwell\_Time\_(Hopping)\_NVNT\_ANT1\_1-DH5\_2441\_00\_One\_Burst\_Time

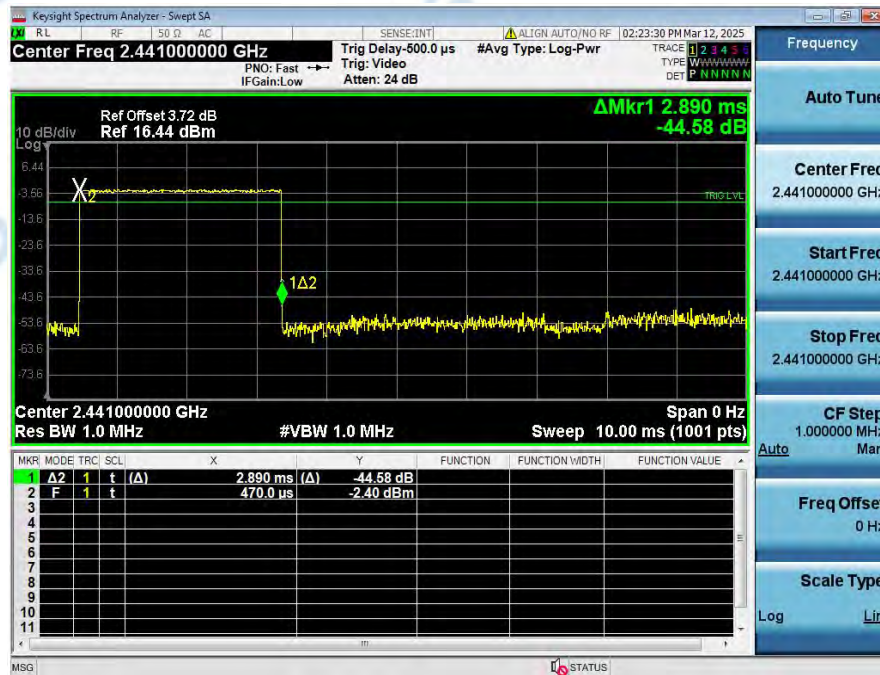


Dwell\_Time\_(Hopping)\_NVNT\_ANT1\_1-DH5\_2441\_00\_Accumulated

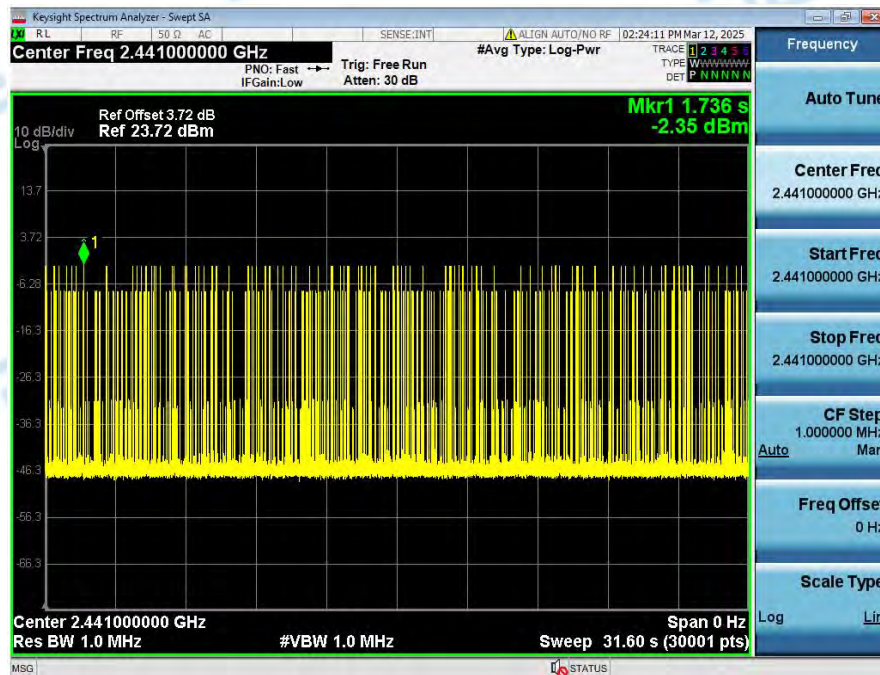




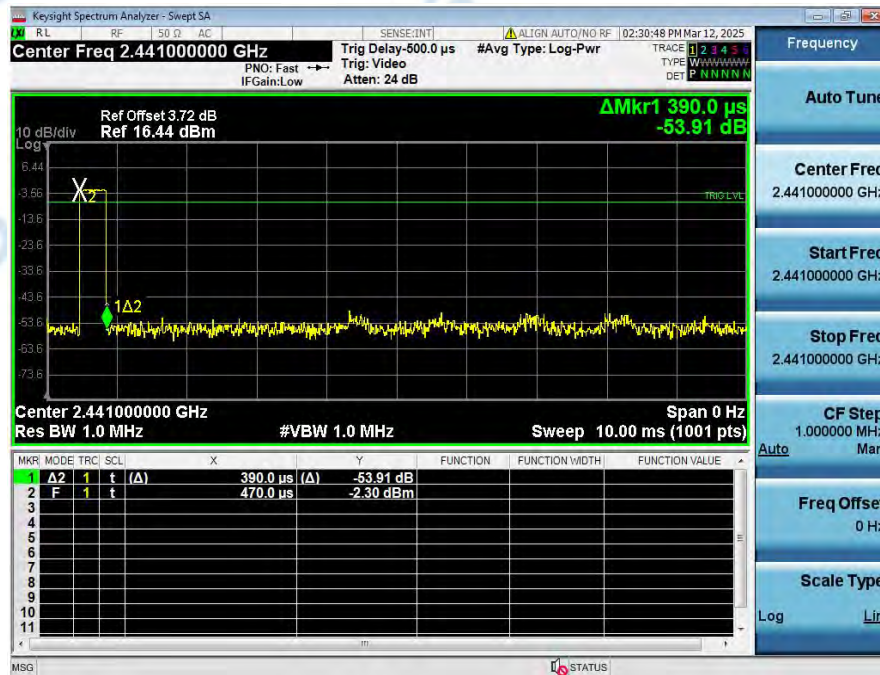
### Dwell\_Time\_(Hopping)\_NVNT\_ANT1\_2-DH5\_2441\_00\_One\_Burst\_Time



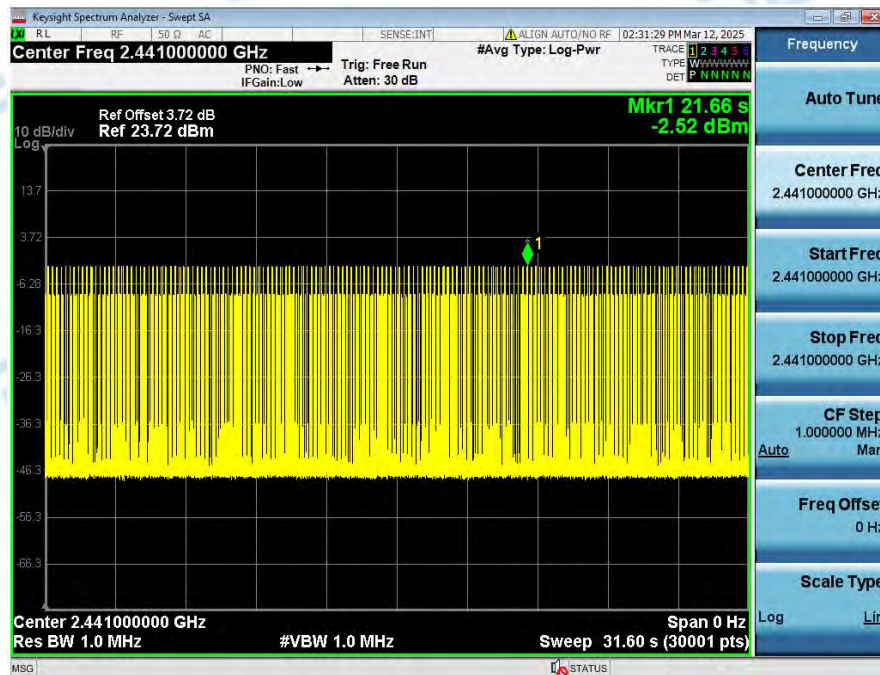
### Dwell\_Time\_(Hopping)\_NVNT\_ANT1\_2-DH5\_2441\_00\_Accumulated



## Dwell\_Time\_(Hopping)\_NVNT\_ANT1\_1-DH1\_2441\_00\_One\_Burst\_Time

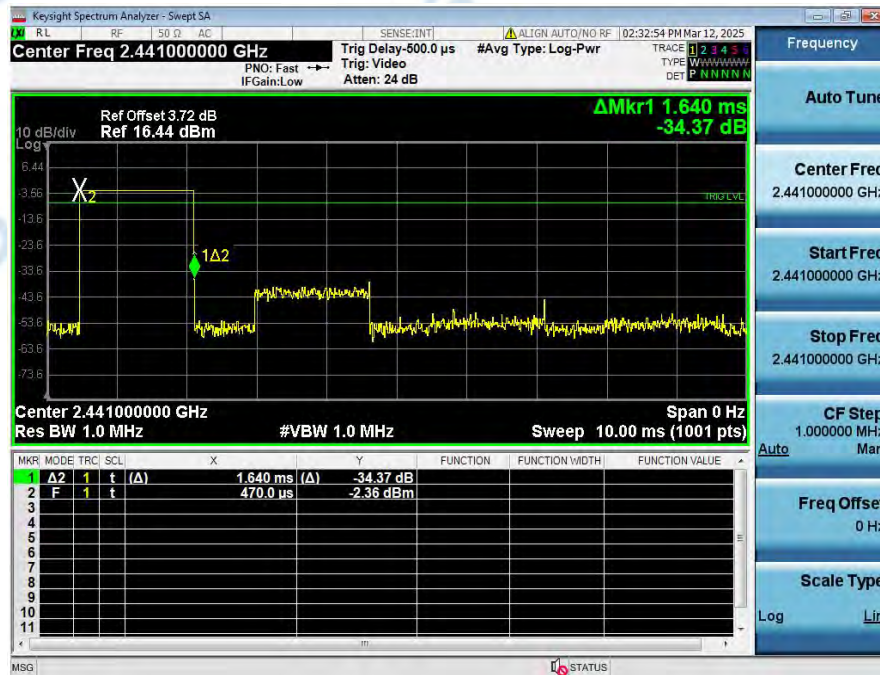


## Dwell\_Time\_(Hopping)\_NVNT\_ANT1\_1-DH1\_2441\_00\_Accumulated

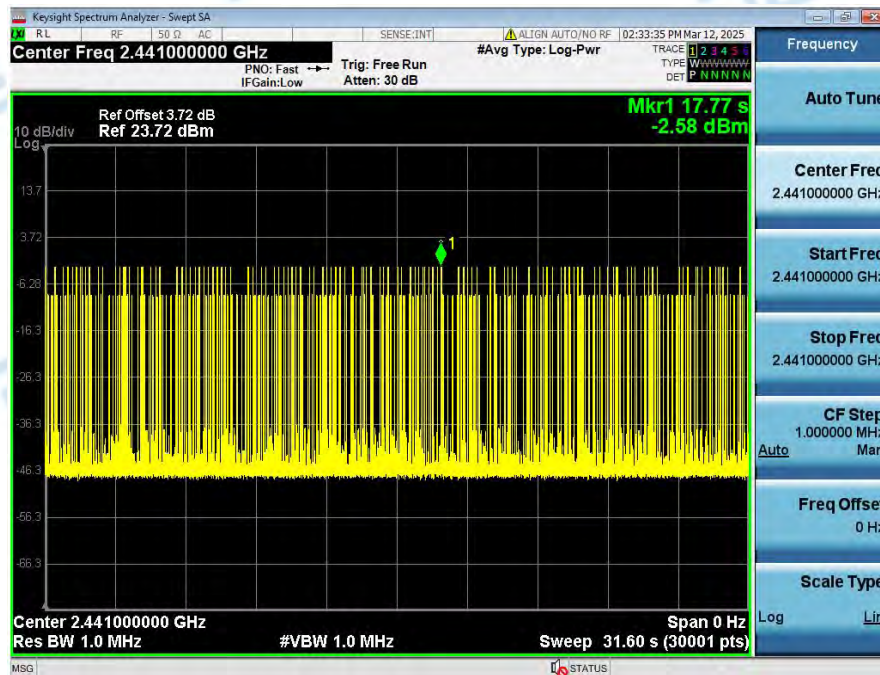




## Dwell\_Time\_(Hopping)\_NVNT\_ANT1\_1-DH3\_2441\_00\_One\_Burst\_Time

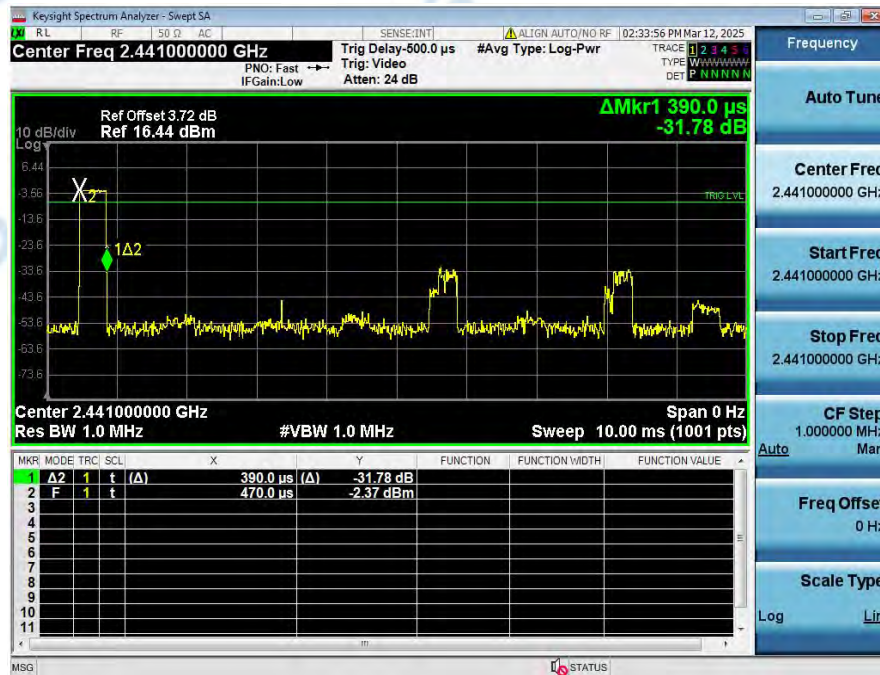


## Dwell\_Time\_(Hopping)\_NVNT\_ANT1\_1-DH3\_2441\_00\_Accumulated

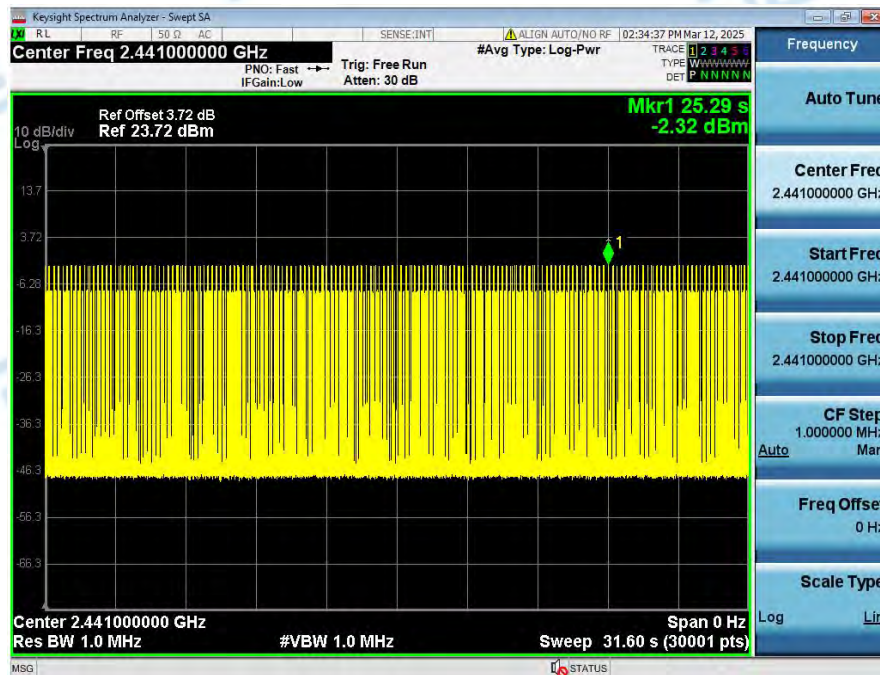




## Dwell\_Time\_(Hopping)\_NVNT\_ANT1\_2-DH1\_2441\_00\_One\_Burst\_Time



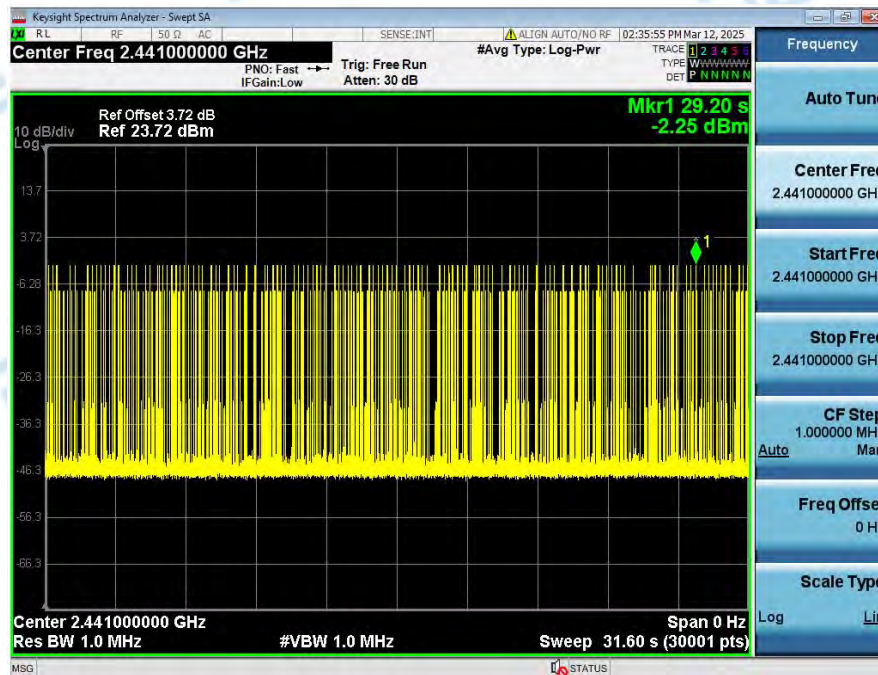
## Dwell\_Time\_(Hopping)\_NVNT\_ANT1\_2-DH1\_2441\_00\_Accumulated



### Dwell\_Time\_(Hopping)\_NVNT\_ANT1\_2-DH3\_2441\_00\_One\_Burst\_Time



### Dwell\_Time\_(Hopping)\_NVNT\_ANT1\_2-DH3\_2441\_00\_Accumulated



\*\*\*\*\* End of Report \*\*\*\*\*