



## FCC TEST REPORT

FCC ID: 2A7ZC-SG20A

On Behalf of

GEOMATE POSITIONING PTE. LTD.

Geodetic GNSS Receiver

Model No.: SG20AR

Prepared for : GEOMATE POSITIONING PTE. LTD.  
Address : 13 Tampines Lane #09-53 Singapore 528479

Prepared By : Shenzhen Alpha Product Testing Co., Ltd.  
Address : Building i, No.2, Lixin Road, Fuyong Street, Bao'an District, 518103,  
Shenzhen, Guangdong, China

Report Number : A2407246-C01-R12  
Date of Receipt : August 2, 2024  
Date of Test : August 2, 2024- August 28, 2024  
Date of Report : August 31, 2024  
Version Number : V0  
**Test Result : Pass**

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TEST REPORT DECLARATION

Applicant : GEOMATE POSITIONING PTE. LTD.  
Address : 13 Tampines Lane #09-53 Singapore 528479  
Manufacturer : GEOMATE POSITIONING PTE. LTD.  
Address : 13 Tampines Lane #09-53 Singapore 528479  
EUT Description : Geodetic GNSS Receiver  
(A) Model No. : SG20AR  
(B) Trademark : 

Measurement Standard Used:

**FCC Rules and Regulations Part 15 Subpart C Section 15.247**  
**ANSI C63.10:2013**

The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 15 Subpart C limits both conducted and radiated emissions. The test results are contained in this test report and Shenzhen Alpha Product Testing Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After the test, our opinion is that EUT compliance with the requirement of the above standards.  
This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Alpha Product Testing Co., Ltd.

|                                      |                                |                                                                                                |
|--------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------|
| Tested by (name + signature).....:   | Yannis Wen<br>Project Engineer | <br>..... |
| Approved by (name + signature).....: | Jack Xu<br>Project Manager     | <br>..... |
| Date of issue.....:                  | August 31, 2024                |                                                                                                |

**Revision History**

| Revision | Issue Date      | Revisions              | Revised By |
|----------|-----------------|------------------------|------------|
| V0       | August 31, 2024 | Initial released Issue | Yannis Wen |

## 1. SUMMARY OF STANDARDS AND RESULTS

### 1.1. Description of Standards and Results

The EUT have been tested according to the applicable standards as referenced below:

| Test Item                                                                                                                                                                                   | Standards Paragraph                         | Result |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|--------|
| Maximum Peak Output Power                                                                                                                                                                   | FCC Part 15: 15.247(b)(1)                   | P      |
| Bandwidth                                                                                                                                                                                   | FCC Part 15: 15.215                         | P      |
| Carrier Frequency Separation                                                                                                                                                                | FCC Part 15: 15.247(a)(1)                   | P      |
| Number Of Hopping Channel                                                                                                                                                                   | FCC Part 15: 15.247(a)(1)                   | P      |
| Dwell Time                                                                                                                                                                                  | FCC Part 15: 15.247(a)(1)                   | P      |
| Radiated Emission                                                                                                                                                                           | FCC Part 15: 15.209, FCC Part 15: 15.247(d) | P      |
| Band Edge Compliance                                                                                                                                                                        | FCC Part 15: 15.247(d)                      | P      |
| Power Line Conducted Emissions                                                                                                                                                              | FCC Part 15: 15.207                         | P      |
| Antenna requirement                                                                                                                                                                         | FCC Part 15: 15.203                         | P      |
| Note: <ol style="list-style-type: none"> <li>1. P is an abbreviation for Pass.</li> <li>2. F is an abbreviation for Fail.</li> <li>3. N/A is an abbreviation for Not Applicable.</li> </ol> |                                             |        |

1. Pass: The EUT complies with the essential requirements in the standard.
2. Frequency Stability: The manufacturer stated in the user's manual.
3. The conclusion of this test report is judged by actual test data without considering measurement uncertainty.

## 2. GENERAL INFORMATION

### 2.1. Description of Device (EUT)

|                        |                                                                                 |
|------------------------|---------------------------------------------------------------------------------|
| Description            | : Geodetic GNSS Receiver                                                        |
| Model Number           | : SG20AR                                                                        |
| Diff                   | : N/A                                                                           |
| Power supply           | : DC 5V from AC Adapter, DC 7.2V from battery.                                  |
| Radio Technology       | : Bluetooth EDR                                                                 |
| Operation frequency    | : 2402-2480MHz                                                                  |
| Channel No.            | : 79 channels                                                                   |
| Channel Separation     | : 1MHz                                                                          |
| Modulation             | : GFSK, $\pi/4$ -DQPSK, 8DPSK                                                   |
| Antenna Type           | : PCB Antenna, max gain 0dBi<br>(Antenna information is provided by applicant.) |
| Software version       | : V1.0                                                                          |
| Hardware version       | : V1.0.1                                                                        |
| Intend use environment | Residential, commercial and light industrial environment                        |

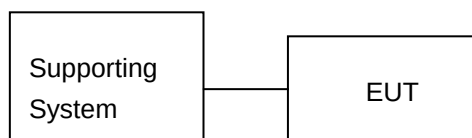
## 2.2. Accessories of Device (EUT)

Accessories : AC Adapter  
 Manufacturer : Yisheng Electronics Co., LTD  
 Model : EA1012AVRU-050  
 INPUT : 100-240Vac, 1.0A, 50-60Hz  
 OUTPUT : 5.0V=2.4A 12.0W  
 Accessories Type-C charging cable  
 Manufacturer /  
 Model /  
 Accessories UHF Receiving Antenna  
 Manufacturer /  
 Model /

## 2.3. Tested Supporting System Details

| No. | Description | Manufacturer | Model        | Serial Number | Certification or SDoC |
|-----|-------------|--------------|--------------|---------------|-----------------------|
| 1.  | Notebook PC | Lenovo       | ThinkPad E14 | --            | --                    |

## 2.4. Block Diagram of connection between EUT and simulators



## 2.5. Test Mode Description

| Tested mode, channel information |              |                 |
|----------------------------------|--------------|-----------------|
| Mode                             | Channel      | Frequency (MHz) |
| GFSK                             | Low :CH0     | 2402            |
|                                  | Middle: CH39 | 2441            |
|                                  | High: CH78   | 2480            |
| $\pi/4$ DQPSK                    | Low :CH0     | 2402            |
|                                  | Middle: CH39 | 2441            |
|                                  | High: CH78   | 2480            |
| 8DPSK                            | Low :CH0     | 2402            |
|                                  | Middle: CH39 | 2441            |
|                                  | High: CH78   | 2480            |

## 2.6. Test Conditions

| Items              | Required  | Actual |
|--------------------|-----------|--------|
| Temperature range: | 15-35°C   | 24°C   |
| Humidity range:    | 25-75%    | 56%    |
| Pressure range:    | 86-106kPa | 98kPa  |

## 2.7. Test Facility

Shenzhen Alpha Product Testing Co., Ltd

Building i, No.2, Lixin Road, Fuyong Street, Bao'an District, 518103,  
Shenzhen, Guangdong, China

June 21, 2018 File on Federal Communication Commission

Registration Number: 293961

July 15, 2019 Certificated by IC

Registration Number: 12135A

## 2.8. Measurement Uncertainty

(95% confidence levels, k=2)

| Item                                                                      | Uncertainty               |
|---------------------------------------------------------------------------|---------------------------|
| Uncertainty for Power point Conducted Emissions Test                      | 1.63dB                    |
| Uncertainty for Radiation Emission test in 3m chamber<br>(below 30MHz)    | 3.5dB                     |
| Uncertainty for Radiation Emission test in 3m chamber<br>(30MHz to 1GHz)  | 3.74dB(Polarize: V)       |
|                                                                           | 3.76dB(Polarize: H)       |
| Uncertainty for Radiation Emission test in 3m chamber<br>(1GHz to 25GHz)  | 3.77dB(Polarize: V)       |
|                                                                           | 3.80dB(Polarize: H)       |
| Uncertainty for Radiation Emission test in 3m chamber<br>(18GHz to 40GHz) | 4.31 dB(Polarize: V)      |
|                                                                           | 4.30 dB(Polarize: H)      |
| Uncertainty for radio frequency                                           | $5.06 \times 10^{-8}$ GHz |
| Uncertainty for conducted RF Power                                        | 0.40dB                    |
| Uncertainty for temperature                                               | 0.2°C                     |
| Uncertainty for humidity                                                  | 1%                        |
| Uncertainty for DC and low frequency voltages                             | 0.06%                     |

## 2.9. Test Equipment List

| Equipment                    | Manufacture   | Model No.        | Firmware version | Serial No.                 | Last cal.  | Cal Interval |
|------------------------------|---------------|------------------|------------------|----------------------------|------------|--------------|
| 9*6*6 anechoic chamber       | CHENYU        | 9*6*6            | /                | N/A                        | 2022.05.18 | 3Year        |
| Spectrum analyzer            | ROHDE&SCHWARZ | FSV40-N          | 2.3              | 102137                     | 2024.08.08 | 1Year        |
| Spectrum analyzer            | Agilent       | N9020A           | A.14.16          | MY499100060                | 2024.08.08 | 1Year        |
| Receiver                     | ROHDE&SCHWARZ | ESR              | 2.28 SP1         | 1316.3003K03-10<br>2082-Wa | 2024.08.08 | 1Year        |
| Receiver                     | R&S           | ESCI             | 4.42 SP1         | 101165                     | 2024.08.08 | 1Year        |
| Bilog Antenna                | Schwarzbeck   | VULB 9168        | /                | VULB 9168#627              | 2023.08.28 | 2Year        |
| Horn Antenna                 | SCHWARZBECK   | BBHA 9120<br>D   | /                | 2106                       | 2023.08.19 | 2Year        |
| Loop Antenna                 | SCHWARZBECK   | FMZB<br>1519B    | /                | 00128                      | 2023.08.19 | 2Year        |
| RF Cable                     | Resenberger   | Cable 1          | /                | RE1                        | 2024.08.08 | 1Year        |
| RF Cable                     | Resenberger   | Cable 2          | /                | RE2                        | 2024.08.08 | 1Year        |
| RF Cable                     | Resenberger   | Cable 3          | /                | CE1                        | 2024.08.08 | 1Year        |
| Pre-amplifier                | HP            | HP8347A          | /                | 2834A00455                 | 2024.08.08 | 1Year        |
| Pre-amplifier                | Agilent       | 8449B            | /                | 3008A02664                 | 2024.08.08 | 1Year        |
| L.I.S.N.#1                   | Schwarzbeck   | NSLK8126         | /                | 8126-466                   | 2024.08.08 | 1Year        |
| L.I.S.N.#2                   | ROHDE&SCHWARZ | ENV216           | /                | 101043                     | 2024.08.08 | 1Year        |
| Horn Antenna                 | SCHWARZBECK   | BBHA 9170        | /                | 00946                      | 2023.08.19 | 2Year        |
| Preamplifier                 | SKET          | LNPA_1840<br>-50 | /                | SK2018101801               | 2024.08.08 | 1 Year       |
| Power Meter                  | Agilent       | E9300A           | /                | MY41496628                 | 2024.08.08 | 1 Year       |
| Power Sensor                 | DARE          | RPR3006W         | /                | 15100041SNO91              | 2024.08.08 | 1 Year       |
| Electronic Thermo-Hygrometer | S.H.Qixiang   | HTC-1            | /                | N/A                        | 2024.08.11 | 1 Year       |
| Switching Mode Power Supply  | JUNKE         | JK12010S         | /                | 20140927-6                 | 2024.08.08 | 1 Year       |
| Adjustable attenuator        | MWRFTest      | N/A              | /                | N/A                        | N/A        | N/A          |
| 10dB Attenuator              | Mini-Circuits | DC-6G            | /                | N/A                        | N/A        | N/A          |

| Software Information |               |              |           |
|----------------------|---------------|--------------|-----------|
| Test Item            | Software Name | Manufacturer | Version   |
| RE                   | EZ-EMC        | EZ           | Alpha-3A1 |
| CE                   | EZ-EMC        | EZ           | Alpha-3A1 |
| RF-CE                | MTS 8310      | MW           | V2.0.0.0  |

### 3. MAXIMUM PEAK OUTPUT POWER

#### 3.1. Limit

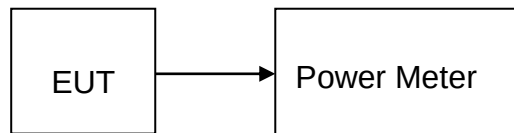
Please refer section 15.247

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, the e.i.r.p shall not exceed 4W

#### 3.2. Test Procedure

The transmitter output is connected to the RF Power Meter. The RF Power Meter is set to the peak power detection.

#### 3.3. Test Setup



#### 3.4. Test Result

| Condition | Mode  | Frequency (MHz) | Antenna | Conducted Power (dBm) | Limit (dBm) | Verdict |
|-----------|-------|-----------------|---------|-----------------------|-------------|---------|
| NVNT      | 1-DH1 | 2402            | Ant1    | 1.949                 | 21          | Pass    |
| NVNT      | 1-DH1 | 2441            | Ant1    | 2.132                 | 21          | Pass    |
| NVNT      | 1-DH1 | 2480            | Ant1    | 1.675                 | 21          | Pass    |
| NVNT      | 1-DH3 | 2441            | Ant1    | 2.495                 | 21          | Pass    |
| NVNT      | 1-DH5 | 2441            | Ant1    | 2.355                 | 21          | Pass    |
| NVNT      | 2-DH1 | 2402            | Ant1    | 2.107                 | 21          | Pass    |
| NVNT      | 2-DH1 | 2441            | Ant1    | 2.559                 | 21          | Pass    |
| NVNT      | 2-DH1 | 2480            | Ant1    | 2.34                  | 21          | Pass    |
| NVNT      | 2-DH3 | 2441            | Ant1    | 1.538                 | 21          | Pass    |
| NVNT      | 2-DH5 | 2441            | Ant1    | 1.661                 | 21          | Pass    |
| NVNT      | 3-DH1 | 2402            | Ant1    | 1.8                   | 21          | Pass    |
| NVNT      | 3-DH1 | 2441            | Ant1    | 2.099                 | 21          | Pass    |
| NVNT      | 3-DH1 | 2480            | Ant1    | 2.238                 | 21          | Pass    |
| NVNT      | 3-DH3 | 2441            | Ant1    | 2.289                 | 21          | Pass    |
| NVNT      | 3-DH5 | 2441            | Ant1    | 2.279                 | 21          | Pass    |

## 4. BANDWIDTH

### 4.1. Limit

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in FCC Section 15.247(a)(1), 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..

### 4.2. Test Procedure

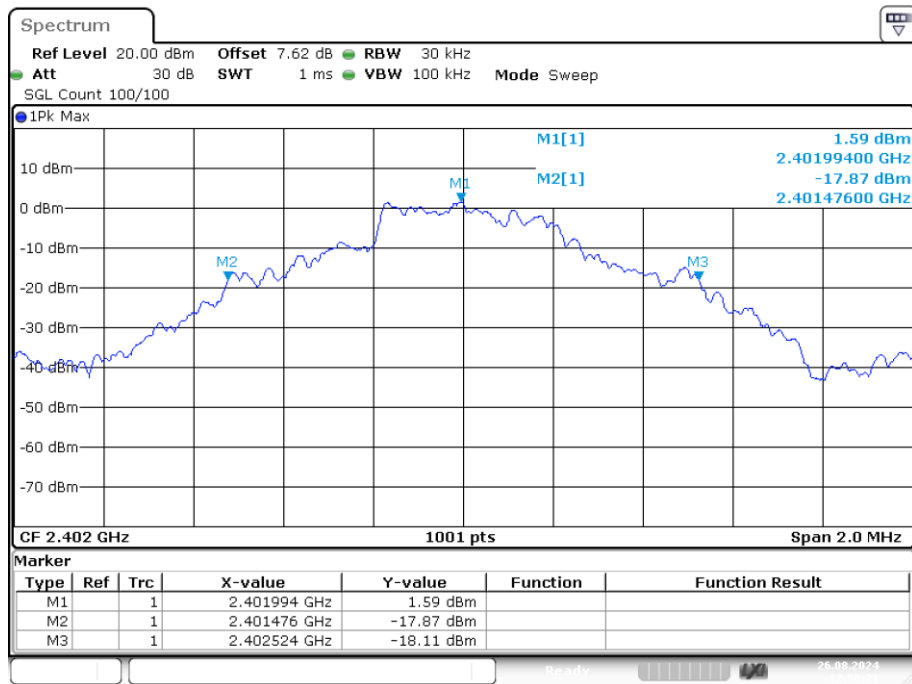
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30kHz RBW and 100kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

### 4.3. Test Result

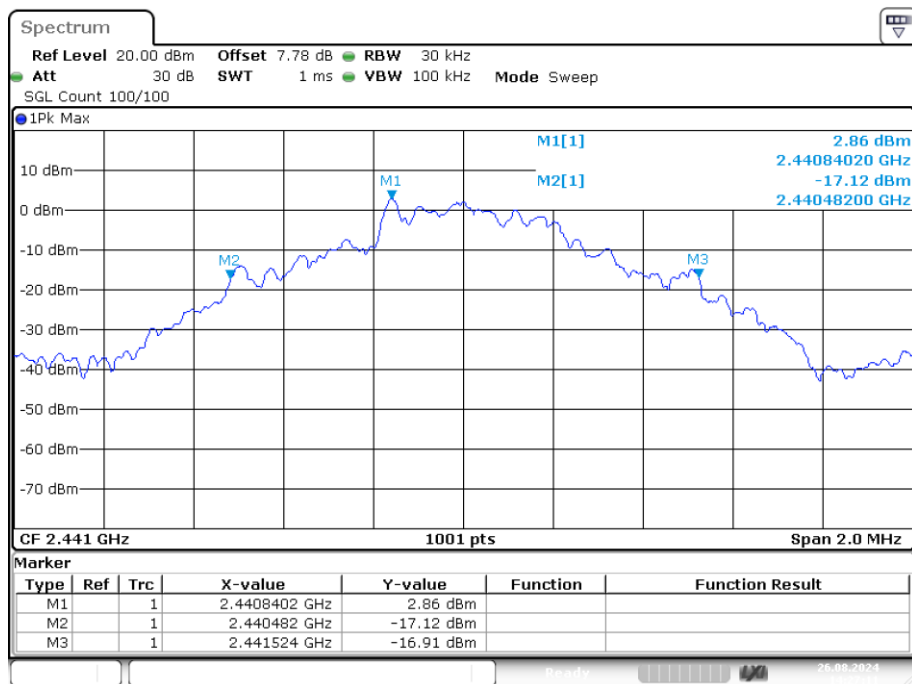
#### -20dB Bandwidth

| Condition | Mode  | Frequency (MHz) | Antenna | -20 dB Bandwidth (MHz) | Limit -20 dB Bandwidth (MHz) | Verdict |
|-----------|-------|-----------------|---------|------------------------|------------------------------|---------|
| NVNT      | 1-DH1 | 2402            | Ant1    | 1.048                  | /                            | Pass    |
| NVNT      | 1-DH1 | 2441            | Ant1    | 1.042                  | /                            | Pass    |
| NVNT      | 1-DH1 | 2480            | Ant1    | 1.026                  | /                            | Pass    |
| NVNT      | 2-DH1 | 2402            | Ant1    | 1.35                   | /                            | Pass    |
| NVNT      | 2-DH1 | 2441            | Ant1    | 1.32                   | /                            | Pass    |
| NVNT      | 2-DH1 | 2480            | Ant1    | 1.348                  | /                            | Pass    |
| NVNT      | 3-DH1 | 2402            | Ant1    | 1.33                   | /                            | Pass    |
| NVNT      | 3-DH1 | 2441            | Ant1    | 1.348                  | /                            | Pass    |
| NVNT      | 3-DH1 | 2480            | Ant1    | 1.268                  | /                            | Pass    |

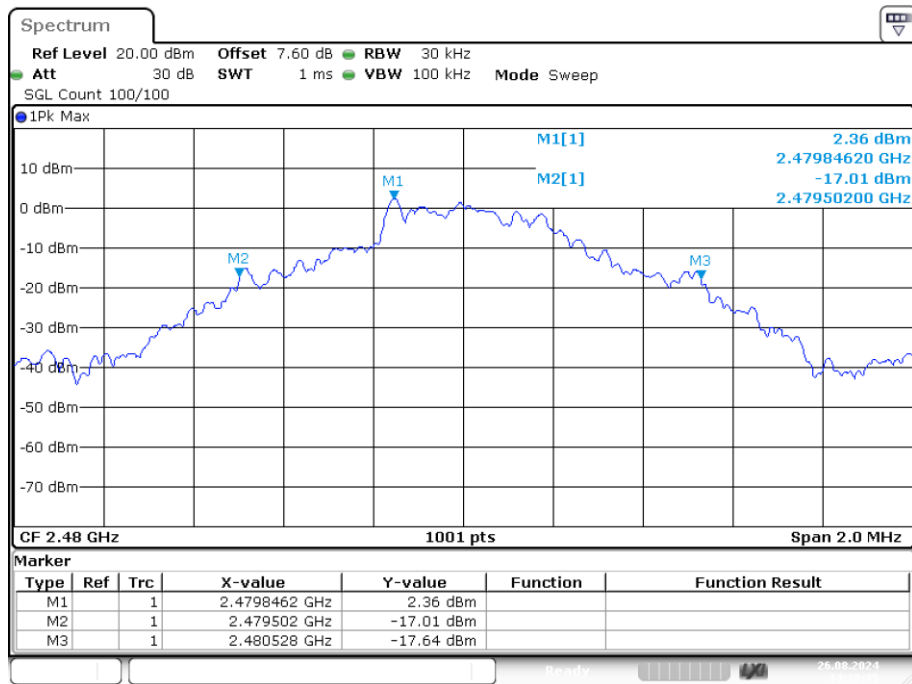
Note: All mode were tested, this Report only show the test plots of the worst case.

**-20dB Bandwidth NVNT 1-DH1 2402MHz Ant1**

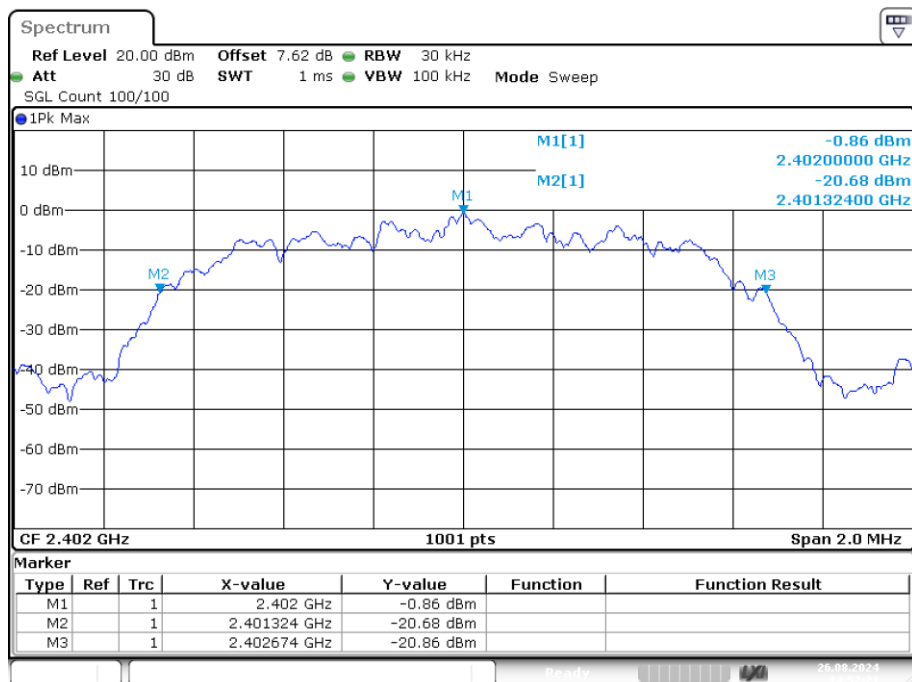
Date: 26.AUG.2024 12:50:21

**-20dB Bandwidth NVNT 1-DH1 2441MHz Ant1**

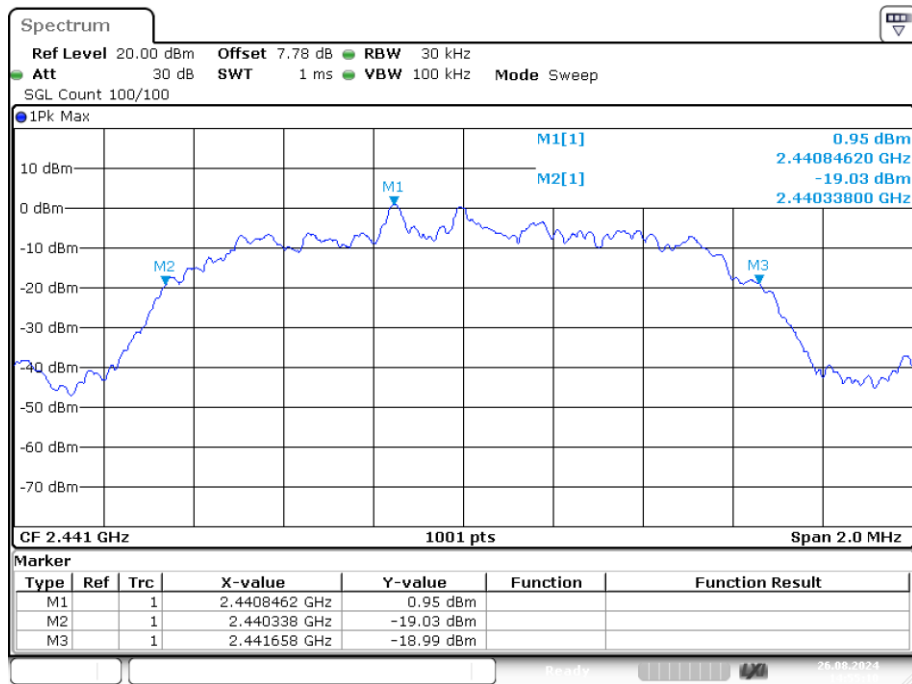
Date: 26.AUG.2024 14:27:11

**-20dB Bandwidth NVNT 1-DH1 2480MHz Ant1**

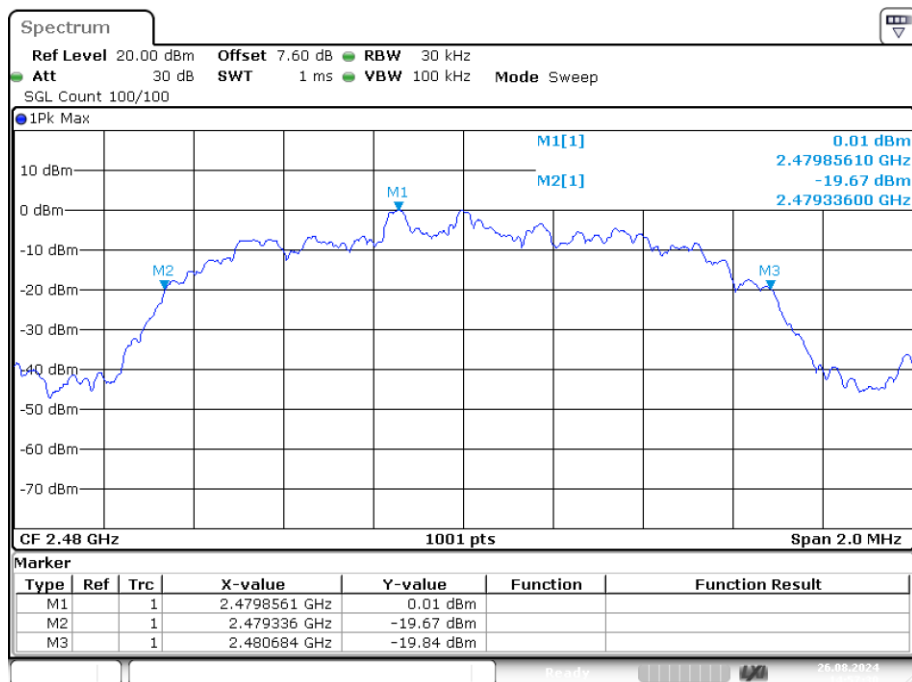
Date: 26.AUG.2024 14:28:35

**-20dB Bandwidth NVNT 2-DH1 2402MHz Ant1**

Date: 26.AUG.2024 14:52:21

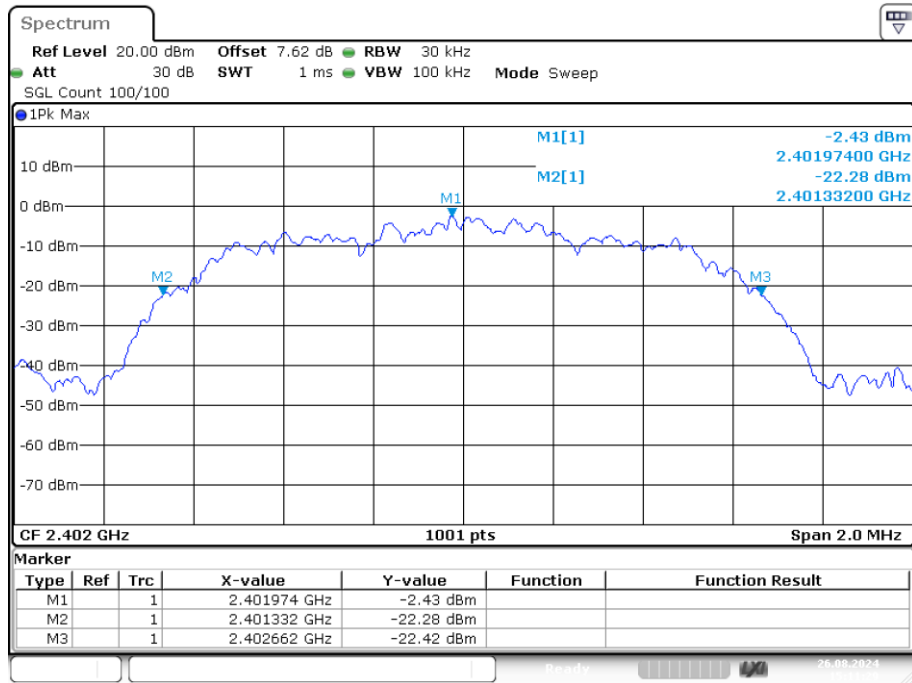
**-20dB Bandwidth NVNT 2-DH1 2441MHz Ant1**

Date: 26.AUG.2024 14:55:10

**-20dB Bandwidth NVNT 2-DH1 2480MHz Ant1**

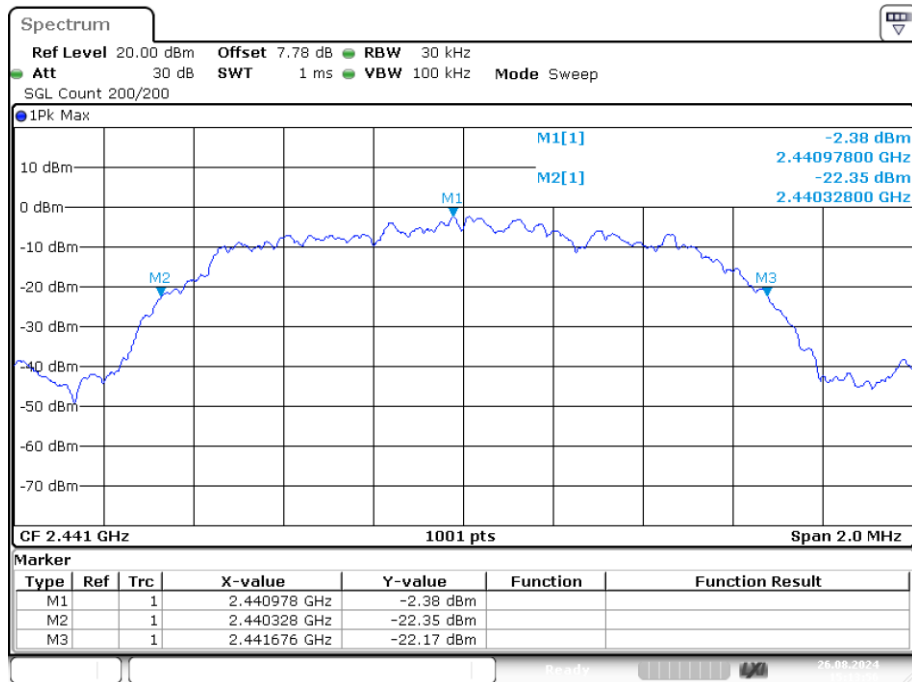
Date: 26.AUG.2024 14:57:31

## -20dB Bandwidth NVNT 3-DH1 2402MHz Ant1



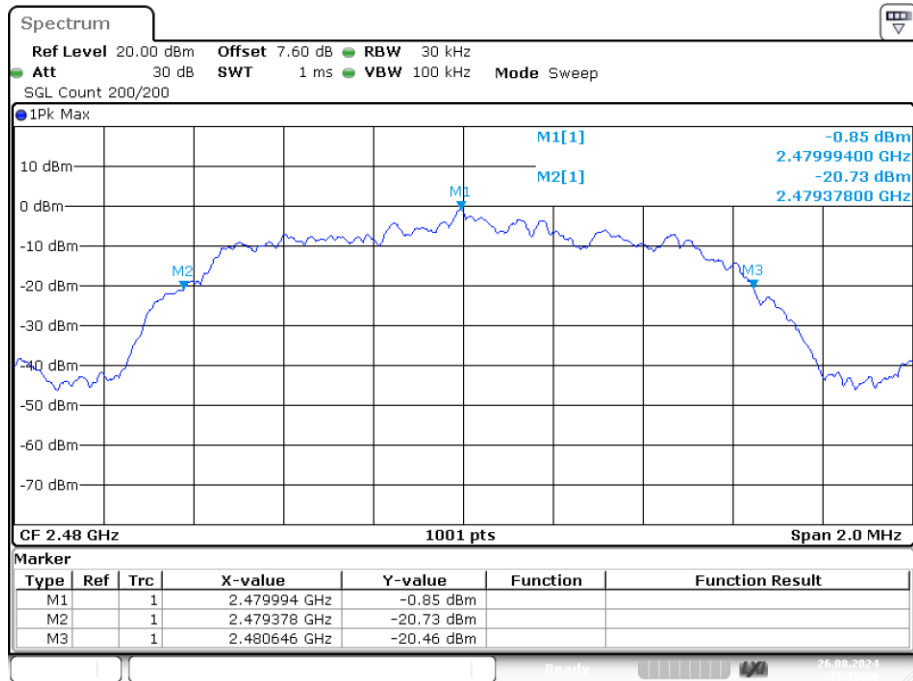
Date: 26.AUG.2024 15:11:29

## -20dB Bandwidth NVNT 3-DH1 2441MHz Ant1



Date: 26.AUG.2024 15:13:56

## -20dB Bandwidth NVNT 3-DH1 2480MHz Ant1

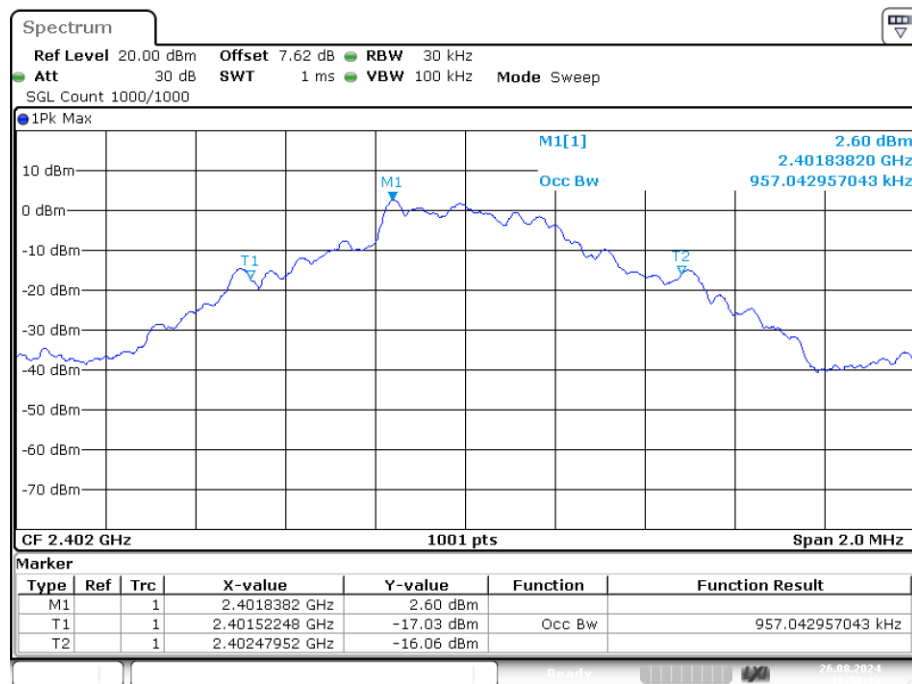


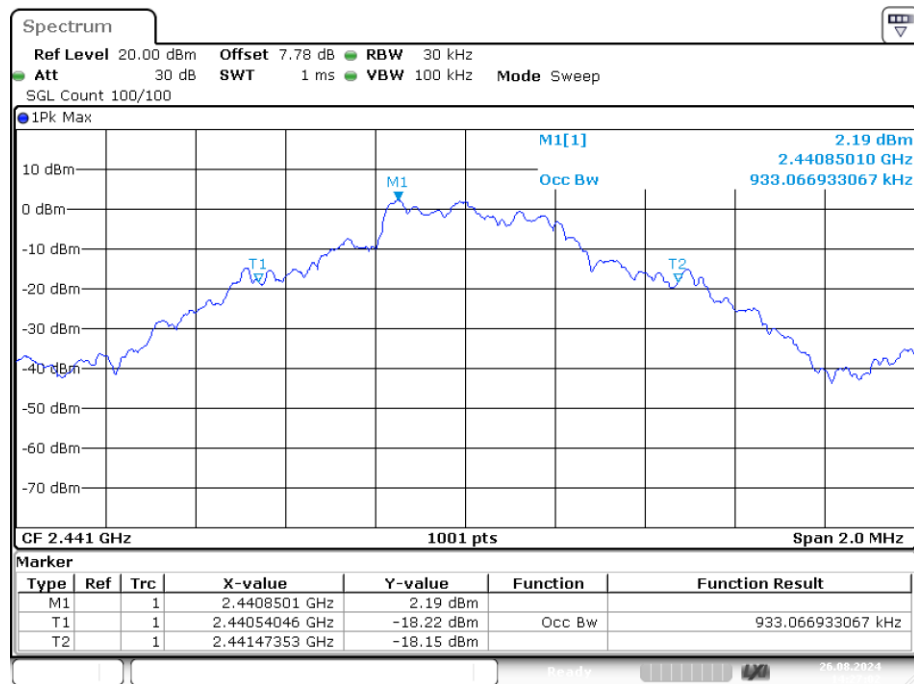
Date: 26.AUG.2024 15:15:35

**Occupied Channel Bandwidth**

| Condition | Mode  | Frequency (MHz) | Antenna | 99% OBW (MHz) |
|-----------|-------|-----------------|---------|---------------|
| NVNT      | 1-DH1 | 2402            | Ant1    | 0.957         |
| NVNT      | 1-DH1 | 2441            | Ant1    | 0.933         |
| NVNT      | 1-DH1 | 2480            | Ant1    | 0.961         |
| NVNT      | 2-DH1 | 2402            | Ant1    | 1.197         |
| NVNT      | 2-DH1 | 2441            | Ant1    | 1.177         |
| NVNT      | 2-DH1 | 2480            | Ant1    | 1.193         |
| NVNT      | 3-DH1 | 2402            | Ant1    | 1.179         |
| NVNT      | 3-DH1 | 2441            | Ant1    | 1.181         |
| NVNT      | 3-DH1 | 2480            | Ant1    | 1.179         |

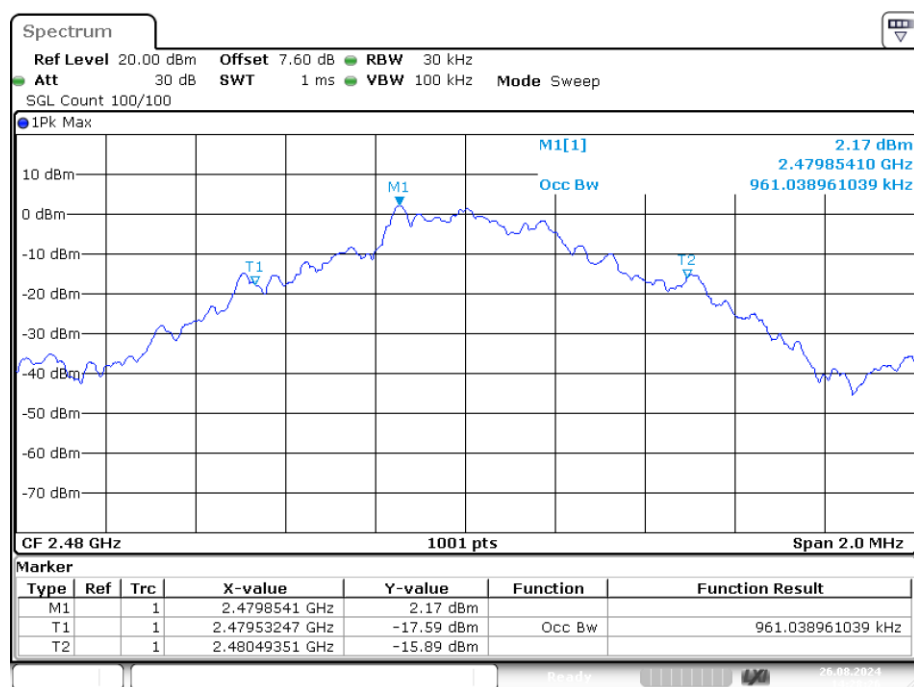
Note: All mode were tested, this Report only show the test plots of the worst case.

**OBW NVNT 1-DH1 2402MHz Ant1****OBW NVNT 1-DH1 2441MHz Ant1**



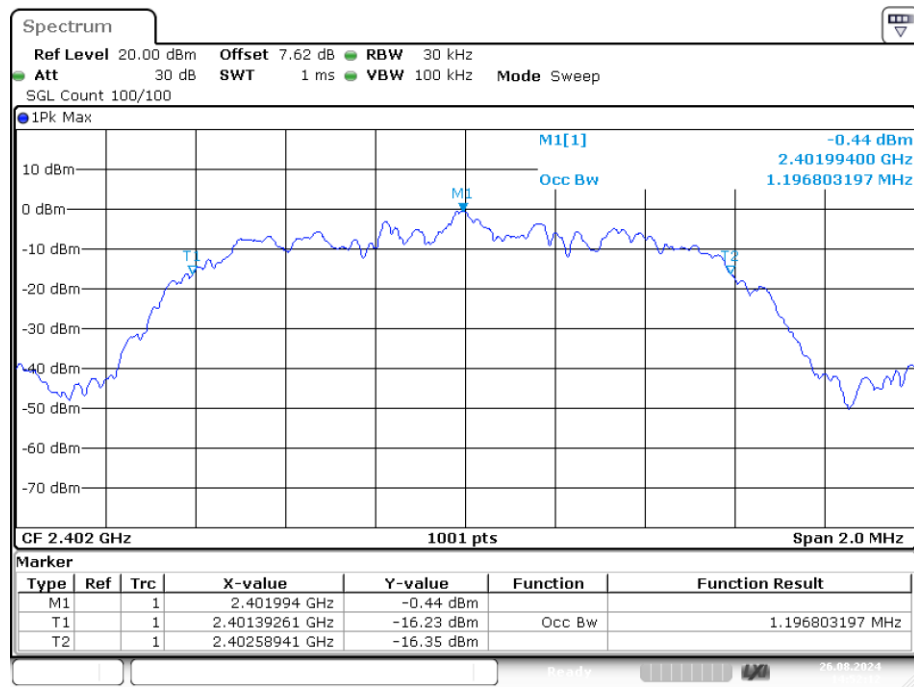
Date: 26.AUG.2024 14:27:02

## OBW NVNT 1-DH1 2480MHz Ant1



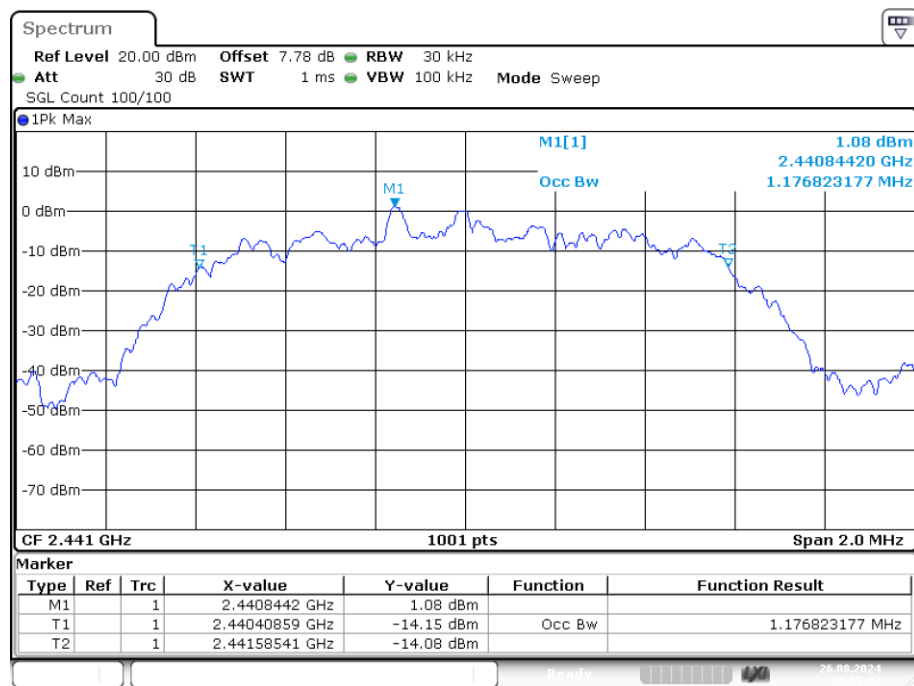
Date: 26.AUG.2024 14:28:26

## OBW NVNT 2-DH1 2402MHz Ant1



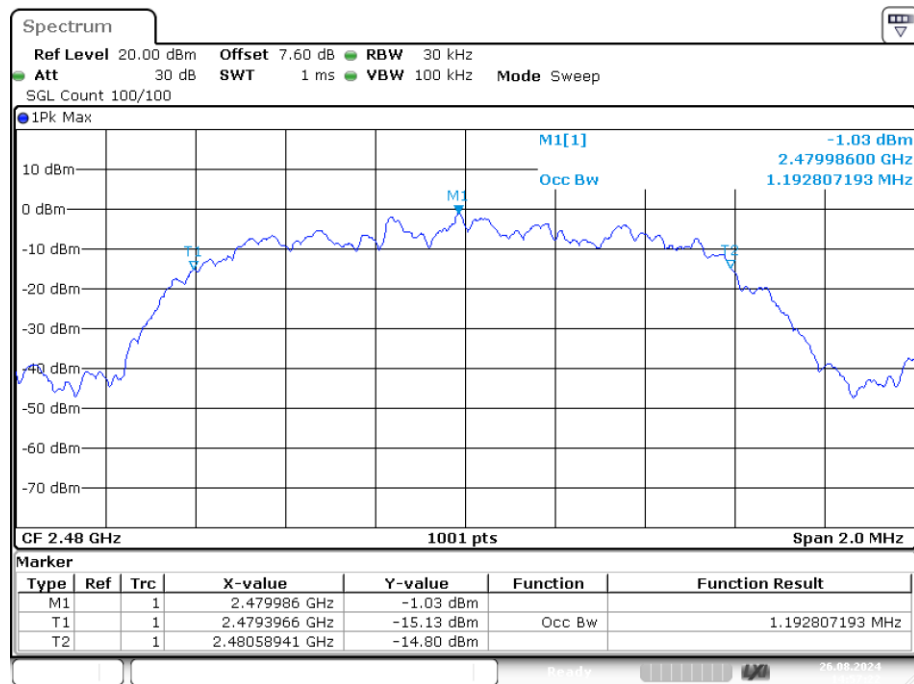
Date: 26.AUG.2024 14:52:13

## OBW NVNT 2-DH1 2441MHz Ant1



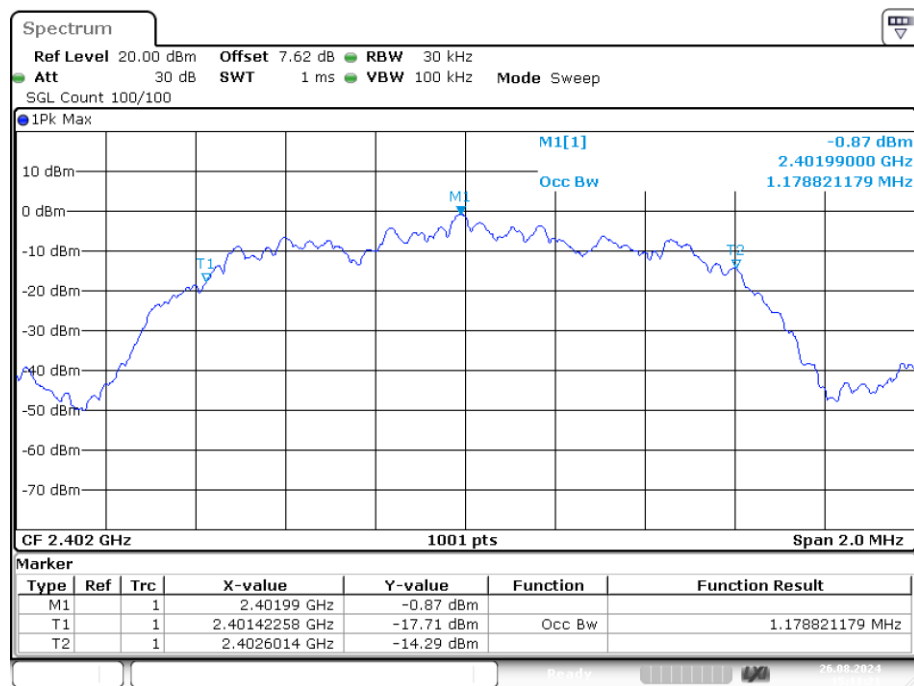
Date: 26.AUG.2024 14:55:02

## OBW NVNT 2-DH1 2480MHz Ant1



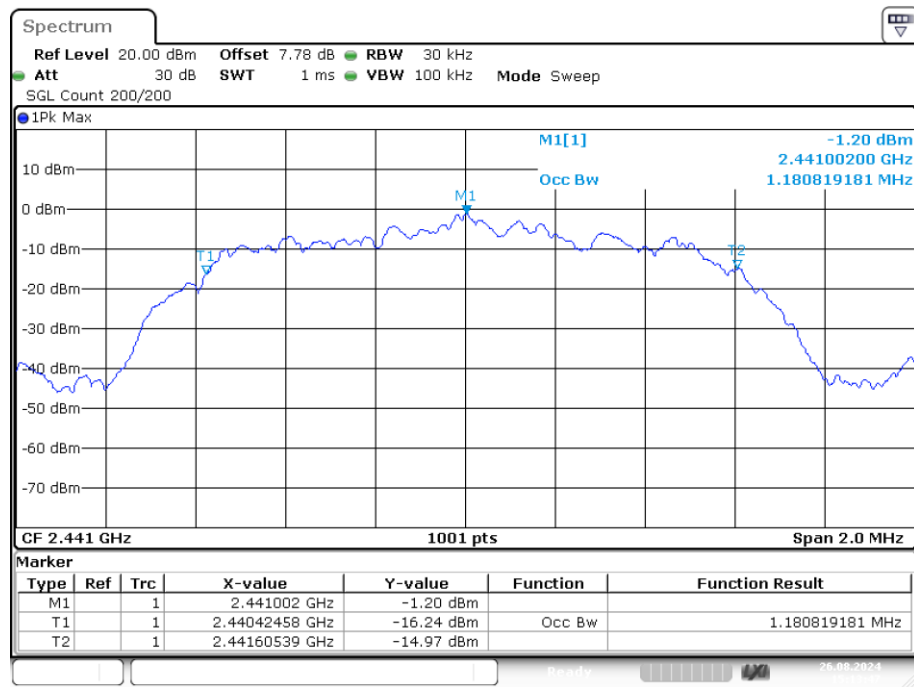
Date: 26.AUG.2024 14:57:23

## OBW NVNT 3-DH1 2402MHz Ant1



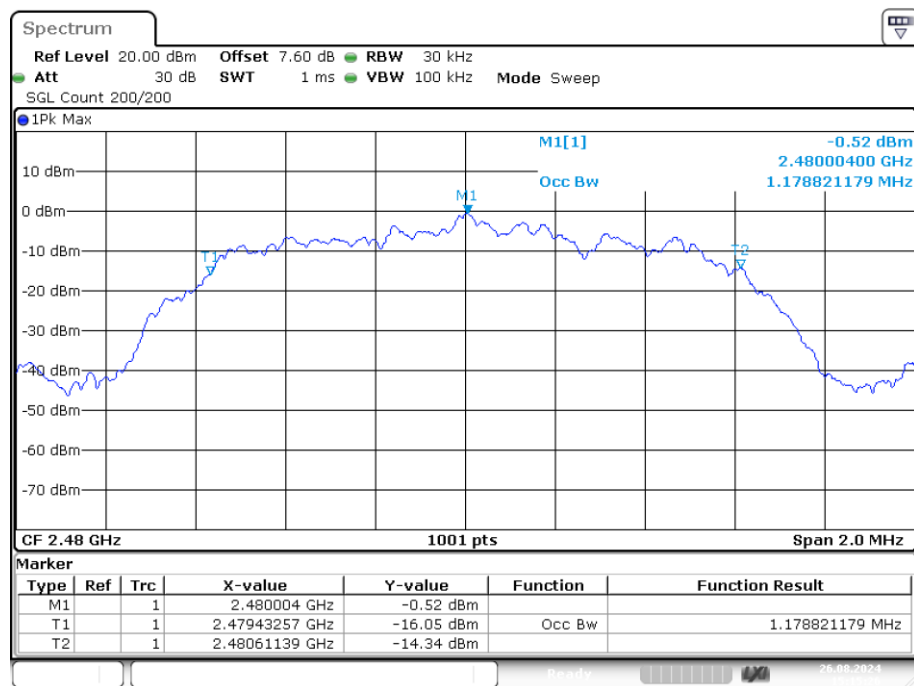
Date: 26.AUG.2024 15:11:20

## OBW NVNT 3-DH1 2441MHz Ant1



Date: 26.AUG.2024 15:13:47

## OBW NVNT 3-DH1 2480MHz Ant1



Date: 26.AUG.2024 15:15:26

## 5. CARRIER FREQUENCY SEPARATION

### 5.1. Limit

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

### 5.2. Test Procedure

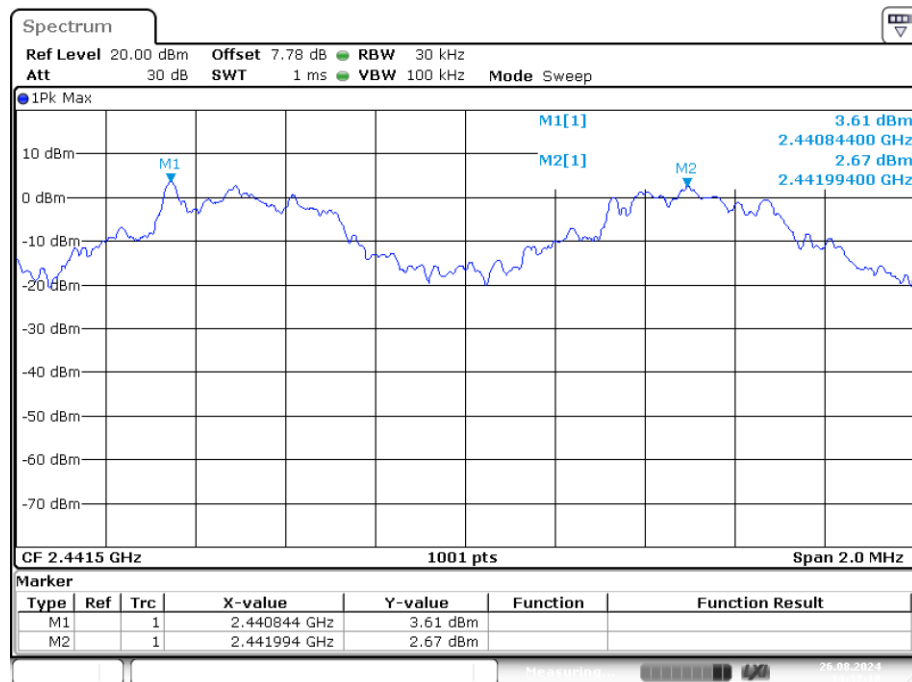
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The carrier frequency was measured by spectrum analyzer with 30kHz RBW and 100kHz VBW.

### 5.3. Test Result

| Condition | Mode  | Antenna | Hopping Freq1 (MHz) | Hopping Freq2 (MHz) | HFS (MHz) | Limit (MHz) | Verdict |
|-----------|-------|---------|---------------------|---------------------|-----------|-------------|---------|
| NVNT      | 1-DH1 | Ant1    | 2440.844            | 2441.994            | 1.15      | 1.042       | Pass    |
| NVNT      | 2-DH1 | Ant1    | 2440.838            | 2441.842            | 1.004     | 0.88        | Pass    |
| NVNT      | 3-DH1 | Ant1    | 2440.992            | 2441.978            | 0.986     | 0.899       | Pass    |

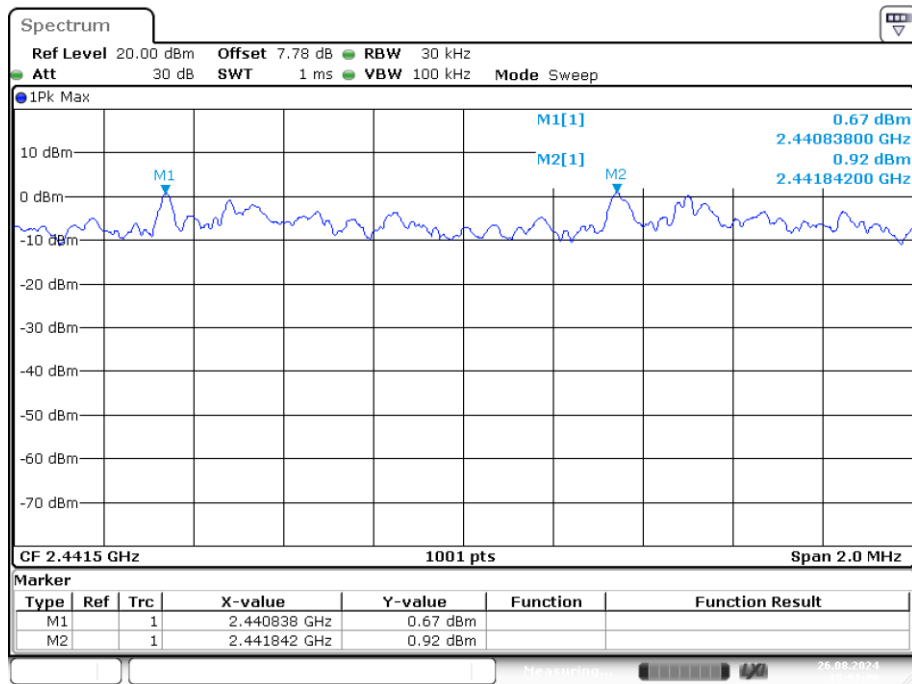
Note: All mode were tested, this Report only show the test plots of the worst case.

CFS NVNT 1-DH1 2441MHz Ant1



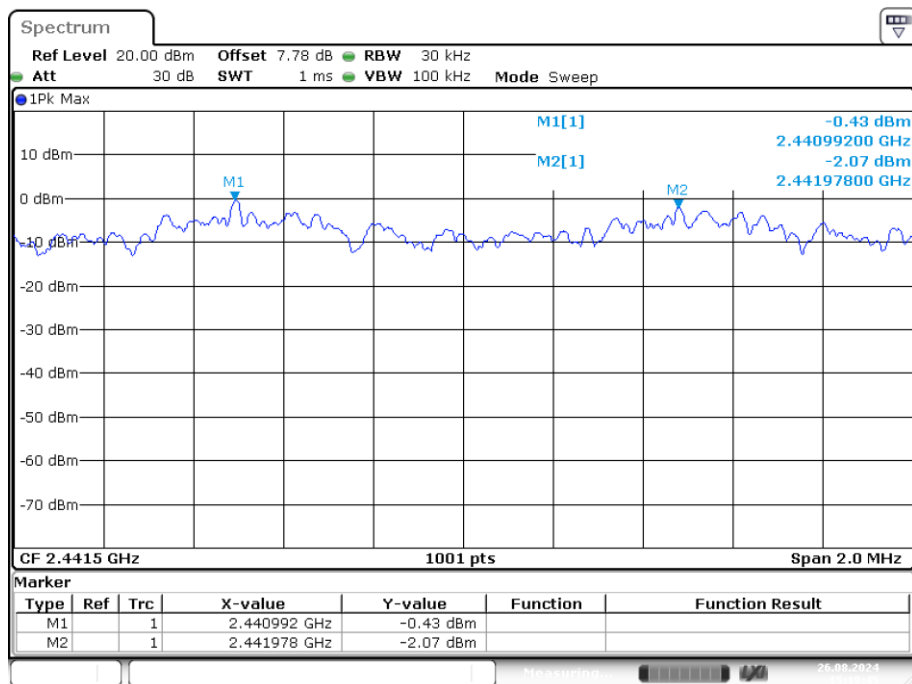
Date: 26.AUG.2024 14:37:11

## CFS NVNT 2-DH1 2441MHz Ant1



Date: 26.AUG.2024 15:01:20

## CFS NVNT 3-DH1 2441MHz Ant1



Date: 26.AUG.2024 15:19:45

## 6. NUMBER OF HOPPING CHANNEL

### 6.1. Limit

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

### 6.2. Test Procedure

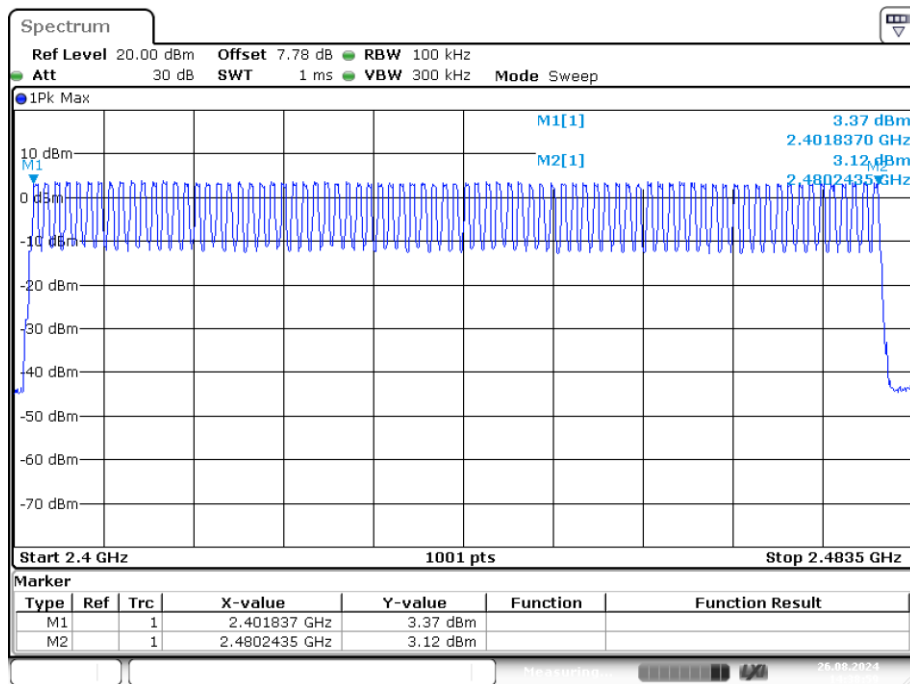
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The number of hopping channel was measured by spectrum analyzer with 100kHz RBW and 300KHz VBW.

### 6.3. Test Result

| Condition | Mode  | Hopping Number | Limit | Verdict |
|-----------|-------|----------------|-------|---------|
| NVNT      | 1-DH1 | 79             | 15    | Pass    |
| NVNT      | 2-DH1 | 79             | 15    | Pass    |
| NVNT      | 3-DH1 | 79             | 15    | Pass    |

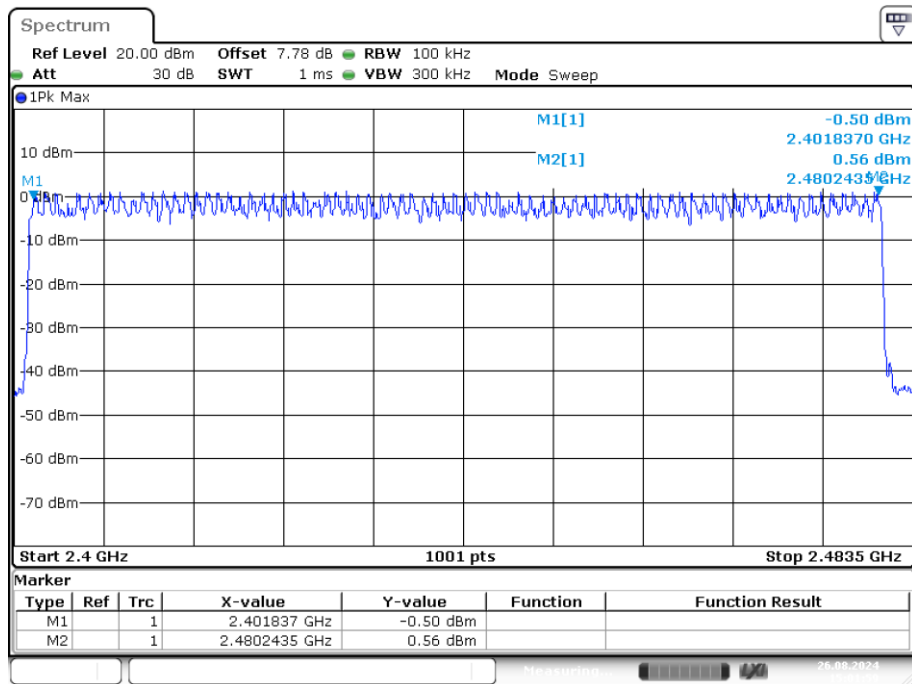
Note: All mode were tested, this Report only show the test plots of the worst case.

Hopping No. NVNT 1-DH1 2441MHz Ant1



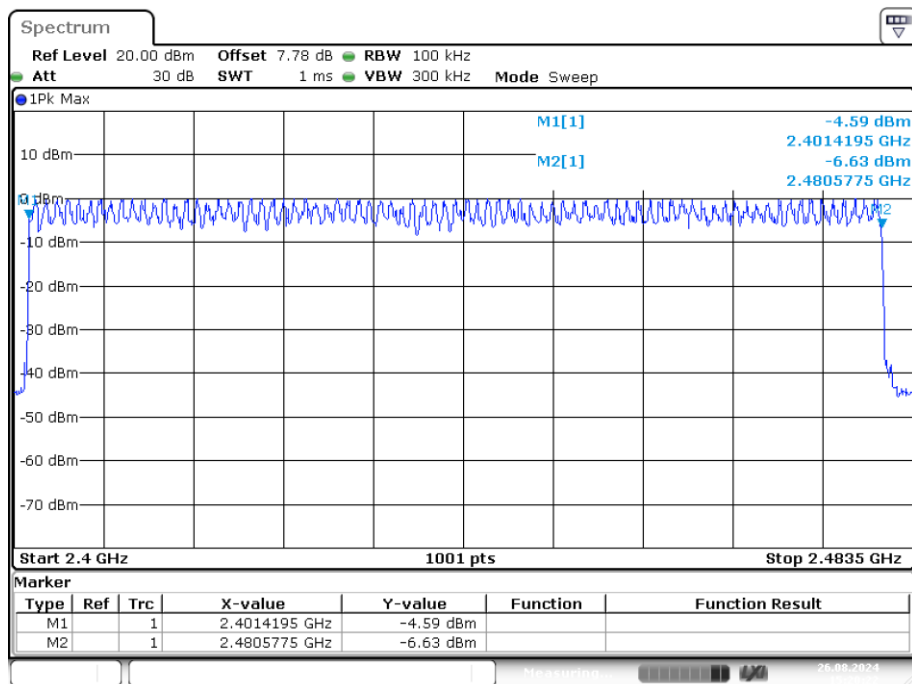
Date: 26.AUG.2024 14:38:59

## Hopping No. NVNT 2-DH1 2441MHz Ant1



Date: 26.AUG.2024 15:01:59

## Hopping No. NVNT 3-DH1 2441MHz Ant1



Date: 26.AUG.2024 15:20:23

## 7. DWELL TIME

### 7.1. Test limit

Please refer section 15.247.

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

### 7.2. Test Procedure

7.2.1. Place the EUT on the table and set it in transmitting mode.

7.2.2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

7.2.3. Set center frequency of spectrum analyzer = operating frequency.

7.2.4. Set the spectrum analyzer as RBW=1MHz, VBW=1MHz, Span = 0Hz, Sweep = auto.

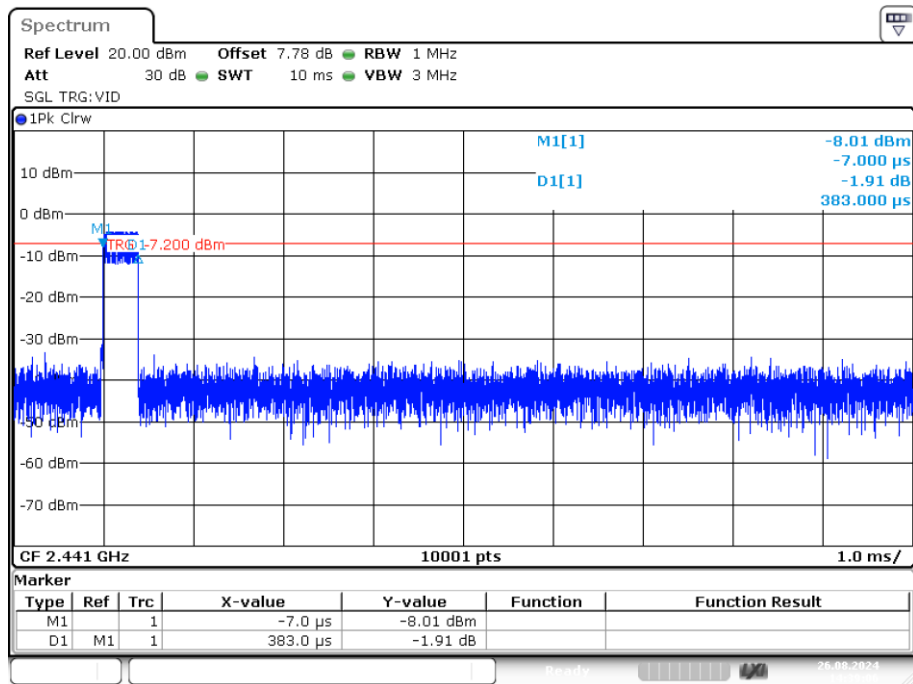
7.2.5. Repeat above procedures until all frequency measured were complete.

### 7.3. Test Result

| Condition | Mode  | Frequency (MHz) | Antenna | Pulse Time (ms) | Total Dwell Time (ms) | Burst Count | Period Time (ms) | Limit (ms) | Verdict |
|-----------|-------|-----------------|---------|-----------------|-----------------------|-------------|------------------|------------|---------|
| NVNT      | 1-DH1 | 2441            | Ant1    | 0.383           | 121.794               | 318         | 31600            | 400        | Pass    |
| NVNT      | 1-DH3 | 2441            | Ant1    | 1.639           | 263.879               | 161         | 31600            | 400        | Pass    |
| NVNT      | 1-DH5 | 2441            | Ant1    | 2.887           | 357.988               | 124         | 31600            | 400        | Pass    |
| NVNT      | 2-DH1 | 2441            | Ant1    | 0.389           | 124.091               | 319         | 31600            | 400        | Pass    |
| NVNT      | 2-DH3 | 2441            | Ant1    | 1.64            | 270.6                 | 165         | 31600            | 400        | Pass    |
| NVNT      | 2-DH5 | 2441            | Ant1    | 2.888           | 268.584               | 93          | 31600            | 400        | Pass    |
| NVNT      | 3-DH1 | 2441            | Ant1    | 0.389           | 123.702               | 318         | 31600            | 400        | Pass    |
| NVNT      | 3-DH3 | 2441            | Ant1    | 1.639           | 263.879               | 161         | 31600            | 400        | Pass    |
| NVNT      | 3-DH5 | 2441            | Ant1    | 2.891           | 291.991               | 101         | 31600            | 400        | Pass    |

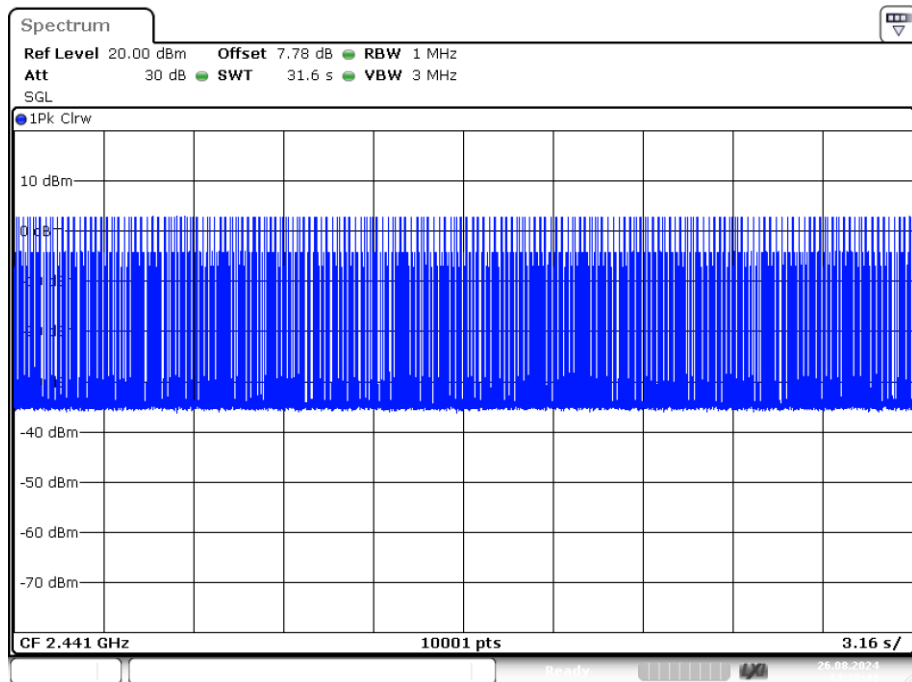
Note: Total Dwell Time= Pulse Time\* Burst Count

## Dwell NVNT 1-DH1 2441MHz Ant1 One Burst



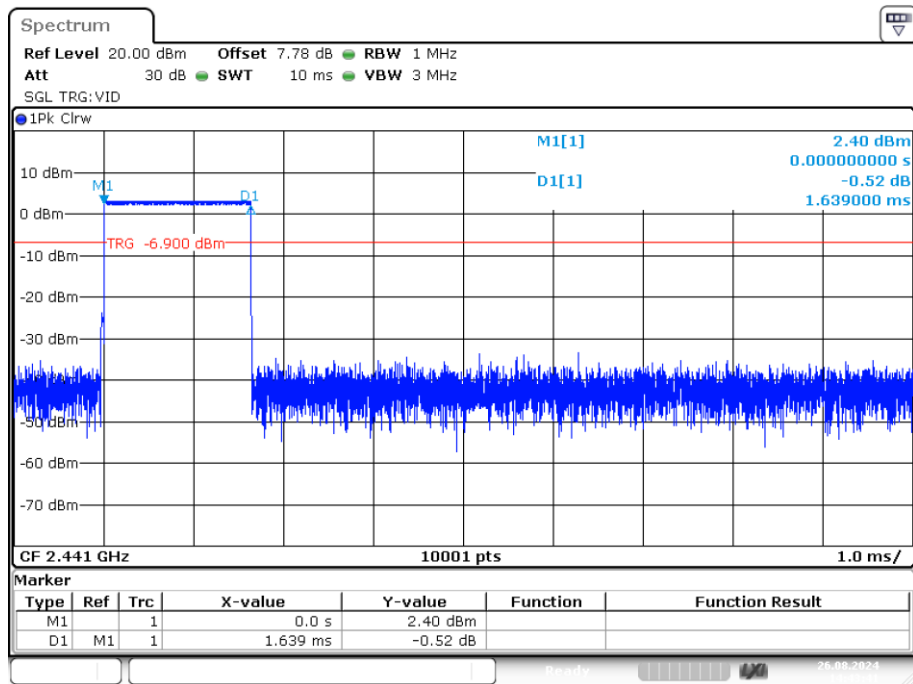
Date: 26.AUG.2024 14:39:06

## Dwell NVNT 1-DH1 2441MHz Ant1 Accumulated



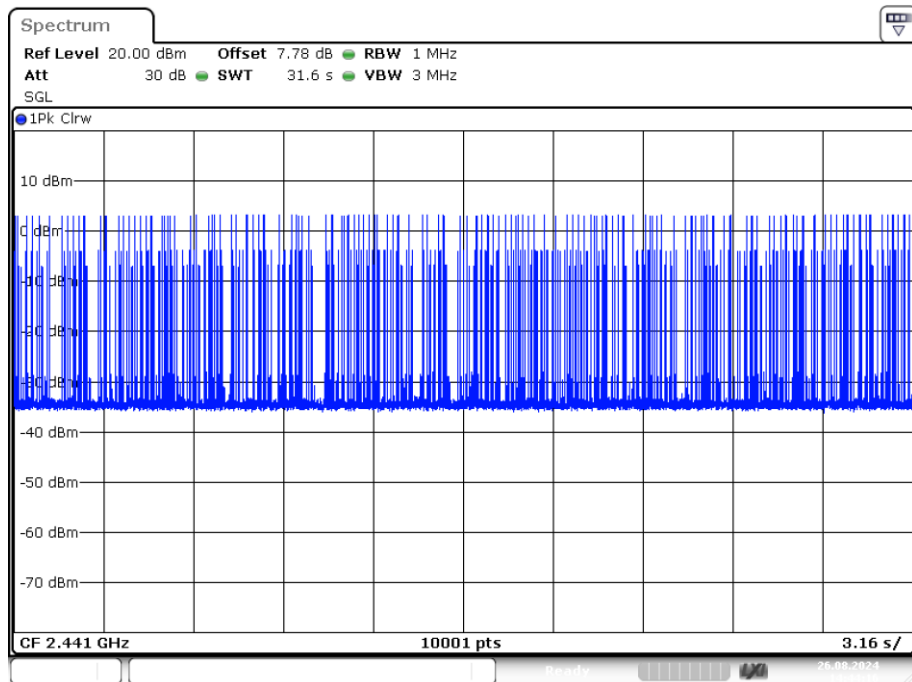
Date: 26.AUG.2024 14:39:41

## Dwell NVNT 1-DH3 2441MHz Ant1 One Burst



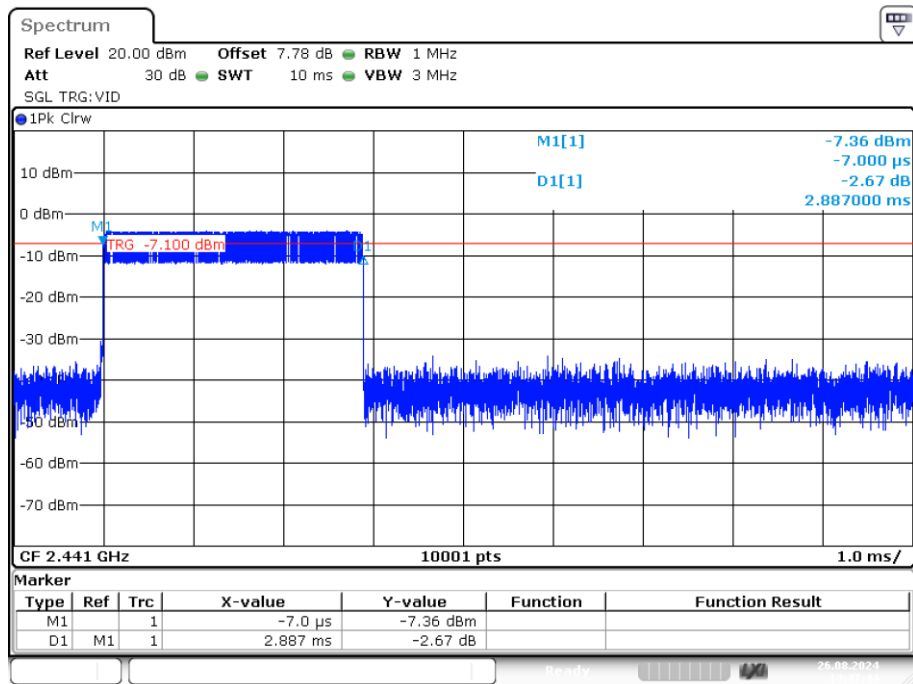
Date: 26.AUG.2024 14:43:41

## Dwell NVNT 1-DH3 2441MHz Ant1 Accumulated



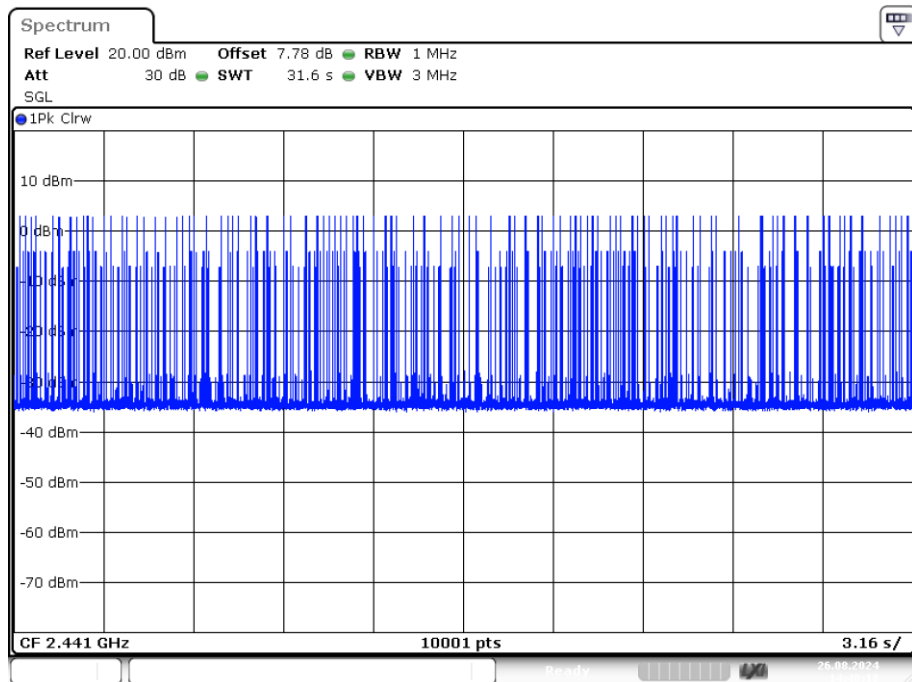
Date: 26.AUG.2024 14:44:16

## Dwell NVNT 1-DH5 2441MHz Ant1 One Burst



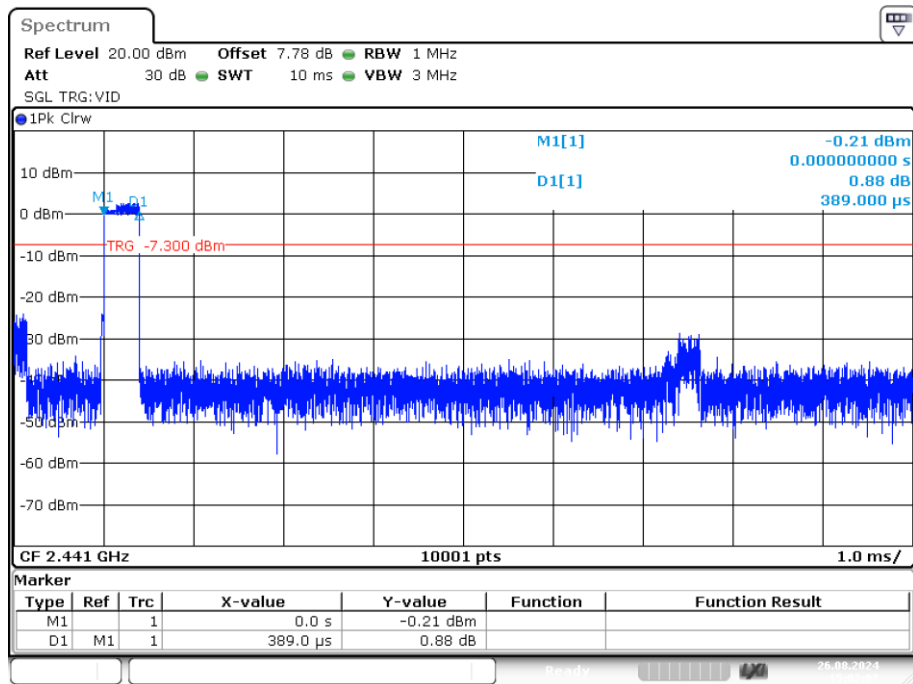
Date: 26.AUG.2024 14:47:43

## Dwell NVNT 1-DH5 2441MHz Ant1 Accumulated



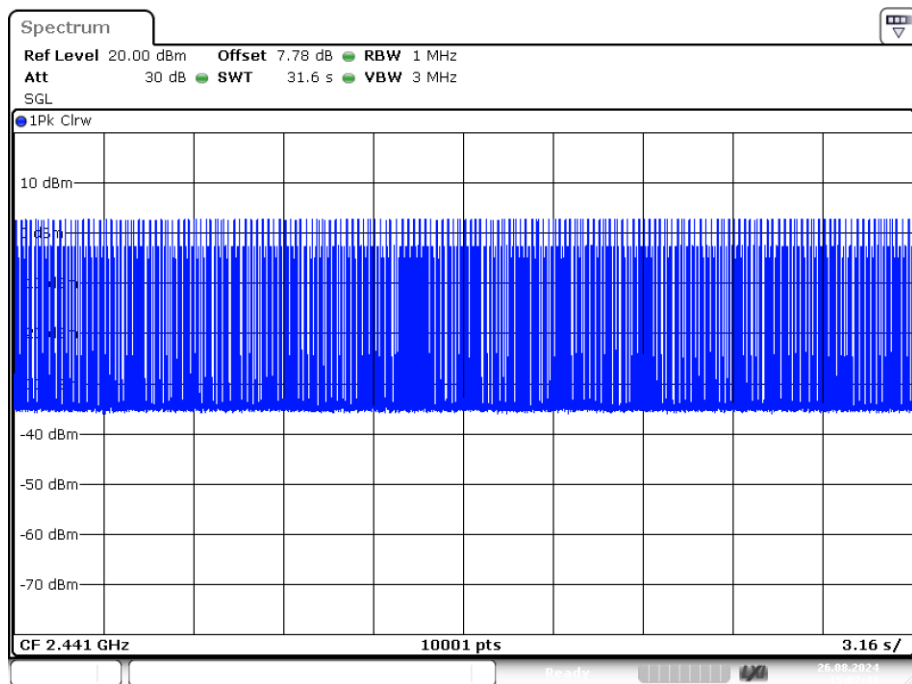
Date: 26.AUG.2024 14:48:18

## Dwell NVNT 2-DH1 2441MHz Ant1 One Burst



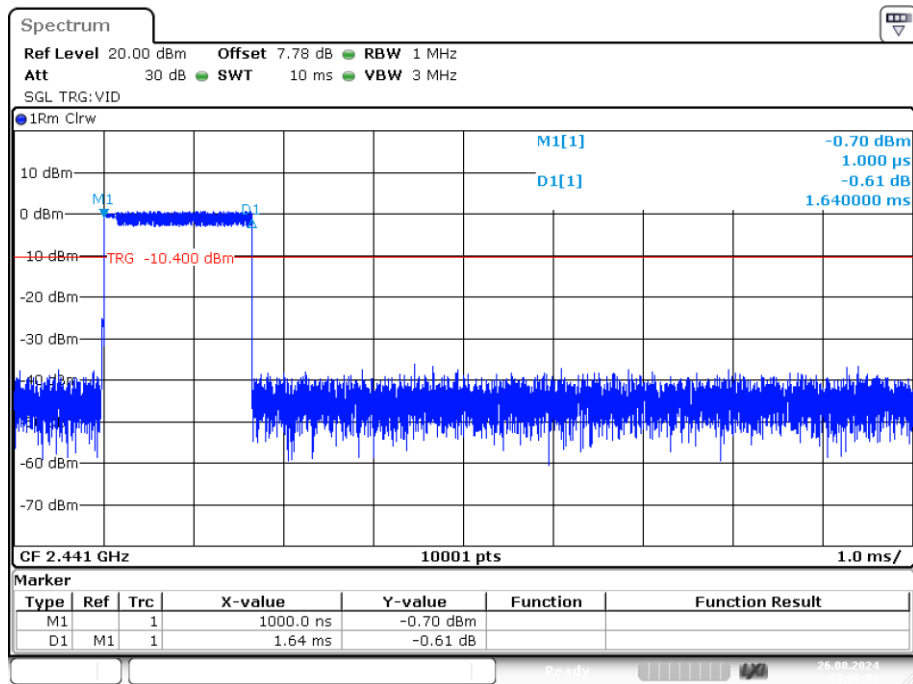
Date: 26.AUG.2024 15:02:06

## Dwell NVNT 2-DH1 2441MHz Ant1 Accumulated



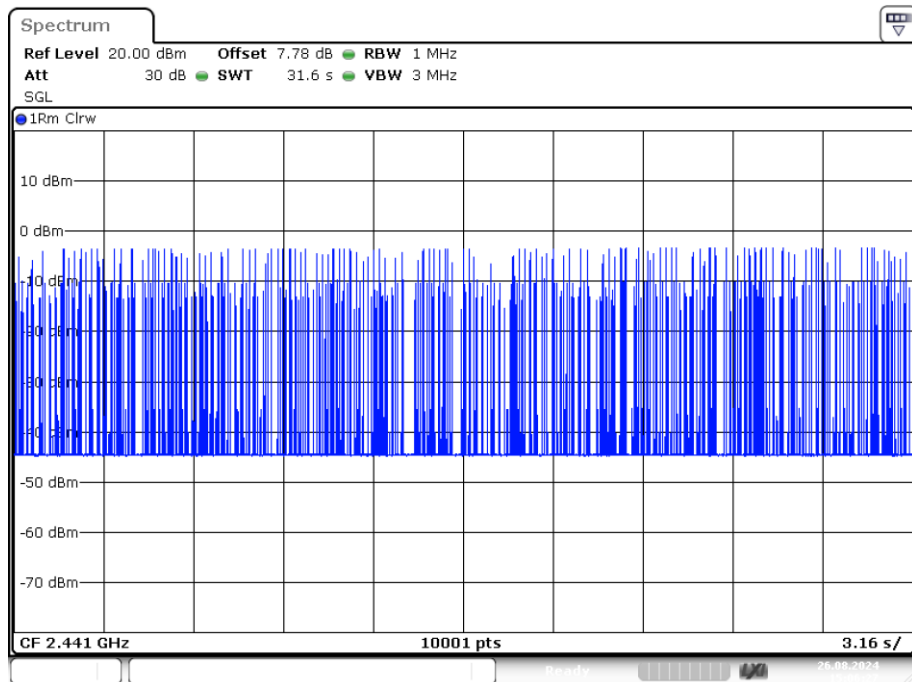
Date: 26.AUG.2024 15:02:41

## Dwell NVNT 2-DH3 2441MHz Ant1 One Burst



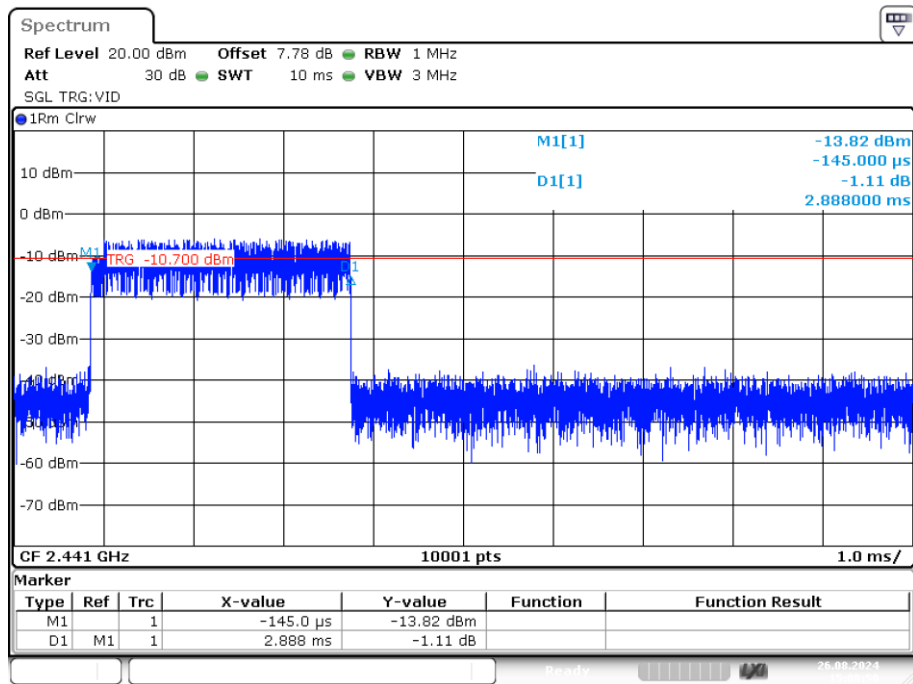
Date: 26.AUG.2024 15:05:53

## Dwell NVNT 2-DH3 2441MHz Ant1 Accumulated



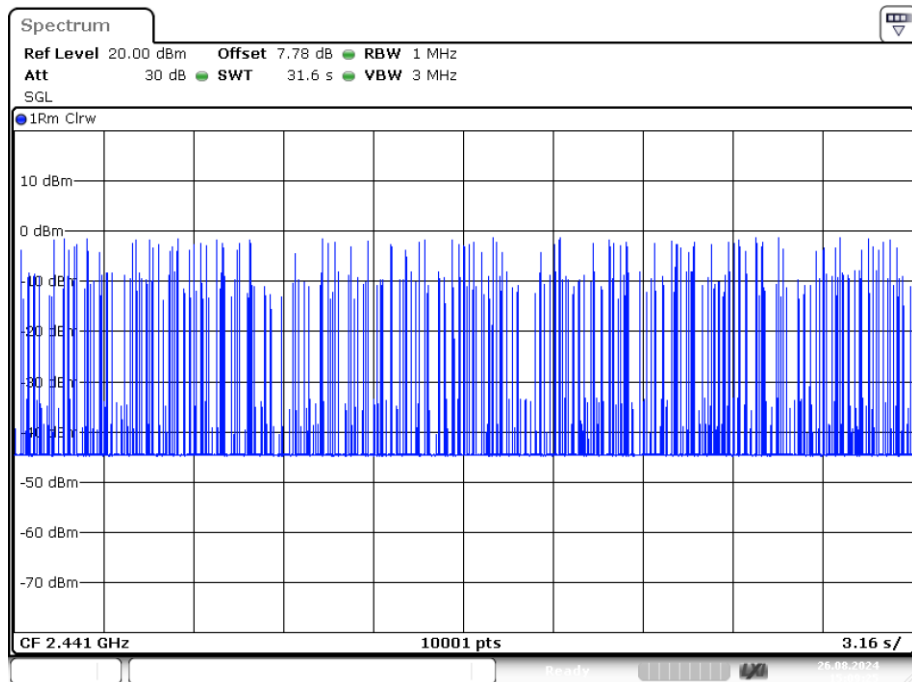
Date: 26.AUG.2024 15:06:27

## Dwell NVNT 2-DH5 2441MHz Ant1 One Burst



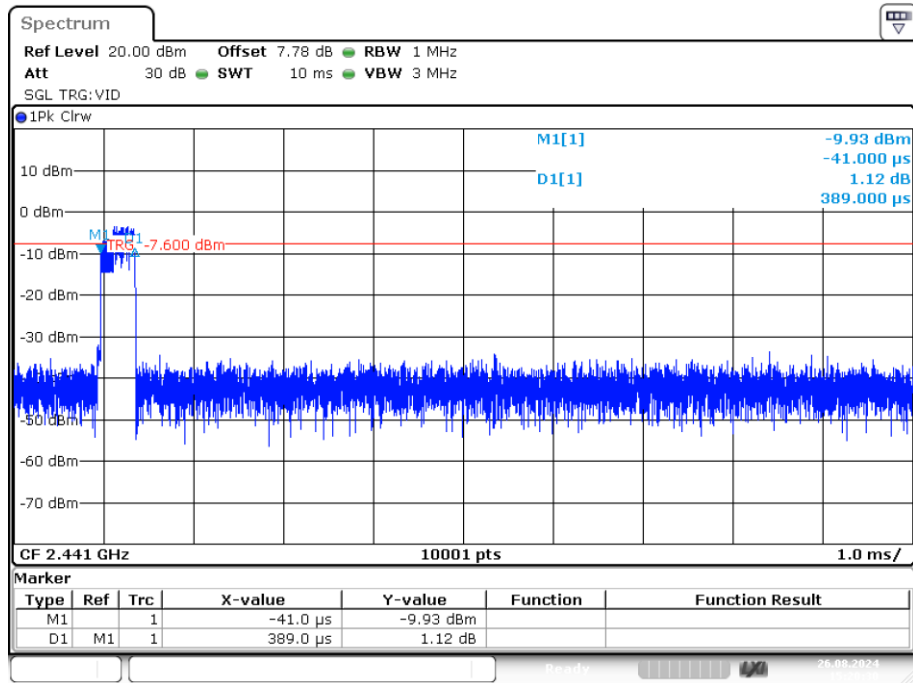
Date: 26.AUG.2024 15:08:50

## Dwell NVNT 2-DH5 2441MHz Ant1 Accumulated



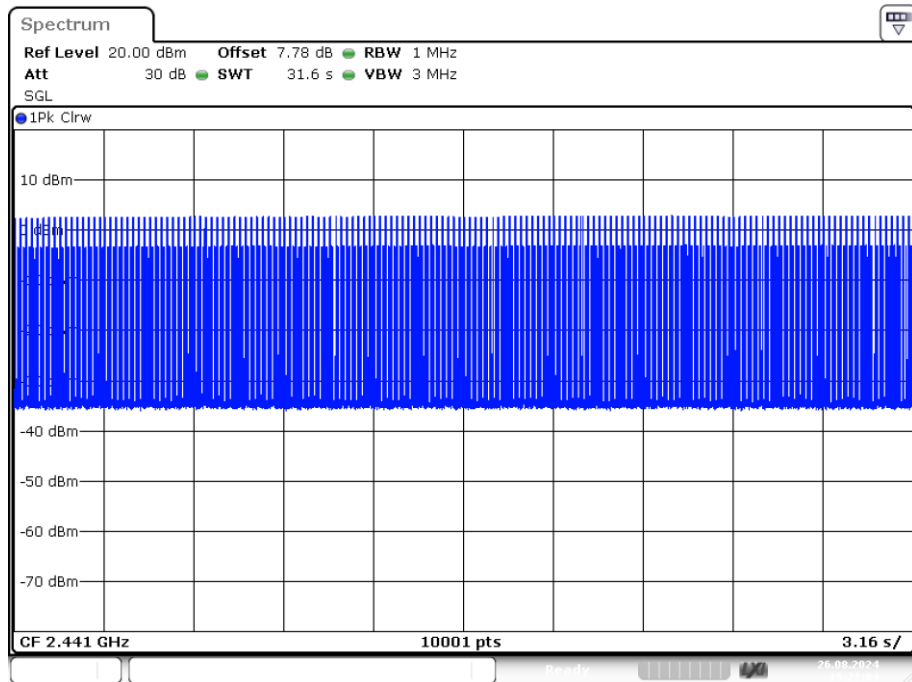
Date: 26.AUG.2024 15:09:25

## Dwell NVNT 3-DH1 2441MHz Ant1 One Burst



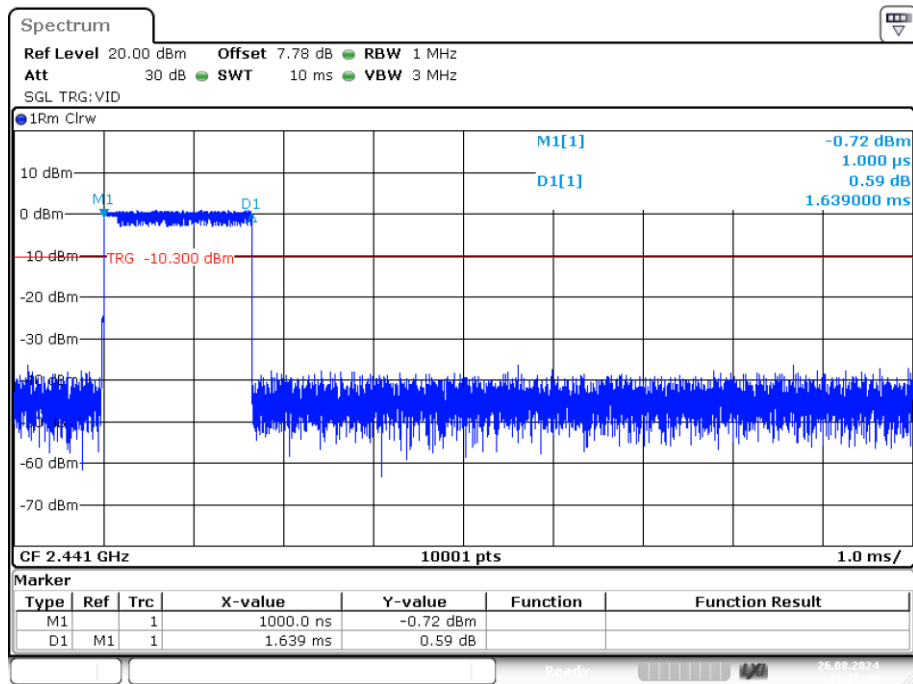
Date: 26.AUG.2024 15:20:30

## Dwell NVNT 3-DH1 2441MHz Ant1 Accumulated



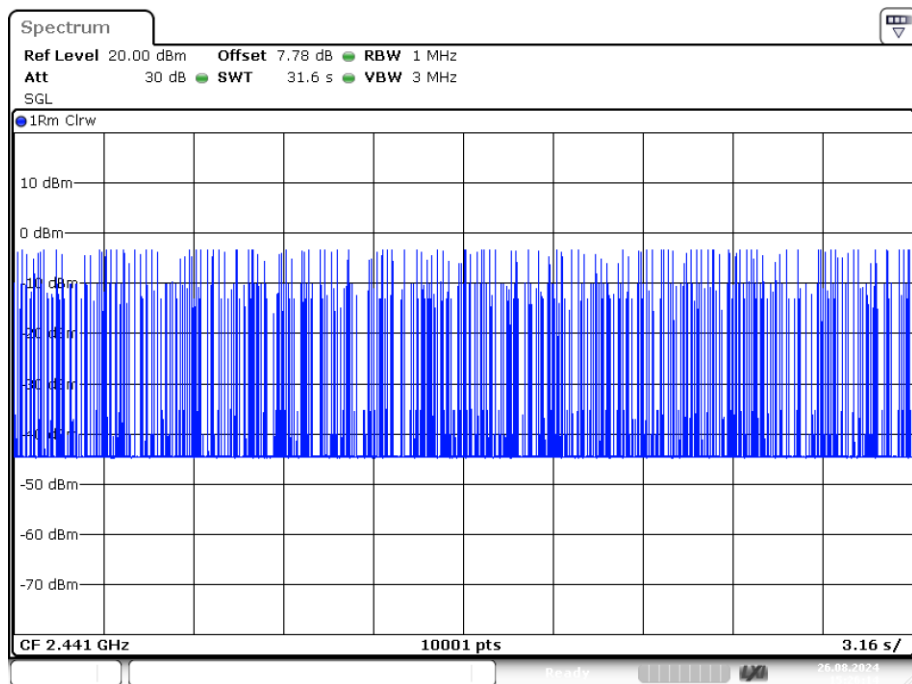
Date: 26.AUG.2024 15:21:04

## Dwell NVNT 3-DH3 2441MHz Ant1 One Burst



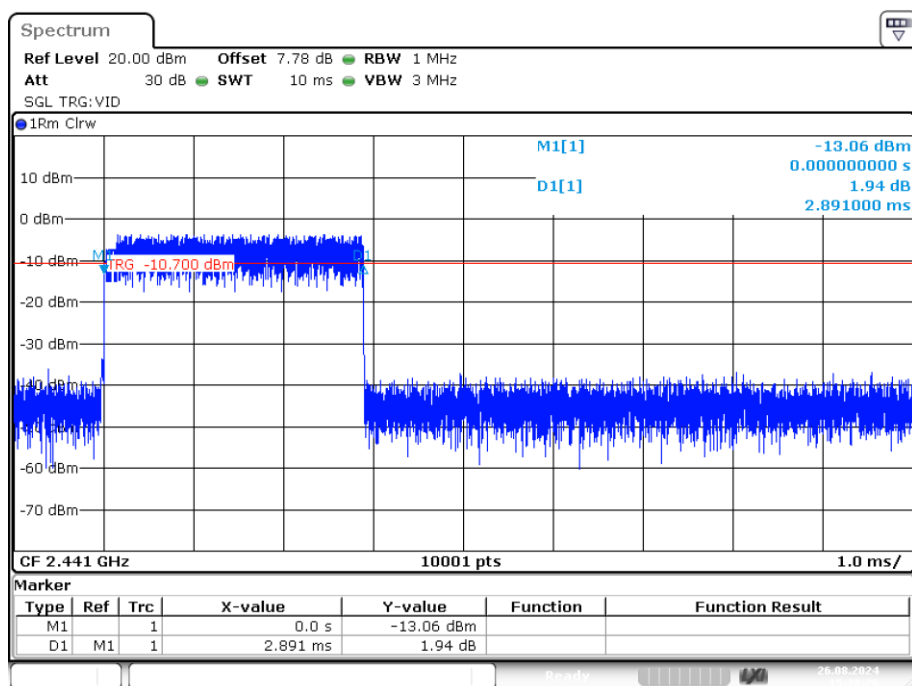
Date: 26.AUG.2024 15:25:40

## Dwell NVNT 3-DH3 2441MHz Ant1 Accumulated



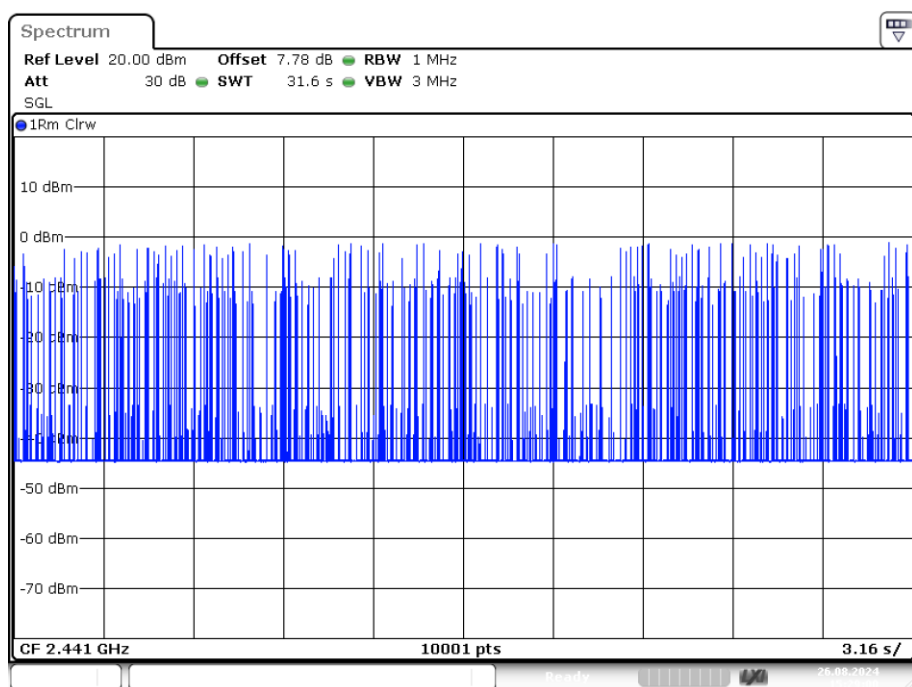
Date: 26.AUG.2024 15:26:14

## Dwell NVNT 3-DH5 2441MHz Ant1 One Burst



Date: 26.AUG.2024 15:28:25

## Dwell NVNT 3-DH5 2441MHz Ant1 Accumulated



Date: 26.AUG.2024 15:29:00

## 8. RADIATED EMISSIONS

### 8.1. Limit

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

#### 15.205 Restricted frequency band

| MHz                        | MHz                   | MHz             | GHz              |
|----------------------------|-----------------------|-----------------|------------------|
| 0.090 - 0.110              | 16.42 - 16.423        | 399.9 - 410     | 4.5 - 5.15       |
| <sup>1</sup> 0.495 - 0.505 | 16.69475 - 16.69525   | 608 - 614       | 5.35 - 5.46      |
| 2.1735 - 2.1905            | 16.80425 - 16.80475   | 960 - 1240      | 7.25 - 7.75      |
| 4.125 - 4.128              | 25.5 - 25.67          | 1300 - 1427     | 8.025 - 8.5      |
| 4.17725 - 4.17775          | 37.5 - 38.25          | 1435 - 1626.5   | 9.0 - 9.2        |
| 4.20725 - 4.20775          | 73 - 74.6             | 1645.5 - 1646.5 | 9.3 - 9.5        |
| 6.215 - 6.218              | 74.8 - 75.2           | 1660 - 1710     | 10.6 - 12.7      |
| 6.26775 - 6.26825          | 108 - 121.94          | 1718.8 - 1722.2 | 13.25 - 13.4     |
| 6.31175 - 6.31225          | 123 - 138             | 2200 - 2300     | 14.47 - 14.5     |
| 8.291 - 8.294              | 149.9 - 150.05        | 2310 - 2390     | 15.35 - 16.2     |
| 8.362 - 8.366              | 156.52475 - 156.52525 | 2483.5 - 2500   | 17.7 - 21.4      |
| 8.37625 - 8.38675          | 156.7 - 156.9         | 2690 - 2900     | 22.01 - 23.12    |
| 8.41425 - 8.41475          | 162.0125 - 167.17     | 3260 - 3267     | 23.6 - 24.0      |
| 12.29 - 12.293             | 167.72 - 173.2        | 3332 - 3339     | 31.2 - 31.8      |
| 12.51975 - 12.52025        | 240 - 285             | 3345.8 - 3358   | 36.43 - 36.5     |
| 12.57675 - 12.57725        | 322 - 335.4           | 3600 - 4400     | ( <sup>2</sup> ) |

#### 15.209 Limit

| FREQUENCY<br>MHz | DISTANCE<br>Meters | FIELD STRENGTHS LIMIT                           |          |
|------------------|--------------------|-------------------------------------------------|----------|
|                  |                    | μV/m                                            | dB(μV)/m |
| 0.009-0.490      | 300                | 2400/F(KHz)                                     | /        |
| 0.490-1.705      | 30                 | 24000/F(KHz)                                    | /        |
| 1.705-30         | 30                 | 30                                              | 29.5     |
| 30 ~ 88          | 3                  | 100                                             | 40.0     |
| 88 ~ 216         | 3                  | 150                                             | 43.5     |
| 216 ~ 960        | 3                  | 200                                             | 46.0     |
| 960 ~ 1000       | 3                  | 500                                             | 54.0     |
| Above 1000       | 3                  | 74.0 dB(μV)/m (Peak)<br>54.0 dB(μV)/m (Average) |          |

Note: The peak limit is 20 dB higher than the average limit

**Table 5 – General field strength limits at frequencies above 30 MHz**

| Frequency (MHz) | Field strength (µV/m at 3 m) |
|-----------------|------------------------------|
| 30 – 88         | 100                          |
| 88 – 216        | 150                          |
| 216 – 960       | 200                          |
| Above 960       | 500                          |

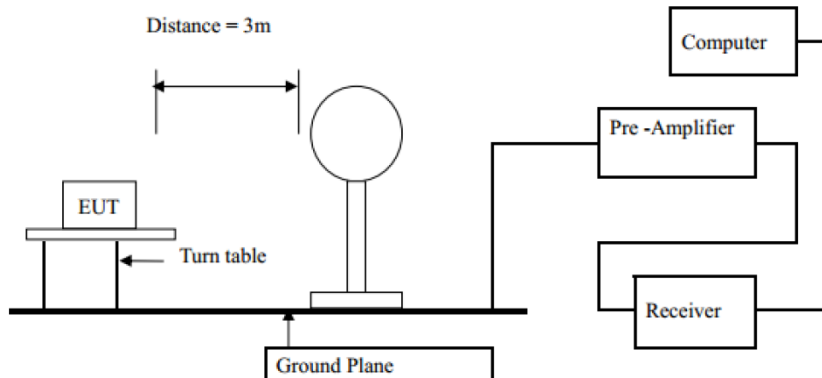
**Table 6 – General field strength limits at frequencies below 30 MHz**

| Frequency                     | Magnetic field strength (H-Field) (µA/m) | Measurement distance (m) |
|-------------------------------|------------------------------------------|--------------------------|
| 9 - 490 kHz <sup>Note 1</sup> | 6.37/F (F in kHz)                        | 300                      |
| 490 - 1705 kHz                | 63.7/F (F in kHz)                        | 30                       |
| 1.705 - 30 MHz                | 0.08                                     | 30                       |

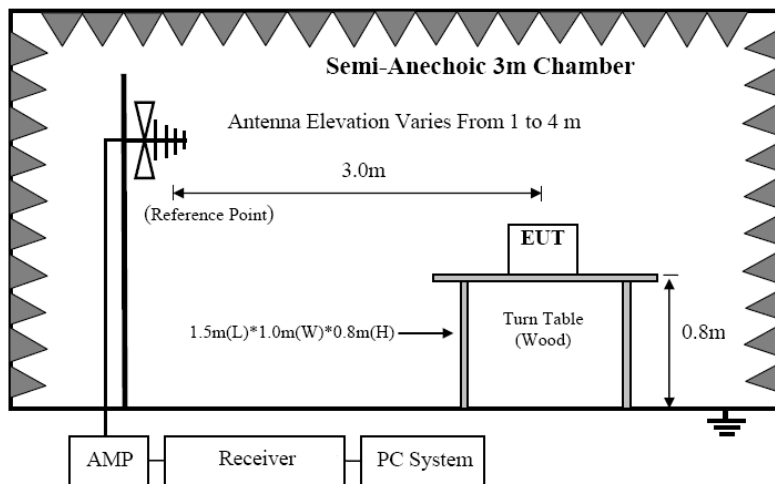
**Note 1:** The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

## 8.2. Block Diagram of Test setup

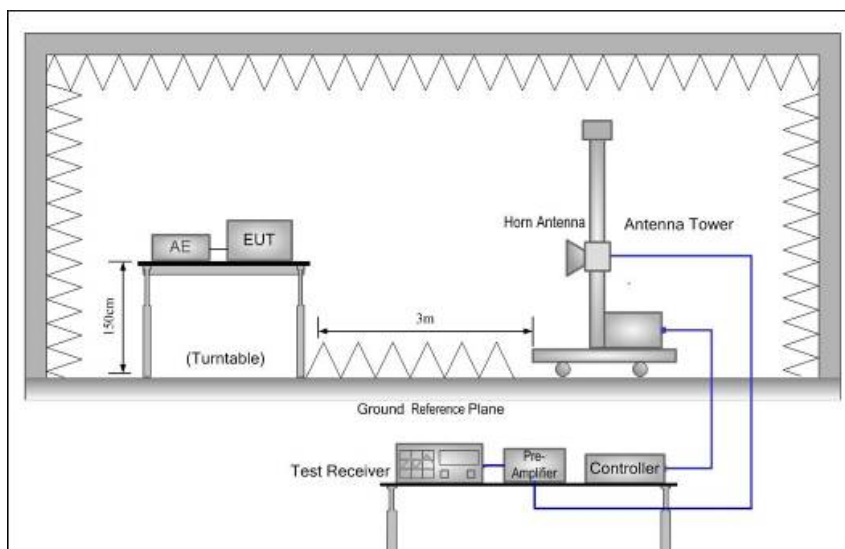
### 8.2.1 In 3m Anechoic Chamber Test Setup Diagram for below 30MHz



### 8.2.1 In 3m Anechoic Chamber Test Setup Diagram for below 1GHz



### 8.2.2 In 3m Anechoic Chamber Test Setup Diagram for frequency above 1GHz



Note: For harmonic emissions test a appropriate high pass filter was inserted in the input port of AMP.

### 8.3. Test Procedure

- (1) EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber.
- (2) Setup EUT and simulator as shown in section 1.4 and 6.1
- (3) Test antenna was located 3m from the EUT on an adjustable mast. Below pre-scan procedure was first performed in order to find prominent radiated emissions.
  - (a) Change work frequency or channel of device if practicable.
  - (b) Change modulation type of device if practicable.
  - (c) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions
- (4) Spectrum frequency from 9KHz to 25GHz (tenth harmonic of fundamental frequency) was investigated
- (5) For final emissions measurements at each frequency of interest, the EUT were rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10:2013on Radiated Emission test.
- (6) For emissions above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1MHz, VBW is set at 3MHz for Peak measure; RBW is set at 1MHz, VBW is set at 10Hz for Average measure.

### 8.4. Test Result

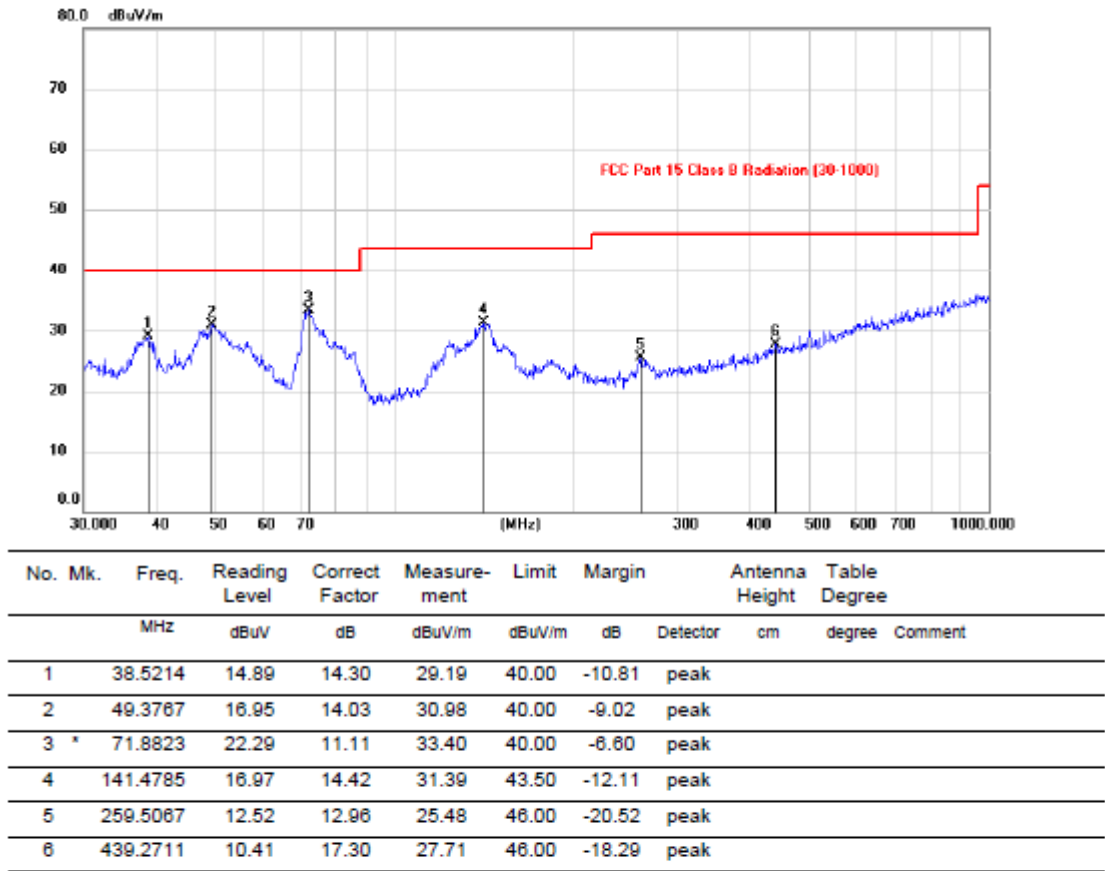
We have scanned the 10th harmonic from 9KHz to the EUT's highest frequency.  
Detailed information please see the following page.

From 9KHz to 30MHz: Conclusion: PASS

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

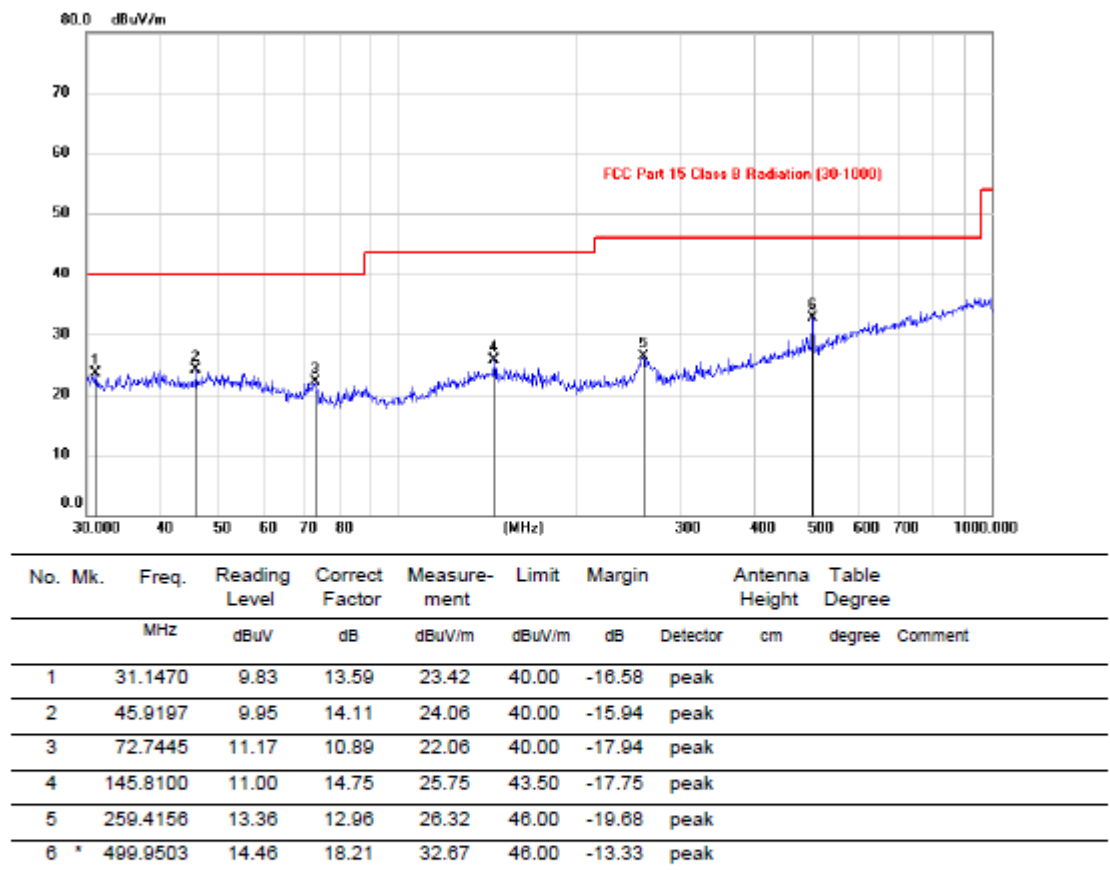
From 30MHz to 1000MHz: Conclusion: PASS

**Vertical:**



Note: 1. \*: Maximum data; x: Over limit; !: over margin.

2. Measurement = Reading Level + Correct Factor; Correct Factor = Antenna Factor + Cable Loss.

**Horizontal:**

Note: 1. \*:Maximum data; x:Over limit; !:over margin.

2.Measurement=Reading Level+Correct Factor; Correct Factor=Antenna Factor+Cable Loss.

Remark: All modes have been tested, and only worst data of GFSK 2402MHz was listed in this report.

From 1G-25GHz

| Test Mode: GFSK TX Low  |                     |             |                       |                |                 |                 |                |             |        |
|-------------------------|---------------------|-------------|-----------------------|----------------|-----------------|-----------------|----------------|-------------|--------|
| Freq (MHz)              | Read Level (dBuV/m) | Polar (H/V) | Antenna Factor (dB/m) | Cable loss(dB) | Amp Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
| 4804                    | 46.86               | V           | 33.95                 | 10.18          | 34.26           | 56.73           | 74             | -17.27      | PK     |
| 4804                    | 37.11               | V           | 33.95                 | 10.18          | 34.26           | 46.98           | 54             | -7.02       | AV     |
| 7206                    | /                   | /           | /                     | /              | /               | /               | /              | /           | /      |
| 9608                    | /                   | /           | /                     | /              | /               | /               | /              | /           | /      |
| 4804                    | 48.22               | H           | 33.95                 | 10.18          | 34.26           | 58.09           | 74             | -15.91      | PK     |
| 4804                    | 37.66               | H           | 33.95                 | 10.18          | 34.26           | 47.53           | 54             | -6.47       | AV     |
| 7206                    | /                   | /           | /                     | /              | /               | /               | /              | /           | /      |
| 9608                    | /                   | /           | /                     | /              | /               | /               | /              | /           | /      |
| Test Mode: GFSK TX Mid  |                     |             |                       |                |                 |                 |                |             |        |
| 4882                    | 44.69               | V           | 33.93                 | 10.2           | 34.29           | 54.53           | 74             | -19.47      | PK     |
| 4882                    | 33.12               | V           | 33.93                 | 10.2           | 34.29           | 42.96           | 54             | -11.04      | AV     |
| 7323                    | /                   | /           | /                     | /              | /               | /               | /              | /           | /      |
| 9764                    | /                   | /           | /                     | /              | /               | /               | /              | /           | /      |
| 4882                    | 46.00               | H           | 33.93                 | 10.2           | 34.29           | 55.84           | 74             | -18.16      | PK     |
| 4882                    | 34.54               | H           | 33.93                 | 10.2           | 34.29           | 44.38           | 54             | -9.62       | AV     |
| 7323                    | /                   | /           | /                     | /              | /               | /               | /              | /           | /      |
| 9764                    | /                   | /           | /                     | /              | /               | /               | /              | /           | /      |
| Test Mode: GFSK TX High |                     |             |                       |                |                 |                 |                |             |        |
| 4960                    | 44.35               | V           | 33.93                 | 10.2           | 34.29           | 54.19           | 74             | -19.81      | PK     |
| 4960                    | 36.23               | V           | 33.93                 | 10.2           | 34.29           | 46.07           | 54             | -7.93       | AV     |
| 7440                    | /                   | /           | /                     | /              | /               | /               | /              | /           | /      |
| 9920                    | /                   | /           | /                     | /              | /               | /               | /              | /           | /      |
| 4960                    | 44.34               | H           | 33.93                 | 10.2           | 34.29           | 54.18           | 74             | -19.82      | PK     |
| 4960                    | 33.10               | H           | 33.93                 | 10.2           | 34.29           | 42.94           | 54             | -11.06      | AV     |
| 7440                    | /                   | /           | /                     | /              | /               | /               | /              | /           | /      |
| 9920                    | /                   | /           | /                     | /              | /               | /               | /              | /           | /      |

Note:

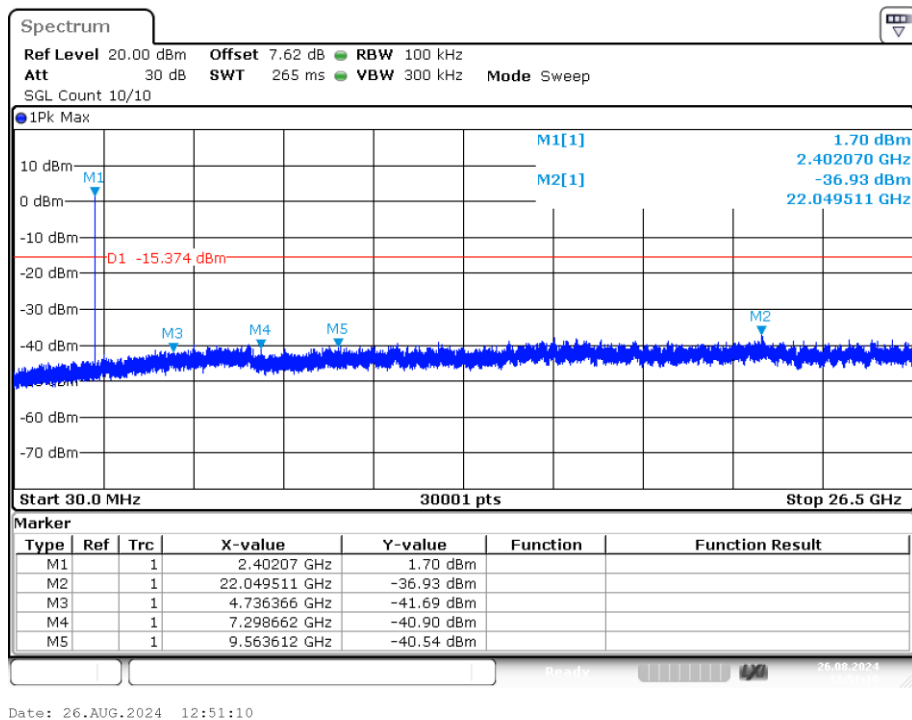
- 1, Result = Read level + Antenna factor + cable loss-Amp factor
- 2, All the other emissions not reported were too low to read and deemed to comply with FCC limit.
3. "/" means the test data is too lower than the limit.



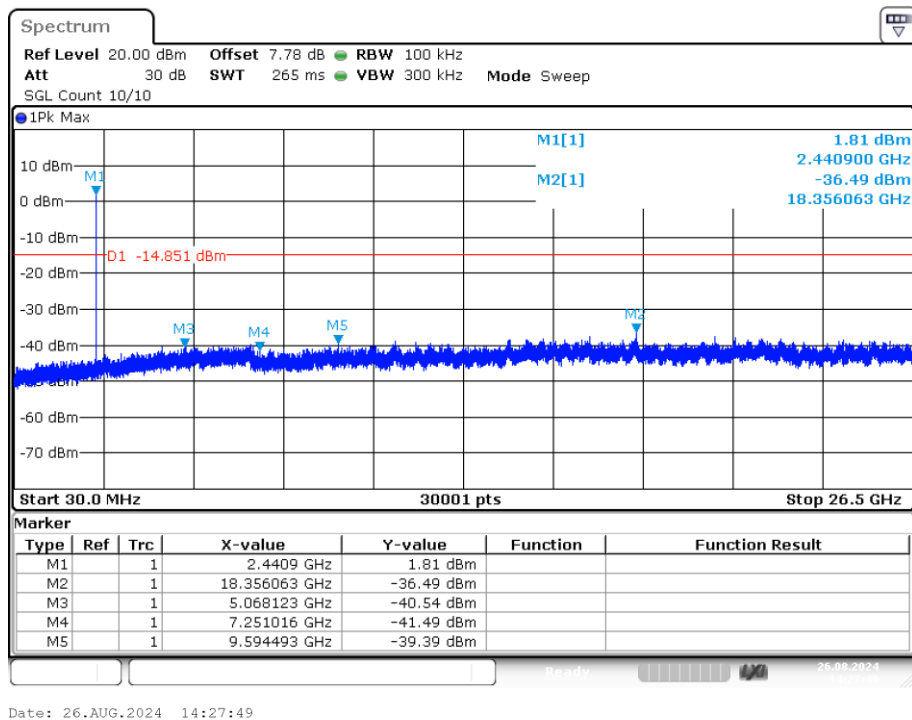


## Conducted RF Spurious Emission

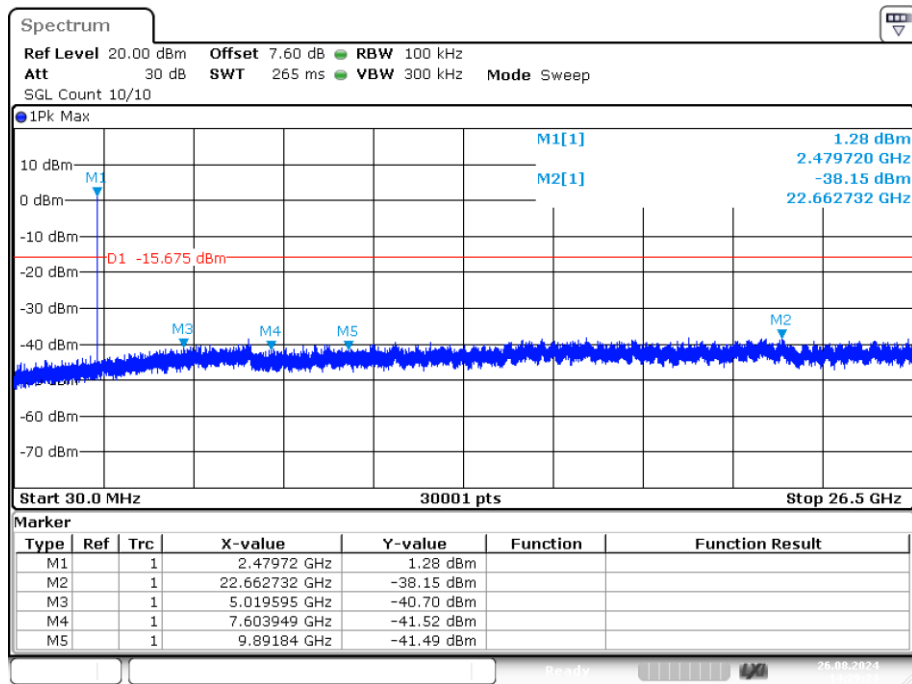
## Tx. Spurious NVNT 1-DH1 2402MHz Ant1 Emission



## Tx. Spurious NVNT 1-DH1 2441MHz Ant1 Emission

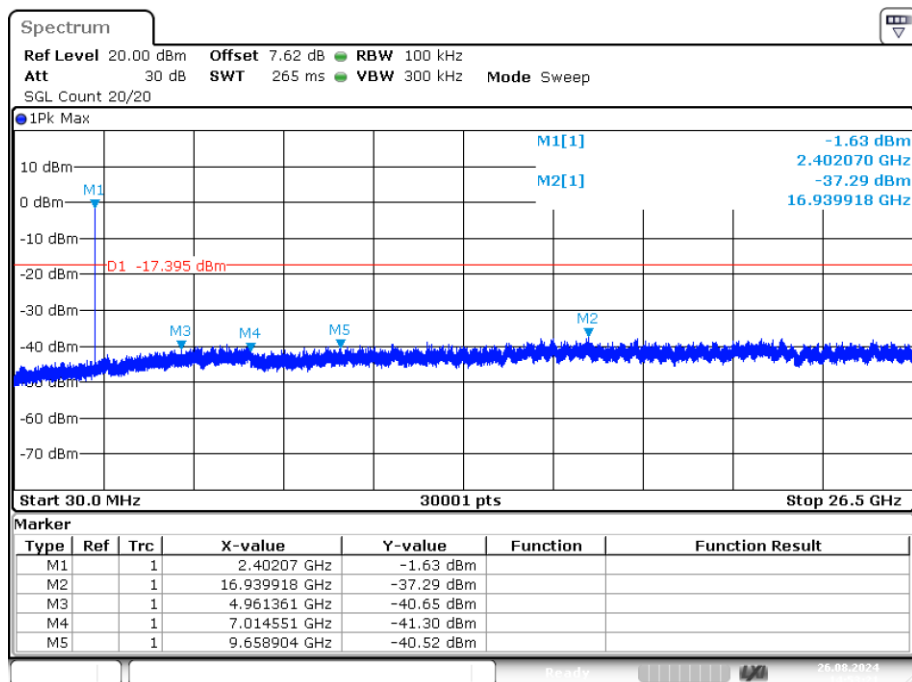


## Tx. Spurious NVNT 1-DH1 2480MHz Ant1 Emission



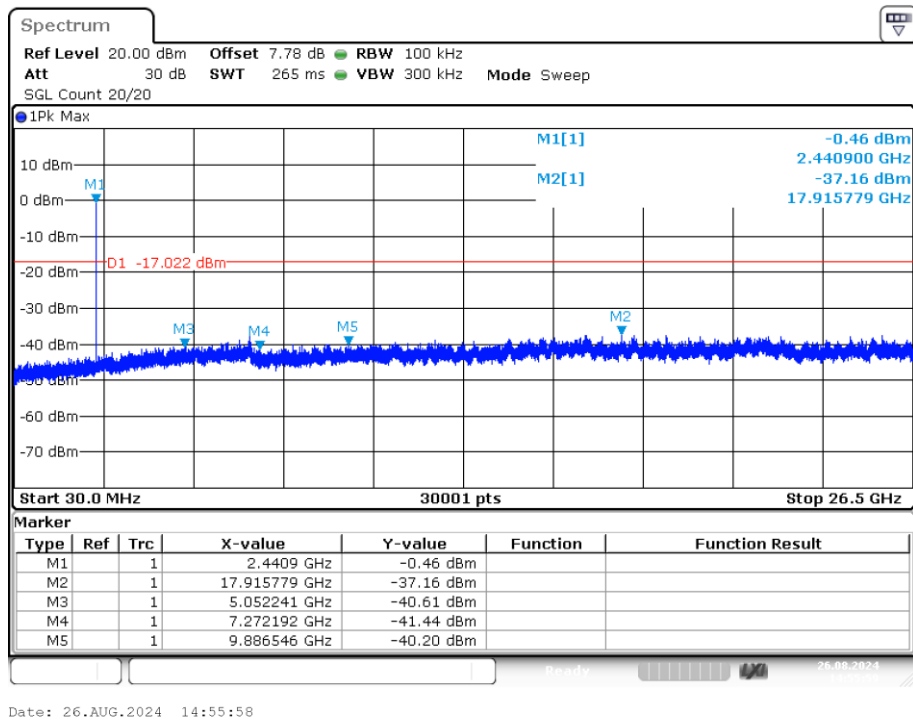
Date: 26.AUG.2024 14:29:24

## Tx. Spurious NVNT 2-DH1 2402MHz Ant1 Emission

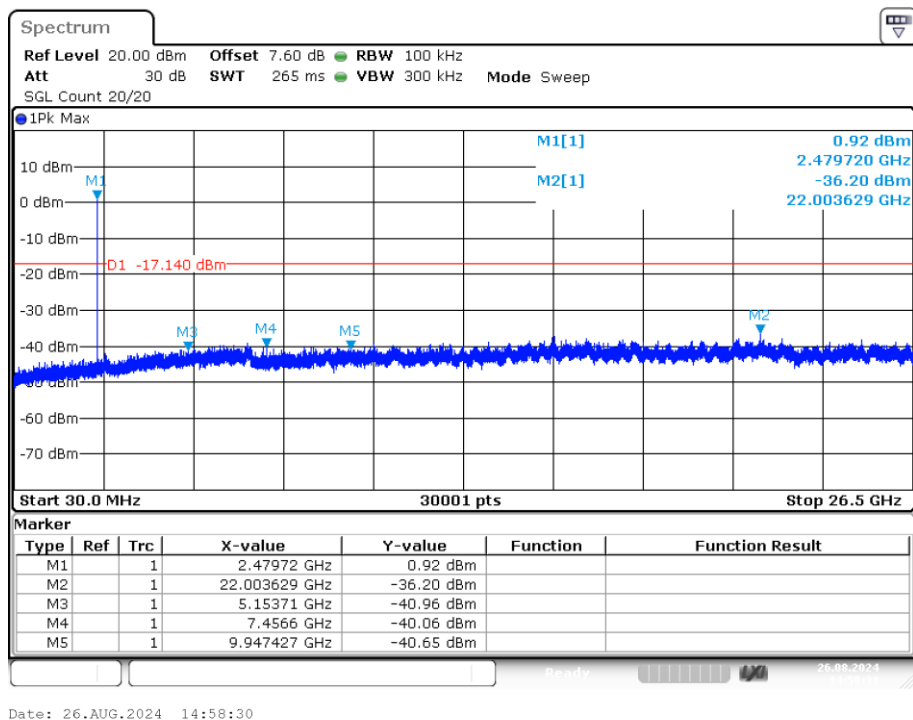


Date: 26.AUG.2024 14:53:21

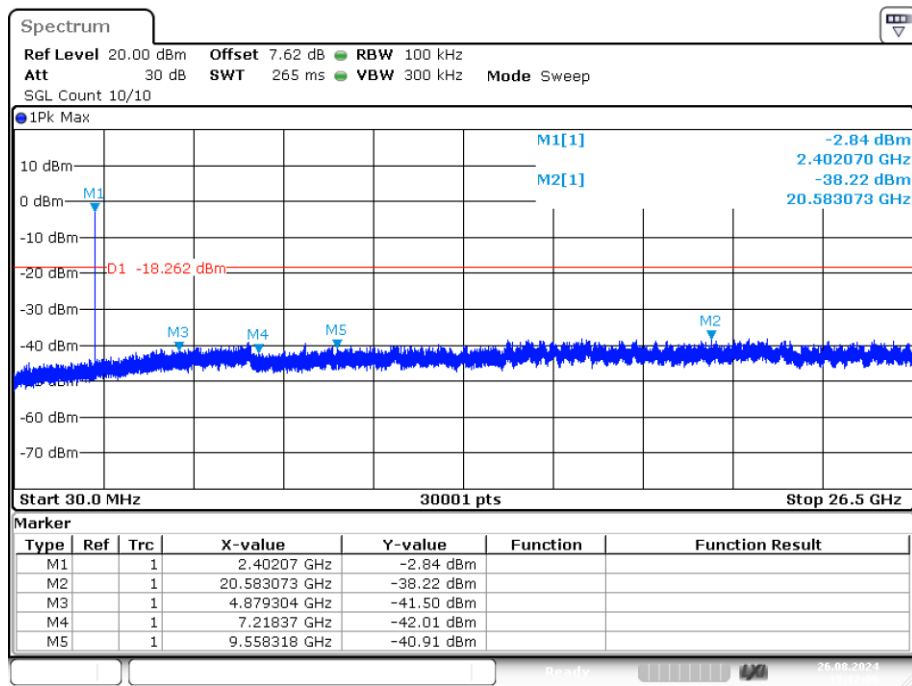
## Tx. Spurious NVNT 2-DH1 2441MHz Ant1 Emission



## Tx. Spurious NVNT 2-DH1 2480MHz Ant1 Emission

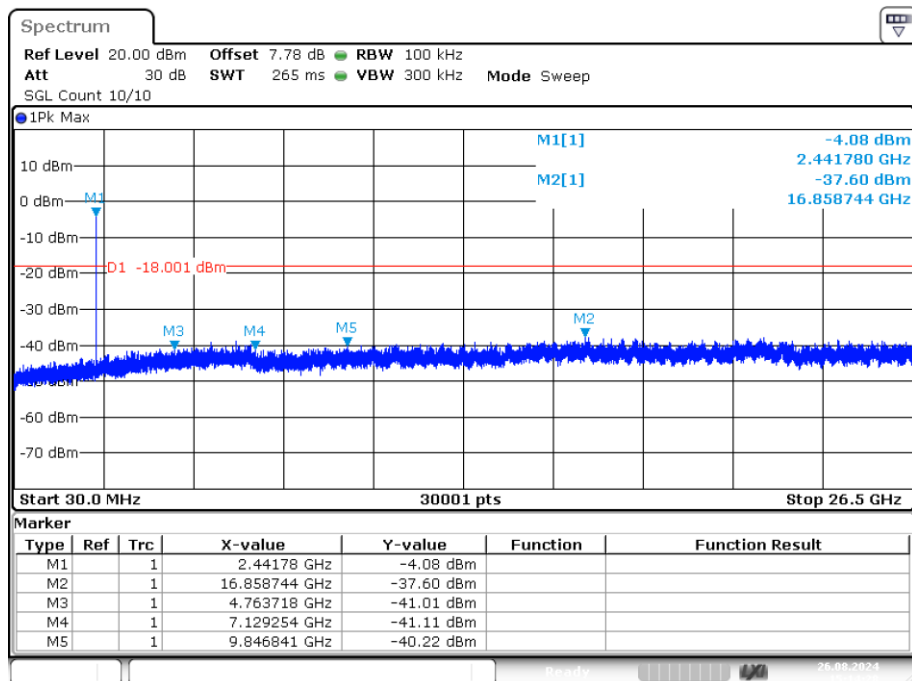


## Tx. Spurious NVNT 3-DH1 2402MHz Ant1 Emission



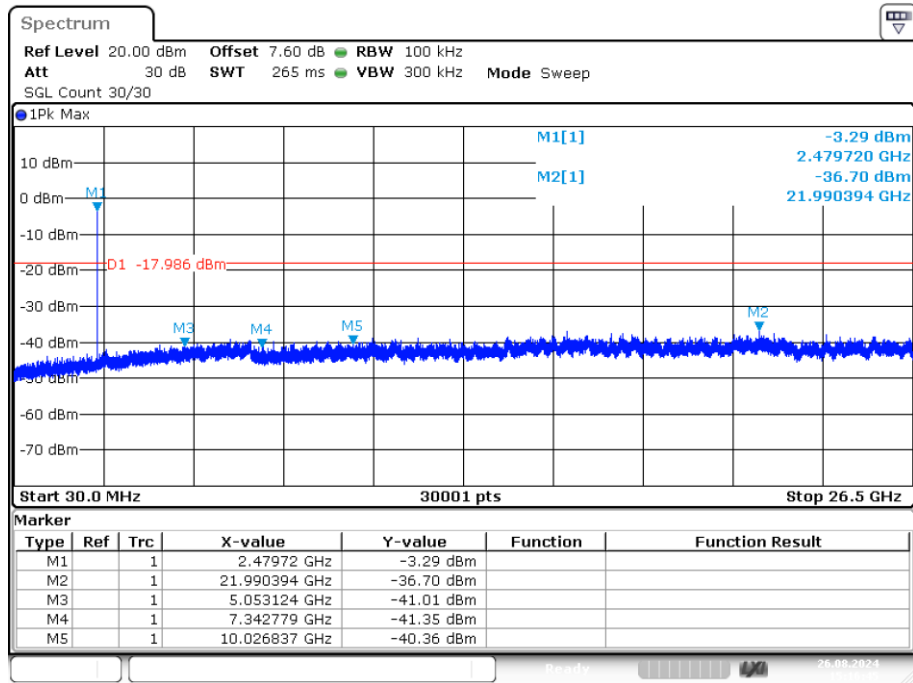
Date: 26.AUG.2024 15:12:06

## Tx. Spurious NVNT 3-DH1 2441MHz Ant1 Emission



Date: 26.AUG.2024 15:14:28

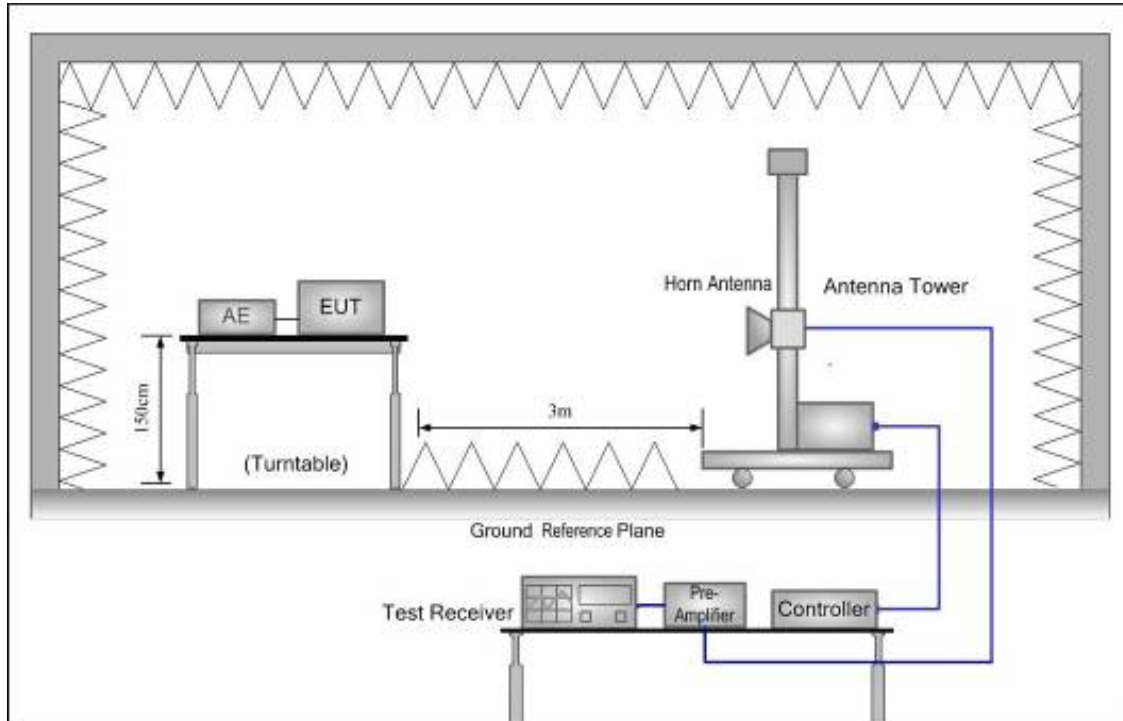
## Tx. Spurious NVNT 3-DH1 2480MHz Ant1 Emission



Date: 26.AUG.2024 15:16:45

## 9. BAND EDGE COMPLIANCE

### 9.1. Block Diagram of Test Setup



### 9.2. Limit

All the lower and upper band-edges emissions appearing within restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

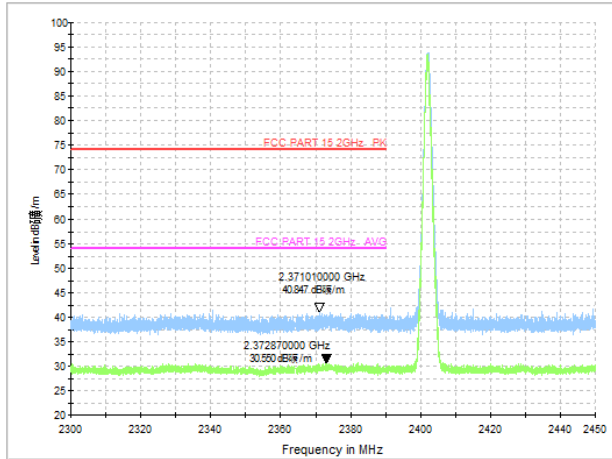
### 9.3. Test Procedure

All restriction band and non- restriction band have been tested , only worse case is reported.

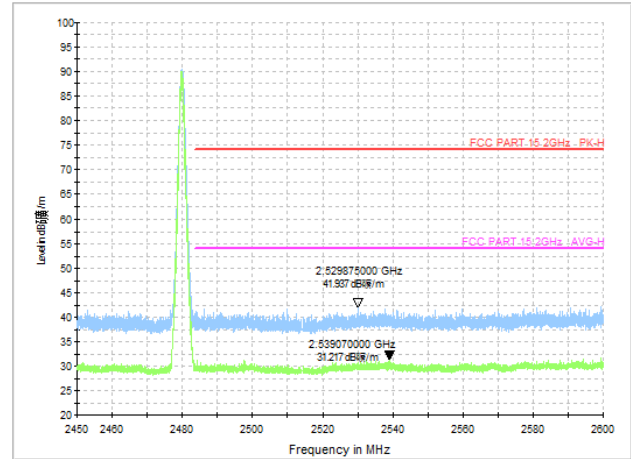
### 9.4. Test Result

PASS. (See below detailed test data)

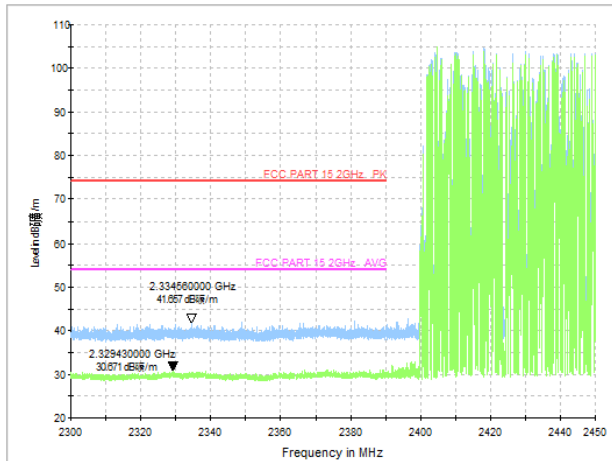
Test Mode: GFSK-Low Hopping-off



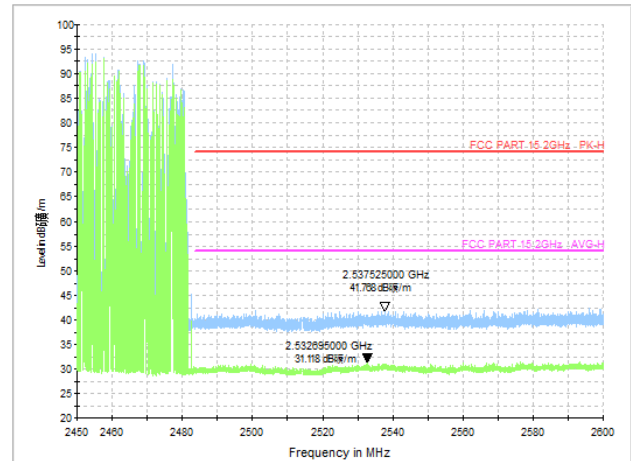
Test Mode: GFSK-High Hopping-off



Test Mode: GFSK-Low Hopping-on

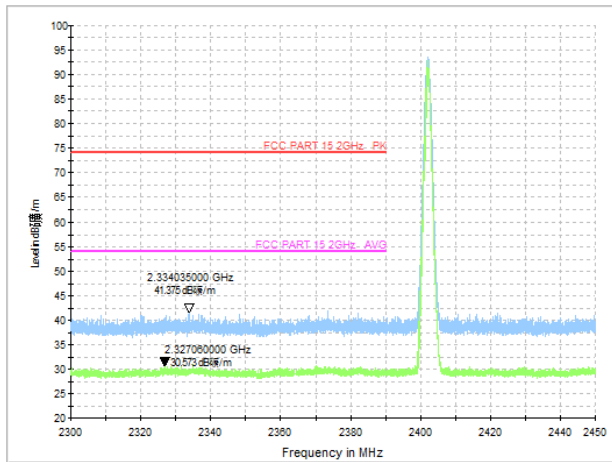
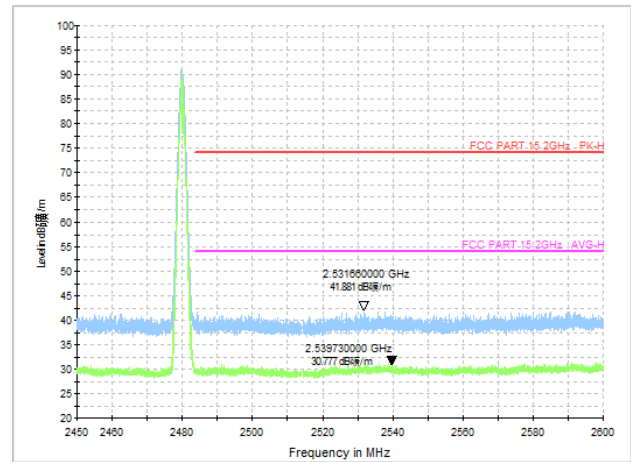
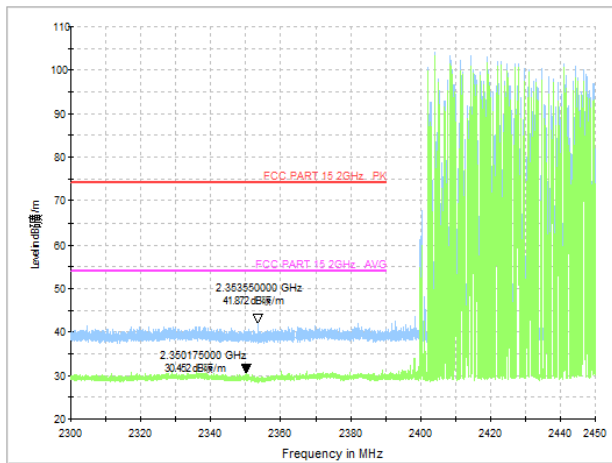
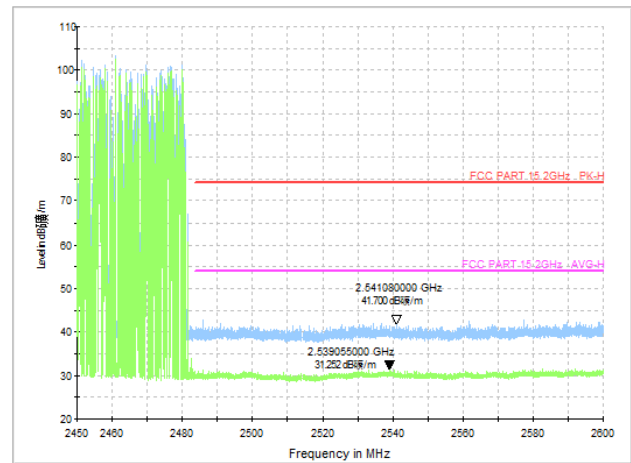


Test Mode: GFSK-High Hopping-on



Note: 1. \*:Maximum data; x:Over limit; !:over margin.

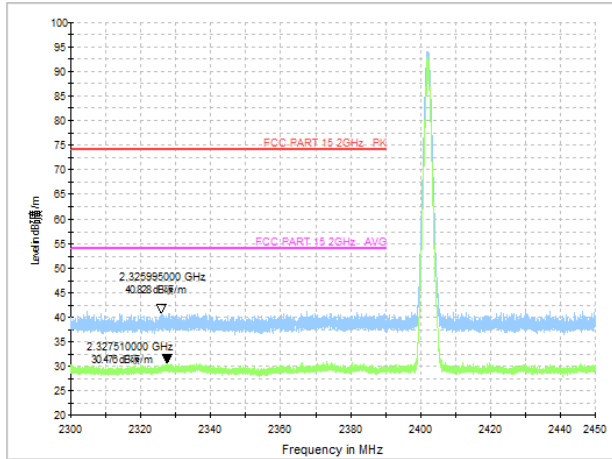
2.Measurement=Reading Level+Correct Factor; Correct Factor=Antenna Factor+Cable Loss.

Test Mode:  $\pi/4$  DQPSK-Low Hopping-offTest Mode:  $\pi/4$  DQPSK-High Hopping-offTest Mode:  $\pi/4$  DQPSK-Low Hopping-onTest Mode:  $\pi/4$  DQPSK-High Hopping-on

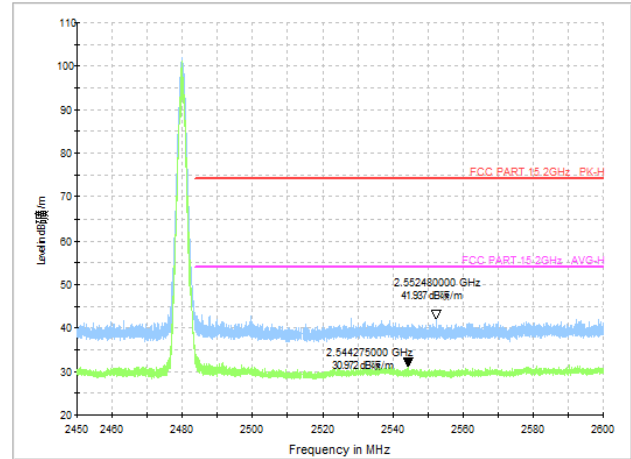
Note: 1. \*:Maximum data; x:Over limit; !:over margin.

2.Measurement=Reading Level+Correct Factor; Correct Factor=Antenna Factor+Cable Loss.

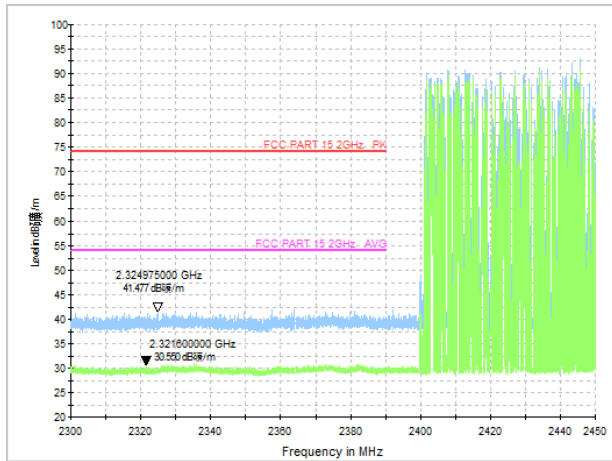
Test Mode: 8DPSK-Low Hopping-off



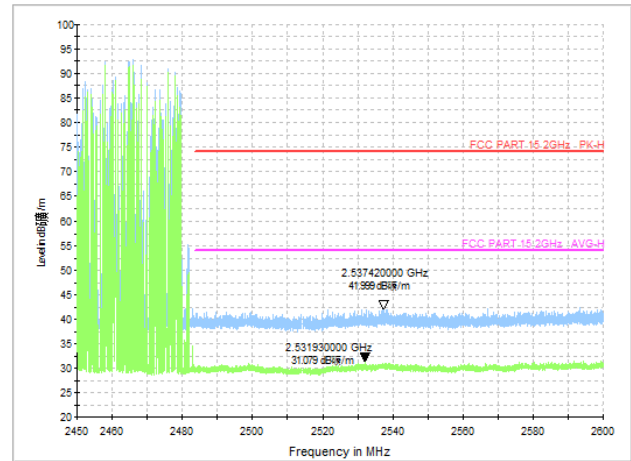
Test Mode: 8DPSK-High Hopping-off



Test Mode: 8DPSK-Low Hopping-on

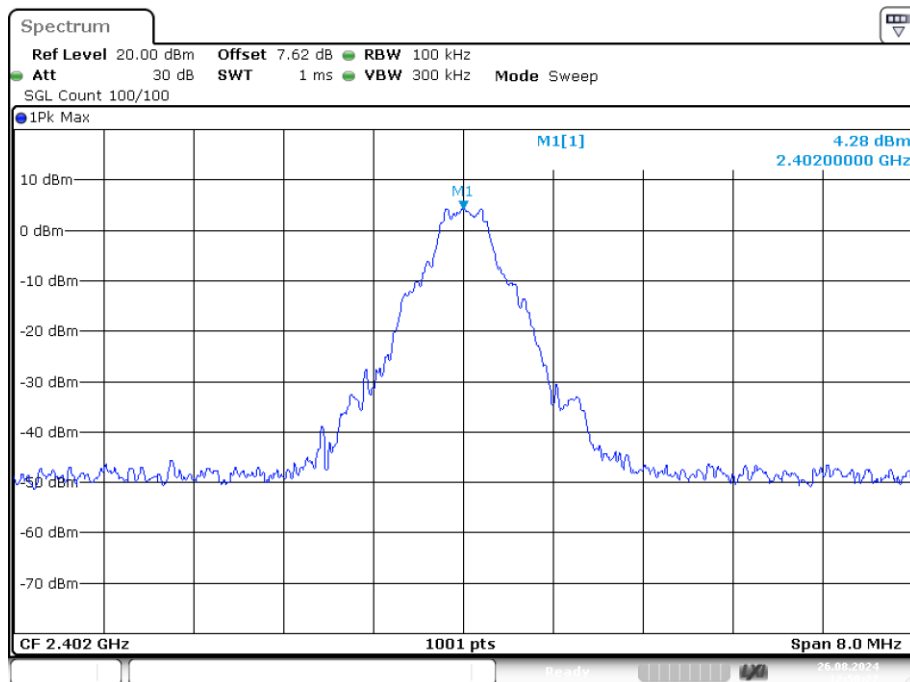


Test Mode: 8DPSK-High Hopping-on

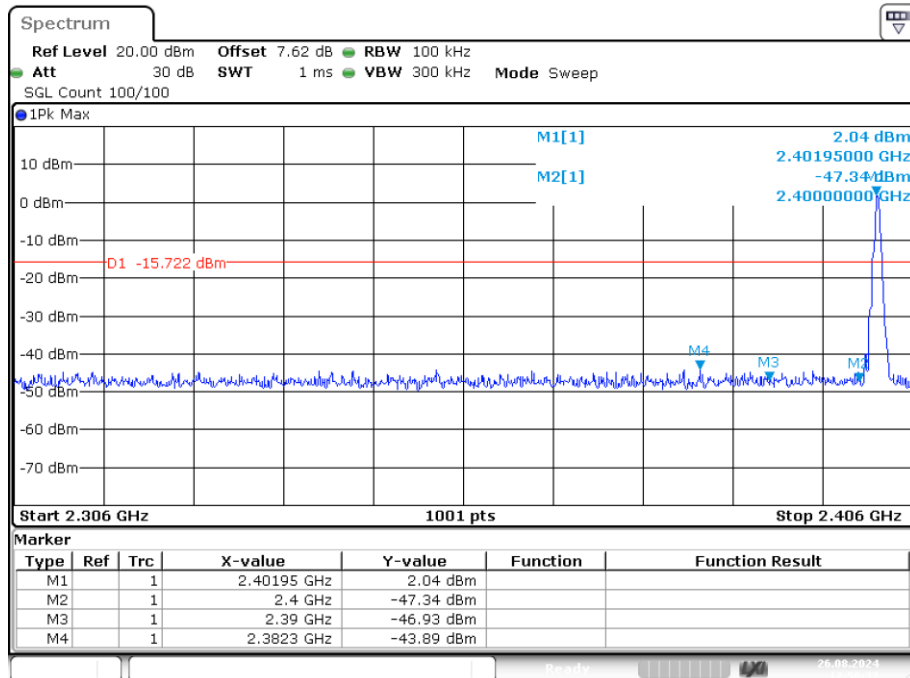


Note: 1. \*:Maximum data; x:Over limit; !:over margin.

2.Measurement=Reading Level+Correct Factor; Correct Factor=Antenna Factor+Cable Loss.

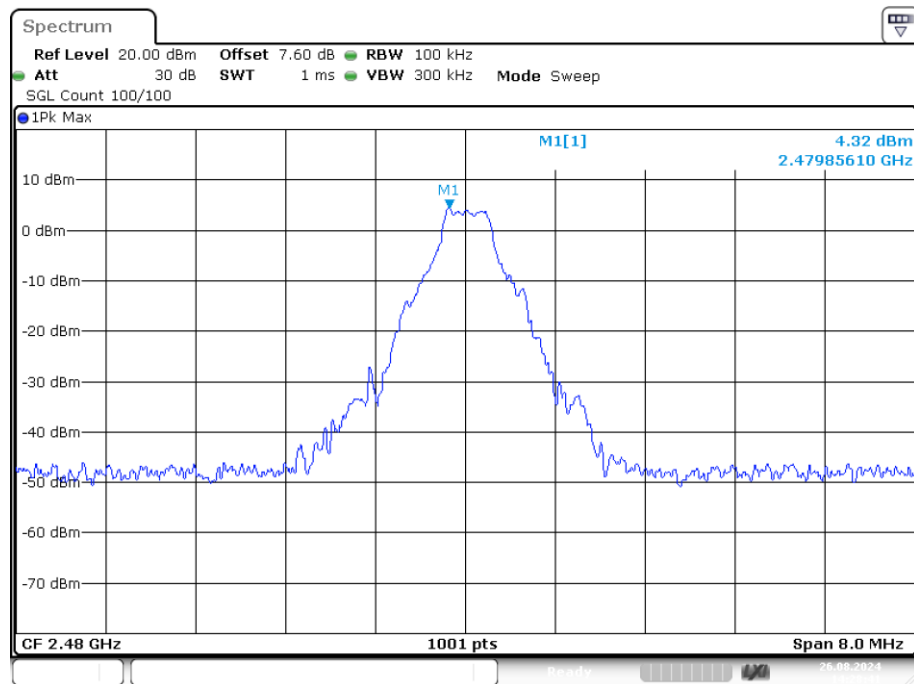
**Conducted Method****GFSK Mode:****Band Edge NVNT 1-DH1 2402MHz Ant1 No-Hopping Ref**

Date: 26.AUG.2024 12:50:28

**Band Edge NVNT 1-DH1 2402MHz Ant1 No-Hopping Emission**

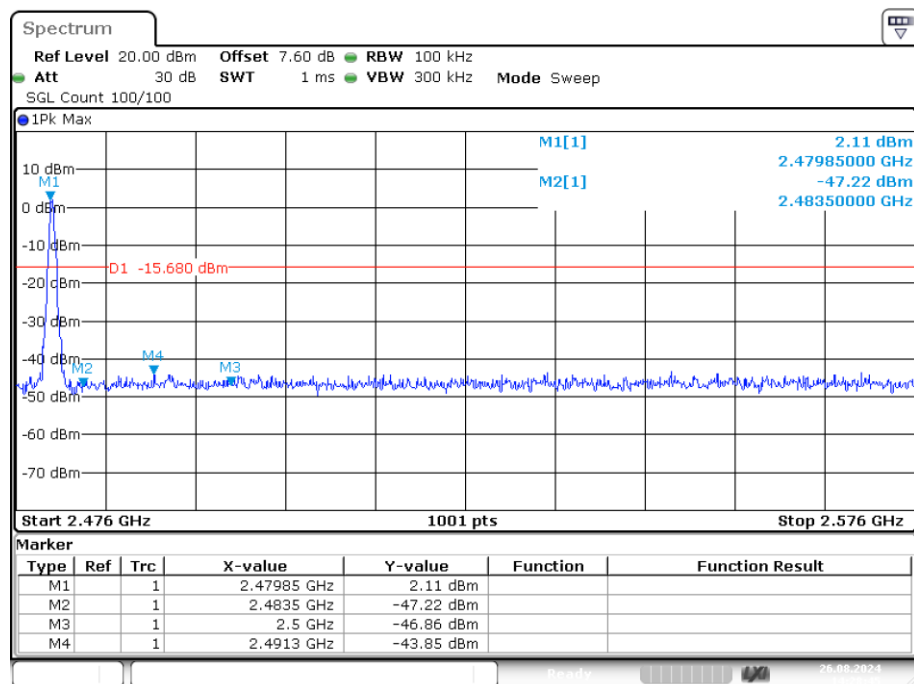
Date: 26.AUG.2024 12:50:32

**Band Edge NVNT 1-DH1 2480MHz Ant1 No-Hopping Ref**



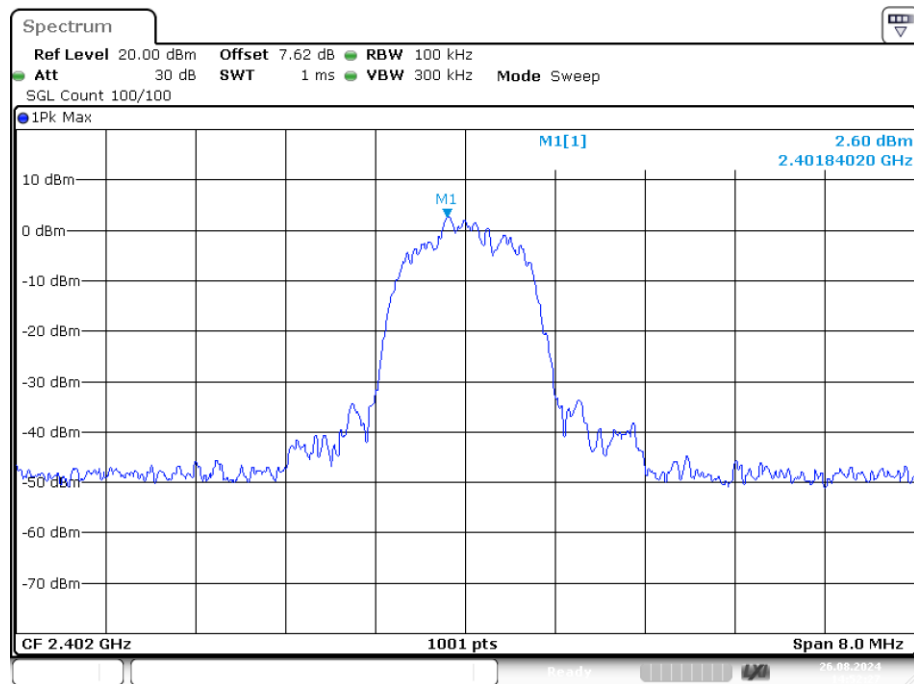
Date: 26.AUG.2024 14:28:41

## Band Edge NVNT 1-DH1 2480MHz Ant1 No-Hopping Emission



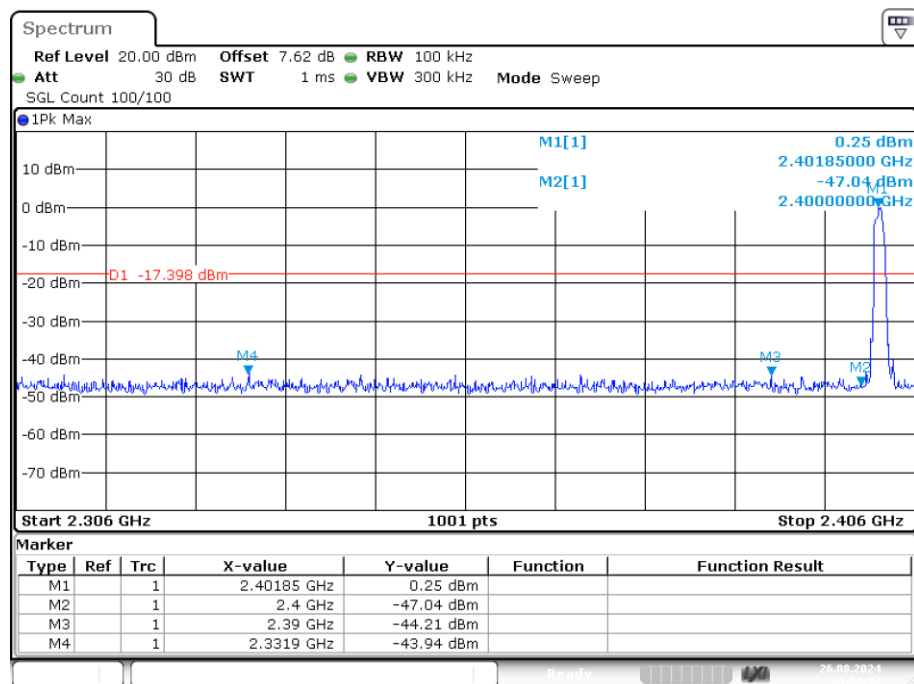
Date: 26.AUG.2024 14:28:45

## Band Edge NVNT 2-DH1 2402MHz Ant1 No-Hopping Ref



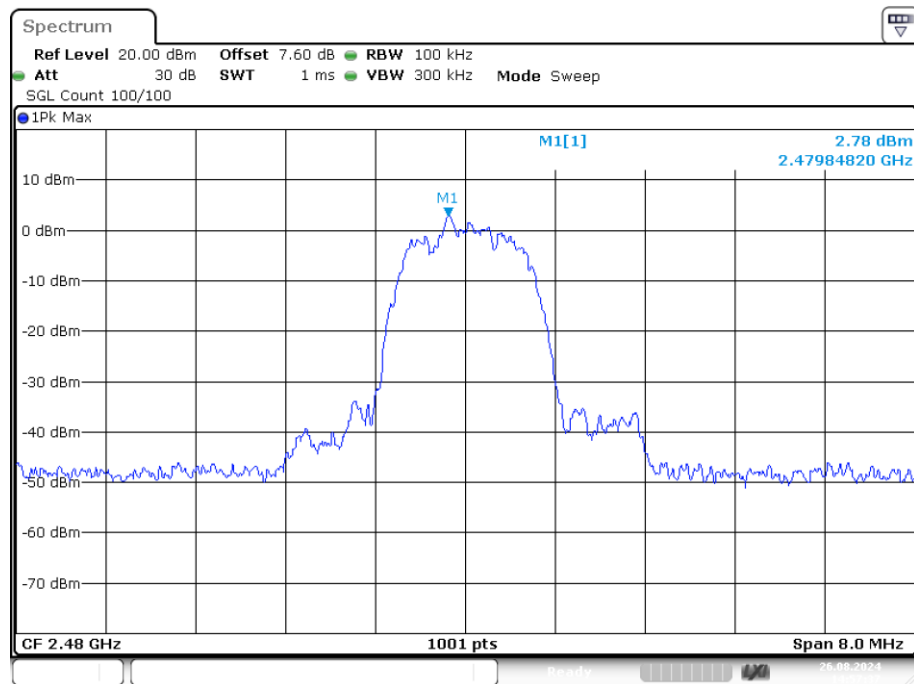
Date: 26.AUG.2024 14:52:28

## Band Edge NVNT 2-DH1 2402MHz Ant1 No-Hopping Emission



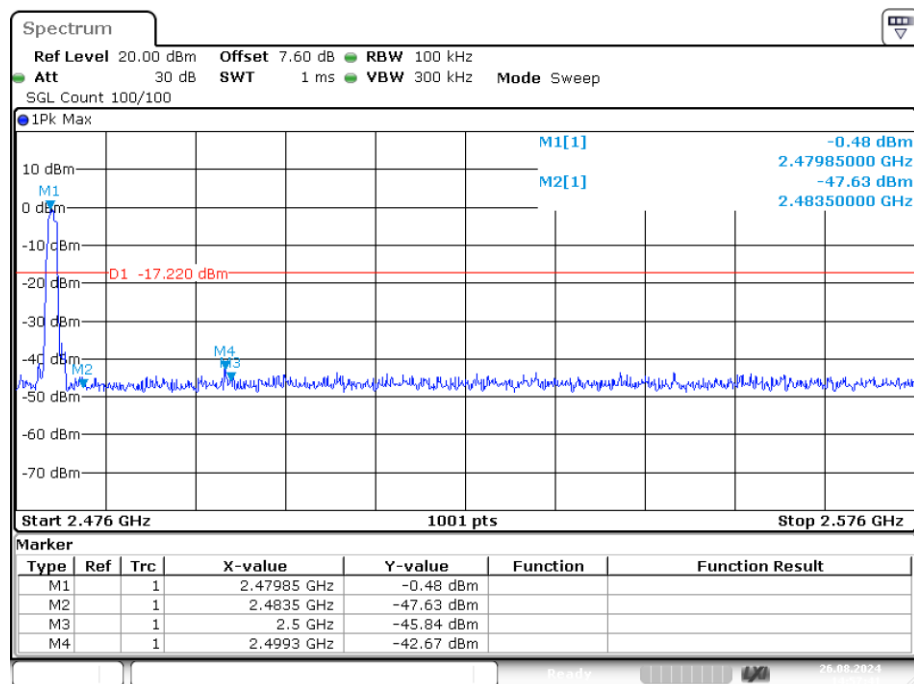
Date: 26.AUG.2024 14:52:32

## Band Edge NVNT 2-DH1 2480MHz Ant1 No-Hopping Ref



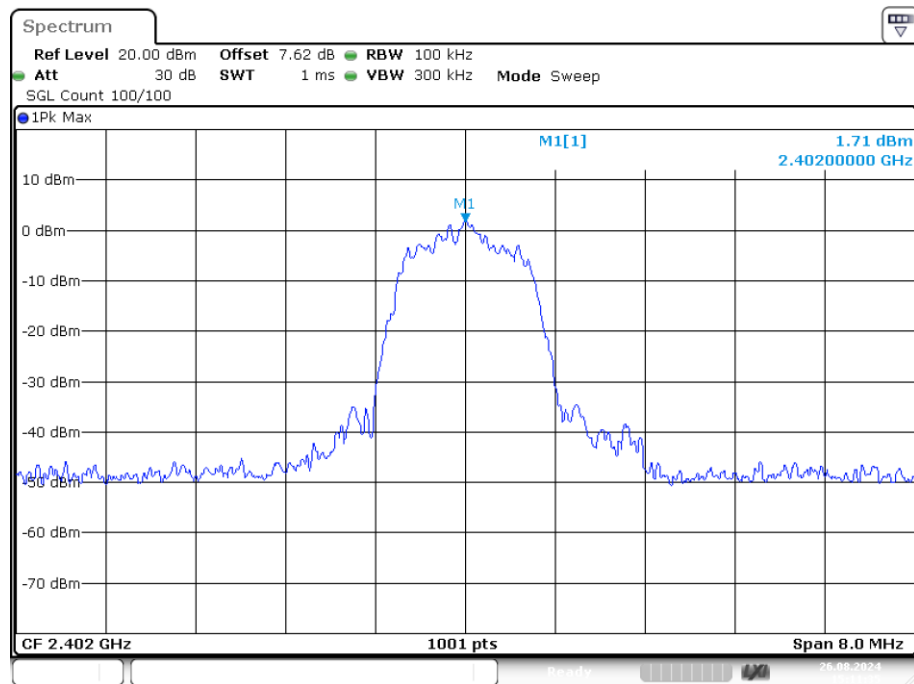
Date: 26.AUG.2024 14:57:37

## Band Edge NVNT 2-DH1 2480MHz Ant1 No-Hopping Emission



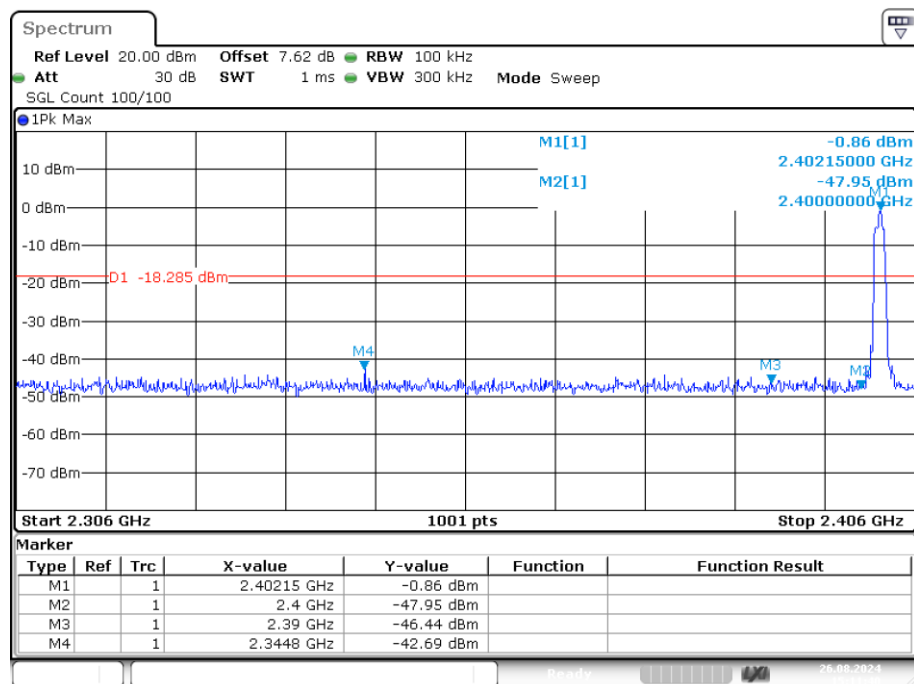
Date: 26.AUG.2024 14:57:41

## Band Edge NVNT 3-DH1 2402MHz Ant1 No-Hopping Ref



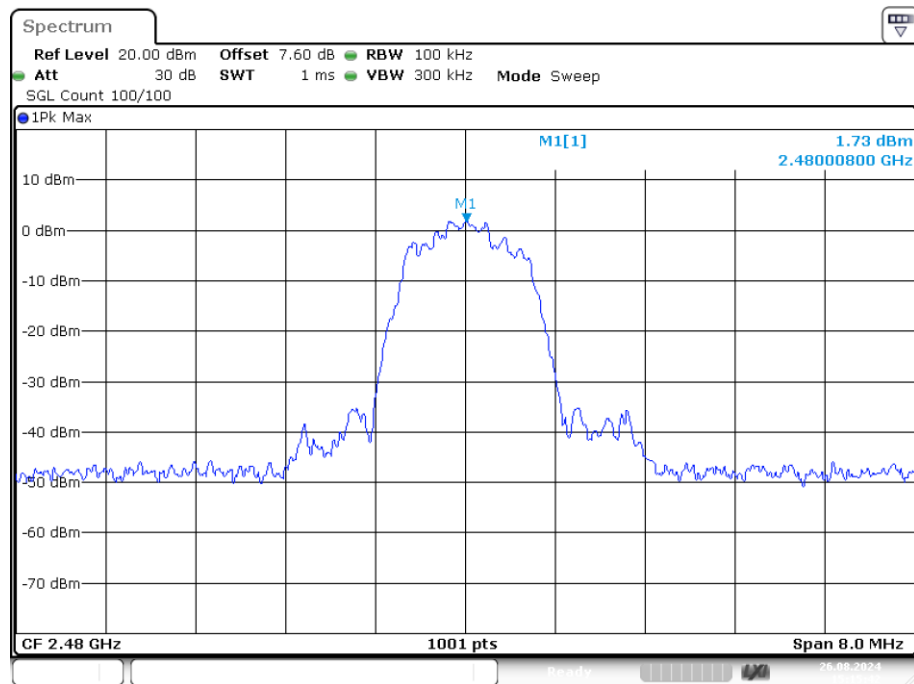
Date: 26.AUG.2024 15:11:35

## Band Edge NVNT 3-DH1 2402MHz Ant1 No-Hopping Emission



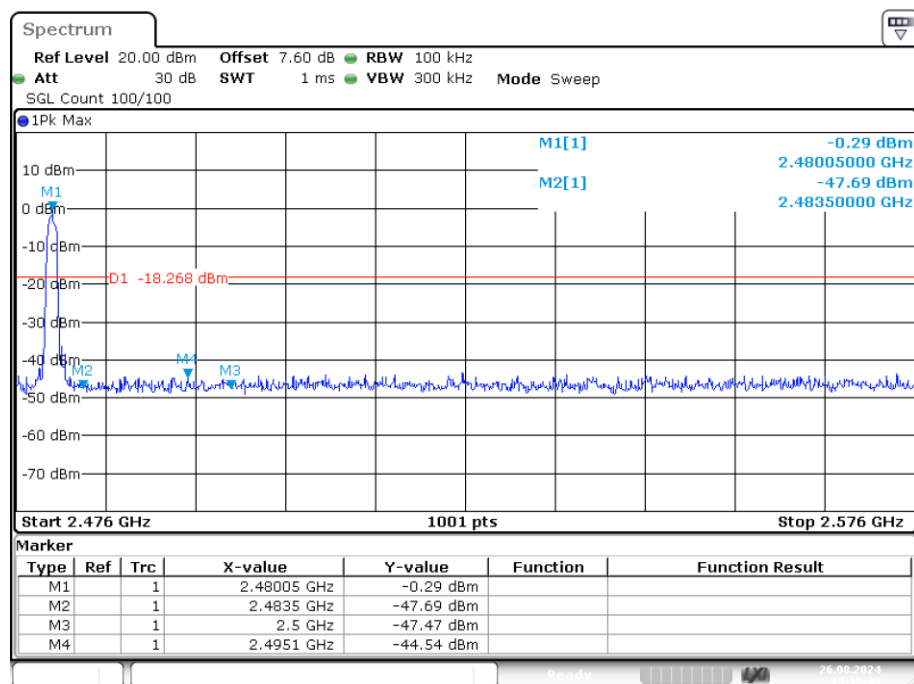
Date: 26.AUG.2024 15:11:39

## Band Edge NVNT 3-DH1 2480MHz Ant1 No-Hopping Ref



Date: 26.AUG.2024 15:15:42

## Band Edge NVNT 3-DH1 2480MHz Ant1 No-Hopping Emission



Date: 26.AUG.2024 15:15:45