



# TEST REPORT

**APPLICANT** : Dongguan SmartAction Technology Co.,Ltd

**PRODUCT NAME** : High resolution music player

**MODEL NAME** : HiBy R4

**BRAND NAME** : HiBy

**FCC ID** : 2AOBQ-HIBYR4

**STANDARD(S)** : 47 CFR Part 15 Subpart C

**RECEIPT DATE** : 2024-01-16

**TEST DATE** : 2024-01-17 to 2024-02-07

**ISSUE DATE** : 2024-03-18



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Change History		
Version	Date	Reason for change
1.0	2024-03-18	First edition



# 1. Summary of Test Result

No.	Section	Description	Test Date	Test Engineer	Result	Method Determination /Remark
1	15.203	Antenna Requirement	N/A	N/A	PASS	No deviation
2	15.247(a) 15.247(h)	Hopping Mechanism	N/A	N/A	PASS	No deviation
3	15.247(a)	Number of Hopping Frequency	Jan. 30, 2024	He Yuyang	PASS	No deviation
4	ANSI C63.10	Duty Cycle	Jan. 30, 2024	He Yuyang	PASS	No deviation
5	15.247(b)	Maximum Peak Conducted Output Power	Jan. 30, 2024	He Yuyang	PASS	No deviation
6	15.247(b)	Maximum Average Conducted Output Power	Jan. 30, 2024	He Yuyang	PASS	No deviation
7	15.247(a)	20dB Bandwidth	Jan. 30, 2024	He Yuyang	PASS	No deviation
8	15.247(a)	Carrier Frequency Separation	Jan. 30, 2024	He Yuyang	PASS	No deviation
9	15.247(a)	Time of Occupancy (Dwell time)	Jan. 30, 2024	He Yuyang	PASS	No deviation
10	15.247(d)	Conducted Spurious Emission	Jan. 30, 2024	He Yuyang	PASS	No deviation
11	15.207	Conducted Emission	Jan. 19, 2024	Wang Deyong	PASS	No deviation
12	15.247(d)	Restricted Frequency Bands	Jan. 31, 2024	Li Hanbin	PASS	No deviation
13	15.209,	Radiated	Jan. 31, 2024	Li Hanbin	PASS	No deviation



	15.247(d)	Emission	Feb. 04, 2024			
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**Note 1:** The tests were performed according to the method of measurements prescribed in ANSI C63.10-2013, KDB558074 D01 v05r02 and DA 00-075.

**Note 2:** Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.

**Note 3:** When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% confidence intervals.

## 1.1. Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 15 Subpart C Radio Frequency Devices



## 1.2. Test Equipment List

### 1.2.1 Conducted Test Equipment

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Due Date
EXA Signal Analyzer	MY53470836	N9010A	Agilent	2023.02.27	2024.02.26
RF Cable (30MHz-26GHz)	CB01	RF01	Morlab	N/A	N/A
Coaxial Cable	CB02	RF02	Morlab	N/A	N/A
SMA Connector	CN01	RF03	HUBER-SUHNER	N/A	N/A

### 1.2.2 Conducted Emission Test Equipment

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Due Date
Receiver	MY56400093	N9038A	KEYSIGHT	2023.02.09	2024.02.08
				2024.01.25	2025.01.24
LISN	8127449	NSLK 8127	Schwarzbeck	2023.02.21	2024.02.20
Pulse Limiter (10dB)	VTSD 9561 F-B #206	VTSD 9561-F	Schwarzbeck	2023.06.27	2024.06.26
RF Coaxial Cable (DC-100MHz)	BNC	MRE04	Qualwave	N/A	N/A

### 1.2.3 List of Software Used

Description	Manufacturer	Software Version
Test System	MaiWei	2.0.0.0
TS+ -[JS36-RSE]	Tonscend	V3.0.0.0
TS+ -[JS32-CE]	Tonscend	V2.5.0.0

**1.2.4 Radiated Test Equipment**

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Due Date
Receiver	MY54130016	N9038A	Agilent	2023.06.21	2024.06.20
Test Antenna - Bi-Log	9163-519	VULB 9163	Schwarzbeck	2023.07.01	2024.06.30
Test Antenna - Loop	1519-022	FMZB1519	Schwarzbeck	2023.06.26	2024.06.25
Test Antenna – Horn	01774	BBHA 9120D	Schwarzbeck	2023.07.01	2024.06.30
Test Antenna – Horn	BBHA9170 #773	BBHA9170	Schwarzbeck	2023.07.01	2024.06.30
Preamplifier (10MHz-6GHz)	46732	S10M100L38 02	LUCIX CORP.	2023.06.27	2024.06.26
Preamplifier (2GHz-18GHz)	61171/61172	S020180L32 03	LUCIX CORP.	2023.06.27	2024.06.26
Preamplifier (18GHz-40GHz)	DS77209	DCLNA0118-40C-S	Decentest	2023.07.04	2024.07.03
RF Coaxial Cable (DC-18GHz)	MRE001	PE330	Pasternack	2023.06.27	2024.06.26
RF Coaxial Cable (DC-18GHz)	MRE002	CLU18	Pasternack	2023.06.27	2024.06.26
RF Coaxial Cable (DC-18GHz)	MRE003	CLU18	Pasternack	2023.06.27	2024.06.26
RF Coaxial Cable (DC-40GHz)	22290045	QA360-40-K K-0.5	Qualwave	2023.07.04	2024.07.03
RF Coaxial Cable (DC-40GHz)	22290046	QA360-40-K KF-2	Qualwave	2023.07.04	2024.07.03
RF Coaxial Cable (DC-18GHz)	22120181	QA500-18-N N-5	Qualwave	2023.07.04	2024.07.03
Notch Filter	N/A	WRCG-2400-2483.5-60SS	Wainwright	N/A	N/A
Anechoic Chamber	N/A	9m*6m*6m	CRT	2022.05.10	2025.05.09



### 1.3. Measurement Uncertainty

Test Items	Uncertainty	Remark
Number of Hopping Frequency	±5%	Confidence levels of 95%
Peak Output Power	±2.22dB	Confidence levels of 95%
Bandwidth	±5%	Confidence levels of 95%
Carrier Frequency Separation	±5%	Confidence levels of 95%
Time of Occupancy (Dwell time)	±5%	Confidence levels of 95%
Conducted Spurious Emission	±2.77dB	Confidence levels of 95%
Restricted Frequency Bands	±5%	Confidence levels of 95%
Radiated Emission	±2.95dB	Confidence levels of 95%
Conducted Emission	±2.44dB	Confidence levels of 95%

### 1.4. Testing Laboratory

<b>Laboratory Name</b>	Shenzhen Morlab Communications Technology Co., Ltd.
<b>Laboratory Address</b>	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
<b>Telephone</b>	+86 755 36698555
<b>Facsimile</b>	+86 755 36698525
<b>FCC Designation Number</b>	CN1192
<b>FCC Test Firm Registration Number</b>	226174





## 2. General Description

### 2.1. Information of Applicant and Manufacturer

<b>Applicant</b>	Dongguan SmartAction Technology Co.,Ltd
<b>Applicant Address</b>	Room 1201, Lianjing Commercial Building, No.39, Hongwei 3rd Road, Nancheng District, Dongguan, Guangdong, China
<b>Manufacturer</b>	DONGGUAN RHYTHM ELECTRONIC CO., LTD
<b>Manufacturer Address</b>	Room 303, Room 403, Unit 1, No. 313, Guancheng Section, Dongcheng middle Road, Guancheng Street, Dongguan City, Guangdong Province, China

### 2.2. Information of EUT

<b>Product Name:</b>	High resolution music player	
<b>Sample No.:</b>	1#	
<b>Hardware Version:</b>	1.2	
<b>Software Version:</b>	1.0	
<b>Equipment Type:</b>	Bluetooth classic	
<b>Bluetooth Version:</b>	5.0	
<b>Modulation Type:</b>	FHSS (GFSK(1Mbps), $\pi/4$ -DQPSK(EDR 2Mbps), 8-DPSK(EDR 3Mbps))	
<b>Operating Frequency Range:</b>	2402MHz-2480MHz	
<b>Antenna Type:</b>	Monopole Antenna	
<b>Antenna Gain:</b>	1.28dBi	
<b>Accessory Information:</b>	Battery	
	<b>Brand Name:</b>	Hiby
	<b>Model No.:</b>	595490
	<b>Serial No.:</b>	N/A
	<b>Capacity:</b>	4500mAh
	<b>Rated Voltage:</b>	3.8V
	<b>Charge Limit:</b>	4.35V
	<b>Manufacturer:</b>	Dongguan Smartaction Technology Co.,Ltd

**Note 1:** We use the dedicated software to control the EUT continuous transmission.

**Note 2:** For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.



## 2.3. Channel List of EUT

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
<b>0</b>	<b>2402</b>	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	<b>78</b>	<b>2480</b>
19	2421	<b>39</b>	<b>2441</b>	59	2461		

**Note 1:** The black bold channels were selected for test.

## 2.4. Test Configuration of EUT

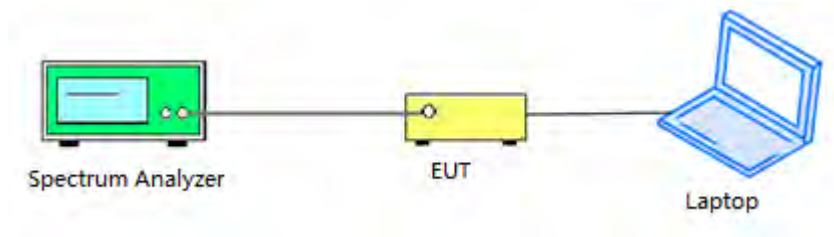
Test mode is used to control the EUT under the maximum power level during test.

## 2.5. Test Conditions

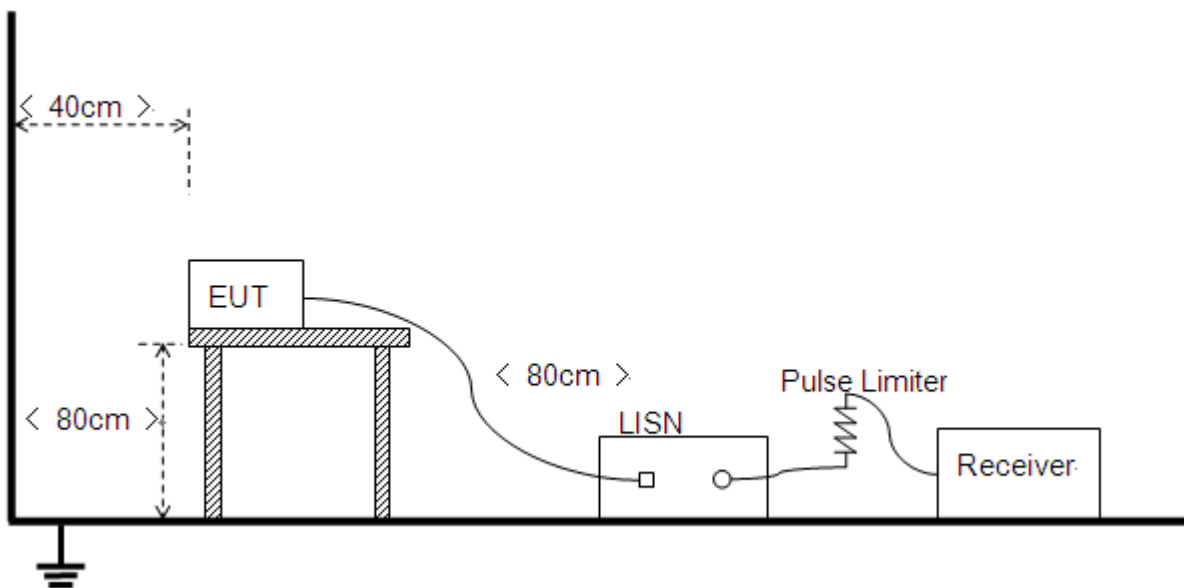
Temperature (°C)	15-35
Relative Humidity (%)	30-60
Atmospheric Pressure (kPa)	86-106

## 2.6. Test Setup Layout Diagram

### 2.6.1. Conducted Measurement

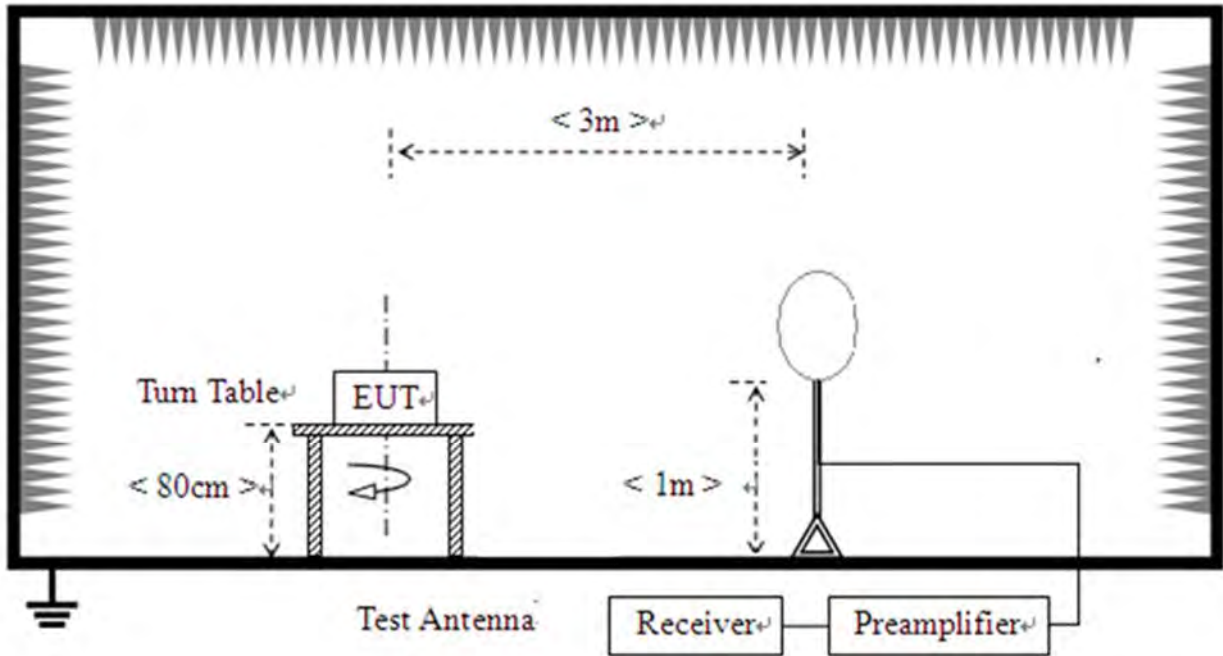


### 2.6.2. Conducted Emission Measurement

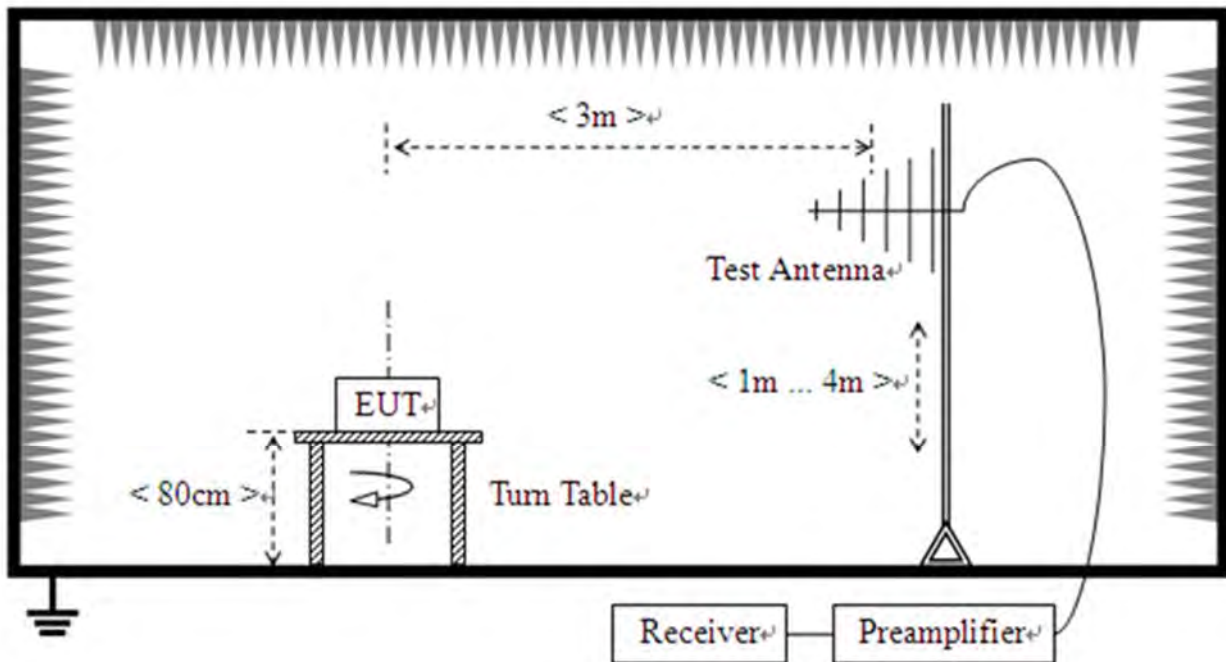


**2.6.3. Radiation Measurement**

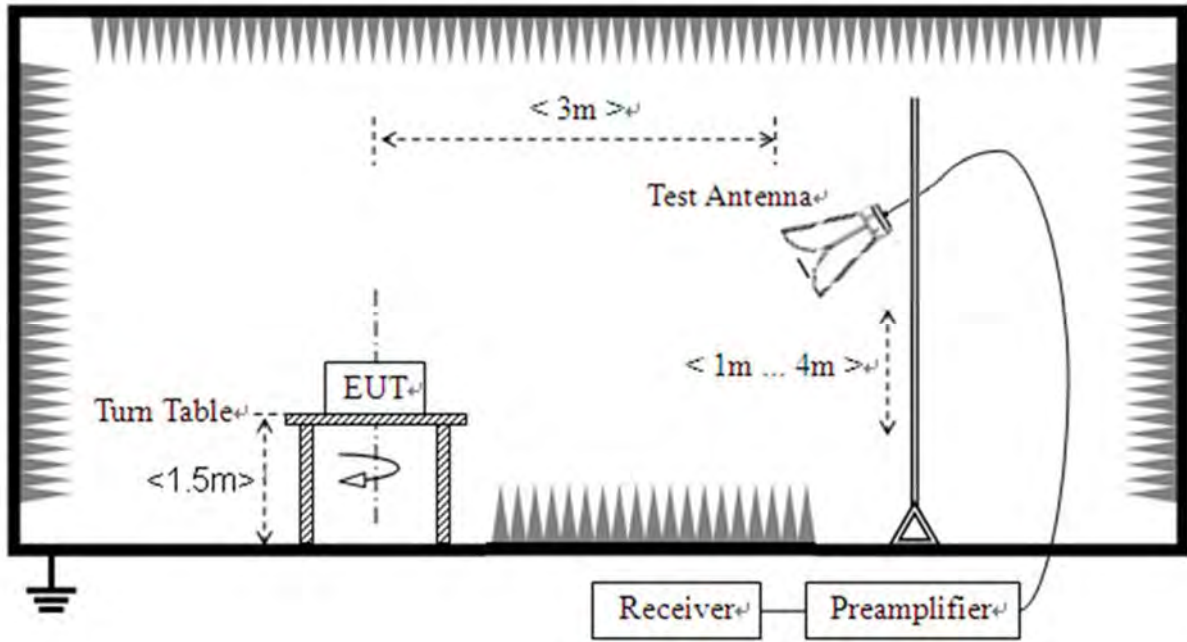
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to 1GHz



3) For radiated emissions above 1GHz





## 3. Test Results

### 3.1. Antenna Requirement

#### 3.1.1. Requirement

According to FCC 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.

#### 3.1.2. Test Result

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

### 3.2. Hopping Mechanism

#### 3.2.1. Requirement

According to FCC section 15.247(a)(1), a frequency hopping spread spectrum system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

According to FCC section 15.247(h), the incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

#### 3.2.2. Test Result

The hopping mechanism of the EUT is in compliance with the document "**Bluetooth core specification v5.1**".



## 3.3. Number of Hopping Frequency

### 3.3.1. Requirement

According to FCC section 15.247(a)(1)(iii), frequency hopping systems operating in the 2400MHz to 2483.5MHz bands shall use at least 15 hopping frequencies.

### 3.3.2. Test Procedures

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = the frequency band of operation

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.

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize

### 3.3.3. Test Setup Layout

Refer to chapter 2.6.1 in this report.

### 3.3.4. Test Result

Refer to Annex A.1 in this report.



## 3.4. Duty Cycle of Test Signal

### 3.4.1. Requirement

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%). When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be used to ensure that measurements are made only during transmissions at the maximum power control level. Such sweep triggering/signal gating techniques will require knowledge of the minimum transmission duration ( $T$ ) over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation. Sweep triggering/signal gating techniques can then be used if the measurement/sweep time of the analyzer can be set such that it does not exceed  $T$  at any time that data are being acquired (i.e., no transmitter OFF-time is to be considered).

When continuous transmission cannot be achieved and sweep triggering/signal gating cannot be implemented, alternative procedures are provided that can be used to measure the average power; however, they will require an additional measurement of the transmitter duty cycle ( $D$ ). Within this sub clause, the duty cycle refers to the fraction of time over which the transmitter is ON and is transmitting at its maximum power control level. The duty cycle is considered to be constant if variations are less than  $\pm 2\%$ ; otherwise, the duty cycle is considered to be non constant.

### 3.4.2. Test Result

Refer to Annex A.2 in this report.





## **3.5. Maximum Peak Conducted Output Power**

### **3.5.1. Requirement**

According to FCC section 15.247(b)(1), for frequency hopping systems that operates in the 2400MHz to 2483.5MHz band employing at least 75 hopping channels, the maximum peak output power of the intentional radiator shall not exceed 1Watt. For all other frequency hopping systems in the 2400MHz to 2483.5MHz band, it is 0.125Watts.

### **3.5.2. Test Procedures**

KDB 558074 Section 8.3.1 was used in order to prove compliance.

### **3.5.3. Test Setup Layout**

Refer to chapter 2.6.1 in this report.

### **3.5.4. Test Result**

Refer to Annex A.3 in this report.



## **3.6. Maximum Average Conducted Output Power**

### **3.6.1. Requirement**

According to FCC section 15.247(b)(1), for frequency hopping systems that operates in the 2400MHz to 2483.5MHz band employing at least 75 hopping channels, the maximum peak output power of the intentional radiator shall not exceed 1Watt. For all other frequency hopping systems in the 2400MHz to 2483.5MHz band, it is 0.125Watts.

### **3.6.2. Test Procedures**

KDB 558074 Section 8.3.2 was used in order to prove compliance.

### **3.6.3. Test Setup Layout**

Refer to chapter 2.6.1 in this report.

### **3.6.4. Test Result**

Refer to Annex A.4 in this report.



## 3.7.20 dB Bandwidth

### 3.7.1.Requirement

According to FCC section 15.247(a)(1), the 20 dB bandwidth is known as the 99% emission bandwidth, or 20 dB bandwidth ( $10 \cdot \log 1\% = 20$  dB) taking the total RF output power.

### 3.7.1.Test Procedures

Use the following spectrum analyzer settings:

Span = between 2 to 5 times the OBW, centered on the test channel

RBW= 1% to 5% of the OBW

VBW  $\geq 3 \times$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

### 3.7.2.Test Setup Layout

Refer to chapter 2.6.1 in this report.

### 3.7.3.Test Result

Refer to Annex A.5 in this report.



## 3.8. Carried Frequency Separation

### 3.8.1. Requirement

According to FCC section 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

### 3.8.2. Test Procedures

The EUT must have its hopping function enabled. According to DA 00-705, use the following spectrum analyzer settings:

Span = wide enough to capture the peaks of two adjacent channels

Resolution (or IF) Bandwidth (RBW)  $\geq$  1% of the span

Video (or Average) Bandwidth (VBW)  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

### 3.8.3. Test Setup Layout

Refer to chapter 2.6.1 in this report.

### 3.8.4. Test Result

Refer to Annex A.6 in this report.



## 3.9. Time of Occupancy (Dwell time)

### 3.9.1. Requirement

According to FCC section 15.247(a) (1) (iii), frequency hopping systems in the 2400 - 2483.5MHz band shall use at least 15 non-overlapping 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.

### 3.9.2. Test Procedures

Normal Mode:

DH1: Dwell time equal to Pulse time (ms) \* (1600 / 2 / 79) \* 31.6 Millisecond  
DH3: Dwell time equal to Pulse time (ms) \* (1600 / 4 / 79) \* 31.6 Millisecond  
DH5: Dwell time equal to Pulse Time (ms) \* (1600 / 6 / 79) \* 31.6 Millisecond

AFH Mode:

DH1: Dwell time equal to Pulse time (ms) \* (800 / 2 / 20) \* (0.4 \* 20) Millisecond  
DH3: Dwell time equal to Pulse time (ms) \* (800 / 4 / 20) \* (0.4 \* 20) Millisecond  
DH5: Dwell time equal to Pulse Time (ms) \* (800 / 6 / 20) \* (0.4 \* 20) Millisecond.

### 3.9.3. Test Setup Layout

Refer to chapter 2.6.1 in this report.

### 3.9.4. Test Result

Refer to Annex A.7 in this report.



## 3.10. Conducted Spurious Emissions and Band Edge

### 3.10.1.Requirement

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

### 3.10.2.Test Procedures

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

### 3.10.3.Test Setup Layout

Refer to chapter 2.6.1 in this report.

### 3.10.4.Test Result

Refer to Annex A.8 and A.9 in this report.

## 3.11. Conducted Emission

### 3.11.1. Requirement

According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 $\mu$ H/50 $\Omega$  line impedance stabilization network (LISN).

Frequency Range (MHz)	Conducted Limit (dB $\mu$ V)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

Note:

- (a) The lower limit shall apply at the band edges.
- (b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

### 3.11.2. Test Procedures

The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10: 2013.

### 3.11.3. Test Setup Layout

Refer to chapter 2.6.2 in this report.

### 3.11.4. Test Result

Refer to Annex A.10 in this report.



## 3.12. Restricted Frequency Bands

### 3.12.1.Requirement

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

### 3.12.2.Test Procedures

The EUT is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.

For the Test Antenna:

Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for  $f \geq 1\text{GHz}$ , 100 kHz for  $f < 1\text{GHz}$

VBW = 3 MHz

Sweep = auto

Detector function = peak/average

Trace = max hold

Allow the trace to stabilize

### 3.12.3.Test Setup Layout

Refer to chapter 2.6.3 in this report.

### 3.12.4.Test Result

Refer to Annex A.11 in this report.





### 3.13. Radiated Emission

#### 3.13.1.Requirement

According to FCC section 15.247(d), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength ( $\mu\text{V}/\text{m}$ )	Measurement Distance (m)
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

**Note1:** For above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.

**Note2:**For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK).In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table).



### 3.13.2. Test Procedures

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 30MHz, the emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9kHz-90 kHz, 110kHz-490 kHz. Radiated emission limits in these two bands are based on measurements employing an average detector.

For measurements below 1GHz the resolution bandwidth is set to 100kHz for peak detection measurements or 120kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1GHz the resolution bandwidth is set to 1MHz, the video band width is set to 3MHz for peak measurements and as applicable for average measurements.

The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions. For measurements above 1 GHz, keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response.

### 3.13.3. Test Setup Layout

Refer to chapter 2.6.3 in this report.

### 3.13.4. Test Result

Refer to Annex A.12 in this report.



## Annex A Test Data and Result

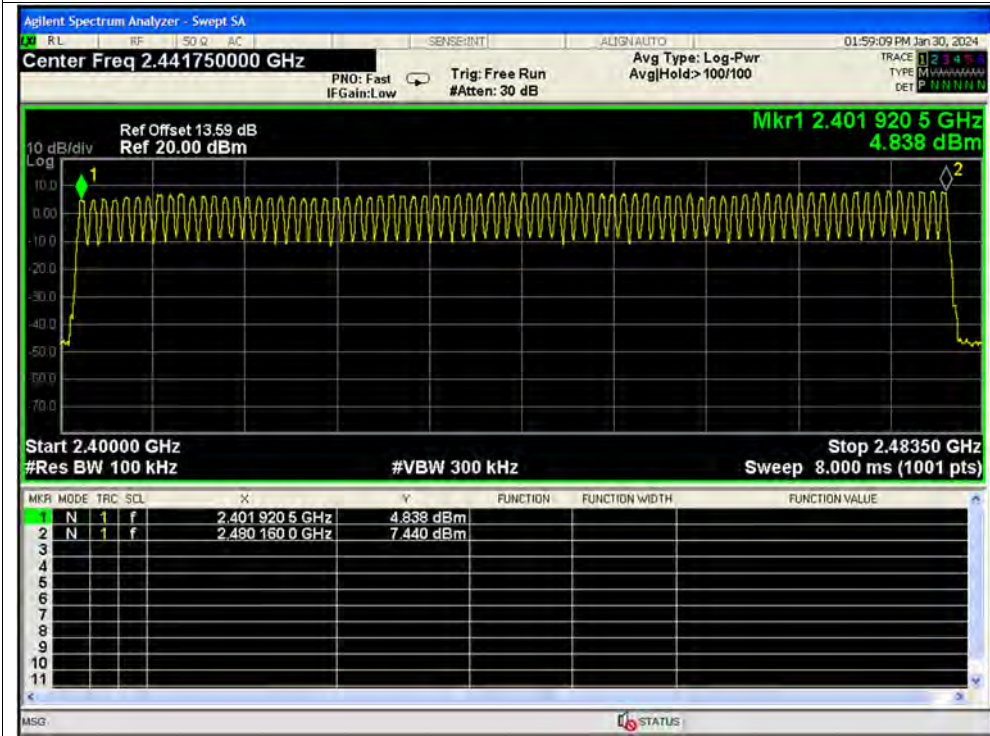
### A.1. Number of Hopping Frequency

Condition	Mode	Antenna	Hopping Number	Limit	Verdict
NVNT	1-DH5	Ant1	79	15	Pass
NVNT	2-DH5	Ant1	79	15	Pass
NVNT	3-DH5	Ant1	79	15	Pass

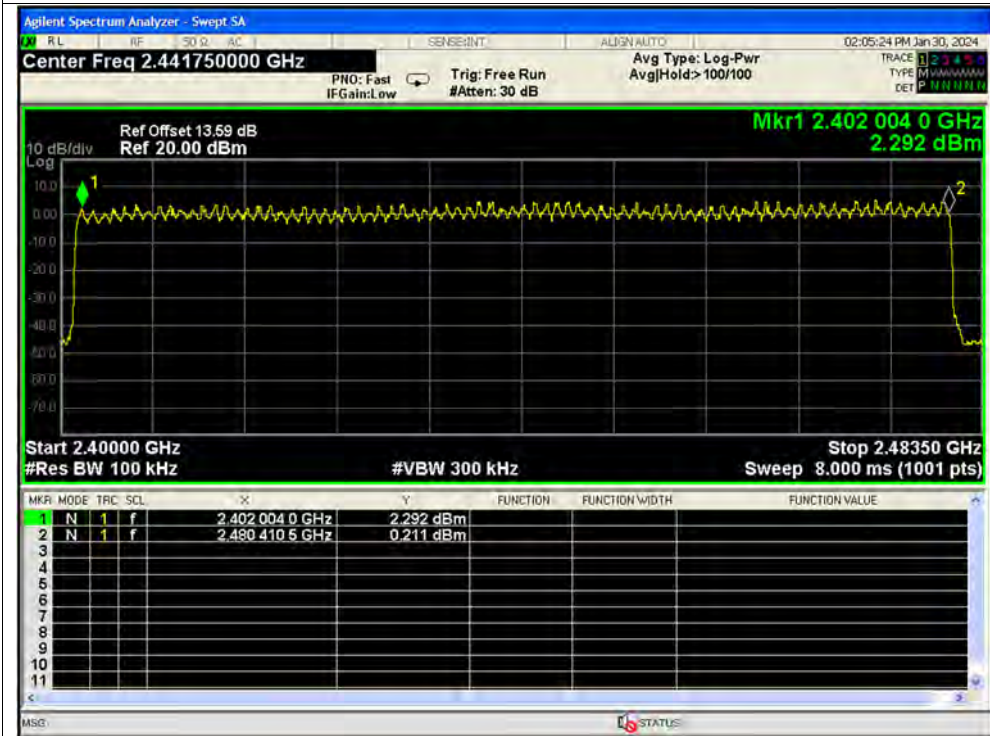


Test Graphs

Hopping No. NVNT 1-DH5 2402MHz Ant1

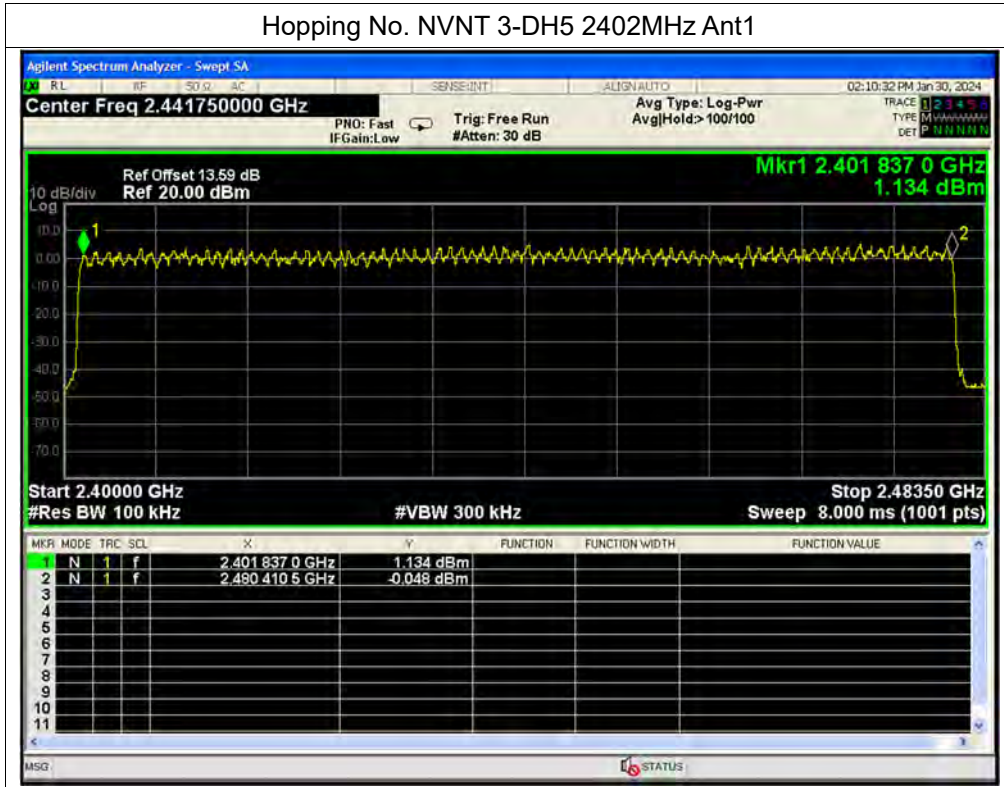


Hopping No. NVNT 2-DH5 2402MHz Ant1





Hopping No. NVNT 3-DH5 2402MHz Ant1





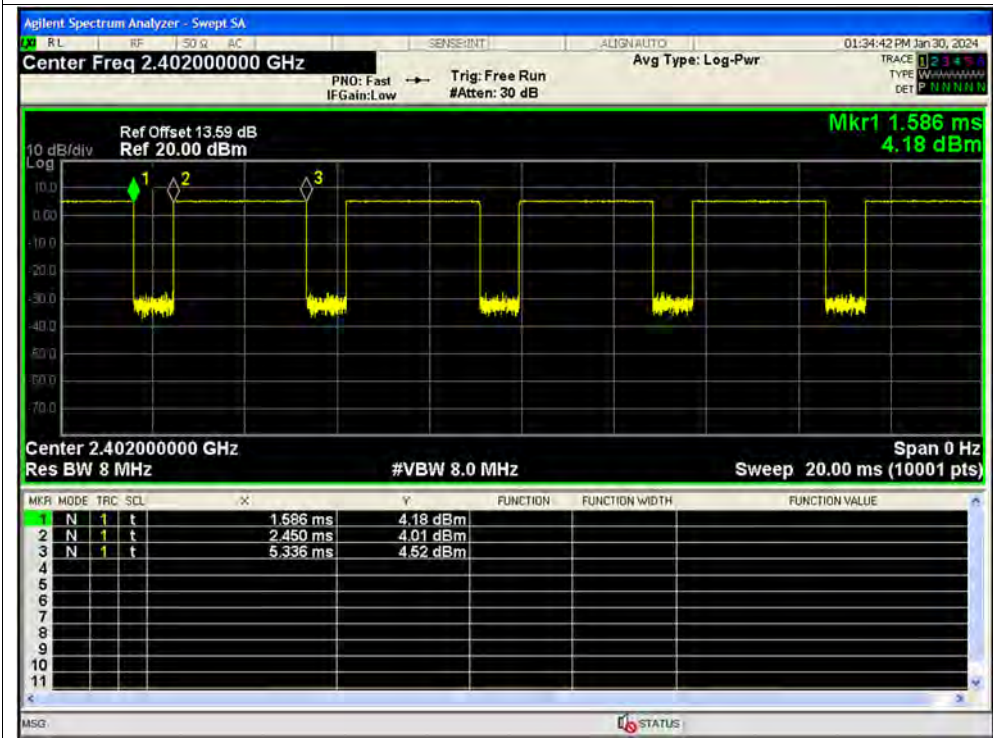
**A.2. Duty Cycle of Test Signal**

Condition	Mode	Frequency (MHz)	Antenna	Duty Cycle (%)	Correction Factor (dB)	1/T (kHz)
NVNT	1-DH5	2402	Ant1	76.96	1.14	0.35
NVNT	1-DH5	2441	Ant1	76.98	1.14	0.35
NVNT	1-DH5	2480	Ant1	76.99	1.14	0.35
NVNT	2-DH5	2402	Ant1	77.04	1.13	0.35
NVNT	2-DH5	2441	Ant1	77.04	1.13	0.35
NVNT	2-DH5	2480	Ant1	77.04	1.13	0.35
NVNT	3-DH5	2402	Ant1	77.09	1.13	0.35
NVNT	3-DH5	2441	Ant1	77.09	1.13	0.35
NVNT	3-DH5	2480	Ant1	77.09	1.13	0.35



Test Graphs

Duty Cycle NVNT 1-DH5 2402MHz Ant1

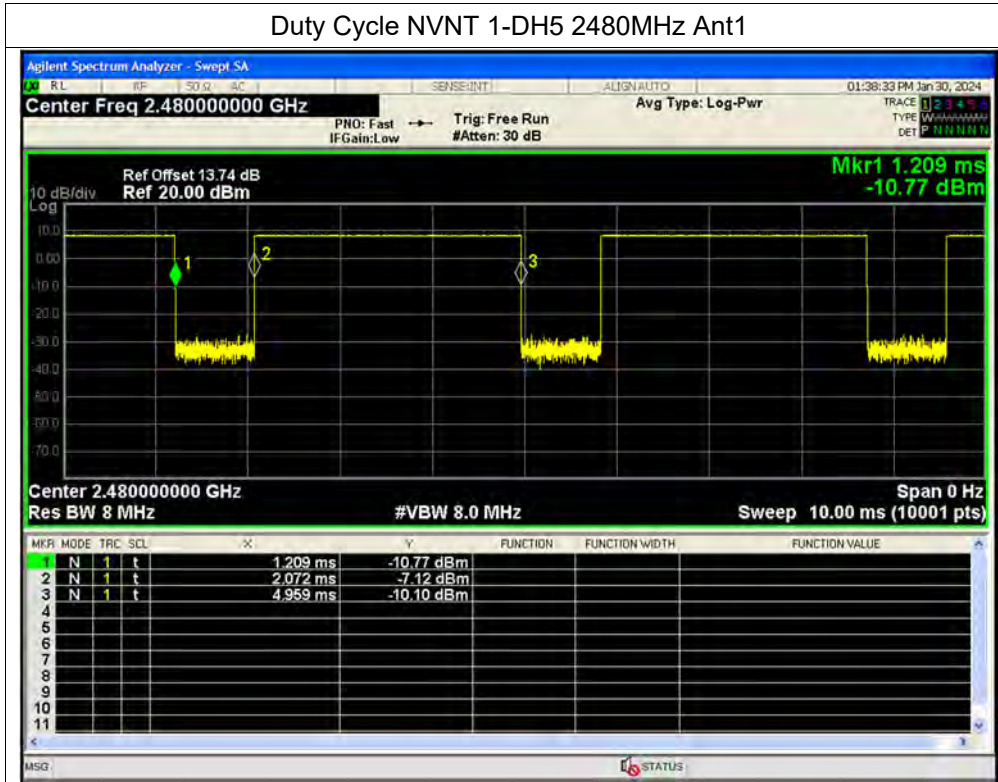


Duty Cycle NVNT 1-DH5 2441MHz Ant1

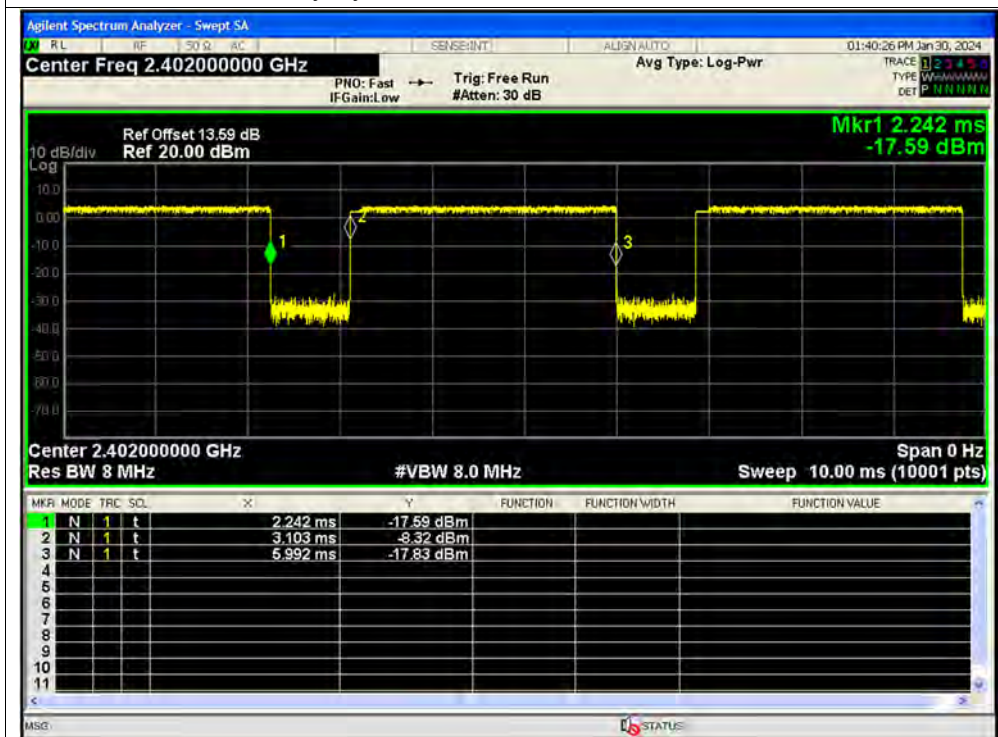




Duty Cycle NVNT 1-DH5 2480MHz Ant1



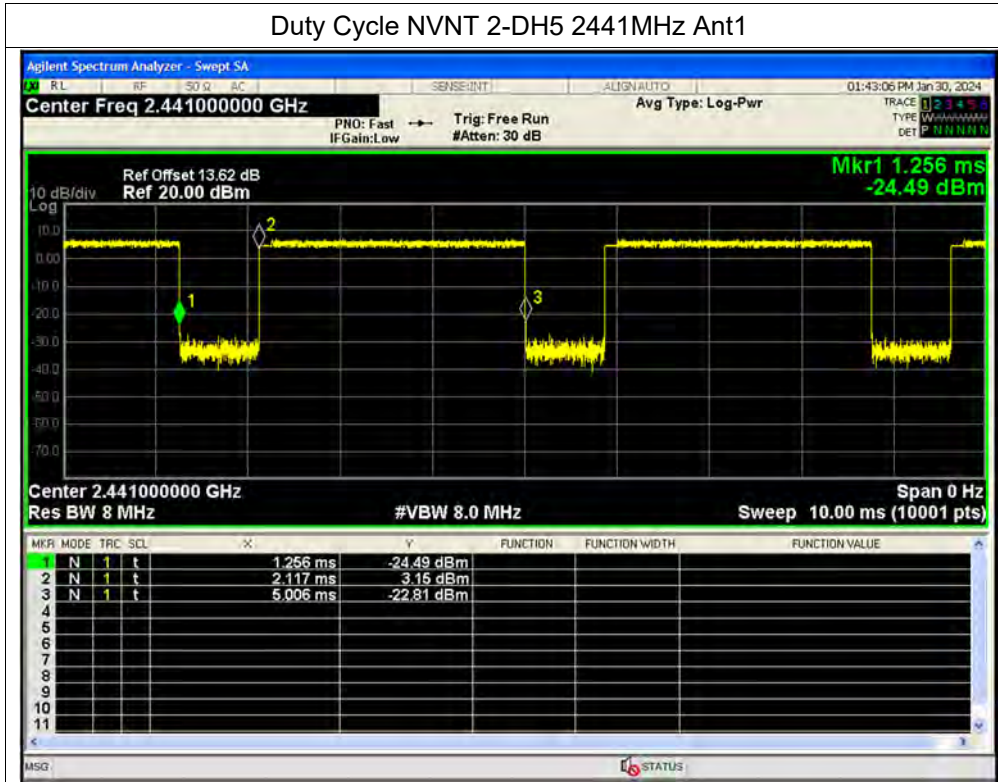
Duty Cycle NVNT 2-DH5 2402MHz Ant1







Duty Cycle NVNT 2-DH5 2441MHz Ant1

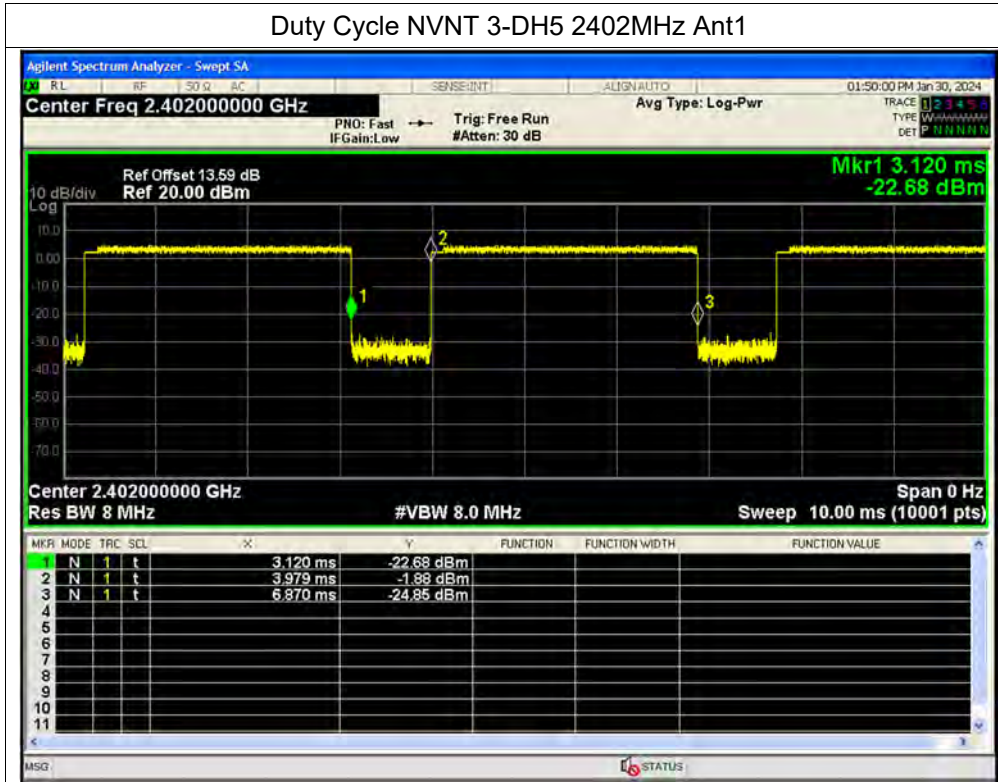


Duty Cycle NVNT 2-DH5 2480MHz Ant1



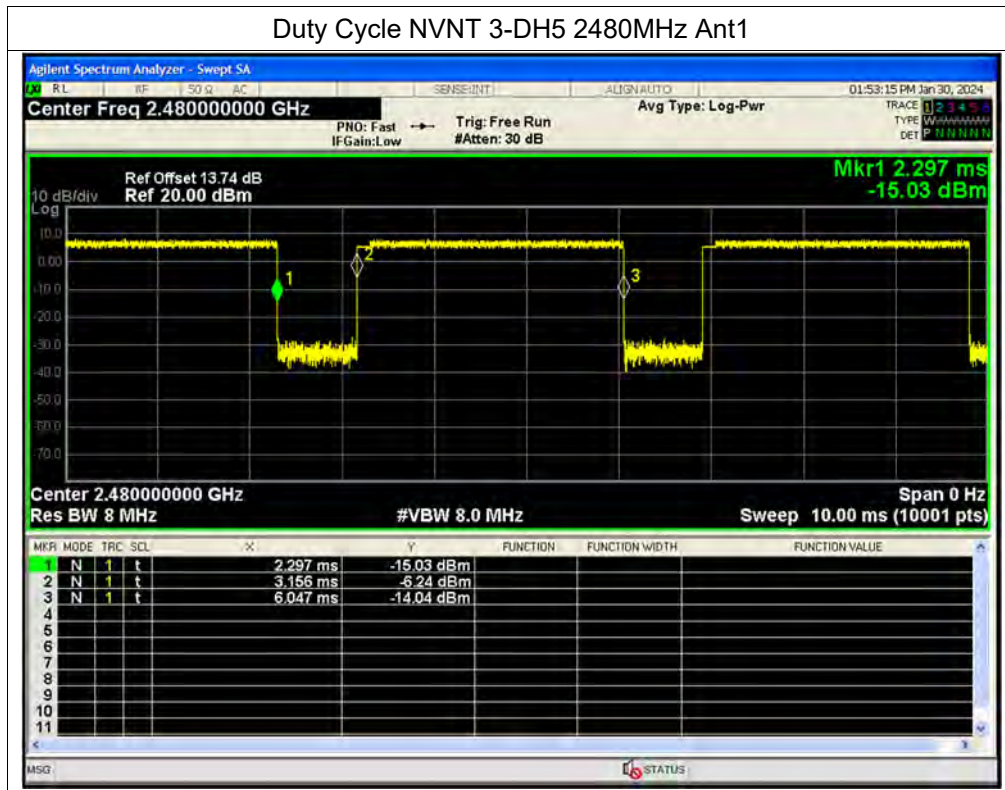


Duty Cycle NVNT 3-DH5 2402MHz Ant1



Duty Cycle NVNT 3-DH5 2441MHz Ant1





**A.3. Maximum Peak Conducted Output Power**

Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Duty Factor (dB)	Total Conducted Power (dBm)	Total Conducted Power (W)	Limit Conducted (dBm)	Verdict
NVNT	1-DH5	2402	Ant1	5.35	0	5.35	0.00343	30	Pass
NVNT	1-DH5	2441	Ant1	7.62	0	7.62	0.00578	30	Pass
NVNT	1-DH5	2480	Ant1	8.20	0	8.20	0.00661	30	Pass
NVNT	2-DH5	2402	Ant1	4.37	0	4.37	0.00274	30	Pass
NVNT	2-DH5	2441	Ant1	6.71	0	6.71	0.00469	30	Pass
NVNT	2-DH5	2480	Ant1	7.42	0	7.42	0.00552	30	Pass
NVNT	3-DH5	2402	Ant1	4.81	0	4.81	0.00303	30	Pass
NVNT	3-DH5	2441	Ant1	7.07	0	7.07	0.00509	30	Pass
NVNT	3-DH5	2480	Ant1	7.77	0	7.77	0.00598	30	Pass



Test Graphs

Peak Power NVNT 1-DH5 2402MHz Ant1

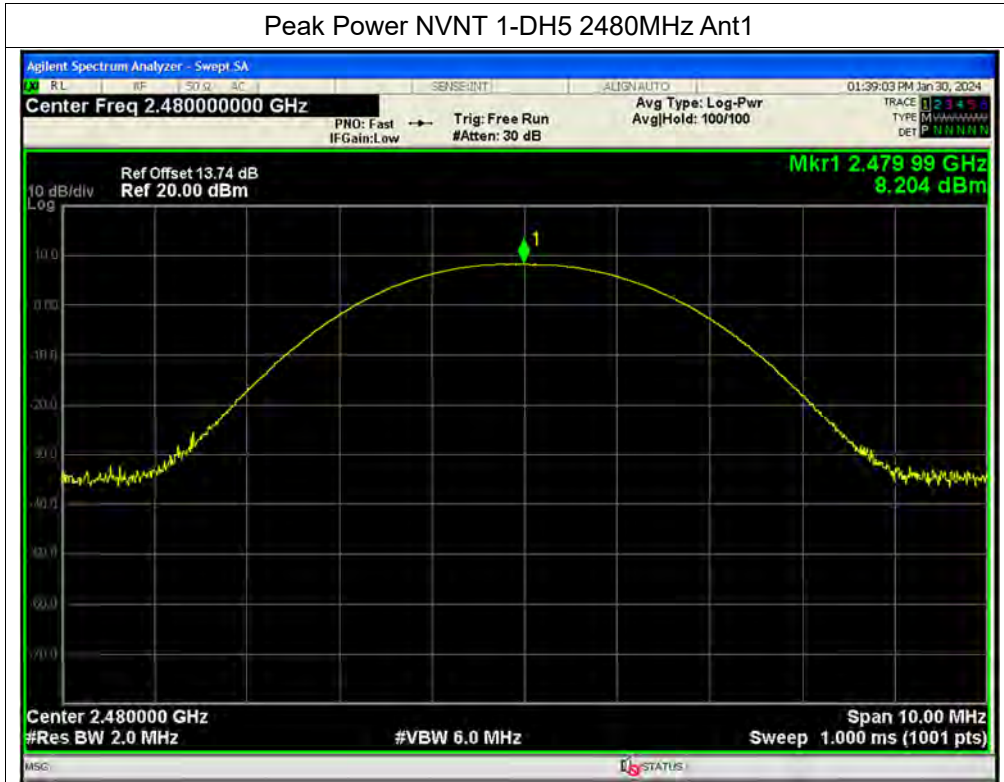


Peak Power NVNT 1-DH5 2441MHz Ant1





Peak Power NVNT 1-DH5 2480MHz Ant1



Peak Power NVNT 2-DH5 2402MHz Ant1



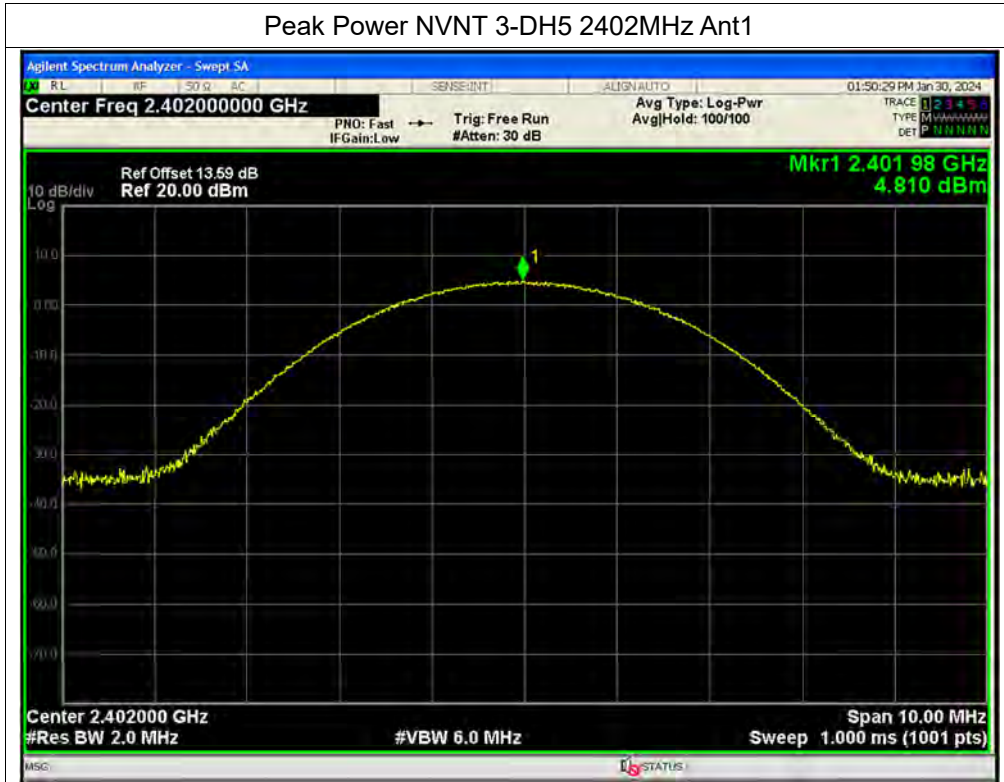
Peak Power NVNT 2-DH5 2441MHz Ant1



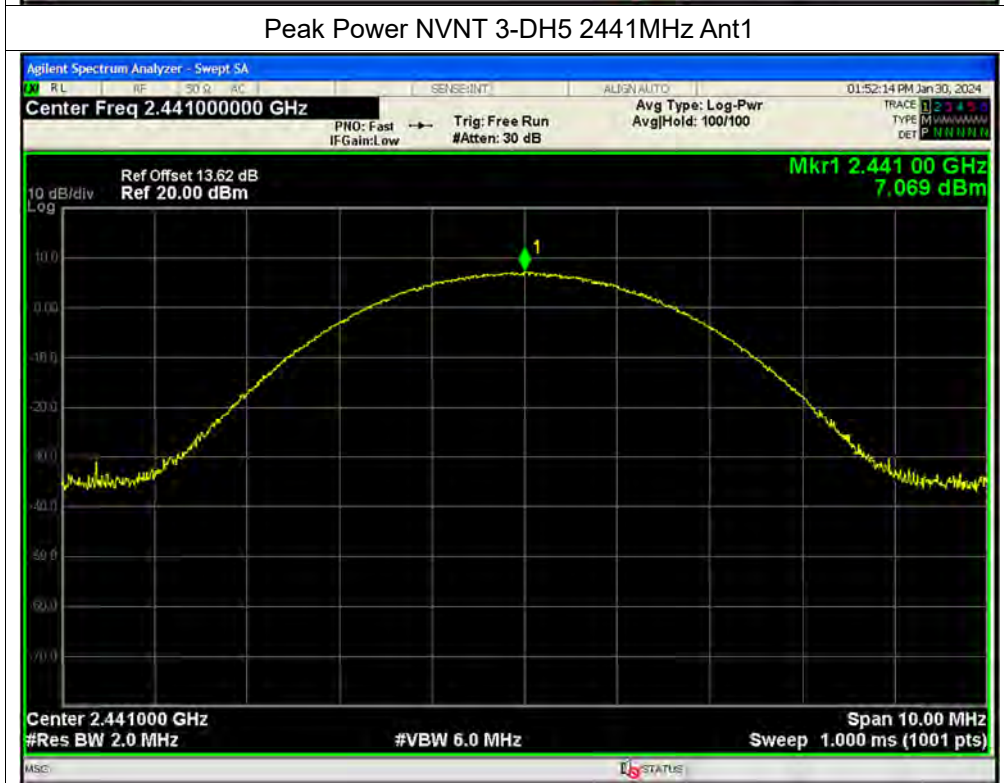
Peak Power NVNT 2-DH5 2480MHz Ant1



Peak Power NVNT 3-DH5 2402MHz Ant1



Peak Power NVNT 3-DH5 2441MHz Ant1







Peak Power NVNT 3-DH5 2480MHz Ant1



**A.4. Maximum Average Conducted Output Power**

Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Duty Factor (dB)	Total Conducted Power (dBm)	Total Conducted Power (W)	Limit Conducted (dBm)	Verdict
NVNT	1-DH5	2402	Ant1	3.84	1.14	4.98	0.00315	30	Pass
NVNT	1-DH5	2441	Ant1	6.47	1.14	7.61	0.00577	30	Pass
NVNT	1-DH5	2480	Ant1	6.77	1.14	7.91	0.00618	30	Pass
NVNT	2-DH5	2402	Ant1	0.44	1.13	1.57	0.00144	30	Pass
NVNT	2-DH5	2441	Ant1	2.84	1.13	3.97	0.00249	30	Pass
NVNT	2-DH5	2480	Ant1	3.41	1.13	4.54	0.00284	30	Pass
NVNT	3-DH5	2402	Ant1	0.39	1.13	1.52	0.00142	30	Pass
NVNT	3-DH5	2441	Ant1	2.9	1.13	4.03	0.00253	30	Pass
NVNT	3-DH5	2480	Ant1	3.44	1.13	4.57	0.00286	30	Pass



Test Graphs

Average Power NVNT 1-DH5 2402MHz Ant1



Average Power NVNT 1-DH5 2441MHz Ant1

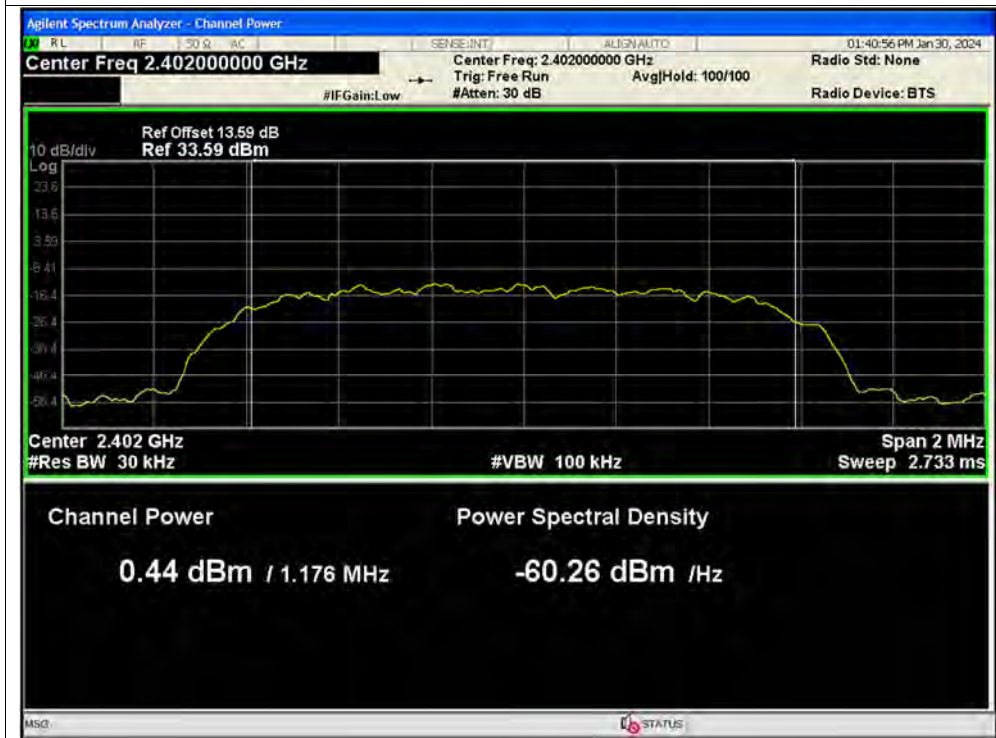




Average Power NVNT 1-DH5 2480MHz Ant1

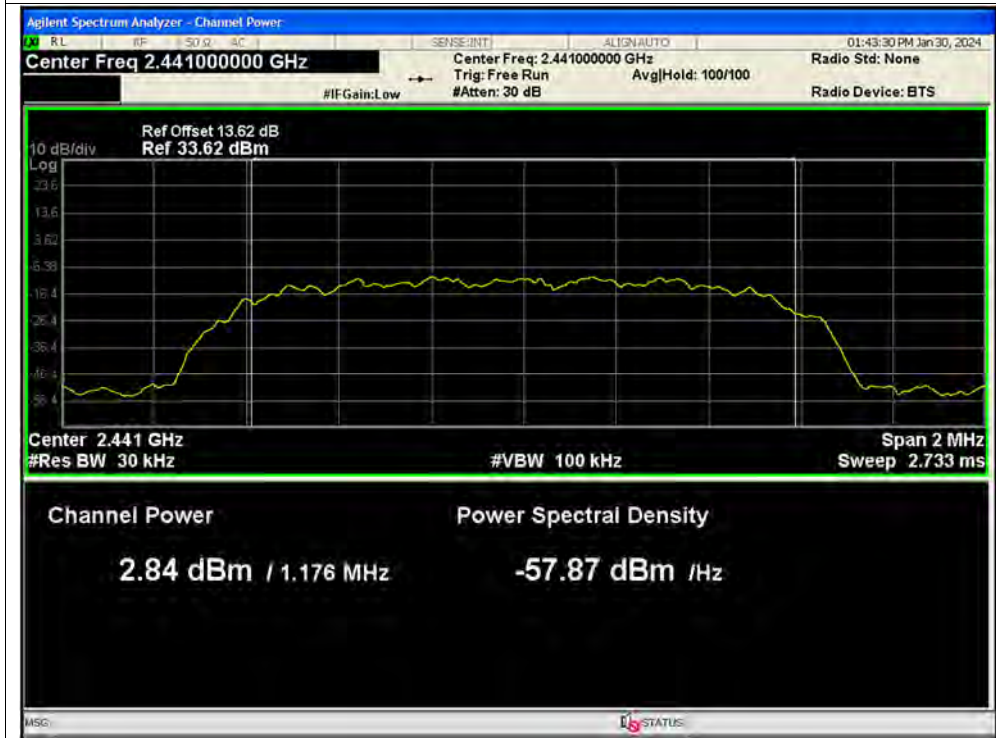


Average Power NVNT 2-DH5 2402MHz Ant1

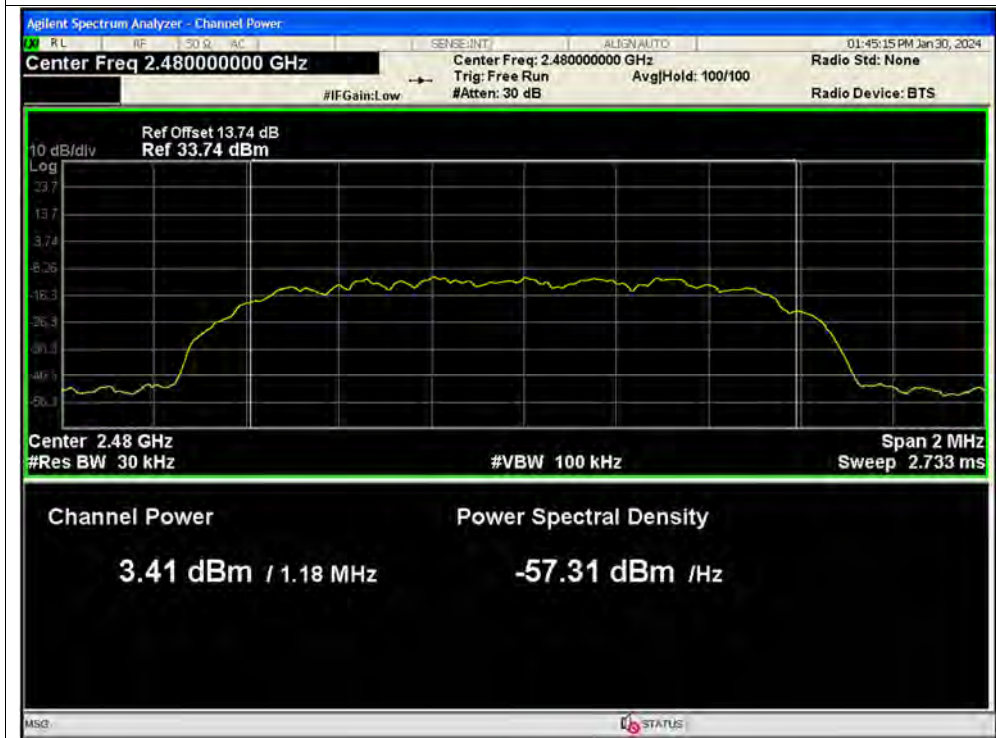




Average Power NVNT 2-DH5 2441MHz Ant1

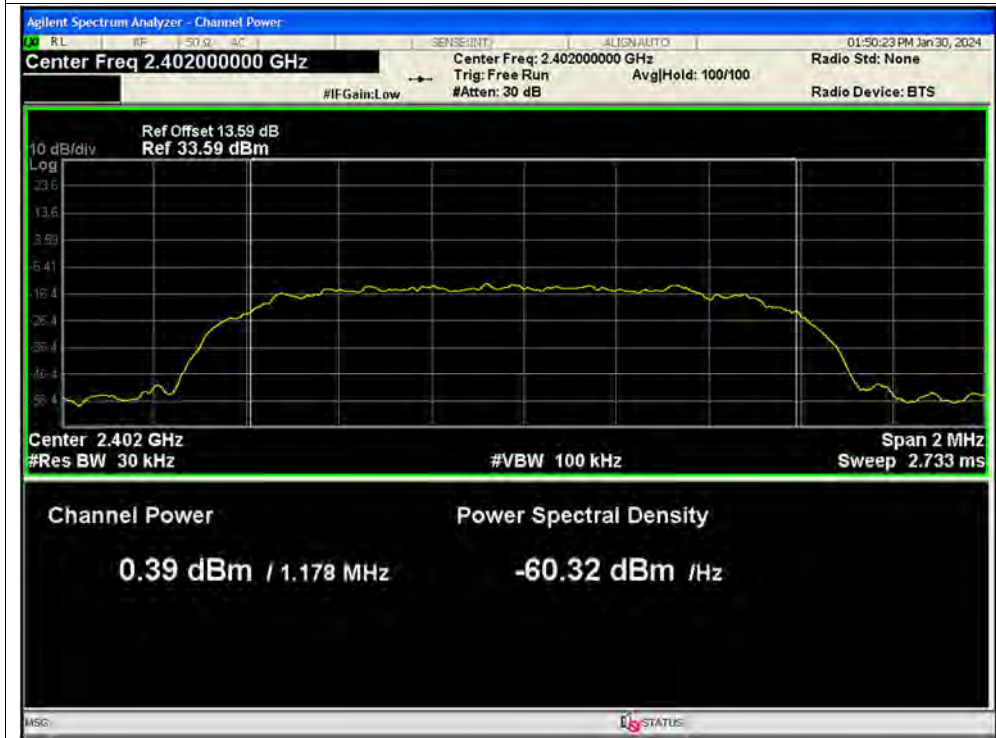


Average Power NVNT 2-DH5 2480MHz Ant1

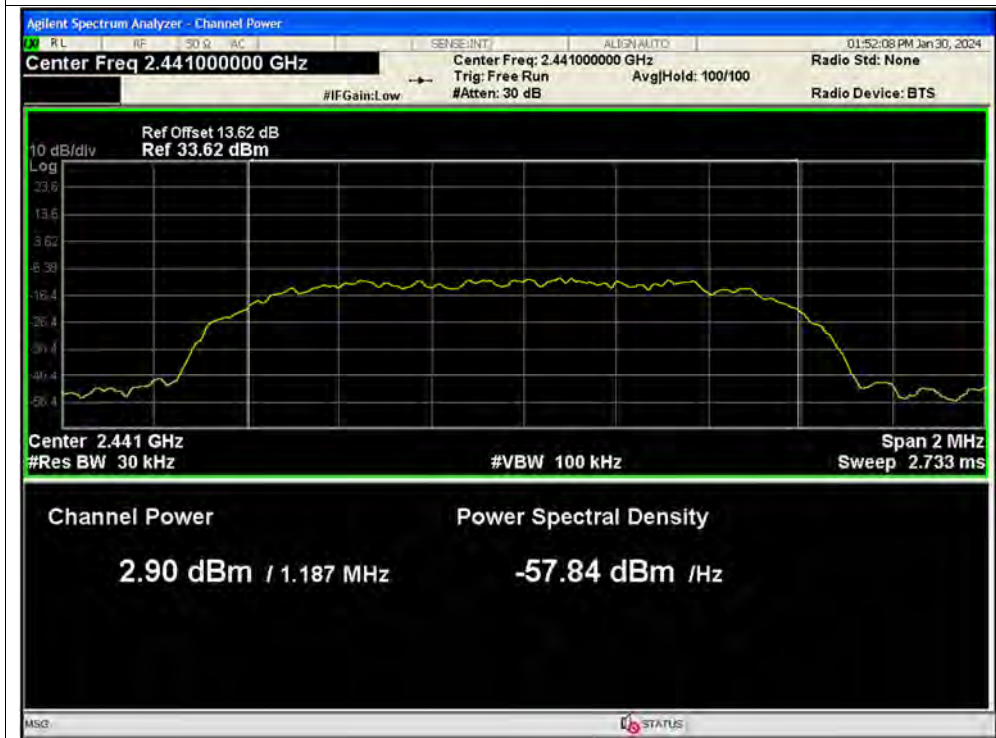


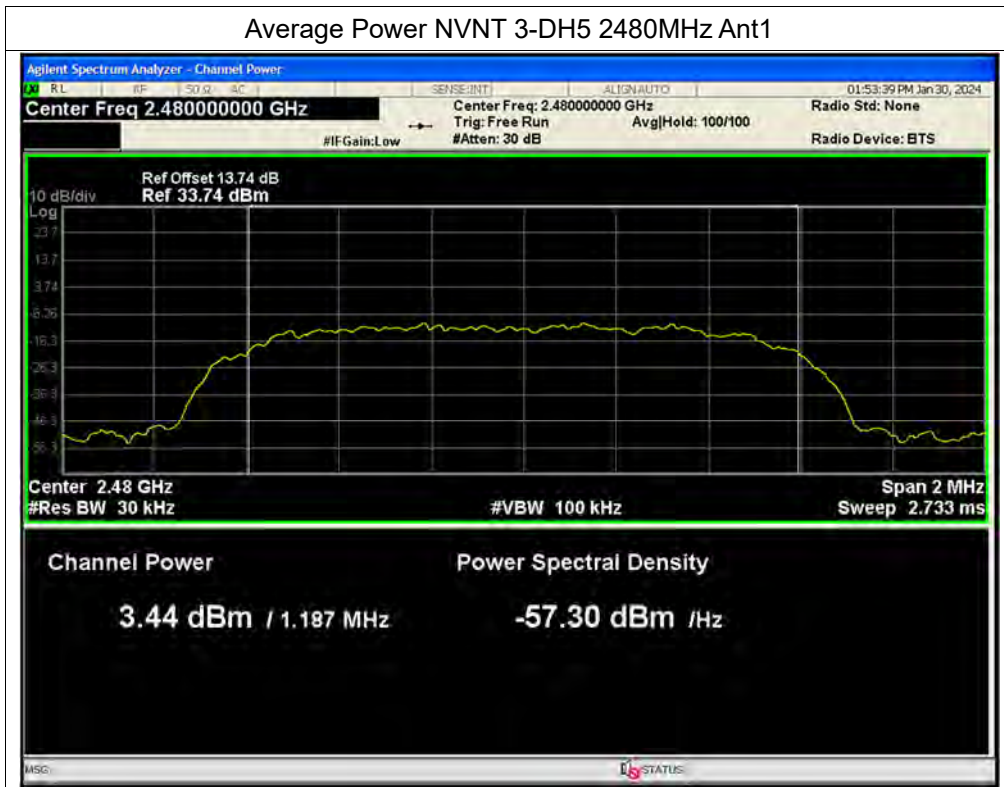


Average Power NVNT 3-DH5 2402MHz Ant1



Average Power NVNT 3-DH5 2441MHz Ant1







**A.5. 20 dB Bandwidth**

Condition	Mode	Frequency (MHz)	Antenna	-20 dB Bandwidth (MHz)
NVNT	1-DH5	2402	Ant1	0.937
NVNT	1-DH5	2441	Ant1	0.941
NVNT	1-DH5	2480	Ant1	0.929
NVNT	2-DH5	2402	Ant1	1.284
NVNT	2-DH5	2441	Ant1	1.285
NVNT	2-DH5	2480	Ant1	1.275
NVNT	3-DH5	2402	Ant1	1.301
NVNT	3-DH5	2441	Ant1	1.286
NVNT	3-DH5	2480	Ant1	1.280





Test Graphs

-20dB Bandwidth NVNT 1-DH5 2402MHz Ant1

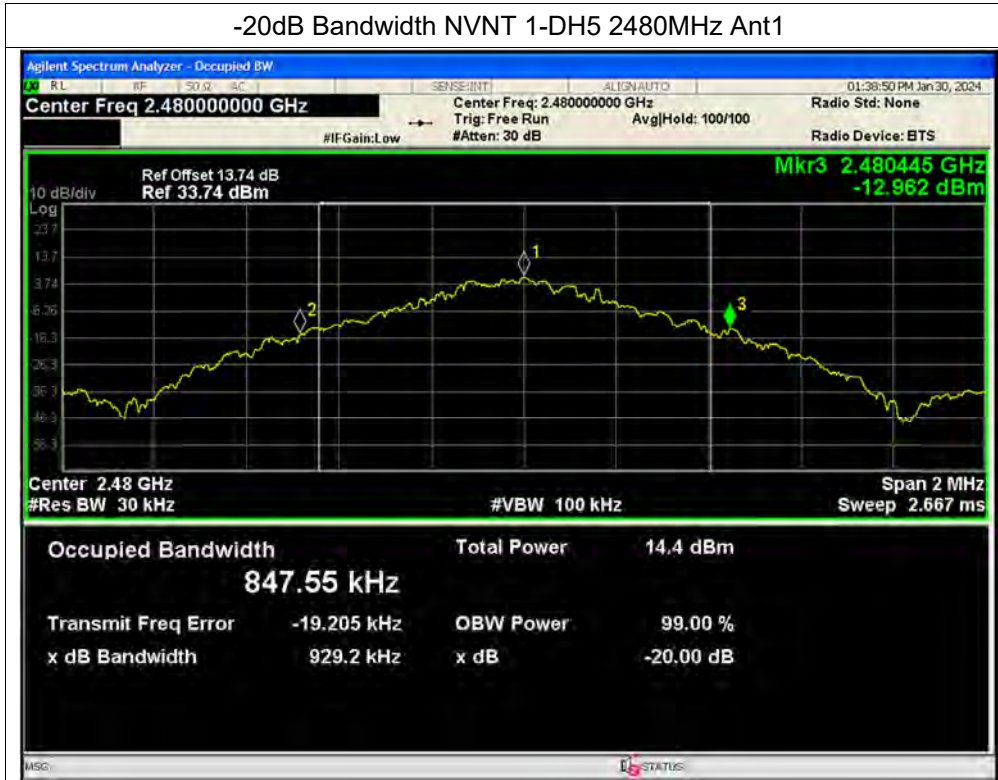


-20dB Bandwidth NVNT 1-DH5 2441MHz Ant1

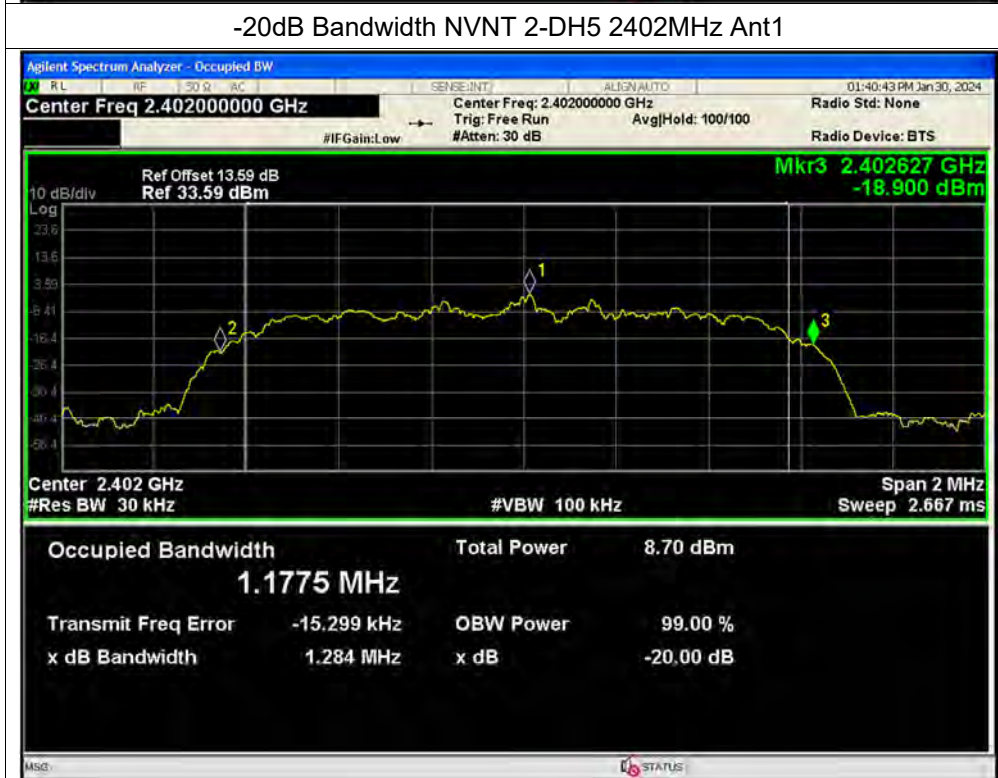




-20dB Bandwidth NVNT 1-DH5 2480MHz Ant1

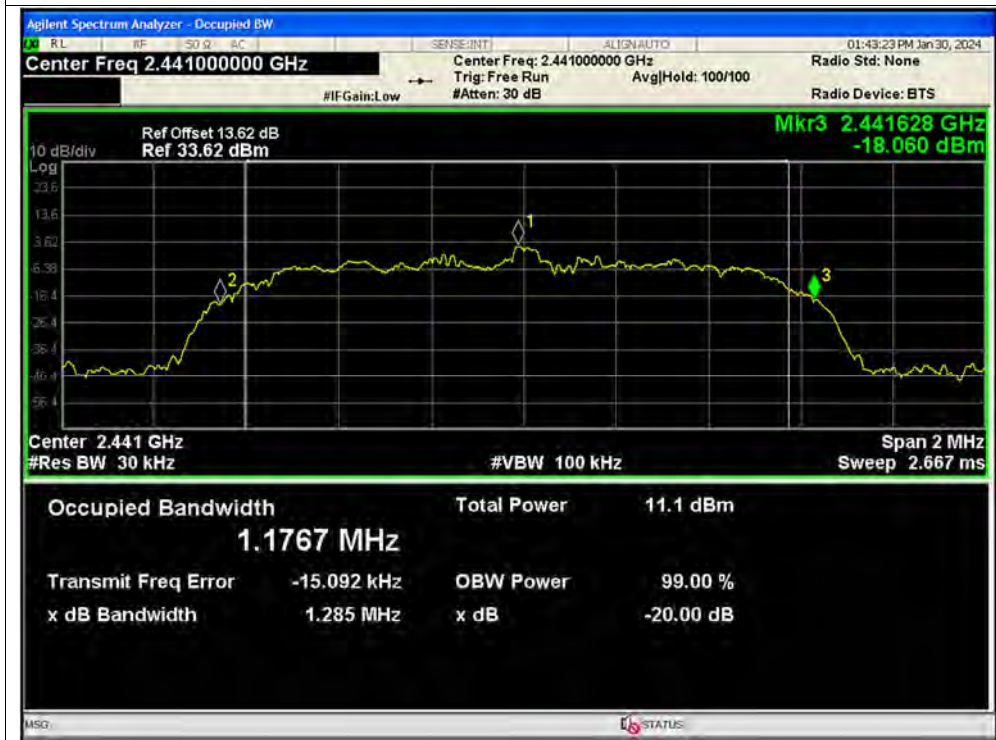


-20dB Bandwidth NVNT 2-DH5 2402MHz Ant1

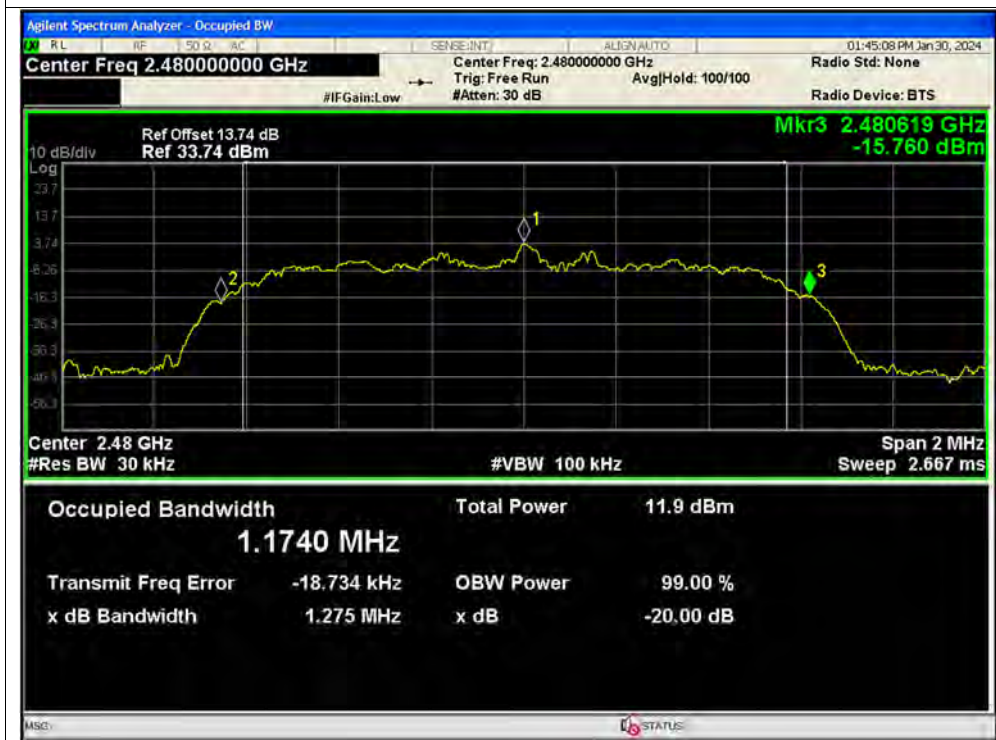




-20dB Bandwidth NVNT 2-DH5 2441MHz Ant1

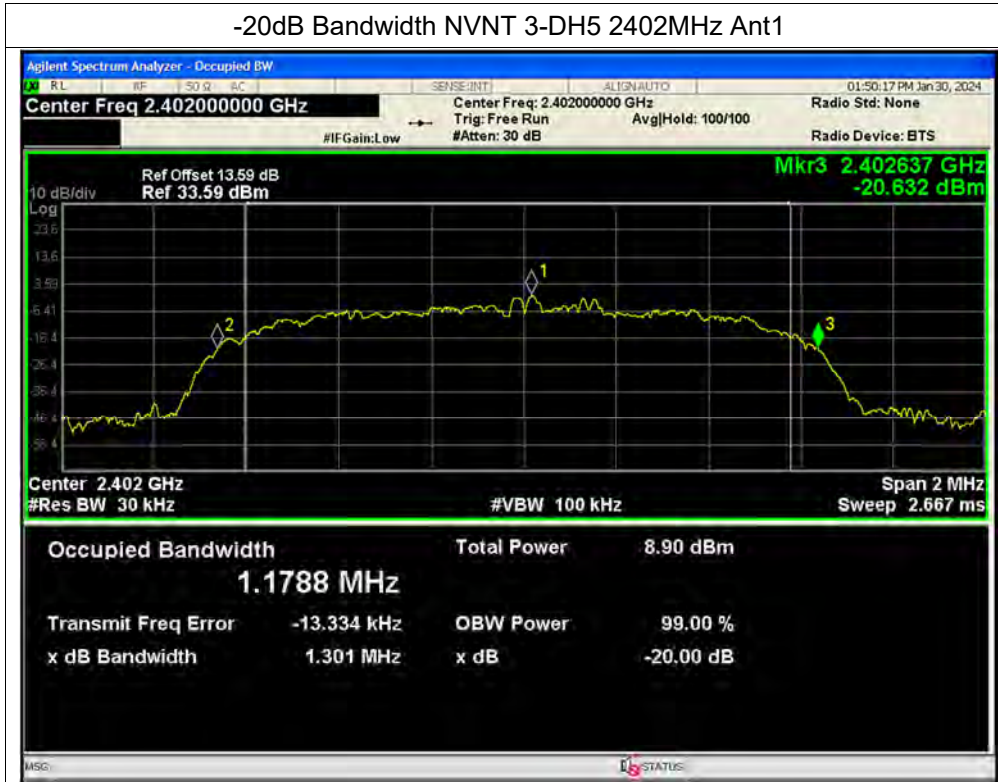


-20dB Bandwidth NVNT 2-DH5 2480MHz Ant1

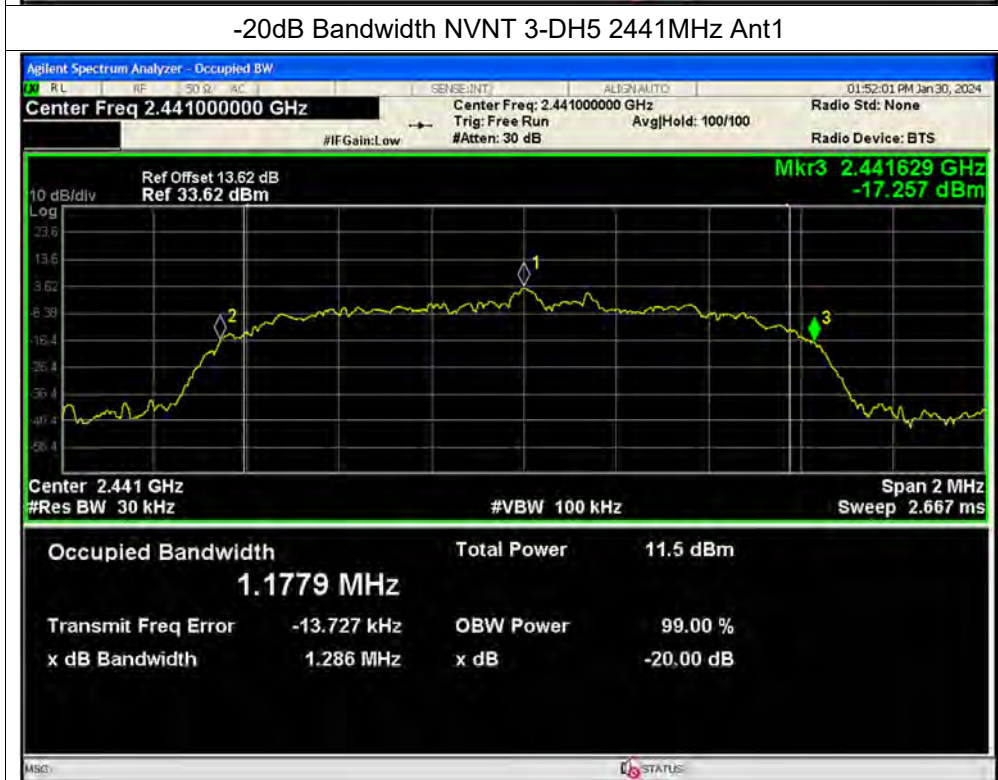


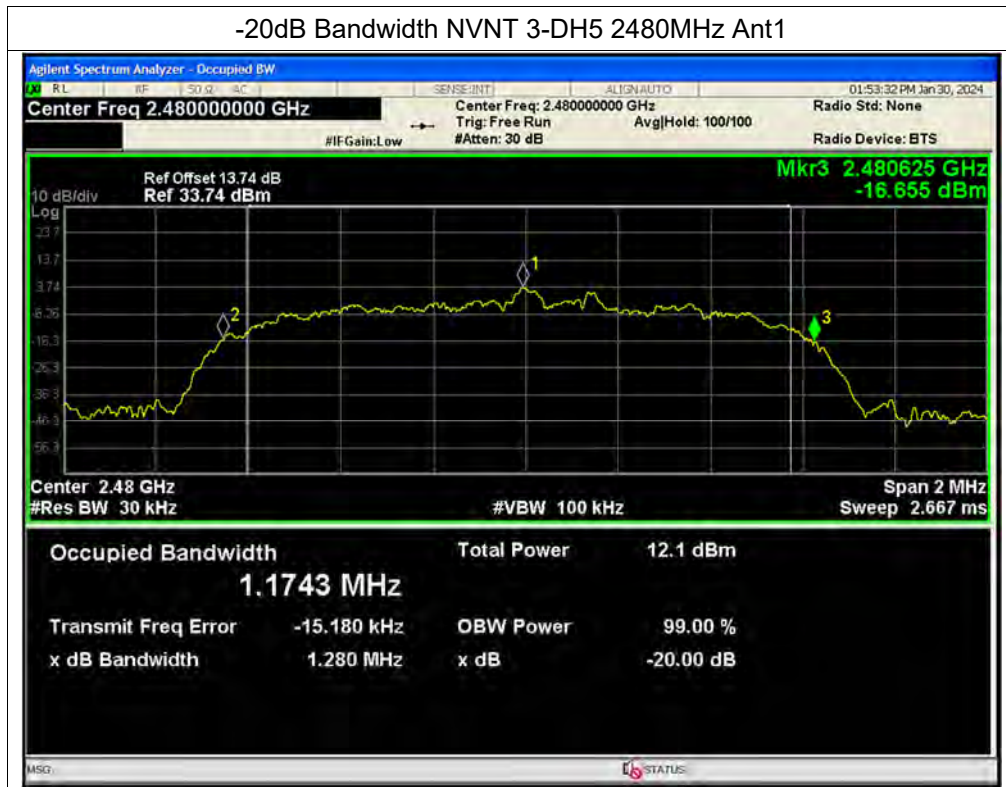


-20dB Bandwidth NVNT 3-DH5 2402MHz Ant1



-20dB Bandwidth NVNT 3-DH5 2441MHz Ant1







Occupied Channel Bandwidth

Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)
NVNT	1-DH5	2402	Ant1	0.8578
NVNT	1-DH5	2441	Ant1	0.8634
NVNT	1-DH5	2480	Ant1	0.8522
NVNT	2-DH5	2402	Ant1	1.1761
NVNT	2-DH5	2441	Ant1	1.1761
NVNT	2-DH5	2480	Ant1	1.1795
NVNT	3-DH5	2402	Ant1	1.178
NVNT	3-DH5	2441	Ant1	1.1868
NVNT	3-DH5	2480	Ant1	1.1874



Test Graphs

OBW NVNT 1-DH5 2402MHz Ant1



OBW NVNT 1-DH5 2441MHz Ant1

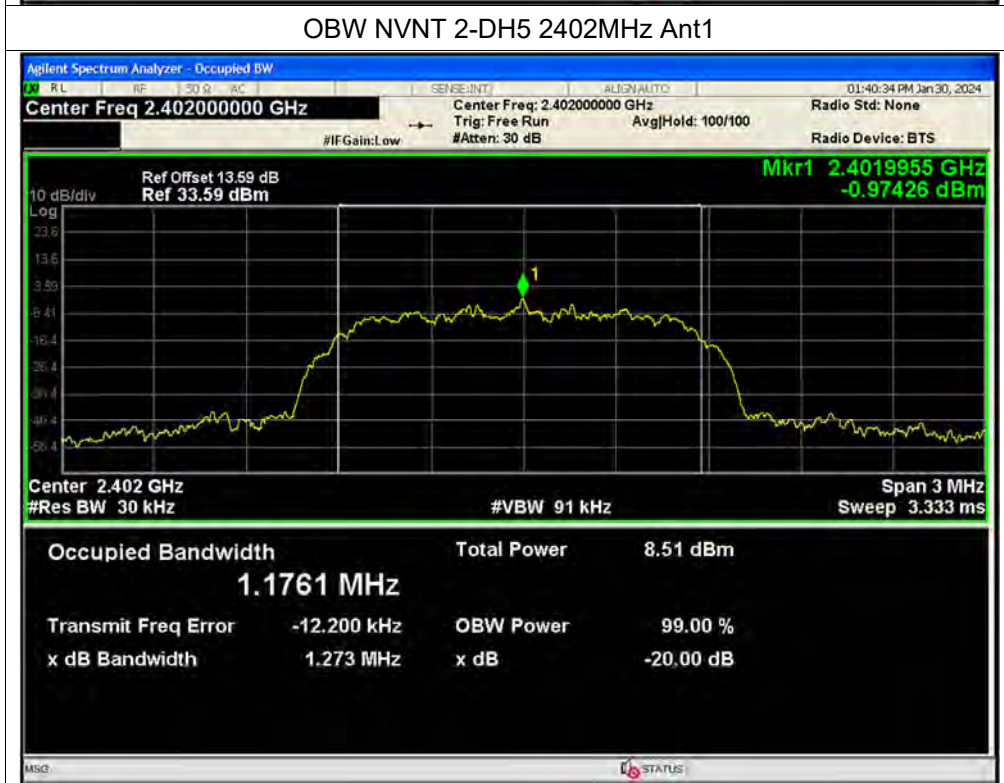




OBW NVNT 1-DH5 2480MHz Ant1



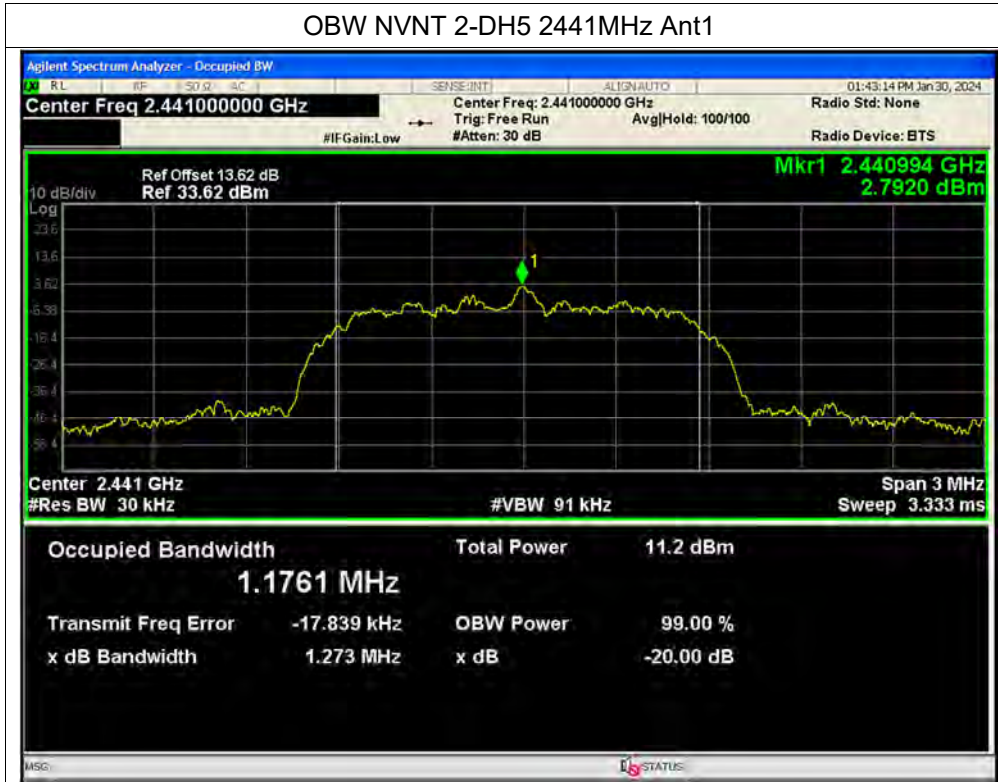
OBW NVNT 2-DH5 2402MHz Ant1



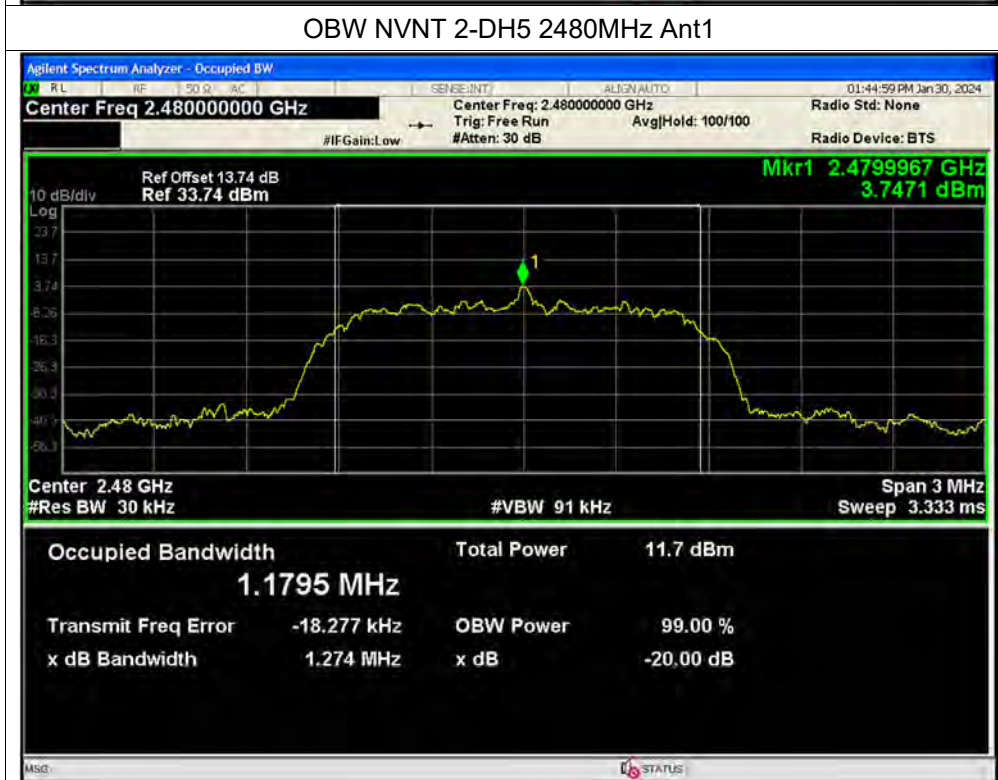




OBW NVNT 2-DH5 2441MHz Ant1



OBW NVNT 2-DH5 2480MHz Ant1



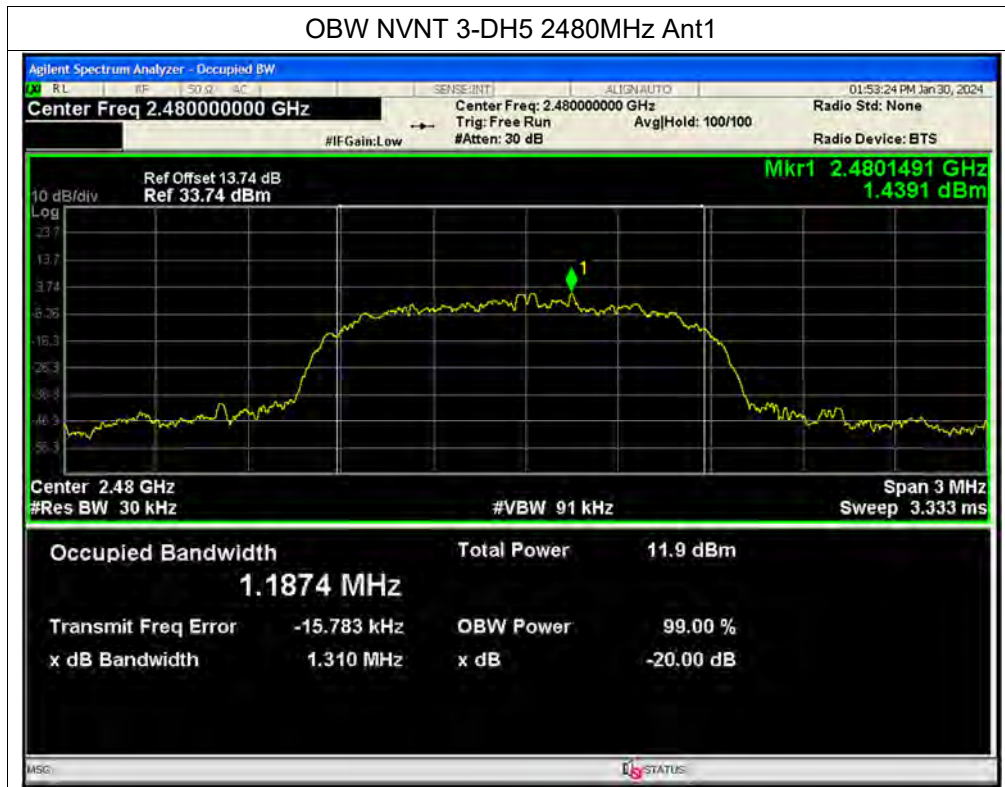


OBW NVNT 3-DH5 2402MHz Ant1



OBW NVNT 3-DH5 2441MHz Ant1

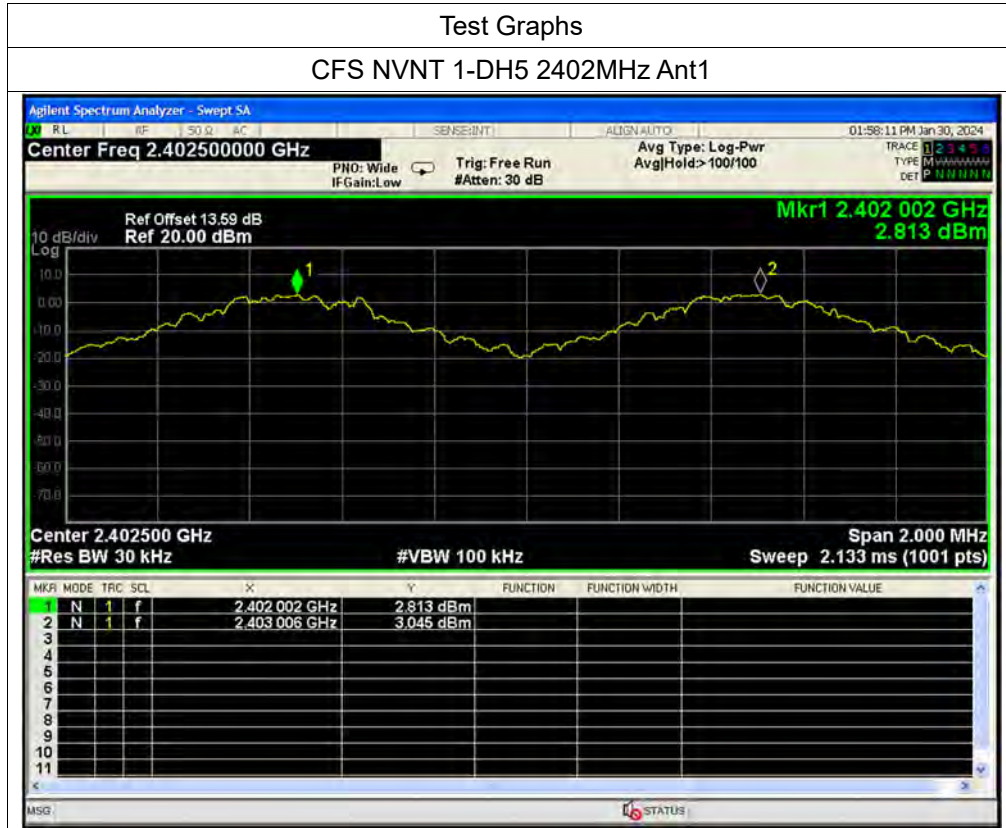






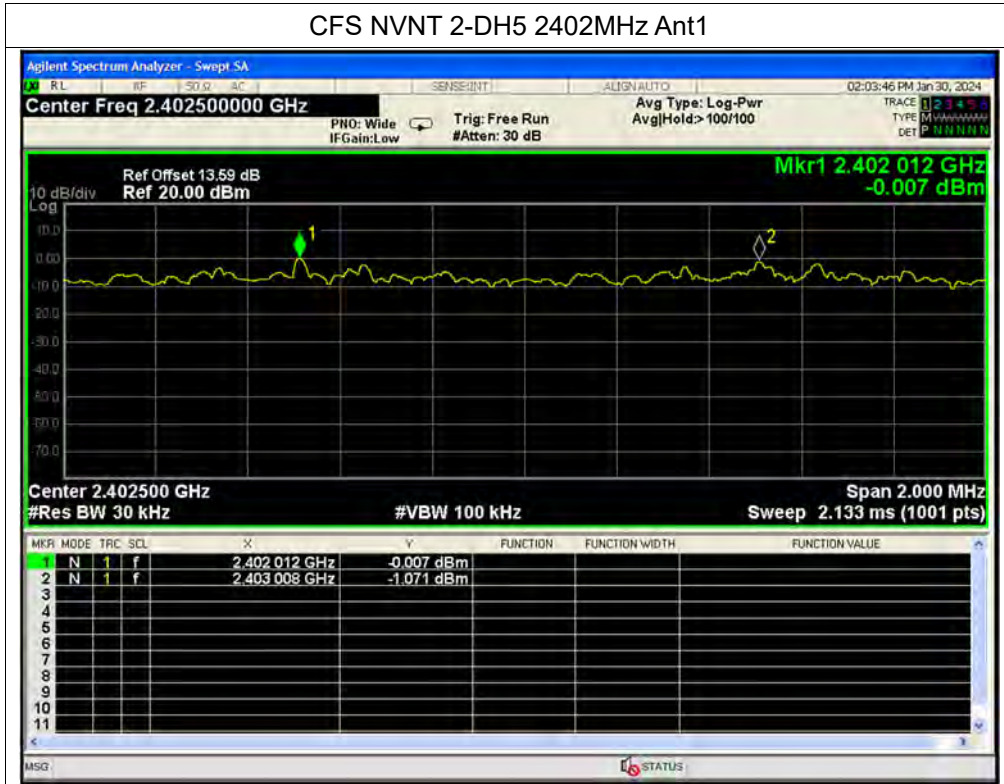
**A.6. Carried Frequency Separation**

Condition	Mode	Antenna	Hopping Freq1 (MHz)	Hopping Freq2 (MHz)	HFS (MHz)	Limit (MHz)	Verdict
NVNT	1-DH5	Ant1	2402.002	2403.006	1.004	0.625	Pass
NVNT	2-DH5	Ant1	2402.012	2403.008	0.996	0.856	Pass
NVNT	3-DH5	Ant1	2402.092	2402.992	0.900	0.867	Pass





CFS NVNT 2-DH5 2402MHz Ant1



CFS NVNT 3-DH5 2402MHz Ant1





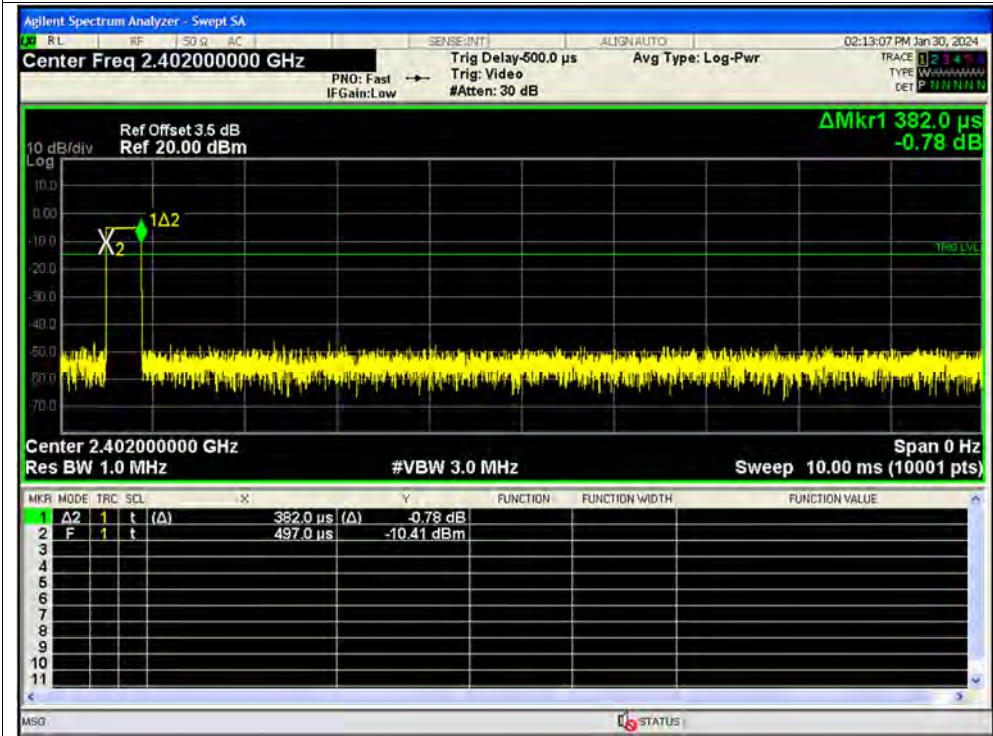
**A.7. Time of Occupancy (Dwell time)**

Condition	Mode	Frequency (MHz)	Antenna	Pulse Time (ms)	Total Dwell Time (ms)	Burst Count	Period Time (ms)	Limit (ms)	Verdict
NVNT	1-DH1	2402	Ant1	0.382	120.712	316	31600	400	Pass
NVNT	1-DH3	2402	Ant1	1.637	255.372	156	31600	400	Pass
NVNT	1-DH5	2402	Ant1	2.886	308.802	107	31600	400	Pass
NVNT	2-DH1	2402	Ant1	0.387	120.744	312	31600	400	Pass
NVNT	2-DH3	2402	Ant1	1.639	265.518	162	31600	400	Pass
NVNT	2-DH5	2402	Ant1	2.887	337.779	117	31600	400	Pass
NVNT	3-DH1	2402	Ant1	0.387	122.292	316	31600	400	Pass
NVNT	3-DH3	2402	Ant1	1.638	273.546	167	31600	400	Pass
NVNT	3-DH5	2402	Ant1	2.89	303.45	105	31600	400	Pass

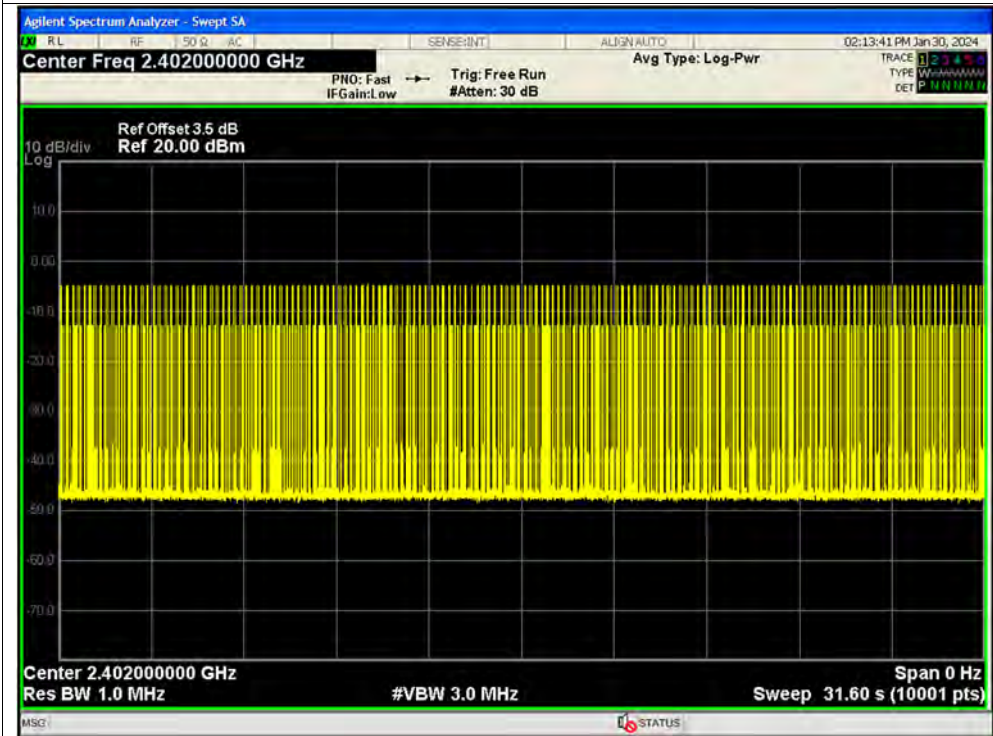


Test Graphs

Dwell NVNT 1-DH1 2402MHz Ant1 One Burst

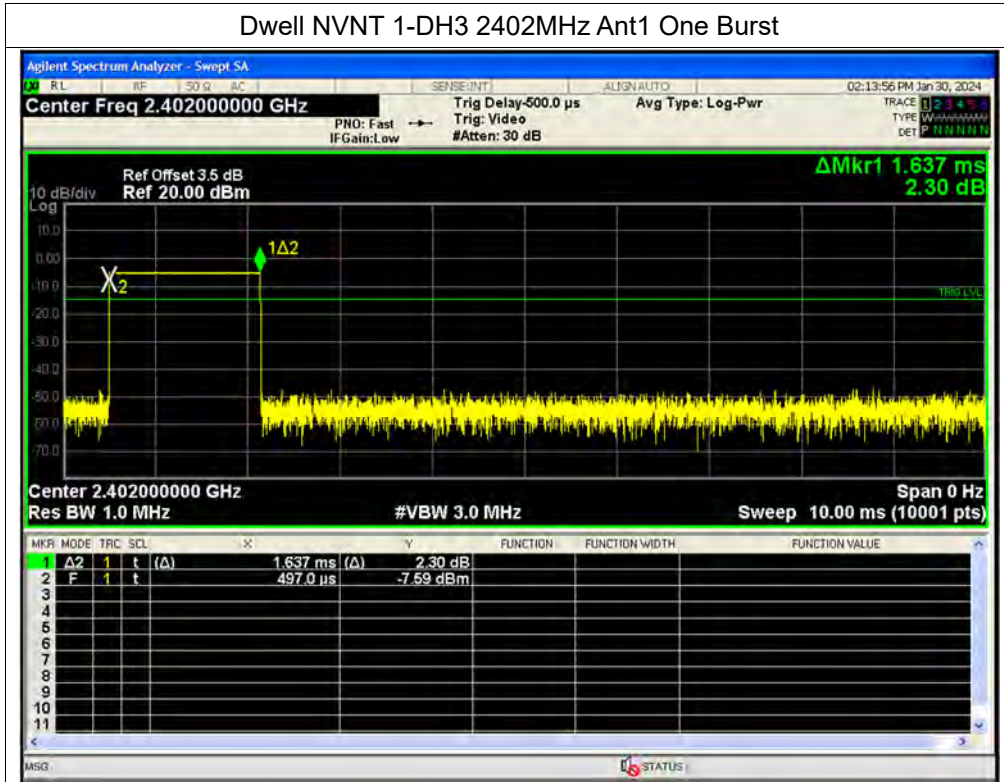


Dwell NVNT 1-DH1 2402MHz Ant1 Accumulated

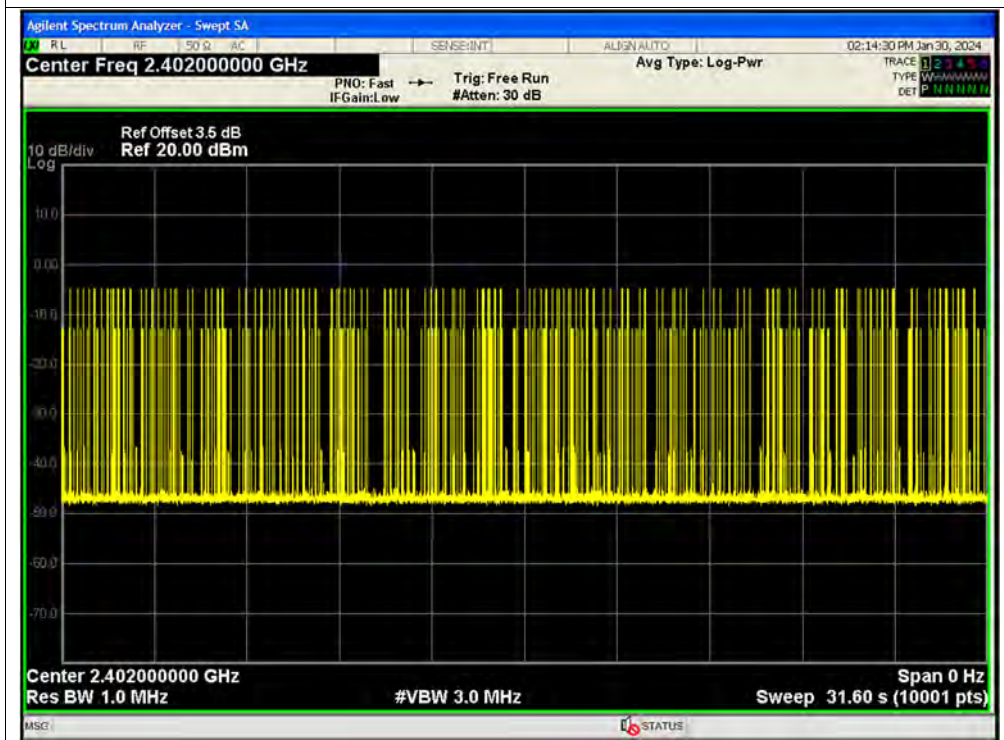




Dwell NVNT 1-DH3 2402MHz Ant1 One Burst



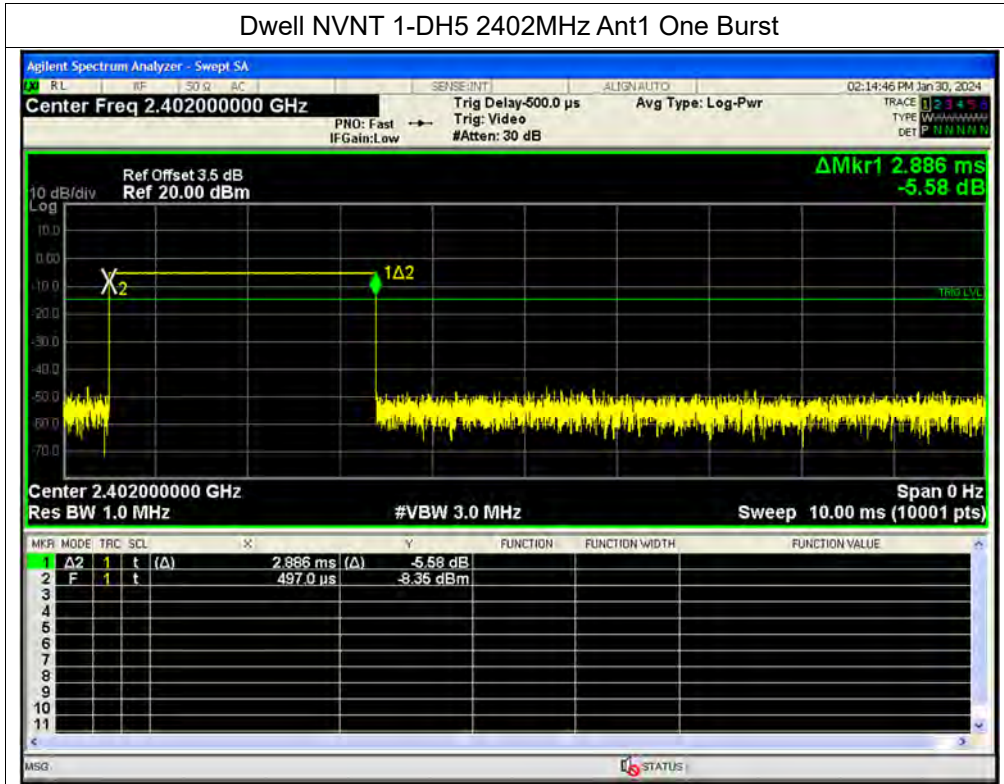
Dwell NVNT 1-DH3 2402MHz Ant1 Accumulated



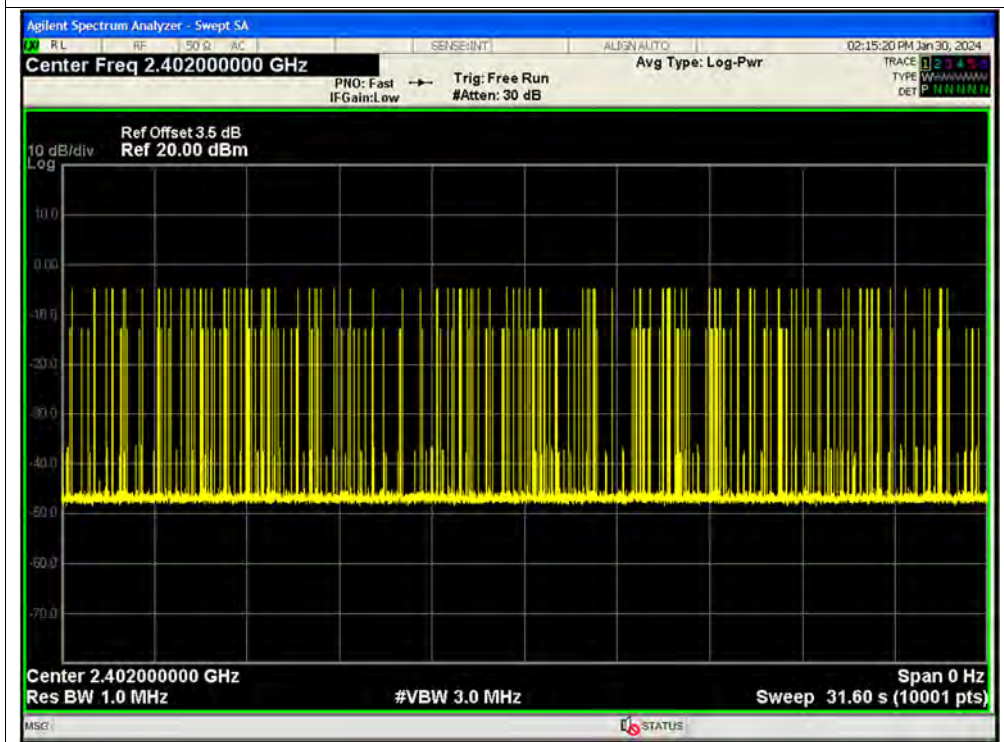




Dwell NVNT 1-DH5 2402MHz Ant1 One Burst

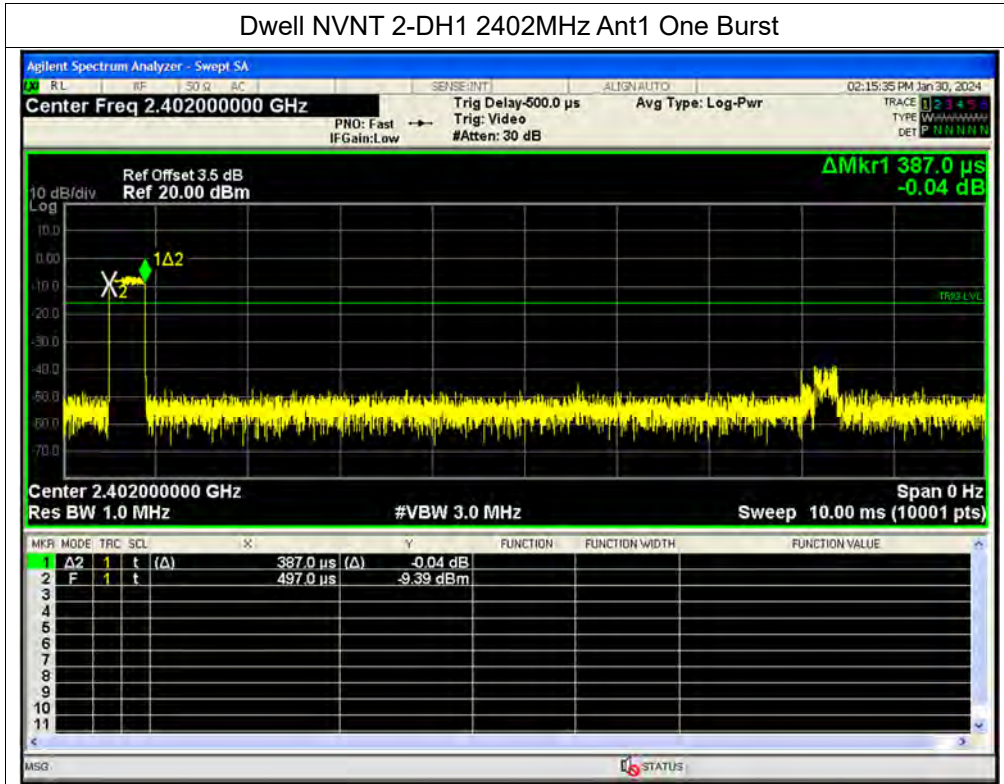


Dwell NVNT 1-DH5 2402MHz Ant1 Accumulated

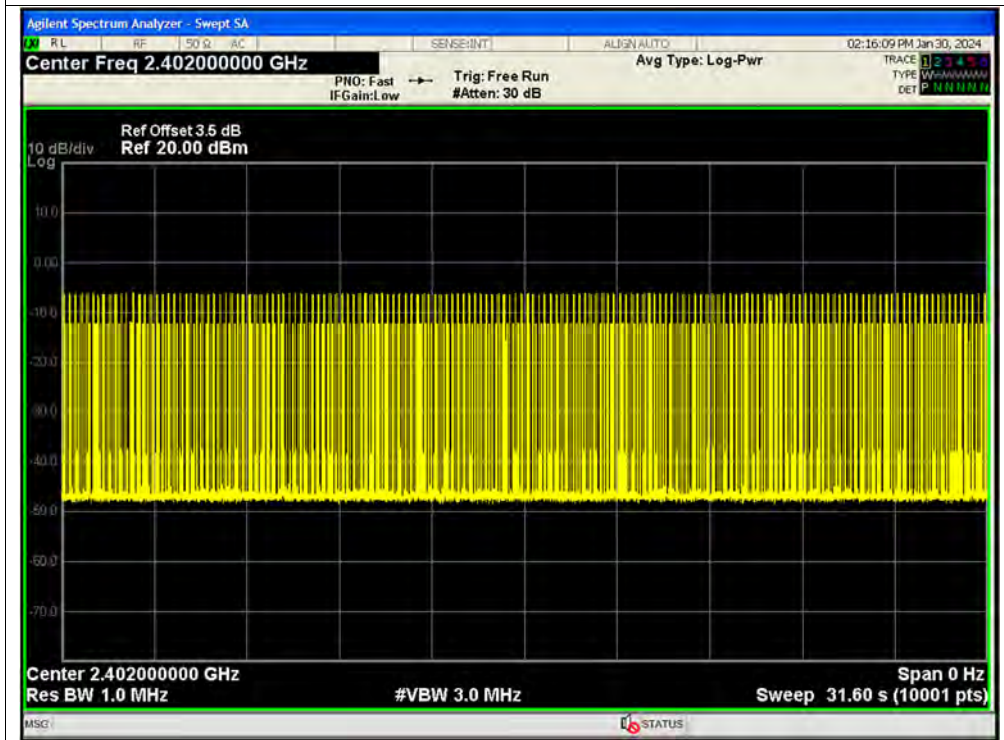




Dwell NVNT 2-DH1 2402MHz Ant1 One Burst

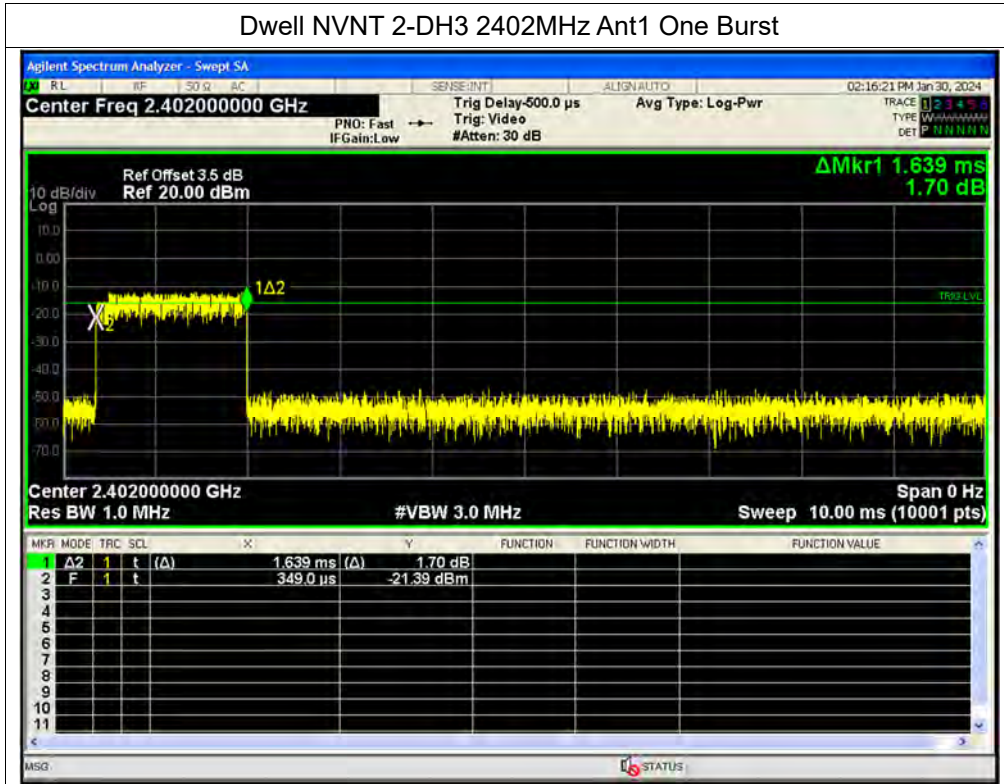


Dwell NVNT 2-DH1 2402MHz Ant1 Accumulated

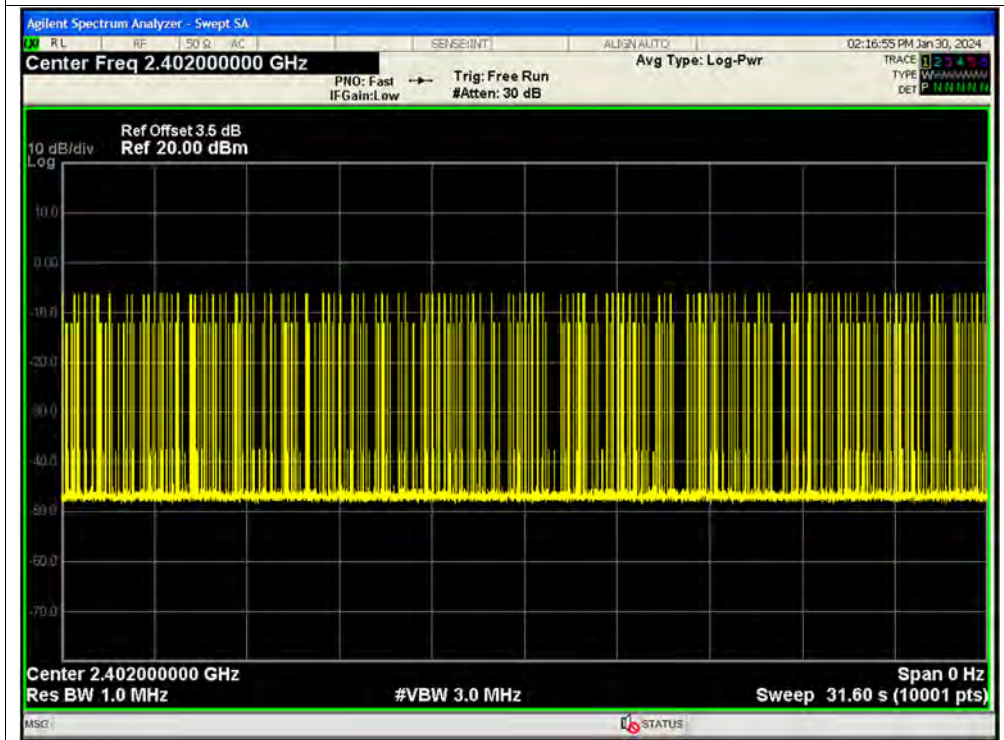




Dwell NVNT 2-DH3 2402MHz Ant1 One Burst

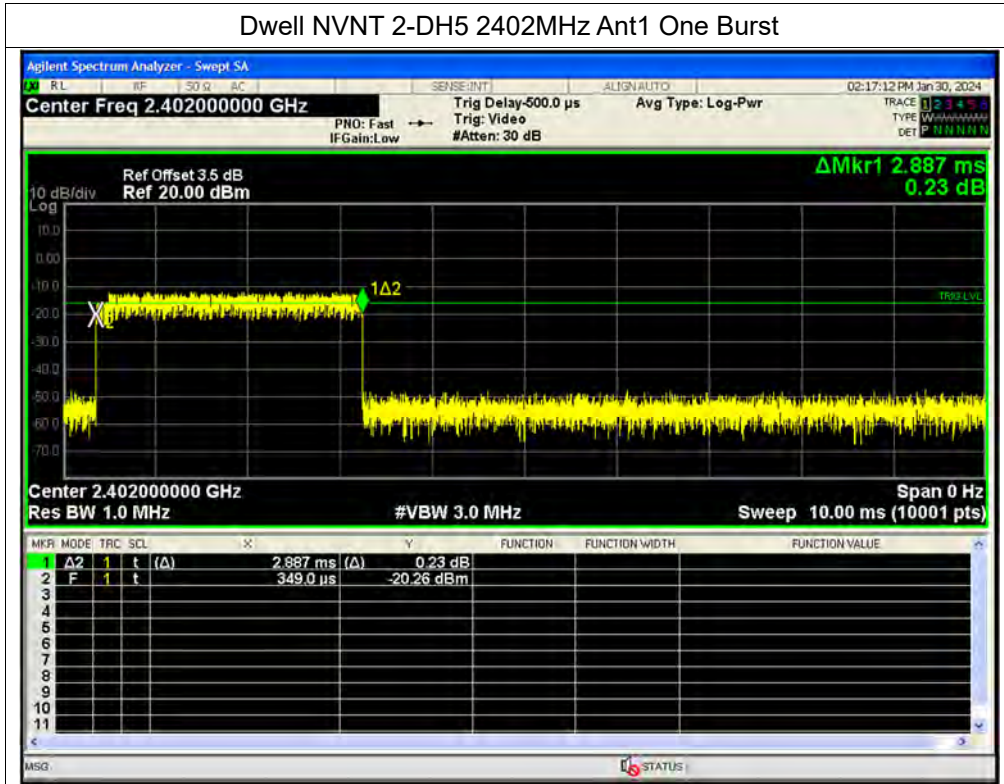


Dwell NVNT 2-DH3 2402MHz Ant1 Accumulated

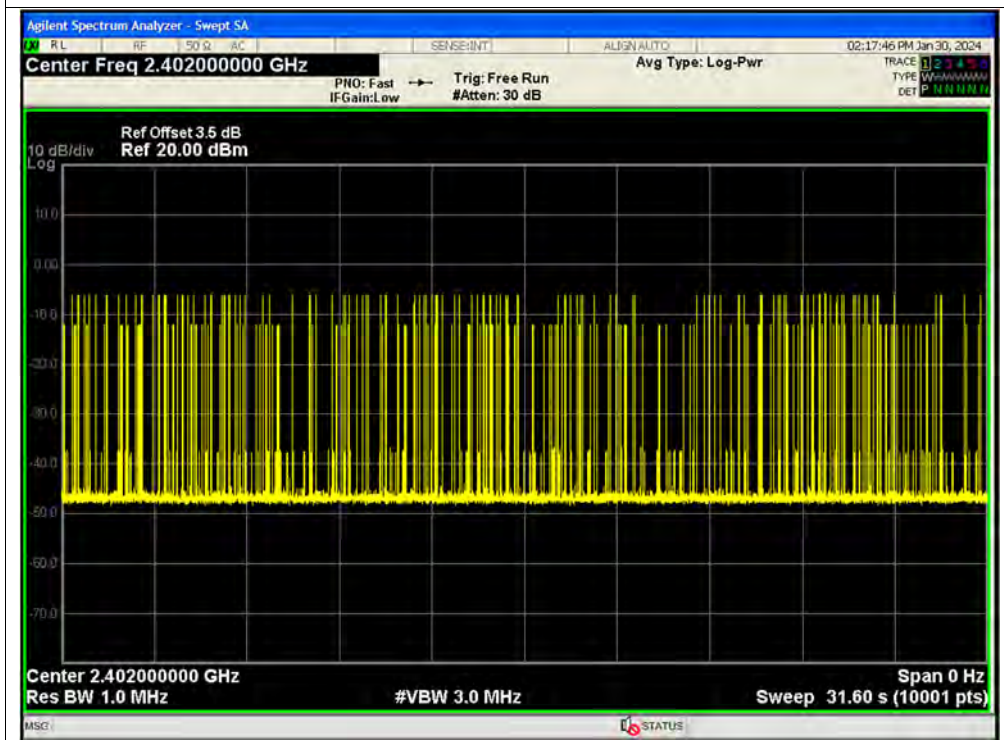




Dwell NVNT 2-DH5 2402MHz Ant1 One Burst

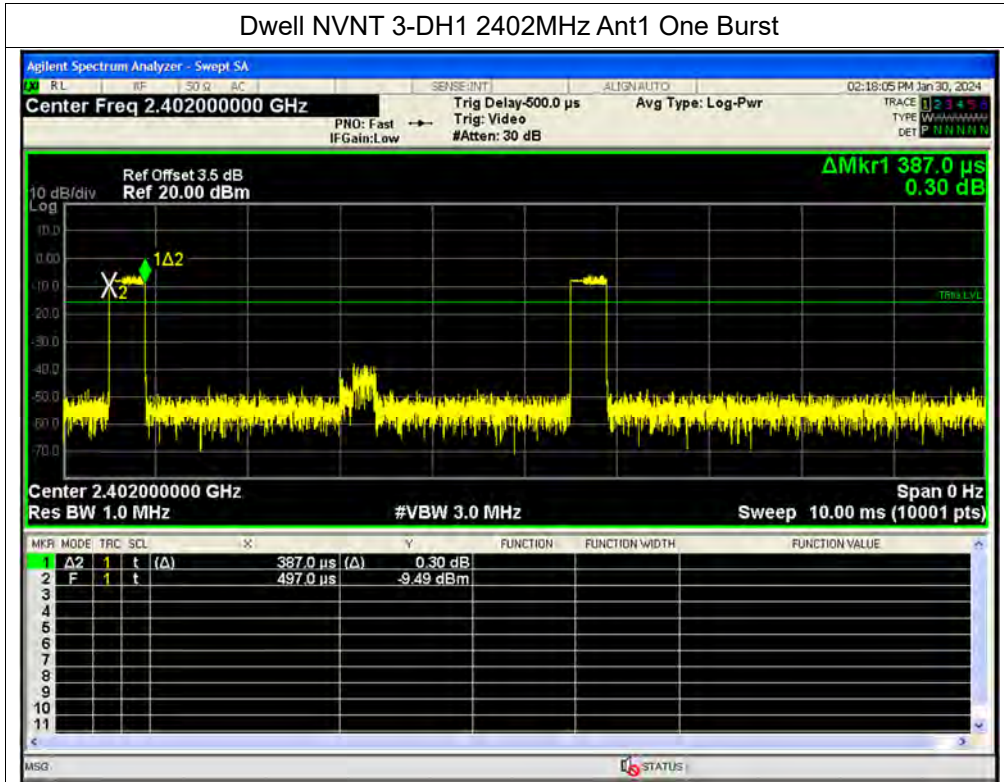


Dwell NVNT 2-DH5 2402MHz Ant1 Accumulated

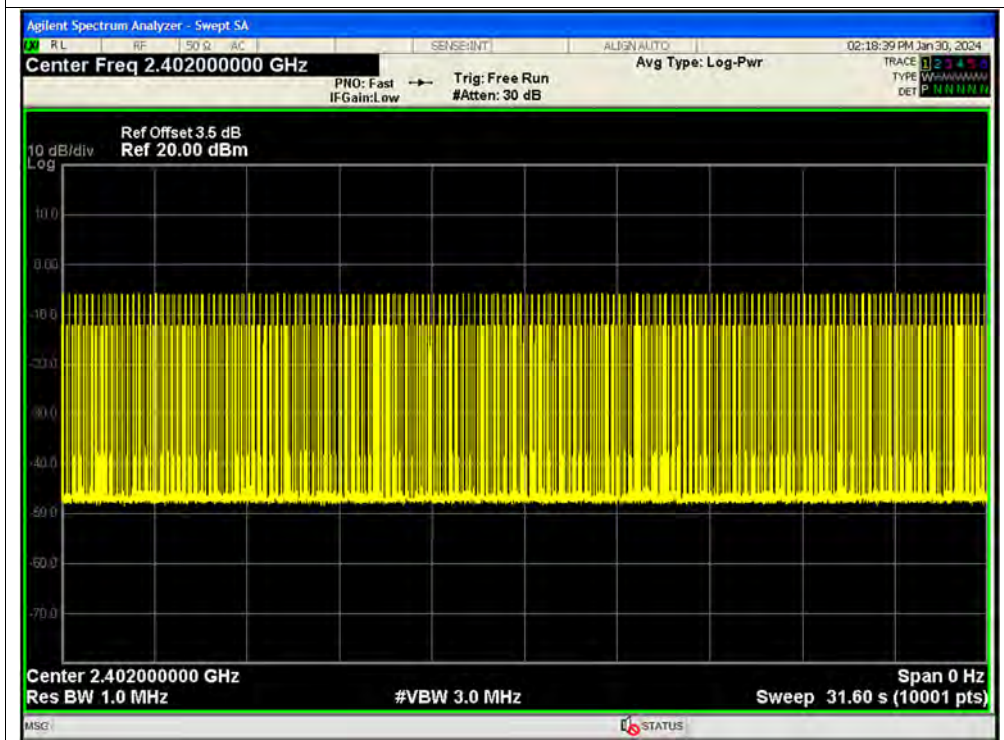




Dwell NVNT 3-DH1 2402MHz Ant1 One Burst

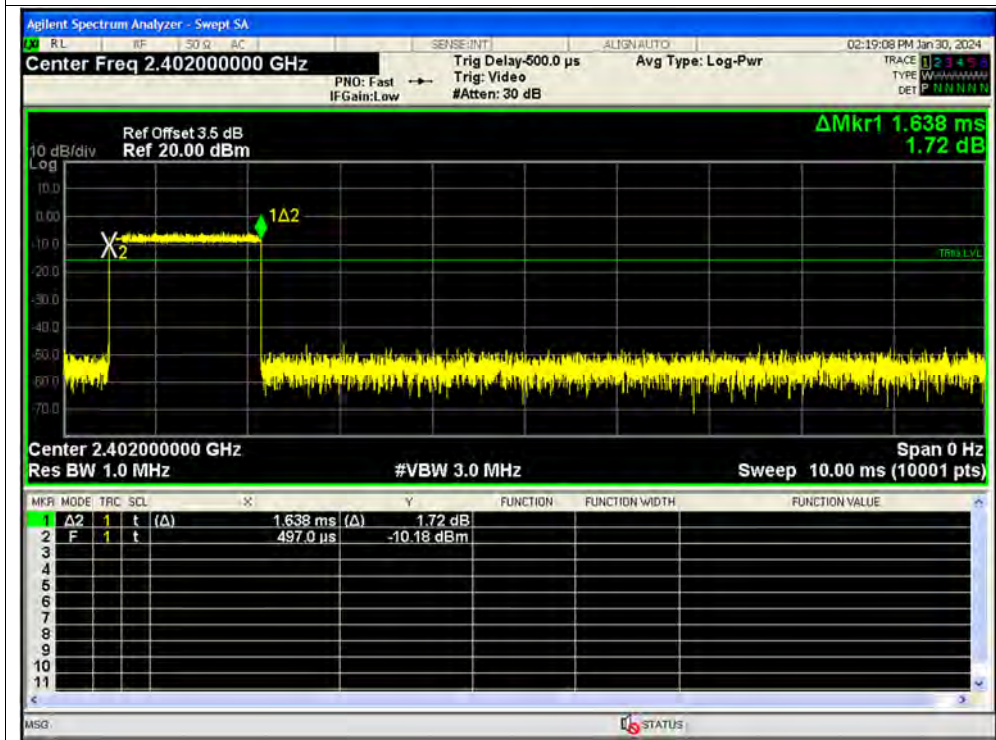


Dwell NVNT 3-DH1 2402MHz Ant1 Accumulated

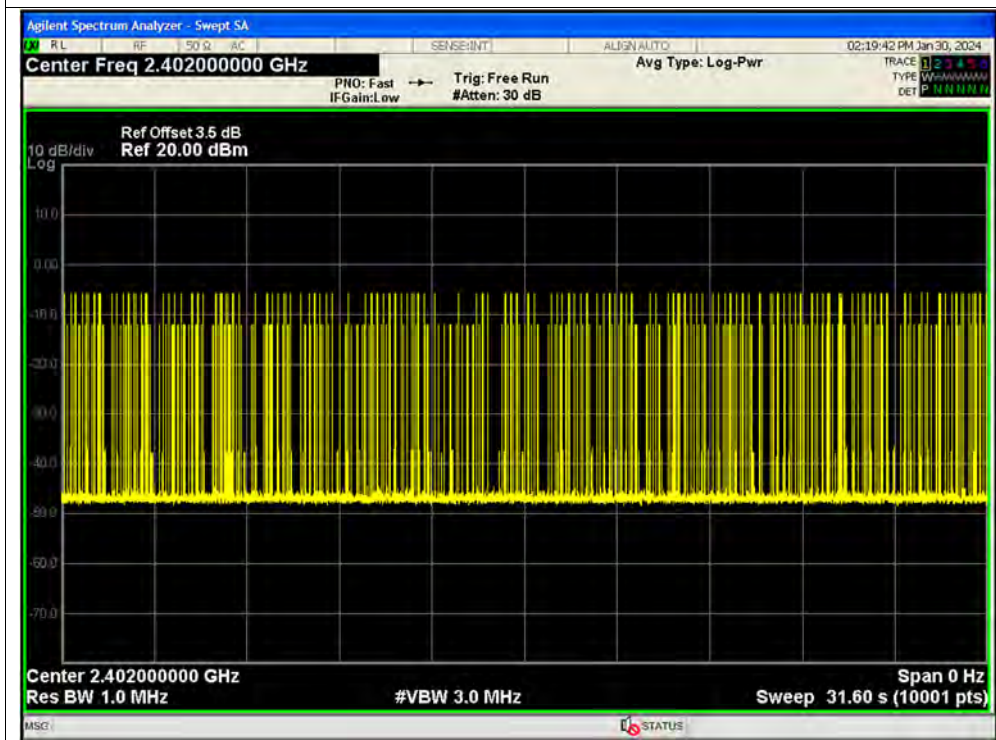




Dwell NVNT 3-DH3 2402MHz Ant1 One Burst

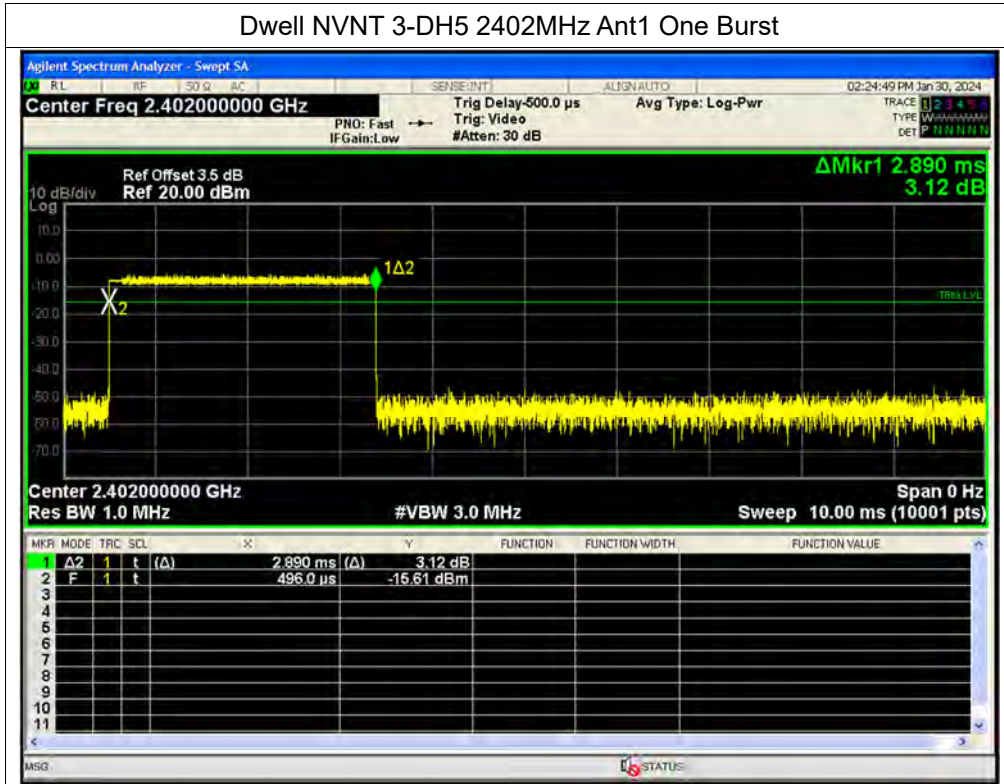


Dwell NVNT 3-DH3 2402MHz Ant1 Accumulated

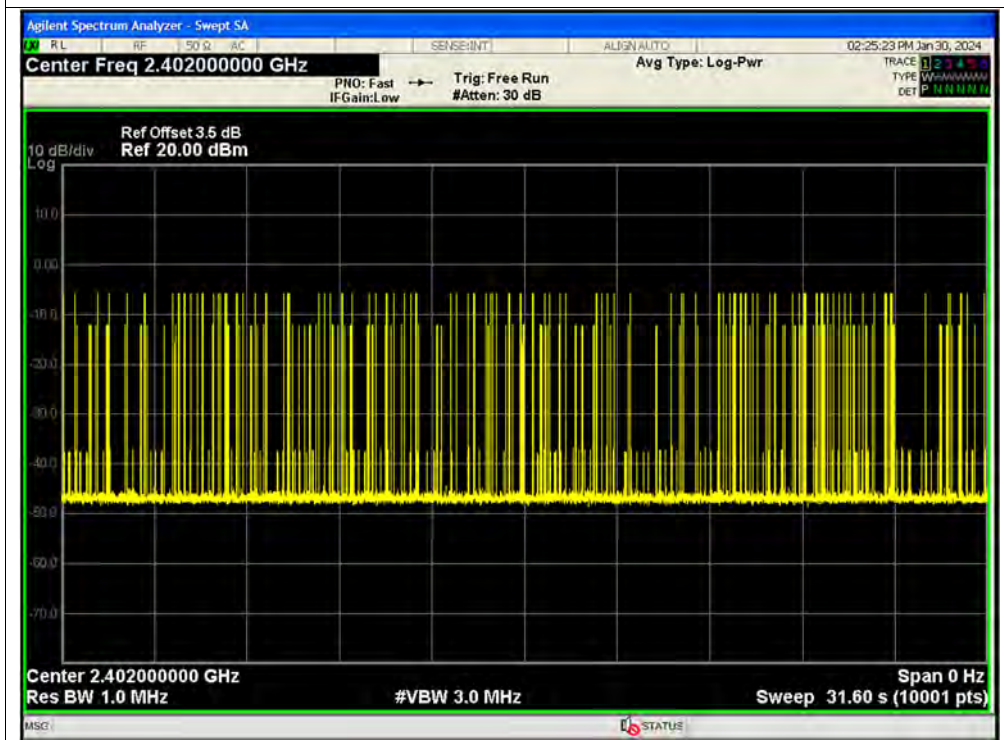




Dwell NVNT 3-DH5 2402MHz Ant1 One Burst



Dwell NVNT 3-DH5 2402MHz Ant1 Accumulated





**A.8. Conducted Spurious Emissions**

Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	1-DH5	2402	Ant1	-43.34	-20	Pass
NVNT	1-DH5	2441	Ant1	-45.37	-20	Pass
NVNT	1-DH5	2480	Ant1	-45.70	-20	Pass
NVNT	2-DH5	2402	Ant1	-39.53	-20	Pass
NVNT	2-DH5	2441	Ant1	-42.65	-20	Pass
NVNT	2-DH5	2480	Ant1	-42.61	-20	Pass
NVNT	3-DH5	2402	Ant1	-40.09	-20	Pass
NVNT	3-DH5	2441	Ant1	-42.19	-20	Pass
NVNT	3-DH5	2480	Ant1	-42.42	-20	Pass



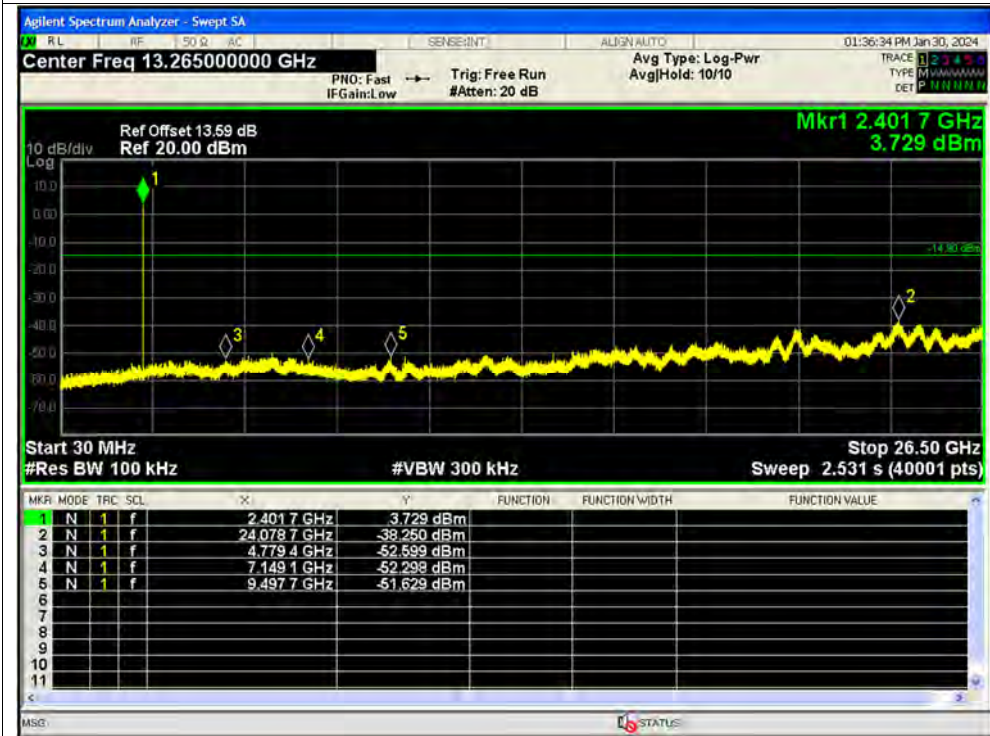


Test Graphs

Tx. Spurious NVNT 1-DH5 2402MHz Ant1 Ref



Tx. Spurious NVNT 1-DH5 2402MHz Ant1 Emission

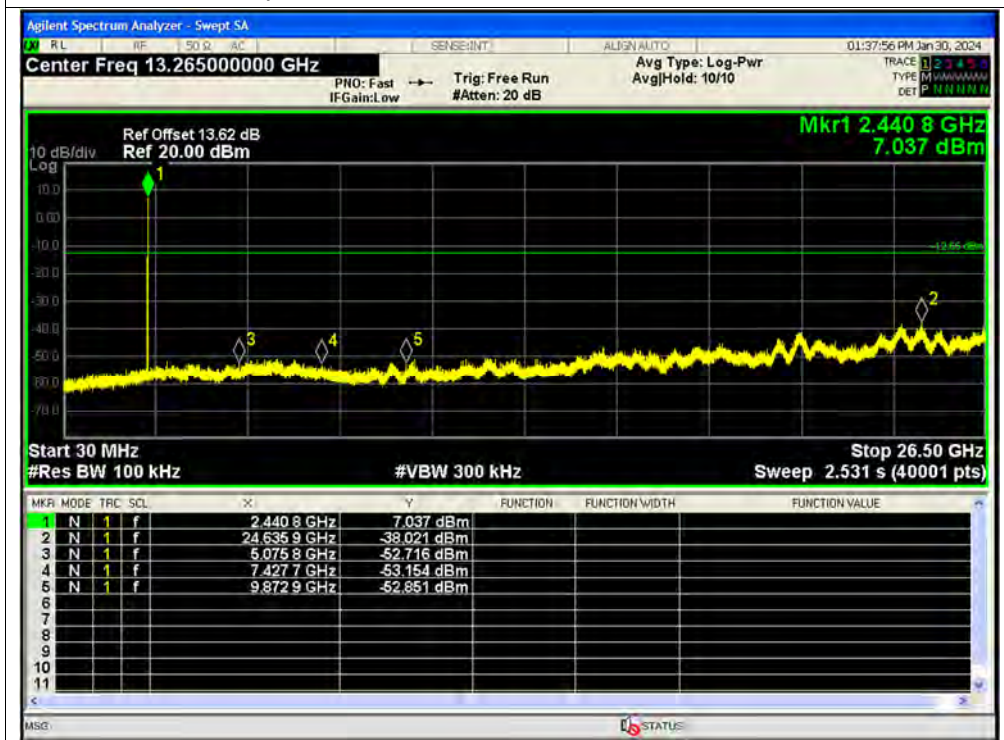




Tx. Spurious NVNT 1-DH5 2441MHz Ant1 Ref



Tx. Spurious NVNT 1-DH5 2441MHz Ant1 Emission

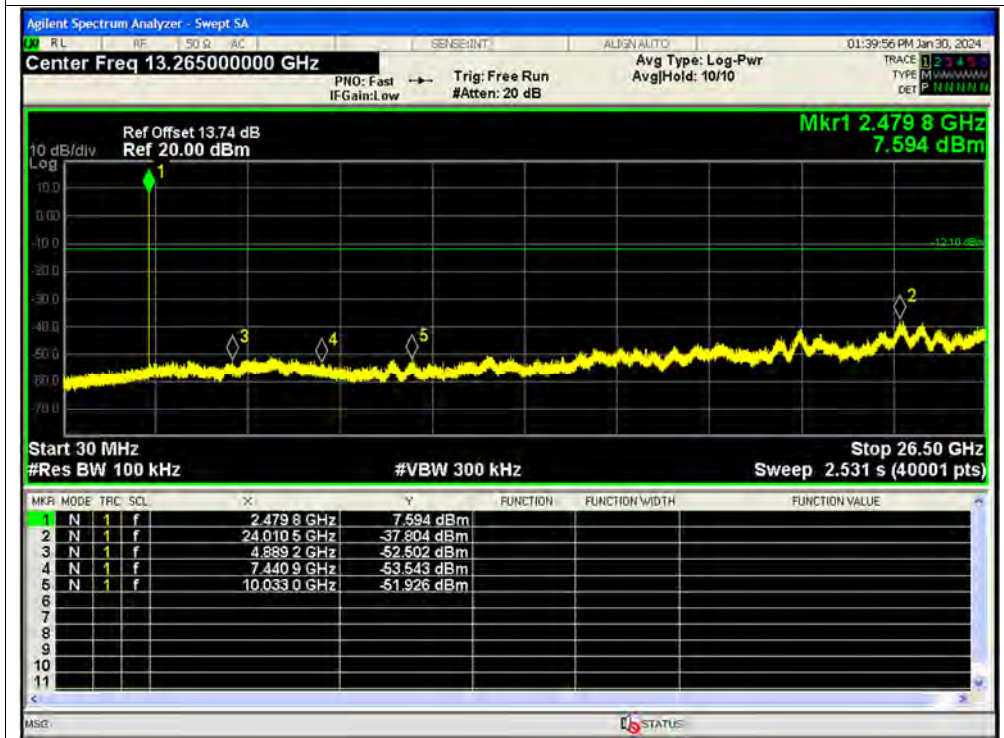




Tx. Spurious NVNT 1-DH5 2480MHz Ant1 Ref

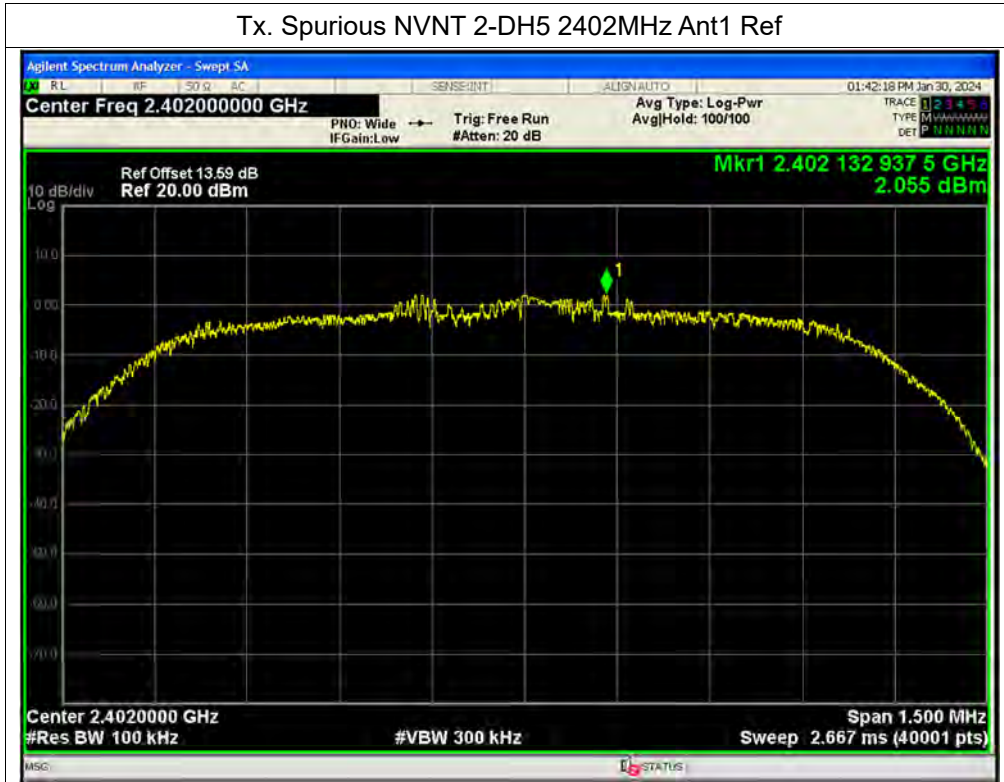


Tx. Spurious NVNT 1-DH5 2480MHz Ant1 Emission

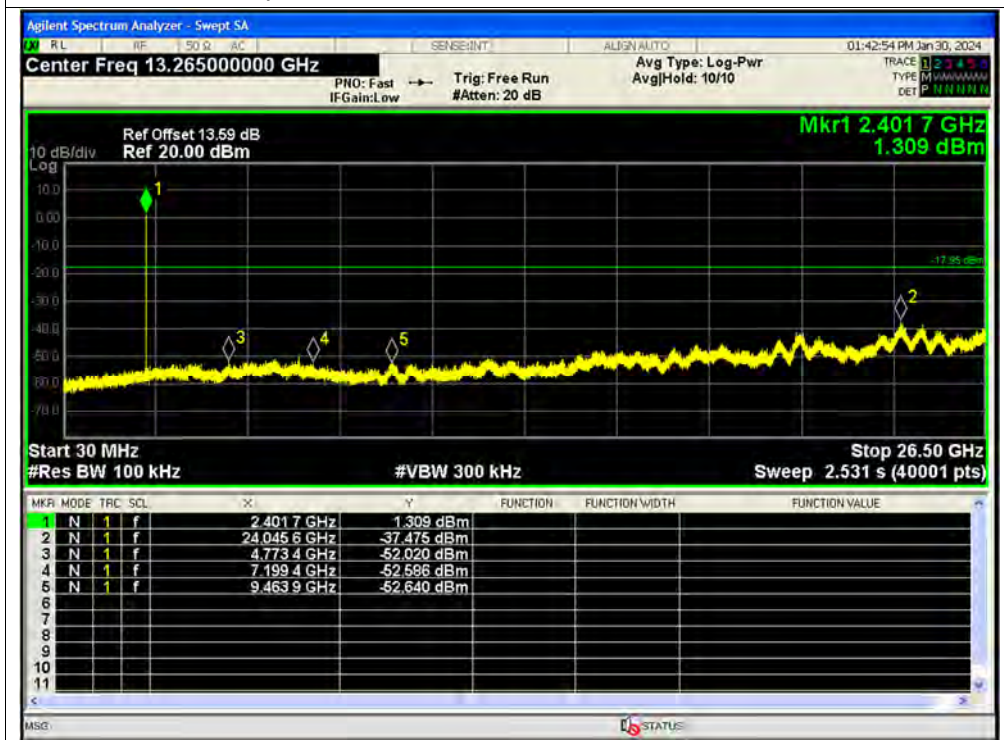




Tx. Spurious NVNT 2-DH5 2402MHz Ant1 Ref



Tx. Spurious NVNT 2-DH5 2402MHz Ant1 Emission

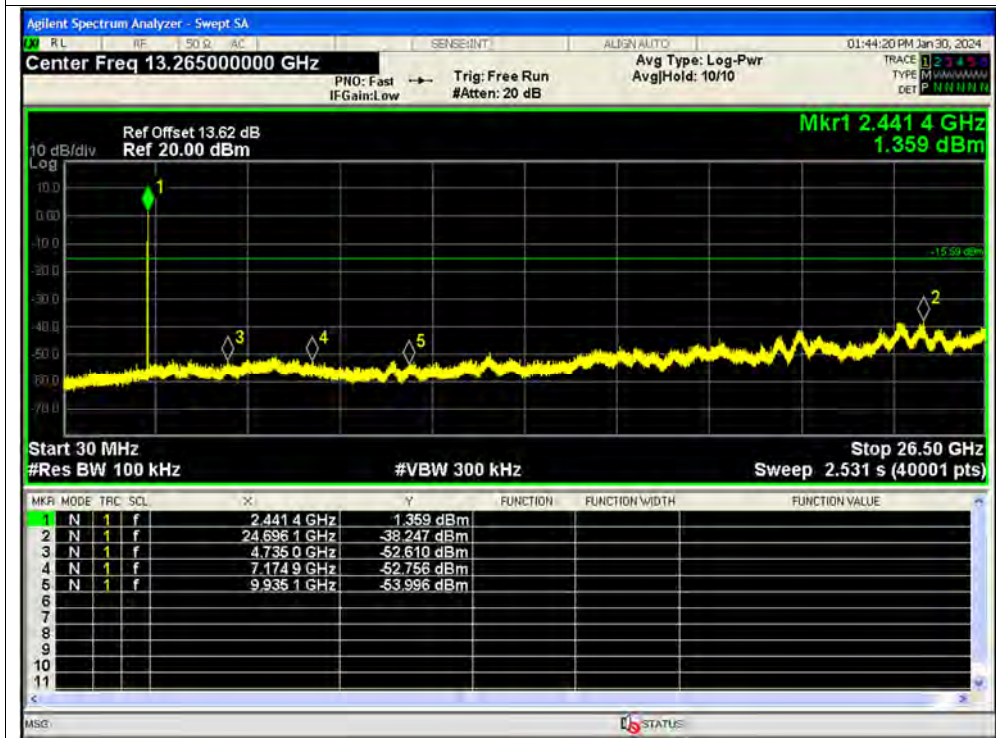




Tx. Spurious NVNT 2-DH5 2441MHz Ant1 Ref



Tx. Spurious NVNT 2-DH5 2441MHz Ant1 Emission

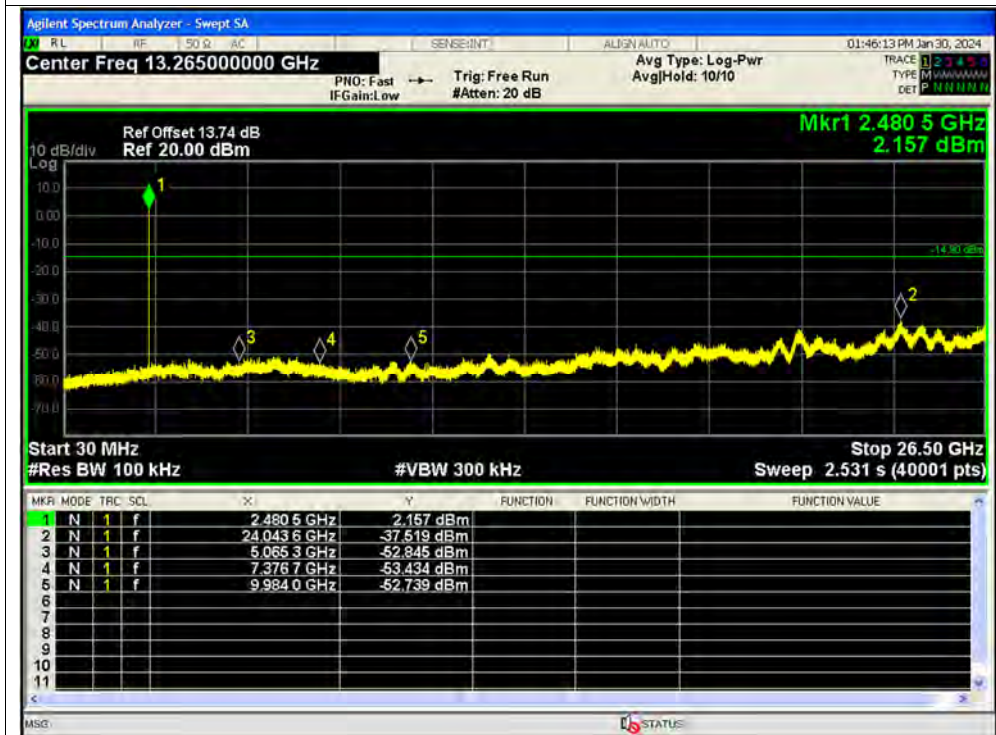




Tx. Spurious NVNT 2-DH5 2480MHz Ant1 Ref



Tx. Spurious NVNT 2-DH5 2480MHz Ant1 Emission

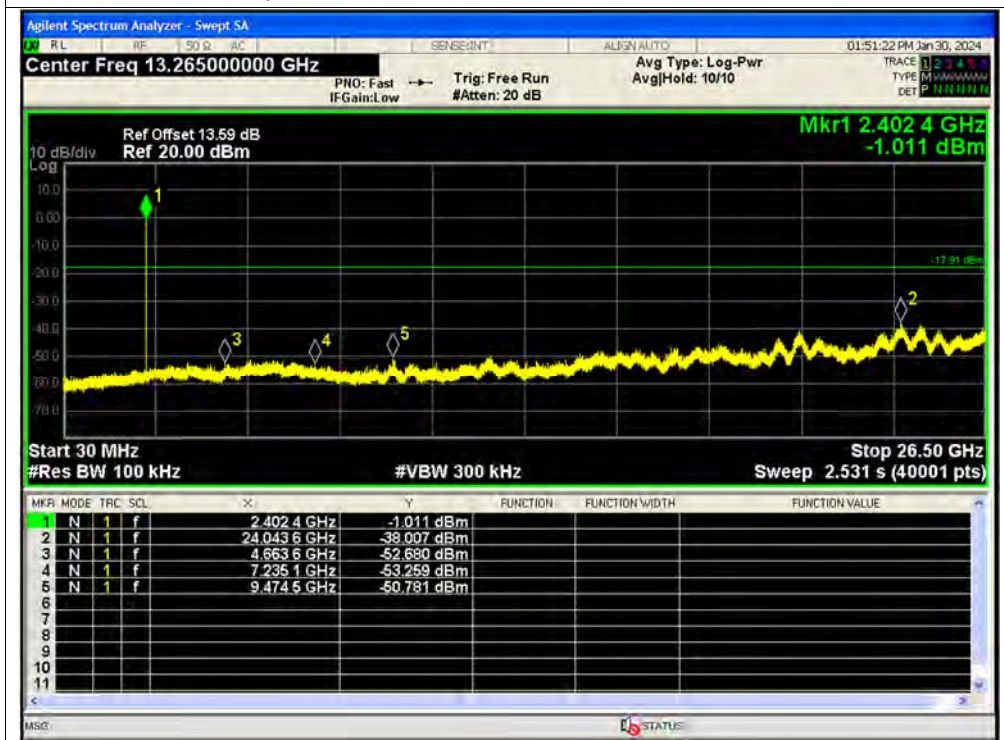




Tx. Spurious NVNT 3-DH5 2402MHz Ant1 Ref

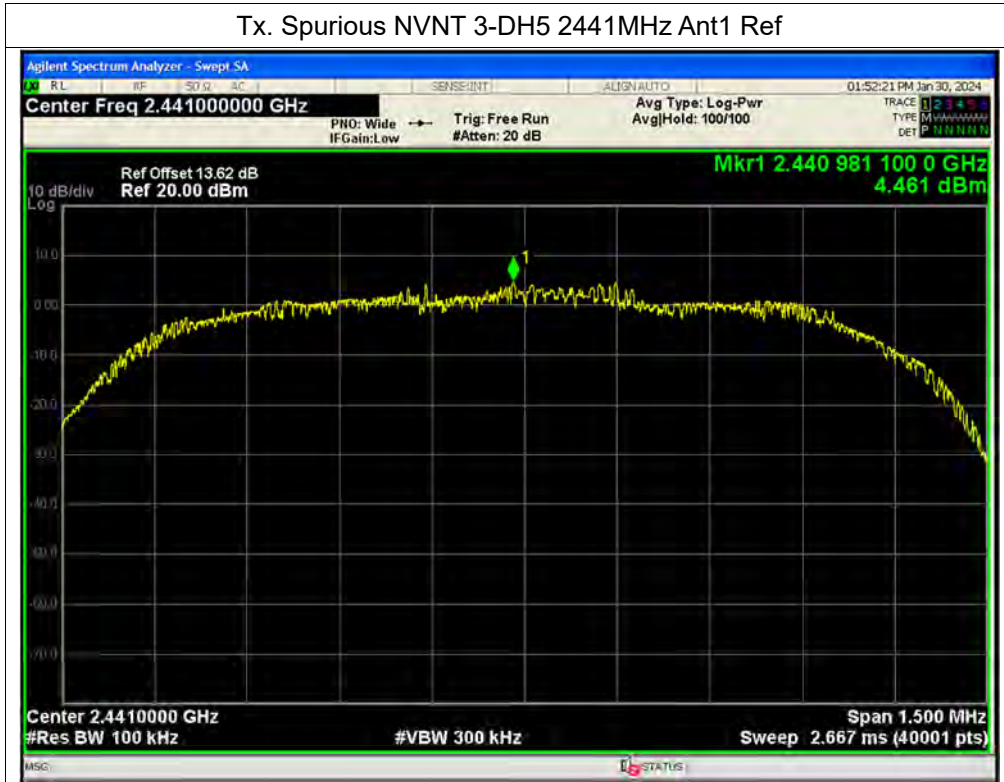


Tx. Spurious NVNT 3-DH5 2402MHz Ant1 Emission

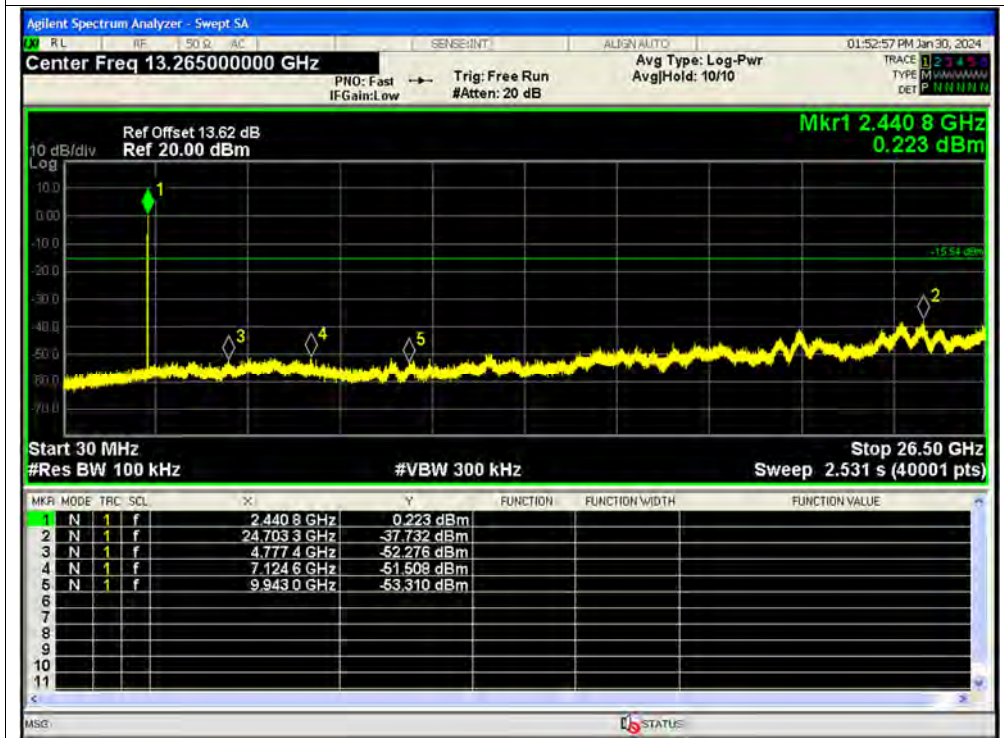




Tx. Spurious NVNT 3-DH5 2441MHz Ant1 Ref



Tx. Spurious NVNT 3-DH5 2441MHz Ant1 Emission



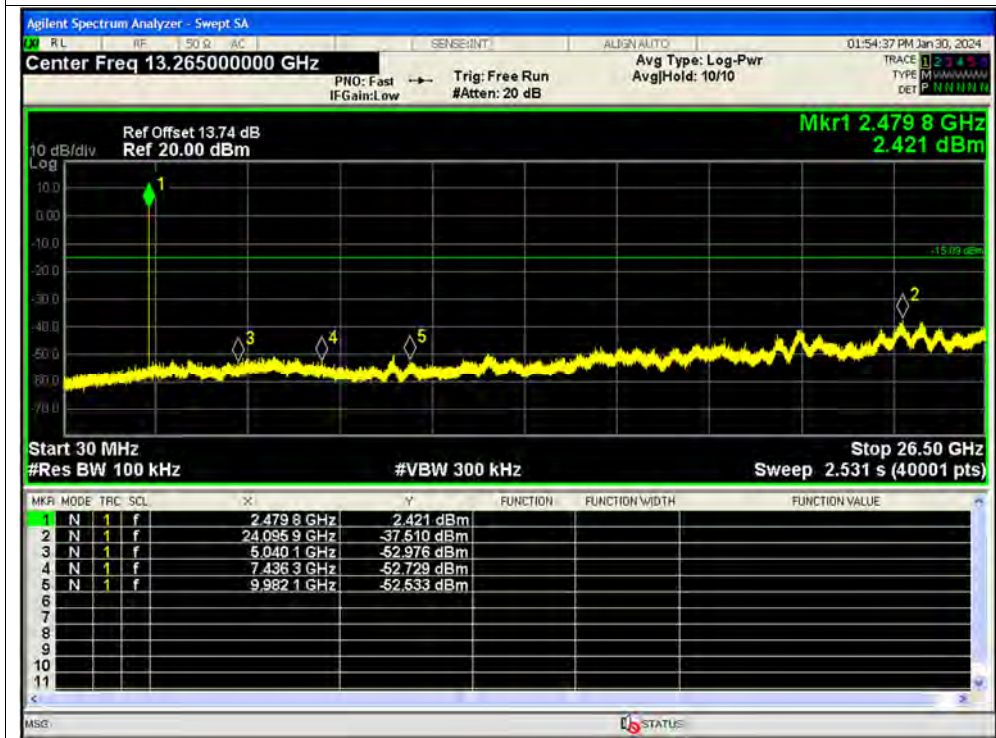




Tx. Spurious NVNT 3-DH5 2480MHz Ant1 Ref



Tx. Spurious NVNT 3-DH5 2480MHz Ant1 Emission



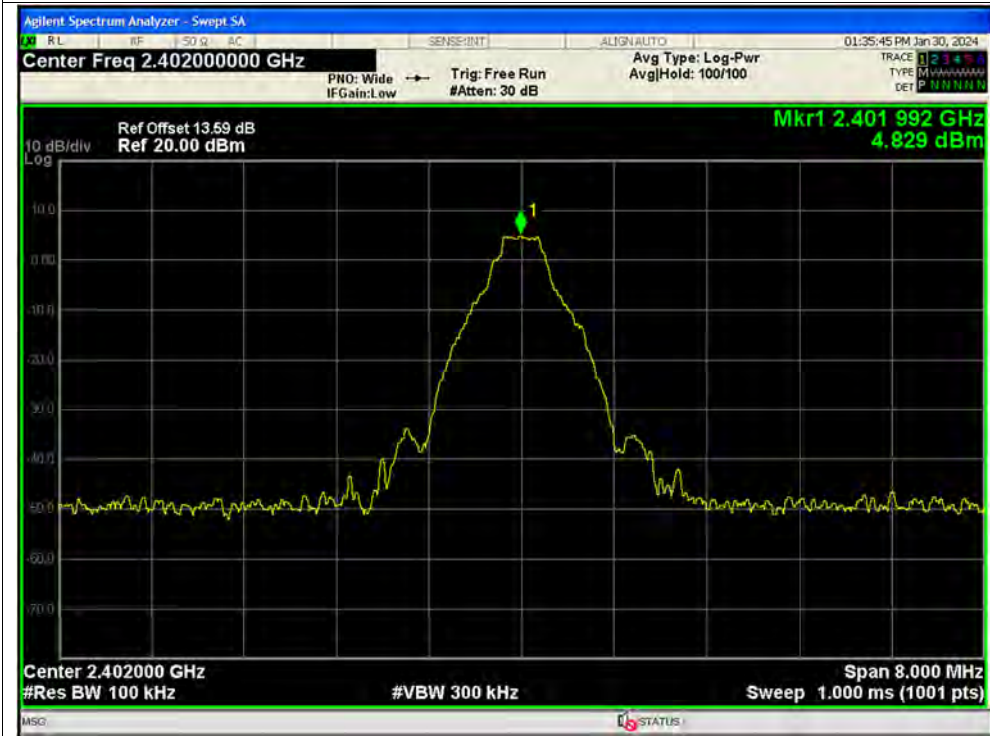
**A.9. Band Edge**

Condition	Mode	Frequency (MHz)	Antenna	Hopping Mode	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	1-DH5	2402	Ant1	No-Hopping	-50.00	-20	Pass
NVNT	1-DH5	2480	Ant1	No-Hopping	-52.89	-20	Pass
NVNT	2-DH5	2402	Ant1	No-Hopping	-47.38	-20	Pass
NVNT	2-DH5	2480	Ant1	No-Hopping	-50.23	-20	Pass
NVNT	3-DH5	2402	Ant1	No-Hopping	-47.60	-20	Pass
NVNT	3-DH5	2480	Ant1	No-Hopping	-50.57	-20	Pass
NVNT	1-DH5	2402	Ant1	Hopping	-49.77	-20	Pass
NVNT	1-DH5	2480	Ant1	Hopping	-52.33	-20	Pass
NVNT	2-DH5	2402	Ant1	Hopping	-47.36	-20	Pass
NVNT	2-DH5	2480	Ant1	Hopping	-49.22	-20	Pass
NVNT	3-DH5	2402	Ant1	Hopping	-46.72	-20	Pass
NVNT	3-DH5	2480	Ant1	Hopping	-49.63	-20	Pass

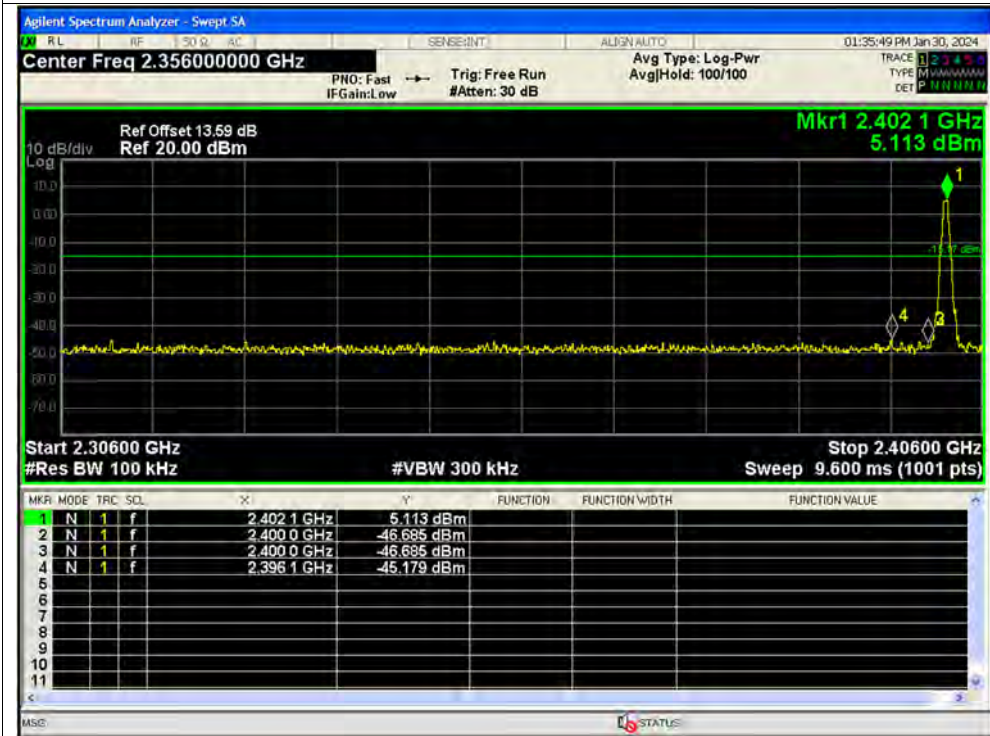


Test Graphs

Band Edge NVNT 1-DH5 2402MHz Ant1 No-Hopping Ref

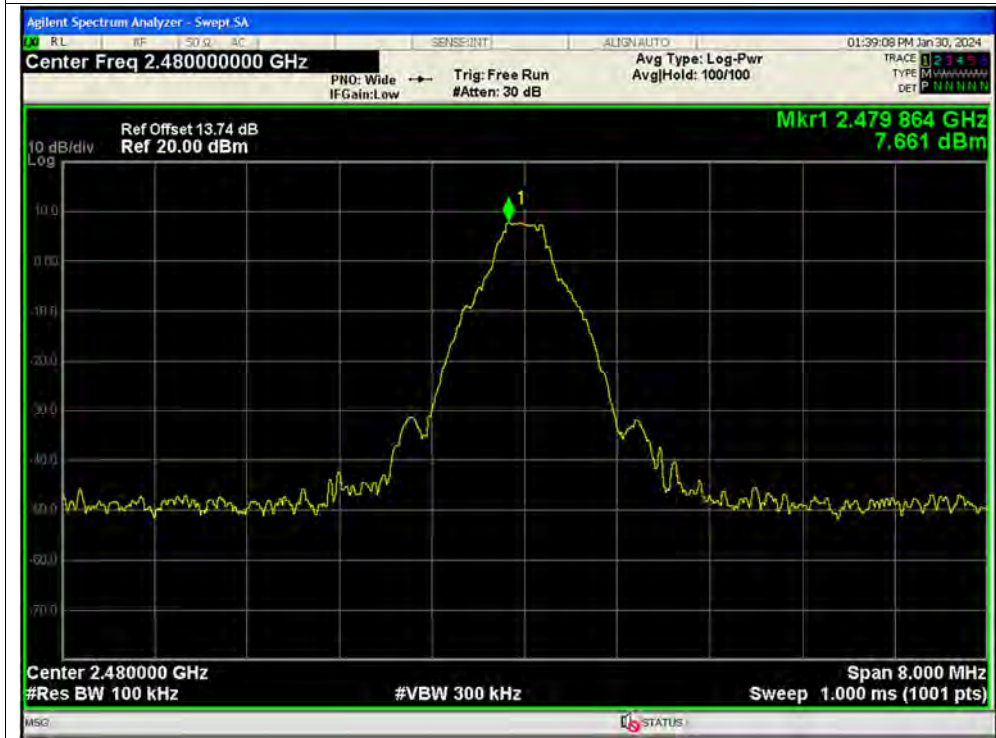


Band Edge NVNT 1-DH5 2402MHz Ant1 No-Hopping Emission

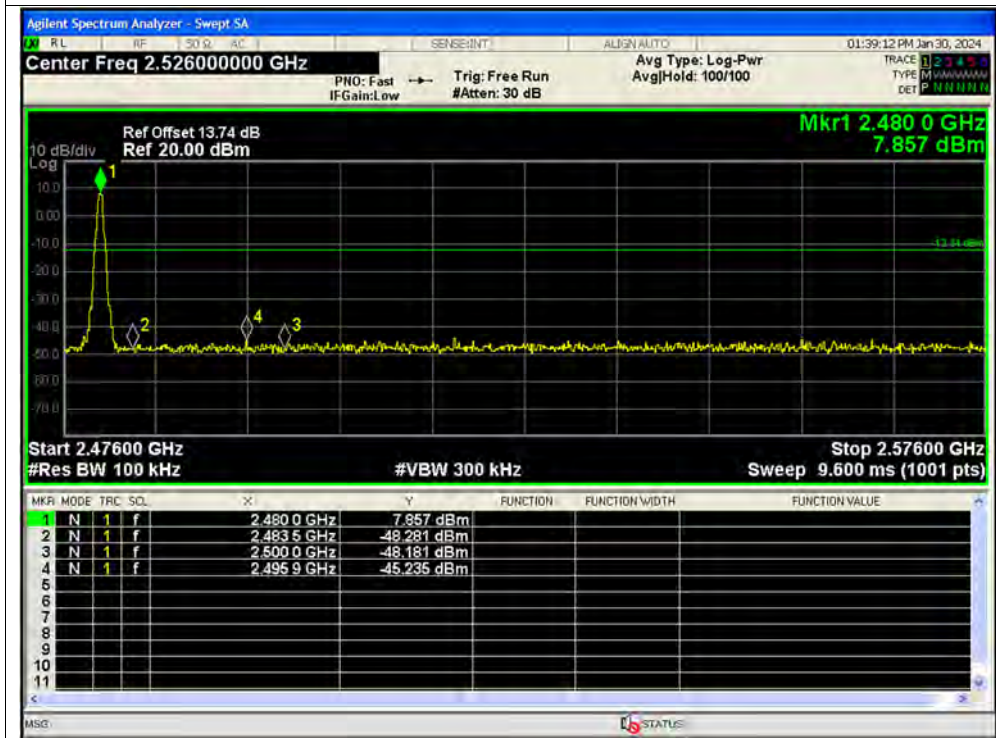




Band Edge NVNT 1-DH5 2480MHz Ant1 No-Hopping Ref



Band Edge NVNT 1-DH5 2480MHz Ant1 No-Hopping Emission

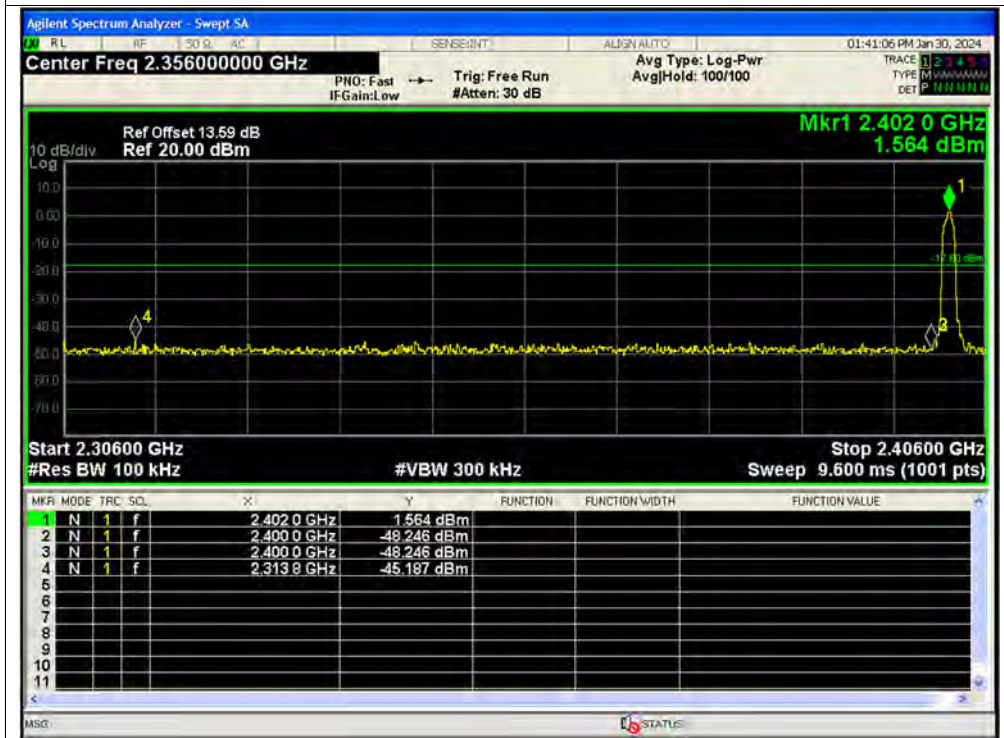




Band Edge NVNT 2-DH5 2402MHz Ant1 No-Hopping Ref



Band Edge NVNT 2-DH5 2402MHz Ant1 No-Hopping Emission

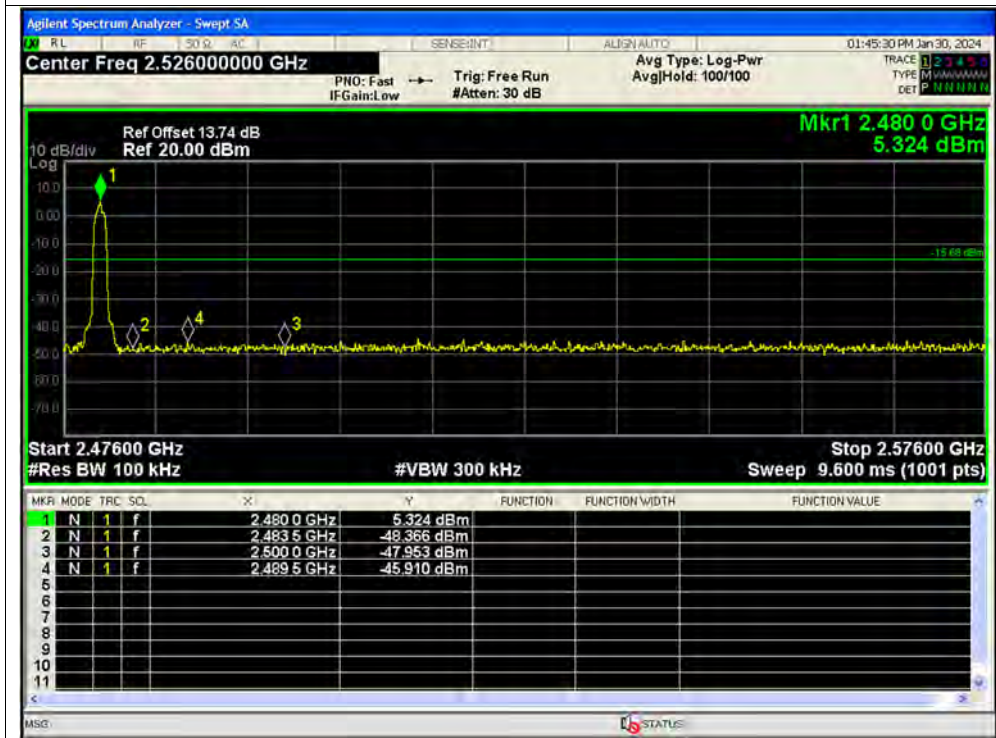




Band Edge NVNT 2-DH5 2480MHz Ant1 No-Hopping Ref



Band Edge NVNT 2-DH5 2480MHz Ant1 No-Hopping Emission

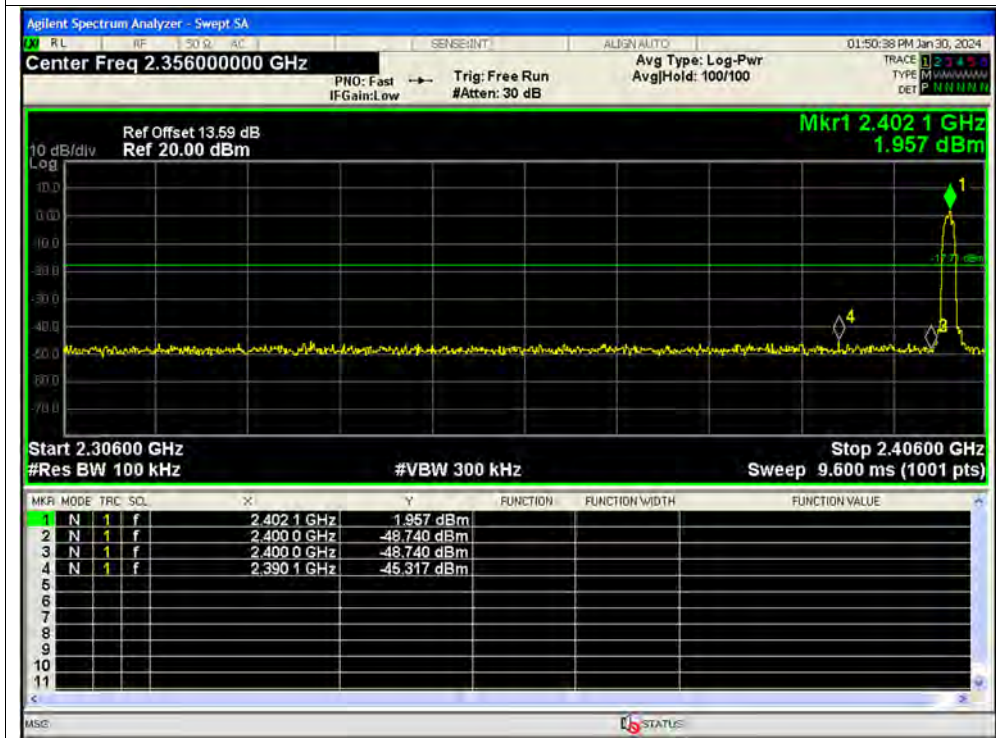




Band Edge NVNT 3-DH5 2402MHz Ant1 No-Hopping Ref



Band Edge NVNT 3-DH5 2402MHz Ant1 No-Hopping Emission

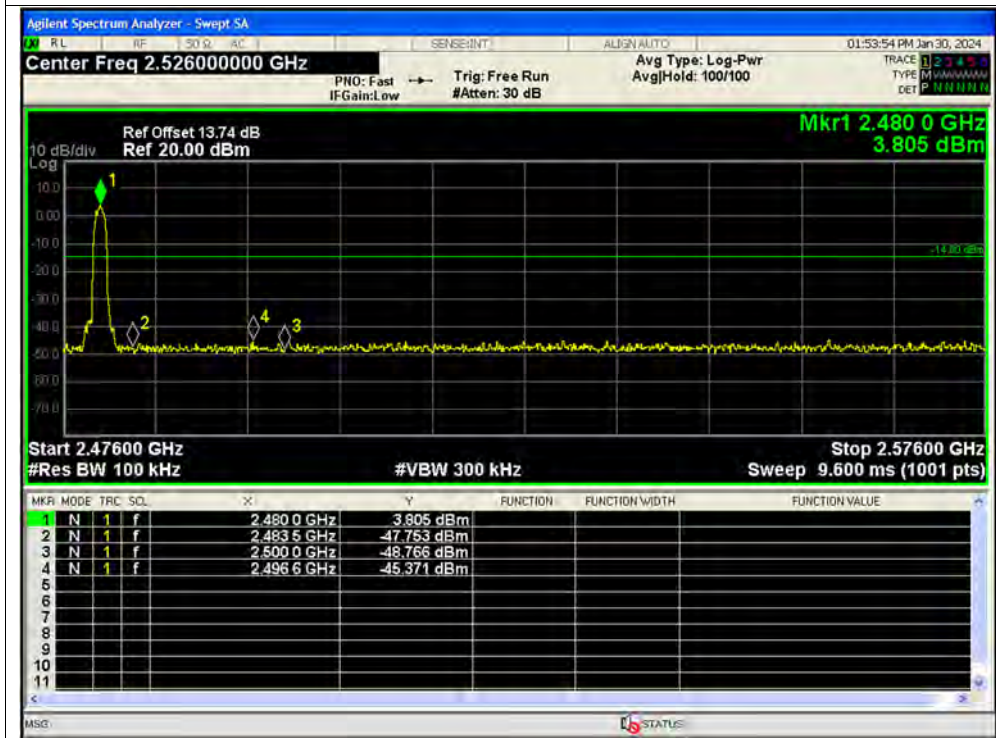




Band Edge NVNT 3-DH5 2480MHz Ant1 No-Hopping Ref



Band Edge NVNT 3-DH5 2480MHz Ant1 No-Hopping Emission





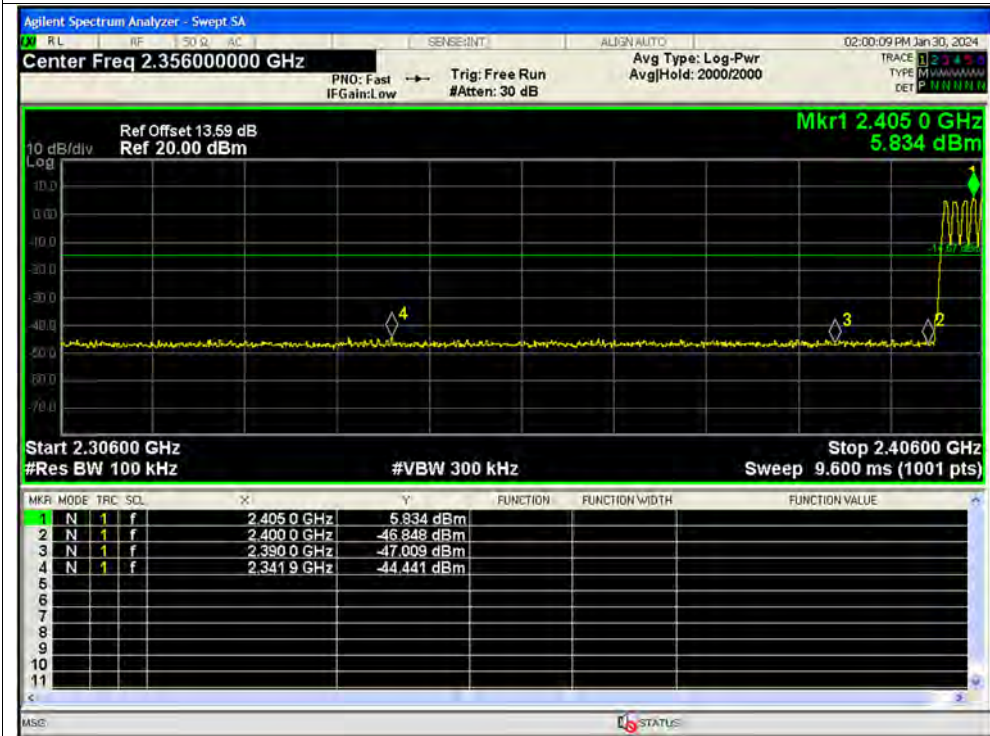


Test Graphs

Band Edge(Hopping) NVNT 1-DH5 2402MHz Ant1 Hopping Ref



Band Edge(Hopping) NVNT 1-DH5 2402MHz Ant1 Hopping Emission

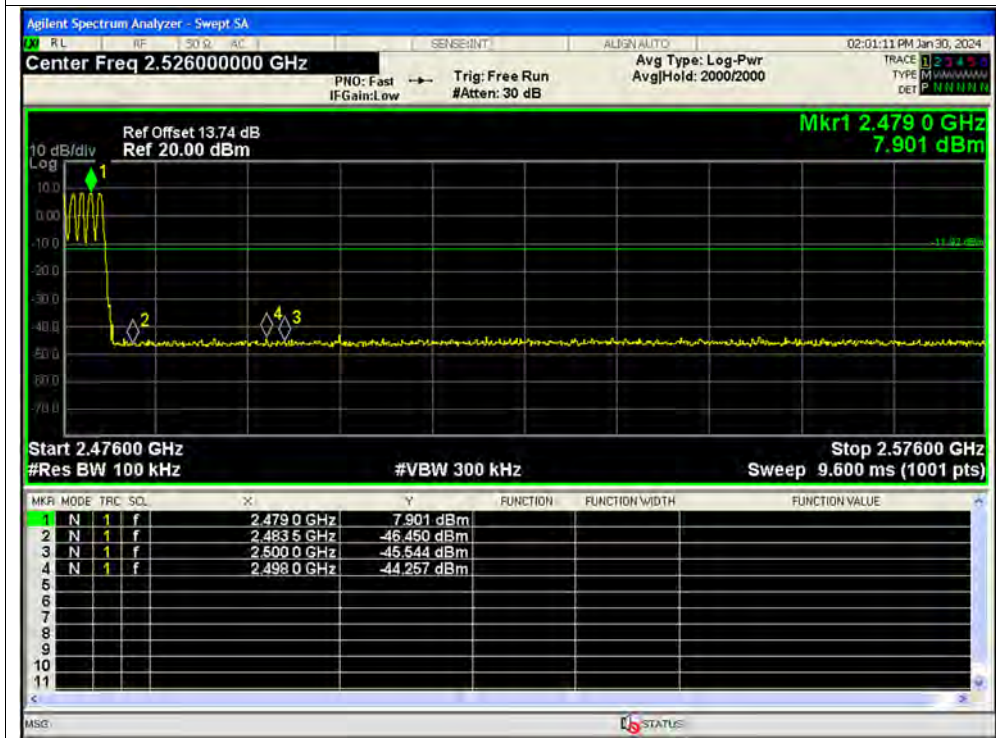




Band Edge(Hopping) NVNT 1-DH5 2480MHz Ant1 Hopping Ref



Band Edge(Hopping) NVNT 1-DH5 2480MHz Ant1 Hopping Emission

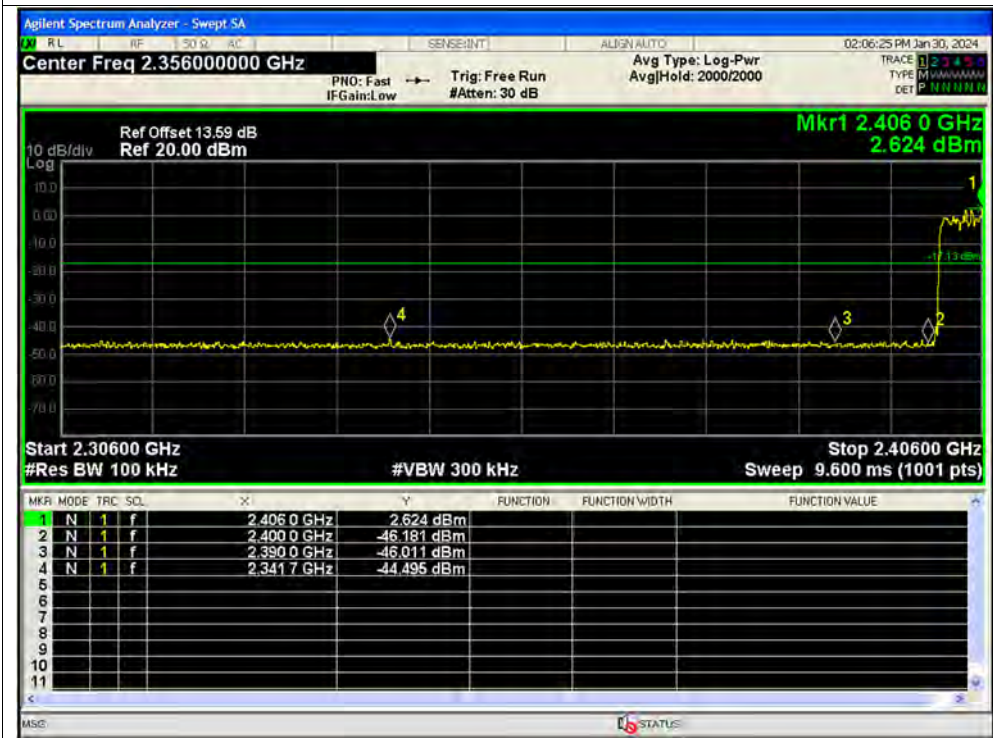




Band Edge(Hopping) NVNT 2-DH5 2402MHz Ant1 Hopping Ref



Band Edge(Hopping) NVNT 2-DH5 2402MHz Ant1 Hopping Emission

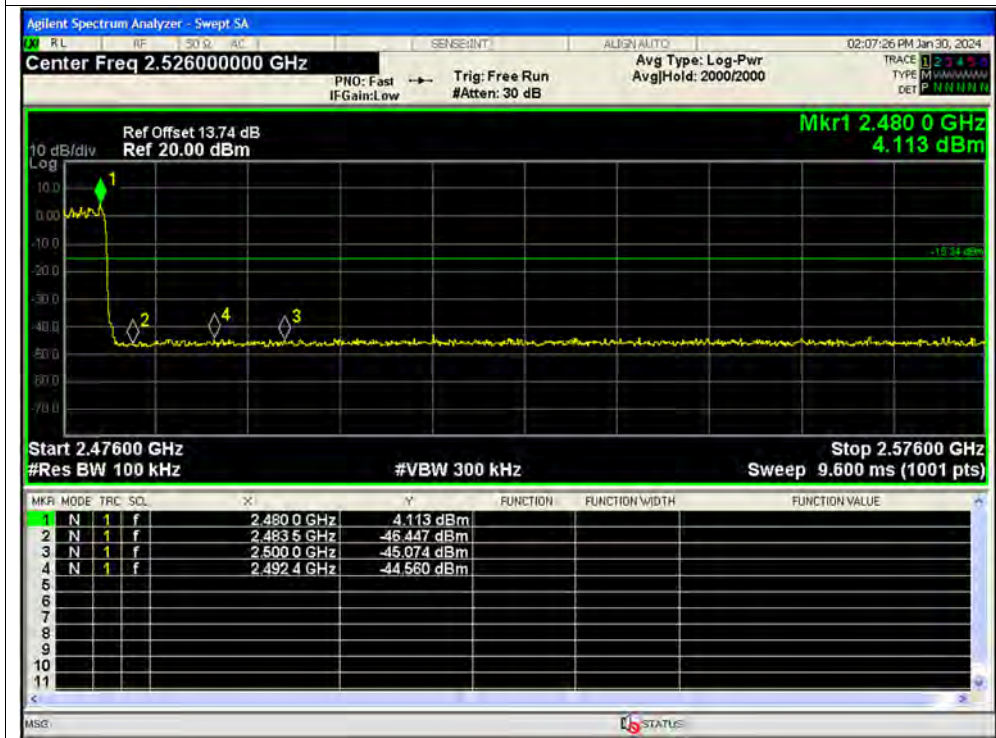




Band Edge(Hopping) NVNT 2-DH5 2480MHz Ant1 Hopping Ref



Band Edge(Hopping) NVNT 2-DH5 2480MHz Ant1 Hopping Emission

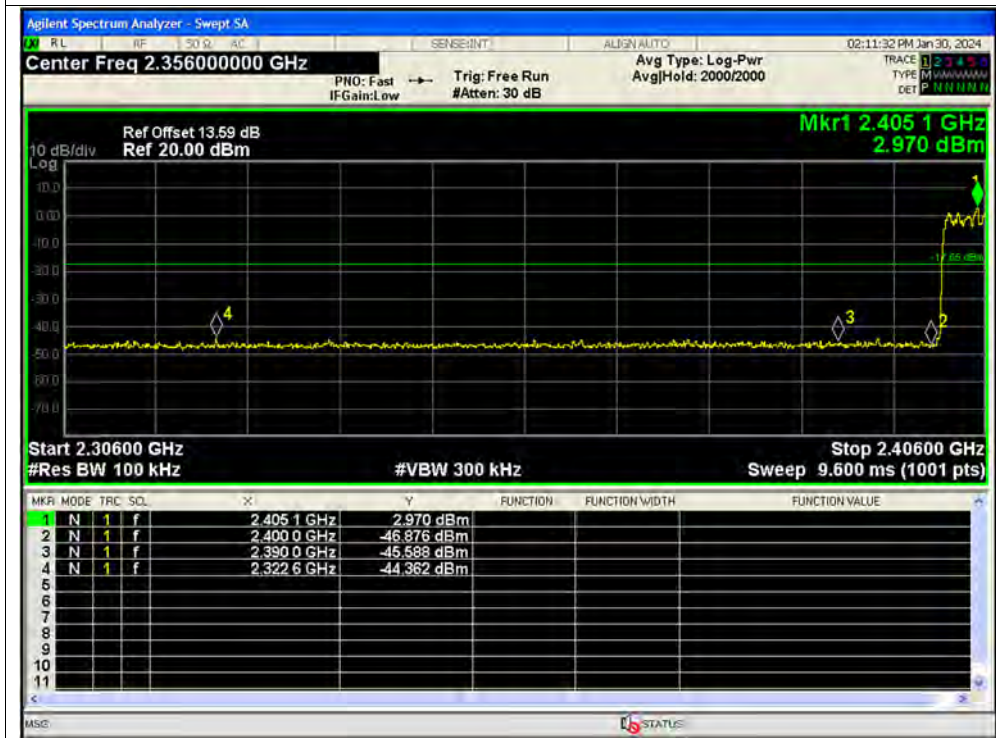




Band Edge(Hopping) NVNT 3-DH5 2402MHz Ant1 Hopping Ref



Band Edge(Hopping) NVNT 3-DH5 2402MHz Ant1 Hopping Emission

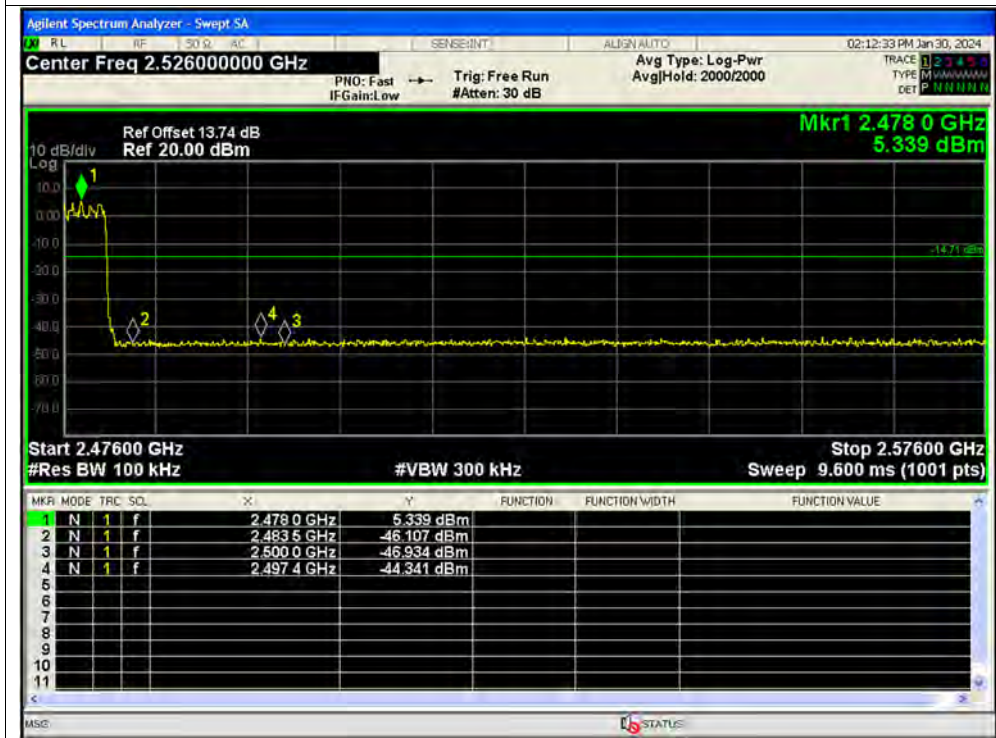




Band Edge(Hopping) NVNT 3-DH5 2480MHz Ant1 Hopping Ref



Band Edge(Hopping) NVNT 3-DH5 2480MHz Ant1 Hopping Emission





### A.10. Conducted Emission

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Set RBW=9kHz, VBW=30kHz. Refer to recorded points and plots below.

**Note:** Both of the test voltage AC 120V/60Hz and AC 230V/50Hz were considered and tested respectively, only the results of the worst case AC 120V/60Hz were recorded in this report.

#### A. Test Setup:

Test Mode: EUT + PC + PC Adapter + BT TX

Test voltage: AC 120V/60Hz

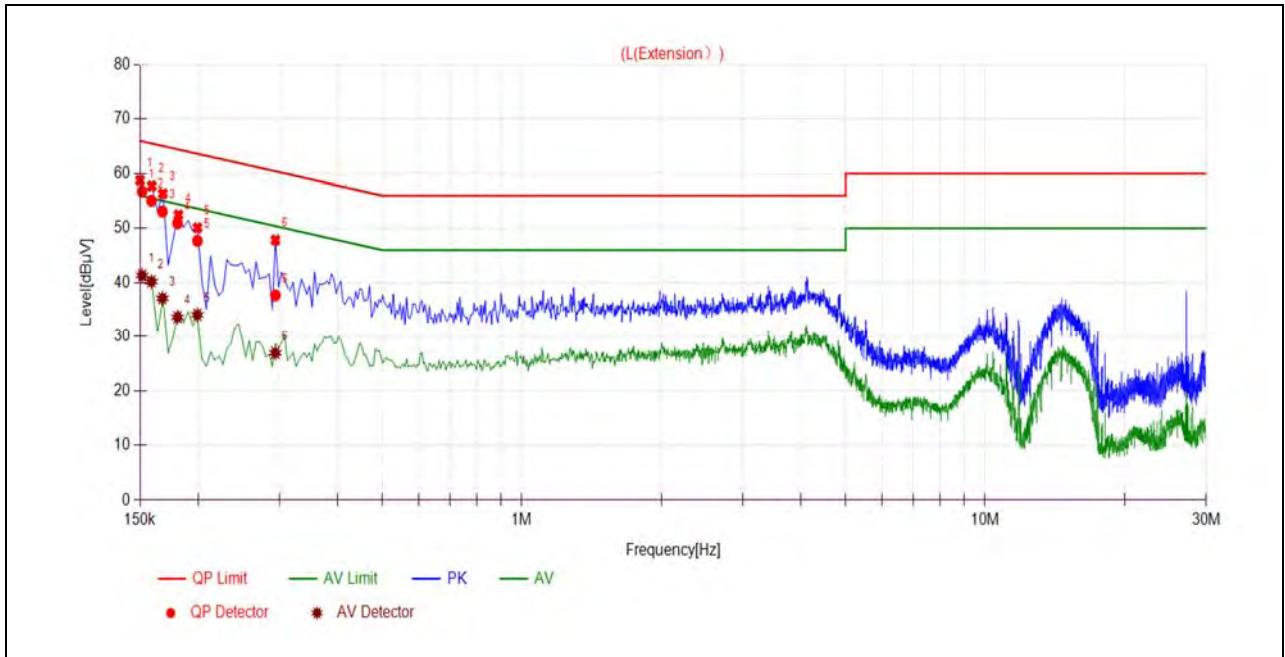
The measurement results are obtained as below:

$$E \text{ [dB}\mu\text{V]} = U_R + L_{\text{Cable loss}} \text{ [dB]} + A_{\text{Factor}}$$

$U_R$ : Receiver Reading

$A_{\text{Factor}}$ : Voltage division factor of LISN

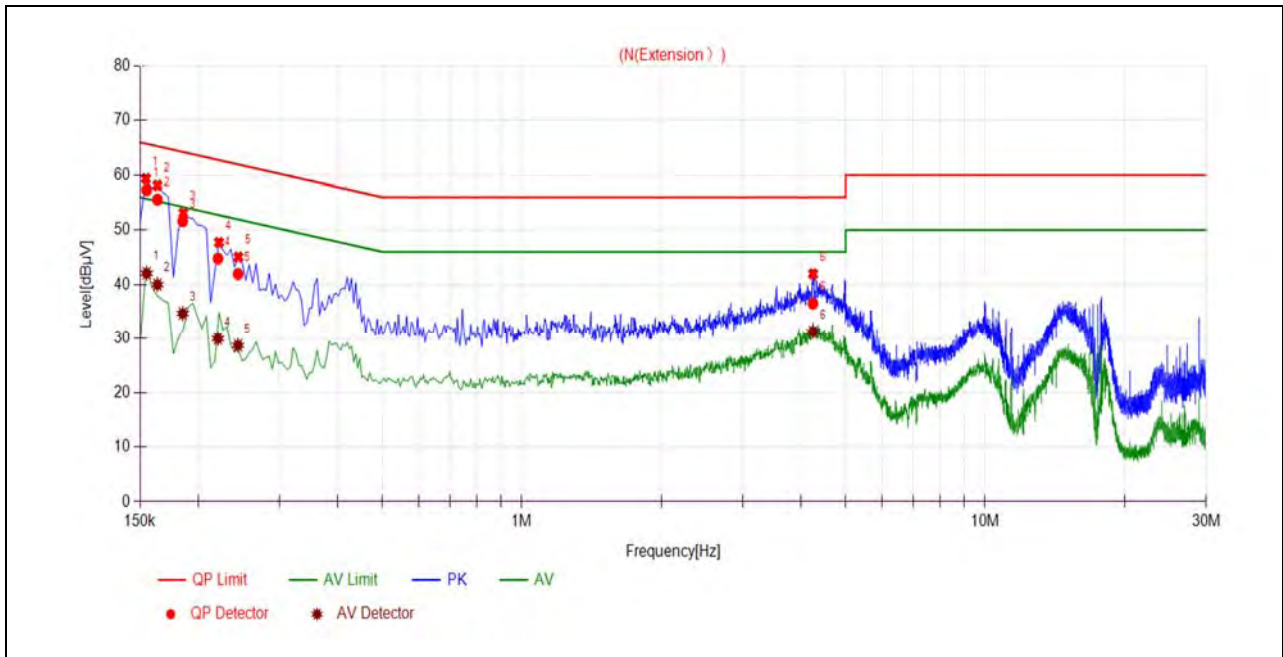
**B. Test Plot:**



(L Phase)

No.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1515	56.78	41.35	65.92	55.92	Line	PASS
2	0.1587	55.07	40.22	65.53	55.53		PASS
3	0.1676	53.07	37.13	65.08	55.08		PASS
4	0.1807	50.95	33.64	64.46	54.46		PASS
5	0.1994	47.72	34.08	63.64	53.64		PASS
6	0.2938	37.67	26.93	60.42	50.42		PASS





(N Phase)

No.	Fre. (MHz)	Emission Level (dBμV)		Limit (dBμV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1550	57.32	42.09	65.73	55.73	Neutral	PASS
2	0.1635	55.58	40.01	65.28	55.28		PASS
3	0.1854	51.64	34.68	64.24	54.24		PASS
4	0.2209	44.78	29.97	62.78	52.78		PASS
5	0.2440	41.95	28.69	61.96	51.96		PASS
6	4.2505	36.52	31.27	56.00	46.00		PASS

**A.11. Restricted Frequency Bands**

The lowest and highest channels are tested to verify the Restricted Frequency Bands.

The measurement results are obtained as below:

$$E \text{ [dB}\mu\text{V/m]} = U_R + A_T + A_{\text{Factor}} \text{ [dB]}; A_T = L_{\text{Cable loss}} \text{ [dB]} - G_{\text{preamp}} \text{ [dB]}$$

$A_T$ : Total correction Factor except Antenna

$U_R$ : Receiver Reading

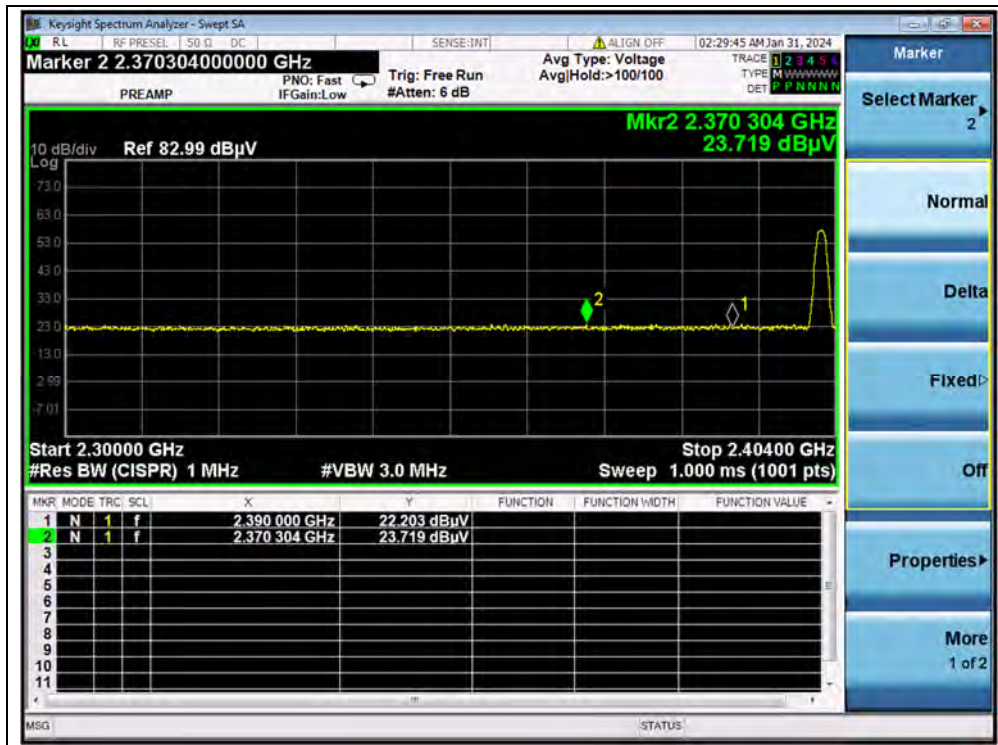
$G_{\text{preamp}}$ : Preamplifier Gain

$A_{\text{Factor}}$ : Antenna Factor at 3m

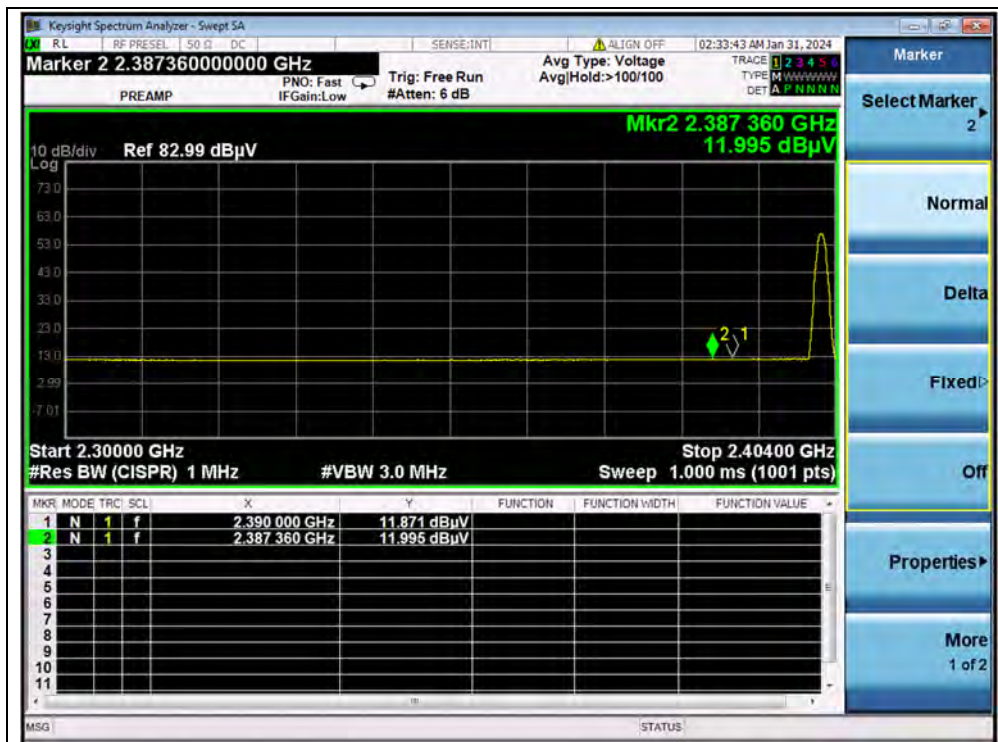
Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

**GFSK Mode**

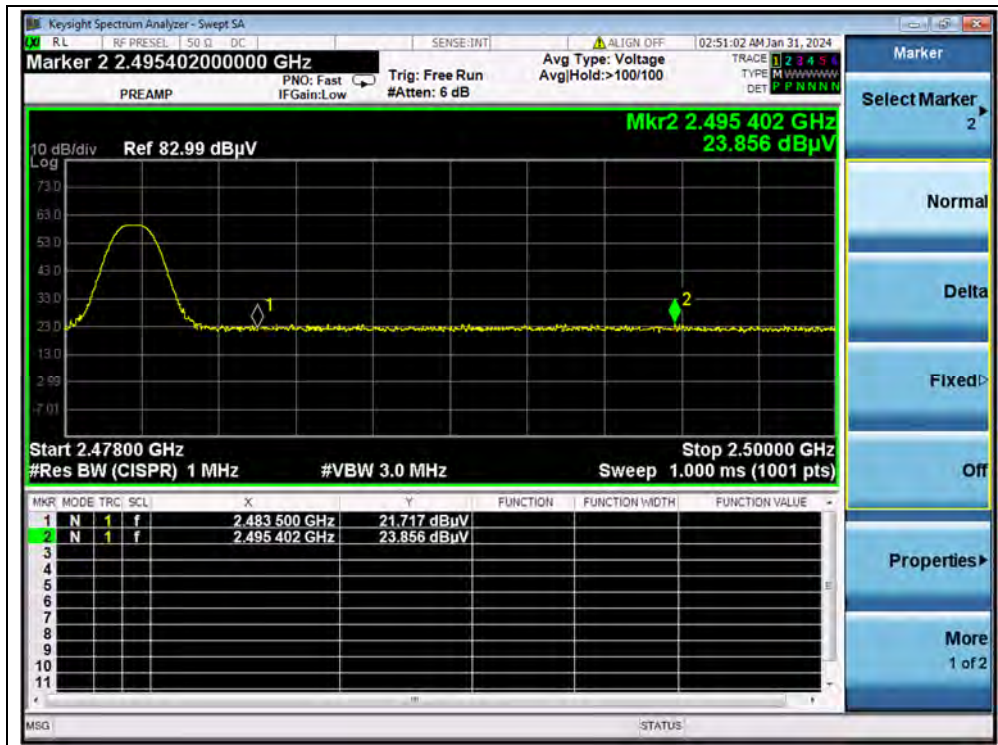
Channel	Frequency (MHz)	Detector	Receiver Reading $U_R$ (dB $\mu$ V)	$A_T$ (dB)	$A_{\text{Factor}}$ (dB@3m)	Max. Emission E (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Verdict
		PK/ AV						
0	2370.30	PK	23.72	6.74	27.20	57.66	74	PASS
0	2387.36	AV	12.00	6.74	27.20	45.94	54	PASS
78	2496.40	PK	23.86	6.74	27.20	57.80	74	PASS
78	2488.30	AV	11.76	6.74	27.20	45.70	54	PASS



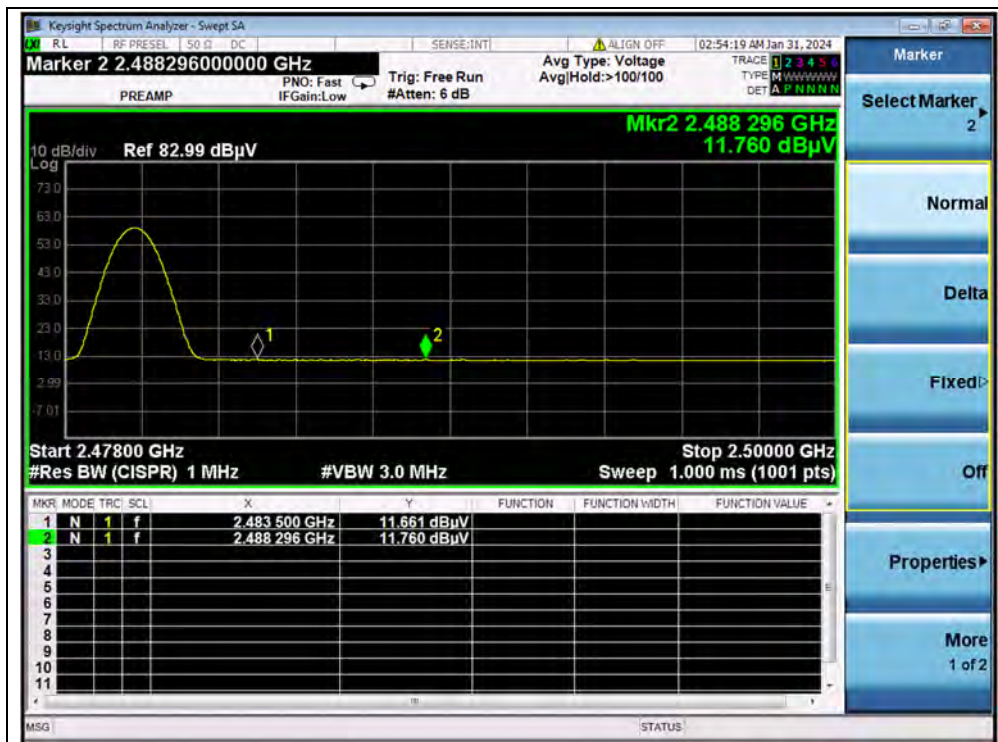
(PEAK, Channel 0, GFSK)



(AVERAGE, Channel 0, GFSK)



(PEAK, Channel 78, GFSK)

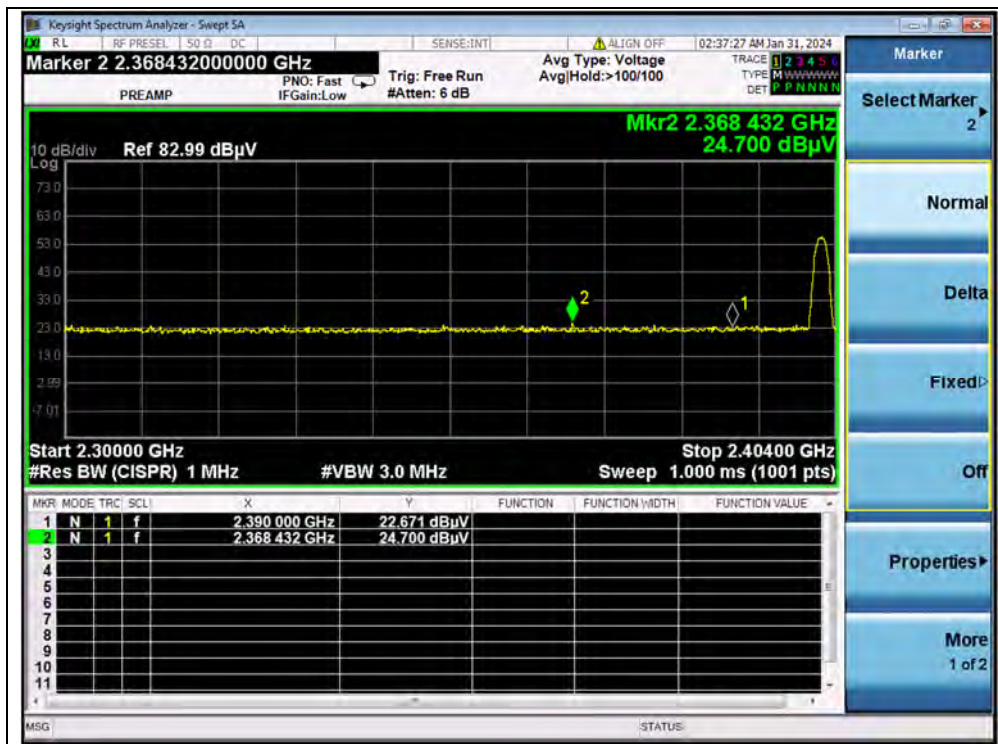


(AVERAGE, Channel 78, GFSK)

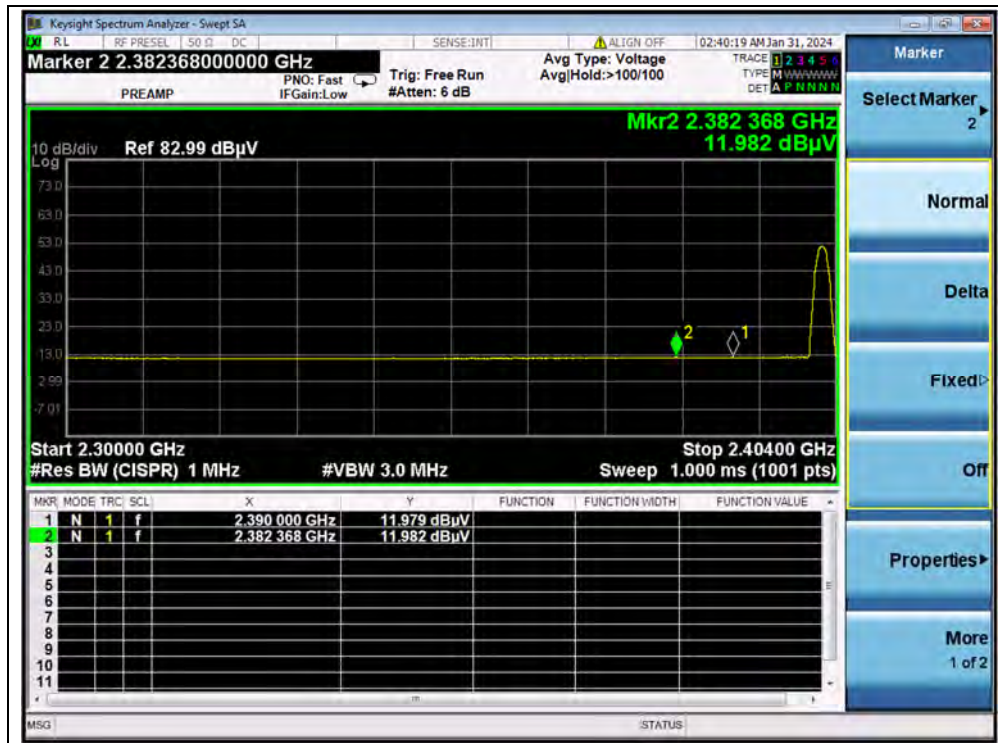


$\pi/4$ -DQPSK Mode

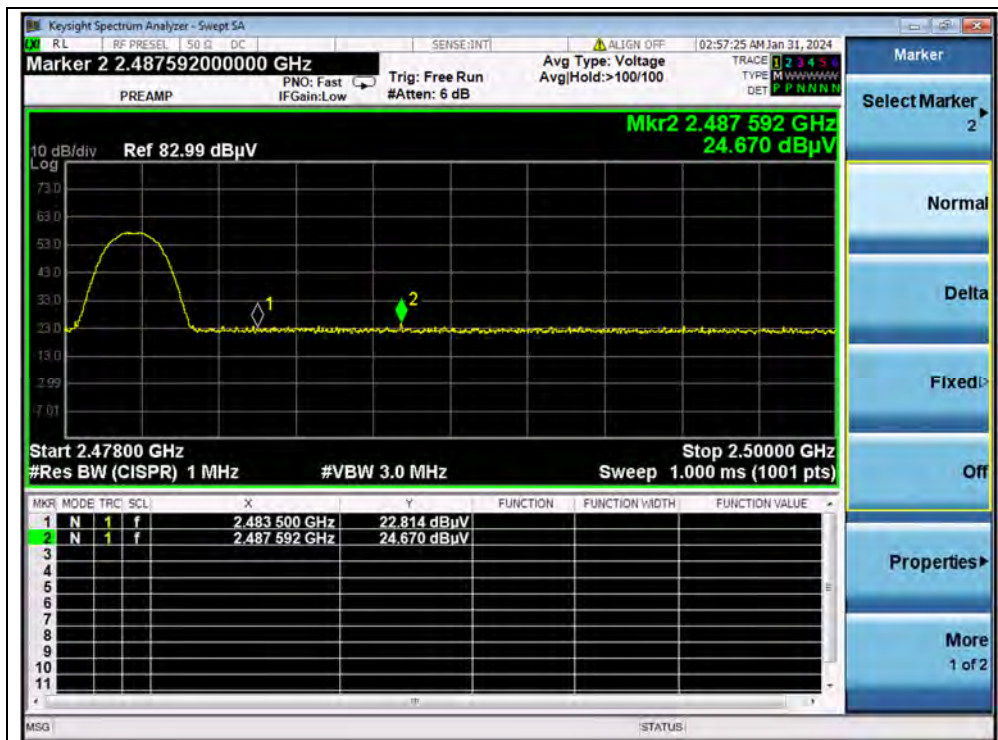
Channel	Frequency (MHz)	Detector	Receiver Reading	A <sub>T</sub> (dB)	A <sub>Factor</sub> (dB@3m)	Max. Emission	Limit (dBμV/m)	Verdict
		PK/ AV	U <sub>R</sub> (dBμV)			E (dBμV/m)		
0	2369.43	PK	24.70	6.74	27.20	58.64	74	PASS
0	2382.37	AV	11.98	6.74	27.20	45.92	54	PASS
78	2487.59	PK	24.67	6.74	27.20	58.61	74	PASS
78	2483.74	AV	11.74	6.74	27.20	45.68	54	PASS



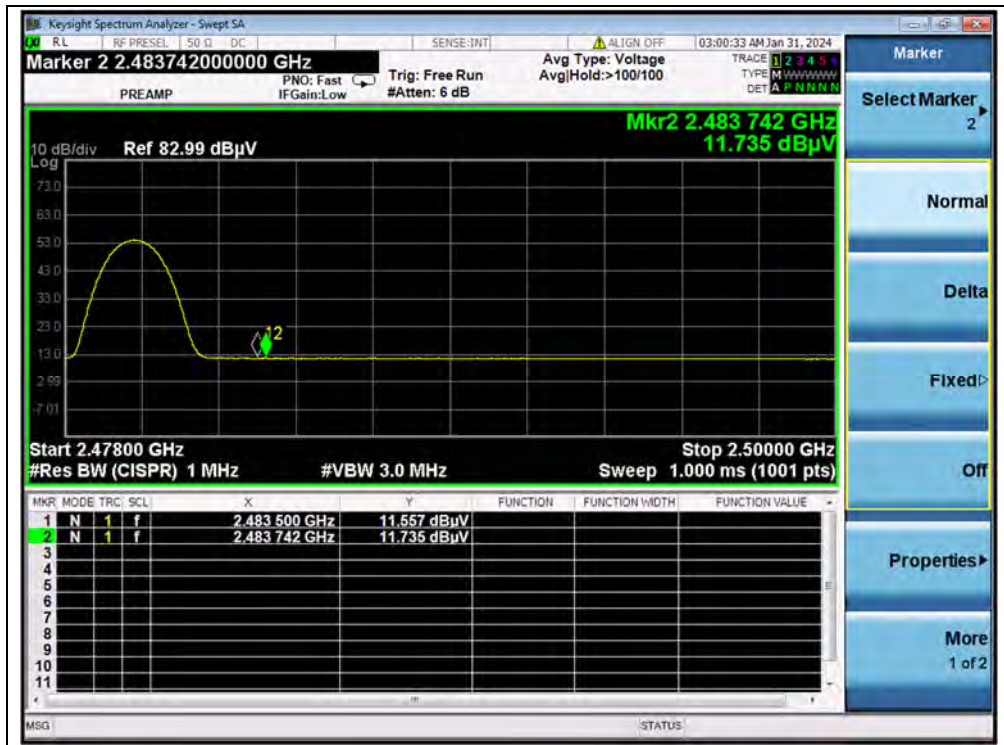
(PEAK, Channel 0,  $\pi/4$ -DQPSK)



(AVERAGE, Channel 0,  $\pi/4$ -DQPSK)



(PEAK, Channel 78,  $\pi/4$ -DQPSK)

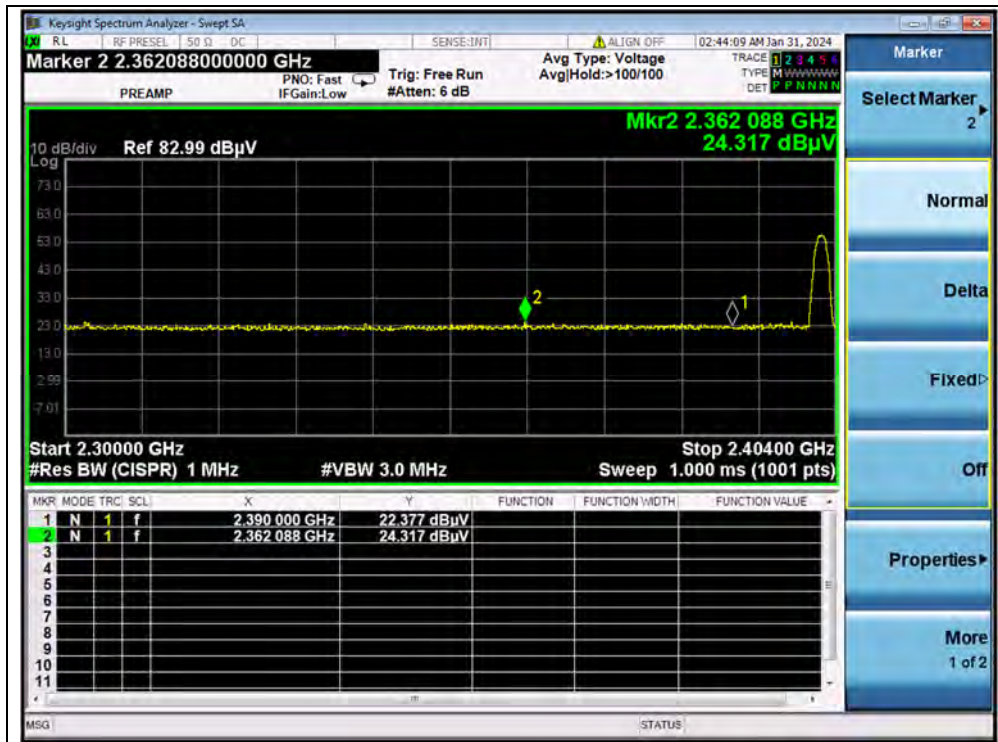


(AVERAGE, Channel 78, π/4-DQPSK)



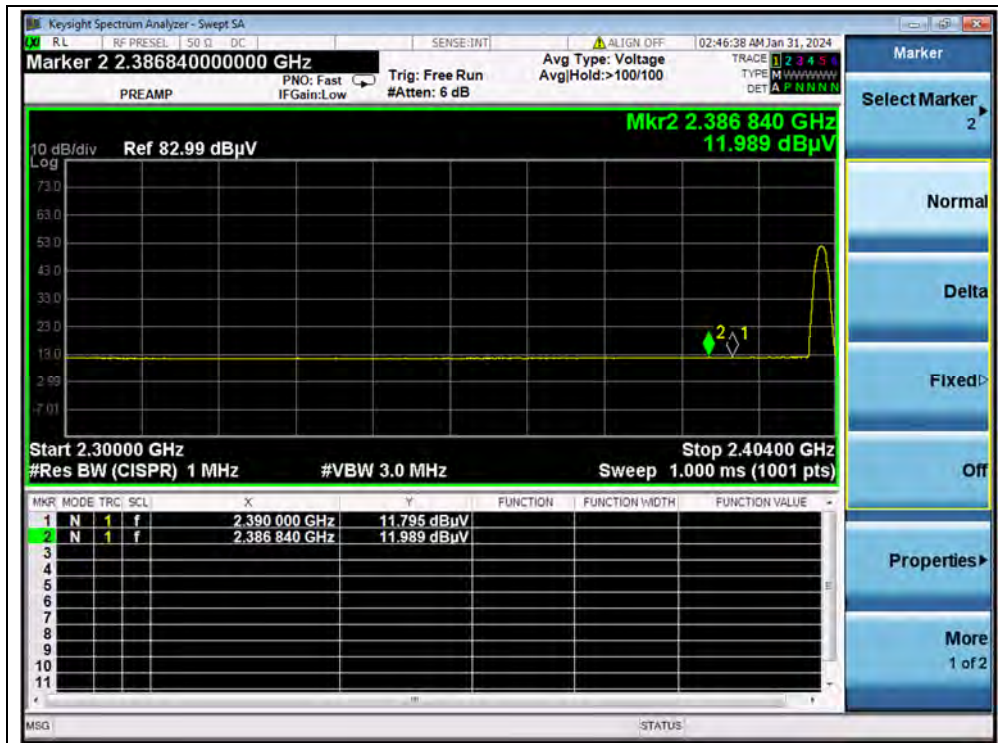
**8-DPSK Mode**

Channel	Frequency (MHz)	Detector	Receiver Reading	A <sub>T</sub> (dB)	A <sub>Factor</sub> (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV	U <sub>R</sub> (dBμV)					
0	2362.09	PK	24.32	6.74	27.20	58.26	74	PASS
0	2386.84	AV	11.99	6.74	27.20	45.93	54	PASS
78	2491.73	PK	23.82	6.74	27.20	57.76	74	PASS
78	2485.11	AV	11.71	6.74	27.20	45.65	54	PASS

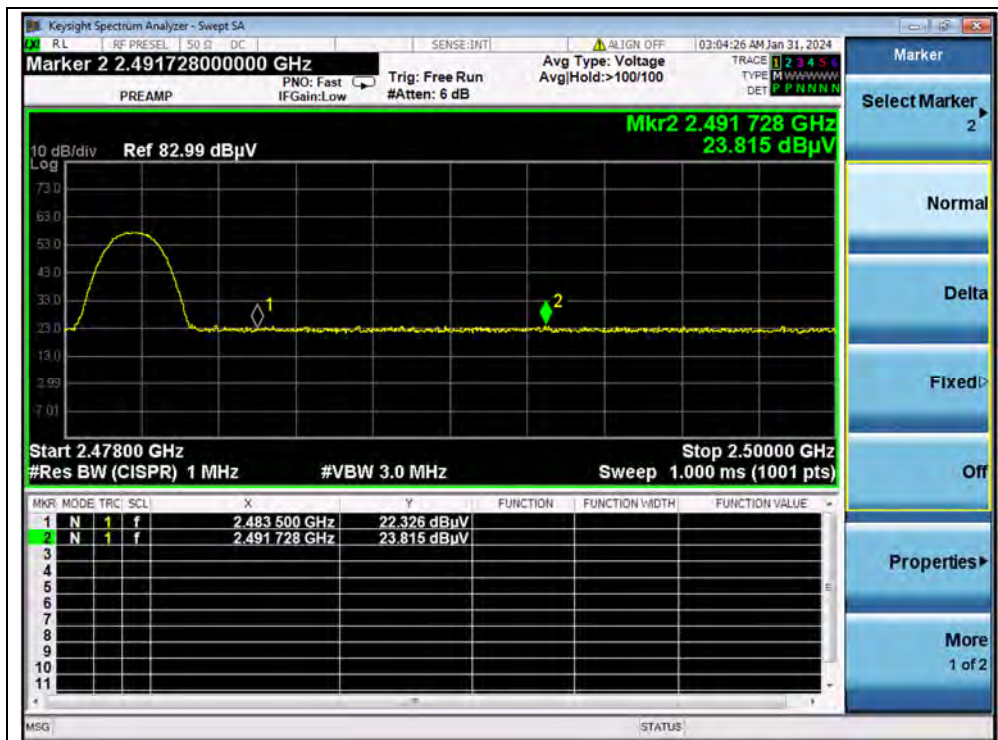


(PEAK, Channel 0, 8-DPSK)

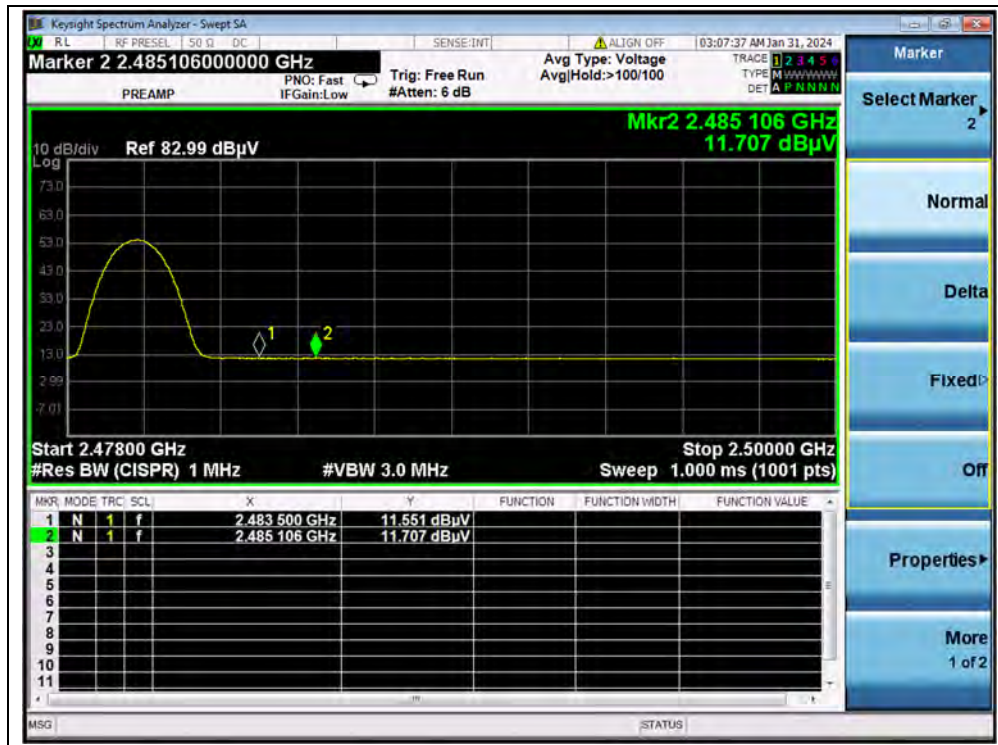




(AVERAGE, Channel 0, 8-DPSK)



(PEAK, Channel 78, 8-DPSK)



(AVERAGE, Channel 78, 8-DPSK)



**A.12. Radiated Emission**

According to ANSI C63.10, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak (or average) limit, it is unnecessary to perform an quasi-peak measurement (or average).

The measurement results are obtained as below:

$$E [dB\mu V/m] = U_R + A_T + A_{Factor} [dB]; A_T = L_{Cable loss} [dB] - G_{preamp} [dB]$$

A<sub>T</sub>: Total correction Factor except Antenna

U<sub>R</sub>: Receiver Reading

G<sub>preamp</sub>: Preamplifier Gain

A<sub>Factor</sub>: Antenna Factor at 3m

During the test, the total correction Factor A<sub>T</sub> and A<sub>Factor</sub> were built in test software.

**Note1:** All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

**Note2:** For the frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

**Note3:** For the frequency, which started from 18GHz to 10th harmonic of the highest frequency, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

Field strength of fundamental:

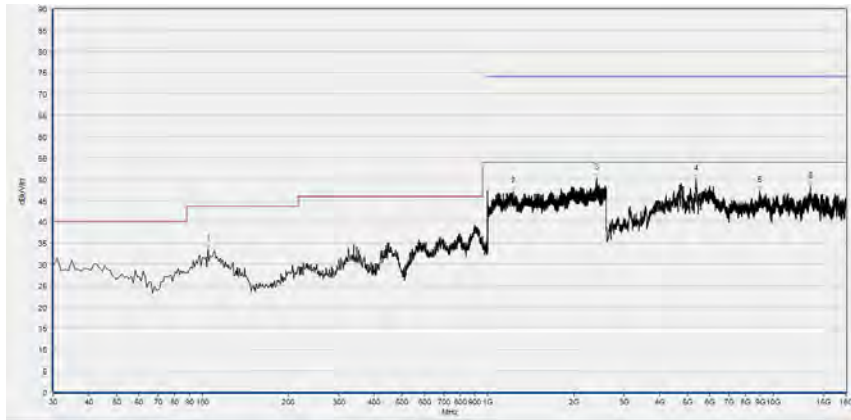
Frequency (MHz)	Reading_Peak (dBμV/m)	Antenna Factor (dB)	Path Loss (dB)	Final_Peak (dBμV/m)	Antenna Polarity
2402.16	54.42	27.20	6.74	88.36	Horizontal
2402.12	55.24	27.20	6.74	89.18	Vertical

The field strength (the lowest) of fundamenta is more than 20dB higher than the unwanted emissions, in accordance with FCC part 15.215(b).



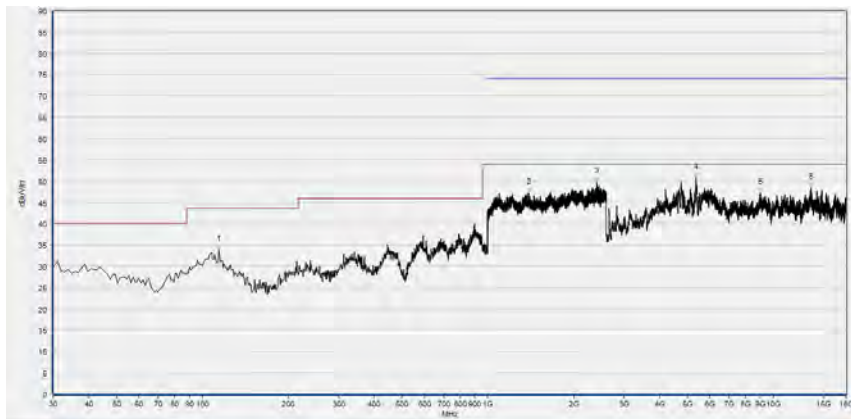
**GFSK Mode**

Plots for Channel 0



Fre. (MHz)	PK (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
104.690	33.51	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1225.600	47.08	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2410.133	50.33	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5356.600	50.02	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8966.360	47.28	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
13481.640	48.21	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

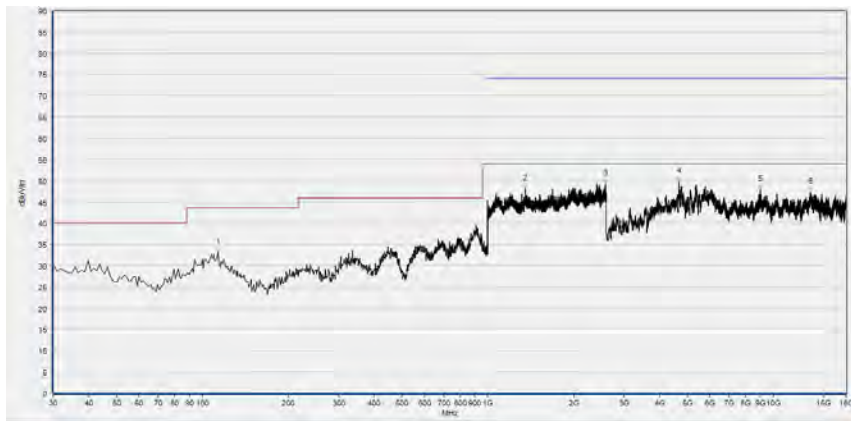
(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	PK (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
114.390	33.83	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1390.400	47.23	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2415.467	49.81	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5359.680	50.71	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
9040.280	47.27	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
13601.760	48.39	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

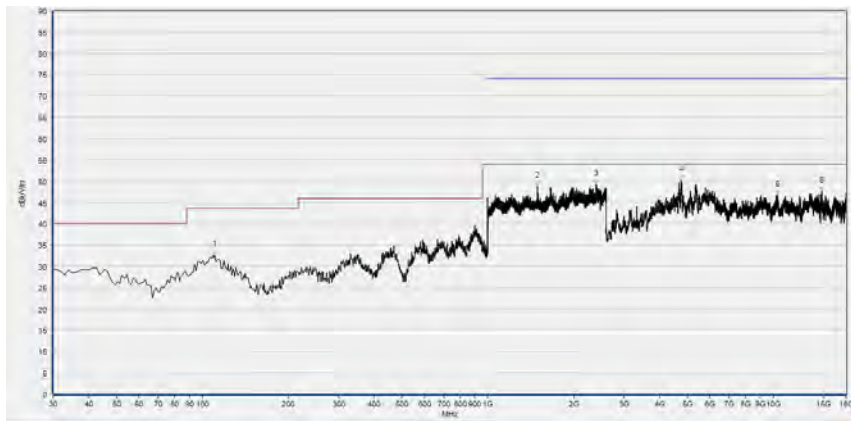
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 39



Fre. (MHz)	PK (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
113.420	33.15	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1355.200	48.14	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2588.267	49.26	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4666.680	49.81	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9037.200	47.87	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
13490.880	47.29	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

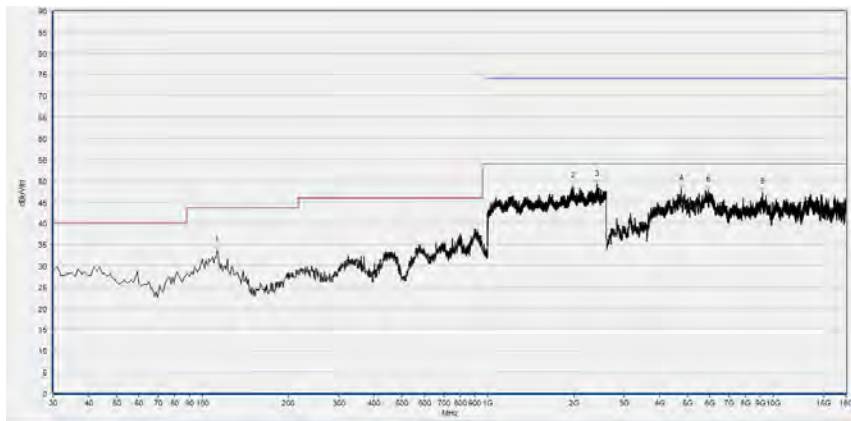
(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	PK (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
110.510	32.65	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1496.533	48.81	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2398.933	49.19	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4756.000	50.31	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
10330.800	46.74	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
14790.640	47.61	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

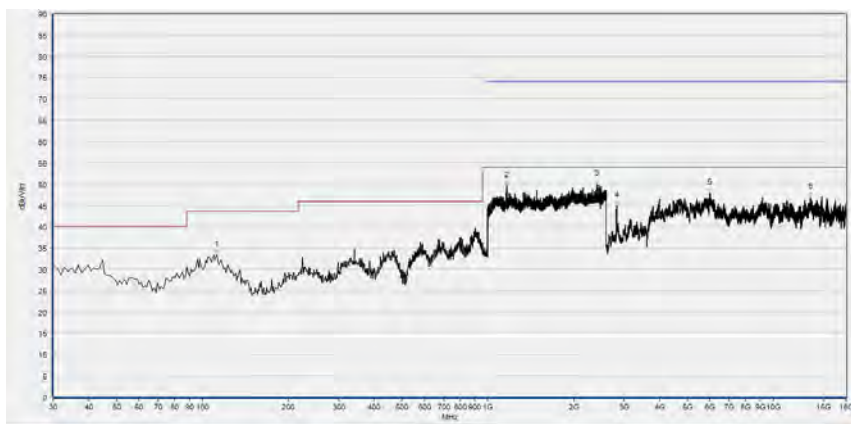
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 78



Fre. (MHz)	PK (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
112.450	33.46	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1991.467	48.55	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2415.467	49.18	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4765.240	48.16	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5904.840	47.81	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9185.040	47.18	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	PK (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
112.450	33.33	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1165.867	49.66	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2406.933	49.92	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2834.080	44.99	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5994.160	47.94	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
13457.000	46.89	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)



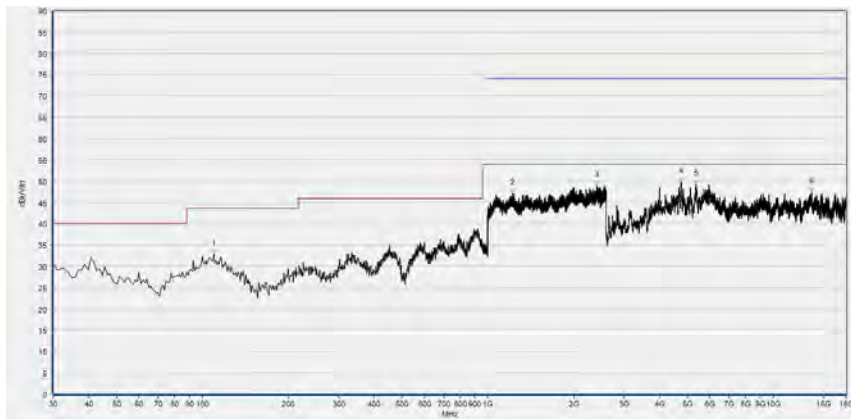
**$\pi/4$ -DQPSK Mode**

**Plots for Channel 0**



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
108.570	33.31	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1971.200	48.72	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2411.733	49.67	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5362.760	49.43	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9037.200	46.71	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
13561.720	48.42	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

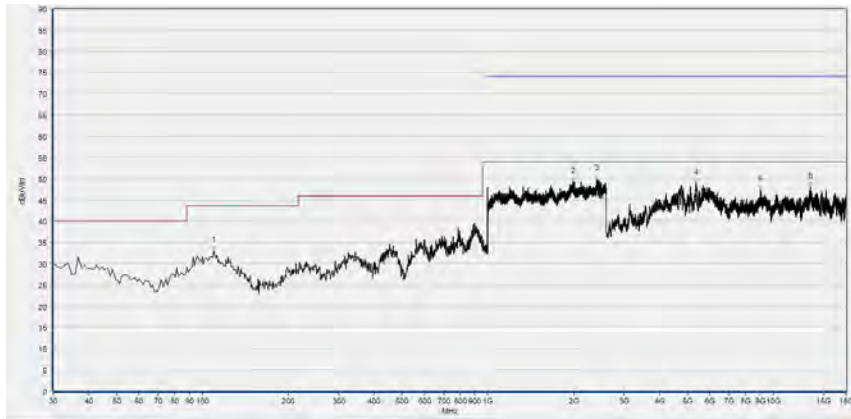
(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
109.540	32.91	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1217.067	47.06	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2415.467	48.87	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4756.000	49.86	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5362.760	49.29	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
13644.880	47.37	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

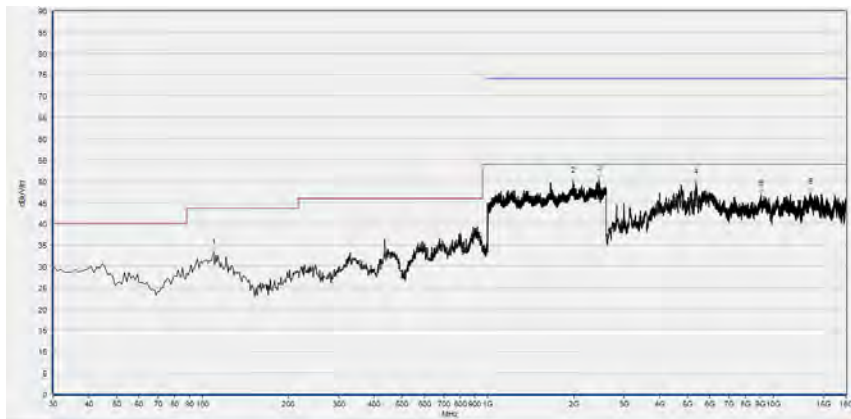
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 39



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
109.540	32.97	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1991.467	49.21	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2413.333	49.87	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5375.080	48.91	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9034.120	47.50	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
13493.960	48.13	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

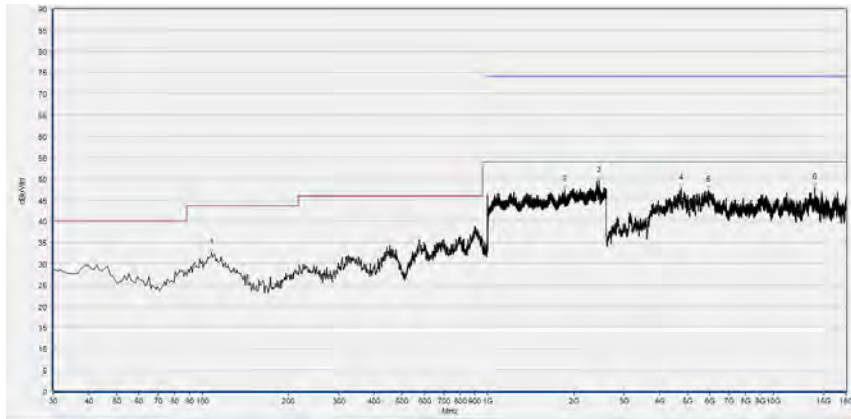


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
109.540	33.14	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1993.600	49.97	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2453.867	50.41	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5356.600	49.68	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
9071.080	46.93	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
13472.400	47.18	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

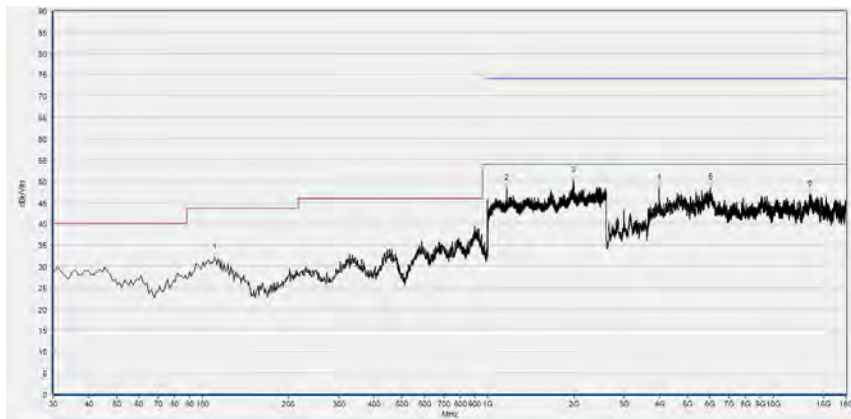


Plot for Channel 78



Fre. (MHz)	Pk (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
107.600	32.47	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1863.467	47.37	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2448.000	49.63	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4759.080	47.82	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5901.760	47.21	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
13959.040	47.98	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)



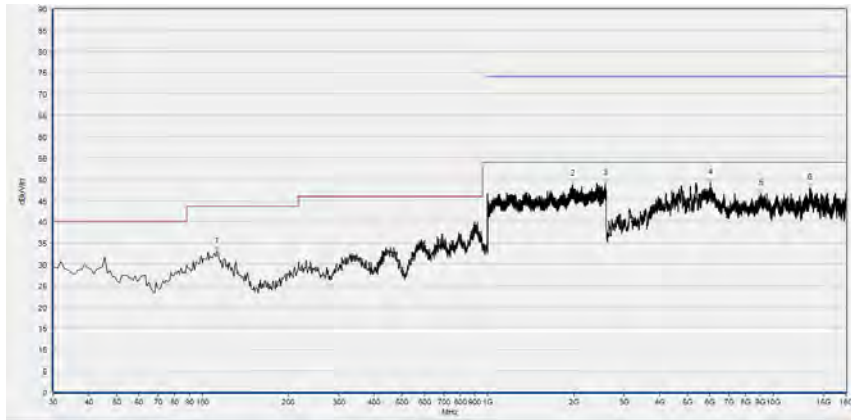
Fre. (MHz)	Pk (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
110.510	32.05	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1165.867	48.34	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
1994.133	50.19	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3986.000	48.25	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
6006.480	48.39	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
13432.360	46.87	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)



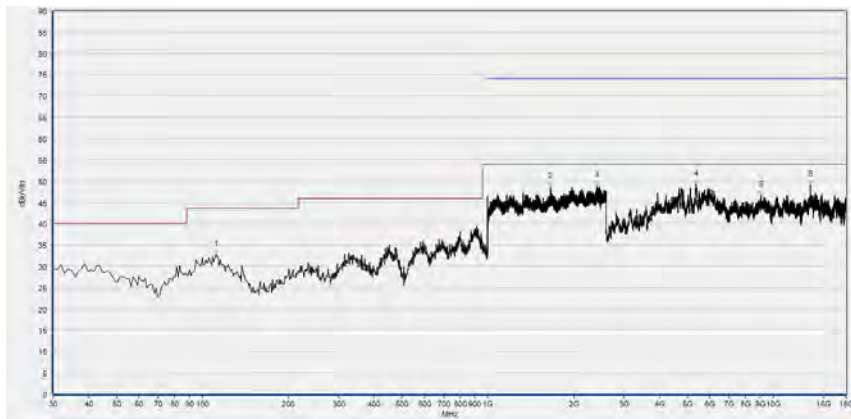
**8-DPSK Mode**

**Plots for Channel 0**



Fre. (MHz)	Pk (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
112.450	33.02	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1985.600	48.73	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2575.467	49.01	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
6018.800	49.11	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9043.360	46.59	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
13441.600	48.00	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

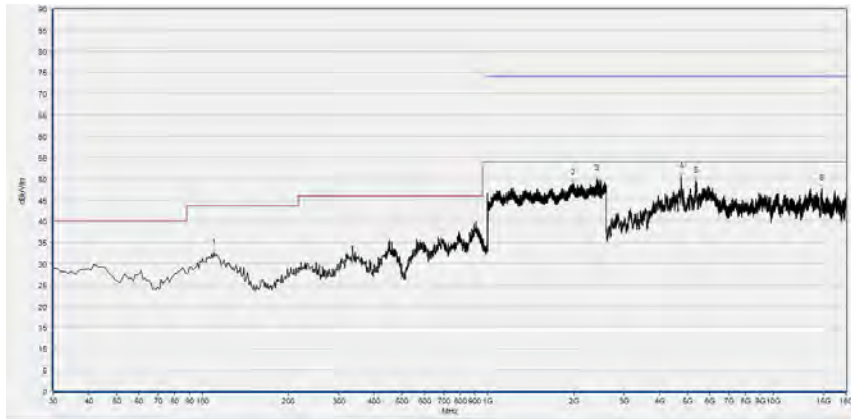
(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	Pk (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
111.480	32.61	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1659.200	48.53	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2413.867	48.94	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5365.840	49.28	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
9080.320	46.77	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
13500.120	49.07	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

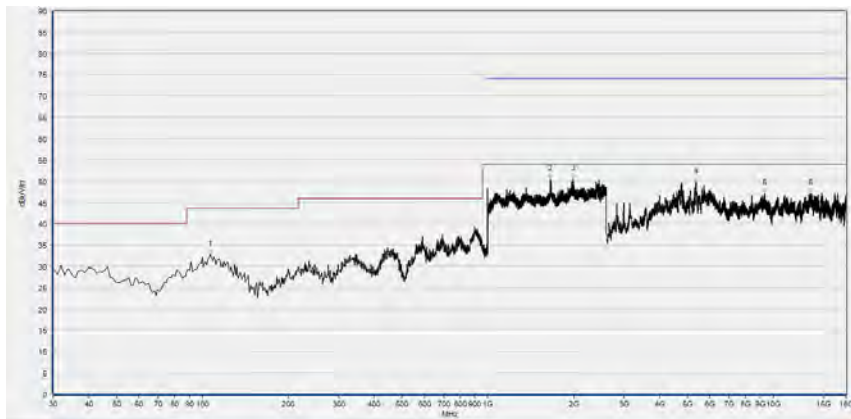
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 39



Fre. (MHz)	Pk (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
109.540	32.51	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1992.000	49.01	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2408.000	49.89	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4756.000	50.47	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5372.000	49.46	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
14762.920	47.60	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

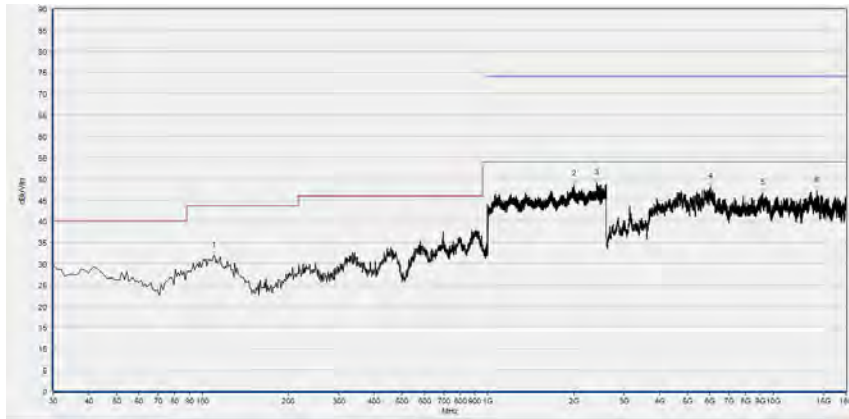
(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	Pk (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
106.630	32.69	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1658.667	50.44	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
1992.000	50.50	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5356.600	49.75	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
9314.400	47.04	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
13481.640	47.02	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

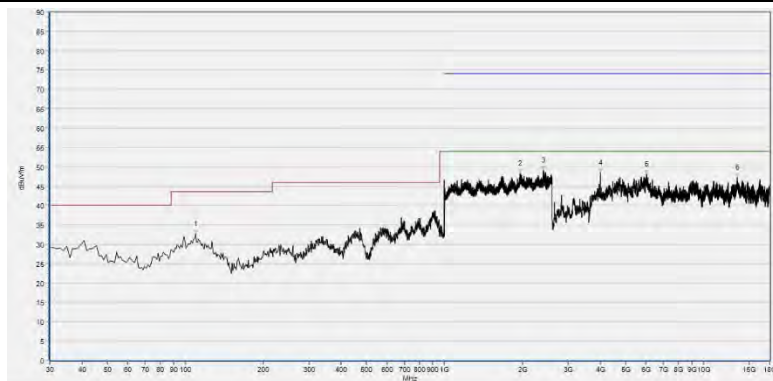
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 78



Fre. (MHz)	Pk (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
109.540	31.87	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1997.333	48.56	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2407.467	48.96	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
6024.960	48.16	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9169.640	46.62	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
14180.800	47.03	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	Pk (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
109.540	32.63	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1954.667	48.28	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2414.400	49.05	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3989.080	48.43	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
6037.280	48.04	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
13457.000	47.22	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

————— END OF REPORT —————