

## 7. HOPPING CHANNEL SEPARATION MEASUREMENT

### 7.1 LIMIT

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

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

### 7.2 TEST PROCEDURE

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

### 7.3 TEST SETUP



### 7.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

### 7.5 TEST RESULTS

Note: The test data please refer to APPENDIX 1.



## 8. BANDWIDTH TEST

### 8.1 LIMIT

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

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

### 8.2 TEST PROCEDURE

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Spectrum Setting: RBW= 30KHz, VBW=100KHz, Sweep time = Auto.

### 8.3 TEST SETUP



### 8.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

### 8.5 TEST RESULTS

Note: The test data please refer to APPENDIX 1.



## 9. OUTPUT POWER TEST

### 9.1 LIMIT

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

### 9.2 TEST PROCEDURE

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

a) Use the following spectrum analyzer settings:

1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.

2) RBW > 20 dB bandwidth of the emission being measured.

3) VBW ≥ RBW.

4) Sweep: Auto.

5) Detector function: Peak.

6) Trace: Max hold.

b) Allow trace to stabilize.

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

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

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

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

PKPM1 Peak power meter method:

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

### 9.3 TEST SETUP



### 9.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

### 9.5 TEST RESULTS

Note: The test data please refer to APPENDIX 1.



## 10. ANTENNA REQUIREMENT

### 10.1 STANDARD REQUIREMENT

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

### 10.2 EUT ANTENNA

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





## APPENDIX 1-TEST DATA

## 1. Dwell Time

Condition	Mode	Frequency (MHz)	Pulse Time (ms)	Total Dwell Time (ms)	Burst Count	Period Time (ms)	Limit (ms)	Verdict
NVNT	1-DH1	2441	0.378	119.07	315	31600	<=400	Pass
NVNT	1-DH3	2441	1.634	241.832	148	31600	<=400	Pass
NVNT	1-DH5	2441	2.882	291.082	101	31600	<=400	Pass
NVNT	2-DH1	2441	0.385	121.66	316	31600	<=400	Pass
NVNT	2-DH3	2441	1.637	258.646	158	31600	<=400	Pass
NVNT	2-DH5	2441	2.885	274.075	95	31600	<=400	Pass
NVNT	3-DH1	2441	0.386	121.976	316	31600	<=400	Pass
NVNT	3-DH3	2441	1.636	256.852	157	31600	<=400	Pass
NVNT	3-DH5	2441	2.887	294.474	102	31600	<=400	Pass



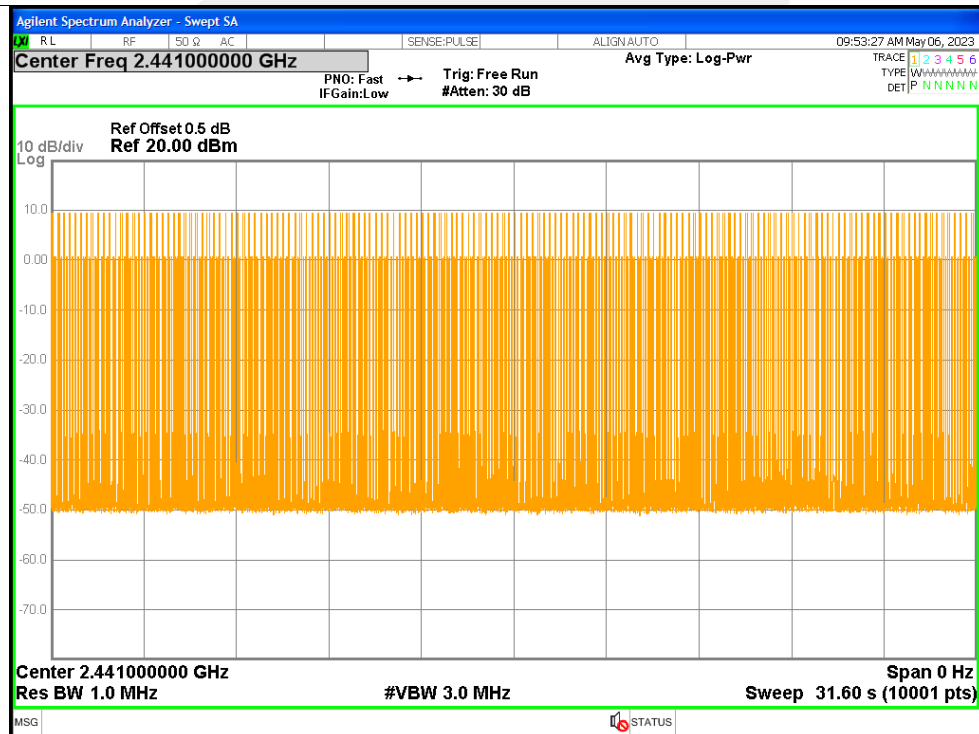


## Test Graphs

## Dwell NVNT 1-DH1 2441MHz One Burst

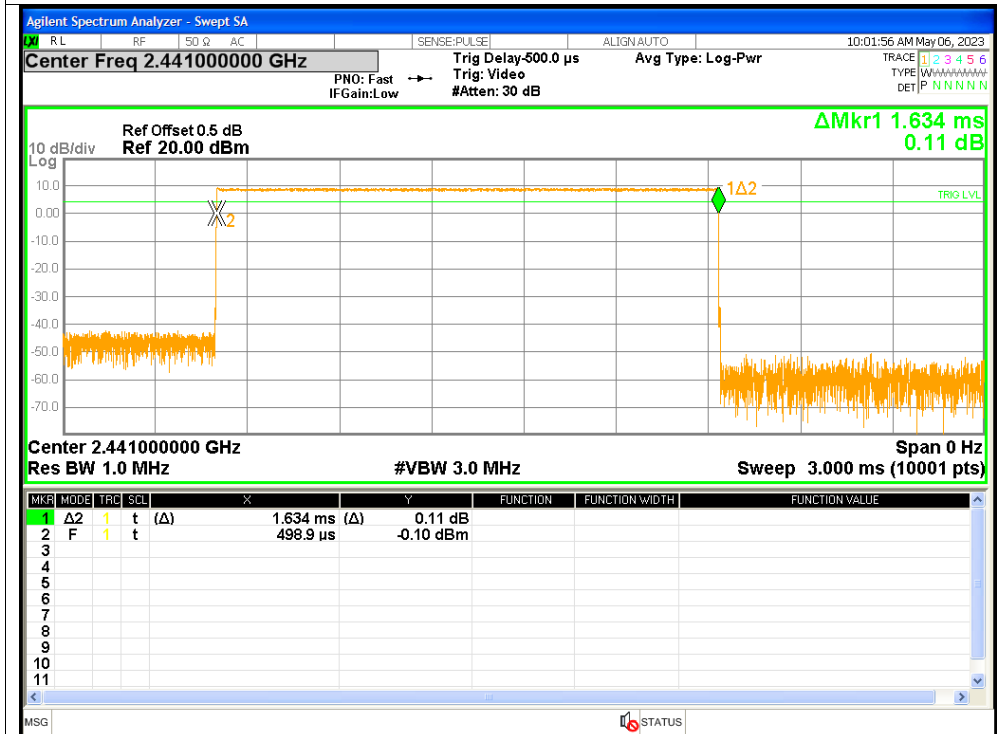


## Dwell NVNT 1-DH1 2441MHz Accumulated

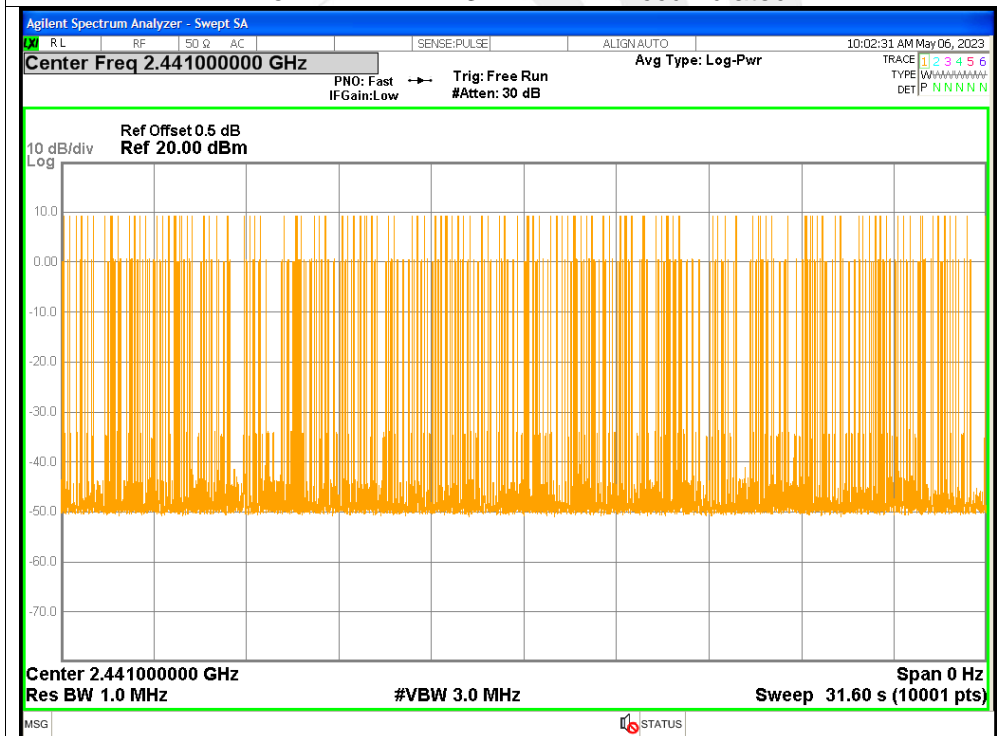




## Dwell NVNT 1-DH3 2441MHz One Burst

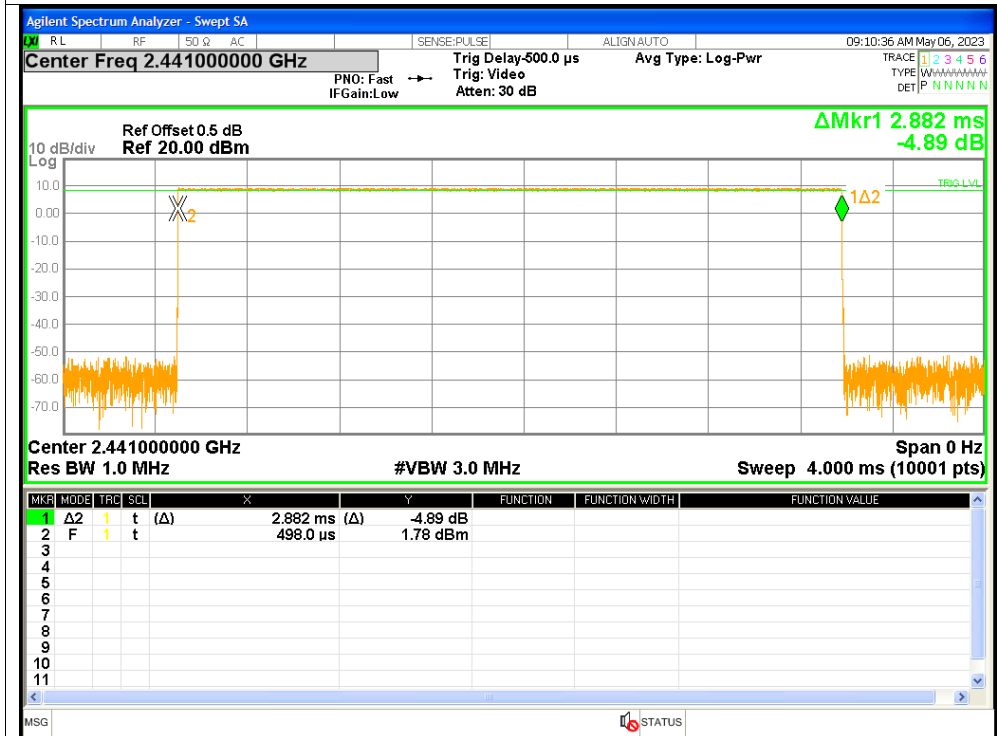


## Dwell NVNT 1-DH3 2441MHz Accumulated

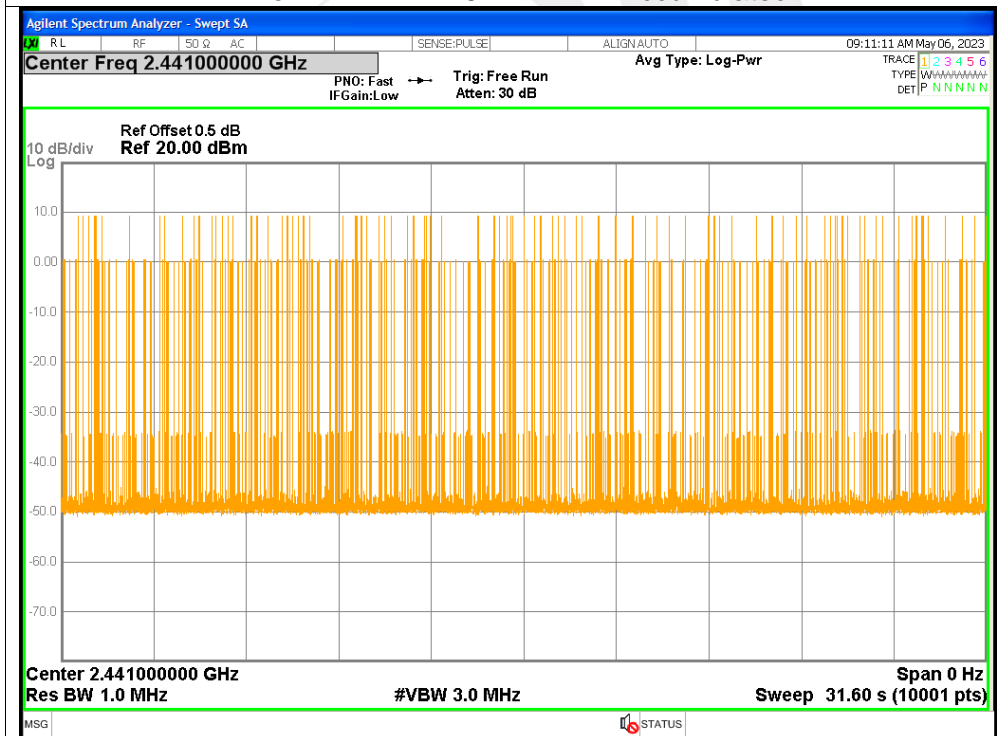




## Dwell NVNT 1-DH5 2441MHz One Burst



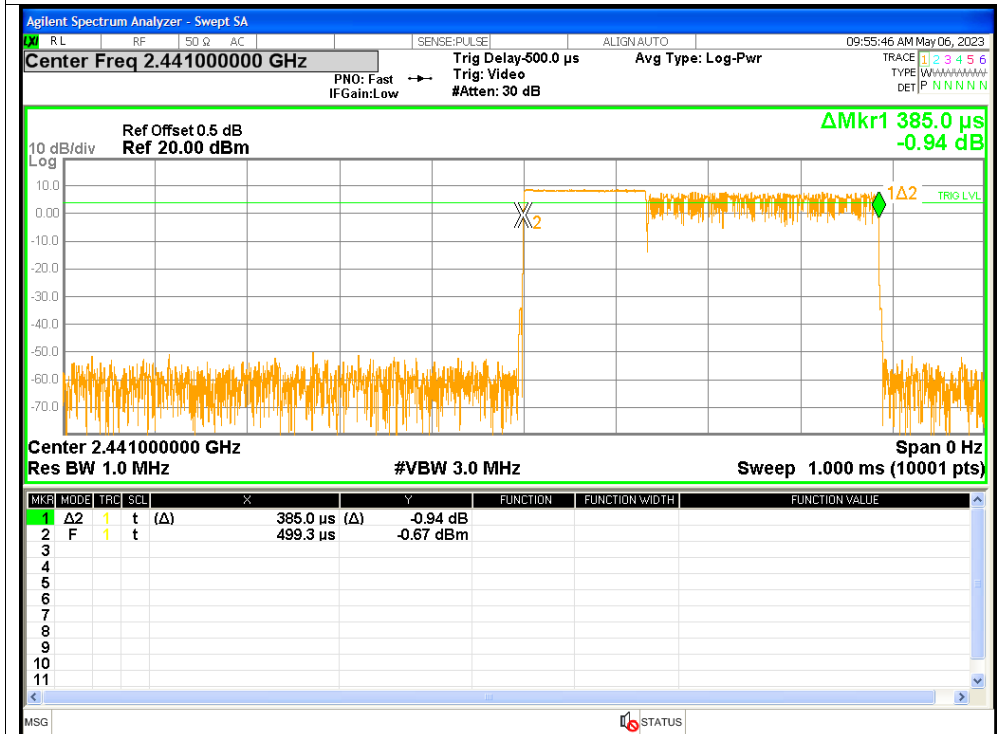
## Dwell NVNT 1-DH5 2441MHz Accumulated



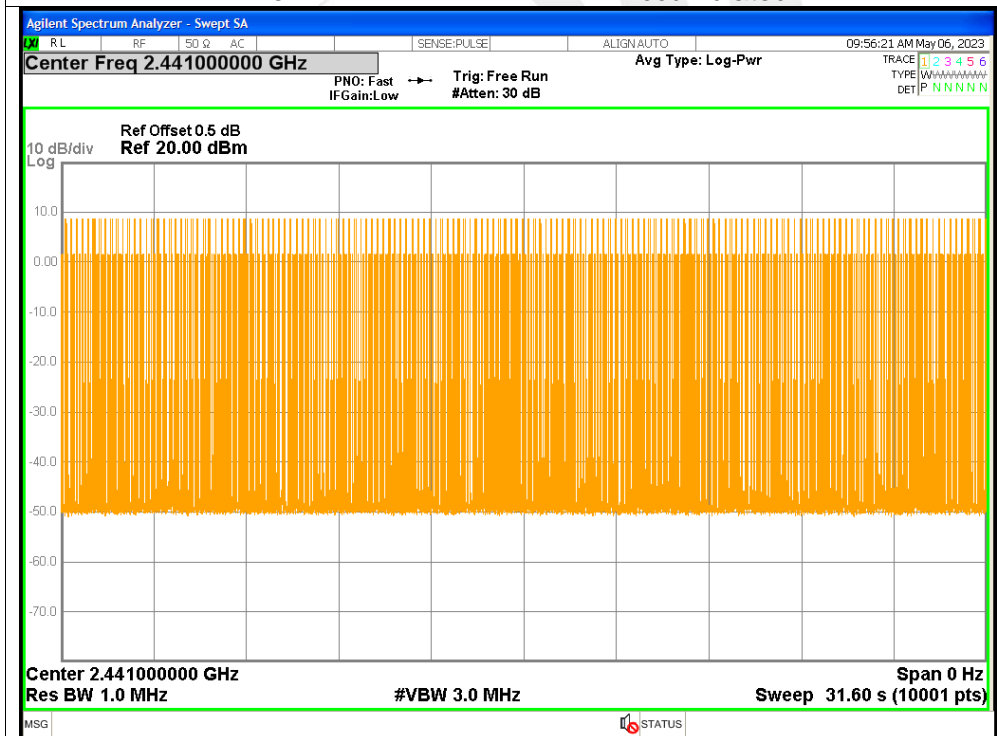




## Dwell NVNT 2-DH1 2441MHz One Burst

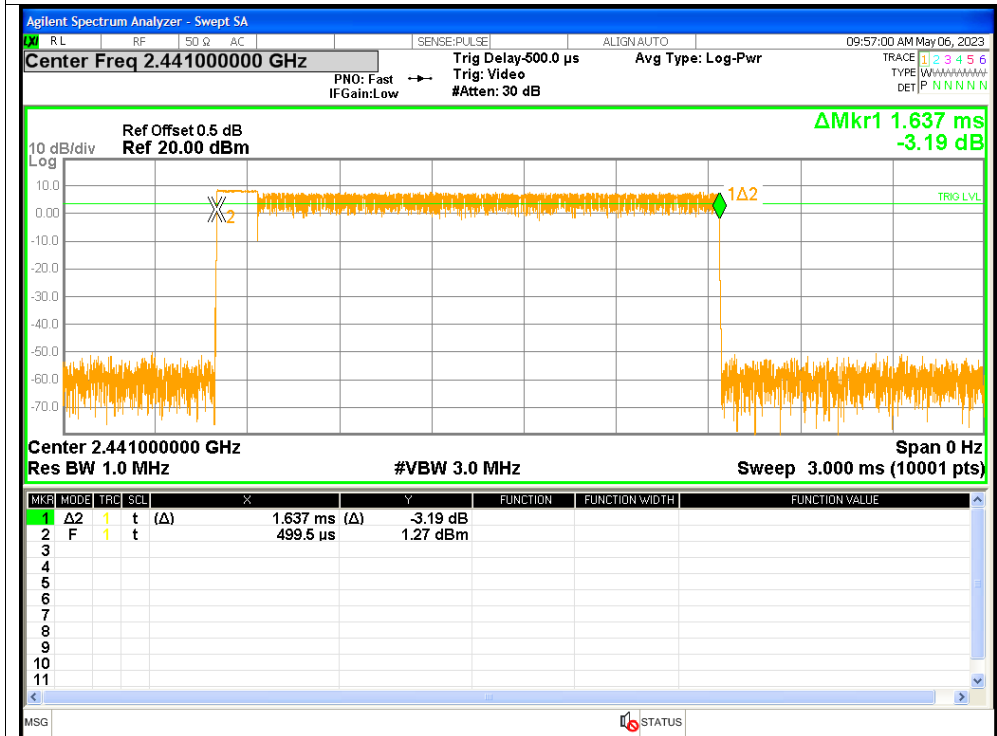


## Dwell NVNT 2-DH1 2441MHz Accumulated

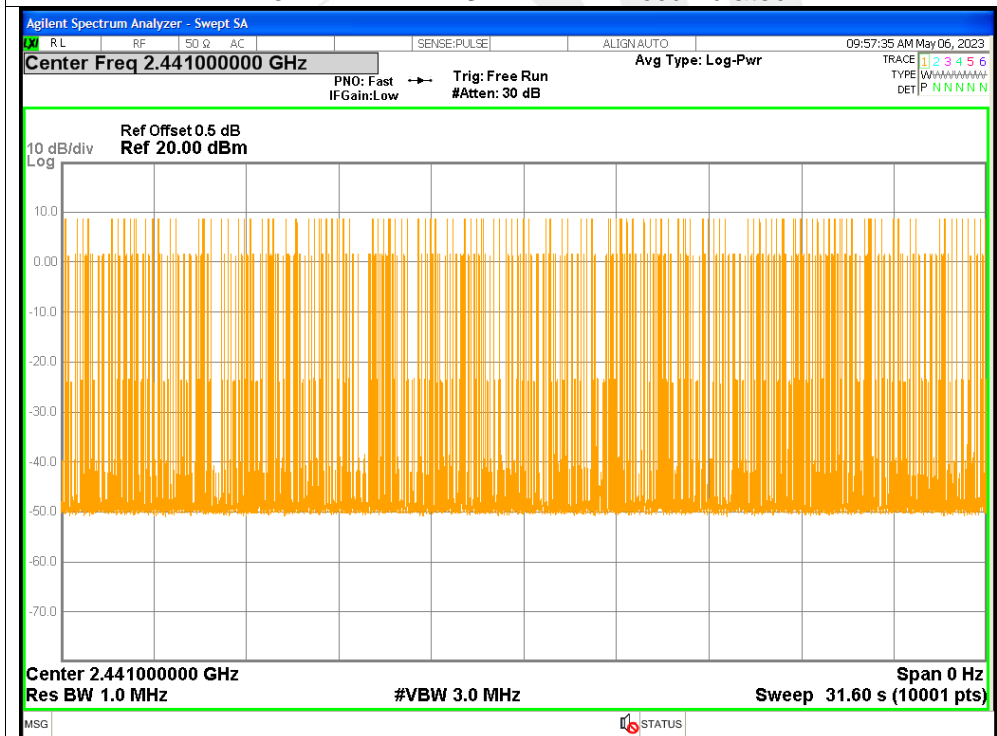




## Dwell NVNT 2-DH3 2441MHz One Burst

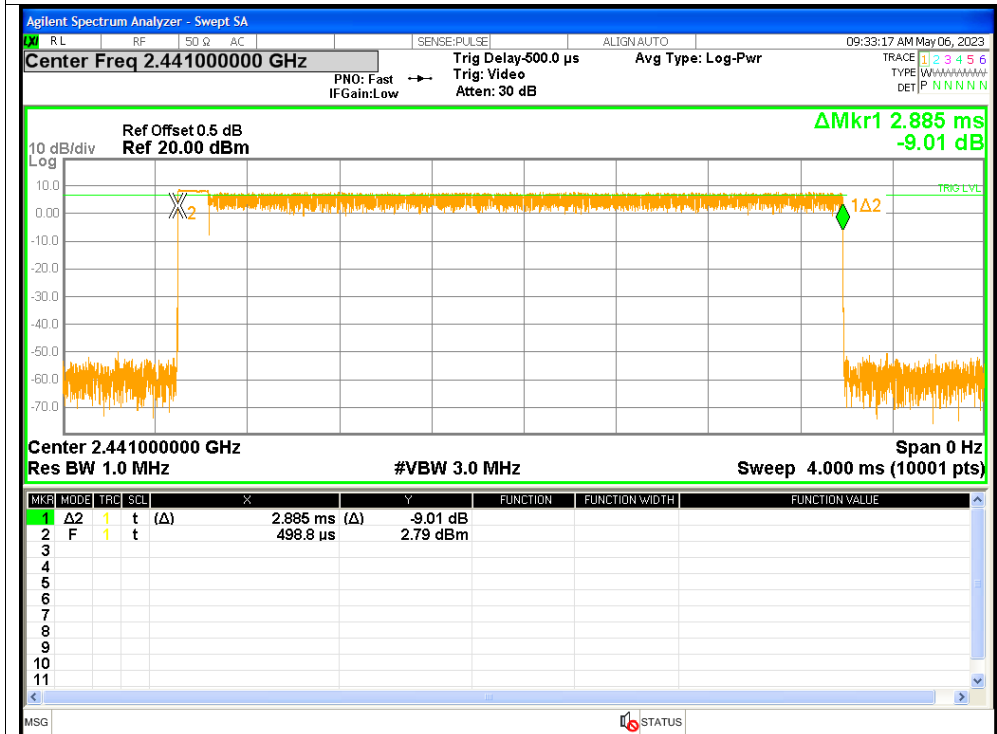


## Dwell NVNT 2-DH3 2441MHz Accumulated

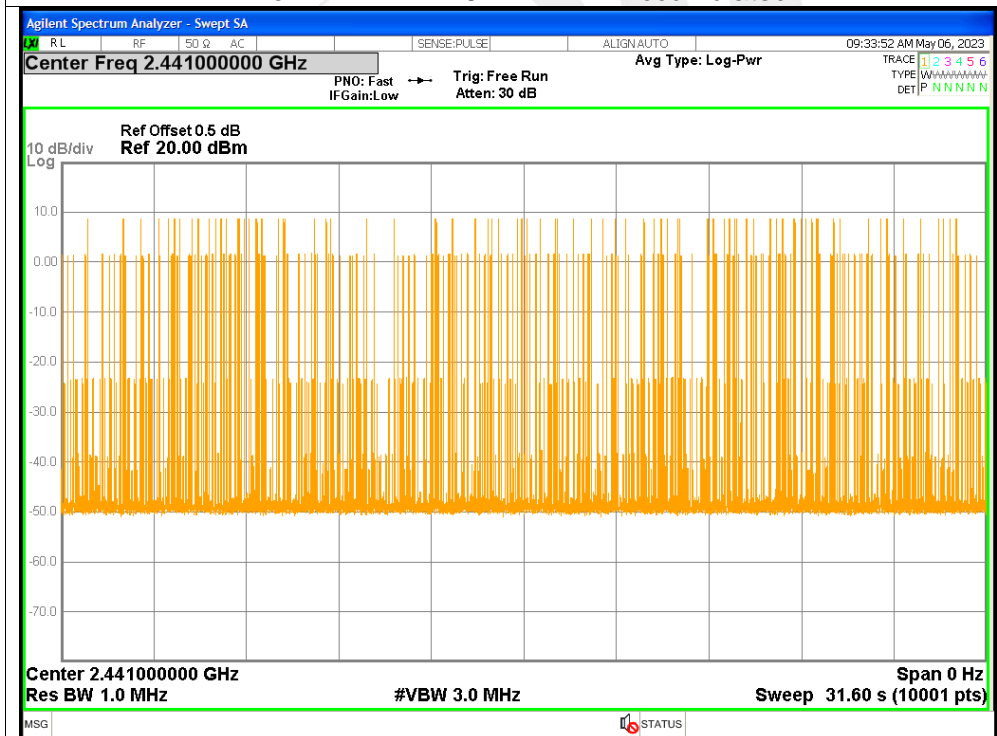




## Dwell NVNT 2-DH5 2441MHz One Burst

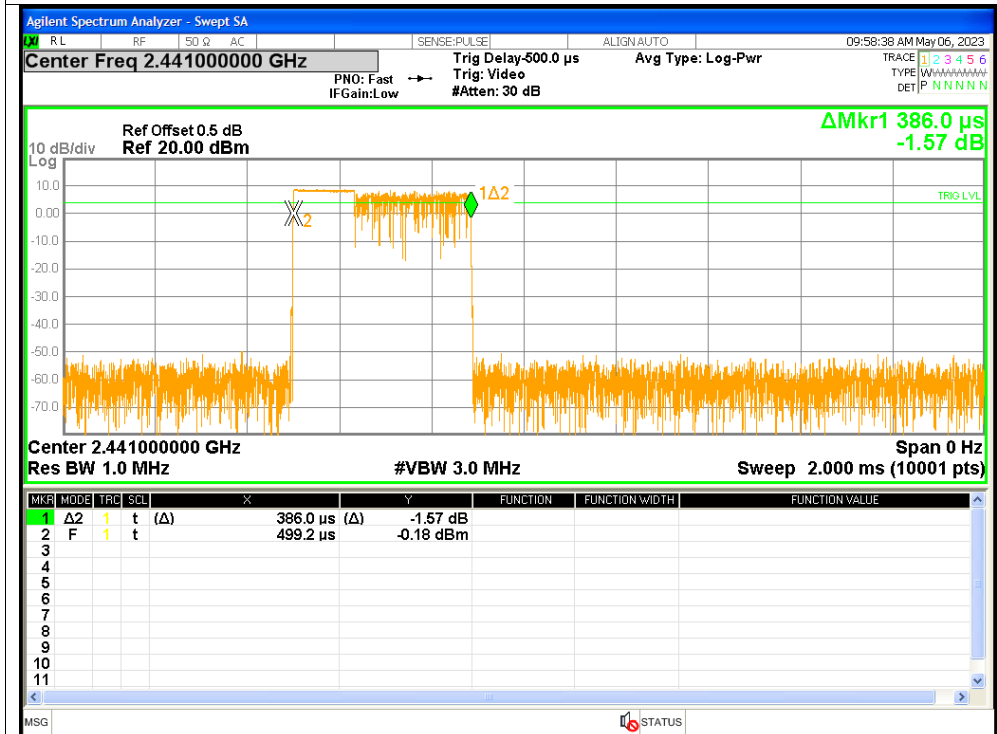


## Dwell NVNT 2-DH5 2441MHz Accumulated

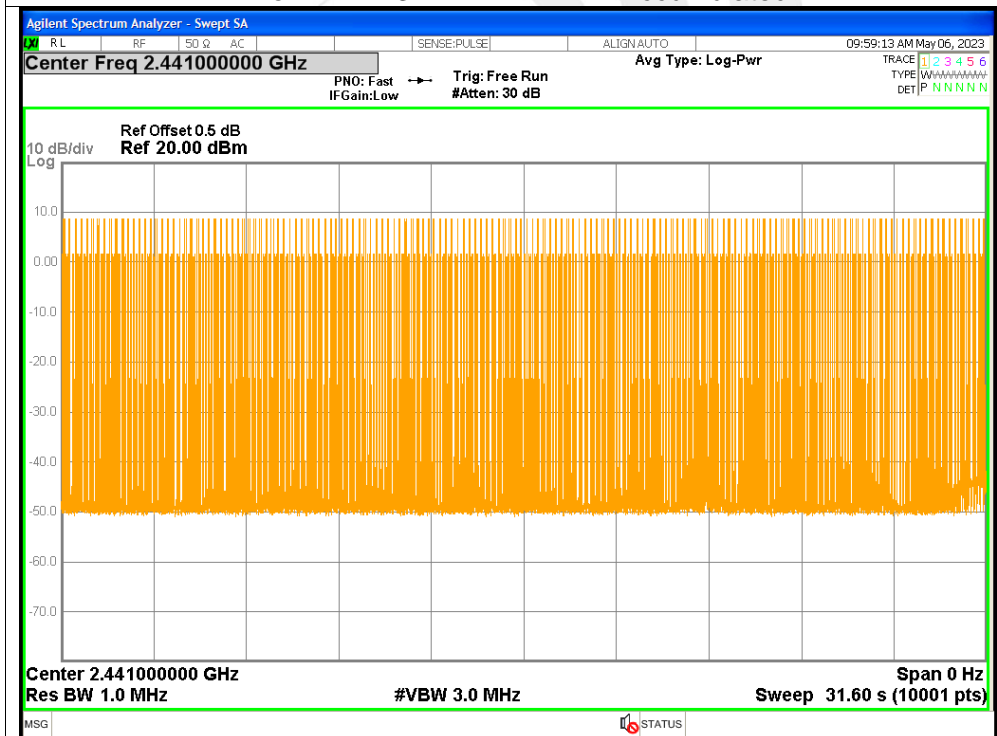




## Dwell NVNT 3-DH1 2441MHz One Burst

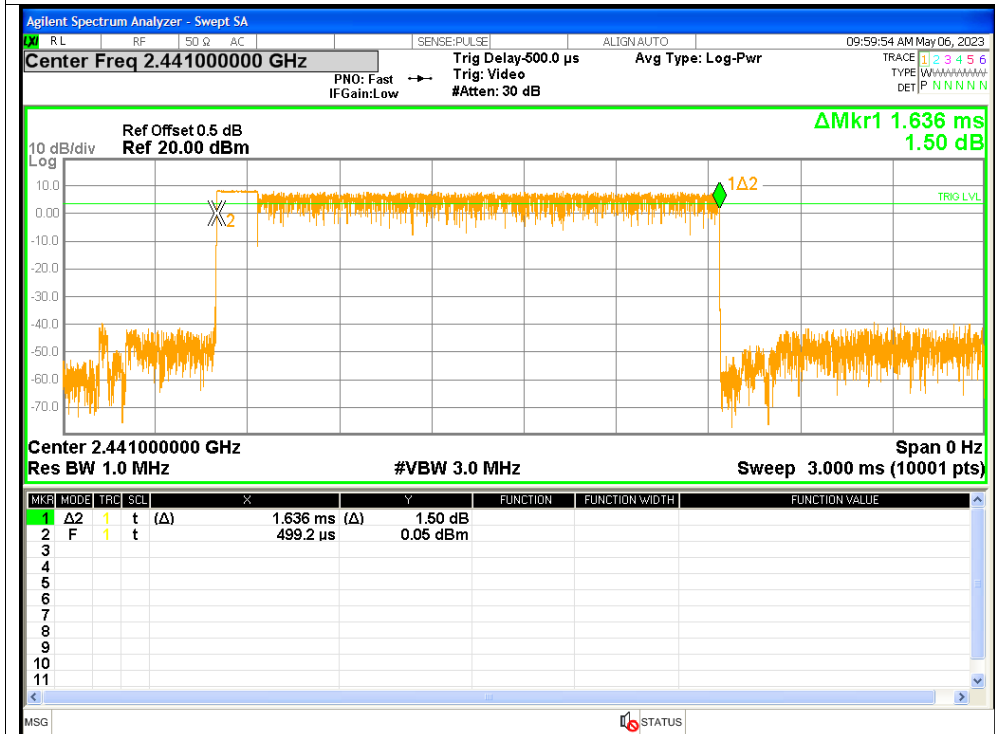


## Dwell NVNT 3-DH1 2441MHz Accumulated

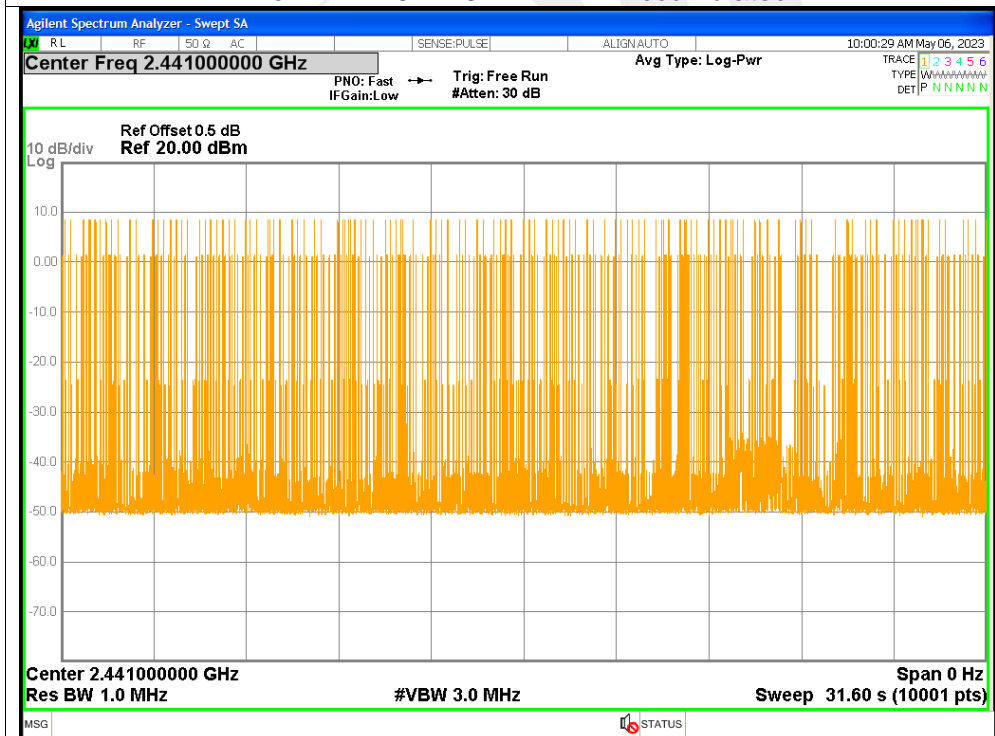




## Dwell NVNT 3-DH3 2441MHz One Burst

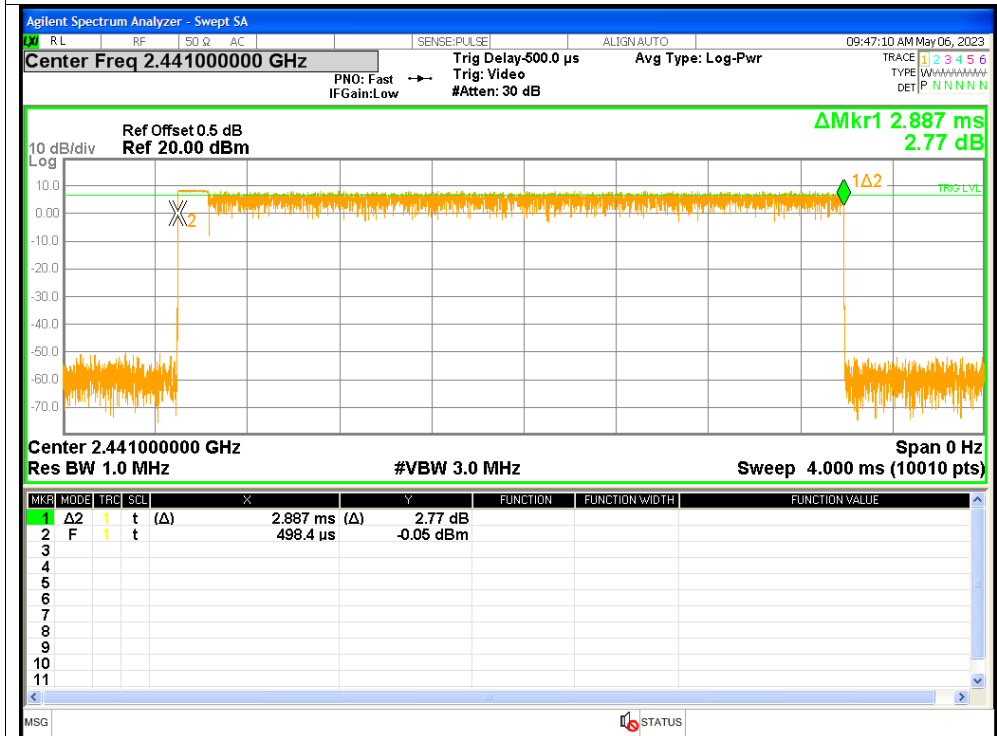


## Dwell NVNT 3-DH3 2441MHz Accumulated

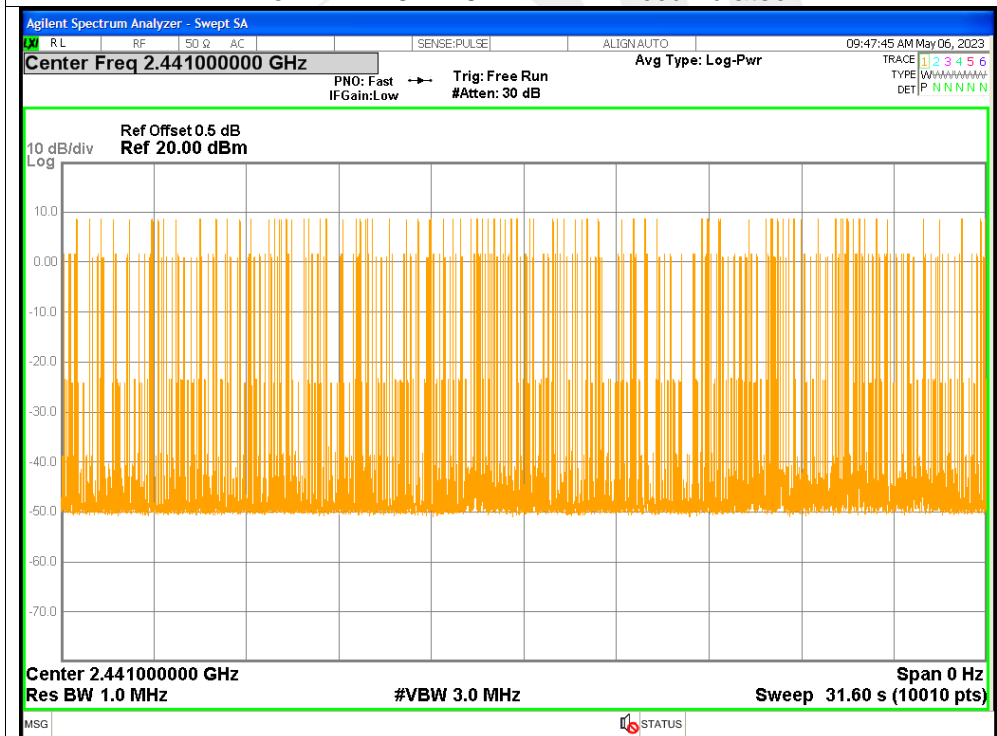




## Dwell NVNT 3-DH5 2441MHz One Burst



## Dwell NVNT 3-DH5 2441MHz Accumulated





## 2. Maximum Average Conducted Output Power

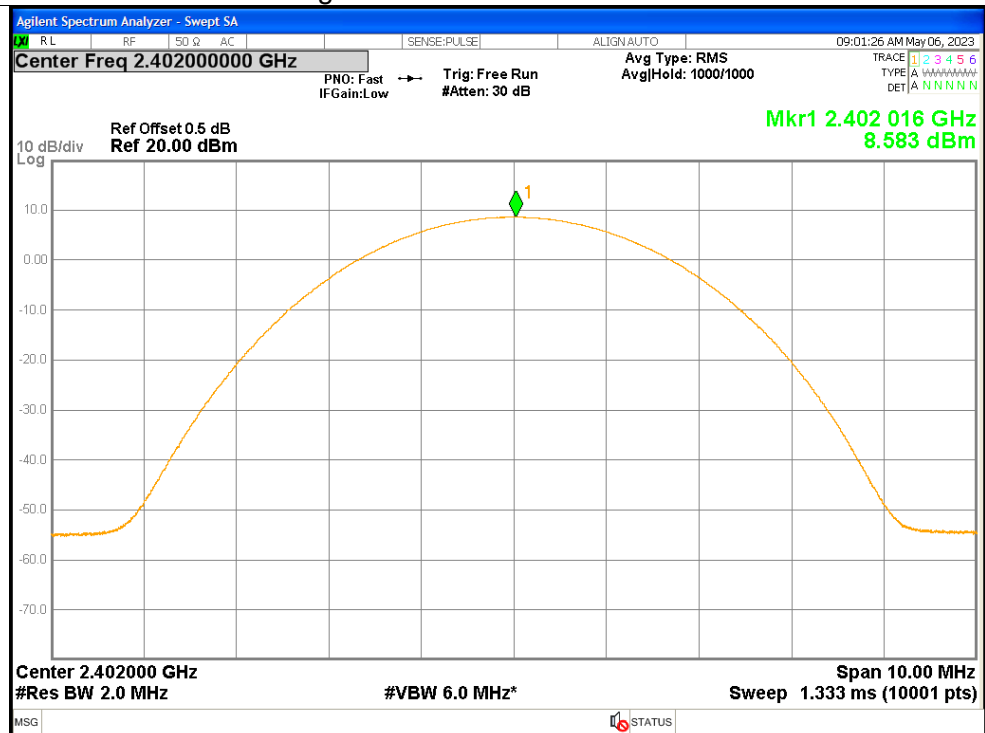
Condition	Mode	Frequency (MHz)	Total Power (dBm)	Limit (dBm)	Verdict
NVNT	1-DH5	2402	8.58	$\leq 20.97$	Pass
NVNT	1-DH5	2441	7.45	$\leq 20.97$	Pass
NVNT	1-DH5	2480	9.03	$\leq 20.97$	Pass
NVNT	2-DH5	2402	5.47	$\leq 20.97$	Pass
NVNT	2-DH5	2441	4.67	$\leq 20.97$	Pass
NVNT	2-DH5	2480	6.11	$\leq 20.97$	Pass
NVNT	3-DH5	2402	5.67	$\leq 20.97$	Pass
NVNT	3-DH5	2441	4.77	$\leq 20.97$	Pass
NVNT	3-DH5	2480	6.16	$\leq 20.97$	Pass



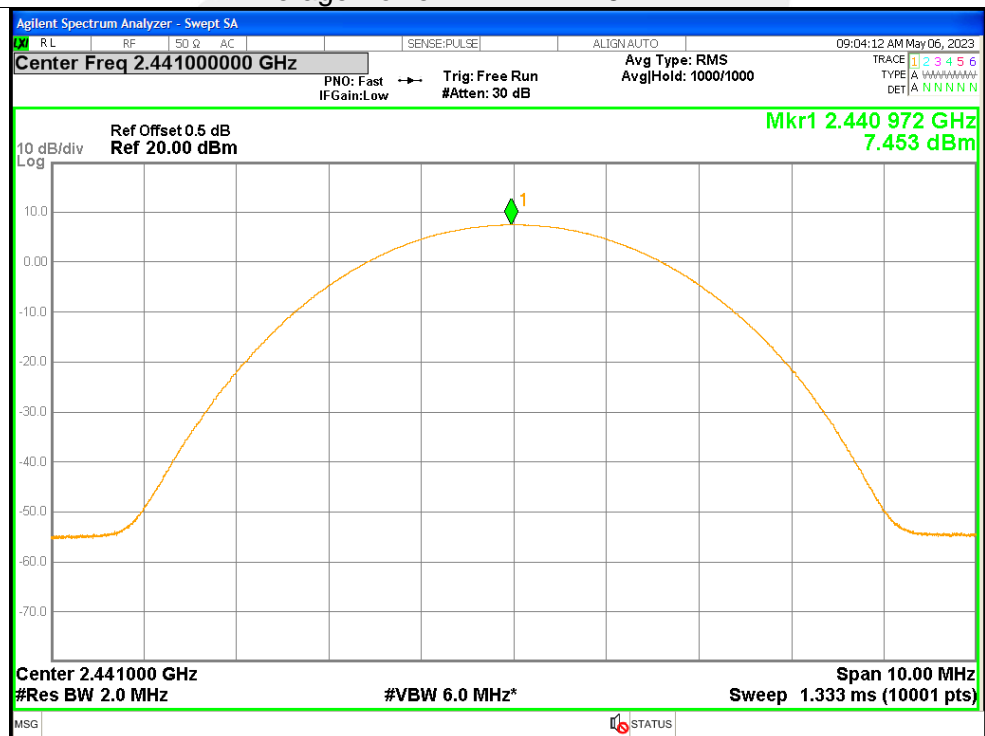


## Test Graphs

## Average Power NVNT 1-DH5 2402MHz



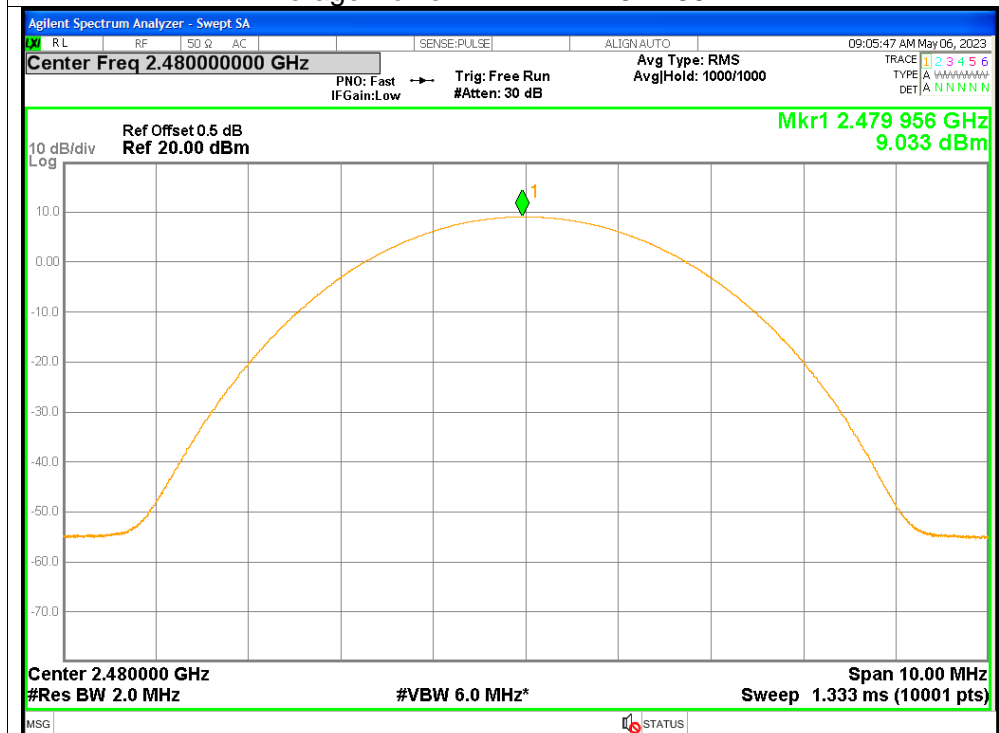
## Average Power NVNT 1-DH5 2441MHz



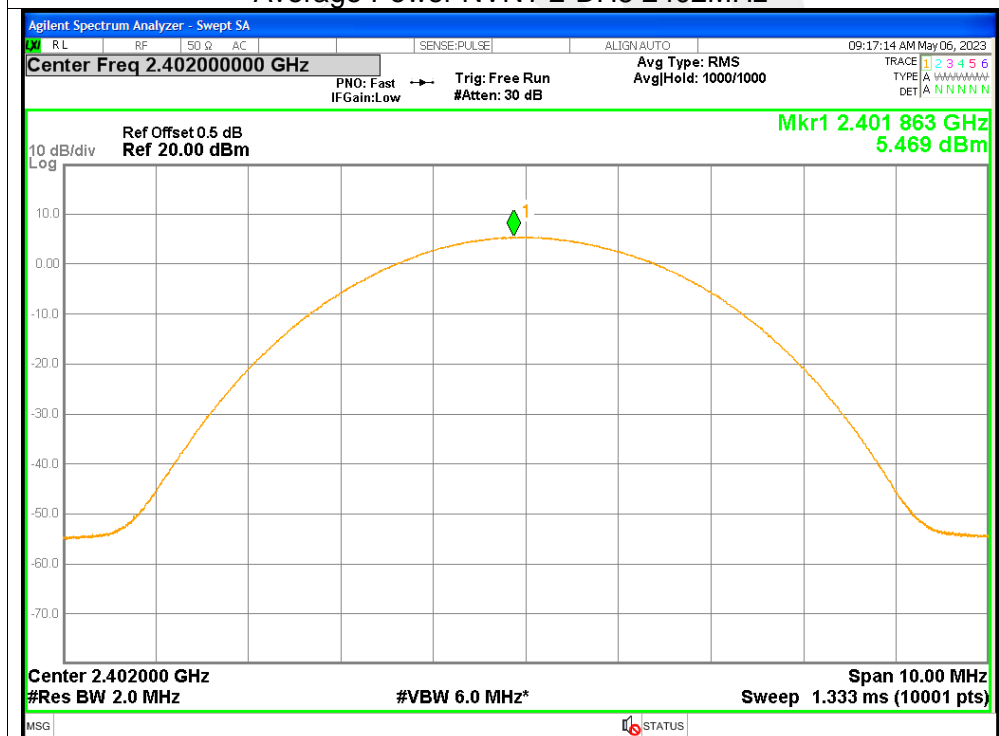




## Average Power NVNT 1-DH5 2480MHz

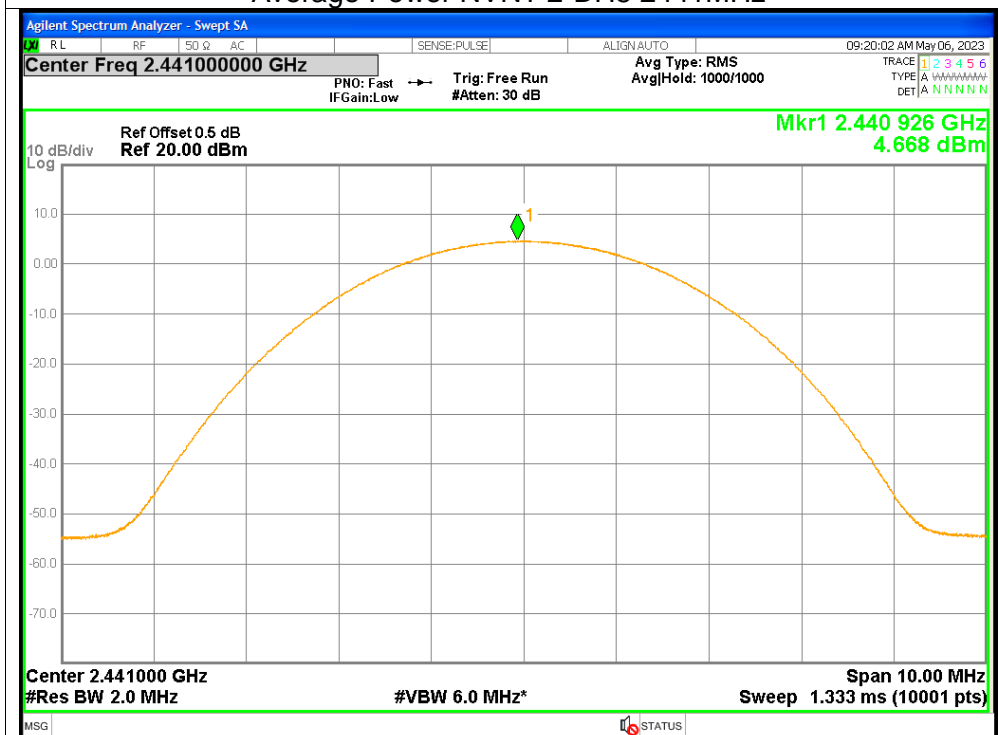


## Average Power NVNT 2-DH5 2402MHz

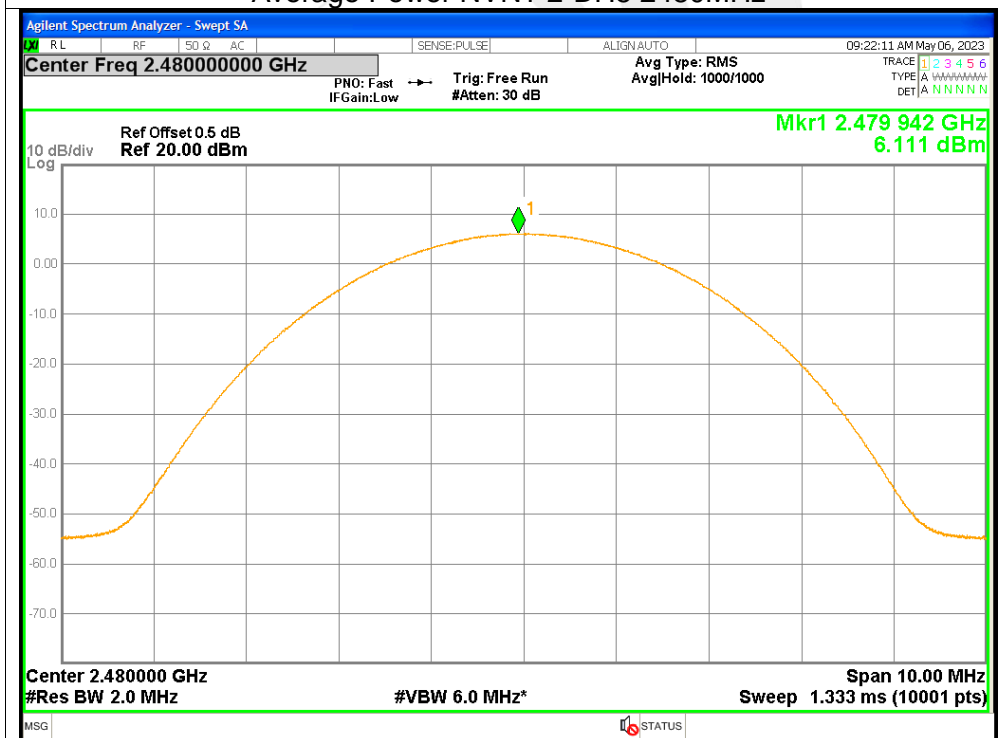




## Average Power NVNT 2-DH5 2441MHz

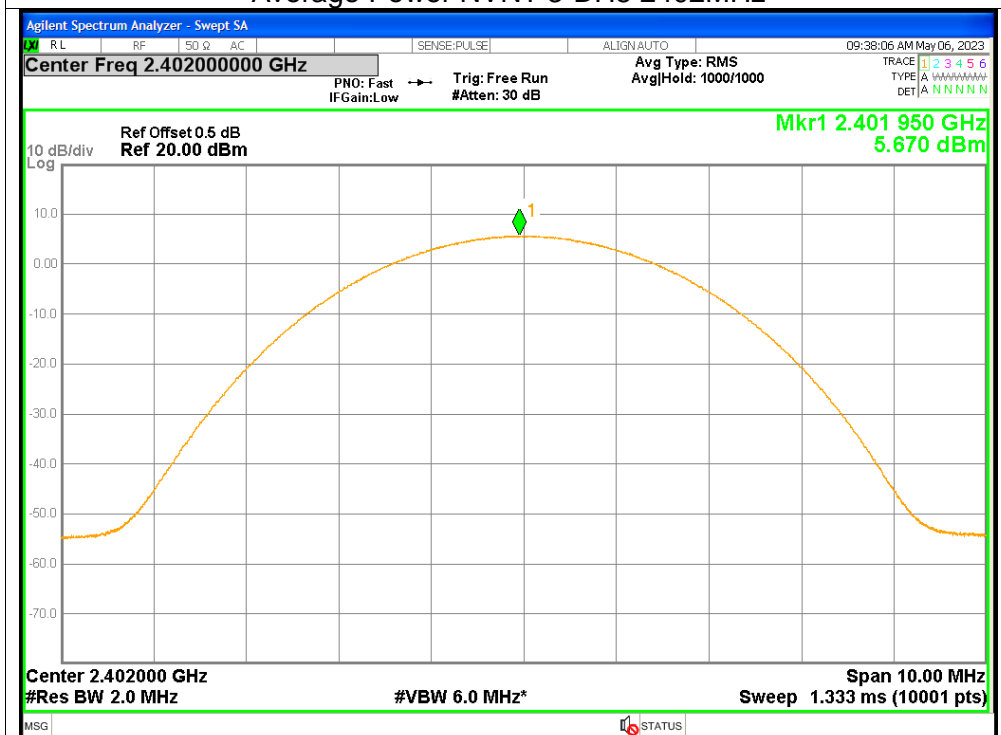


## Average Power NVNT 2-DH5 2480MHz

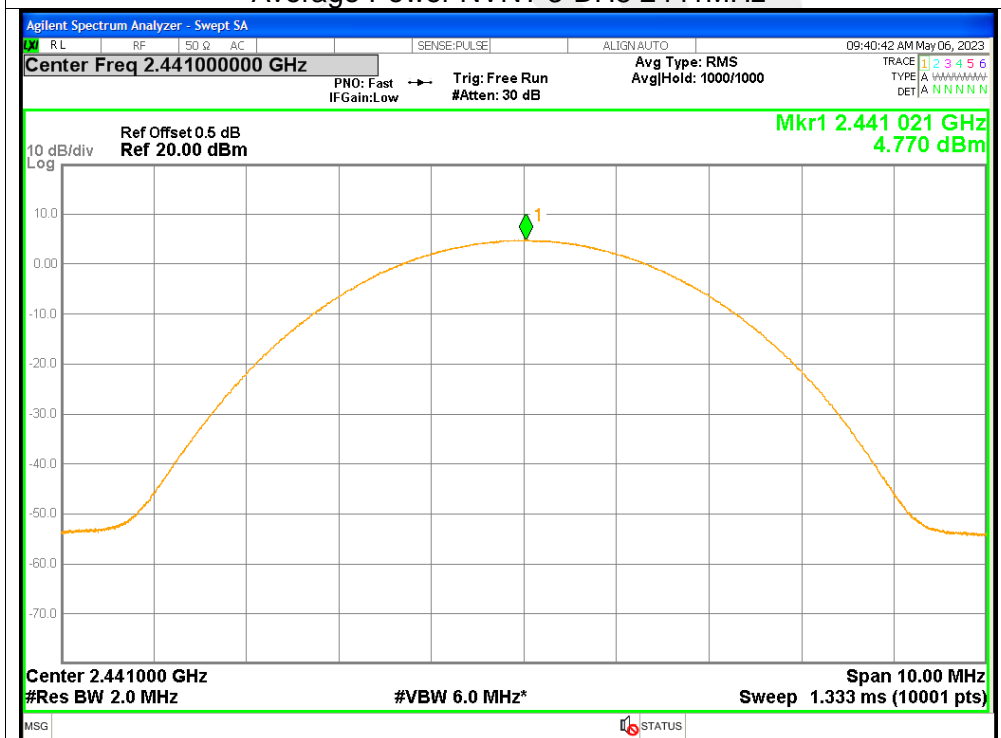


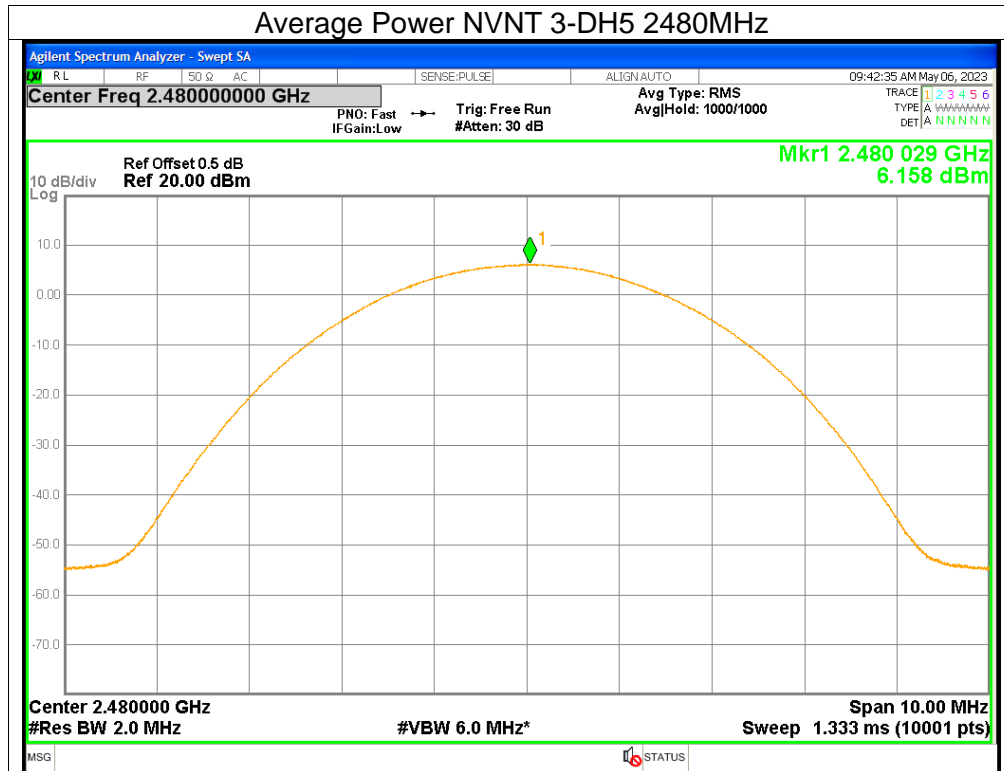


## Average Power NVNT 3-DH5 2402MHz



## Average Power NVNT 3-DH5 2441MHz







### 3. Maximum Peak Conducted Output Power

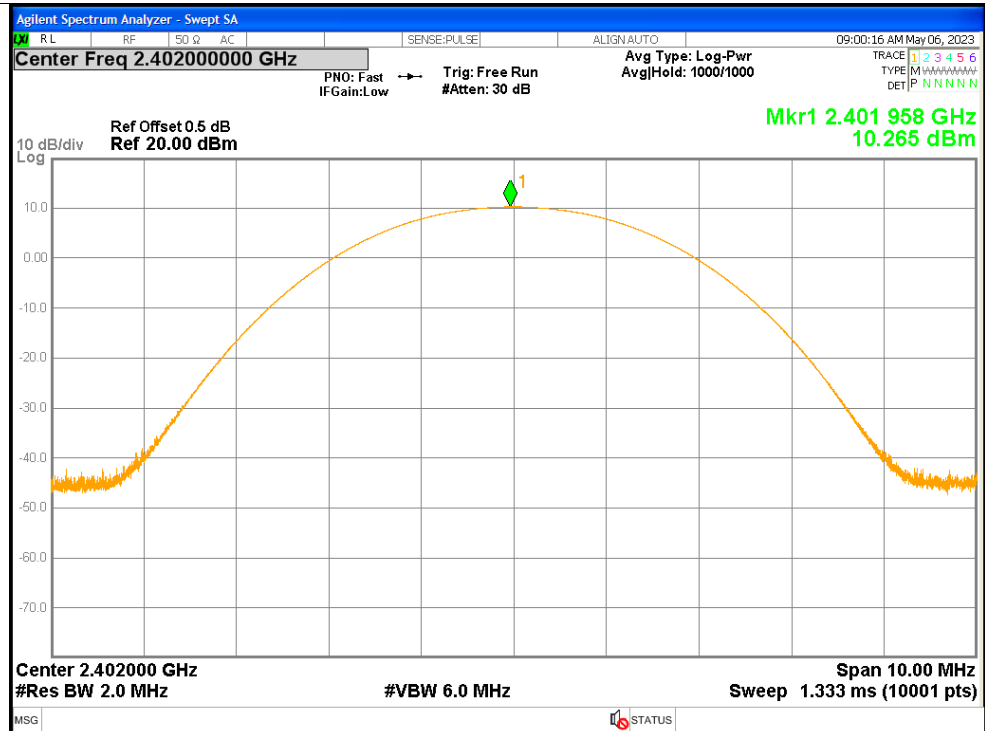
Condition	Mode	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	1-DH5	2402	10.27	$\leq 20.97$	Pass
NVNT	1-DH5	2441	9.3	$\leq 20.97$	Pass
NVNT	1-DH5	2480	10.71	$\leq 20.97$	Pass
NVNT	2-DH5	2402	9.49	$\leq 20.97$	Pass
NVNT	2-DH5	2441	8.59	$\leq 20.97$	Pass
NVNT	2-DH5	2480	10.04	$\leq 20.97$	Pass
NVNT	3-DH5	2402	9.59	$\leq 20.97$	Pass
NVNT	3-DH5	2441	8.61	$\leq 20.97$	Pass
NVNT	3-DH5	2480	10.09	$\leq 20.97$	Pass



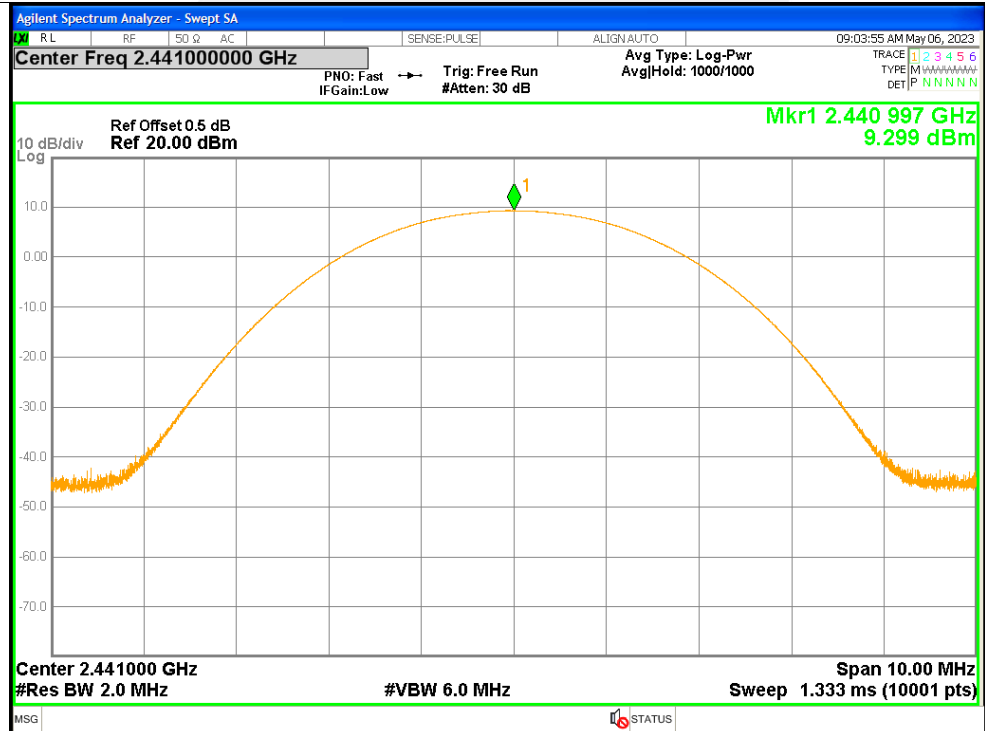


## Test Graphs

## Peak Power NVNT 1-DH5 2402MHz

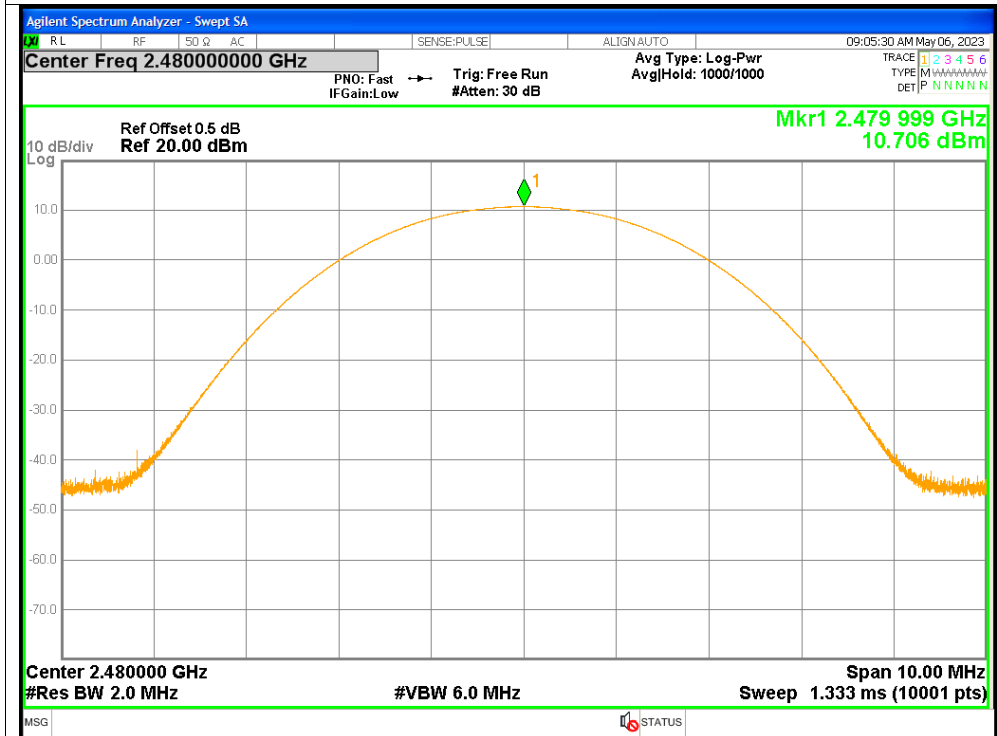


## Peak Power NVNT 1-DH5 2441MHz

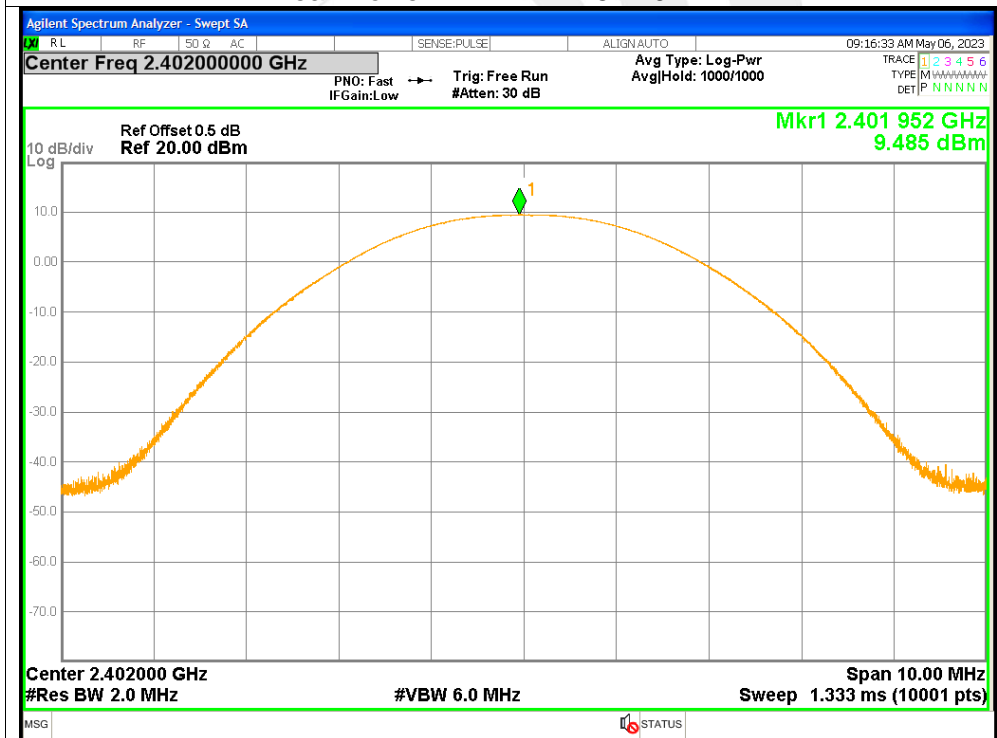




## Peak Power NVNT 1-DH5 2480MHz

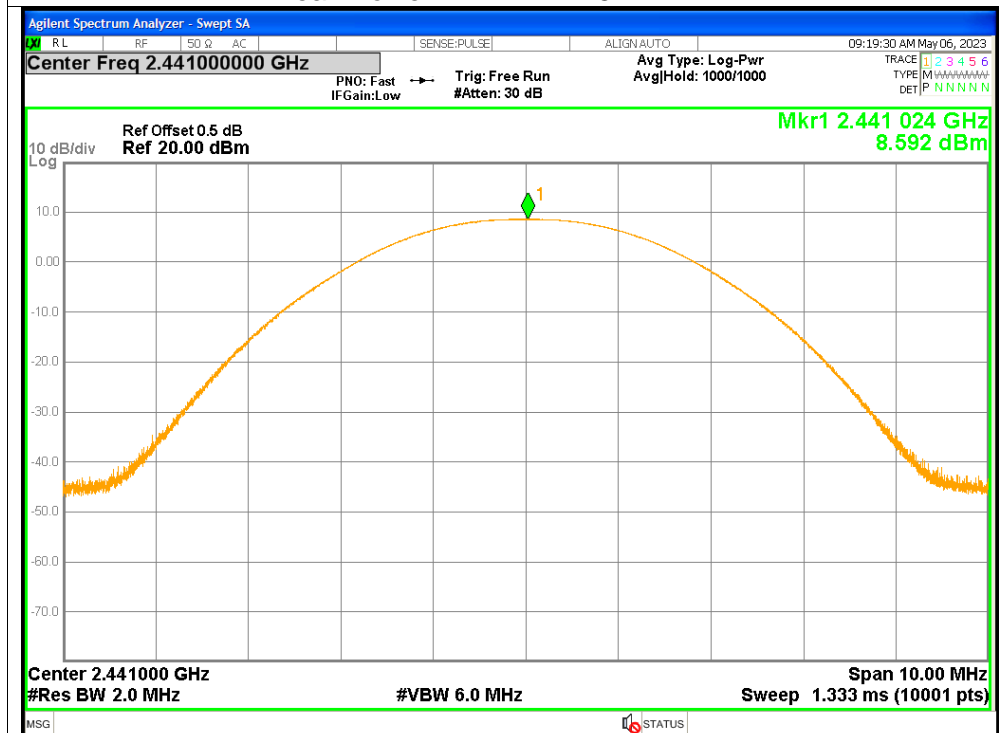


## Peak Power NVNT 2-DH5 2402MHz

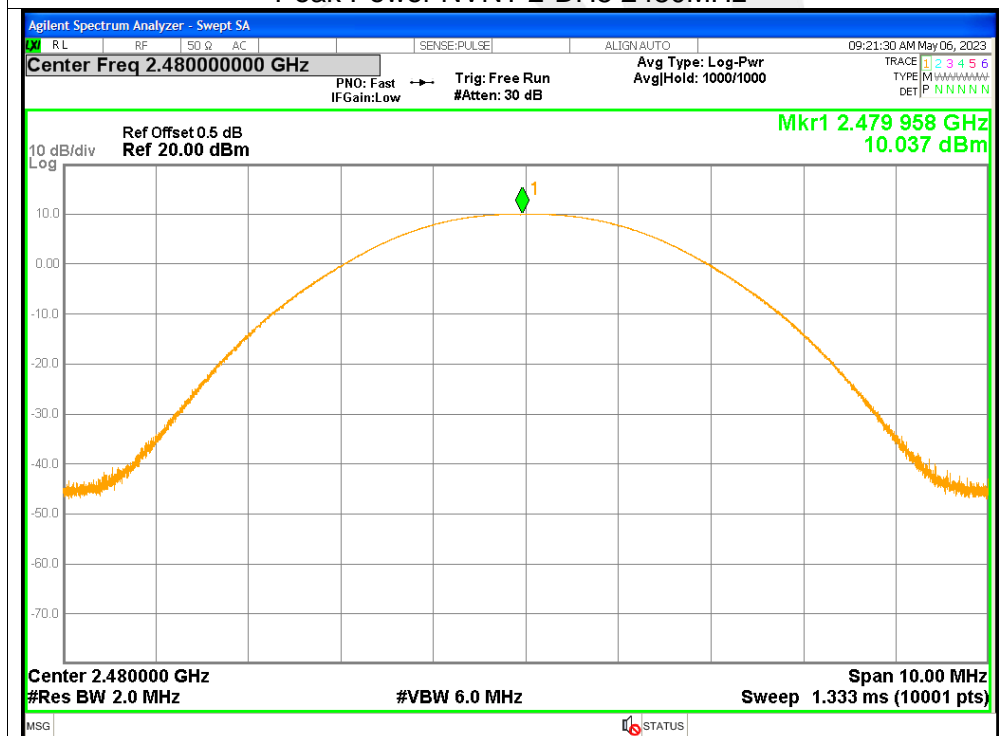




## Peak Power NVNT 2-DH5 2441MHz



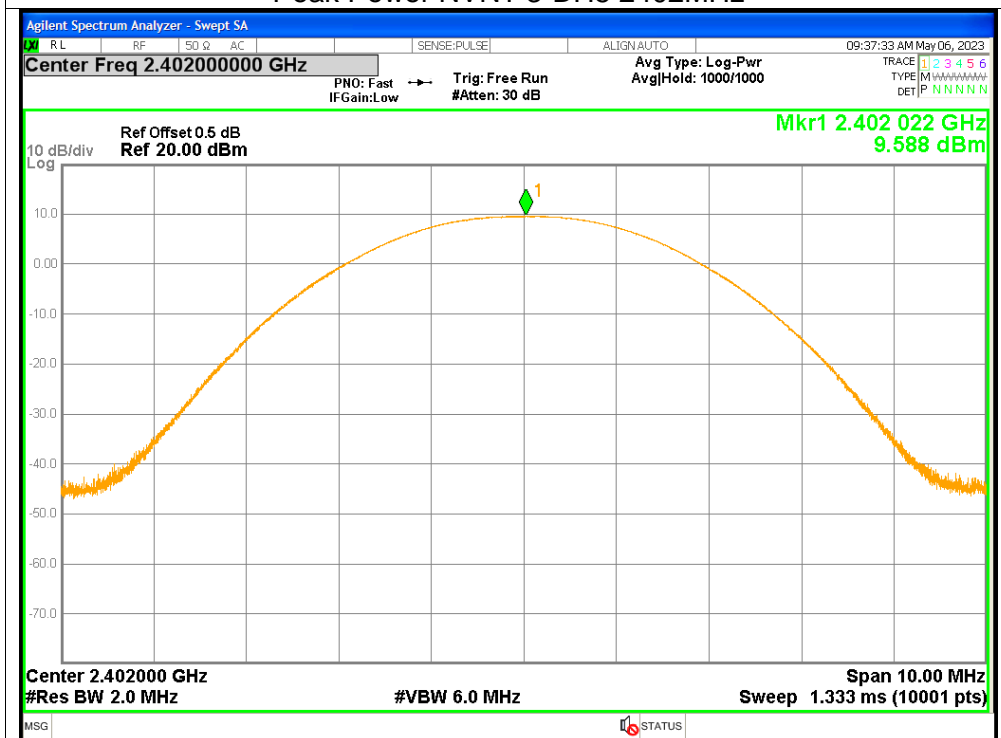
## Peak Power NVNT 2-DH5 2480MHz



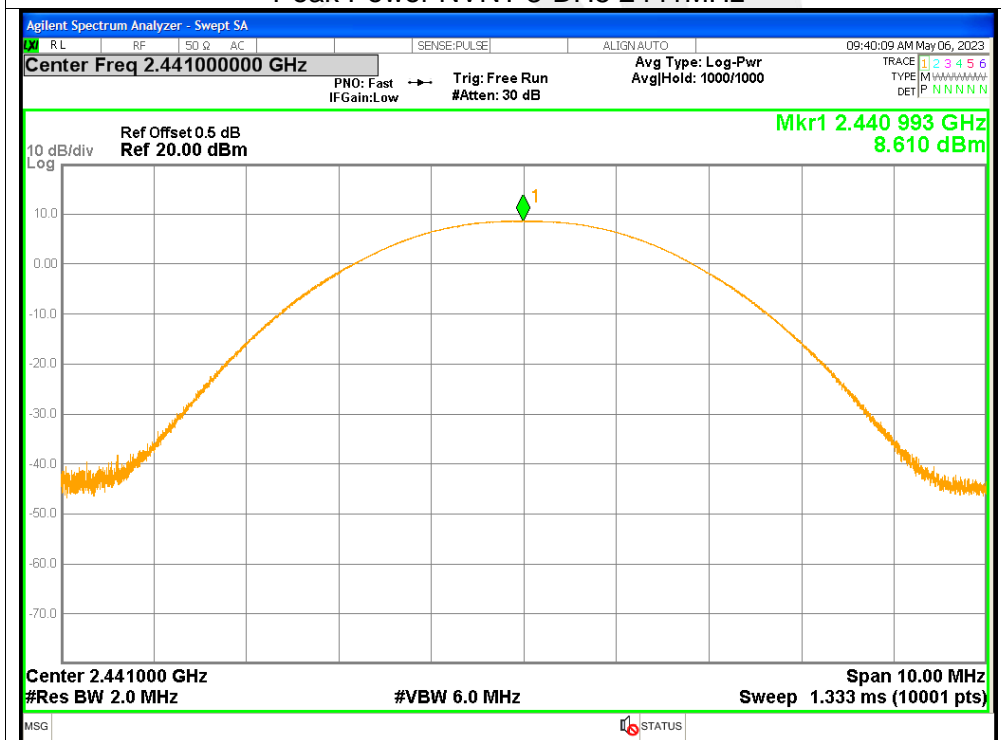


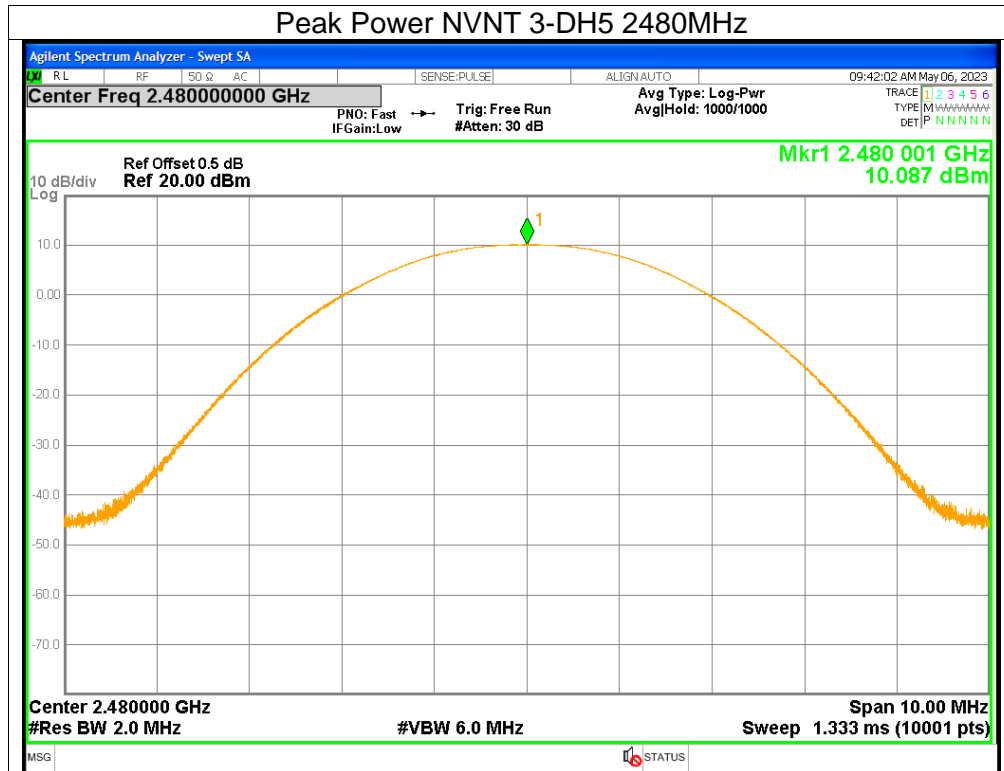


## Peak Power NVNT 3-DH5 2402MHz



## Peak Power NVNT 3-DH5 2441MHz







#### 4. -20dB Bandwidth

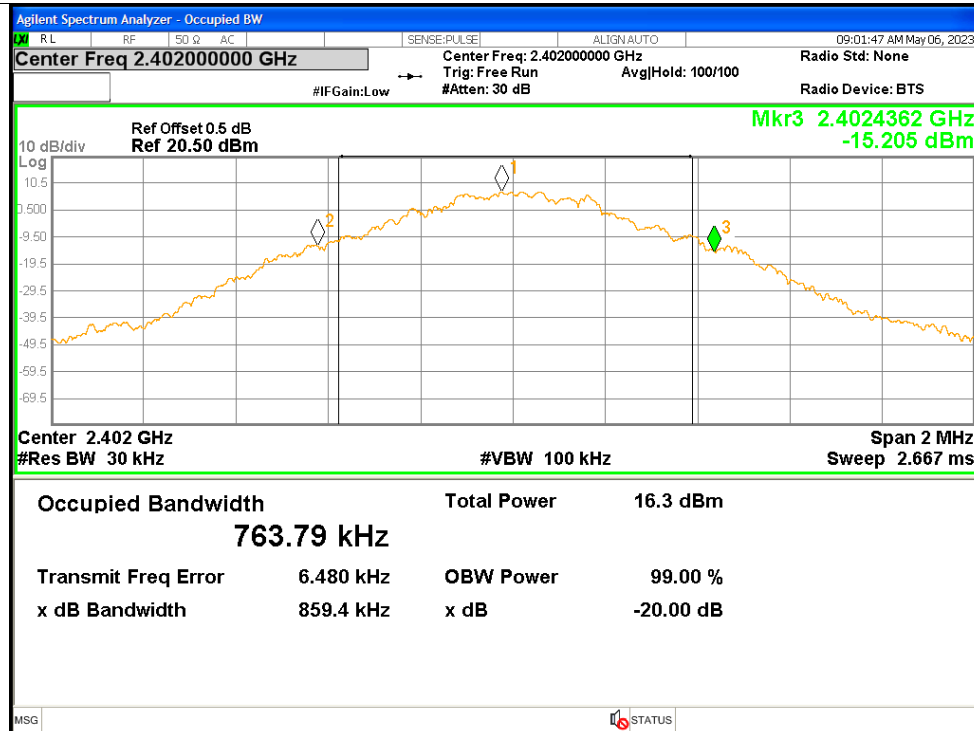
Condition	Mode	Frequency (MHz)	-20 dB Bandwidth (MHz)	Verdict
NVNT	1-DH5	2402	0.8594	Pass
NVNT	1-DH5	2441	0.8434	Pass
NVNT	1-DH5	2480	0.8499	Pass
NVNT	2-DH5	2402	1.2644	Pass
NVNT	2-DH5	2441	1.2752	Pass
NVNT	2-DH5	2480	1.2796	Pass
NVNT	3-DH5	2402	1.293	Pass
NVNT	3-DH5	2441	1.2649	Pass
NVNT	3-DH5	2480	1.2903	Pass



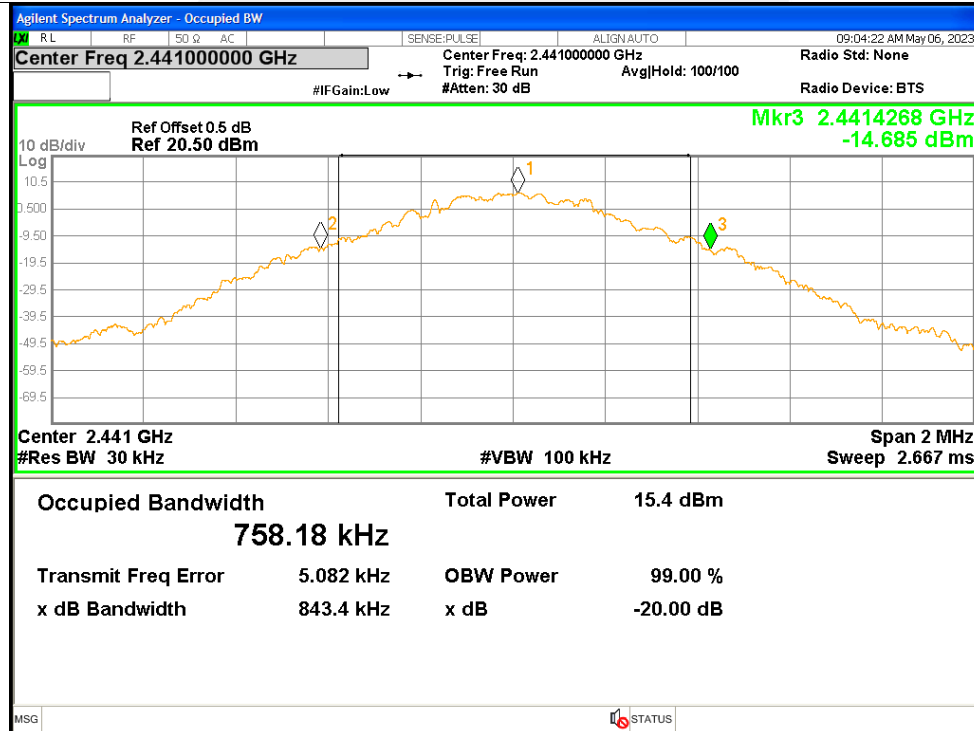


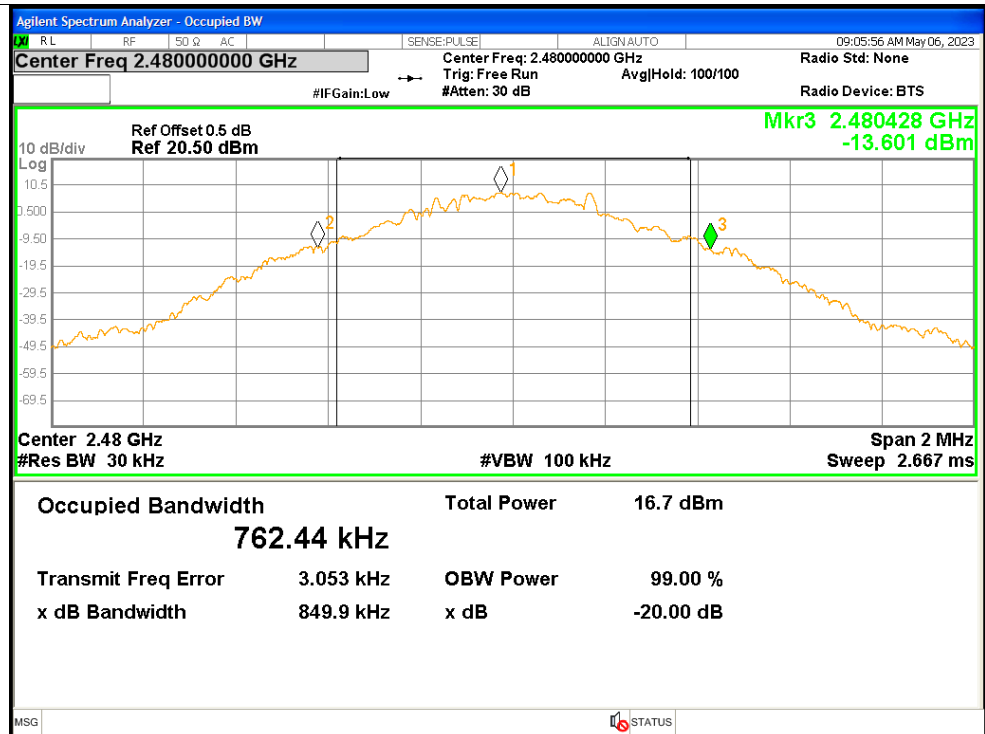
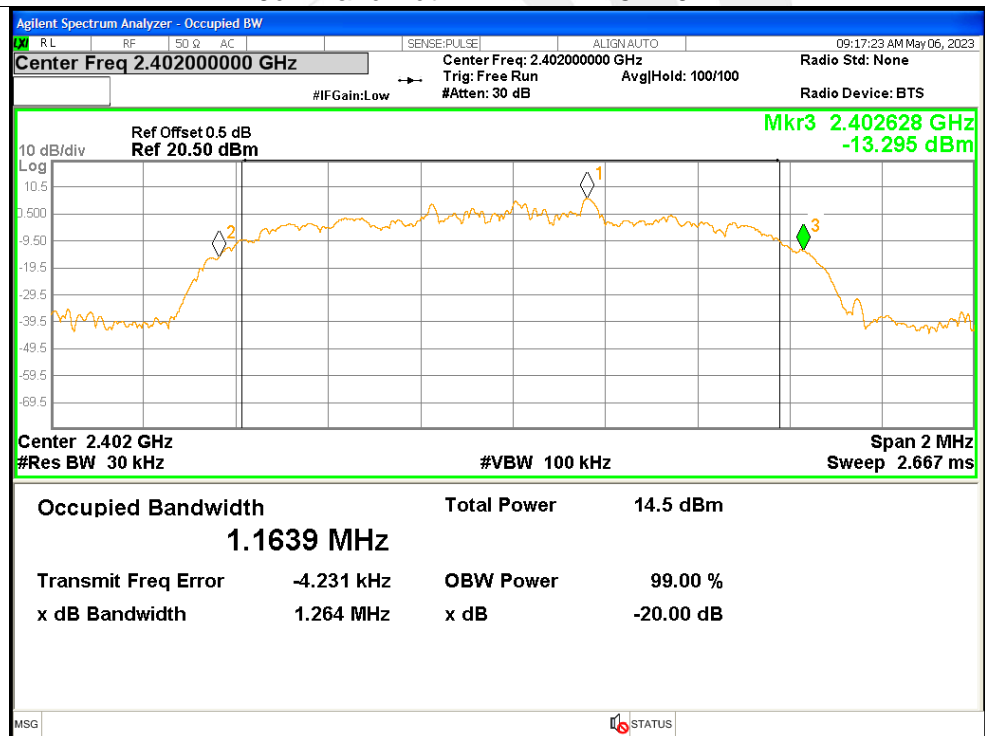
## Test Graphs

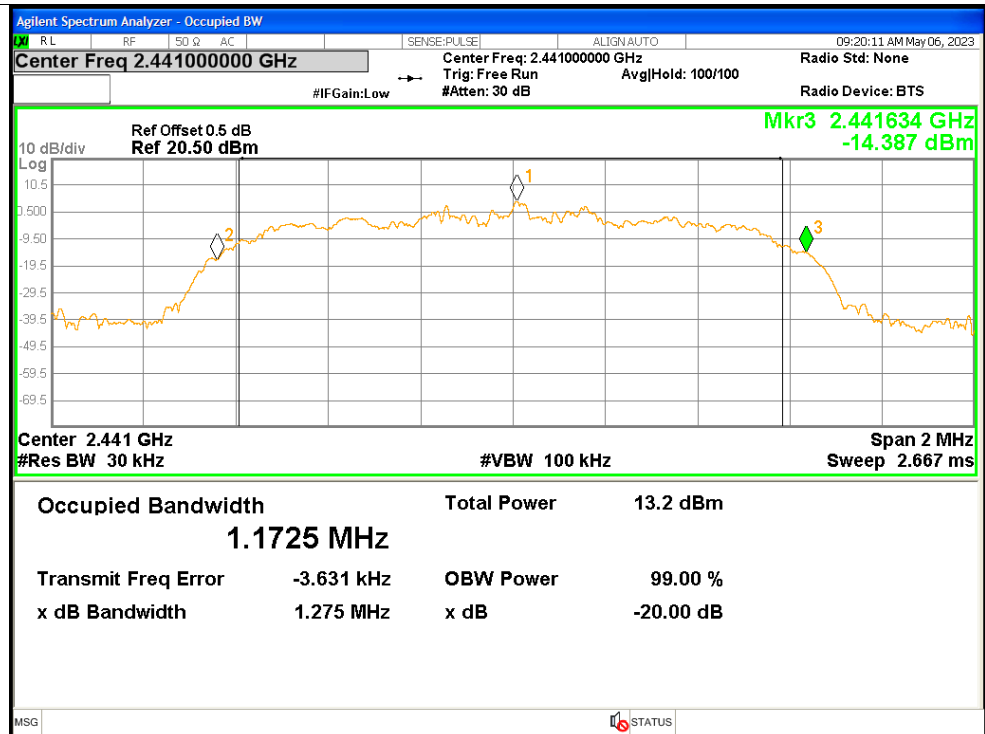
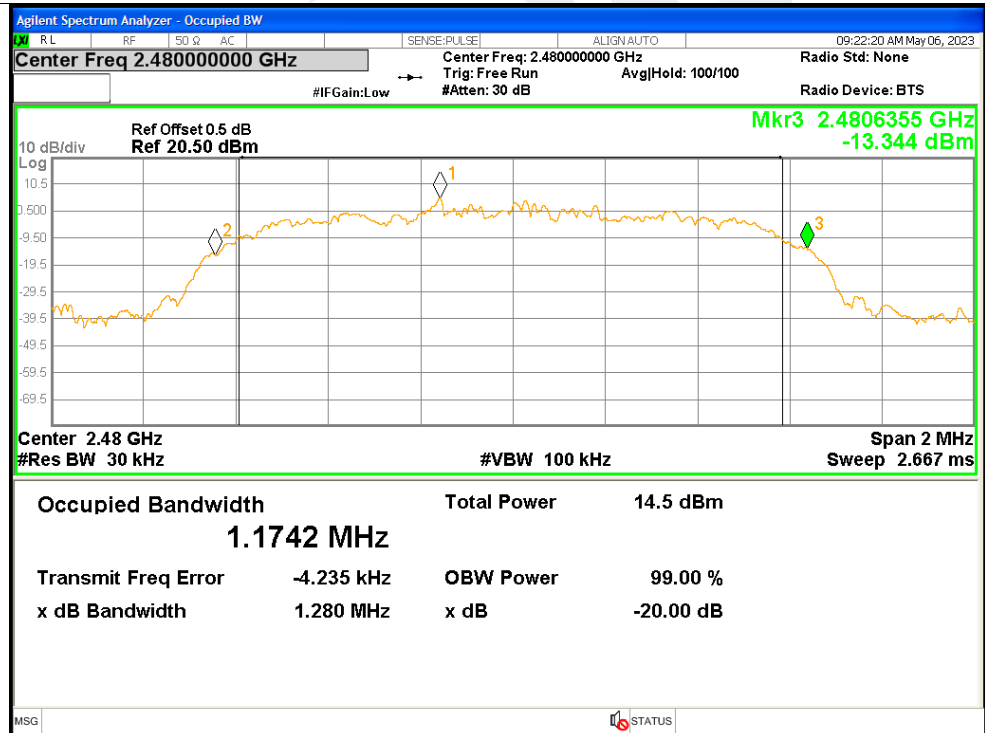
## -20dB Bandwidth NVNT 1-DH5 2402MHz

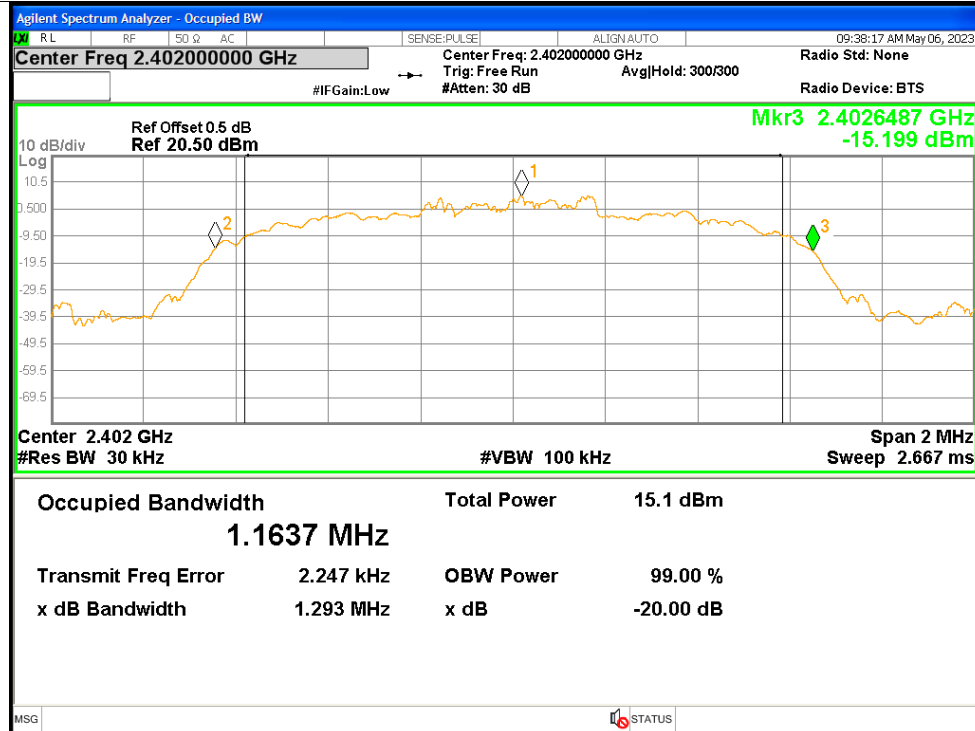
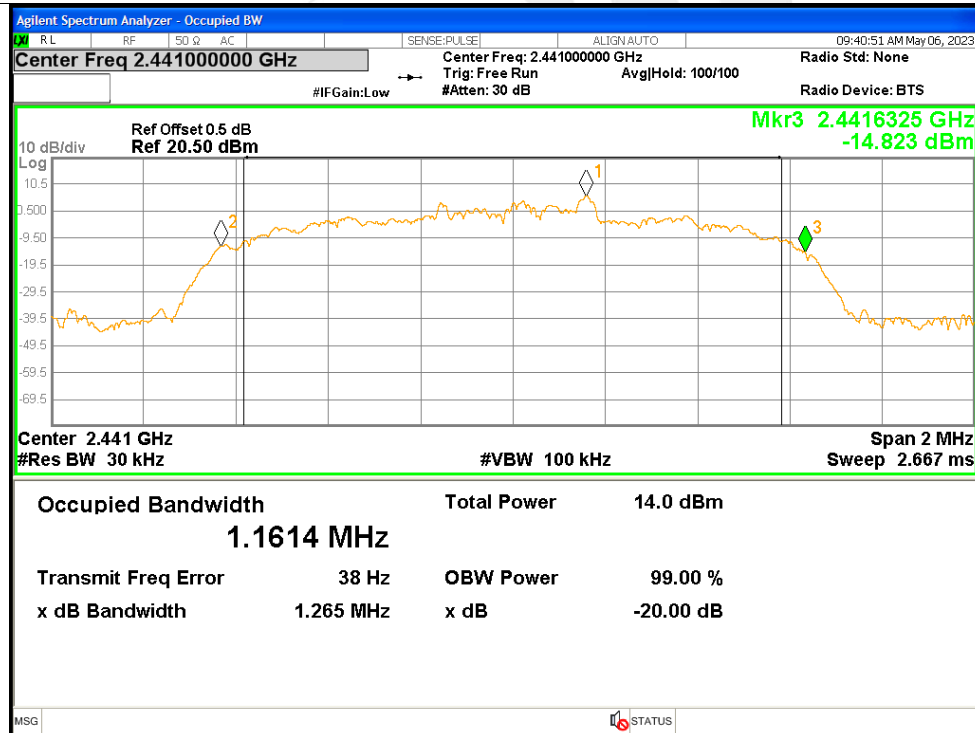


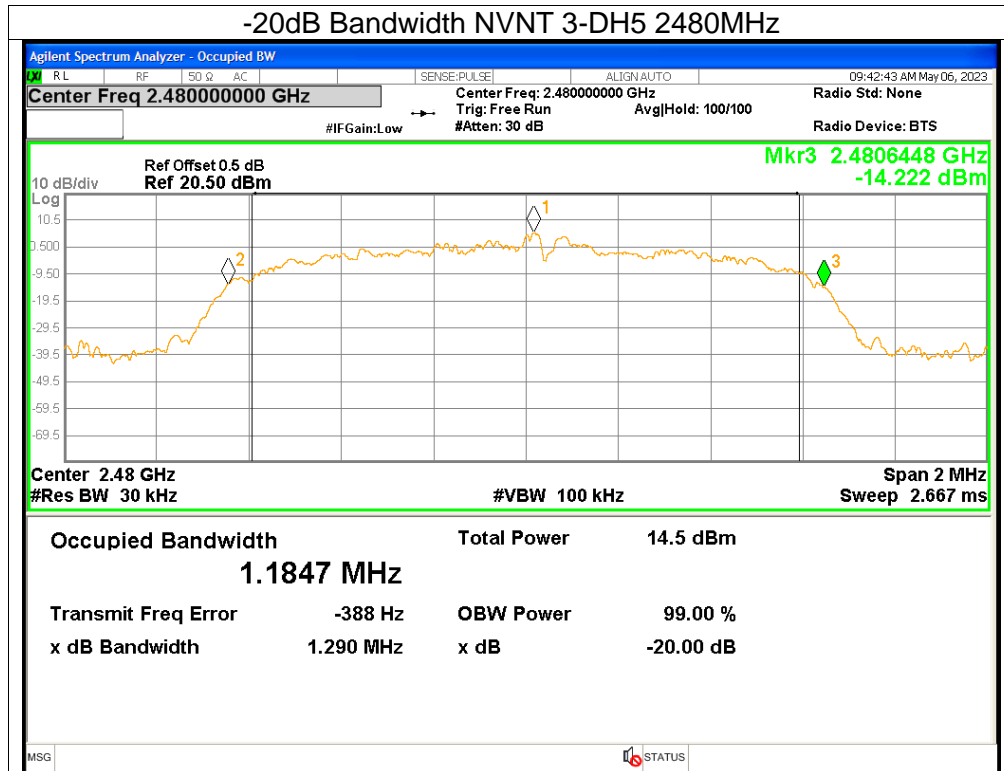
## -20dB Bandwidth NVNT 1-DH5 2441MHz



**-20dB Bandwidth NVNT 1-DH5 2480MHz****-20dB Bandwidth NVNT 2-DH5 2402MHz**

**-20dB Bandwidth NVNT 2-DH5 2441MHz****-20dB Bandwidth NVNT 2-DH5 2480MHz**

**-20dB Bandwidth NVNT 3-DH5 2402MHz****-20dB Bandwidth NVNT 3-DH5 2441MHz**







## 5. Carrier Frequencies Separation

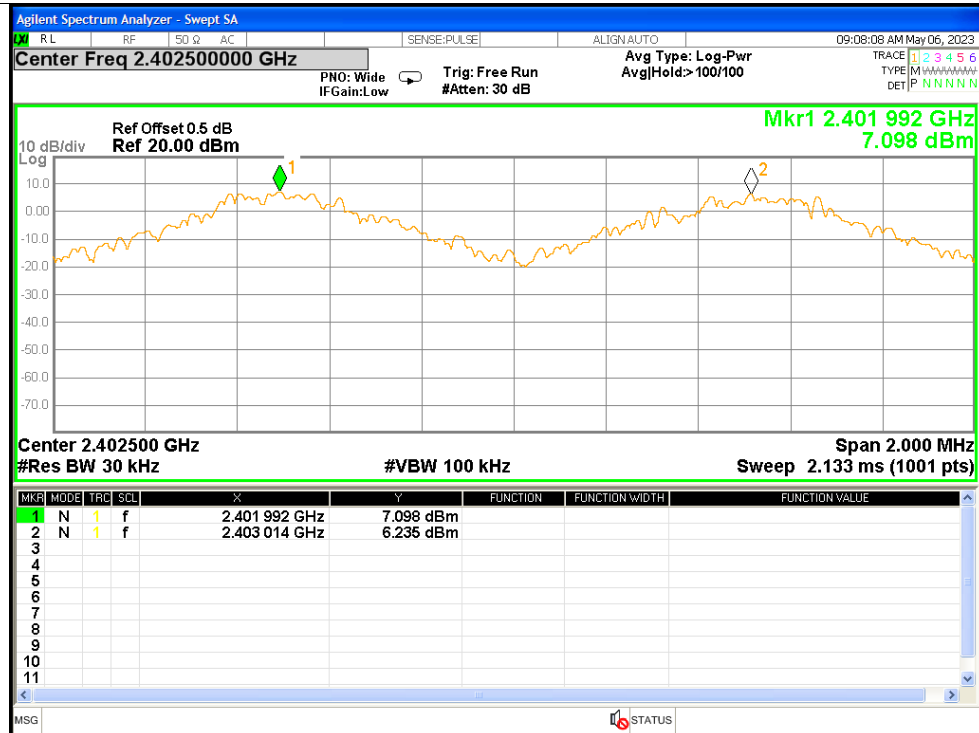
Condition	Mode	Hopping Freq1 (MHz)	Hopping Freq2 (MHz)	HFS (MHz)	Limit (MHz)	Verdict
NVNT	1-DH5	2401.992	2403.014	1.022	$\geq 0.573$	Pass
NVNT	1-DH5	2439.986	2441.016	1.03	$\geq 0.562$	Pass
NVNT	1-DH5	2478.984	2479.968	0.984	$\geq 0.567$	Pass
NVNT	2-DH5	2401.92	2403.164	1.244	$\geq 0.843$	Pass
NVNT	2-DH5	2441.006	2442.166	1.16	$\geq 0.85$	Pass
NVNT	2-DH5	2479.012	2479.884	0.872	$\geq 0.853$	Pass
NVNT	3-DH5	2402.166	2403.106	0.94	$\geq 0.862$	Pass
NVNT	3-DH5	2441.102	2442.104	1.002	$\geq 0.843$	Pass
NVNT	3-DH5	2479.15	2480.128	0.978	$\geq 0.86$	Pass





### Test Graphs

#### CFS NVNT 1-DH5 2402MHz



#### CFS NVNT 1-DH5 2441MHz

