(1GHz~25GHz) Spurious emission Requirements

Frequency	Meter Reading	Amplifier	Loss	Antenna Factor	Corrected Factor	Emission Level	Limits	Margin	Detector	Comment
(MHz)	(dBμV)	(dB)	(dB)	(dB/m)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	Type	
Low Channel (8DPSK/2402 MHz)										
3264.70	61.36	44.70	6.70	28.20	-9.80	51.56	74.00	-22.44	PK	Vertical
3264.70	50.94	44.70	6.70	28.20	-9.80	41.14	54.00	-12.86	AV	Vertical
3264.71	62.07	44.70	6.70	28.20	-9.80	52.27	74.00	-21.73	PK	Horizontal
3264.71	50.79	44.70	6.70	28.20	-9.80	40.99	54.00	-13.01	AV	Horizontal
4804.35	58.20	44.20	9.04	31.60	-3.56	54.64	74.00	-19.36	PK	Vertical
4804.35	49.29	44.20	9.04	31.60	-3.56	45.73	54.00	-8.27	AV	Vertical
4804.40	59.24	44.20	9.04	31.60	-3.56	55.68	74.00	-18.32	PK	Horizontal
4804.40	49.48	44.20	9.04	31.60	-3.56	45.92	54.00	-8.08	AV	Horizontal
5359.86	49.33	44.20	9.86	32.00	-2.34	46.98	74.00	-27.02	PK	Vertical
5359.86	39.19	44.20	9.86	32.00	-2.34	36.85	54.00	-17.15	AV	Vertical
5359.67	48.49	44.20	9.86	32.00	-2.34	46.15	74.00	-27.85	PK	Horizontal
5359.67	38.09	44.20	9.86	32.00	-2.34	35.75	54.00	-18.25	AV	Horizontal
7205.95	53.59	43.50	11.40	35.50	3.40	56.99	74.00	-17.01	PK	Vertical
7205.95	43.70	43.50	11.40	35.50	3.40	47.10	54.00	-6.90	AV	Vertical
7205.95	53.75	43.50	11.40	35.50	3.40	57.15	74.00	-16.85	PK	Horizontal
7205.95	44.90	43.50	11.40	35.50	3.40	48.30	54.00	-5.70	AV	Horizontal
Middle Channel (8DPSK/2441 MHz)										
3264.89	61.45	44.70	6.70	28.20	-9.80	51.65	74.00	-22.35	PK	Vertical
3264.89	50.56	44.70	6.70	28.20	-9.80	40.76	54.00	-13.24	AV	Vertical
3264.81	61.00	44.70	6.70	28.20	-9.80	51.20	74.00	-22.80	PK	Horizontal
3264.81	50.70	44.70	6.70	28.20	-9.80	40.90	54.00	-13.10	AV	Horizontal
4882.53	58.78	44.20	9.04	31.60	-3.56	55.22	74.00	-18.78	PK	Vertical
4882.53	49.64	44.20	9.04	31.60	-3.56	46.08	54.00	-7.92	AV	Vertical
4882.54	58.70	44.20	9.04	31.60	-3.56	55.14	74.00	-18.86	PK	Horizontal
4882.54	50.41	44.20	9.04	31.60	-3.56	46.85	54.00	-7.15	AV	Horizontal
5359.82	48.24	44.20	9.86	32.00	-2.34	45.90	74.00	-28.10	PK	Vertical
5359.82	40.36	44.20	9.86	32.00	-2.34	38.01	54.00	-15.99	AV	Vertical
5359.87	47.77	44.20	9.86	32.00	-2.34	45.43	74.00	-28.57	PK	Horizontal
5359.87	38.59	44.20	9.86	32.00	-2.34	36.25	54.00	-17.75	AV	Horizontal
7323.96	53.91	43.50	11.40	35.50	3.40	57.31	74.00	-16.69	PK	Vertical
7323.96	44.77	43.50	11.40	35.50	3.40	48.17	54.00	-5.83	AV	Vertical
7323.88	54.19	43.50	11.40	35.50	3.40	57.59	74.00	-16.41	PK	Horizontal
7323.88	43.71	43.50	11.40	35.50	3.40	47.11	54.00	-6.89	AV	Horizontal

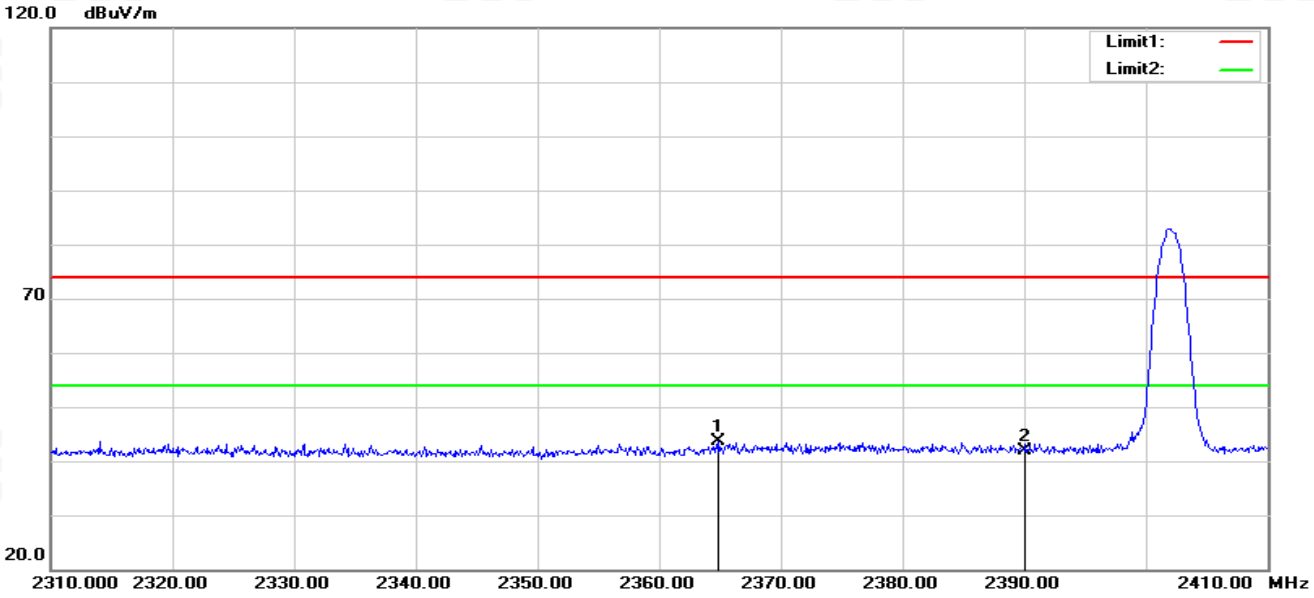
High Channel (8DPSK/2480 MHz)										
3264.73	61.50	44.70	6.70	28.20	-9.80	51.70	74.00	-22.30	PK	Vertical
3264.73	51.60	44.70	6.70	28.20	-9.80	41.80	54.00	-12.20	AV	Vertical
3264.63	61.04	44.70	6.70	28.20	-9.80	51.24	74.00	-22.76	PK	Horizontal
3264.63	50.57	44.70	6.70	28.20	-9.80	40.77	54.00	-13.23	AV	Horizontal
4960.31	59.13	44.20	9.04	31.60	-3.56	55.57	74.00	-18.43	PK	Vertical
4960.31	50.48	44.20	9.04	31.60	-3.56	46.92	54.00	-7.08	AV	Vertical
4960.33	59.13	44.20	9.04	31.60	-3.56	55.57	74.00	-18.43	PK	Horizontal
4960.33	49.24	44.20	9.04	31.60	-3.56	45.68	54.00	-8.32	AV	Horizontal
5359.68	48.52	44.20	9.86	32.00	-2.34	46.18	74.00	-27.82	PK	Vertical
5359.68	39.22	44.20	9.86	32.00	-2.34	36.87	54.00	-17.13	AV	Vertical
5359.74	47.41	44.20	9.86	32.00	-2.34	45.06	74.00	-28.94	PK	Horizontal
5359.74	39.43	44.20	9.86	32.00	-2.34	37.09	54.00	-16.91	AV	Horizontal
7439.94	54.48	43.50	11.40	35.50	3.40	57.88	74.00	-16.12	PK	Vertical
7439.94	43.56	43.50	11.40	35.50	3.40	46.96	54.00	-7.04	AV	Vertical
7439.80	53.76	43.50	11.40	35.50	3.40	57.16	74.00	-16.84	PK	Horizontal
7439.80	43.86	43.50	11.40	35.50	3.40	47.26	54.00	-6.74	AV	Horizontal

Note:

1) All modes have been measurement, only worst mode was reported.
2) Factor = Antenna Factor + Cable Loss – Pre-amplifier.
   Emission Level = Reading + Factor
3) The frequency emission of peak points that did not show above the forms are at least 20dB below the limit, the frequency emission is mainly from the environment noise.

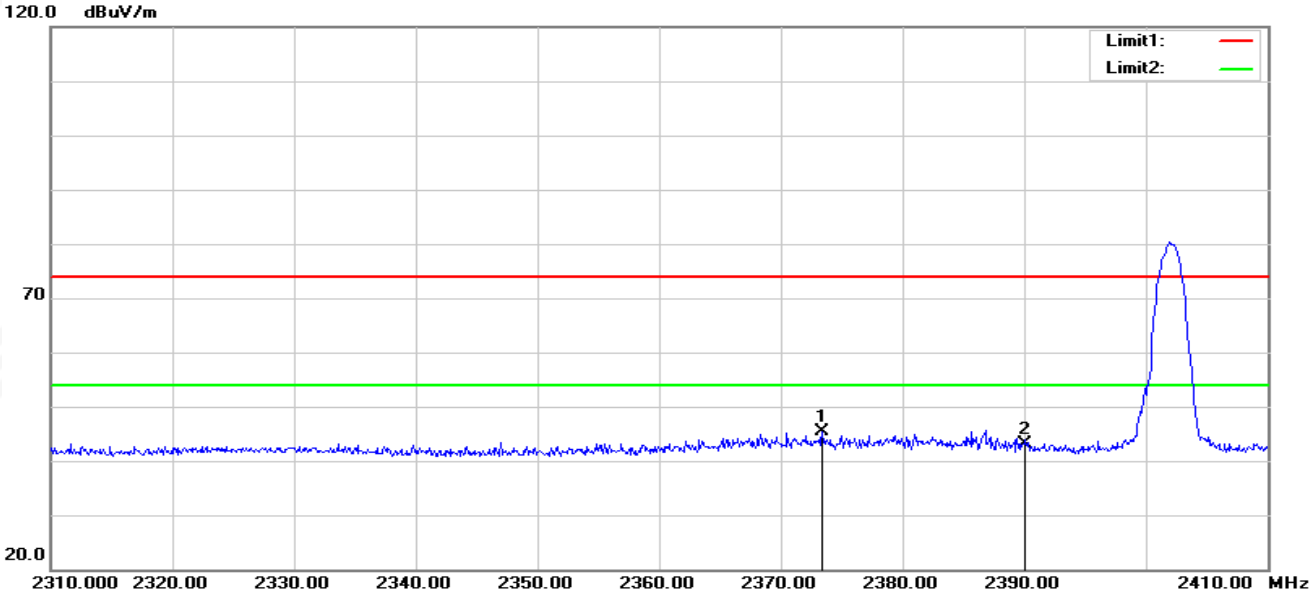
Restricted band Requirements

8DPSK -Low
Horizontal



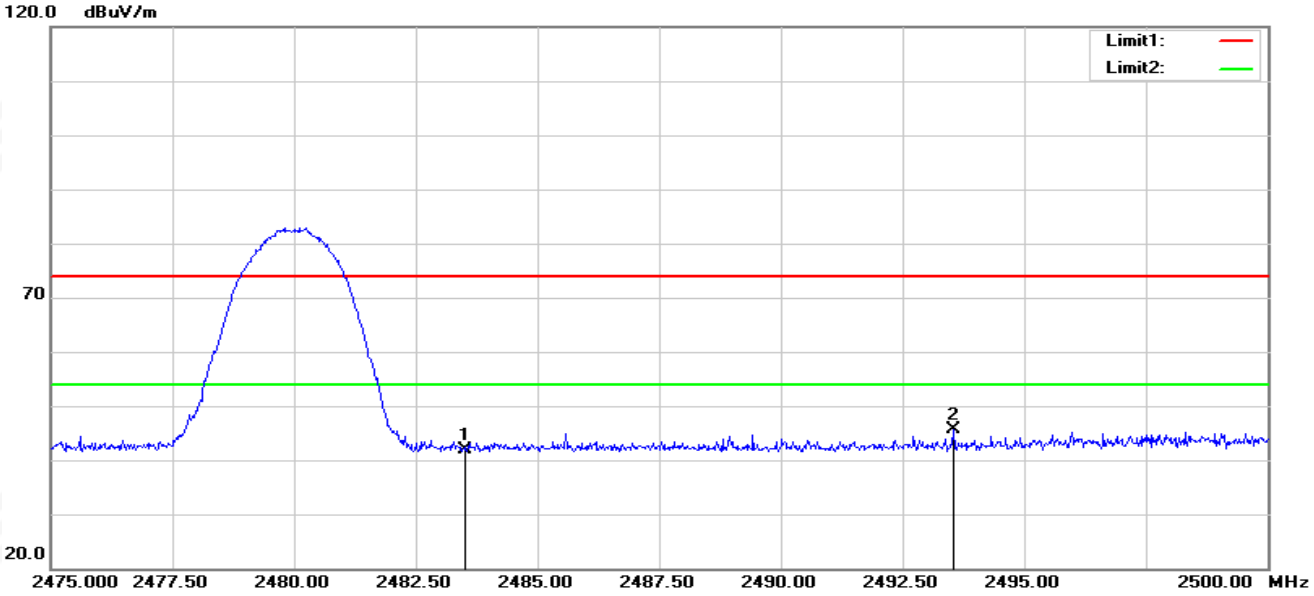
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2364.900	39.64	3.96	43.60	74.00	-30.40	peak
2	2390.000	37.50	4.34	41.84	74.00	-32.16	peak

Vertical



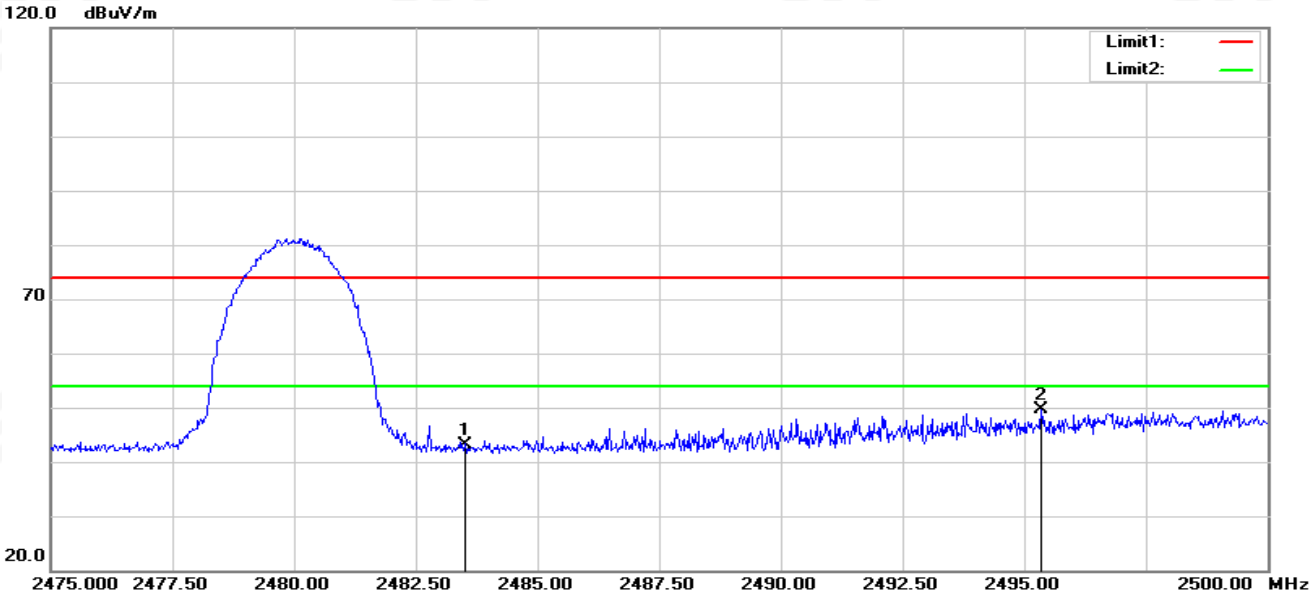
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2373.400	41.25	4.09	45.34	74.00	-28.66	peak
2	2390.000	38.72	4.34	43.06	74.00	-30.94	peak

8DPSK -High
Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	37.23	4.60	41.83	74.00	-32.17	peak
2	2493.550	40.89	4.64	45.53	74.00	-28.47	peak

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	38.51	4.60	43.11	74.00	-30.89	peak
2	2495.350	44.94	4.63	49.57	74.00	-24.43	peak

Note: All modes have been measurement, only worst mode was reported.

4. CONDUCTED SPURIOUS & BAND EDGE EMISSION

4.1 LIMIT

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

4.2 TEST PROCEDURE

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

For Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 2300 – 2407 MHz Upper Band Edge: 2475 – 2500 MHz
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

For Hopping Band edge

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

4.3 TEST SETUP

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

4.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

4.5 TEST RESULTS

Note: The test data please refer to APPENDIX 1.

5. NUMBER OF HOPPING CHANNEL

5.1 LIMIT

FCC Part 15.247,Subpart C				
Section	Test Item	Limit	FrequencyRange (MHz)	Result
15.247 (a)(1)(iii)	Number of Hopping Channel	≥15	2400-2483.5	PASS

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> Operating FrequencyRange
RB	100KHz
VB	300KHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

5.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
b. Spectrum Setting: RBW= 100KHz, VBW=300KHz, Sweep time = Auto.

5.3 TEST SETUP

5.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

5.5 TEST RESULTS

Note: The test data please refer to APPENDIX 1.

6. AVERAGE TIME OF OCCUPANCY

6.1 LIMIT

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

6.2 TEST PROCEDURE

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

The Dwell Time=Burst Width*Total Hops.The detailed calculations are showed as follows:
The duration for dwell time calculation: 0.4[s]*hopping number=0.4[s]*79[ch)=31.6[s*ch];
Dwell Time Calculate formula:
Dwell time = pulse time (ms) x pulse number in 31.6s

6.3 TEST SETUP

6.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

6.5 TEST RESULTS

Note: The test data please refer to APPENDIX 1.

7. HOPPING CHANNEL SEPARATION MEASUREMEN

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

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

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
b. 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 if channel separation > 2/3 bandwidthprovided thesystems operatewith an output power no greater than125 mW(20.97dBm)	2400-2483.5	PASS

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.

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

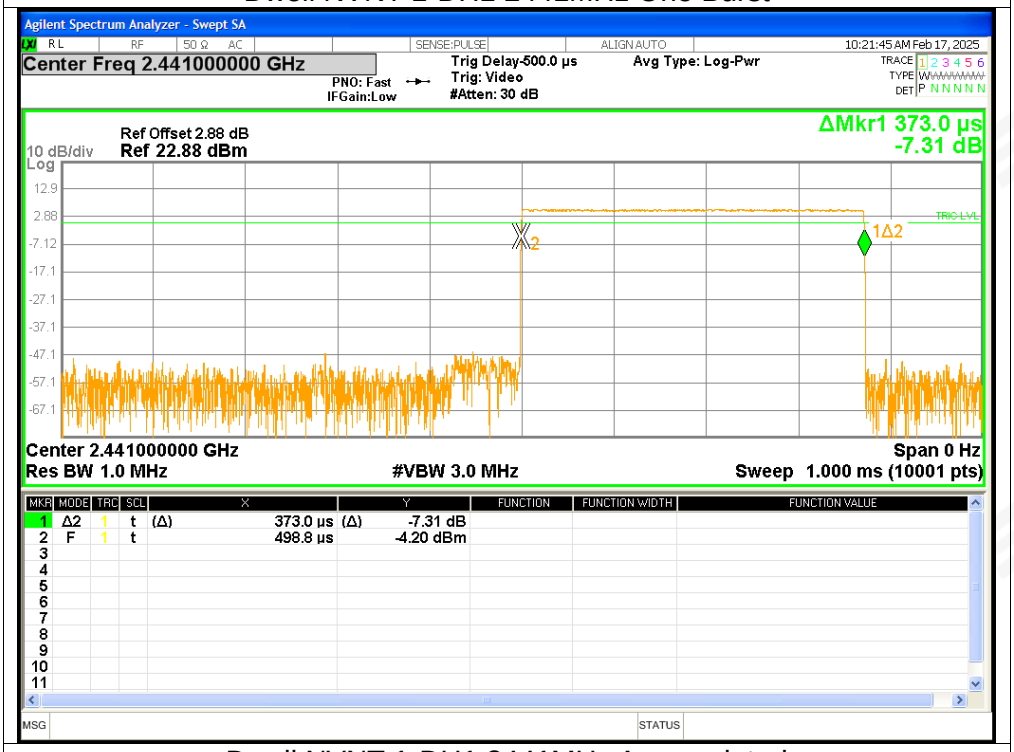
The EUT antenna is PCB Antenna. It comply with the standard requirement.

APPENDIX 1-TEST DATA

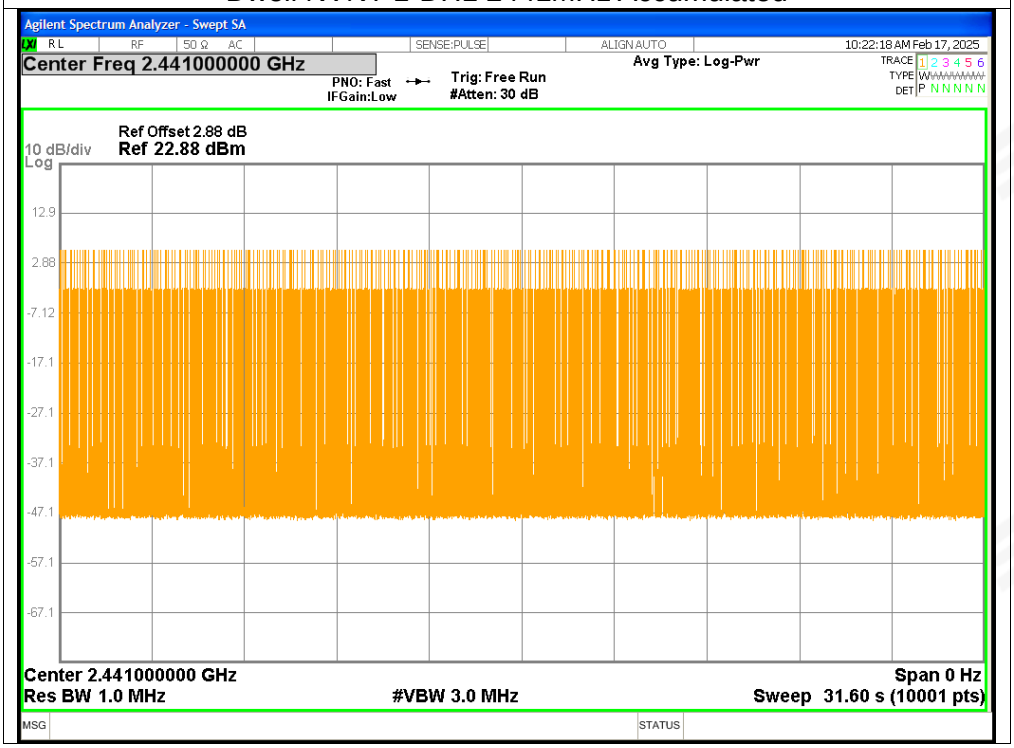
1. Dwell Time

Condition	Mode	Frequency (MHz)	Pulse Time (ms)	Total Dwell Time (ms)	Burst Count	Period Time (ms)	Limit (ms)	Verdict
NVNT	1-DH1	2441	0.373	118.614	318	31600	<=400	Pass
NVNT	1-DH3	2441	1.62	259.2	160	31600	<=400	Pass
NVNT	1-DH5	2441	2.868	306.876	107	31600	<=400	Pass
NVNT	2-DH1	2441	0.38	120.84	318	31600	<=400	Pass
NVNT	2-DH3	2441	1.632	261.12	160	31600	<=400	Pass
NVNT	2-DH5	2441	2.88	311.04	108	31600	<=400	Pass
NVNT	3-DH1	2441	0.38	120.84	318	31600	<=400	Pass
NVNT	3-DH3	2441	1.63	259.17	159	31600	<=400	Pass
NVNT	3-DH5	2441	2.881	308.267	107	31600	<=400	Pass

Test Graphs
Dwell NVNT 1-DH1 2441MHz One Burst

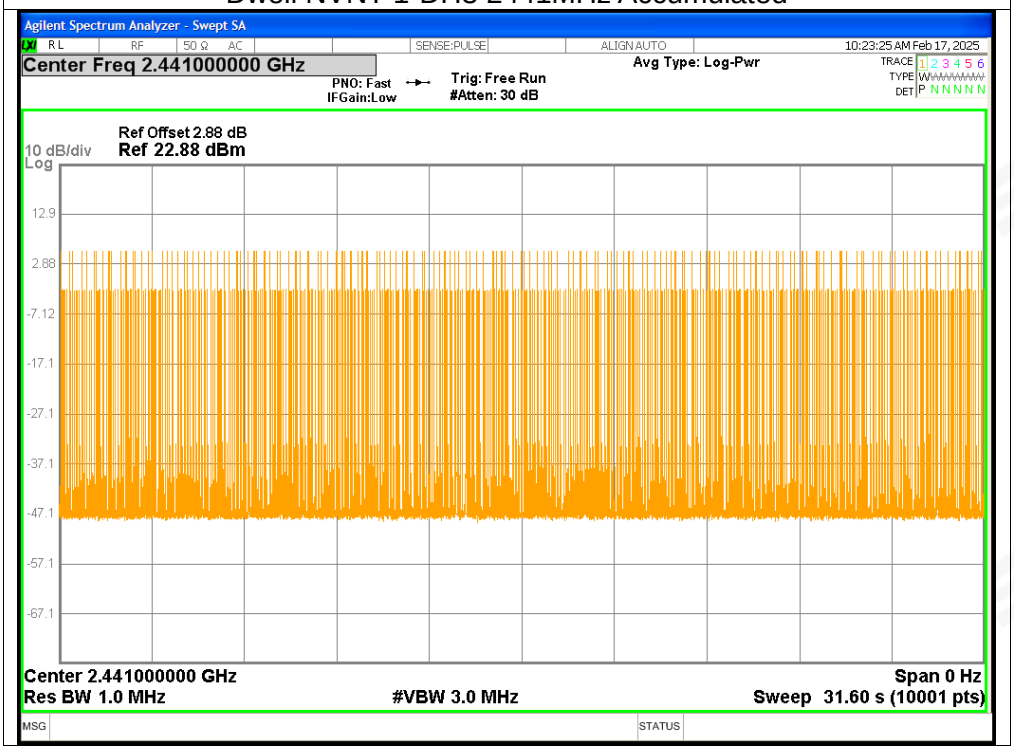


Dwell NVNT 1-DH1 2441MHz Accumulated

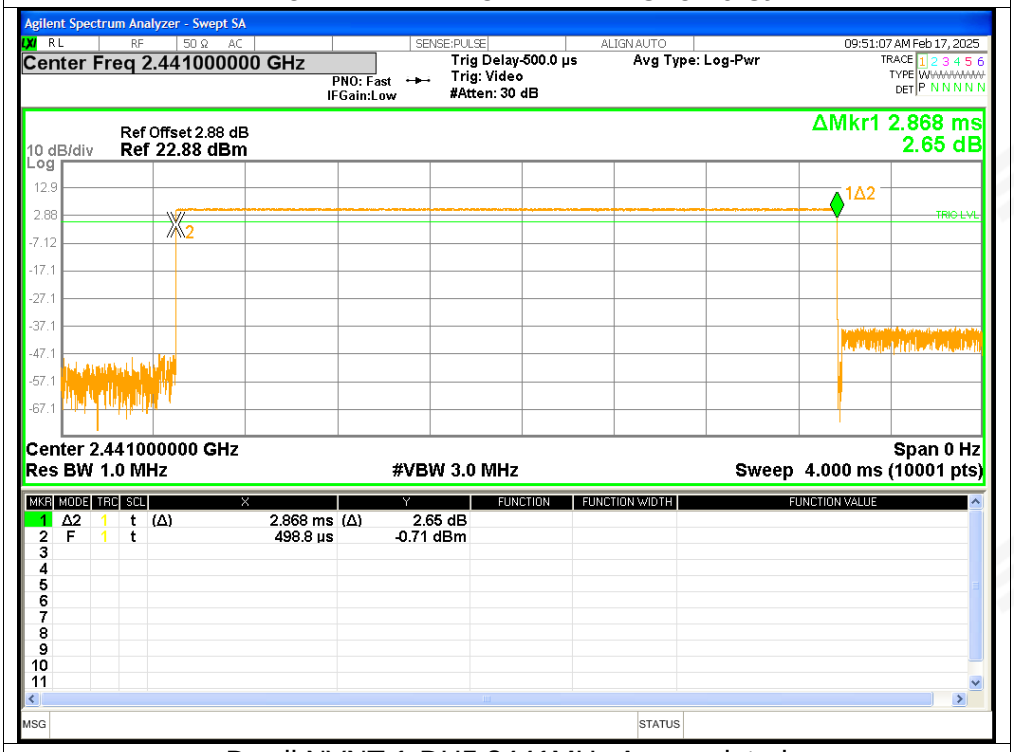


Dwell NVNT 1-DH3 2441MHz One Burst

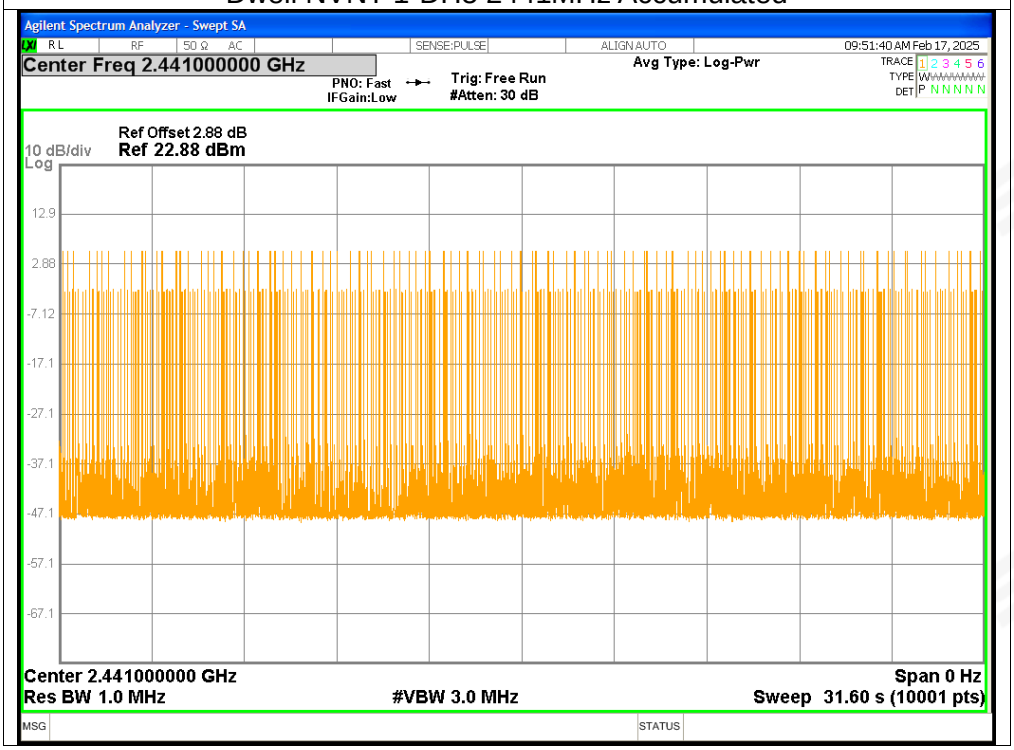
Dwell NVNT 1-DH3 2441MHz Accumulated



Dwell NVNT 1-DH5 2441MHz One Burst

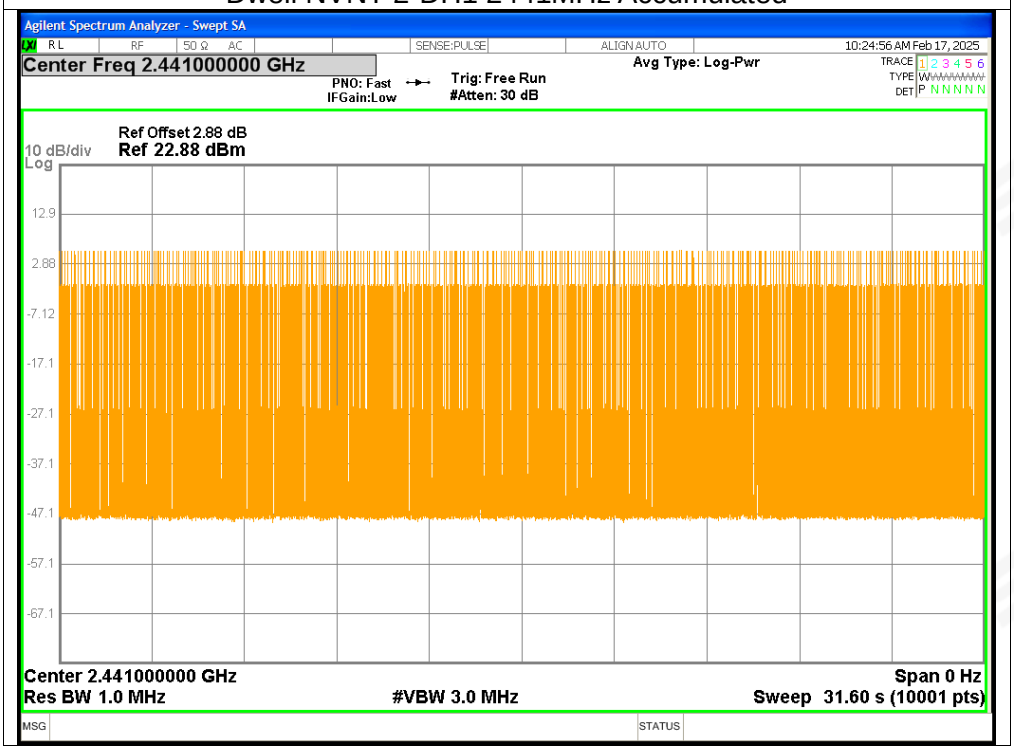


Dwell NVNT 1-DH5 2441MHz Accumulated



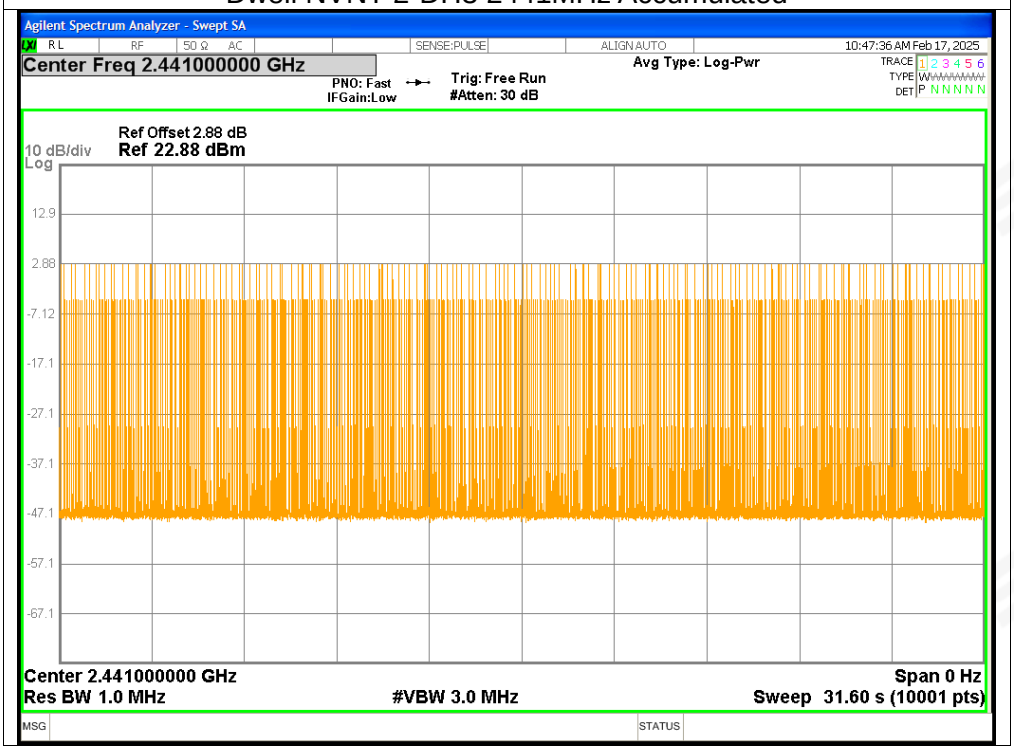
Dwell NVNT 2-DH1 2441MHz One Burst

Dwell NVNT 2-DH1 2441MHz Accumulated



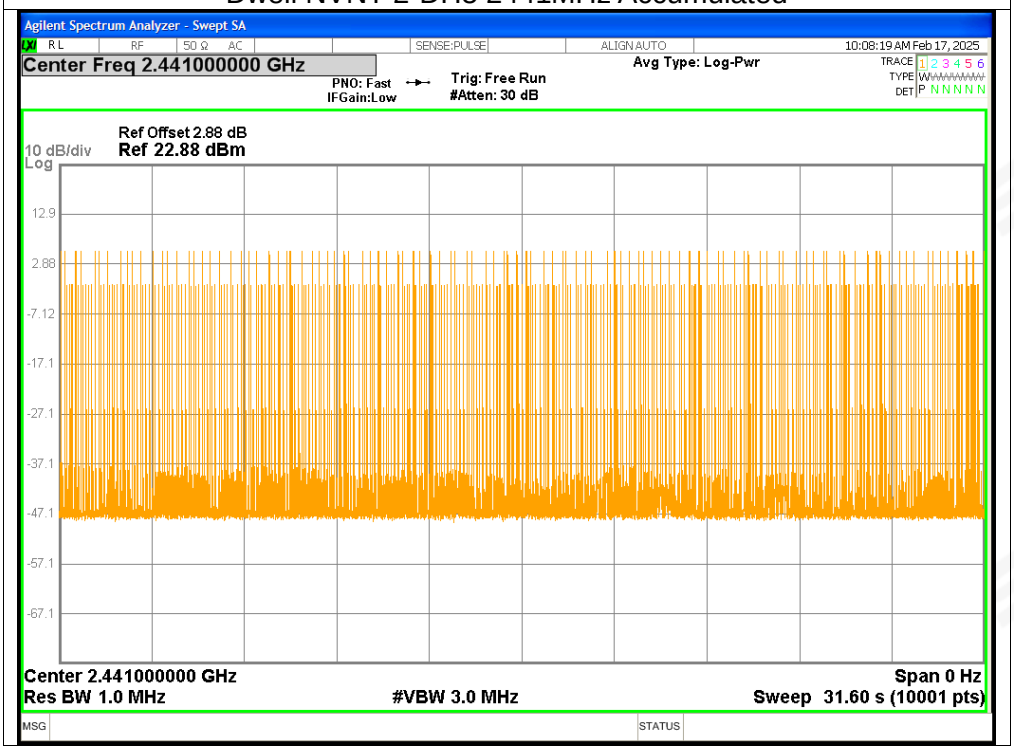
Dwell NVNT 2-DH3 2441MHz One Burst

Dwell NVNT 2-DH3 2441MHz Accumulated



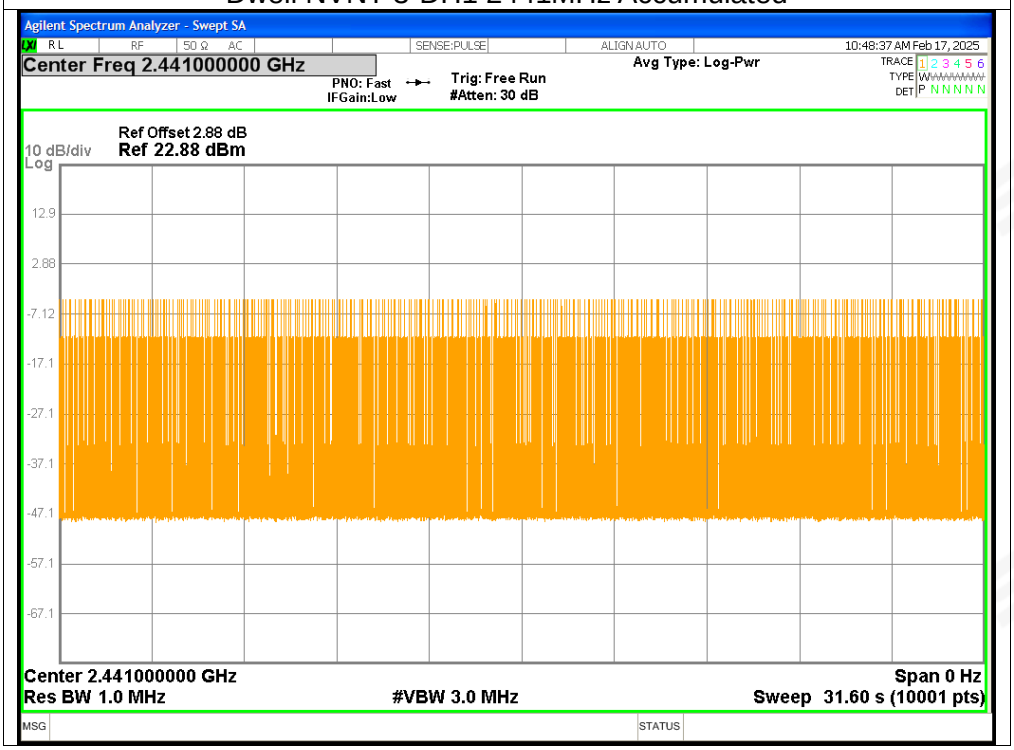
Dwell NVNT 2-DH5 2441MHz One Burst

Dwell NVNT 2-DH5 2441MHz Accumulated



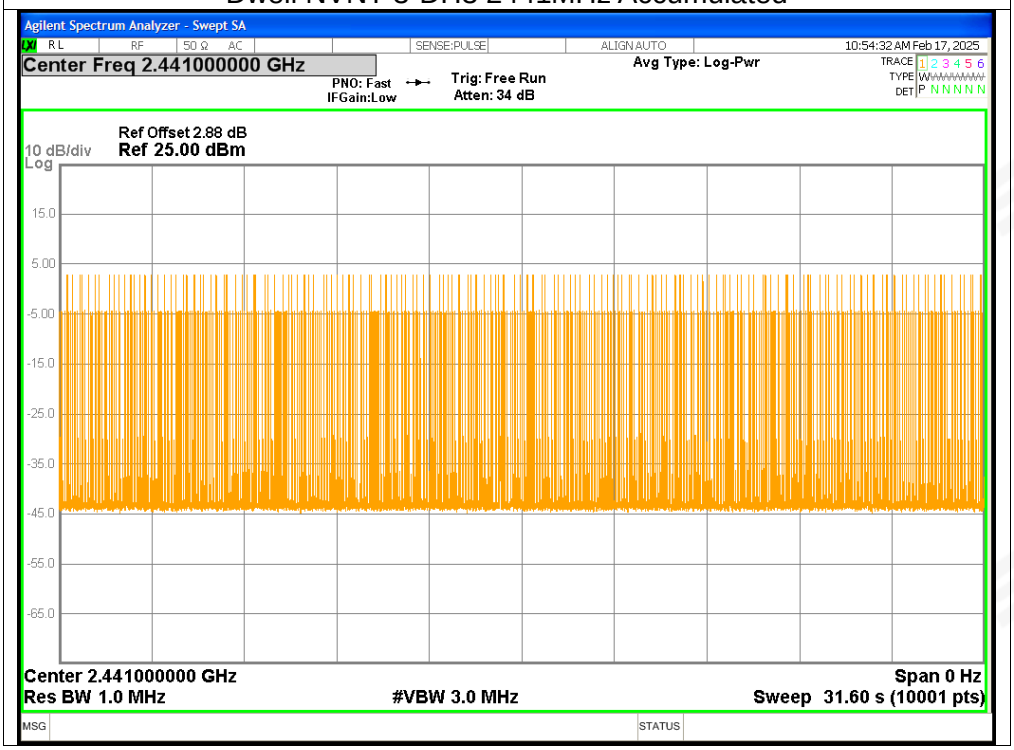
Dwell NVNT 3-DH1 2441MHz One Burst

Dwell NVNT 3-DH1 2441MHz Accumulated



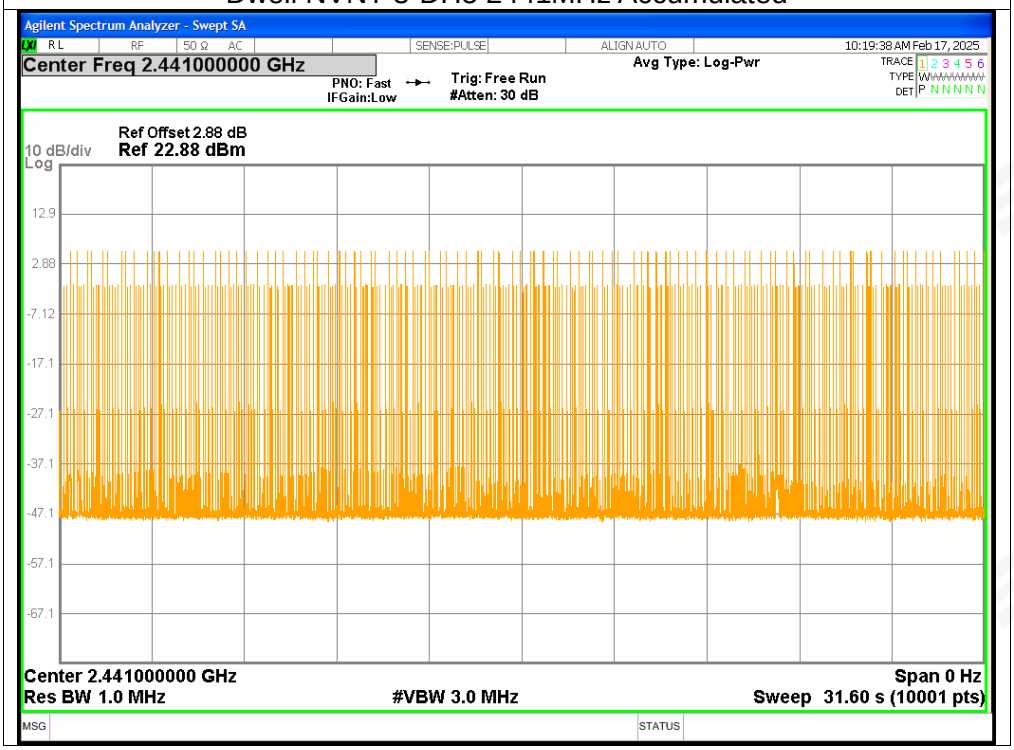
Dwell NVNT 3-DH3 2441MHz One Burst

Dwell NVNT 3-DH3 2441MHz Accumulated



Dwell NVNT 3-DH5 2441MHz One Burst

Dwell NVNT 3-DH5 2441MHz Accumulated

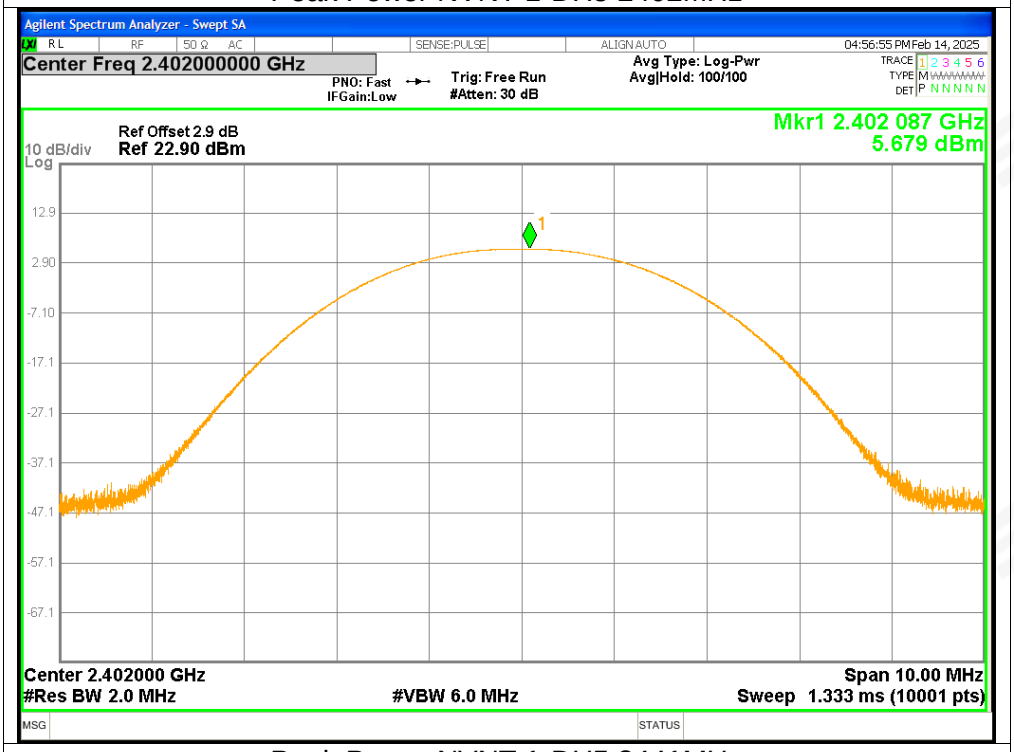


2. Maximum Peak Conducted Output Power

Condition	Mode	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	1-DH5	2402	5.68	<=21	Pass
NVNT	1-DH5	2441	5.63	<=21	Pass
NVNT	1-DH5	2480	4.67	<=21	Pass
NVNT	2-DH5	2402	5.6	<=21	Pass
NVNT	2-DH5	2441	5.48	<=21	Pass
NVNT	2-DH5	2480	4.62	<=21	Pass
NVNT	3-DH5	2402	5.69	<=21	Pass
NVNT	3-DH5	2441	5.58	<=21	Pass
NVNT	3-DH5	2480	4.6	<=21	Pass

Test Graphs

Peak Power NVNT 1-DH5 2402MHz



Peak Power NVNT 1-DH5 2441MHz