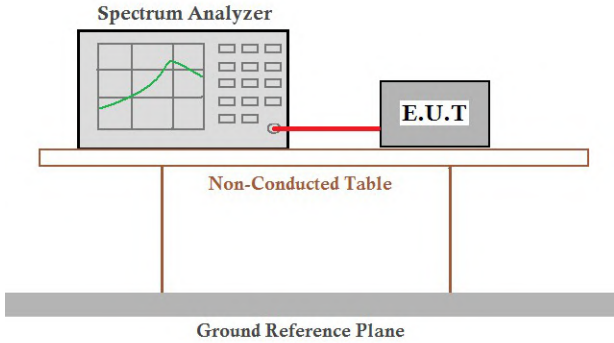


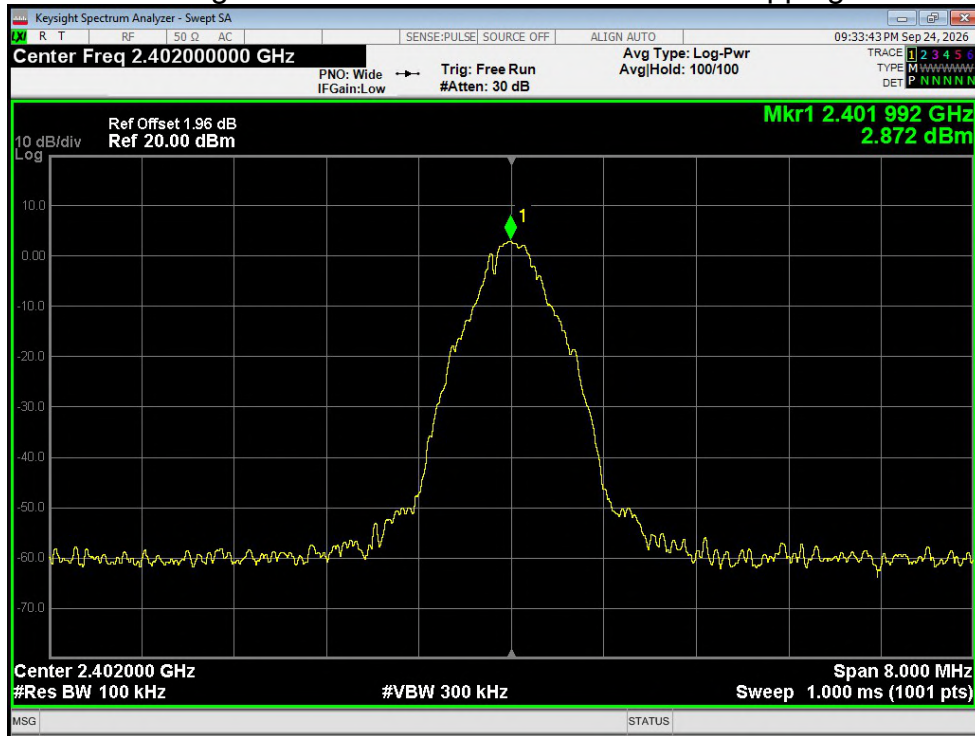
4.8 Band Edge

4.8.1 Conducted Emission Method

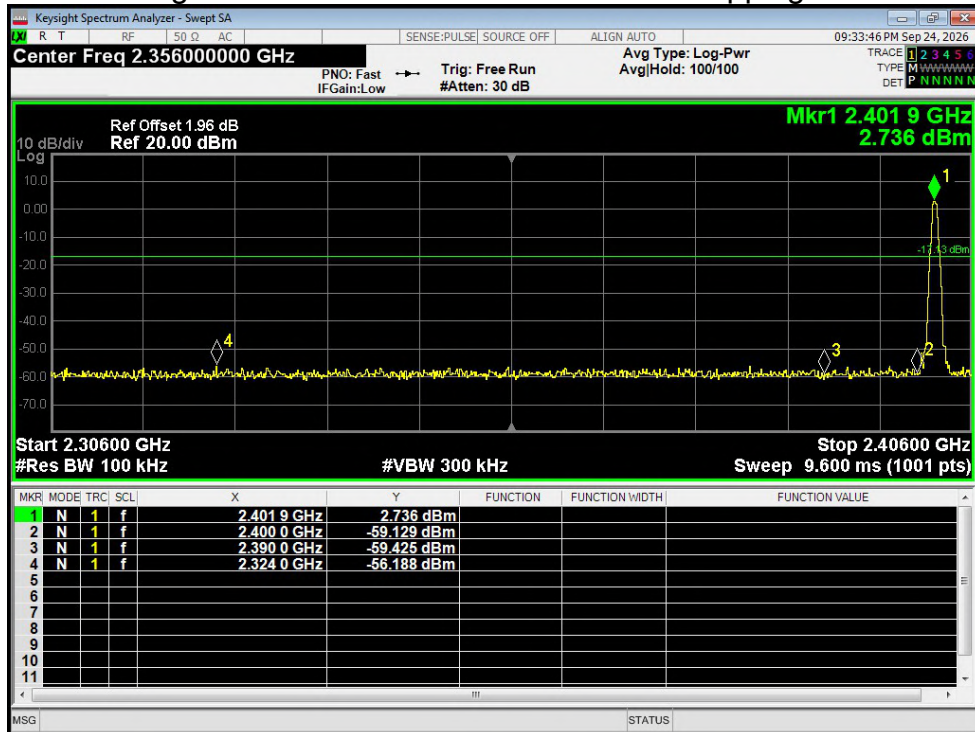
Test Requirement:	47CRF Part 15.247 (d)	
Test Method:	ANSI C63.10-2020 + Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 §7.8.6	
Receiver setup:	RBW=100kHz, VBW=300kHz, Detector=Peak	
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.	
Test setup:		
Test Instruments:	Refer to section 3.0 for details	
Test mode:	Refer to section 2.2 for details	
Test environment:	Temp.: 23.2°C	Humid.: 41%RH
Test voltage:	DC 7.7V from battery	
Test results:	Pass	

Test plot as follows:

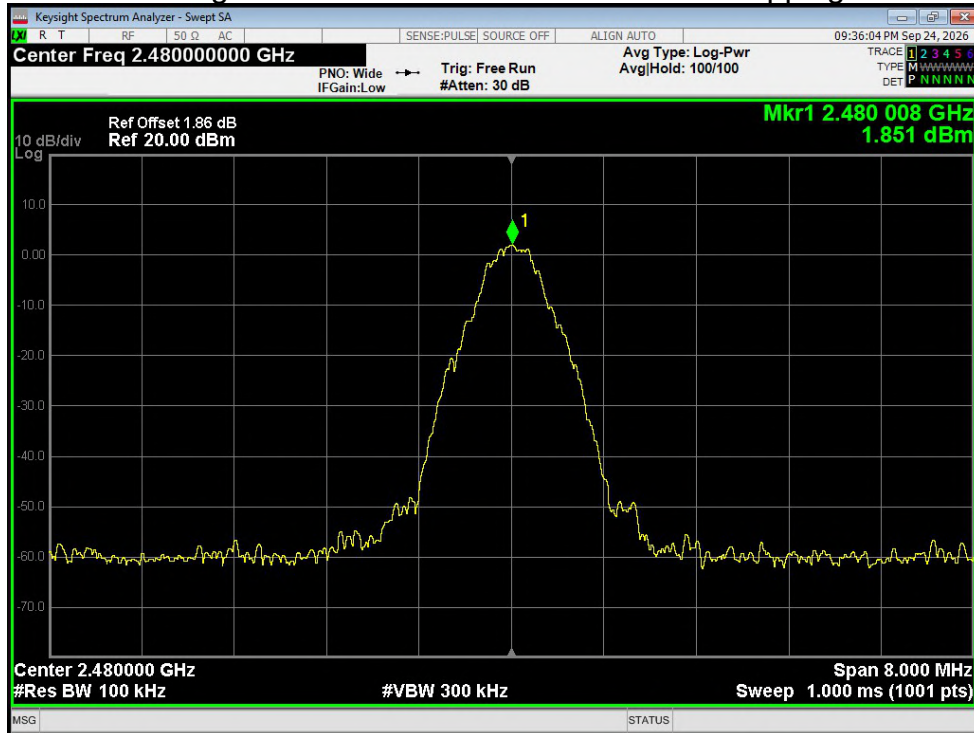
Band Edge NVNT 1-DH5 2402MHz Ant1 No-Hopping Ref



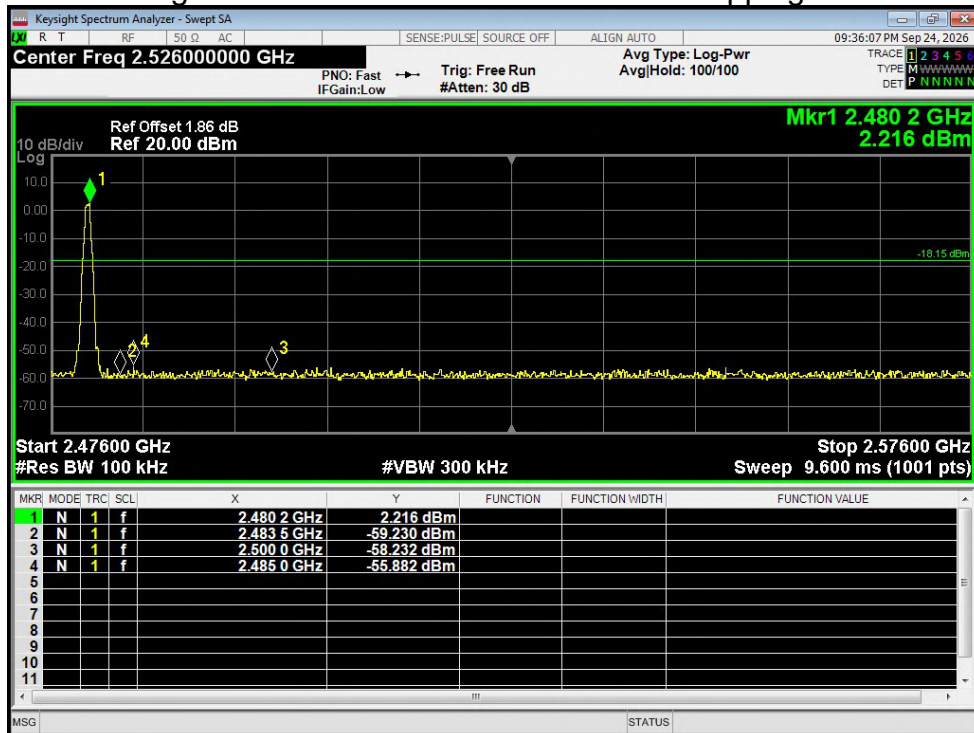
Band Edge NVNT 1-DH5 2402MHz Ant1 No-Hopping Emission



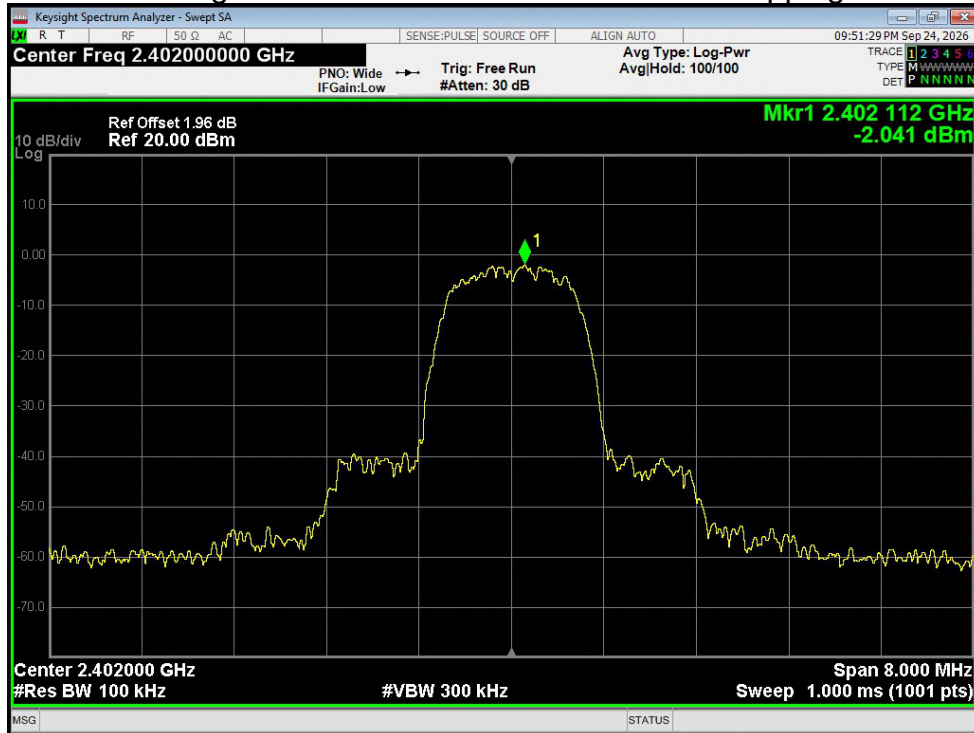
Band Edge NVNT 1-DH5 2480MHz Ant1 No-Hopping Ref



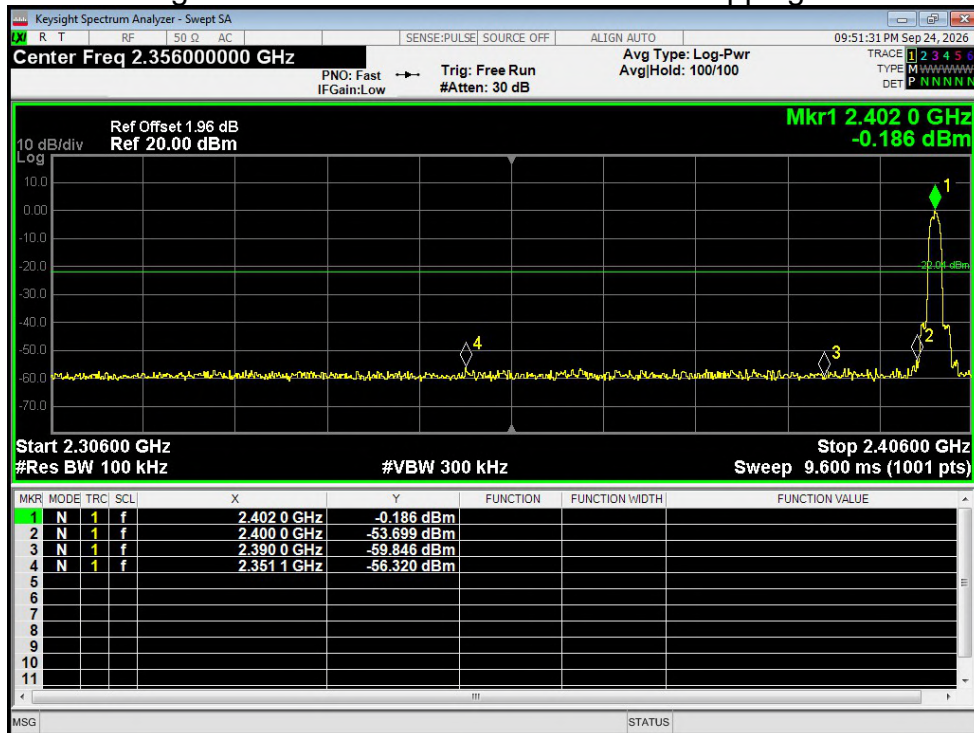
Band Edge NVNT 1-DH5 2480MHz Ant1 No-Hopping Emission



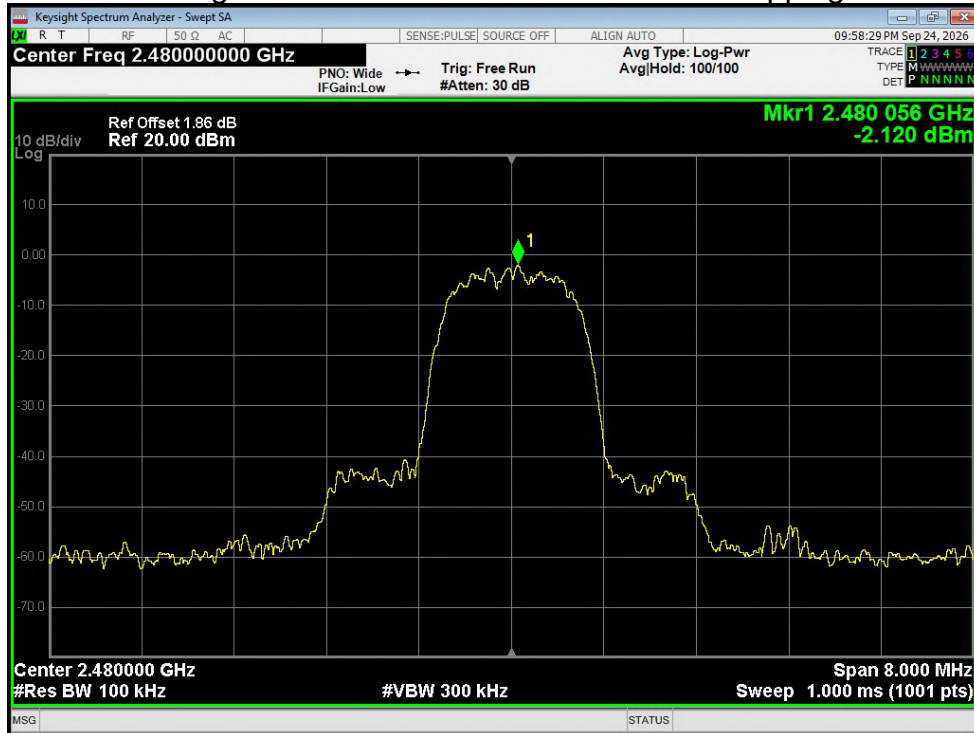
Band Edge NVNT 2-DH5 2402MHz Ant1 No-Hopping Ref



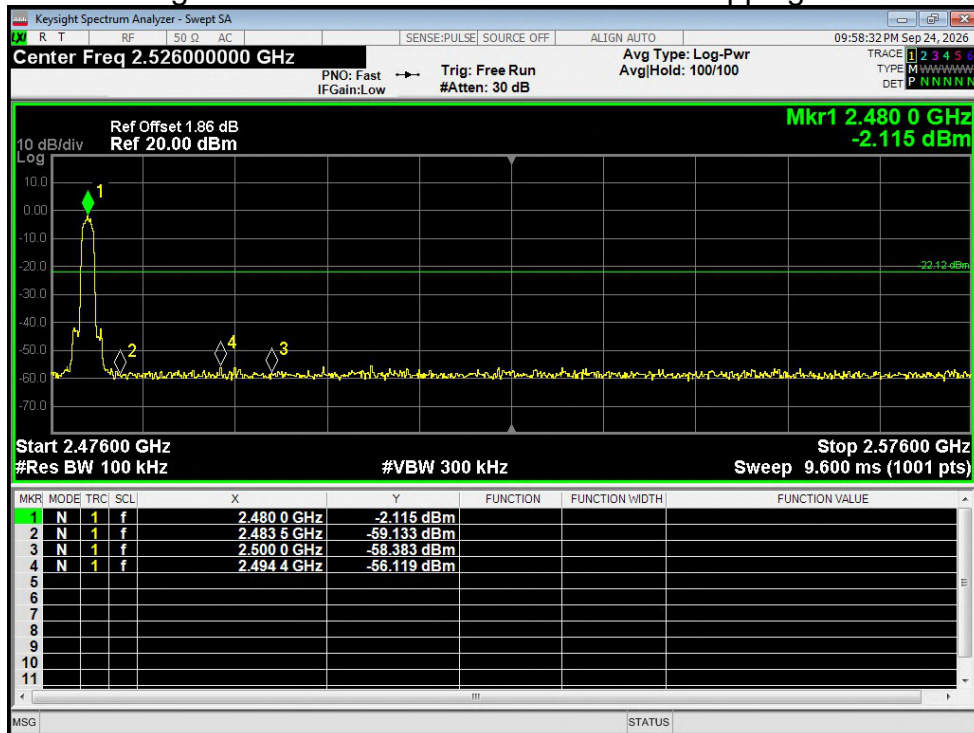
Band Edge NVNT 2-DH5 2402MHz Ant1 No-Hopping Emission



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



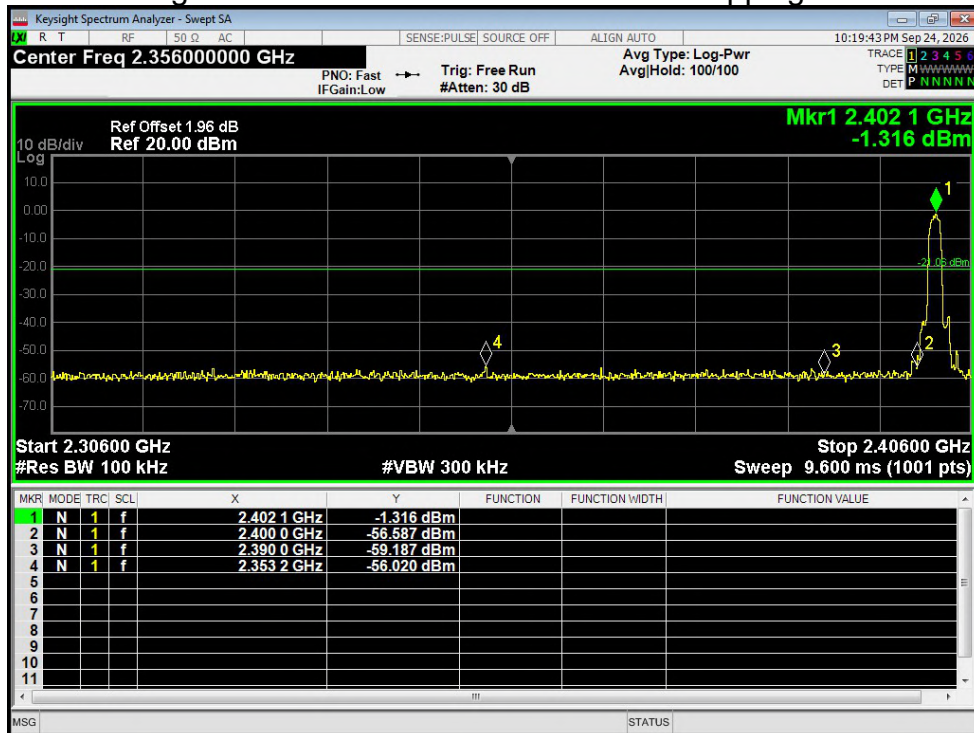
Band Edge NVNT 2-DH5 2480MHz Ant1 No-Hopping Emission



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



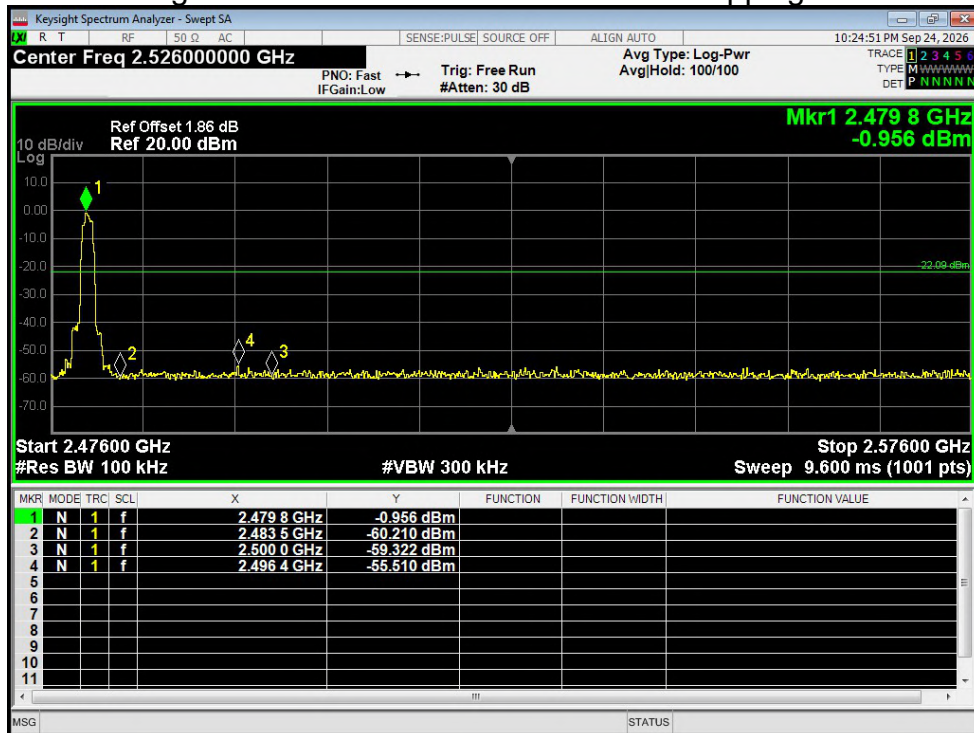
Band Edge NVNT 3-DH5 2402MHz Ant1 No-Hopping Emission



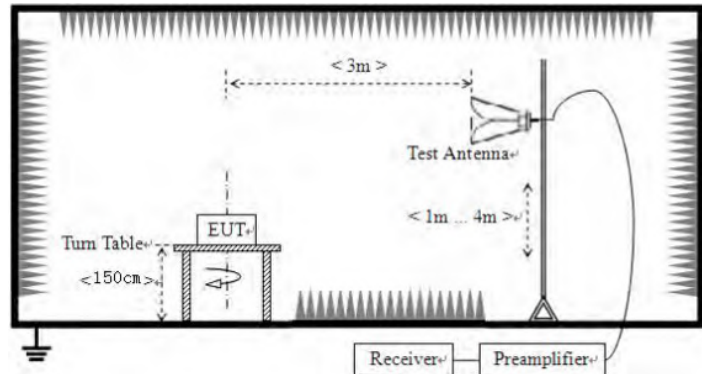
Band Edge NVNT 3-DH5 2480MHz Ant1 No-Hopping Ref



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



4.8.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209 and 15.205				
Test Method:	ANSI C63.10-2020 + Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024				
Test Frequency Range:	All of the restrict bands were tested, only the worst band's (2310MHz to 2500MHz) data was showed.				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		Peak	1MHz	10Hz	Average Value
Limit:	Frequency		Limit (dBuV/m @3m)		Remark
	Above 1GHz		54.00		Average Value
			74.00		Peak Value
Test setup:					
Test Procedure:	1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.				
Test Instruments:	Refer to section 3.0 for details				
Test mode:	Refer to section 2.2 for details				
Test environment:	Temp.: 23.2°C			Humid.: 41%RH	
Test voltage:	DC 7.7V from battery				
Test results:	Pass				

Measurement Data

Test channel:	Lowest
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Polarization
2310.00	61.91	-13.36	48.55	74.00	-25.45	Horizontal
2390.00	65.87	-13.03	52.84	74.00	-21.16	Horizontal
2310.00	61.50	-13.36	48.14	74.00	-25.86	Vertical
2390.00	65.56	-13.03	52.53	74.00	-21.47	Vertical

Average value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310.00	49.70	-13.36	36.34	54.00	-17.66	Horizontal
2390.00	54.98	-13.03	41.95	54.00	-12.05	Horizontal
2310.00	50.14	-13.36	36.78	54.00	-17.22	Vertical
2390.00	54.95	-13.03	41.92	54.00	-12.08	Vertical

Test channel:	Highest
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	67.39	-12.64	54.75	74.00	-19.25	Horizontal
2500.00	61.72	-12.57	49.15	74.00	-24.85	Horizontal
2483.50	67.44	-12.64	54.80	74.00	-19.20	Vertical
2500.00	61.98	-12.57	49.41	74.00	-24.59	Vertical

Average value:

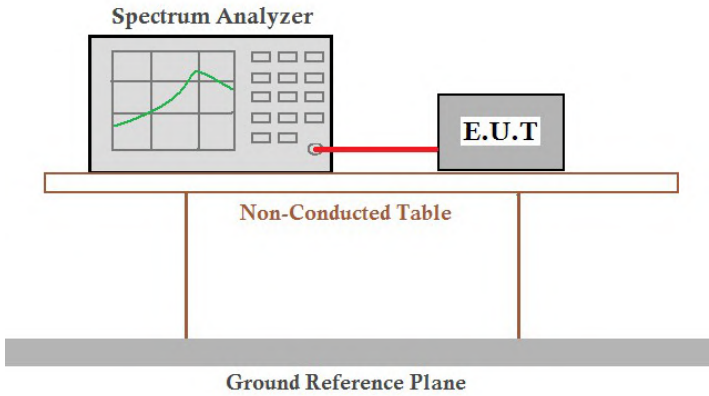
Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	55.40	-12.64	42.76	54.00	-11.24	Horizontal
2500.00	49.86	-12.57	37.29	54.00	-16.71	Horizontal
2483.50	56.26	-12.64	43.62	54.00	-10.38	Vertical
2500.00	50.96	-12.57	38.39	54.00	-15.61	Vertical

Remarks:

- Level = Read level + Factor
- Factor=Antenna Factor + Cable Loss – Preamplifier Factor
- The emission levels of other frequencies are very lower than the limit and not show in test report.
- The pre-test were performed on lowest, middle and highest frequencies, only the worst case's (lowest and highest frequencies) data was showed.
- During the test, pre-scan the GFSK, $\pi/4$ -DQPSK, 8-DPSK modulation, and found the 8-DPSK modulation which it is worse case.

4.9 Spurious Emission

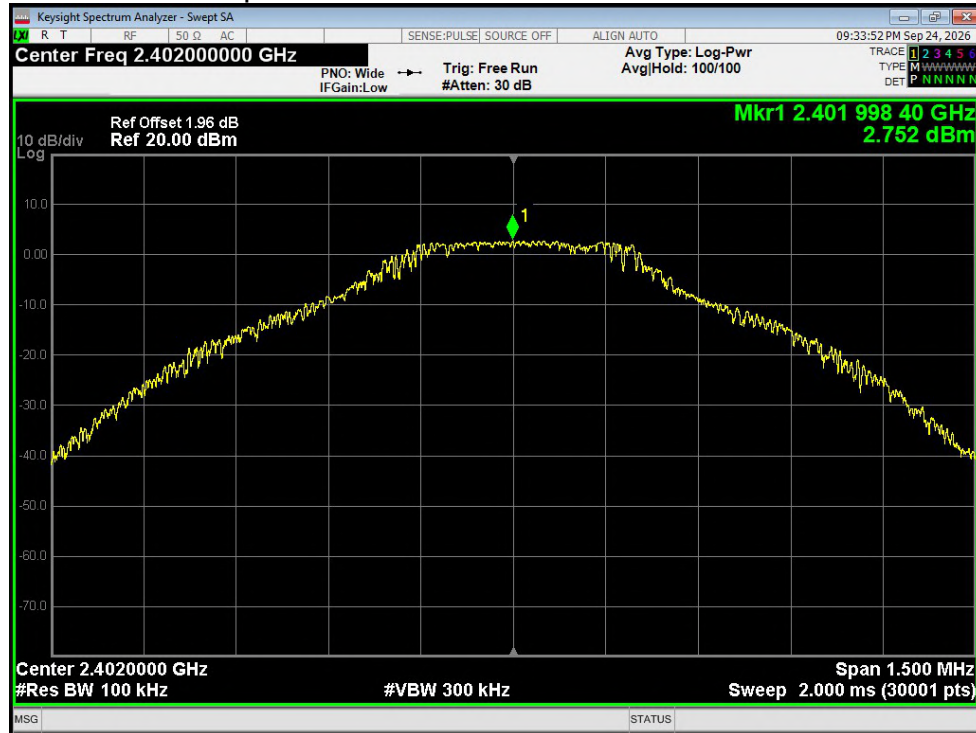
4.9.1 Conducted Emission Method

Test Requirement:	47CRF Part 15.247 (d), 47CRF Part 15.209 and 15.205	
Test Method:	ANSI C63.10-2020 + Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 §7.8.7	
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.	
Test setup:	 The diagram illustrates the test setup for conducted emission measurement. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table, which is supported by a Ground Reference Plane.	
Test Instruments:	Refer to section 3.0 for details	
Test mode:	Refer to section 2.2 for details	
Test environment:	Temp.: 23.2°C	Humid.: 41%RH
Test voltage:	DC 7.7V from battery	
Test results:	Pass	

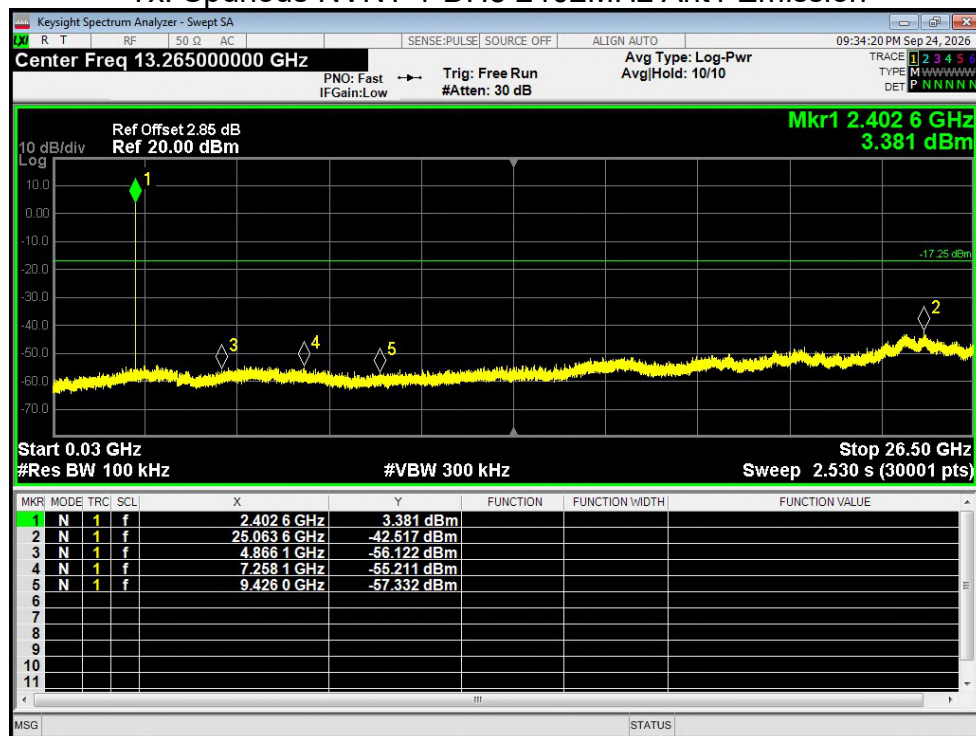
Remark:

1. Cable loss data included in Offset.

Tx. Spurious NVNT 1-DH5 2402MHz Ant1 Ref



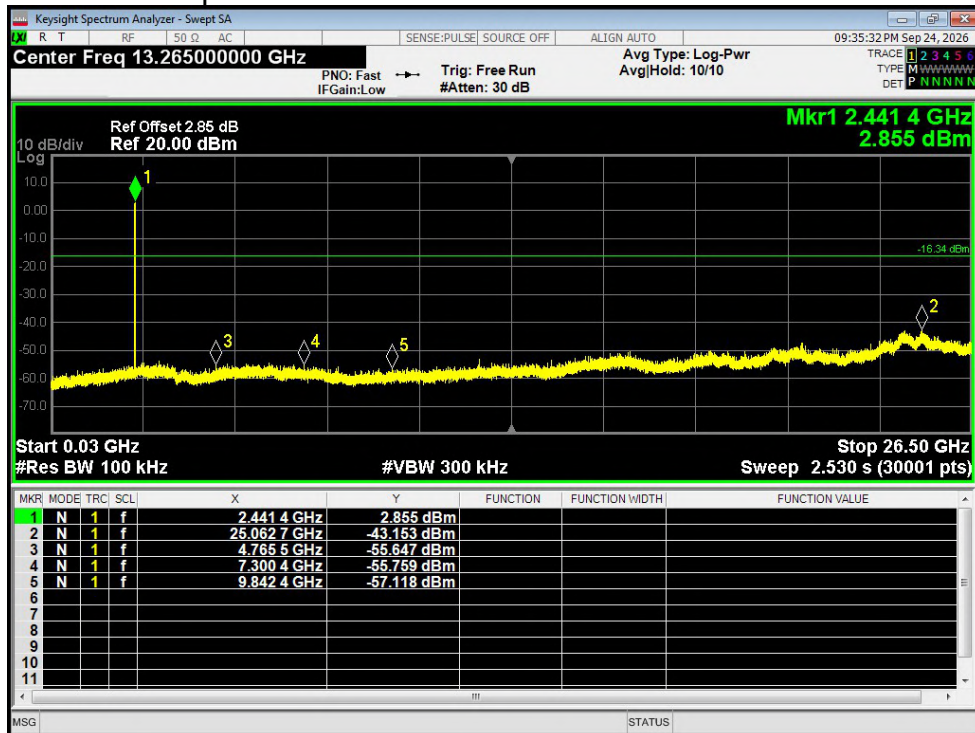
Tx. Spurious NVNT 1-DH5 2402MHz Ant1 Emission



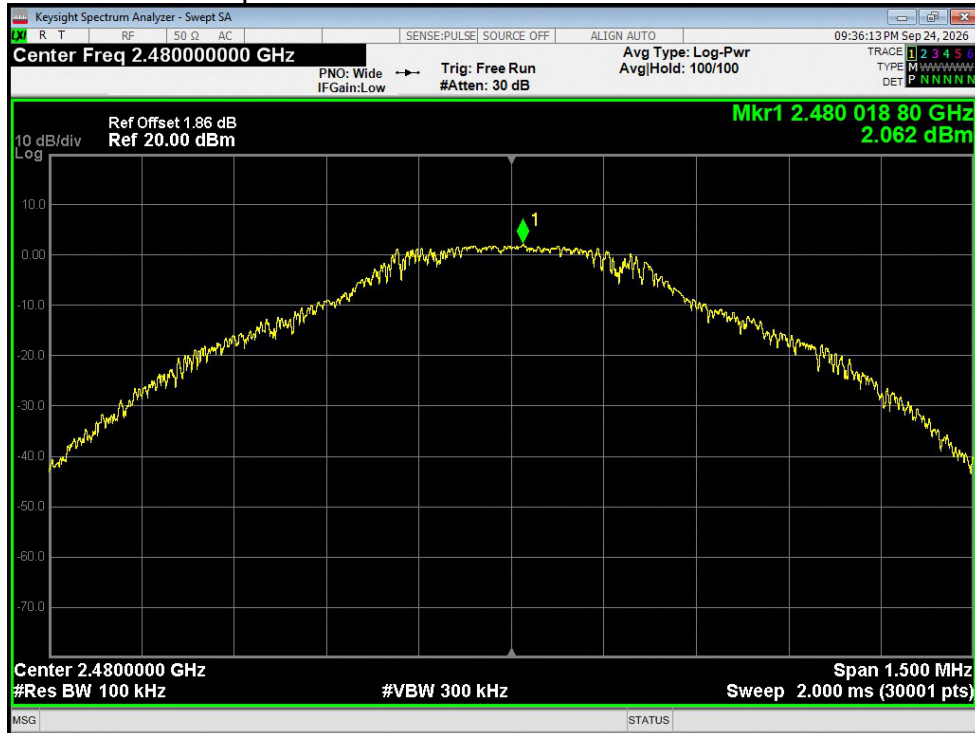
Tx. Spurious NVNT 1-DH5 2441MHz Ant1 Ref



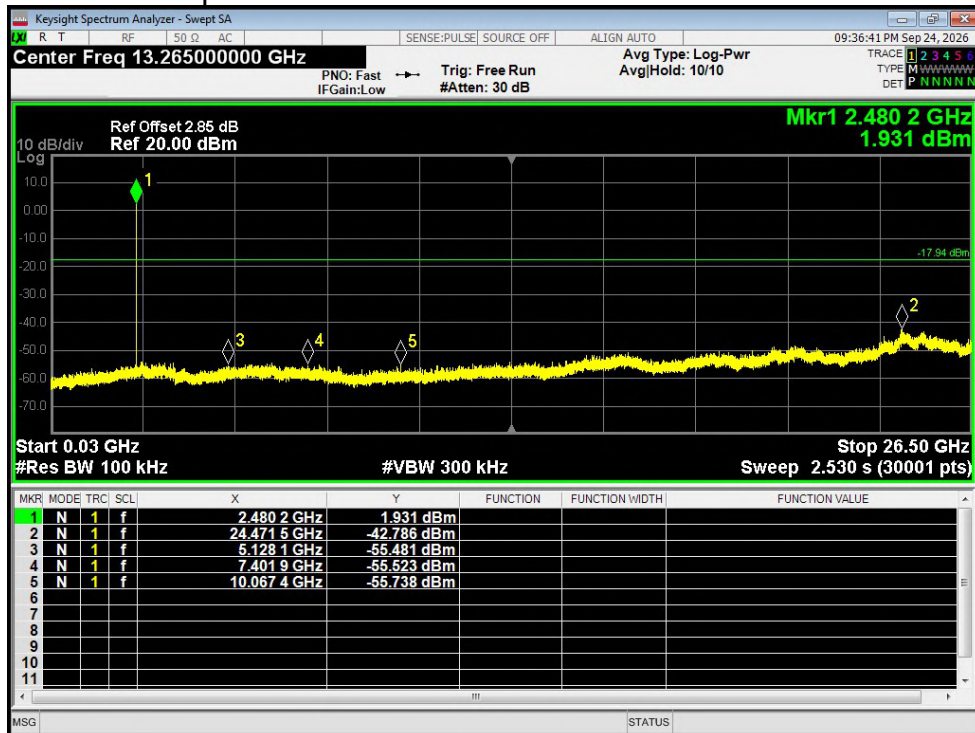
Tx. Spurious NVNT 1-DH5 2441MHz Ant1 Emission



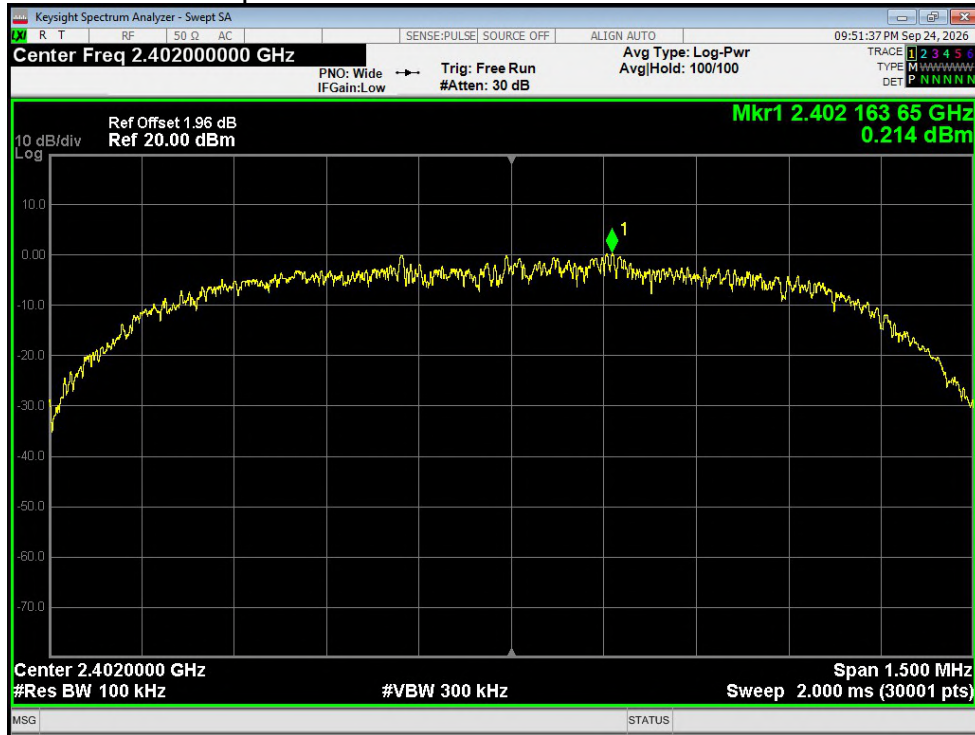
Tx. Spurious NVNT 1-DH5 2480MHz Ant1 Ref



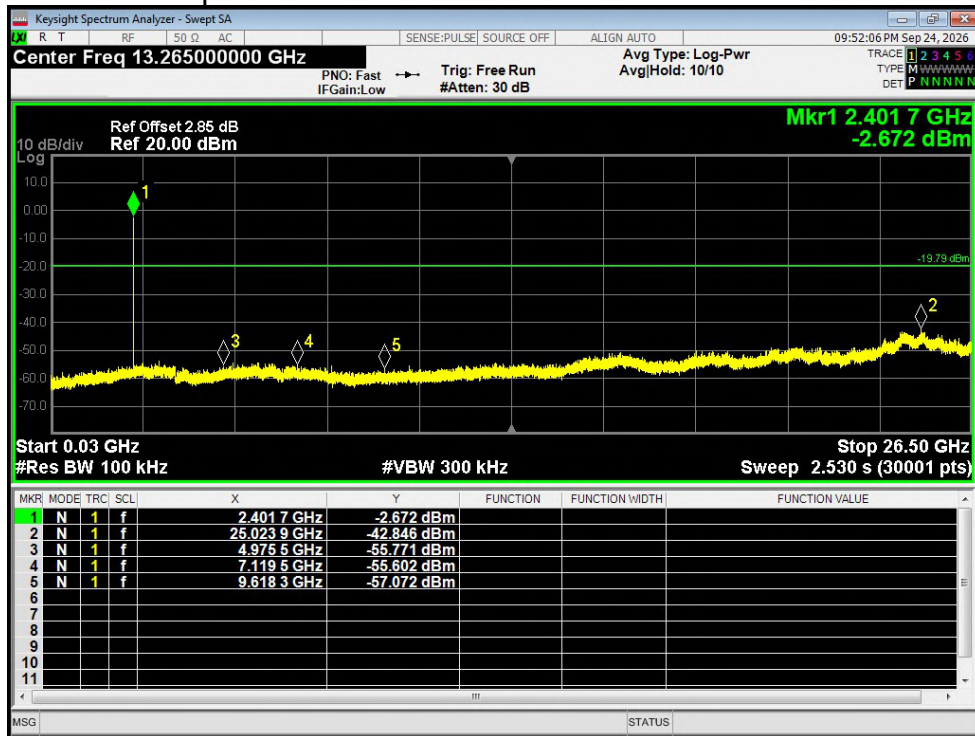
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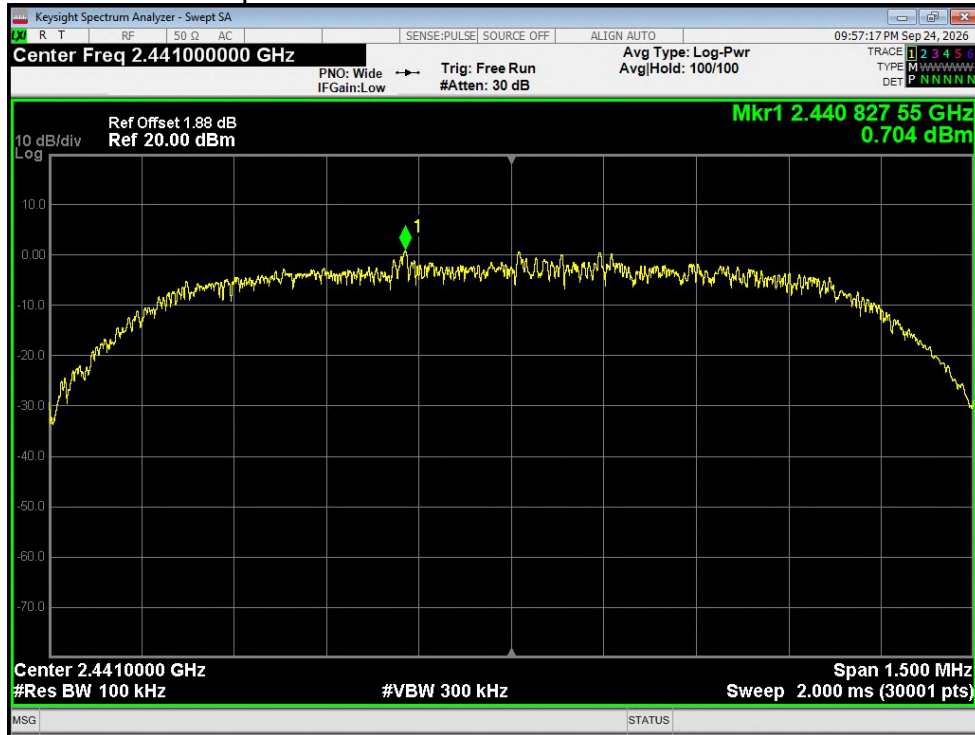
Tx. Spurious NVNT 2-DH5 2402MHz Ant1 Ref



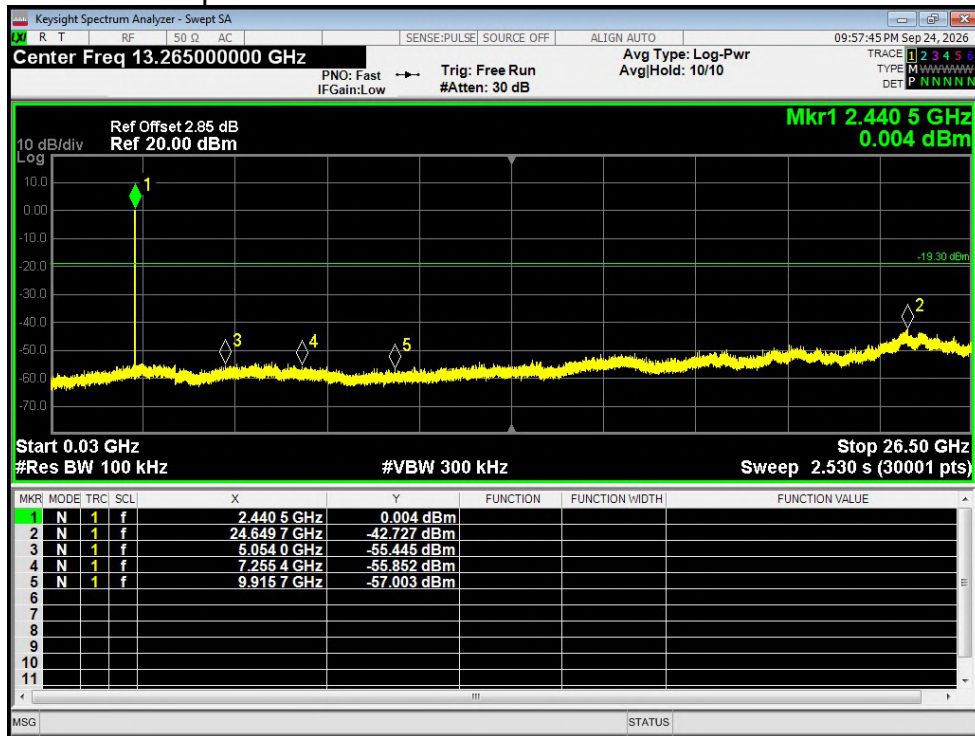
Tx. Spurious NVNT 2-DH5 2402MHz Ant1 Emission



Tx. Spurious NVNT 2-DH5 2441MHz Ant1 Ref



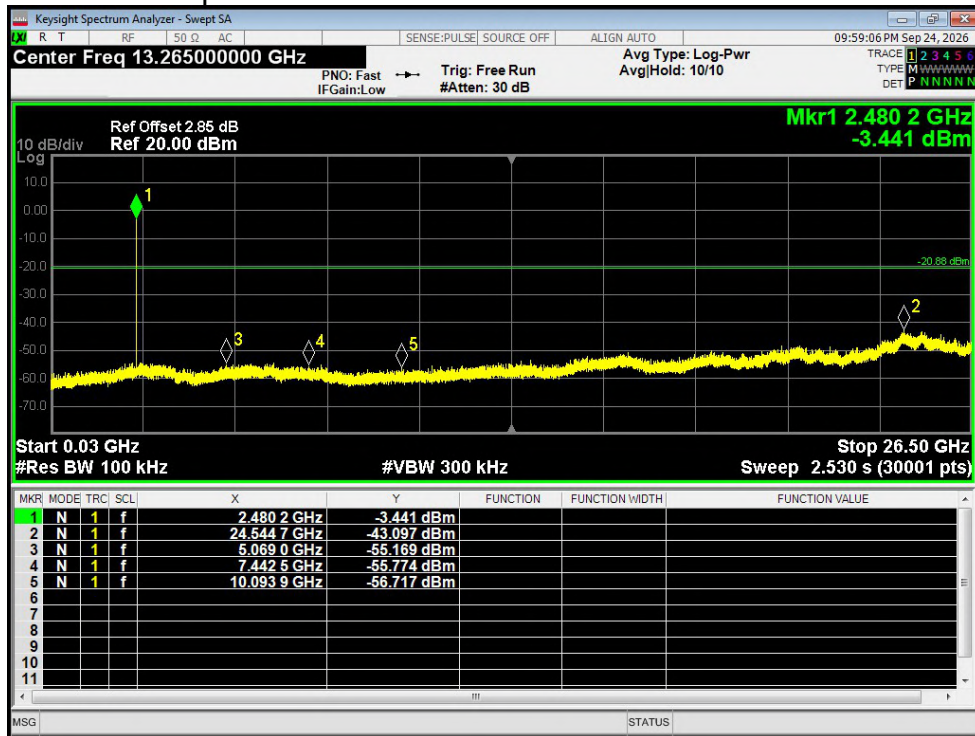
Tx. Spurious NVNT 2-DH5 2441MHz Ant1 Emission



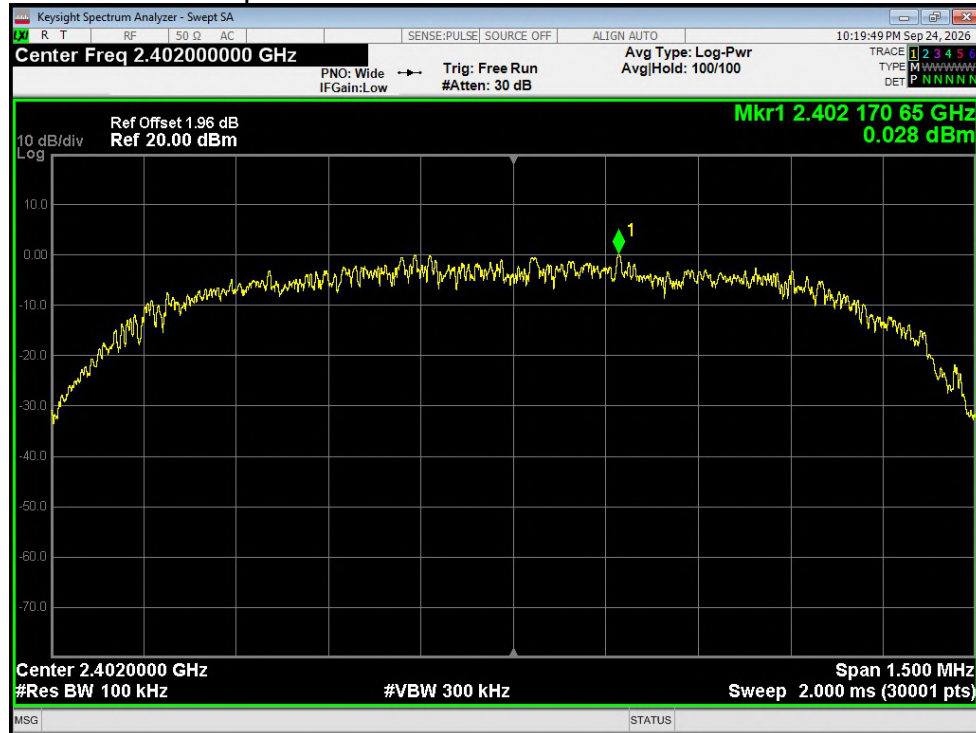
Tx. Spurious NVNT 2-DH5 2480MHz Ant1 Ref



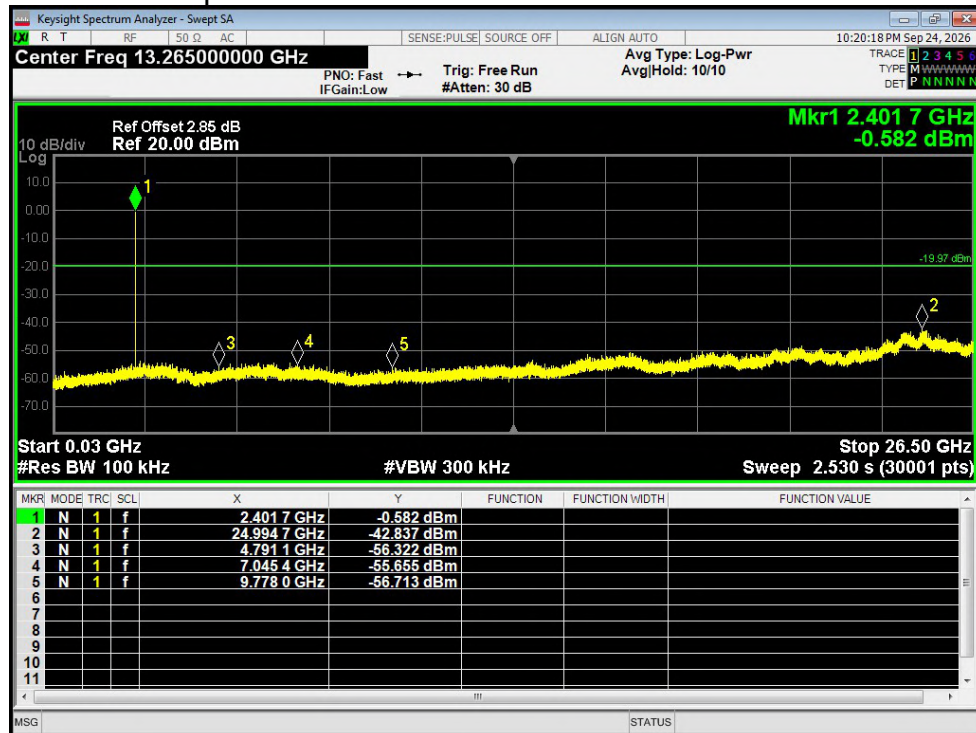
Tx. Spurious NVNT 2-DH5 2480MHz Ant1 Emission



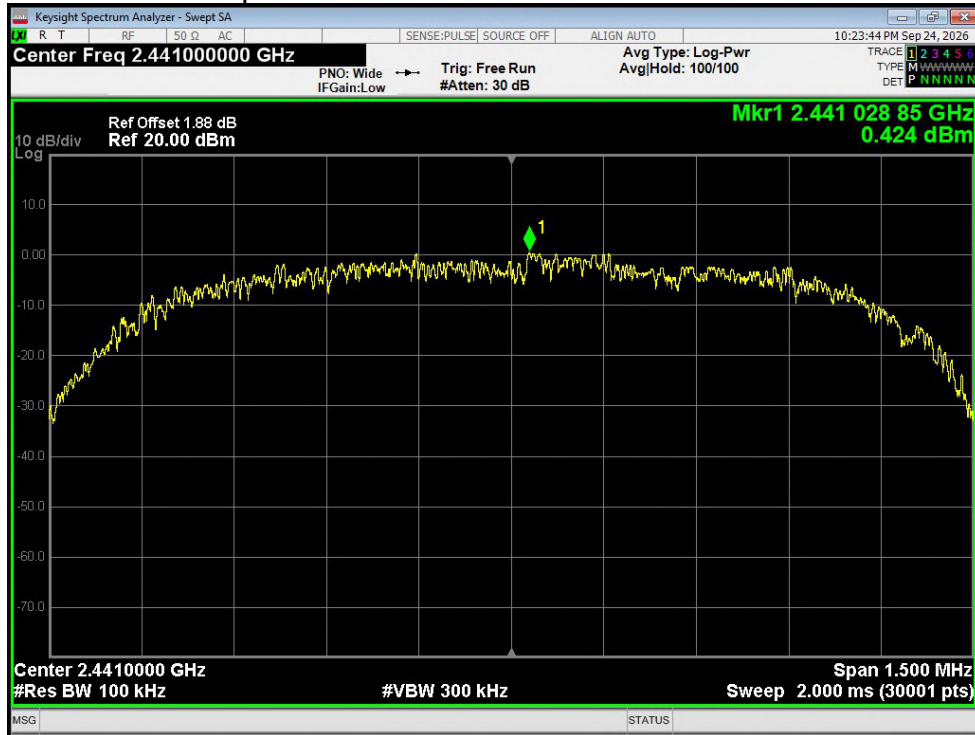
Tx. Spurious NVNT 3-DH5 2402MHz Ant1 Ref



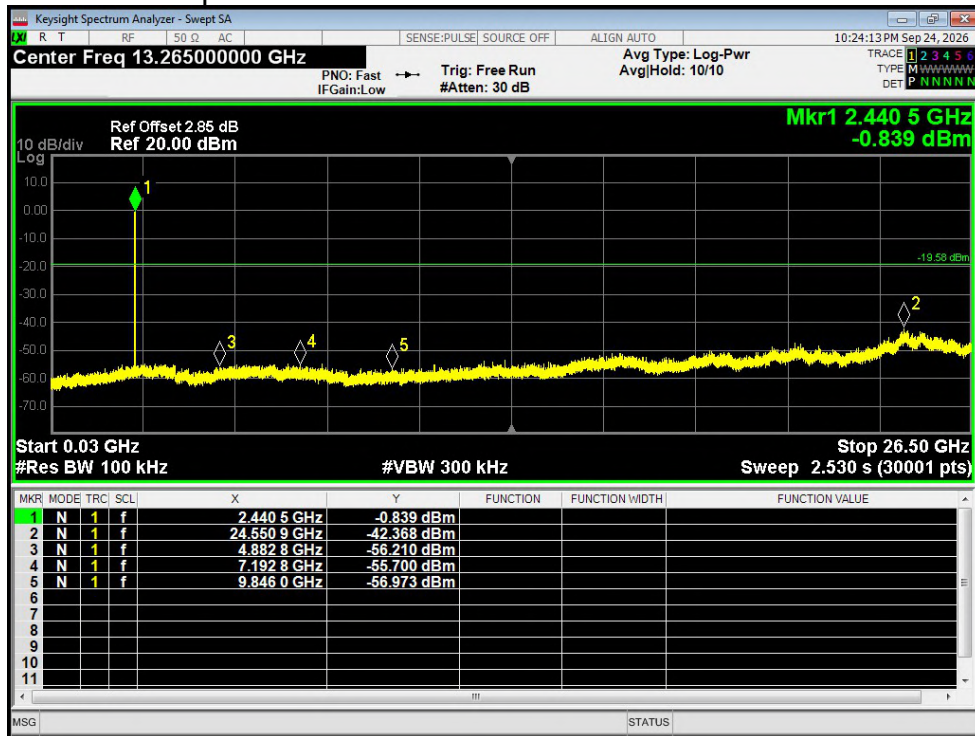
Tx. Spurious NVNT 3-DH5 2402MHz Ant1 Emission



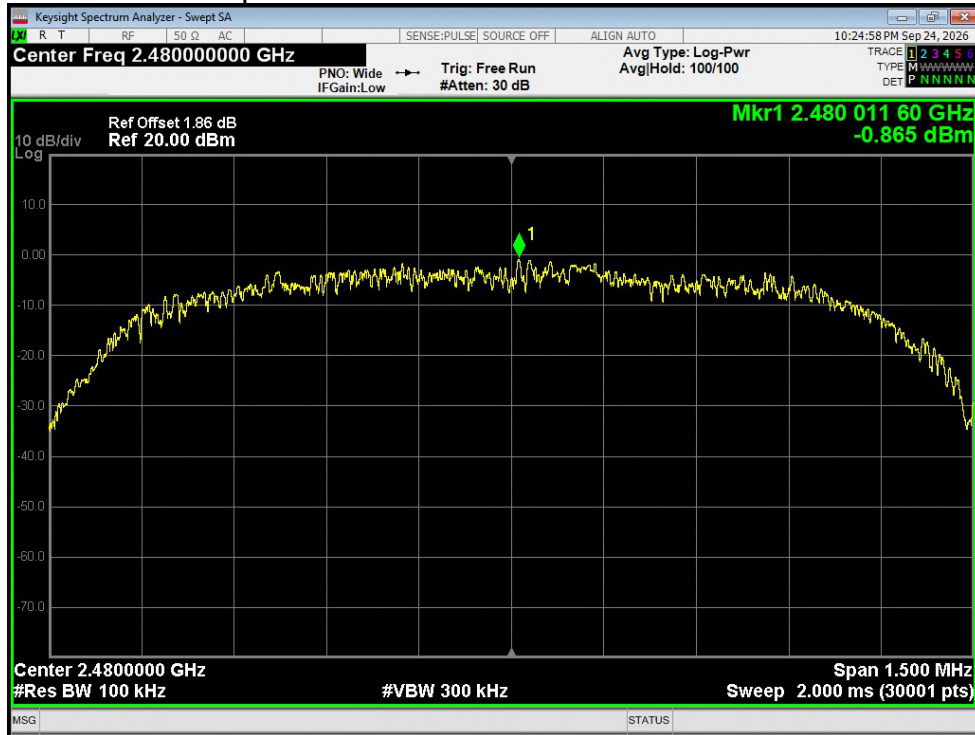
Tx. Spurious NVNT 3-DH5 2441MHz Ant1 Ref



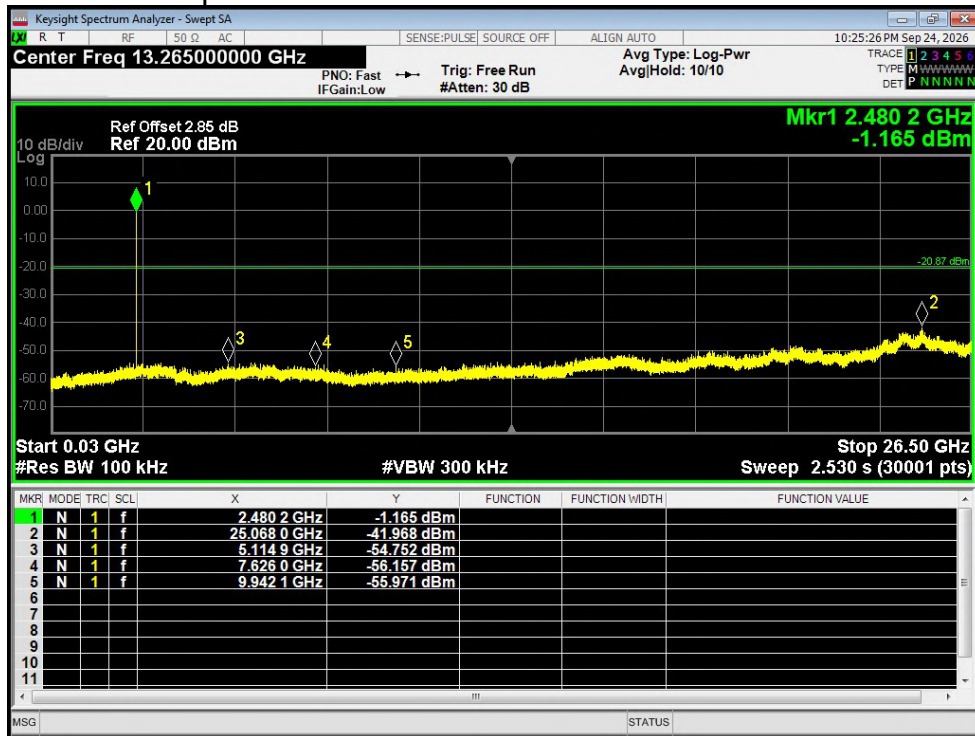
Tx. Spurious NVNT 3-DH5 2441MHz Ant1 Emission



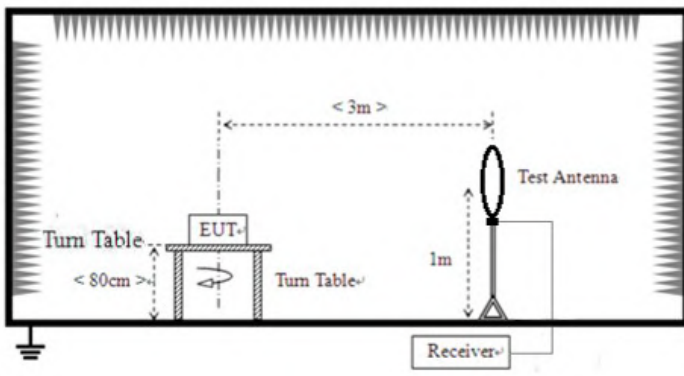
Tx. Spurious NVNT 3-DH5 2480MHz Ant1 Ref

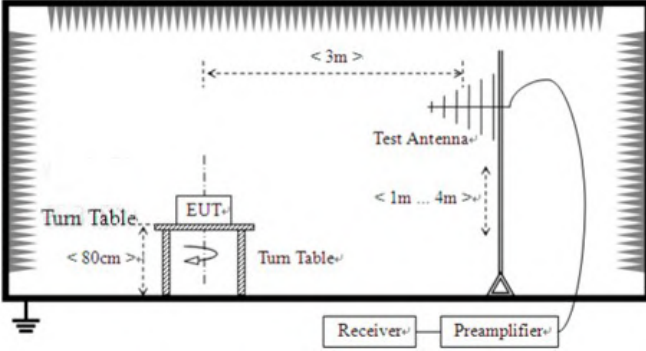
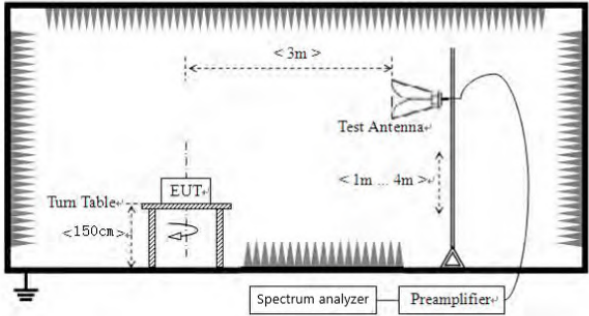


Tx. Spurious NVNT 3-DH5 2480MHz Ant1 Emission



4.9.2 Radiated Emission Method

Test Requirement:	47CRF Part 15.247 (d), 47CRF Part 15.209 and 15.205				
Test Method:	ANSI C63.10-2020 + Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 §6.4&6.5&6.6				
Test Frequency Range:	9kHz to 25GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	9KHz-150KHz	Quasi-peak	200Hz	600Hz	Quasi-peak
	150KHz-30MHz	Quasi-peak	9KHz	30KHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average
Limit:	Frequency	Limit (uV/m)	Value	Measurement Distance	
	0.009MHz-0.490MHz	6.37/F(KHz)	QP	300m	
	0.490MHz-1.705MHz	63.7/F(KHz)	QP	30m	
	1.705MHz-30MHz	0.08	QP	30m	
	30MHz-88MHz	100	QP	3m	
	88MHz-216MHz	150	QP		
	216MHz-960MHz	200	QP		
	960MHz-1GHz	500	QP		
	Above 1GHz	500	Average		
		5000	Peak		
Test setup:	For radiated emissions from 9kHz to 30MHz				
					

	For radiated emissions from 30MHz to1GHz  For radiated emissions above 1GHz 
Test Procedure:	1. The EUT was placed on the top of a rotating table (0.8m for below 1G and 1.5m for above 1G) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
Test Instruments:	Refer to section 3.0 for details
Test mode:	Refer to section 2.2 for details
Test results:	Pass



Measurement data:

Remarks:

1. *The report only shows the worst mode.*
2. *Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.*

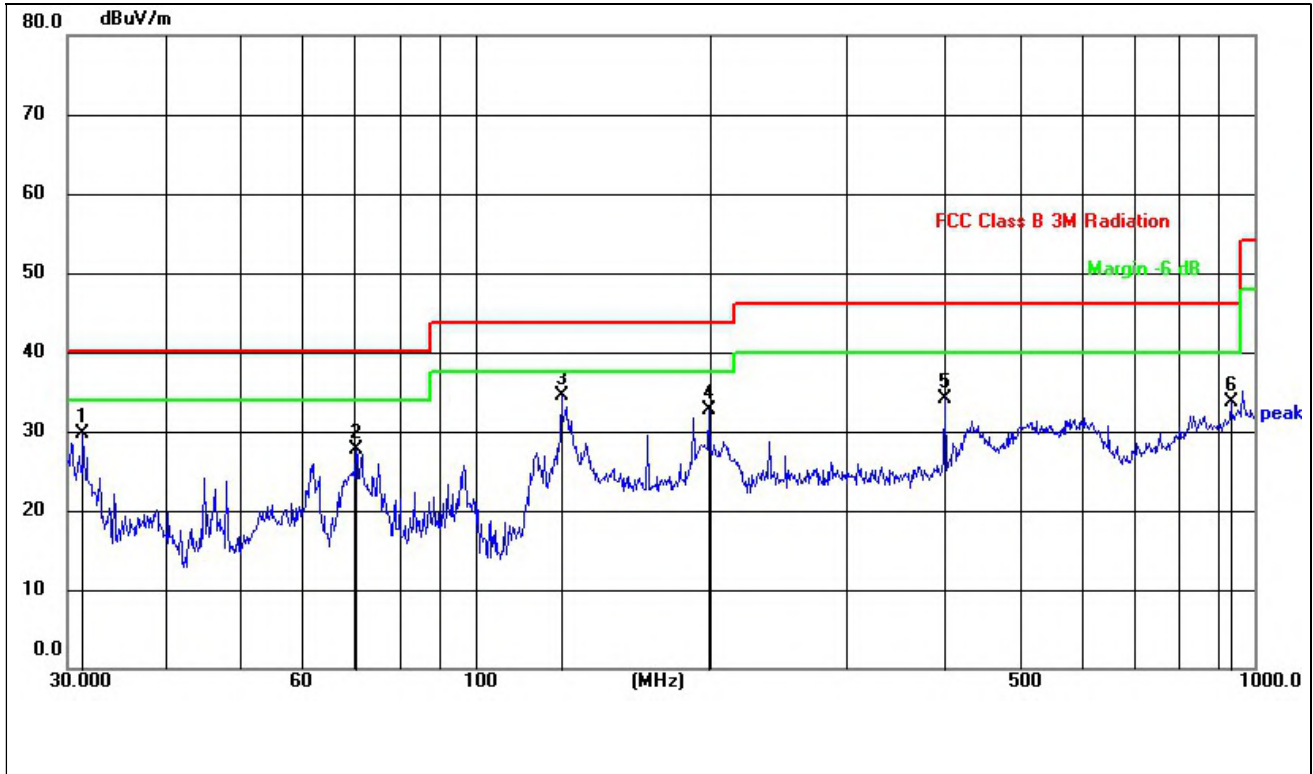
■ **9kHz~30MHz**

The emission from 9 kHz to 30MHz was pre-tested and found the result was 20dB lower than the limit, and according to 47CRF part 15.31(o), the test result no need to reported.

■ **Below 1GHz**

All modes have been tested, and the report only displays the worst mode GFSK (2441MHz) data.

Test polarization:	Horizontal	Test voltage:	DC 12V from adapter with AC 120V/60Hz
Temp.:	24.4°C	Humid.:	60%RH

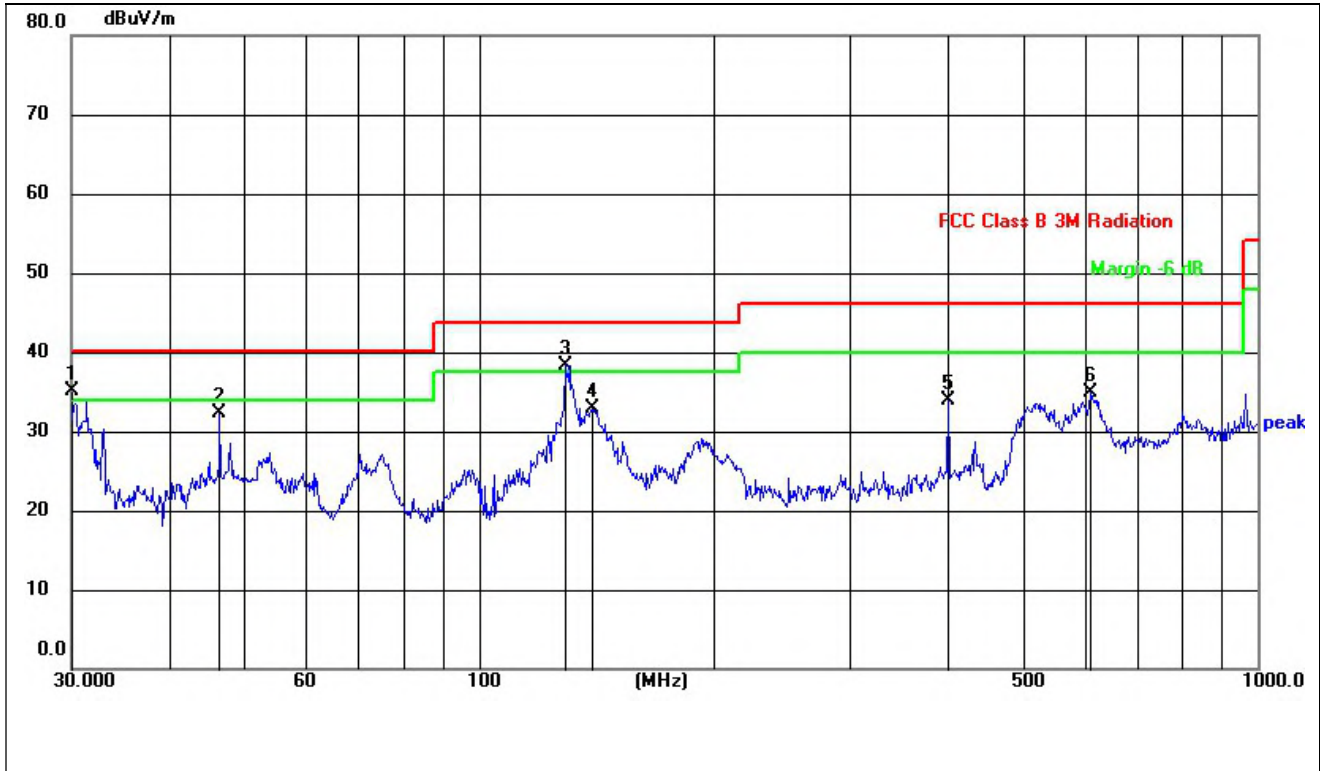


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	31.3992	52.42	-22.64	29.78	40.00	-10.22	QP
2	70.3365	52.21	-24.52	27.69	40.00	-12.31	QP
3	129.0144	57.38	-22.93	34.45	43.50	-9.05	QP
4	199.2855	56.56	-23.82	32.74	43.50	-10.76	QP
5	400.4318	51.83	-17.64	34.19	46.00	-11.81	QP
6	932.2714	37.71	-4.09	33.62	46.00	-12.38	QP

Factor= Antenna Factor + Cable Loss – Preamplifier Factor

Level = Reading + Factor, Margin=level-Limit

Test polarization:	Vertical	Test voltage:	DC 12V from adapter with AC 120V/60Hz
Temp.:	24.4°C	Humid.:	60%RH



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	30.0000	58.06	-22.93	35.13	40.00	-4.87	QP
2	46.5030	53.86	-21.60	32.26	40.00	-7.74	QP
3	129.0145	61.33	-22.93	38.40	43.50	-5.10	QP
4	139.8508	54.93	-21.97	32.96	43.50	-10.54	QP
5	400.4318	51.63	-17.64	33.99	46.00	-12.01	QP
6	609.9217	46.07	-11.09	34.98	46.00	-11.02	QP

Level = Reading + Factor, Margin=level-Limit

Factor= Antenna Factor + Cable Loss – Preamplifier Factor

■ **Above 1GHz**

All modes have been tested, and the report only displays the worst mode (GFSK) data.

Test voltage:	DC 12V from adapter with AC 120V/60Hz		
Temp.:	24.1°C	Humid.:	65%RH

Test channel:	Lowest
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4804.00	56.56	-7.69	48.87	74.00	-25.13	Vertical
7206.00	51.09	-1.70	49.39	74.00	-24.61	Vertical
9608.00	50.66	1.31	51.97	74.00	-22.03	Vertical
12010.00	*	--	--	74.00	--	Vertical
14412.00	*	--	--	74.00	--	Vertical
4804.00	55.90	-7.69	48.21	74.00	-25.79	Horizontal
7206.00	50.89	-1.70	49.19	74.00	-24.81	Horizontal
9608.00	49.74	1.31	51.05	74.00	-22.95	Horizontal
12010.00	*	--	--	74.00	--	Horizontal
14412.00	*	--	--	74.00	--	Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4804.00	43.02	-7.69	35.33	54.00	-18.67	Vertical
7206.00	37.85	-1.70	36.15	54.00	-17.85	Vertical
9608.00	37.72	1.31	39.03	54.00	-14.97	Vertical
12010.00	*	--	--	54.00	--	Vertical
14412.00	*	--	--	54.00	--	Vertical
4804.00	42.07	-7.69	34.38	54.00	-19.62	Horizontal
7206.00	36.70	-1.70	35.00	54.00	-19.00	Horizontal
9608.00	37.24	1.31	38.55	54.00	-15.45	Horizontal
12010.00	*	--	--	54.00	--	Horizontal
14412.00	*	--	--	54.00	--	Horizontal



Test channel:	Middle
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4882.00	57.30	-7.56	49.74	74.00	-24.26	Vertical
7323.00	50.13	-1.38	48.75	74.00	-25.25	Vertical
9764.00	49.24	1.19	50.43	74.00	-23.57	Vertical
12205.00	*	--	--	74.00	--	Vertical
14646.00	*	--	--	74.00	--	Vertical
4882.00	56.85	-7.56	49.29	74.00	-24.71	Horizontal
7323.00	50.53	-1.38	49.15	74.00	-24.85	Horizontal
9764.00	49.42	1.19	50.61	74.00	-23.39	Horizontal
12205.00	*	--	--	74.00	--	Horizontal
14646.00	*	--	--	74.00	--	Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4882.00	43.47	-7.56	35.91	54.00	-18.09	Vertical
7323.00	38.02	-1.38	36.64	54.00	-17.36	Vertical
9764.00	37.35	1.19	38.54	54.00	-15.46	Vertical
12205.00	*	--	--	54.00	--	Vertical
14646.00	*	--	--	54.00	--	Vertical
4882.00	44.09	-7.56	36.53	54.00	-17.47	Horizontal
7323.00	37.13	-1.38	35.75	54.00	-18.25	Horizontal
9764.00	36.51	1.19	37.70	54.00	-16.30	Horizontal
12205.00	*	--	--	54.00	--	Horizontal
14646.00	*	--	--	54.00	--	Horizontal



Test channel:	Highest
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	56.67	-7.43	49.24	74.00	-24.76	Vertical
7440.00	51.30	-1.02	50.28	74.00	-23.72	Vertical
9920.00	49.36	1.08	50.44	74.00	-23.56	Vertical
12400.00	*	--	--	74.00	--	Vertical
14880.00	*	--	--	74.00	--	Vertical
4960.00	57.92	-7.43	50.49	74.00	-23.51	Horizontal
7440.00	51.49	-1.02	50.47	74.00	-23.53	Horizontal
9920.00	49.74	1.08	50.82	74.00	-23.18	Horizontal
12400.00	*	--	--	74.00	--	Horizontal
14880.00	*	--	--	74.00	--	Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	43.43	-7.43	36.00	54.00	-18.00	Vertical
7440.00	37.45	-1.02	36.43	54.00	-17.57	Vertical
9920.00	37.49	1.08	38.57	54.00	-15.43	Vertical
12400.00	*	--	--	54.00	--	Vertical
14880.00	*	--	--	54.00	--	Vertical
4960.00	44.75	-7.43	37.32	54.00	-16.68	Horizontal
7440.00	36.67	-1.02	35.65	54.00	-18.35	Horizontal
9920.00	36.89	1.08	37.97	54.00	-16.03	Horizontal
12400.00	*	--	--	54.00	--	Horizontal
14880.00	*	--	--	54.00	--	Horizontal

Remarks:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *“*”*, means this data is the too weak instrument of signal is unable to test.
3. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

5 Test Setup Photo

Reference to the file No.: ET-26094902SP for details.

6 EUT Constructional Details

Reference to the file No.: ET-26094902EP and ET-26094902IP for details.

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