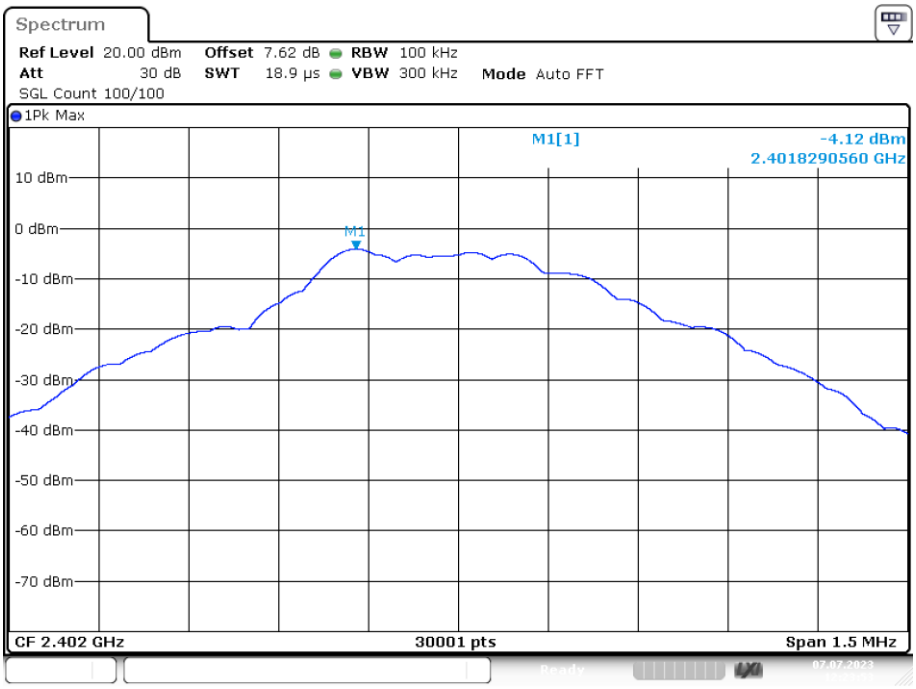
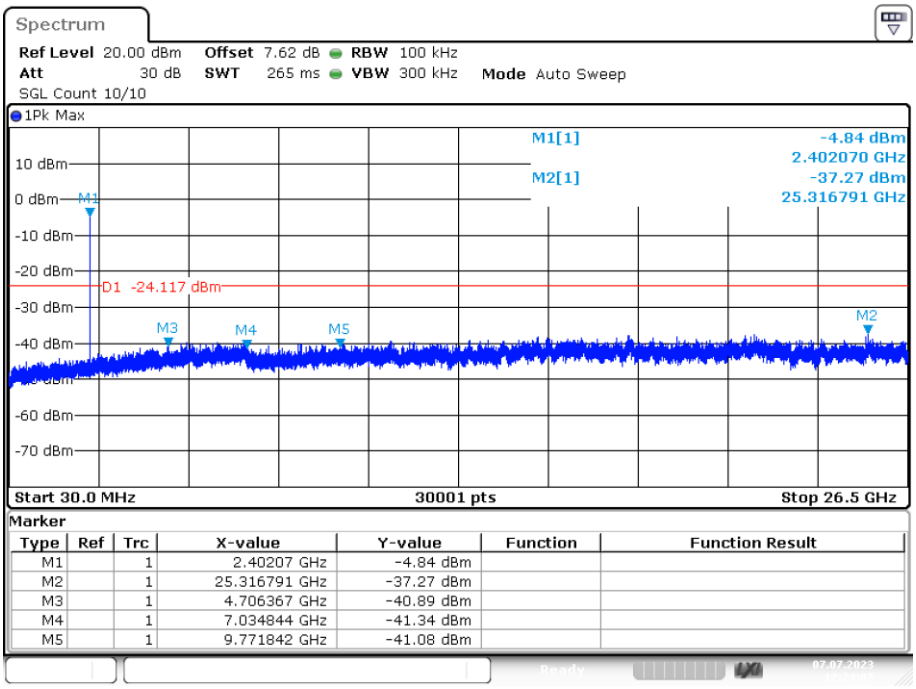
Conducted RF Spurious Emission

Tx. Spurious NVNT 1-DH1 2402MHz Ant1 Ref



Date: 7.JUL.2023 12:23:53

Tx. Spurious NVNT 1-DH1 2402MHz Ant1 Emission

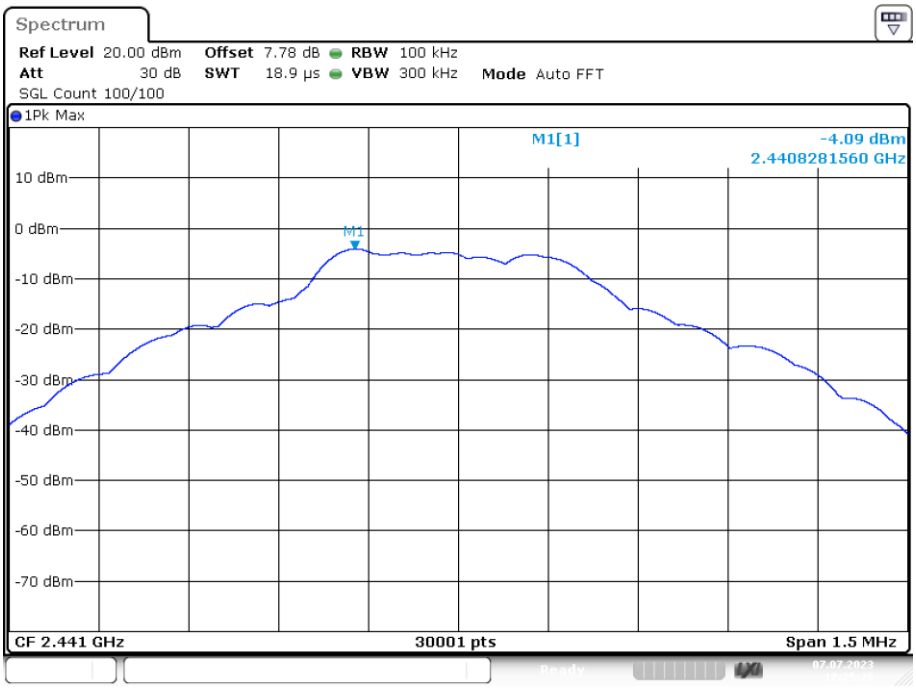


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40207 GHz	-4.84 dBm		
M2		1	25.316791 GHz	-37.27 dBm		
M3		1	4.706367 GHz	-40.89 dBm		
M4		1	7.034844 GHz	-41.34 dBm		
M5		1	9.771842 GHz	-41.08 dBm		

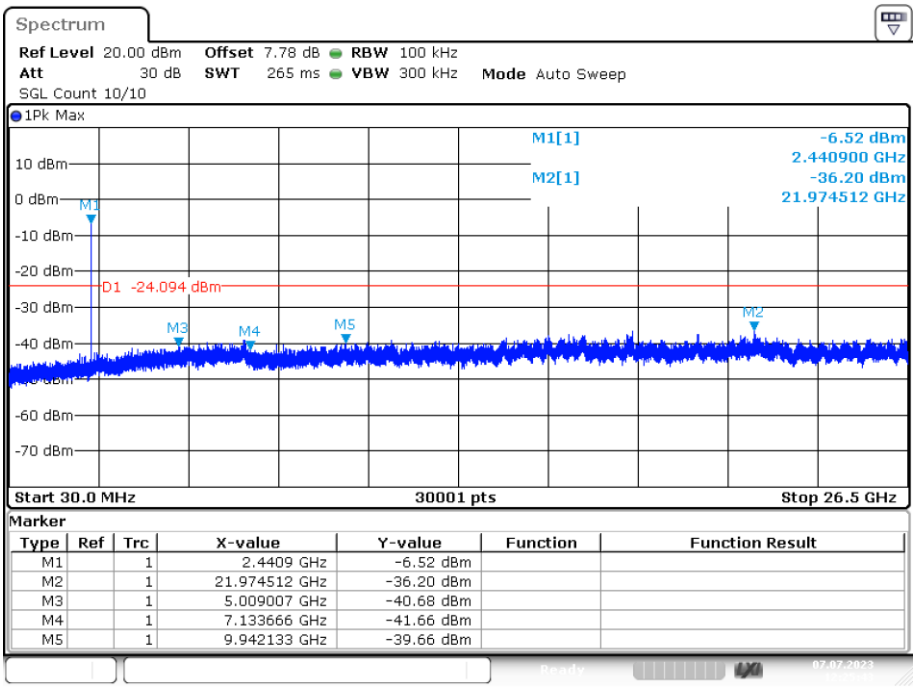
Date: 7.JUL.2023 12:24:07

Tx. Spurious NVNT 1-DH1 2441MHz Ant1 Ref



Date: 7.JUL.2023 12:25:29

Tx. Spurious NVNT 1-DH1 2441MHz Ant1 Emission

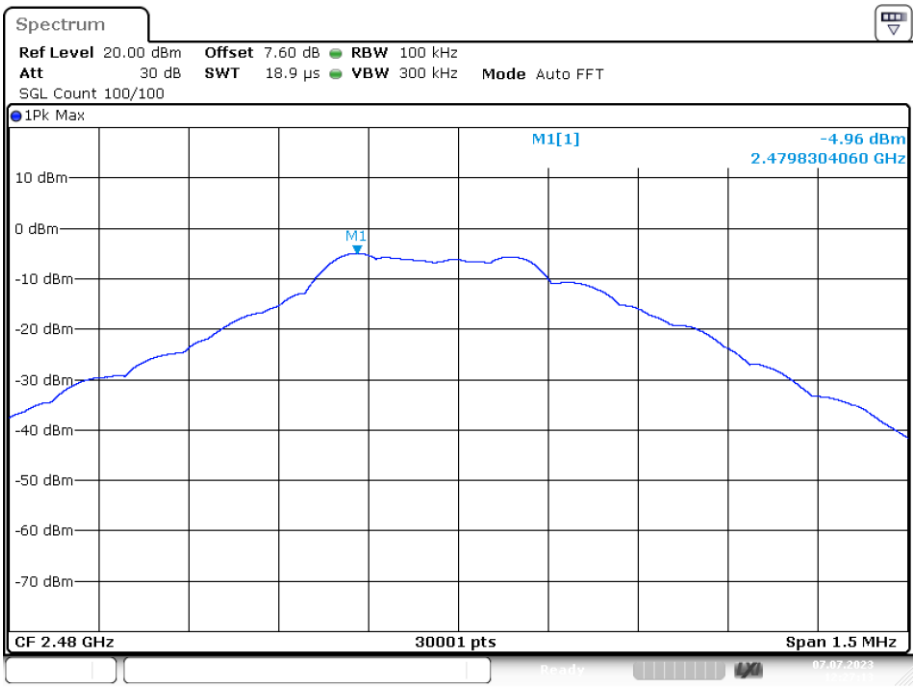


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4409 GHz	-6.52 dBm		
M2		1	21.974512 GHz	-36.20 dBm		
M3		1	5.009007 GHz	-40.68 dBm		
M4		1	7.133666 GHz	-41.66 dBm		
M5		1	9.942133 GHz	-39.66 dBm		

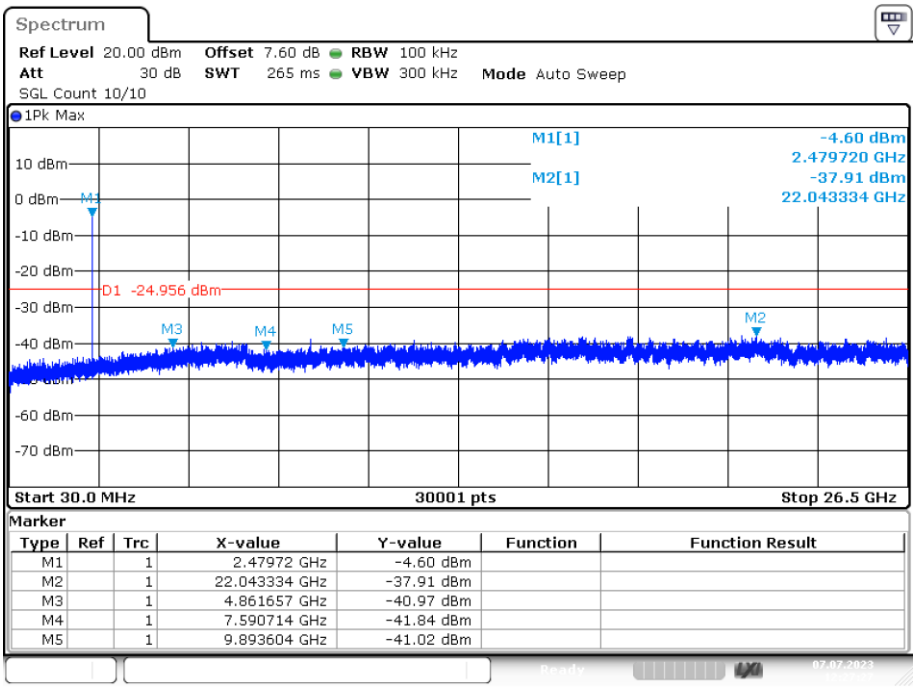
Date: 7.JUL.2023 12:25:43

Tx. Spurious NVNT 1-DH1 2480MHz Ant1 Ref



Date: 7.JUL.2023 12:27:13

Tx. Spurious NVNT 1-DH1 2480MHz Ant1 Emission

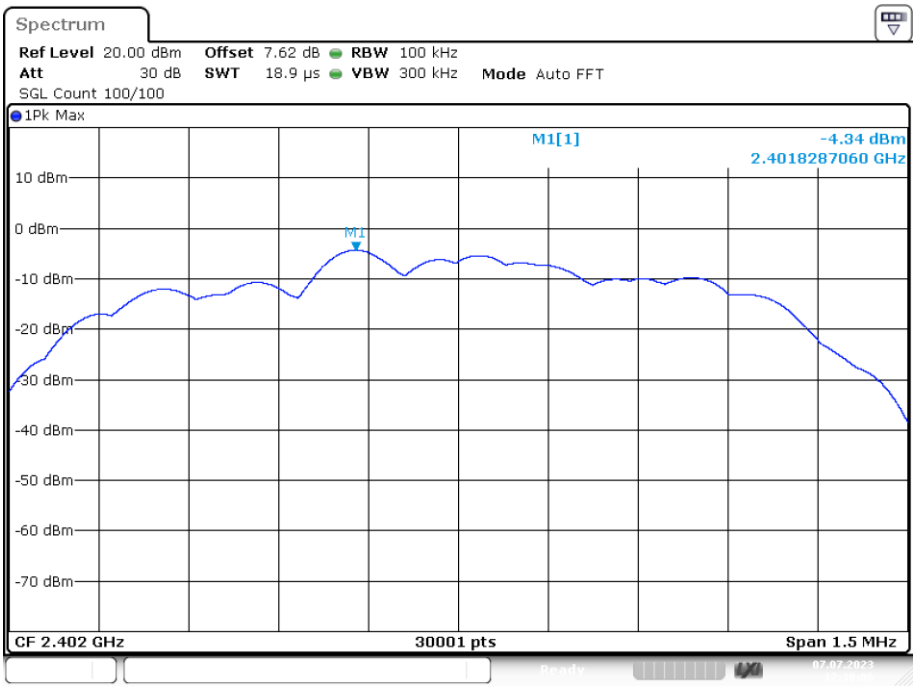


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47972 GHz	-4.60 dBm		
M2		1	22.043334 GHz	-37.91 dBm		
M3		1	4.861657 GHz	-40.97 dBm		
M4		1	7.590714 GHz	-41.84 dBm		
M5		1	9.893604 GHz	-41.02 dBm		

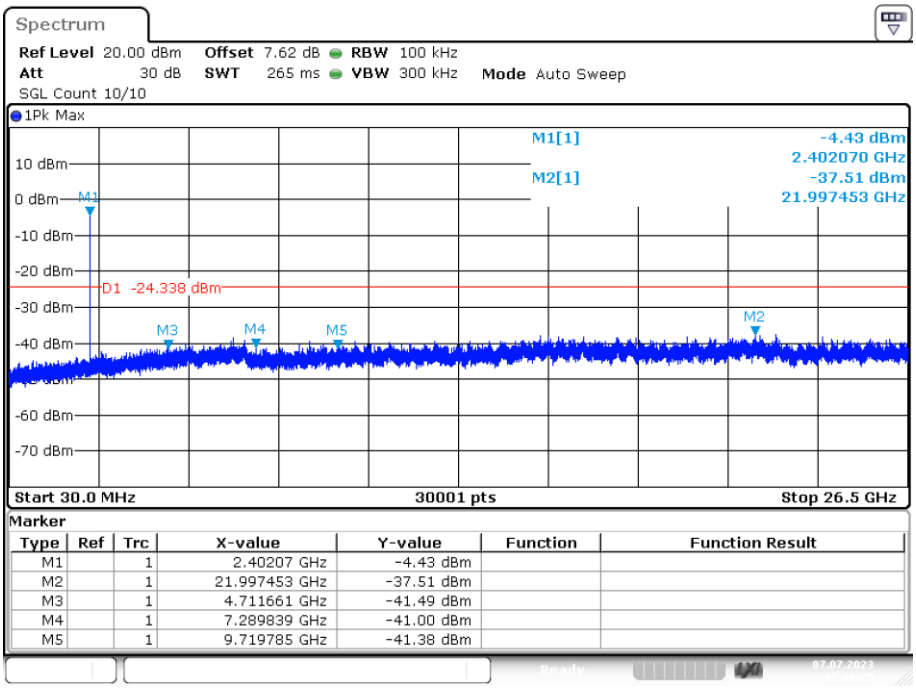
Date: 7.JUL.2023 12:27:27

Tx. Spurious NVNT 2-DH1 2402MHz Ant1 Ref



Date: 7.JUL.2023 12:30:06

Tx. Spurious NVNT 2-DH1 2402MHz Ant1 Emission

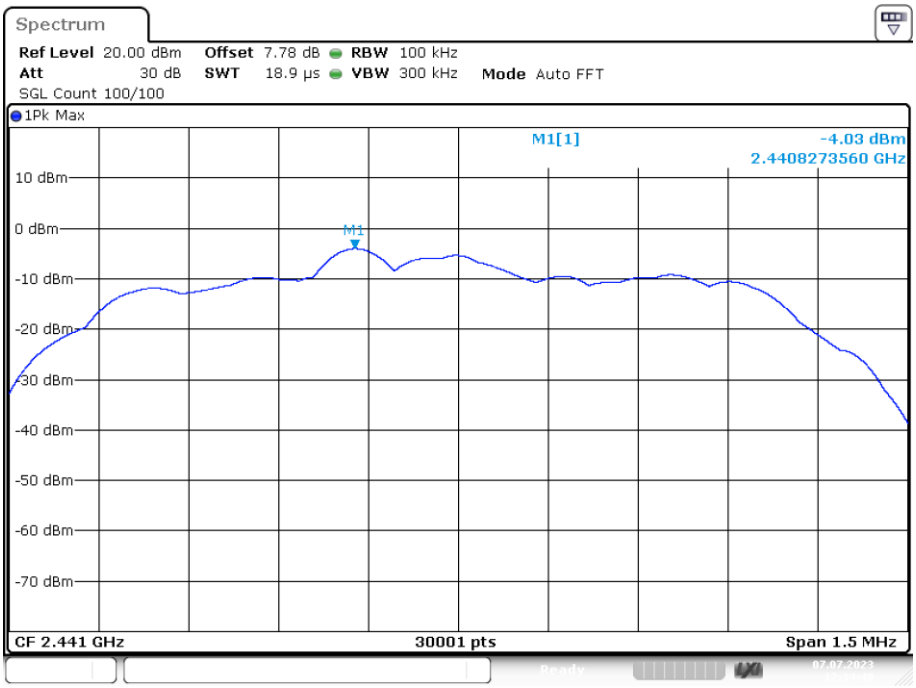


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40207 GHz	-4.43 dBm		
M2		1	21.997453 GHz	-37.51 dBm		
M3		1	4.711661 GHz	-41.49 dBm		
M4		1	7.289839 GHz	-41.00 dBm		
M5		1	9.719785 GHz	-41.38 dBm		

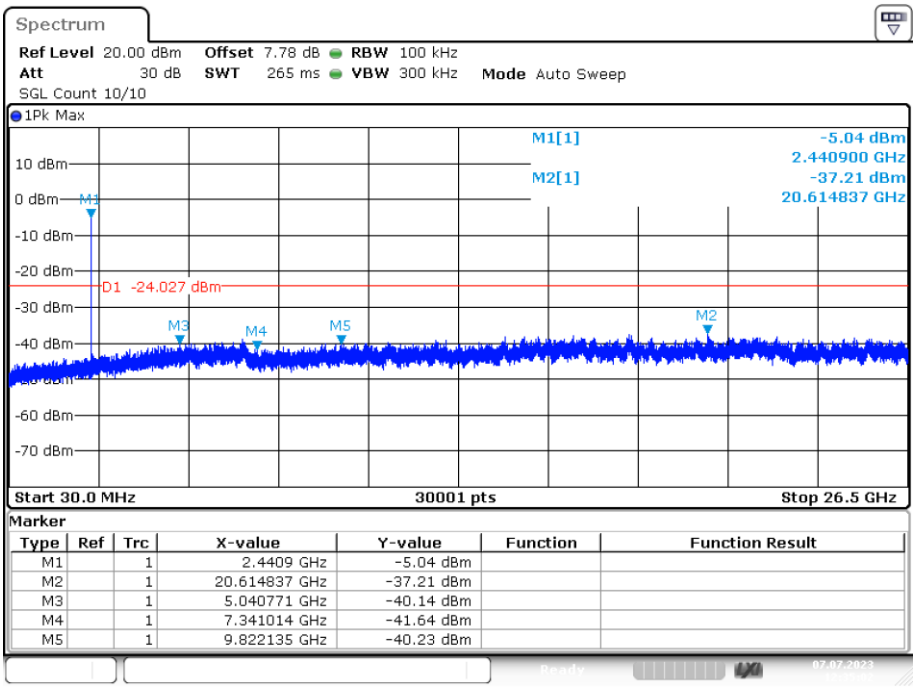
Date: 7.JUL.2023 12:30:19

Tx. Spurious NVNT 2-DH1 2441MHz Ant1 Ref



Date: 7.JUL.2023 12:34:49

Tx. Spurious NVNT 2-DH1 2441MHz Ant1 Emission

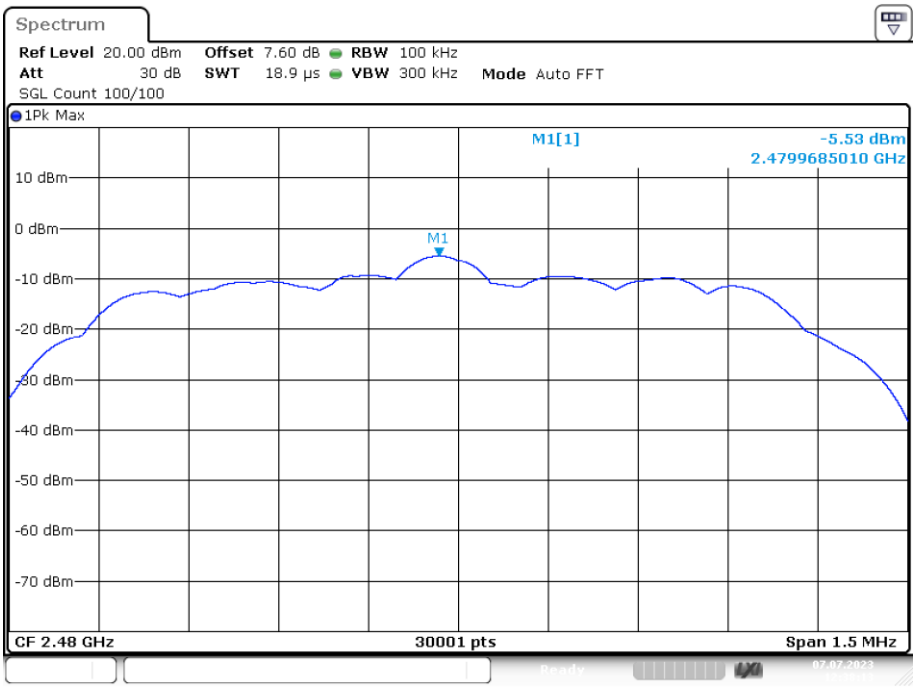


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4409 GHz	-5.04 dBm		
M2		1	20.614837 GHz	-37.21 dBm		
M3		1	5.040771 GHz	-40.14 dBm		
M4		1	7.341014 GHz	-41.64 dBm		
M5		1	9.822135 GHz	-40.23 dBm		

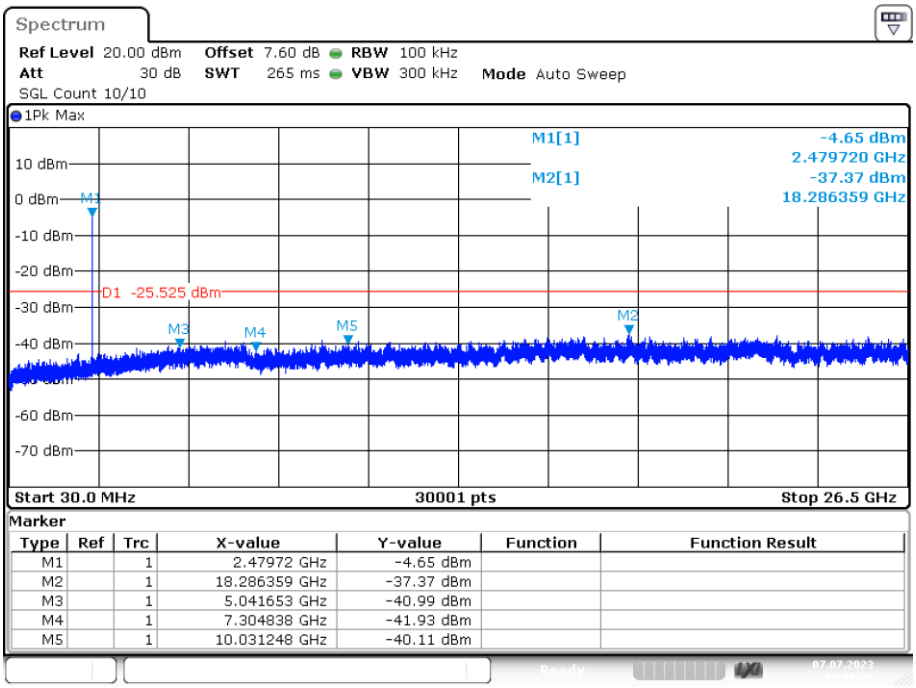
Date: 7.JUL.2023 12:35:03

Tx. Spurious NVNT 2-DH1 2480MHz Ant1 Ref



Date: 7.JUL.2023 12:38:13

Tx. Spurious NVNT 2-DH1 2480MHz Ant1 Emission

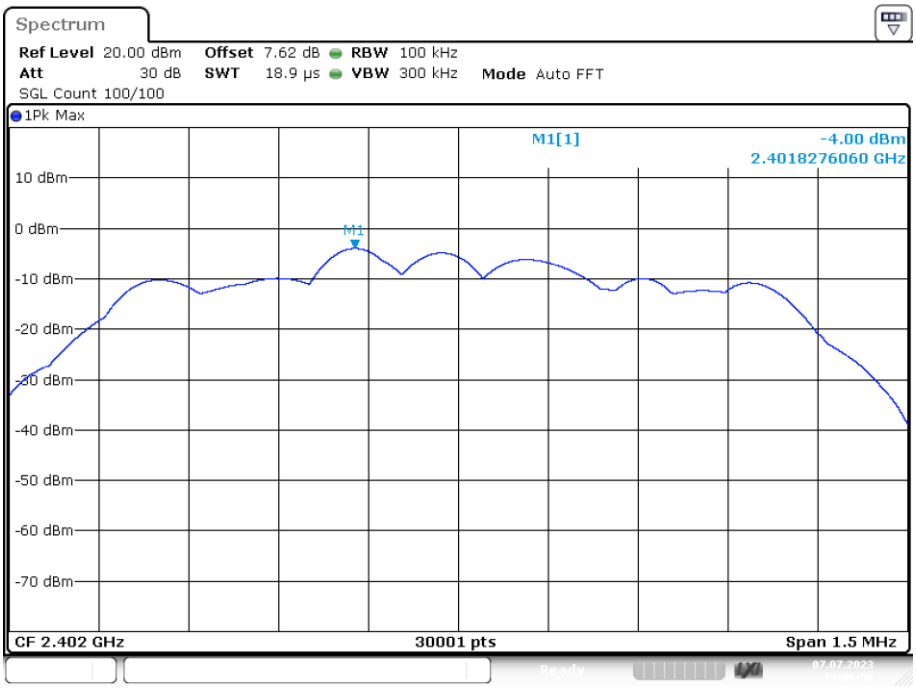


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47972 GHz	-4.65 dBm		
M2		1	18.286359 GHz	-37.37 dBm		
M3		1	5.041653 GHz	-40.99 dBm		
M4		1	7.304838 GHz	-41.93 dBm		
M5		1	10.031248 GHz	-40.11 dBm		

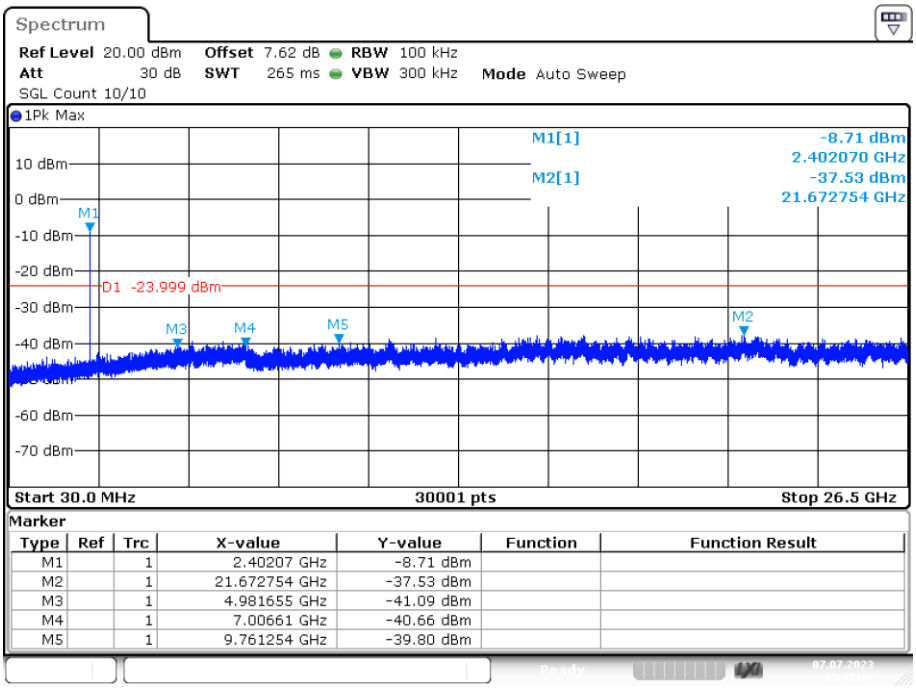
Date: 7.JUL.2023 12:38:27

Tx. Spurious NVNT 3-DH1 2402MHz Ant1 Ref



Date: 7.JUL.2023 13:06:57

Tx. Spurious NVNT 3-DH1 2402MHz Ant1 Emission

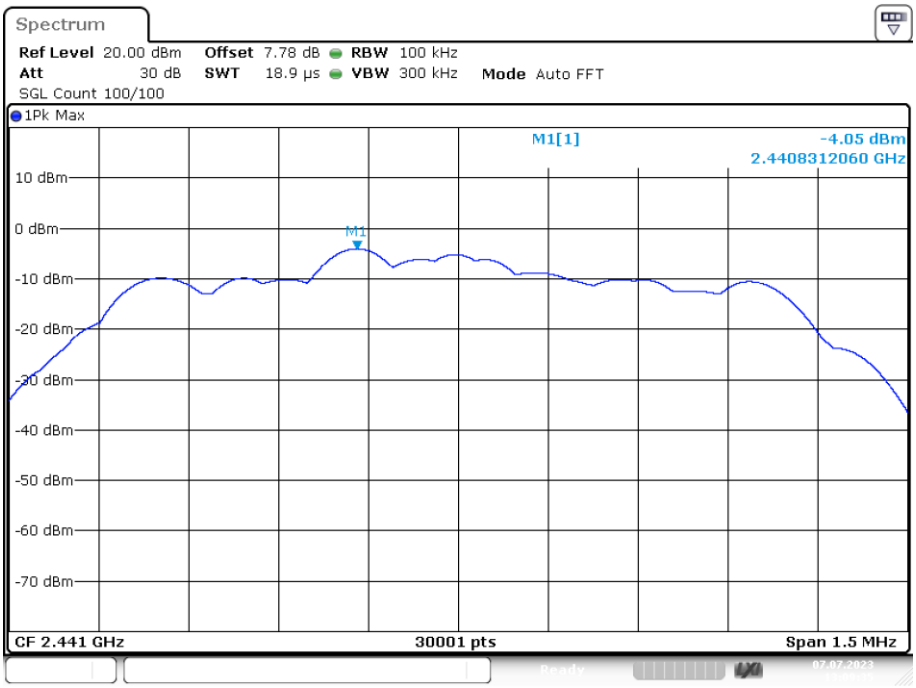


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40207 GHz	-8.71 dBm		
M2		1	21.672754 GHz	-37.53 dBm		
M3		1	4.981655 GHz	-41.09 dBm		
M4		1	7.00661 GHz	-40.66 dBm		
M5		1	9.761254 GHz	-39.80 dBm		

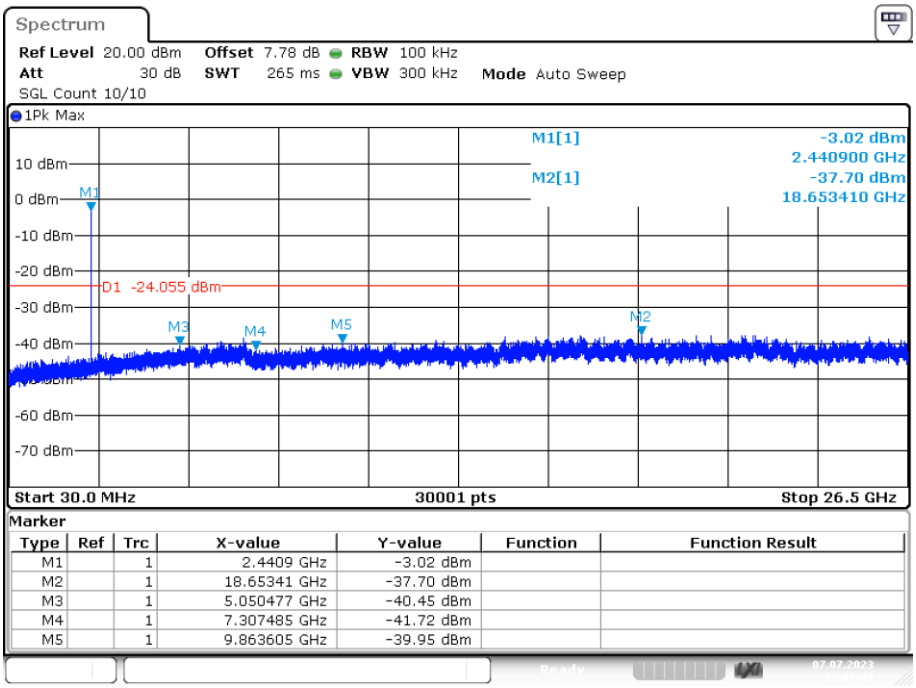
Date: 7.JUL.2023 13:07:10

Tx. Spurious NVNT 3-DH1 2441MHz Ant1 Ref



Date: 7.JUL.2023 13:09:35

Tx. Spurious NVNT 3-DH1 2441MHz Ant1 Emission

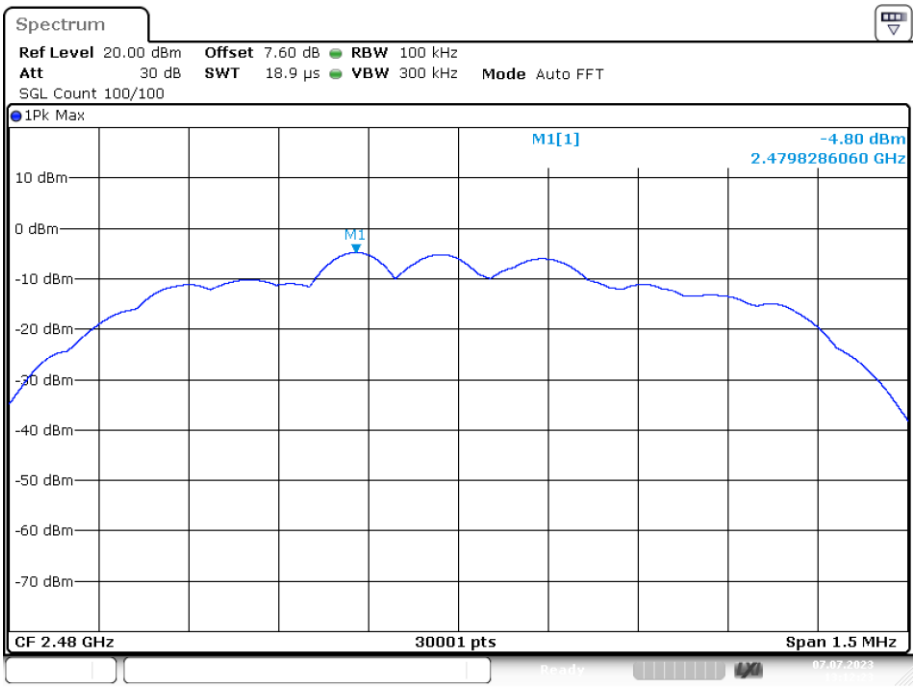


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4409 GHz	-3.02 dBm		
M2		1	18.65341 GHz	-37.70 dBm		
M3		1	5.050477 GHz	-40.45 dBm		
M4		1	7.307485 GHz	-41.72 dBm		
M5		1	9.863605 GHz	-39.95 dBm		

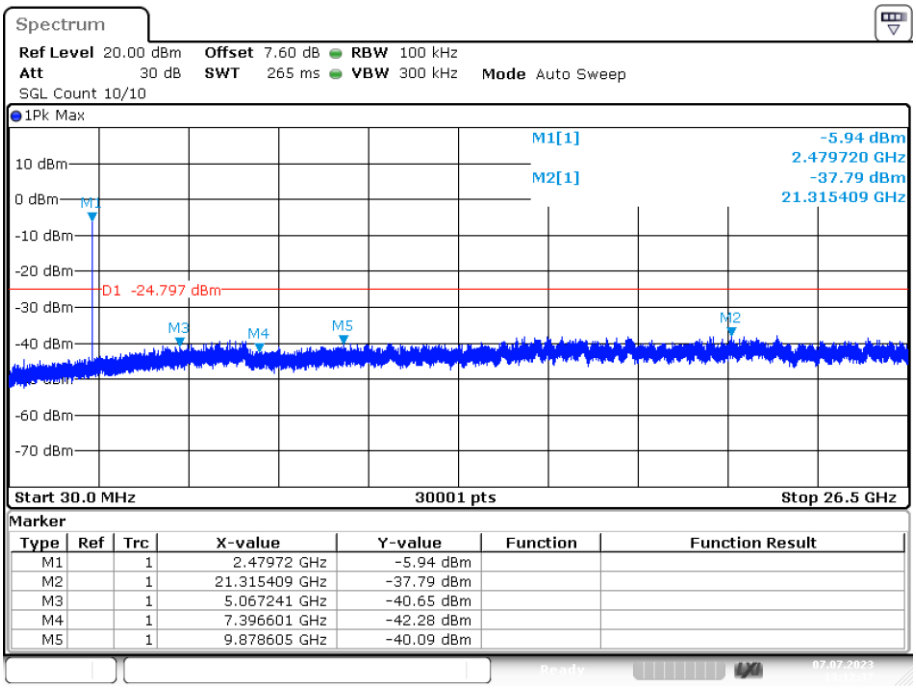
Date: 7.JUL.2023 13:09:48

Tx. Spurious NVNT 3-DH1 2480MHz Ant1 Ref



Date: 7.JUL.2023 13:12:24

Tx. Spurious NVNT 3-DH1 2480MHz Ant1 Emission



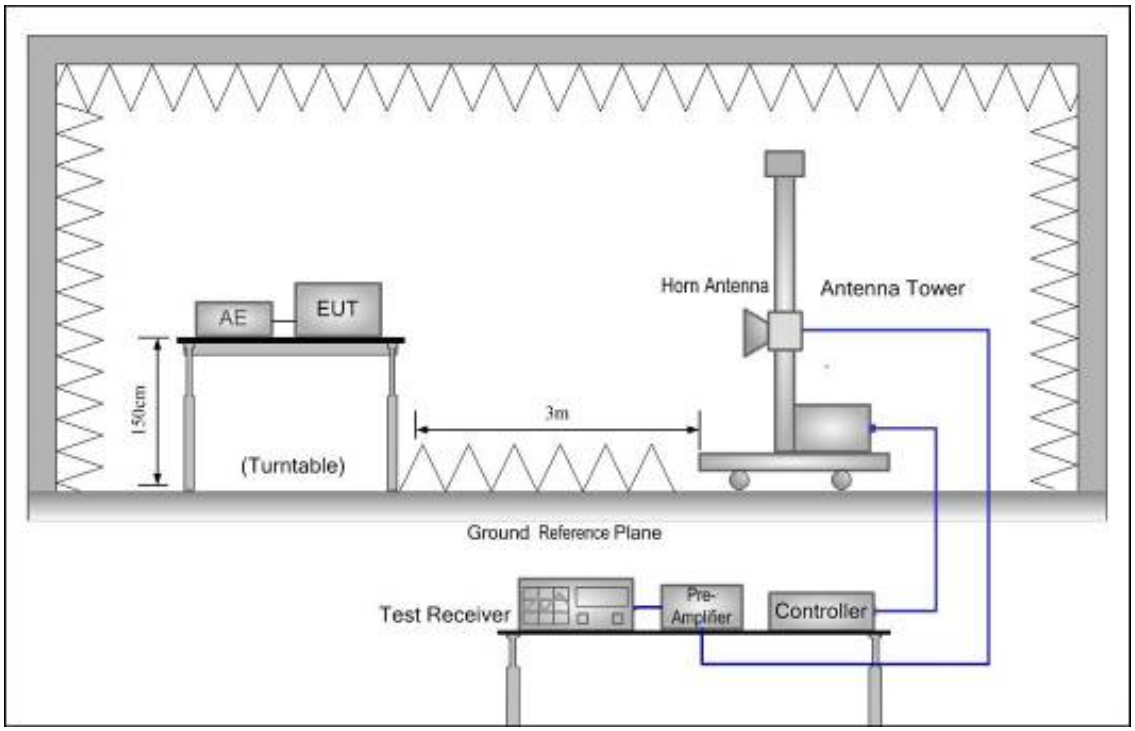
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47972 GHz	-5.94 dBm		
M2		1	21.315409 GHz	-37.79 dBm		
M3		1	5.067241 GHz	-40.65 dBm		
M4		1	7.396601 GHz	-42.28 dBm		
M5		1	9.878605 GHz	-40.09 dBm		

Date: 7.JUL.2023 13:12:37

9. BAND EDGE COMPLIANCE

9.1. Block Diagram of Test Setup



9.2. Limit

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

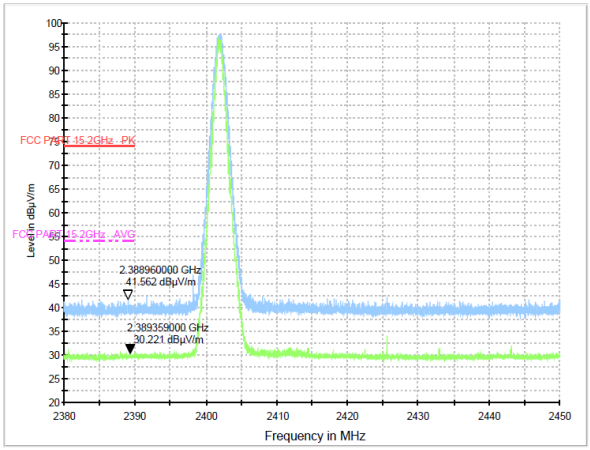
9.3. Test Procedure

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

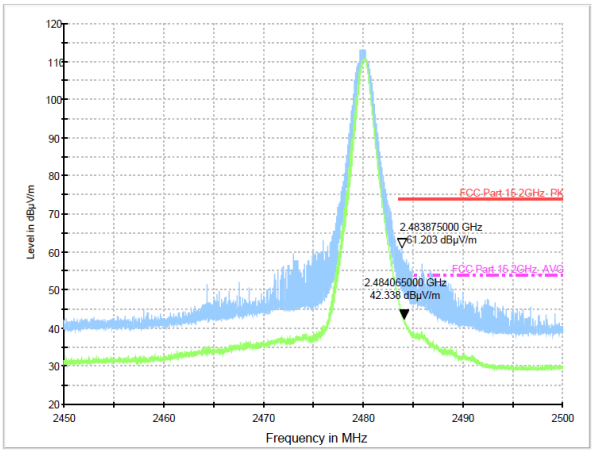
9.4. Test Result

PASS. (See below detailed test data)

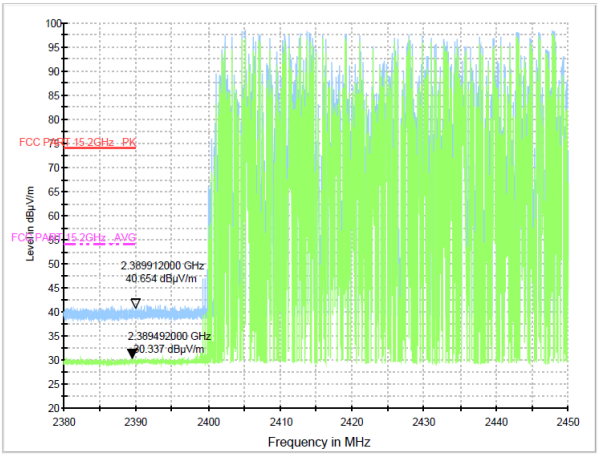
Test Mode: GFSK-Low Hopping-off



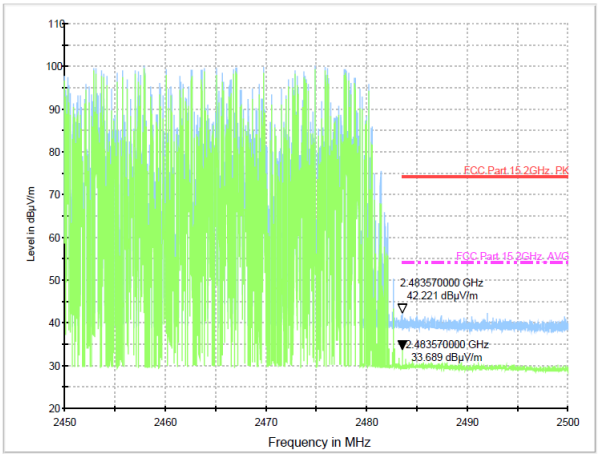
Test Mode: GFSK-High Hopping-off



Test Mode: GFSK-Low Hopping-on



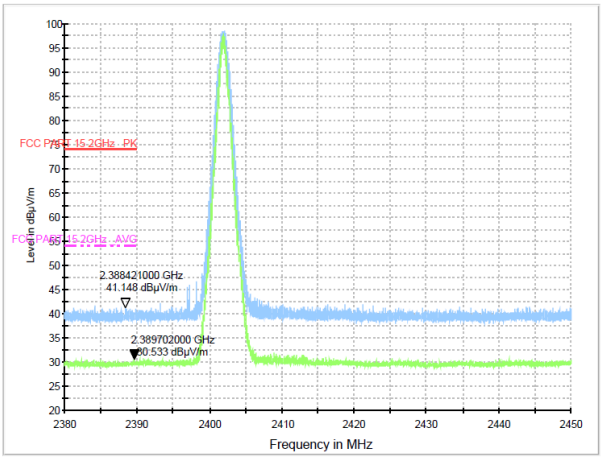
Test Mode: GFSK-High Hopping-on



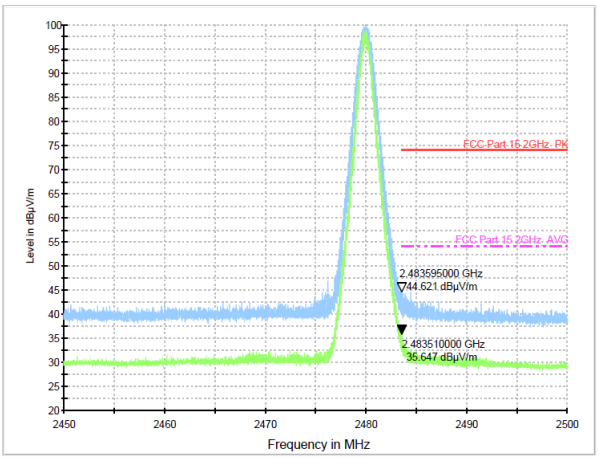
Note: 1. *:Maximum data; x:Over limit; !:over margin.

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

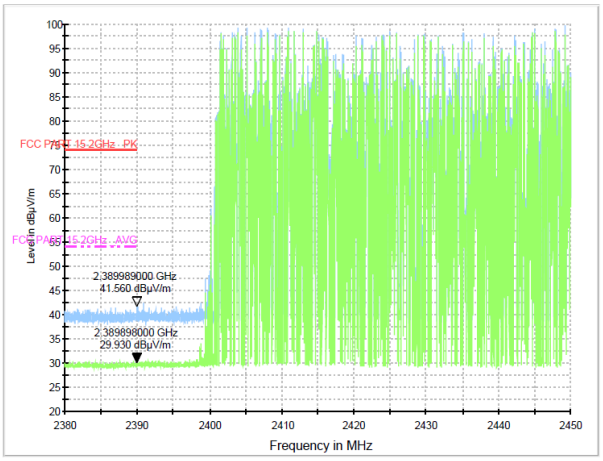
Test Mode: π/4 DQPSK-Low Hopping-off



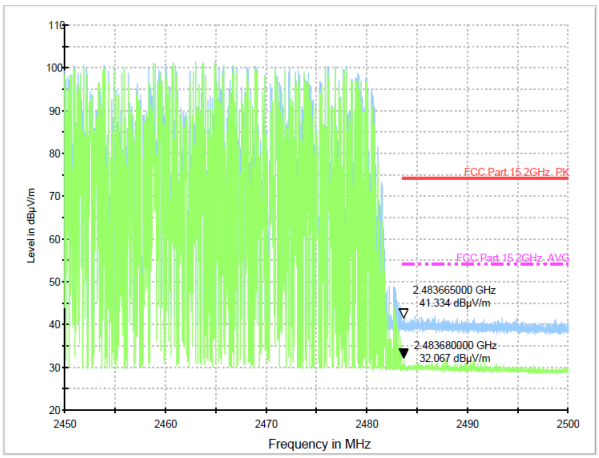
Test Mode: π/4 DQPSK-High Hopping-off



Test Mode: π/4 DQPSK-Low Hopping-on



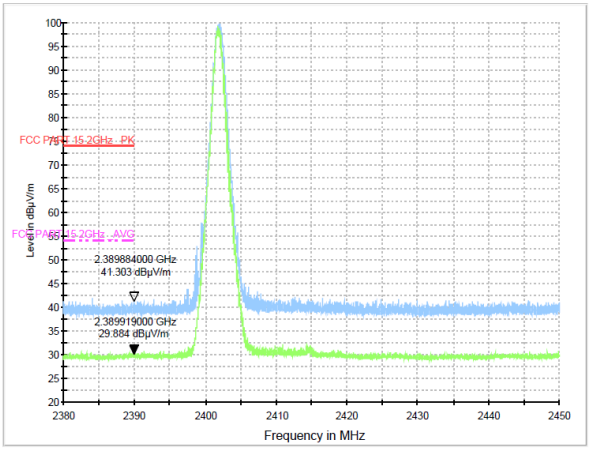
Test Mode: π/4 DQPSK-High Hopping-on



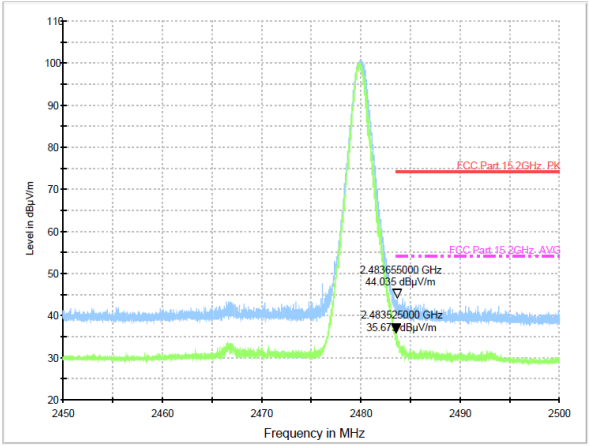
Note: 1. *:Maximum data; x:Over limit; !:over margin.

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

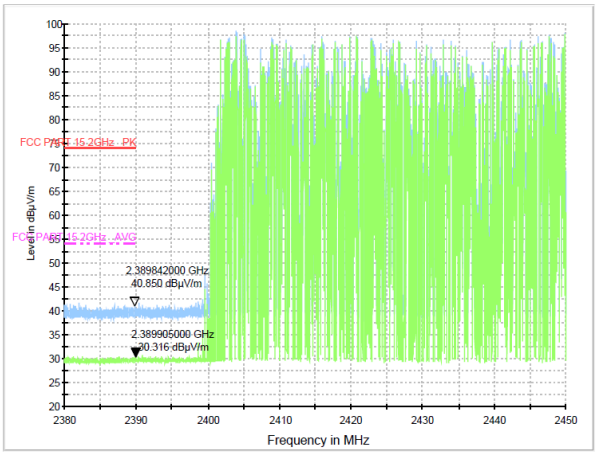
Test Mode: 8DPSK-Low Hopping-off



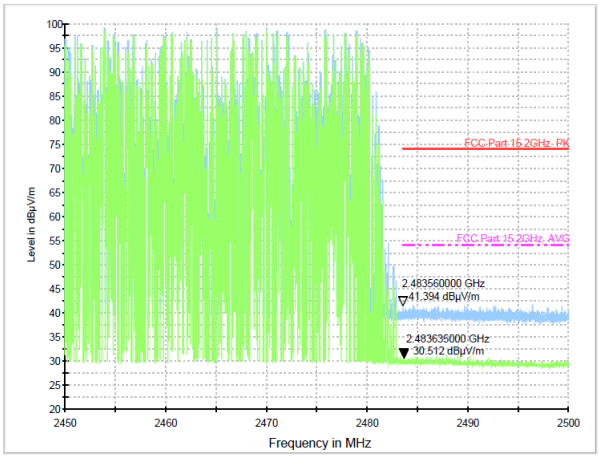
Test Mode: 8DPSK-High Hopping-off



Test Mode: 8DPSK-Low Hopping-on



Test Mode: 8DPSK-High Hopping-on

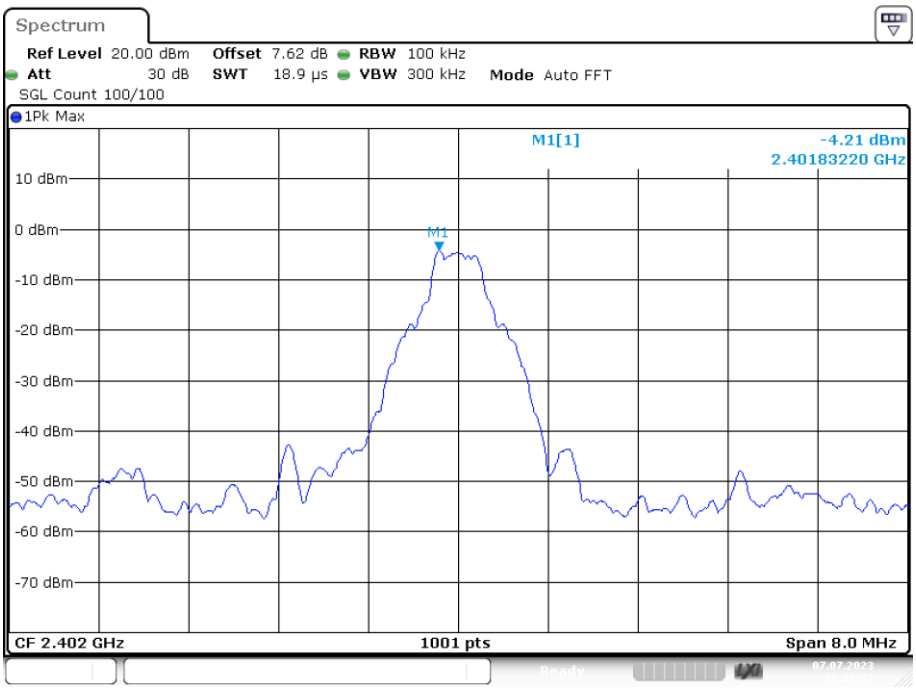


Note: 1. *:Maximum data; x:Over limit; !:over margin.

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

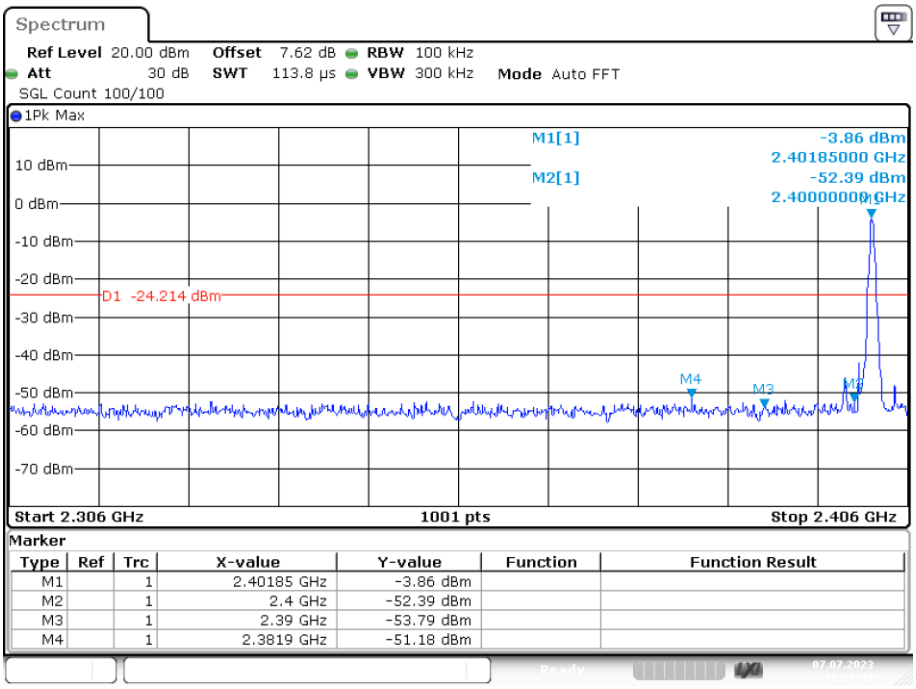
Conducted Method

Band Edge NVNT 1-DH1 2402MHz Ant1 No-Hopping Ref



Date: 7.JUL.2023 12:23:38

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

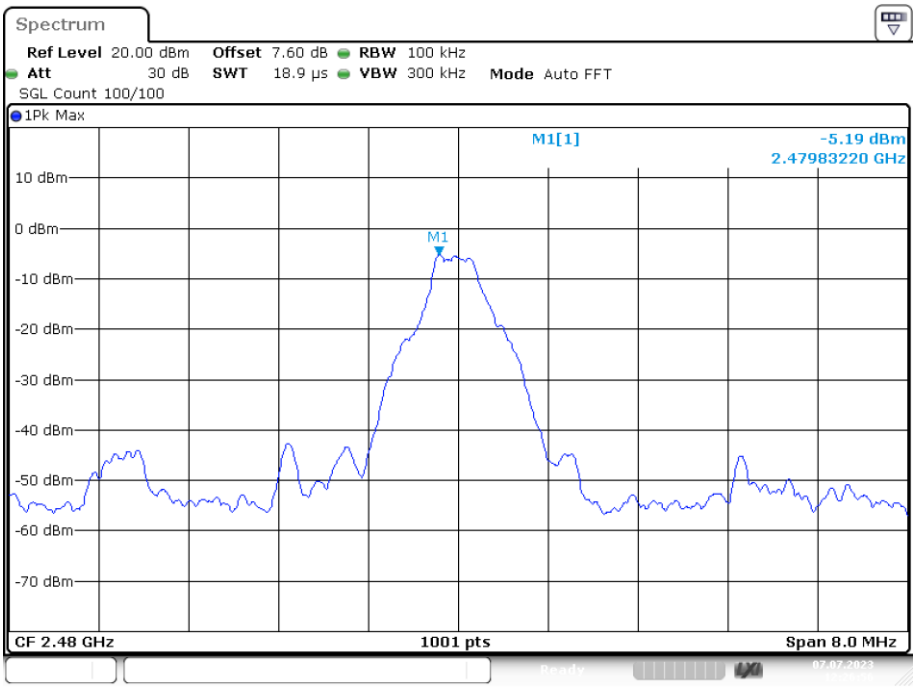


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40185 GHz	-3.86 dBm		
M2		1	2.4 GHz	-52.39 dBm		
M3		1	2.39 GHz	-53.79 dBm		
M4		1	2.3819 GHz	-51.18 dBm		

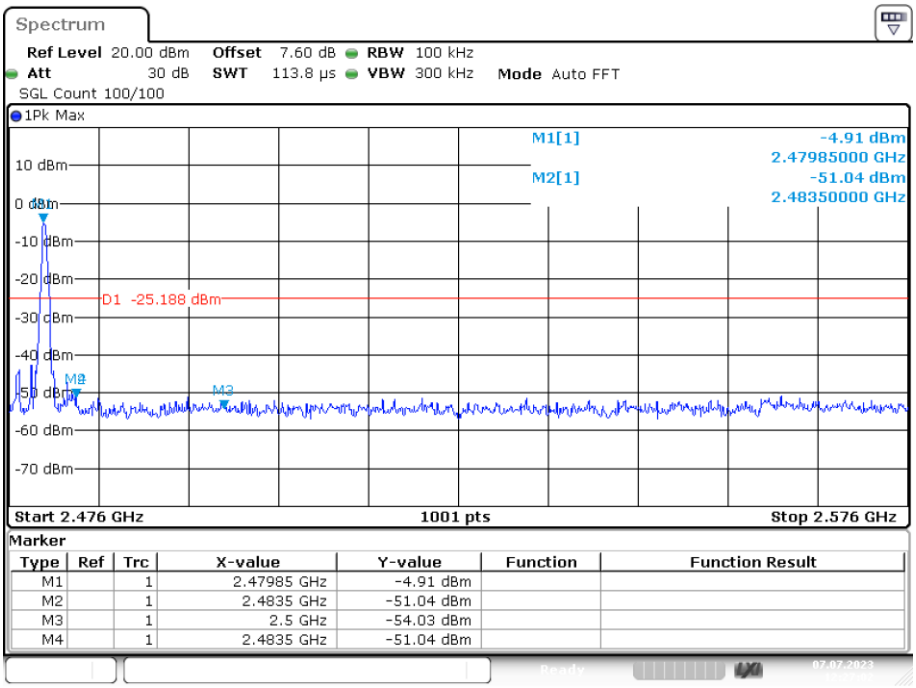
Date: 7.JUL.2023 12:23:43

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



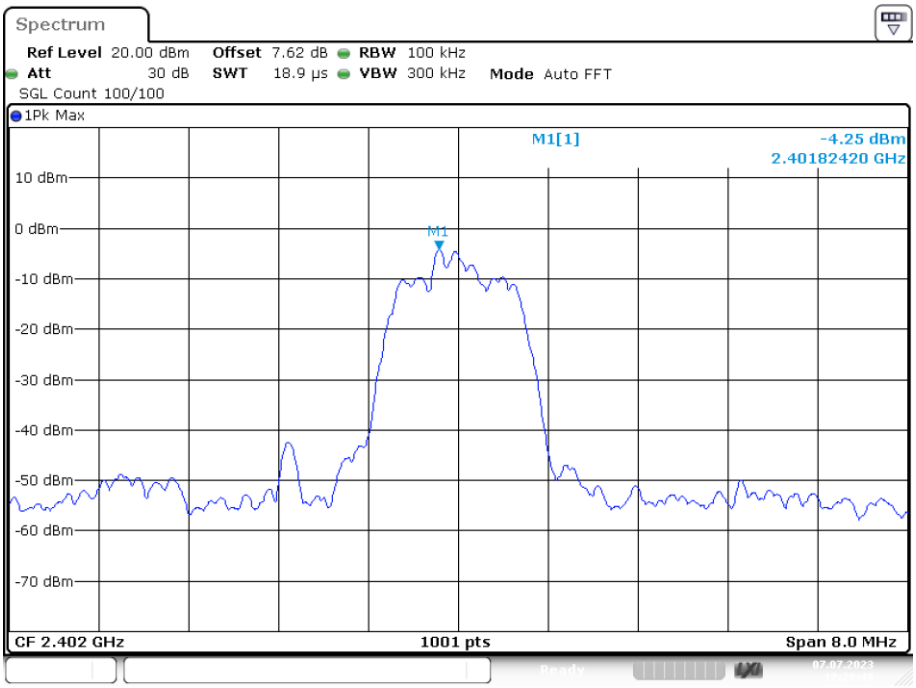
Date: 7.JUL.2023 12:26:57

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



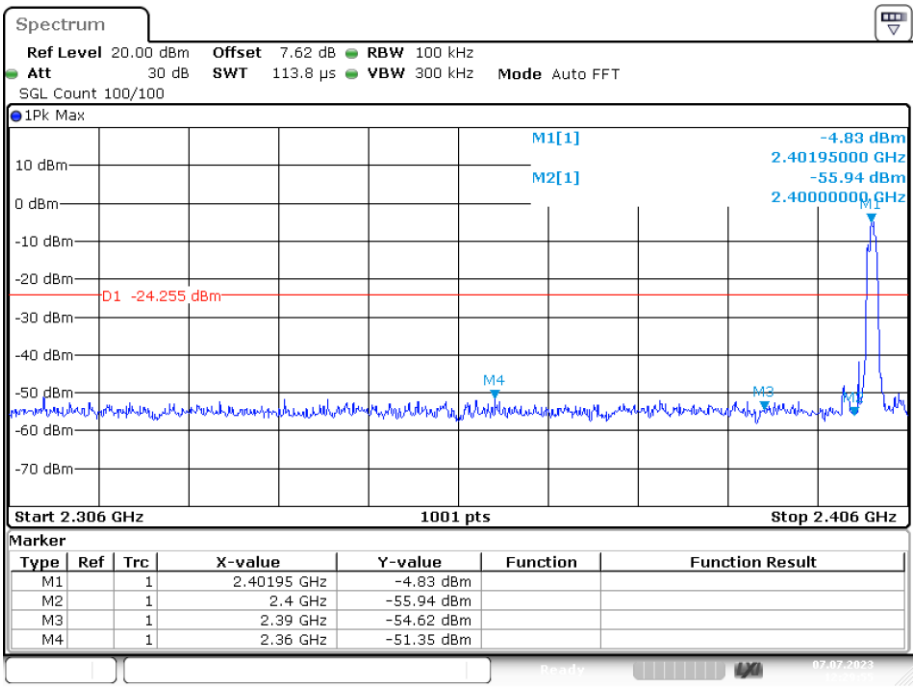
Date: 7.JUL.2023 12:27:02

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



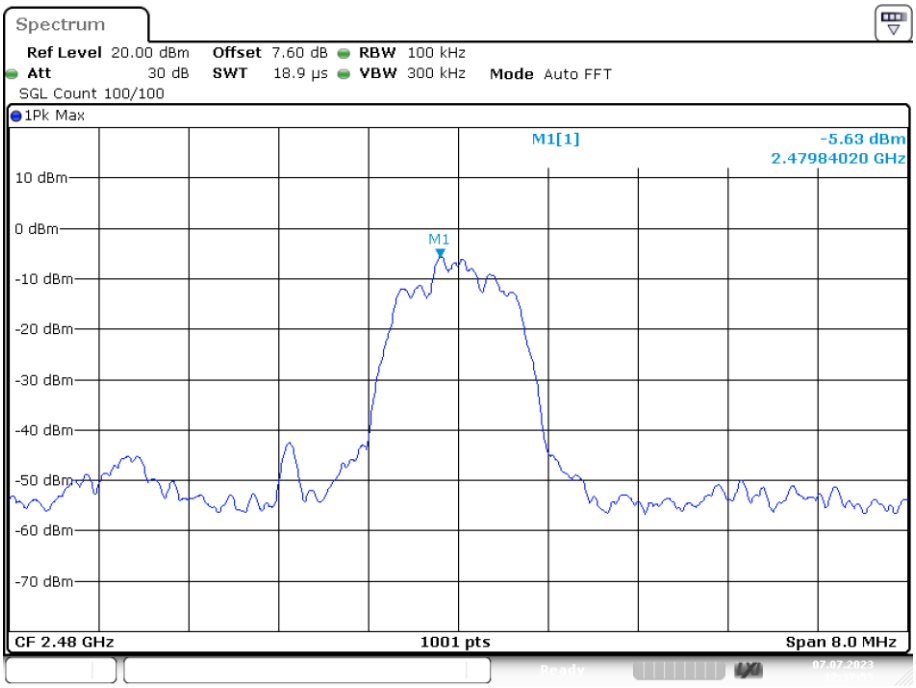
Date: 7.JUL.2023 12:29:48

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



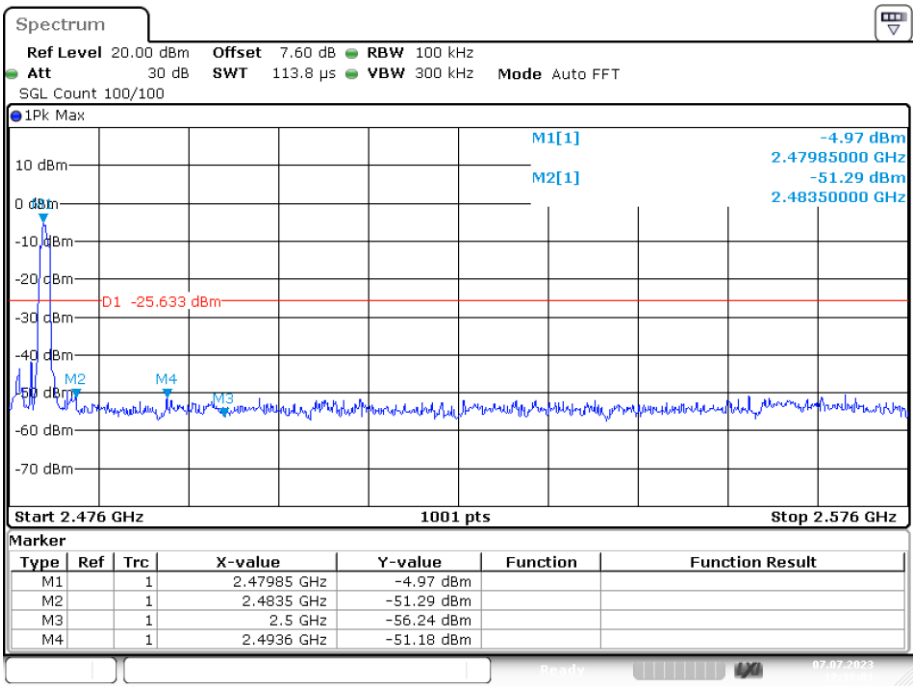
Date: 7.JUL.2023 12:29:54

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



Date: 7.JUL.2023 12:37:54

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

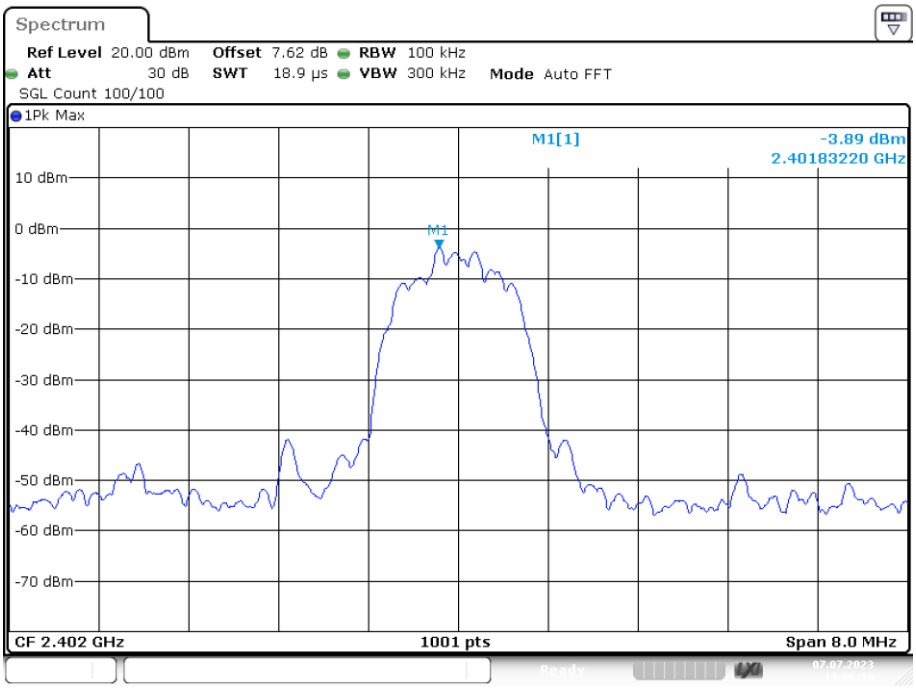


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47985 GHz	-4.97 dBm		
M2		1	2.4835 GHz	-51.29 dBm		
M3		1	2.5 GHz	-56.24 dBm		
M4		1	2.4936 GHz	-51.18 dBm		

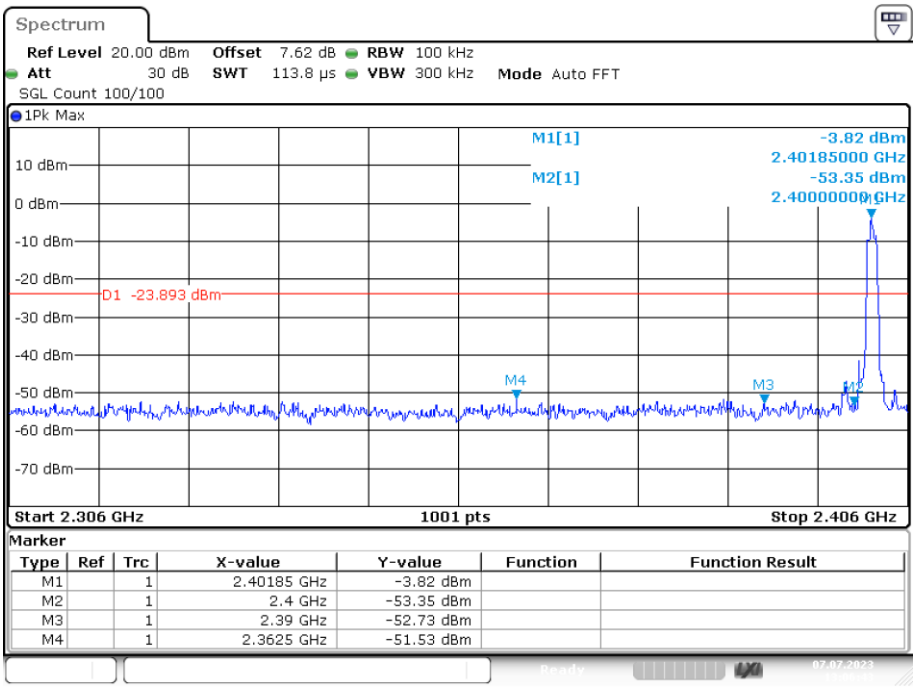
Date: 7.JUL.2023 12:38:00

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



Date: 7.JUL.2023 13:06:37

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

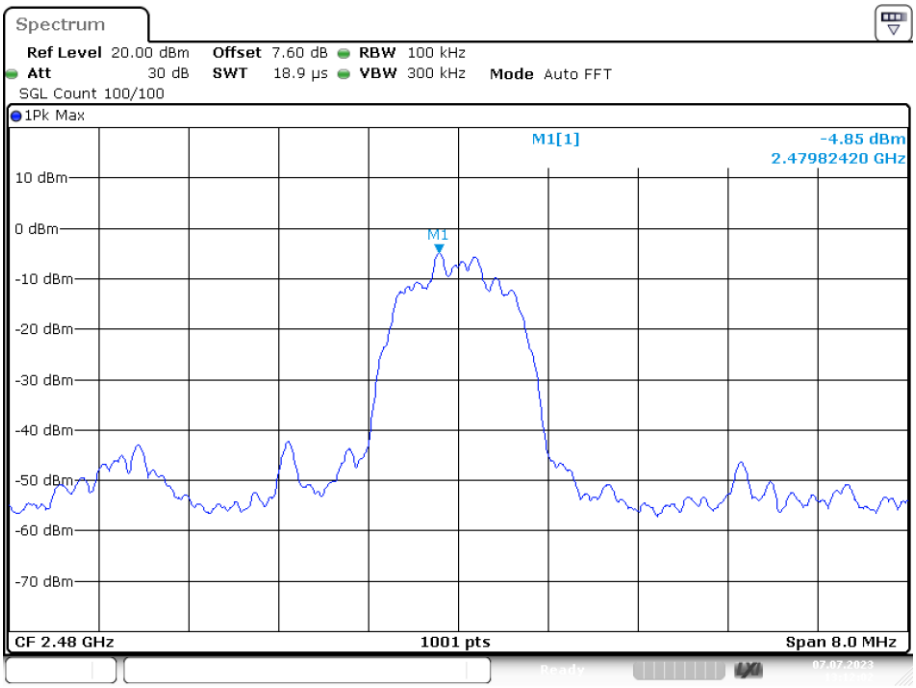


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40185 GHz	-3.82 dBm		
M2		1	2.4 GHz	-53.35 dBm		
M3		1	2.39 GHz	-52.73 dBm		
M4		1	2.3625 GHz	-51.53 dBm		

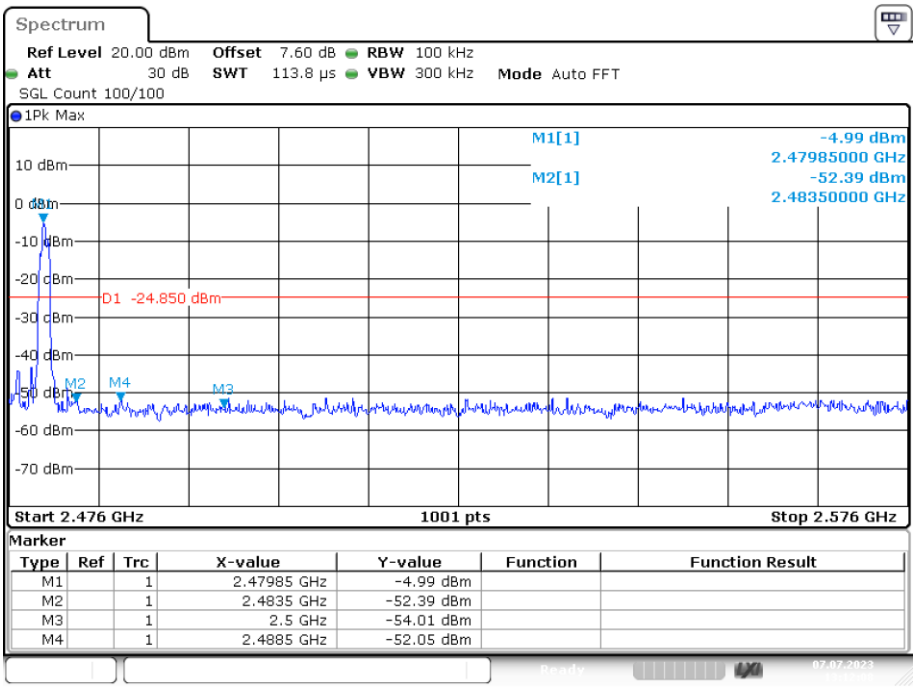
Date: 7.JUL.2023 13:06:43

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



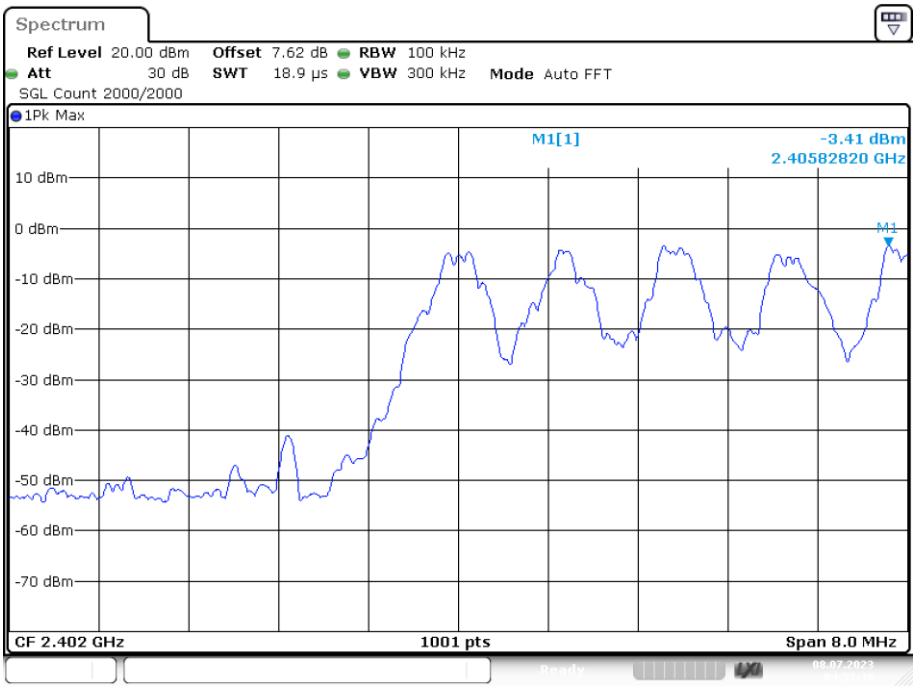
Date: 7.JUL.2023 13:12:02

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



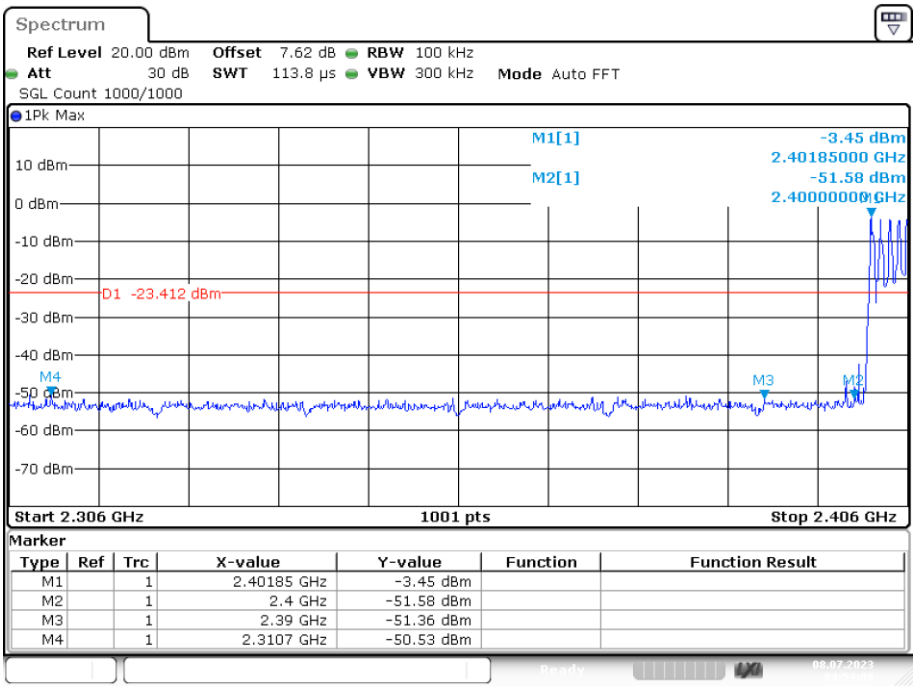
Date: 7.JUL.2023 13:12:08

Band Edge(Hopping) NVNT 1-DH1 2402MHz Ant1 Hopping Ref



Date: 8.JUL.2023 04:53:39

Band Edge(Hopping) NVNT 1-DH1 2402MHz Ant1 Hopping Emission

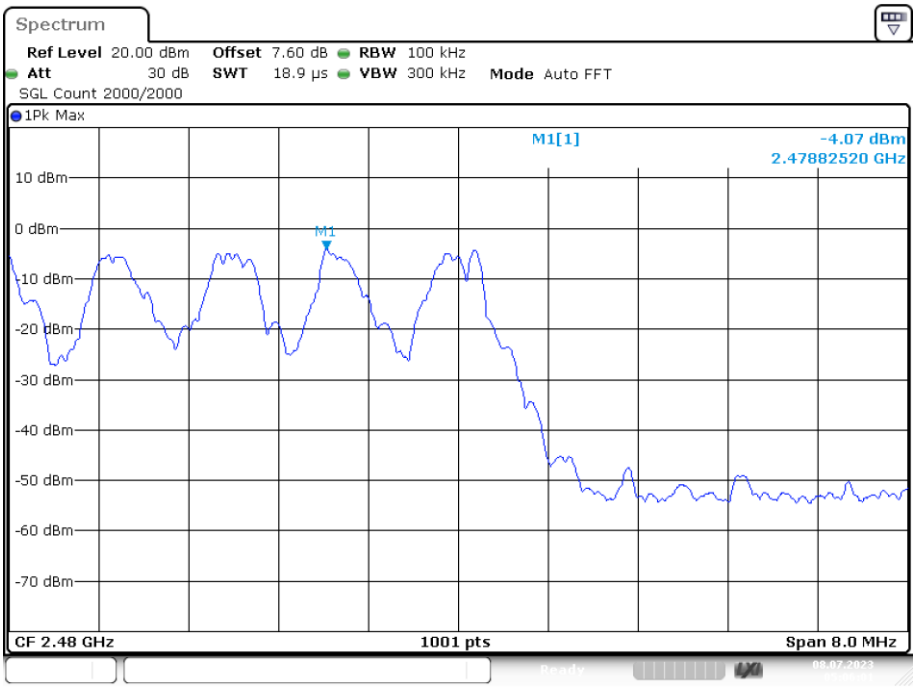


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40185 GHz	-3.45 dBm		
M2		1	2.4 GHz	-51.58 dBm		
M3		1	2.39 GHz	-51.36 dBm		
M4		1	2.3107 GHz	-50.53 dBm		

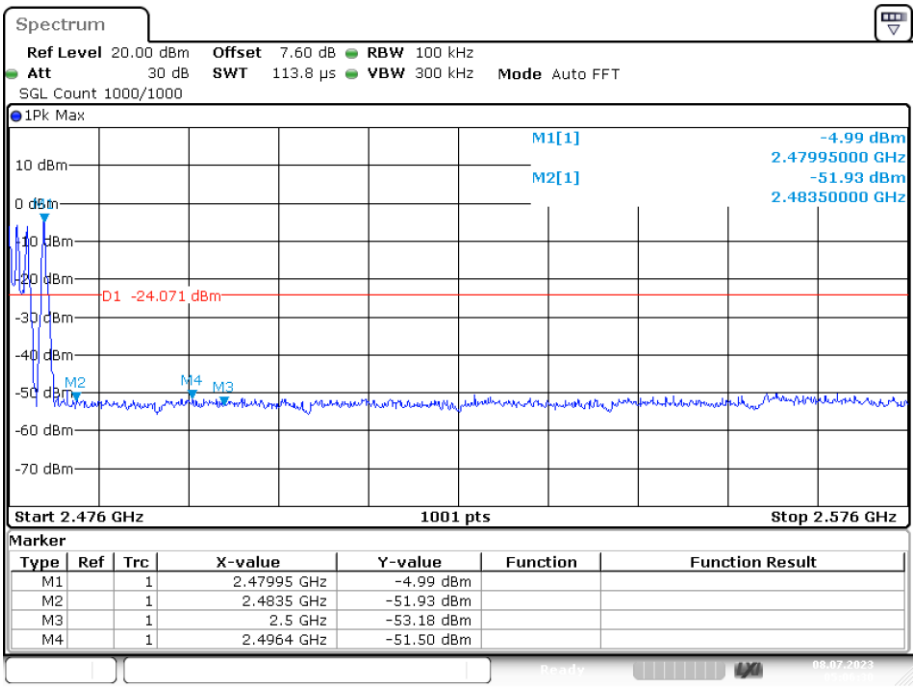
Date: 8.JUL.2023 04:54:09

Band Edge(Hopping) NVNT 1-DH1 2480MHz Ant1 Hopping Ref



Date: 8.JUL.2023 05:06:01

Band Edge(Hopping) NVNT 1-DH1 2480MHz Ant1 Hopping Emission

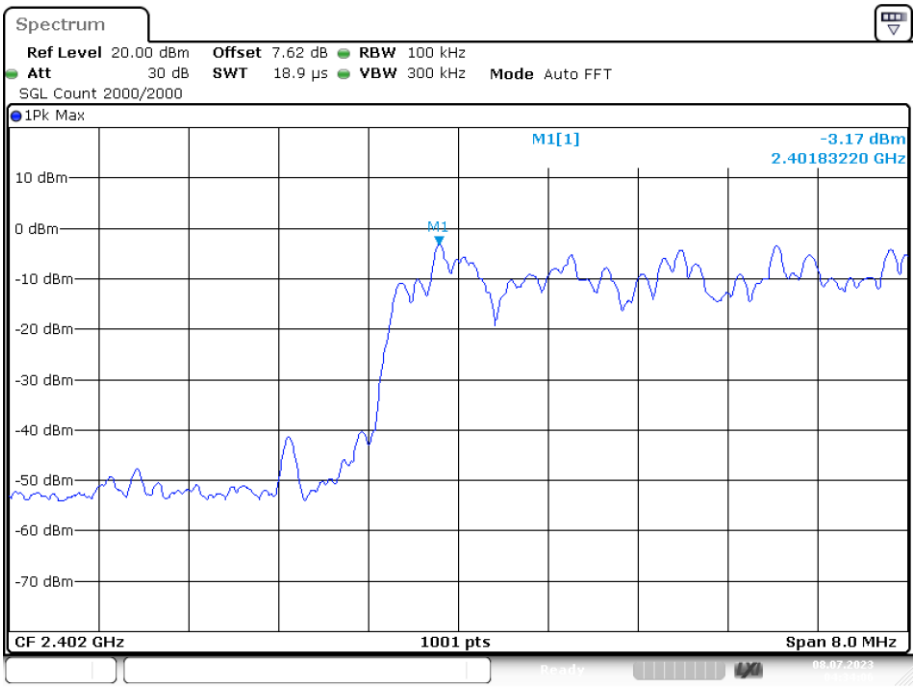


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47995 GHz	-4.99 dBm		
M2		1	2.4835 GHz	-51.93 dBm		
M3		1	2.5 GHz	-53.18 dBm		
M4		1	2.4964 GHz	-51.50 dBm		

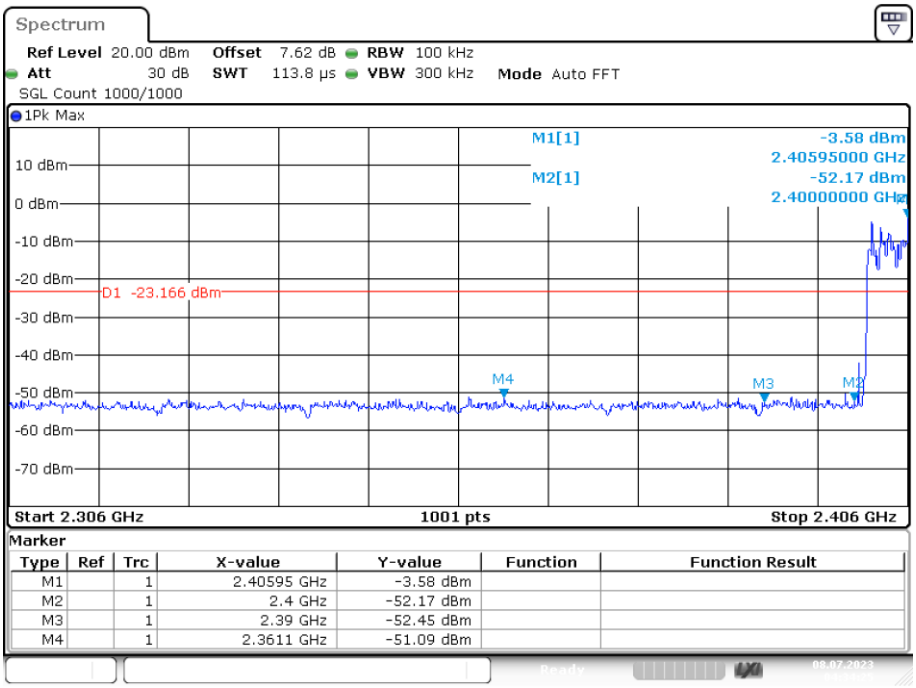
Date: 8.JUL.2023 05:06:30

Band Edge(Hopping) NVNT 2-DH1 2402MHz Ant1 Hopping Ref



Date: 8.JUL.2023 04:34:06

Band Edge(Hopping) NVNT 2-DH1 2402MHz Ant1 Hopping Emission

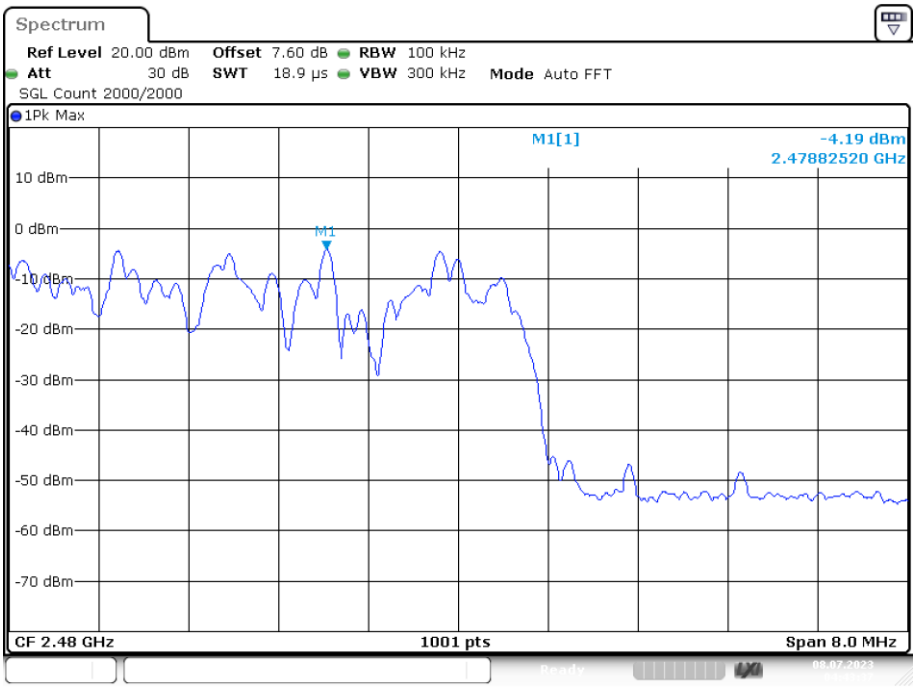


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40595 GHz	-3.58 dBm		
M2		1	2.4 GHz	-52.17 dBm		
M3		1	2.39 GHz	-52.45 dBm		
M4		1	2.3611 GHz	-51.09 dBm		

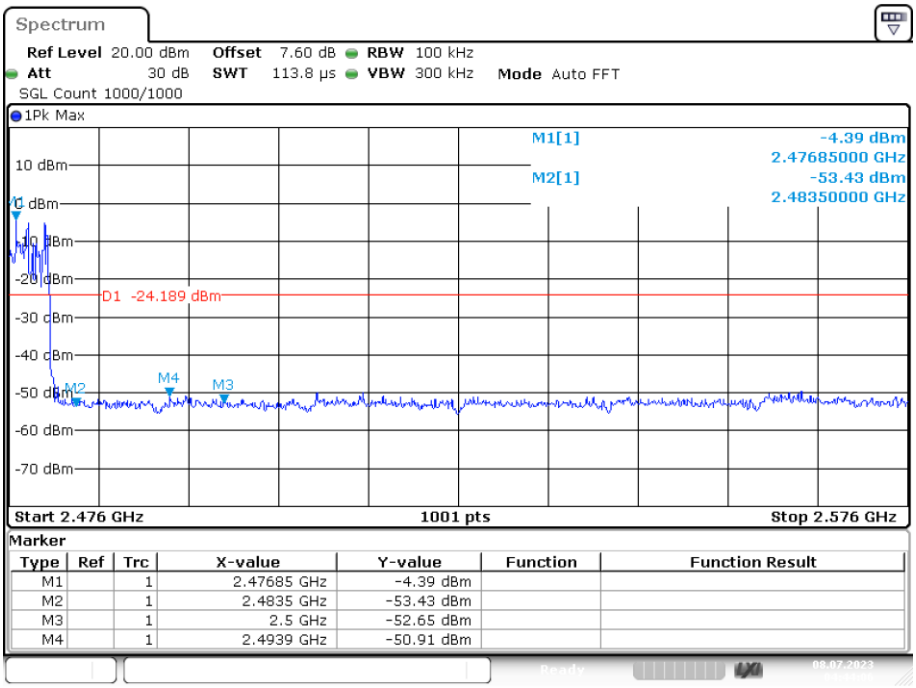
Date: 8.JUL.2023 04:34:25

Band Edge(Hopping) NVNT 2-DH1 2480MHz Ant1 Hopping Ref



Date: 8.JUL.2023 04:43:37

Band Edge(Hopping) NVNT 2-DH1 2480MHz Ant1 Hopping Emission

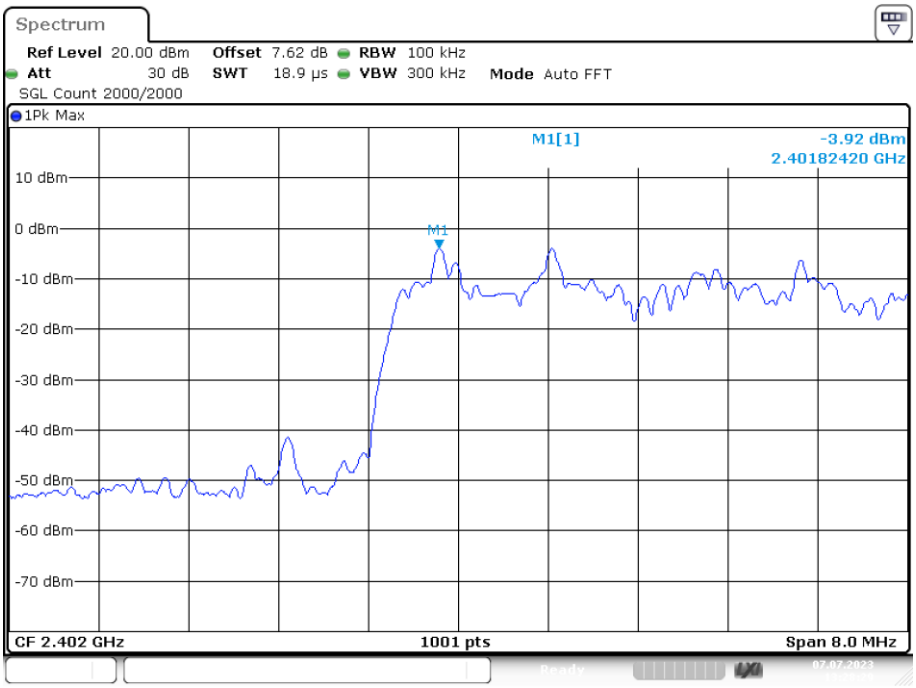


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47685 GHz	-4.39 dBm		
M2		1	2.4835 GHz	-53.43 dBm		
M3		1	2.5 GHz	-52.65 dBm		
M4		1	2.4939 GHz	-50.91 dBm		

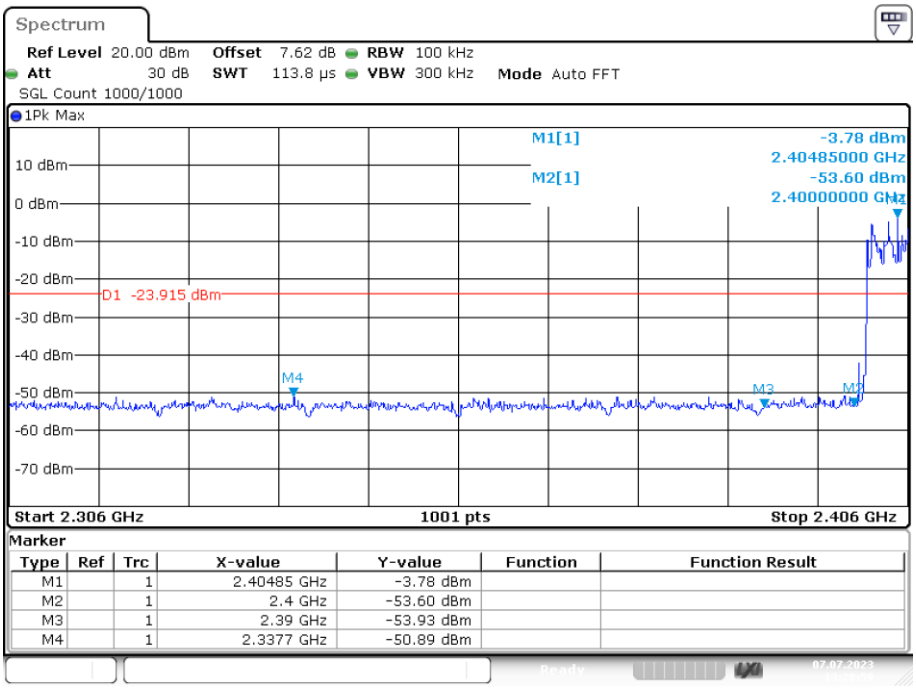
Date: 8.JUL.2023 04:44:06

Band Edge(Hopping) NVNT 3-DH1 2402MHz Ant1 Hopping Ref



Date: 7.JUL.2023 13:28:29

Band Edge(Hopping) NVNT 3-DH1 2402MHz Ant1 Hopping Emission

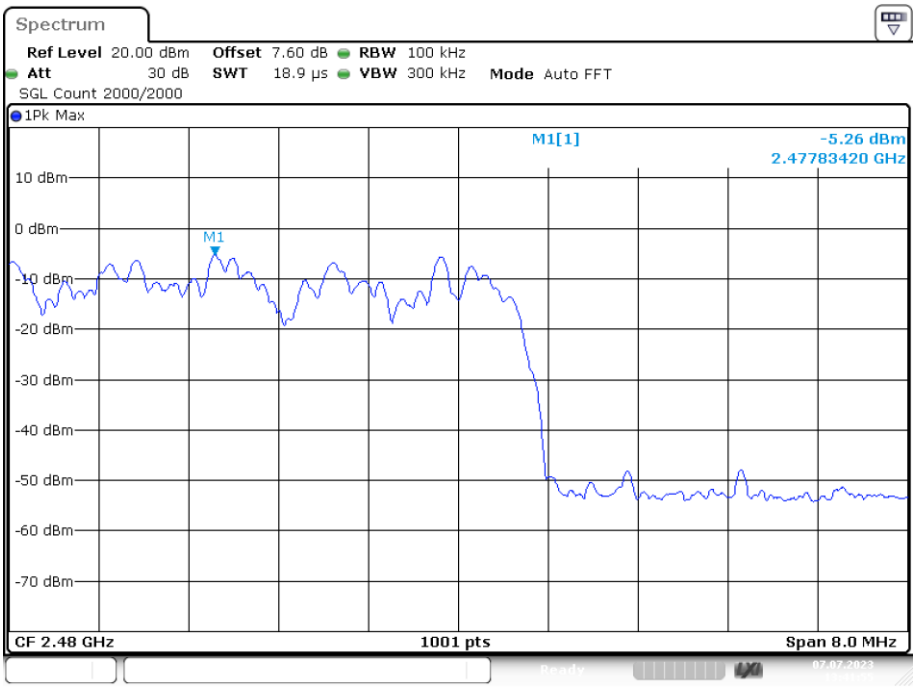


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40485 GHz	-3.78 dBm		
M2		1	2.4 GHz	-53.60 dBm		
M3		1	2.39 GHz	-53.93 dBm		
M4		1	2.3377 GHz	-50.89 dBm		

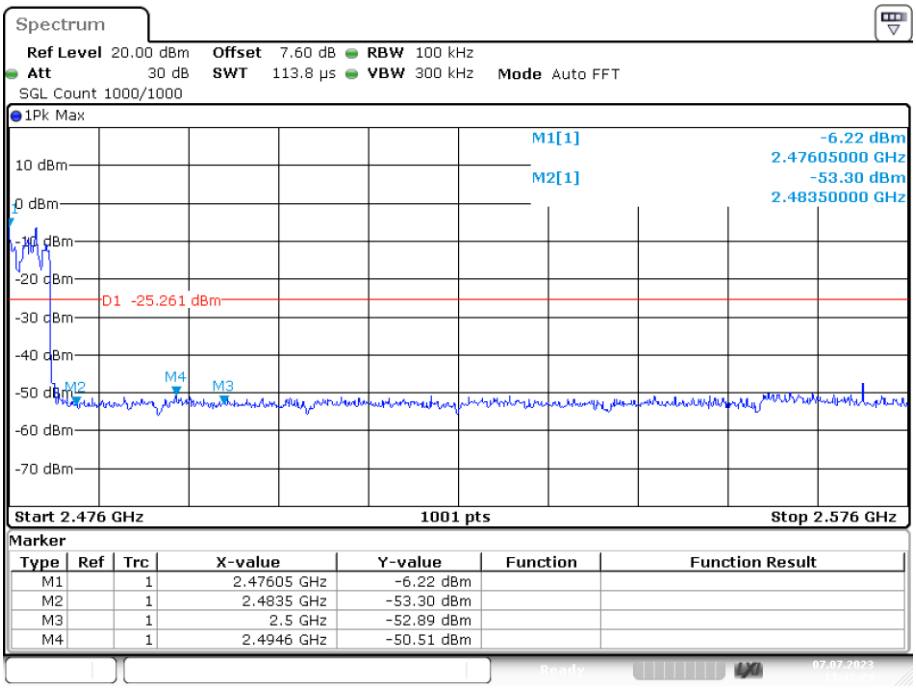
Date: 7.JUL.2023 13:28:58

Band Edge(Hopping) NVNT 3-DH1 2480MHz Ant1 Hopping Ref



Date: 7.JUL.2023 13:41:54

Band Edge(Hopping) NVNT 3-DH1 2480MHz Ant1 Hopping Emission



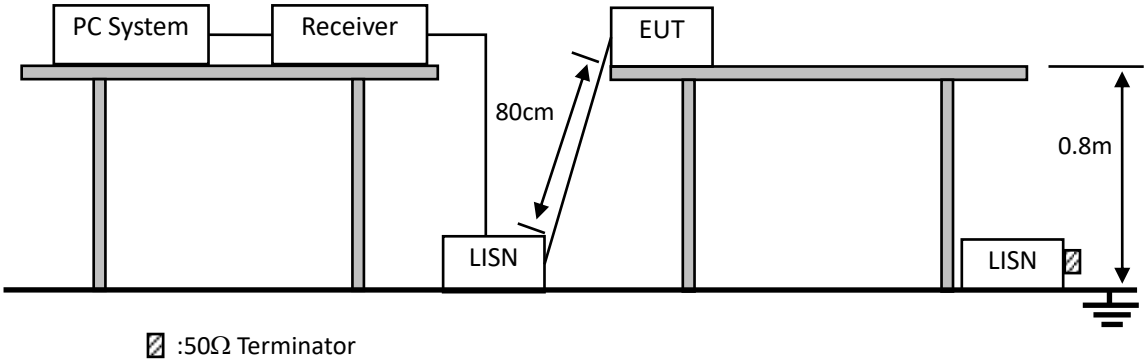
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47605 GHz	-6.22 dBm		
M2		1	2.4835 GHz	-53.30 dBm		
M3		1	2.5 GHz	-52.89 dBm		
M4		1	2.4946 GHz	-50.51 dBm		

Date: 7.JUL.2023 13:42:23

10. POWER LINE CONDUCTED EMISSIONS

10.1.Block Diagram of Test Setup



10.2.Limit

Frequency	Maximum RF Line Voltage	
	Quasi-Peak Level dB(μV)	Average Level dB(μV)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Notes: 1. * Decreasing linearly with logarithm of frequency.
2. The lower limit shall apply at the transition frequencies.

10.3.Test Procedure

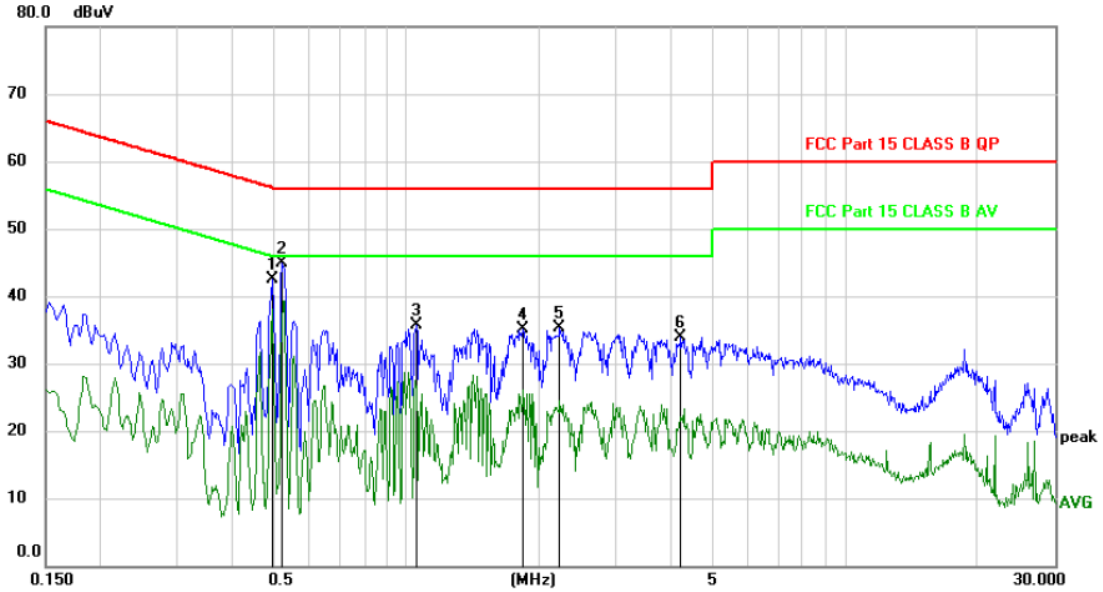
(1) The EUT was placed on a non-metallic table, 80cm above the ground plane.
(2) Setup the EUT and simulator as shown in 10.1
(3) The EUT Power connected to the power mains through a power adapter and a line impedance stabilization network (L.I.S.N1). The other peripheral devices power cord connected to the power mains through a line impedance stabilization network (L.I.S.N2), this provided a 50-ohm coupling impedance for the EUT (Please refer to the block diagram of the test setup and photographs). Both sides of power line were checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10 :2013on conducted Emission test.
(4) The bandwidth of test receiver is set at 10KHz.
(5) The frequency range from 150 KHz to 30MHz is checked.

10.4.Test Result

PASS. (See below detailed test data)

Note: If peak Result comply with AV limit, QP and AV Result is deemed to comply with AV limit

Line:

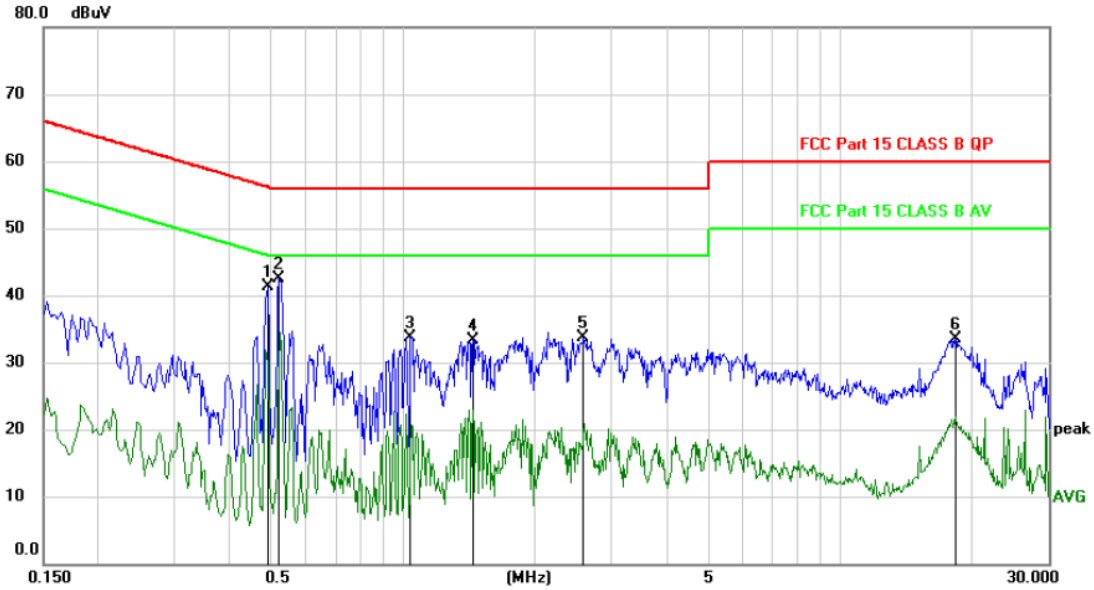


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.4950	32.70	9.83	42.53	56.08	-13.55	peak	
2	*	0.5190	35.04	9.83	44.87	56.00	-11.13	peak	
3		1.0500	25.79	9.83	35.62	56.00	-20.38	peak	
4		1.8420	25.33	9.78	35.11	56.00	-20.89	peak	
5		2.2349	25.49	9.77	35.26	56.00	-20.74	peak	
6		4.2150	24.06	9.85	33.91	56.00	-22.09	peak	

*:Maximum data x:Over limit !:over margin 〈Reference Only

Note: Measurement=Reading Level+Correc Factor. Factor=(LISN or ISN or PLC or Current Probe)Factor+Cable

Neutral:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.4890	31.45	9.83	41.28	56.18	-14.90	peak	
2	*	0.5190	32.73	9.83	42.56	56.00	-13.44	peak	
3		1.0410	23.96	9.84	33.80	56.00	-22.20	peak	
4		1.4460	23.54	9.81	33.35	56.00	-22.65	peak	
5		2.5830	23.97	9.79	33.76	56.00	-22.24	peak	
6		18.3300	23.36	10.09	33.45	60.00	-26.55	peak	

*:Maximum data x:Over limit !:over margin 〈Reference Only

Note: Measurement=Reading Level+Correc Factor. Factor=(LISN or ISN or PLC or Current Probe)Factor+Cable

Note: All modes and channels have been tested and only the GFSK 2402MHz mode with the worst data is listed.

11. ANTENNA REQUIREMENTS

11.1.Limit

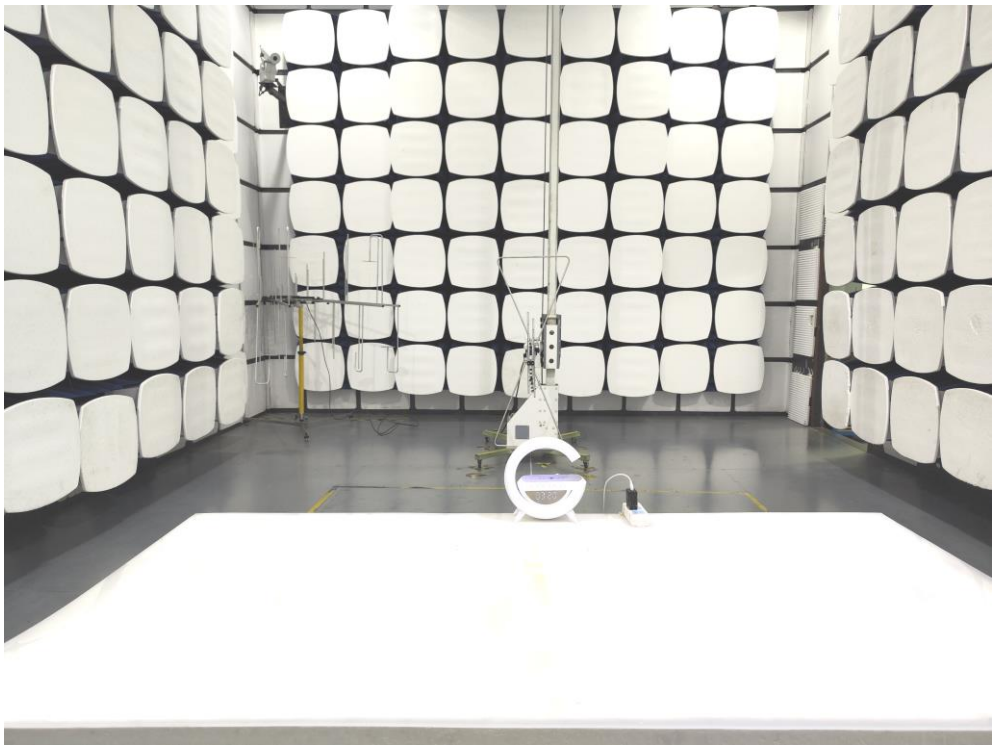
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

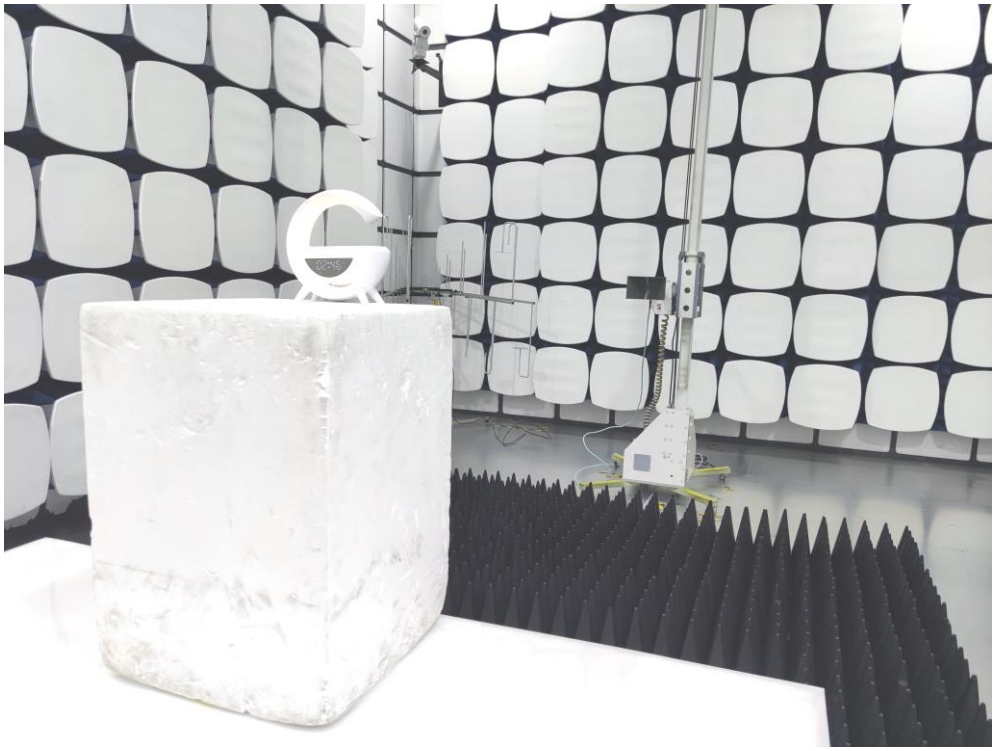
11.2.Result

The EUT antenna is Internal Antenna. It complies with the standard requirement.

12. TEST SETUP PHOTO

12.1.Photo of Radiated Emission test





12.2.Photo of Conducted Emission test

-------END OF REPORT-------