FCC TEST REPORT

FCC ID: 2ATQZ-DH05I

On Behalf of

Shenzhen Mooer Audio Co., Ltd

Guitar Amplifier

Model No.: DH05i

Prepared for	:	Shenzhen Mooer Audio Co., Ltd
Address	:	5F/2F, Unit B and 6F, Unit D, Jinghang Building, Liuxian 3rd Road, Baoan 71 District, Shenzhen

Prepared By	:	Shenzhen Alpha Product Testing Co., Ltd.
Address	:	Building i, No.2, Lixin Road, Fuyong Street, Bao'an District, 518103, Shenzhen, Guangdong, China

Report Number	:	A2302064-C01-R05
Date of Receipt	:	April 14, 2023
Date of Test	:	April 14, 2023-May 15, 2023
Date of Report	:	May 15, 2023
Version Number	:	V0

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TEST REPORT DECLARATION

Applicant	:	Shenzhen Mooer Audio Co., Ltd
Address	:	5F/2F, Unit B and 6F, Unit D, Jinghang Building, Liuxian 3rd Road, Baoan 71 District, Shenzhen
Manufacturer	:	Shenzhen Mooer Audio Co., Ltd
Address	:	5F/2F, Unit B and 6F, Unit D, Jinghang Building, Liuxian 3rd Road, Baoan 71 District, Shenzhen
EUT Description	:	Guitar Amplifier
		(A) Model No. : DH05i
		(B) Trademark : MOOER

Measurement Standard Used:

FCC Rules and Regulations Part 15 Subpart C Section 15.247

ANSI C63.10:2013

The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 15 Subpart C limits both conducted and radiated emissions. The test results are contained in this test report and Shenzhen Alpha Product Testing Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After the test, our opinion is that EUT compliance with the requirement of the above standards.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Alpha Product Testing Co., Ltd.

Tested by (name + signature).....…..:	Lucas Pang Project Engineer	Lucas Pang
Approved by (name + signature)…....:	Reak Yang Project Manager	
Date of issue……..:	May 15, 2023	

Revision History

Revision	Issue Date	Revisions	Revised By
V0	May 15, 2023	Initial released Issue	Lucas Pang

1. SUMMARY OF STANDARDS AND RESULTS

1.1. Description of Standards and Results

The EUT have been tested according to the applicable standards as referenced below:

Test Item	Standards Paragraph	Result
Maximum Peak Output Power	FCC Part 15: 15.247(b)(1) ANSI C63.10 :2013	P
Bandwidth	FCC Part 15: 15.215 ANSI C63.10 :2013	P
Carrier Frequency Separation	FCC Part 15: 15.247(a)(1) ANSI C63.10 :2013	P
Number Of Hopping Channel	FCC Part 15: 15.247(a)(1)(iii) ANSI C63.10 :2013	P
Dwell Time	FCC Part 15: 15.247(a)(1)(iii) ANSI C63.10 :2013	P
Radiated Emission	FCC Part 15: 15.209 FCC Part 15: 15.247(d) ANSI C63.10 :2013	P
Band Edge Compliance	FCC Part 15: 15.247(d) ANSI C63.10 :2013	P
Power Line Conducted Emissions	FCC Part 15: 15.207 ANSI C63.10 :2013	P
Antenna requirement	FCC Part 15: 15.203	P

Note: 1. P is an abbreviation for Pass.

2. F is an abbreviation for Fail.

3. N/A is an abbreviation for Not Applicable.

4. The conclusion of this test report is judged by actual test data without considering measurement uncertainty.

2. GENERAL INFORMATION

2.1. Description of Device (EUT)

Description	:	Guitar Amplifier
Model Number	:	DH05i
Diff	:	N/A
Power supply	:	DC 7.4V from battery, DC 5V from USB
Radio Technology	:	Bluetooth V5.0 EDR
Operation frequency	:	2402-2480MHz
Channel No.	:	79 channels
Channel Separation	:	1MHz
Modulation	:	GFSK, π/4-DQPSK
Antenna Type	:	Internal antenna, Maximum Gain is 1.50dBi (Antenna information is provided by applicant.)
Software version	:	V1.0
Hardware version	:	V1.0
Connector cable loss	:	N/A
Intend use environment	:	Residential, commercial and light industrial environment

Remark: EUT has two RF antennas, one of them is PIFA Antenna, max. gain -0.58dBi, the other one is chip antenna, max. gain 1.5dBi, So this report evaluates the one with the largest antenna gain, that is the worst data.

2.2. Accessories of Device (EUT)

Accessories : /

Manufacturer : /

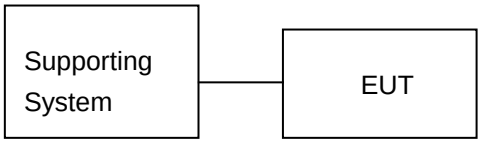
Model : /

Ratings : /

2.3. Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number	Certification or SDoC
1.	Jetta	Mooer	--	--	--
2.	Adapter	Huoniu	HNFCQC3024UU	--	--
3.	--	--	--	--	--

2.4. Block Diagram of connection between EUT and simulators



2.5. Test Mode Description

Tested mode, channel information		
Mode	**Channel**	**Frequency (MHz)**
GFSK	Low :CH1	2402
	Middle: CH40	2441
	High: CH79	2480
π/4 DQPSK	Low :CH1	2402
	Middle: CH40	2441
	High: CH79	2480

2.6. Test Conditions

Items	Required	Actual
Temperature range:	15-35℃	24℃
Humidity range:	25-75%	56%
Pressure range:	86-106kPa	980kPa

2.7. Test Facility

Shenzhen Alpha Product Testing Co., Ltd
Building i, No.2, Lixin Road, Fuyong Street, Bao'an District, 518103,
Shenzhen, Guangdong, China

June 21, 2018 File on Federal Communication Commission
Registration Number: 293961

September 15, 2019 Certificated by IC
Registration Number: CN0085

2.8. Measurement Uncertainty

(95% confidence levels, k=2)

Item	**Uncertainty**
Uncertainty for Power point Conducted Emissions Test	1.63dB
Uncertainty for Radiation Emission test in 3m chamber (below 30MHz)	3.5dB
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.74dB(Polarize: V)
	3.76dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	3.77dB(Polarize: V)
	3.80dB(Polarize: H)
Uncertainty for radio frequency	5.06×10^{-8}GHz
Uncertainty for conducted RF Power	0.40dB
Uncertainty for temperature	0.2℃
Uncertainty for humidity	1%
Uncertainty for DC and low frequency voltages	0.06%

2.9. Test Equipment List

Equipment	Manufacture	Model No.	Firmware version	Serial No.	Last cal.	Cal Interval
9*6*6 anechoic chamber	CHENYU	9*6*6	/	N/A	2022.05.17	3Year
Spectrum analyzer	ROHDE&SCHWARZ	FSV40-N	2.3	102137	2022.08.22	1Year
Spectrum analyzer	Agilent	N9020A	A.14.16	MY499100060	2022.08.22	1Year
Receiver	ROHDE&SCHWARZ	ESR	2.28 SP1	1316.3003K03-102082-Wa	2022.08.22	1Year
Receiver	R&S	ESCI	4.42 SP1	101165	2022.08.22	1Year
Bilog Antenna	Schwarzbeck	VULB 9168	/	VULB 9168#627	2021.08.30	2Year
Horn Antenna	SCHWARZBECK	BBHA 9120 D	/	2106	2021.08.30	2Year
Active Loop Antenna	SCHWARZBECK	FMZB 1519B	/	00059	2021.08.30	2Year
RF Cable	Resenberger	Cable 1	/	RE1	2022.08.22	1Year
RF Cable	Resenberger	Cable 2	/	RE2	2022.08.22	1Year
RF Cable	Resenberger	Cable 3	/	CE1	2022.08.22	1Year
Pre-amplifier	HP	HP8347A	/	2834A00455	2022.08.22	1Year
Pre-amplifier	Agilent	8449B	/	3008A02664	2022.08.22	1Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	/	8126-466	2022.08.22	1Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	/	101043	2022.08.23	1 Year
Horn Antenna	SCHWARZBECK	BBHA9170	/	00946	2021.08.30	2 Year
Preamplifier	SKET	LNPA_1840-50	/	SK2018101801	2022.08.22	1 Year
Power Meter	Agilent	E9300A	/	MY41496628	2022.08.22	1 Year
Power Sensor	DARE	RPR3006W	/	15100041SNO91	2022.08.22	1 Year
Temp. & Humid. Chamber	Weihuang	WHTH-1000-40-880	/	100631	2022.08.22	1 Year
Switching Mode Power Supply	JUNKE	JK12010S	/	20140927-6	2022.08.22	1 Year
Adjustable attenuator	MWRFtest	N/A	/	N/A	N/A	N/A
10dB Attenuator	Mini-Circuits	DC-6G	/	N/A	N/A	N/A

Software Information			
Test Item	Software Name	Manufacturer	Version
RE	EZ-EMC	EZ	Alpha-3A1
CE	EZ-EMC	EZ	Alpha-3A1
RF-CE	MTS 8310	MW	V2.0.0.0

3. MAXIMUM PEAK OUTPUT POWER

3.1. Limit

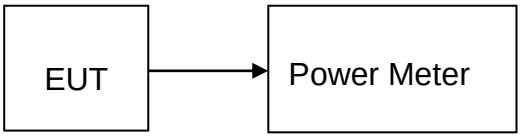
Please refer section 15.247.

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts, the e.i.r.p shall not exceed 4W

3.2. Test Procedure

The transmitter output is connected to the RF Power Meter. The RF Power Meter is set to the peak power detection.

3.3. Test Setup



3.4. Test Result

Mode	Freq(MHz)	PK Output Power(dBm)	Limit(dBm)	Result
GFSK	2402	4.287	21	Pass
	2441	**4.482**	21	Pass
	2480	3.38	21	Pass
π/4 DQPSK	2402	0.104	30	Pass
	2441	0.144	30	Pass
	2480	-0.525	30	Pass

4. BANDWIDTH

4.1. Limit

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

4.2. Test Procedure

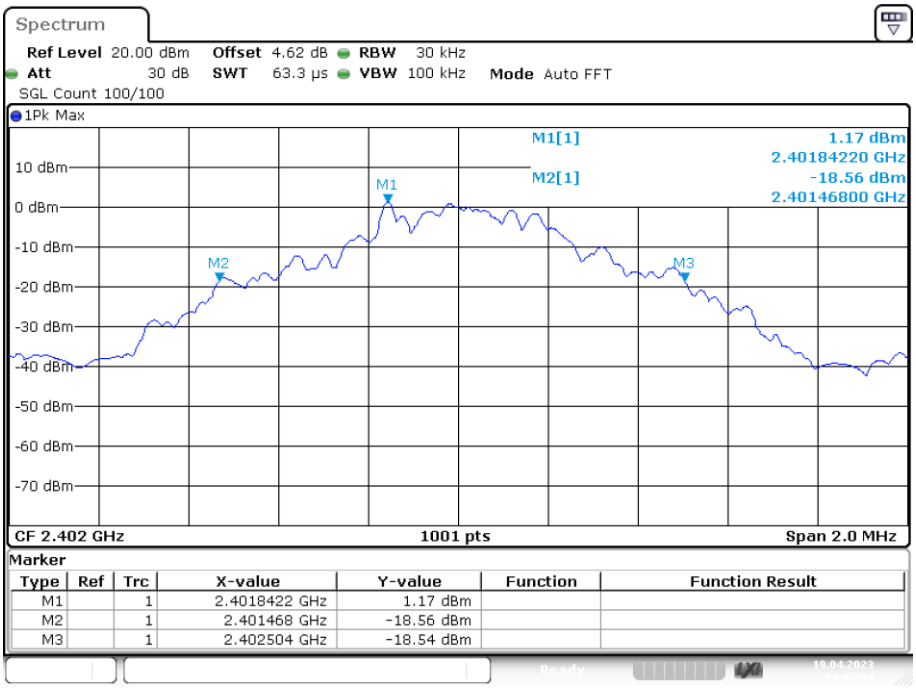
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30kHz RBW and 100kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

4.3. Test Result

-20dB Bandwidth

Condition	Mode	Frequency (MHz)	Antenna	-20 dB Bandwidth (MHz)	Limit -20 dB Bandwidth (MHz)	Verdict
NVNT	1-DH1	2402	Ant1	1.036	/	Pass
NVNT	1-DH1	2441	Ant1	1.048	/	Pass
NVNT	1-DH1	2480	Ant1	0.962	/	Pass
NVNT	2-DH1	2402	Ant1	1.348	/	Pass
NVNT	2-DH1	2441	Ant1	1.34	/	Pass
NVNT	2-DH1	2480	Ant1	1.34	/	Pass

-20dB Bandwidth NVNT 1-DH1 2402MHz Ant1



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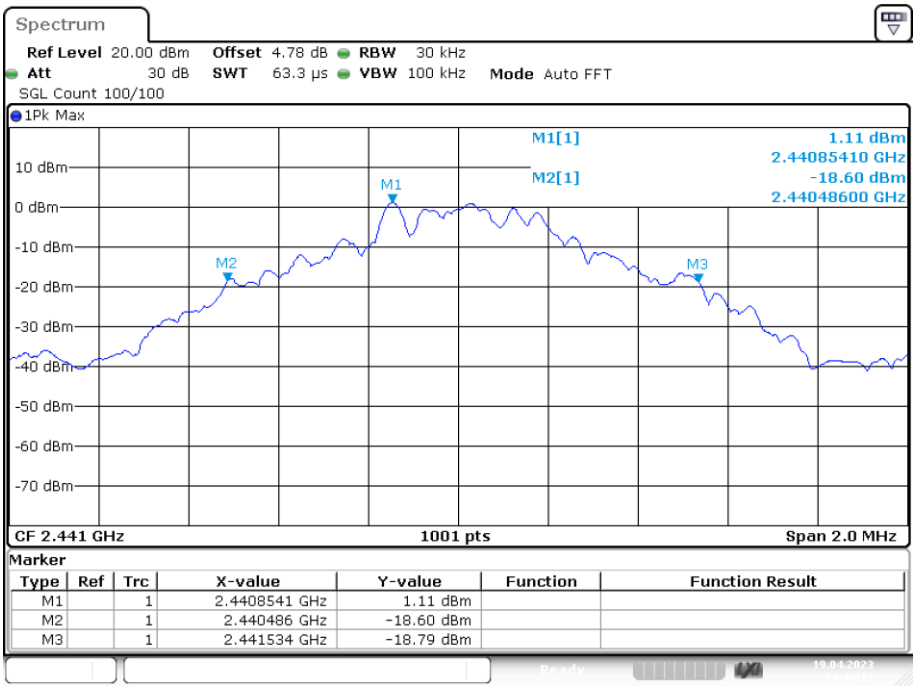
-20dB Bandwidth NVNT 1-DH1 2441MHz Ant1



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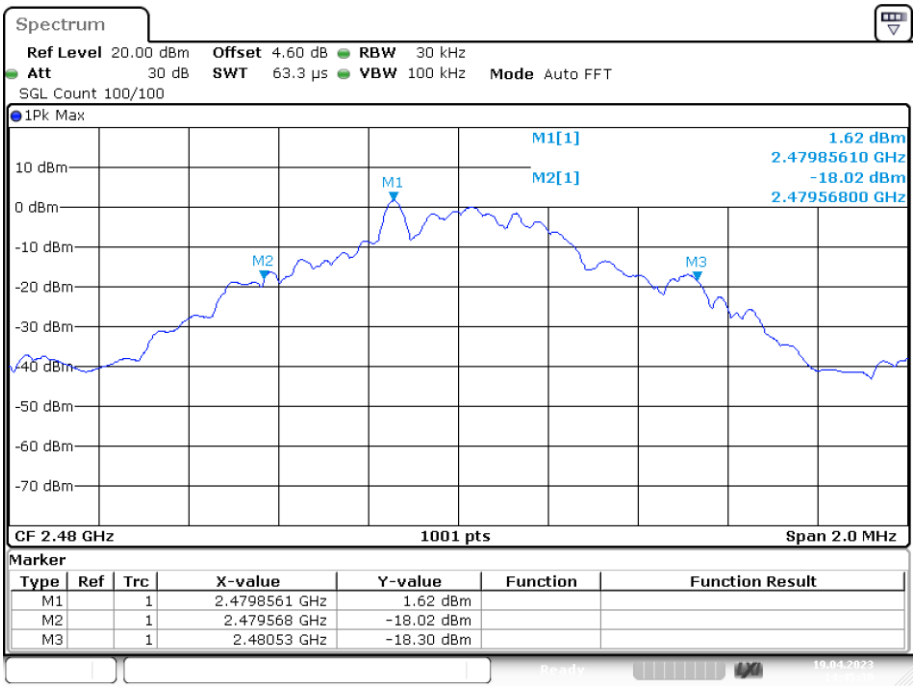
-20dB Bandwidth NVNT 1-DH1 2480MHz Ant1



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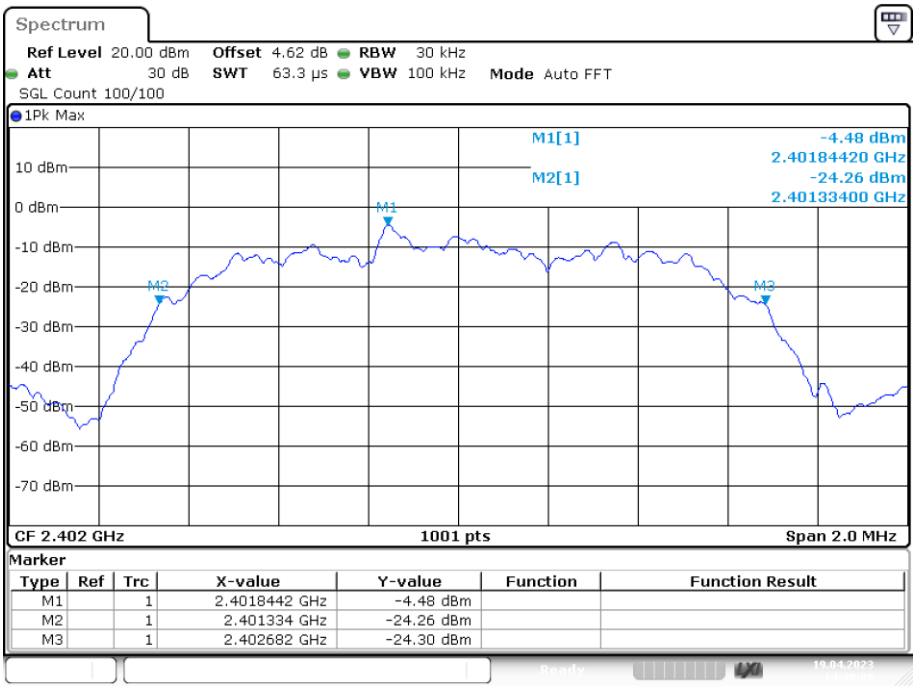
-20dB Bandwidth NVNT 2-DH1 2402MHz Ant1



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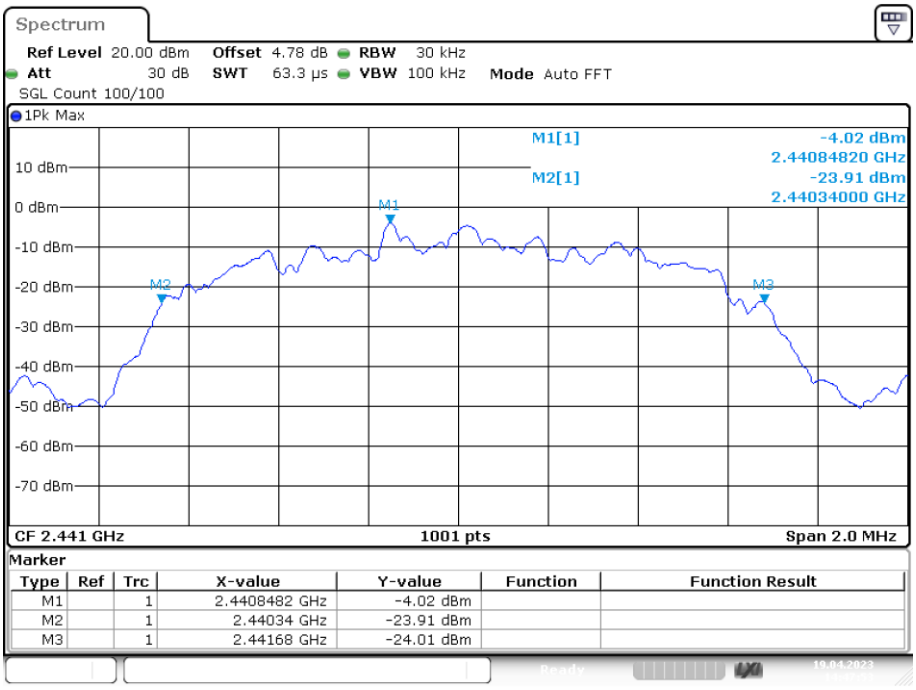
-20dB Bandwidth NVNT 2-DH1 2441MHz Ant1



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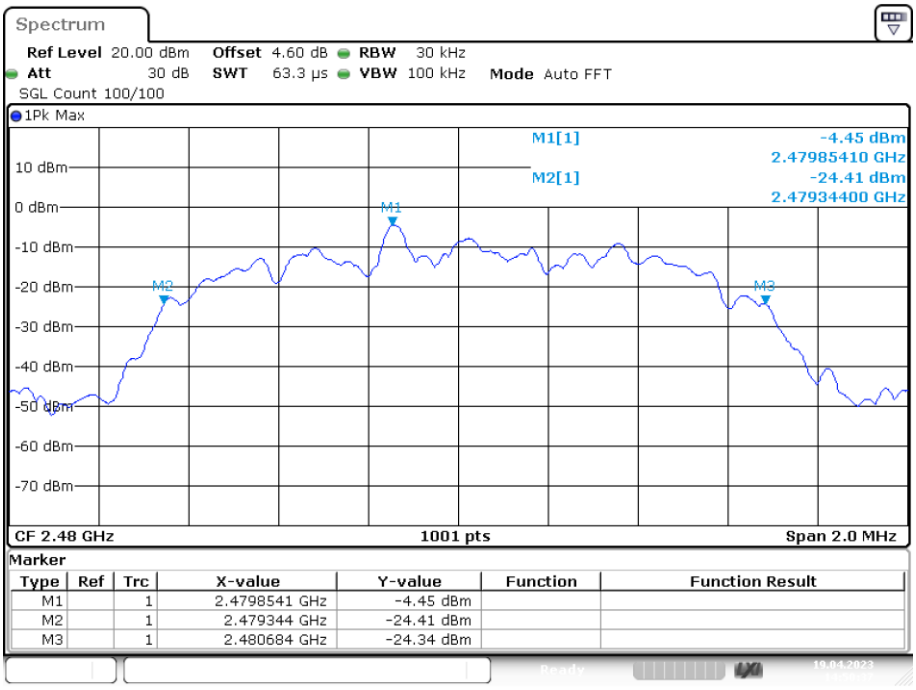
-20dB Bandwidth NVNT 2-DH1 2480MHz Ant1



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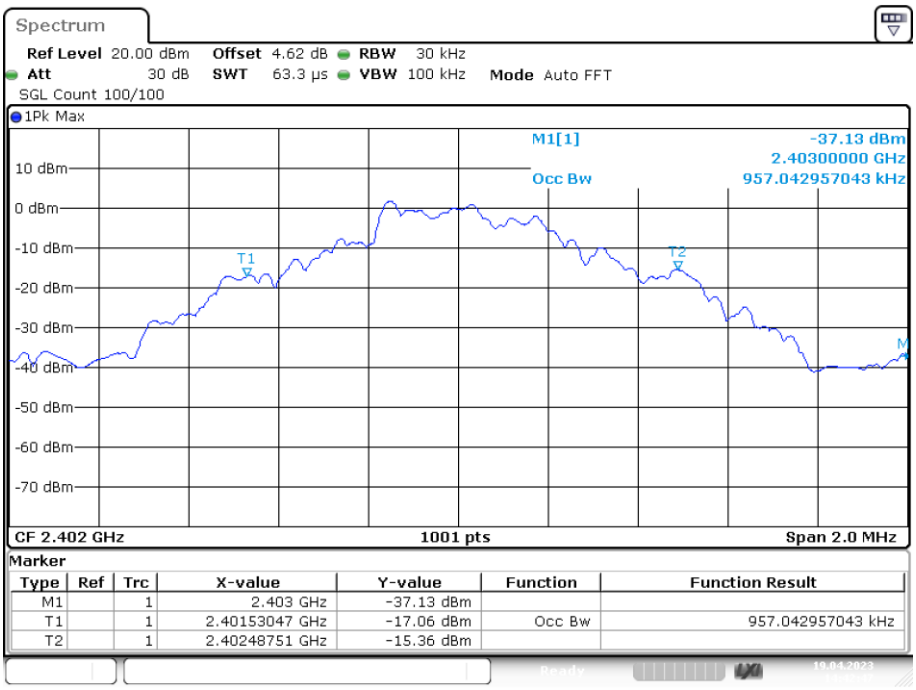
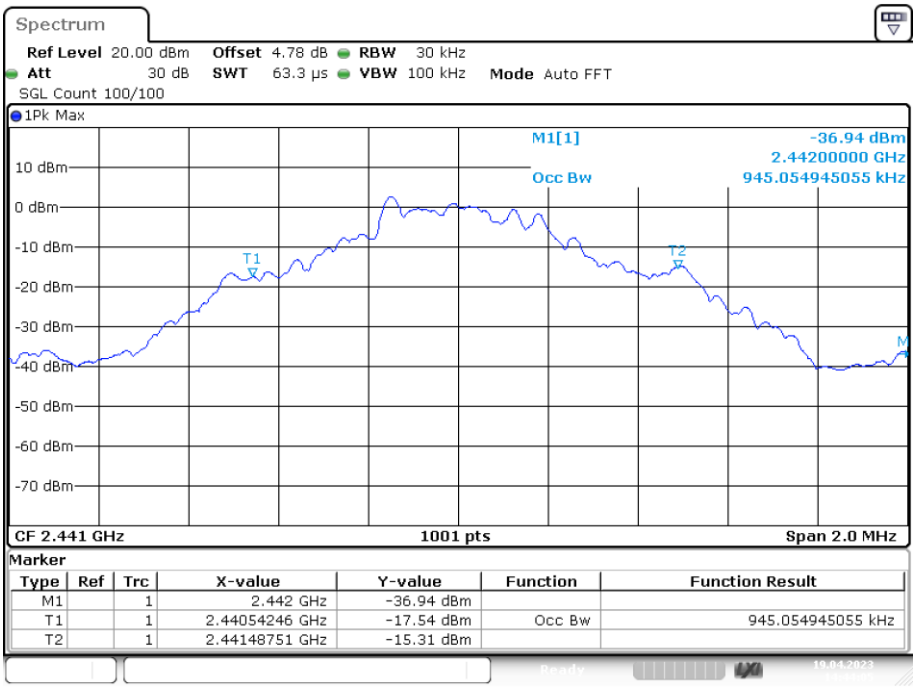
Occupied Channel Bandwidth

Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)
NVNT	1-DH1	2402	Ant1	0.957
NVNT	1-DH1	2441	Ant1	0.945
NVNT	1-DH1	2480	Ant1	0.951
NVNT	2-DH1	2402	Ant1	1.185
NVNT	2-DH1	2441	Ant1	1.165
NVNT	2-DH1	2480	Ant1	1.203

OBW NVNT 1-DH1 2402MHz Ant1



OBW NVNT 1-DH1 2441MHz Ant1



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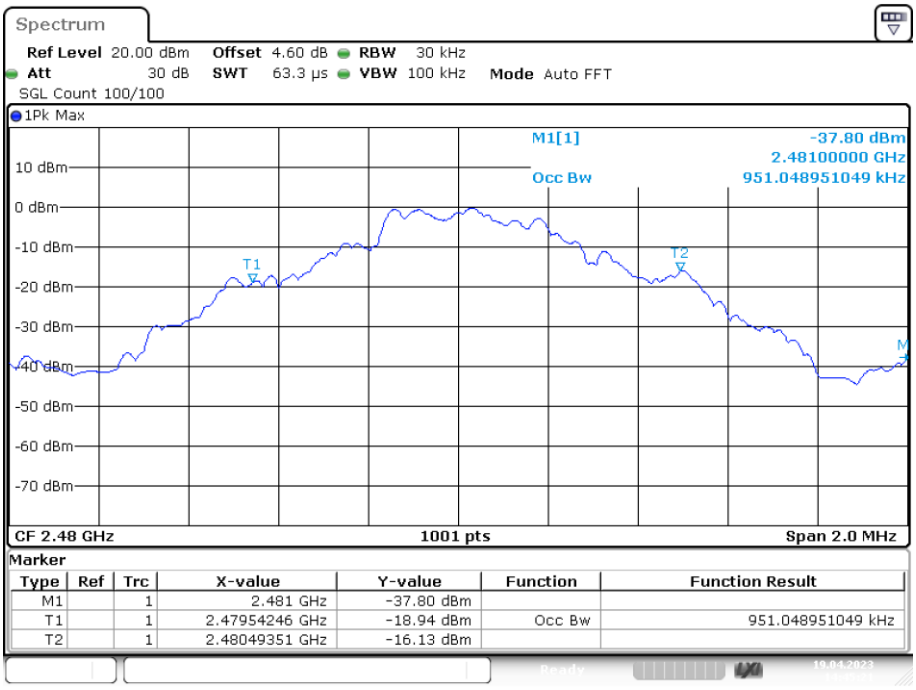

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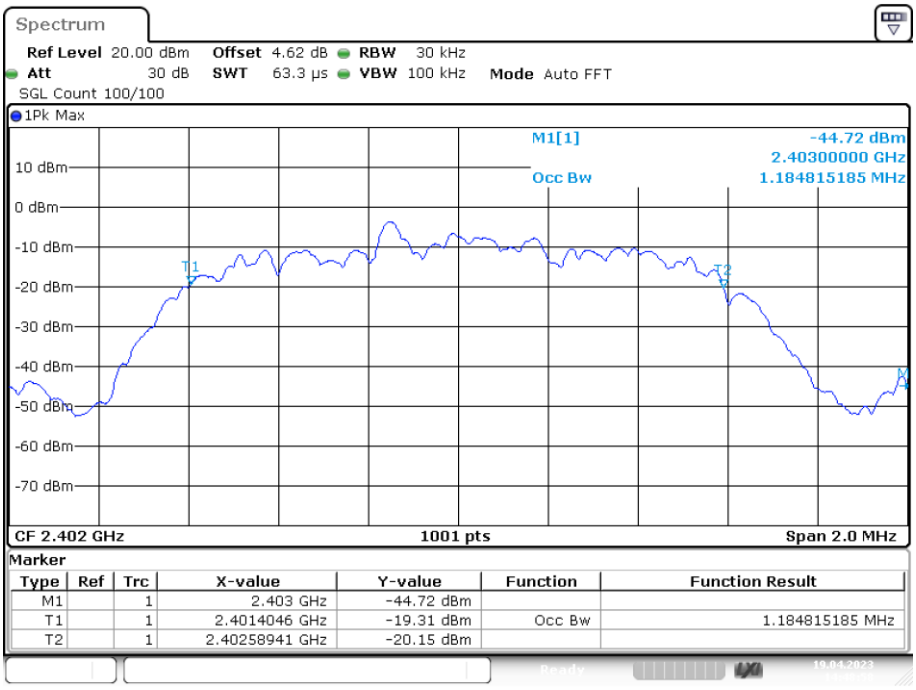
OBW NVNT 2-DH1 2402MHz Ant1



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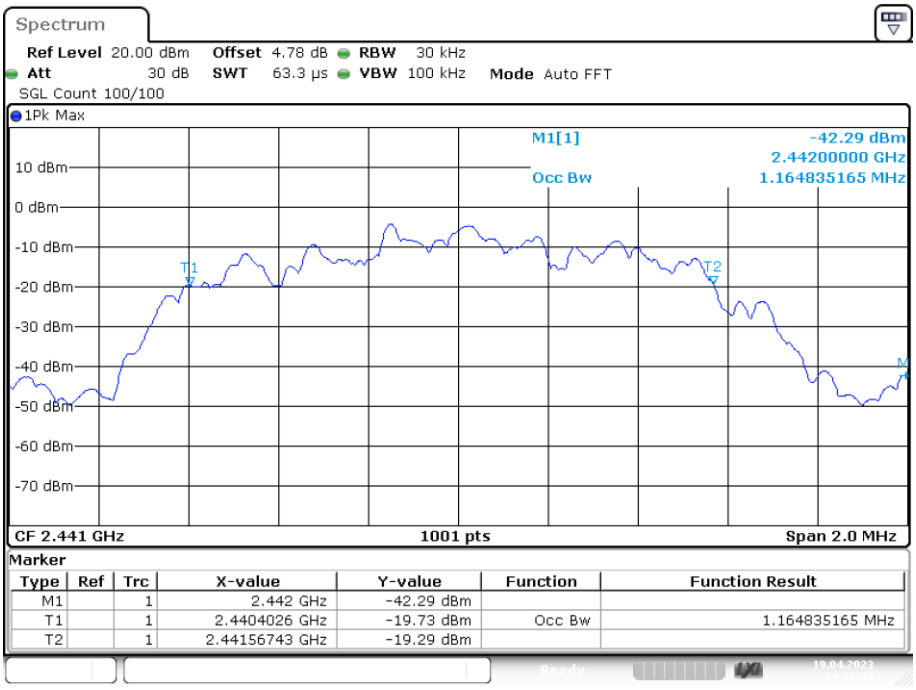
OBW NVNT 2-DH1 2441MHz Ant1



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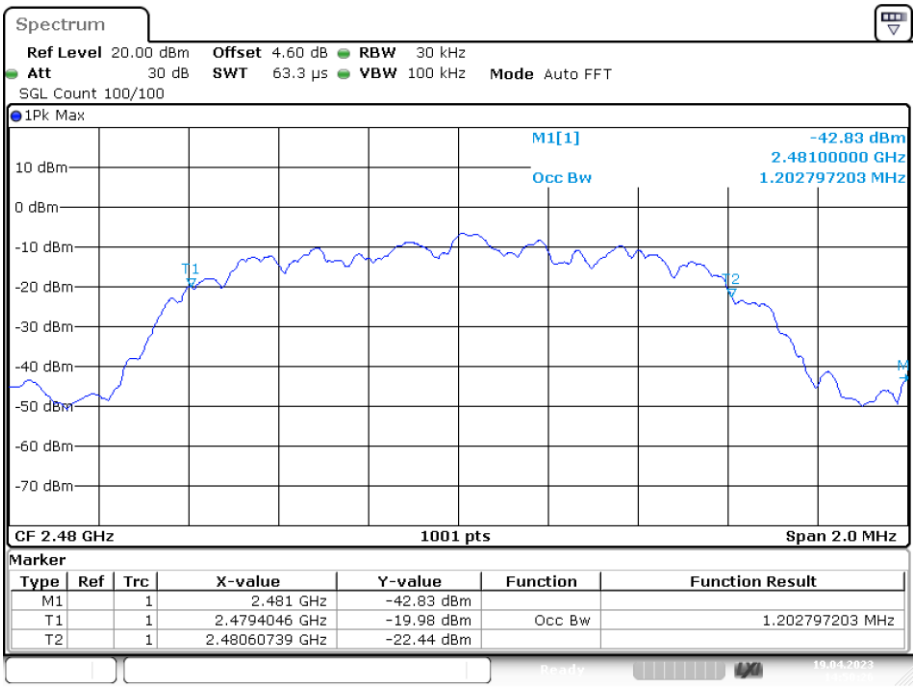
OBW NVNT 2-DH1 2480MHz Ant1



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5. CARRIER FREQUENCY SEPARATION

5.1. 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

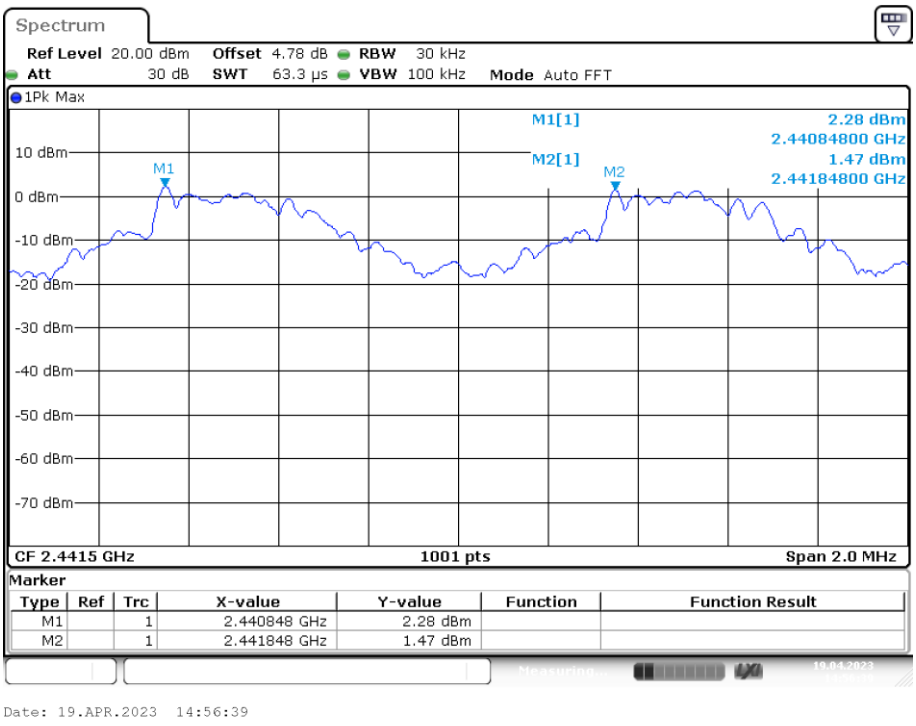
5.2. Test Procedure

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The carrier frequency was measured by spectrum analyzer with 30kHz RBW and 100kHz VBW.

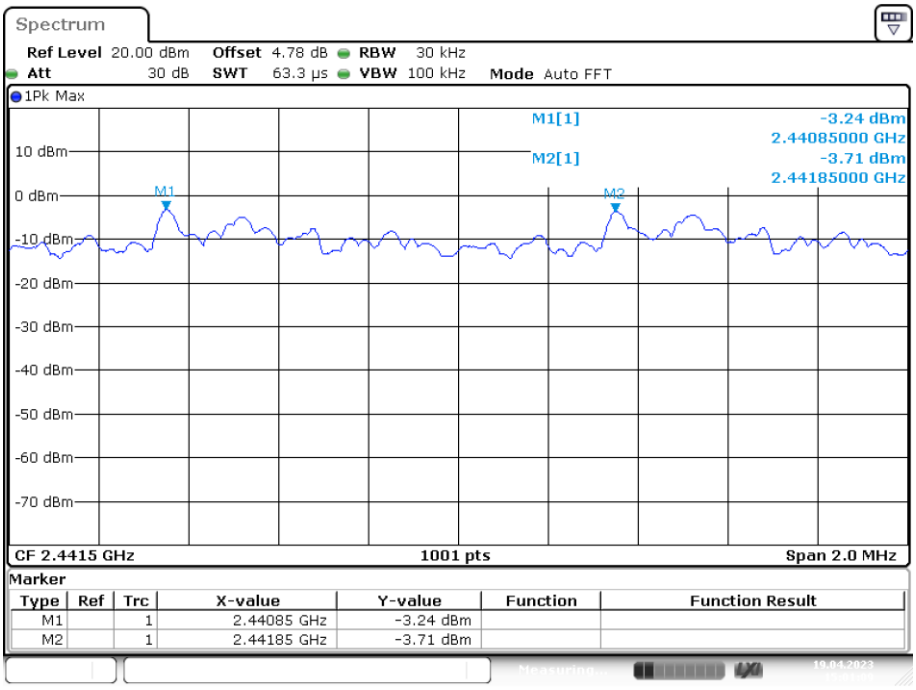
5.3. Test Result

Condition	Mode	Antenna	Hopping Freq1 (MHz)	Hopping Freq2 (MHz)	HFS (MHz)	Limit (MHz)	Verdict
NVNT	1-DH1	Ant1	2440.848	2441.848	1.029	0.956	Pass
NVNT	2-DH1	Ant1	2440.85	2441.85	1.334	0.829	Pass

CFS NVNT 1-DH1 2441MHz Ant1



CFS NVNT 2-DH1 2441MHz Ant1



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6. NUMBER OF HOPPING CHANNEL

6.1. Limit

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels

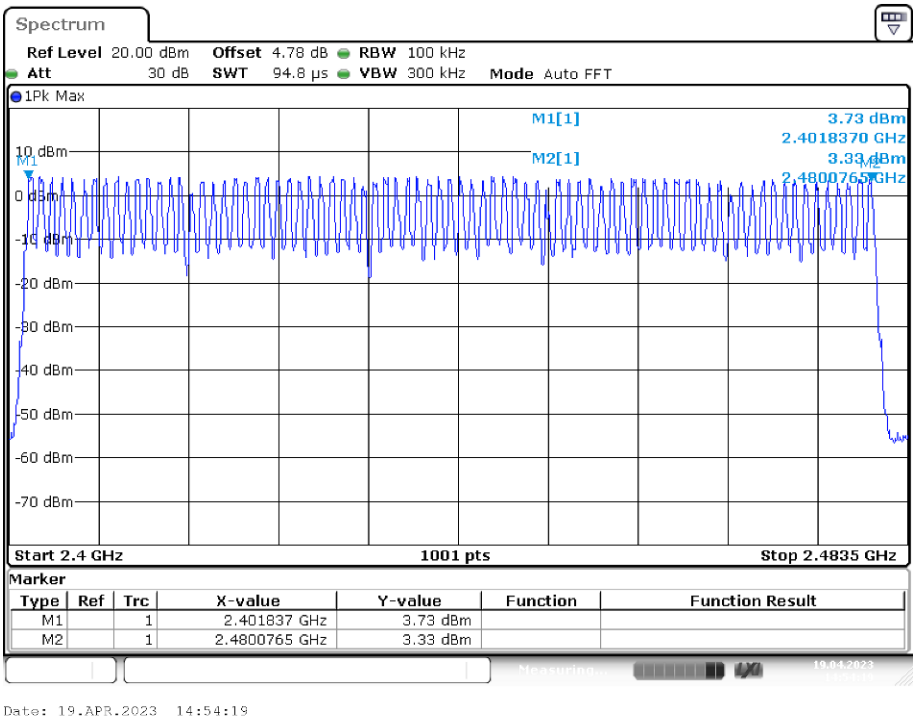
6.2. Test Procedure

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The number of hopping channel was measured by spectrum analyzer with 100kHz RBW and 300KHz VBW.

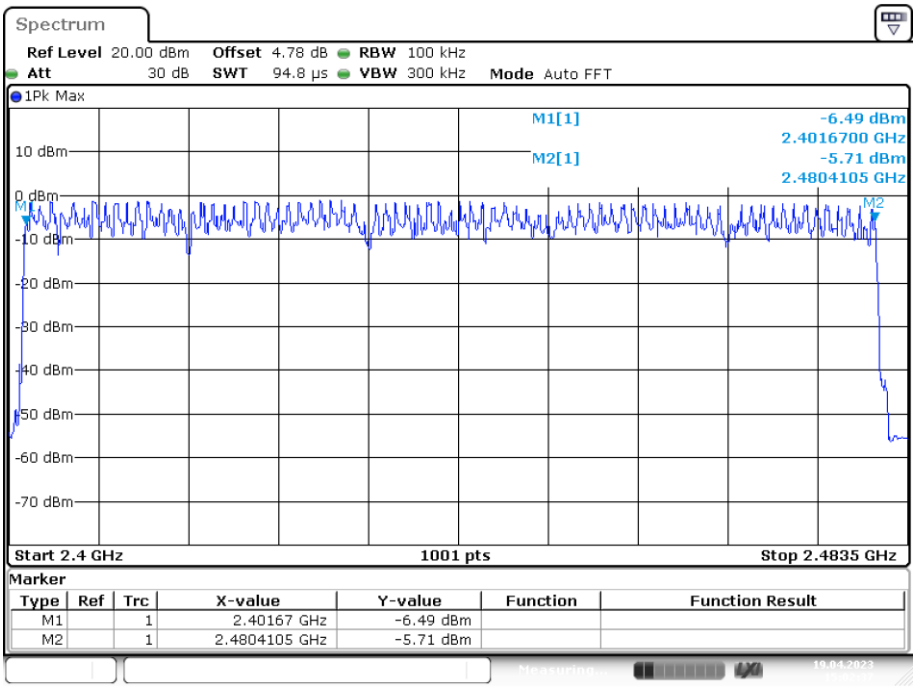
6.3. Test Result

Condition	Mode	Hopping Number	Limit	Verdict
NVNT	1-DH1	79	15	Pass
NVNT	2-DH1	79	15	Pass

Hopping No. NVNT 1-DH1 2441MHz Ant1



Hopping No. NVNT 2-DH1 2441MHz Ant1



7. DWELL TIME

7.1. Test limit

Please refer section15.247

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 sec- onds multiplied by the number of hopping channel employed.

7.2. Test Procedure

7.2.1. Place the EUT on the table and set it in transmitting mode.

7.2.2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

7.2.3. Set center frequency of spectrum analyzer = operating frequency.

7.2.4. Set the spectrum analyzer as RBW=1MHz, VBW=1MHz, Span = 0Hz, Sweep = auto.

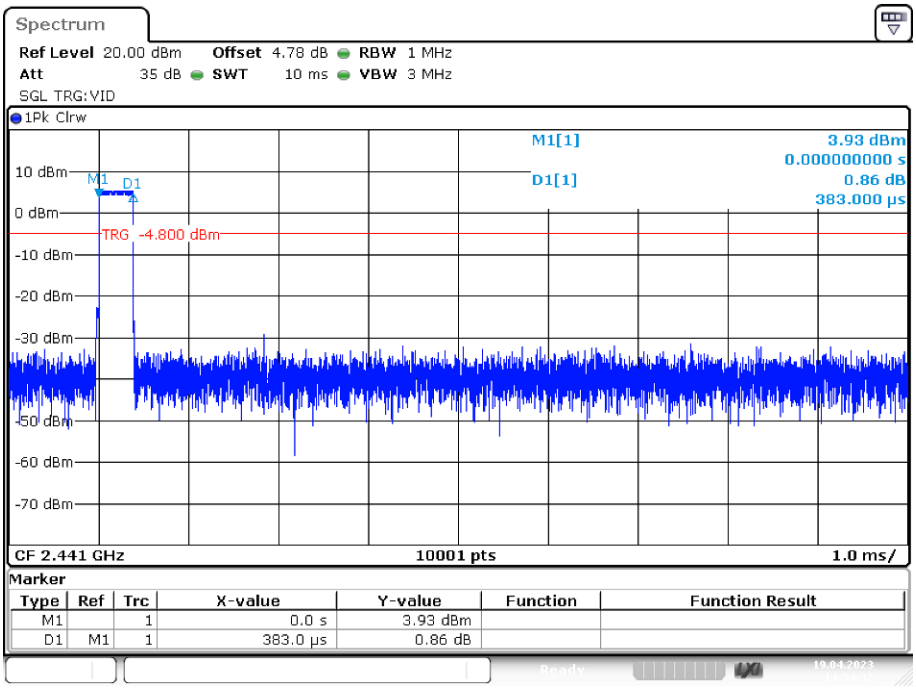
7.2.5. Repeat above procedures until all frequency measured were complete.

7.3. Test Result

Condition	Mode	Frequency (MHz)	Antenna	Pulse Time (ms)	Total Dwell Time (ms)	Burst Count	Period Time (ms)	Limit (ms)	Verdict
NVNT	1-DH1	2441	Ant1	0.383	121.411	317	31600	400	Pass
NVNT	1-DH3	2441	Ant1	1.639	265.518	162	31600	400	Pass
NVNT	1-DH5	2441	Ant1	2.888	245.48	85	31600	400	Pass
NVNT	2-DH1	2441	Ant1	0.389	123.702	318	31600	400	Pass
NVNT	2-DH3	2441	Ant1	1.64	260.76	159	31600	400	Pass
NVNT	2-DH5	2441	Ant1	2.888	311.904	108	31600	400	Pass

Note: Total Dwell Time= Pulse Time* Burst Count

Dwell NVNT 1-DH1 2441MHz Ant1 One Burst



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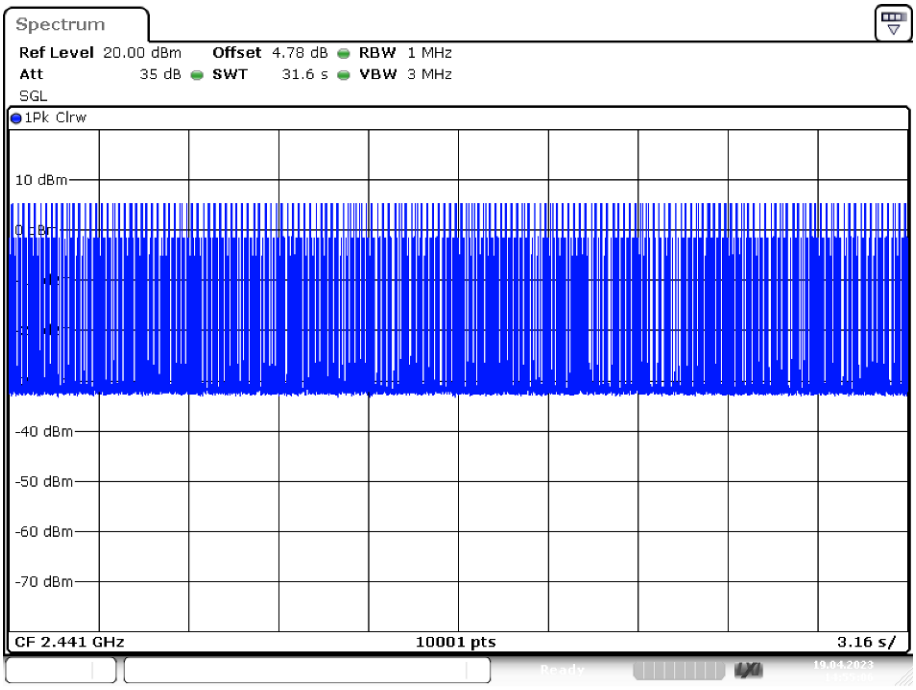
Dwell NVNT 1-DH1 2441MHz Ant1 Accumulated



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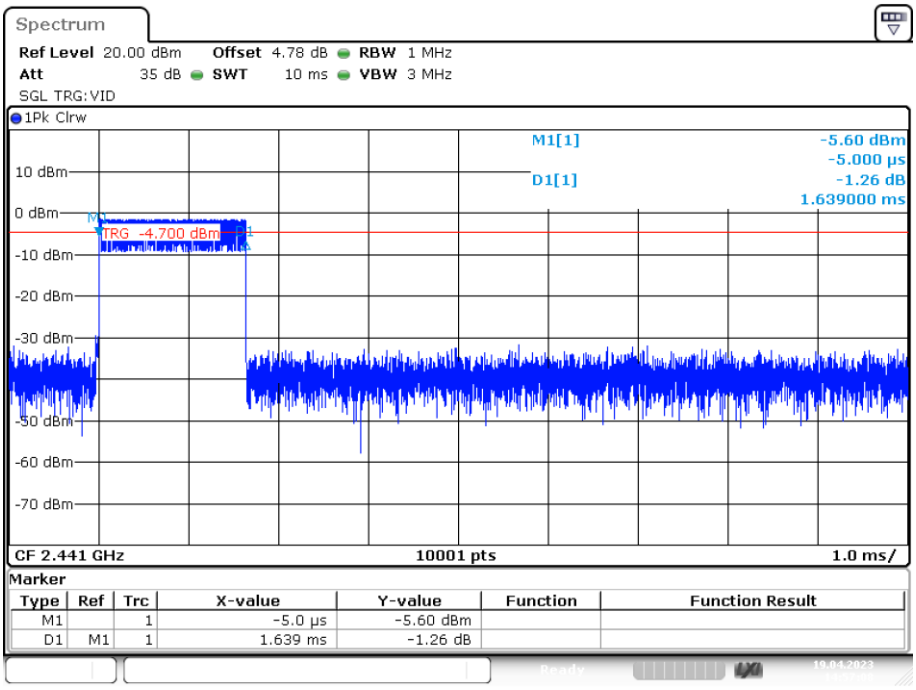

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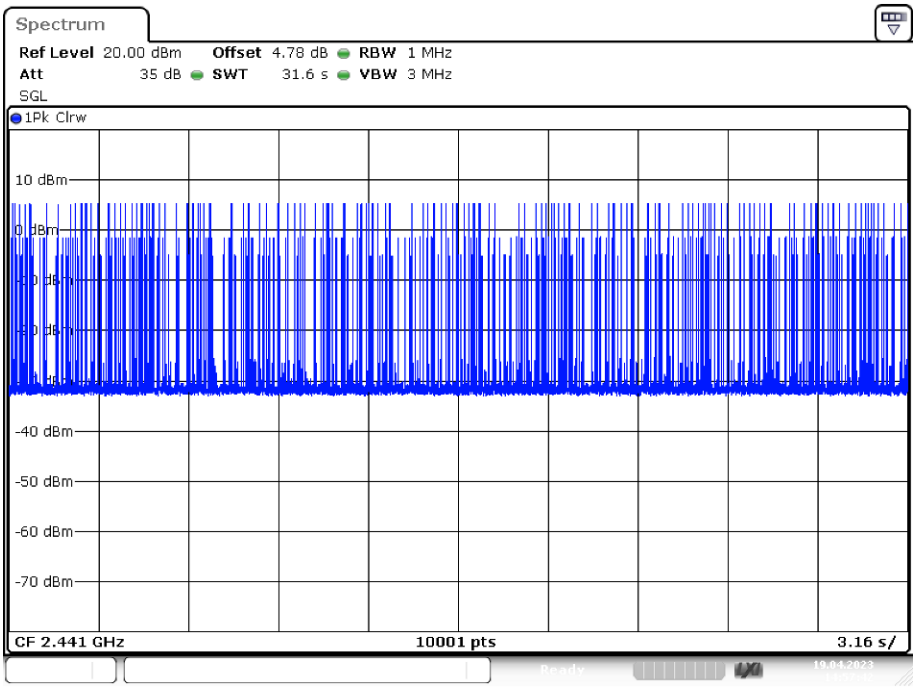

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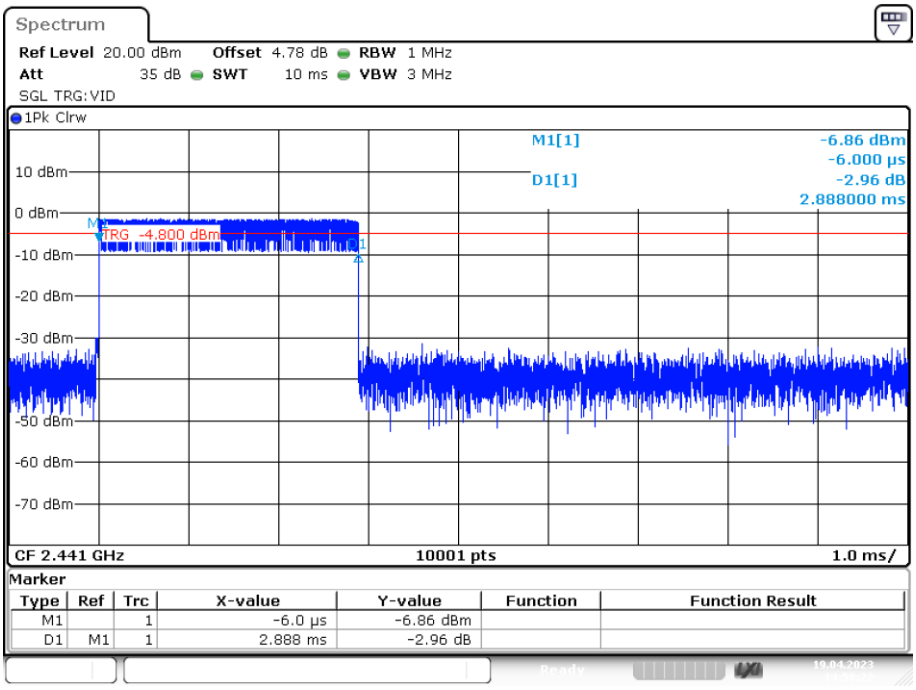
Dwell NVNT 1-DH5 2441MHz Ant1 One Burst



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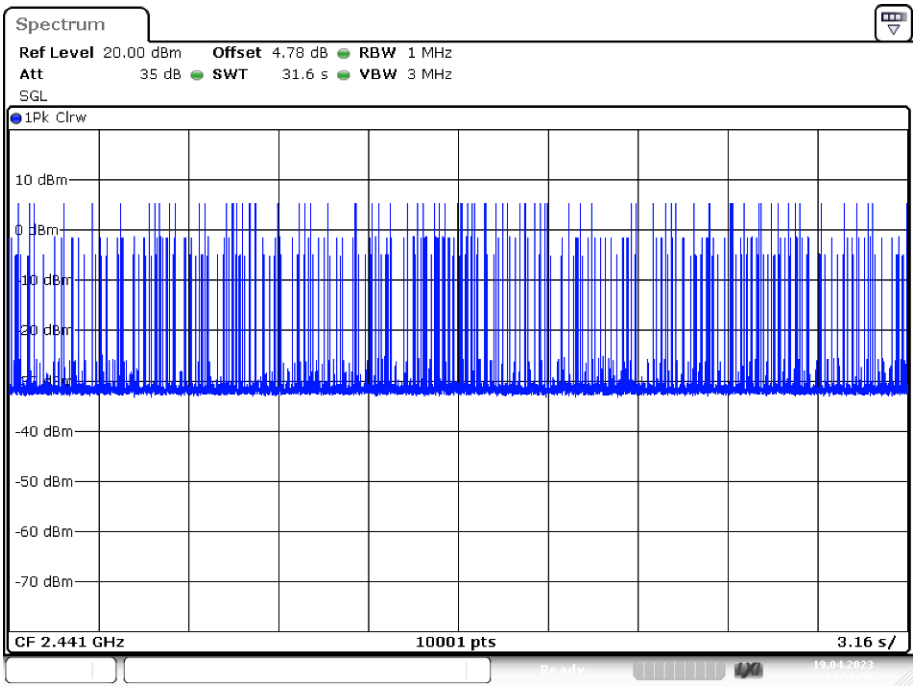
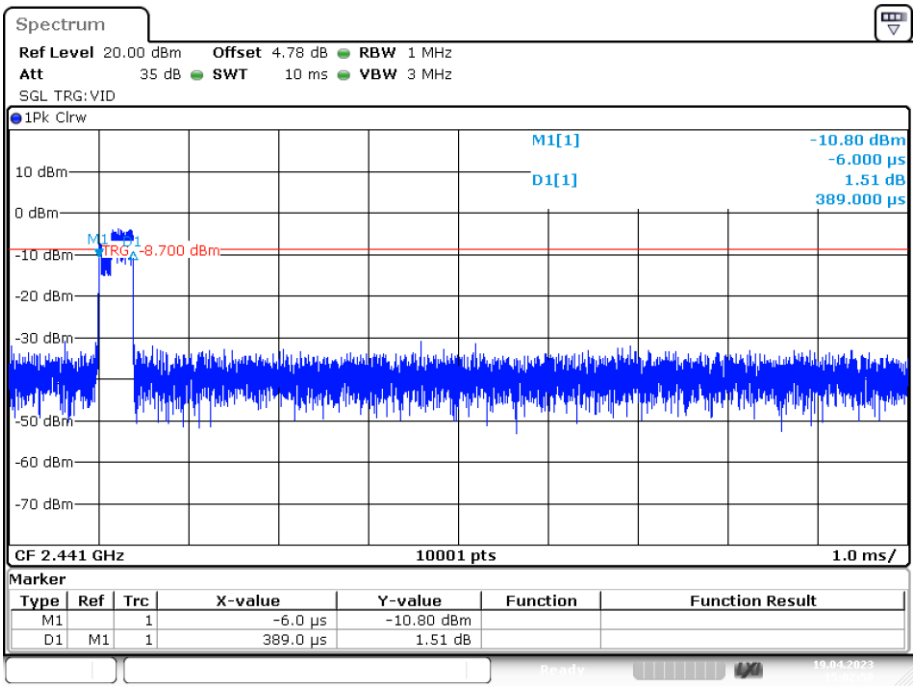
Dwell NVNT 1-DH5 2441MHz Ant1 Accumulated



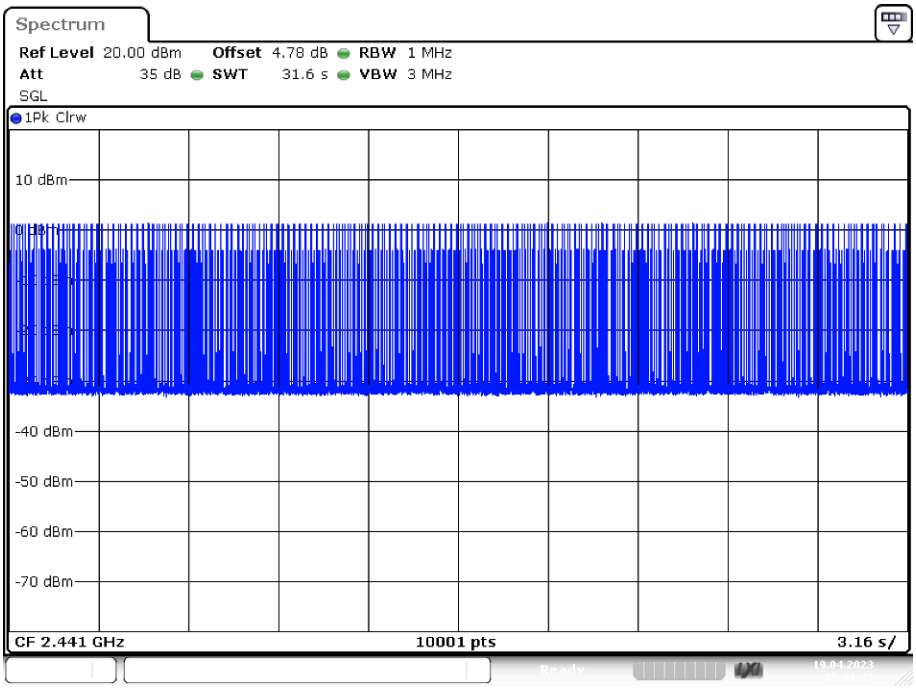
Date: 19.APR.2023 14:58:56

Dwell NVNT 2-DH1 2441MHz Ant1 One Burst



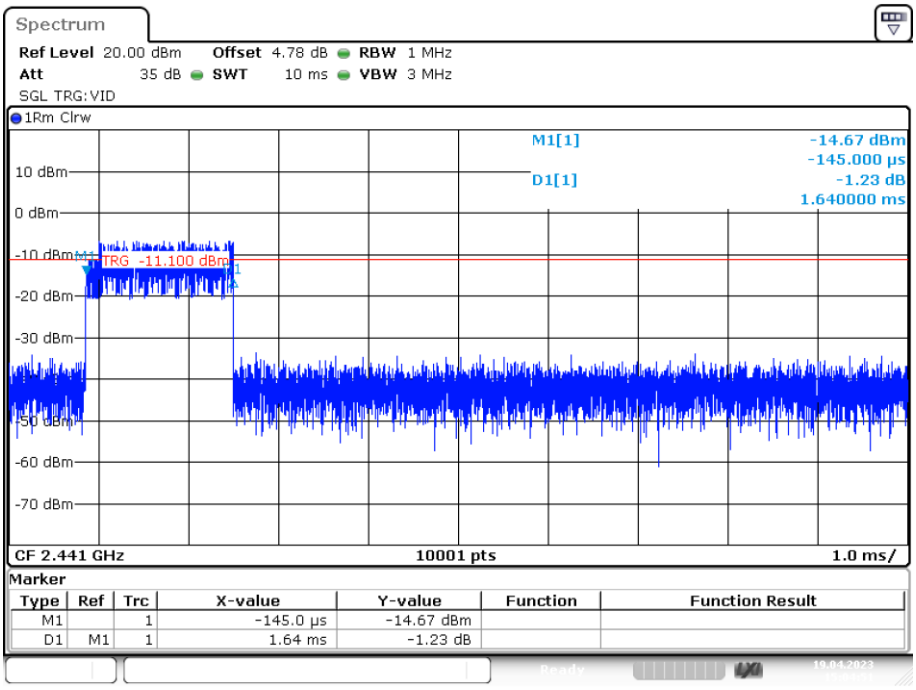
Date: 19.APR.2023 15:02:51

Dwell NVNT 2-DH1 2441MHz Ant1 Accumulated



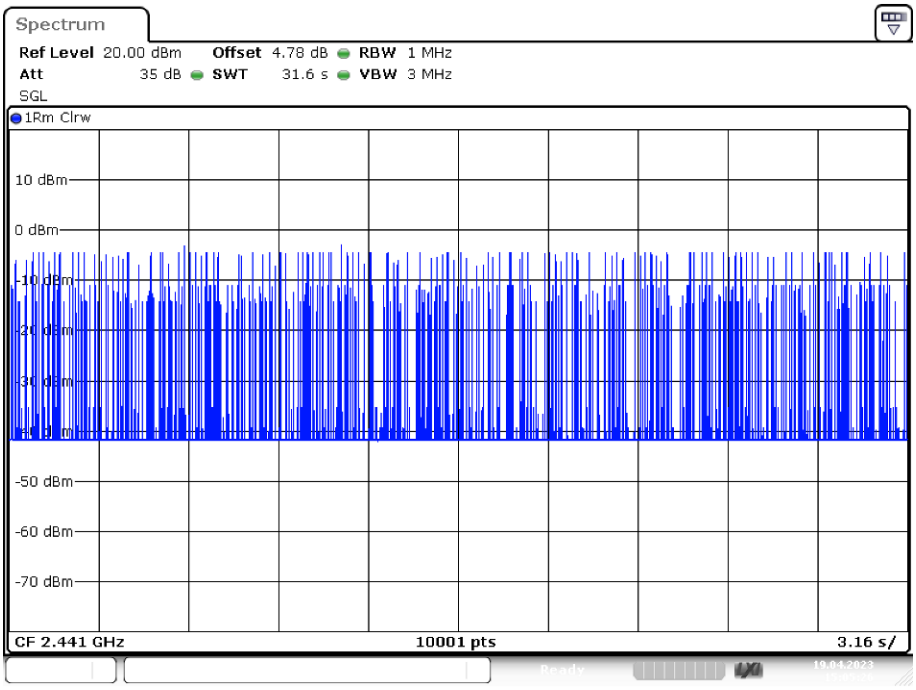
Date: 19.APR.2023 15:03:25

Dwell NVNT 2-DH3 2441MHz Ant1 One Burst



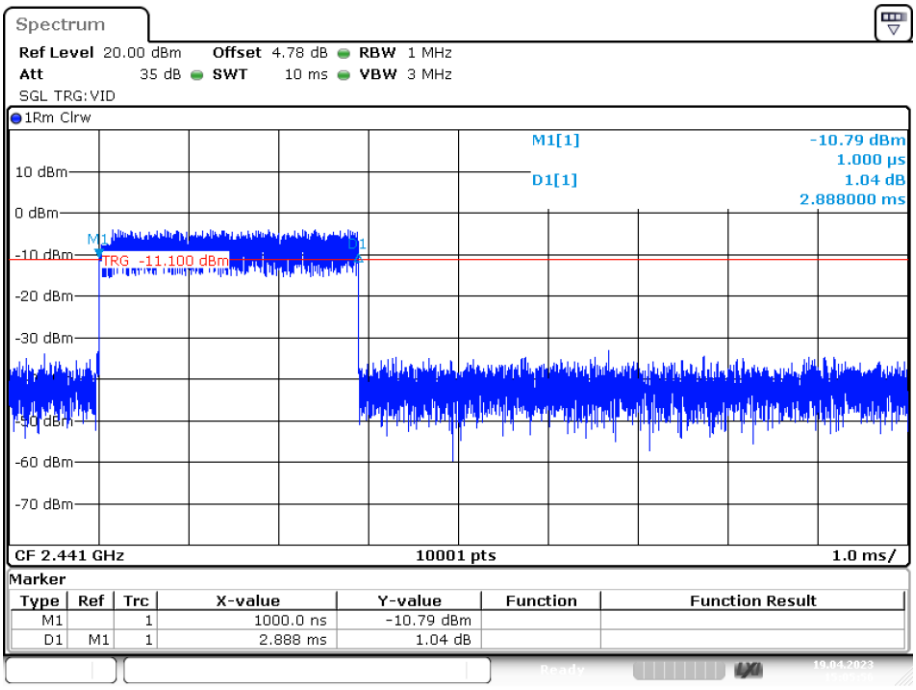
Date: 19.APR.2023 15:04:51

Dwell NVNT 2-DH3 2441MHz Ant1 Accumulated



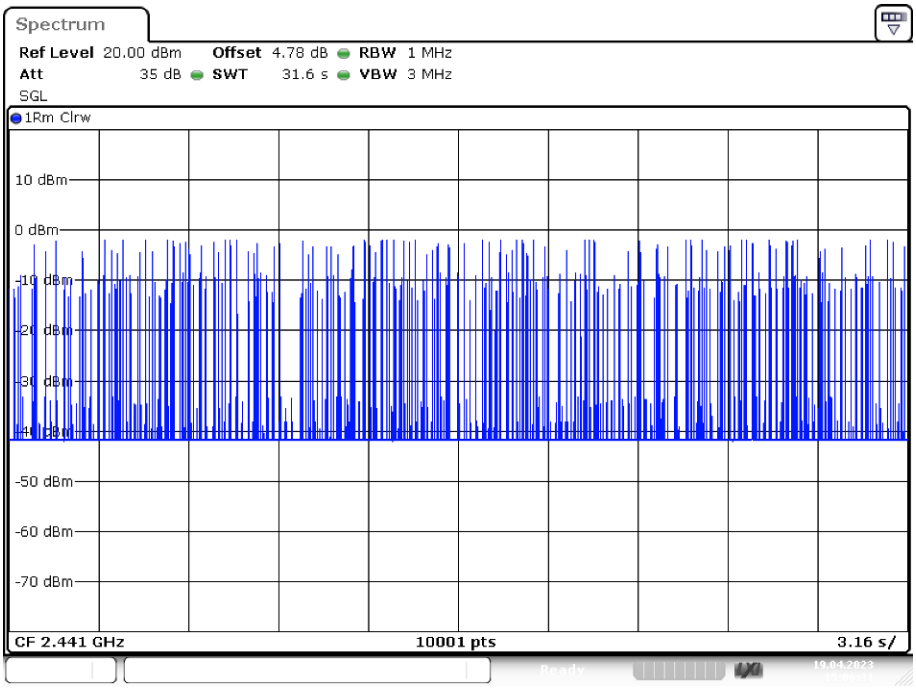
Date: 19.APR.2023 15:05:26

Dwell NVNT 2-DH5 2441MHz Ant1 One Burst



Date: 19.APR.2023 15:05:57

Dwell NVNT 2-DH5 2441MHz Ant1 Accumulated



Date: 19.APR.2023 15:06:31

8. RADIATED EMISSIONS

8.1. Limit

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

15.205 Restricted frequency band

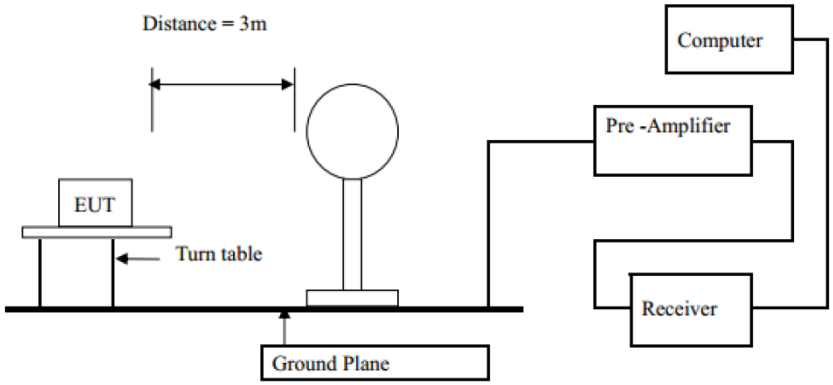
MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])

15.209 Limit

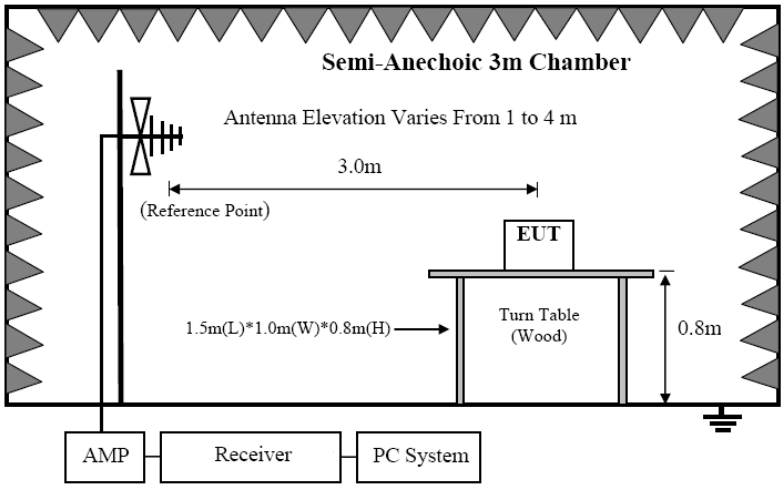
FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
0.009-0.490	300	2400/F(KHz)	/
0.490-1.705	30	24000/F(KHz)	/
1.705-30	30	30	29.5
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

8.2. Block Diagram of Test setup

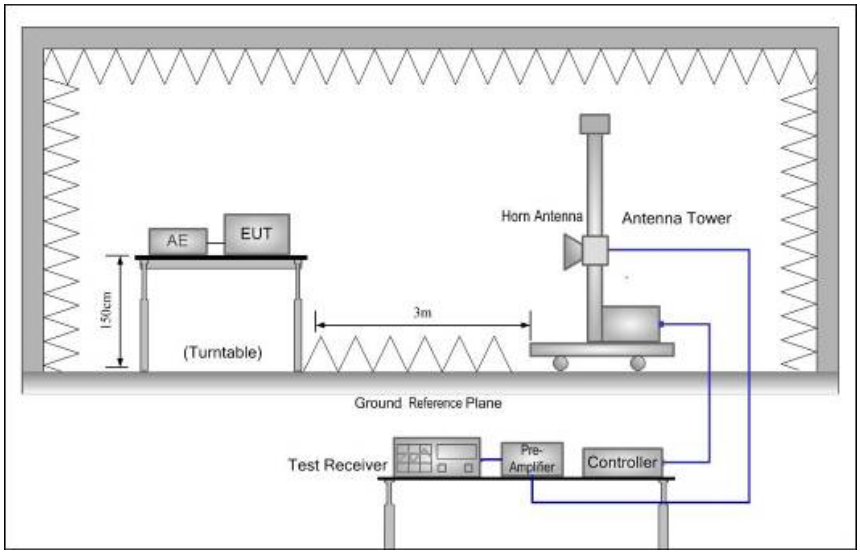
8.2.1 In 3m Anechoic Chamber Test Setup Diagram for below 30MHz



8.2.1 In 3m Anechoic Chamber Test Setup Diagram for below 1GHz



8.2.2 In 3m Anechoic Chamber Test Setup Diagram for frequency above 1GHz



Note: For harmonic emissions test a appropriate high pass filter was inserted in the input port of AMP.

8.3. Test Procedure

(1) EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber.

(2) Setup EUT and simulator as shown in section 1.4 and 6.1

(3) Test antenna was located 3m from the EUT on an adjustable mast. Below pre-scan procedure was first performed in order to find prominent radiated emissions.

(a) Change work frequency or channel of device if practicable.

(b) Change modulation type of device if practicable.

(c) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions

(4) Spectrum frequency from 9KHz to 25GHz (tenth harmonic of fundamental frequency) was investigated

(5) For final emissions measurements at each frequency of interest, the EUT were rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. 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 Radiated Emission test.

(6) For emissions above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1MHz, VBW is set at 3MHz for Peak measure; RBW is set at 1MHz, VBW is set at 10Hz for Average measure.

8.4. Test Result

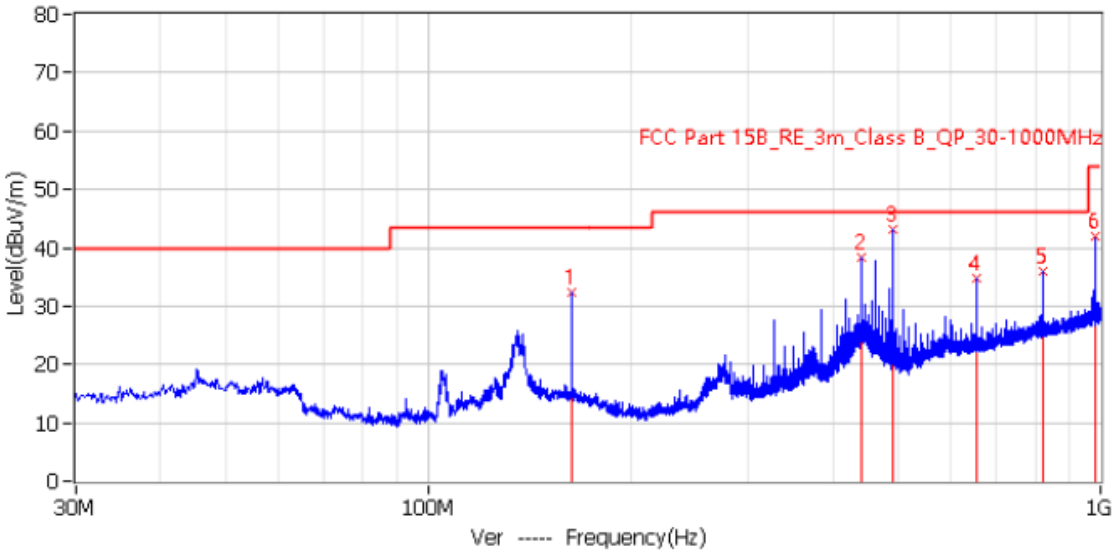
We have scanned the 10th harmonic from 9KHz to the EUT's highest frequency.
Detailed information please see the following page.

From 9KHz to 30MHz: Conclusion: PASS

Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

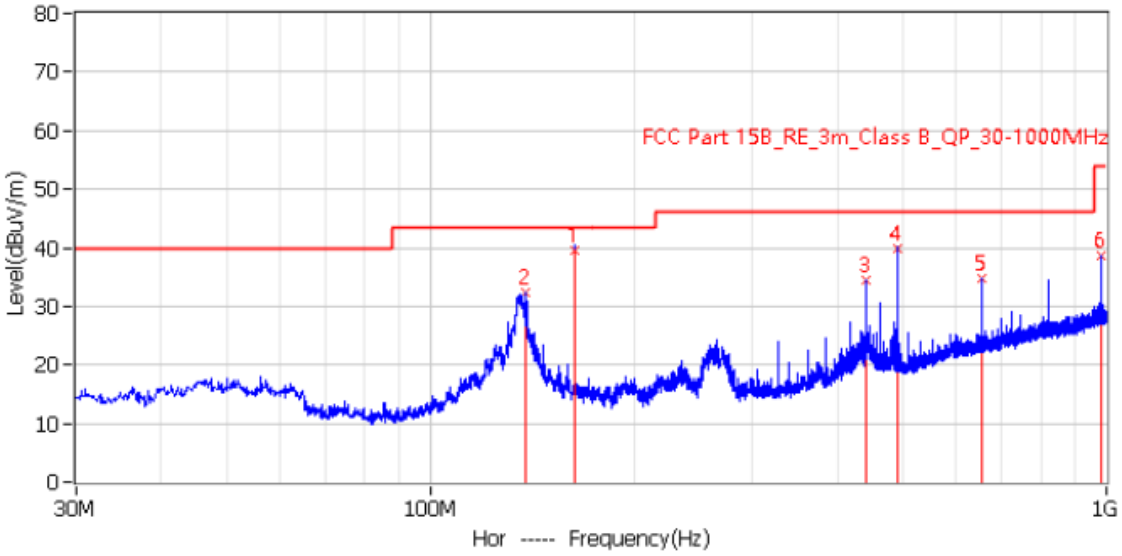
From 30MHz to 1000MHz: Conclusion: PASS

Antenna polarity: Vertical



No.	Frequency	Level dBuV/m	Factor dB/m	Limit dBuV/m	Margin dB	Detector	Height cm	Height cm	Angle deg
1*	163.860MHz	32.3	15.9	43.5	-11.2	PK	Ver	100.0	112.0
2*	440.310MHz	38.4	19.0	46.0	-7.6	PK	Ver	100.0	49.0
3*	491.599MHz	43.1	19.8	46.0	-2.9	PK	Ver	100.0	40.0
4*	655.529MHz	34.8	23.3	46.0	-11.2	PK	Ver	100.0	204.0
5*	819.338MHz	36.1	25.7	46.0	-9.9	PK	Ver	100.0	294.0
6*	983.268MHz	41.8	27.4	54.0	-12.2	PK	Ver	100.0	0.0

Antenna polarity: Horizontal



No.	Frequency	Level dBuV/m	Factor dB/m	Limit dBuV/m	Margin dB	Detector	Height cm	Height cm	Angle deg
1	163.871MHz	39.6	15.9	43.5	-3.9	QP	Hor	200.0	246.0
2*	138.276MHz	32.4	15.2	43.5	-11.1	PK	Hor	200.0	270.0
3*	440.310MHz	34.4	19.0	46.0	-11.6	PK	Hor	200.0	298.0
4*	491.599MHz	40.0	19.8	46.0	-6.0	PK	Hor	200.0	28.0
5*	655.529MHz	34.9	23.3	46.0	-11.1	PK	Hor	200.0	264.0
6*	983.268MHz	38.8	27.4	54.0	-15.2	PK	Hor	200.0	221.0

Remark: All modes have been tested, and only worst data of GFSK mode, Channel 2441MHz was listed in this report.

From 1G-25GHz

Test Mode: GFSK TX Low									
Freq (MHz)	Read Level (dBuV/m)	Polar (H/V)	Antenna Factor (dB/m)	Cable loss(dB)	Amp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4804	48.96	V	33.93	10.18	34.26	58.81	74	-15.19	PK
4804	36.34	V	33.93	10.18	34.26	46.19	54	-7.81	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
4804	47.62	H	33.93	10.18	34.26	57.47	74	-16.53	PK
4804	35.32	H	33.93	10.18	34.26	45.17	54	-8.83	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
Test Mode: GFSK TX Mid									
4882	49.64	V	33.95	10.20	34.26	59.53	74	-14.47	PK
4882	35.39	V	33.95	10.20	34.26	45.28	54	-8.72	AV
7323	/	/	/	/	/	/	/	/	/
9764	/	/	/	/	/	/	/	/	/
4882	48.85	H	33.95	10.20	34.26	58.74	74	-15.26	PK
4882	34.53	H	33.95	10.20	34.26	44.42	54	-9.58	AV
7323	/	/	/	/	/	/	/	/	/
9764	/	/	/	/	/	/	/	/	/
Test Mode: GFSK TX High									
4960	47.48	V	33.98	10.22	34.25	57.43	74	-16.57	PK
4960	33.05	V	33.98	10.22	34.25	43.00	54	-11.00	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/
4960	46.99	H	33.98	10.22	34.25	56.94	74	-17.06	PK
4960	32.45	H	33.98	10.22	34.25	42.40	54	-11.60	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/

Note:

1, Result = Read level + Antenna factor + cable loss-Amp factor

2, All the other emissions not reported were too low to read and deemed to comply with FCC limit.

Test Mode: π/4 DQPSK TX Low									
Freq (MHz)	Read Level (dBuV/m)	Polar (H/V)	Antenna Factor (dB/m)	Cable loss(dB)	Amp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4804	48.43	V	33.93	10.18	34.26	58.28	74	-15.72	PK
4804	36.59	V	33.93	10.18	34.26	46.44	54	-7.56	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
4804	47.80	H	33.93	10.18	34.26	57.65	74	-16.35	PK
4804	35.96	H	33.93	10.18	34.26	45.81	54	-8.19	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
Test Mode: π/4 DQPSK TX Mid									
4882	49.77	V	33.95	10.20	34.26	59.66	74	-14.34	PK
4882	35.96	V	33.95	10.20	34.26	45.85	54	-8.15	AV
7323	/	/	/	/	/	/	/	/	/
9764	/	/	/	/	/	/	/	/	/
4882	48.75	H	33.95	10.20	34.26	58.64	74	-15.36	PK
4882	34.74	H	33.95	10.20	34.26	44.63	54	-9.37	AV
7323	/	/	/	/	/	/	/	/	/
9764	/	/	/	/	/	/	/	/	/
Test Mode: π/4 DQPSK TX High									
4960	47.17	V	33.98	10.22	34.25	57.12	74	-16.88	PK
4960	33.60	V	33.98	10.22	34.25	43.55	54	-10.45	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/
4960	46.98	H	33.98	10.22	34.25	56.93	74	-17.07	PK
4960	32.44	H	33.98	10.22	34.25	42.39	54	-11.61	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/

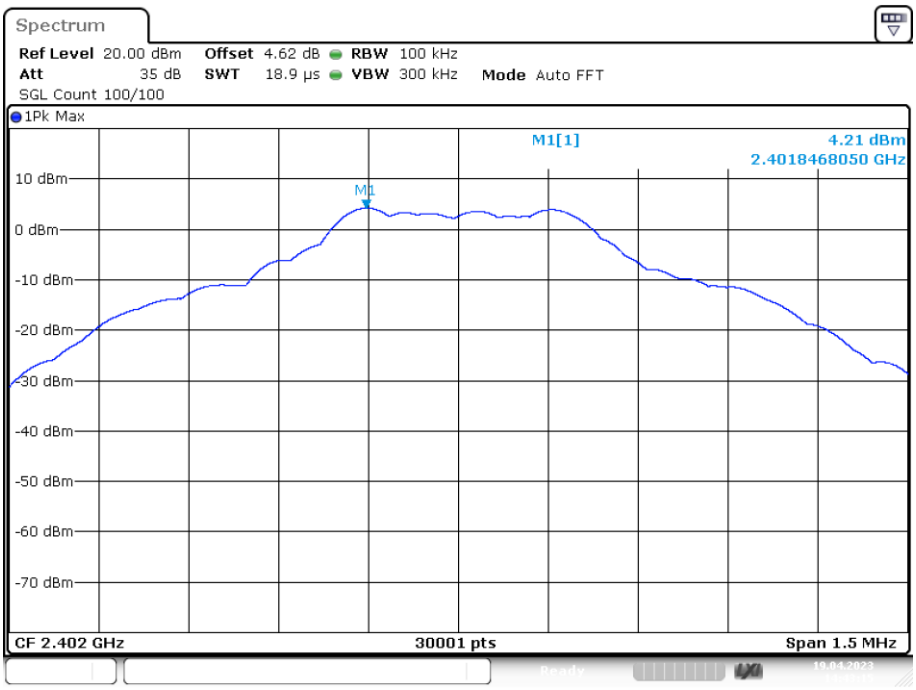
Note:

1, Result = Read level + Antenna factor + cable loss-Amp factor

2, All the other emissions not reported were too low to read and deemed to comply with FCC limit.

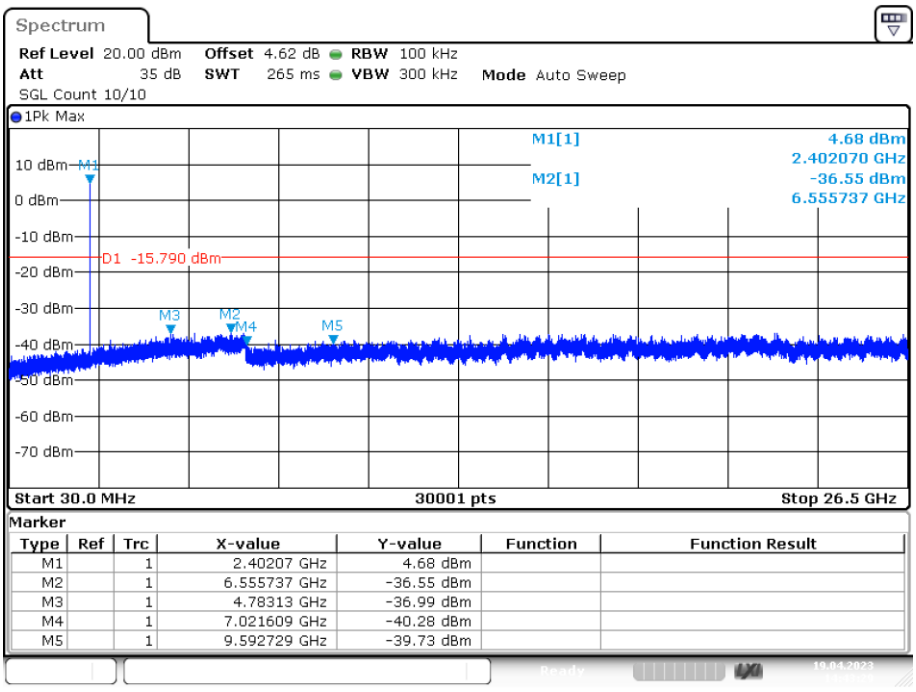
Conducted RF Spurious Emission

Tx. Spurious NVNT 1-DH1 2402MHz Ant1 Ref



Date: 19.APR.2023 14:43:15

Tx. Spurious NVNT 1-DH1 2402MHz Ant1 Emission

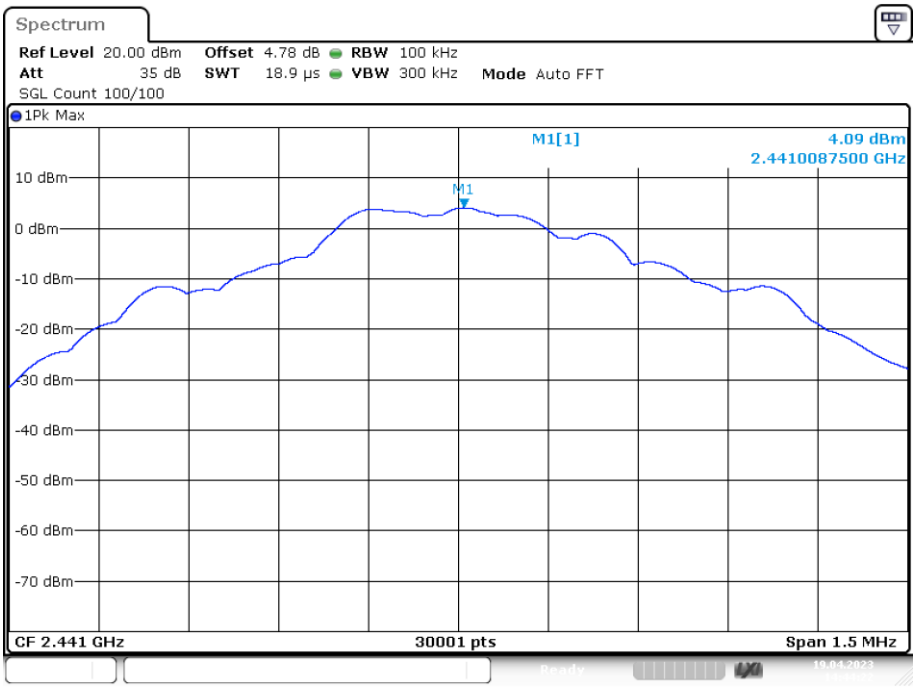


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40207 GHz	4.68 dBm		
M2		1	6.555737 GHz	-36.55 dBm		
M3		1	4.78313 GHz	-36.99 dBm		
M4		1	7.021609 GHz	-40.28 dBm		
M5		1	9.592729 GHz	-39.73 dBm		

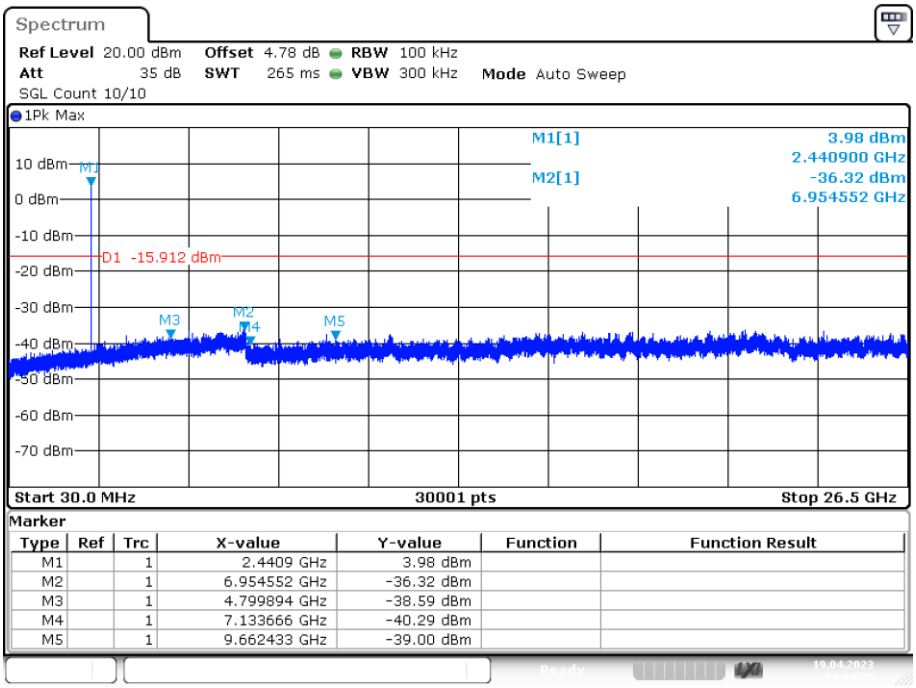
Date: 19.APR.2023 14:43:29

Tx. Spurious NVNT 1-DH1 2441MHz Ant1 Ref



Date: 19.APR.2023 14:44:22

Tx. Spurious NVNT 1-DH1 2441MHz Ant1 Emission



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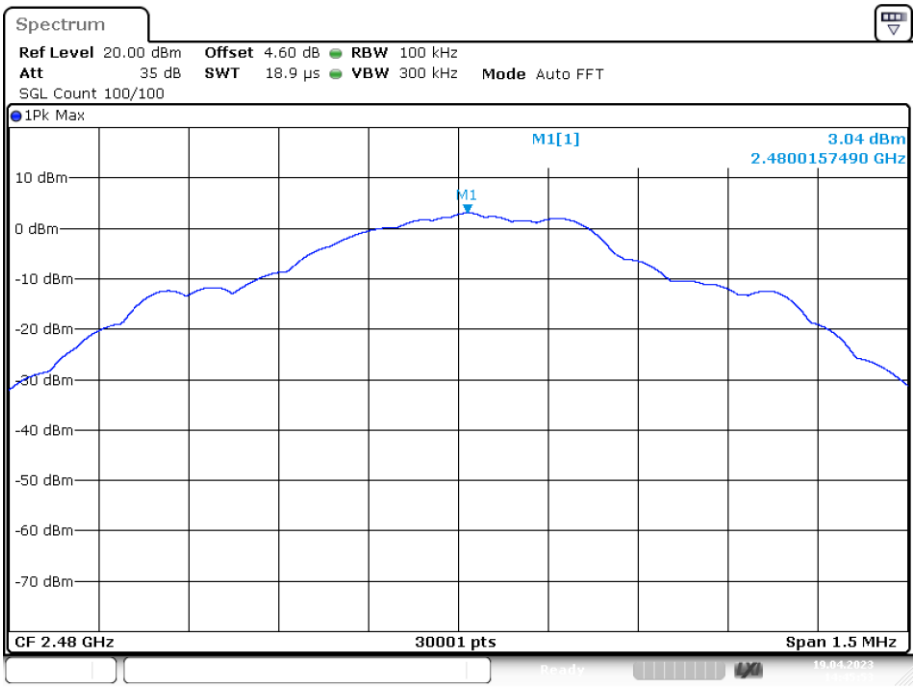
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4409 GHz	3.98 dBm		
M2		1	6.954552 GHz	-36.32 dBm		
M3		1	4.799894 GHz	-38.59 dBm		
M4		1	7.133666 GHz	-40.29 dBm		
M5		1	9.662433 GHz	-39.00 dBm		

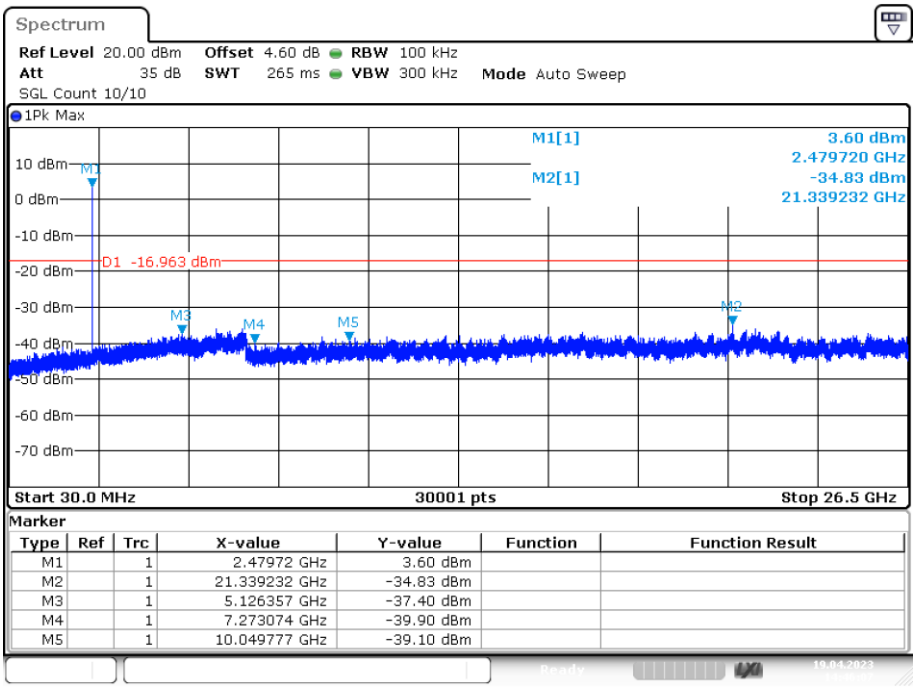
Date: 19.APR.2023 14:44:36

Tx. Spurious NVNT 1-DH1 2480MHz Ant1 Ref



Date: 19.APR.2023 14:45:53

Tx. Spurious NVNT 1-DH1 2480MHz Ant1 Emission



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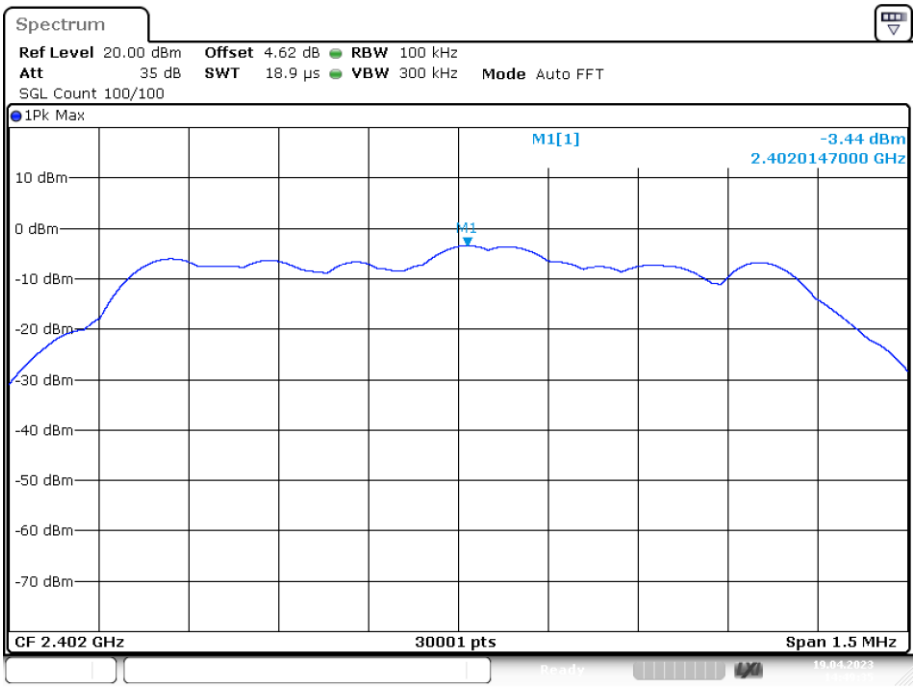
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47972 GHz	3.60 dBm		
M2		1	21.339232 GHz	-34.83 dBm		
M3		1	5.126357 GHz	-37.40 dBm		
M4		1	7.273074 GHz	-39.90 dBm		
M5		1	10.049777 GHz	-39.10 dBm		

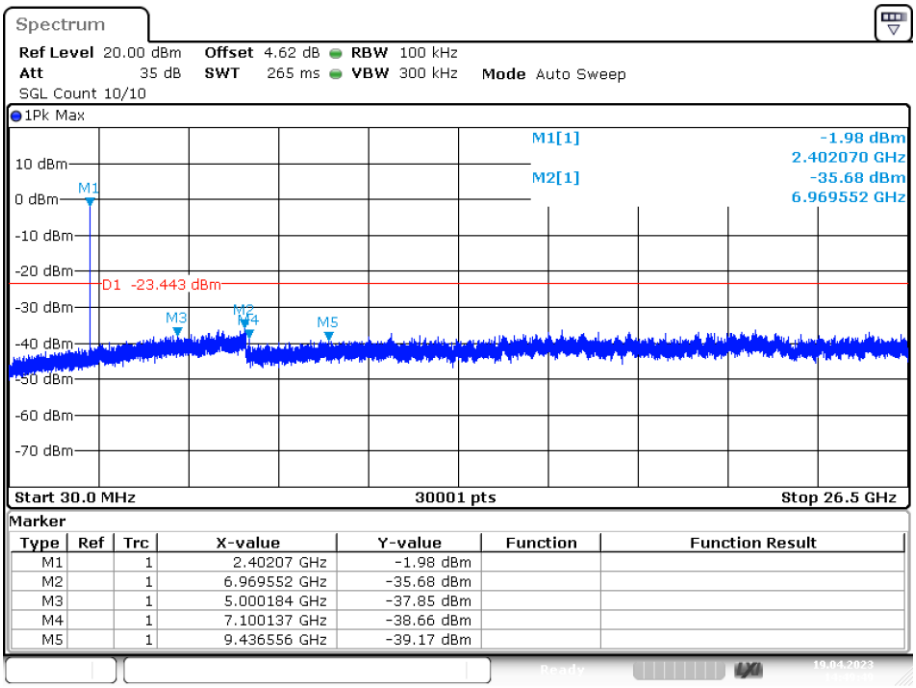
Date: 19.APR.2023 14:46:07

Tx. Spurious NVNT 2-DH1 2402MHz Ant1 Ref



Date: 19.APR.2023 14:49:35

Tx. Spurious NVNT 2-DH1 2402MHz Ant1 Emission

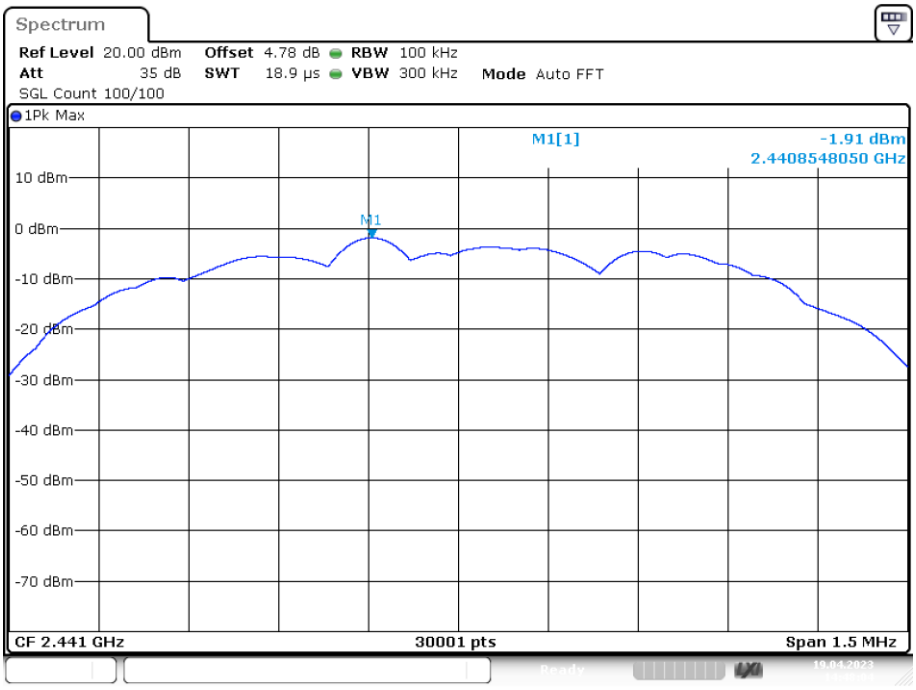


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40207 GHz	-1.98 dBm		
M2		1	6.969552 GHz	-35.68 dBm		
M3		1	5.000184 GHz	-37.85 dBm		
M4		1	7.100137 GHz	-38.66 dBm		
M5		1	9.436556 GHz	-39.17 dBm		

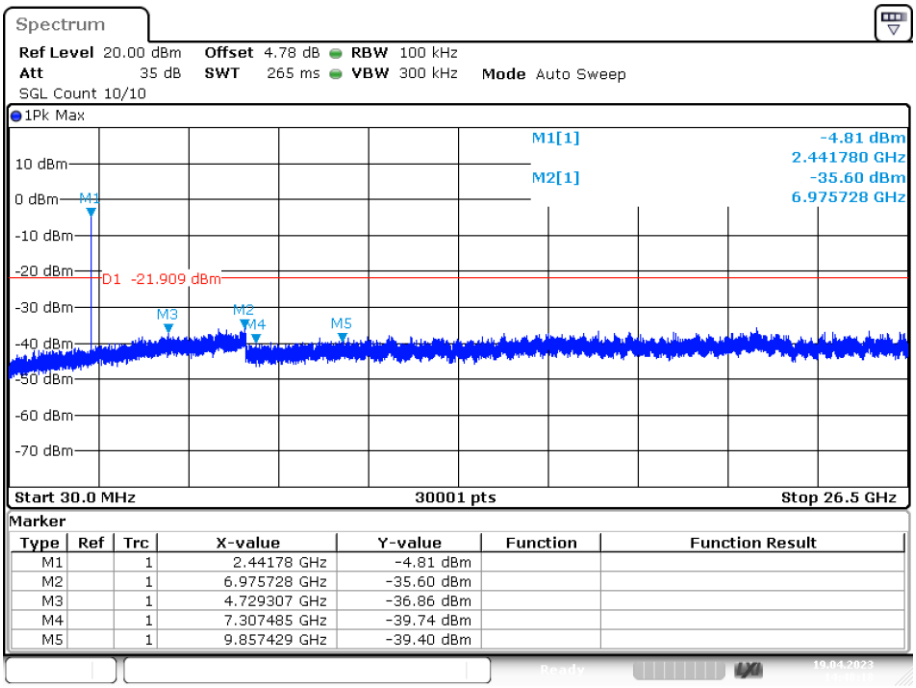
Date: 19.APR.2023 14:49:49

Tx. Spurious NVNT 2-DH1 2441MHz Ant1 Ref



Date: 19.APR.2023 14:48:04

Tx. Spurious NVNT 2-DH1 2441MHz Ant1 Emission

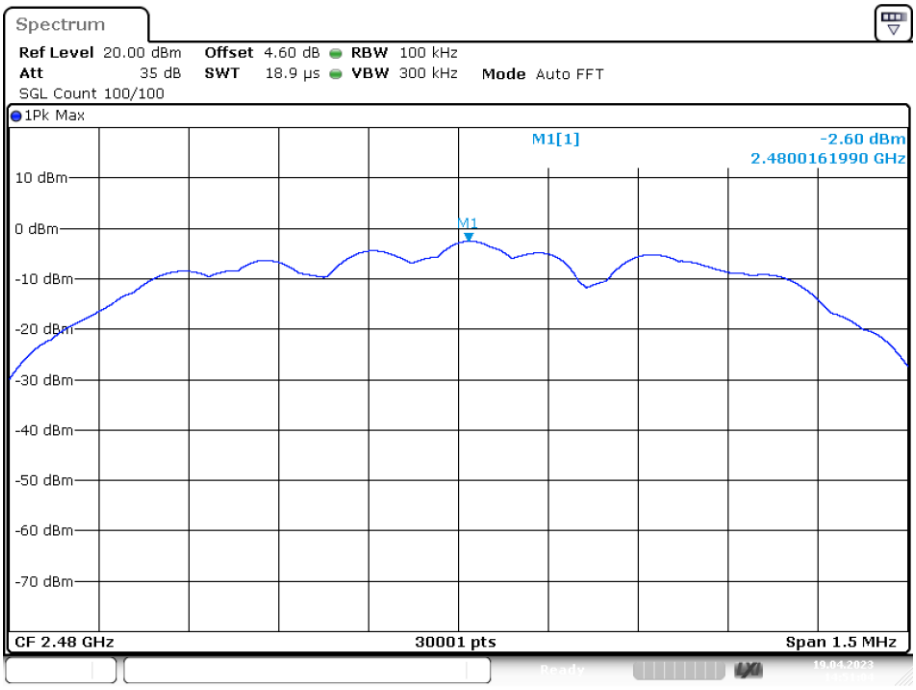


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.44178 GHz	-4.81 dBm		
M2		1	6.975728 GHz	-35.60 dBm		
M3		1	4.729307 GHz	-36.86 dBm		
M4		1	7.307485 GHz	-39.74 dBm		
M5		1	9.857429 GHz	-39.40 dBm		

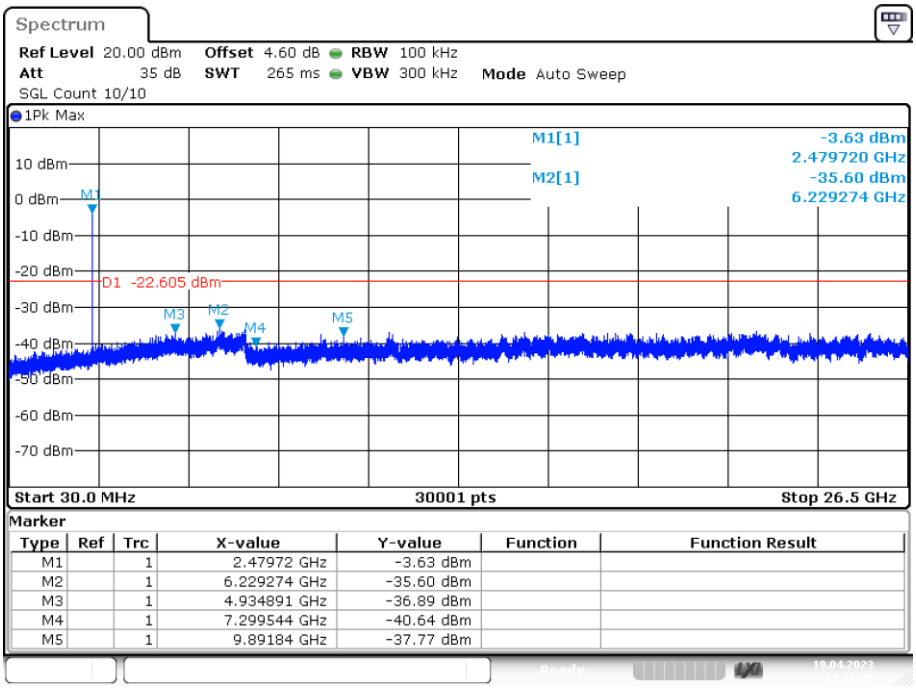
Date: 19.APR.2023 14:48:18

Tx. Spurious NVNT 2-DH1 2480MHz Ant1 Ref



Date: 19.APR.2023 14:51:05

Tx. Spurious NVNT 2-DH1 2480MHz Ant1 Emission



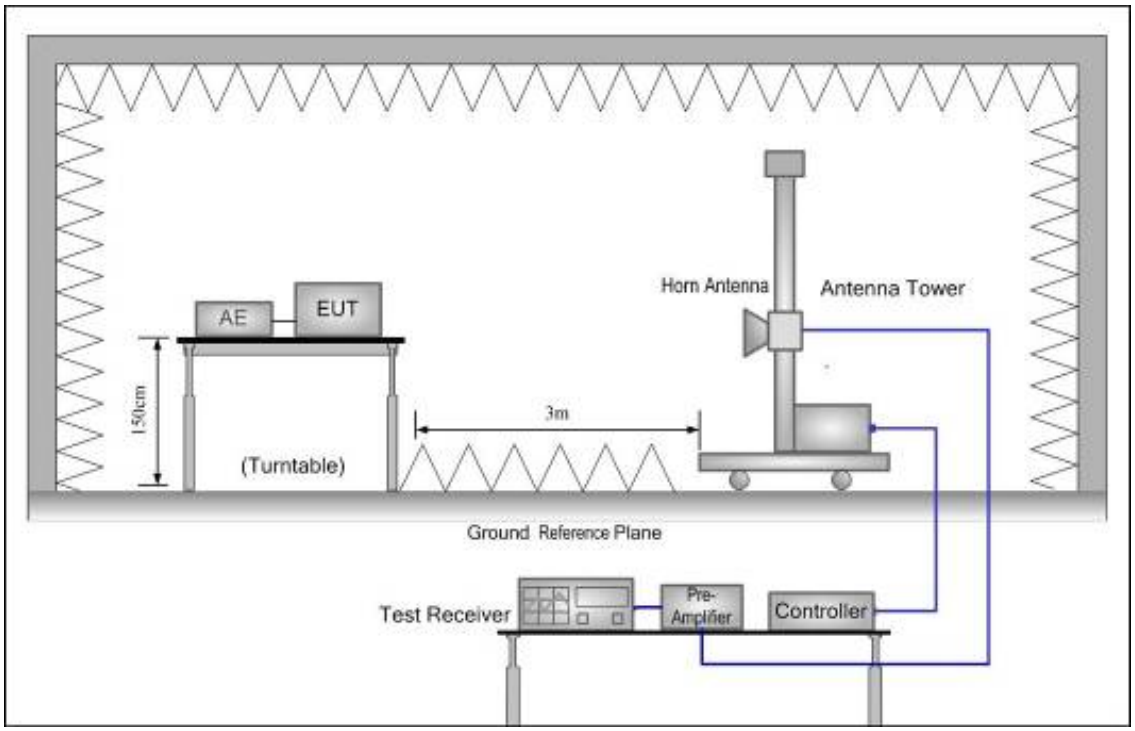
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47972 GHz	-3.63 dBm		
M2		1	6.229274 GHz	-35.60 dBm		
M3		1	4.934891 GHz	-36.89 dBm		
M4		1	7.299544 GHz	-40.64 dBm		
M5		1	9.89184 GHz	-37.77 dBm		

Date: 19.APR.2023 14:51:18

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.

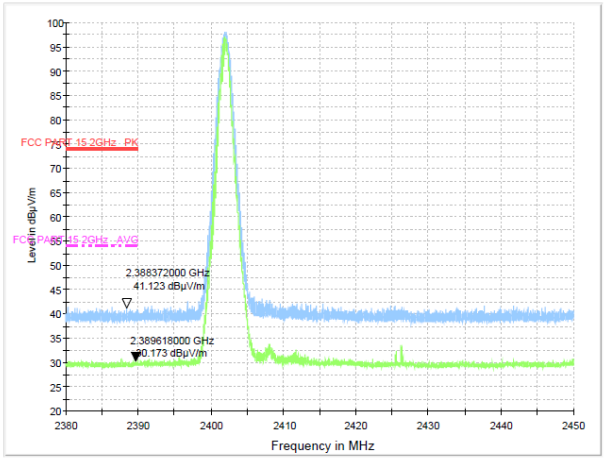
9.3. Test Procedure

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

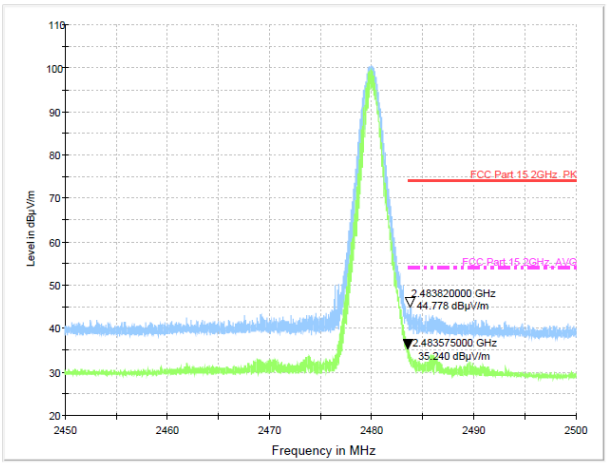
9.4. Test Result

PASS. (See below detailed test data)

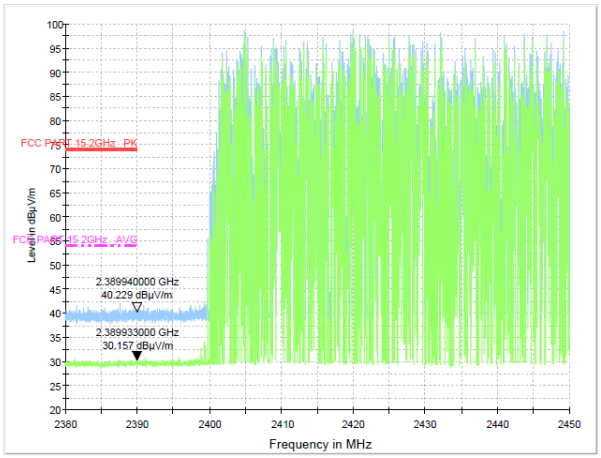
Test Mode: GFSK-Low Hopping-off



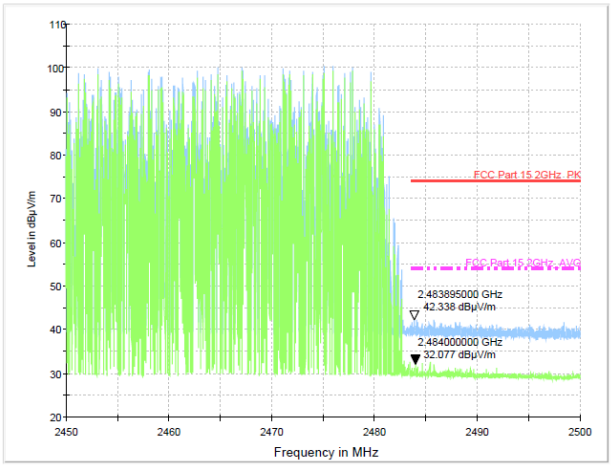
Test Mode: GFSK-High Hopping-off



Test Mode: GFSK-Low Hopping-on



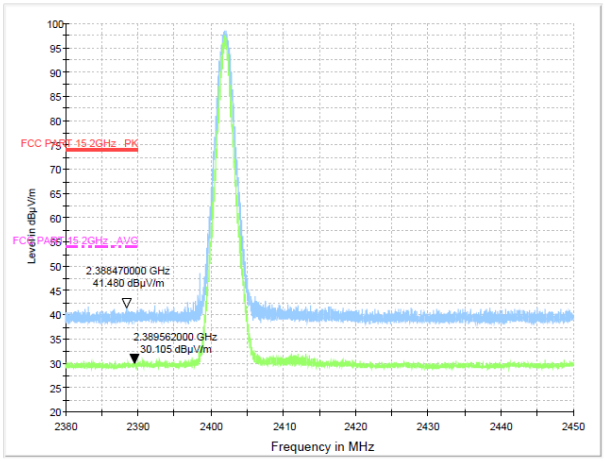
Test Mode: GFSK-High Hopping-on



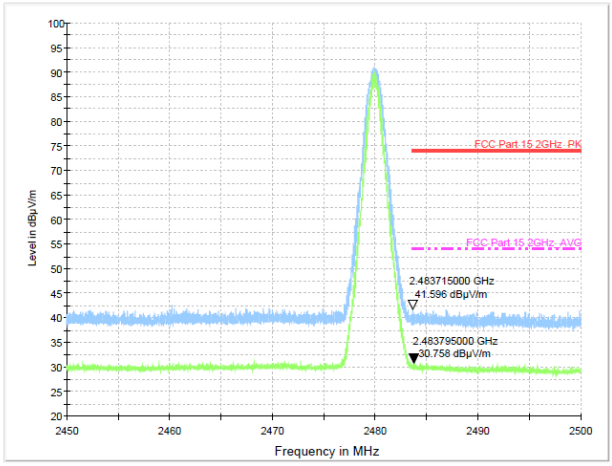
Note: 1. *:Maximum data; x:Over limit; !:over margin.

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

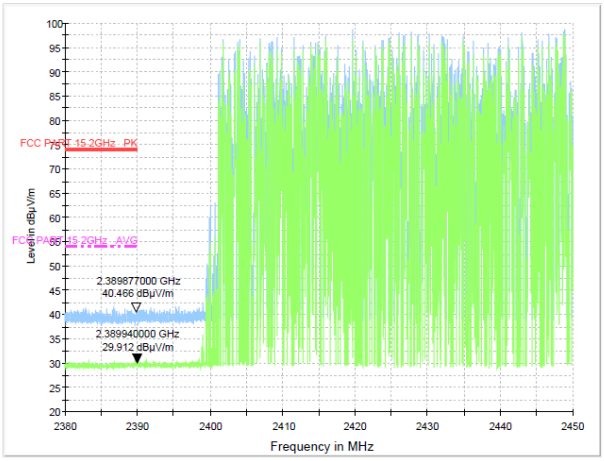
Test Mode: π/4 DQPSK-Low Hopping-off



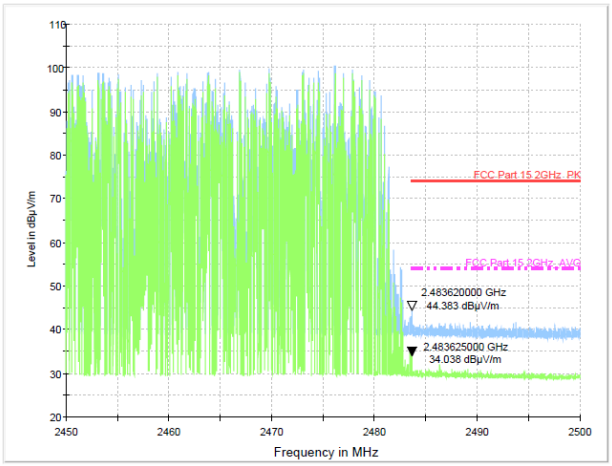
Test Mode: π/4 DQPSK-High Hopping-off



Test Mode: π/4 DQPSK-Low Hopping-on



Test Mode: π/4 DQPSK-High Hopping-on



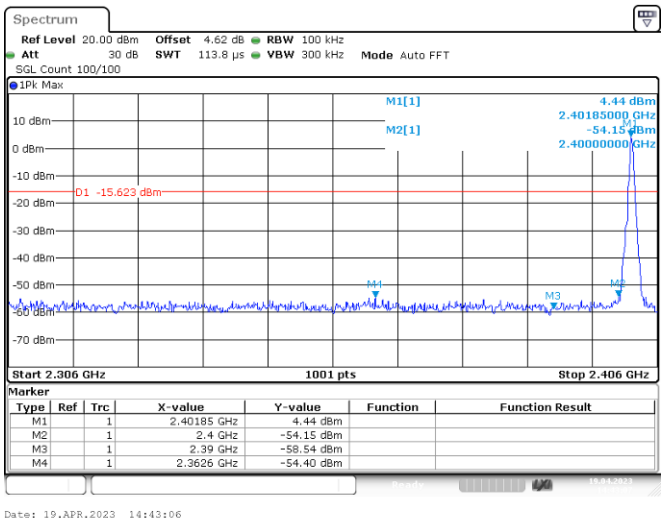
Note: 1. *:Maximum data; x:Over limit; !:over margin.

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

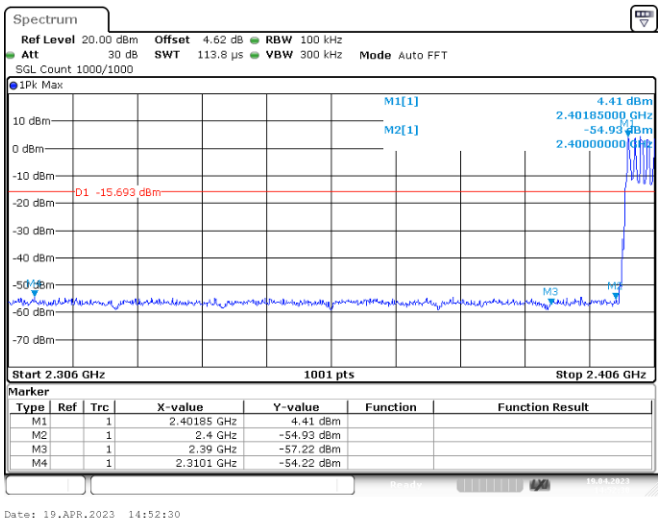
Conducted Method

GFSK Mode:

Test channel:	Lowest channel

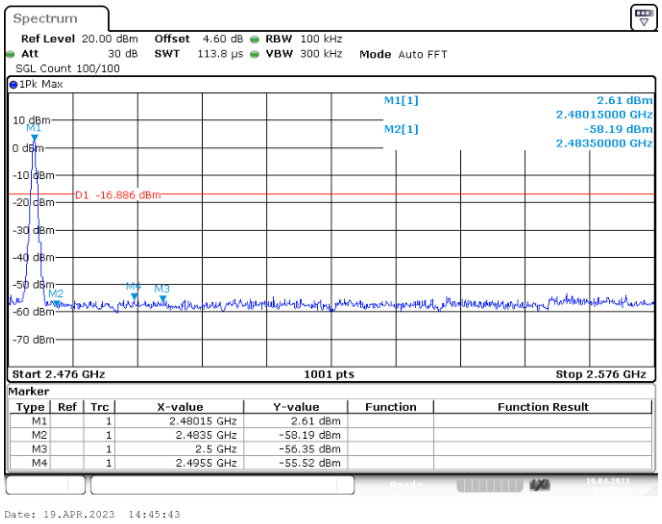


No-hopping mode

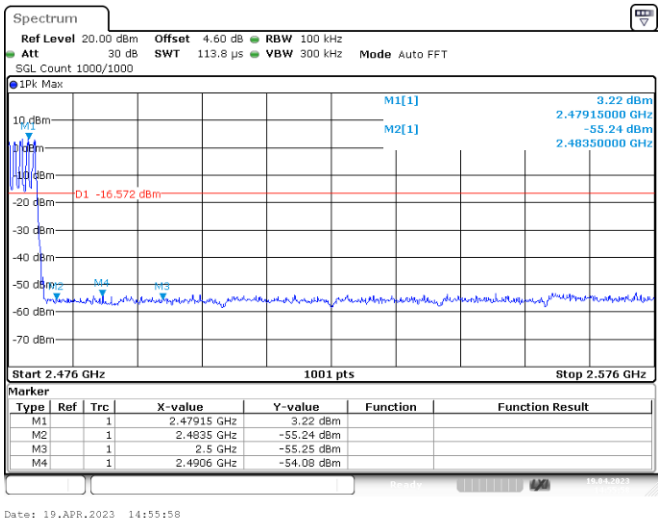


Hopping mode

Test channel:	Highest channel



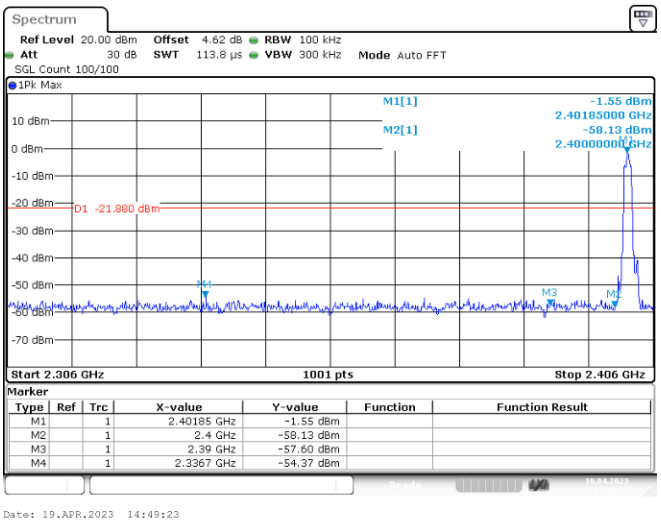
No-hopping mode



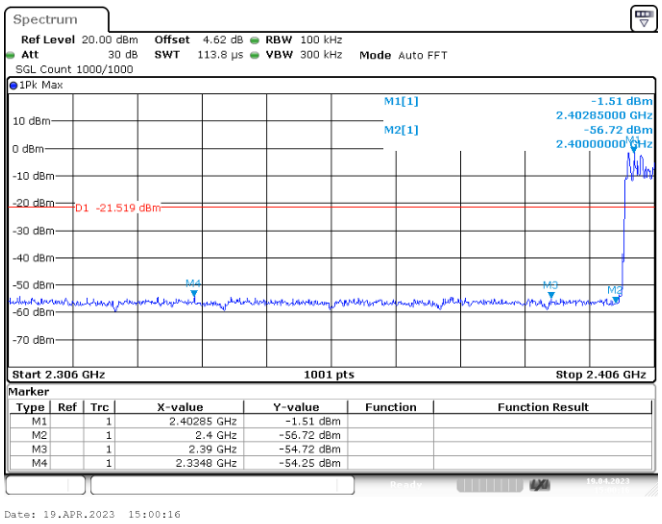
Hopping mode

π/4DQPSK Mode:

Test channel:	Lowest channel

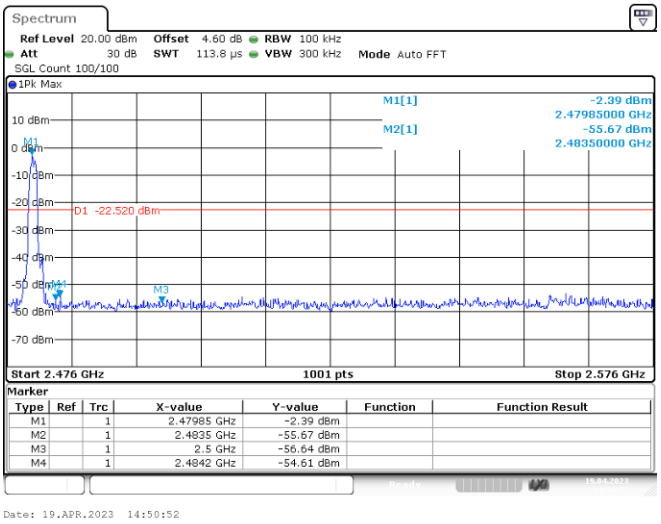


No-hopping mode

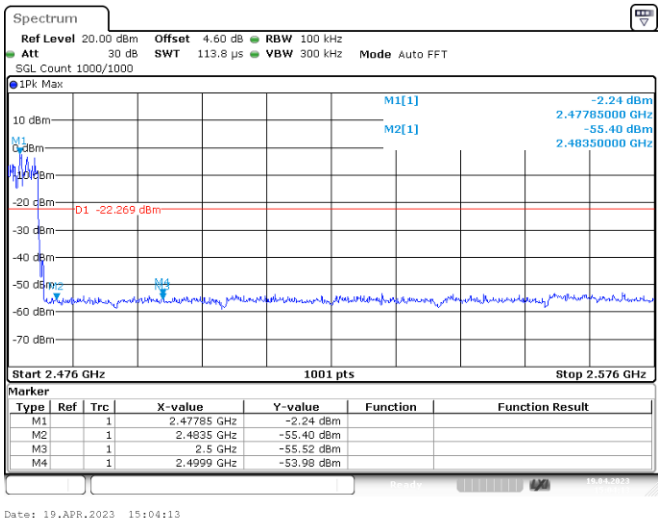


Hopping mode

Test channel:	Highest channel



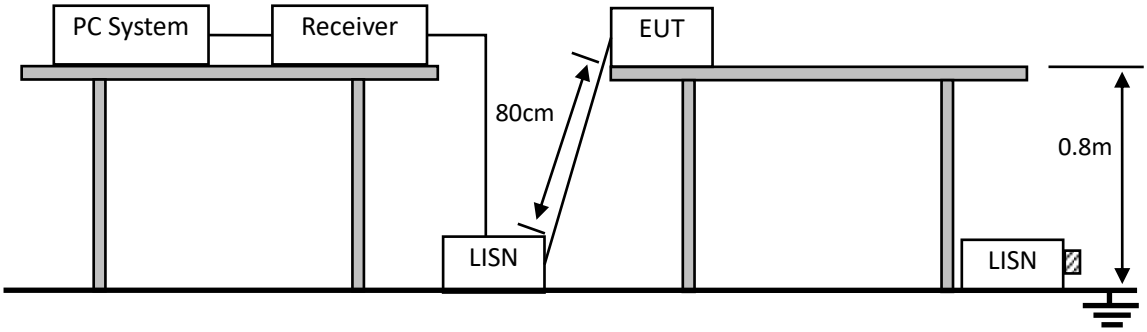
No-hopping mode



Hopping mode

10. POWER LINE CONDUCTED EMISSIONS

10.1.Block Diagram of Test Setup



:50Ω Terminator

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.

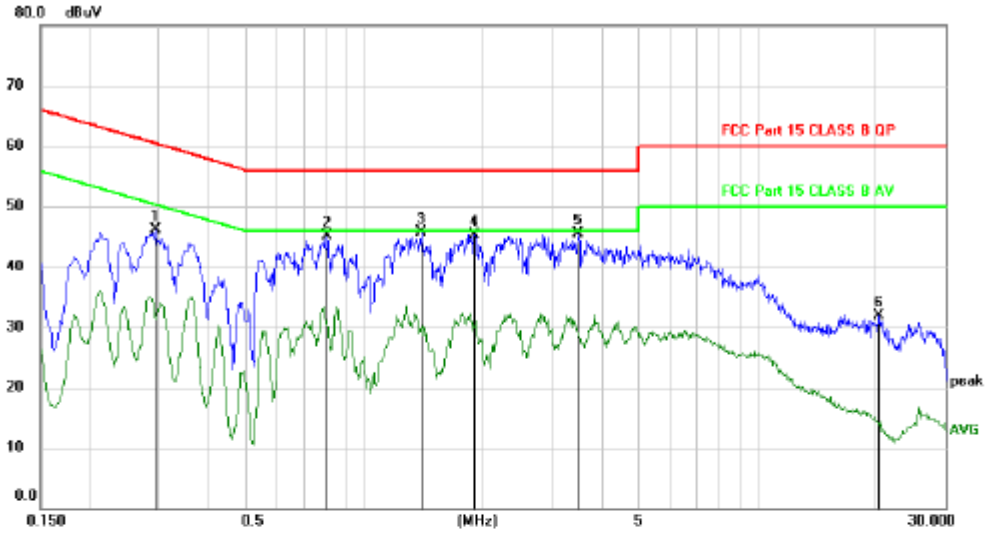
(5) The frequency range from 150 KHz to 30MHz is checked.

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

Polarity: L

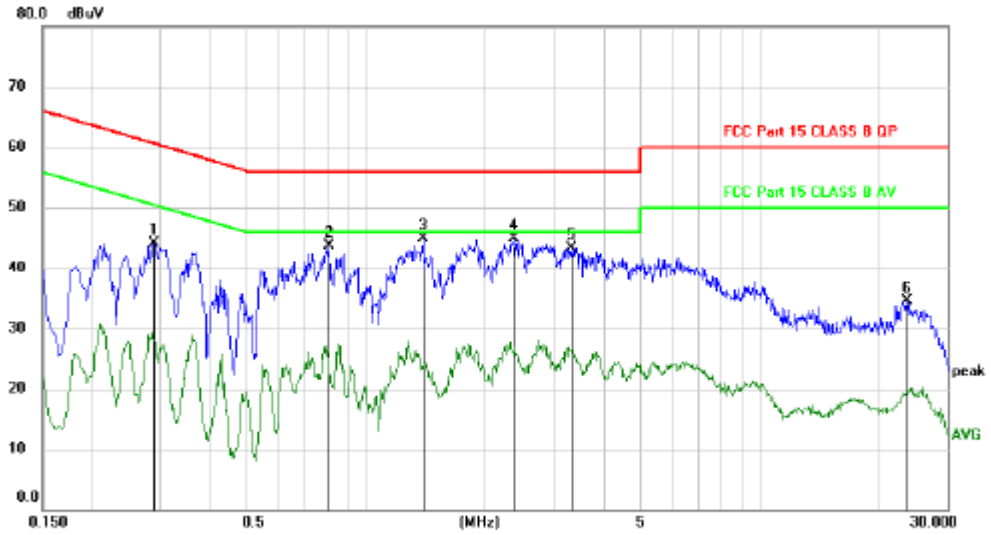


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.2940	36.20	9.93	46.13	60.41	-14.28	peak	
2		0.8070	35.23	9.94	45.17	56.00	-10.83	peak	
3	*	1.3950	35.86	9.90	45.76	56.00	-10.24	peak	
4		1.9050	35.47	9.88	45.35	56.00	-10.65	peak	
5		3.5070	35.56	9.96	45.52	56.00	-10.48	peak	
6		20.3460	21.41	10.46	31.87	60.00	-28.13	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

Polarity: N



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.2880	34.20	9.93	44.13	60.58	-16.45	peak	
2		0.8070	33.75	9.94	43.69	56.00	-12.31	peak	
3	*	1.3950	35.02	9.90	44.92	56.00	-11.08	peak	
4		2.3790	35.02	9.90	44.92	56.00	-11.08	peak	
5		3.3120	33.43	9.95	43.38	56.00	-12.62	peak	
6		23.7300	24.08	10.45	34.53	60.00	-25.47	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 2441MHz 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