



FCC TEST REPORT

FCC ID: 2BAF2-AJG

On Behalf of

Shenzhen Fusion Aurora Technology Co., Ltd

Carplay Android Box

Model No.: ZONE, R601, R602, R608, R603

Prepared for : Shenzhen Fusion Aurora Technology Co., Ltd
Address : L25, 4th Floor, Lianhui Building, Longhua Street, Longhua 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

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TEST REPORT DECLARATION

Applicant : Shenzhen Fusion Aurora Technology Co., Ltd
Address : L25, 4th Floor, Lianhui Building, Longhua Street, Longhua District, Shenzhen
Manufacturer : Shenzhen Fusion Aurora Technology Co., Ltd
Address : L25, 4th Floor, Lianhui Building, Longhua Street, Longhua District, Shenzhen
EUT Description : Carplay Android Box
(A) Model No. ZONE, R601, R602, R608, R603
(B) Trademark N/A

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.

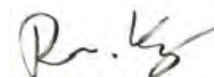
After the test, our opinion is that EUT compliance with the requirement of the above standards.

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



Approved by (name + signature).....: Reak Yang
Project Manager



Date of issue.....: March 18, 2023

Revision History

Revision	Issue Date	Revisions	Revised By
V0	March 18, 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	: Carplay Android Box
Model Number	: ZONE, R601, R602, R608, R603
Diff	: There is no difference except the name of the model. All tests are made with the ZONE model.
Power supply	: DC 5V from USB
Radio Technology	: Bluetooth V5.0 EDR
Operation frequency	: 2402-2480MHz
Channel No.	: 79 Channels
Channel spacing	: 1MHz
Modulation type	: GFSK, $\pi/4$ DQPSK, 8DPSK
Antenna Type	: FPC antenna, max gain 1.05dBi (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

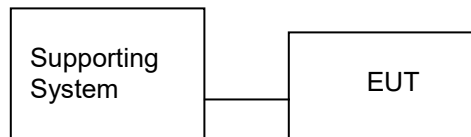
2.2. Accessories of Device (EUT)

Accessories : /
 Manufacturer : /
 Model : /
 Ratings : /

2.3. Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number	Certification or SDoC
1.	TV	TCL	32 inches	N/A	N/A
2.	Adapter	Huoniu	HNFCQC3024UU	N/A	N/A

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
$\pi/4$ DQPSK	Low :CH1	2402
	Middle: CH40	2441
	High: CH79	2480
8DPSK	Low :CH1	2402
	Middle: CH40	2441
	High: CH79	2480

2.6. Test Conditions

Items	Required	Actual
Temperature range:	15-35°C	24°C
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°C
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	1316.3003K03-10 2082-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	Wei Huang	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

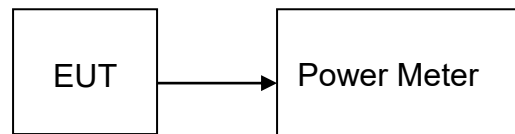
Please refer section 15.247.

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

Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Duty Factor (dB)	Total Power (dBm)	Limit (dBm)	Verdict
NVNT	1-DH1	2402	Ant1	1.251	0	1.251	21	Pass
NVNT	1-DH1	2441	Ant1	1.566	0	1.566	21	Pass
NVNT	1-DH1	2480	Ant1	0.877	0	0.877	21	Pass
NVNT	1-DH3	2441	Ant1	1.474	0	1.474	21	Pass
NVNT	1-DH5	2441	Ant1	1.28	0	1.28	21	Pass
NVNT	2-DH1	2402	Ant1	1.256	0	1.256	21	Pass
NVNT	2-DH1	2441	Ant1	1.606	0	1.606	21	Pass
NVNT	2-DH1	2480	Ant1	0.782	0	0.782	21	Pass
NVNT	2-DH3	2441	Ant1	1.569	0	1.569	21	Pass
NVNT	2-DH5	2441	Ant1	1.398	0	1.398	21	Pass
NVNT	3-DH1	2402	Ant1	-1.376	0	-1.376	21	Pass
NVNT	3-DH1	2441	Ant1	0.611	0	0.611	21	Pass
NVNT	3-DH1	2480	Ant1	-0.079	0	-0.079	21	Pass
NVNT	3-DH3	2441	Ant1	0.698	0	0.698	21	Pass
NVNT	3-DH5	2441	Ant1	0.989	0	0.989	21	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.

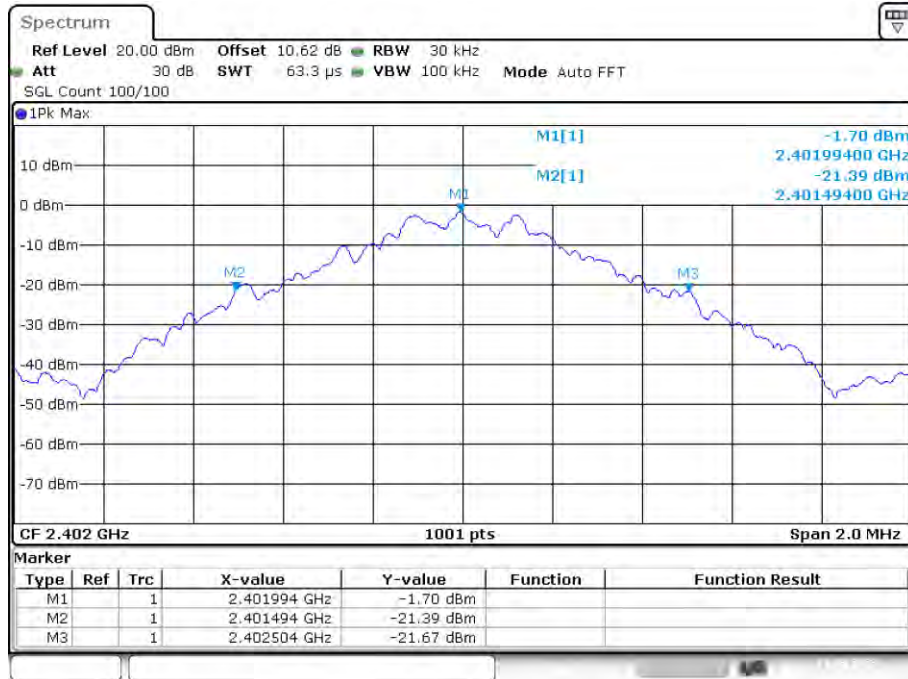
4.2. Test Procedure

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.

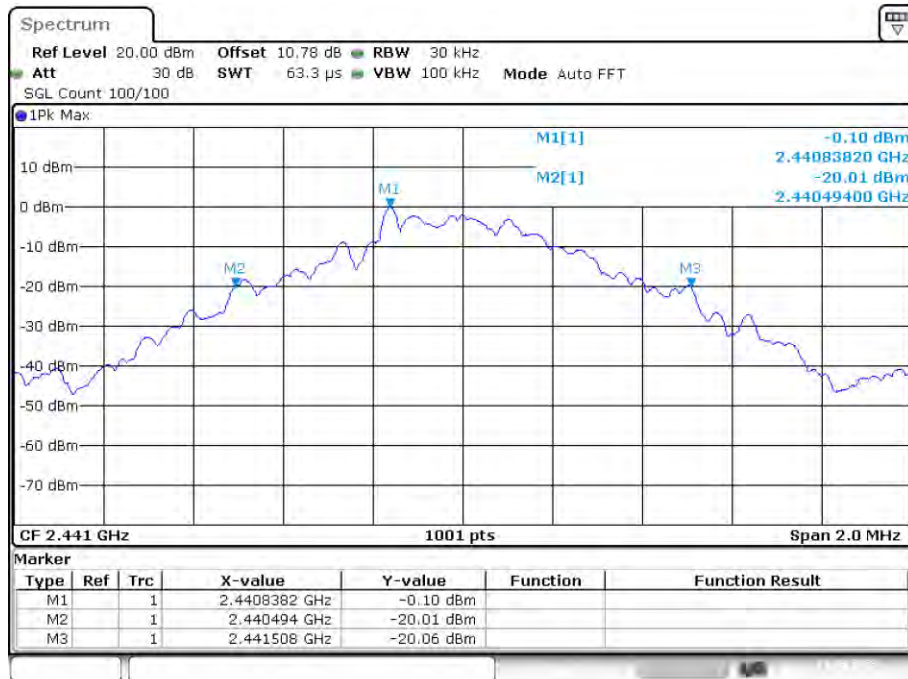
4.3. Test Result

-20dB Bandwidth

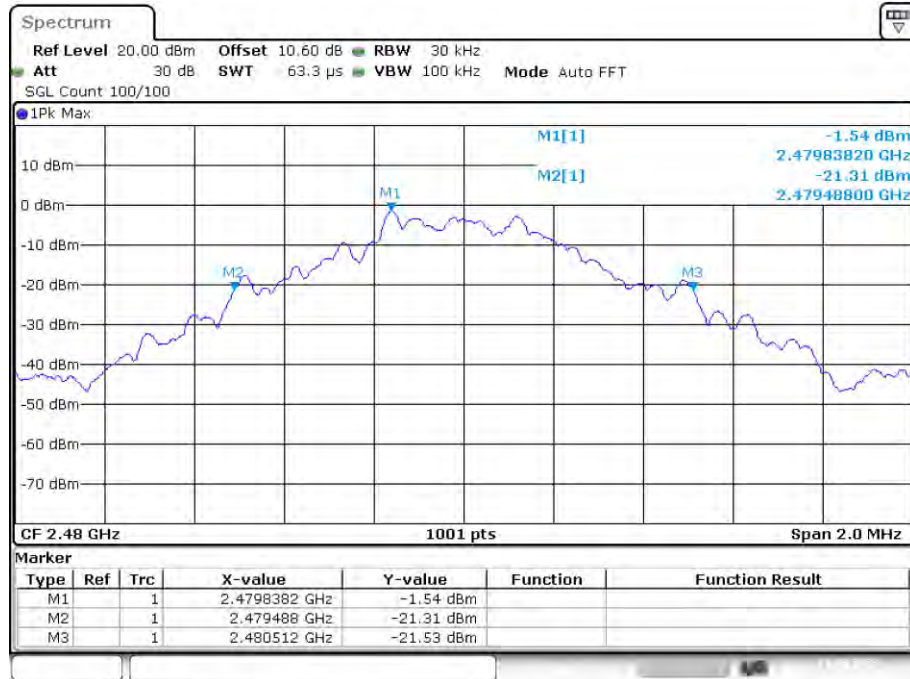
Condition	Mode	Frequency (MHz)	Antenna	-20 dB Bandwidth (MHz)	Limit -20 dB Bandwidth (MHz)	Verdict
NVNT	1-DH1	2402	Ant1	1.01	/	Pass
NVNT	1-DH1	2441	Ant1	1.014	/	Pass
NVNT	1-DH1	2480	Ant1	1.024	/	Pass
NVNT	2-DH1	2402	Ant1	1.258	/	Pass
NVNT	2-DH1	2441	Ant1	1.246	/	Pass
NVNT	2-DH1	2480	Ant1	1.278	/	Pass
NVNT	3-DH1	2402	Ant1	1.276	/	Pass
NVNT	3-DH1	2441	Ant1	1.282	/	Pass
NVNT	3-DH1	2480	Ant1	1.224	/	Pass

-20dB Bandwidth NVNT 1-DH1 2402MHz Ant1

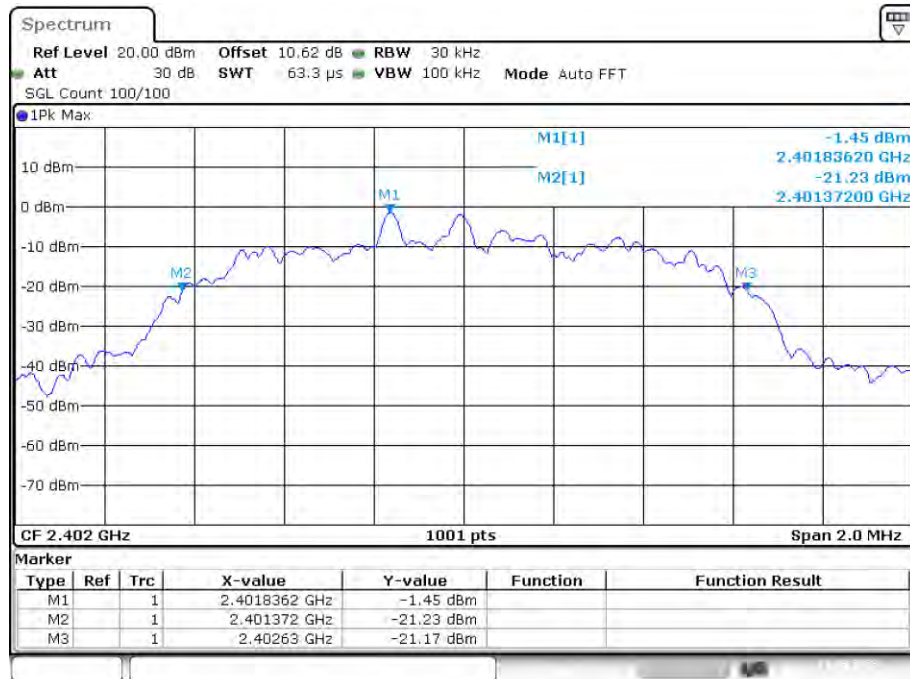
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-20dB Bandwidth NVNT 1-DH1 2441MHz Ant1

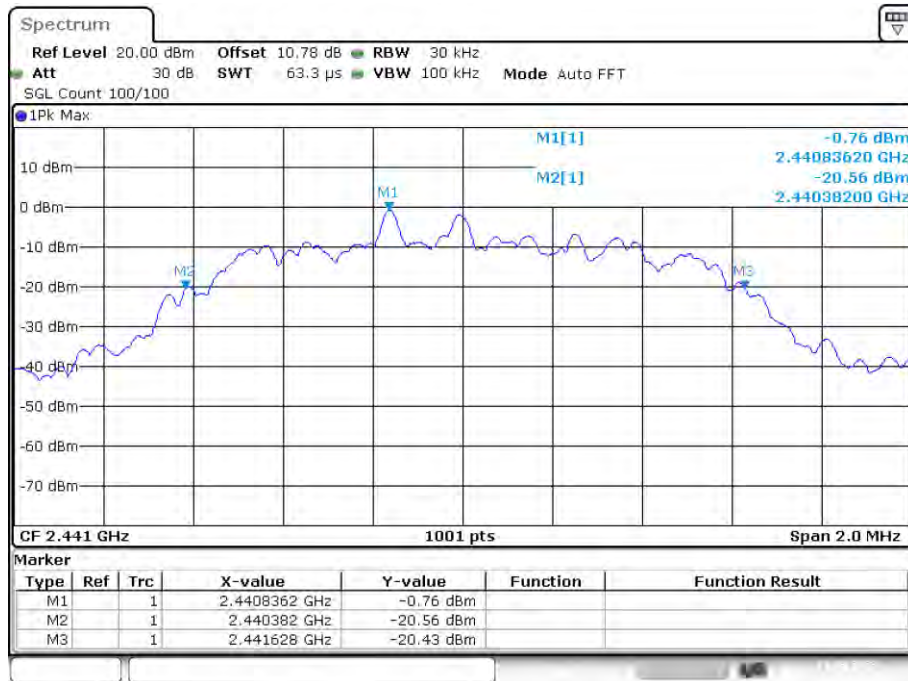
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-20dB Bandwidth NVNT 1-DH1 2480MHz Ant1

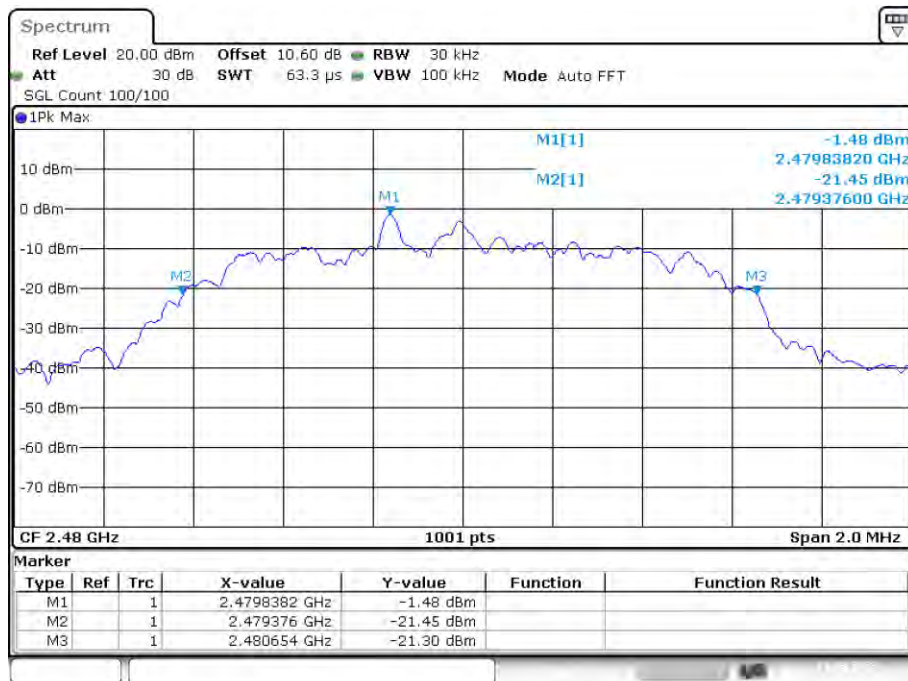
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-20dB Bandwidth NVNT 2-DH1 2402MHz Ant1

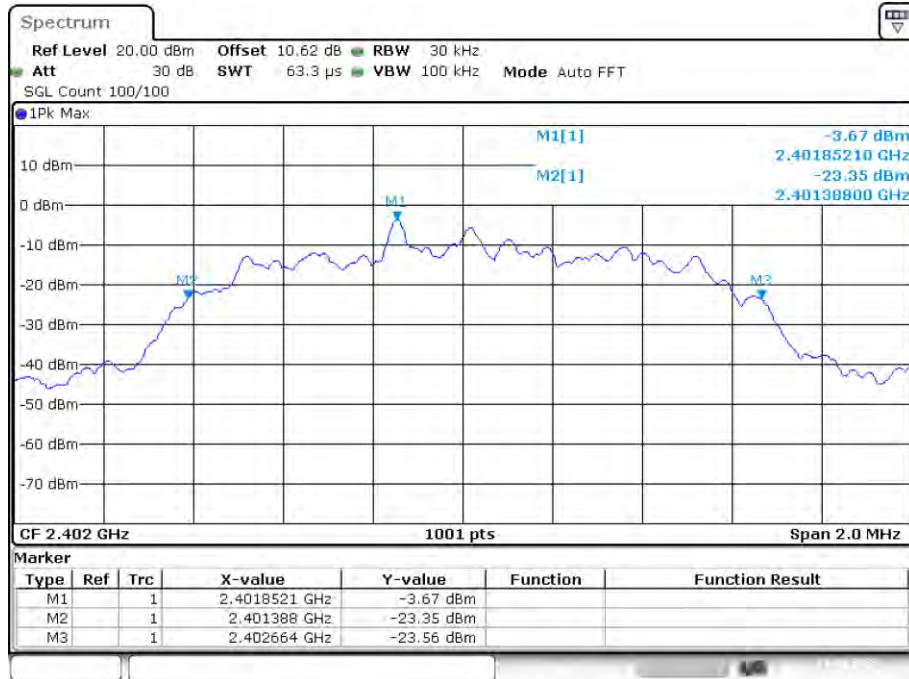
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-20dB Bandwidth NVNT 2-DH1 2441MHz Ant1

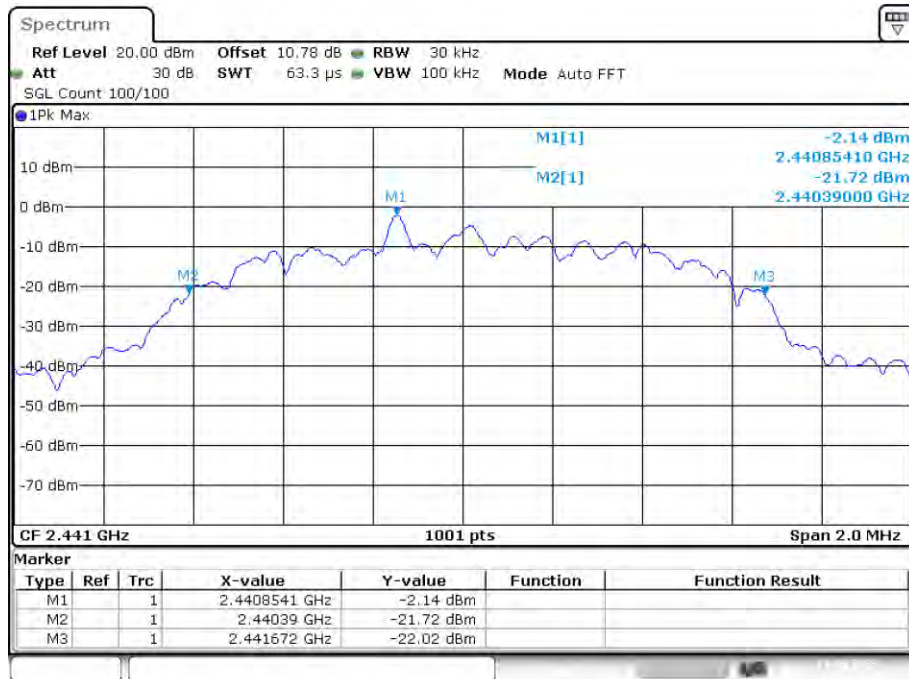
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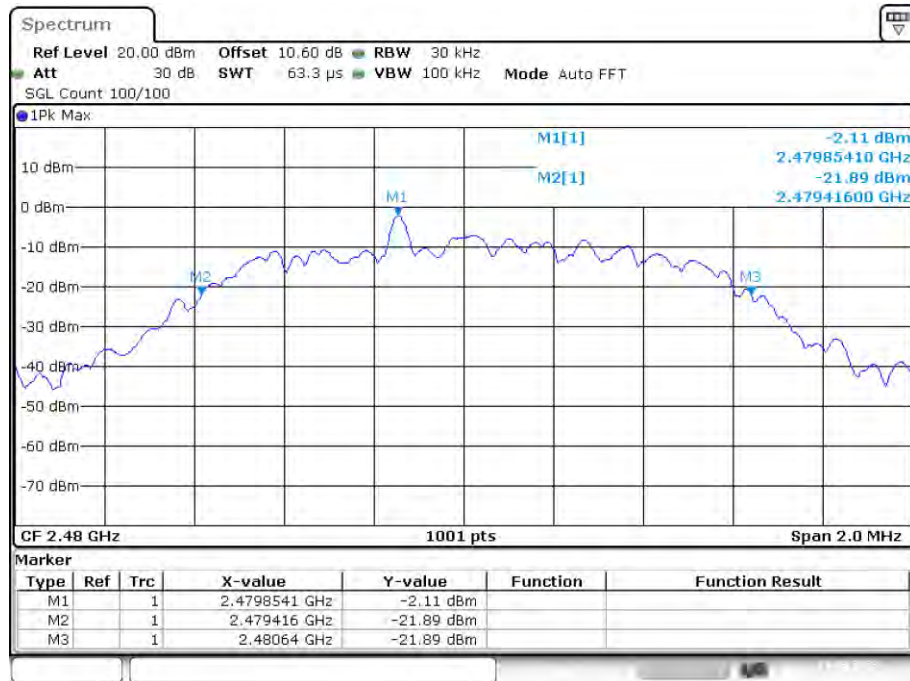
-20dB Bandwidth NVNT 3-DH1 2402MHz Ant1

Date: 13.MAR.2023 05:51:02

-20dB Bandwidth NVNT 3-DH1 2441MHz Ant1

Date: 13.MAR.2023 05:54:12

-20dB Bandwidth NVNT 3-DH1 2480MHz Ant1

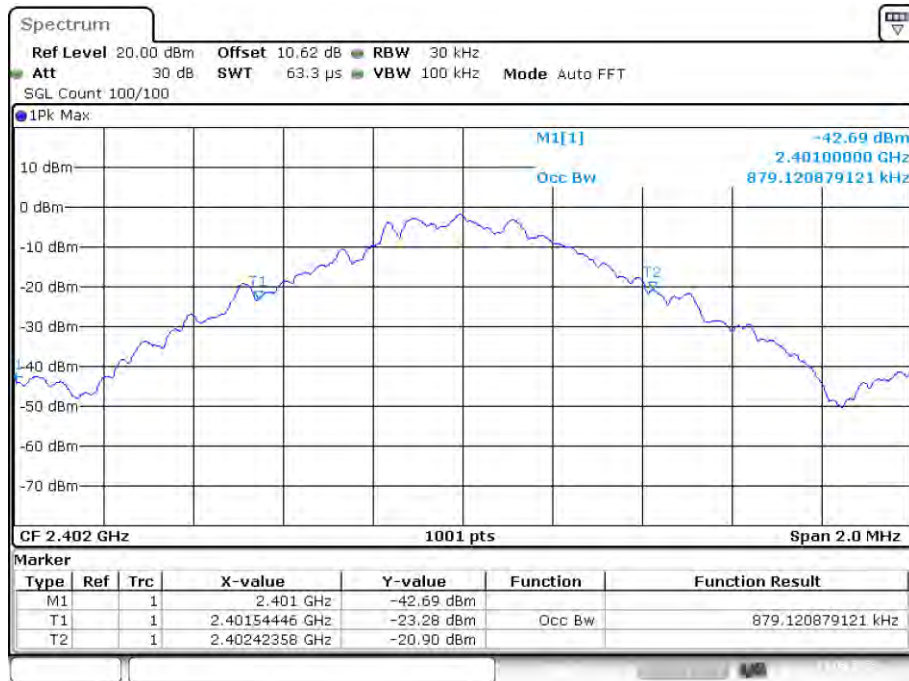


Date: 13.MAR.2023 05:56:14

Occupied Channel Bandwidth

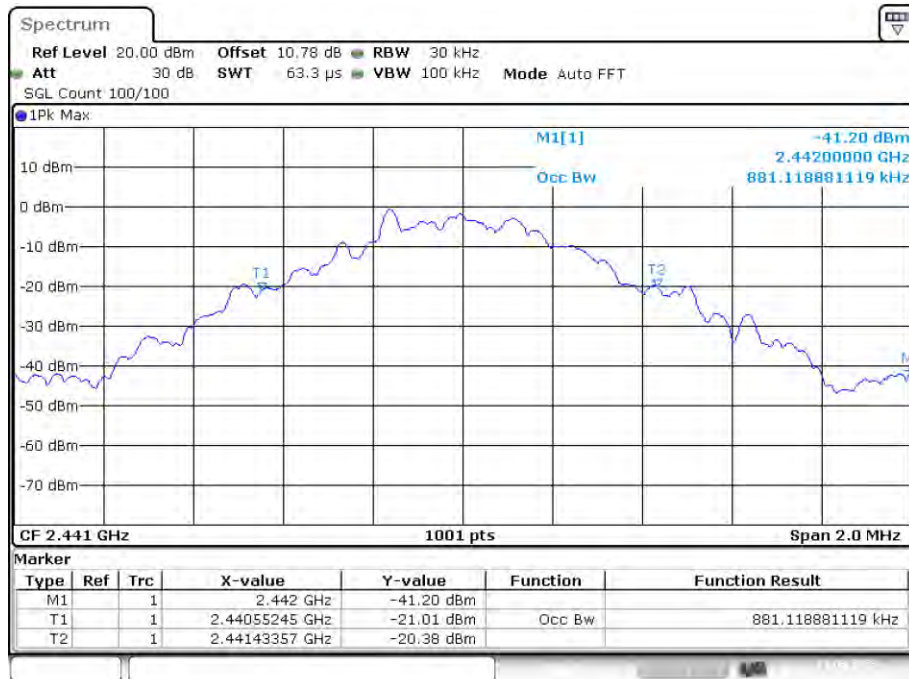
Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)
NVNT	1-DH1	2402	Ant1	0.879
NVNT	1-DH1	2441	Ant1	0.881
NVNT	1-DH1	2480	Ant1	0.927
NVNT	2-DH1	2402	Ant1	1.179
NVNT	2-DH1	2441	Ant1	1.189
NVNT	2-DH1	2480	Ant1	1.195
NVNT	3-DH1	2402	Ant1	1.157
NVNT	3-DH1	2441	Ant1	1.195
NVNT	3-DH1	2480	Ant1	1.179

OBW NVNT 1-DH1 2402MHz Ant1



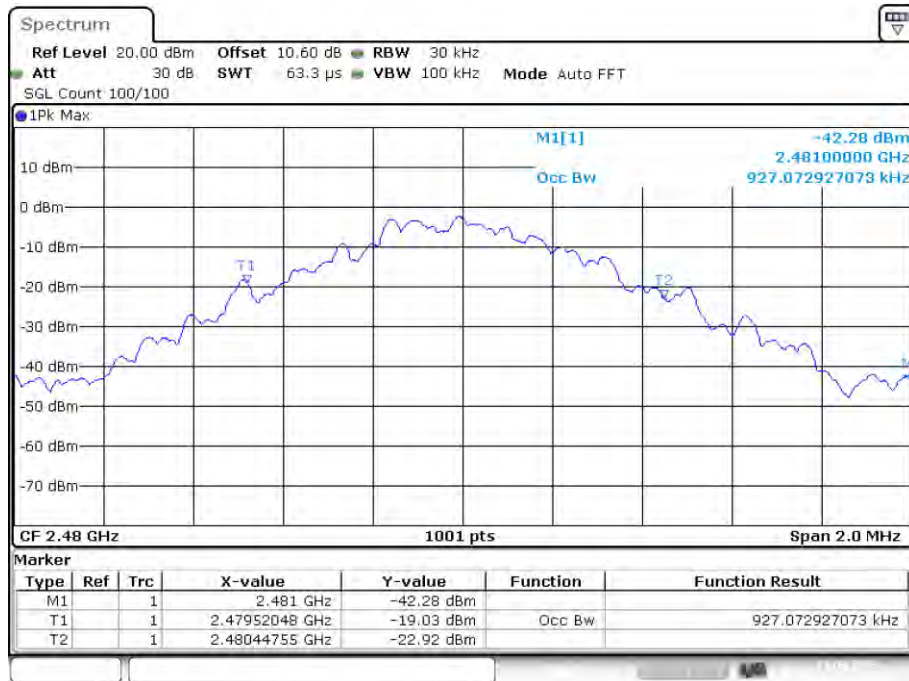
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OBW NVNT 1-DH1 2441MHz Ant1



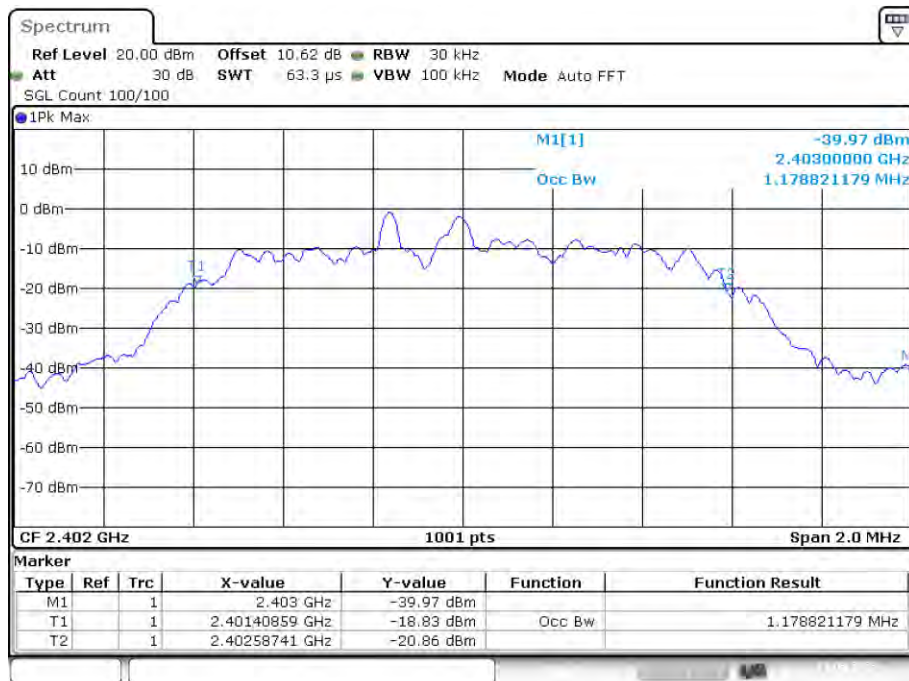
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OBW NVNT 1-DH1 2480MHz Ant1



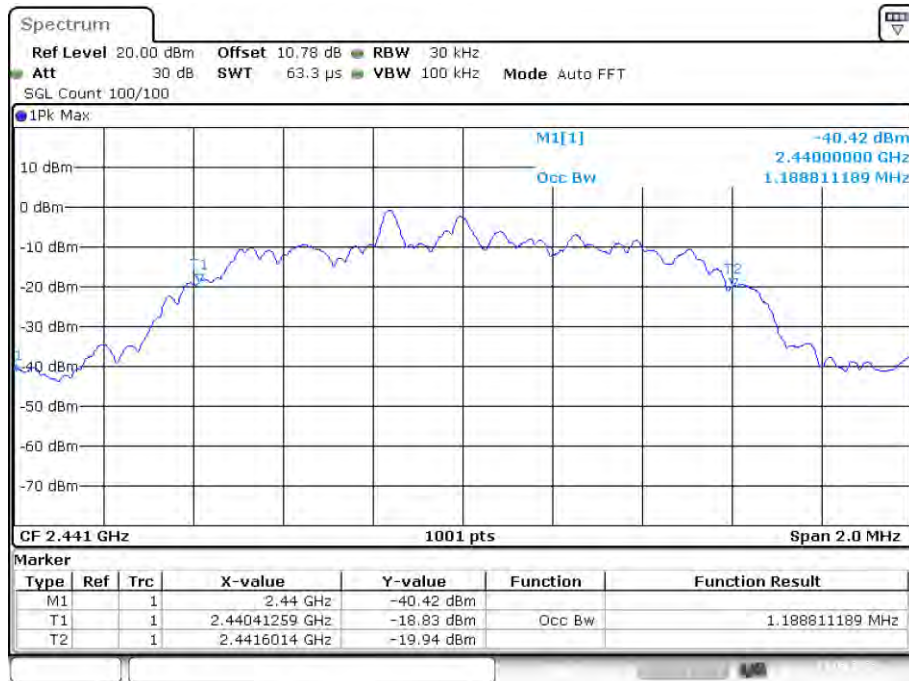
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OBW NVNT 2-DH1 2402MHz Ant1



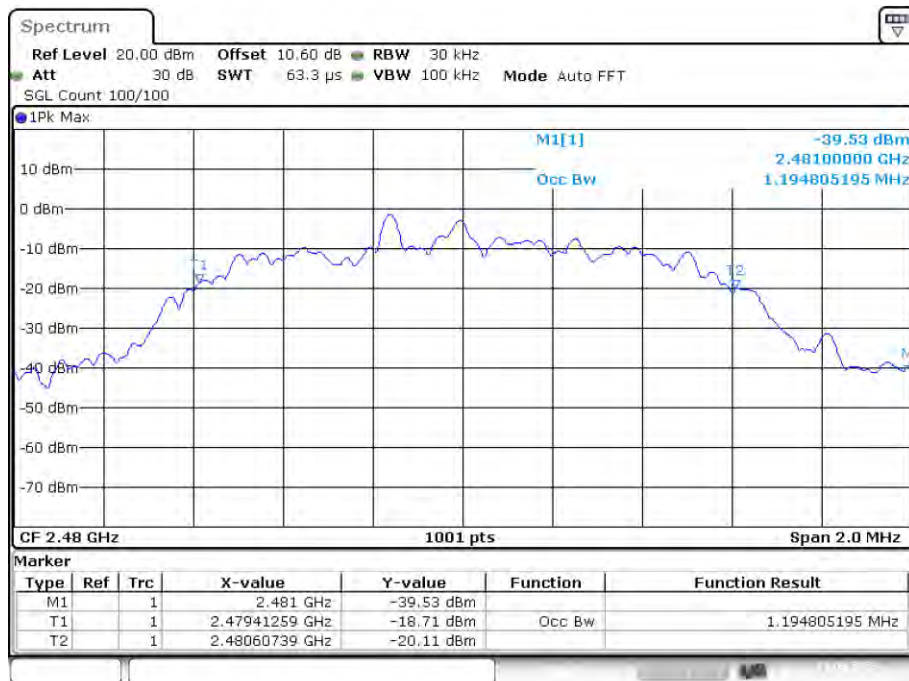
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OBW NVNT 2-DH1 2441MHz Ant1



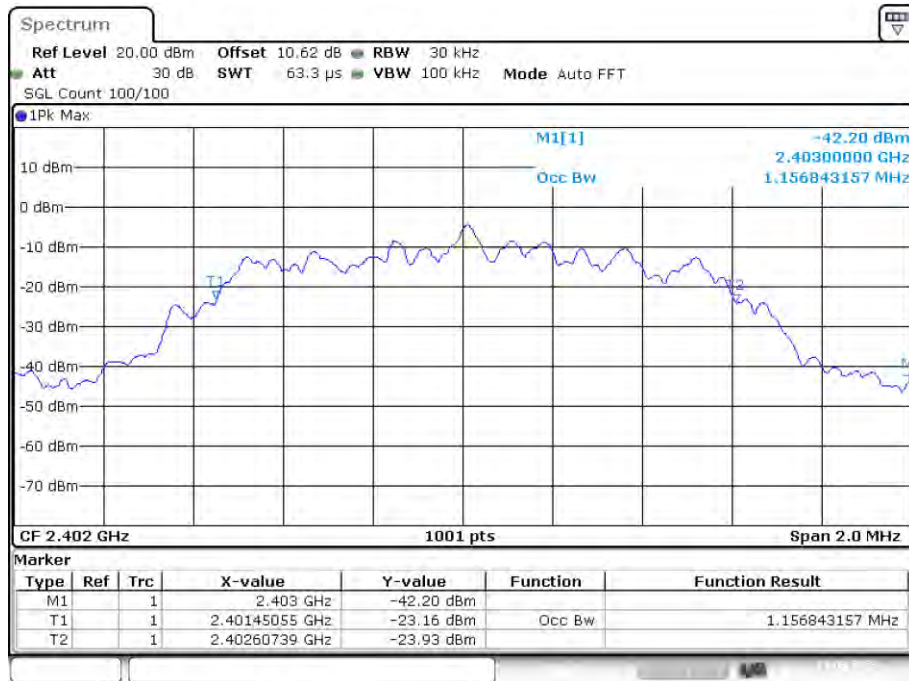
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OBW NVNT 2-DH1 2480MHz Ant1



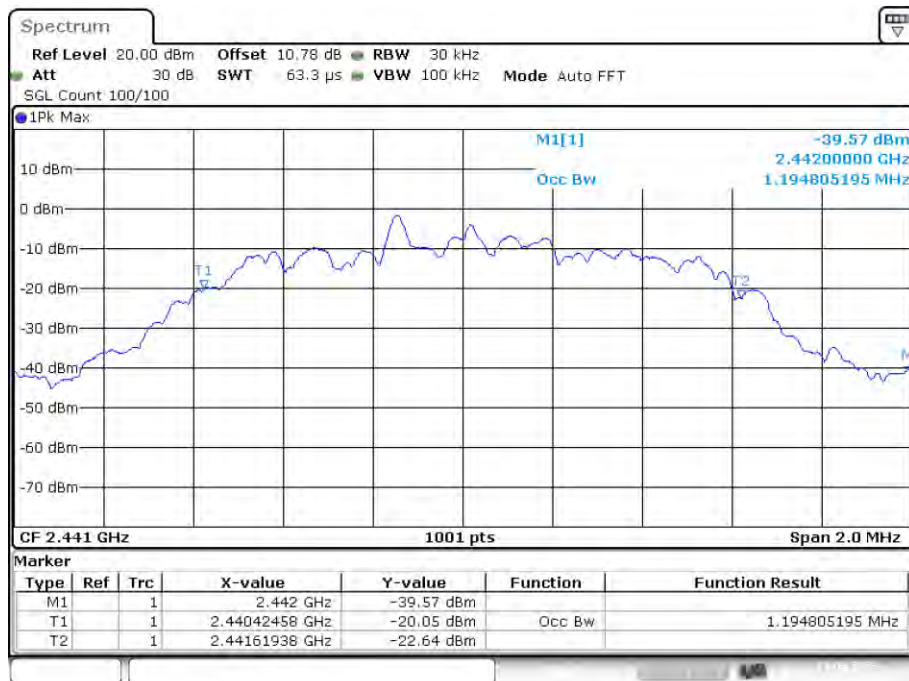
Date: 13.MAR.2023 04:34:42

OBW NVNT 3-DH1 2402MHz Ant1



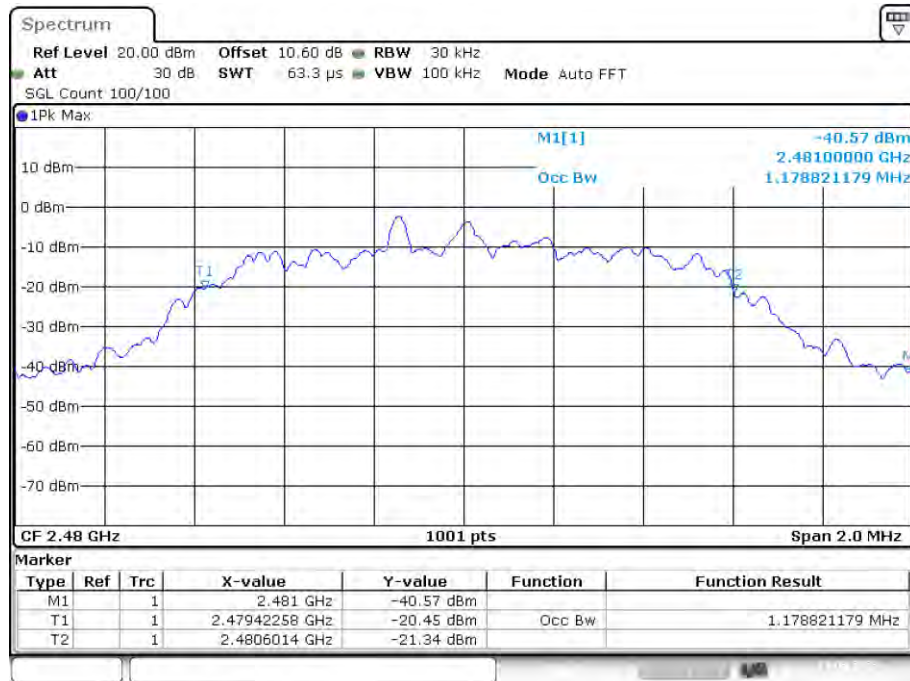
Date: 13.MAR.2023 05:50:49

OBW NVNT 3-DH1 2441MHz Ant1



Date: 13.MAR.2023 05:53:58

OBW NVNT 3-DH1 2480MHz Ant1



Date: 13.MAR.2023 05:56:00

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

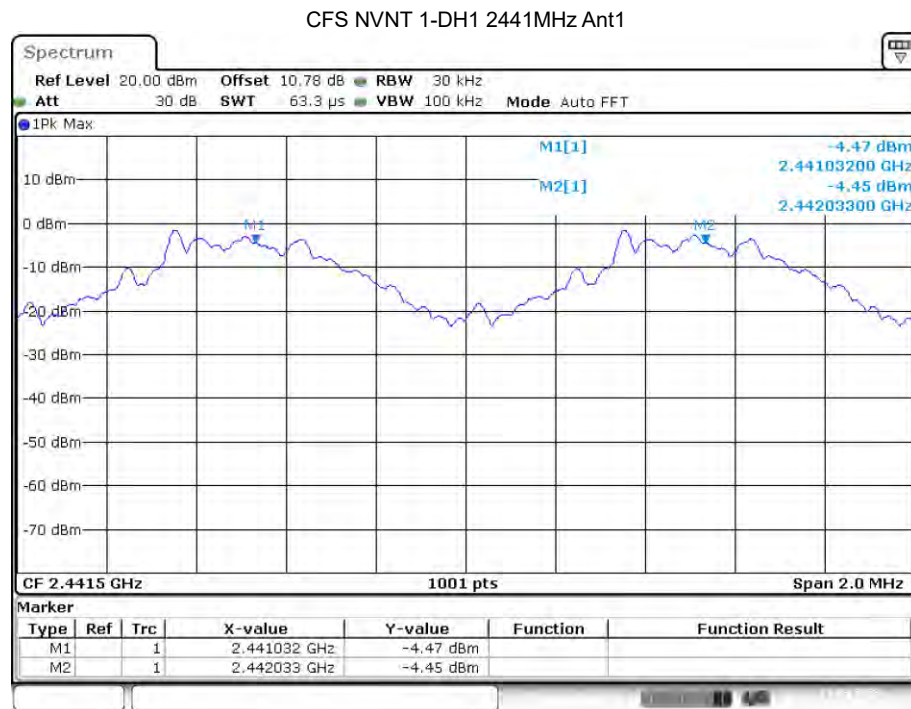
5.2. Test Procedure

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

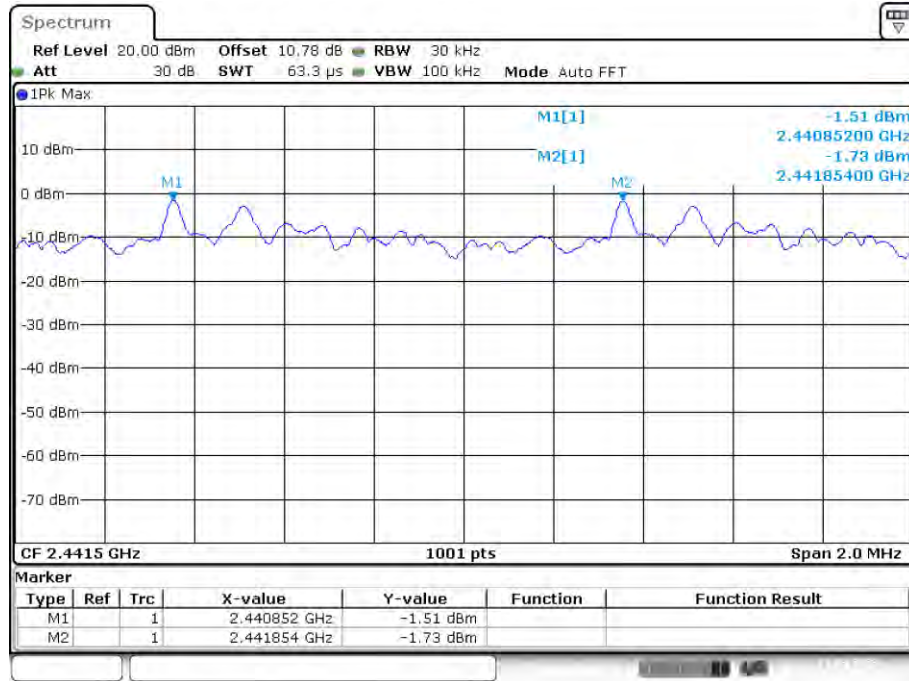
Carrier Frequencies Separation

Condition	Mode	Antenna	Hopping Freq1 (MHz)	Hopping Freq2 (MHz)	HFS (MHz)	Limit (MHz)	Verdict
NVNT	1-DH1	Ant1	2441.032	2442.033	1.001	0.9	Pass
NVNT	2-DH1	Ant1	2440.852	2441.854	1.002	0.831	Pass
NVNT	3-DH1	Ant1	2440.852	2441.854	1.002	0.855	Pass



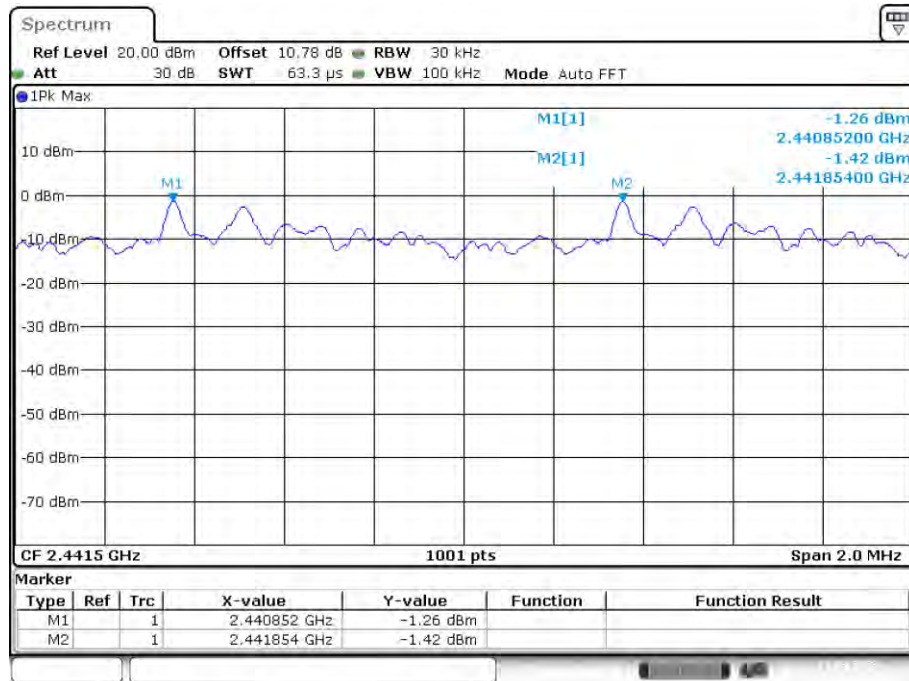
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CFS NVNT 2-DH1 2441MHz Ant1



Date: 13.MAR.2023 04:58:48

CFS NVNT 3-DH1 2441MHz Ant1



Date: 13.MAR.2023 06:14:47

6. NUMBER OF HOPPING CHANNEL

6.1. Limit

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

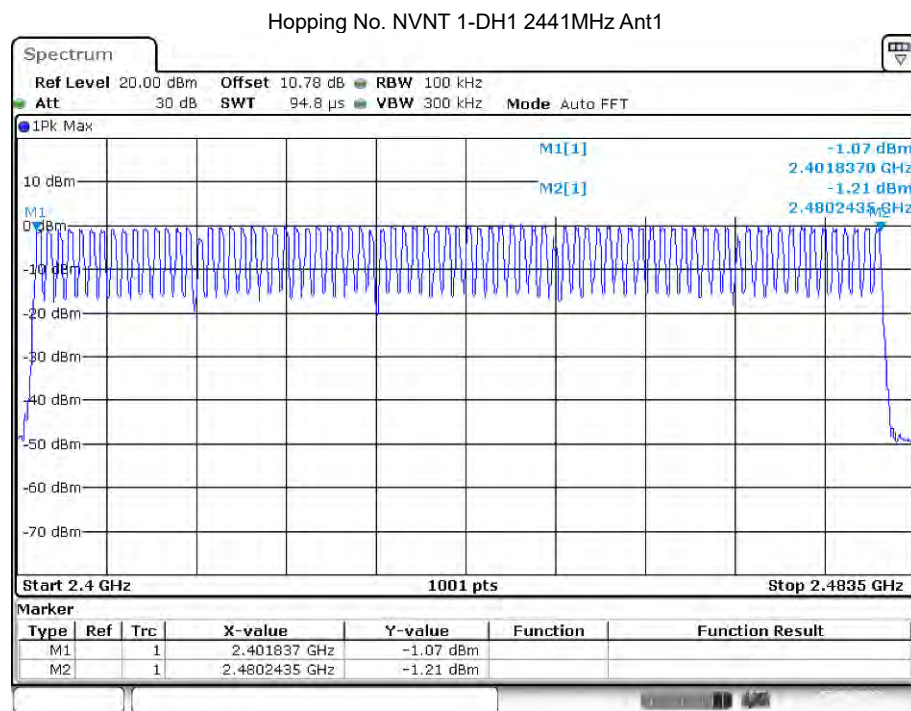
6.2. Test Procedure

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

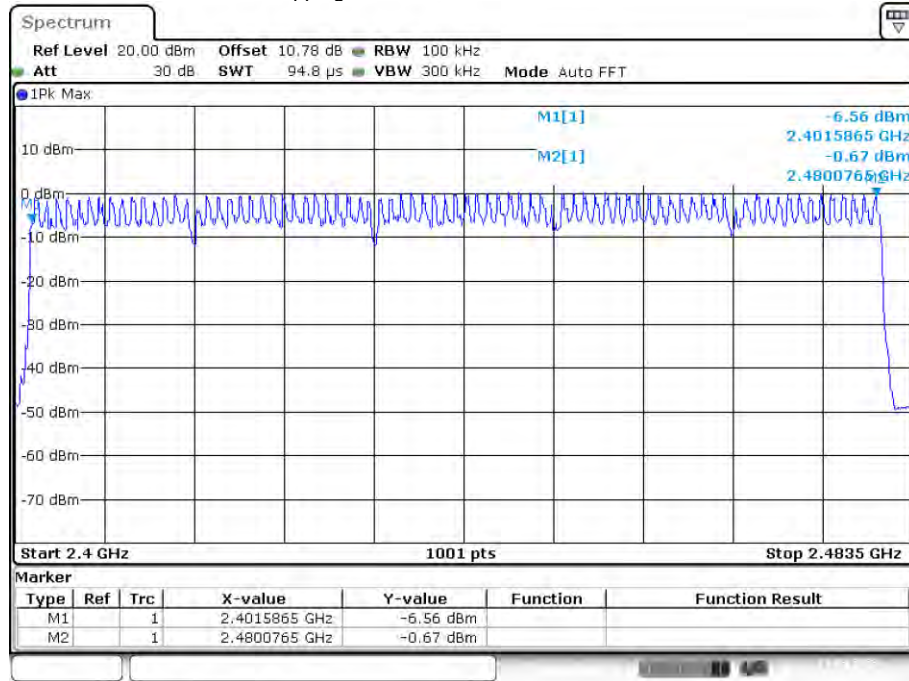
Number of Hopping Channel

Condition	Mode	Antenna	Hopping Number	Limit	Verdict
NVNT	1-DH1	Ant1	79	15	Pass
NVNT	2-DH1	Ant1	79	15	Pass
NVNT	3-DH1	Ant1	79	15	Pass



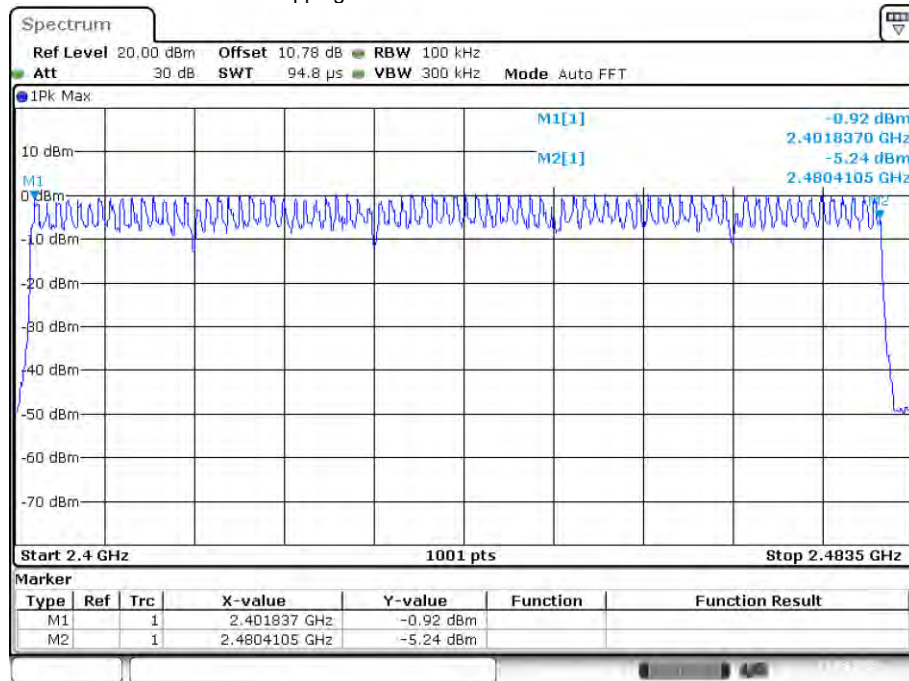
Date: 13.MAR.2023 05:20:54

Hopping No. NVNT 2-DH1 2441MHz Ant1



Date: 13.MAR.2023 05:02:20

Hopping No. NVNT 3-DH1 2441MHz Ant1



Date: 13.MAR.2023 06:18:24

7. DWELL TIME

7.1. Test limit

Please refer section 15.247

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.

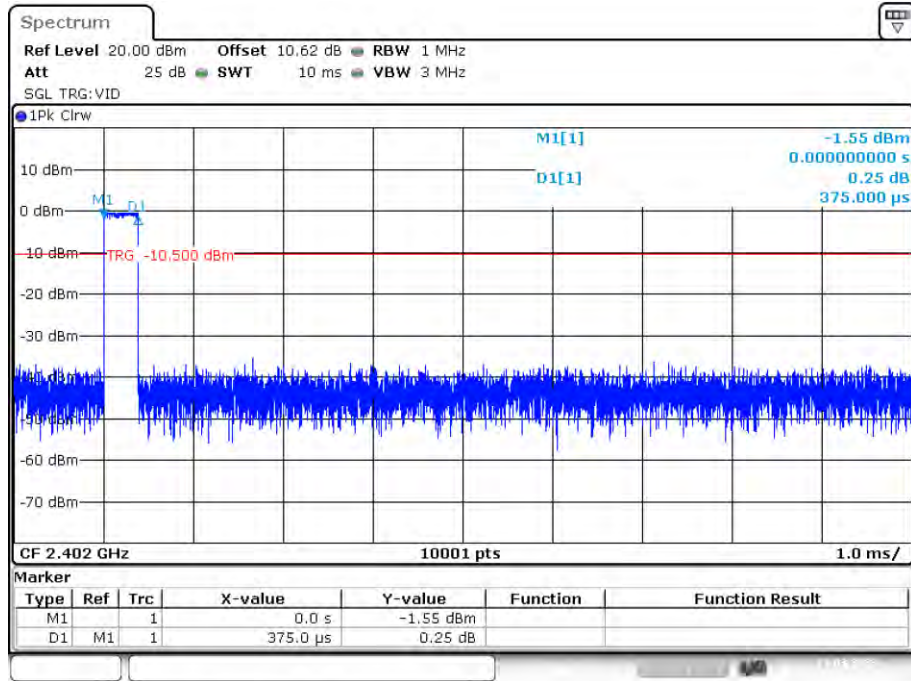
7.3. Test Result

Dwell Time

Condition	Mode	Frequency (MHz)	Antenna	Pulse Time (ms)	Total Dwell Time (ms)	Burst Count	Period Time (ms)	Limit (ms)	Verdict
NVNT	1-DH1	2402	Ant1	0.375	118.5	316	31600	400	Pass
NVNT	1-DH1	2441	Ant1	0.374	147.73	395	31600	400	Pass
NVNT	1-DH1	2480	Ant1	0.374	187.374	501	31600	400	Pass
NVNT	1-DH3	2441	Ant1	1.631	287.056	176	31600	400	Pass
NVNT	1-DH5	2441	Ant1	2.88	371.52	129	31600	400	Pass
NVNT	2-DH1	2402	Ant1	0.385	122.43	318	31600	400	Pass
NVNT	2-DH1	2441	Ant1	0.385	192.885	501	31600	400	Pass
NVNT	2-DH1	2480	Ant1	0.385	192.885	501	31600	400	Pass
NVNT	2-DH3	2441	Ant1	1.631	264.222	162	31600	400	Pass
NVNT	2-DH5	2441	Ant1	2.885	305.81	106	31600	400	Pass
NVNT	3-DH1	2402	Ant1	0.386	123.906	321	31600	400	Pass
NVNT	3-DH1	2441	Ant1	0.386	193.386	501	31600	400	Pass
NVNT	3-DH1	2480	Ant1	0.386	193.386	501	31600	400	Pass
NVNT	3-DH3	2441	Ant1	1.632	280.704	172	31600	400	Pass
NVNT	3-DH5	2441	Ant1	2.885	323.12	112	31600	400	Pass

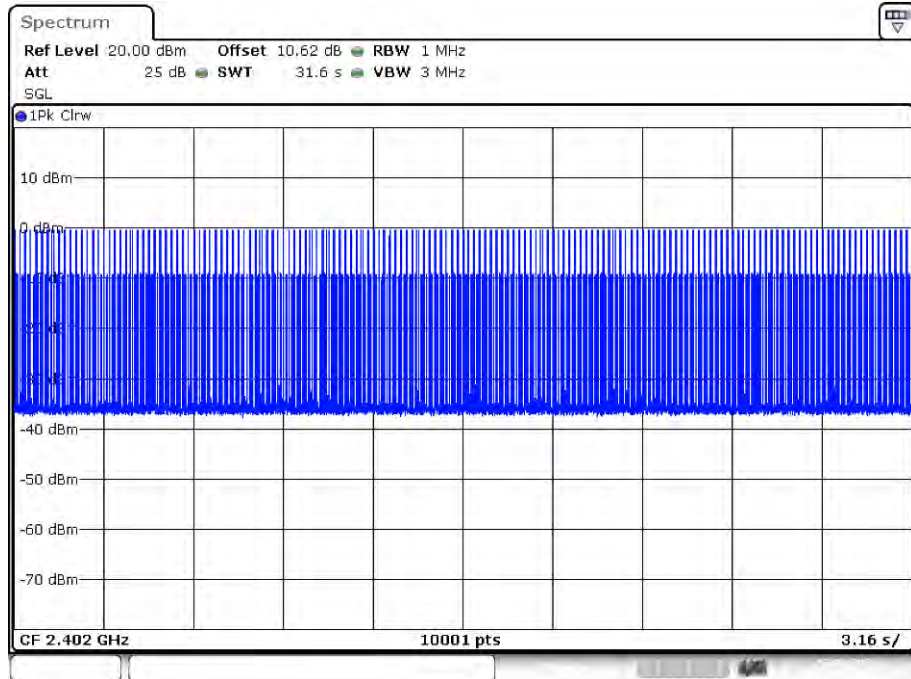
Note: Total Dwell Time= Pulse Time* Burst Count

Dwell NVNT 1-DH1 2402MHz Ant1 One Burst



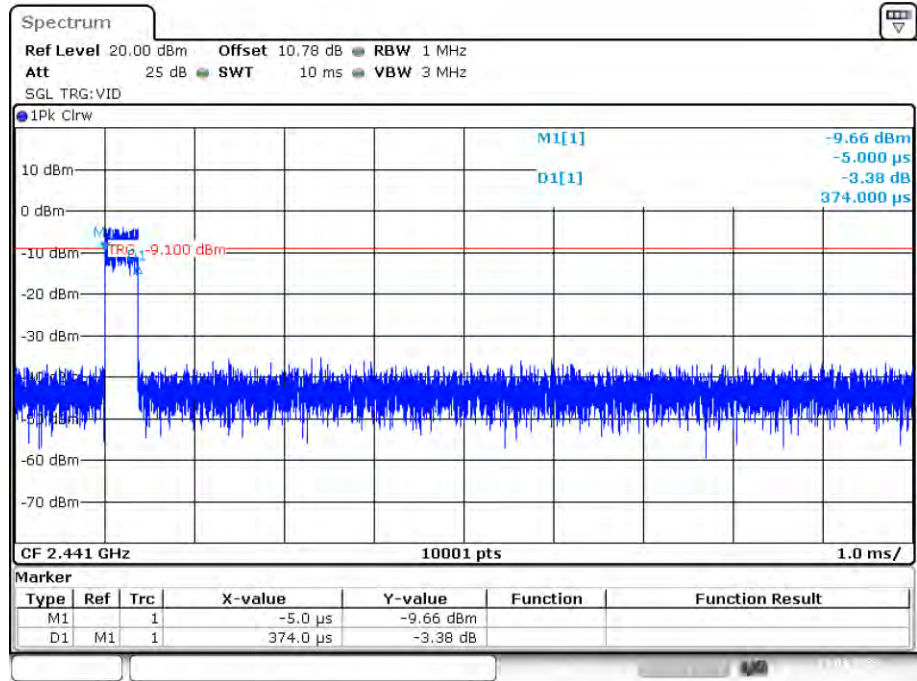
Date: 13.MAR.2023 05:24:20

Dwell NVNT 1-DH1 2402MHz Ant1 Accumulated



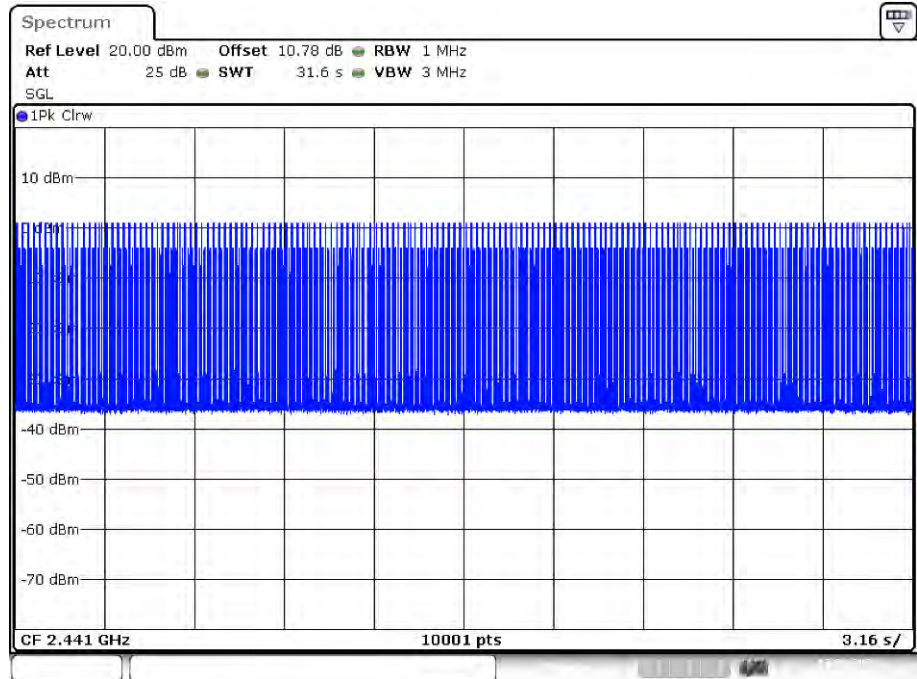
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Dwell NVNT 1-DH1 2441MHz Ant1 One Burst



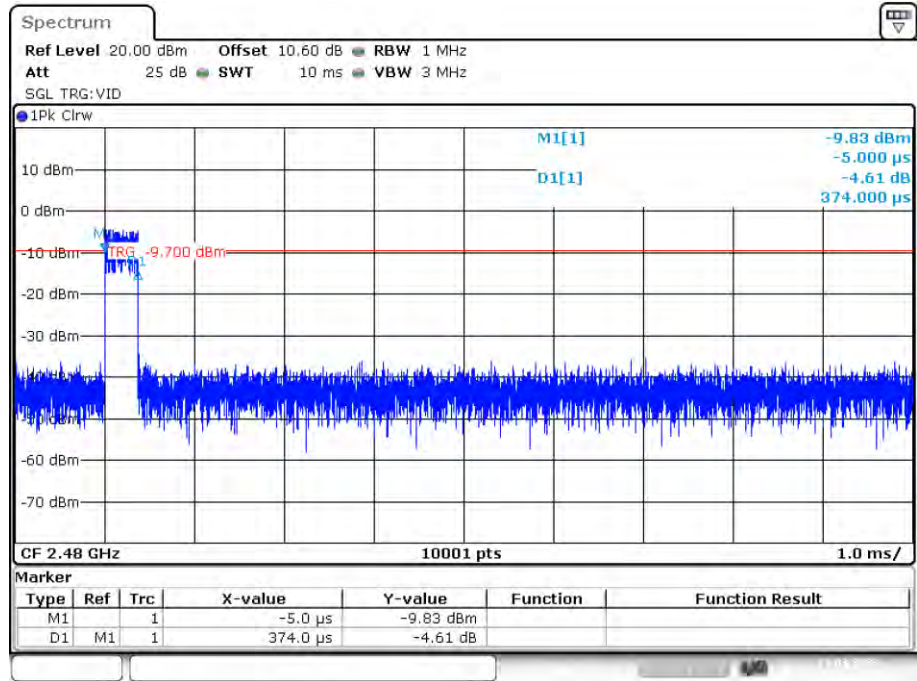
Date: 13.MAR.2023 05:27:24

Dwell NVNT 1-DH1 2441MHz Ant1 Accumulated



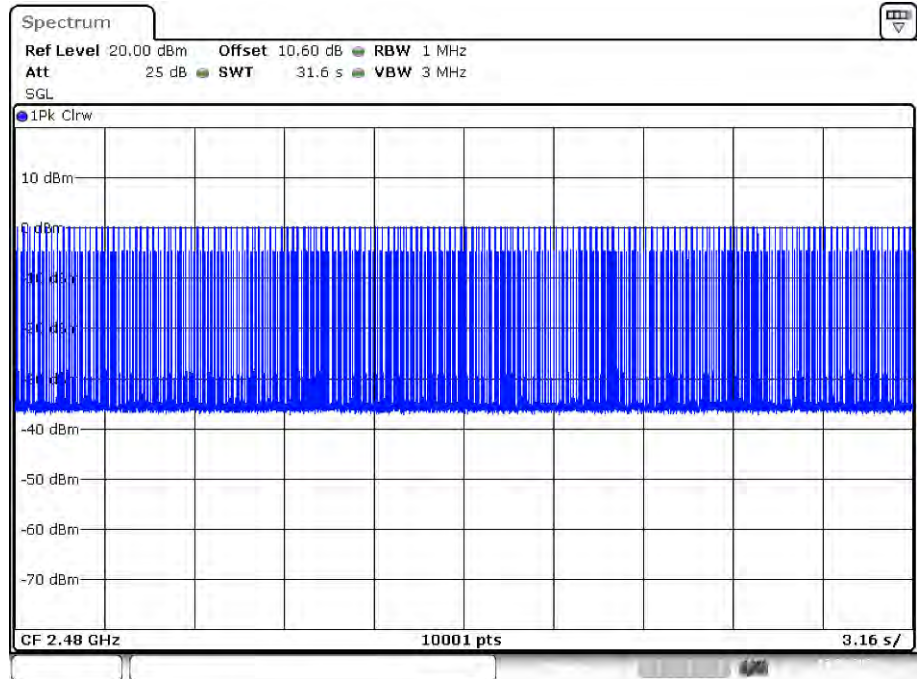
Date: 13.MAR.2023 05:27:58

Dwell NVNT 1-DH1 2480MHz Ant1 One Burst



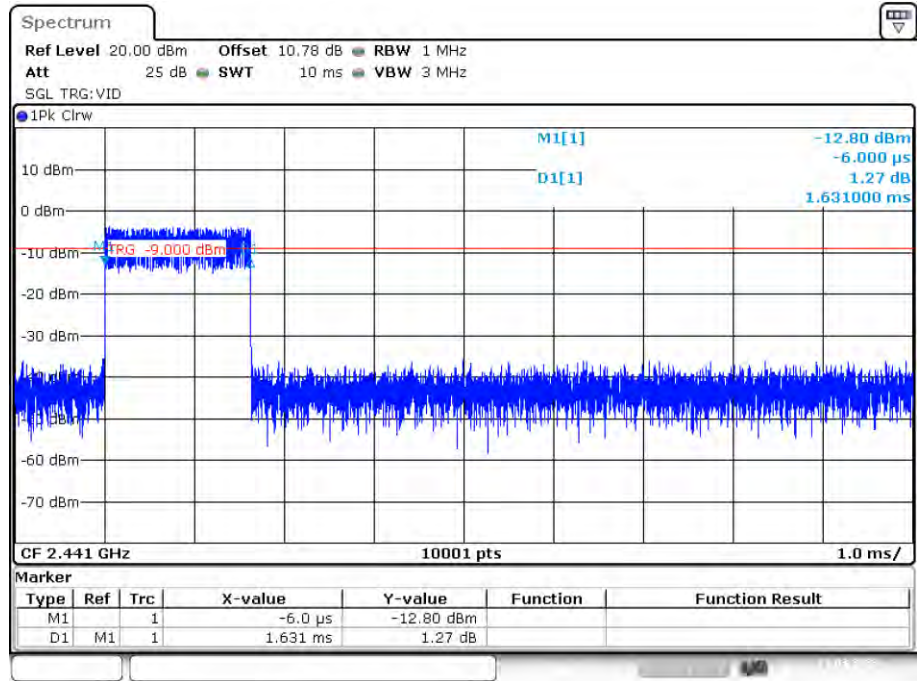
Date: 13.MAR.2023 05:21:57

Dwell NVNT 1-DH1 2480MHz Ant1 Accumulated



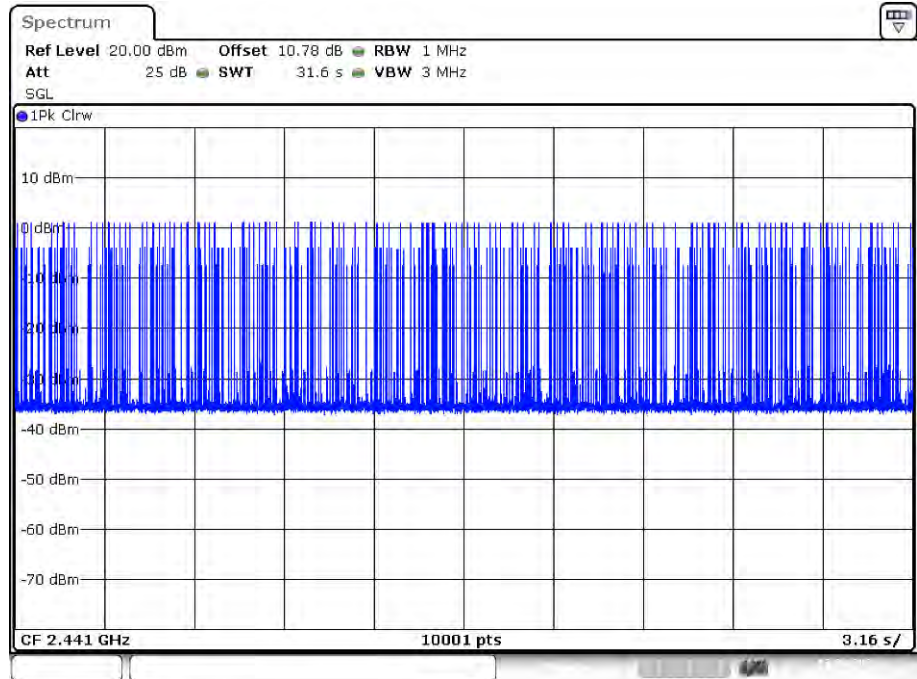
Date: 13.MAR.2023 05:22:31

Dwell NVNT 1-DH3 2441MHz Ant1 One Burst



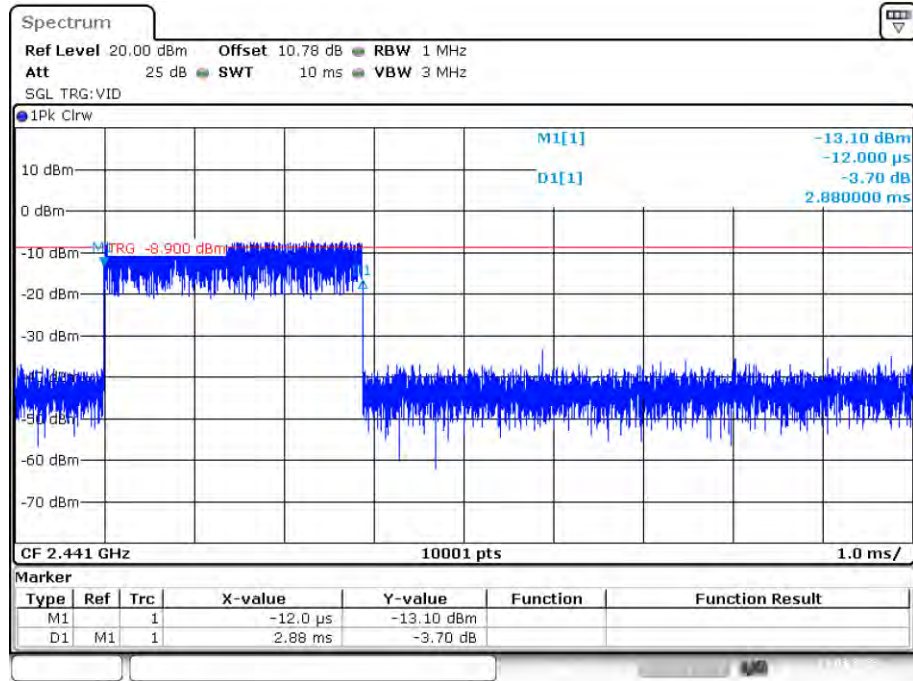
Date: 13.MAR.2023 04:51:07

Dwell NVNT 1-DH3 2441MHz Ant1 Accumulated



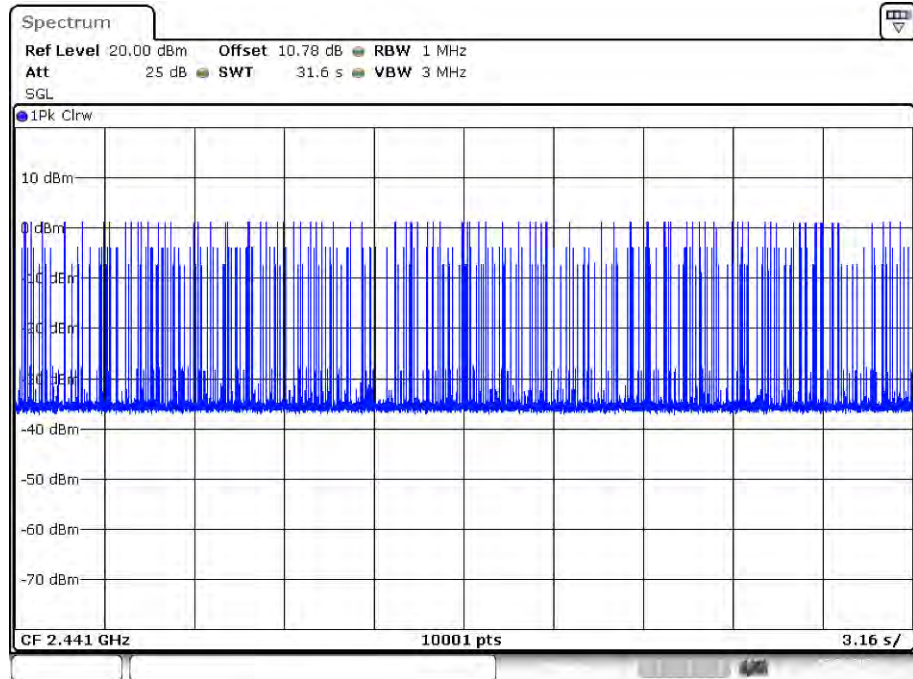
Date: 13.MAR.2023 04:51:41

Dwell NVNT 1-DH5 2441MHz Ant1 One Burst



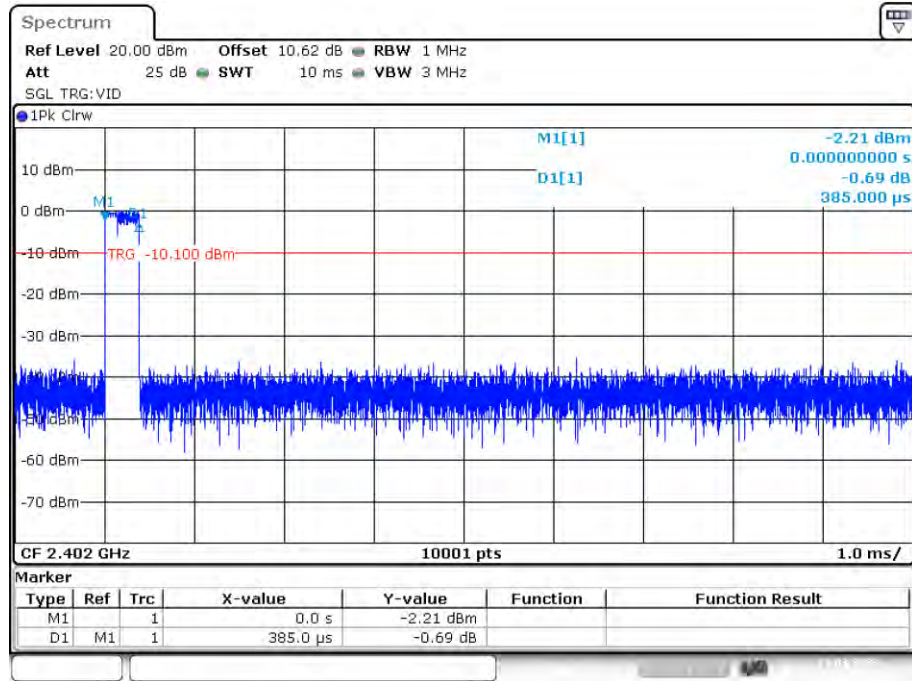
Date: 13.MAR.2023 05:07:08

Dwell NVNT 1-DH5 2441MHz Ant1 Accumulated



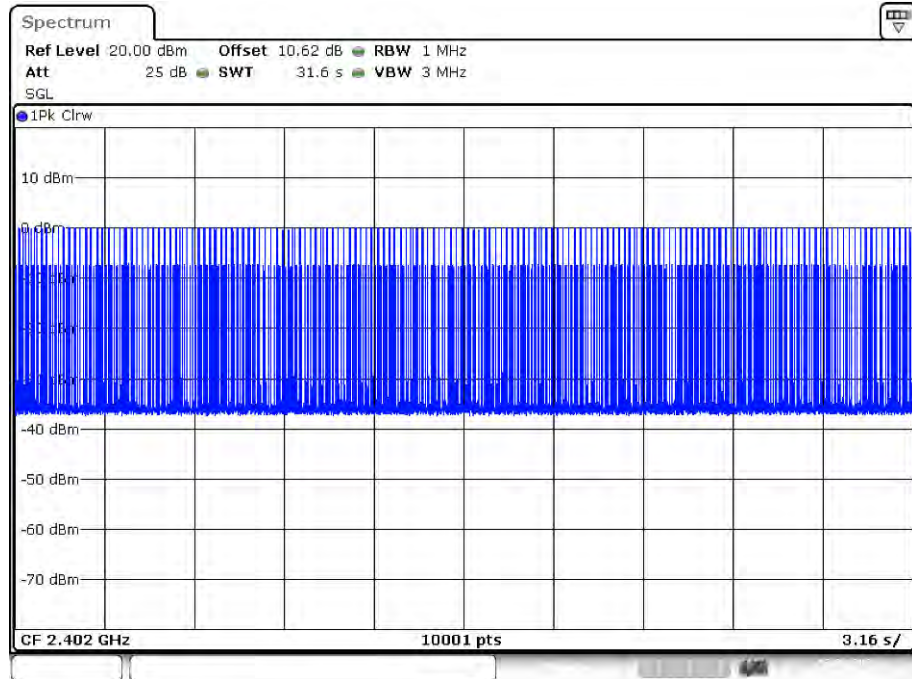
Date: 13.MAR.2023 05:07:43

Dwell NVNT 2-DH1 2402MHz Ant1 One Burst



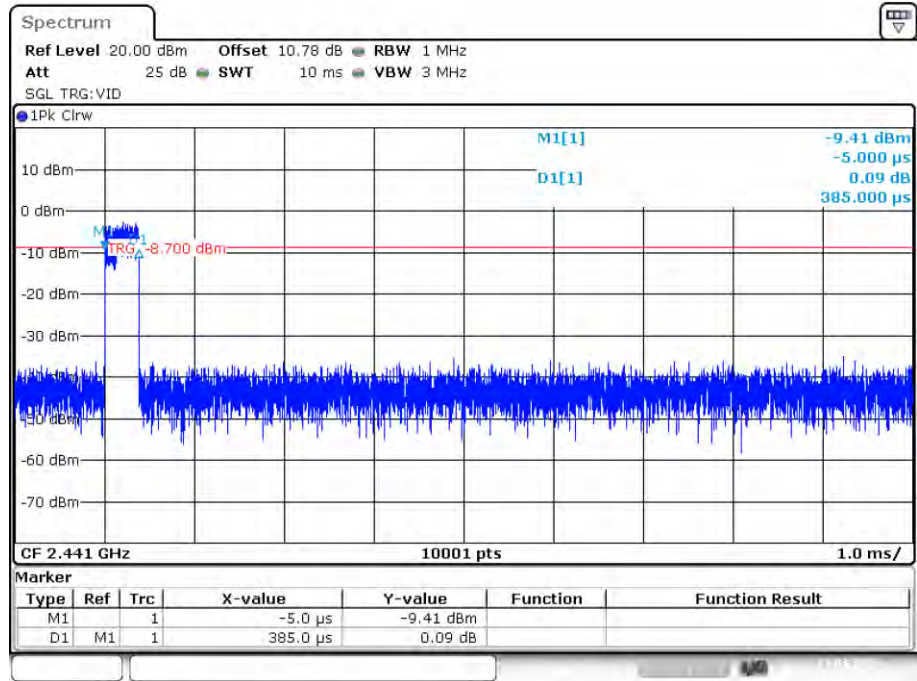
Date: 13.MAR.2023 05:05:59

Dwell NVNT 2-DH1 2402MHz Ant1 Accumulated

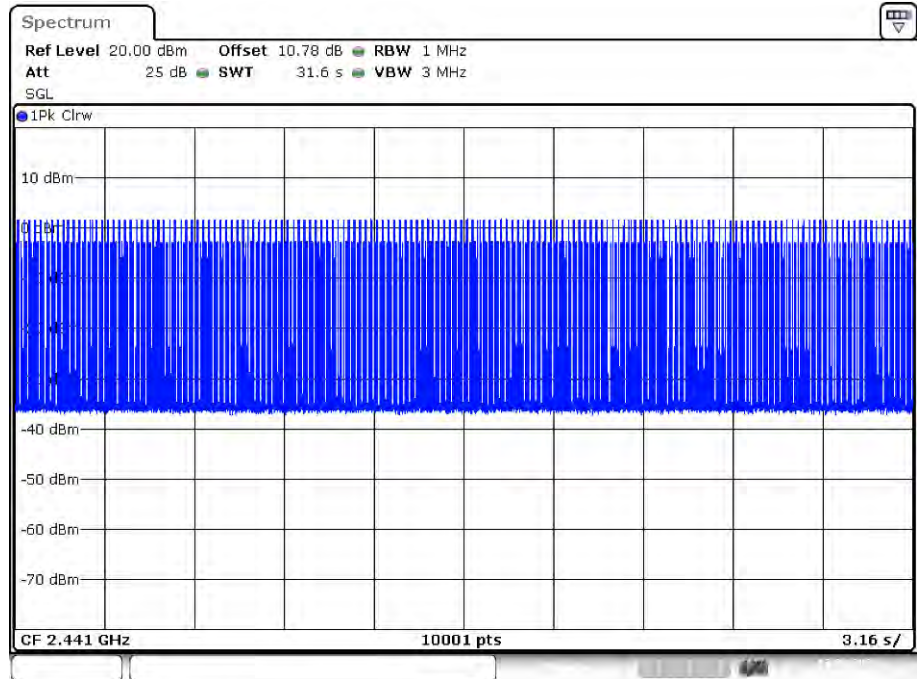


Date: 13.MAR.2023 05:06:33

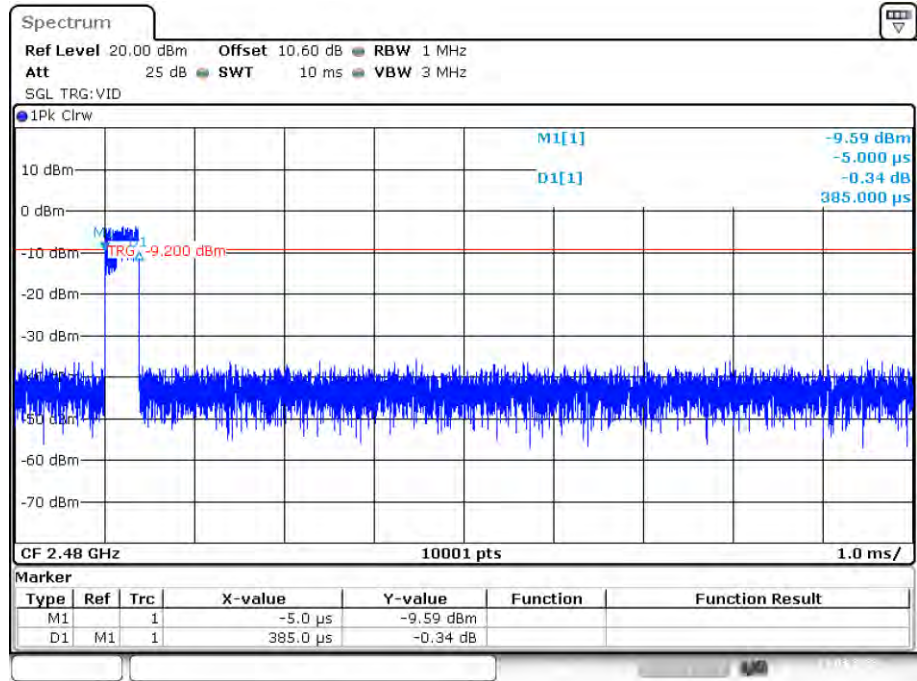
Dwell NVNT 2-DH1 2441MHz Ant1 One Burst



Dwell NVNT 2-DH1 2441MHz Ant1 Accumulated

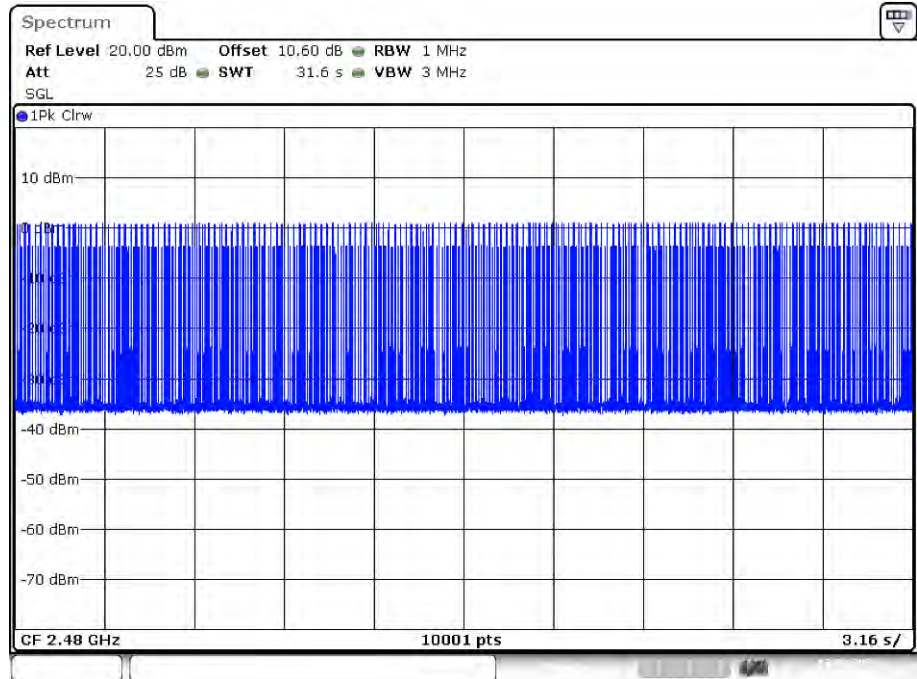


Dwell NVNT 2-DH1 2480MHz Ant1 One Burst



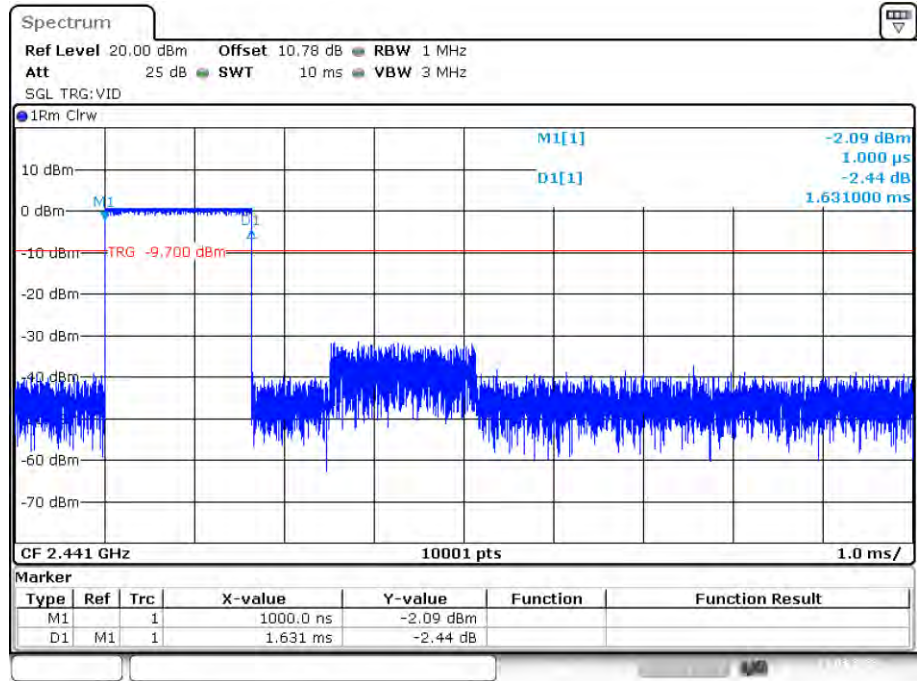
Date: 13.MAR.2023 05:03:32

Dwell NVNT 2-DH1 2480MHz Ant1 Accumulated



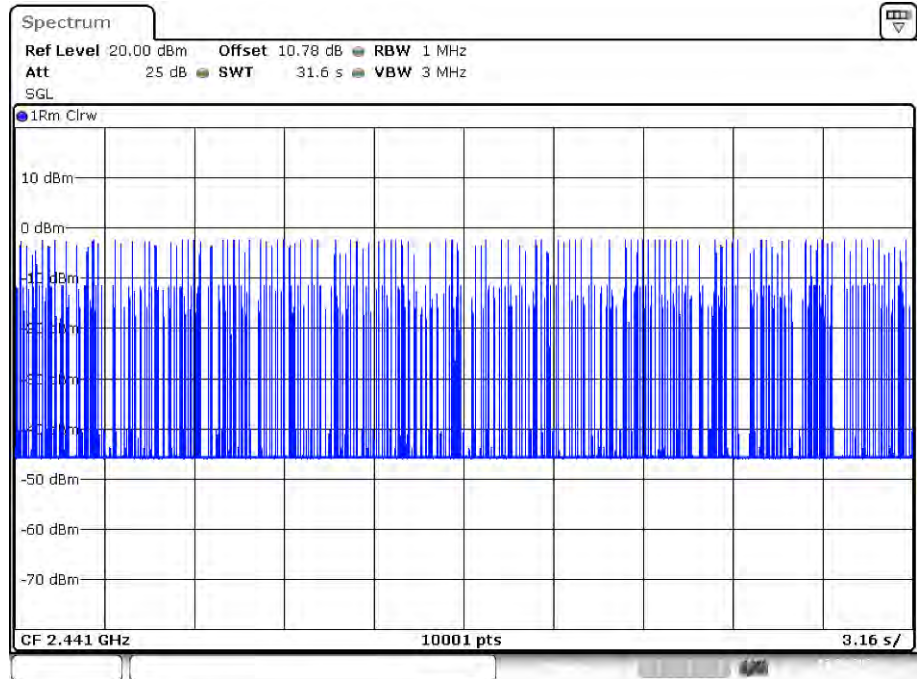
Date: 13.MAR.2023 05:04:06

Dwell NVNT 2-DH3 2441MHz Ant1 One Burst



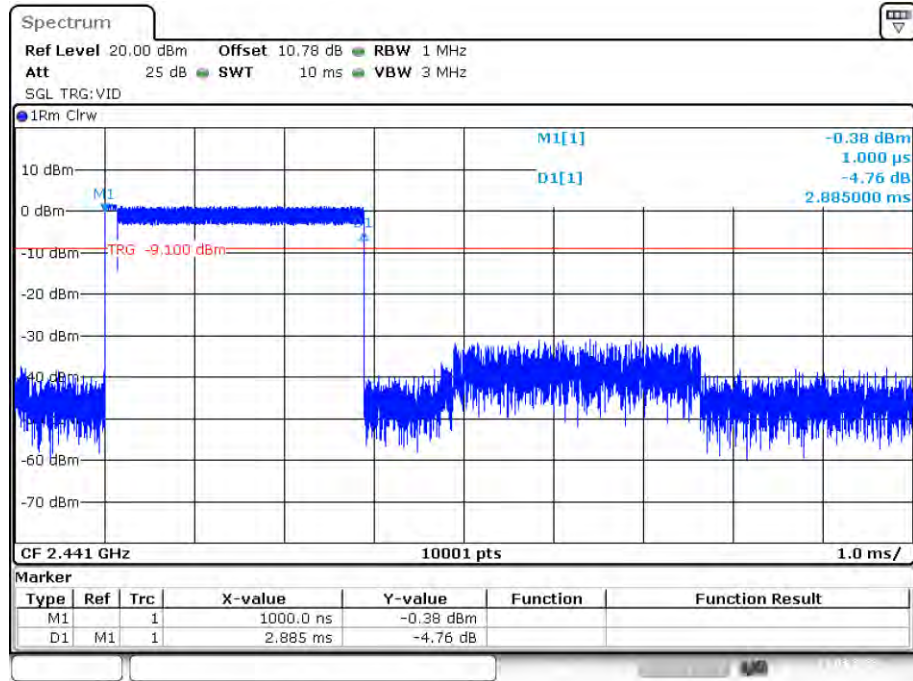
Date: 13.MAR.2023 04:52:09

Dwell NVNT 2-DH3 2441MHz Ant1 Accumulated



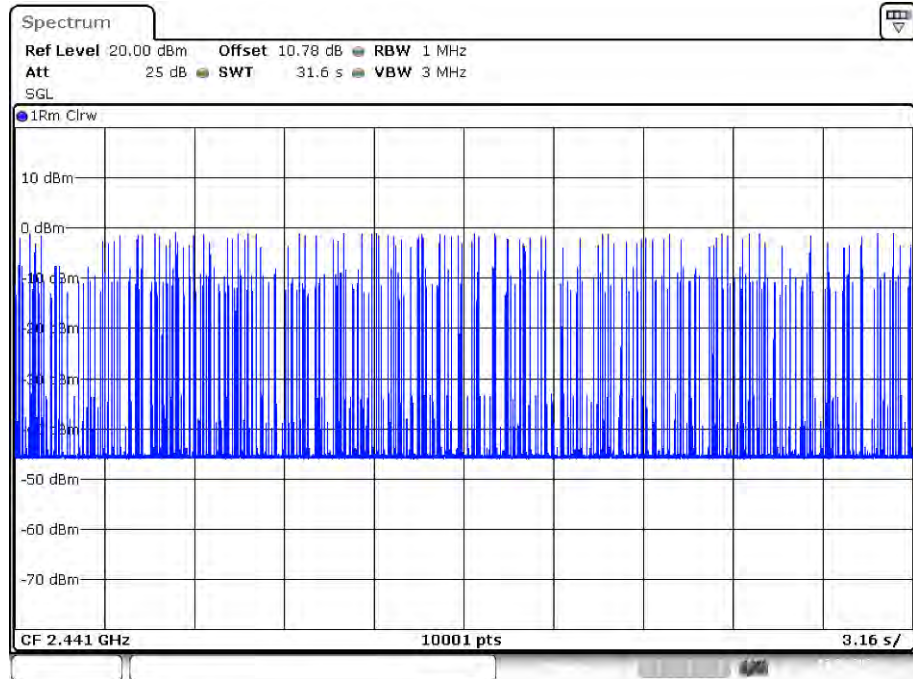
Date: 13.MAR.2023 04:52:43

Dwell NVNT 2-DH5 2441MHz Ant1 One Burst



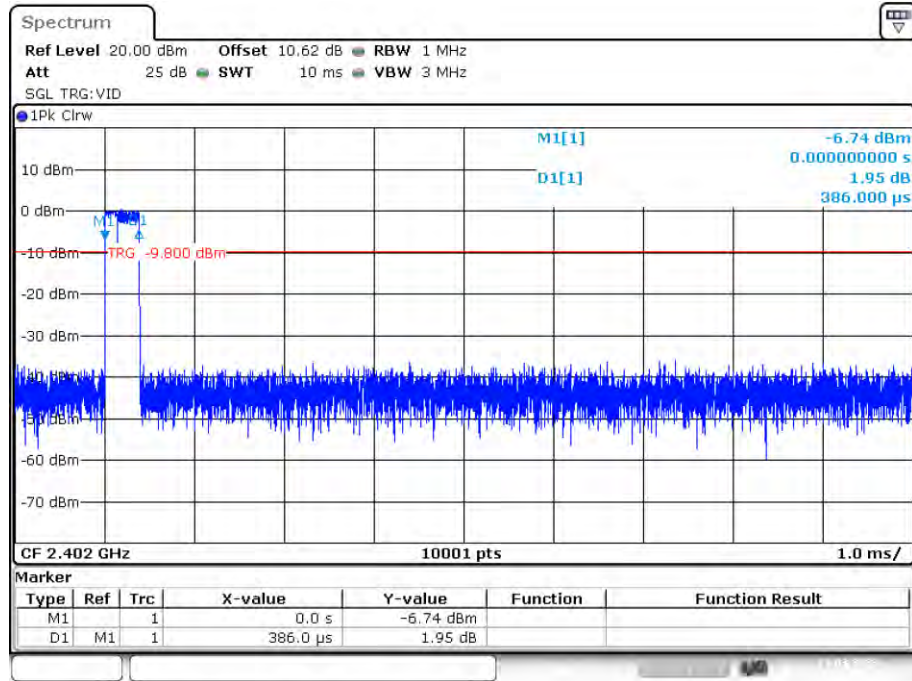
Date: 13.MAR.2023 04:38:10

Dwell NVNT 2-DH5 2441MHz Ant1 Accumulated



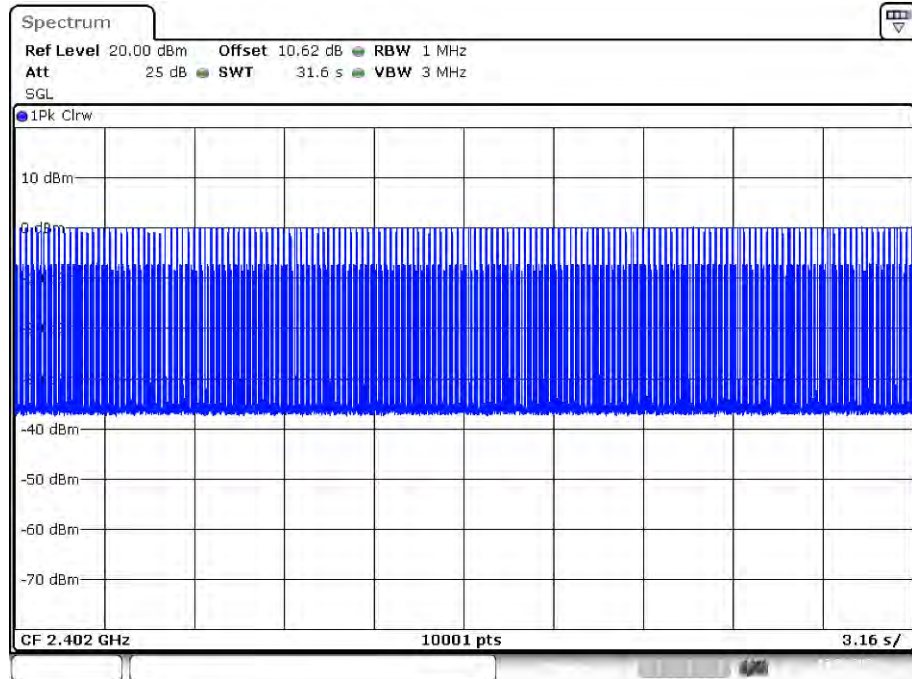
Date: 13.MAR.2023 04:38:44

Dwell NVNT 3-DH1 2402MHz Ant1 One Burst



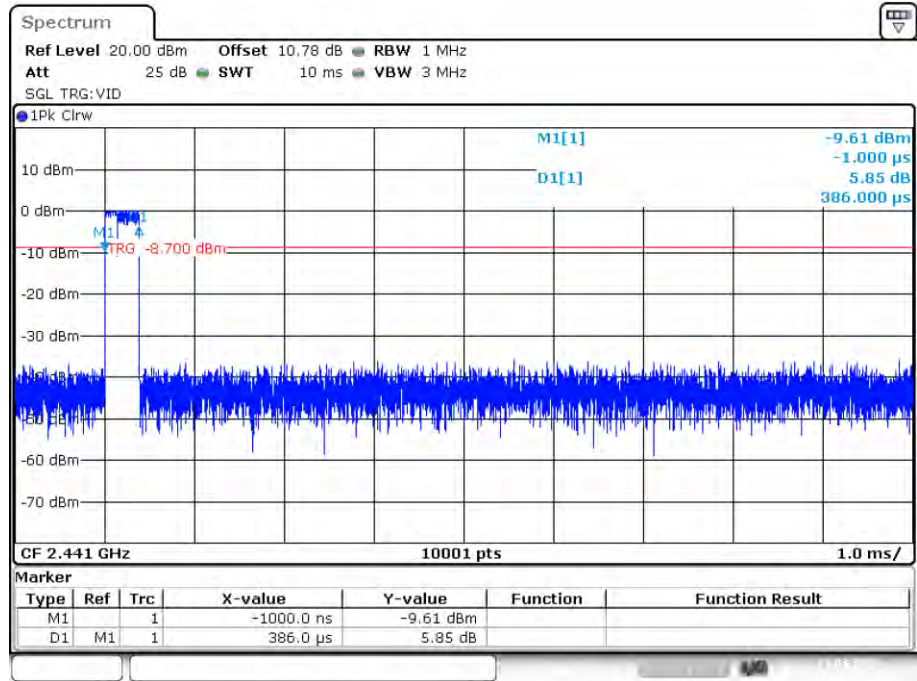
Date: 13.MAR.2023 06:09:08

Dwell NVNT 3-DH1 2402MHz Ant1 Accumulated



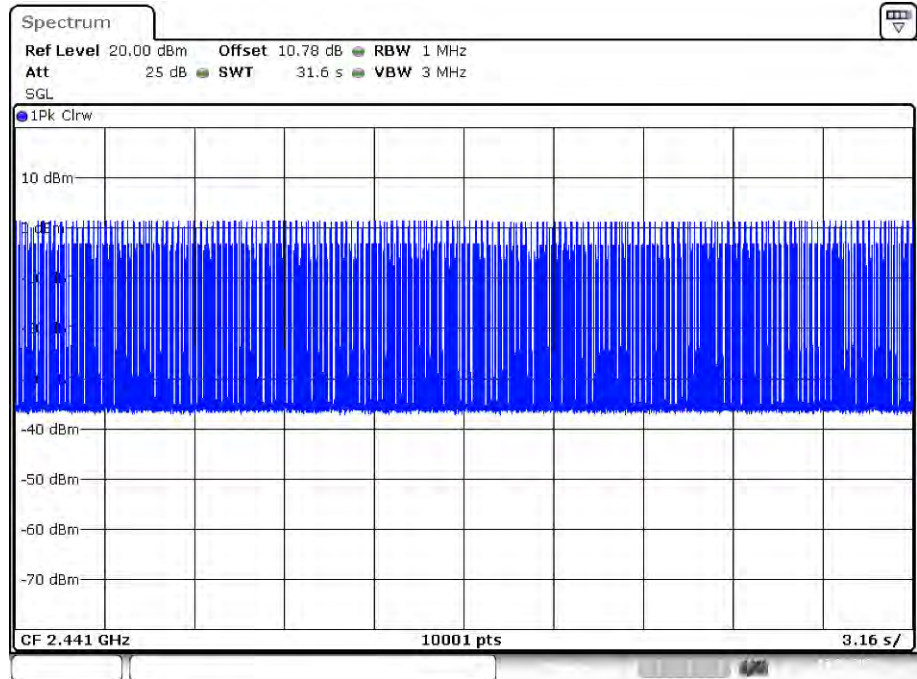
Date: 13.MAR.2023 06:09:42

Dwell NVNT 3-DH1 2441MHz Ant1 One Burst



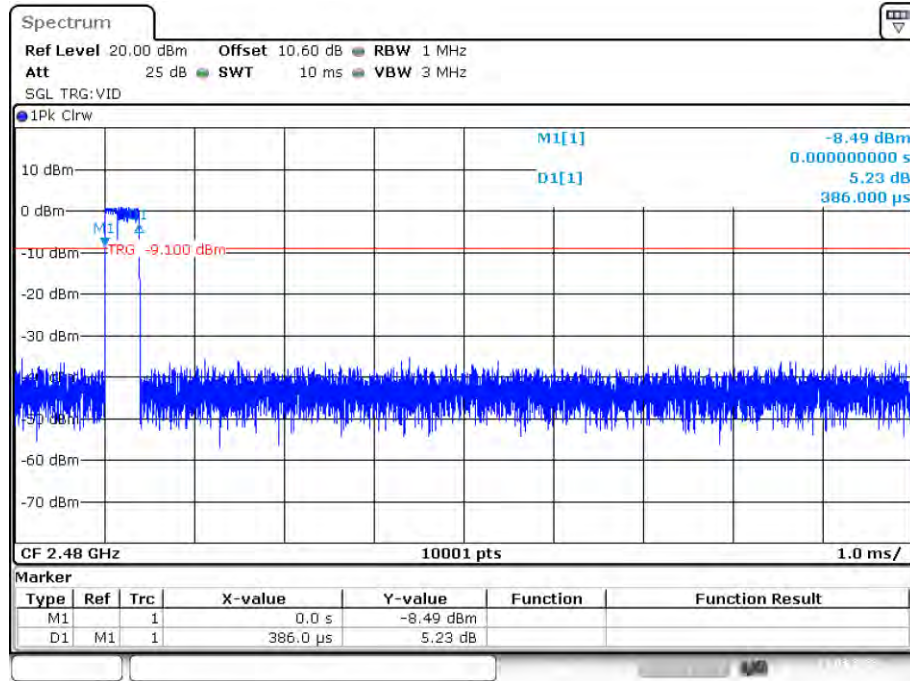
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Dwell NVNT 3-DH1 2441MHz Ant1 Accumulated



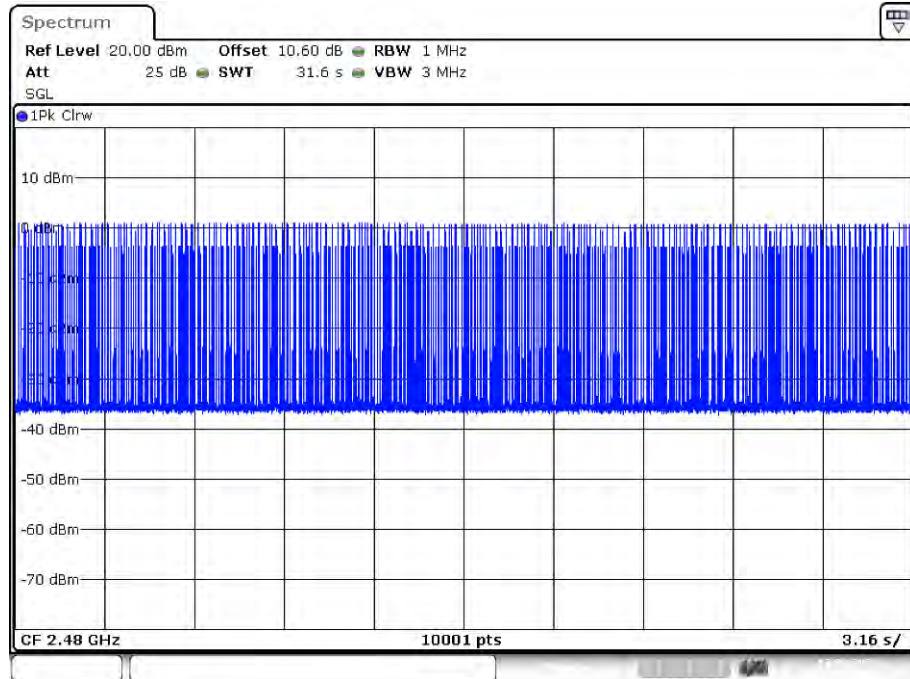
Date: 13.MAR.2023 06:19:16

Dwell NVNT 3-DH1 2480MHz Ant1 One Burst



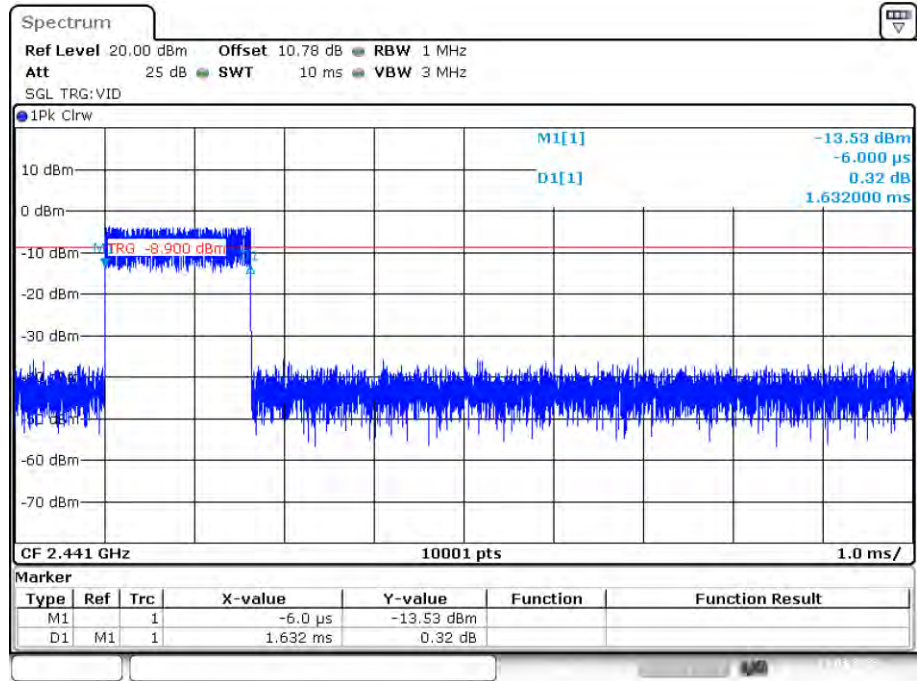
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Dwell NVNT 3-DH1 2480MHz Ant1 Accumulated



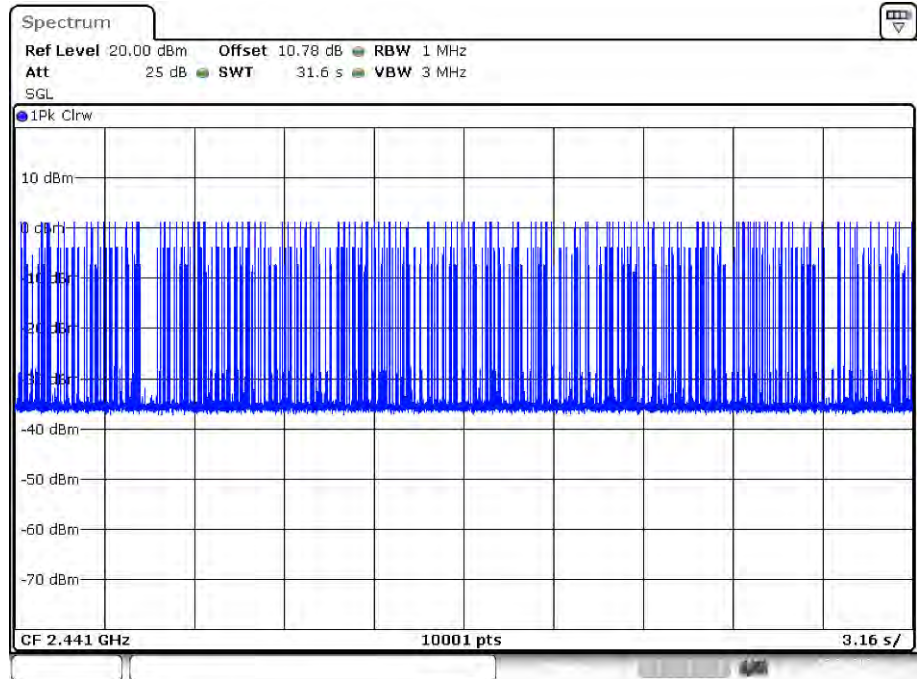
Date: 13.MAR.2023 06:20:09

Dwell NVNT 3-DH3 2441MHz Ant1 One Burst



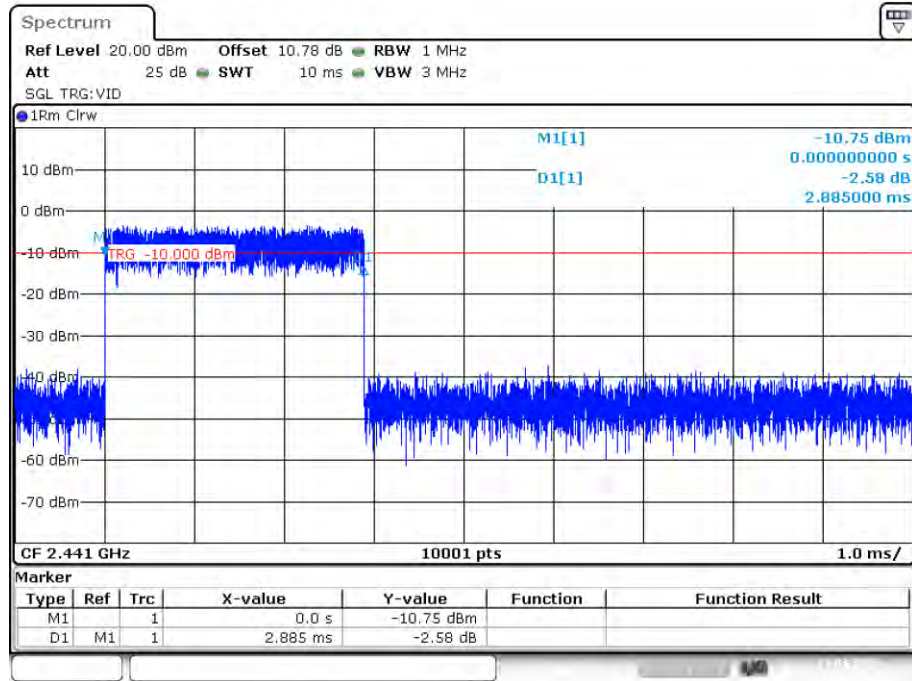
Date: 13.MAR.2023 06:08:04

Dwell NVNT 3-DH3 2441MHz Ant1 Accumulated



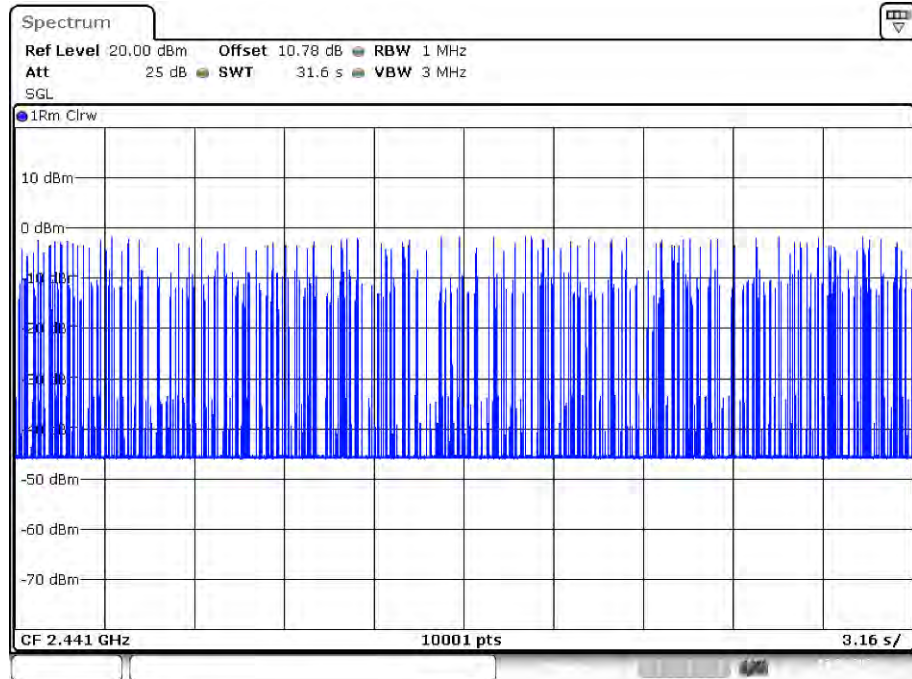
Date: 13.MAR.2023 06:08:38

Dwell NVNT 3-DH5 2441MHz Ant1 One Burst



Date: 13.MAR.2023 06:04:47

Dwell NVNT 3-DH5 2441MHz Ant1 Accumulated



Date: 13.MAR.2023 06:05:22

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

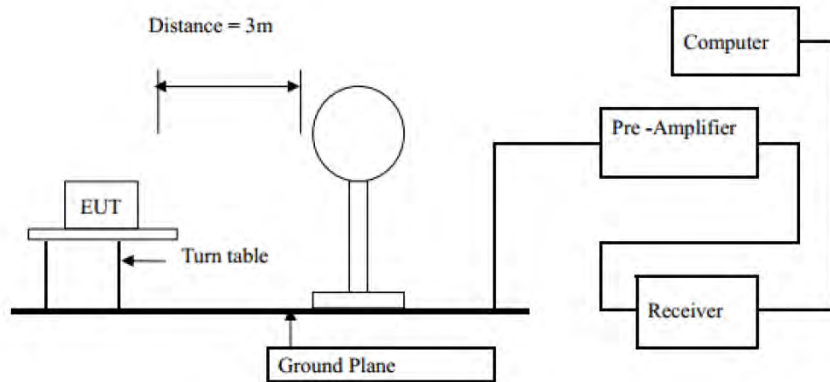
MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 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

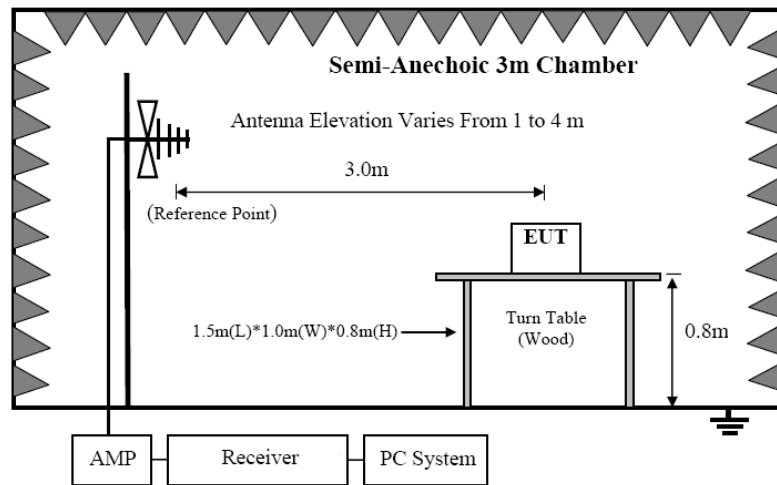
FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
0.009-0.490	300	2400/F(KHz)	/
0.490-1.705	30	24000/F(KHz)	/
1.705-30	30	30	29.5
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

8.2. Block Diagram of Test setup

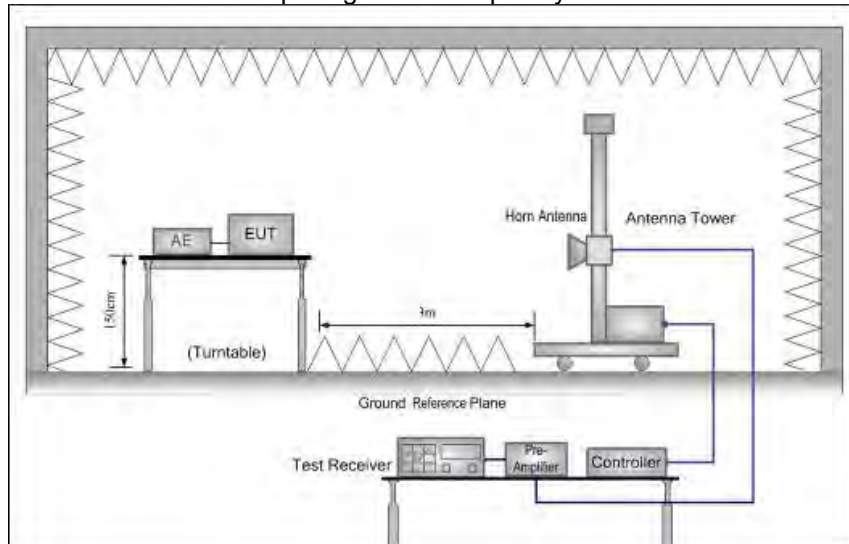
8.2.1 In 3m Anechoic Chamber Test Setup Diagram for below 30MHz



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

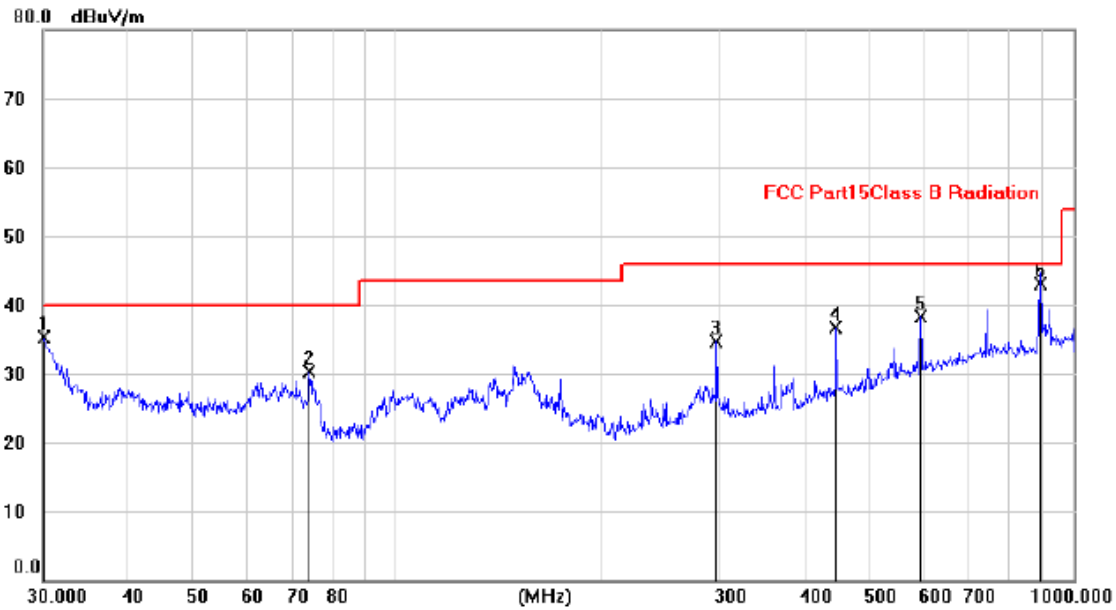
We have scanned the 10th harmonic from 9KHz to the EUT's highest frequency.
Detailed information please see the following page.

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

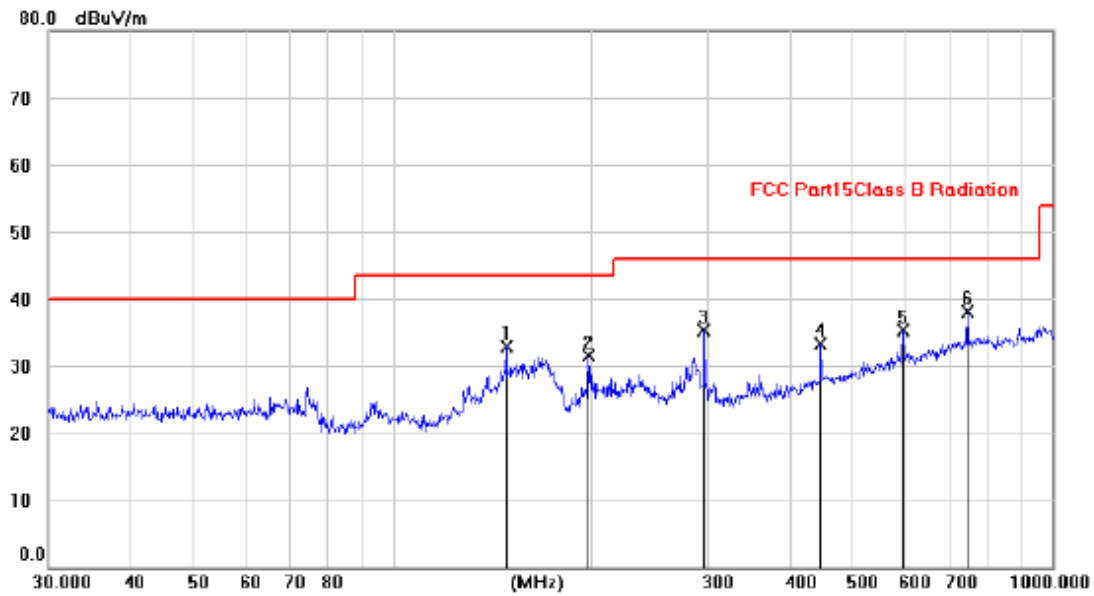
Vertical:



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Margin	Antenna	Table	
		MHz	Level	Factor	ment			Height	Degree	
			dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1		30.0351	21.73	13.52	35.25	40.00	-4.75	QP		
2		74.2045	19.64	10.75	30.39	40.00	-9.61	peak		
3		297.0157	20.67	14.03	34.70	46.00	-11.30	peak		
4		445.5279	19.32	17.46	36.78	46.00	-9.22	peak		
5		594.0208	18.28	20.10	38.38	46.00	-7.62	peak		
6	*	891.0402	19.23	23.92	43.15	46.00	-2.85	QP		

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

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

Horizontal:

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Margin	Antenna	Table	
		MHz	Level	Factor	ment			Height	Degree	
			dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1		148.5104	17.99	14.95	32.94	43.50	-10.56	peak		
2		197.9622	20.42	11.02	31.44	43.50	-12.06	peak		
3		297.0157	21.18	14.03	35.21	46.00	-10.79	peak		
4		445.5279	15.88	17.46	33.34	46.00	-12.66	peak		
5		594.0208	15.23	20.10	35.33	46.00	-10.67	peak		
6	*	742.5190	15.71	22.31	38.02	46.00	-7.98	peak		

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

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

Remark: All modes have been tested, and only worst data of GFSK mode, Channel 2402MHz was listed in this report.

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	48.11	V	33.93	10.18	34.26	57.96	74	-16.04	PK
4804	36.24	V	33.93	10.18	34.26	46.09	54	-7.91	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
4804	47.96	H	33.93	10.18	34.26	57.81	74	-16.19	PK
4804	35.40	H	33.93	10.18	34.26	45.25	54	-8.75	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
Test Mode: GFSK TX Mid									
4882	49.60	V	33.95	10.20	34.26	59.49	74	-14.51	PK
4882	35.35	V	33.95	10.20	34.26	45.24	54	-8.76	AV
7323	/	/	/	/	/	/	/	/	/
9764	/	/	/	/	/	/	/	/	/
4882	48.62	H	33.95	10.20	34.26	58.51	74	-15.49	PK
4882	34.60	H	33.95	10.20	34.26	44.49	54	-9.51	AV
7323	/	/	/	/	/	/	/	/	/
9764	/	/	/	/	/	/	/	/	/
Test Mode: GFSK TX High									
4960	47.60	V	33.98	10.22	34.25	57.55	74	-16.45	PK
4960	33.70	V	33.98	10.22	34.25	43.65	54	-10.35	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/
4960	46.53	H	33.98	10.22	34.25	56.48	74	-17.52	PK
4960	32.84	H	33.98	10.22	34.25	42.79	54	-11.21	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: $\pi/4$ 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	48.23	V	33.93	10.18	34.26	58.08	74	-15.92	PK
4804	36.02	V	33.93	10.18	34.26	45.87	54	-8.13	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
4804	47.01	H	33.93	10.18	34.26	56.86	74	-17.14	PK
4804	35.51	H	33.93	10.18	34.26	45.36	54	-8.64	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
Test Mode: $\pi/4$ DQPSK TX Mid									
4882	49.03	V	33.95	10.20	34.26	58.92	74	-15.08	PK
4882	35.08	V	33.95	10.20	34.26	44.97	54	-9.03	AV
7323	/	/	/	/	/	/	/	/	/
9764	/	/	/	/	/	/	/	/	/
4882	48.50	H	33.95	10.20	34.26	58.39	74	-15.61	PK
4882	34.12	H	33.95	10.20	34.26	44.01	54	-9.99	AV
7323	/	/	/	/	/	/	/	/	/
9764	/	/	/	/	/	/	/	/	/
Test Mode: $\pi/4$ DQPSK TX High									
4960	47.60	V	33.98	10.22	34.25	57.55	74	-16.45	PK
4960	33.83	V	33.98	10.22	34.25	43.78	54	-10.22	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/
4960	46.87	H	33.98	10.22	34.25	56.82	74	-17.18	PK
4960	32.77	H	33.98	10.22	34.25	42.72	54	-11.28	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.

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.

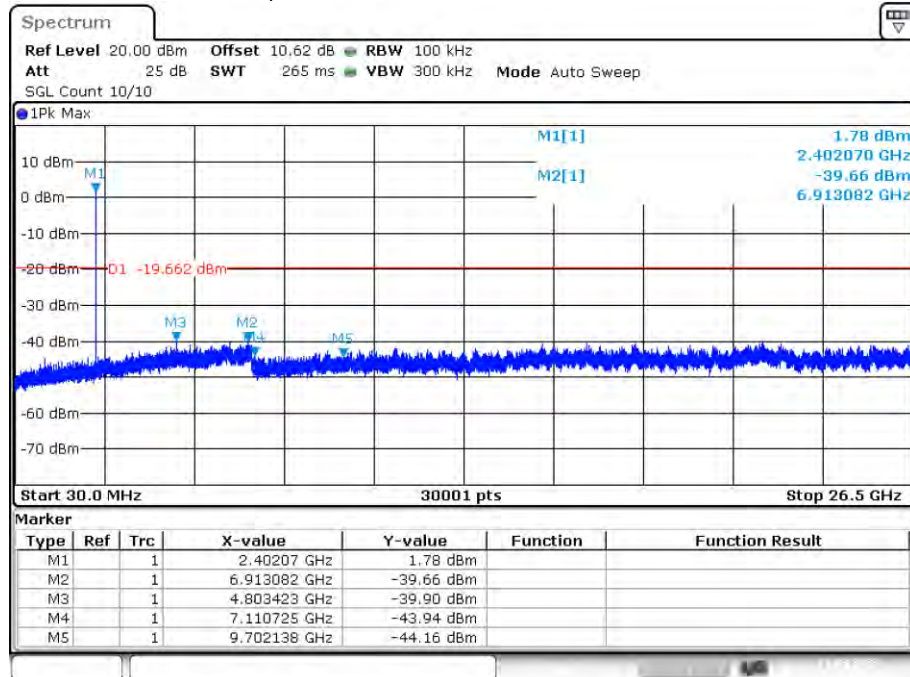
Conducted RF Spurious Emission

Tx. Spurious NVNT 1-DH1 2402MHz Ant1 Ref



Date: 13.MAR.2023 04:09:15

Tx. Spurious NVNT 1-DH1 2402MHz Ant1 Emission



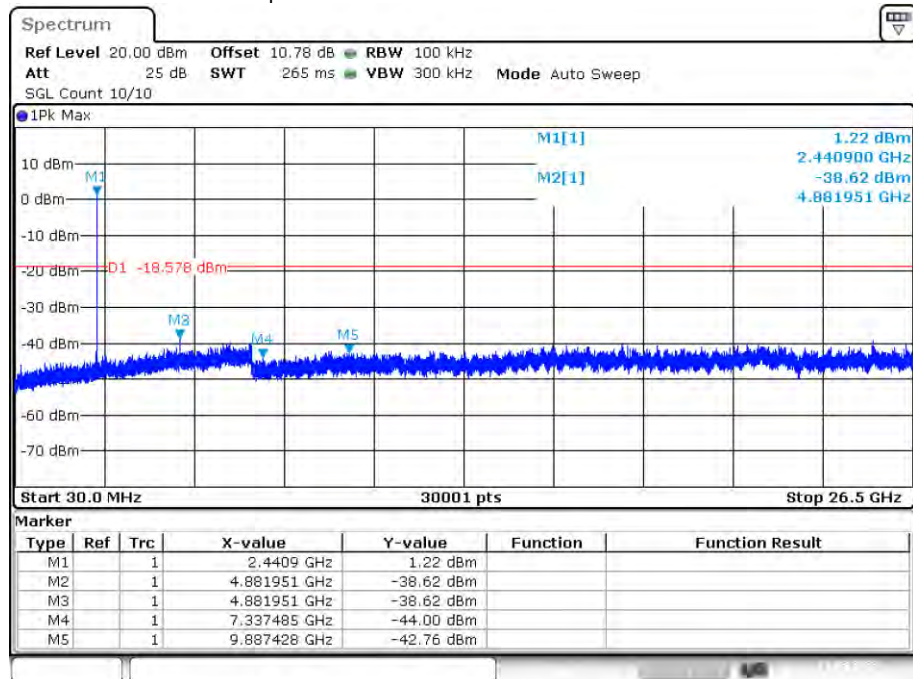
Date: 13.MAR.2023 04:09:29

Tx. Spurious NVNT 1-DH1 2441MHz Ant1 Ref



Date: 13.MAR.2023 04:11:35

Tx. Spurious NVNT 1-DH1 2441MHz Ant1 Emission



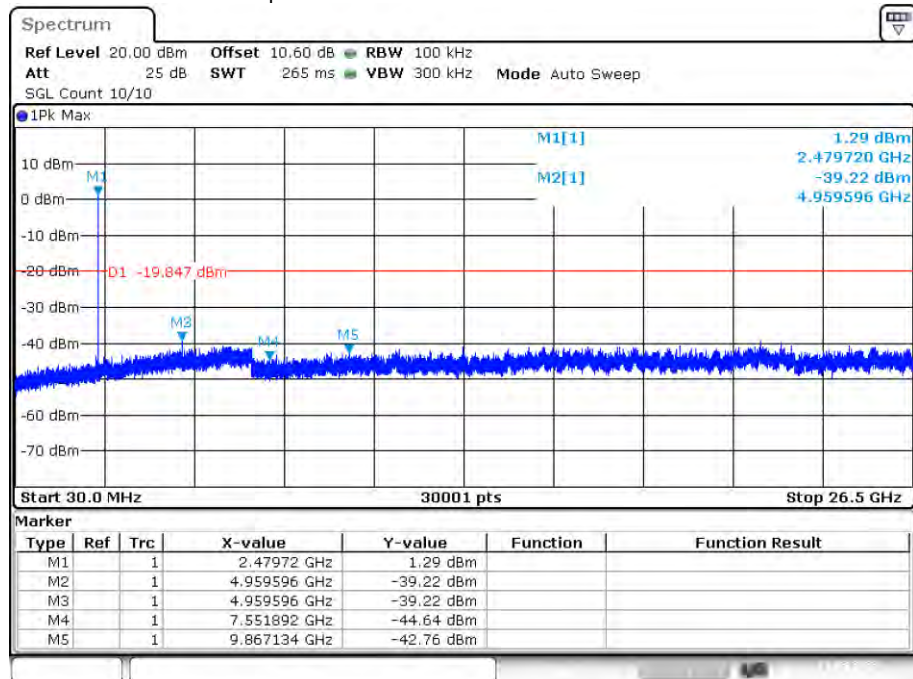
Date: 13.MAR.2023 04:11:48

Tx. Spurious NVNT 1-DH1 2480MHz Ant1 Ref



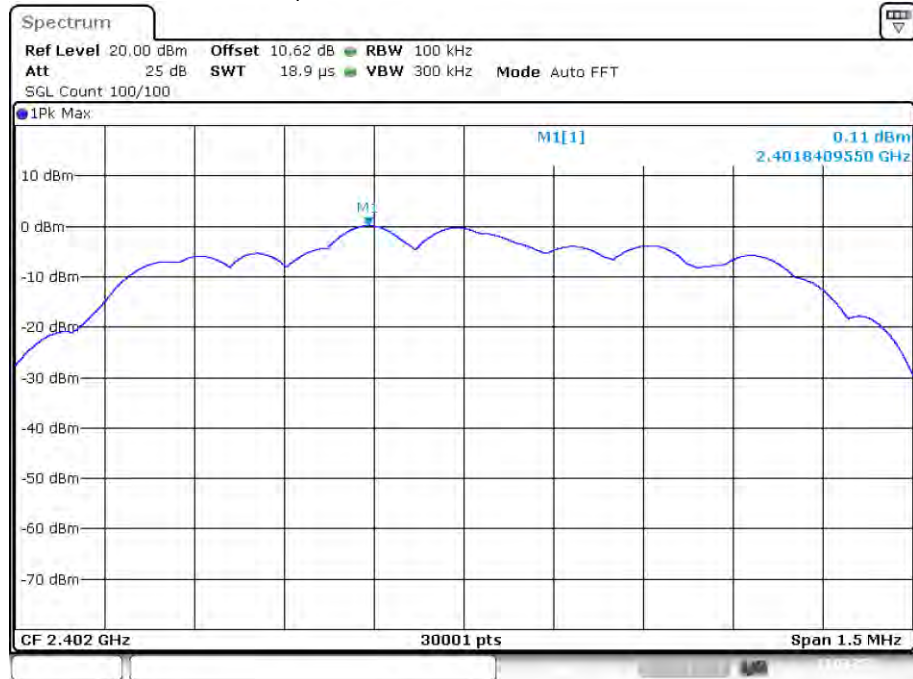
Date: 13.MAR.2023 04:13:29

Tx. Spurious NVNT 1-DH1 2480MHz Ant1 Emission



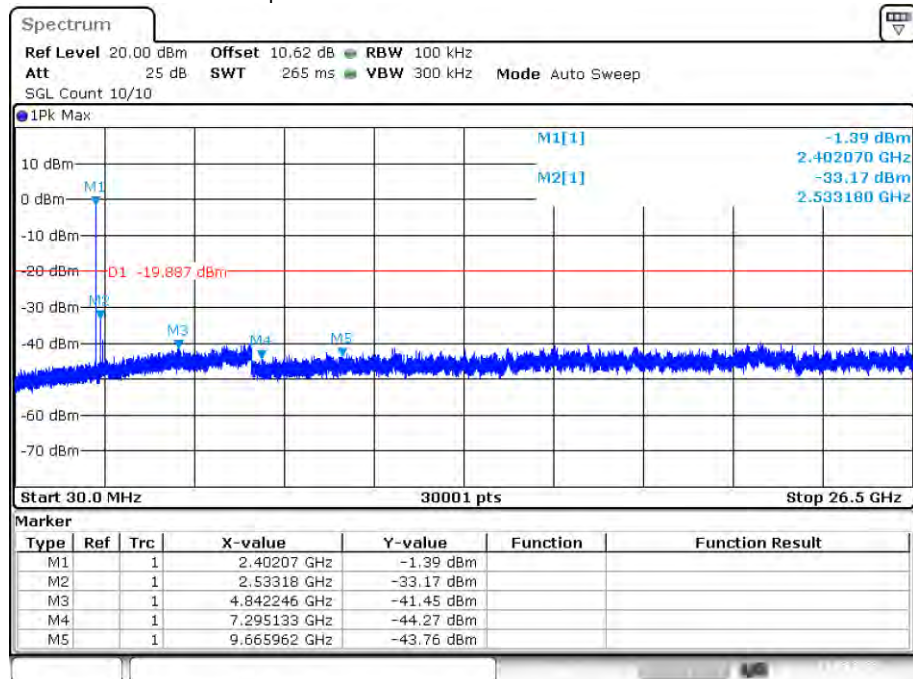
Date: 13.MAR.2023 04:13:43

Tx. Spurious NVNT 2-DH1 2402MHz Ant1 Ref



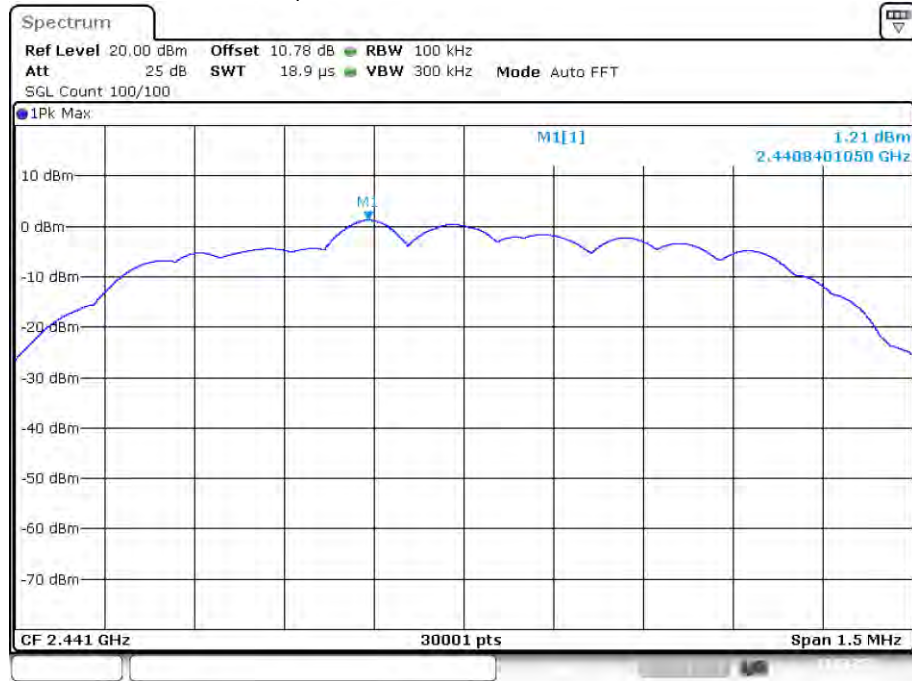
Date: 13.MAR.2023 04:28:40

Tx. Spurious NVNT 2-DH1 2402MHz Ant1 Emission



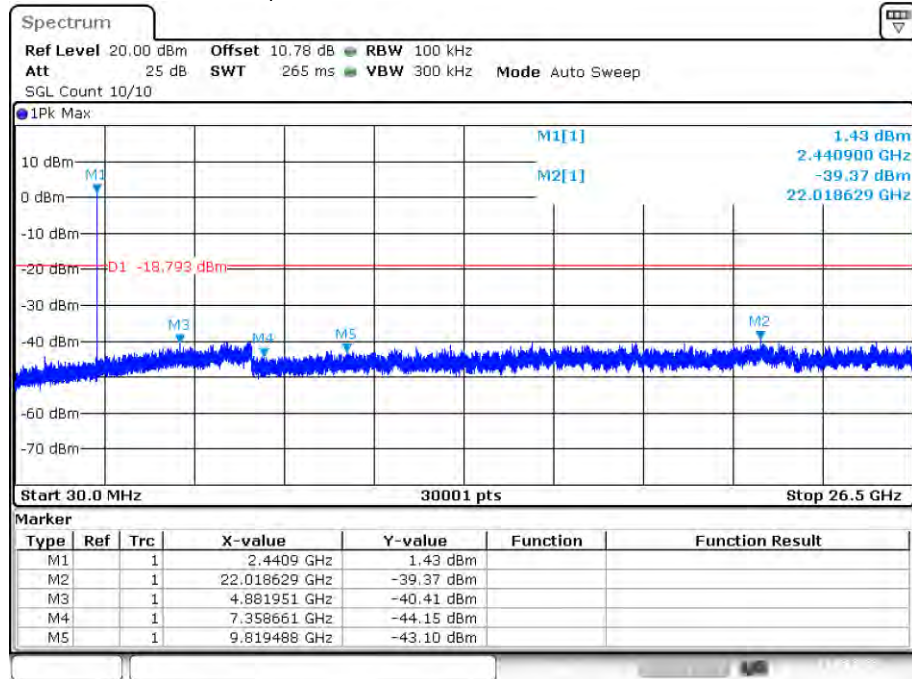
Date: 13.MAR.2023 04:28:53

Tx. Spurious NVNT 2-DH1 2441MHz Ant1 Ref



Date: 13.MAR.2023 04:33:06

Tx. Spurious NVNT 2-DH1 2441MHz Ant1 Emission



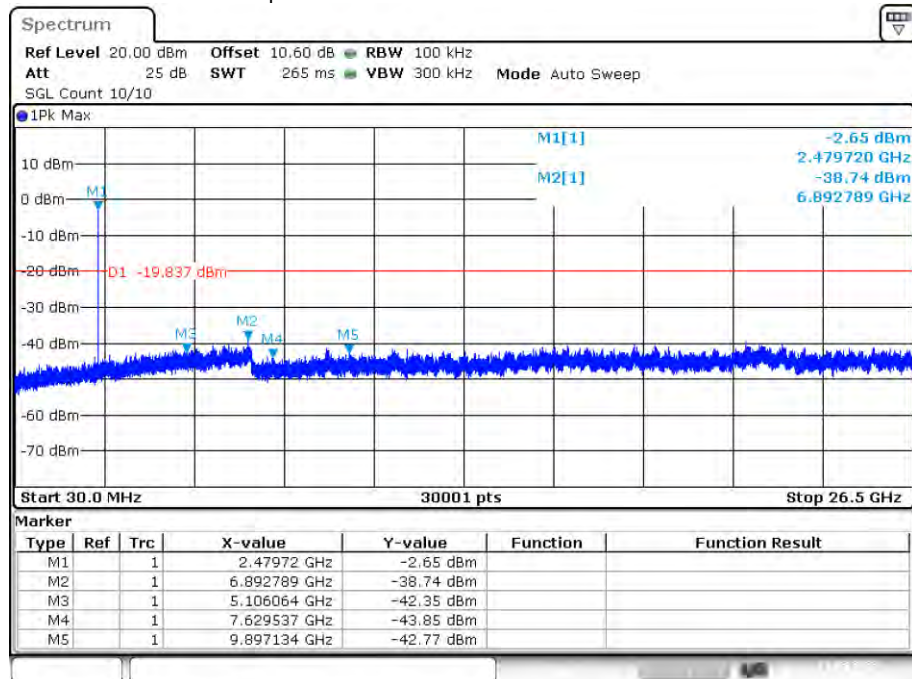
Date: 13.MAR.2023 04:33:20

Tx. Spurious NVNT 2-DH1 2480MHz Ant1 Ref



Date: 13.MAR.2023 04:35:20

Tx. Spurious NVNT 2-DH1 2480MHz Ant1 Emission



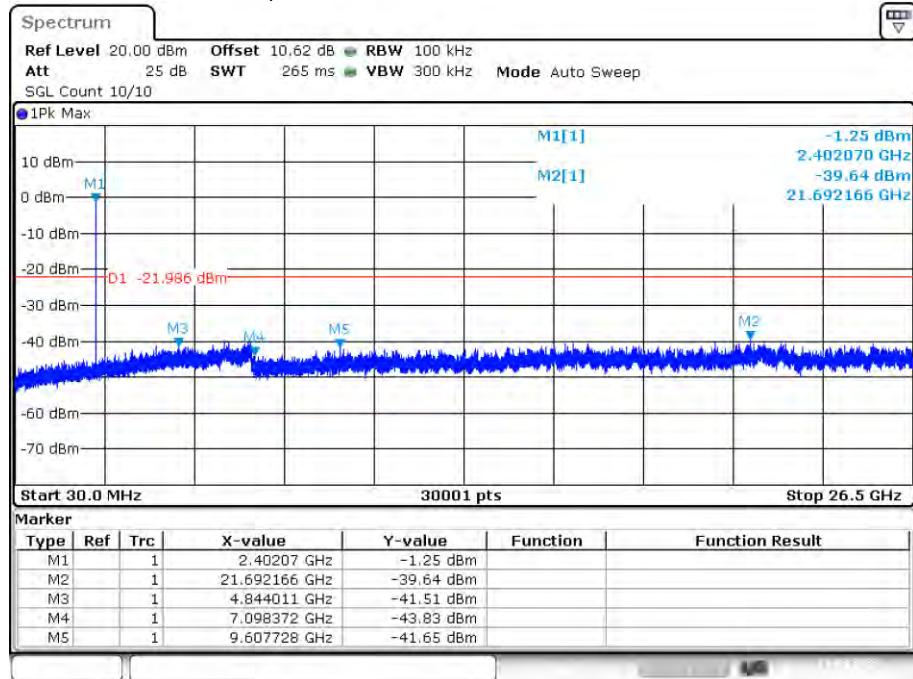
Date: 13.MAR.2023 04:35:34

Tx. Spurious NVNT 3-DH1 2402MHz Ant1 Ref



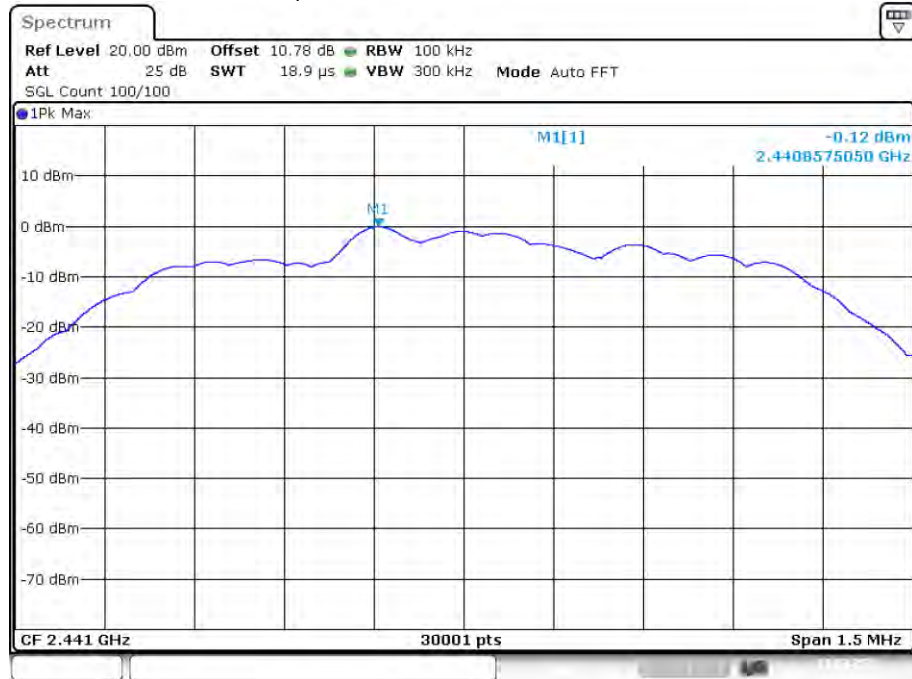
Date: 13.MAR.2023 05:51:34

Tx. Spurious NVNT 3-DH1 2402MHz Ant1 Emission



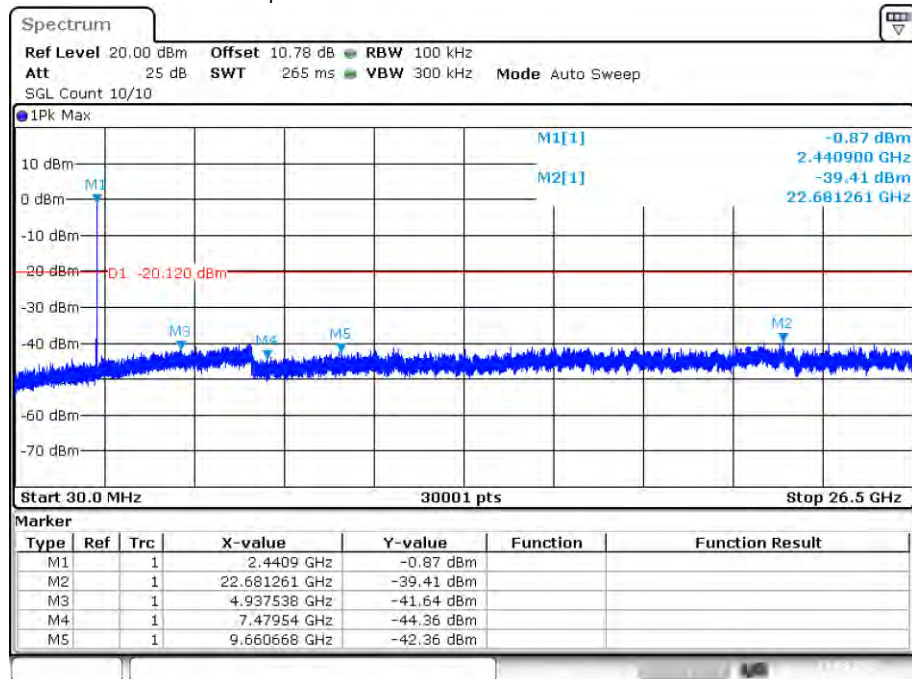
Date: 13.MAR.2023 05:51:48

Tx. Spurious NVNT 3-DH1 2441MHz Ant1 Ref



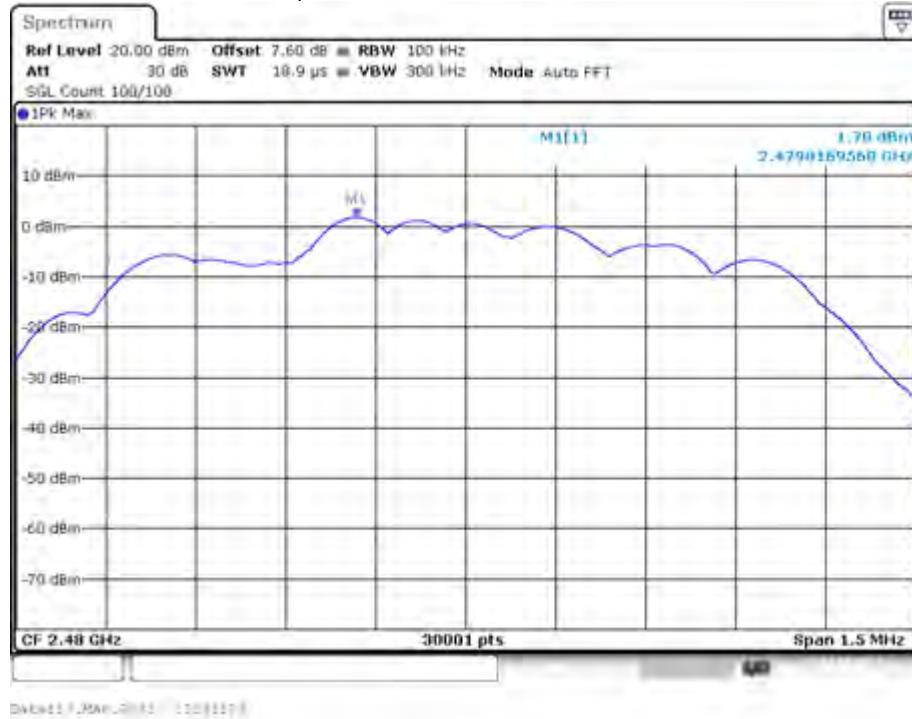
Date: 13.MAR.2023 05:54:27

Tx. Spurious NVNT 3-DH1 2441MHz Ant1 Emission

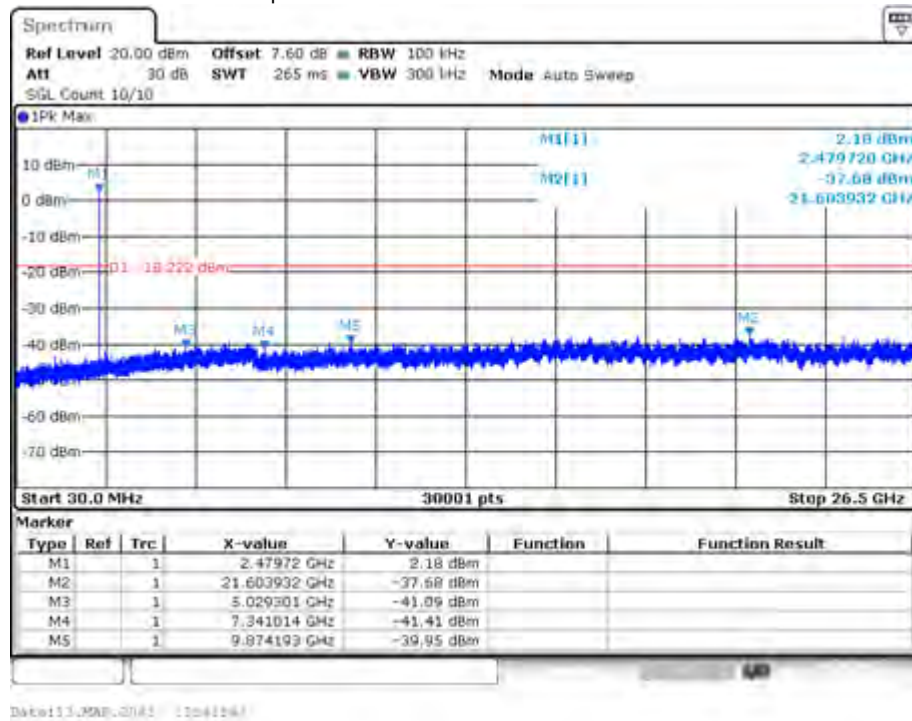


Date: 13.MAR.2023 05:54:41

Tx. Spurious NVNT 3-DH1 2480MHz Ant1 Ref

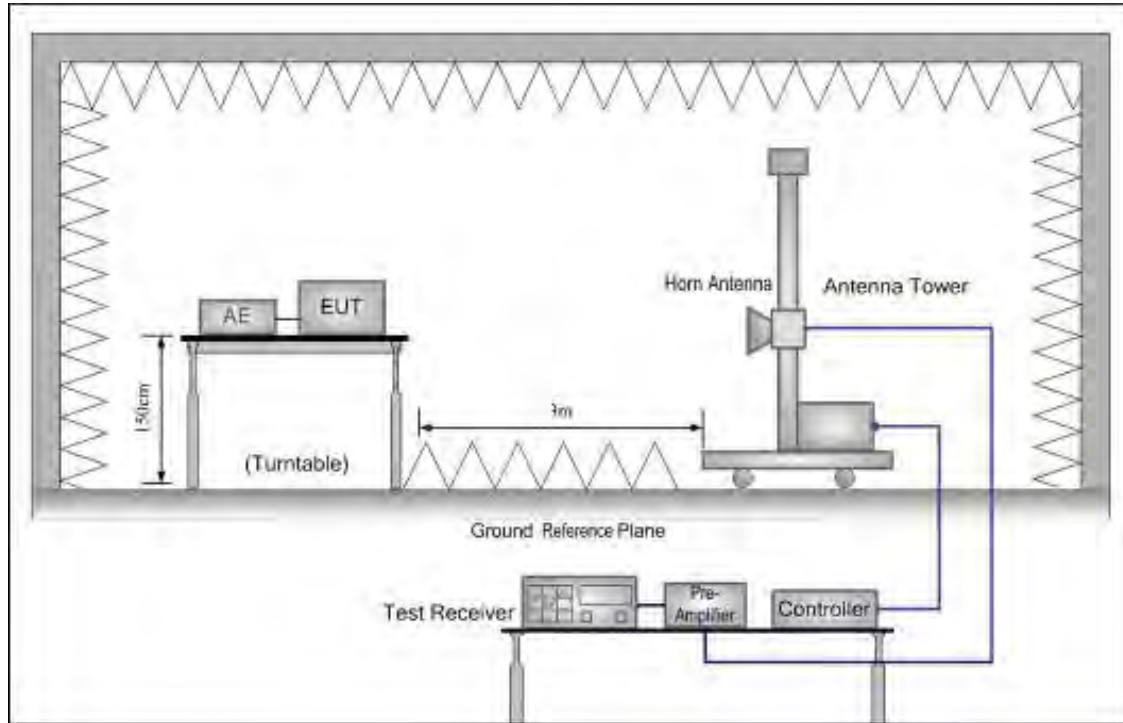


Tx. Spurious NVNT 3-DH1 2480MHz Ant1 Emission



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.

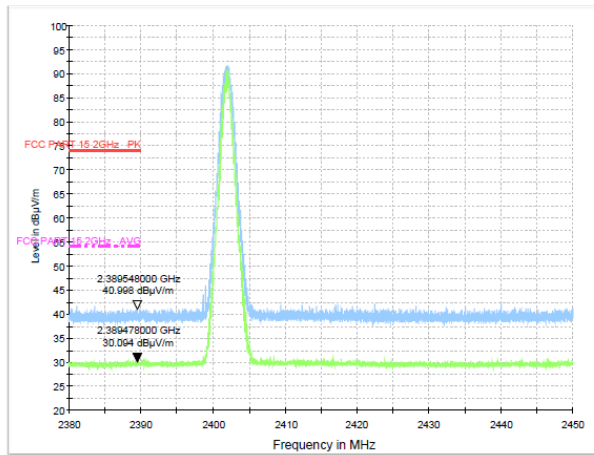
9.3. Test Procedure

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

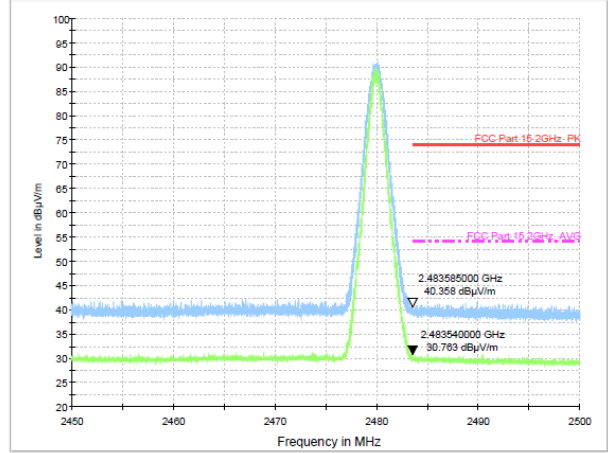
9.4. Test Result

PASS. (See below detailed test data)

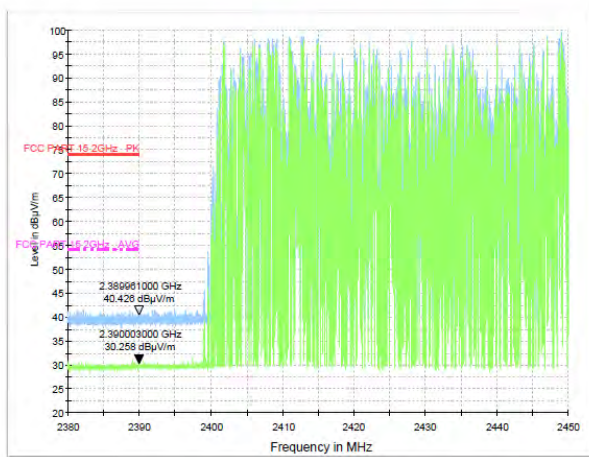
Test Mode: GFSK-Low Hopping-off



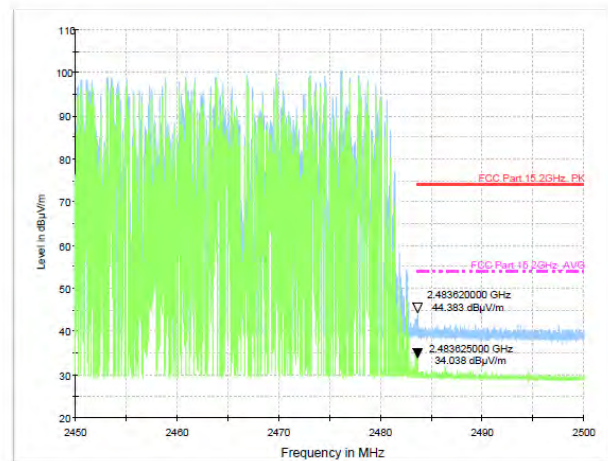
Test Mode: GFSK-High Hopping-off

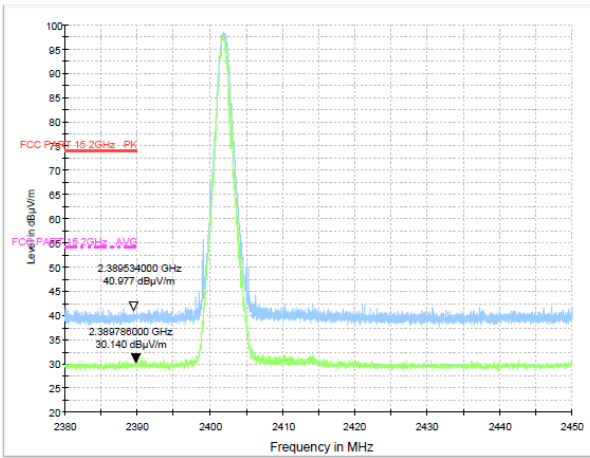
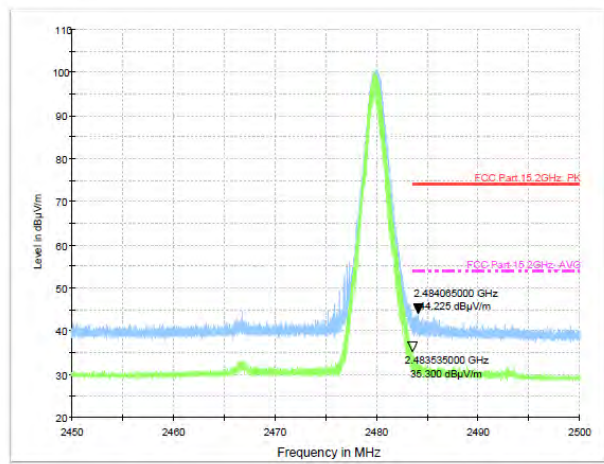
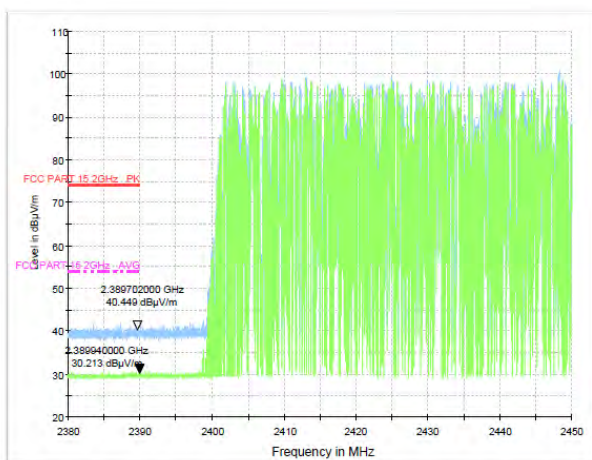
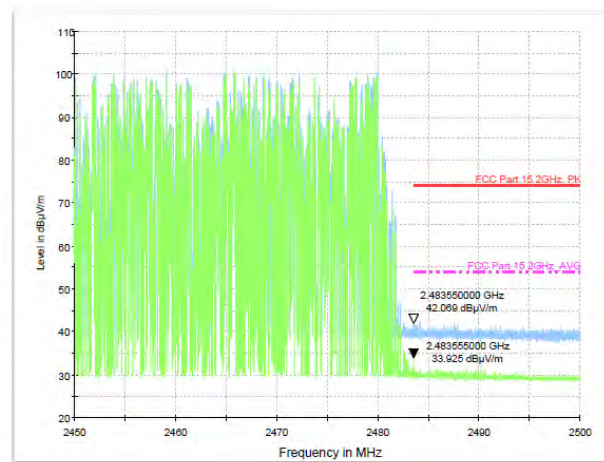


Test Mode: GFSK-Low Hopping-on

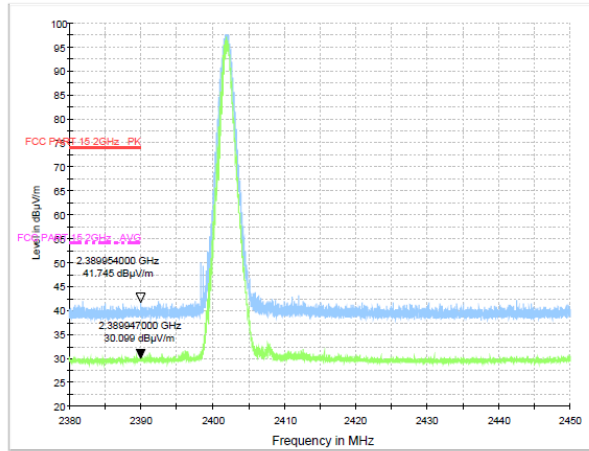


Test Mode: GFSK-High Hopping-on

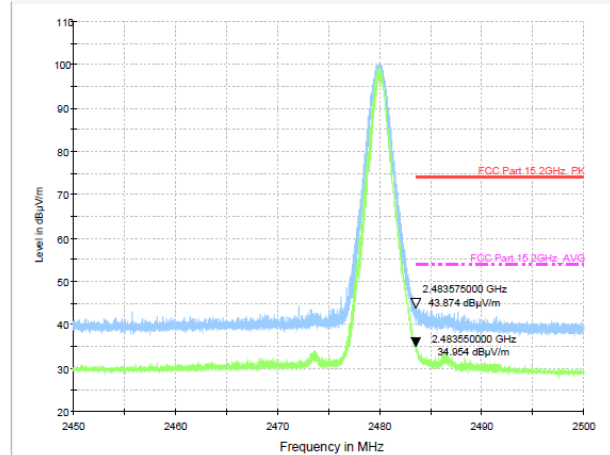


Test Mode: $\pi/4$ DQPSK-Low Hopping-offTest Mode: $\pi/4$ DQPSK-High Hopping-offTest Mode: $\pi/4$ DQPSK-Low Hopping-onTest Mode: $\pi/4$ DQPSK-High Hopping-on

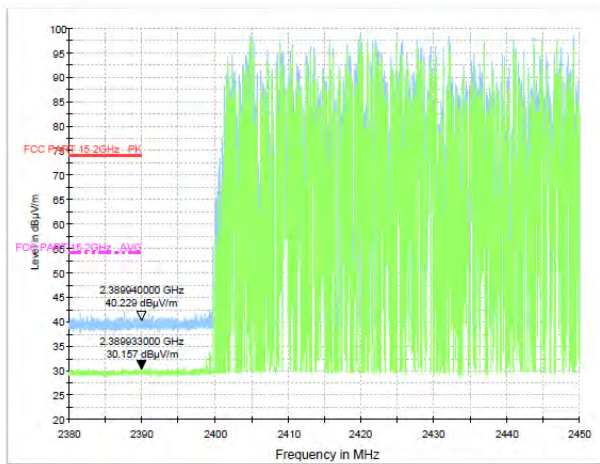
Test Mode: 8DPSK-Low Hopping-off



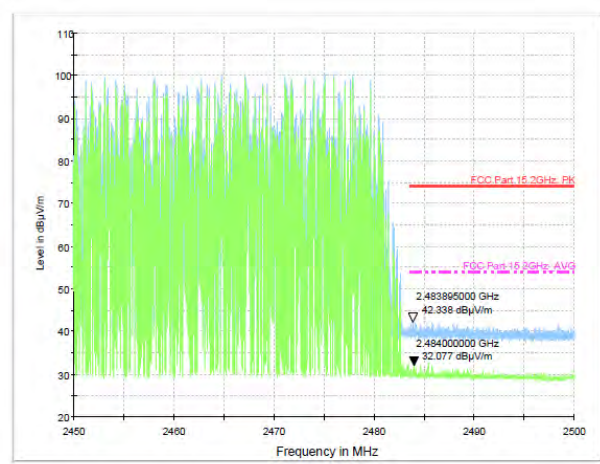
Test Mode: 8DPSK-High Hopping-off



Test Mode: 8DPSK-Low Hopping-on



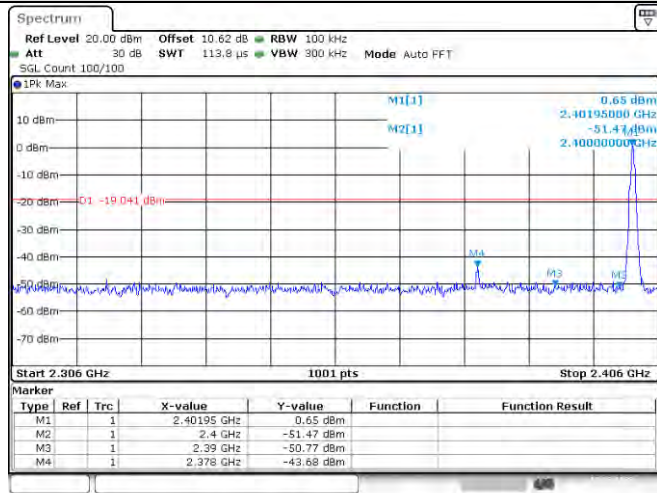
Test Mode: 8DPSK-High Hopping-on



Conducted Method

GFSK Mode:

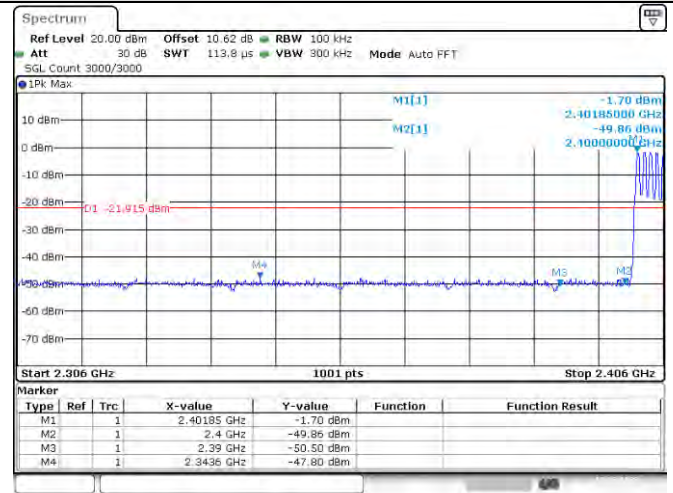
Test channel:



Date: 13.MAR.2023 04:09:16

No-hopping mode

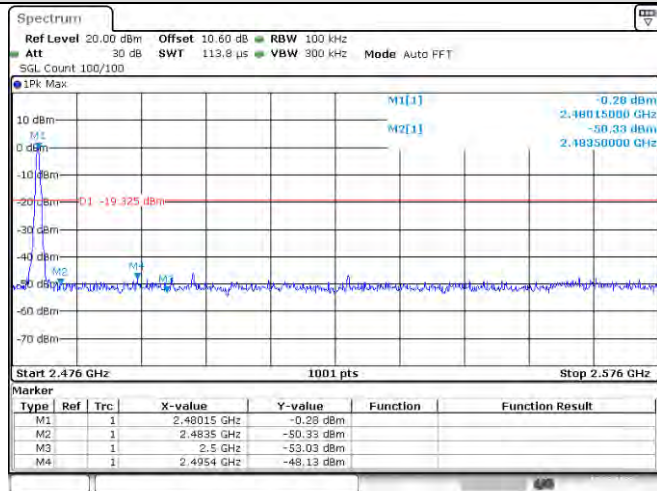
Lowest channel



Date: 13.MAR.2023 05:11:11

Hopping mode

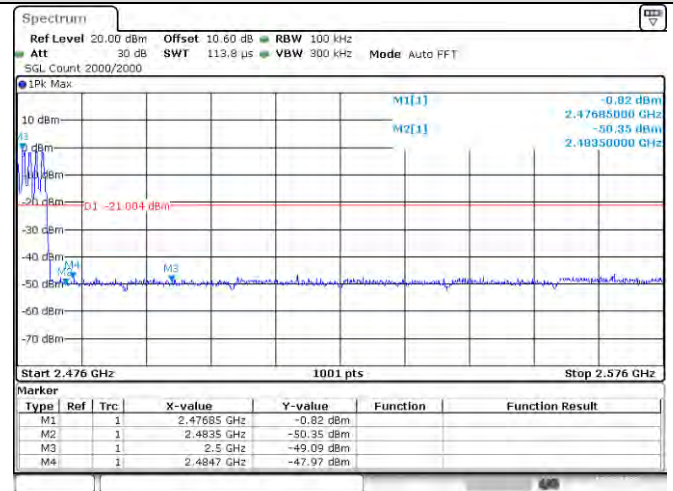
Test channel:



Date: 13.MAR.2023 04:13:19

No-hopping mode

Highest channel

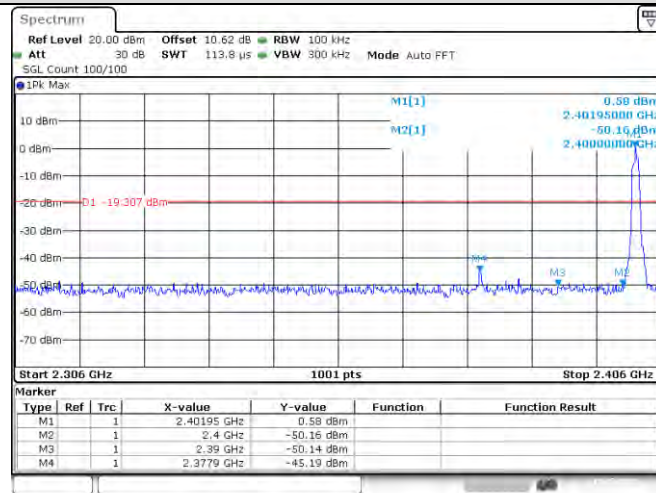


Date: 13.MAR.2023 05:23:43

Hopping mode

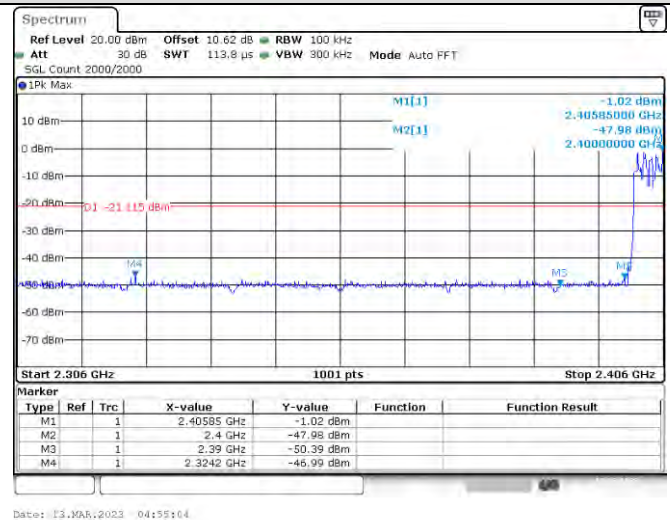
$\pi/4$ DQPSK Mode:

Test channel:



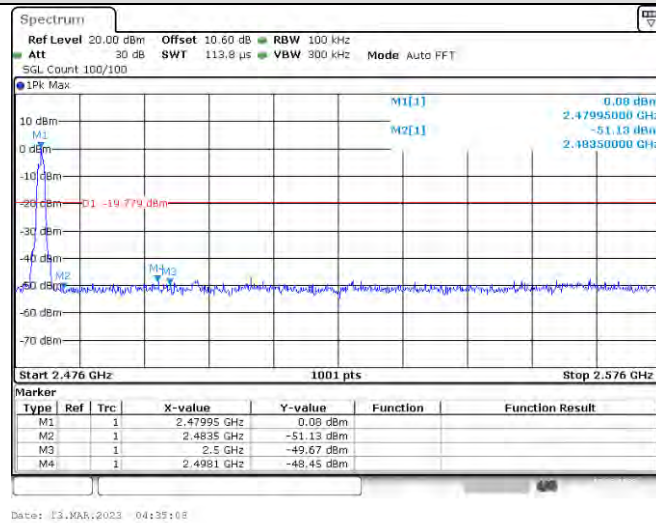
No-hopping mode

Lowest channel



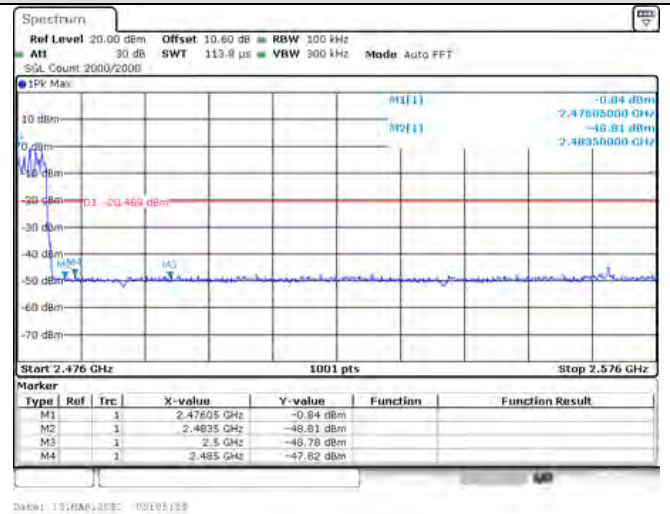
Hopping mode

Test channel:



No-hopping mode

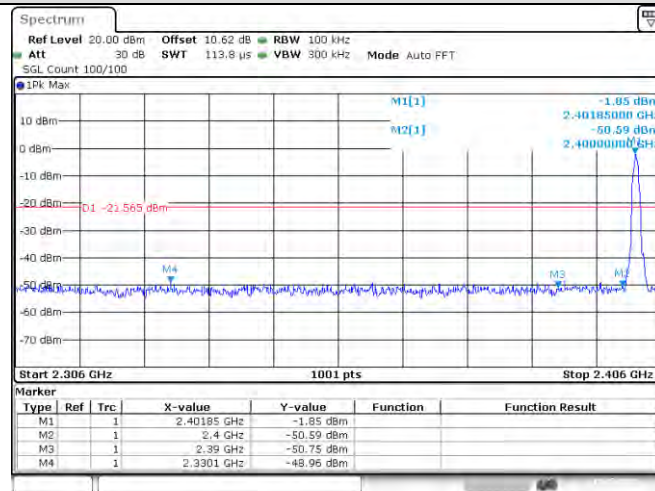
Highest channel



Hopping mode

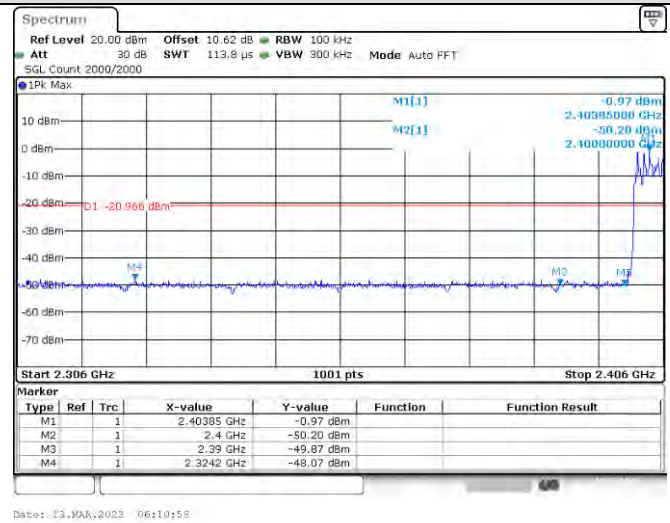
8DPSK Mode:

Test channel:



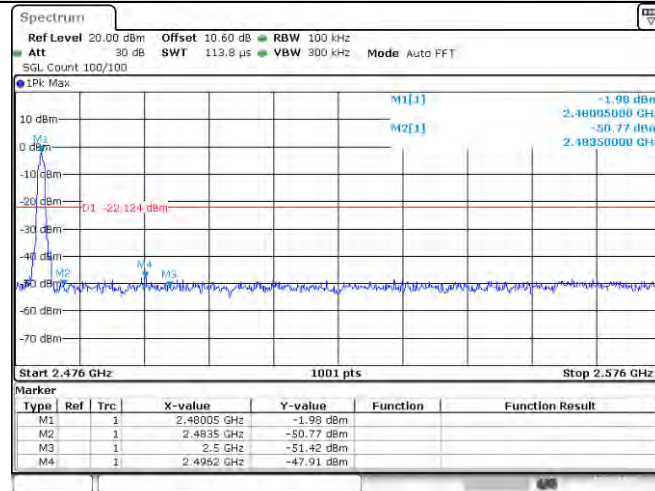
No-hopping mode

Lowest channel



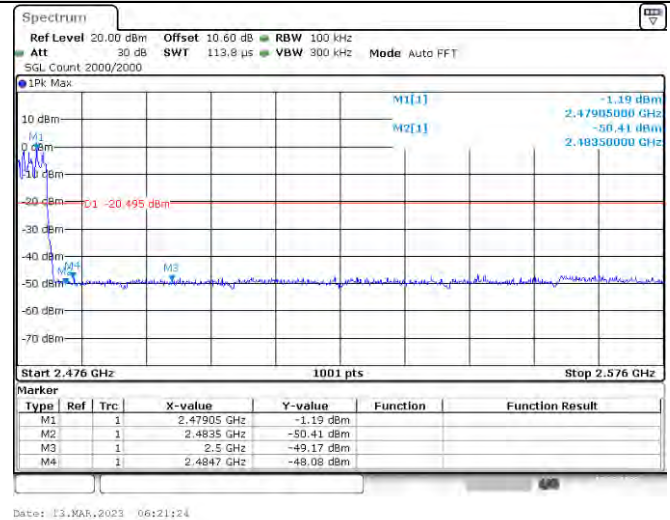
Hopping mode

Test channel:



No-hopping mode

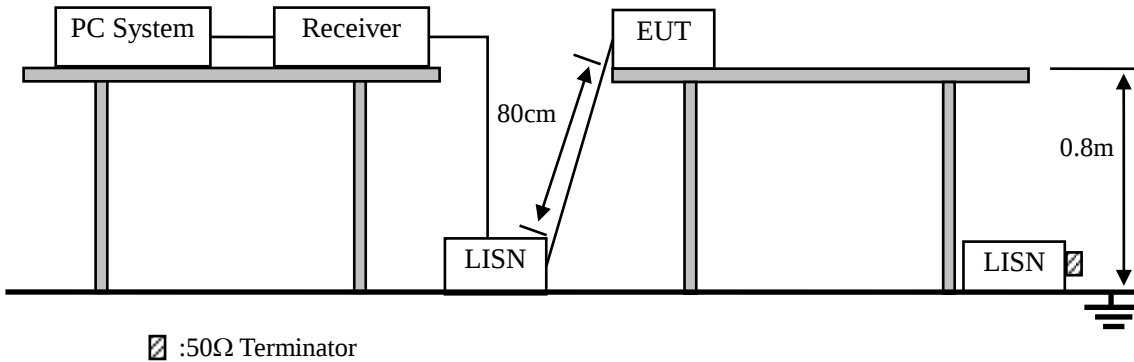
Highest channel



Hopping mode

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

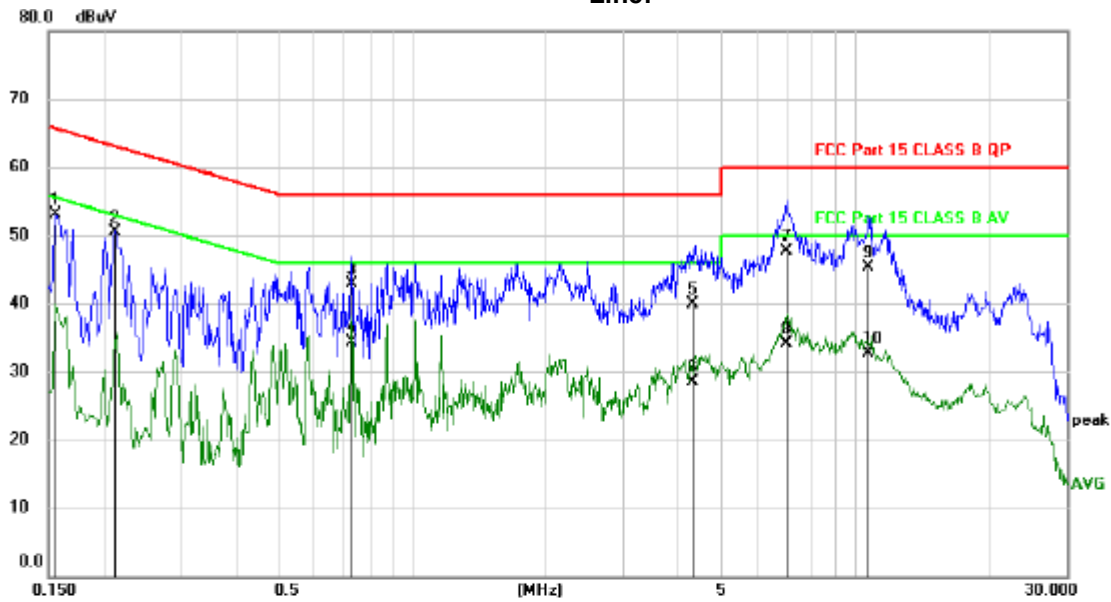
- (1) The EUT was placed on a non-metallic table, 80cm above the ground plane.
- (2) Setup the EUT and simulator as shown in 10.1
- (3) The EUT Power connected to the power mains through a power adapter and a line impedance stabilization network (L.I.S.N1). The other peripheral devices power cord connected 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:

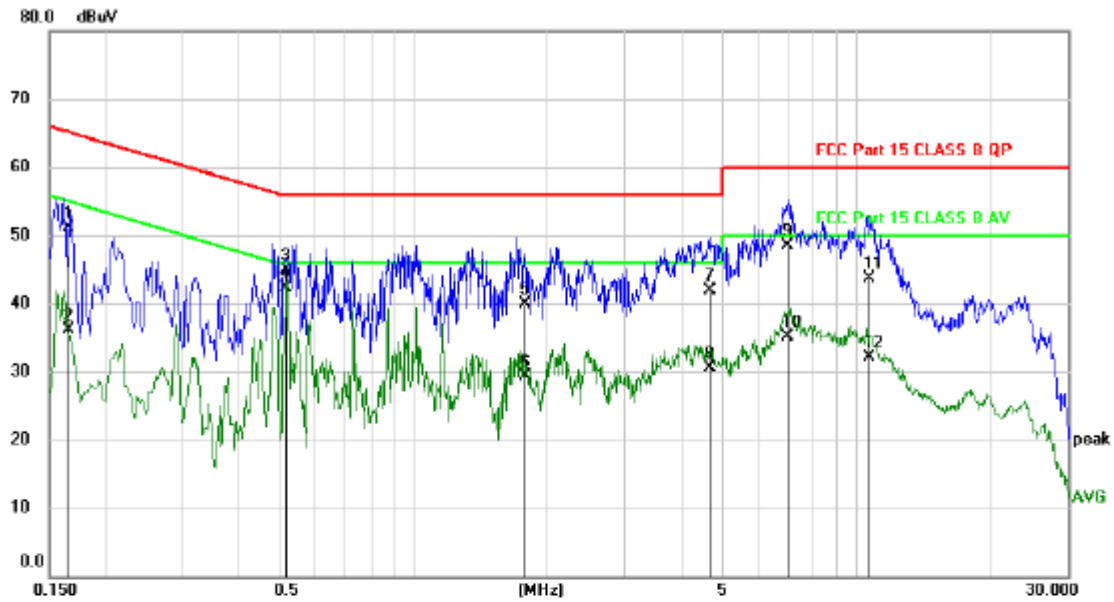


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1		0.1560	43.06	10.06	53.12	65.67	-12.55	peak	
2		0.2130	40.50	10.10	50.60	63.09	-12.49	peak	
3		0.7290	32.52	10.33	42.85	56.00	-13.15	QP	
4	*	0.7290	24.05	10.33	34.38	46.00	-11.62	AVG	
5		4.2809	29.35	10.60	39.95	56.00	-16.05	QP	
6		4.2809	17.87	10.60	28.47	46.00	-17.53	AVG	
7		6.9470	37.00	10.71	47.71	60.00	-12.29	QP	
8		6.9470	23.43	10.71	34.14	50.00	-15.86	AVG	
9		10.6871	34.40	10.84	45.24	60.00	-14.76	QP	
10		10.6871	21.83	10.84	32.67	50.00	-17.33	AVG	

*: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. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1		0.1657	41.11	10.05	51.16	65.17	-14.01	QP	
2		0.1657	26.04	10.05	36.09	55.17	-19.08	AVG	
3		0.5160	34.61	10.27	44.88	56.00	-11.12	QP	
4	*	0.5160	32.07	10.27	42.34	46.00	-3.66	AVG	
5		1.7943	29.47	10.41	39.88	56.00	-16.12	QP	
6		1.7943	18.89	10.41	29.30	46.00	-16.70	AVG	
7		4.6432	31.37	10.62	41.99	56.00	-14.01	QP	
8		4.6432	19.96	10.62	30.58	46.00	-15.42	AVG	
9		6.9977	37.73	10.71	48.44	60.00	-11.56	QP	
10		6.9977	24.45	10.71	35.16	50.00	-14.84	AVG	
11		10.7207	32.81	10.84	43.65	60.00	-16.35	QP	
12		10.7207	21.30	10.84	32.14	50.00	-17.86	AVG	

*: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

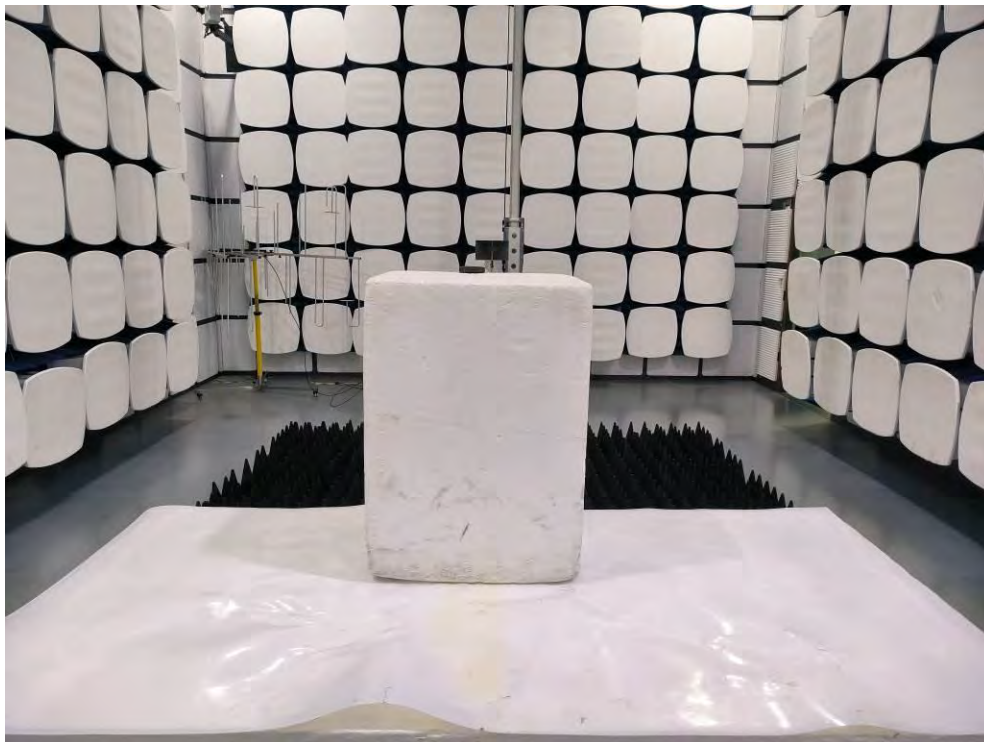
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional 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

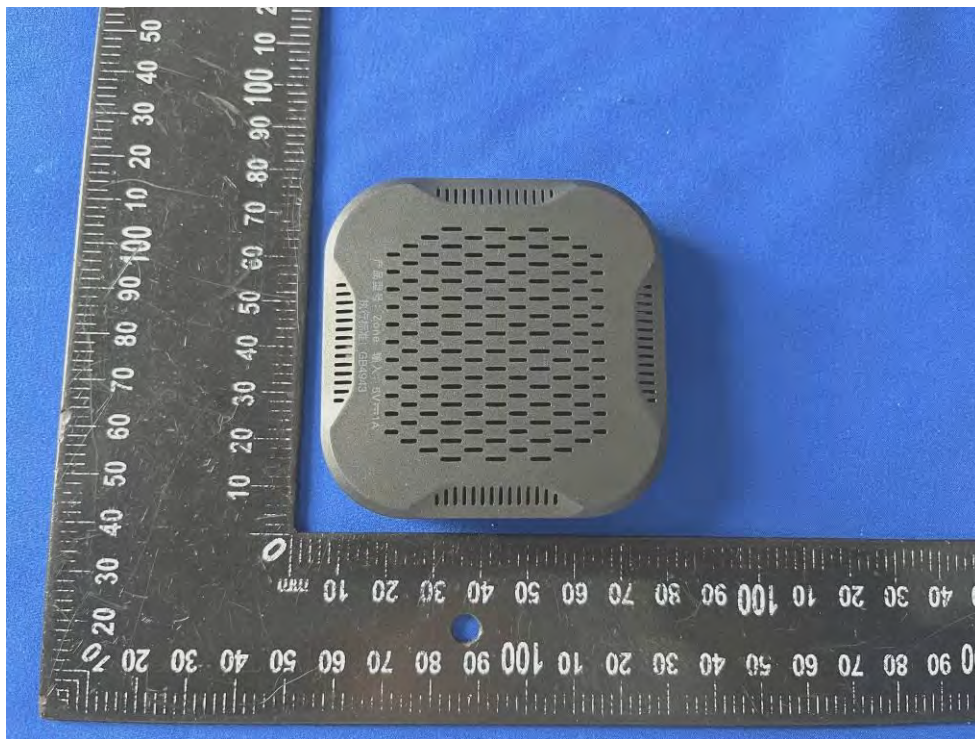
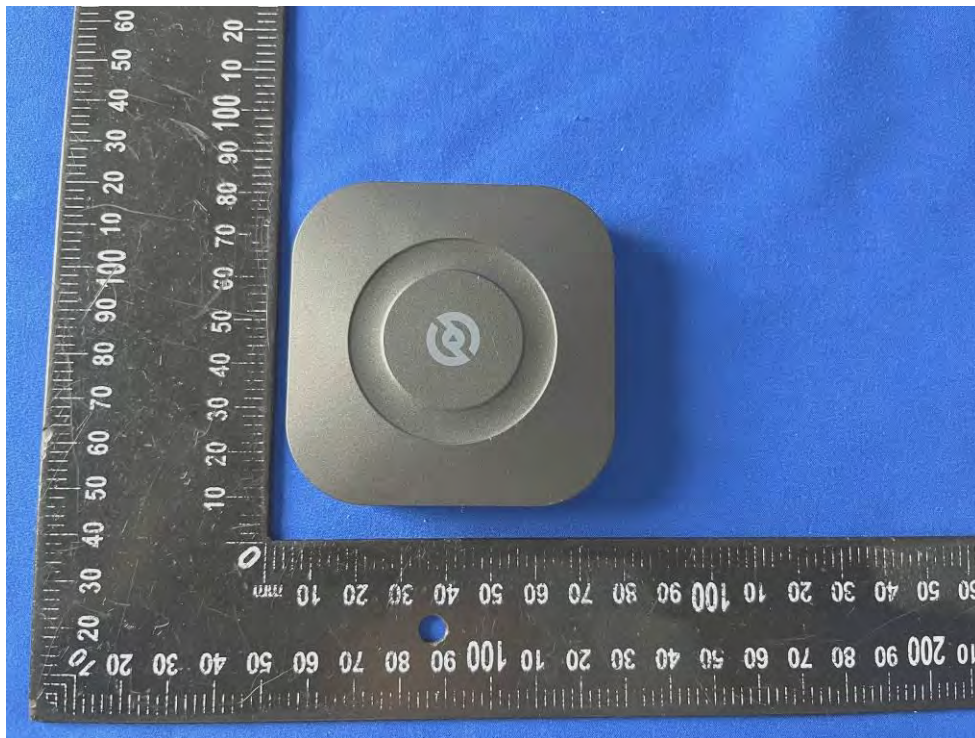
12.1. Photo of Radiated Emission test

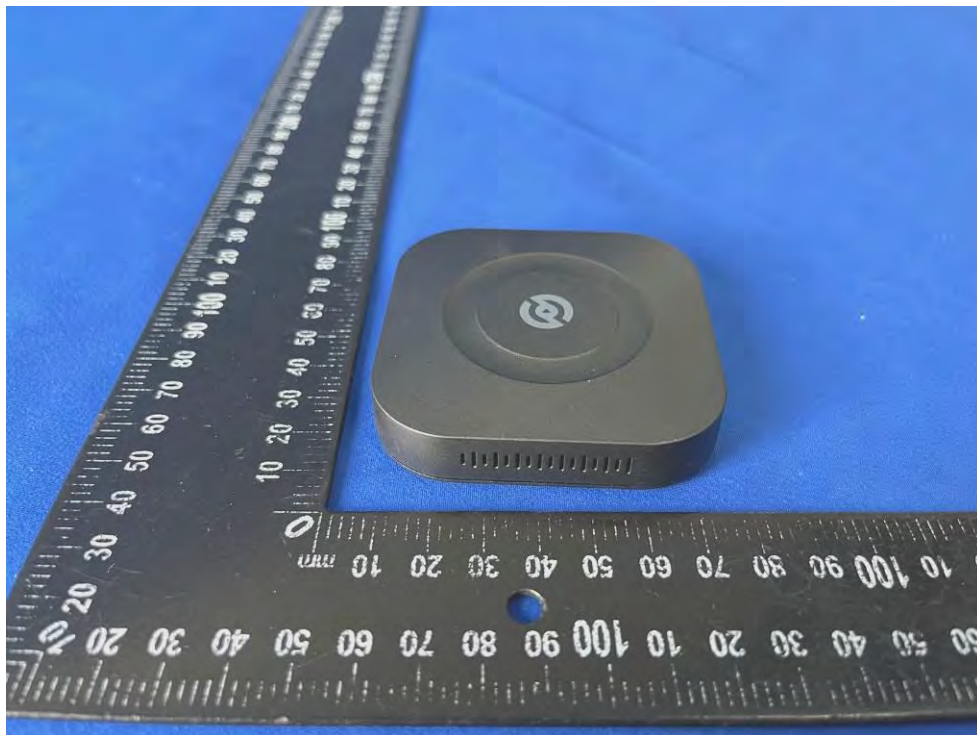


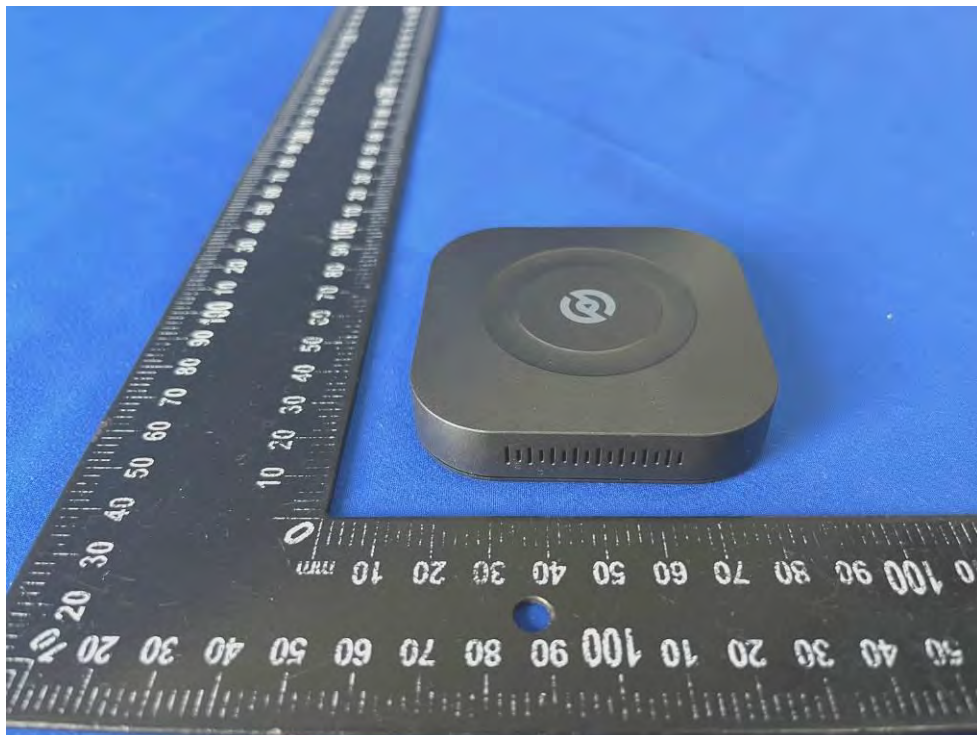
12.2.Photo of Conducted Emission test

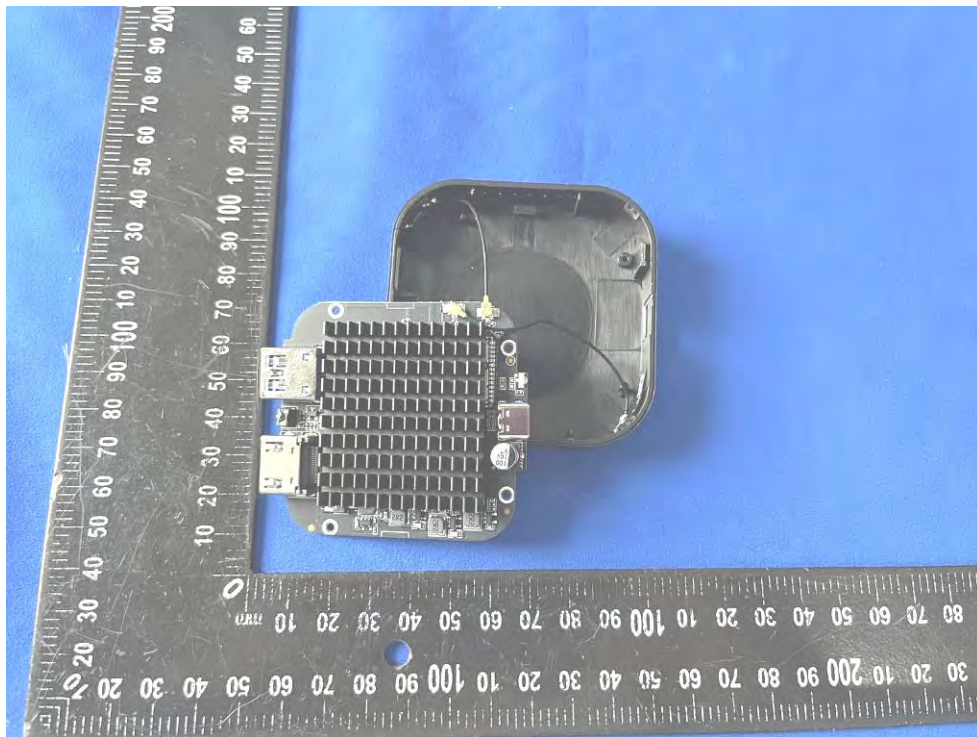
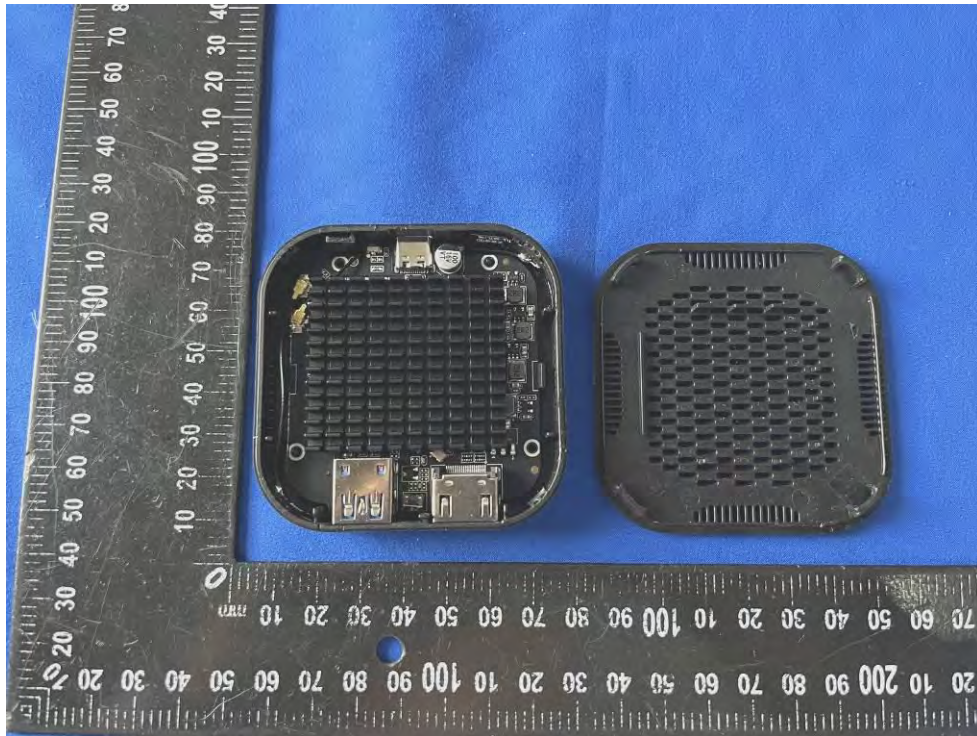


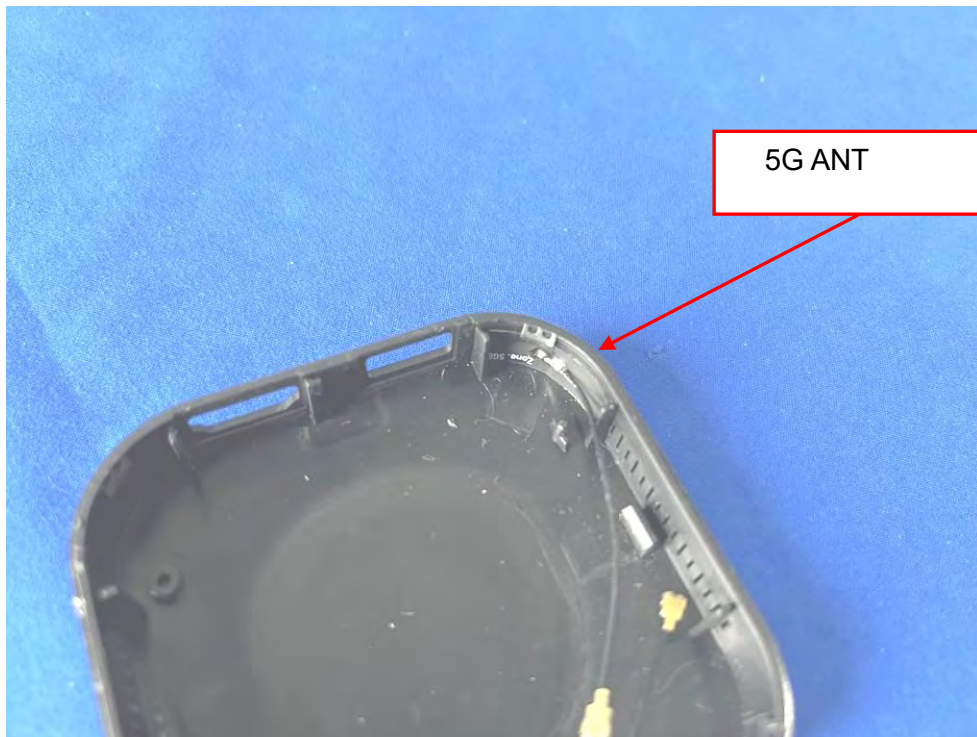
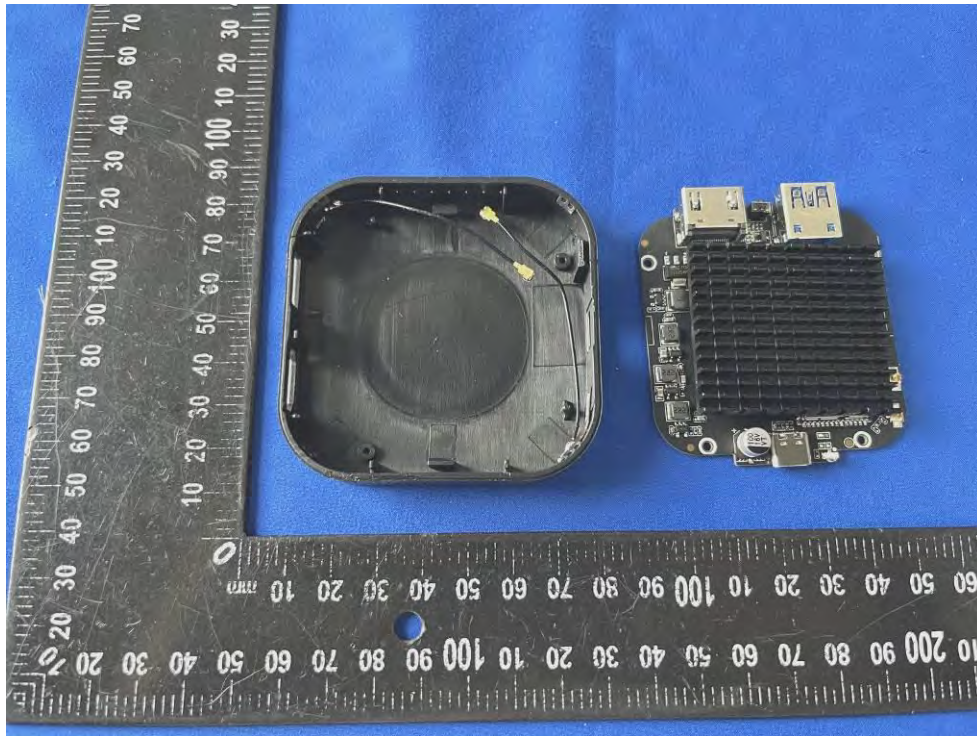
13.EUT Photo

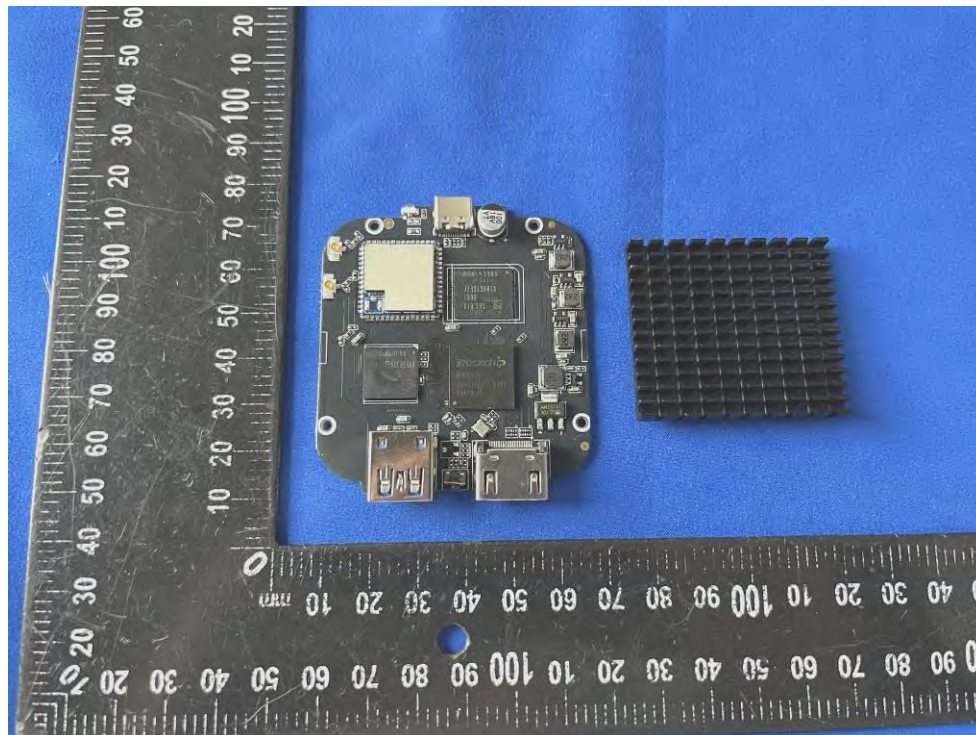
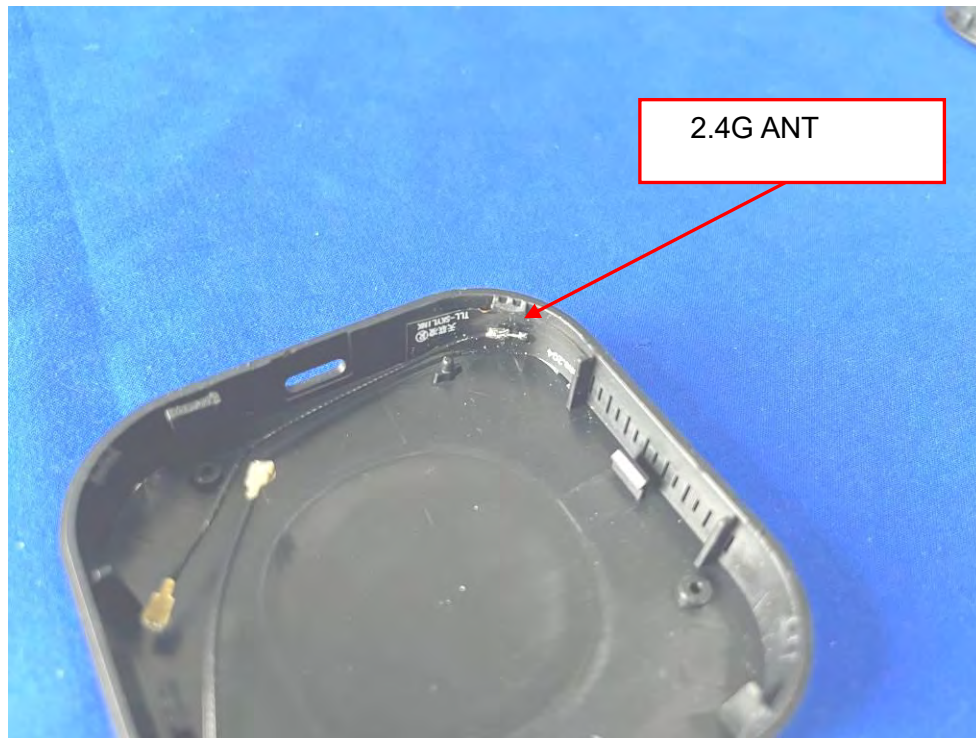


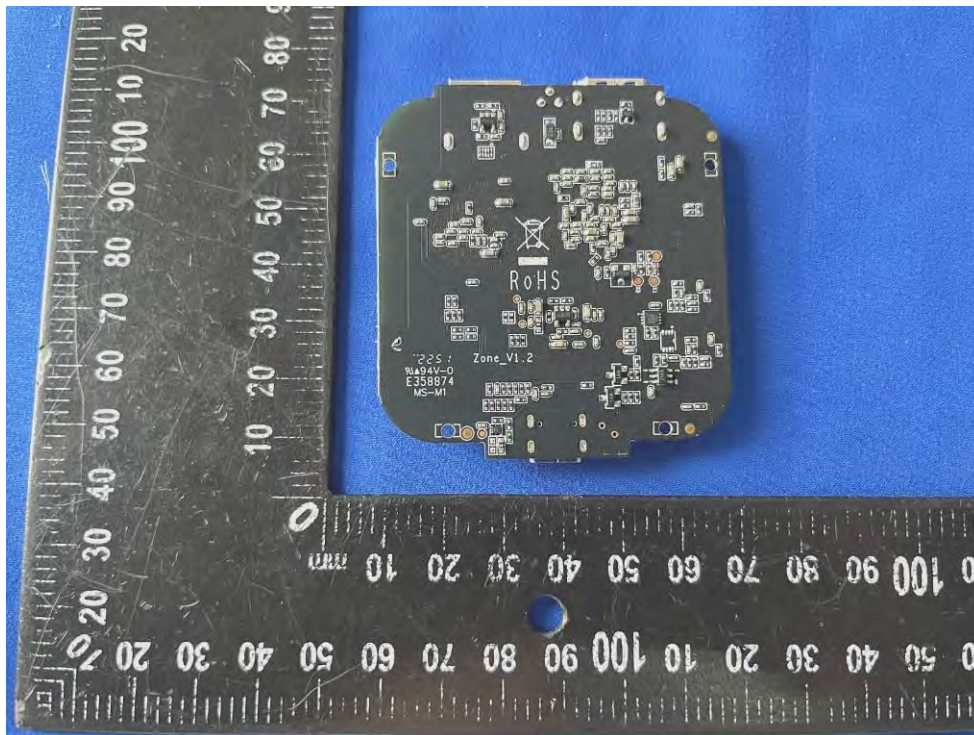
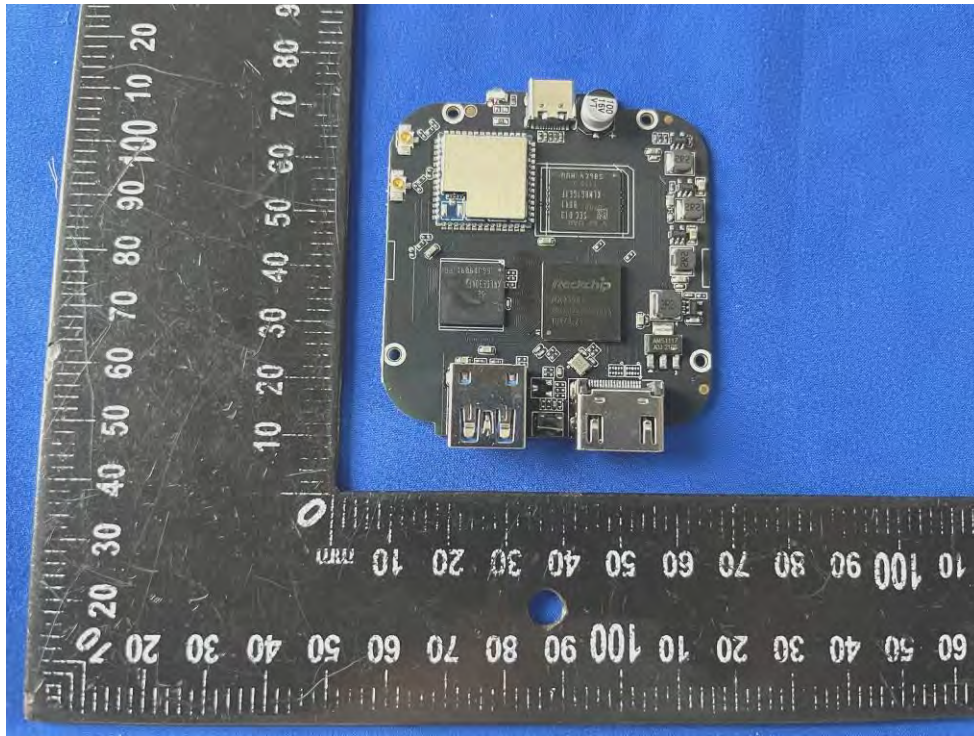


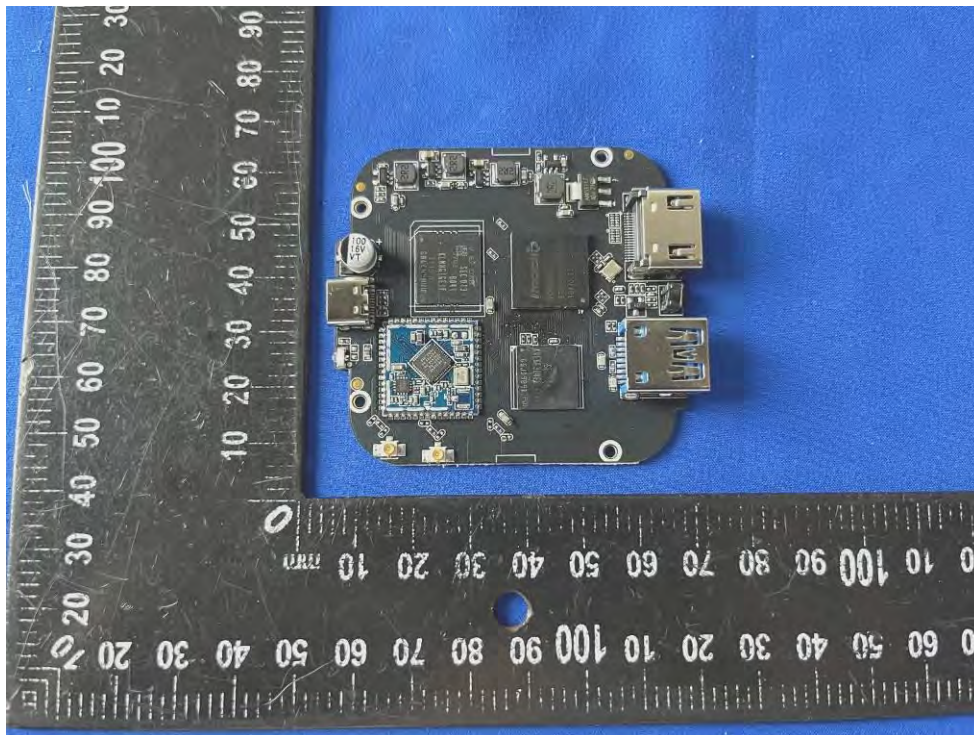
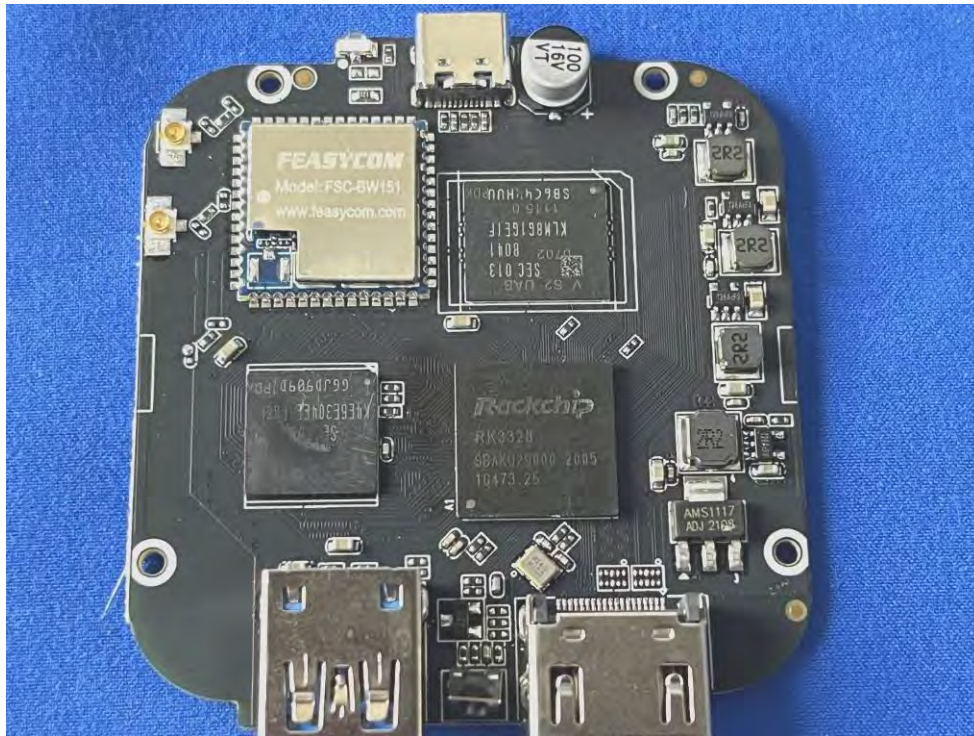


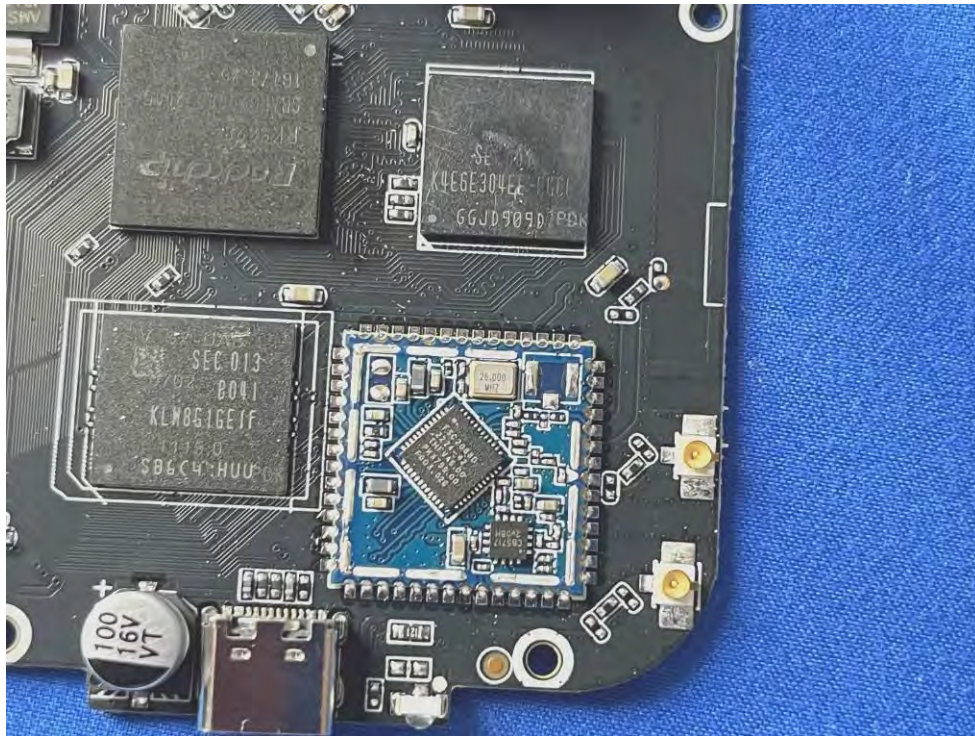












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