



FCC TEST REPORT

FCC ID: 2AJZ2-UP01

On Behalf of

U-tec Group Inc.

Smart Plug

Model No.: UP01

Prepared for : U-tec Group Inc.
Address : 32920 Alvarado-Niles Rd Ste 220, Union City, CA 94587

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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Date of Receipt : June 19, 2023
Date of Test : June 19, 2023-July 11, 2023
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TEST REPORT DECLARATION

Applicant : U-tec Group Inc.
Address : 32920 Alvarado-Niles Rd Ste 220, Union City, CA 94587
Manufacturer : U-tec Group Inc.
Address : 32920 Alvarado-Niles Rd Ste 220, Union City, CA 94587
EUT Description : Smart Plug
(A) Model No. : UP01
(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.

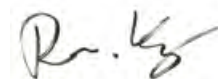
After the test, our opinion is that EUT compliance with the requirement of the above standards.

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.....: July 11, 2023

Revision History

Revision	Issue Date	Revisions	Revised By
V0	July 11, 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
Conducted Emission	FCC Part 15: 15.207 ANSI C63.10	P
6dB Bandwidth	FCC PART 15:15.247(a)(2) ANSI C63.10	P
Output Power	FCC Part 15: 15.247(b)(3) ANSI C63.10	P
Radiated Spurious Emission	FCC Part 15: 15.209 FCC Part 15: 15.247(d) ANSI C63.10	P
Conducted Spurious & Band Edge Emission	FCC Part 15: 15.247(d) ANSI C63.10	P
Power Spectral Density	FCC PART 15:15.247(e) ANSI C63.10	P
Radiated Band Edge Emission	FCC Part 15: 15.247(d) ANSI C63.10	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)

EUT Name : Smart Plug
Model No. : UP01
DIFF. : N/A
Power supply : AC 120V/60Hz

2.4G WIFI :

Operation frequency : 2412MHz-2462MHz for IEEE 802.11 b, g, n/HT20
2422MHz~2452MHz for IEEE802.11n/HT40
Channel No. : 802.11b/802.11g /802.11n(HT20): 11CH
802.11(HT40): 7CH
Modulation type : IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK)
IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK)
IEEE 802.11n:OFDM(64QAM, 16QAM, QPSK, BPSK)
Antenna Type : Internal antenna, max gain 7.29dBi
(Antenna information is provided by applicant.)

Software version : V1.0
Hardware version : V1.0

Intend use environment : Residential, commercial and light industrial environment

Note : /

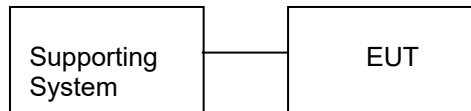
2.2. Accessories of Device (EUT)

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

2.3. Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number	Certification or SDOC
1	Notebook PC	Lenovo	E14	/	/

2.4. Block Diagram of connection between EUT and simulators



2.5. Test Mode Description

Duty cycle :100% Keeping TX			
Mode	data rate (Mbps)(see Note)	Channel	Frequency (MHz)
IEEE 802.11b	1	Low :CH1	2412
	1	Middle: CH6	2437
	1	High: CH11	2462
IEEE 802.11g	6	Low :CH1	2412
	6	Middle: CH6	2437
	6	High: CH11	2462
IEEE 802.11 n/HT20	6.5	Low :CH1	2412
	6.5	Middle: CH6	2437
	6.5	High: CH11	2462
IEEE 802.11 n/HT40	13.5	Low :CH3	2422
	13.5	Middle: CH6	2437
	13.5	High: CH9	2452
Note: According exploratory test, EUT will have maximum output power in those data rate. So those data rate were used for all test.			

Channel list:					
For IEEE 802.11b, g, n/HT20					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
CH1	2412	CH5	2432	CH9	2452
CH2	2417	CH6	2437	CH10	2457
CH3	2422	CH7	2442	CH11	2462
CH4	2427	CH8	2447		
For IEEE 802.11 n/HT40					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
CH3	2422	CH7	2442		
CH4	2427	CH8	2447		
CH5	2432	CH9	2452		
CH6	2437				

2.6. Test Conditions

Items	Required	Actual
Temperature range:	15-35°C	24°C
Humidity range:	25-75%	56%
Pressure range:	86-106kPa	98kPa

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

Designation Number: CN1236

July 15, 2019 Certificated by IC

Registration Number: 12135A

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	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	MWRFTtest	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	Farad	Alpha-3A1
CE	EZ-EMC	Farad	Alpha-3A1
RF-CE	MTS 8310	MW	V2.0.0.0

3. SPURIOUS EMISSION

3.1. Test Limits

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)	
Note 1: The peak limit is 20 dB higher than the average limit			
Note 2: Peak limit applies (AVG limit + 20 dB) as well as RSS-247 Section 5.5			

3.2. Test Procedure

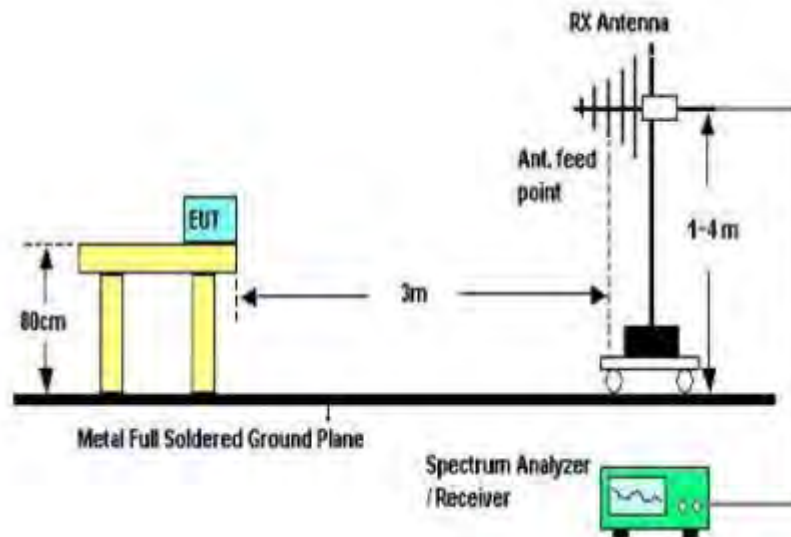
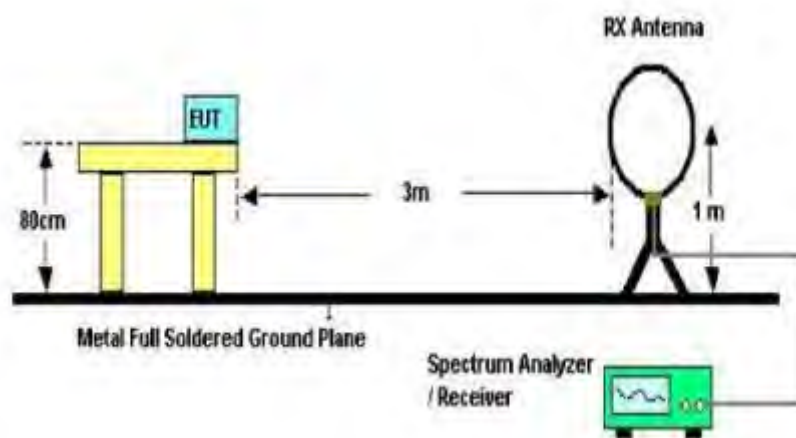
The measuring distance of 3m shall be used for measurements at frequency up to 1GHz and above 1GHz. The EUT was placed on a rotating 0.8 m high above ground for below 1GHz and 1.5m high for above 1GHz testing, the table was rotated 360 degrees to determine the position of the highest radiation. The Test antenna shall vary between 1m and 4m, both Horizontal and Vertical antenna are set of make measurement.

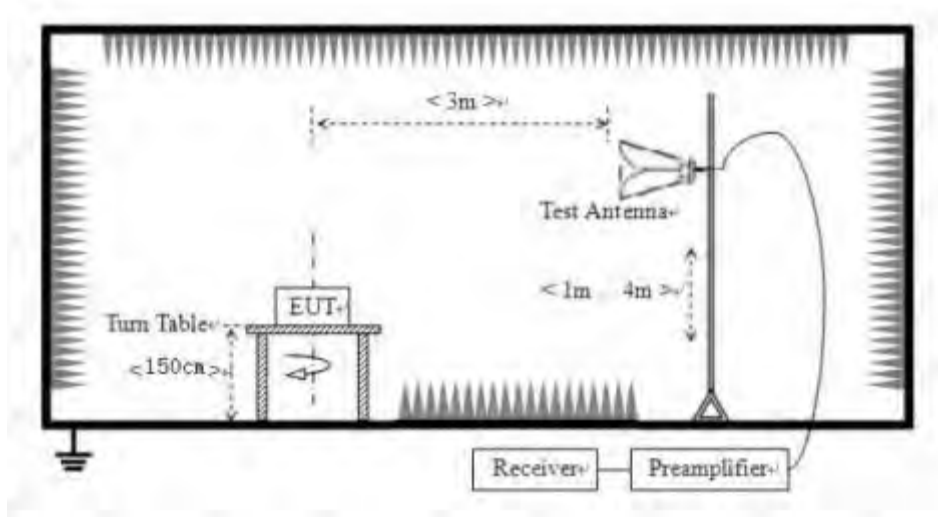
The initial step in collecting radiated emission data is a spectrum analyzer Peak detector mode pre-scanning the measurement frequency range. Significant Peaks are then marked. and then Quasi Peak Detector mode premeasured

If Peak value comply with QP limit below 1GHz, the EUT deemed to comply with QP limit. But the Peak value and average value both need to comply with applicable limit above 1GHz.

For the actual test configuration, please see the test setup photo.

3.3. Test Setup





Above 1GHz Test Setup

3.4. Test Results

Test Condition

Continual Transmitting in maximum power.

9KHz~150KHz	RBW200Hz	VBW1KHz
150KHz~30MHz	RBW9KHz	VBW 30KHz
30MHz~1GHz	RBW120KHz	VBW 300KHz
Above1GHz	RBW1MHz	VBW 3MHz

We have scanned the EUT from 9kHz up to the 10th harmonic of the fundamental.

Detailed information please see the following page.

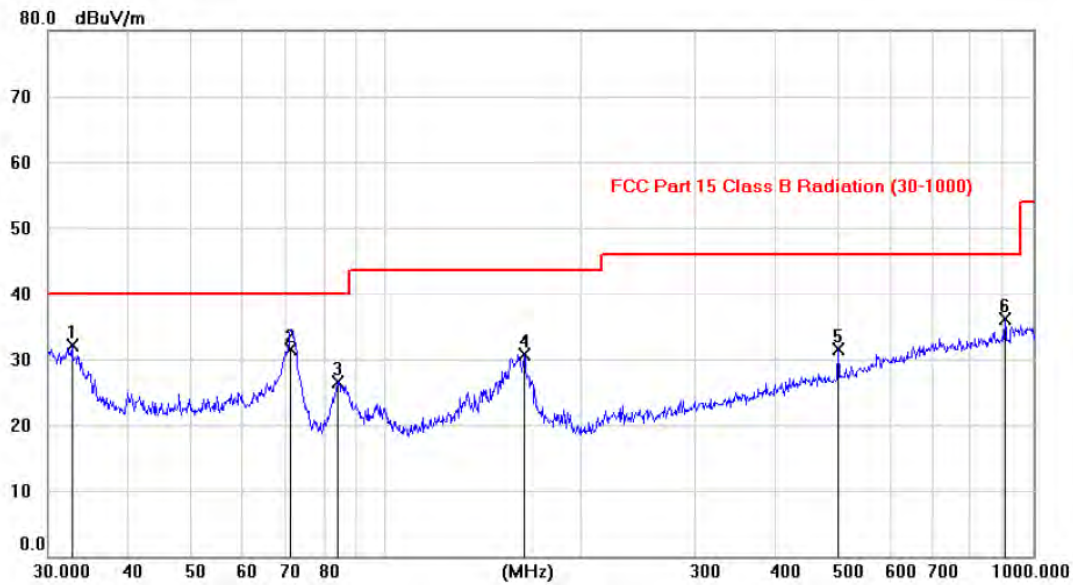
From 9KHz to 30MHz: Conclusion: PASS

Note: 1.The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

2.Only show the test data of the worst Channel in this report.

From 30MHz to 1000MHz: Conclusion: PASS

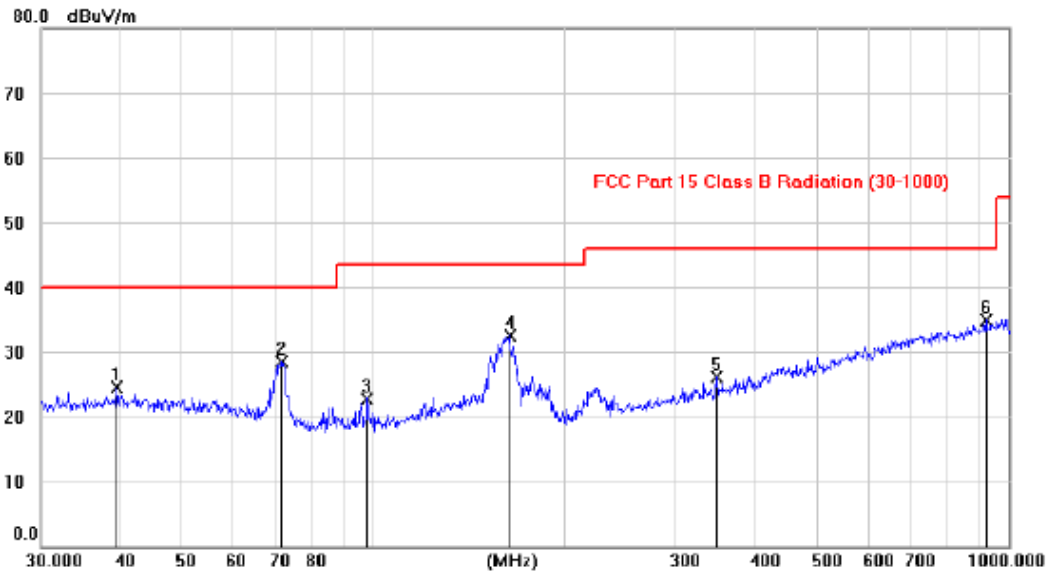
Vertical:



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Antenna Height cm	Table Degree	Comment
1	*	32.7295	18.49	13.65	32.14	40.00	-7.86	peak		
2		71.1385	20.35	11.11	31.46	40.00	-8.54	QP	100	0
3		84.2084	16.57	9.96	26.53	40.00	-13.47	peak		
4		163.5255	15.98	14.70	30.68	43.50	-12.82	peak		
5		500.0088	13.22	18.21	31.43	46.00	-14.57	peak		
6		906.2706	11.99	24.12	36.11	46.00	-9.89	peak		

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	cm	degree	Comment
1		39.5572	10.12	14.47	24.59	40.00	-15.41	peak		
2		71.8320	17.35	11.11	28.46	40.00	-11.54	peak		
3		98.0272	12.11	10.69	22.80	43.50	-20.70	peak		
4	*	163.9848	17.94	14.66	32.60	43.50	-10.90	peak		
5		347.0120	10.88	15.19	26.07	46.00	-19.93	peak		
6		919.3940	10.62	24.31	34.93	46.00	-11.07	peak		

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

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

Notes: Above is below 1GHz test data. This report only shall the worst case mode for b 2412MHz.

From 1G-25GHz

Test Mode: IEEE 802.11b 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
4824	48.60	V	33.93	10.18	34.26	58.45	74	-15.55	PK
4824	36.17	V	33.93	10.18	34.26	46.02	54	-7.98	AV
7236	/	/	/	/	/	/	/	/	/
9648	/	/	/	/	/	/	/	/	/
4824	47.07	H	33.93	10.18	34.26	56.92	74	-17.08	PK
4824	35.75	H	33.93	10.18	34.26	45.60	54	-8.40	AV
7236	/	/	/	/	/	/	/	/	/
9648	/	/	/	/	/	/	/	/	/

Test Mode: IEEE 802.11b TX Mid

4874	49.52	V	33.95	10.20	34.26	59.41	74	-14.59	PK
4874	35.53	V	33.95	10.20	34.26	45.42	54	-8.58	AV
7311	/	/	/	/	/	/	/	/	/
9748	/	/	/	/	/	/	/	/	/
4874	48.55	H	33.95	10.20	34.26	58.44	74	-15.56	PK
4874	34.17	H	33.95	10.20	34.26	44.06	54	-9.94	AV
7311	/	/	/	/	/	/	/	/	/
9748	/	/	/	/	/	/	/	/	/

Test Mode: IEEE 802.11b TX High

4924	47.95	V	33.98	10.22	34.25	57.90	74	-16.10	PK
4924	33.45	V	33.98	10.22	34.25	43.40	54	-10.60	AV
7386	/	/	/	/	/	/	/	/	/
9848	/	/	/	/	/	/	/	/	/
4924	46.69	H	33.98	10.22	34.25	56.64	74	-17.36	PK
4924	32.46	H	33.98	10.22	34.25	42.41	54	-11.59	AV
7386	/	/	/	/	/	/	/	/	/
9848	/	/	/	/	/	/	/	/	/

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: IEEE 802.11g 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
4824	48.71	V	33.93	10.18	34.26	58.56	74	-15.44	PK
4824	36.91	V	33.93	10.18	34.26	46.76	54	-7.24	AV
7236	/	/	/	/	/	/	/	/	/
9648	/	/	/	/	/	/	/	/	/
4824	47.40	H	33.93	10.18	34.26	57.25	74	-16.75	PK
4824	35.32	H	33.93	10.18	34.26	45.17	54	-8.83	AV
7236	/	/	/	/	/	/	/	/	/
9648	/	/	/	/	/	/	/	/	/
Test Mode: IEEE 802.11g TX Mid									
4874	49.72	V	33.95	10.20	34.26	59.61	74	-14.39	PK
4874	35.78	V	33.95	10.20	34.26	45.67	54	-8.33	AV
7311	/	/	/	/	/	/	/	/	/
9748	/	/	/	/	/	/	/	/	/
4874	48.43	H	33.95	10.20	34.26	58.32	74	-15.68	PK
4874	34.25	H	33.95	10.20	34.26	44.14	54	-9.86	AV
7311	/	/	/	/	/	/	/	/	/
9748	/	/	/	/	/	/	/	/	/
Test Mode: IEEE 802.11g TX High									
4924	47.74	V	33.98	10.22	34.25	57.69	74	-16.31	PK
4924	33.45	V	33.98	10.22	34.25	43.40	54	-10.60	AV
7386	/	/	/	/	/	/	/	/	/
9848	/	/	/	/	/	/	/	/	/
4924	46.13	H	33.98	10.22	34.25	56.08	74	-17.92	PK
4924	32.48	H	33.98	10.22	34.25	42.43	54	-11.57	AV
7386	/	/	/	/	/	/	/	/	/
9848	/	/	/	/	/	/	/	/	/
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: IEEE 802.11n HT20 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
4824	48.51	V	33.93	10.18	34.26	58.36	74	-15.64	PK
4824	36.39	V	33.93	10.18	34.26	46.24	54	-7.76	AV
7236	/	/	/	/	/	/	/	/	/
9648	/	/	/	/	/	/	/	/	/
4824	47.98	H	33.93	10.18	34.26	57.83	74	-16.17	PK
4824	35.08	H	33.93	10.18	34.26	44.93	54	-9.07	AV
7236	/	/	/	/	/	/	/	/	/
9648	/	/	/	/	/	/	/	/	/

Test Mode: IEEE 802.11n HT20 TX Mid

4874	49.29	V	33.95	10.20	34.26	59.18	74	-14.82	PK
4874	35.51	V	33.95	10.20	34.26	45.40	54	-8.60	AV
7311	/	/	/	/	/	/	/	/	/
9748	/	/	/	/	/	/	/	/	/
4874	48.52	H	33.95	10.20	34.26	58.41	74	-15.59	PK
4874	34.38	H	33.95	10.20	34.26	44.27	54	-9.73	AV
7311	/	/	/	/	/	/	/	/	/
9748	/	/	/	/	/	/	/	/	/

Test Mode: IEEE 802.11n HT20 TX High

4924	47.08	V	33.98	10.22	34.25	57.03	74	-16.97	PK
4924	33.75	V	33.98	10.22	34.25	43.70	54	-10.30	AV
7386	/	/	/	/	/	/	/	/	/
9848	/	/	/	/	/	/	/	/	/
4924	46.60	H	33.98	10.22	34.25	56.55	74	-17.45	PK
4924	32.95	H	33.98	10.22	34.25	42.90	54	-11.10	AV
7386	/	/	/	/	/	/	/	/	/
9848	/	/	/	/	/	/	/	/	/

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: IEEE 802.11n HT40 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
4824	48.56	V	33.93	10.18	34.26	58.41	74	-15.59	PK
4824	36.35	V	33.93	10.18	34.26	46.20	54	-7.80	AV
7236	/	/	/	/	/	/	/	/	/
9648	/	/	/	/	/	/	/	/	/
4824	47.57	H	33.93	10.18	34.26	57.42	74	-16.58	PK
4824	35.83	H	33.93	10.18	34.26	45.68	54	-8.32	AV
7236	/	/	/	/	/	/	/	/	/
9648	/	/	/	/	/	/	/	/	/

Test Mode: IEEE 802.11n HT40 TX Mid

4874	49.41	V	33.95	10.20	34.26	59.30	74	-14.70	PK
4874	35.53	V	33.95	10.20	34.26	45.42	54	-8.58	AV
7311	/	/	/	/	/	/	/	/	/
9748	/	/	/	/	/	/	/	/	/
4874	48.05	H	33.95	10.20	34.26	57.94	74	-16.06	PK
4874	34.33	H	33.95	10.20	34.26	44.22	54	-9.78	AV
7311	/	/	/	/	/	/	/	/	/
9748	/	/	/	/	/	/	/	/	/

Test Mode: IEEE 802.11n HT40 TX High

4924	47.59	V	33.98	10.22	34.25	57.54	74	-16.46	PK
4924	33.33	V	33.98	10.22	34.25	43.28	54	-10.72	AV
7386	/	/	/	/	/	/	/	/	/
9848	/	/	/	/	/	/	/	/	/
4924	46.42	H	33.98	10.22	34.25	56.37	74	-17.63	PK
4924	32.26	H	33.98	10.22	34.25	42.21	54	-11.79	AV
7386	/	/	/	/	/	/	/	/	/
9848	/	/	/	/	/	/	/	/	/

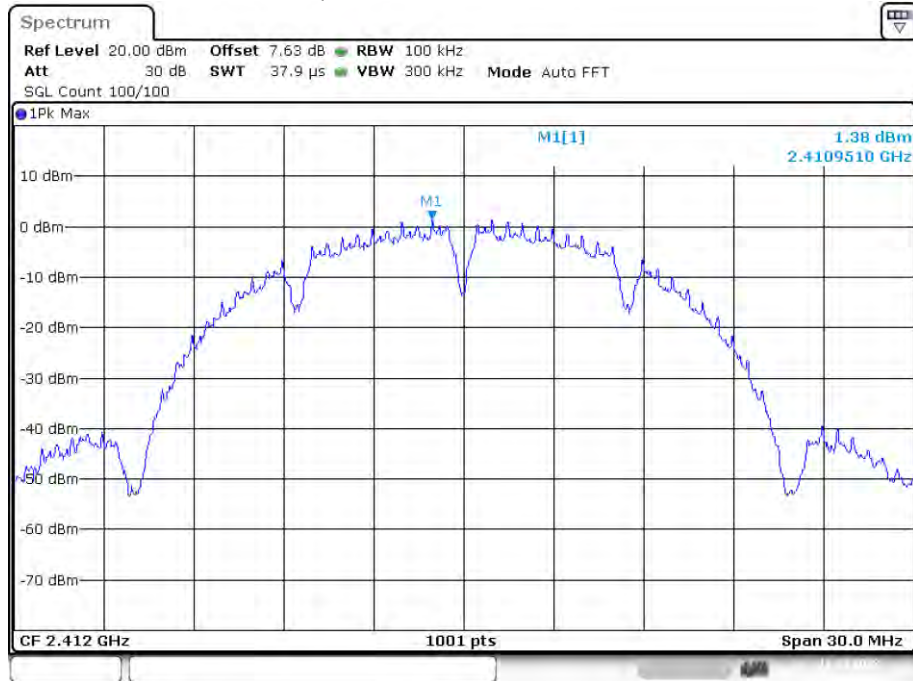
Note:

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.

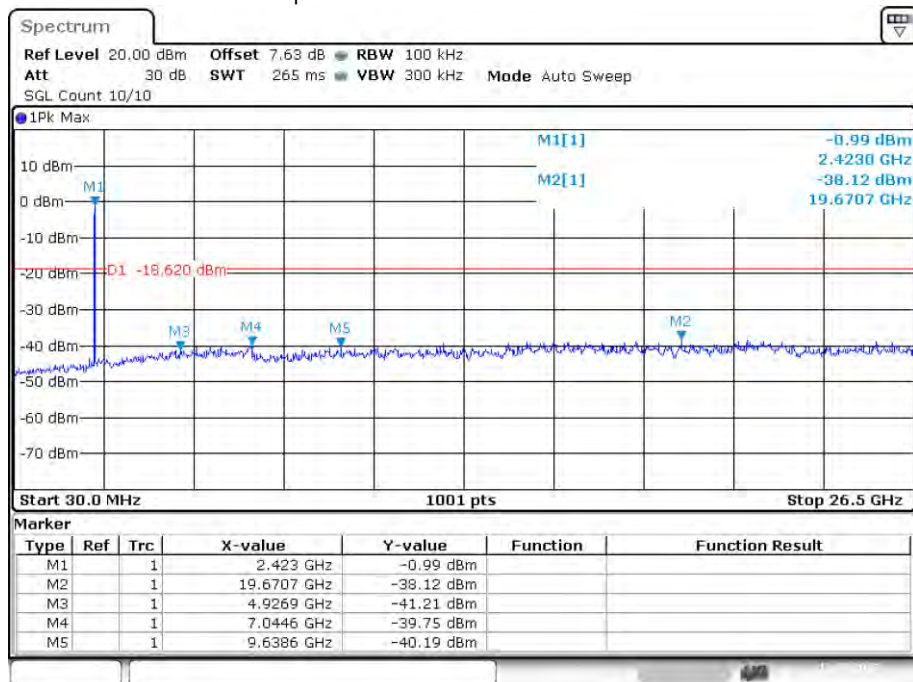
Conducted RF Spurious Emission

Tx. Spurious NVNT b 2412MHz Ant1 Ref



Date: 11.JUL.2023 04:38:14

Tx. Spurious NVNT b 2412MHz Ant1 Emission



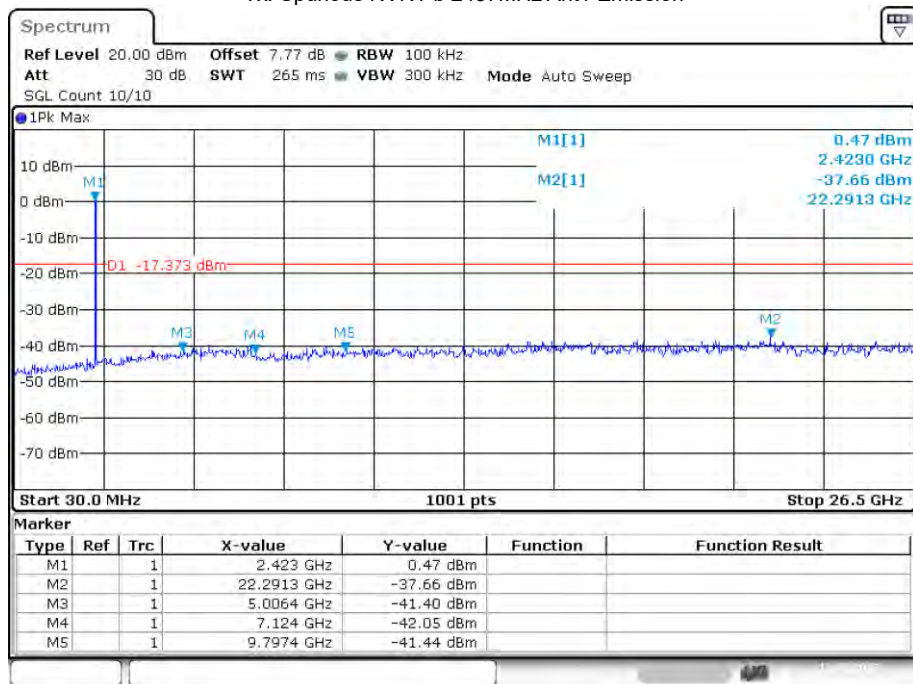
Date: 11.JUL.2023 04:38:32

Tx. Spurious NVNT b 2437MHz Ant1 Ref



Date: 11.JUL.2023 04:46:37

Tx. Spurious NVNT b 2437MHz Ant1 Emission



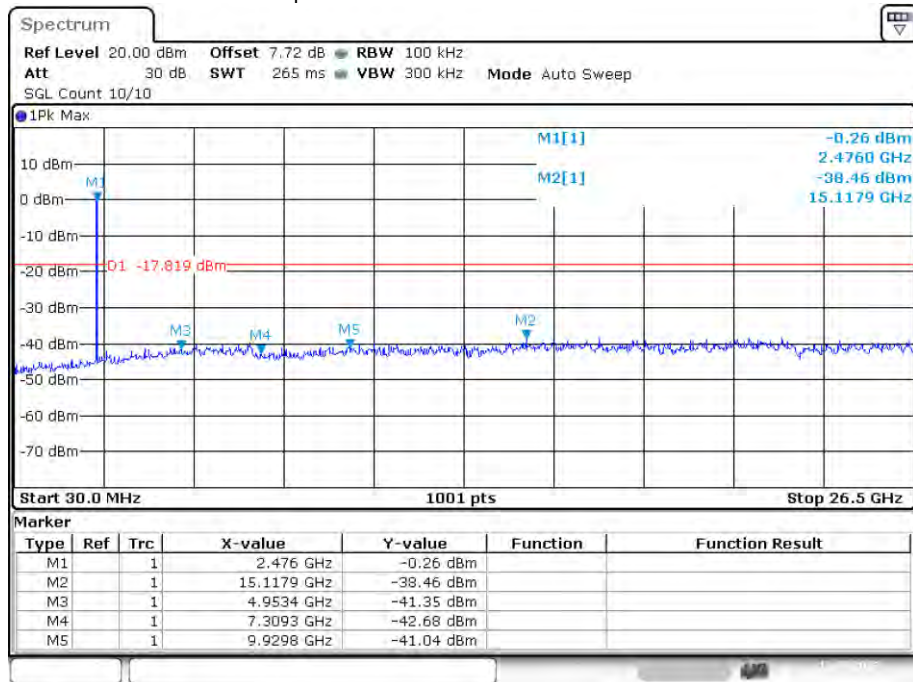
Date: 11.JUL.2023 04:46:55

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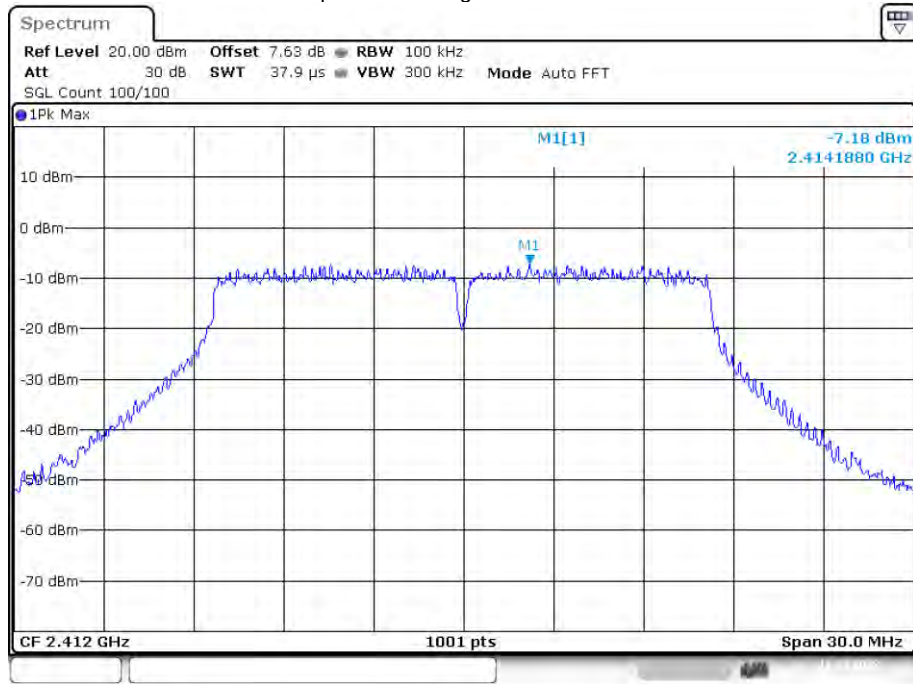
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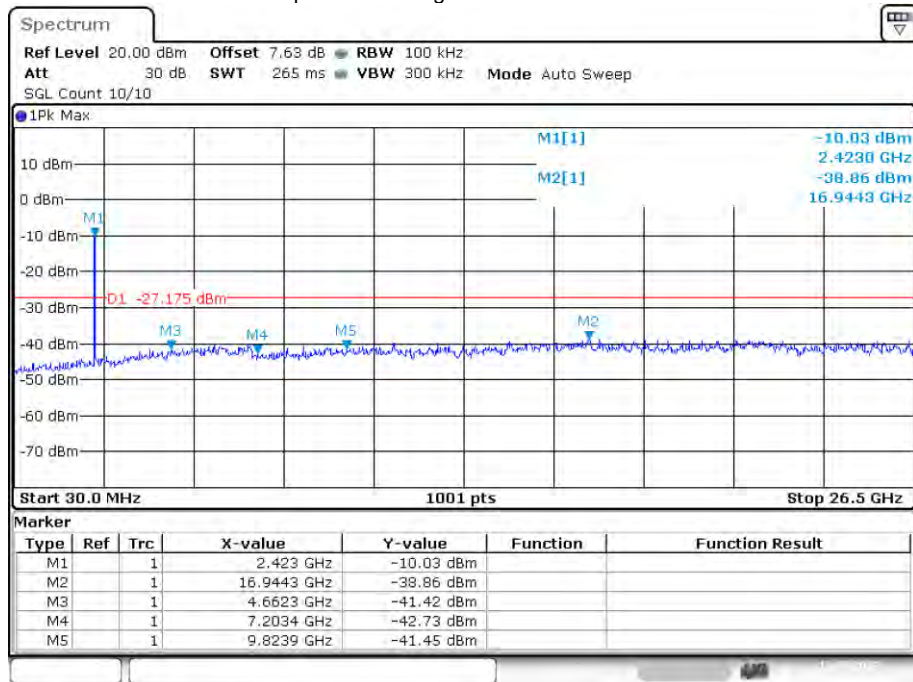
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Tx. Spurious NVNT g 2412MHz Ant1 Ref



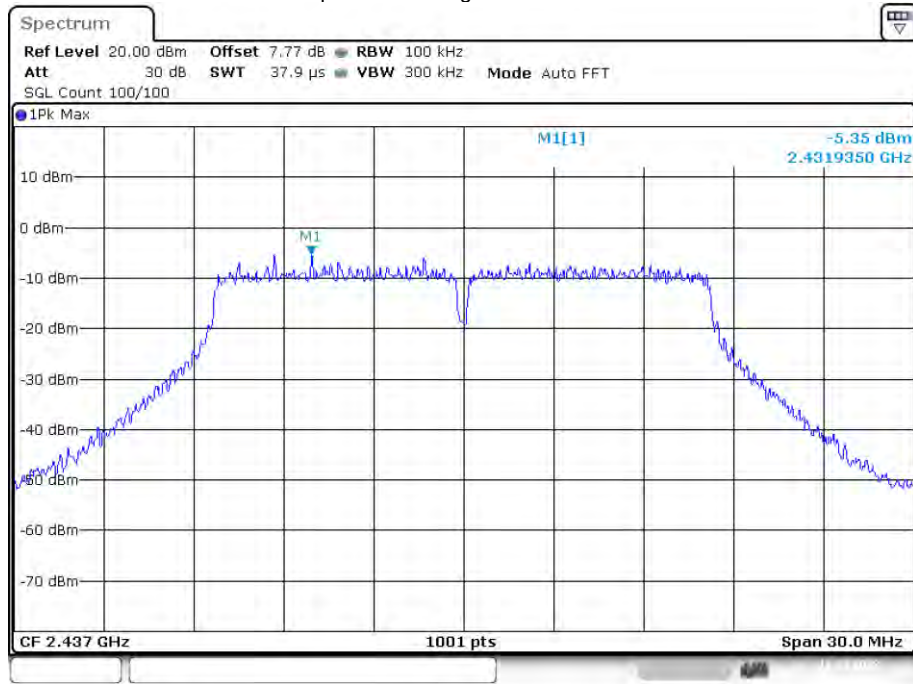
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Tx. Spurious NVNT g 2412MHz Ant1 Emission



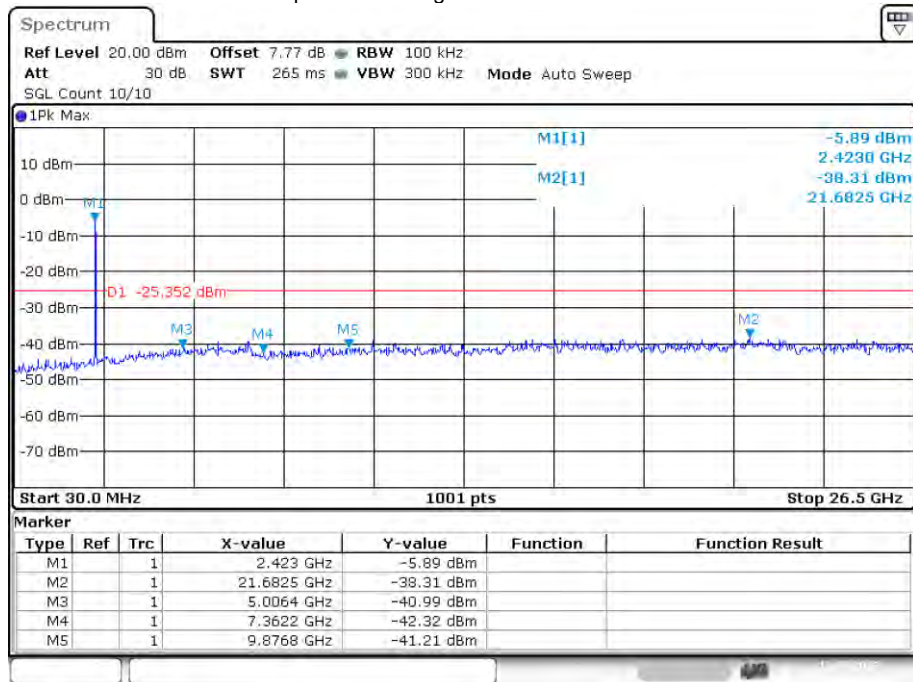
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Tx. Spurious NVNT g 2437MHz Ant1 Ref



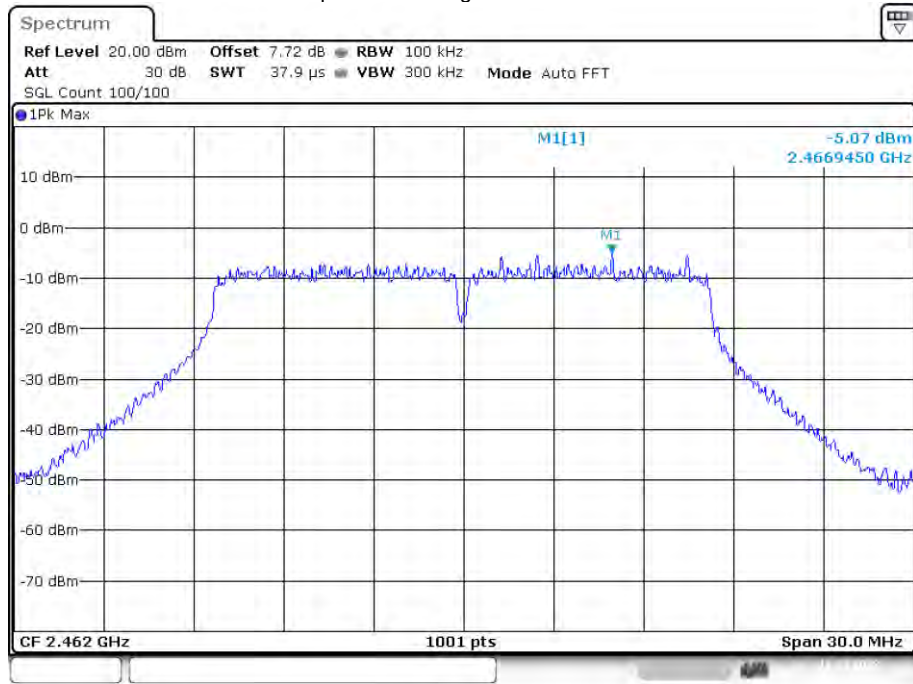
Date: 11.JUL.2023 04:59:09

Tx. Spurious NVNT g 2437MHz Ant1 Emission



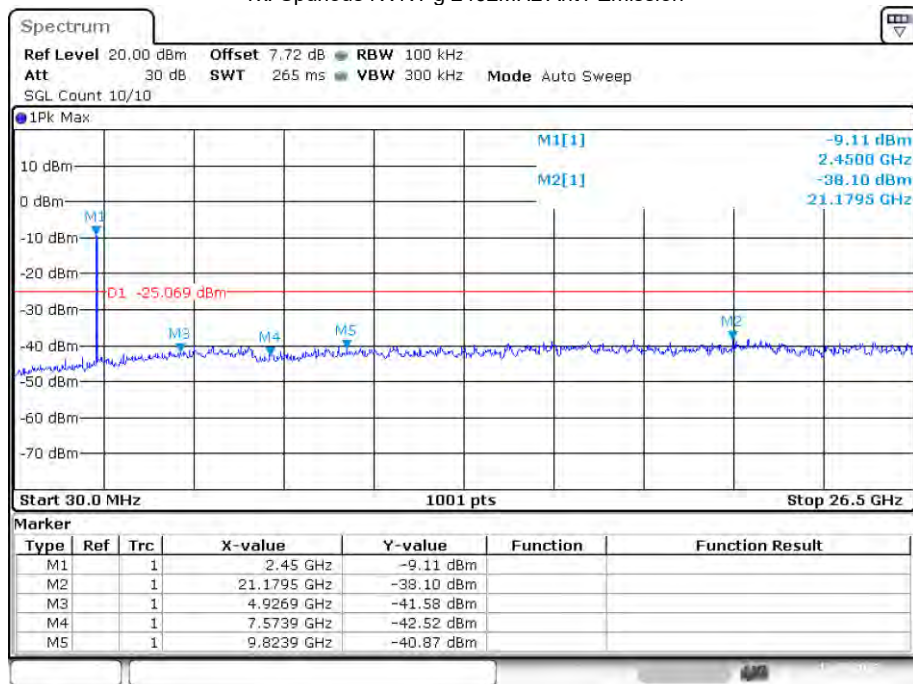
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Tx. Spurious NVNT g 2462MHz Ant1 Ref



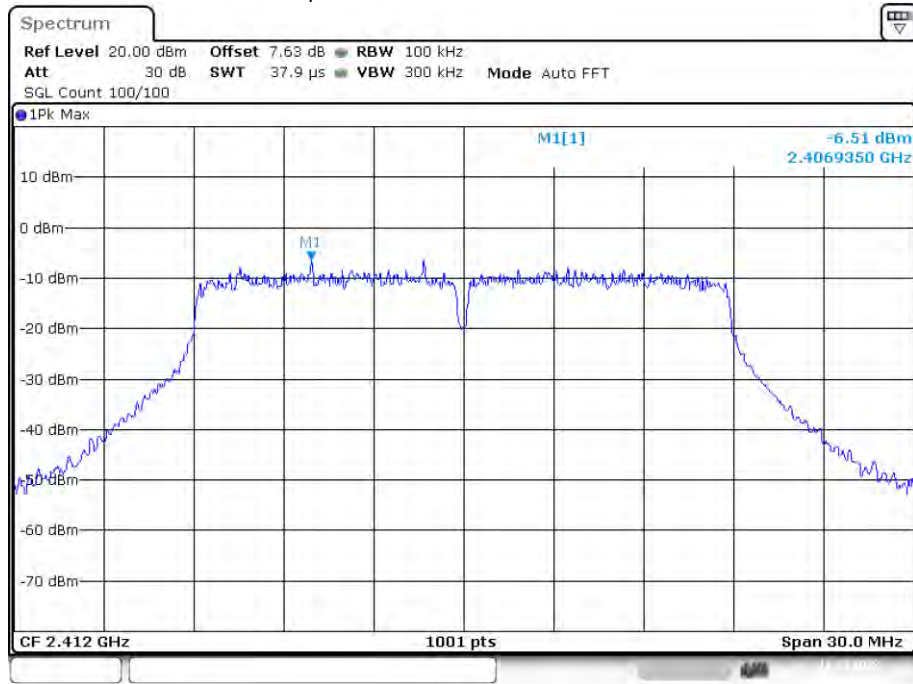
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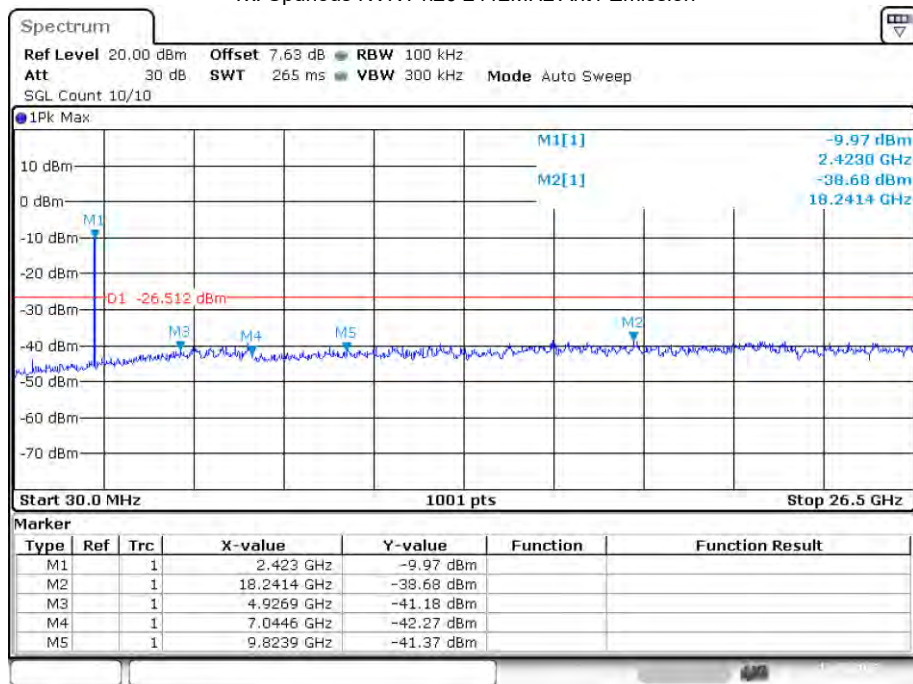
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Tx. Spurious NVNT n20 2412MHz Ant1 Ref



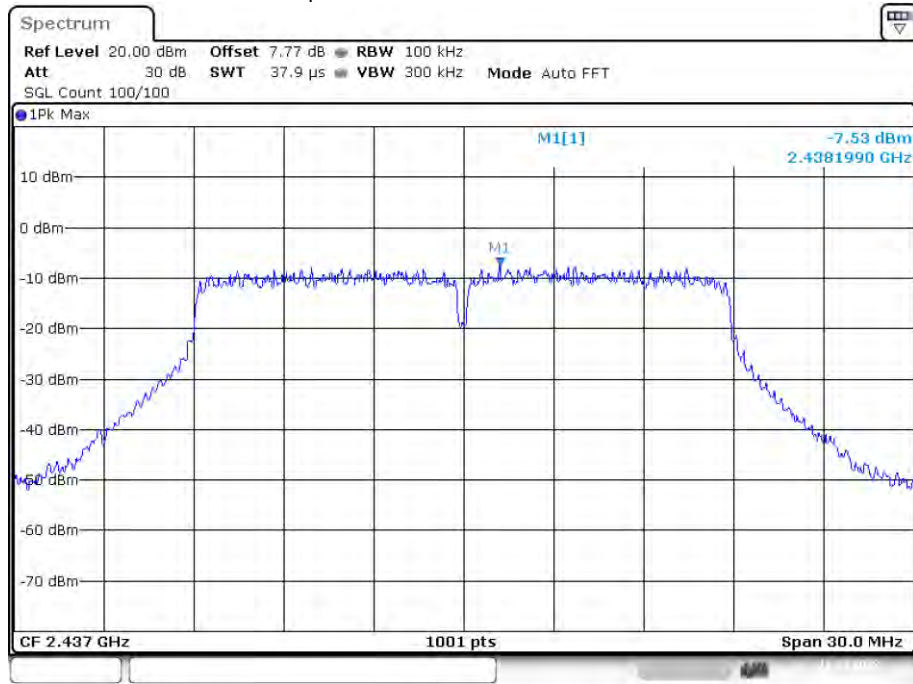
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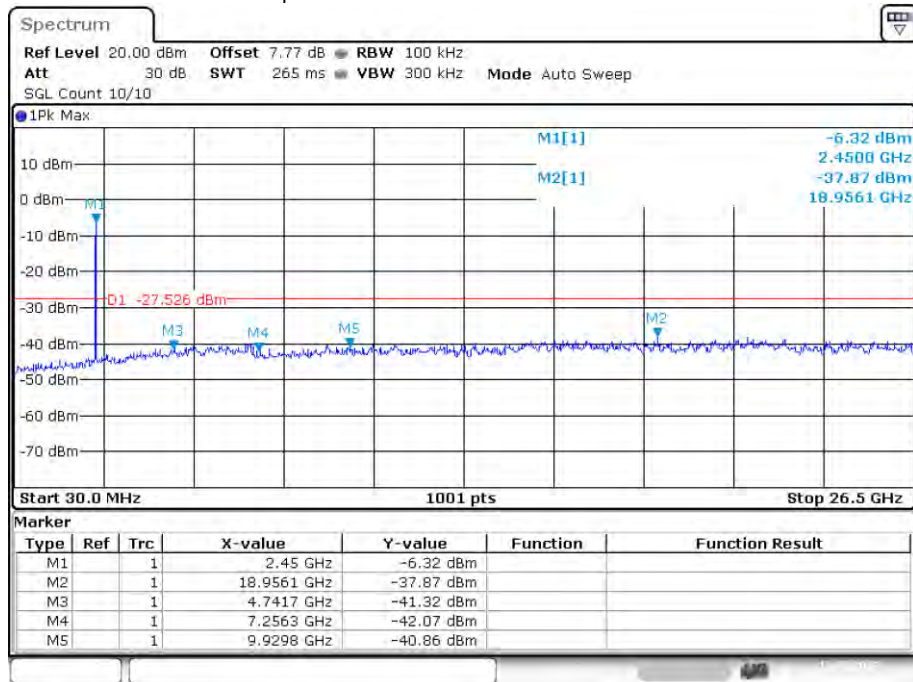
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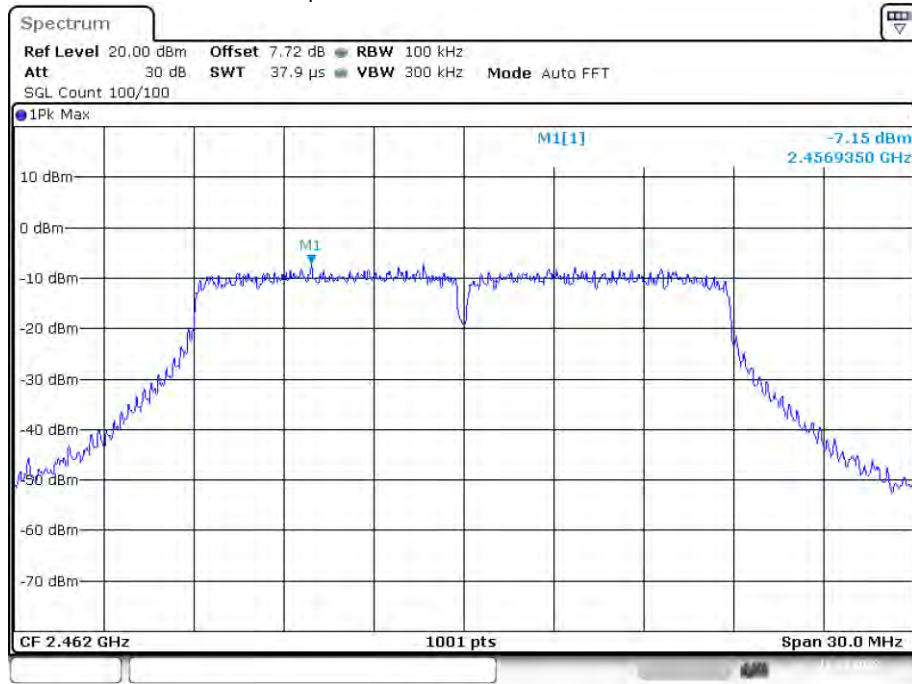
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Tx. Spurious NVNT n20 2437MHz Ant1 Emission



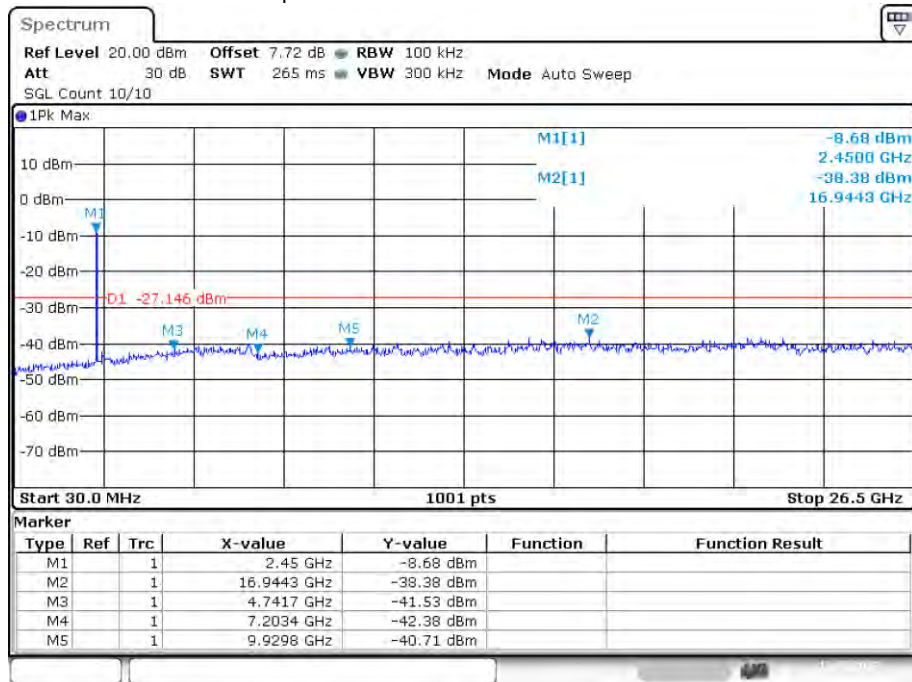
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Tx. Spurious NVNT n20 2462MHz Ant1 Ref



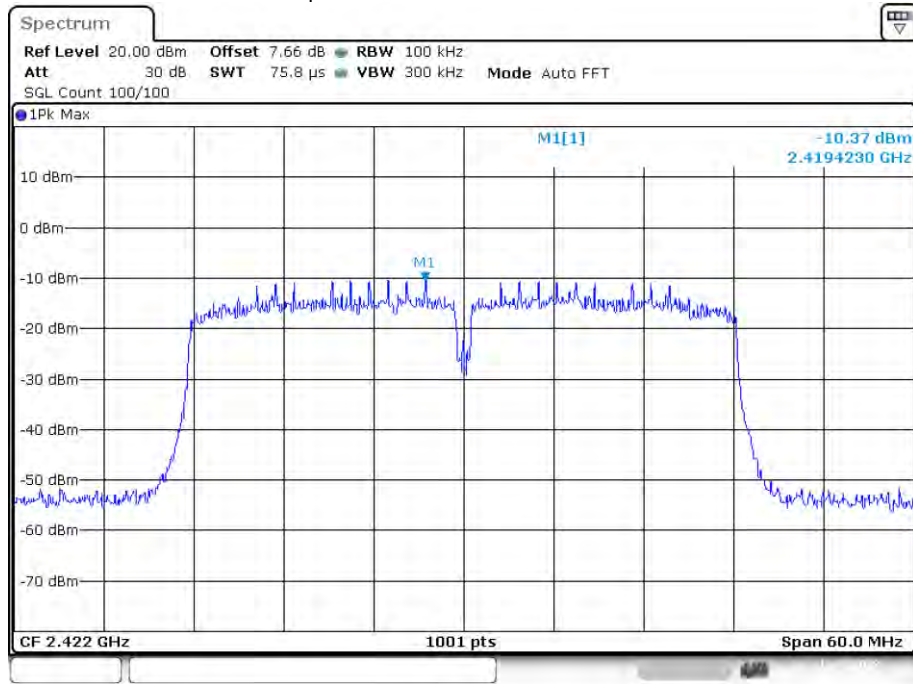
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Tx. Spurious NVNT n20 2462MHz Ant1 Emission



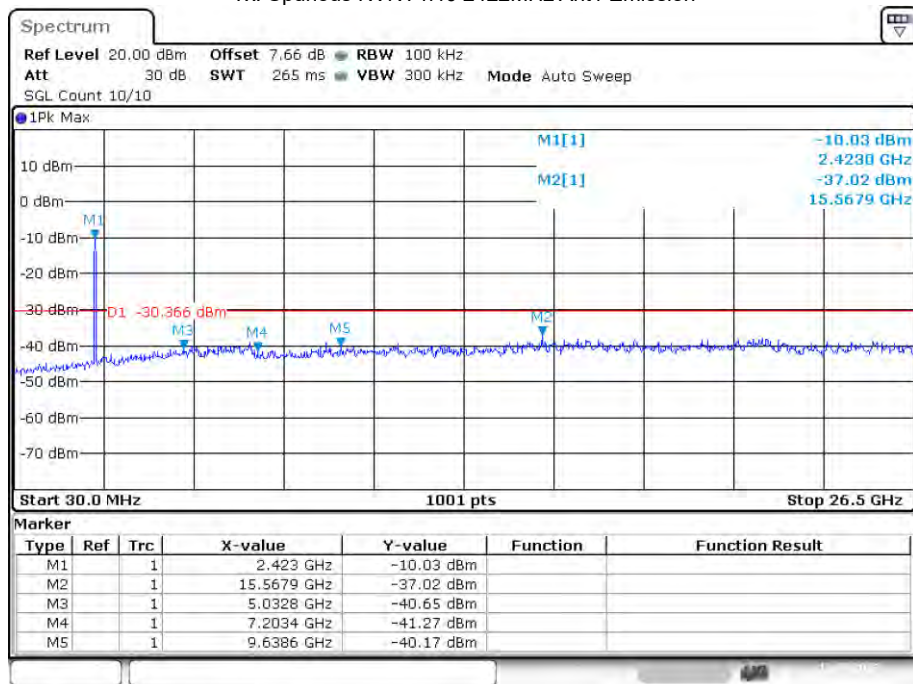
Date: 11.JUL.2023 05:15:14

Tx. Spurious NVNT n40 2422MHz Ant1 Ref



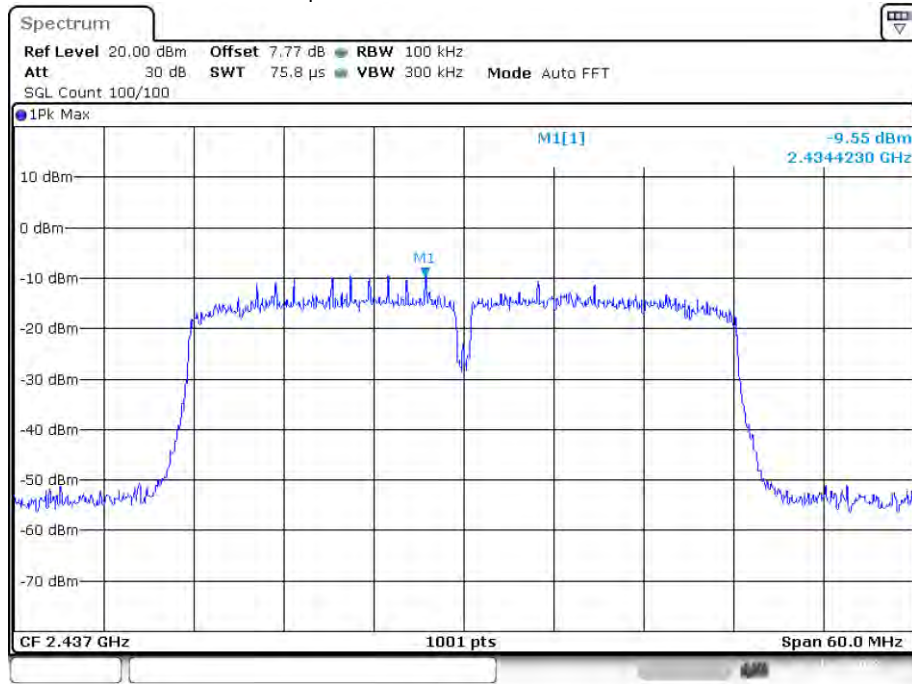
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Tx. Spurious NVNT n40 2422MHz Ant1 Emission



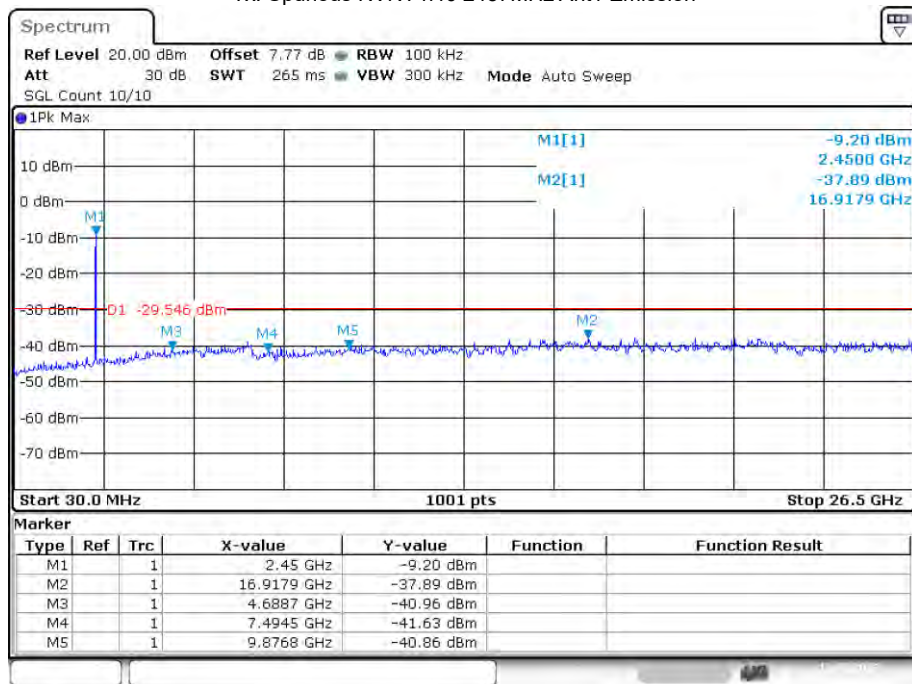
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Tx. Spurious NVNT n40 2437MHz Ant1 Ref



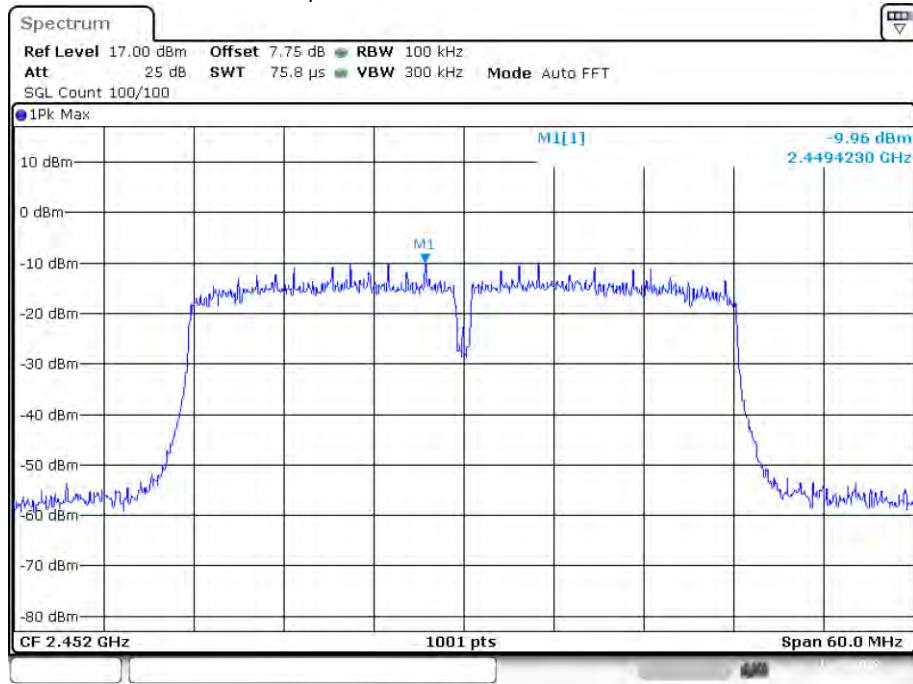
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Tx. Spurious NVNT n40 2437MHz Ant1 Emission



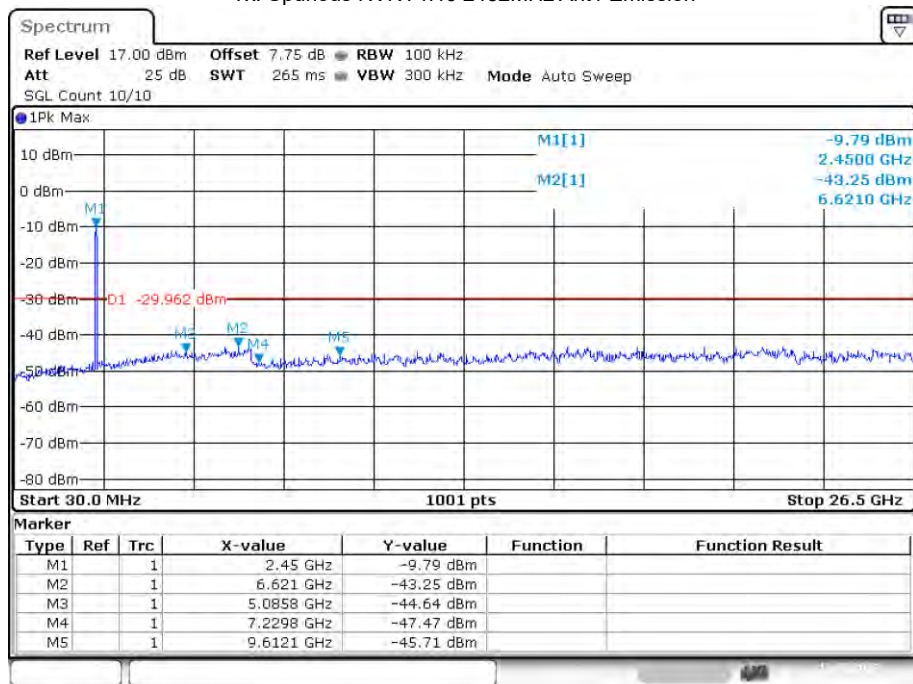
Date: 11.JUL.2023 05:42:21

Tx. Spurious NVNT n40 2452MHz Ant1 Ref



Date: 11.JUL.2023 05:46:17

Tx. Spurious NVNT n40 2452MHz Ant1 Emission



Date: 11.JUL.2023 05:46:35

4. POWER LINE CONDUCTED EMISSION

4.1. Test Limits

Frequency MHz	Limits dB(μ V)	
	Quasi-peak Level	Average Level
0.15 -0.50	66 -56*	56 - 46*
0.50 -5.00	56	46
5.00 -30.00	60	50

Notes: 1. *Decreasing linearly with logarithm of frequency.

2. The lower limit shall apply at the transition frequencies.

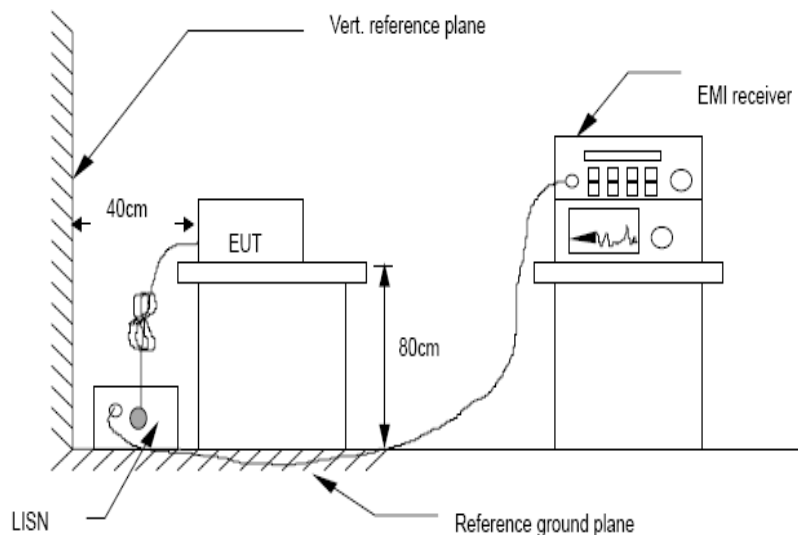
3. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

4.2. Test Procedure

The EUT is put on the plane 0.8m high above the ground by insulating support and is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC lines are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to ANSI C63.10:2013 on Conducted Emission Measurement.

The bandwidth of test receiver is set at 9 kHz.

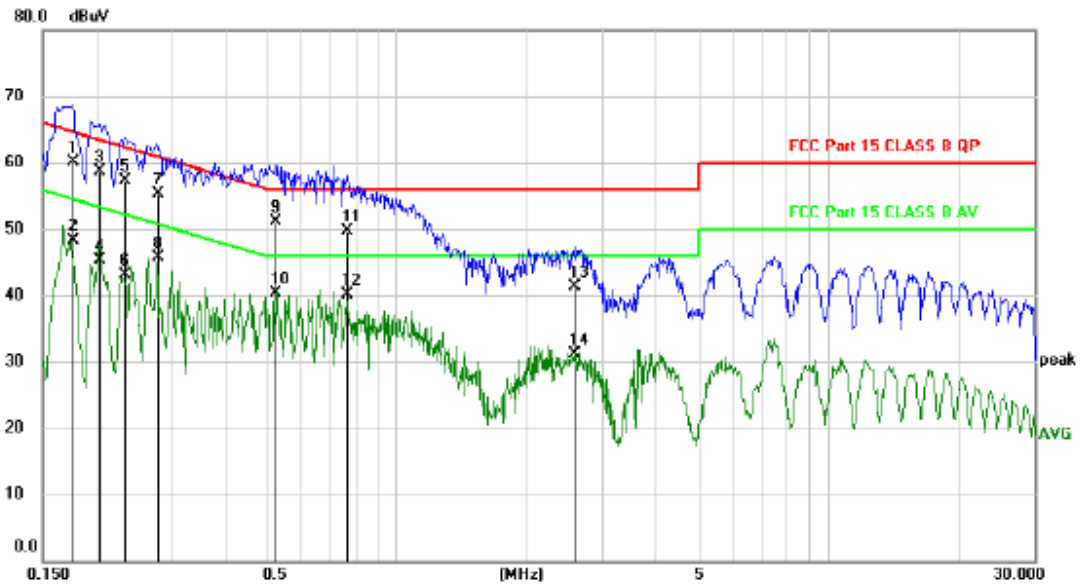
4.3. Test Setup



4.4. Test Results

Pass

L:

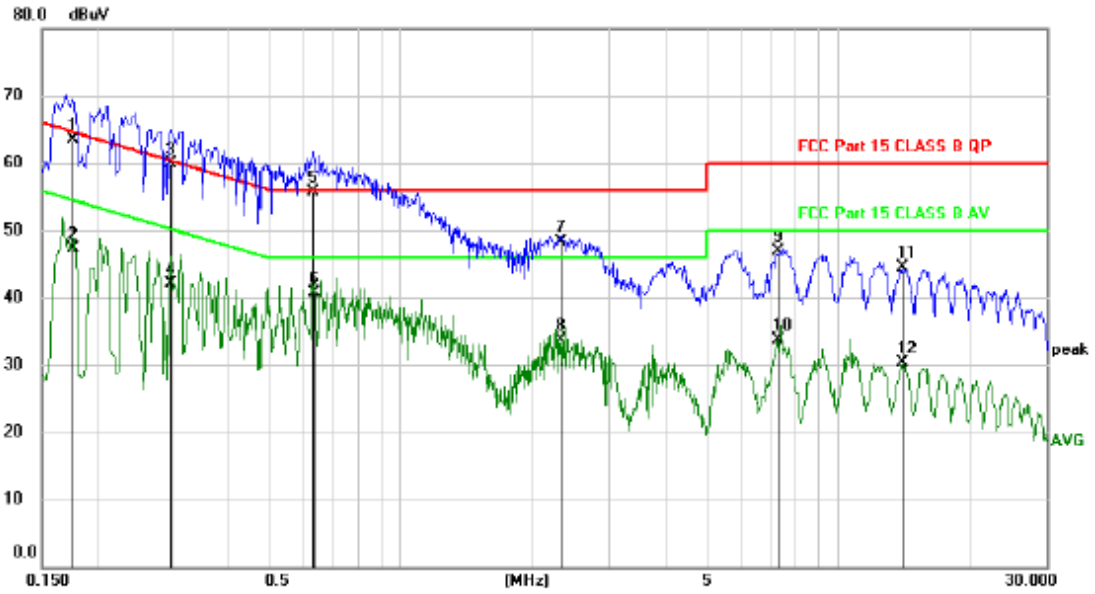


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1	*	0.1768	50.30	9.83	60.13	64.63	-4.50	QP	
2		0.1768	38.49	9.83	48.32	54.63	-6.31	AVG	
3		0.2039	48.80	9.83	58.63	63.45	-4.82	QP	
4		0.2039	35.43	9.83	45.26	53.45	-8.19	AVG	
5		0.2340	47.38	9.83	57.21	62.31	-5.10	QP	
6		0.2340	33.18	9.83	43.01	52.31	-9.30	AVG	
7		0.2790	45.48	9.83	55.31	60.85	-5.54	QP	
8		0.2790	35.80	9.83	45.63	50.85	-5.22	AVG	
9		0.5220	41.37	9.83	51.20	56.00	-4.80	QP	
10		0.5220	30.38	9.83	40.21	46.00	-5.79	AVG	
11		0.7650	39.79	9.84	49.63	56.00	-6.37	QP	
12		0.7650	30.19	9.84	40.03	46.00	-5.97	AVG	
13		2.5678	31.47	9.79	41.26	56.00	-14.74	QP	

*: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

N:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1		0.1768	53.71	9.83	63.54	64.63	-1.09	QP	
2		0.1768	37.49	9.83	47.32	54.63	-7.31	AVG	
3		0.2968	50.00	9.83	59.83	60.33	-0.50	QP	
4		0.2968	32.31	9.83	42.14	50.33	-8.19	AVG	
5	*	0.6300	45.86	9.83	55.69	56.00	-0.31	QP	
6		0.6330	30.78	9.83	40.61	46.00	-5.39	AVG	
7		2.3308	38.50	9.77	48.27	56.00	-7.73	QP	
8		2.3308	23.99	9.77	33.76	46.00	-12.24	AVG	
9		7.3079	36.99	9.93	46.92	60.00	-13.08	peak	
10		7.3079	23.70	9.93	33.63	50.00	-16.37	AVG	
11		13.9946	34.39	10.03	44.42	60.00	-15.58	peak	
12		13.9946	20.34	10.03	30.37	50.00	-19.63	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: This report only shall the worst case mode for b 2412MHz.

5. CONDUCTED MAXIMUM OUTPUT POWER

5.1. Test limits

Please refer RSS-247 & FCC PART 15: 15.247.

Regulation 15.247(b) The limit of Maximum Peak Output Power Measurement is 1 W(30dBm)

5.2. Test Procedure

Details see the KDB558074 D01 Meas Guidance v05r02

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

5.2.2 Connected the EUT's antenna port to peak power meter by 20dB attenuator.

5.2.3 Measure out each mode and each bands peak output power of EUT.

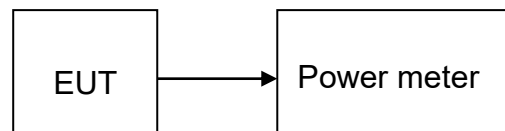
Note: The cable loss and attenuator loss were offset into measure device as amplitude offset.

5.2.4 The measure-and-sum technique shall be used for measuring in-band transmit power of a device.

Total power is the sum of the conducted power levels measured at the various output ports.

(First measure the power (mW) of each antenna separately, and the total power is equal to $\text{Ant1}^{\text{mW}} + \text{Ant2}^{\text{mW}} + \dots$)

5.3. Test Setup



5.4. Test Results

Condition	Mode	Frequency (MHz)	Antenna	Total Power (dBm)	Limit (dBm)	EIRP(dBm)	Limit (dBm)	Verdict
NVNT	b	2412	Ant1	12.19	28.71	19.480	36	Pass
NVNT	b	2437	Ant1	12.032	28.71	19.322	36	Pass
NVNT	b	2462	Ant1	12.19	28.71	19.480	36	Pass
NVNT	g	2412	Ant1	12.375	28.71	19.665	36	Pass
NVNT	g	2437	Ant1	12.309	28.71	19.599	36	Pass
NVNT	g	2462	Ant1	12.312	28.71	19.602	36	Pass
NVNT	n20	2412	Ant1	12.482	28.71	19.772	36	Pass
NVNT	n20	2437	Ant1	12.309	28.71	19.599	36	Pass
NVNT	n20	2462	Ant1	12.326	28.71	19.616	36	Pass
NVNT	n40	2422	Ant1	11.901	28.71	19.191	36	Pass
NVNT	n40	2437	Ant1	11.82	28.71	19.110	36	Pass
NVNT	n40	2452	Ant1	11.812	28.71	19.102	36	Pass

Note: Antenna gain= 7.29dBi, so the Conducted Power Limit need to reduce 1.29dB.

6. PEAK POWER SPECTRAL DENSITY

6.1. Test limits

6.1.1 Please refer RSS-247 & FCC PART 15: 15.247.

6.1.2 For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

6.1.3 The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

6.2. Test Procedure

Details see the KDB558074 D01 Meas Guidance v05r02

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

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

6.2.3 Set the spectrum analyzer as $RBW = 3\text{kHz}$ (Set the RBW to: $3\text{ kHz} \leq RBW \leq 100\text{ kHz}$), $VBW = 10\text{kHz}$ (Set the $VBW \geq 3 \times RBW$), $\text{span} \geq 1.5 \times \text{DTS bandwidth}$., detail see the test plot.

6.2.4 Record the max reading.

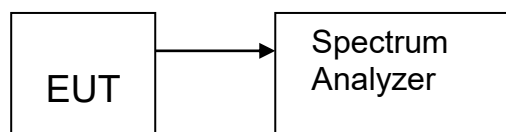
6.2.5 Repeat the above procedure until the measurements for all frequencies are completed.

6.2.6 The measure-and-sum technique shall be used for measuring in-band transmit power of a device.

Total power is the sum of the conducted power spectral density levels measured at the various output ports.

(First measure the power (mW/MHz) of each antenna separately, and the total power is equal to $\text{Ant1}^{\text{mW/MHz}} + \text{Ant2}^{\text{mW/MHz}} + \dots$)

6.3. Test Setup



6.4. Test Results

Condition	Mode	Frequency (MHz)	Antenna	Max PSD (dBm)	Limit (dBm)	Verdict
NVNT	b	2412	Ant1	-5.589	6.71	Pass
NVNT	b	2437	Ant1	-5.685	6.71	Pass
NVNT	b	2462	Ant1	-5.127	6.71	Pass
NVNT	g	2412	Ant1	-22.364	6.71	Pass
NVNT	g	2437	Ant1	-20.95	6.71	Pass
NVNT	g	2462	Ant1	-22.632	6.71	Pass
NVNT	n20	2412	Ant1	-21.9	6.71	Pass
NVNT	n20	2437	Ant1	-21.592	6.71	Pass
NVNT	n20	2462	Ant1	-22.035	6.71	Pass
NVNT	n40	2422	Ant1	-24.611	6.71	Pass
NVNT	n40	2437	Ant1	-24.246	6.71	Pass
NVNT	n40	2452	Ant1	-24.328	6.71	Pass

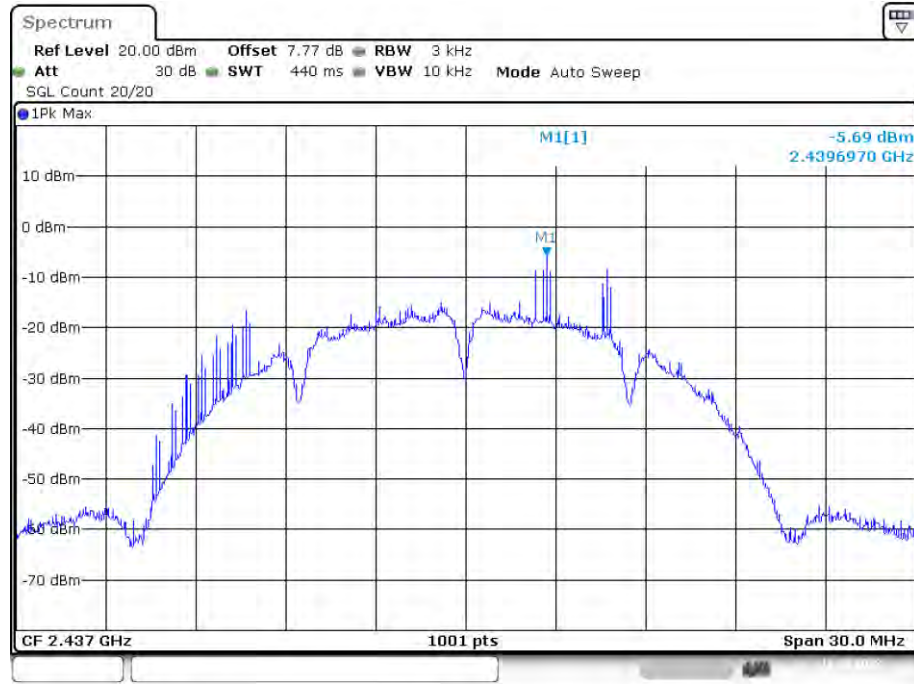
Note: Antenna gain= 7.29dBi, so the Conducted Power Limit need to reduce 1.29dB.

PSD NVNT b 2412MHz Ant1



Date: 11.JUL.2023 04:37:47

PSD NVNT b 2437MHz Ant1



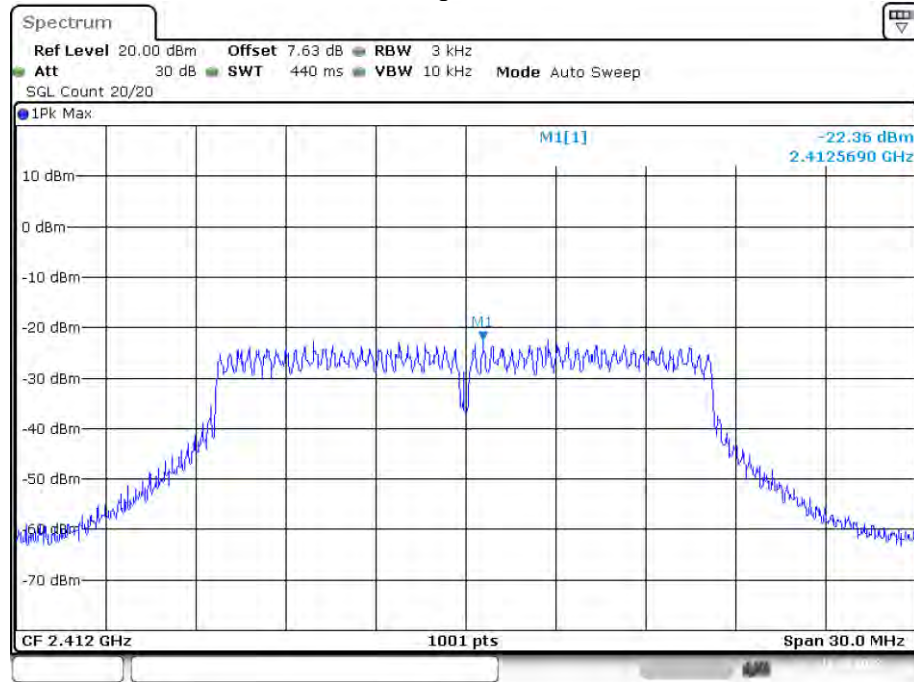
Date: 11.JUL.2023 04:49:16

PSD NVNT b 2462MHz Ant1

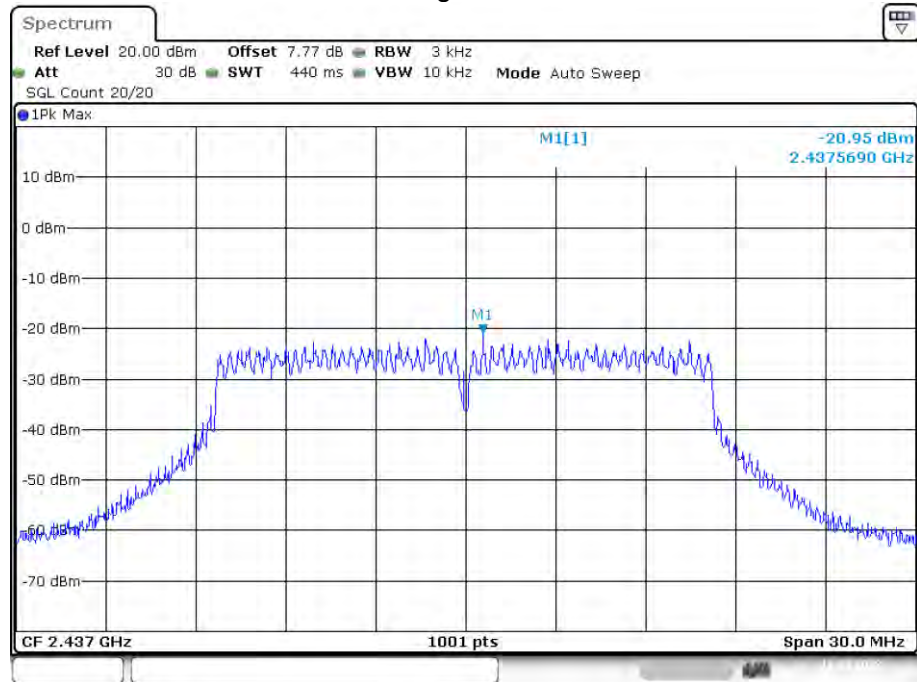


Date: 11.JUL.2023 04:51:52

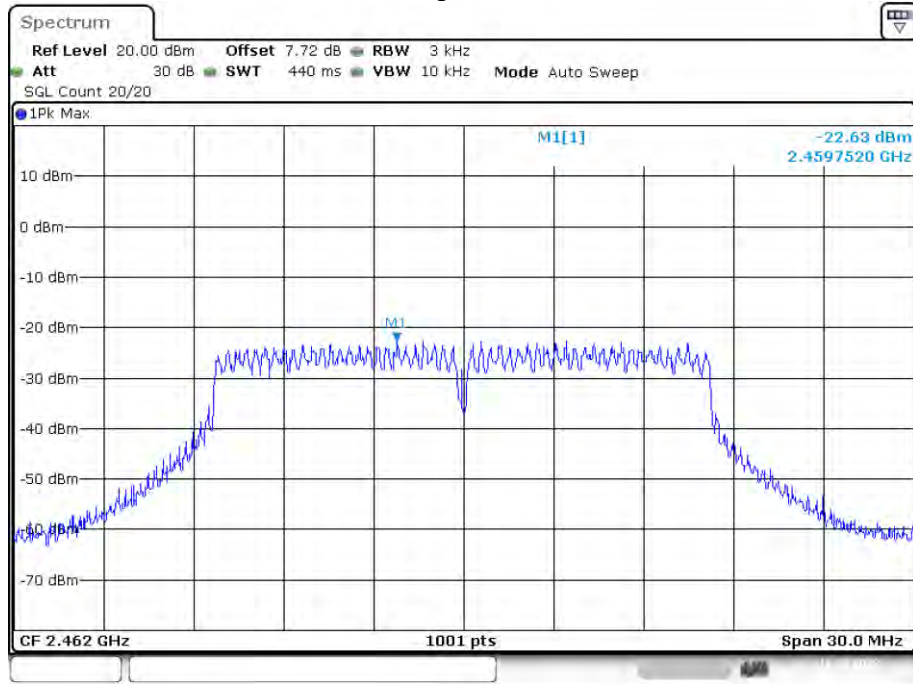
PSD NVNT g 2412MHz Ant1



PSD NVNT g 2437MHz Ant1

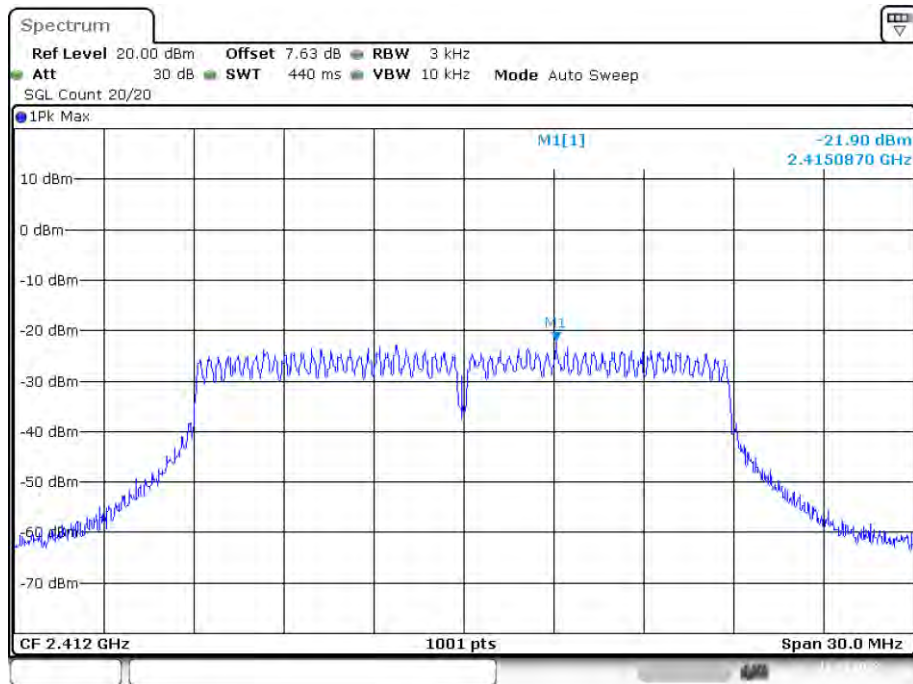


PSD NVNT g 2462MHz Ant1



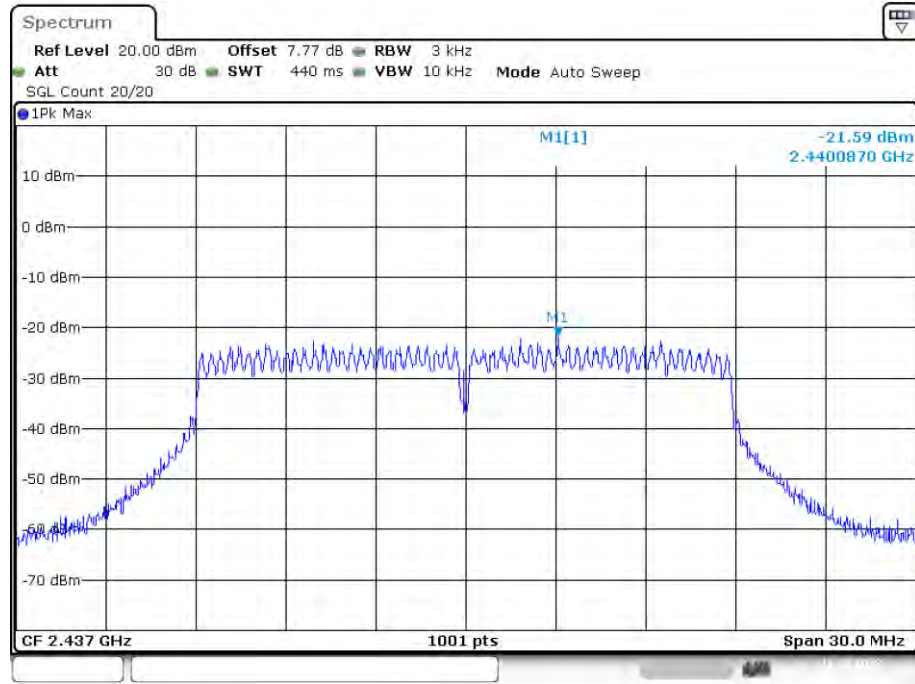
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PSD NVNT n20 2412MHz Ant1



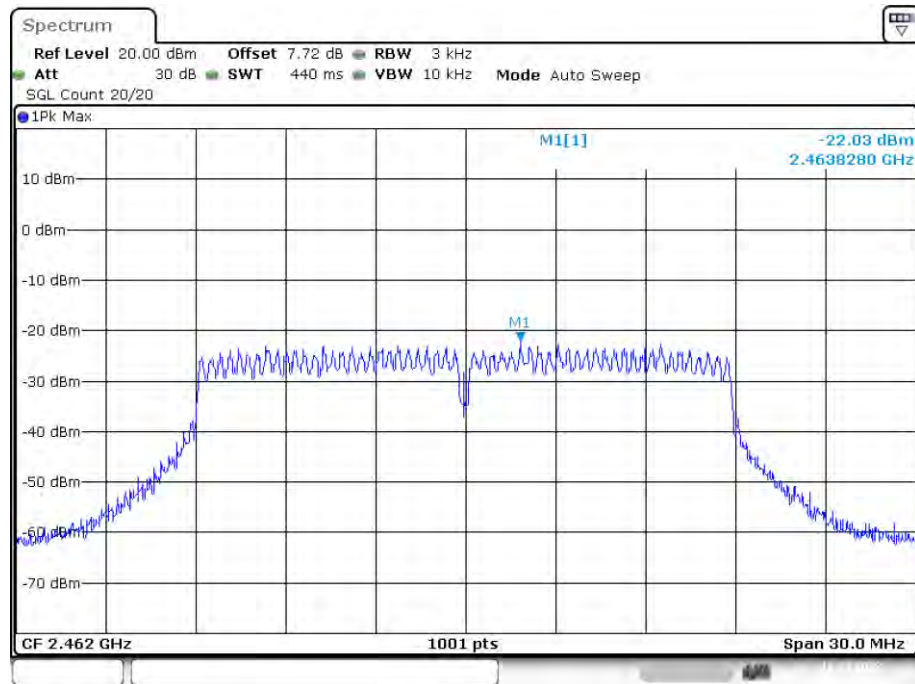
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PSD NVNT n20 2437MHz Ant1



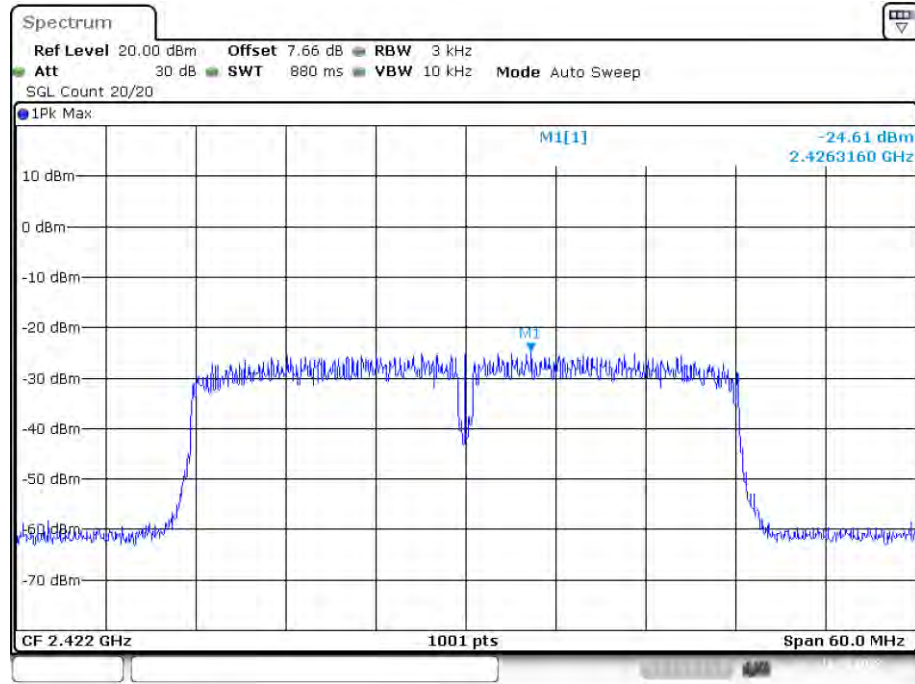
Date: 11.JUL.2023 05:12:13

PSD NVNT n20 2462MHz Ant1



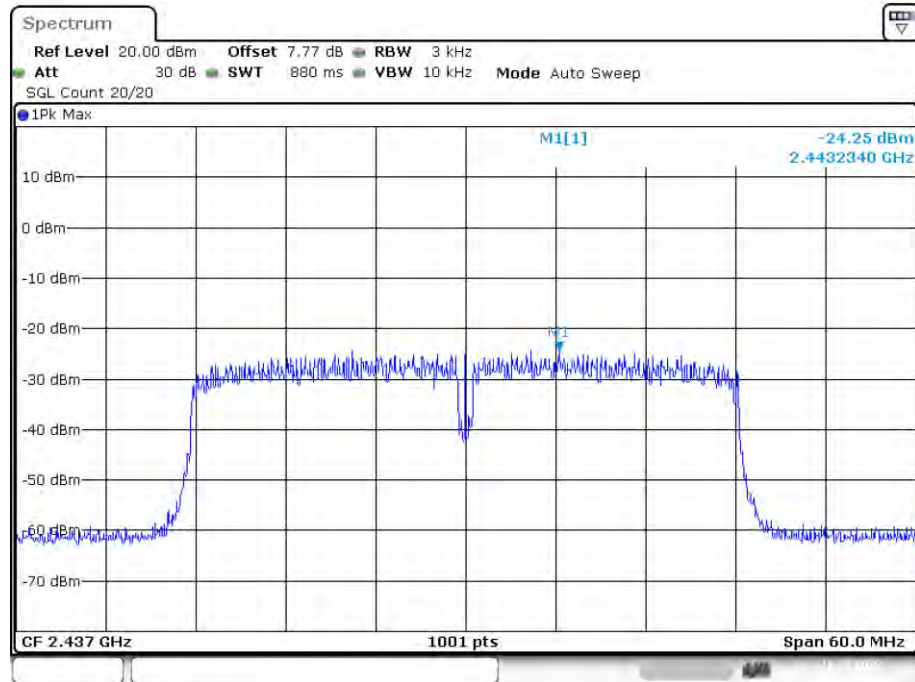
Date: 11.JUL.2023 05:14:24

PSD NVNT n40 2422MHz Ant1



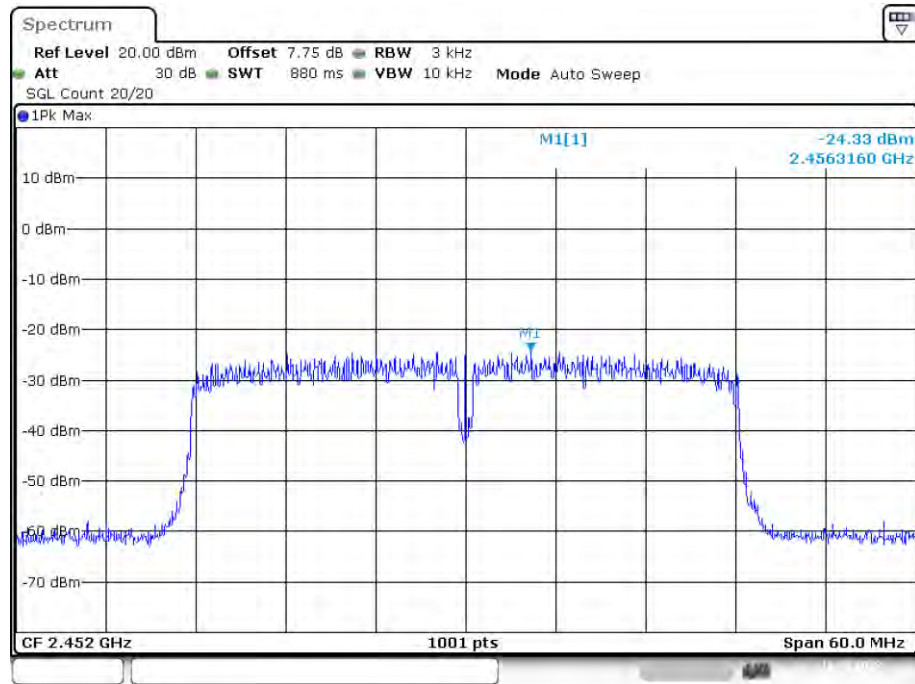
Date: 11.JUL.2023 05:38:31

PSD NVNT n40 2437MHz Ant1



Date: 11.JUL.2023 05:41:48

PSD NVNT n40 2452MHz Ant1



Date: 11.JUL.2023 05:45:38

7. BANDWIDTH

7.1. Test limits

Please refer RSS-247 & FCC PART 15: 15.247

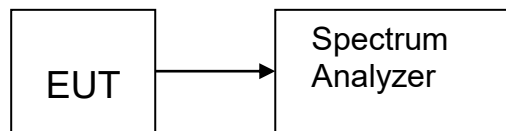
For direct sequence systems, the minimum 6dB bandwidth shall be at least 500 kHz.

7.2. Test Procedure

Details see the KDB558074 D01 Meas Guidance v05r02

- a) The bandwidth is measured at an amplitude level reduced 6dB from the reference level. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.
- b) The test receiver set RBW = 100kHz, VBW $\geq$ 3*RBW =300kHz,, Peak Detector, Sweep time set auto, detail see the test plot.

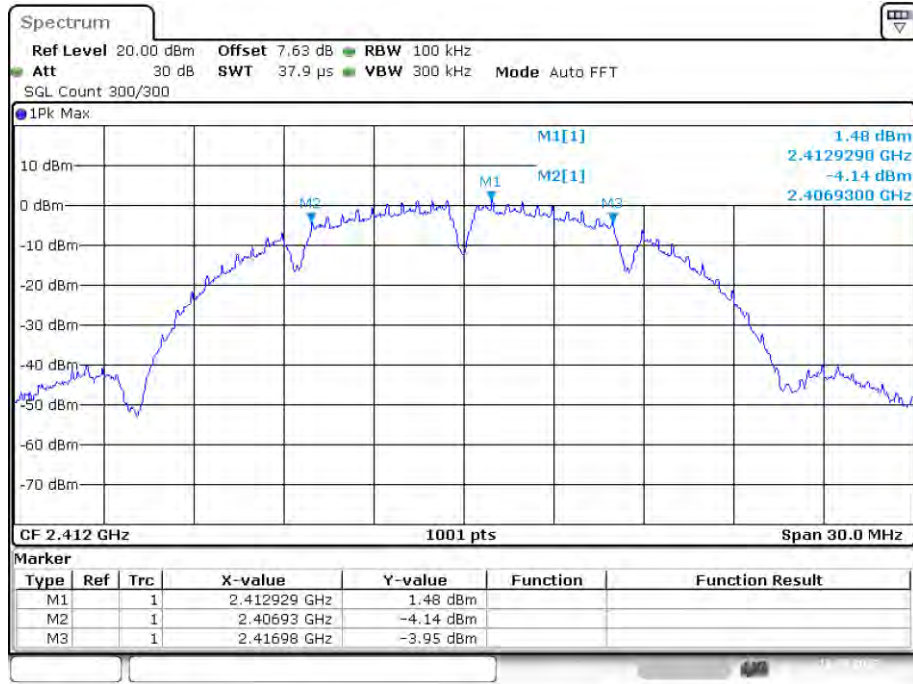
7.3. Test Setup



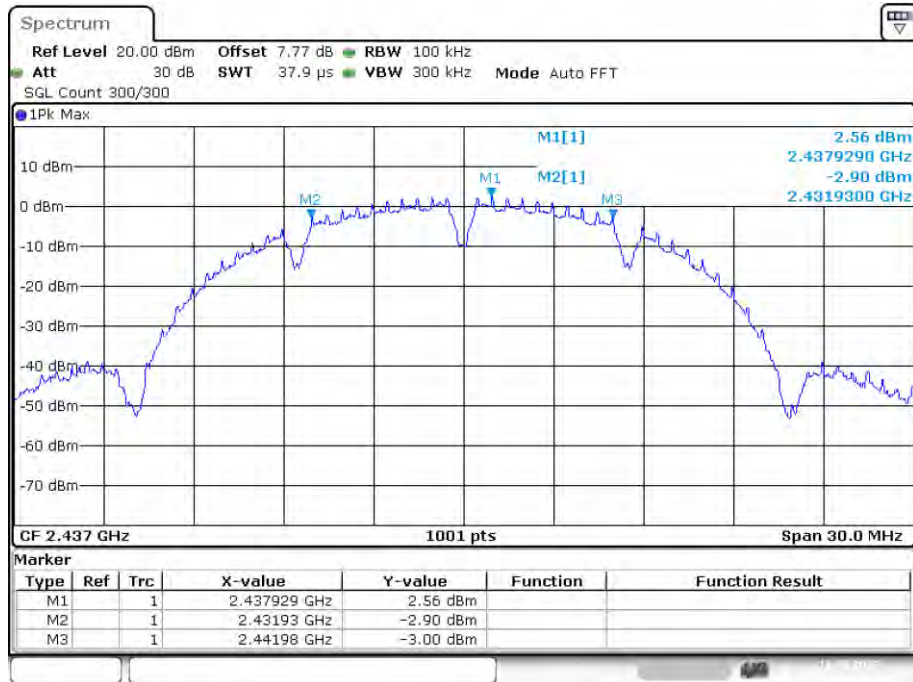
7.4. Test Results

-6dB Bandwidth

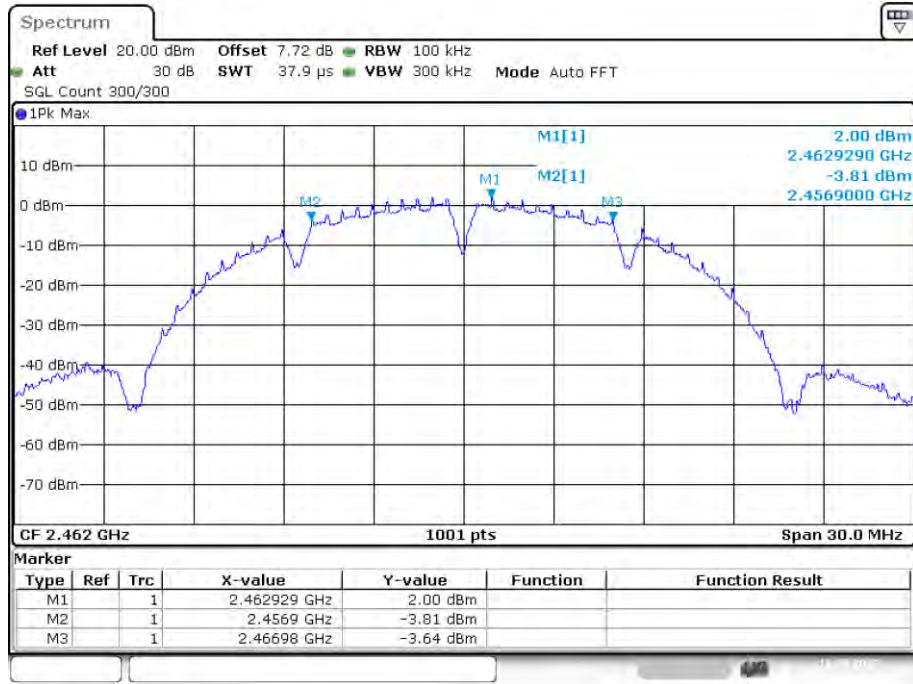
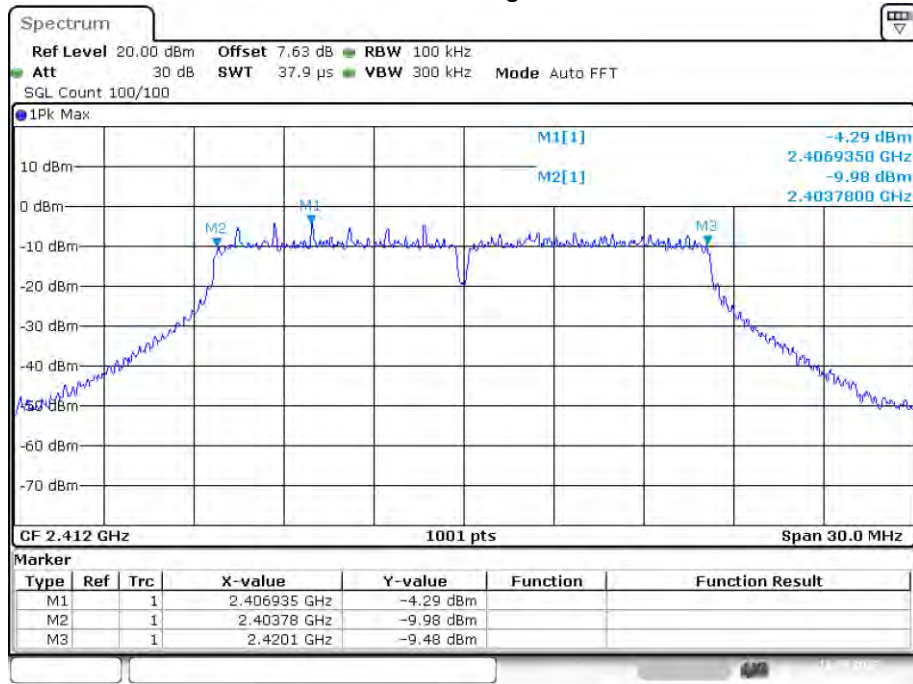
Condition	Mode	Frequency (MHz)	Antenna	-6 dB Bandwidth (MHz)	Limit -6 dB Bandwidth (MHz)	Verdict
NVNT	b	2412	Ant1	10.05	0.5	Pass
NVNT	b	2437	Ant1	10.05	0.5	Pass
NVNT	b	2462	Ant1	10.08	0.5	Pass
NVNT	g	2412	Ant1	16.32	0.5	Pass
NVNT	g	2437	Ant1	16.56	0.5	Pass
NVNT	g	2462	Ant1	16.56	0.5	Pass
NVNT	n20	2412	Ant1	17.61	0.5	Pass
NVNT	n20	2437	Ant1	17.31	0.5	Pass
NVNT	n20	2462	Ant1	17.07	0.5	Pass
NVNT	n40	2422	Ant1	34.98	0.5	Pass
NVNT	n40	2437	Ant1	35.52	0.5	Pass
NVNT	n40	2452	Ant1	33.9	0.5	Pass

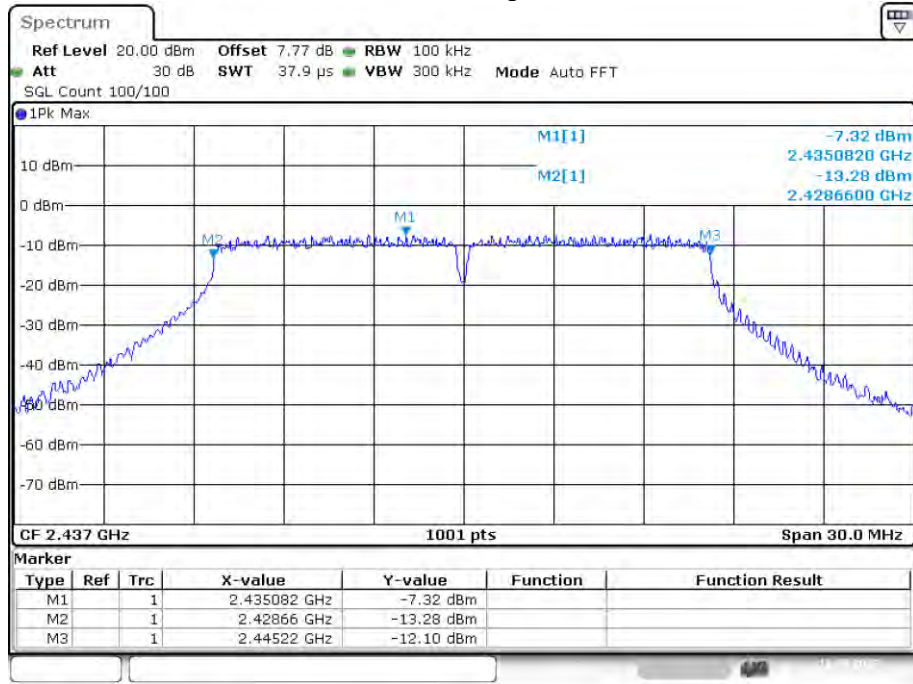
-6dB Bandwidth NVNT b 2412MHz Ant1

Date: 11.JUL.2023 04:37:28

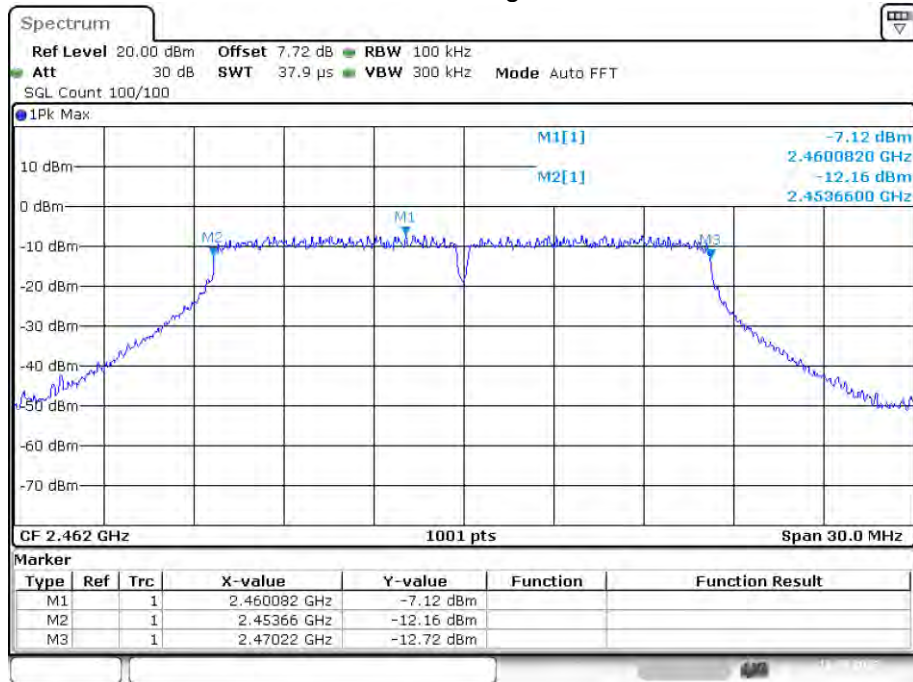
-6dB Bandwidth NVNT b 2437MHz Ant1

Date: 11.JUL.2023 04:46:08

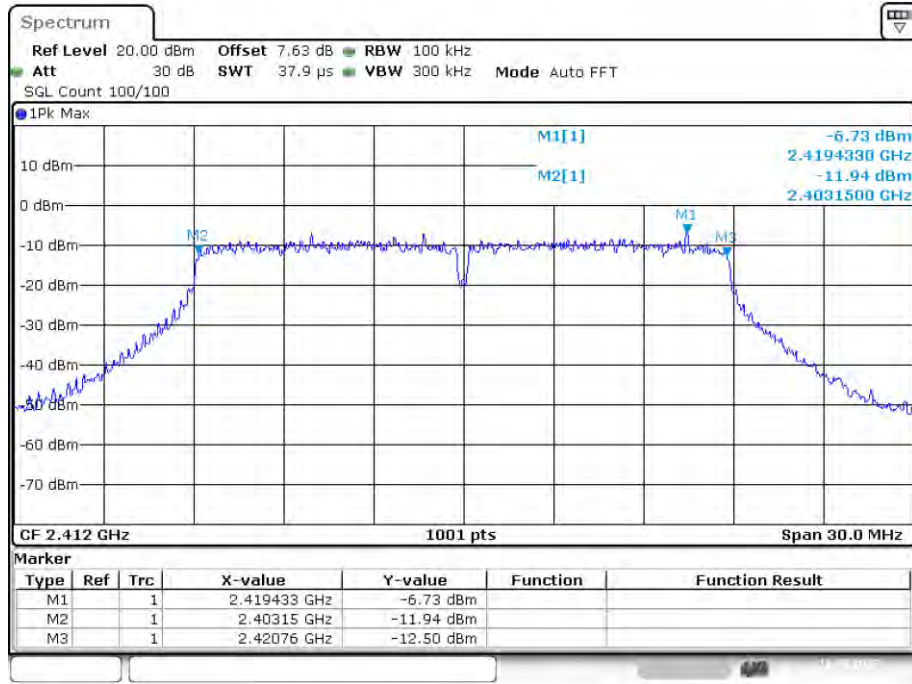
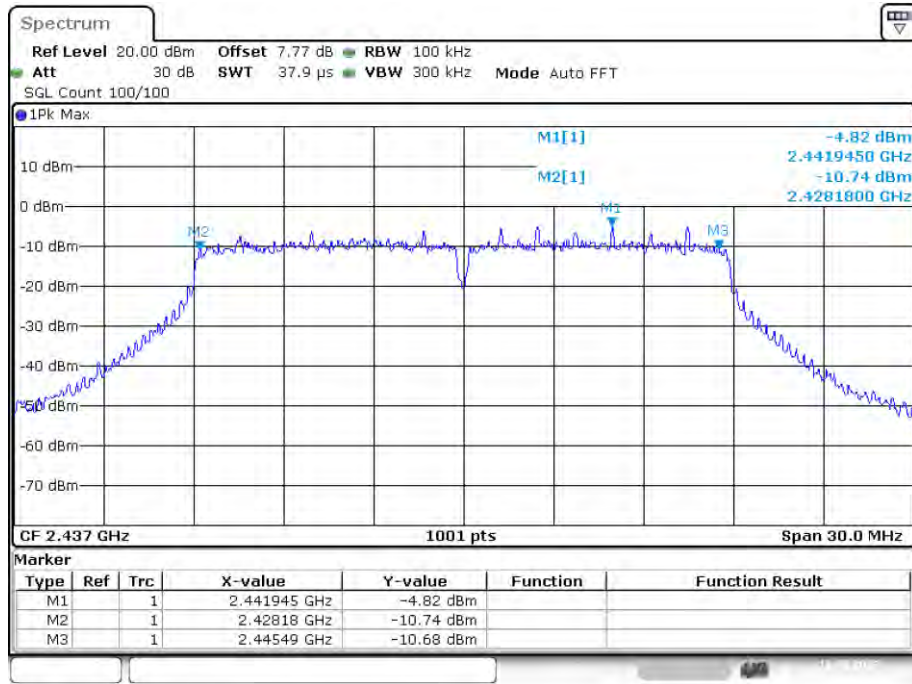
-6dB Bandwidth NVNT b 2462MHz Ant1**-6dB Bandwidth NVNT g 2412MHz Ant1**

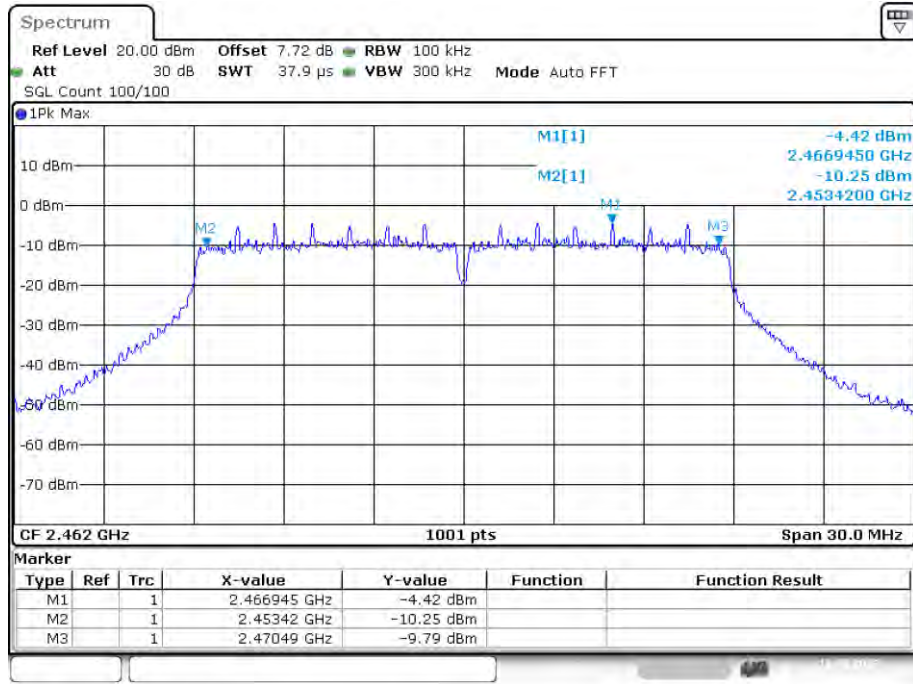
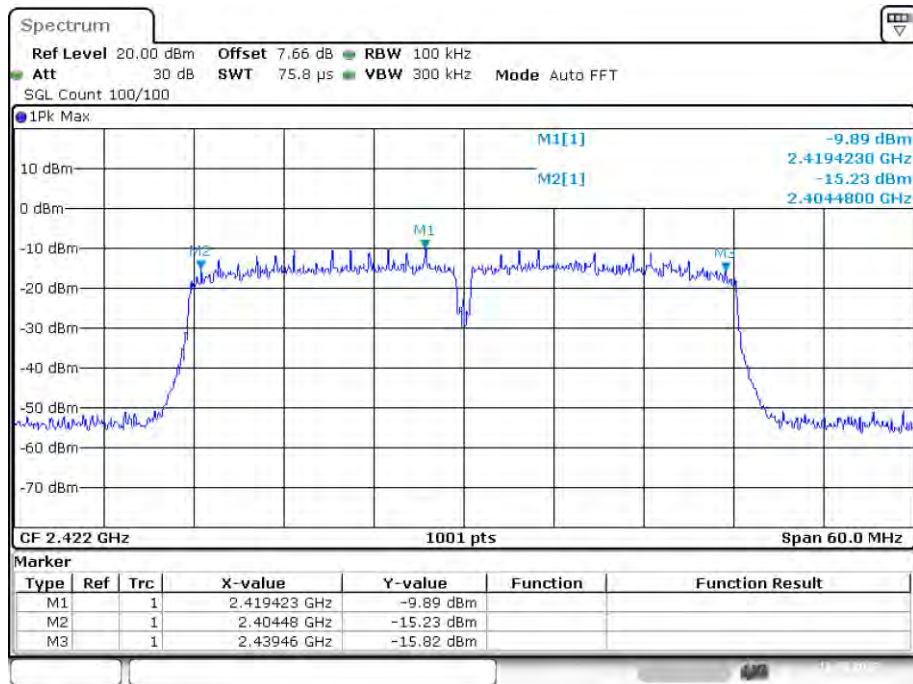
-6dB Bandwidth NVNT g 2437MHz Ant1

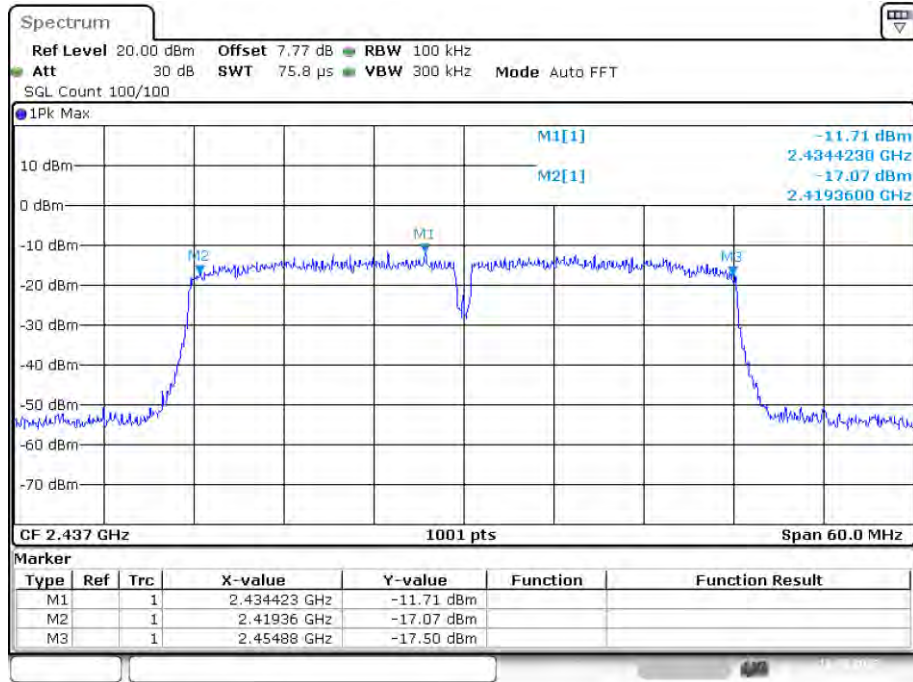
Date: 11.JUL.2023 04:58:37

-6dB Bandwidth NVNT g 2462MHz Ant1

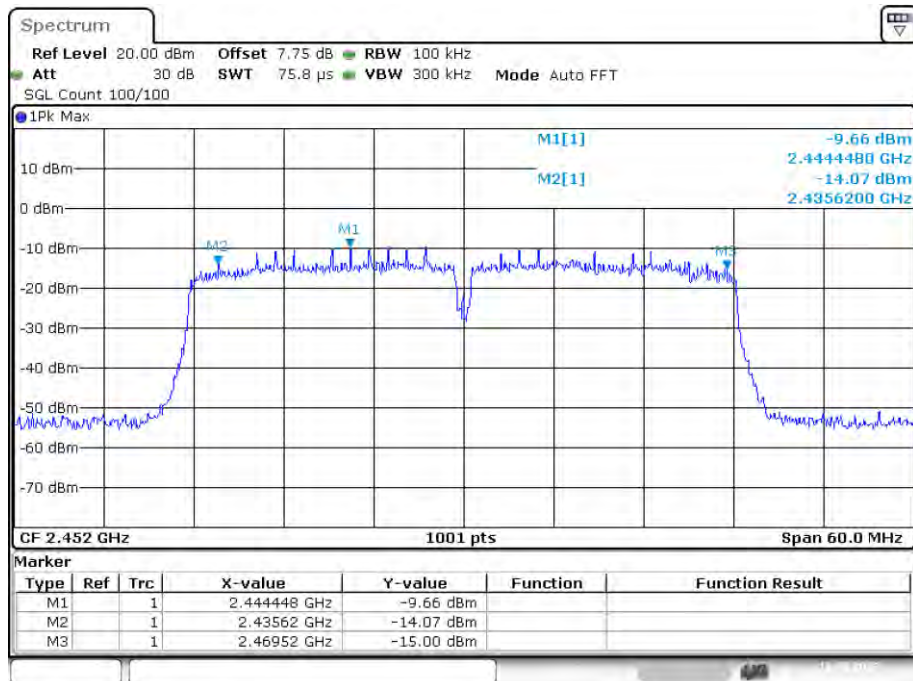
Date: 11.JUL.2023 05:02:26

-6dB Bandwidth NVNT n20 2412MHz Ant1**-6dB Bandwidth NVNT n20 2437MHz Ant1**

-6dB Bandwidth NVNT n20 2462MHz Ant1**-6dB Bandwidth NVNT n40 2422MHz Ant1**

-6dB Bandwidth NVNT n40 2437MHz Ant1

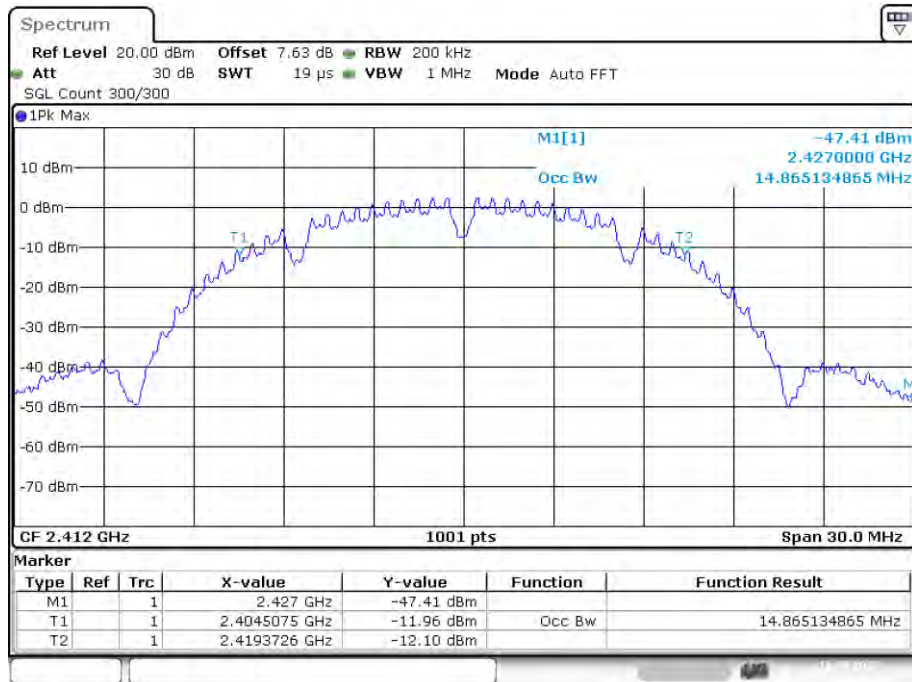
Date: 11.JUL.2023 05:41:09

-6dB Bandwidth NVNT n40 2452MHz Ant1

Date: 11.JUL.2023 05:44:58

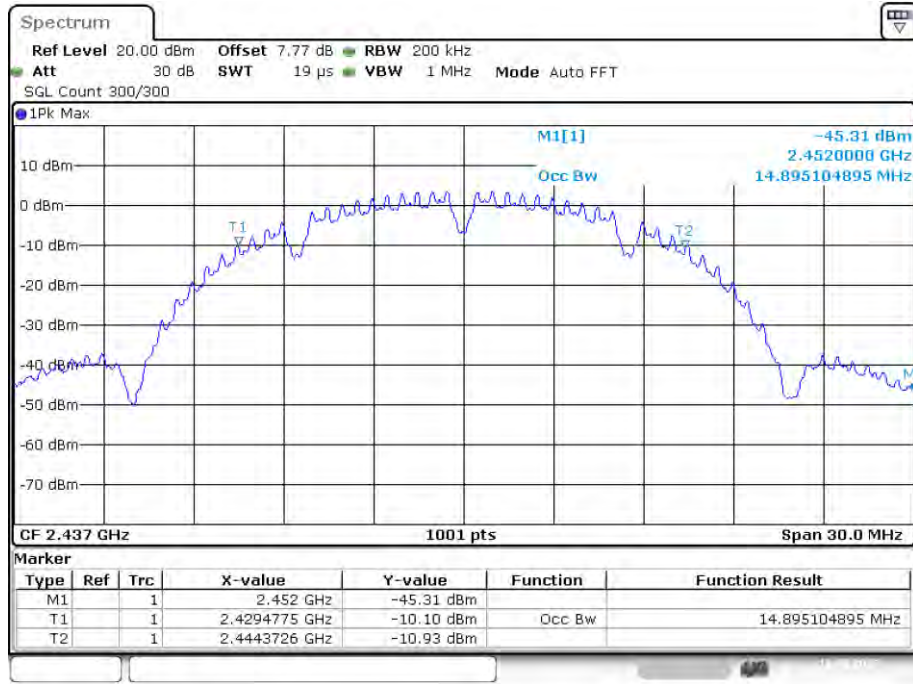
Occupied Channel Bandwidth

Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)
NVNT	b	2412	Ant1	14.865
NVNT	b	2437	Ant1	14.895
NVNT	b	2462	Ant1	14.895
NVNT	g	2412	Ant1	16.783
NVNT	g	2437	Ant1	16.933
NVNT	g	2462	Ant1	16.693
NVNT	n20	2412	Ant1	17.742
NVNT	n20	2437	Ant1	17.742
NVNT	n20	2462	Ant1	17.742
NVNT	n40	2422	Ant1	35.664
NVNT	n40	2437	Ant1	35.724
NVNT	n40	2452	Ant1	35.664

OBW NVNT b 2412MHz Ant1

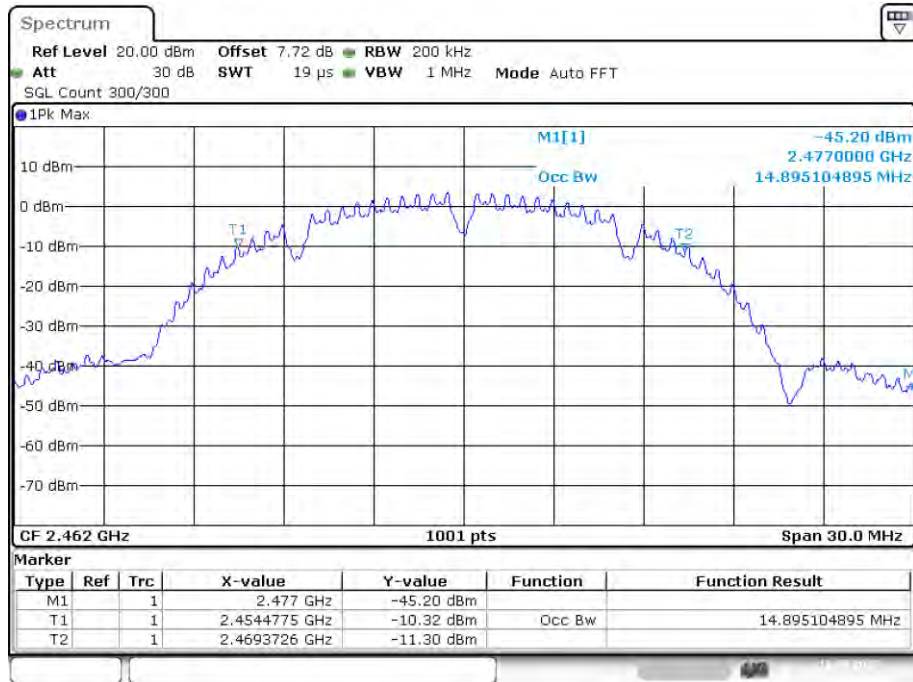
Date: 11.JUL.2023 04:37:16

OBW NVNT b 2437MHz Ant1



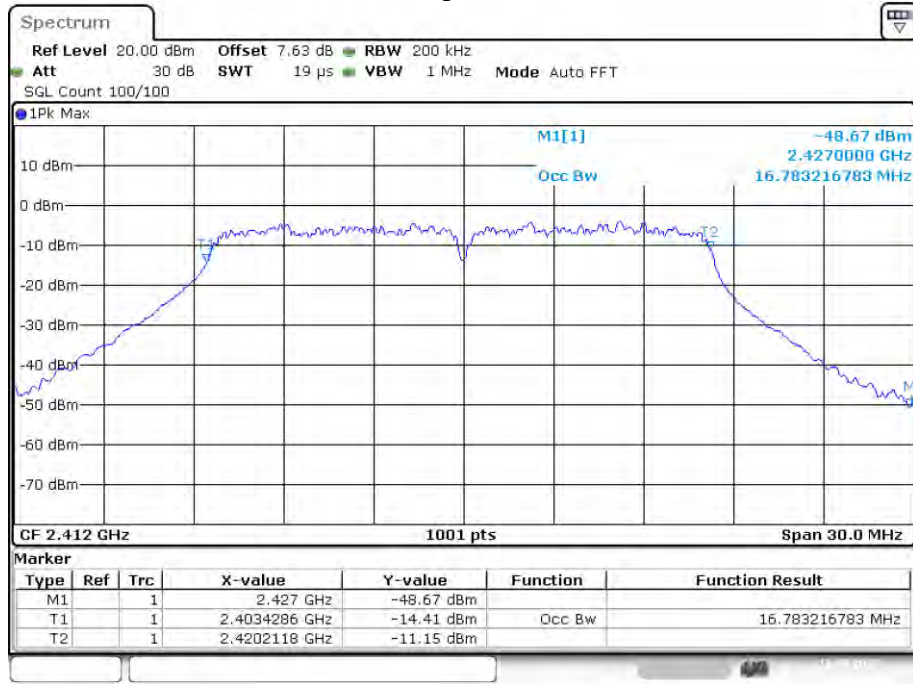
Date: 11.JUL.2023 04:45:56

OBW NVNT b 2462MHz Ant1

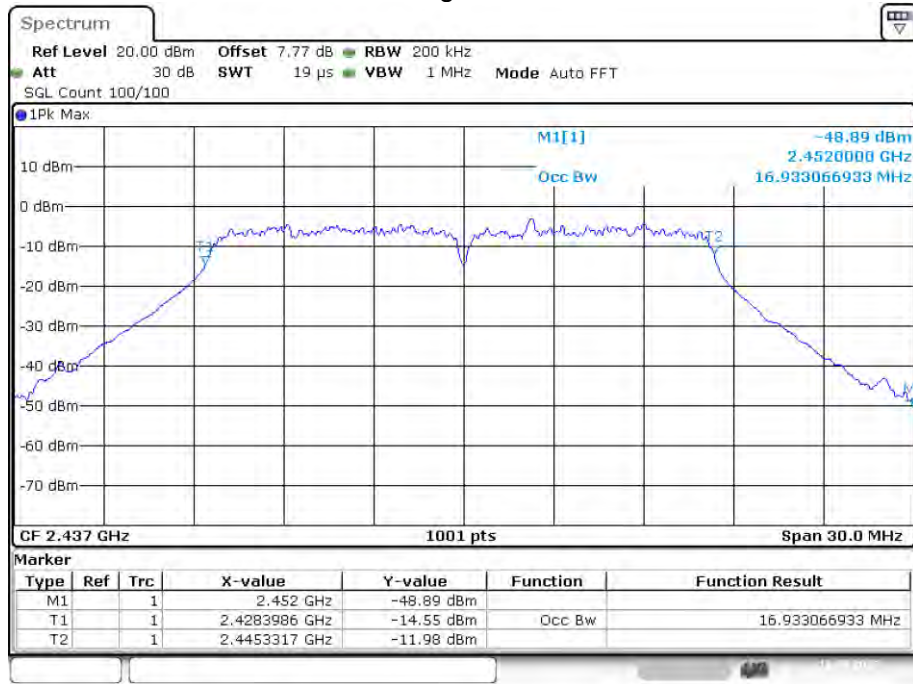


Date: 11.JUL.2023 04:51:18

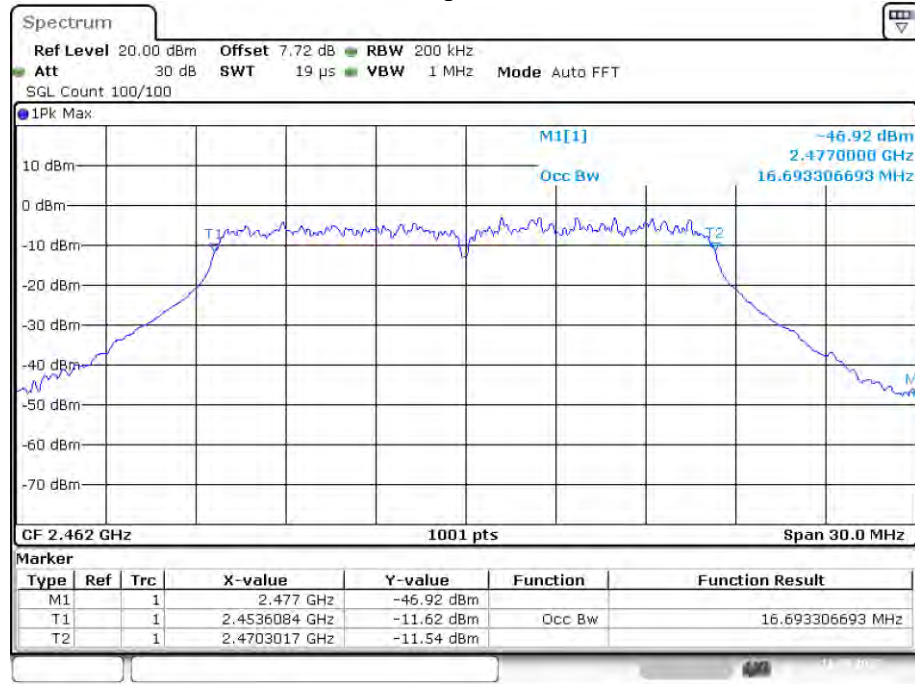
OBW NVNT g 2412MHz Ant1



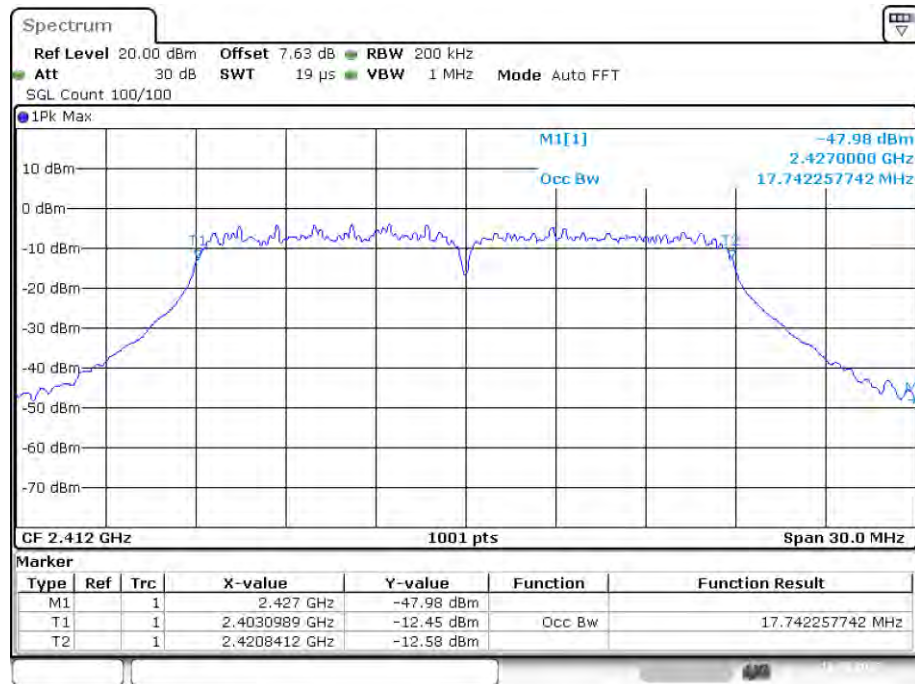
OBW NVNT g 2437MHz Ant1



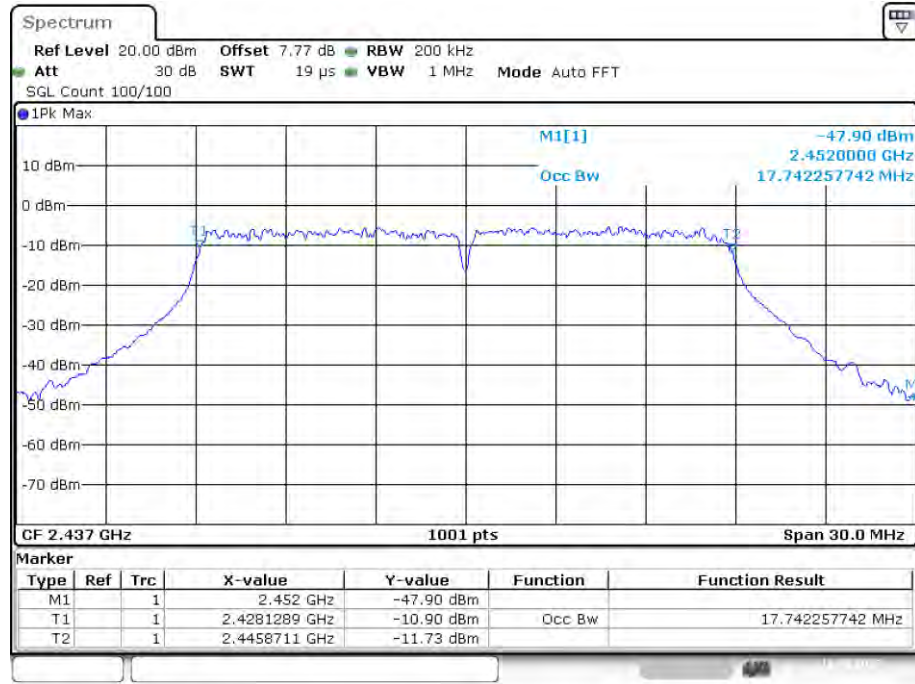
OBW NVNT g 2462MHz Ant1



OBW NVNT n20 2412MHz Ant1

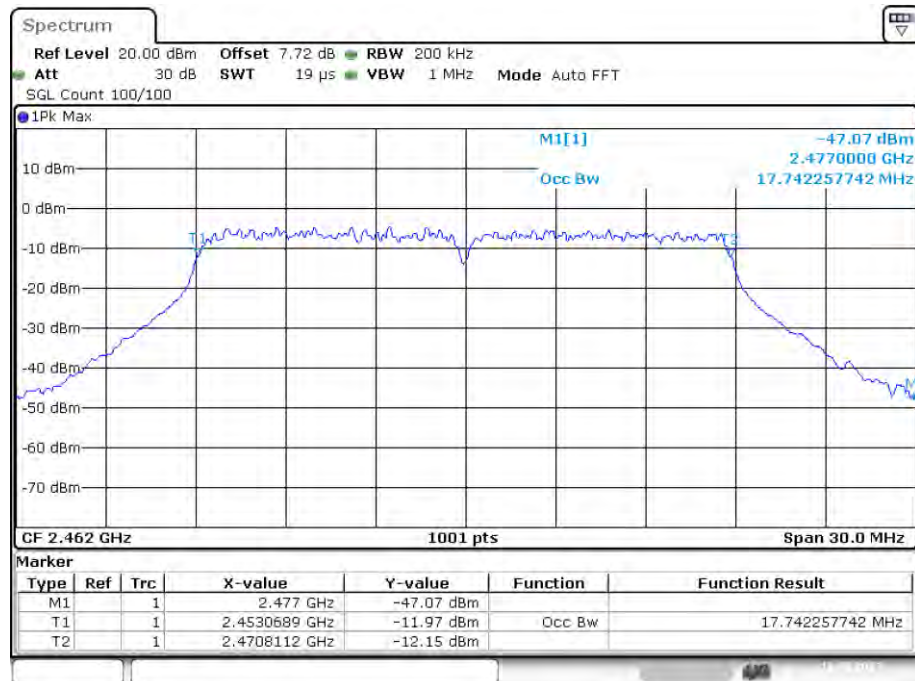


OBW NVNT n20 2437MHz Ant1



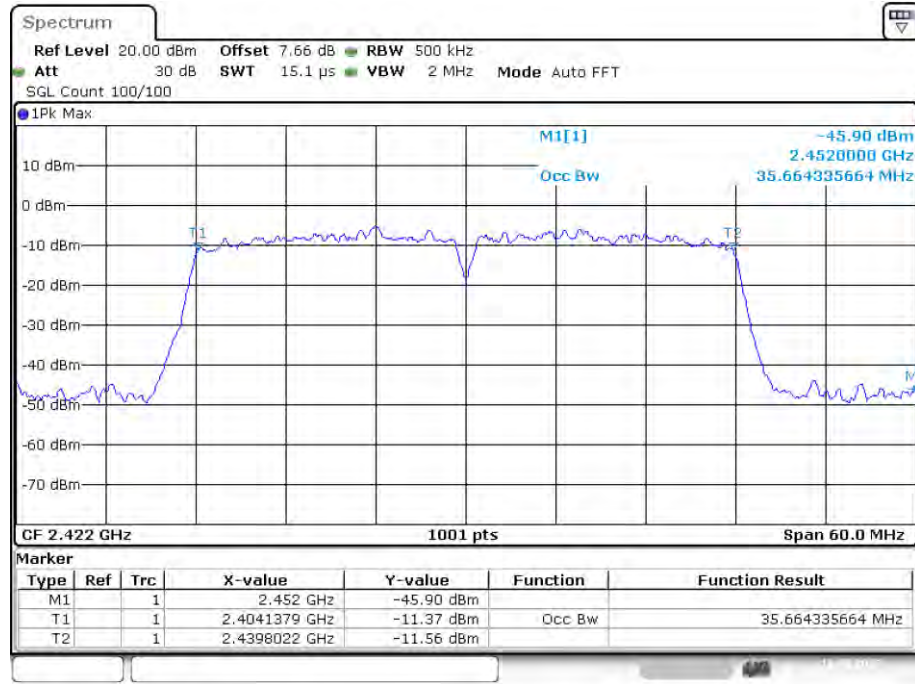
Date: 11.JUL.2023 05:11:35

OBW NVNT n20 2462MHz Ant1



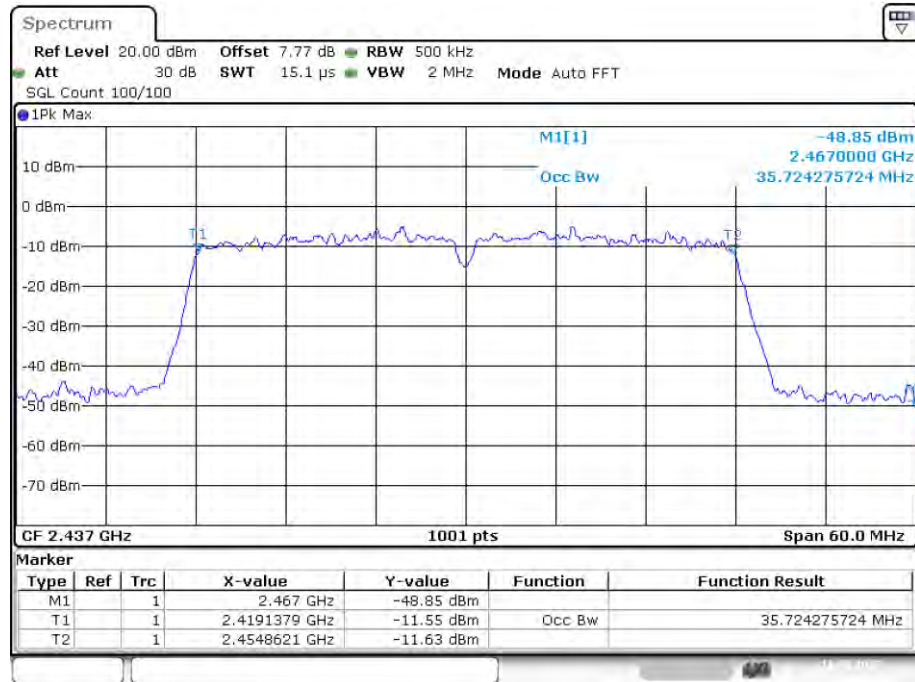
Date: 11.JUL.2023 05:13:45

OBW NVNT n40 2422MHz Ant1



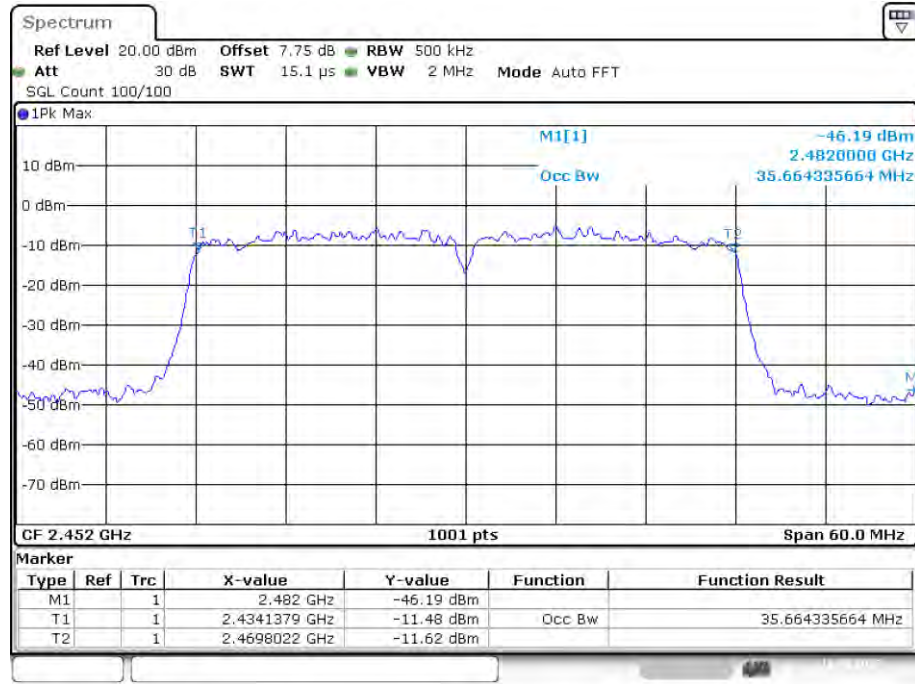
Date: 11.JUL.2023 05:37:37

OBW NVNT n40 2437MHz Ant1



Date: 11.JUL.2023 05:40:52

OBW NVNT n40 2452MHz Ant1



Date: 11.JUL.2023 05:44:40

8. BAND EDGE CHECK

8.1. Test limits

Please refer RSS-GEN & FCC PART 15: 15.247

All the lower and upper band-edges emissions appearing within 2310MHz to 2390MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits and RSS-GEN limits.

8.2. Test Procedure

Details see the KDB558074 D01 Meas Guidance v05r02

8.2.1 Put the EUT on a 1.5m high table, power on the EUT. Emissions were scanned and measured rotating the EUT to 360 degrees, Find the maximum Emission

8.2.2 Check the spurious emissions out of band.

8.2.3 RBW 1MHz, VBW 3MHz, peak detector for peak value, RBW 1MHz, VBW 10Hz, RMS detector for AV value.

8.3. Test Setup

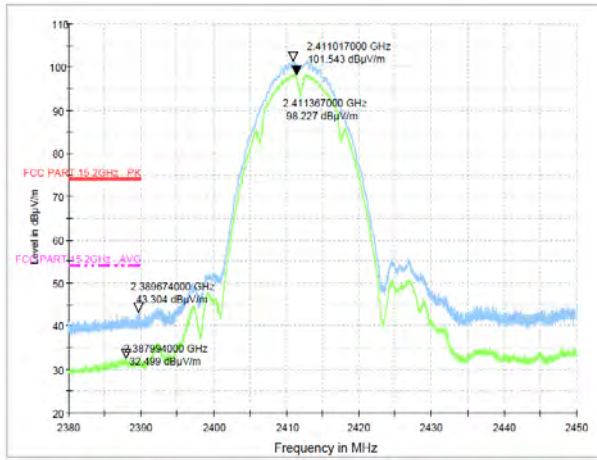
Same as 5.2.2.

8.4. Test Results

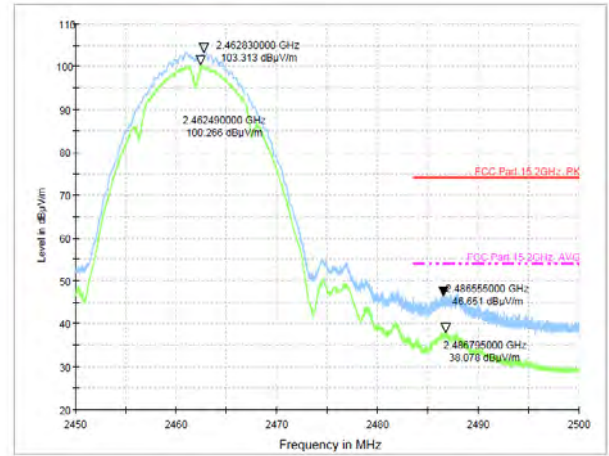
PASS.

Detailed information please see the following page.

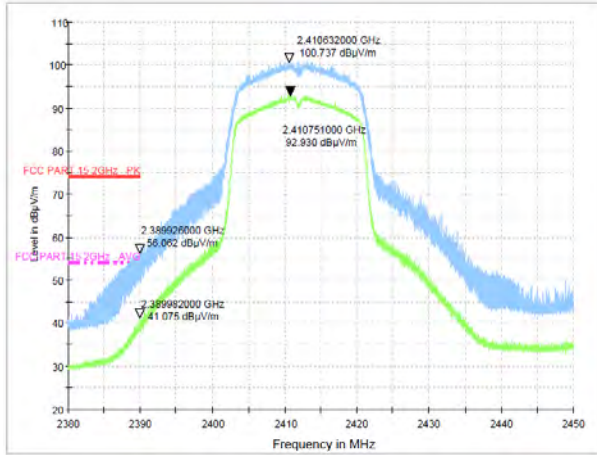
Test Mode: IEEE 802.11b-Low



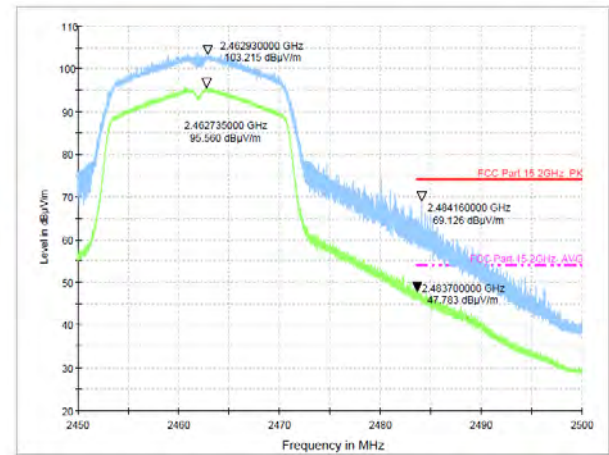
Test Mode: IEEE 802.11b-High



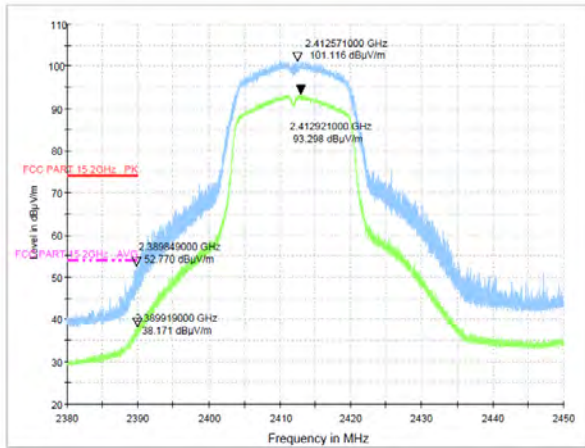
Test Mode: IEEE 802.11g-Low



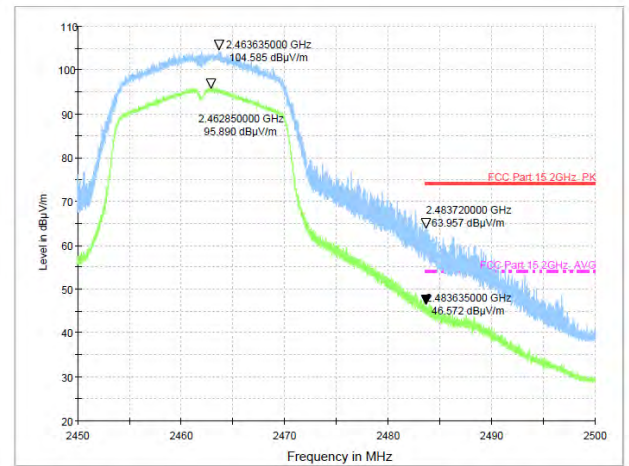
Test Mode: IEEE 802.11g-High



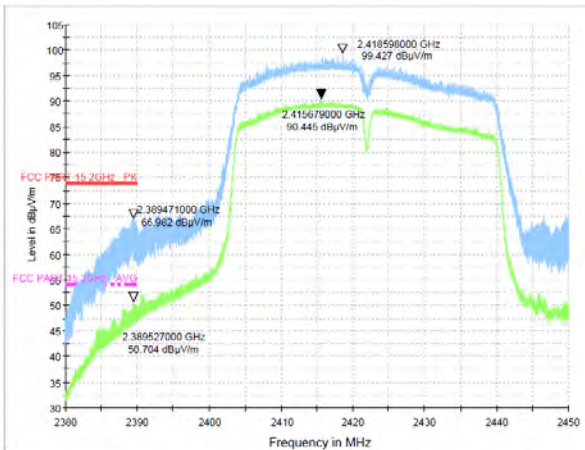
Test Mode: IEEE 802.11n20-Low



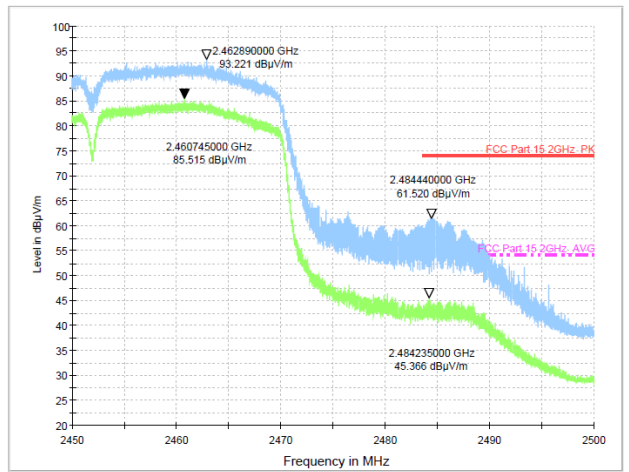
Test Mode: IEEE 802.11n20-High



Test Mode: IEEE 802.11n40-Low



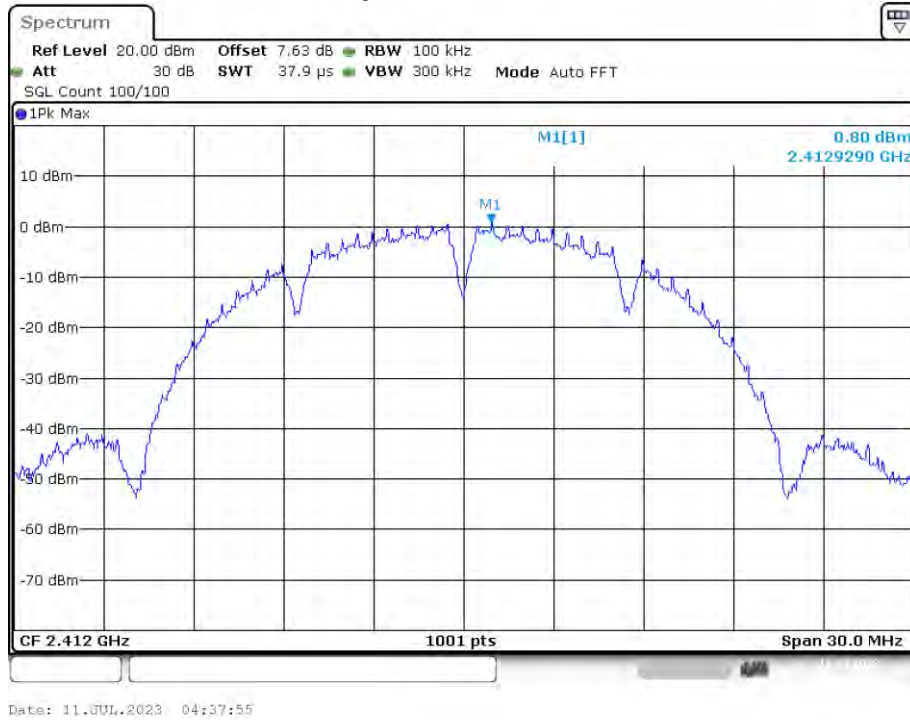
Test Mode: IEEE 802.11n40-High



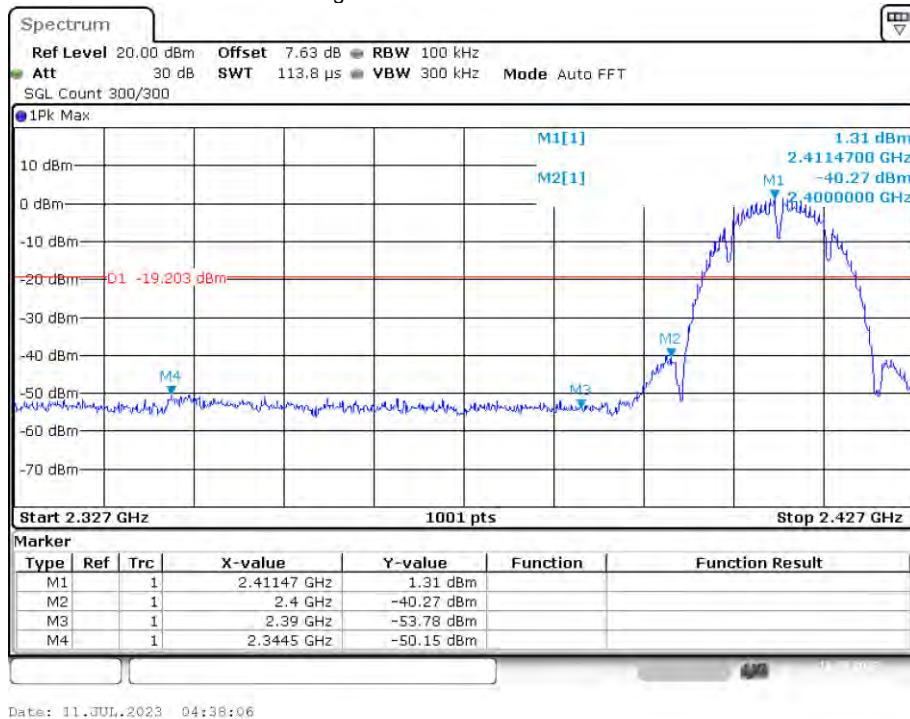
Band Edge

Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	b	2412	Ant1	-50.95	-20	Pass
NVNT	b	2462	Ant1	-52.58	-20	Pass
NVNT	g	2412	Ant1	-45.23	-20	Pass
NVNT	g	2462	Ant1	-47.26	-20	Pass
NVNT	n20	2412	Ant1	-42.32	-20	Pass
NVNT	n20	2462	Ant1	-45.01	-20	Pass
NVNT	n40	2422	Ant1	-41.3	-20	Pass
NVNT	n40	2452	Ant1	-41.05	-20	Pass

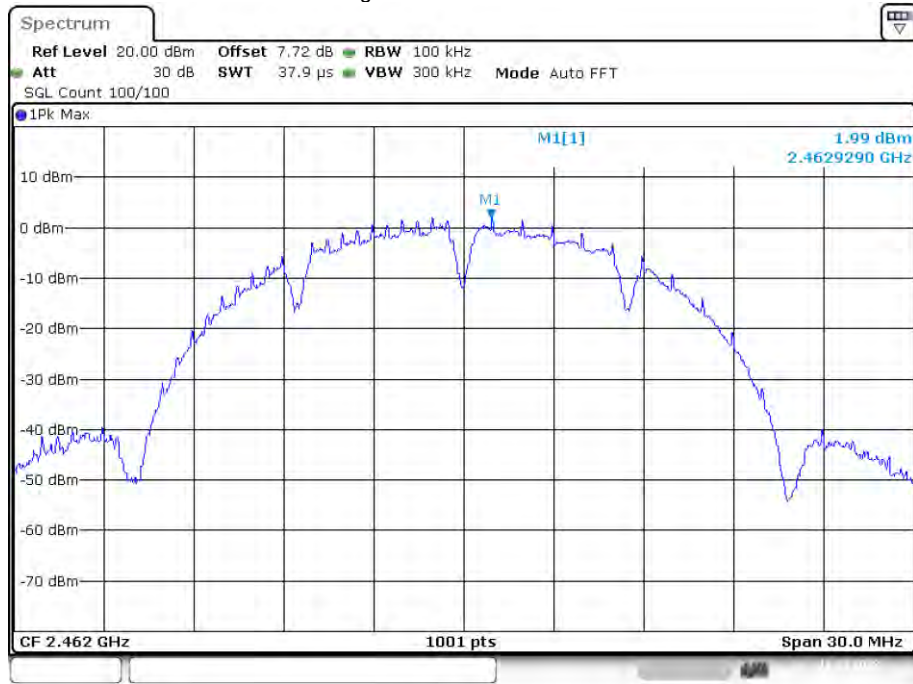
Band Edge NVNT b 2412MHz Ant1 Ref



Band Edge NVNT b 2412MHz Ant1 Emission

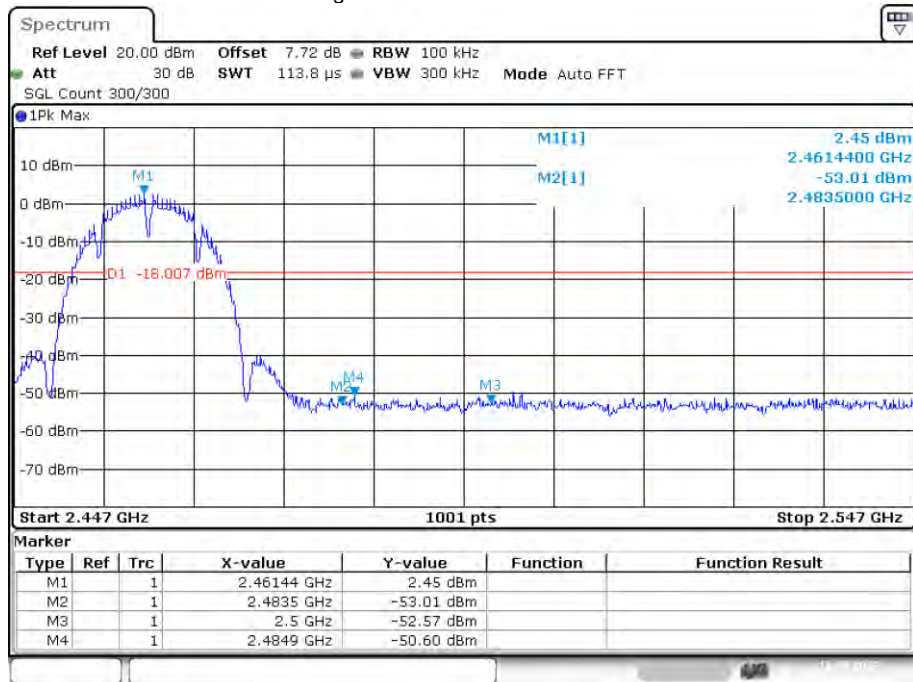


Band Edge NVNT b 2462MHz Ant1 Ref



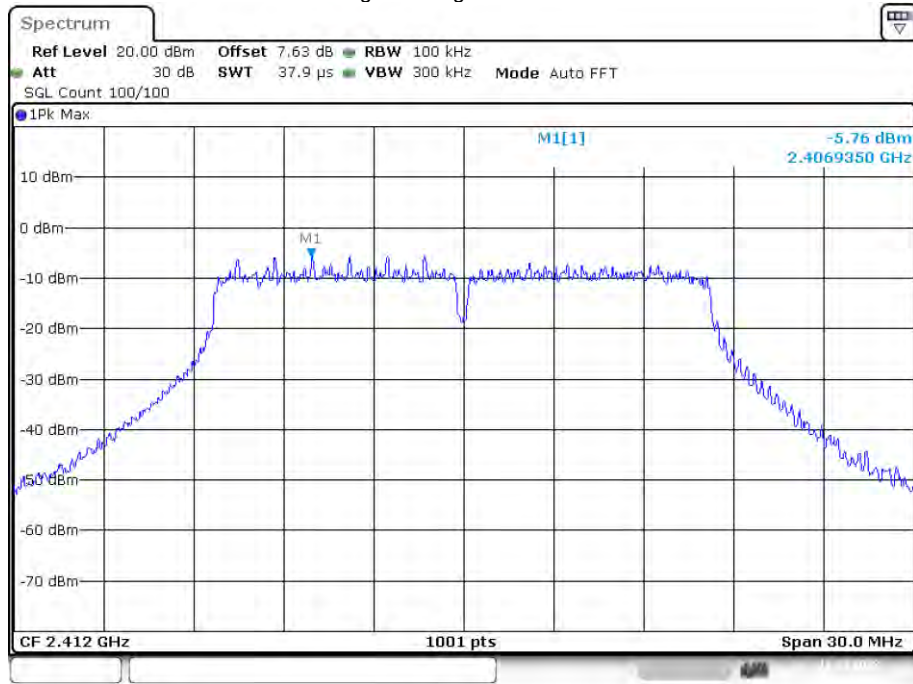
Date: 11.JUL.2023 04:52:01

Band Edge NVNT b 2462MHz Ant1 Emission



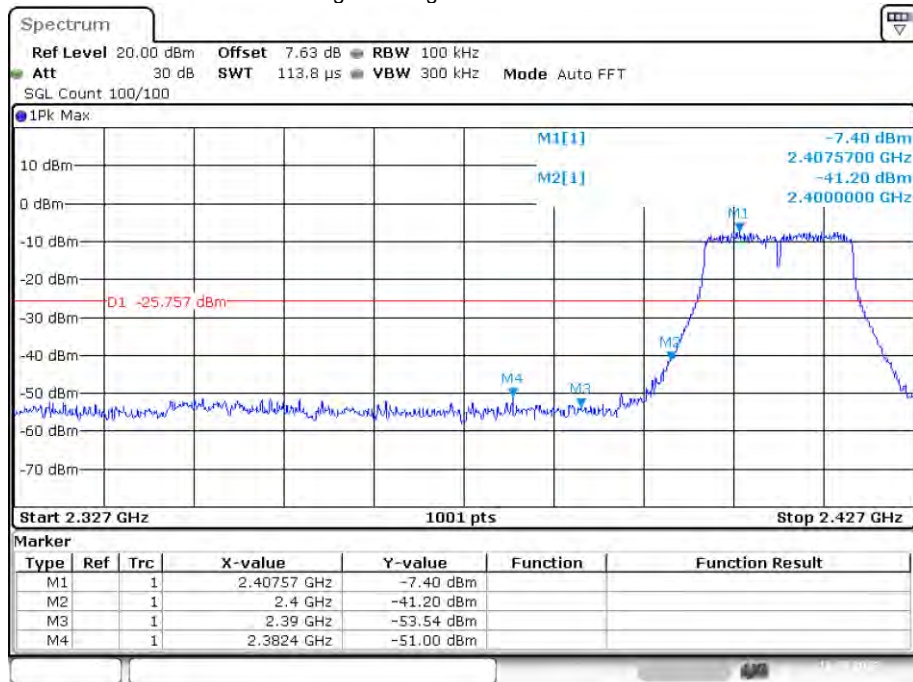
Date: 11.JUL.2023 04:52:12

Band Edge NVNT g 2412MHz Ant1 Ref



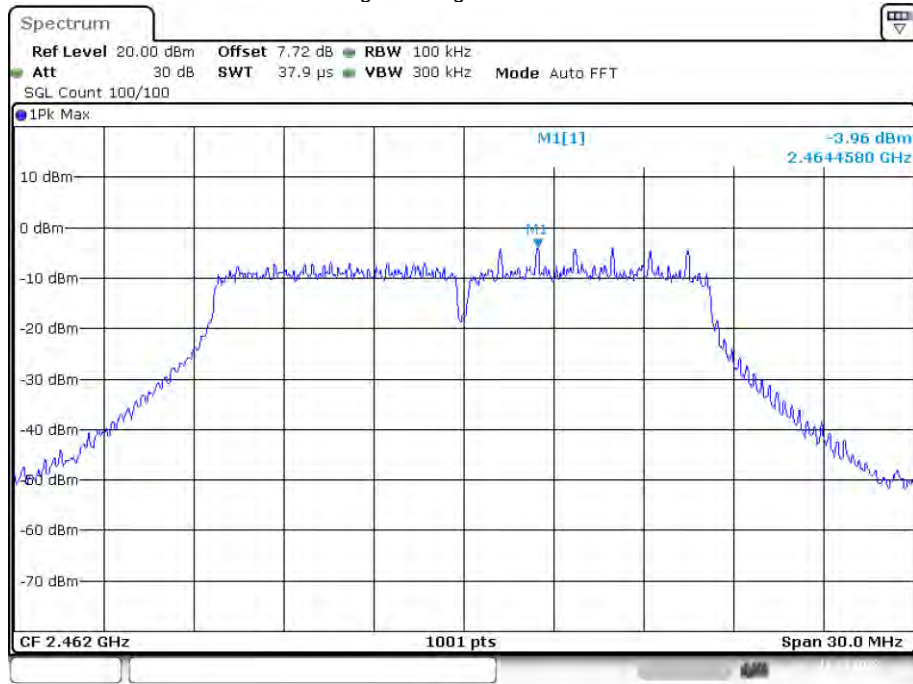
Date: 11.JUL.2023 04:55:33

Band Edge NVNT g 2412MHz Ant1 Emission



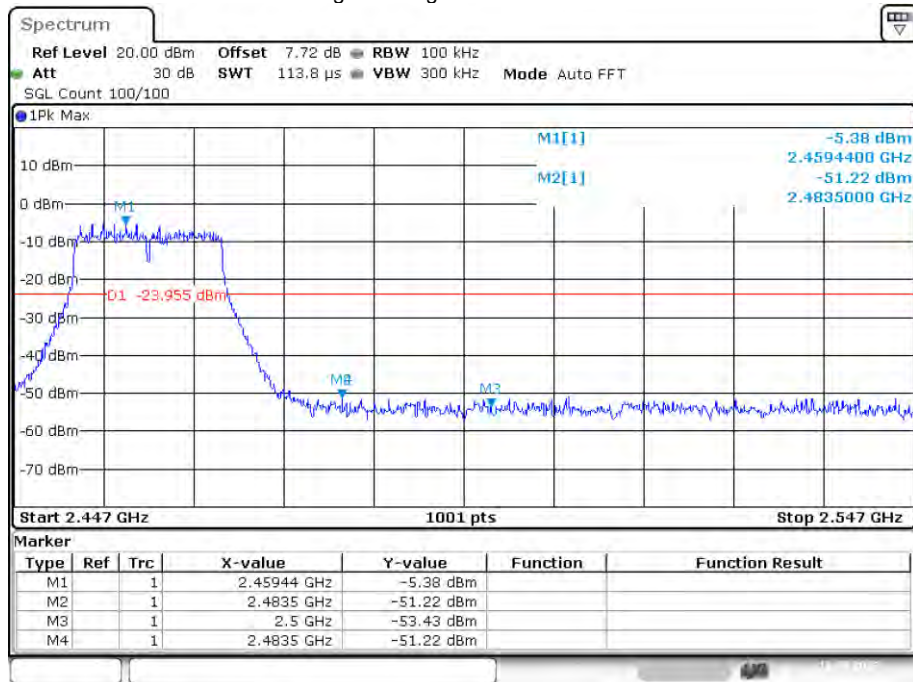
Date: 11.JUL.2023 04:55:38

Band Edge NVNT g 2462MHz Ant1 Ref



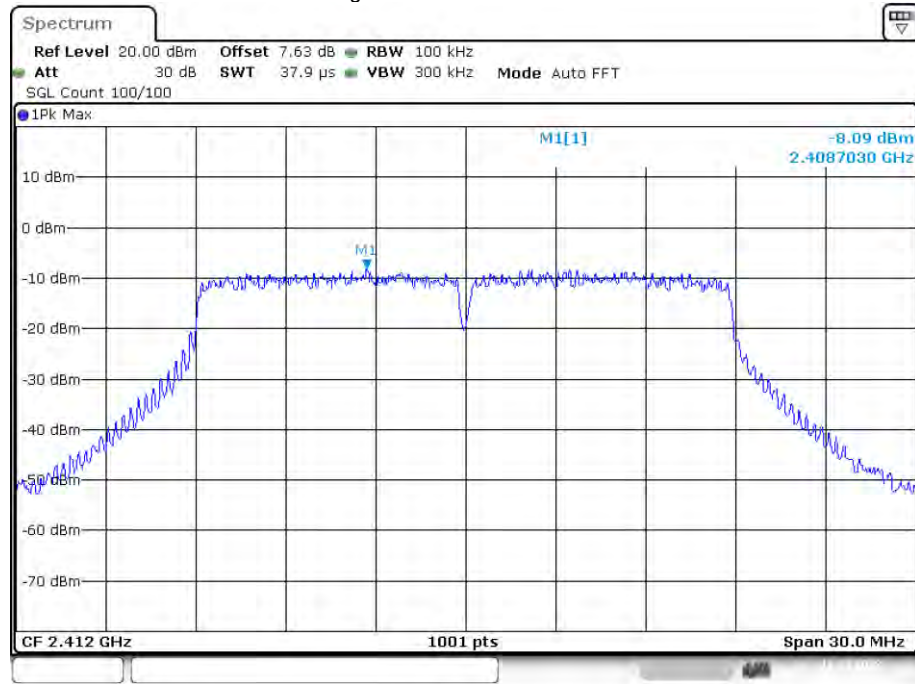
Date: 11.JUL.2023 05:03:00

Band Edge NVNT g 2462MHz Ant1 Emission



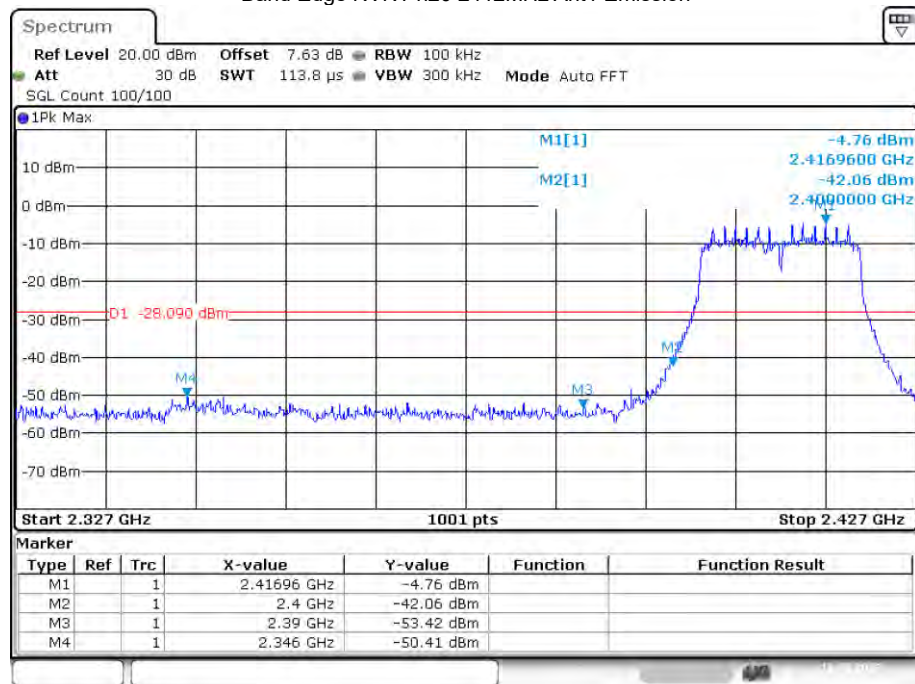
Date: 11.JUL.2023 05:03:05

Band Edge NVNT n20 2412MHz Ant1 Ref



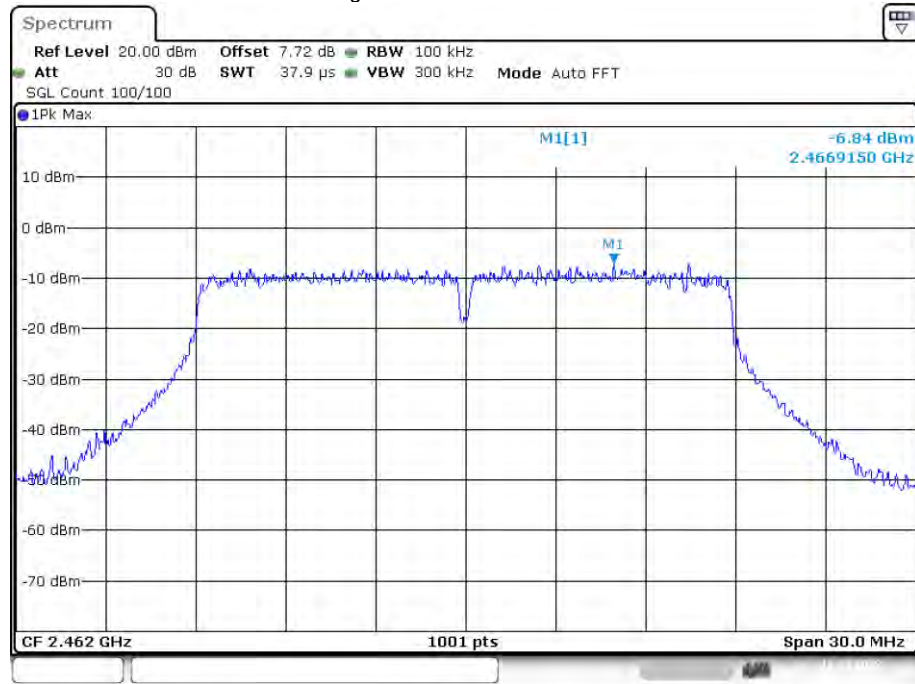
Date: 11.JUL.2023 05:10:03

Band Edge NVNT n20 2412MHz Ant1 Emission



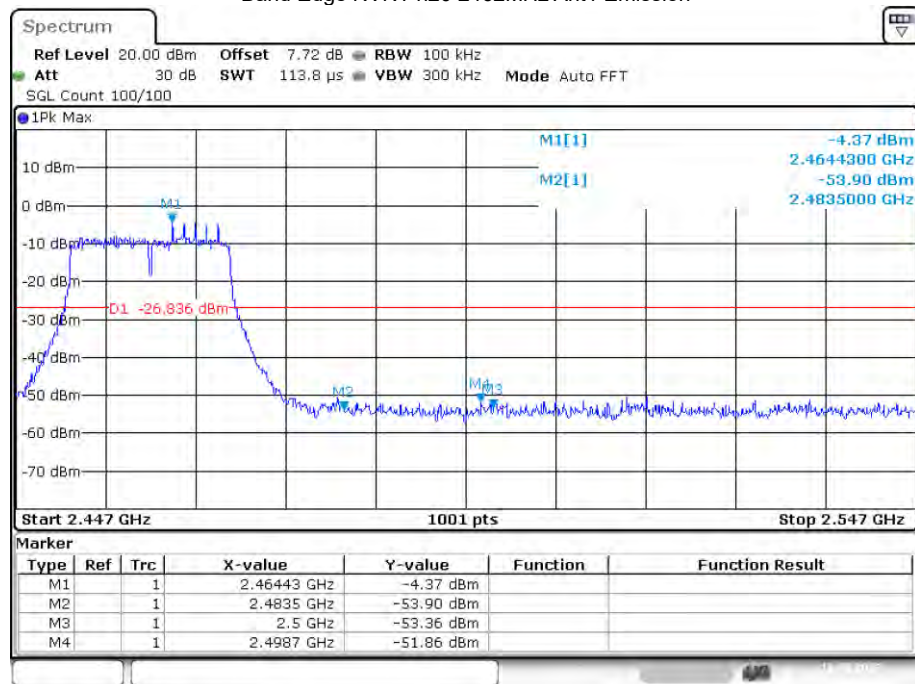
Date: 11.JUL.2023 05:10:09

Band Edge NVNT n20 2462MHz Ant1 Ref



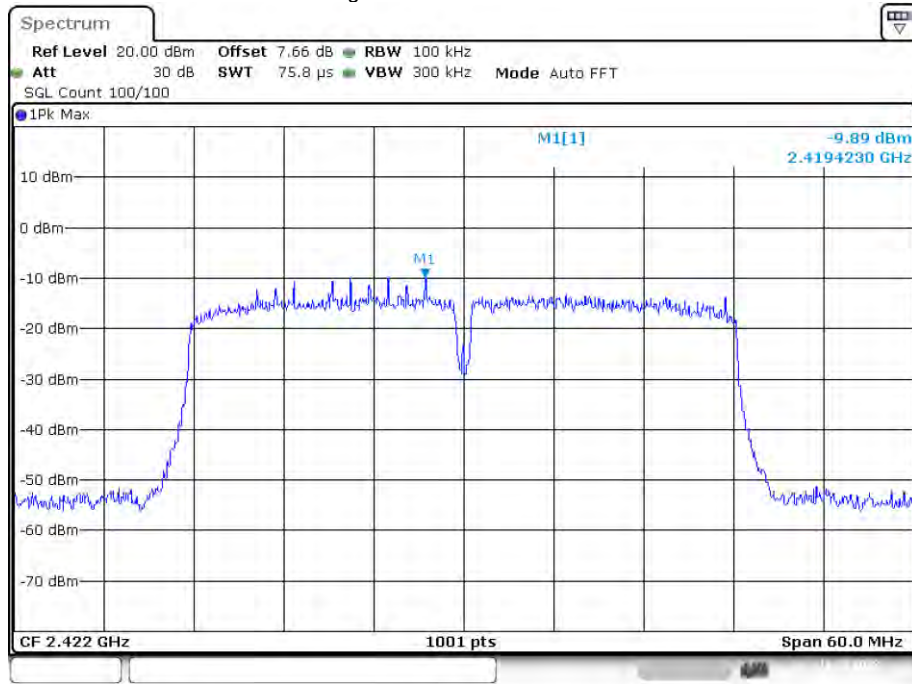
Date: 11.JUL.2023 05:14:37

Band Edge NVNT n20 2462MHz Ant1 Emission



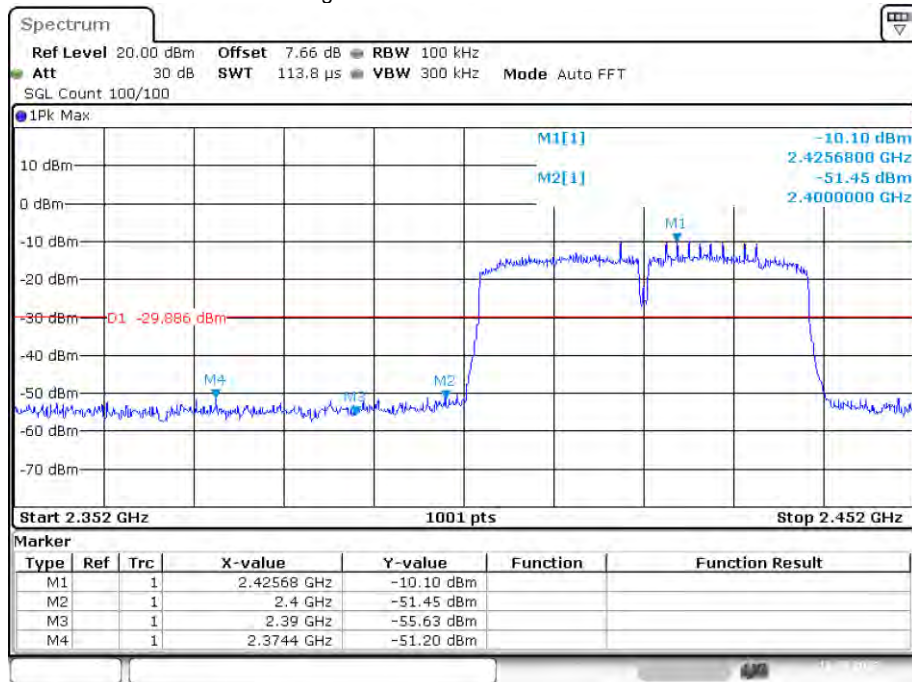
Date: 11.JUL.2023 05:14:43

Band Edge NVNT n40 2422MHz Ant1 Ref



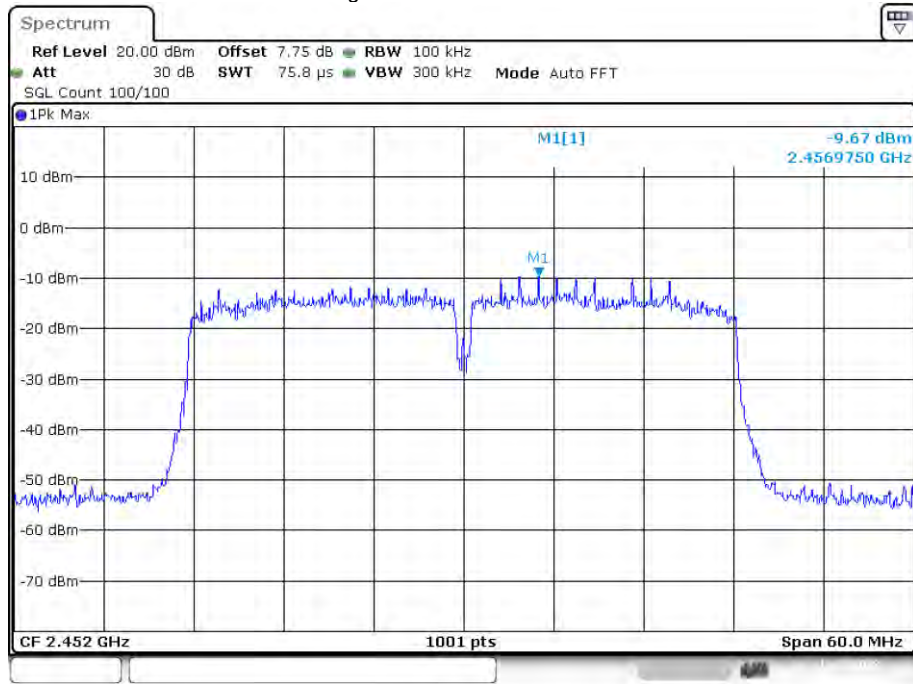
Date: 11.JUL.2023 05:38:46

Band Edge NVNT n40 2422MHz Ant1 Emission



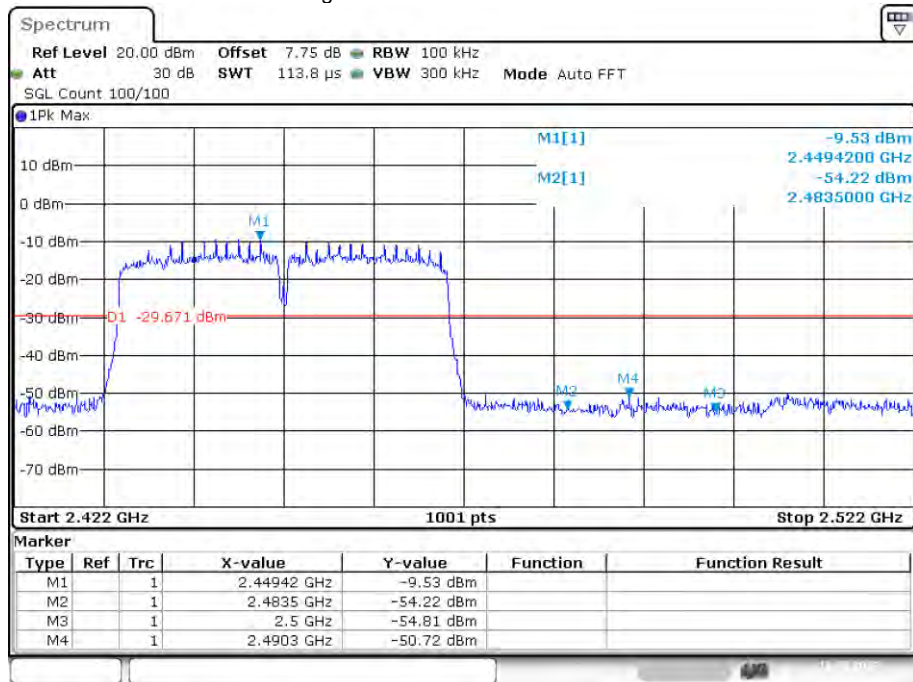
Date: 11.JUL.2023 05:38:52

Band Edge NVNT n40 2452MHz Ant1 Ref



Date: 11.JUL.2023 05:45:55

Band Edge NVNT n40 2452MHz Ant1 Emission



Date: 11.JUL.2023 05:46:01

9. ANTENNA REQUIREMENT

9.1. Standard Requirement

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

9.2. Antenna Connected Construction

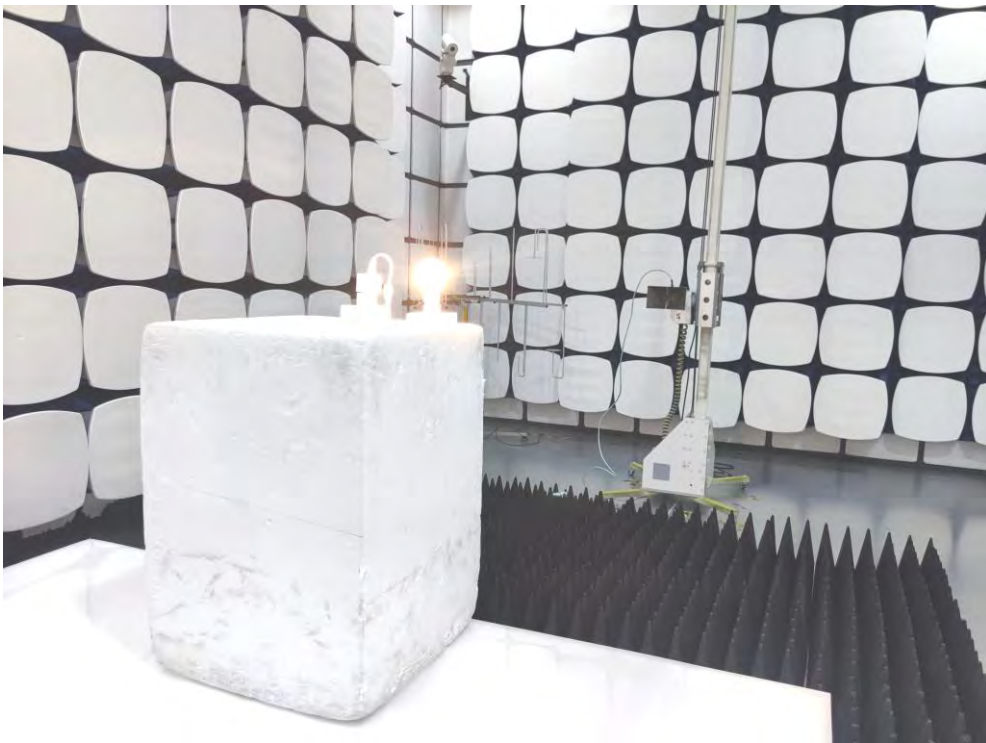
The antenna connector is unique antenna and no consideration of replacement. Please see EUT photo for details.

9.3. Results

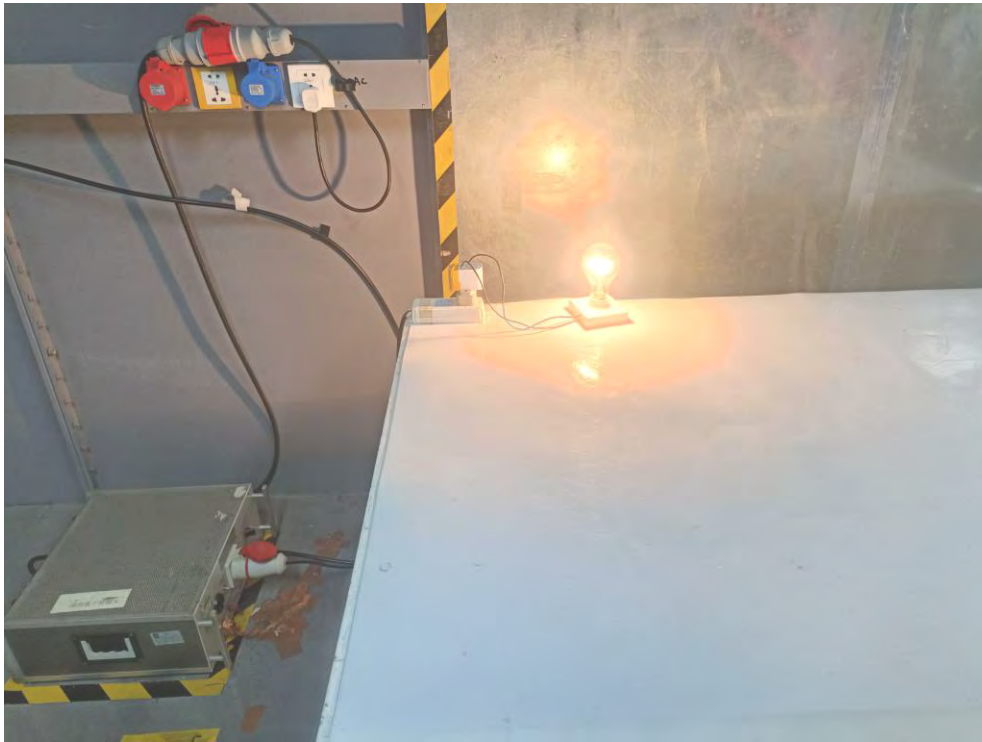
The use of an antenna that is uniquely coupled to the intended radiator shall be considered sufficient to comply with the provisions of this section.

10. TEST SETUP PHOTO

10.1. Photos of Radiated emission



10.2.Photos of Conducted Emission test



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