FCC&IC TEST REPORT

FCC ID: 2AZ3P-RH-WLD2021

IC: 27309-RHWLD2021

On Behalf of

SmartH Technology Limited

Water Leakage Detector

Model No.: RH-WLD2021

Prepared for	:	SmartH Technology Limited
Address	:	48 Leary Cres, Richmond Hill, ON. Canada

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	:	SmartH Technology Limited
Address	:	48 Leary Cres, Richmond Hill, ON. Canada
Manufacturer	:	Shenzhen SmartHPro Technology Co., Ltd
Address	:	6th Floor, Building B, Baifuli Industrial Park, Shanghenglang Industrial Zone, Henglang Community, Dalang Street, Longhua District, Shenzhen
EUT Description	:	Water Leakage Detector
		(A) Model No. : RH-WLD2021
		(B) Trademark : RHINO

Measurement Standard Used:

FCC Rules and Regulations Part 15 Subpart C Section 15.247,

RSS-247 Issue 2, RSS-Gen Issue 5, ANSI C63.10:2013, CISPR 16-1-4:2010

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

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

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

Tested by (name + signature).....…..:	Lucas Pang Project Engineer	Lucas Pang
Approved by (name + signature)…....:	Simple Guan Project Manager	
Date of issue…… ……..:	May 19, 2021	

Revision History

Revision	Issue Date	Revisions	Revised By
V0	May 19, 2021	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 RSS-GEN(8.8) ANSI C63.10 :2013	N/A
6dB Bandwidth	FCC PART 15:15.247(a)(2) RSS-247(5.2 a) ANSI C63.10 :2013	P
Output Power	FCC Part 15: 15.247(b)(3) RSS-247(5.4 d) ANSI C63.10 :2013	P
Radiated Spurious Emission	FCC Part 15: 15.209 FCC Part 15: 15.247(d) RSS-Gen(8.9), RSS-247(5.5) ANSI C63.10 :2013	P
Conducted Spurious & Band Edge Emission	FCC Part 15: 15.247(d) RSS-Gen(8.9), RSS-247(5.5) ANSI C63.10 :2013	P
Power Spectral Density	FCC PART 15:15.247(e) RSS-247(5.2 b) ANSI C63.10 :2013	P
Radiated Band Edge Emission	FCC Part 15: 15.247(d) RSS-GEN(6.13) ANSI C63.10 :2013	P
Frequency stability	RSS-GEN(6.11)	P
Antenna Requirement	FCC Part 15: 15.203 RSS-GEN(6.8)	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.	

2. GENERAL INFORMATION

2.1.Description of Device (EUT)

Description/PMN	:	Water Leakage Detector
Model Number/HVIN(s)	:	RH-WLD2021
Diff.	:	/
Trademark	:	RHINO
Test Voltage	:	DC 3V from Battery
RF Technology	:	2.4G WIFI
Operation frequency	:	2412MHz-2462MHz for IEEE 802.11 b, g. n/HT20
Channel No.	:	802.11b/802.11g /802.11n(HT20): 11
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, Maximum Gain is 0dBi.
Software Version	:	V1.0

Remark:
1. The worst-case simultaneous transmission configuration was evaluated with no non-compliance found. Results in this report are only for 2.4G Wi-Fi function, and there is no other transmitter involved.
2. In this report, the main test model is RH-WLD2021, and the main test model serial number is LM2103303538669S.

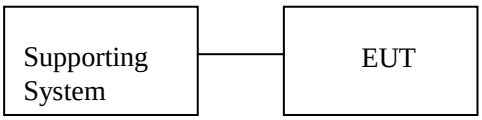
2.2.Accessories of Device (EUT)

Accessories1	:	/
Manufacturer	:	/
Model	:	/
Ratings	:	/

2.3.Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number	Certification or SDOC
1	Notebook	Thinkpad	E490	N/A	N/A

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	Low :CH3	/
	13	Middle: CH6	/
	13	High: CH9	/
Note: According exploratory test, EUT will have maximum output power in those data rate. So those data rate were used for all test. New batteries were used during all test.			

Software (Used for test) from client

Mode	Special software is used. The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.
Power level setup in software	
Test Software Name	Secure CRT
Test Software Version	V8.3
Soft Set	TX level is set as defaults value.

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		

Setting output power (Max)			
802.11b	802.11g	802.11n(HT20)	802.11n(HT40)
15±2dBm	15±2dBm	15±2dBm	/

2.6.Test Conditions

Items	Required	Actual
Temperature range:	15-35℃	24℃
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: CN0085

2.8.Measurement Uncertainty

(95% confidence levels, k=2)

Item	Uncertainty
Uncertainty for Power point Conducted Emissions Test	2.74dB
Uncertainty for Radiation Emission test in 3m chamber (below 30MHz)	2.13 dB(Polarize: V)
	2.57dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.77dB(Polarize: V)
	3.80dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	4.16dB(Polarize: H)
	4.13dB(Polarize: V)
Uncertainty for radio frequency	5.4×10-8
Uncertainty for conducted RF Power	0.37dB
Uncertainty for temperature	0.2℃
Uncertainty for humidity	1%
Uncertainty for DC and low frequency voltages	0.06%

2.9.Test Equipment List

Equipment	Manufacture	Model No.	Serial No.	Last cal.	Cal Interval
9*6*6 anechoic chamber	CHENYU	9*6*6	N/A	2019.09.06	3Year
Spectrum analyzer	ROHDE&SCHWARZ	FSV40-N	102137	2020.09.02	1Year
Spectrum analyzer	Agilent	N9020A	MY499100060	2020.09.02	1Year
Receiver	ROHDE&SCHWARZ	ESR	1316.3003K03-102082-Wa	2020.09.02	1Year
Receiver	R&S	ESCI	101165	2020.09.02	1Year
Bilog Antenna	Schwarzbeck	VULB 9168	VULB9168-438	2020.04.12	2Year
Horn Antenna	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D(1201)	2020.04.12	2Year
Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00059	2019.09.07	2Year
Cable	Resenberger	N/A	No.1	2020.09.02	1Year
Cable	Resenberger	N/A	No.2	2020.09.02	1Year
Cable	Resenberger	N/A	No.3	2020.09.02	1Year
Pre-amplifier	HP	HP8347A	2834A00455	2020.09.02	1Year
Pre-amplifier	Agilent	8449B	3008A02664	2020.09.02	1Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	8126466	2020.09.02	1Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	101043	2020.09.02	1 Year
20db Attenuator	ICPROBING	IATS1	82347	2020.09.02	1 Year
Horn Antenna	SCHWARZBECK	BBHA9170	00946	2019.09.07	2 Year
Preamplifier	SKET	LNPA_1840-50	SK2018101801	2020.09.02	1 Year
Power Meter	Agilent	E9300A	MY41496625	2020.09.02	1 Year
Temp. &Humid. Chamber	Weihuang	WHTH-1000-40-880	100631	2020.09.02	1 Year
Switching Mode Power Supply	JUNKE	JK12010S	20140927-6	2020.09.02	1 Year

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])

RSS-GEN Restricted frequency band

Table 7 – Restricted frequency bands **Note 1**

MHz	MHz	GHz
0.090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 – 285	15.35 - 16.2

4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 – 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	
16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 – 8500	
108 – 138		

Note 1: Certain frequency bands listed in table 7 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

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			

Harmonic emissions limits comply with below 54 dBuV/m at 3m. Other emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or comply with the radiated emissions limits specified in section 15.209(a) limit in the table below has to be followed.

Table 5 – General field strength limits at frequencies above 30 MHz	
Frequency (MHz)	**Field strength (μV/m at 3 m)**
30 – 88	100
88 – 216	150
216 – 960	200
Above 960	500

Table 6 – General field strength limits at frequencies below 30 MHz		
Frequency	**Magnetic field strength (H-Field) (μA/m)**	**Measurement distance (m)**
9 - 490 kHz[Note 1]	6.37/F (F in kHz)	300
490 - 1705 kHz	63.7/F (F in kHz)	30
1.705 - 30 MHz	0.08	30

Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

3.2.Test Procedure

The measuring distance of 3m shall be used for measurements at frequency up to 1GH and above 1GHz. The EUT was placed on a rotating 0.8 m high above ground for below 1GHz and 1.5m high for above1GHz testing, the table was rotated 360 degrees to determine the position of the highest radiation

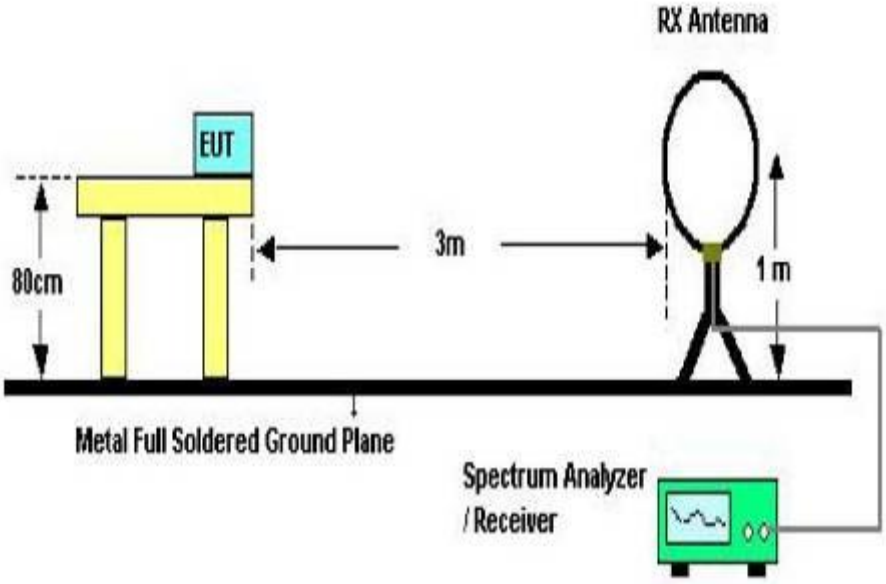
The Test antenna shall vary between 1m and 4m, both Horizontal and Vertical antenna are set of make measurement.

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

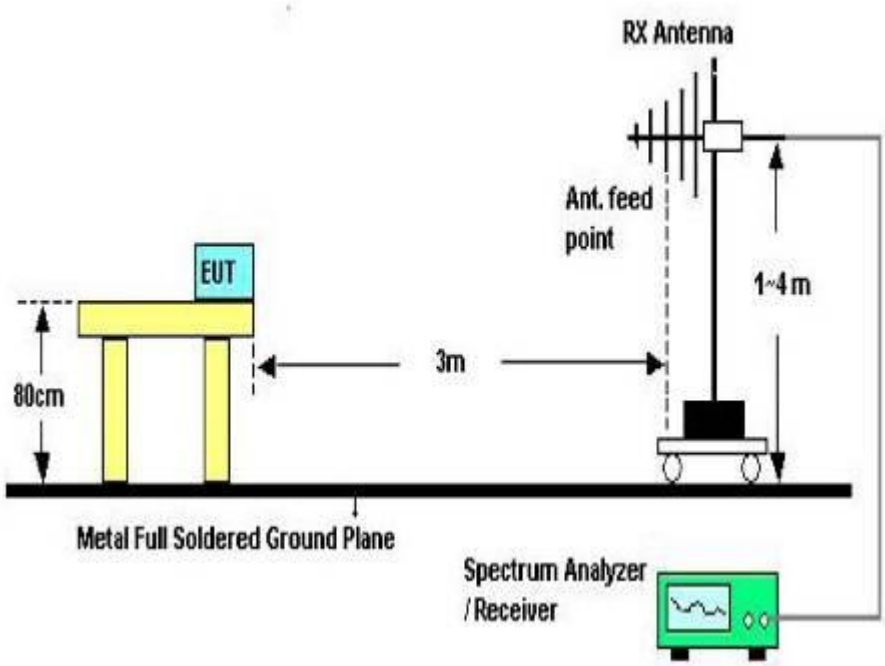
If Peak value comply with QP limit below 1GHz, the EUT deemed to comply with QP limit. But the Peak value and average value both need to comply with applicable limit above 1GHz.

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

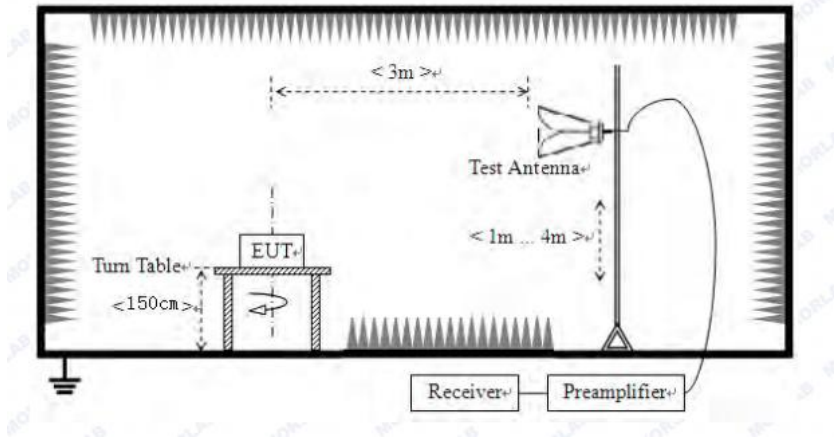
3.3.Test Setup



Below 30MHz Test Setup



Above 30MHz 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.

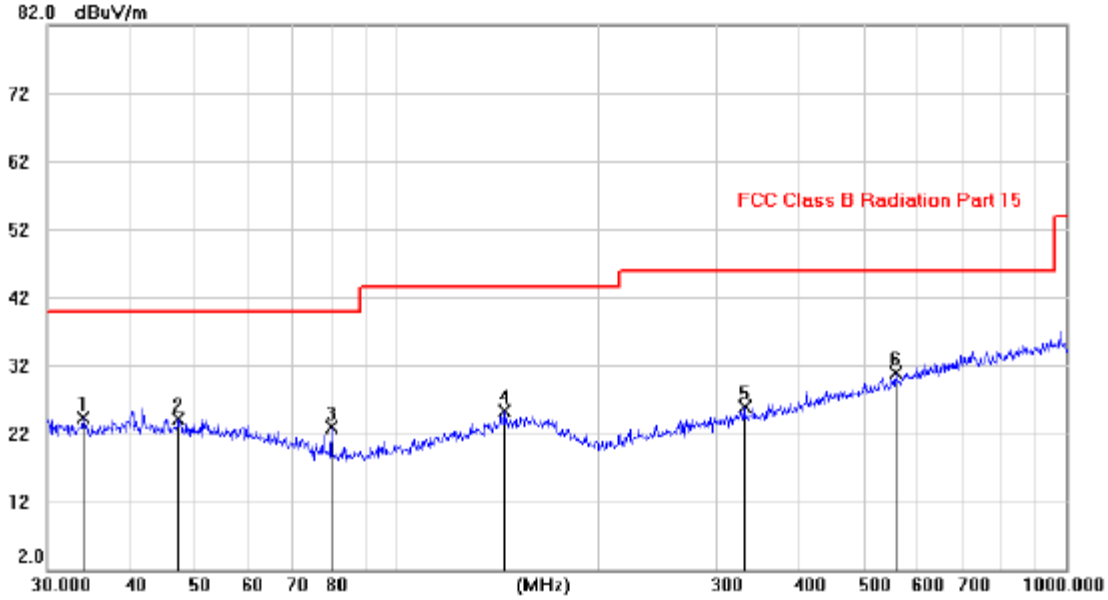
Detailed information please see the following page.

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.

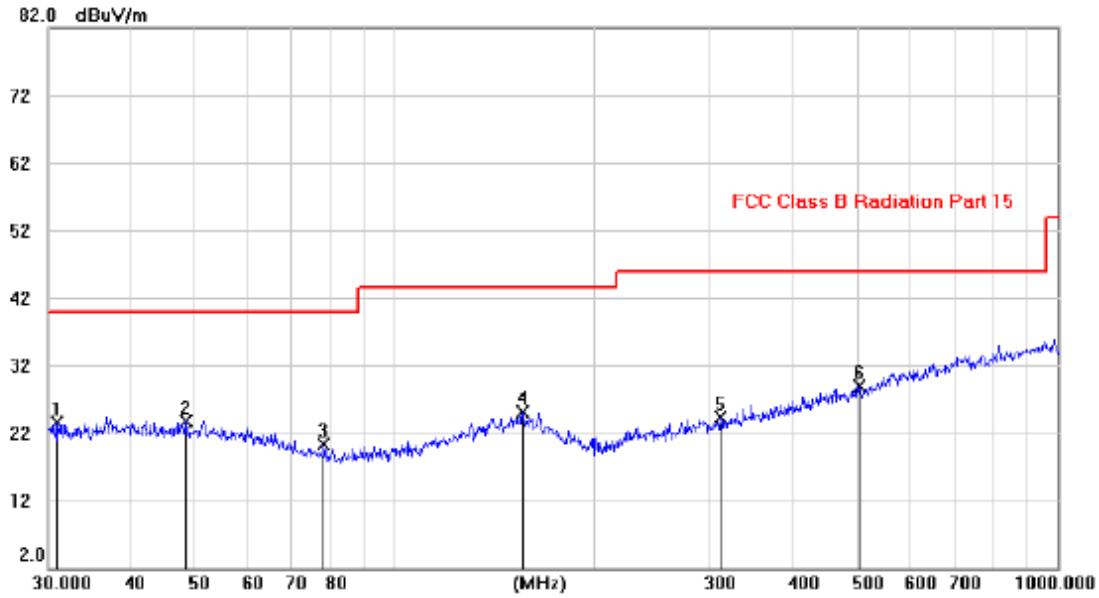
Test result for 802.11b (High Channel), DC 3V from battery
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		34.0325	10.72	13.67	24.39	40.00	-15.61	peak			
2		47.2315	10.01	14.07	24.08	40.00	-15.92	peak			
3		80.0337	13.06	9.89	22.95	40.00	-17.05	peak			
4		144.9095	10.59	14.68	25.27	43.50	-18.23	peak			
5		330.3878	11.01	14.83	25.84	46.00	-20.16	peak			
6	*	556.7093	11.55	19.31	30.86	46.00	-15.14	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 Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		30.9004	9.91	13.58	23.49	40.00	-16.51	peak			
2	*	48.4506	9.68	14.05	23.73	40.00	-16.27	peak			
3		78.1570	10.20	10.15	20.35	40.00	-19.65	peak			
4		155.9466	10.13	15.05	25.18	43.50	-18.32	peak			
5		310.9049	9.92	14.37	24.29	46.00	-21.71	peak			
6		502.1172	10.59	18.25	28.84	46.00	-17.16	peak			

Note:1. *:Maximum data; x:Over limit; !:over margin.
2.Measurement=Reading Level+Correct Factor; Correct Factor=Antenna Factor+Cable Loss.

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	46.46	V	33.98	10.22	34.25	56.41	74	17.59	PK
4824	35.22	V	33.98	10.22	34.25	45.17	54	8.83	AV
7236	/	/	/	/	/	/	/	/	/
9648	/	/	/	/	/	/	/	/	/
4824	45.99	H	33.98	10.22	34.25	55.94	74	18.06	PK
4824	34.27	H	33.98	10.22	34.25	44.22	54	9.78	AV
7236	/	/	/	/	/	/	/	/	/
9648	/	/	/	/	/	/	/	/	/
Test Mode: IEEE 802.11b TX Mid									
4874	46.17	V	33.98	10.22	34.25	56.12	74	17.88	PK
4874	35.54	V	33.98	10.22	34.25	45.49	54	8.51	AV
7311	/	/	/	/	/	/	/	/	/
9748	/	/	/	/	/	/	/	/	/
4874	46.57	H	33.98	10.22	34.25	56.52	74	17.48	PK
4874	35.12	H	33.98	10.22	34.25	45.07	54	8.93	AV
7311	/	/	/	/	/	/	/	/	/
9748	/	/	/	/	/	/	/	/	/
Test Mode: IEEE 802.11b TX High									
4924	45.86	V	33.98	10.22	34.25	55.81	74	18.19	PK
4924	35.84	V	33.98	10.22	34.25	45.79	54	8.21	AV
7386	/	/	/	/	/	/	/	/	/
9848	/	/	/	/	/	/	/	/	/
4924	46.19	H	33.98	10.22	34.25	56.14	74	17.86	PK
4924	34.88	H	33.98	10.22	34.25	44.83	54	9.17	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	46.11	V	33.98	10.22	34.25	56.06	74	17.94	PK
4824	35.69	V	33.98	10.22	34.25	45.64	54	8.36	AV
7236	/	/	/	/	/	/	/	/	/
9648	/	/	/	/	/	/	/	/	/
4824	46.18	H	33.98	10.22	34.25	56.13	74	17.87	PK
4824	34.71	H	33.98	10.22	34.25	44.66	54	9.34	AV
7236	/	/	/	/	/	/	/	/	/
9648	/	/	/	/	/	/	/	/	/
Test Mode: IEEE 802.11g TX Mid									
4874	46.11	V	33.98	10.22	34.25	56.06	74	17.94	PK
4874	36.16	V	33.98	10.22	34.25	46.11	54	7.89	AV
7311	/	/	/	/	/	/	/	/	/
9748	/	/	/	/	/	/	/	/	/
4874	45.99	H	33.98	10.22	34.25	55.94	74	18.06	PK
4874	34.69	H	33.98	10.22	34.25	44.64	54	9.36	AV
7311	/	/	/	/	/	/	/	/	/
9748	/	/	/	/	/	/	/	/	/
Test Mode: IEEE 802.11g TX High									
4924	46.61	V	33.98	10.22	34.25	56.56	74	17.44	PK
4924	35.86	V	33.98	10.22	34.25	45.81	54	8.19	AV
7386	/	/	/	/	/	/	/	/	/
9848	/	/	/	/	/	/	/	/	/
4924	46.35	H	33.98	10.22	34.25	56.30	74	17.70	PK
4924	34.76	H	33.98	10.22	34.25	44.71	54	9.29	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 ModeIEEE 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	45.90	V	33.98	10.22	34.25	55.85	74	18.15	PK
4824	35.87	V	33.98	10.22	34.25	45.82	54	8.18	AV
7236	/	/	/	/	/	/	/	/	/
9648	/	/	/	/	/	/	/	/	/
4824	45.98	H	33.98	10.22	34.25	55.93	74	18.07	PK
4824	34.58	H	33.98	10.22	34.25	44.53	54	9.47	AV
7236	/	/	/	/	/	/	/	/	/
9648	/	/	/	/	/	/	/	/	/
Test Mode:IEEE 802.11n HT20 TX Mid									
4874	45.74	V	33.98	10.22	34.25	55.69	74	18.31	PK
4874	35.58	V	33.98	10.22	34.25	45.53	54	8.47	AV
7311	/	/	/	/	/	/	/	/	/
9748	/	/	/	/	/	/	/	/	/
4874	46.72	H	33.98	10.22	34.25	56.67	74	17.33	PK
4874	34.97	H	33.98	10.22	34.25	44.92	54	9.08	AV
7311	/	/	/	/	/	/	/	/	/
9748	/	/	/	/	/	/	/	/	/
Test Mode:IEEE 802.11n HT20 TX High									
4924	46.50	V	33.98	10.22	34.25	56.45	74	17.55	PK
4924	35.80	V	33.98	10.22	34.25	45.75	54	8.25	AV
7386	/	/	/	/	/	/	/	/	/
9848	/	/	/	/	/	/	/	/	/
4924	46.34	H	33.98	10.22	34.25	56.29	74	17.71	PK
4924	34.71	H	33.98	10.22	34.25	44.66	54	9.34	AV
7386	/	/	/	/	/	/	/	/	/
9848	/	/	/	/	/	/	/	/	/

Note:

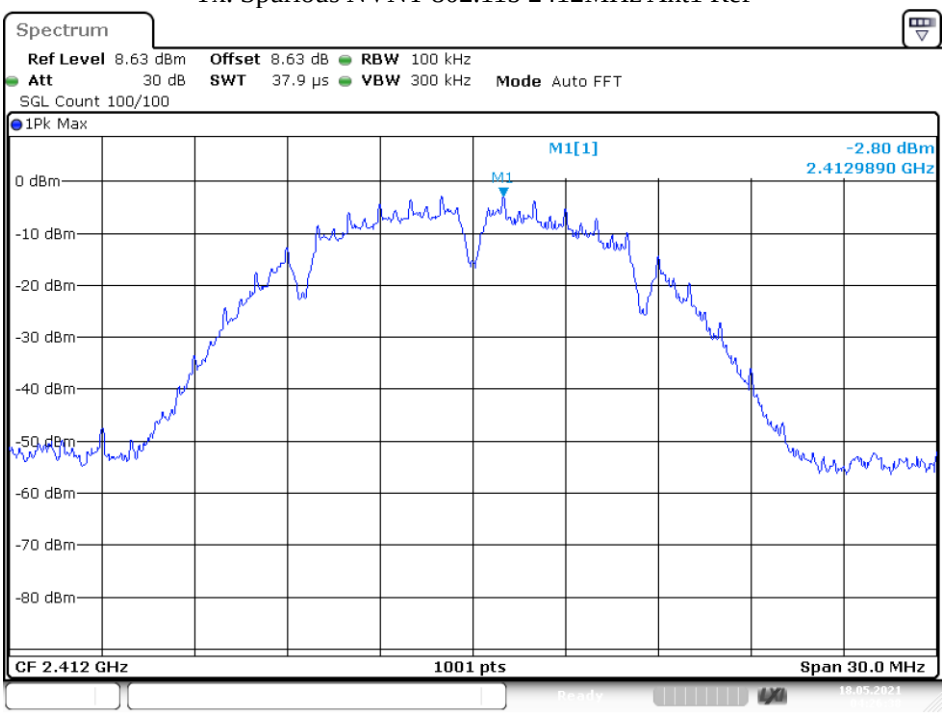
1, Result = Read level + Antenna factor + cable loss-Amp factor

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

Conducted RF Spurious Emission

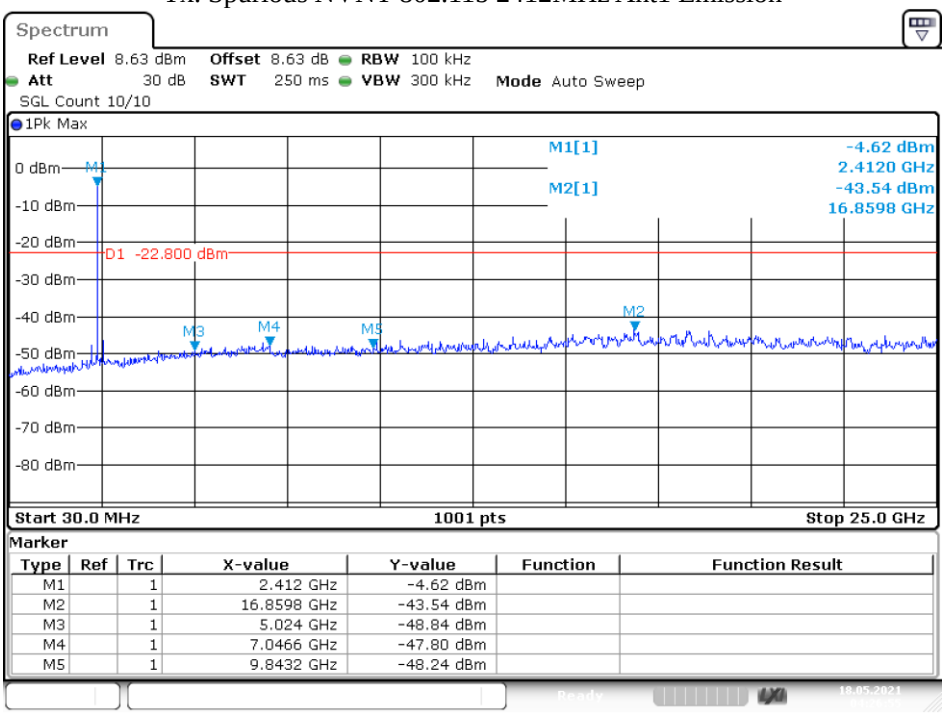
Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	802.11b	2412	Ant 1	-40.73030641556	-20	Pass
NVNT	802.11b	2437	Ant 1	-45.20521969795	-20	Pass
NVNT	802.11b	2462	Ant 1	-45.37811435223	-20	Pass
NVNT	802.11g	2412	Ant 1	-43.15071519136	-20	Pass
NVNT	802.11g	2437	Ant 1	-44.69240292072	-20	Pass
NVNT	802.11g	2462	Ant 1	-42.53864518642	-20	Pass
NVNT	802.11n(HT20)	2412	Ant 1	-43.41018697381	-20	Pass
NVNT	802.11n(HT20)	2437	Ant 1	-44.64677903175	-20	Pass
NVNT	802.11n(HT20)	2462	Ant 1	-42.21497329473	-20	Pass

Tx. Spurious NVNT 802.11b 2412MHz Ant1 Ref



Date: 18.MAY.2021 04:26:38

Tx. Spurious NVNT 802.11b 2412MHz Ant1 Emission

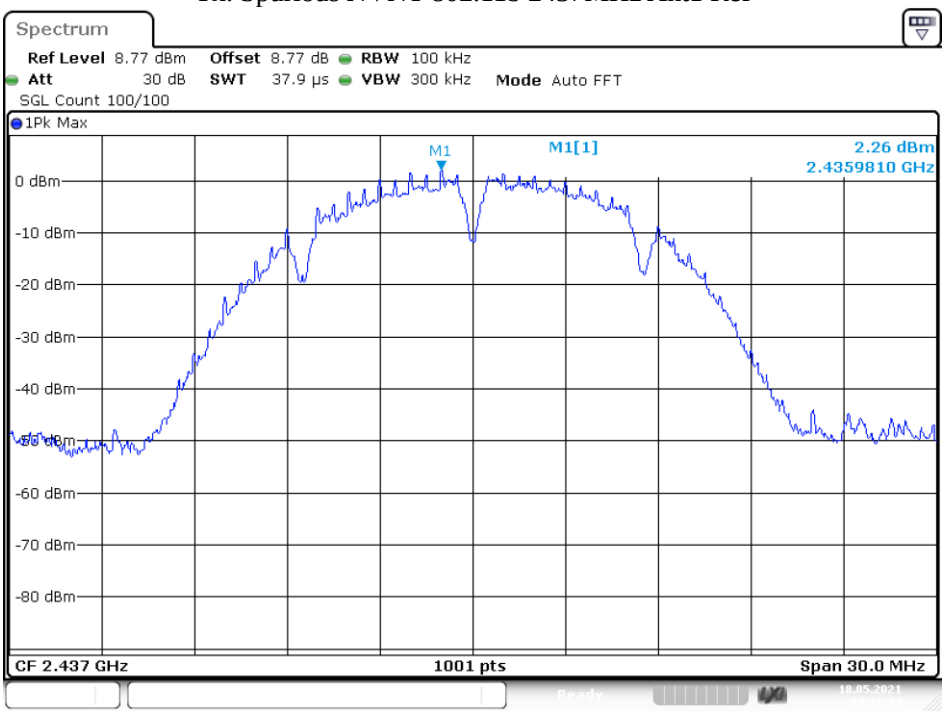


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.412 GHz	-4.62 dBm		
M2		1	16.8598 GHz	-43.54 dBm		
M3		1	5.024 GHz	-48.84 dBm		
M4		1	7.0466 GHz	-47.80 dBm		
M5		1	9.8432 GHz	-48.24 dBm		

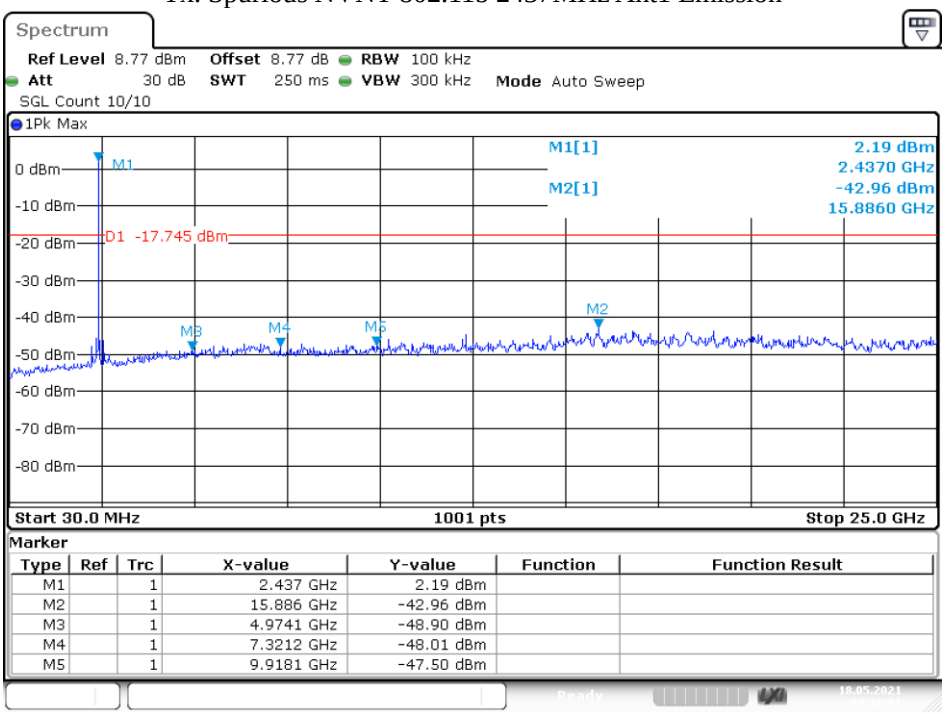
Date: 18.MAY.2021 04:26:55

Tx. Spurious NVNT 802.11b 2437MHz Ant1 Ref



Date: 18.MAY.2021 04:37:45

Tx. Spurious NVNT 802.11b 2437MHz Ant1 Emission

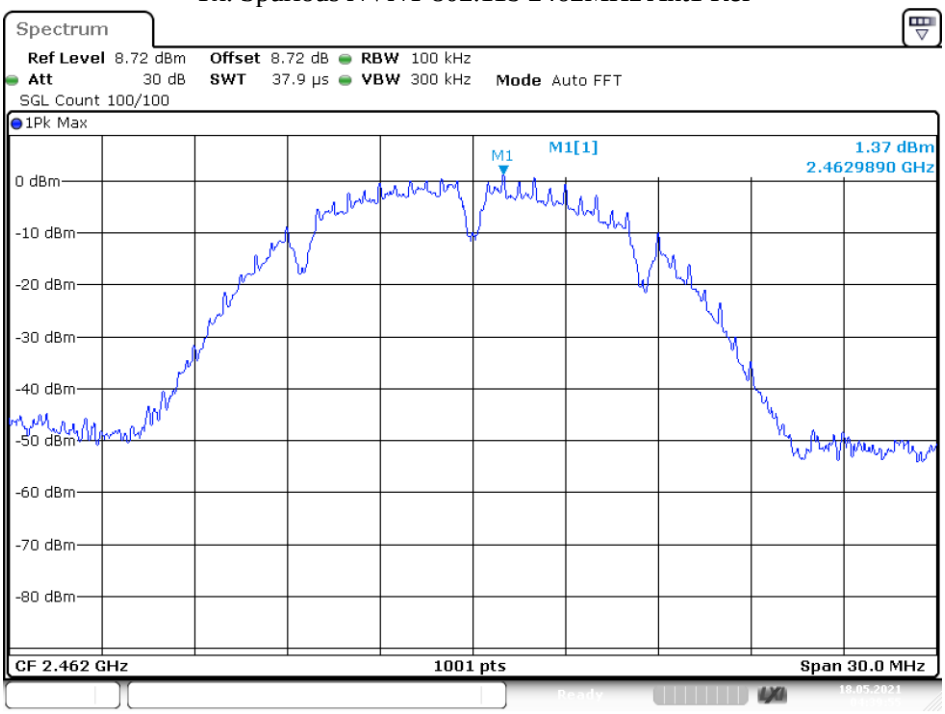


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.437 GHz	2.19 dBm		
M2		1	15.886 GHz	-42.96 dBm		
M3		1	4.9741 GHz	-48.90 dBm		
M4		1	7.3212 GHz	-48.01 dBm		
M5		1	9.9181 GHz	-47.50 dBm		

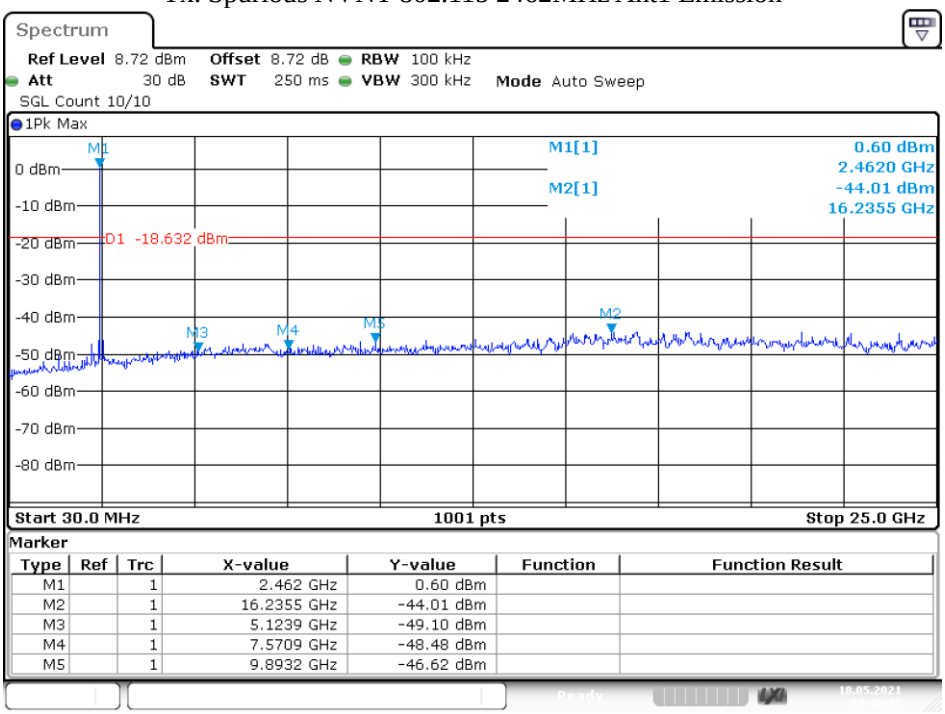
Date: 18.MAY.2021 04:38:02

Tx. Spurious NVNT 802.11b 2462MHz Ant1 Ref



Date: 18.MAY.2021 04:39:55

Tx. Spurious NVNT 802.11b 2462MHz Ant1 Emission

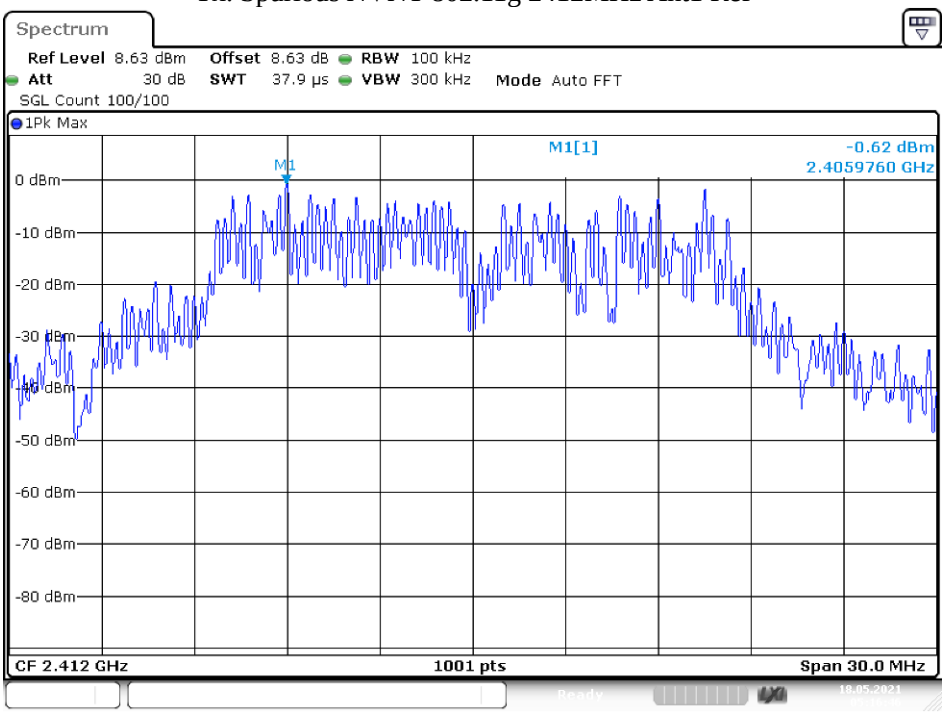


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.462 GHz	0.60 dBm		
M2		1	16.2355 GHz	-44.01 dBm		
M3		1	5.1239 GHz	-49.10 dBm		
M4		1	7.5709 GHz	-48.48 dBm		
M5		1	9.8932 GHz	-46.62 dBm		

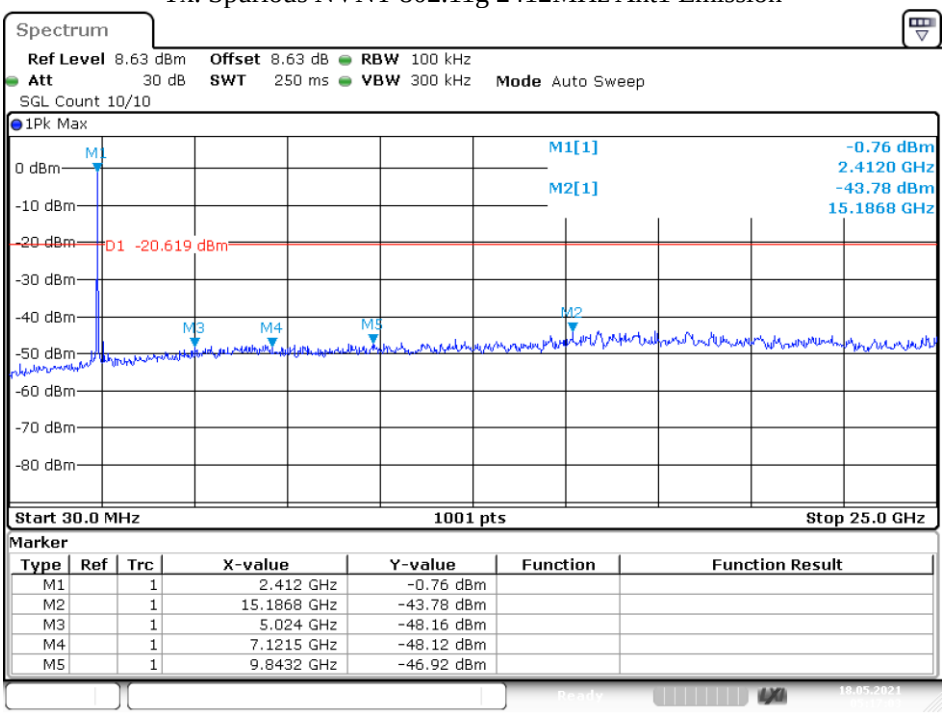
Date: 18.MAY.2021 04:40:12

Tx. Spurious NVNT 802.11g 2412MHz Ant1 Ref



Date: 18.MAY.2021 05:16:46

Tx. Spurious NVNT 802.11g 2412MHz Ant1 Emission

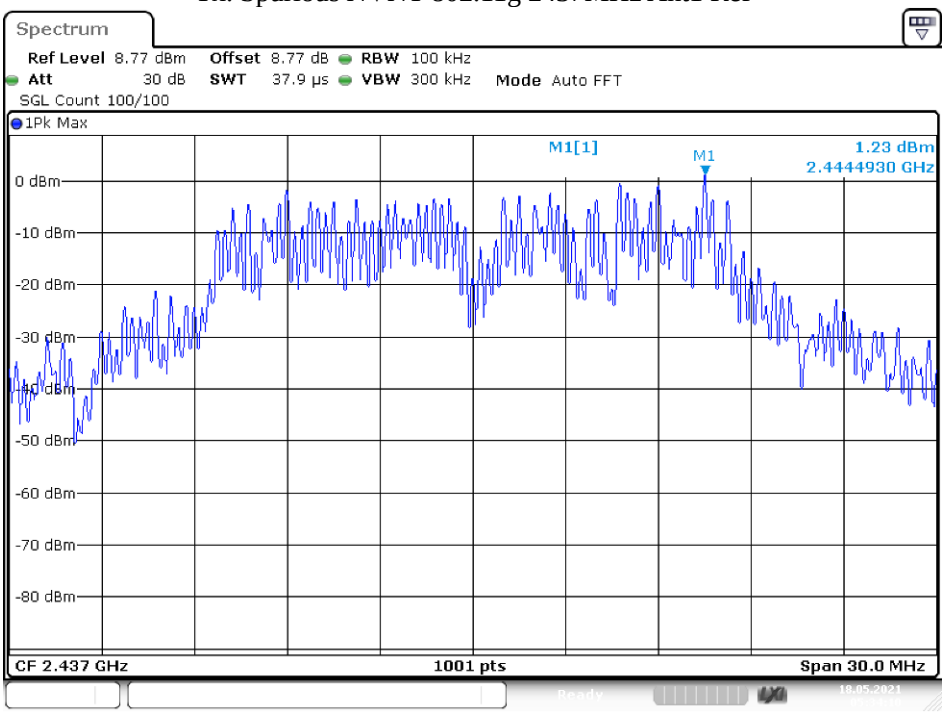


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.412 GHz	-0.76 dBm		
M2		1	15.1868 GHz	-43.78 dBm		
M3		1	5.024 GHz	-48.16 dBm		
M4		1	7.1215 GHz	-48.12 dBm		
M5		1	9.8432 GHz	-46.92 dBm		

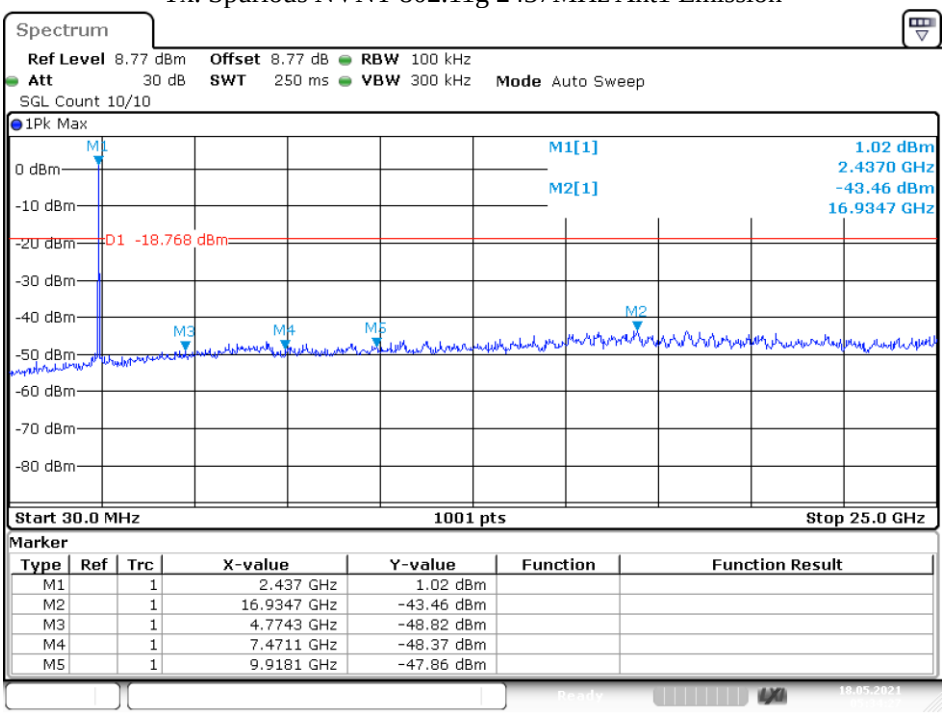
Date: 18.MAY.2021 05:17:02

Tx. Spurious NVNT 802.11g 2437MHz Ant1 Ref



Date: 18.MAY.2021 05:34:10

Tx. Spurious NVNT 802.11g 2437MHz Ant1 Emission

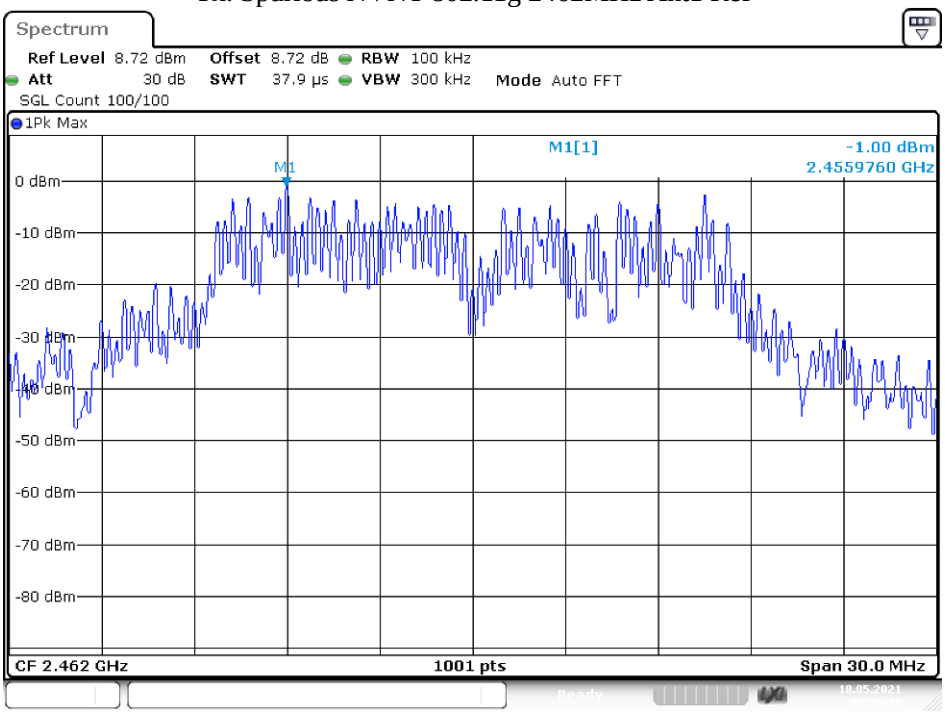


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.437 GHz	1.02 dBm		
M2		1	16.9347 GHz	-43.46 dBm		
M3		1	4.7743 GHz	-48.82 dBm		
M4		1	7.4711 GHz	-48.37 dBm		
M5		1	9.9181 GHz	-47.86 dBm		

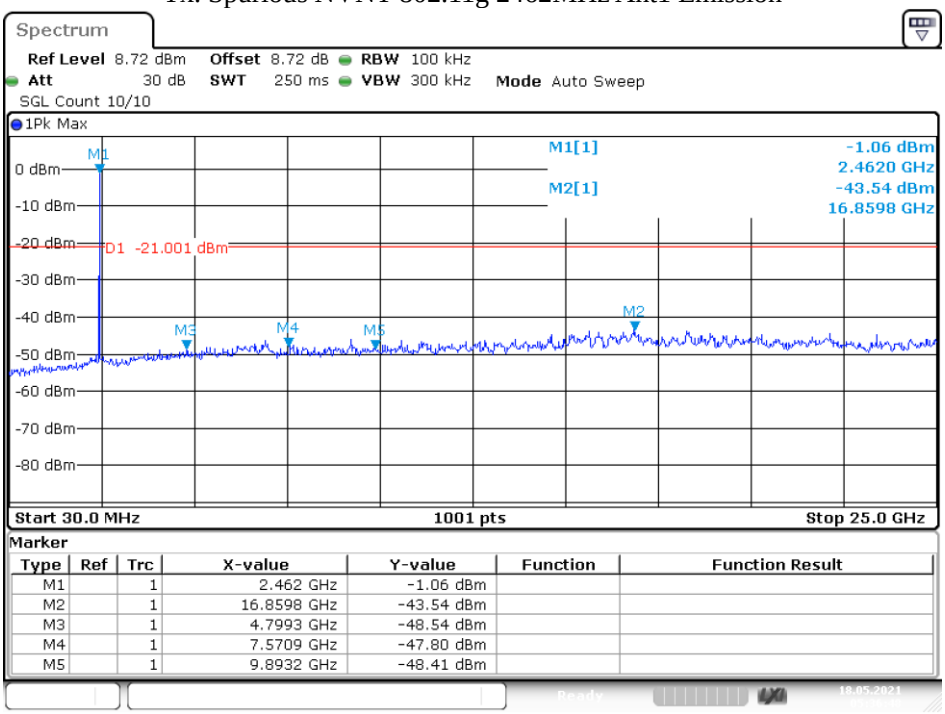
Date: 18.MAY.2021 05:34:27

Tx. Spurious NVNT 802.11g 2462MHz Ant1 Ref



Date: 18.MAY.2021 05:36:31

Tx. Spurious NVNT 802.11g 2462MHz Ant1 Emission

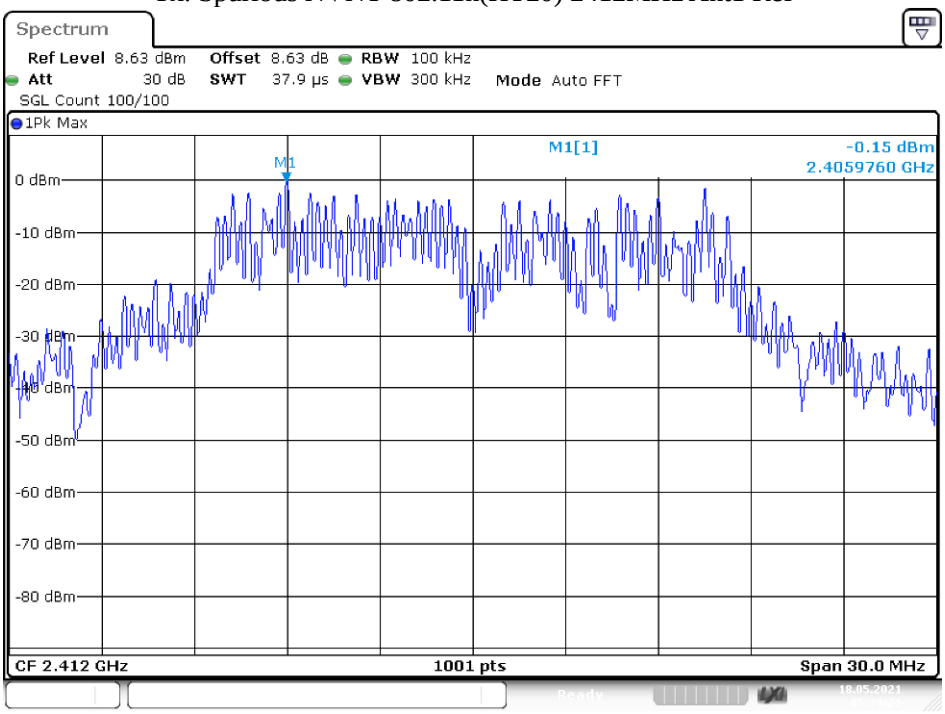


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.462 GHz	-1.06 dBm		
M2		1	16.8598 GHz	-43.54 dBm		
M3		1	4.7993 GHz	-48.54 dBm		
M4		1	7.5709 GHz	-47.80 dBm		
M5		1	9.8932 GHz	-48.41 dBm		

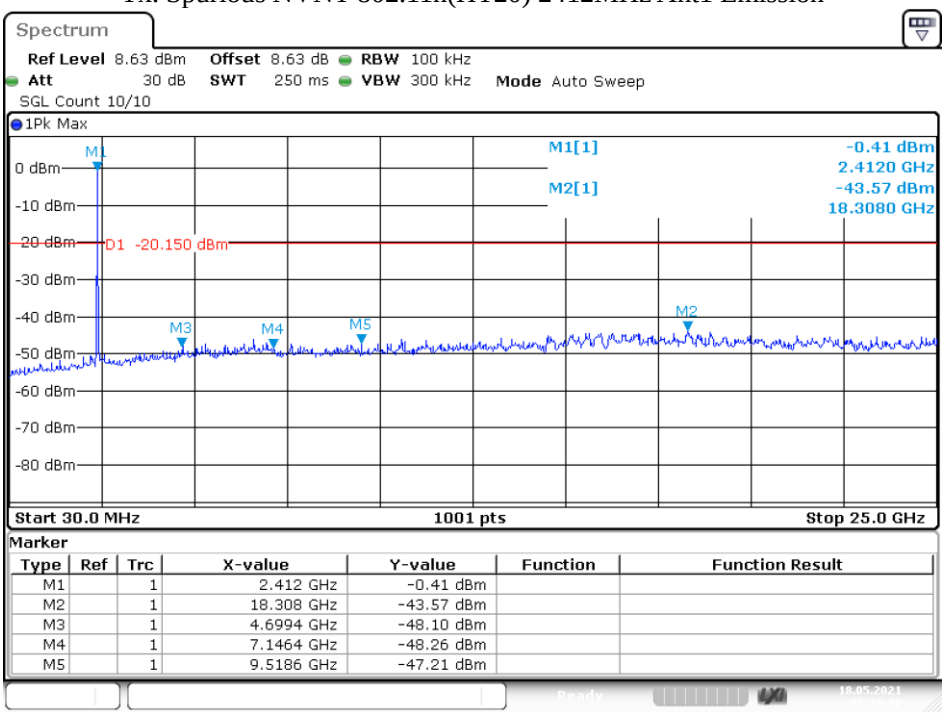
Date: 18.MAY.2021 05:36:48

Tx. Spurious NVNT 802.11n(HT20) 2412MHz Ant1 Ref



Date: 18.MAY.2021 05:39:21

Tx. Spurious NVNT 802.11n(HT20) 2412MHz Ant1 Emission

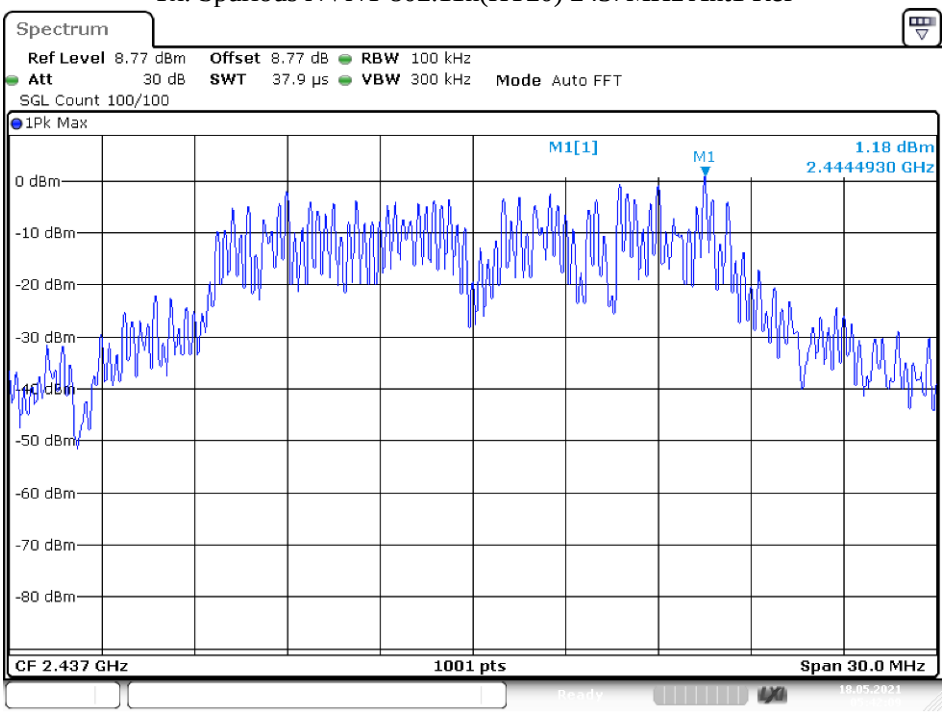


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.412 GHz	-0.41 dBm		
M2		1	18.308 GHz	-43.57 dBm		
M3		1	4.6994 GHz	-48.10 dBm		
M4		1	7.1464 GHz	-48.26 dBm		
M5		1	9.5186 GHz	-47.21 dBm		

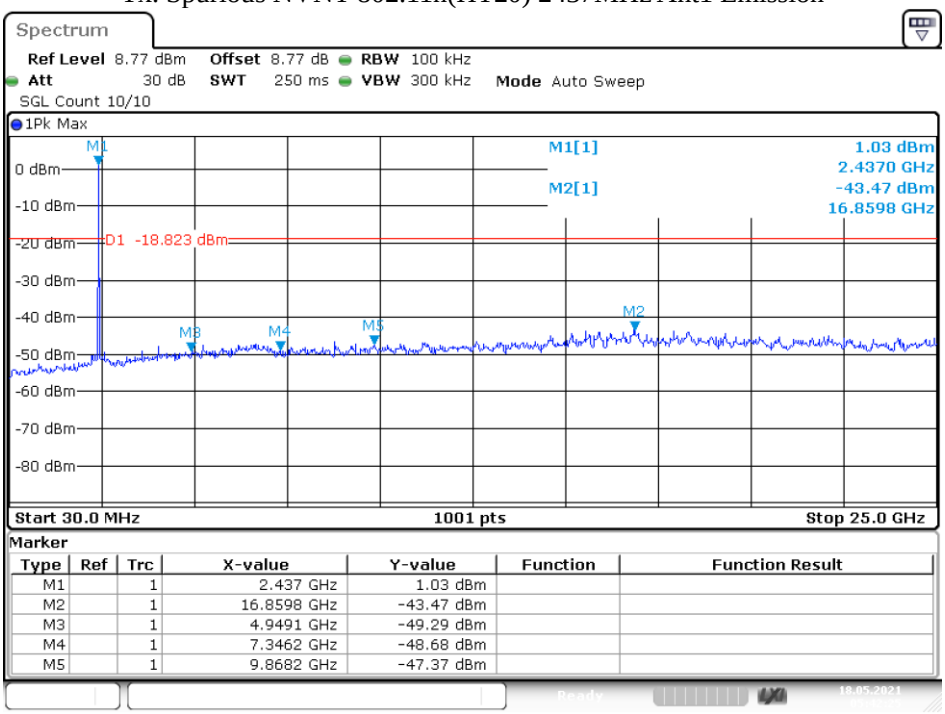
Date: 18.MAY.2021 05:39:38

Tx. Spurious NVNT 802.11n(HT20) 2437MHz Ant1 Ref



Date: 18.MAY.2021 05:42:09

Tx. Spurious NVNT 802.11n(HT20) 2437MHz Ant1 Emission

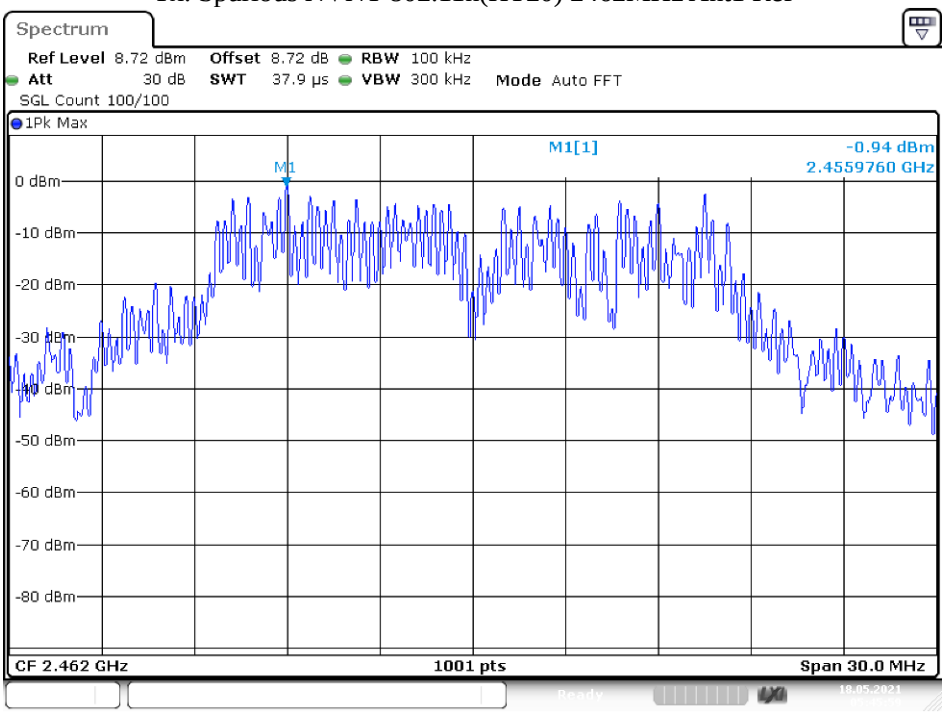


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.437 GHz	1.03 dBm		
M2		1	16.8598 GHz	-43.47 dBm		
M3		1	4.9491 GHz	-49.29 dBm		
M4		1	7.3462 GHz	-48.68 dBm		
M5		1	9.8682 GHz	-47.37 dBm		

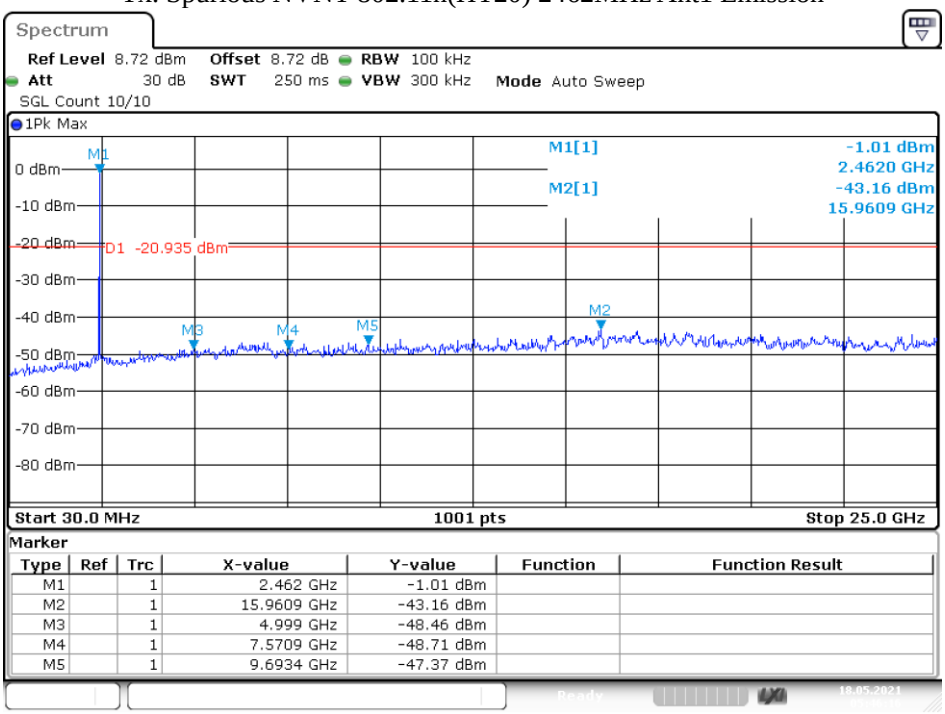
Date: 18.MAY.2021 05:42:26

Tx. Spurious NVNT 802.11n(HT20) 2462MHz Ant1 Ref



Date: 18.MAY.2021 05:45:58

Tx. Spurious NVNT 802.11n(HT20) 2462MHz Ant1 Emission



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.462 GHz	-1.01 dBm		
M2		1	15.9609 GHz	-43.16 dBm		
M3		1	4.999 GHz	-48.46 dBm		
M4		1	7.5709 GHz	-48.71 dBm		
M5		1	9.6934 GHz	-47.37 dBm		

Date: 18.MAY.2021 05:46:15

4. POWER LINE CONDUCTED EMISSION

4.1. Test Limits

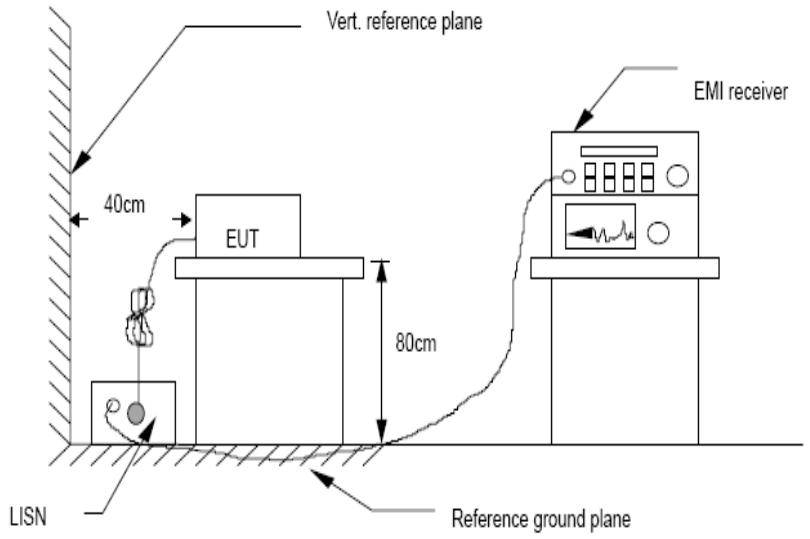
Frequency	Limits dB(μV)	
MHz	Quasi-peak Level	Average Level
0.15 -0.50	66 -56*	56 - 46*
0.50 -5.00	56	46
5.00 -30.00	60	50

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 rang 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

The EUT is battery powered, not applicable.

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

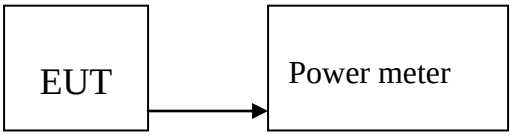
5.2.1 Place the EUT on the table and set it in transmitting mode.

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.

5.3.Test Setup



5.4.Test Results

PASS

Detailed information please see the following page.

Mode	Frequency (MHz)	PK Output power(dBm)	Limit (dBm)	Result
IEEE 802.11 b	CH1: 2412	15.899	30	PASS
	CH6: 2437	14.661	30	PASS
	CH11: 2462	13.215	30	PASS
IEEE 802.11 g	CH1: 2412	16.224	30	PASS
	CH6: 2437	**17.004**	30	PASS
	CH11: 2462	15.573	30	PASS
IEEE 802.11 n/HT20	CH1: 2412	16.624	30	PASS
	CH6: 2437	16.876	30	PASS
	CH11: 2462	15.659	30	PASS

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.

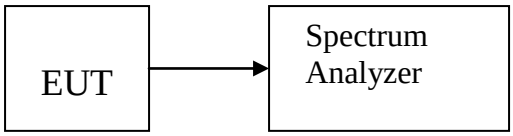
6.2.2 Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

6.2.3 Set the spectrum analyzer as RBW = 3kHz(Set the RBW to: 3 kHz≤RBW≤100 kHz.), VBW = 10kHz(Set the VBW≥3×RBW), span≥1.5×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.

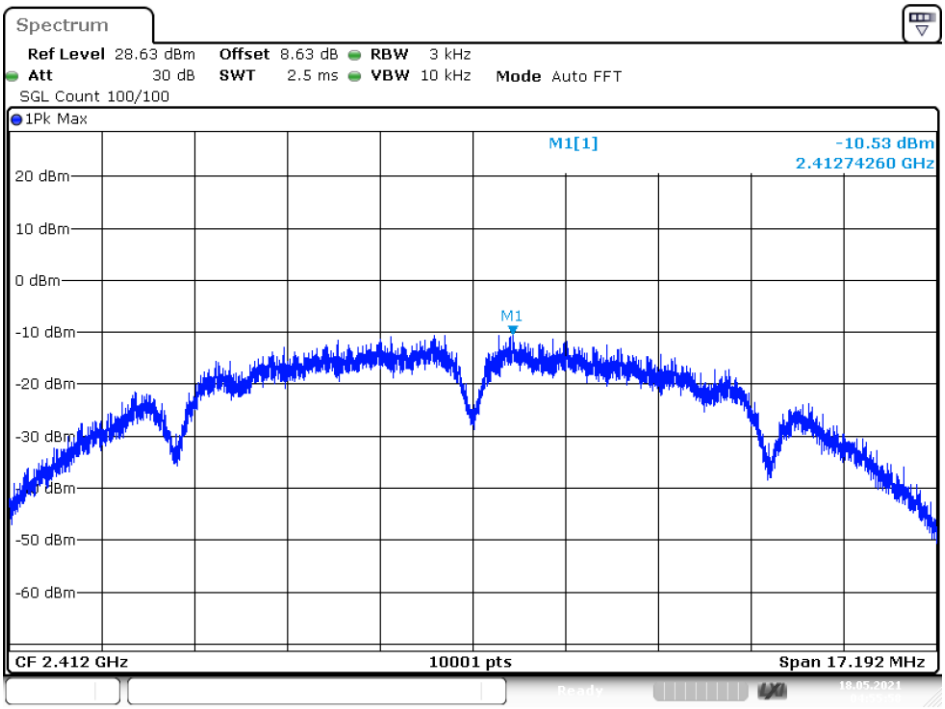
6.3.Test Setup



6.4.Test Results

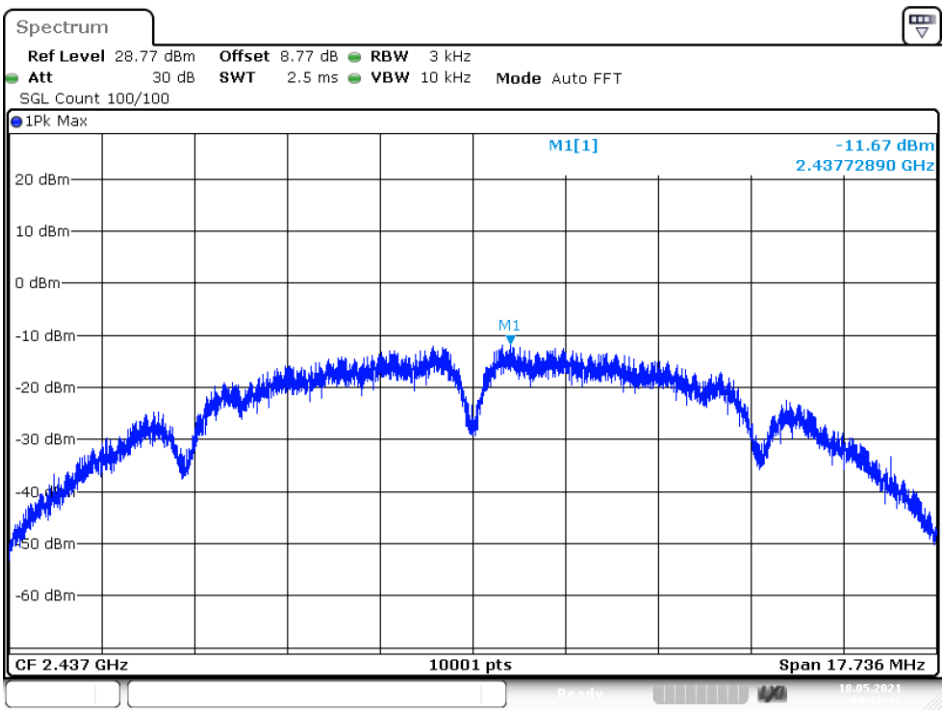
Condition	Mode	Frequency (MHz)	Antenna	Max PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
NVNT	802.11b	2412	Ant 1	-10.528	8	Pass
NVNT	802.11b	2437	Ant 1	-11.666	8	Pass
NVNT	802.11b	2462	Ant 1	-13.235	8	Pass
NVNT	802.11g	2412	Ant 1	4.928	8	Pass
NVNT	802.11g	2437	Ant 1	1.01	8	Pass
NVNT	802.11g	2462	Ant 1	-1.48	8	Pass
NVNT	802.11n(HT20)	2412	Ant 1	-0.457	8	Pass
NVNT	802.11n(HT20)	2437	Ant 1	0.926	8	Pass
NVNT	802.11n(HT20)	2462	Ant 1	-1.408	8	Pass

PSD NVNT 802.11b 2412MHz Ant1



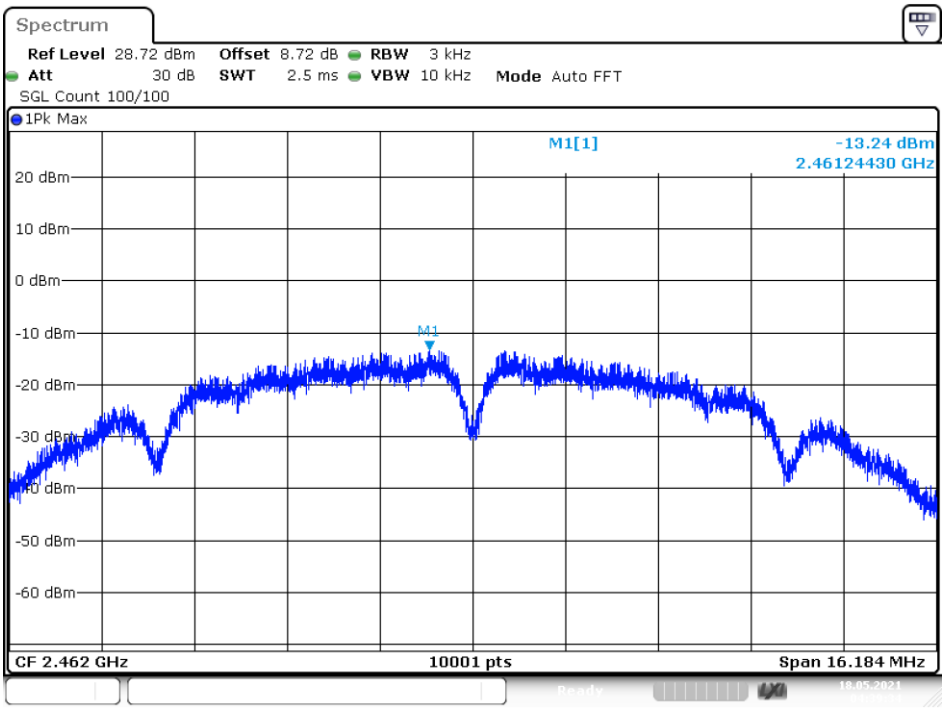
Date: 18.MAY.2021 04:55:59

PSD NVNT 802.11b 2437MHz Ant1



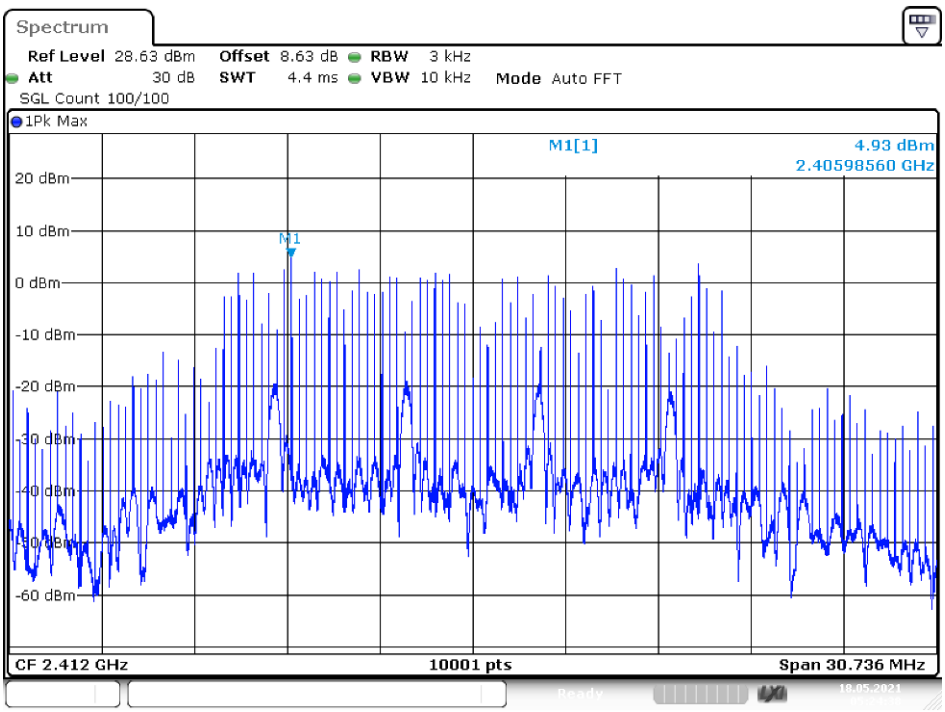
Date: 18.MAY.2021 04:37:37

PSD NVNT 802.11b 2462MHz Ant1



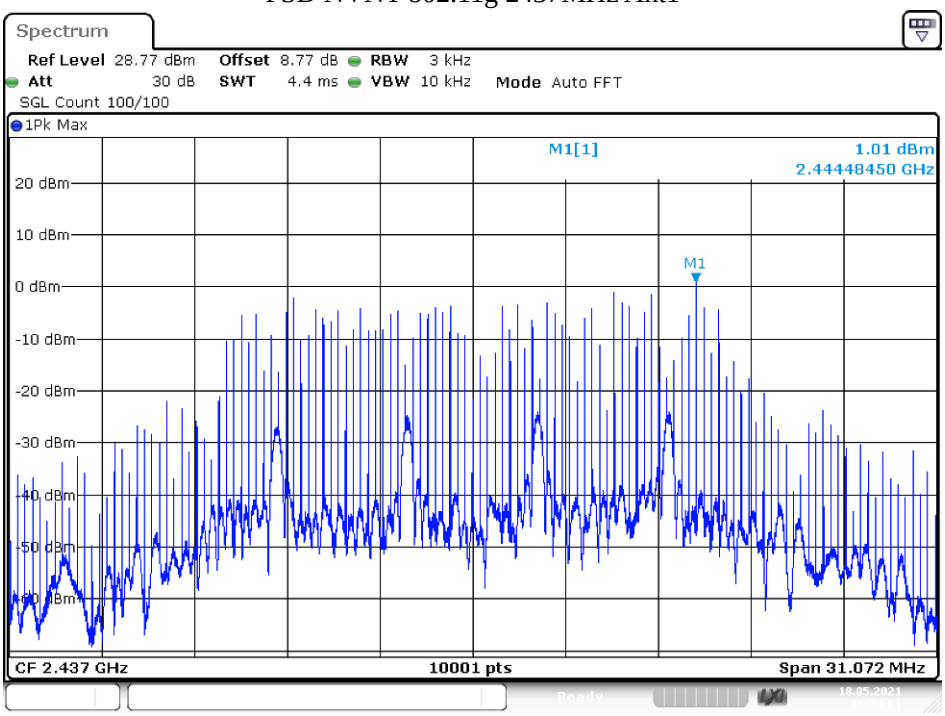
Date: 18.MAY.2021 04:39:33

PSD NVNT 802.11g 2412MHz Ant1



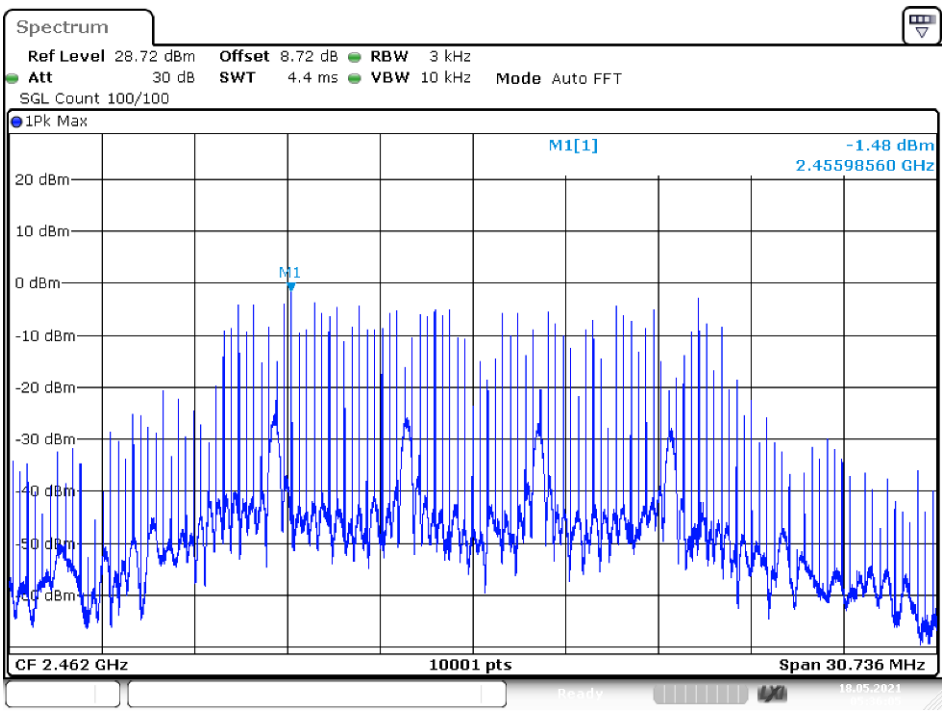
Date: 18.MAY.2021 05:24:37

PSD NVNT 802.11g 2437MHz Ant1



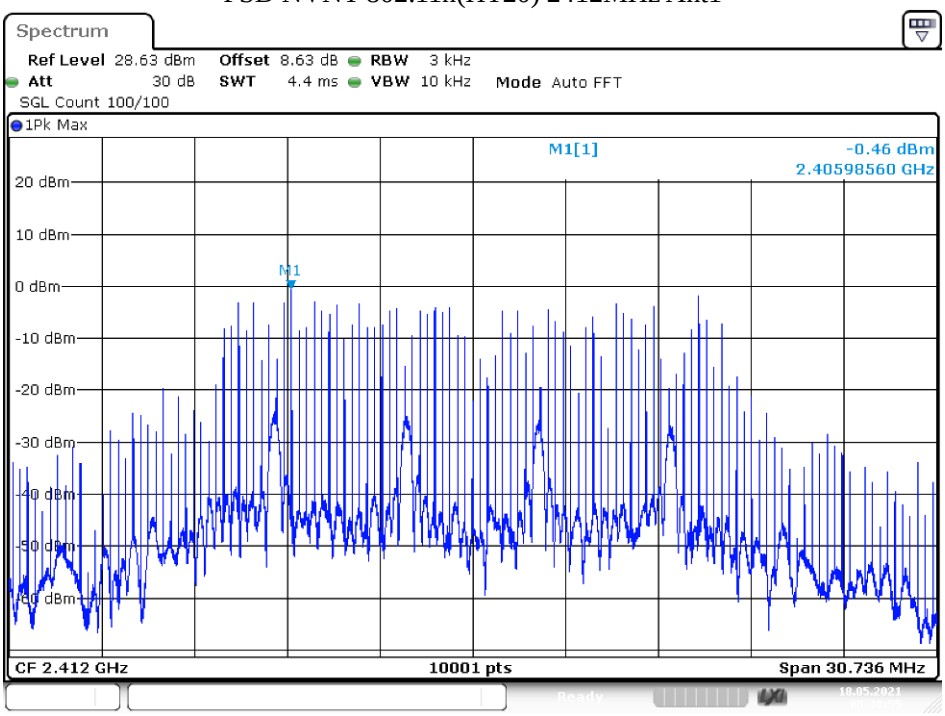
Date: 18.MAY.2021 05:34:01

PSD NVNT 802.11g 2462MHz Ant1



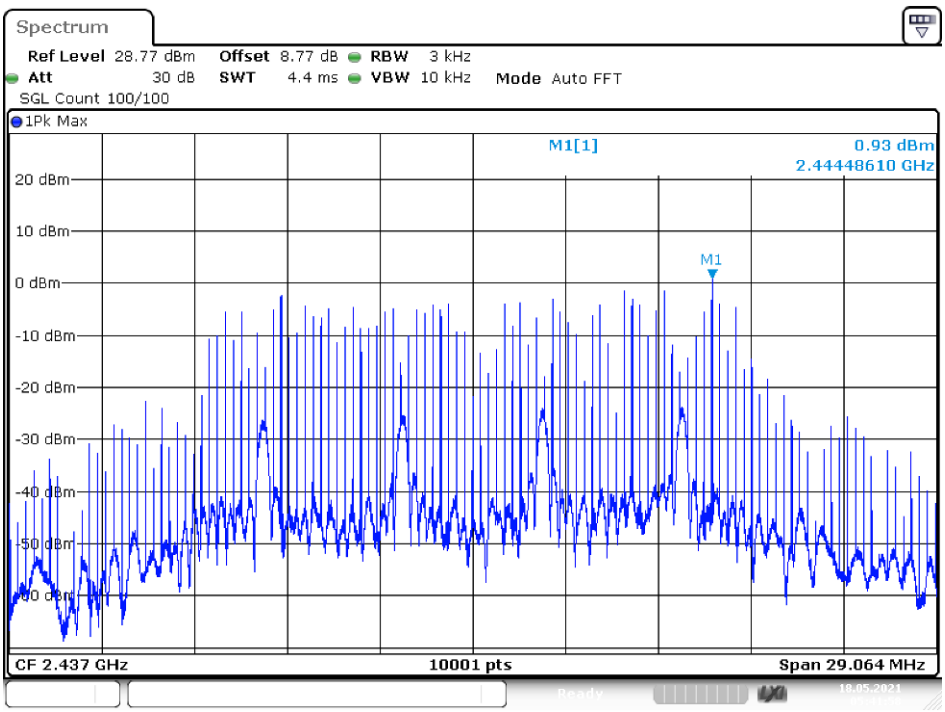
Date: 18.MAY.2021 05:36:05

PSD NVNT 802.11n(HT20) 2412MHz Ant1



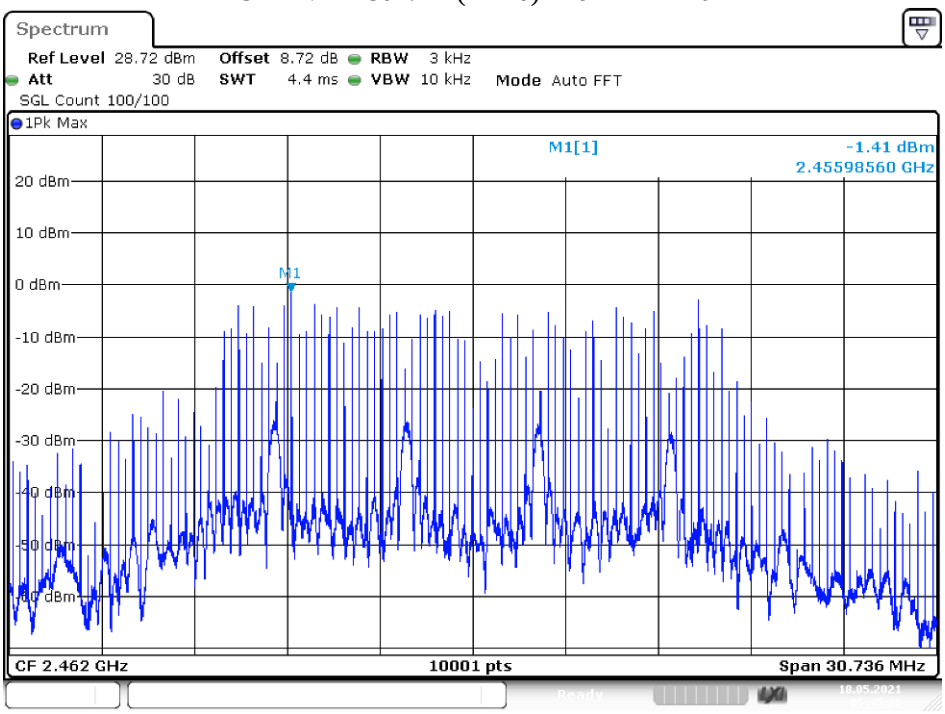
Date: 18.MAY.2021 05:38:54

PSD NVNT 802.11n(HT20) 2437MHz Ant1



Date: 18.MAY.2021 05:41:58

PSD NVNT 802.11n(HT20) 2462MHz Ant1



Date: 18.MAY.2021 05:45:29

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

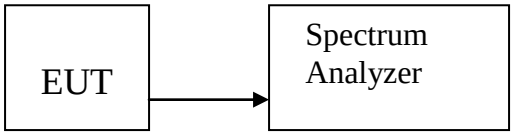
Details see the KDB558074 D01 Meas Guidance v05r02

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 =1-5%BW, VBW≥3*RBW, Sweep time set auto, detail see the test plot for 99% Bandwidth.

c) The test receiver set RBW = 100kHz, VBW≥3*RBW =300kHz, Sweep time set auto, detail see the test plot for 6dB Bandwidth.

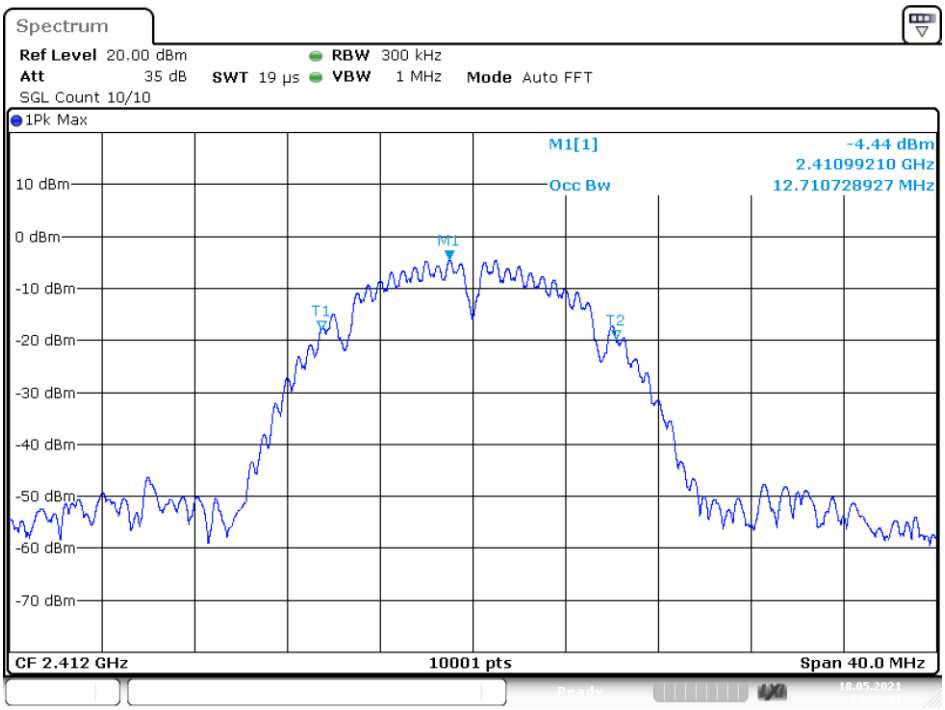
7.3.Test Setup



7.4.Test Results

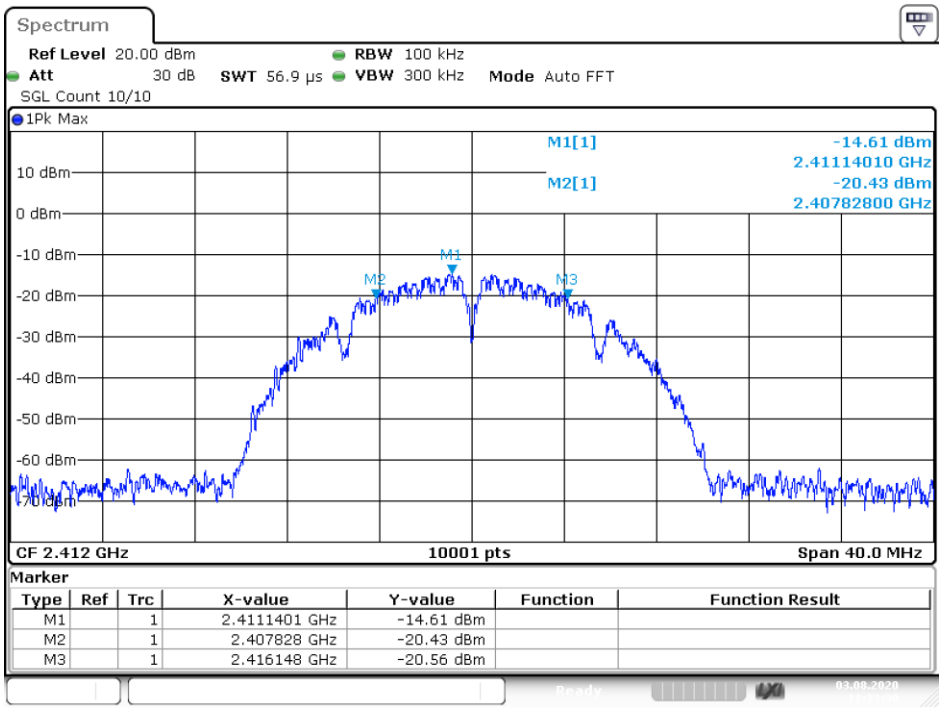
Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)	-6 dB Bandwidth (MHz)	Limit -6 dB Bandwidth (MHz)	Verdict
NVNT	802.11b	2412	Ant 1	12.7107	8.320	0.5	Pass
NVNT	802.11b	2437	Ant 1	12.6747	8.868	0.5	Pass
NVNT	802.11b	2462	Ant 1	12.7147	8.092	0.5	Pass
NVNT	802.11g	2412	Ant 1	16.9183	15.368	0.5	Pass
NVNT	802.11g	2437	Ant 1	17.1823	15.536	0.5	Pass
NVNT	802.11g	2462	Ant 1	16.8743	15.368	0.5	Pass
NVNT	802.11n(HT20)	2412	Ant 1	16.9503	15.368	0.5	Pass
NVNT	802.11n(HT20)	2437	Ant 1	16.9423	14.532	0.5	Pass
NVNT	802.11n(HT20)	2462	Ant 1	17.0623	15.368	0.5	Pass

OBW NVNT 802.11b 2412MHz Ant1



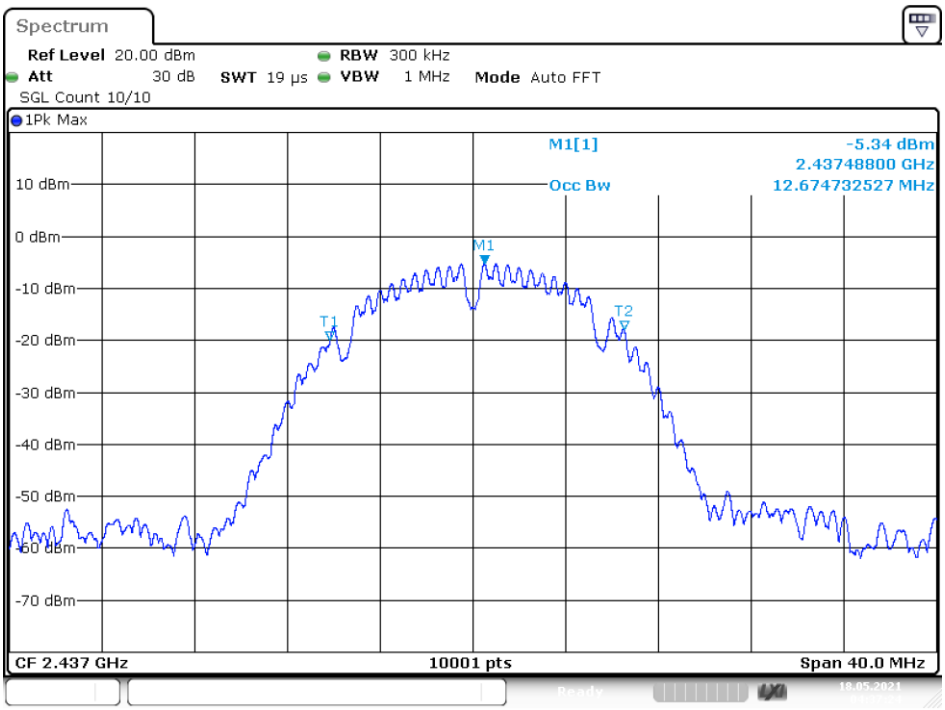
Date: 18.MAY.2021 04:55:41

-6 dB BW NVNT 802.11b 2412MHz Ant1



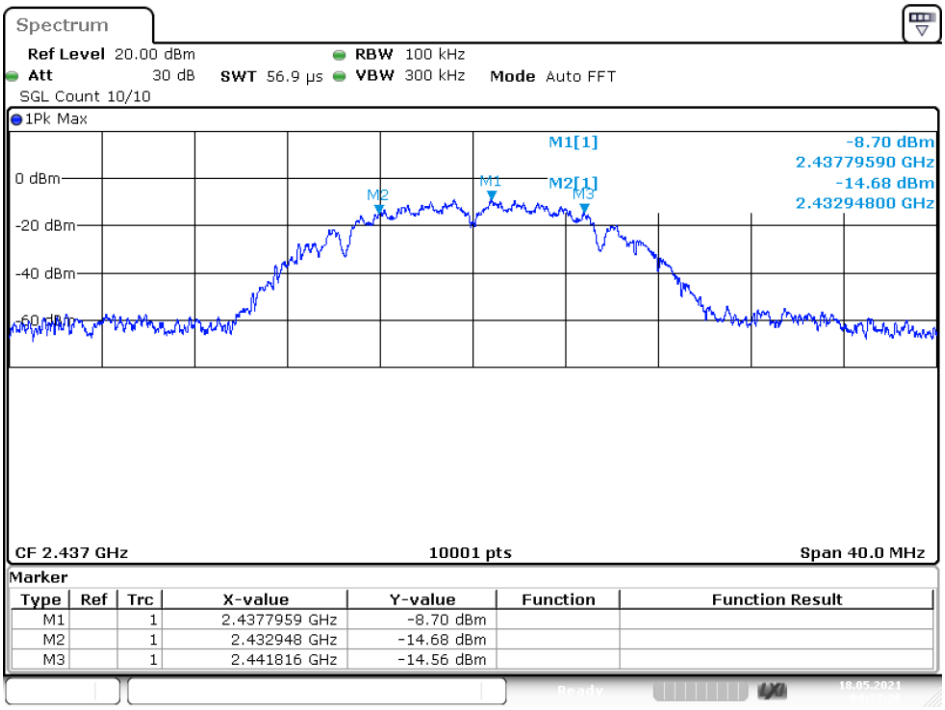
Date: 18.MAY.2021 11:33:31

OBW NVNT 802.11b 2437MHz Ant1



Date: 18.MAY.2021 04:37:24

-6 dB BW NVNT 802.11b 2437MHz Ant1

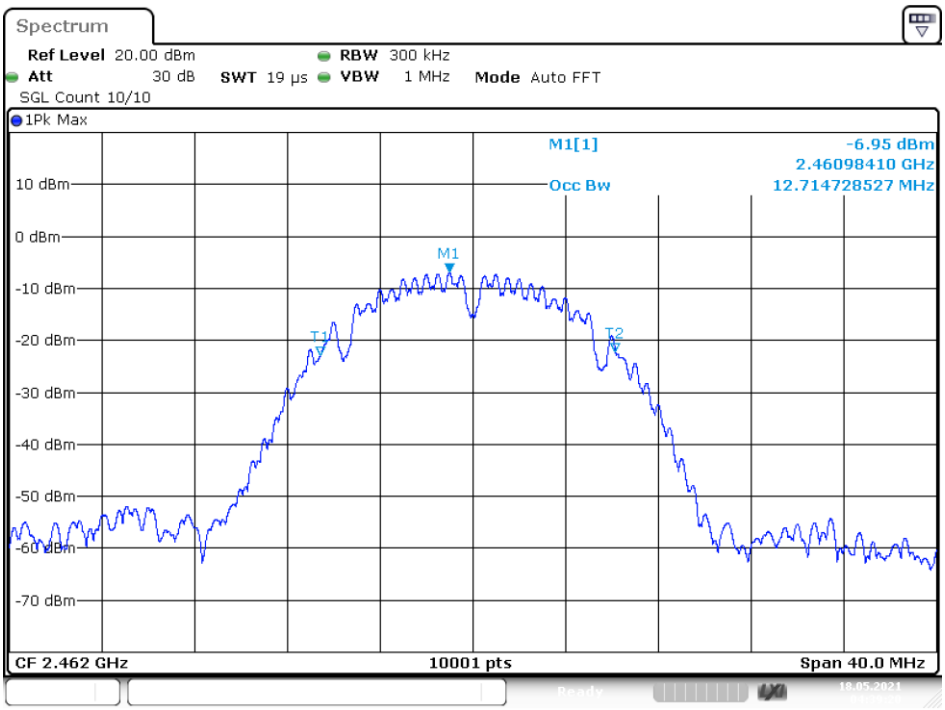


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4377959 GHz	-8.70 dBm		
M2		1	2.432948 GHz	-14.68 dBm		
M3		1	2.441816 GHz	-14.56 dBm		

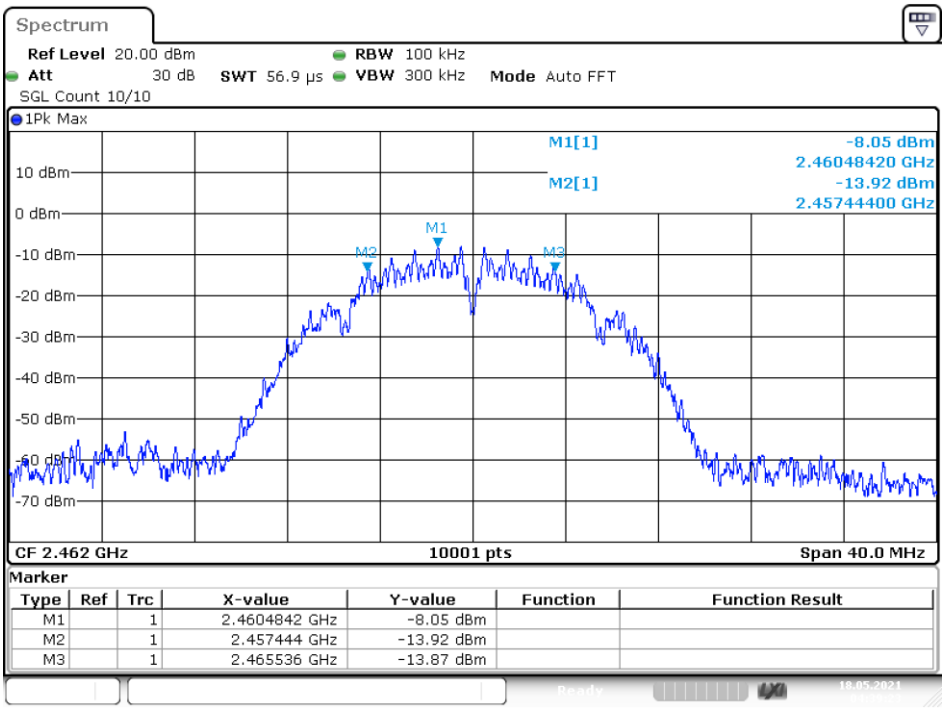
Date: 18.MAY.2021 04:37:27

OBW NVNT 802.11b 2462MHz Ant1



Date: 18.MAY.2021 04:39:20

-6 dB BW NVNT 802.11b 2462MHz Ant1

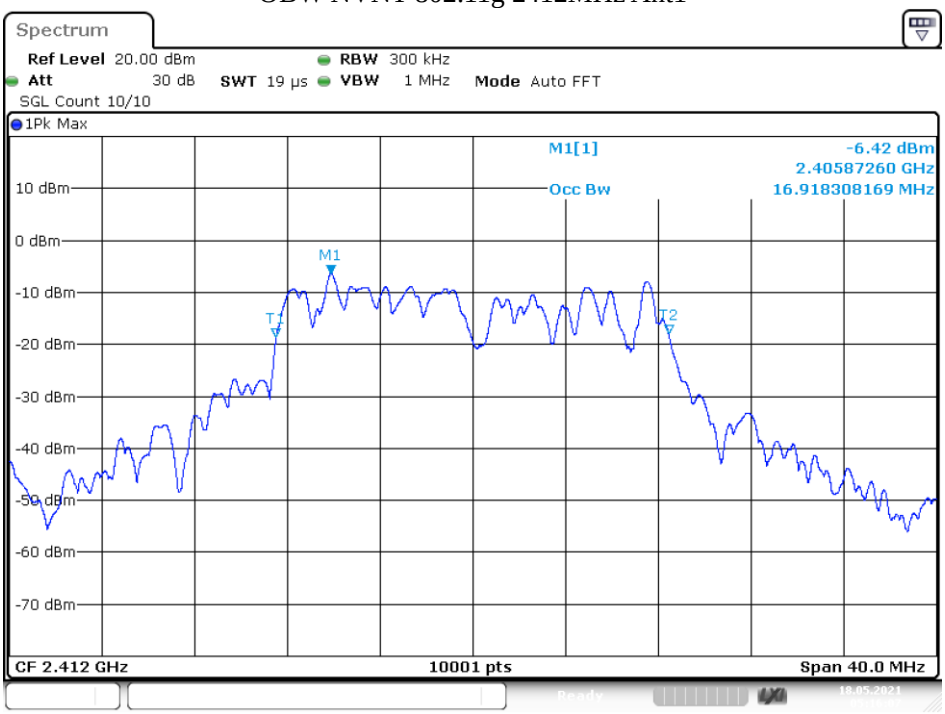


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4604842 GHz	-8.05 dBm		
M2		1	2.457444 GHz	-13.92 dBm		
M3		1	2.465536 GHz	-13.87 dBm		

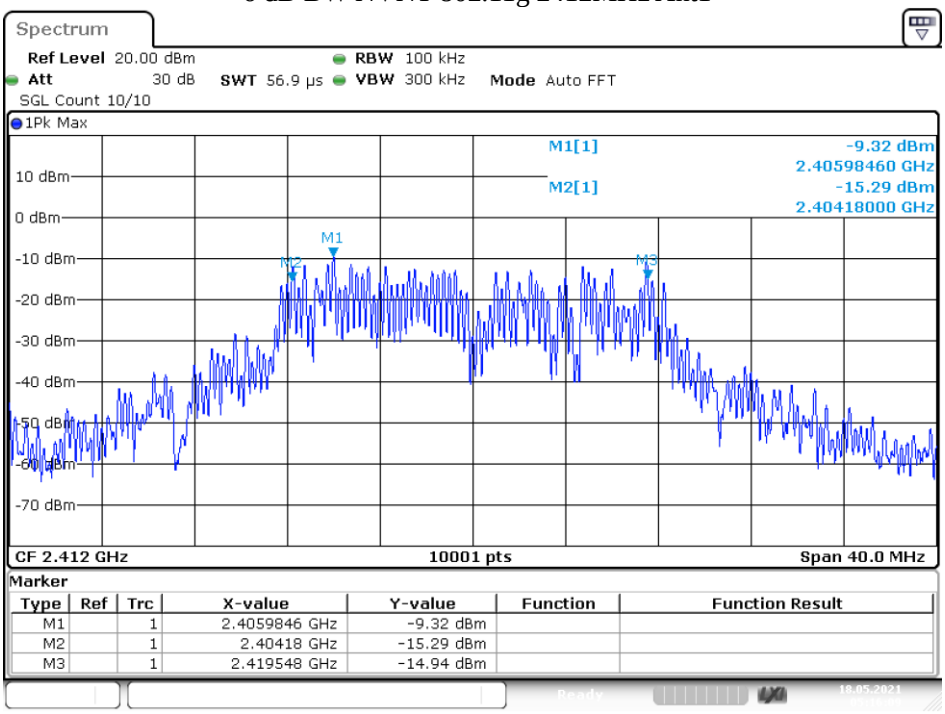
Date: 18.MAY.2021 04:39:23

OBW NVNT 802.11g 2412MHz Ant1



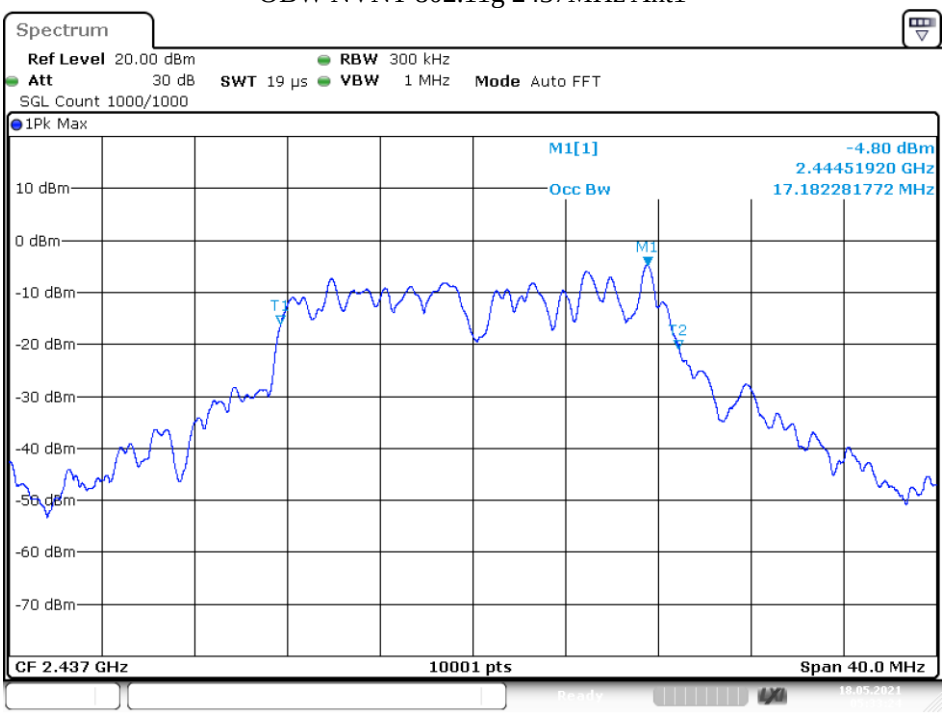
Date: 18.MAY.2021 05:16:07

-6 dB BW NVNT 802.11g 2412MHz Ant1



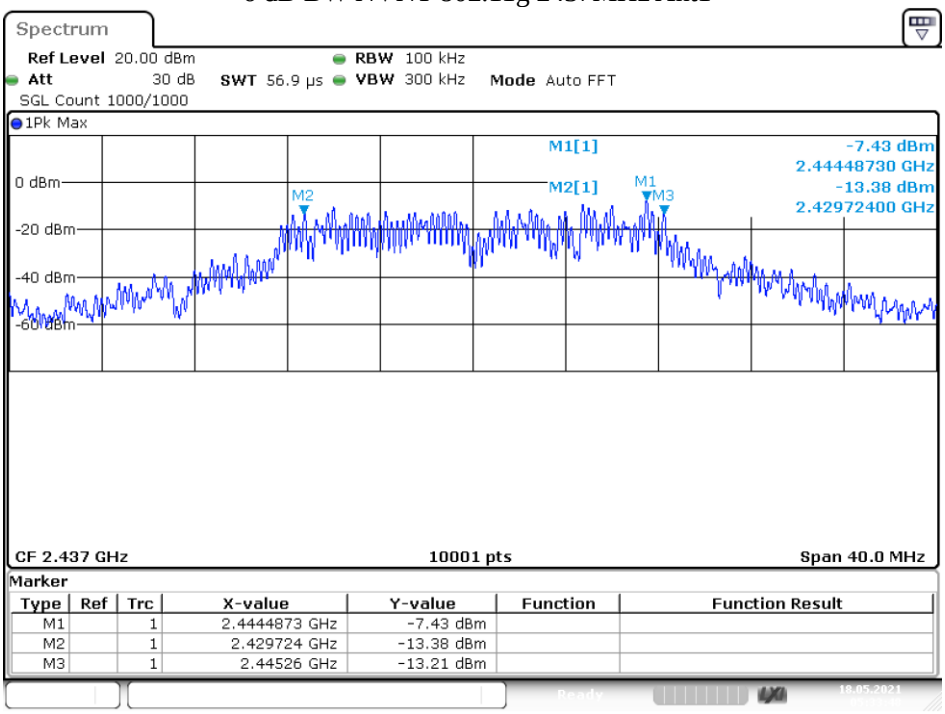
Date: 18.MAY.2021 05:16:09

OBW NVNT 802.11g 2437MHz Ant1



Date: 18.MAY.2021 05:33:25

-6 dB BW NVNT 802.11g 2437MHz Ant1

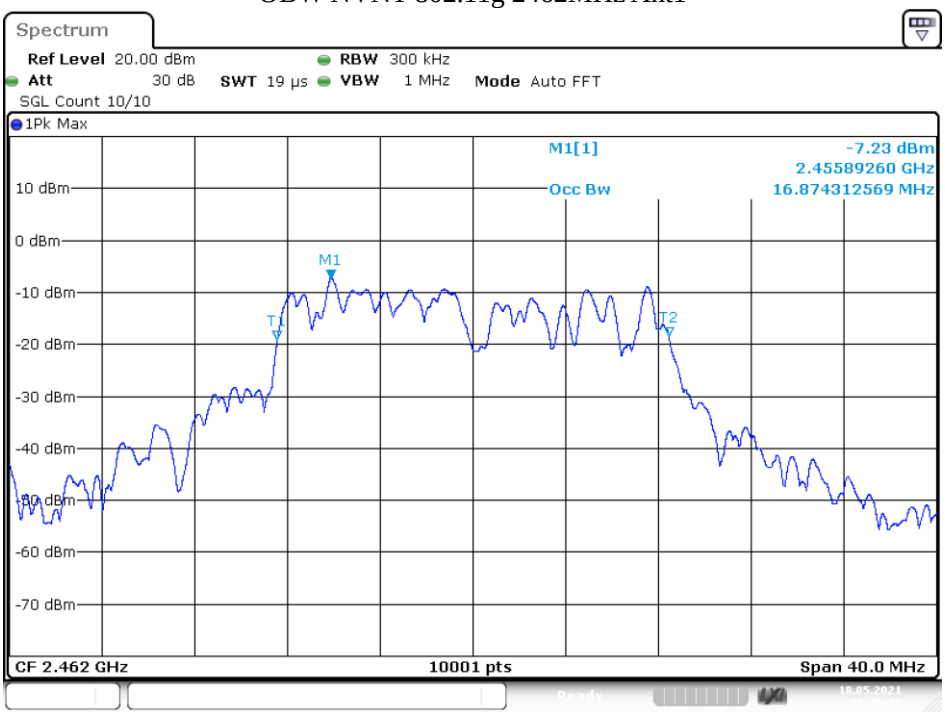


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4444873 GHz	-7.43 dBm		
M2		1	2.429724 GHz	-13.38 dBm		
M3		1	2.44526 GHz	-13.21 dBm		

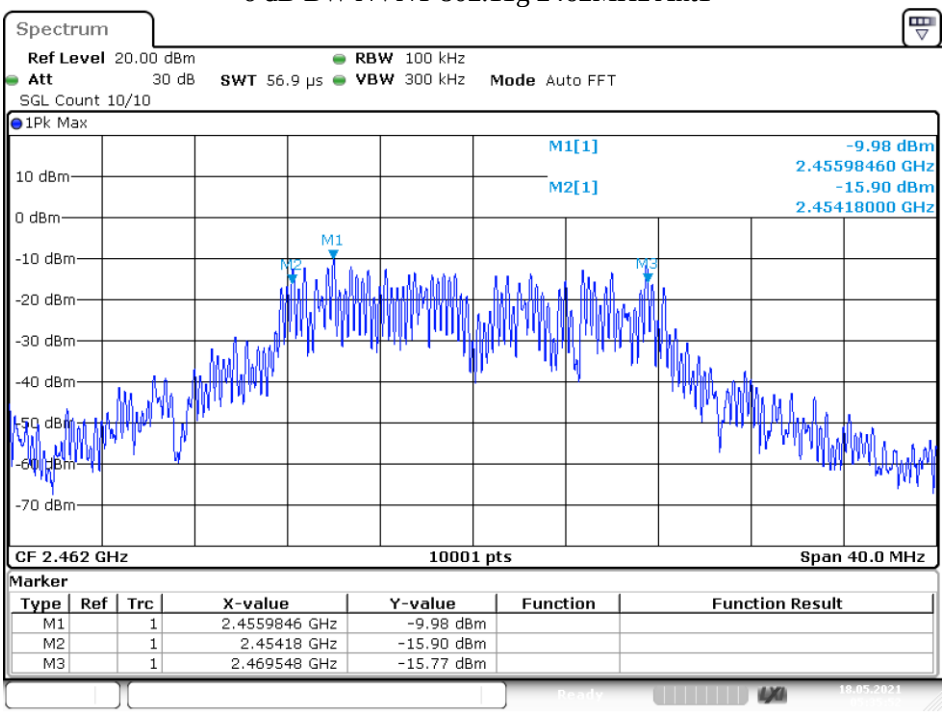
Date: 18.MAY.2021 05:33:47

OBW NVNT 802.11g 2462MHz Ant1



Date: 18.MAY.2021 05:35:49

-6 dB BW NVNT 802.11g 2462MHz Ant1

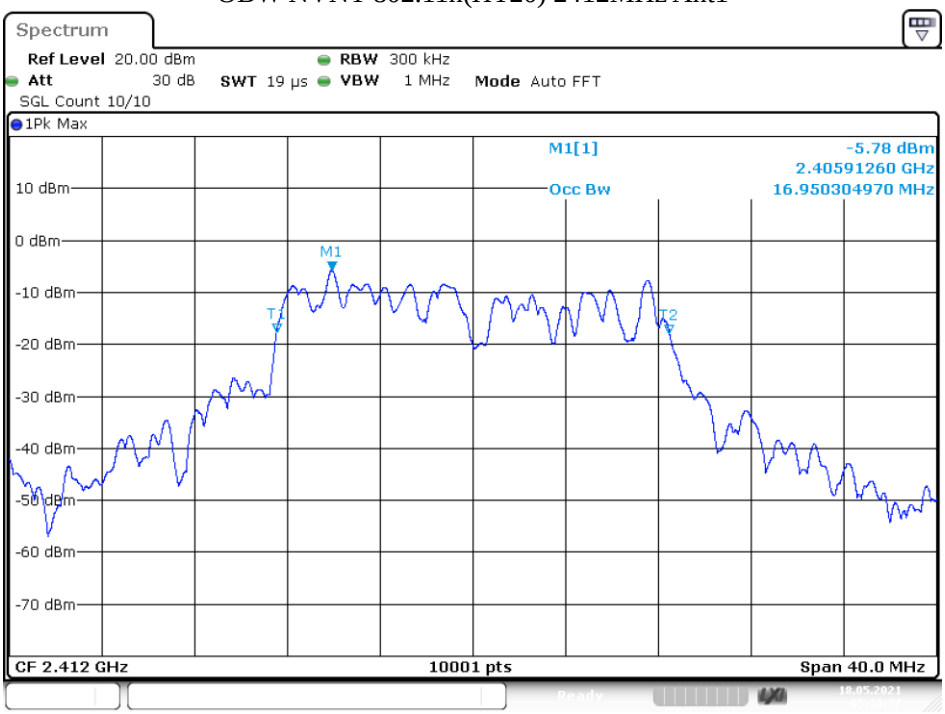


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4559846 GHz	-9.98 dBm		
M2		1	2.45418 GHz	-15.90 dBm		
M3		1	2.469548 GHz	-15.77 dBm		

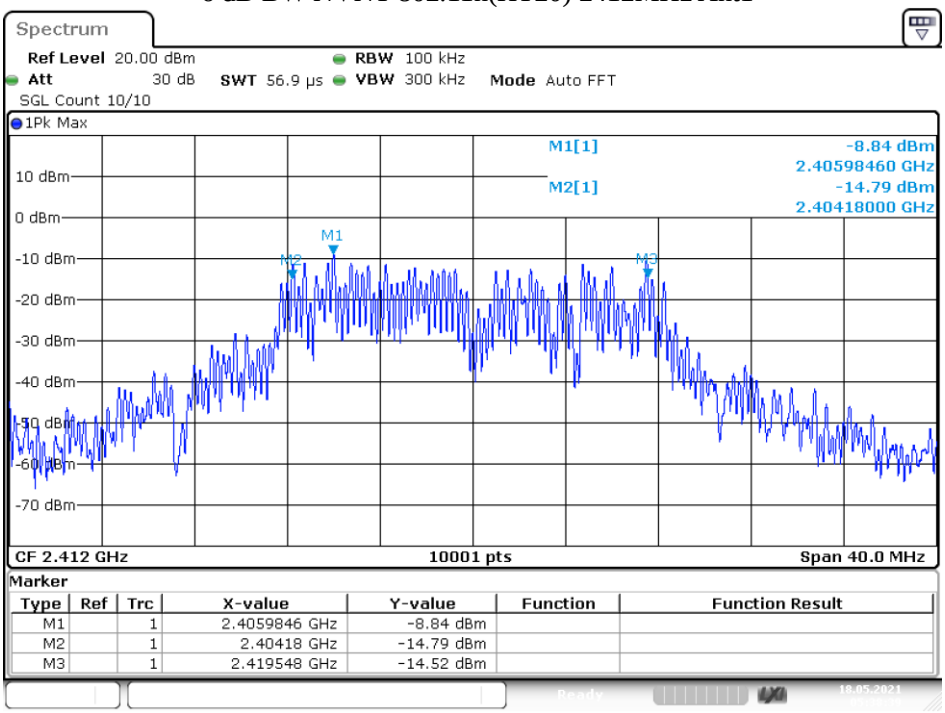
Date: 18.MAY.2021 05:35:51

OBW NVNT 802.11n(HT20) 2412MHz Ant1



Date: 18.MAY.2021 05:38:37

-6 dB BW NVNT 802.11n(HT20) 2412MHz Ant1

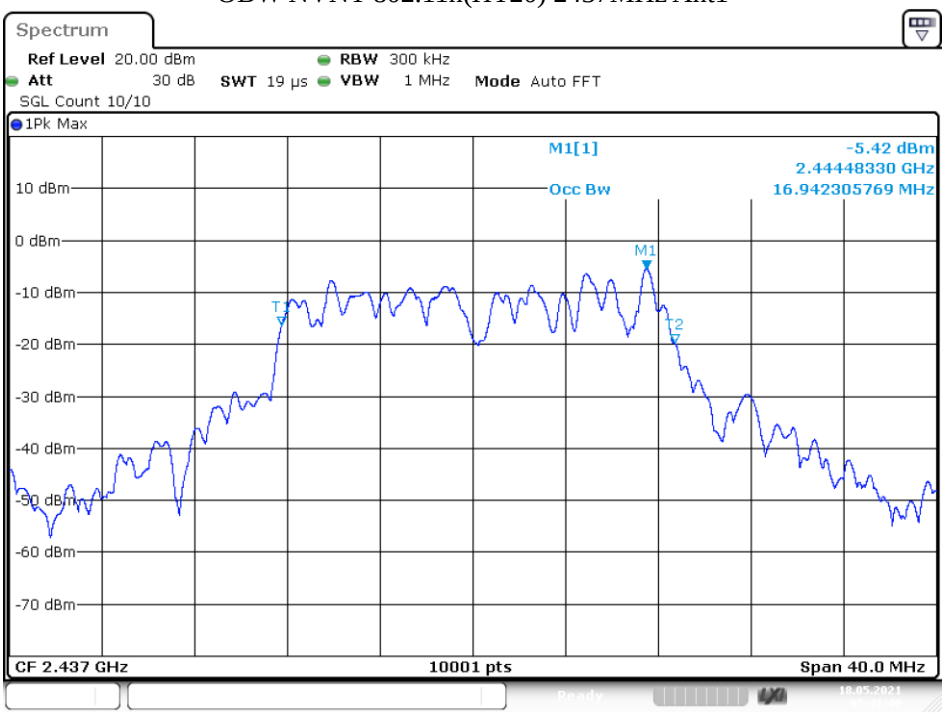


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4059846 GHz	-8.84 dBm		
M2		1	2.40418 GHz	-14.79 dBm		
M3		1	2.419548 GHz	-14.52 dBm		

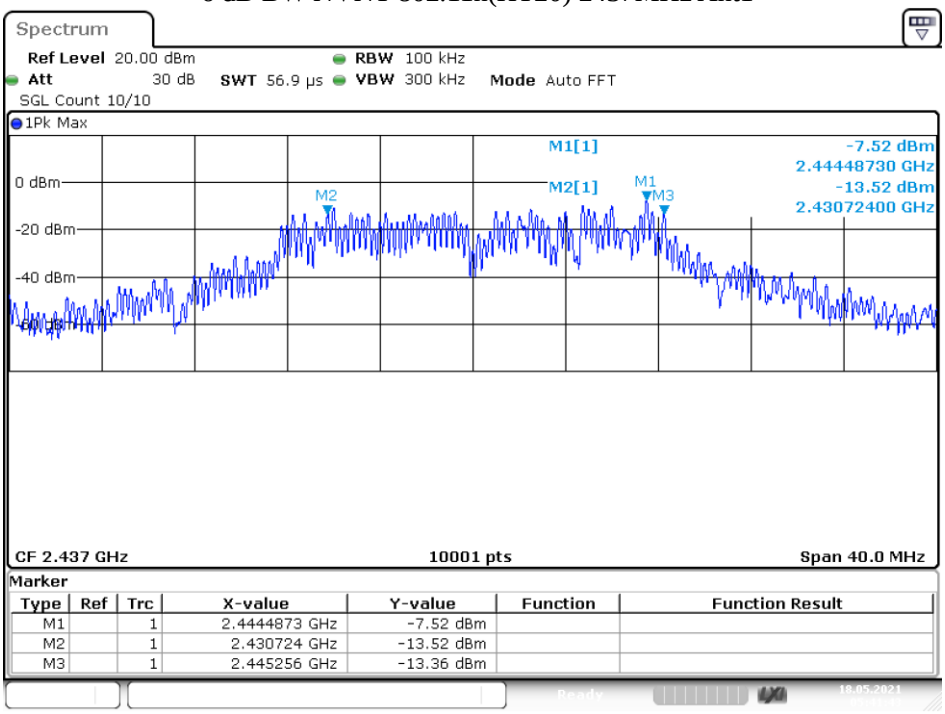
Date: 18.MAY.2021 05:38:40

OBW NVNT 802.11n(HT20) 2437MHz Ant1



Date: 18.MAY.2021 05:41:41

-6 dB BW NVNT 802.11n(HT20) 2437MHz Ant1

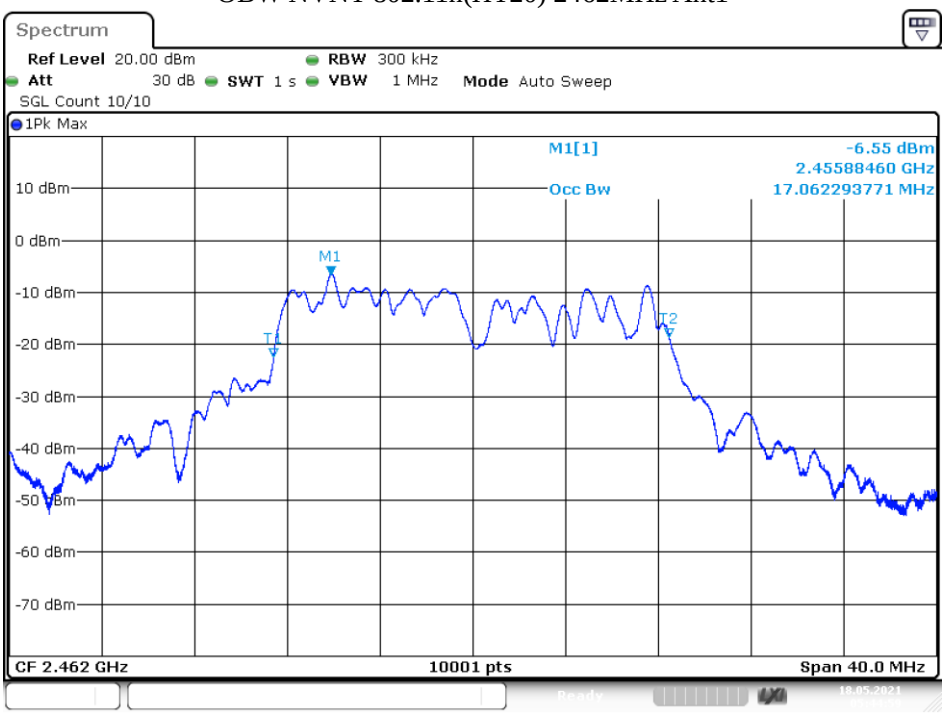


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4444873 GHz	-7.52 dBm		
M2		1	2.430724 GHz	-13.52 dBm		
M3		1	2.445256 GHz	-13.36 dBm		

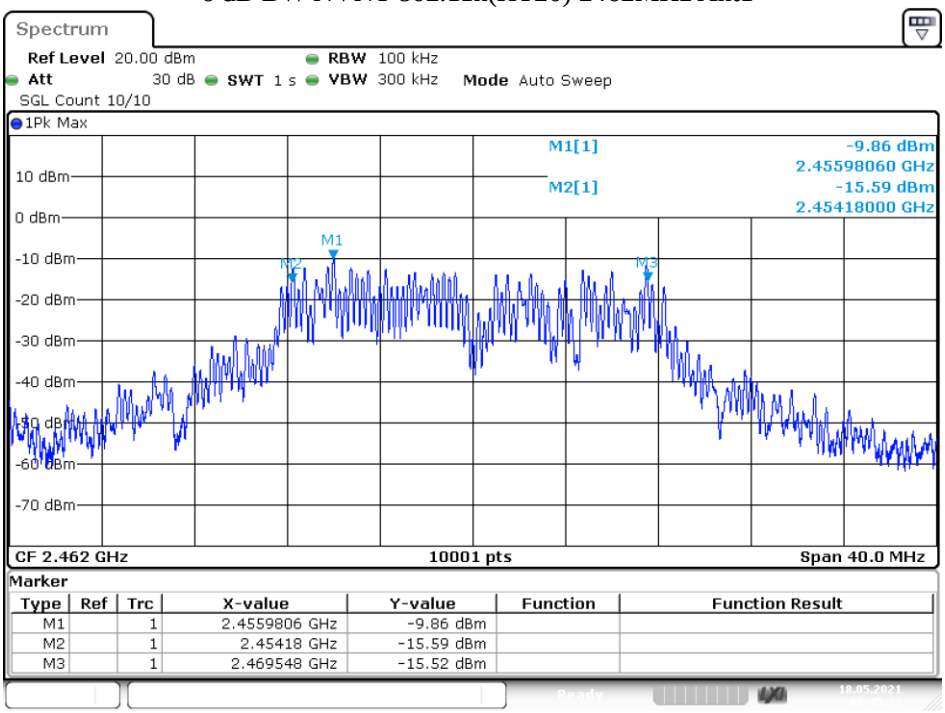
Date: 18.MAY.2021 05:41:43

OBW NVNT 802.11n(HT20) 2462MHz Ant1



Date: 18.MAY.2021 05:44:59

-6 dB BW NVNT 802.11n(HT20) 2462MHz Ant1



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4559806 GHz	-9.86 dBm		
M2		1	2.45418 GHz	-15.59 dBm		
M3		1	2.469548 GHz	-15.52 dBm		

Date: 18.MAY.2021 05:45:13

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

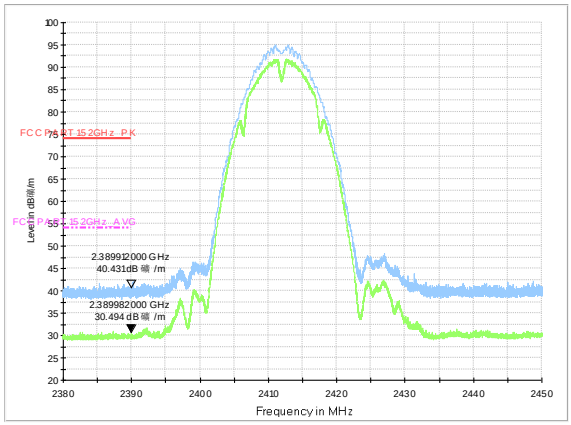
Same as 5.2.2.

8.4.Test Results

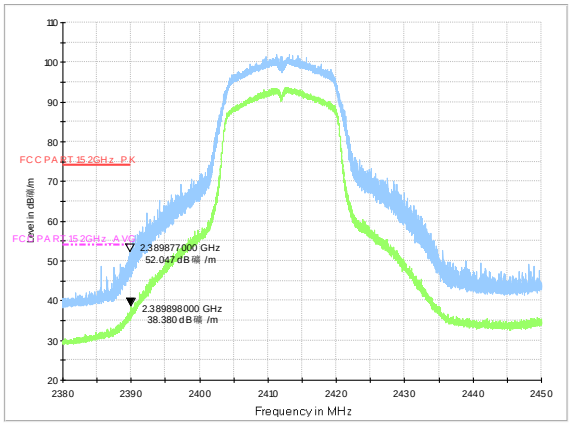
PASS.

Detailed information please see the following page.

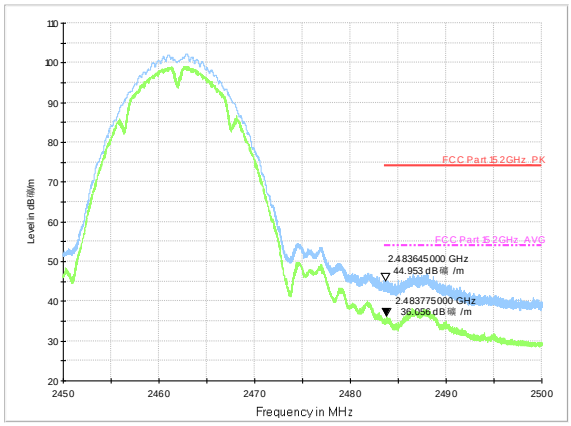
Test Mode: IEEE 802.11b-Low



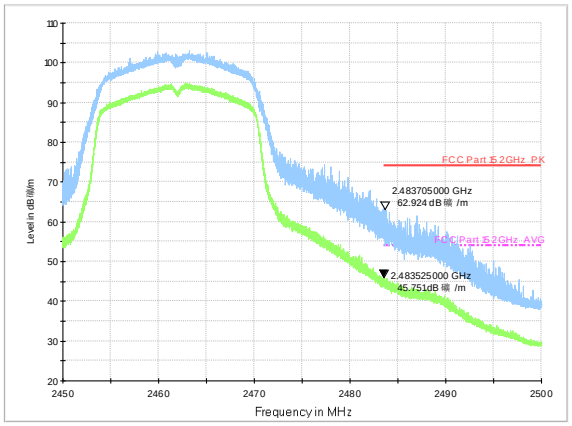
Test Mode: IEEE 802.11g-Low



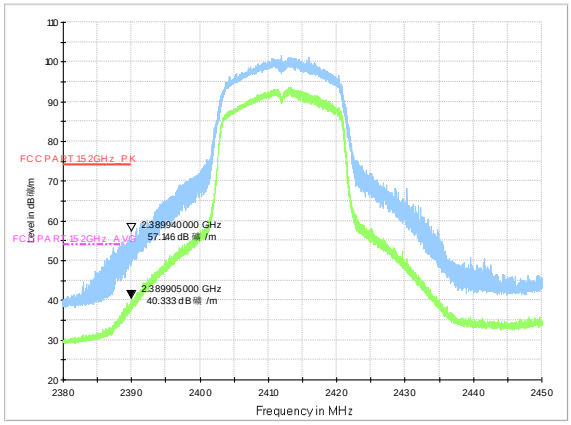
Test Mode: IEEE 802.11b-High



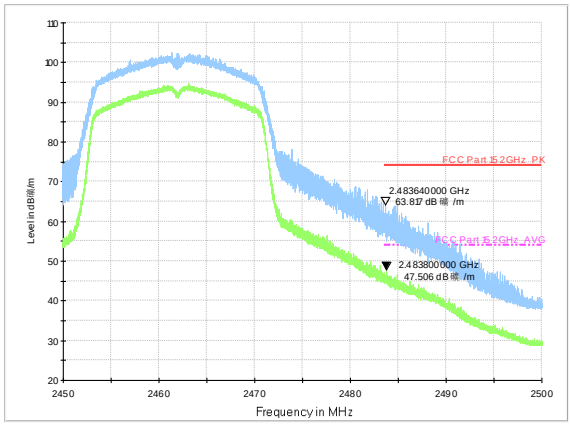
Test Mode: IEEE 802.11g-High



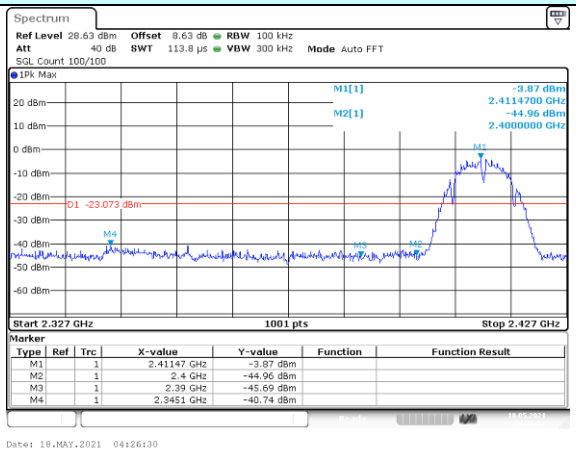
Test Mode: IEEE 802.11n20-Low



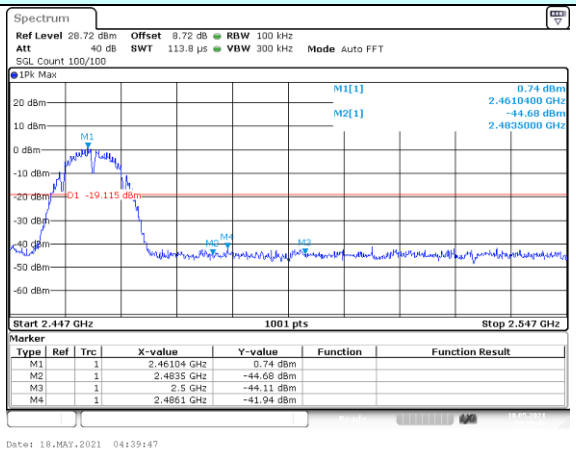
Test Mode: IEEE 802.11n20-High



Test mode: 802.11b



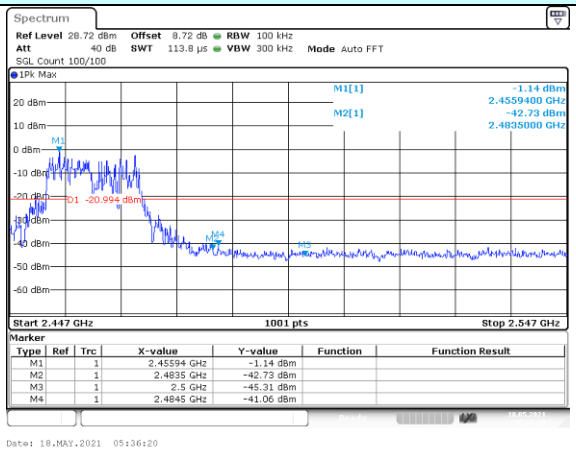
Lowest channel



Highest channel

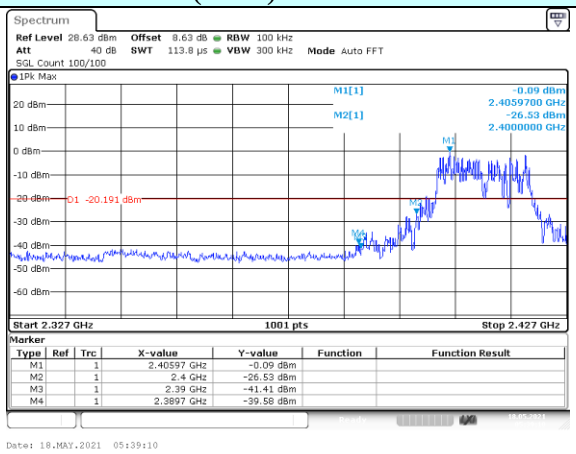
Test mode: 802.11g

Lowest channel

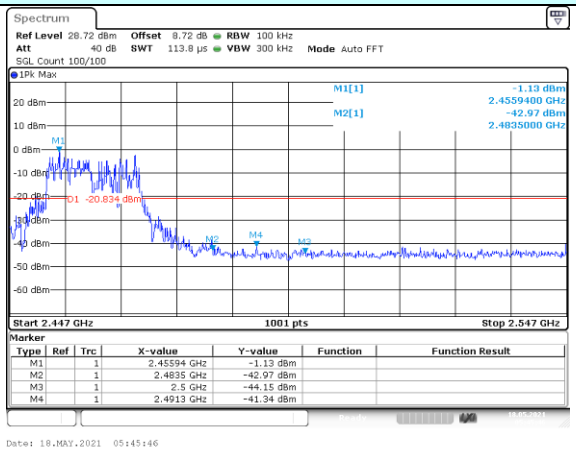


Highest channel

Test mode: 802.11n(HT20)



Lowest channel



Highest channel

9. FREQUENCY STABILITY

9.1.Test limit

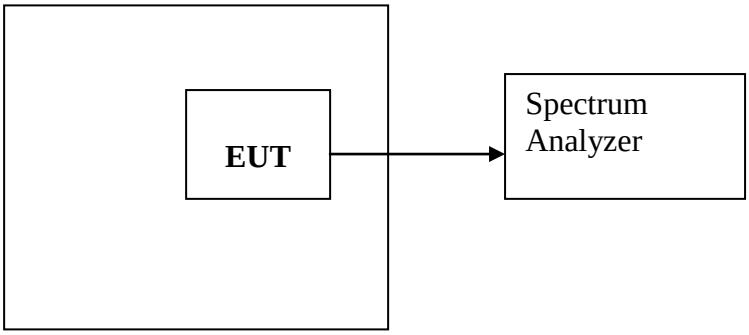
Please refer section RSS-Gen.

Regulation RSS-Gen If the frequency stability of the licence-exempt radio apparatus is not specified in the applicable RSS, the fundamental emissions of the radio apparatus should be kept within at least the central 80% of its permitted operating frequency band in order to minimize the possibility of out-of-band operation. In addition, its occupied bandwidth shall be entirely outside the restricted bands and the prohibited TV bands of 54-72 MHz, 76-88 MHz, 174-216 MHz, and 470-602 MHz, unless otherwise indicated.

9.2.Test Procedure

The following equipment are installed on the emission measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

9.3.Test Setup



Temperature controller

9.4.Test Results

PASS.

Detailed information please see the following page.

Assigned Frequency(MHz): 2412MHz				
Voltage	Temperature	Measured Frequency (MHz)	Frequency stability(MHz)	Limit(MHz)
Low DC 2.7V	+20℃	2411.987	-0.013	±0.020
Normal DC 3V	-10℃	2411.983	-0.017	±0.020
	-5℃	2411.990	-0.010	±0.020
	0℃	2411.998	-0.002	±0.020
	+10℃	2411.993	-0.007	±0.020
	+20℃	2411.995	-0.005	±0.020
	+30℃	2411.992	-0.008	±0.020
	+40℃	2411.990	-0.010	±0.020
	+50℃	2411.995	-0.005	±0.020
	+60℃	2411.991	-0.009	±0.020
High DC 3.3V	+20℃	2411.988	-0.012	±0.020

10. ANTENNA REQUIREMENT

10.1. 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.

10.2. Antenna Connected Construction

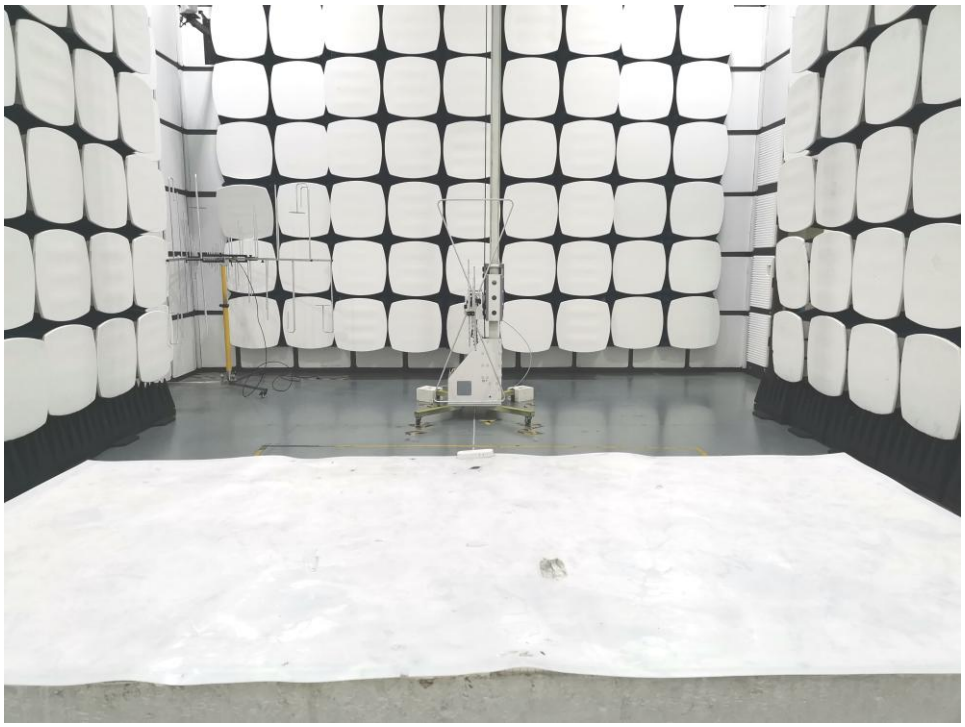
The antenna is PCB antenna and no consideration of replacement. Please see EUT photo for details.

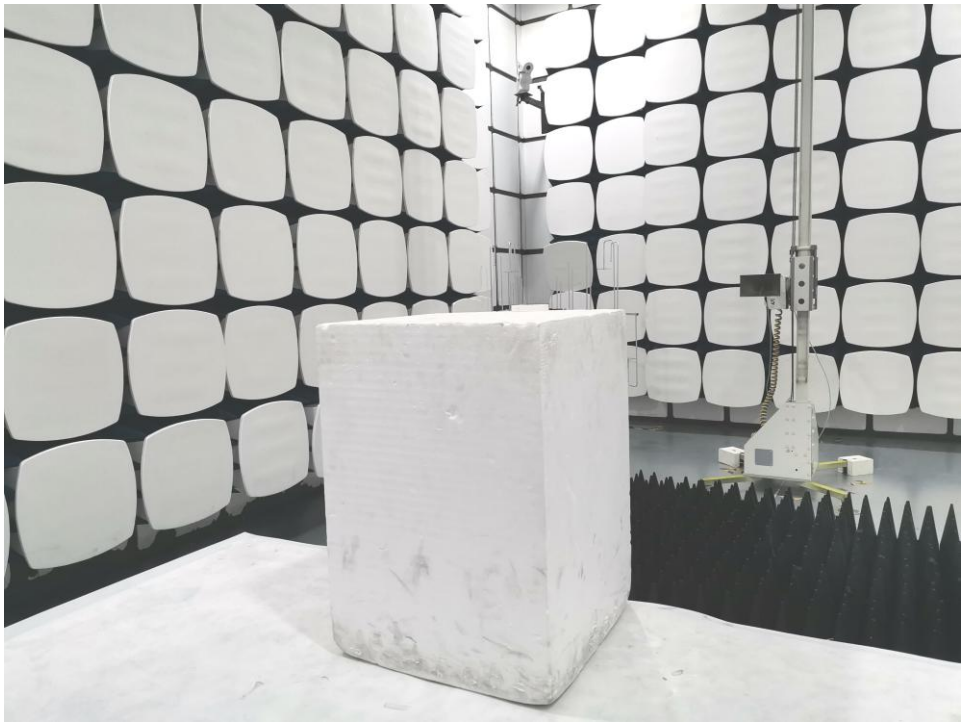
10.3. Results

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

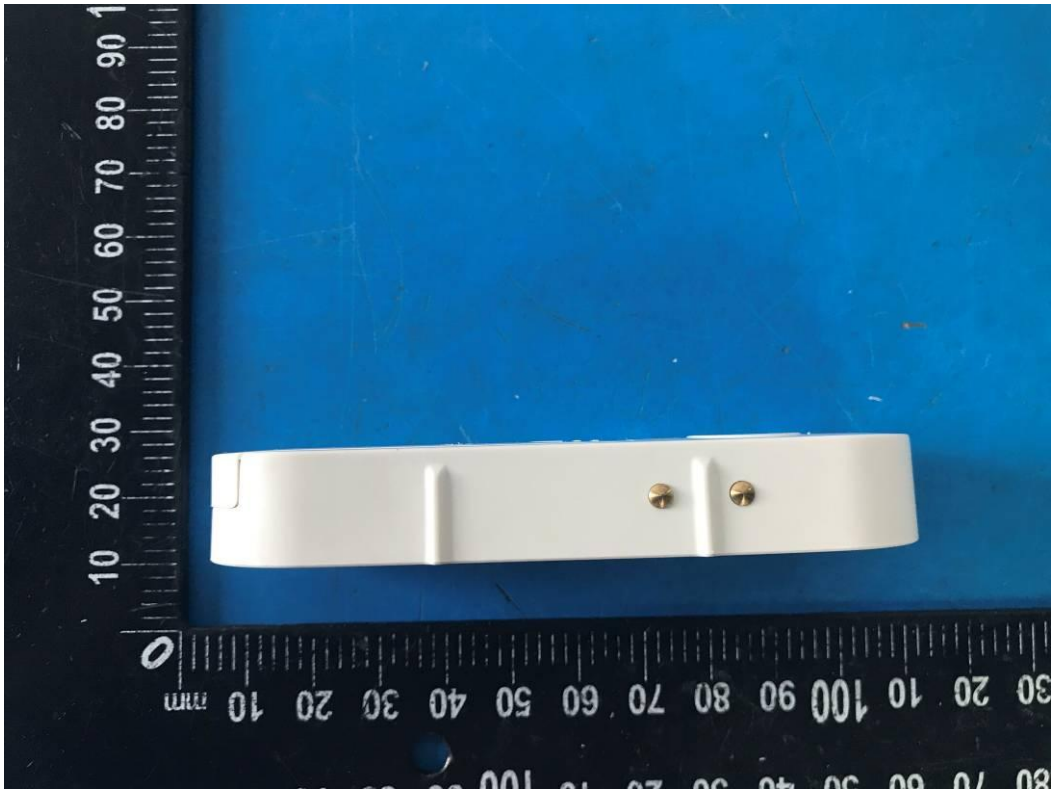
11. TEST SETUP PHOTO

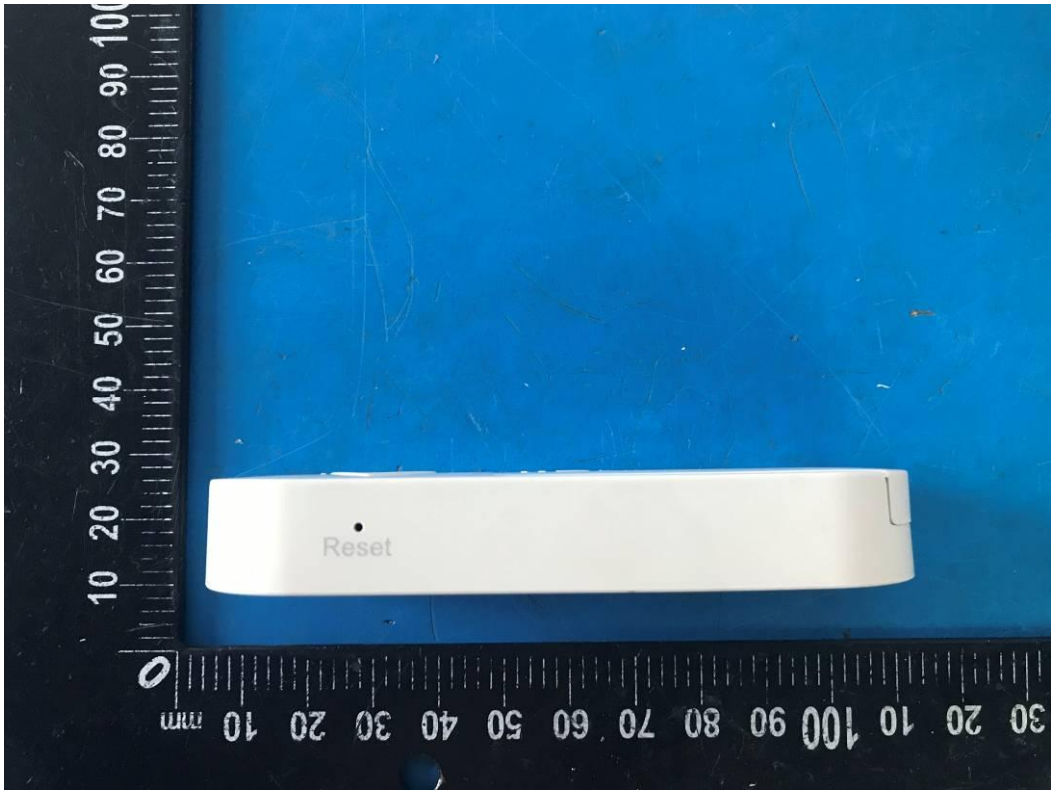
Photos of Radiated emission



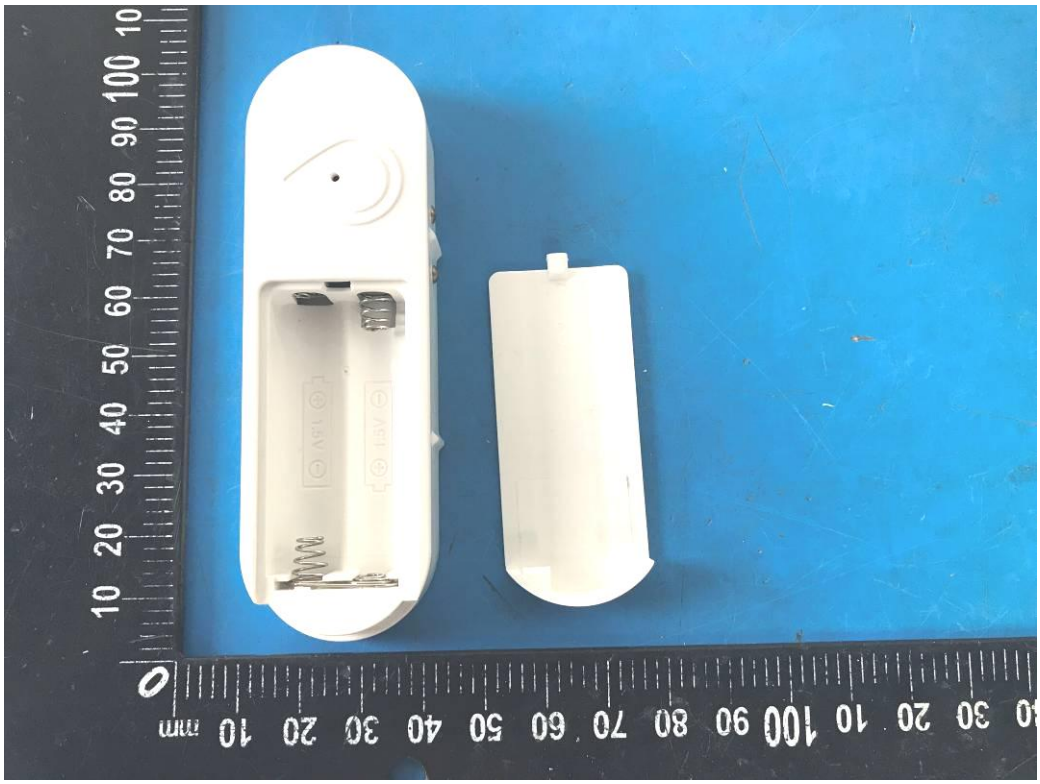


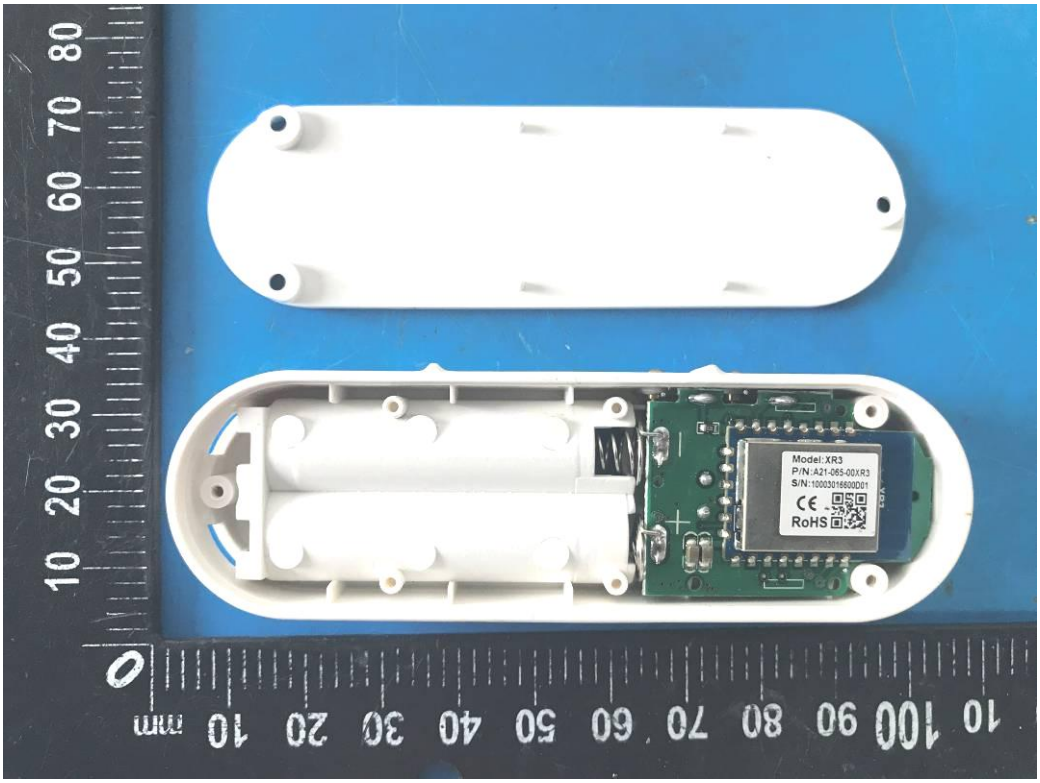
12. PHOTOS OF EUT




Reset

RHINO

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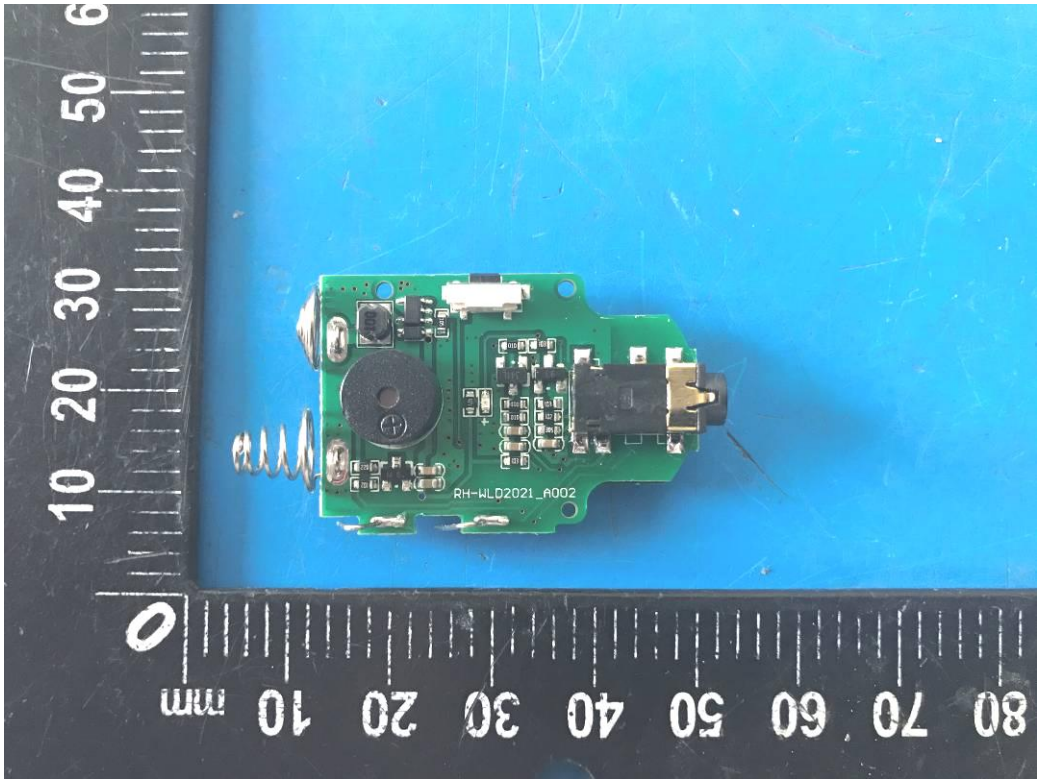
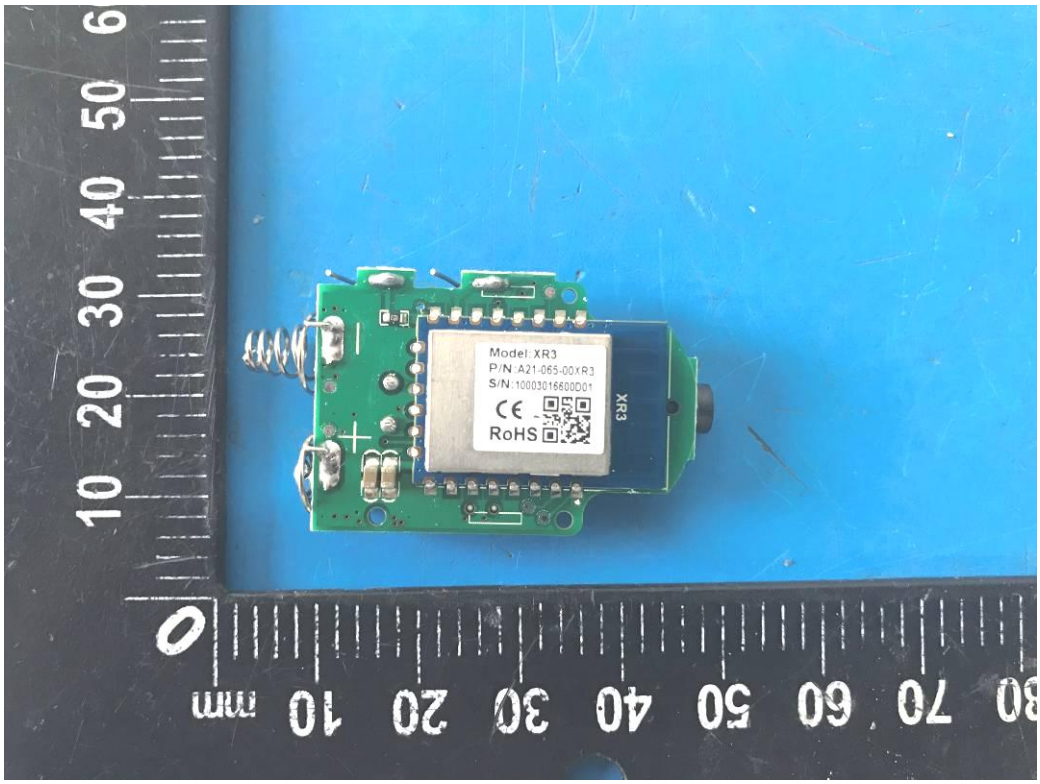
S/N:10003016600D01
RoHS


RH-WLD2021_A002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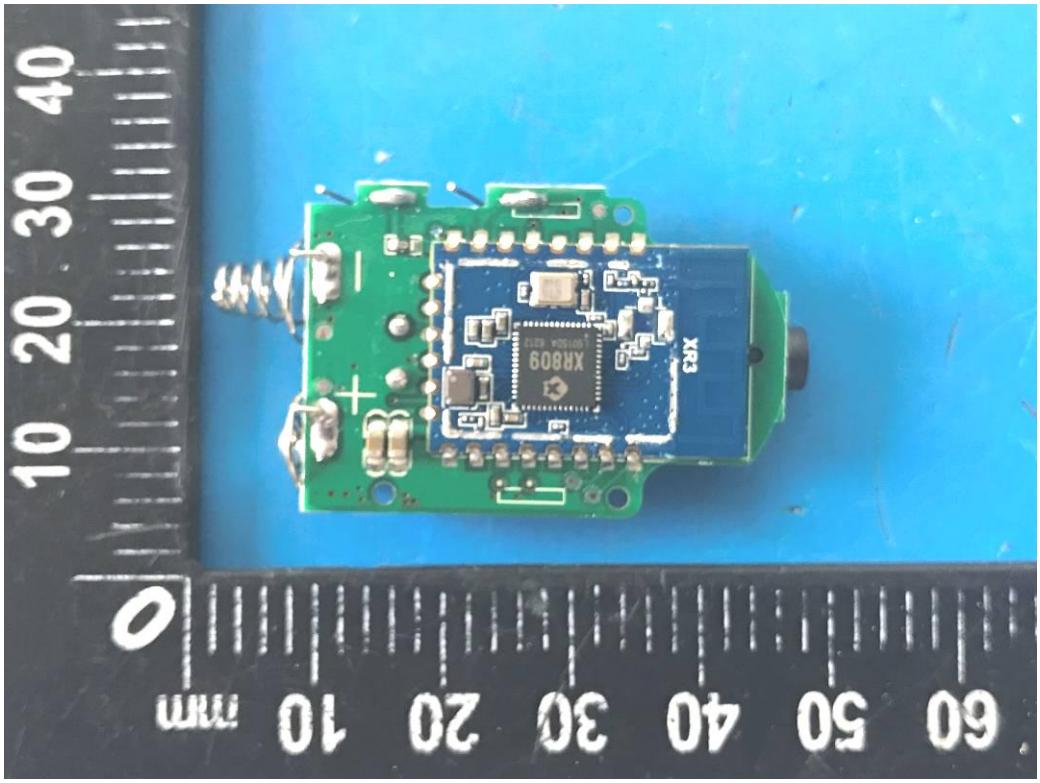
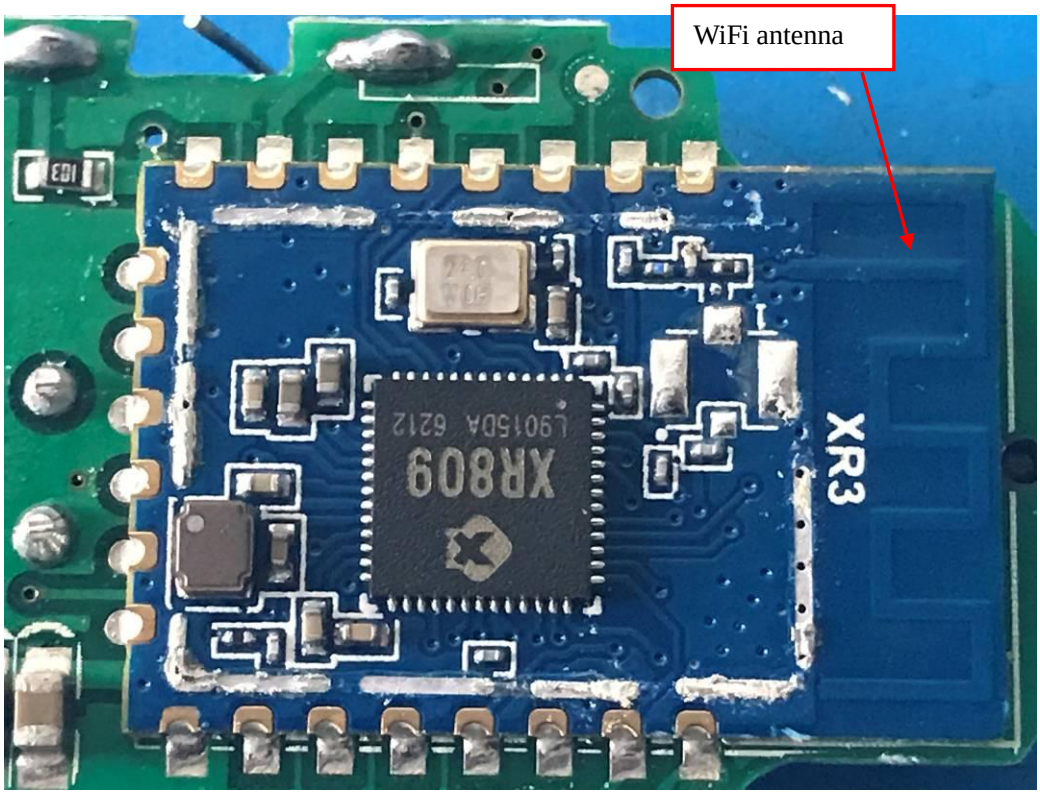
P/N: A21-065-00XR3
S/N: 10003016600D01
RoHS
XR3





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