

RF Test Report

For

Applicant name: Dongguan Swirl Outdoor Products Co., Ltd.
Address: Room 301, Building 3, No. 47, Longyan 2nd Road, Humen Town, Dongguan City, Guangdong Province, P.R. China
EUT name: Heated Vest
Brand name: N/A
Model number: HVM-A
Series model number: HVM-B
FCC ID: 2BVXEHVM-A

Issued By

Company name: BTF Testing Lab (Shenzhen) Co., Ltd.
Address: Plant 101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, Guangdong, China

Report number: BTF251211R01001
Test standards: 47 CFR Part 15.247
Test conclusion: Pass

Date of sample receipt: 2026-04-15
Test date: 2026-04-15 to 2026-04-21
Date of issue: 2026-04-22

Test by:

Vivi Yan

Vivi. Yan / Tester

Prepared by:

Chris Liu

Chris Liu / Project engineer

Approved by:



Ryan CJ / EMC Manager

Note: All the test results in this report only related to the testing samples. Which can be duplicated completely for the legal use with approval of applicant; it shall not be reproduced except in full without the written approval of BTF Testing Lab (Shenzhen) Co., Ltd.. All the objections should be raised within thirty days from the date of issue. To validate the report, you can contact us.

Revision History		
Version	Issue Date	Revisions Content
R_V0	2026-04-22	Original
Note: <i>Once the revision has been made, then previous versions reports are invalid.</i>		

Table of Contents

1 Introduction	4
1.1 Laboratory Location	4
1.2 Laboratory Facility	4
1.3 Announcement	4
2 Product Information	5
2.1 Application Information	5
2.2 Manufacturer Information	5
2.3 Factory Information	5
2.4 General Description of Equipment under Test (EUT)	5
2.5 Technical Information	6
3 Summary of Test Results	7
3.1 Test Standards	7
3.2 Uncertainty of Test	7
3.3 Summary of Test Result	7
3.4 Additions to, deviations, or exclusions from the method	7
4 Test Configuration	8
4.1 Test Equipment List	8
4.2 Test Auxiliary Equipment	10
4.3 Test Modes	10
4.4 Test Channel of EUT	10
4.5 Test software	10
5 Evaluation Results (Evaluation)	11
5.1 Antenna requirement	11
5.1.1 Conclusion	11
6 Radio Spectrum Matter Test Results (RF)	12
6.1 Conducted Emission at AC power line	12
6.1.1 Test Data	13
6.2 6dB Bandwidth	15
6.2.1 Test Data	16
6.3 Maximum Conducted Output Power	17
6.3.1 Test Data	17
6.4 Power Spectral Density	18
6.4.1 Test Data	18
6.5 Emissions in non-restricted frequency bands	19
6.5.1 Test Data	19
6.6 Band edge emissions (Radiated)	20
6.6.1 Test Data	21
6.7 Emissions in frequency bands (below 1GHz)	22
6.7.1 Test Data	24
6.8 Emissions in frequency bands (above 1GHz)	26
6.8.1 Test Data	27
7 Test Setup Photos	29
8 EUT Constructional Details (EUT Photos)	29
9 Appendix	30

1 Introduction

1.1 Laboratory Location

Test location:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	Plant 101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, Guangdong, China
Phone number:	+86-0755-23146130
Fax number:	+86-0755-23146130

1.2 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC - Designation No.: CN1409**
BTF Testing Lab (Shenzhen) Co., Ltd. has been accredited as a testing laboratory by FCC (Federal Communications Commission). The test firm Registration No. is 695374.
- **CNAS - Registration No.: CNAS L17568**
BTF Testing Lab (Shenzhen) Co., Ltd. is accredited to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L17568.
- **A2LA - Registration No.: 6660.01**
BTF Testing Lab (Shenzhen) Co., Ltd. is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories.
- **ISED – CAB identifier.: CN0135**
The 3m Semi-anechoic chamber of BTF Testing Lab (Shenzhen) Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 27844.

1.3 Announcement

- 1) The test report reference to the report template version v0.
- 2) The test report is invalid if not marked with the signatures of the persons responsible for preparing, reviewing and approving the test report.
- 3) The test report is invalid if there is any evidence and/or falsification.
- 4) This document may not be altered or revised in any way unless done so by BTF and all revisions are duly noted in the revisions section.
- 5) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.
- 6) The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.
- 7) (7) All entrusted information in this report is provided by the client and has been confirmed through consultation with the client; The testing items for this report have been discussed and confirmed with the client, and our company is only responsible for the content reflected in the report.

2 Product Information

2.1 Application Information

Company name:	Dongguan Swirl Outdoor Products Co., Ltd.
Address:	Room 301, Building 3, No. 47, Longyan 2nd Road, Humen Town, Dongguan City, Guangdong Province, P.R. China

2.2 Manufacturer Information

Company name:	Dongguan Swirl Outdoor Products Co., Ltd.
Address:	Room 301, Building 3, No. 47, Longyan 2nd Road, Humen Town, Dongguan City, Guangdong Province, P.R. China

2.3 Factory Information

Company name:	Dongguan Swirl Outdoor Products Co., Ltd.
Address:	Room 301, Building 3, No. 47, Longyan 2nd Road, Humen Town, Dongguan City, Guangdong Province, P.R. China

2.4 General Description of Equipment under Test (EUT)

EUT name:	Heated Vest
Under test model name:	HVM-A
Series model name:	HVM-B
Description of model name differentiation:	They only differ in appearance.
Hardware version:	N/A
Software version:	N/A
Ratings:	Input: DC 5V Power Bank Model: HVM-A Cell capacity: 3.85V/10000mAh 38.5Wh Rated capacity: 5500mAh(5VDC/3A) Type-C Input: 5VDC/3A Micro Input: 5VDC/2A Type-C Output: 5VDC/3A, 12VDC/1A USB-A Output: 5VDC/3A, 12VDC/1A Max. Power: 15W

2.5 Technical Information

Operation Frequency:	2402MHz to 2480MHz
Channel numbers:	40
Channel separation:	2MHz
Data Rate:	LE 1Mbps/2Mbps
Modulation technology:	GFSK
Maximum Conducted Power:	-1.48 dBm
Antenna type:	PCB Antenna
Antenna gain:	-0.58 dBi (declare by Applicant)

Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

3 Summary of Test Results

3.1 Test Standards

The tests were performed according to following standards:

47 CFR Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

ANSI C63.10-2020+Cor.1-2023: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

KDB 558074 D01 15.247 Meas Guidance v05r02: Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of The FCC Rules.

3.2 Uncertainty of Test

Measurement	Value
Conducted Emission for LISN (150kHz ~ 30MHz)	±2.45 dB
Occupied Channel Bandwidth	±173.1Hz
RF output power, conducted	±0.66 dB
Power Spectral Density, conducted	±3.0 dB
Unwanted Emissions, conducted	±2.32 dB
Radiated Emission (9kHz ~ 30MHz)	2.20dB
Radiated Emission(1GHz~18GHz)	±4.80 dB
Radiated Emission(30MHZ~1000MHZ)	±4.94 dB
The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

3.3 Summary of Test Result

Item	Standard	Requirement	Result
Antenna requirement	47 CFR Part 15.247	47 CFR 15.203	Pass
Conducted Emission at AC power line	47 CFR Part 15.247	47 CFR 15.207(a)	Pass
6dB Bandwidth	47 CFR Part 15.247	47 CFR 15.247(a)(2)	Pass
Maximum Conducted Output Power	47 CFR Part 15.247	47 CFR 15.247(b)(3)	Pass
Power Spectral Density	47 CFR Part 15.247	47 CFR 15.247(e)	Pass
Emissions in non-restricted frequency bands	47 CFR Part 15.247	47 CFR 15.247(d)	Pass
Band edge emissions (Radiated)	47 CFR Part 15.247	47 CFR 15.247(d), 15.209, 15.205	Pass
Emissions in frequency bands (below 1GHz)	47 CFR Part 15.247	47 CFR 15.247(d), 15.209, 15.205	Pass
Emissions in frequency bands (above 1GHz)	47 CFR Part 15.247	47 CFR 15.247(d), 15.209, 15.205	Pass
Remark: 1. Pass: Meet the requirements. 2. N/A: not applicable.			

3.4 Additions to, deviations, or exclusions from the method

None

4 Test Configuration

4.1 Test Equipment List

Conducted Emission at AC power line					
Test Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Test Software	Frad	EZ_EMC	Version: EMC-CON 3A1.1+	/	/
EMI Receiver	Rohde & Schwarz	ESCI3	101422	2025-10-17	2026-10-16
V-LISN	Schwarzbeck	NSLK 8127	01073	2025-08-23	2026-08-22
Coaxial Switcher	Schwarzbeck	CX210	CX210	/	/
Pulse Limiter	Schwarzbeck	VTSD 9561-F	00953	/	/
LISN-Cable	REBES Talent	LISN9K30M	21101580	2025-08-23	2026-08-22

Maximum Conducted Output Power/Power Spectral Density Emissions in non-restricted frequency bands/6dB Bandwidth					
Test Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Test Software	TST Pass	/	Version: 2.0	/	/
Cell Site Test Set	HP	8921A	US35010158	2025-10-17	2026-10-16
Spectrum Analyzer	Keysight	N9020A	MY50410020	2025-10-17	2026-10-16
ESG Vector Signal Generator	Agilent	E4438C	MY45094854	2025-10-17	2026-10-16
MXG Vector Signal Generator	Agilent	N5182A	MY46240163	2025-10-17	2026-10-16
Wideband Radio Communication Tester	Rohde&Schwarz	CMW500	161997	2025-10-17	2026-10-16
Programmable Constant Temperature and Humidity Test Chamber	ZZCKONG	ZZ-K02A	20210928007	2025-10-17	2026-10-16
DC Power Supply	Tongmen	etm-6050c	20211026123	2025-10-17	2026-10-16
RF Control Unit	Techy	TR1029-1	10291	2025-10-17	2026-10-16
RF Sensor Unit	Techy	TR1029-2	10292	2025-10-17	2026-10-16
RF shielding box	Yinuoxin Electronics	50*50*50 cm	050505M	2025-05-26	2026-05-25

Emissions in frequency bands (above 1GHz) Band edge emissions (Radiated) Emissions in frequency bands (below 1GHz)					
Test Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Test Software	Frad	EZ EMC	Version: FA-03A2 RE+	/	/
EMI Receiver	R&S	ESCI7	101032	2025-10-17	2026-10-16
Signal Analyzer	R&S	FSQ40	100010	2025-10-17	2026-10-16
Loop Antenna	Schwarzbeck	FMZB 1519 B	00059	2025-06-25	2027-06-24
Log periodic antenna	Schwarzbeck	VULB 9168	01328	2025-10-18	2026-10-17
Preamplifier (30MHz ~ 1GHz)	Schwarzbeck	BBV9744	00246	2025-05-26	2026-05-25
Coaxial Cable	REBES Talent	9K-1G	21101576	2025-08-23	2026-08-22
Horn Antenna	Schwarzbeck	BBHA9120D	2597	2025-10-18	2026-10-17
Preamplifier (1GHz ~ 18GHz)	Schwarzbeck	BBV9718D	00008	2025-10-18	2026-10-17
Preamplifier	TSTPASS	LNA10180G45	TS2215007	2025-05-26	2026-05-25
Coaxial Cable	REBES Talent	1~18G	21101558	2025-08-23	2026-08-22
Horn Antenna	SCHWARZBECK	BBHA9170	1157	2025-10-18	2026-10-17
Low Noise Preamplifier	Sket	LNPA_1840G-50	SK2022032902	2025-10-17	2026-10-16
Coaxial Cable-1	REBES Talent	18~40G	21101686	2025-08-23	2026-08-22
Coaxial Cable-2	REBES Talent	18~40G	21101687	2025-08-23	2026-08-22
6dB Attenuator	Eeatsheep	LM-XX-6-5W	N/A	2025-06-25	2027-06-24
Filter	SongYi	ZBSF6-M2400-2483.5-2990	08226825	2025-08-23	2026-08-22

4.2 Test Auxiliary Equipment

No.	Description	Manufacturer	Model	Serial Number	Certification
1	Portable Computer	lenovo	ThinkBook 14 G5+ IRH	YX073Y1H	
2	Power Adapter	HUAWEI	HW-110600C02	JH72L5N5910164	/

4.3 Test Modes

No.	Test Modes
TM1	GFSK-LE 1Mbps-TX Mode
TM2	GFSK-LE 2Mbps-TX Mode

4.4 Test Channel of EUT

Operation Band: 2400-2483.5 MHz

Bandwidth (MHz)	Lowest Channel (LCH) (MHz)	Middle Channel (MCH) (MHz)	Highest Channel (HCH) (MHz)
1	2402	2440	2480
2	2402	2440	2480

4.5 Test software

Test software:	Version:	Power Class:
FCC_assist1.0.4.exe	v1.0.4	10

5 Evaluation Results (Evaluation)

5.1 Antenna requirement

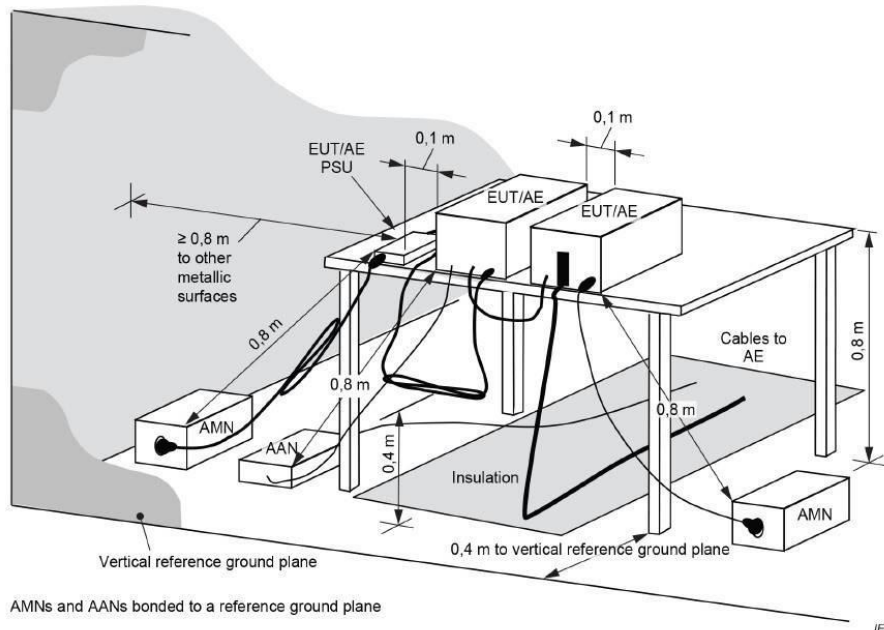
Test Requirement:	Refer to 47 CFR Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.
Test Method:	---
Operating Environment:	
Temperature:	25.7 °C
Humidity:	48.9 %
Atmospheric Pressure:	1010 mbar
Test voltage:	N/A

5.1.1 Conclusion

The Bluetooth antenna is an PCB antenna which permanently attached, and the best case gain of the antenna is -0.58dBi. See product internal photos for details.

6 Radio Spectrum Matter Test Results (RF)

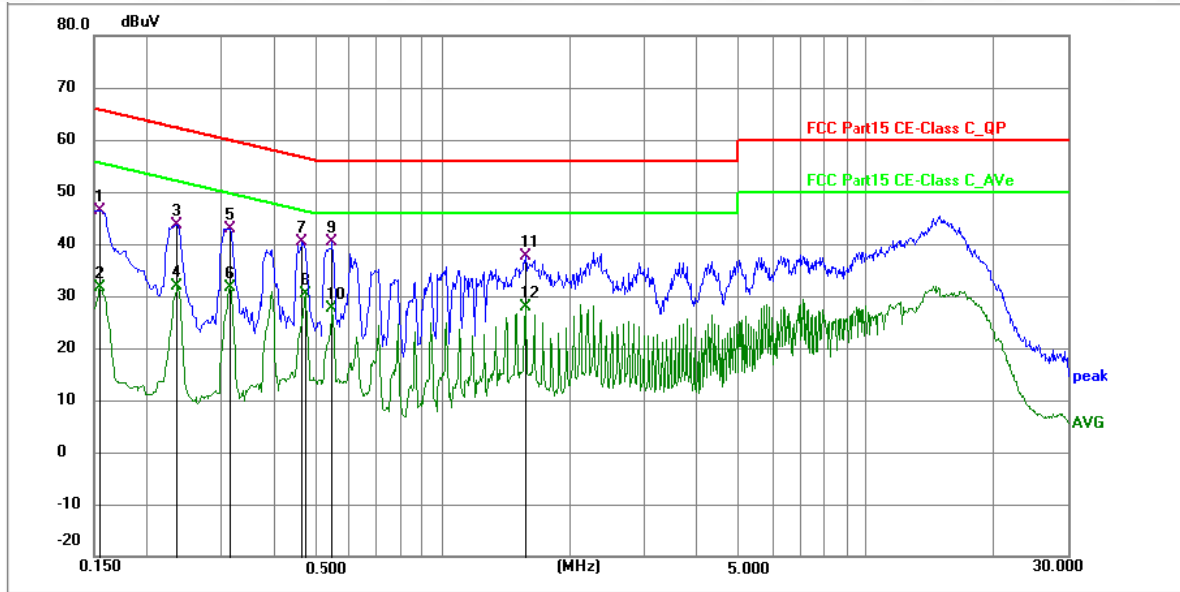
6.1 Conducted Emission at AC power line

Test Requirement:	Refer to 47 CFR 15.207(a), Except as shown in paragraphs (b)and (c)of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN).		
Test Method:	ANSI C63.10-2020+Cor.1-2023 section 6.2		
Test Limit:	Frequency of emission (MHz)	Conducted limit (dBμV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
	*Decreases with the logarithm of the frequency.		
Procedure:	Refer to ANSI C63.10-2020+Cor.1-2023 section 6.2, standard test method for ac power-line conducted emissions from unlicensed wireless devices		
Test Setup:			
Operating Environment:			
Temperature:	23.2 °C		
Humidity:	45 %		
Atmospheric Pressure:	1010 mbar		
Test voltage:	DC 5V From Adapter with AC 120V/60Hz		

6.1.1 Test Data

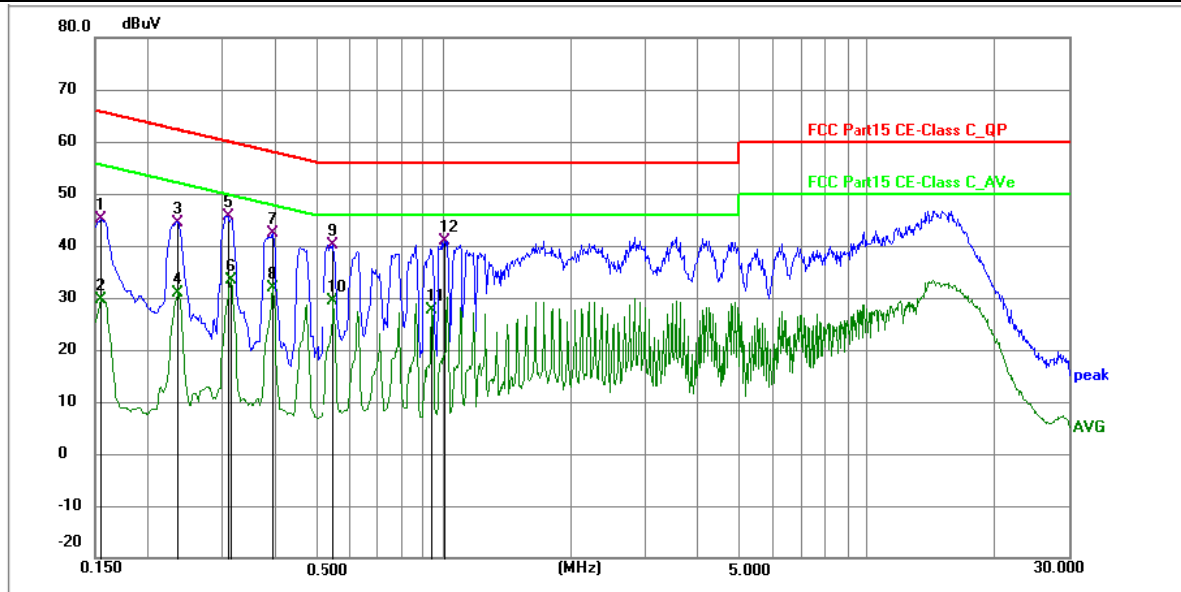
Remark: The report only reflects the test data of worst mode TM2.

TM2 / Line: Line / Band: 2400-2483.5 MHz / BW: 1 / CH: M



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.1544	36.37	10.12	46.49	65.76	-19.27	QP	P	
2	0.1544	21.44	10.12	31.56	55.76	-24.20	AVG	P	
3	0.2353	33.40	10.11	43.51	62.26	-18.75	QP	P	
4	0.2353	21.66	10.11	31.77	52.26	-20.49	AVG	P	
5	0.3120	32.76	10.12	42.88	59.92	-17.04	QP	P	
6	0.3120	21.42	10.12	31.54	49.92	-18.38	AVG	P	
7	0.4636	30.27	10.14	40.41	56.63	-16.22	QP	P	
8	0.4692	20.35	10.14	30.49	46.53	-16.04	AVG	P	
9 *	0.5503	30.19	10.14	40.33	56.00	-15.67	QP	P	
10	0.5503	17.43	10.14	27.57	46.00	-18.43	AVG	P	
11	1.5720	27.43	10.19	37.62	56.00	-18.38	QP	P	
12	1.5720	17.74	10.19	27.93	46.00	-18.07	AVG	P	

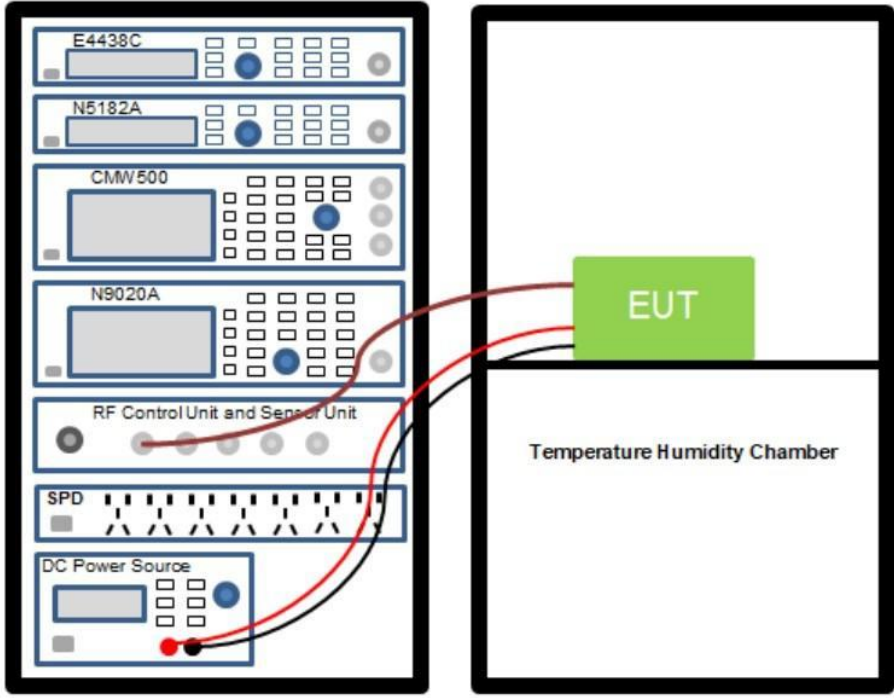
TM2 / Line: Neutral / Band: 2400-2483.5 MHz / BW: 1 / CH: M



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.1544	34.92	10.13	45.05	65.76	-20.71	QP	P	
2	0.1544	19.41	10.13	29.54	55.76	-26.22	AVG	P	
3	0.2353	34.39	10.08	44.47	62.26	-17.79	QP	P	
4	0.2353	20.86	10.08	30.94	52.26	-21.32	AVG	P	
5 *	0.3074	35.38	10.13	45.51	60.04	-14.53	QP	P	
6	0.3120	23.29	10.13	33.42	49.92	-16.50	AVG	P	
7	0.3930	32.35	10.09	42.44	58.00	-15.56	QP	P	
8	0.3930	21.69	10.09	31.78	48.00	-16.22	AVG	P	
9	0.5503	30.00	10.12	40.12	56.00	-15.88	QP	P	
10	0.5503	19.16	10.12	29.28	46.00	-16.72	AVG	P	
11	0.9420	17.54	10.16	27.70	46.00	-18.30	AVG	P	
12	1.0095	30.66	10.21	40.87	56.00	-15.13	QP	P	

Note:Margin=Level-Limit=Reading+factor-Limit=Reading+LISN+Cable loss-Limit

6.2 6dB Bandwidth

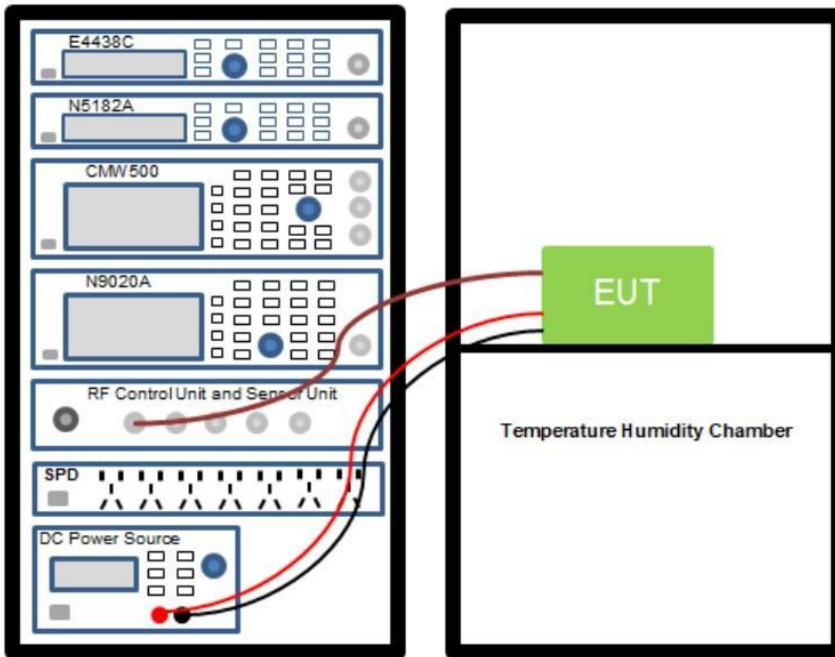
Test Requirement:	47 CFR 15.247(a)(2)
Test Method:	ANSI C63.10-2020+Cor.1-2023, section 11.8 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 15.247(a)(2), Systems using digital modulation techniques may operate in the 902-928 MHz, and 2400-2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.
Procedure:	11.8.1 Option 1 The steps for the first option are as follows: - Set RBW = shall be in the range of 1% to 5% of the OBW but not less than 100 kHz. - Set the VBW $\geq [3 \times \text{RBW}]$. - Detector = peak. - Trace mode = max-hold. - Sweep = No faster than coupled (auto) time. - Allow the trace to stabilize. - Measure the maximum width of the emission by placing two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the “-6 dB down amplitude”. If a marker is below this “-6 dB down amplitude” value, then it shall be as close as possible to this value. 11.8.2 Option 2 The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described in 11.8.1 (i.e., RBW = 100 kHz, VBW $\geq 3 \times \text{RBW}$, and peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.
Test Setup:	 The diagram illustrates the test setup. On the left, a rack of instruments is shown, including an E4438C, N5182A, CMW500, N9020A, RF Control Unit and Sensor Unit, SPD, and a DC Power Source. On the right, a Temperature Humidity Chamber contains the EUT (Equipment Under Test). Red and black cables connect the instruments to the EUT and the chamber.
Operating Environment:	

Temperature:	22.8 °C
Humidity:	50.9 %
Atmospheric Pressure:	1010 mbar
Test voltage:	DC 5V From Desktop computer

6.2.1 Test Data

Please Refer to Appendix for Details.

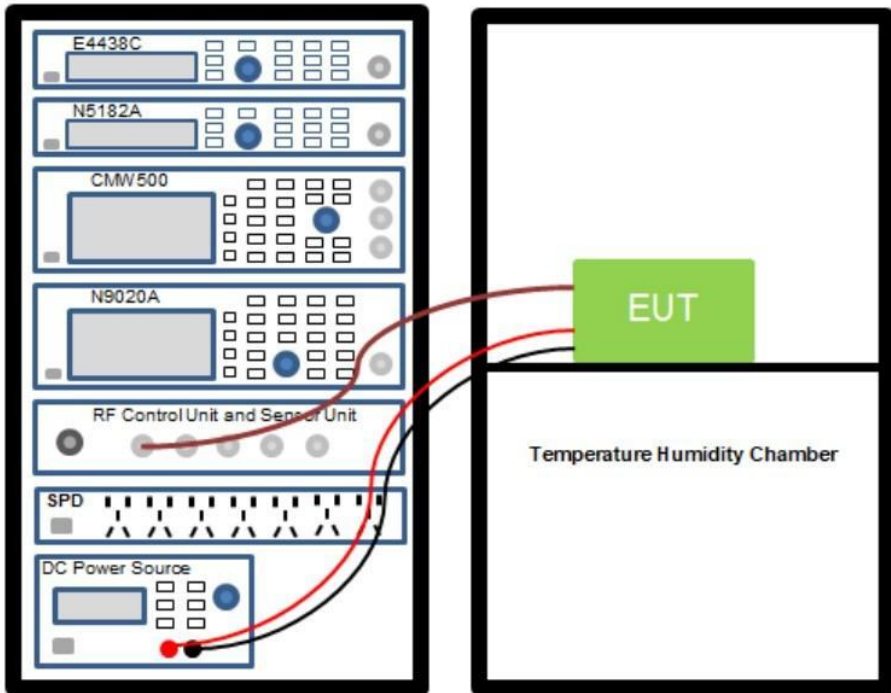
6.3 Maximum Conducted Output Power

Test Requirement:	47 CFR 15.247(b)(3)
Test Method:	ANSI C63.10-2020+Cor.1-2023 section 11.9.1 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 15.247(b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.
Procedure:	ANSI C63.10-2020+Cor.1-2023, section 11.9.1 Maximum peak conducted output power
Test Setup:	
Operating Environment:	
Temperature:	25.6 °C
Humidity:	48.9 %
Atmospheric Pressure:	1010 mbar
Test voltage:	DC 5V From Desktop computer

6.3.1 Test Data

Please Refer to Appendix for Details.

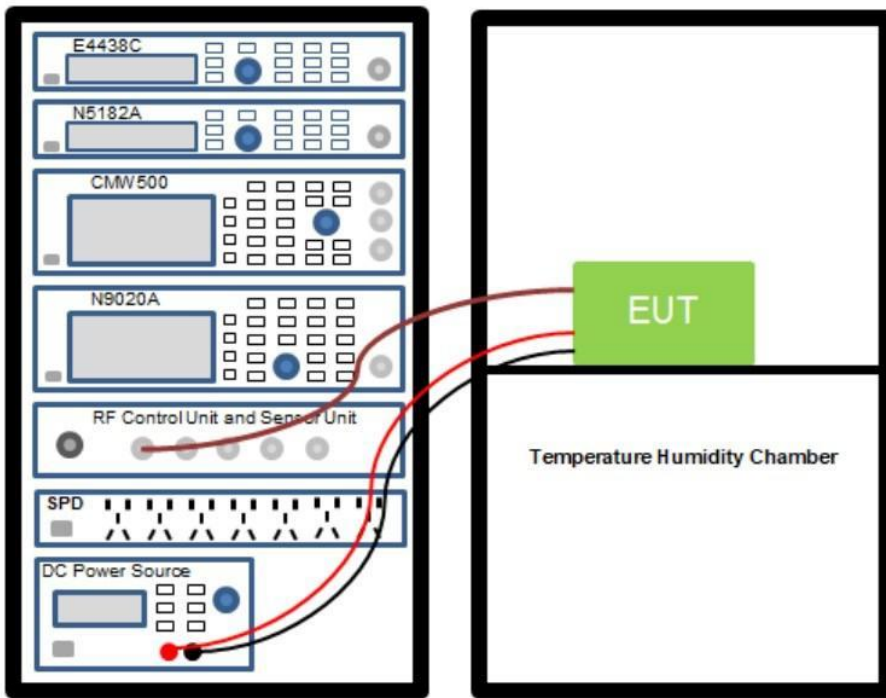
6.4 Power Spectral Density

Test Requirement:	47 CFR 15.247(e)
Test Method:	ANSI C63.10-2020+Cor.1-2023, section 11.10 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 15.247(e), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.
Procedure:	ANSI C63.10-2020+Cor.1-2023+Cor 1-2023, section 11.10, Maximum power spectral density level in the fundamental emission
Test Setup:	
Operating Environment:	
Temperature:	23.8 °C
Humidity:	48.3 %
Atmospheric Pressure:	1010 mbar
Test voltage:	DC 5V From Desktop computer

6.4.1 Test Data

Please Refer to Appendix for Details.

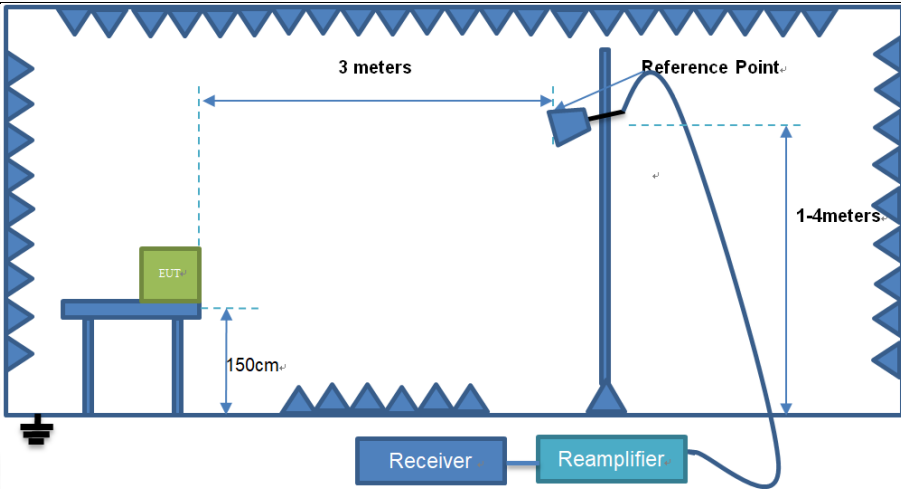
6.5 Emissions in non-restricted frequency bands

Test Requirement:	47 CFR 15.247(d)
Test Method:	ANSI C63.10-2020+Cor.1-2023 section 11.11 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 15.247(d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required.
Procedure:	ANSI C63.10-2020+Cor.1-2023 Section 11.11.1, Section 11.11.2, Section 11.11.3
Test Setup:	
Operating Environment:	
Temperature:	24.6 °C
Humidity:	48.6 %
Atmospheric Pressure:	1010 mbar
Test voltage:	DC 5V From Desktop computer

6.5.1 Test Data

Please Refer to Appendix for Details.

6.6 Band edge emissions (Radiated)

Test Requirement:	Refer to 47 CFR 15.247(d), In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).		
Test Method:	ANSI C63.10-2020+Cor.1-2023 section 6.10 KDB 558074 D01 15.247 Meas Guidance v05r02		
Test Limit:	Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
	0.009-0.490	2400/F(kHz)	300
	0.490-1.705	24000/F(kHz)	30
	1.705-30.0	30	30
	30-88	100 **	3
	88-216	150 **	3
	216-960	200 **	3
	Above 960	500	3
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241. In the emission table above, the tighter limit applies at the band edges. The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.			
Procedure:	ANSI C63.10-2020+Cor.1-2023 section 6.10.5.2		
Test Setup:			
Operating Environment:			
Temperature:	22.4 °C		
Humidity:	45.2 %		
Atmospheric Pressure:	1010 mbar		
Test voltage:	DC 5V From Desktop computer		

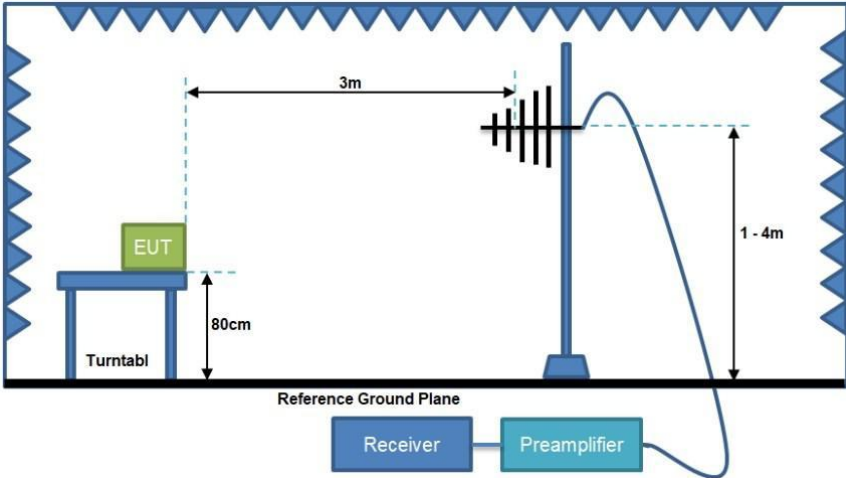
6.6.1 Test Data

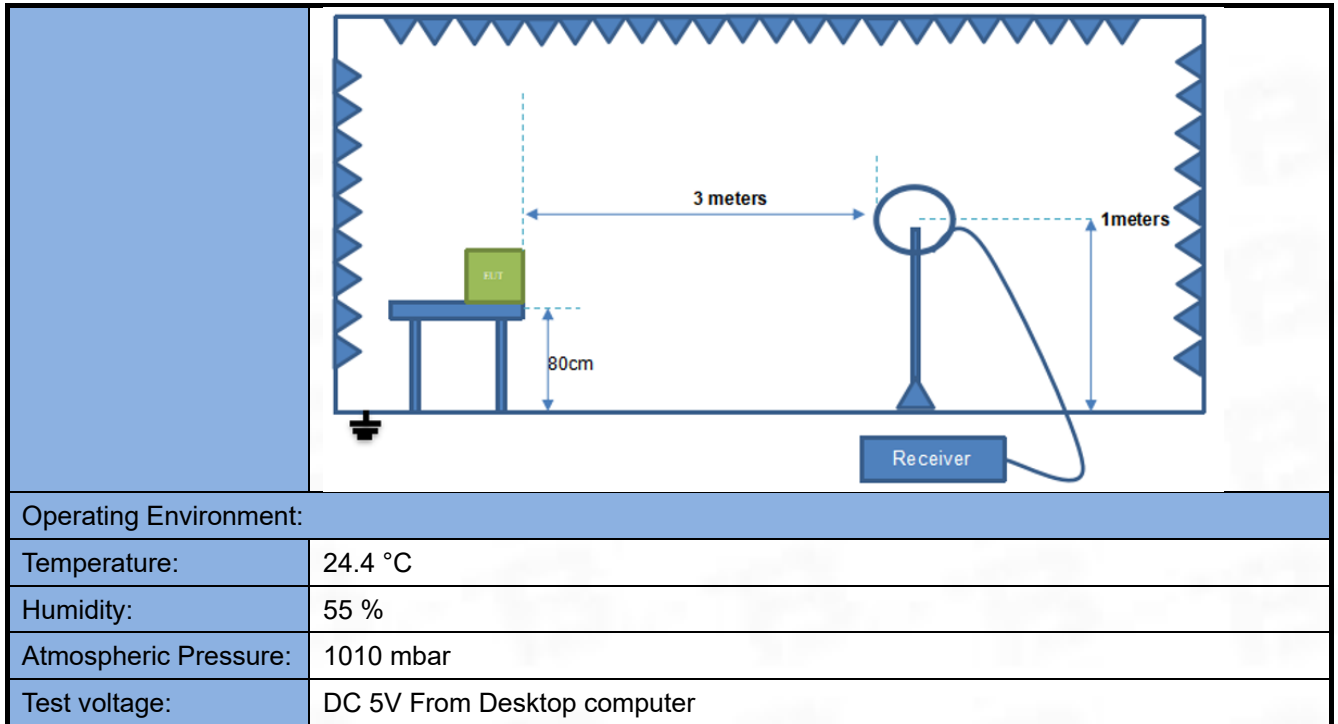
Remark: The report only reflects the test data of worst mode TM2.

Test Channel: Lowest channel, Test Polarization: Vertical							
Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
2310.00	48.58	3.85	52.43	74.00	-21.57	Peak	Pass
2310.00	37.64	3.85	41.49	54.00	-12.51	AVG	Pass
2390.00	47.51	3.91	51.42	74.00	-22.58	Peak	Pass
2390.00	37.91	3.91	41.82	54.00	-12.18	AVG	Pass
Test Channel: Lowest channel, Test Polarization: Horizontal							
Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
2310.00	48.66	3.85	52.51	74.00	-21.49	Peak	Pass
2310.00	38.98	3.85	42.83	54.00	-11.17	AVG	Pass
2390.00	47.72	3.91	51.64	74.00	-22.36	Peak	Pass
2390.00	37.47	3.91	41.39	54.00	-12.61	AVG	Pass
Test Channel: Highest channel, Test Polarization: Vertical							
Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
2483.50	48.90	3.99	52.89	74.00	-21.11	Peak	Pass
2483.50	38.65	3.99	42.64	54.00	-11.36	AVG	Pass
2500.00	52.46	4.00	56.46	74.00	-17.54	Peak	Pass
2500.00	42.82	4.00	46.82	54.00	-7.18	AVG	Pass
Test Channel: Highest channel, Test Polarization: Horizontal							
Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
2483.50	48.62	3.99	52.61	74.00	-21.39	Peak	Pass
2483.50	38.89	3.99	42.88	54.00	-11.12	AVG	Pass
2500.00	51.07	4.00	55.07	74.00	-18.93	Peak	Pass
2500.00	40.18	4.00	44.18	54.00	-9.82	AVG	Pass

Note:Margin=Level-Limit=Reading+factor-Limit=Reading+Antenna factor+ cable loss -Limit

6.7 Emissions in frequency bands (below 1GHz)

Test Requirement:	Refer to 47 CFR 15.247(d), In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).		
Test Method:	ANSI C63.10-2020+Cor.1-2023 section 6.5.4 KDB 558074 D01 15.247 Meas Guidance v05r02		
Test Limit:	Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
	0.009-0.490	2400/F(kHz)	300
	0.490-1.705	24000/F(kHz)	30
	1.705-30.0	30	30
	30-88	100 **	3
	88-216	150 **	3
	216-960	200 **	3
	Above 960	500	3
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241. In the emission table above, the tighter limit applies at the band edges. The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.			
Procedure:	ANSI C63.10-2020+Cor.1-2023 section 6.5.4		
Test Setup:			



6.7.1 Test Data

(9KHz-30 MHz)

Note:

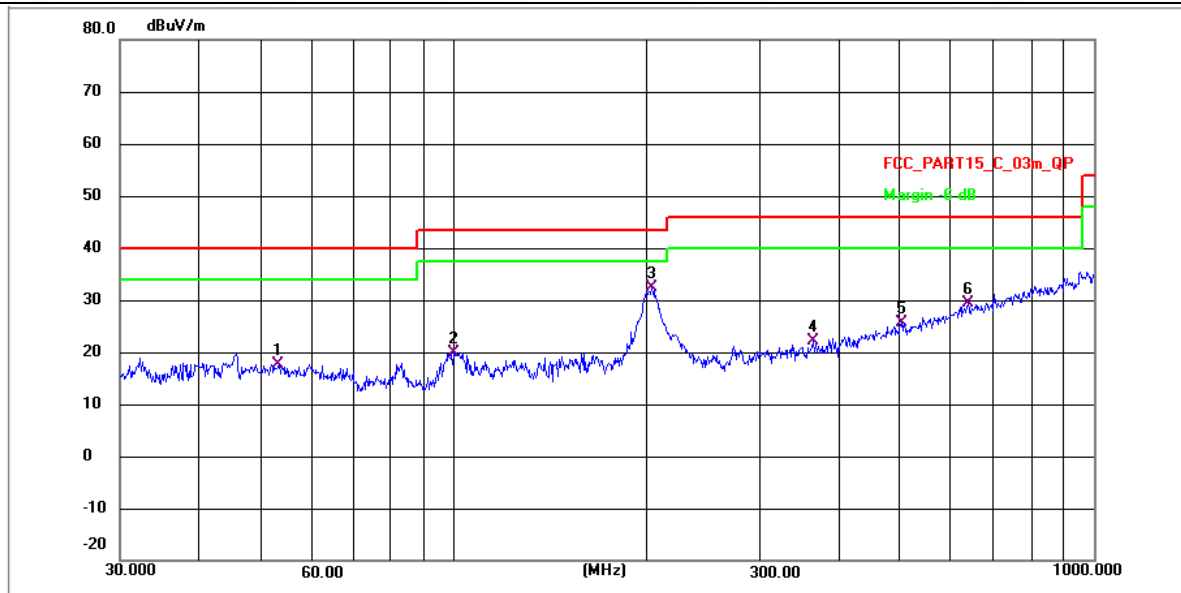
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance/test distance})$ (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

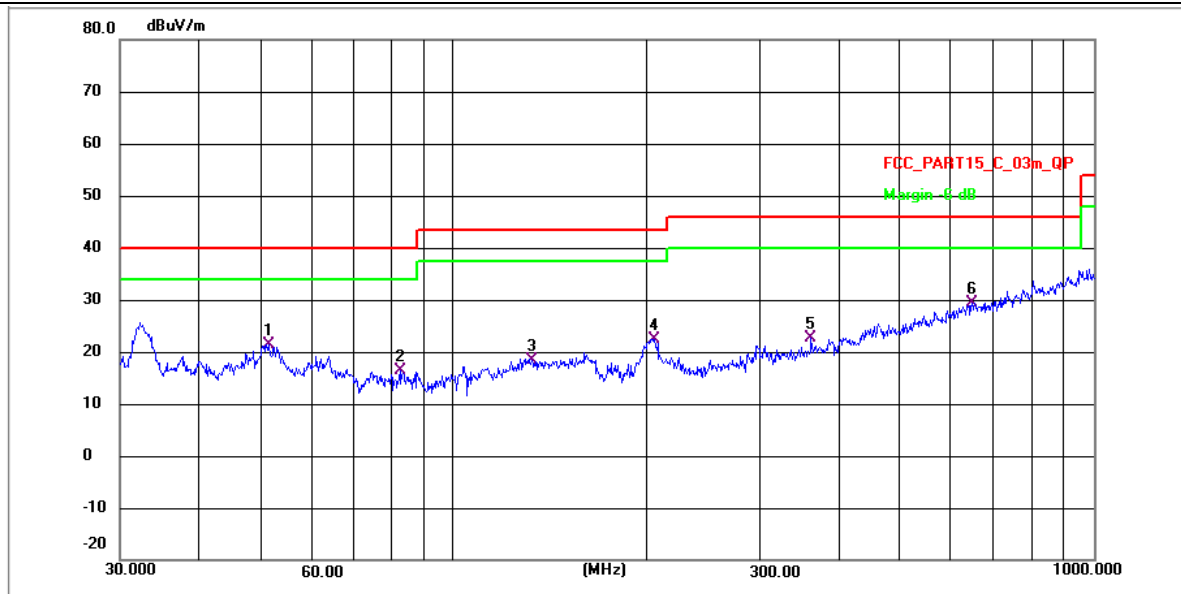
Remark: The report only reflects the test data of worst mode TM2.

TM2 / Polarization: Horizontal / Band: 2400-2483.5 MHz / BW: 1 / CH: M



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	53.3179	27.26	-9.55	17.71	40.00	-22.29	QP	P
2	99.8777	47.85	-27.91	19.94	43.50	-23.56	QP	P
3 *	203.5228	59.14	-26.72	32.42	43.50	-11.08	QP	P
4	364.2595	47.32	-25.21	22.11	46.00	-23.89	QP	P
5	502.9395	49.67	-24.06	25.61	46.00	-20.39	QP	P
6	636.1340	52.44	-22.96	29.48	46.00	-16.52	QP	P

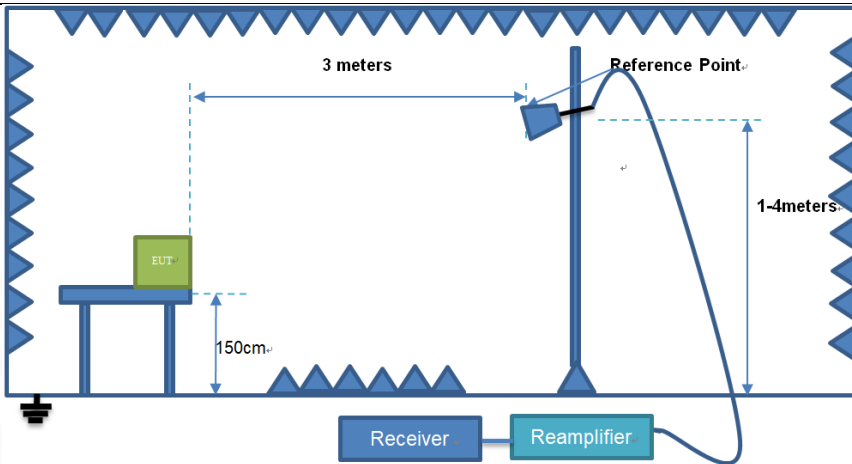
TM2 / Polarization: Vertical / Band: 2400-2483.5 MHz / BW: 1 / CH: M



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	51.2106	30.98	-9.57	21.41	40.00	-18.59	QP	P
2	82.5034	44.46	-28.15	16.31	40.00	-23.69	QP	P
3	132.4526	45.96	-27.52	18.44	43.50	-25.06	QP	P
4	206.0360	49.11	-26.70	22.41	43.50	-21.09	QP	P
5	361.0802	47.87	-25.23	22.64	46.00	-23.36	QP	P
6 *	647.3856	52.30	-22.87	29.43	46.00	-16.57	QP	P

Note: Margin = Level - Limit = Reading + factor - Limit = Reading + Antenna factor + cable loss - amplifier gain - Limit

6.8 Emissions in frequency bands (above 1GHz)

Test Requirement:	Refer to 47 CFR 15.247(d), in addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).		
Test Method:	ANSI C63.10-2020+Cor.1-2023 section 6.5.4 KDB 558074 D01 15.247 Meas Guidance v05r02		
Test Limit:	Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
	0.009-0.490	2400/F(kHz)	300
	0.490-1.705	24000/F(kHz)	30
	1.705-30.0	30	30
	30-88	100 **	3
	88-216	150 **	3
	216-960	200 **	3
	Above 960	500	3
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241. In the emission table above, the tighter limit applies at the band edges. The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.			
Procedure:	ANSI C63.10-2020+Cor.1-2023 section 6.5.4		
Test Setup:			
Operating Environment:			
Temperature:	23.4 °C		
Humidity:	50 %		
Atmospheric Pressure:	1010 mbar		
Test voltage:	DC 5V From Desktop computer		

6.8.1 Test Data

Remark: The report only reflects the test data of worst mode TM2.

Test Channel: Lowest channel, Test Polarization: Vertical							
Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
4804.00	61.30	-48.84	12.47	74.00	-61.53	Peak	Pass
4804.00	51.58	-48.84	2.74	54.00	-51.26	AVG	Pass
7206.00	76.38	-46.89	29.49	74.00	-44.51	Peak	Pass
7206.00	65.95	-46.89	19.07	54.00	-34.93	AVG	Pass
Test Channel: Lowest channel, Test Polarization: Horizontal							
Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
4804.00	76.34	-48.84	27.50	74.00	-46.50	Peak	Pass
4804.00	65.96	-48.84	17.12	54.00	-36.88	AVG	Pass
7206.00	76.29	-46.89	29.40	74.00	-44.60	Peak	Pass
7206.00	65.67	-46.89	18.78	54.00	-35.22	AVG	Pass
Test Channel: Middle channel, Test Polarization: Vertical							
Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
4880.00	60.95	-48.84	12.12	74.00	-61.88	Peak	Pass
4880.00	50.31	-48.84	1.47	54.00	-52.53	AVG	Pass
7320.00	76.52	-46.89	29.64	74.00	-44.36	Peak	Pass
7320.00	66.54	-46.89	19.65	54.00	-34.35	AVG	Pass
Test Channel: Middle channel, Test Polarization: Horizontal							
Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
4880.00	76.20	-48.84	27.37	74.00	-46.63	Peak	Pass
4880.00	65.42	-48.84	16.59	54.00	-37.41	AVG	Pass
7320.00	75.87	-46.89	28.99	74.00	-45.01	Peak	Pass
7320.00	66.37	-46.89	19.48	54.00	-34.52	AVG	Pass

Test Channel: Highest channel, Test Polarization: Vertical

Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
4960.00	70.76	-49.97	20.79	74.00	-53.21	Peak	Pass
4960.00	59.83	-49.97	9.86	54.00	-44.14	AVG	Pass
7440.00	60.35	-49.59	10.76	74.00	-63.24	Peak	Pass
7440.00	49.44	-49.59	-0.14	54.00	-54.14	AVG	Pass
Test Channel: Highest channel, Test Polarization: Horizontal							
Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
4960.00	58.00	-49.22	8.78	74.00	-65.22	Peak	Pass
4960.00	47.70	-49.22	-1.52	54.00	-55.52	AVG	Pass
7440.00	67.79	-49.30	18.49	74.00	-55.51	Peak	Pass
7440.00	57.99	-49.30	8.69	54.00	-45.31	AVG	Pass

Note:Margin=Level-Limit=Reading+factor-Limit=Reading+Antenna factor+ cable loss -amplifier gain-Limit

7 Test Setup Photos

Refer to Appendix I Test Setup Photos

8 EUT Constructional Details (EUT Photos)

Refer to Appendix II External Photos and Appendix III Internal Photos

9 Appendix

1. Duty Cycle

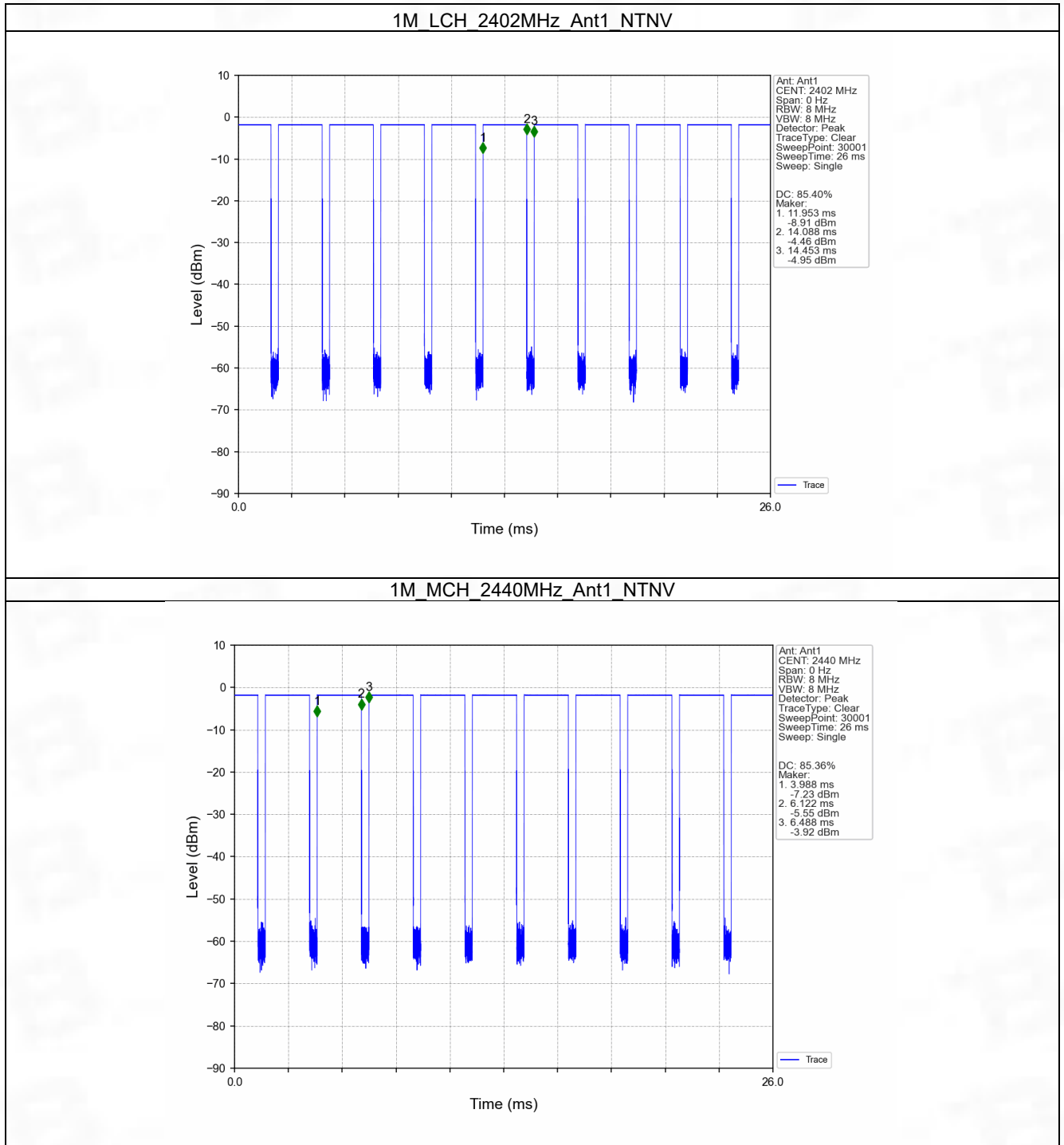
1.1 Test Result

1.1.1 Ant1

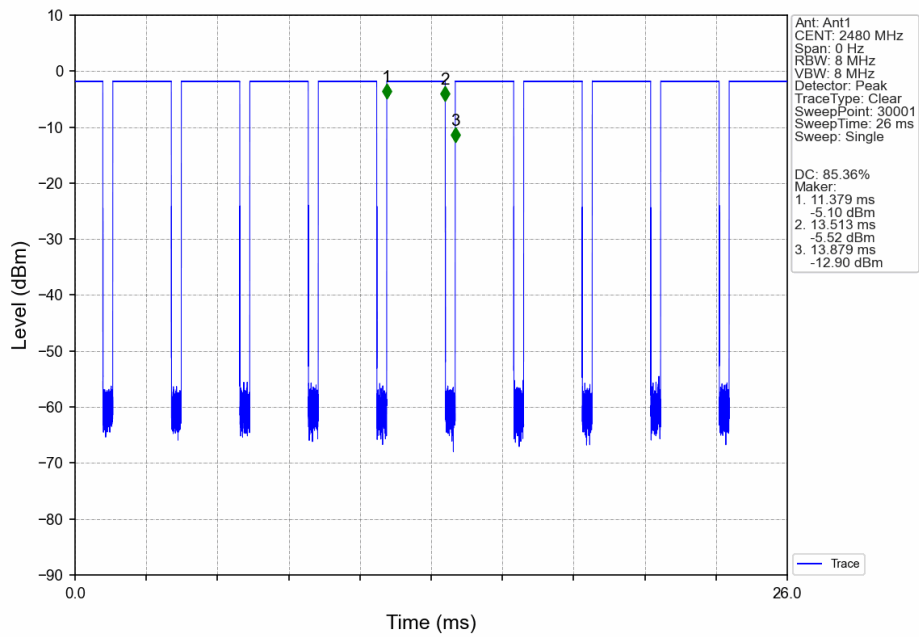
Ant1							
Mode	TX Type	Frequency (MHz)	T_on (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	Max. DC Variation (%)
1M	SISO	2402	2.135	2.500	85.40	0.69	0.03
		2440	2.134	2.500	85.36	0.69	0.03
		2480	2.134	2.500	85.36	0.69	0.03
2M	SISO	2402	1.083	2.501	43.30	3.63	0.03
		2440	1.083	2.501	43.30	3.63	0.02
		2480	1.083	2.501	43.30	3.63	0.03

1.2 Test Graph

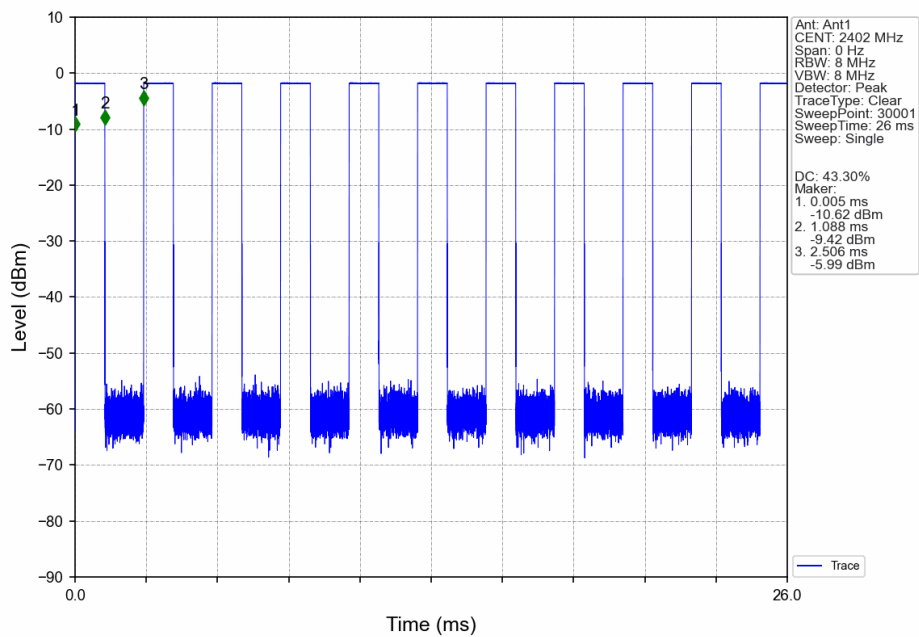
1.2.1 Ant1



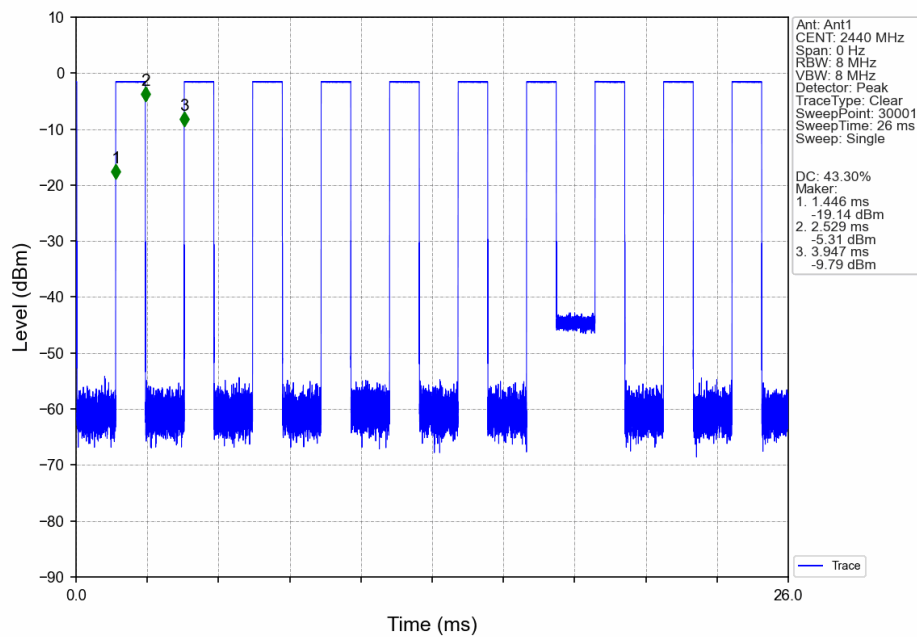
1M_HCH_2480MHz_Ant1_NTNV



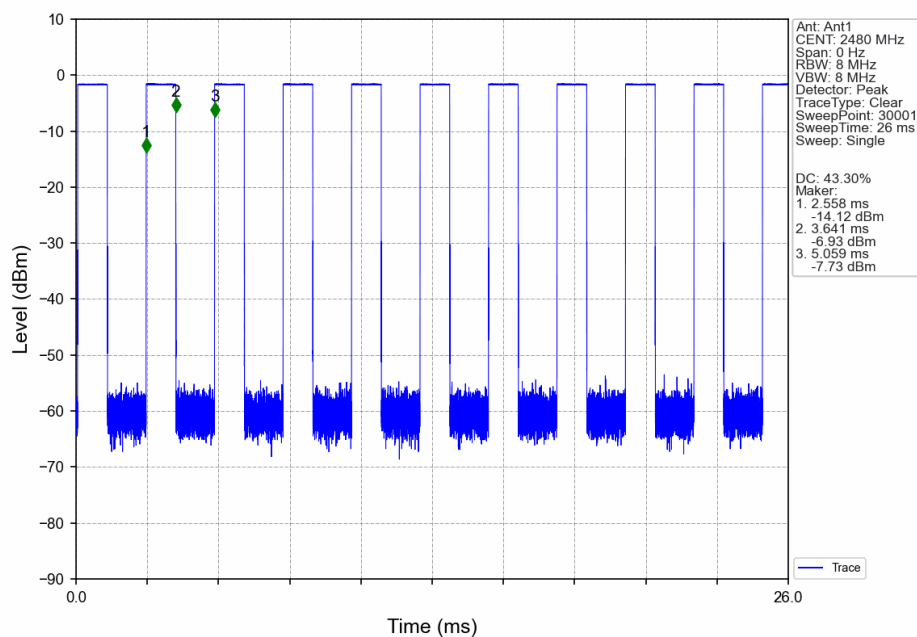
2M_LCH_2402MHz_Ant1_NTNV



2M_MCH_2440MHz_Ant1_NTNV



2M_HCH_2480MHz_Ant1_NTNV



2. Bandwidth

2.1 Test Result

2.1.1 OBW

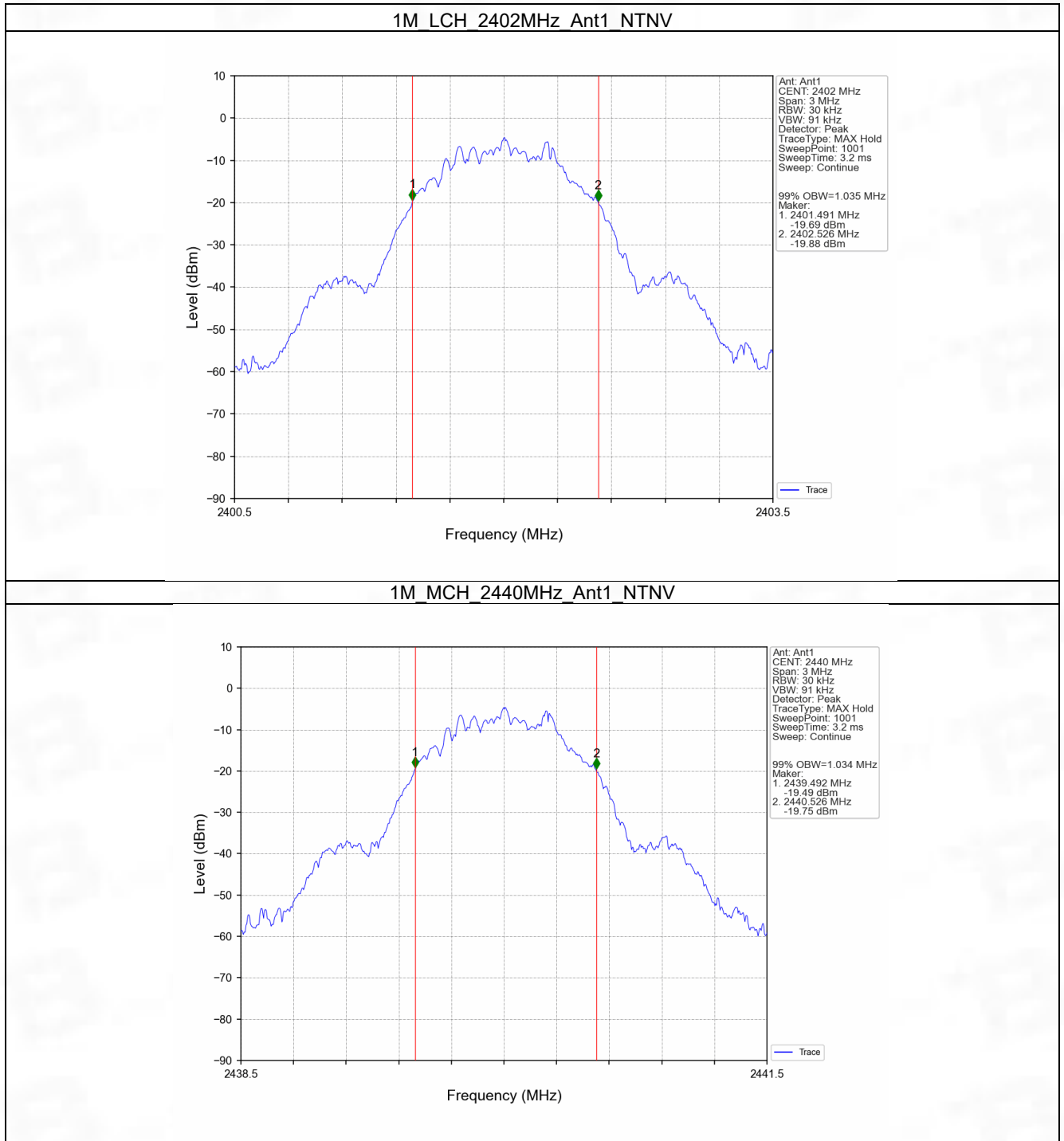
Mode	TX Type	Frequency (MHz)	ANT	99% Occupied Bandwidth (MHz)		Verdict
				Result	Limit	
1M	SISO	2402	1	1.035	/	Pass
		2440	1	1.034	/	Pass
		2480	1	1.039	/	Pass
2M	SISO	2402	1	2.037	/	Pass
		2440	1	2.044	/	Pass
		2480	1	2.043	/	Pass

2.1.2 6dB BW

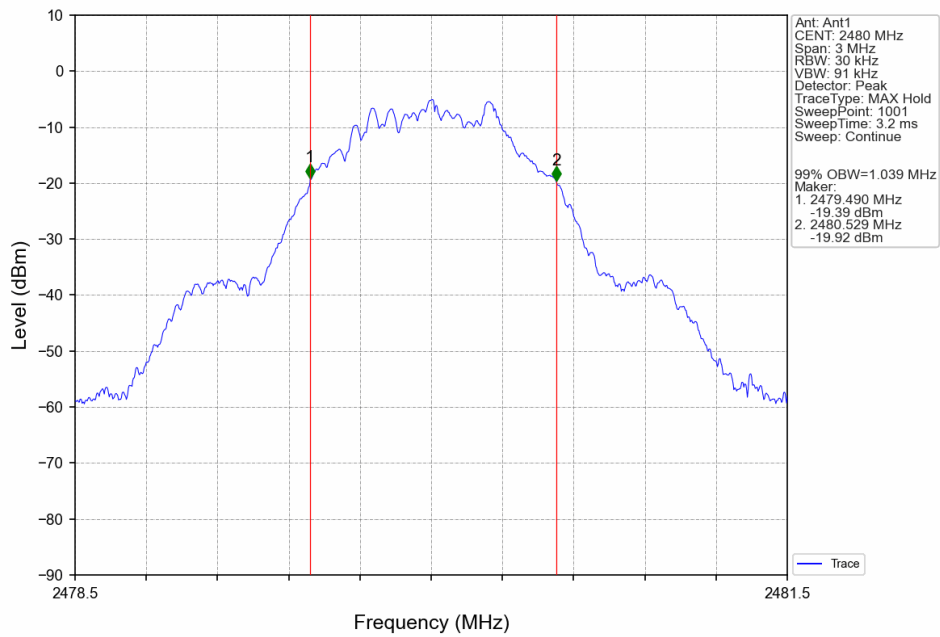
Mode	TX Type	Frequency (MHz)	ANT	6dB Bandwidth (MHz)		Verdict
				Result	Limit	
1M	SISO	2402	1	0.669	≥ 0.5	Pass
		2440	1	0.676	≥ 0.5	Pass
		2480	1	0.678	≥ 0.5	Pass
2M	SISO	2402	1	1.179	≥ 0.5	Pass
		2440	1	1.161	≥ 0.5	Pass
		2480	1	1.167	≥ 0.5	Pass

2.2 Test Graph

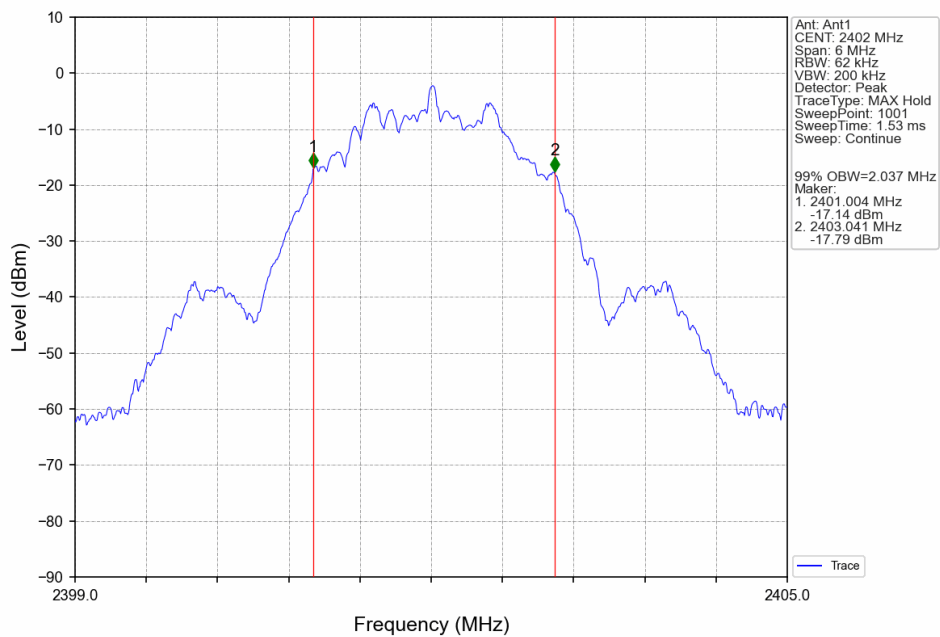
2.2.1 OBW



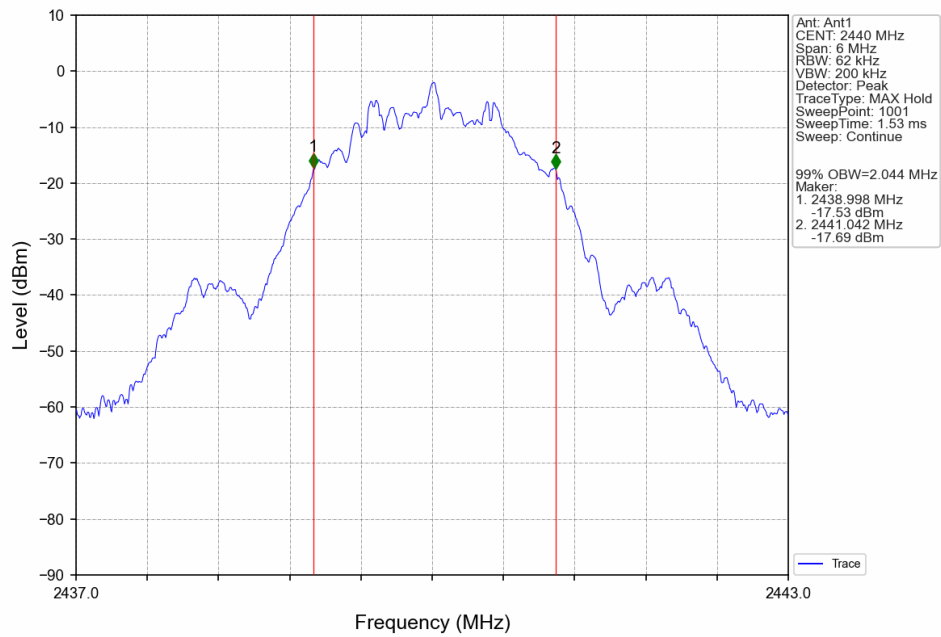
1M_HCH_2480MHz_Ant1_NTNV



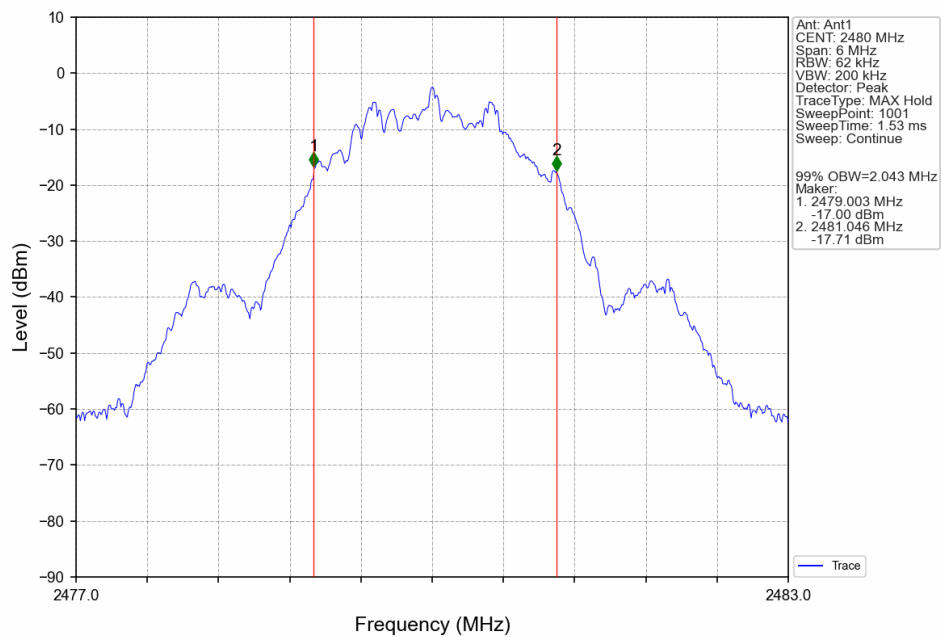
2M_LCH_2402MHz_Ant1_NTNV



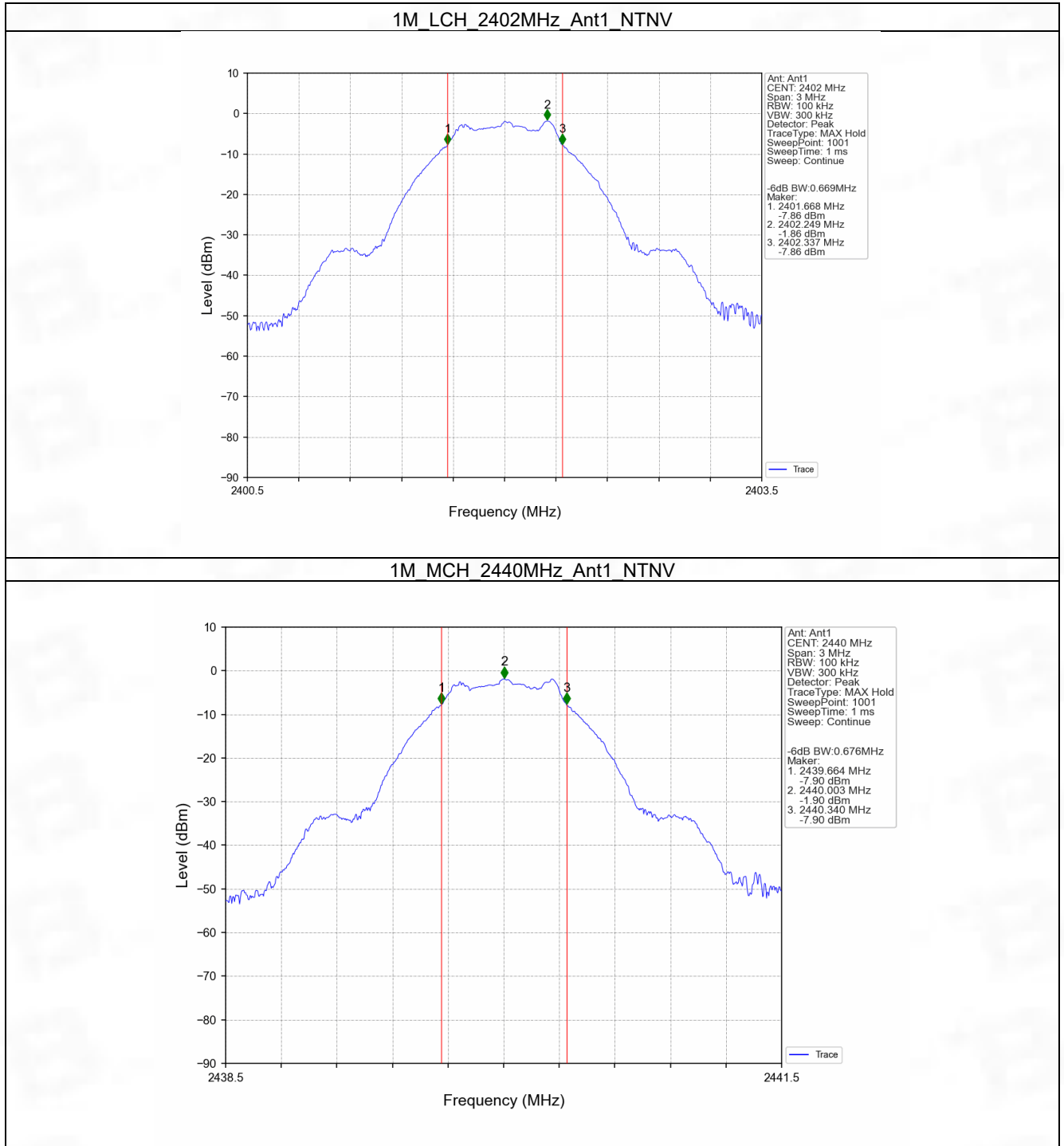
2M_MCH_2440MHz_Ant1_NTNV



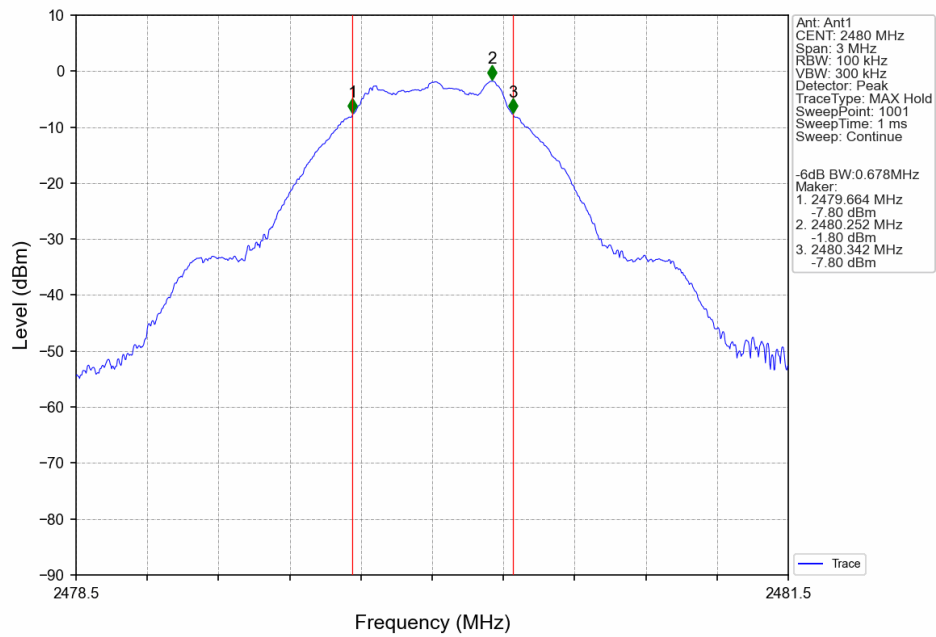
2M_HCH_2480MHz_Ant1_NTNV



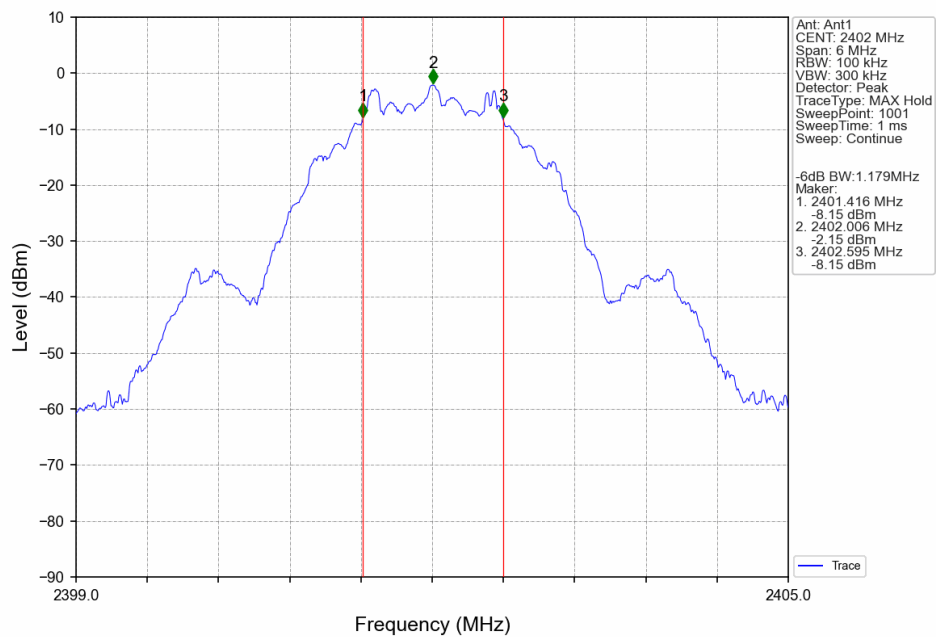
2.2.2 6dB BW



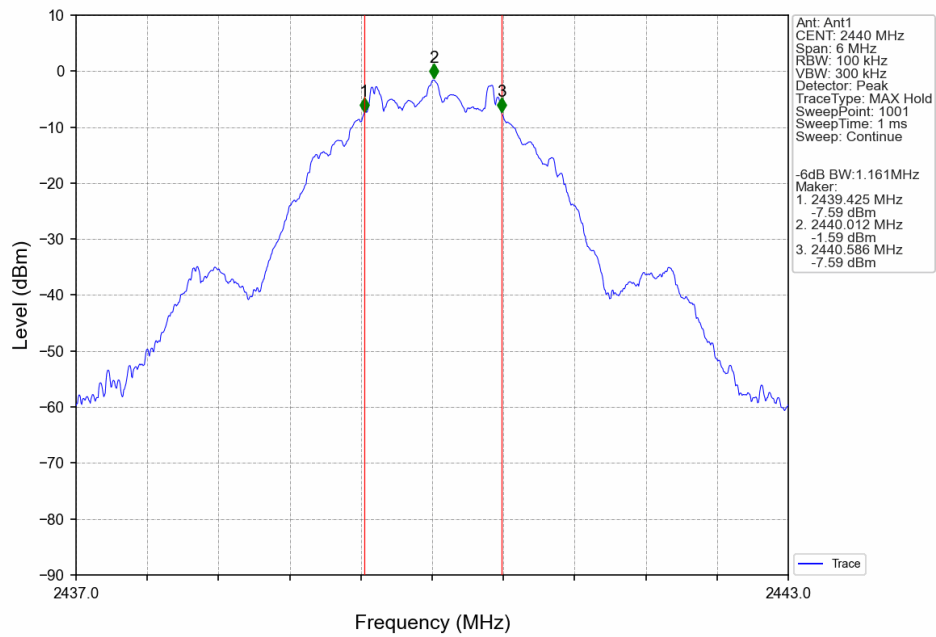
1M_HCH_2480MHz_Ant1_NTNV



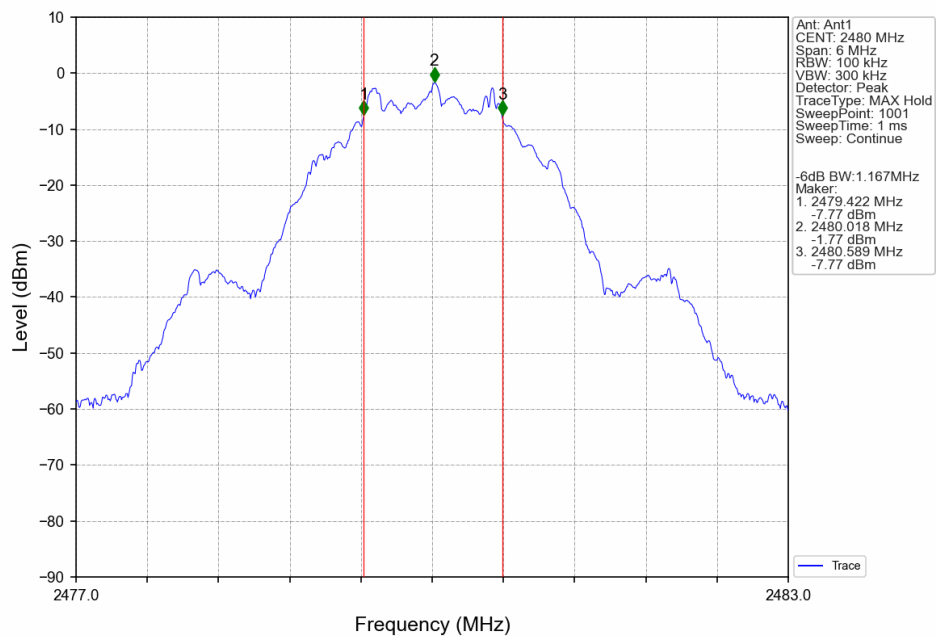
2M_LCH_2402MHz_Ant1_NTNV



2M_MCH_2440MHz_Ant1_NTNV



2M_HCH_2480MHz_Ant1_NTNV



3. Maximum Conducted Output Power

3.1 Test Result

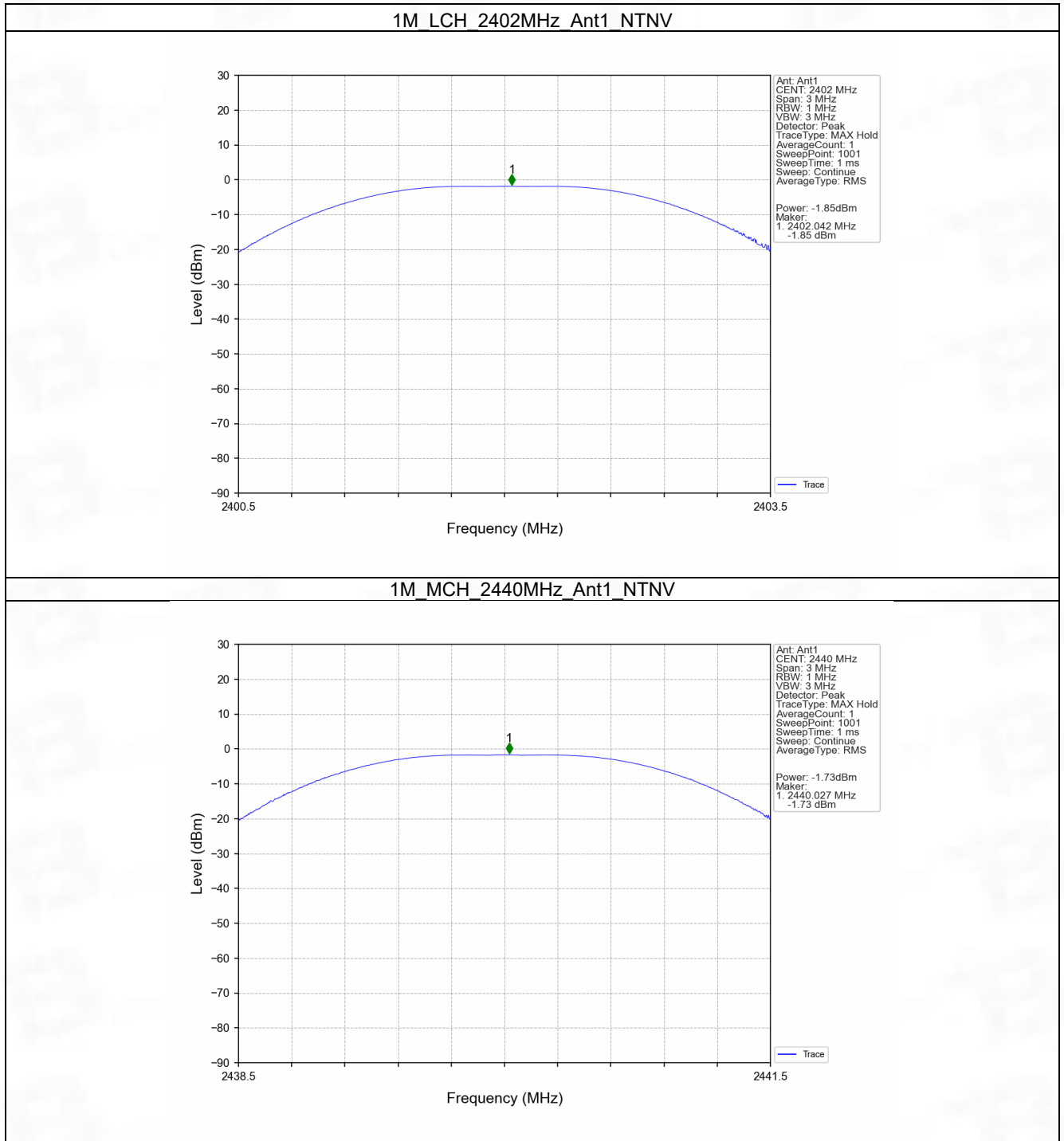
3.1.1 Power

Mode	TX Type	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)		Verdict
			ANT1	Limit	
1M	SISO	2402	-1.85	≤ 30	Pass
		2440	-1.73	≤ 30	Pass
		2480	-1.78	≤ 30	Pass
2M	SISO	2402	-1.72	≤ 30	Pass
		2440	-1.48	≤ 30	Pass
		2480	-1.57	≤ 30	Pass

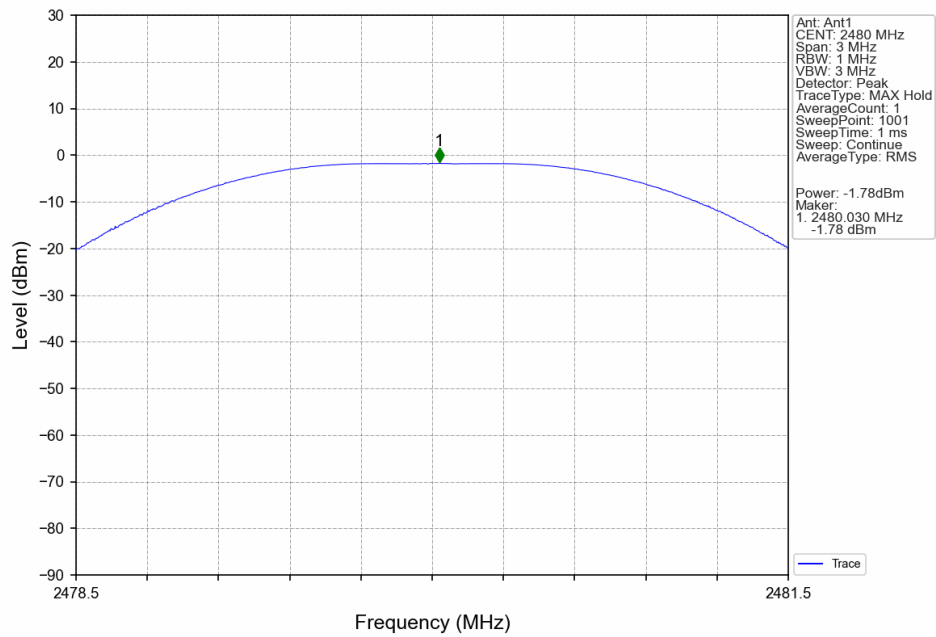
Note1: Antenna Gain: Ant1: -0.58dBi;

3.2 Test Graph

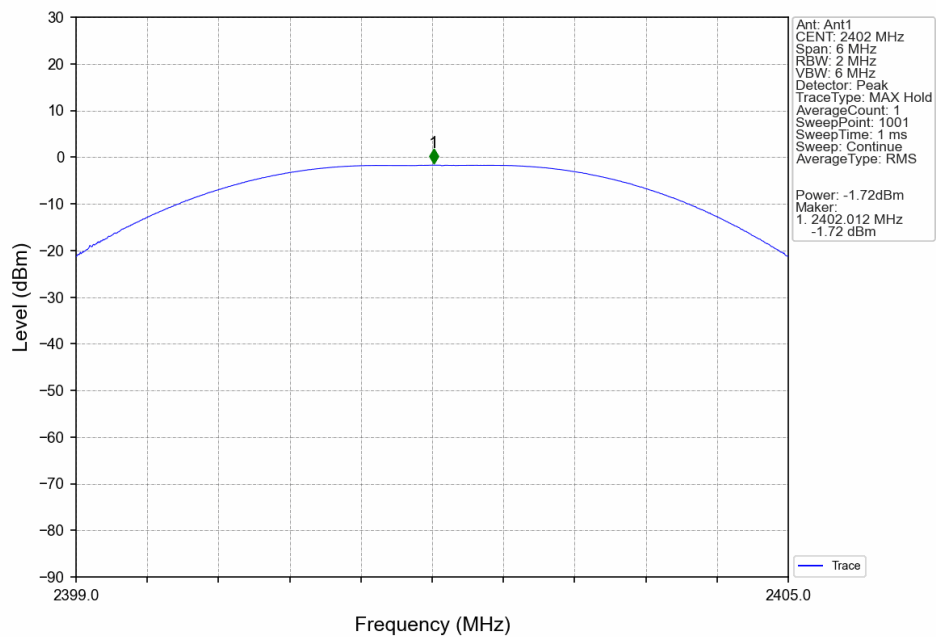
3.2.1 Power



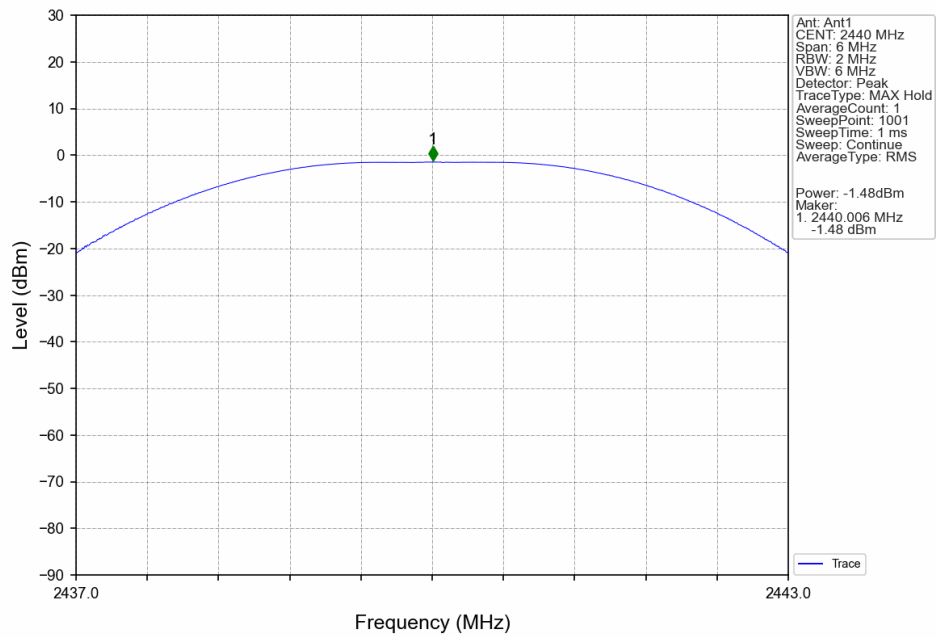
1M_HCH_2480MHz_Ant1_NTNV



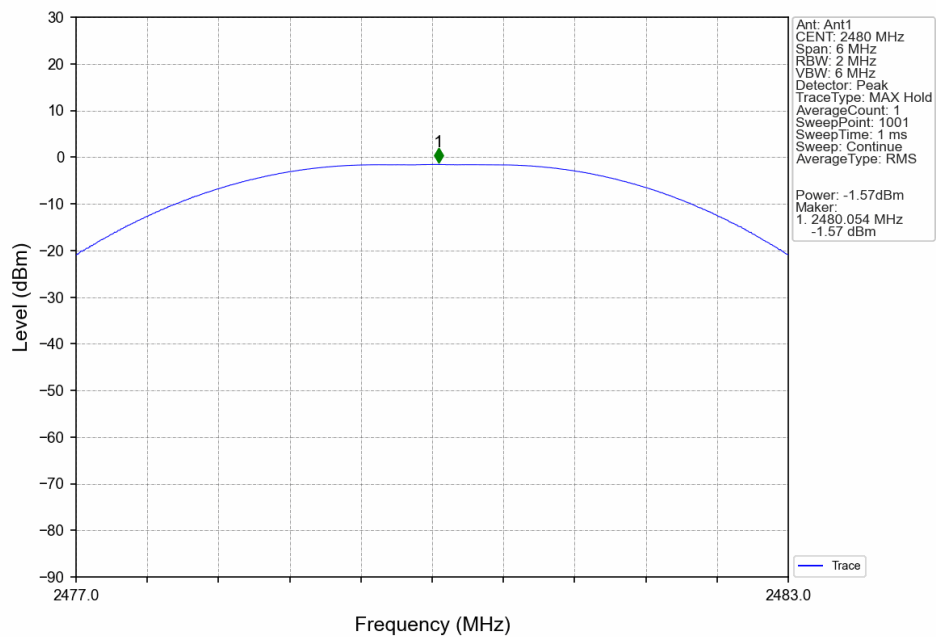
2M_LCH_2402MHz_Ant1_NTNV



2M_MCH_2440MHz_Ant1_NTNV



2M_HCH_2480MHz_Ant1_NTNV



4. Maximum Power Spectral Density

4.1 Test Result

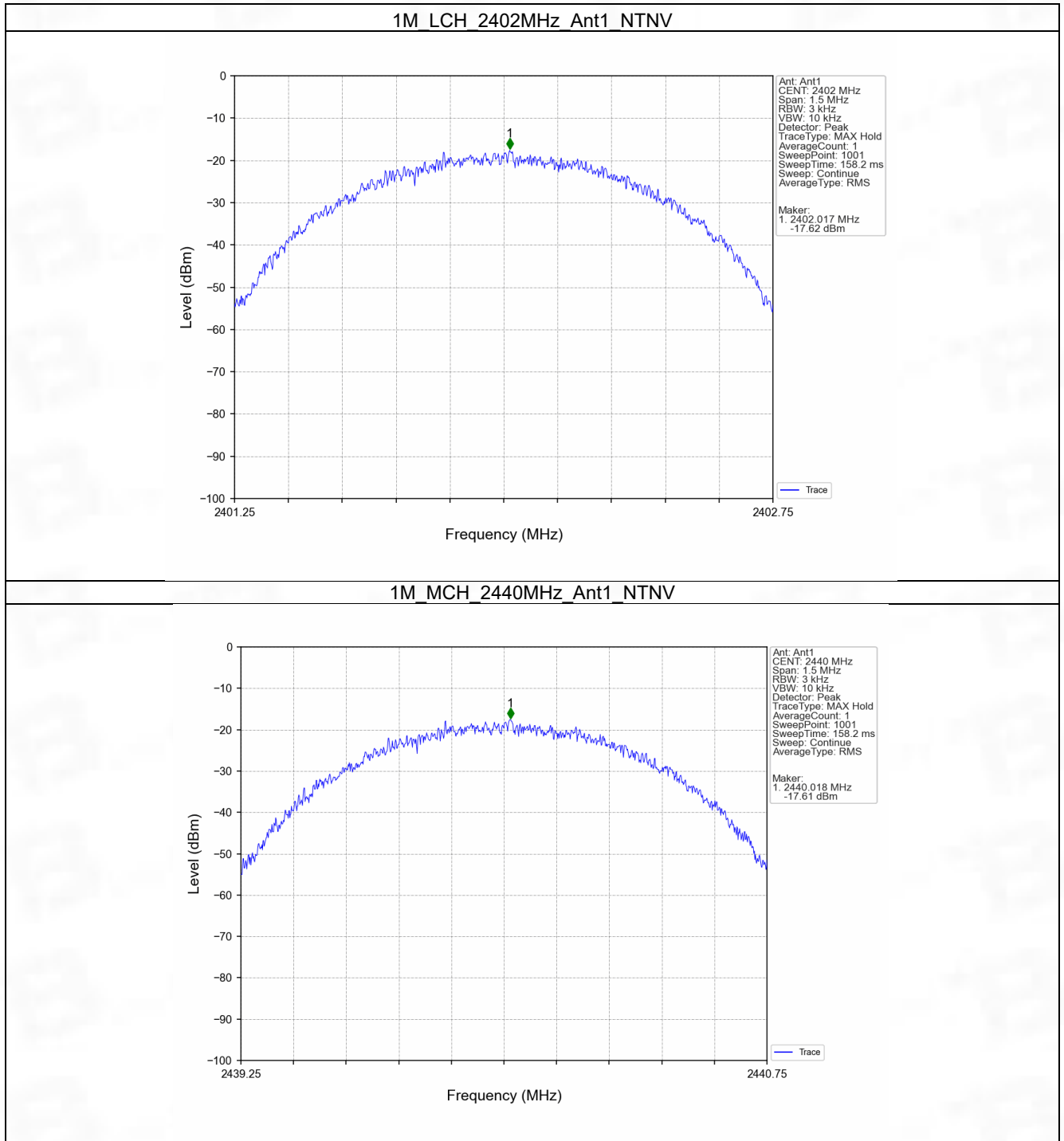
4.1.1 PSD

Mode	TX Type	Frequency (MHz)	Maximum PSD (dBm)		Verdict
			ANT1	Limit	
1M	SISO	2402	-17.62	<=8	Pass
		2440	-17.61	<=8	Pass
		2480	-17.47	<=8	Pass
2M	SISO	2402	-20.43	<=8	Pass
		2440	-20.32	<=8	Pass
		2480	-20.01	<=8	Pass

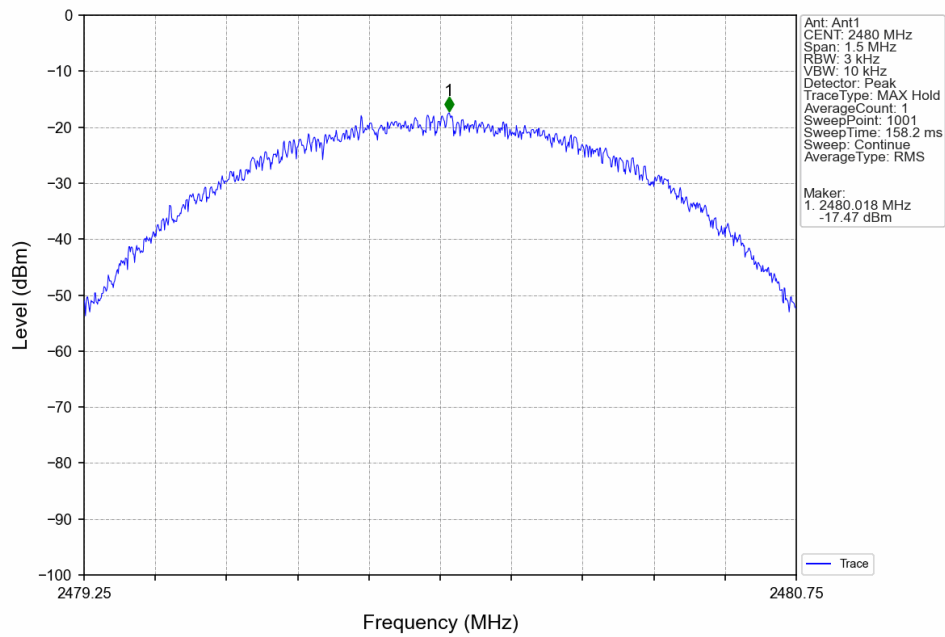
Note1: Antenna Gain: Ant1: -0.58dBi;

4.2 Test Graph

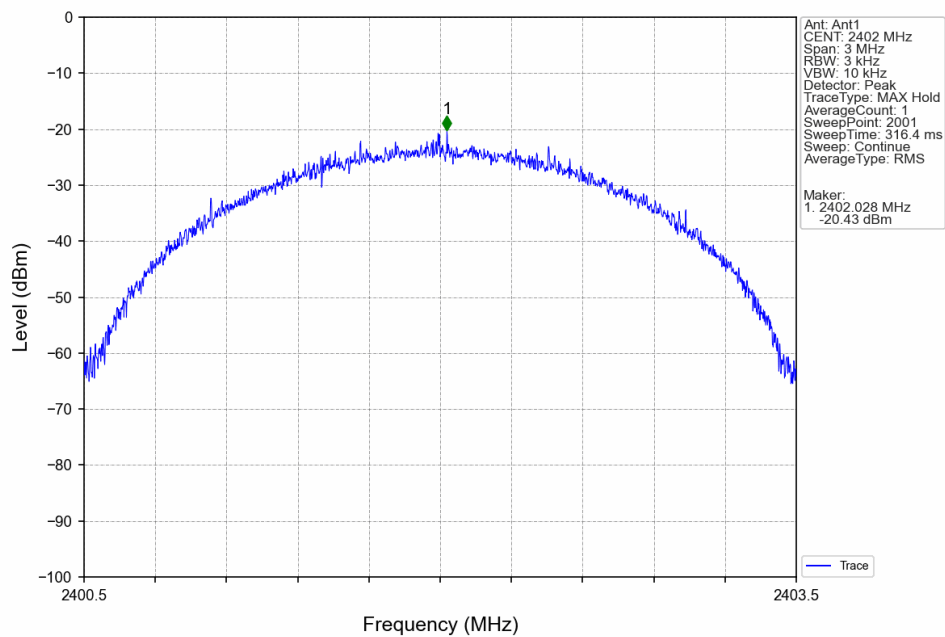
4.2.1 PSD



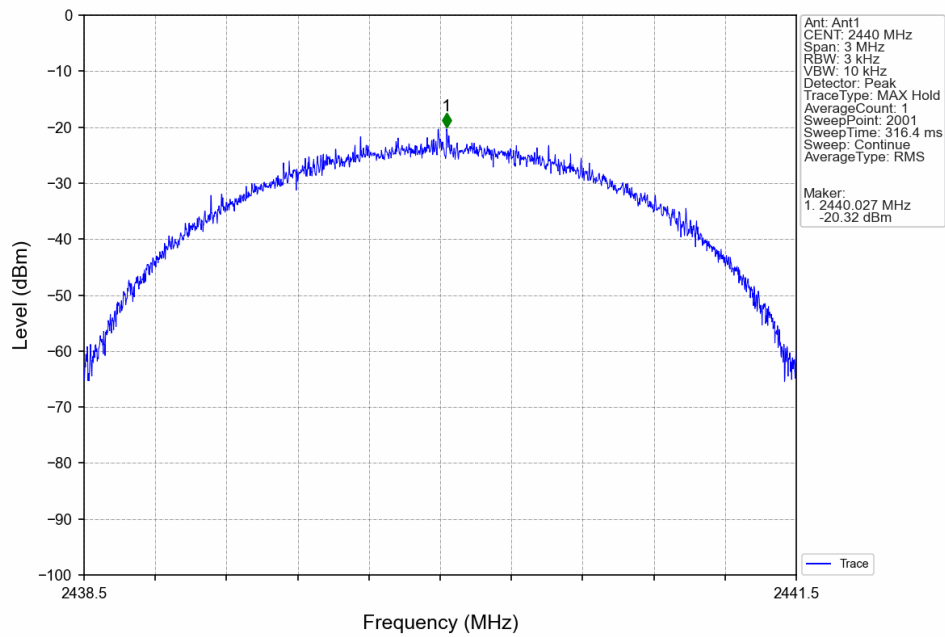
1M_HCH_2480MHz_Ant1_NTNV



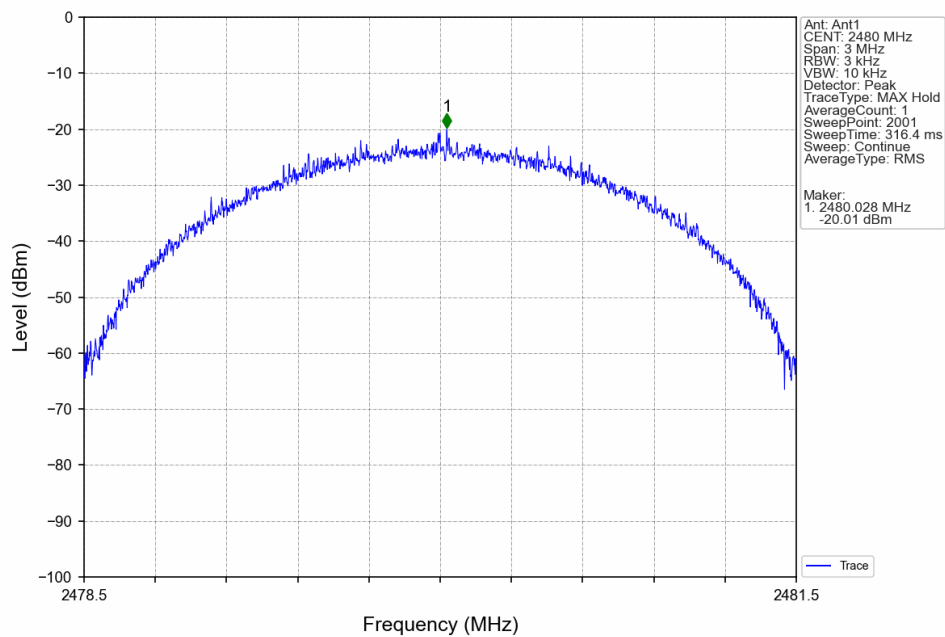
2M_LCH_2402MHz_Ant1_NTNV



2M_MCH_2440MHz_Ant1_NTNV



2M_HCH_2480MHz_Ant1_NTNV



5. Unwanted Emissions In Non-restricted Frequency Bands

5.1 Test Result

5.1.1 Ref

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)
1M	SISO	2402	1	-1.87
		2440	1	-1.75
		2480	1	-1.81
2M	SISO	2402	1	-1.94
		2440	1	-1.69
		2480	1	-1.84

Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2020, the channel contains the maximum PSD level was used to establish the reference level.

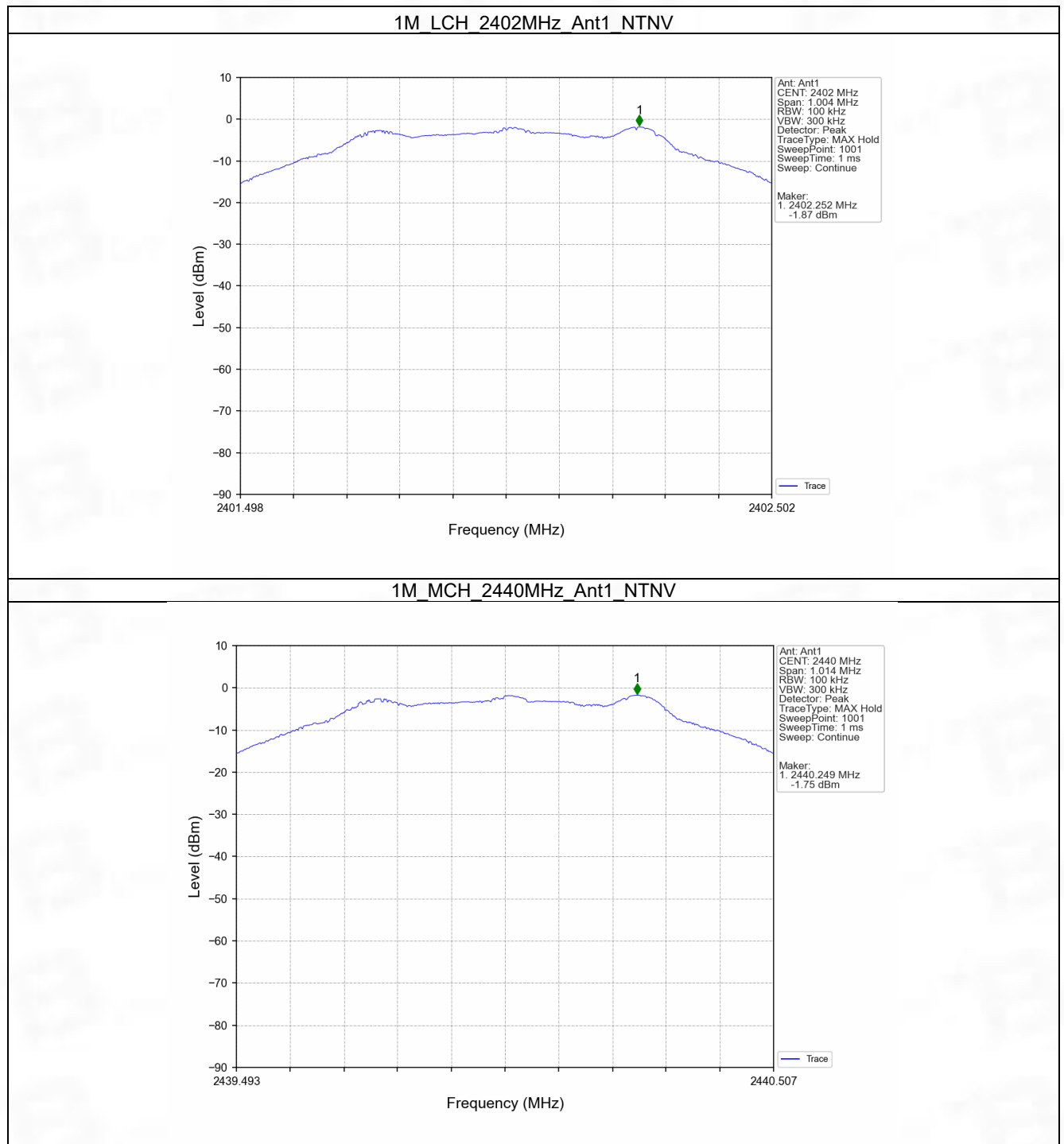
5.1.2 CSE

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
1M	SISO	2402	1	-1.87	-21.87	Pass
		2440	1	-1.75	-21.75	Pass
		2480	1	-1.81	-21.81	Pass
2M	SISO	2402	1	-1.94	-21.94	Pass
		2440	1	-1.69	-21.69	Pass
		2480	1	-1.84	-21.84	Pass

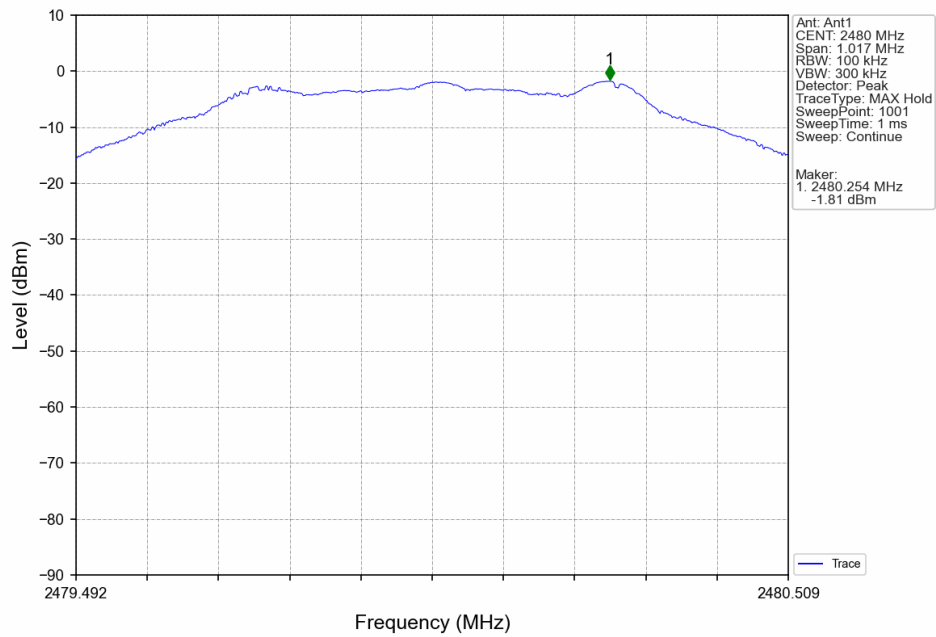
Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2020, the channel contains the maximum PSD level was used to establish the reference level.

5.2 Test Graph

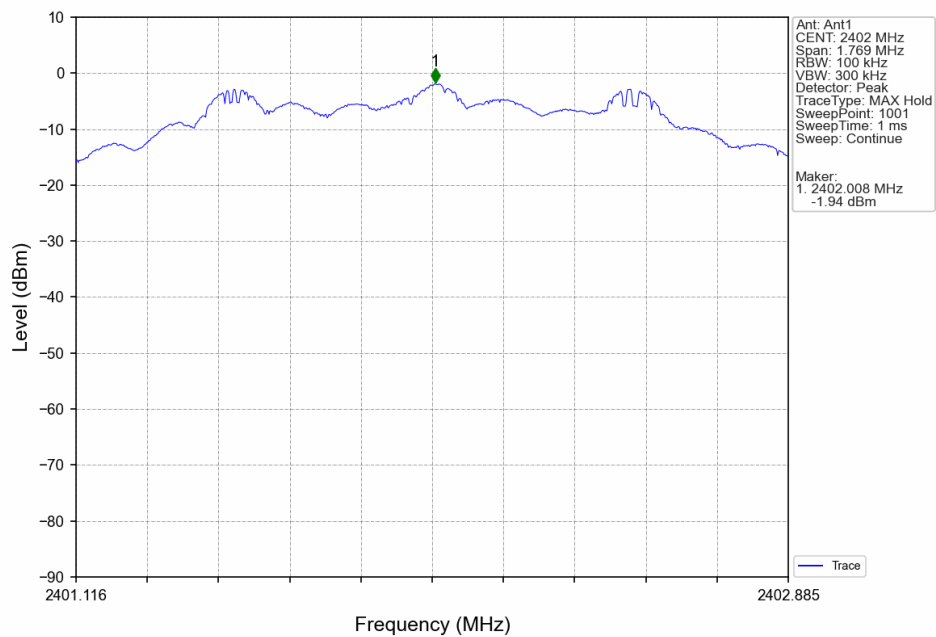
5.2.1 Ref



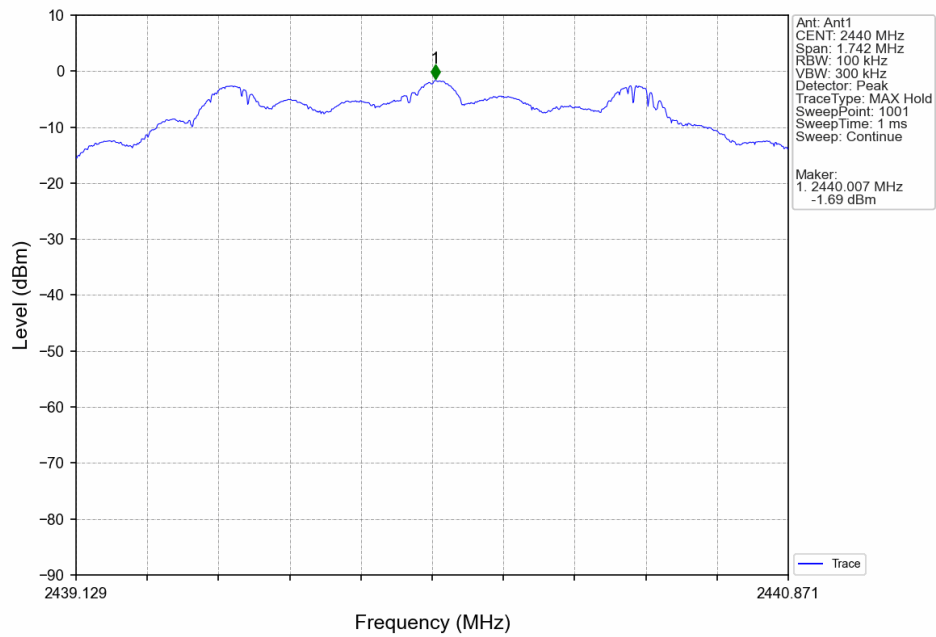
1M_HCH_2480MHz_Ant1_NTNV



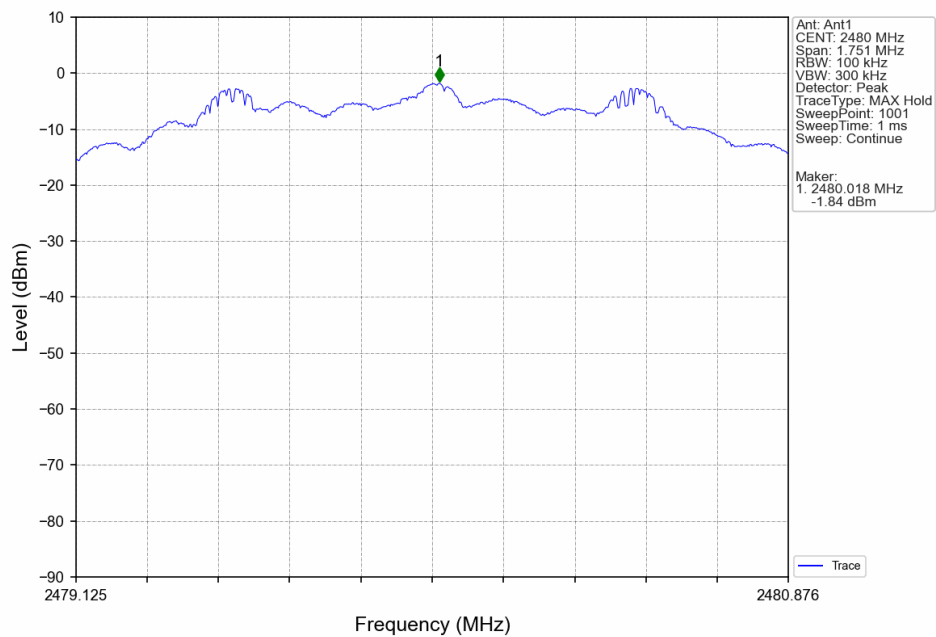
2M_LCH_2402MHz_Ant1_NTNV



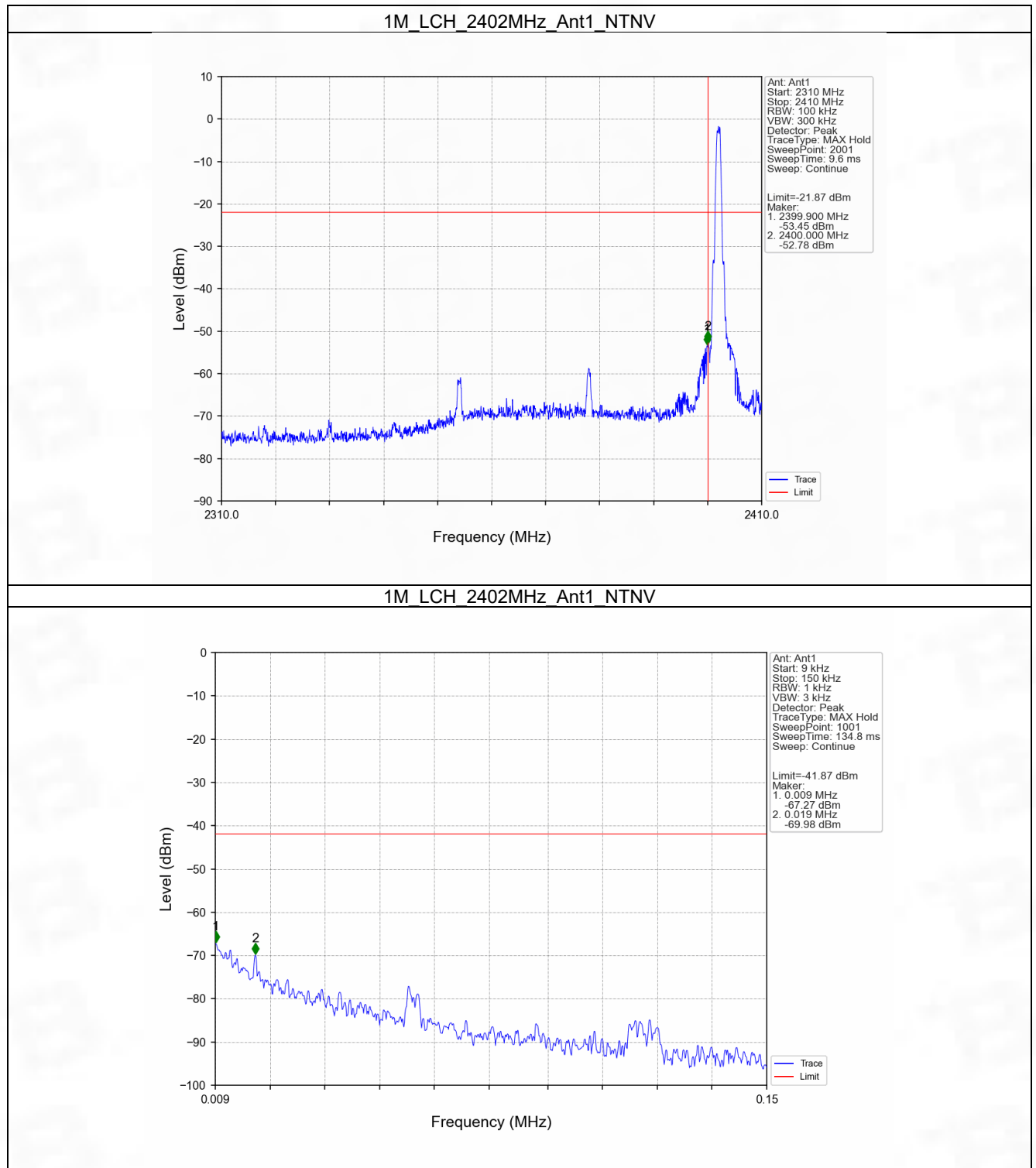
2M_MCH_2440MHz_Ant1_NTNV



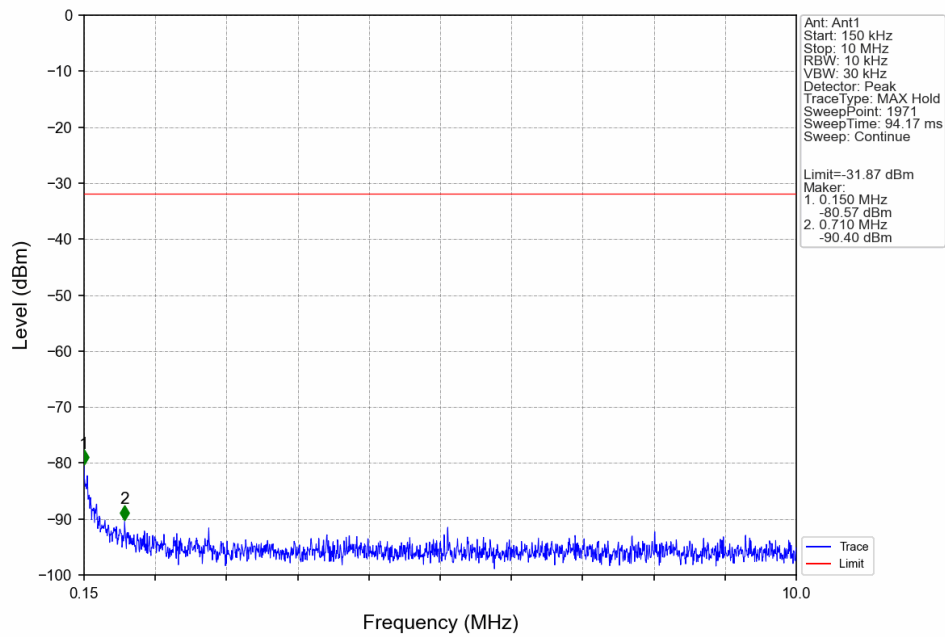
2M_HCH_2480MHz_Ant1_NTNV



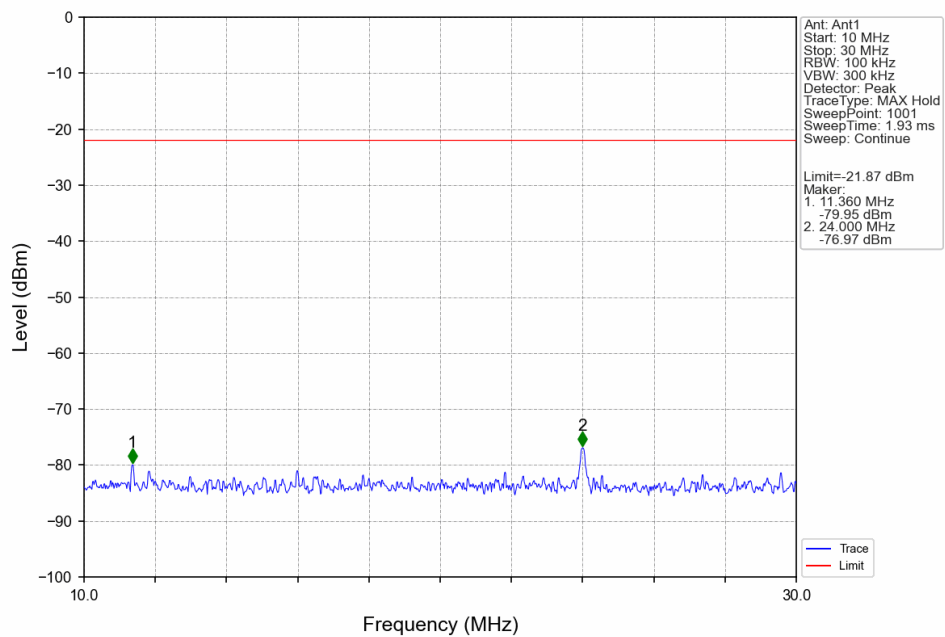
5.2.2 CSE



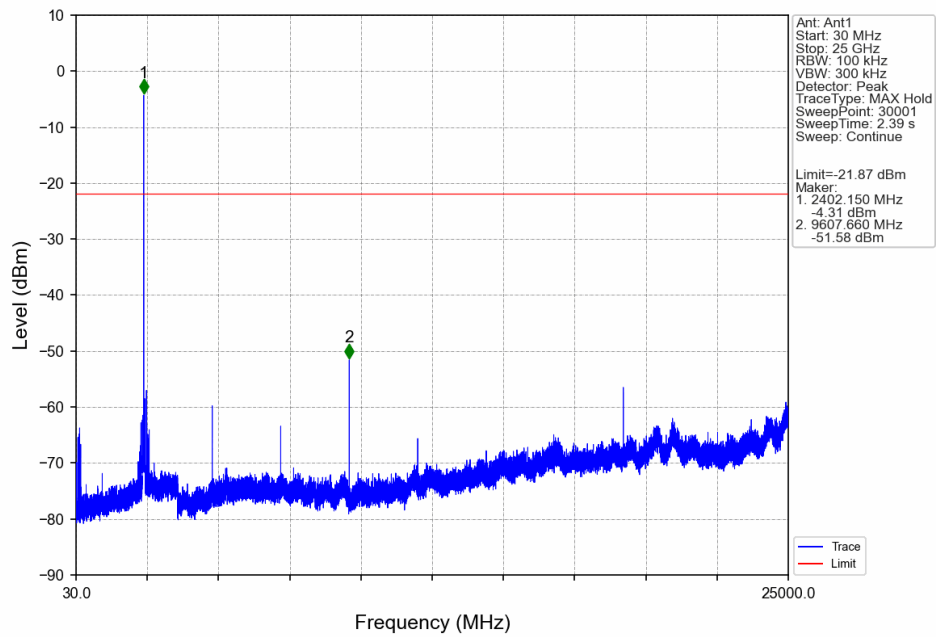
1M_LCH_2402MHz_Ant1_NTNV



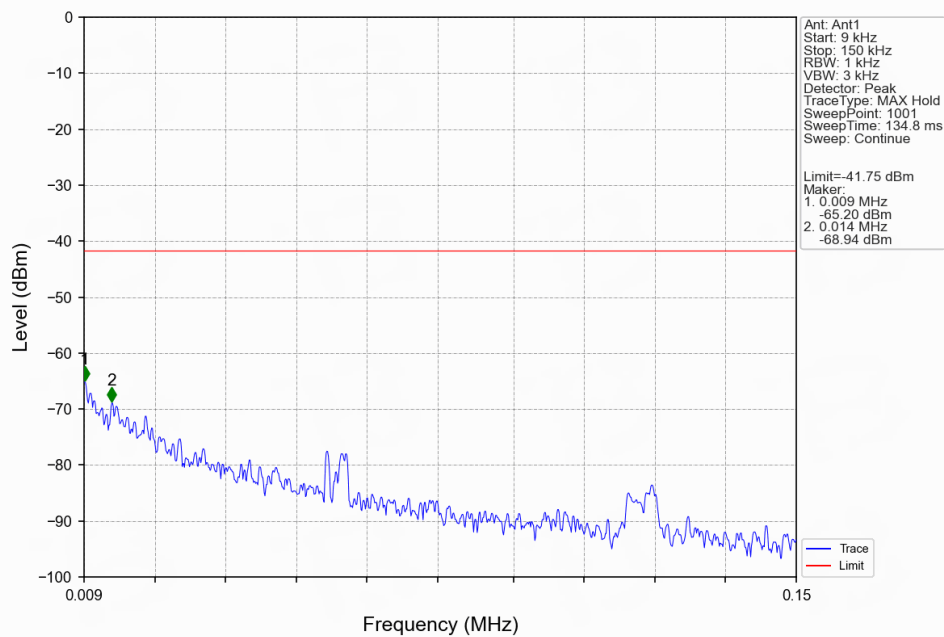
1M_LCH_2402MHz_Ant1_NTNV



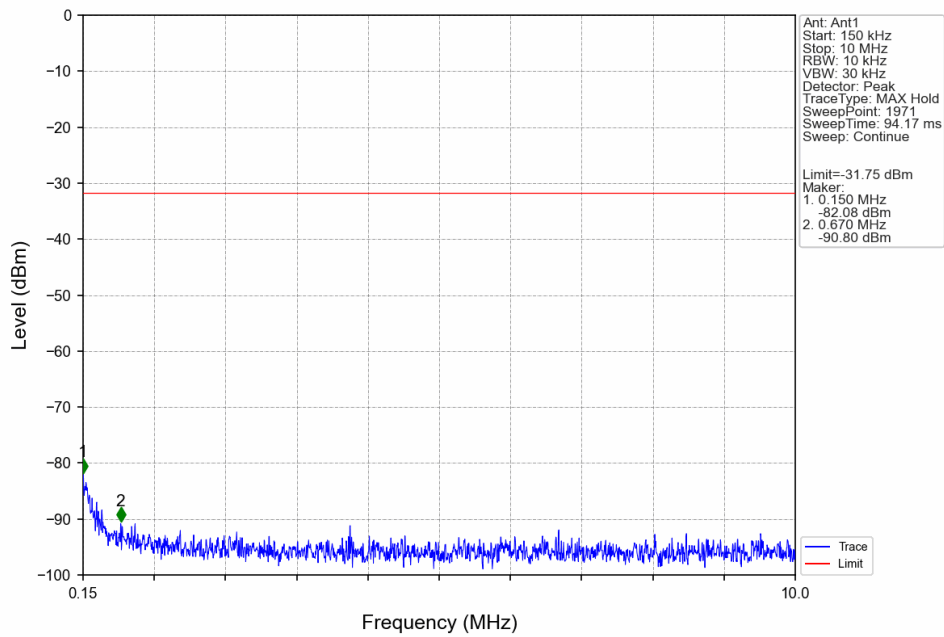
1M_LCH_2402MHz_Ant1_NTNV



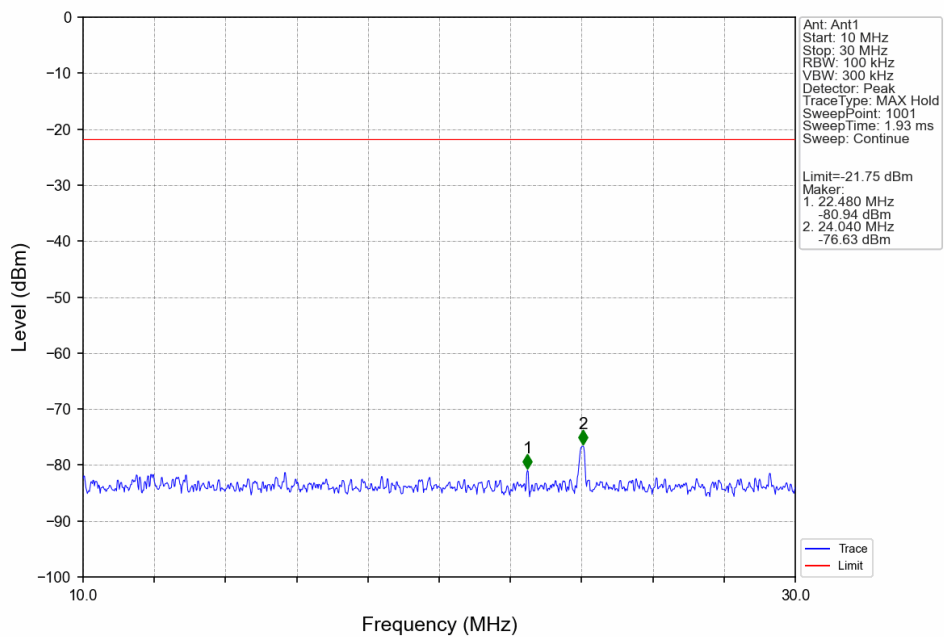
1M_MCH_2440MHz_Ant1_NTNV



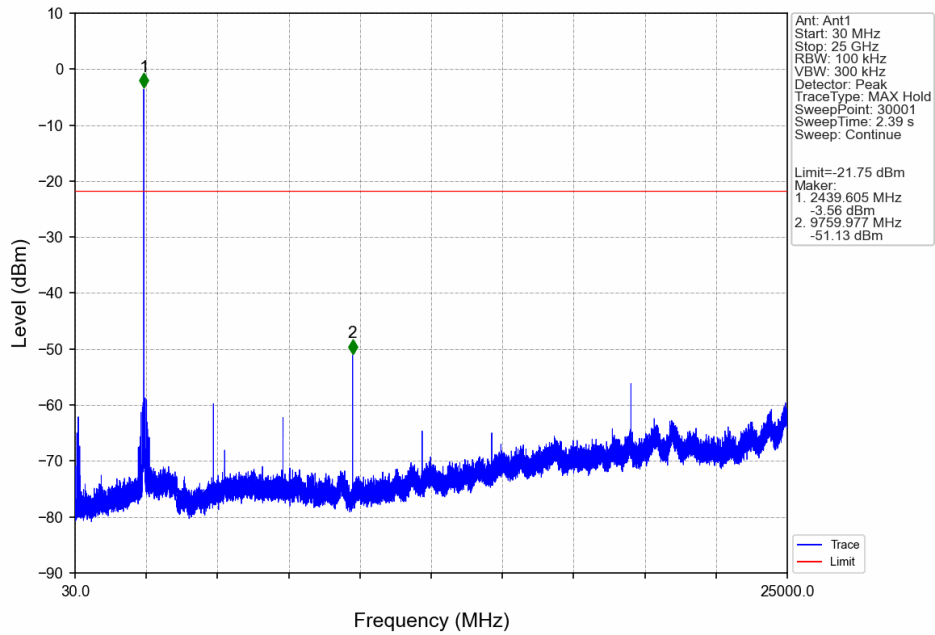
1M_MCH_2440MHz_Ant1_NTNV



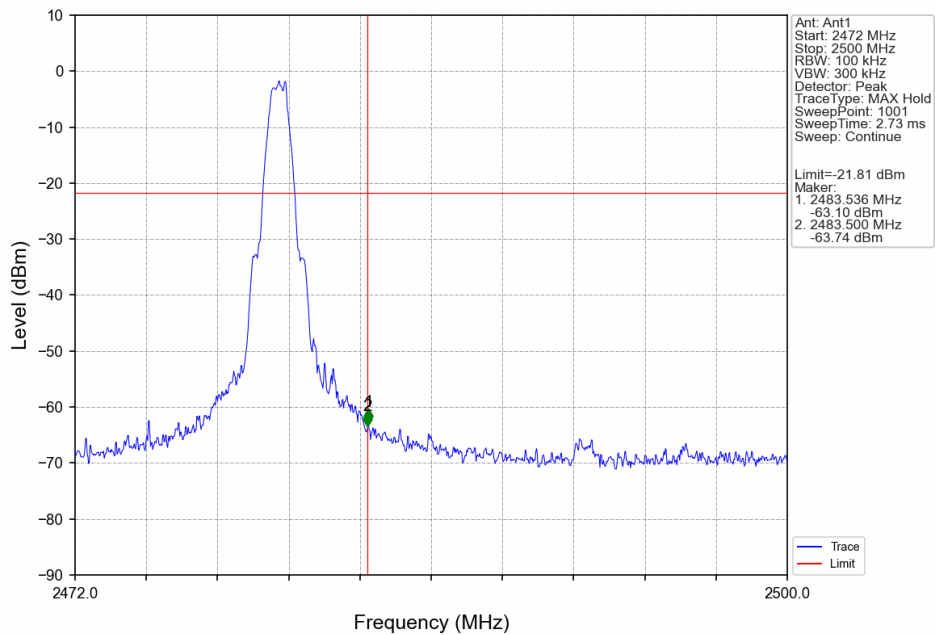
1M_MCH_2440MHz_Ant1_NTNV



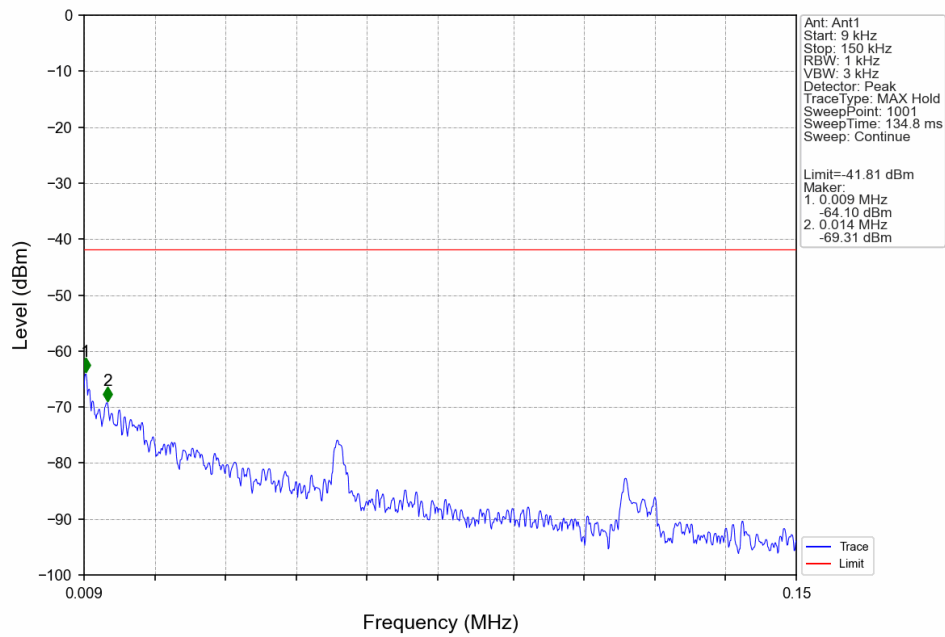
1M_MCH_2440MHz_Ant1_NTNV



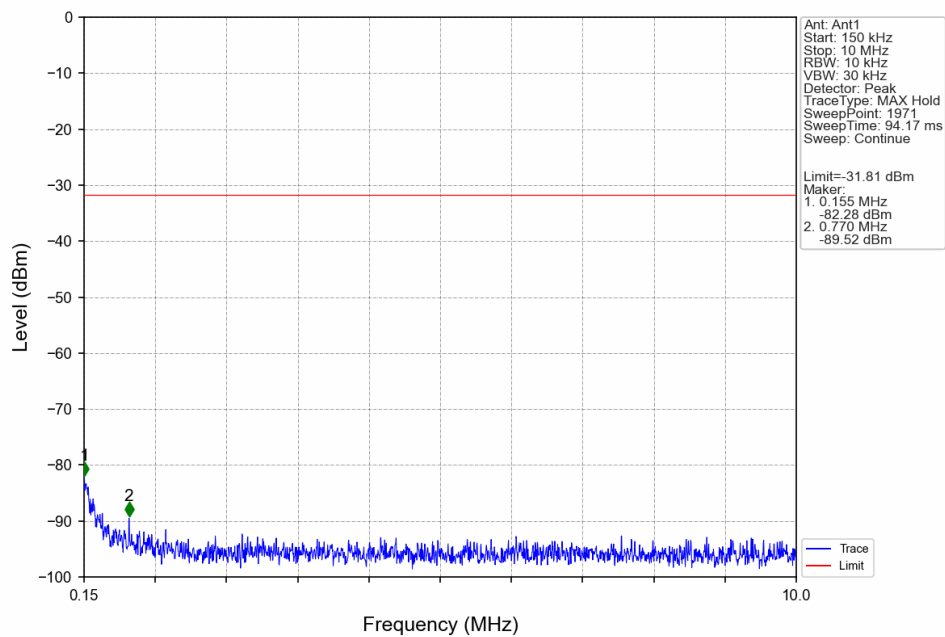
1M_HCH_2480MHz_Ant1_NTNV



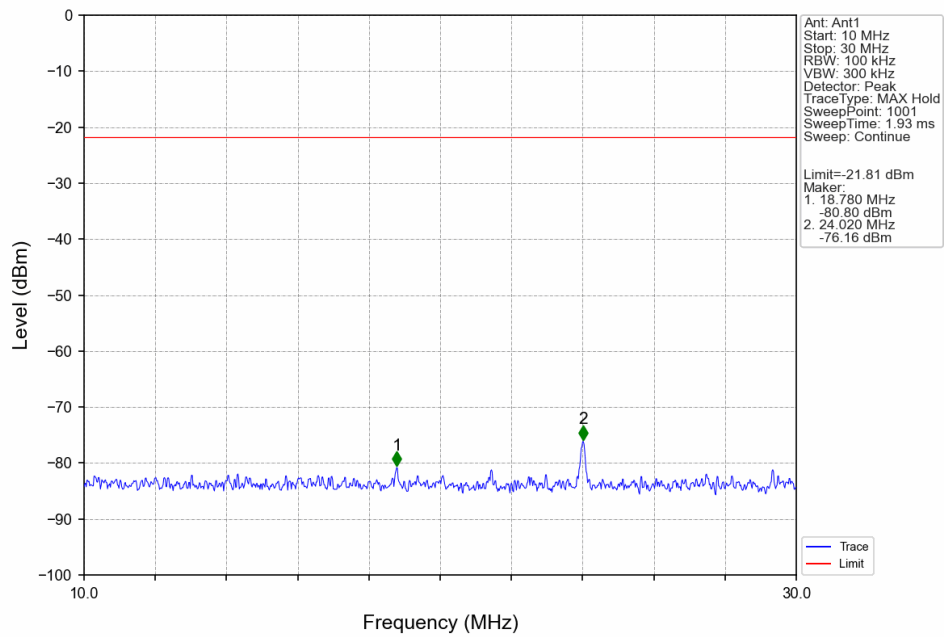
1M_HCH_2480MHz_Ant1_NTNV



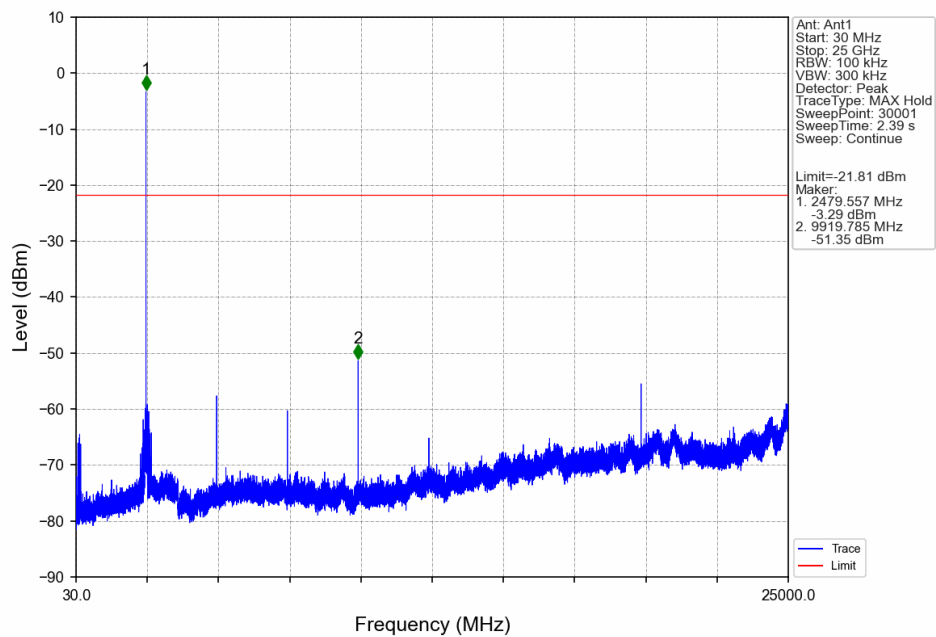
1M_HCH_2480MHz_Ant1_NTNV



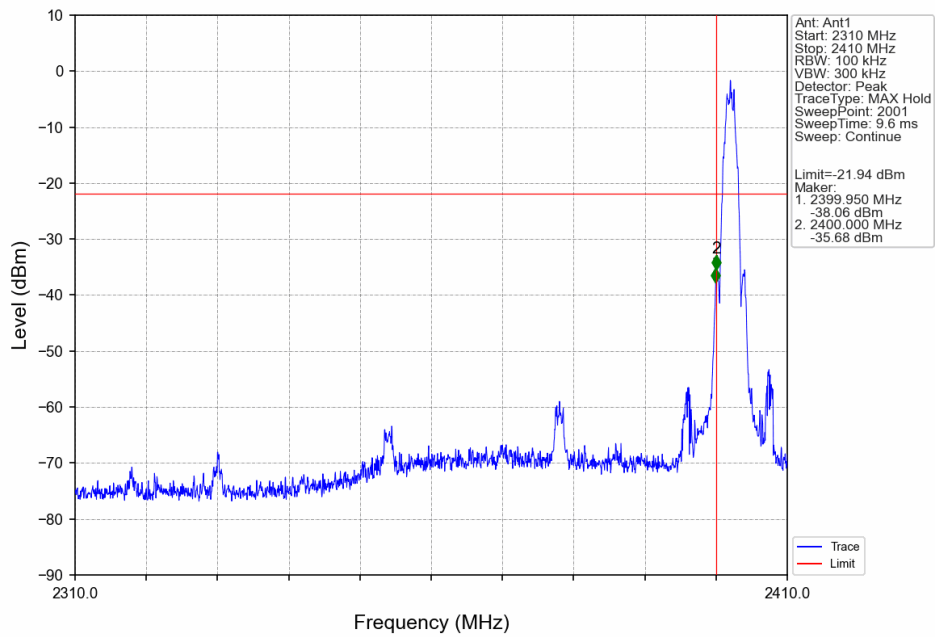
1M_HCH_2480MHz_Ant1_NTNV



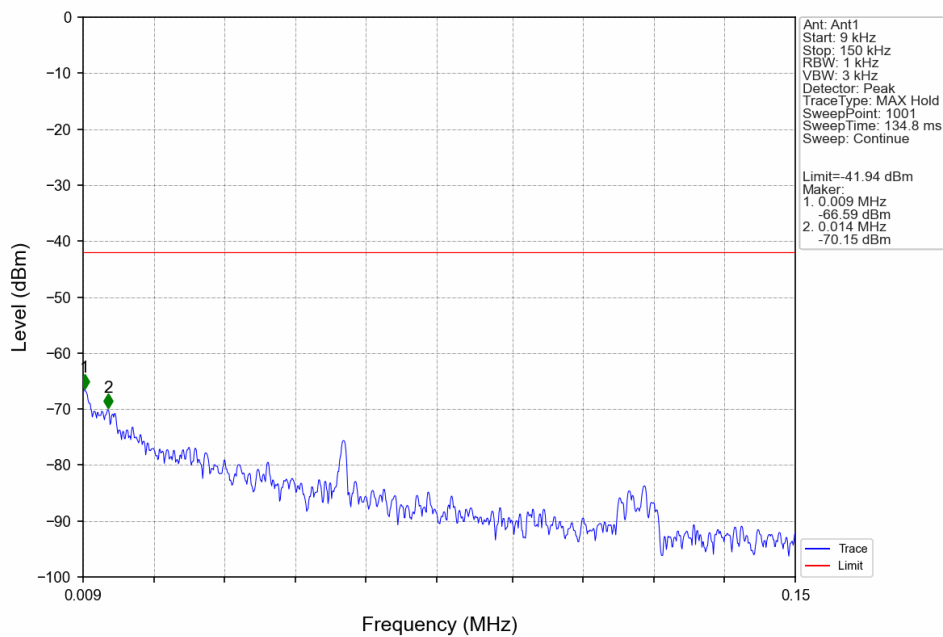
1M_HCH_2480MHz_Ant1_NTNV



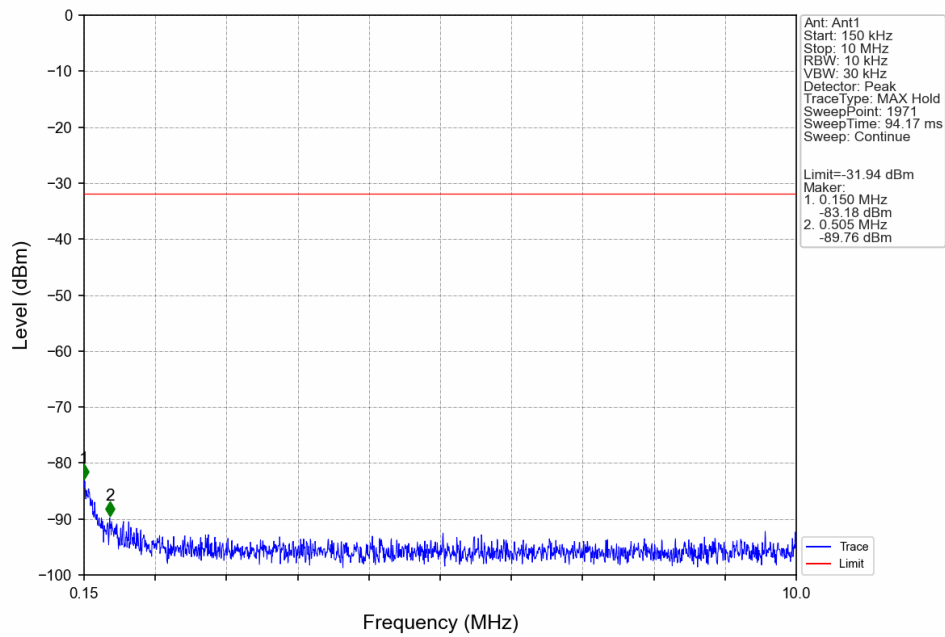
2M_LCH_2402MHz_Ant1_NTNV



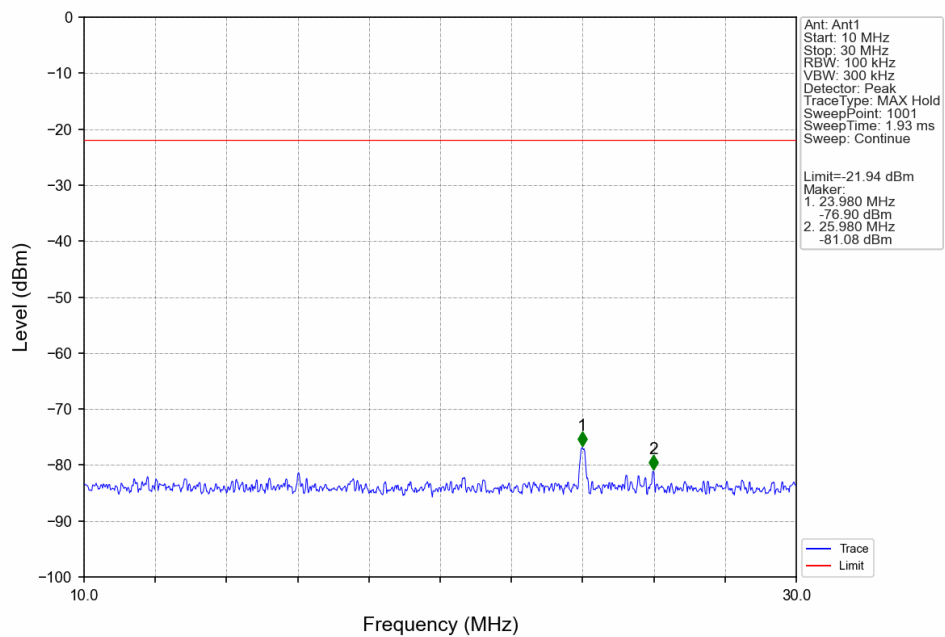
2M_LCH_2402MHz_Ant1_NTNV



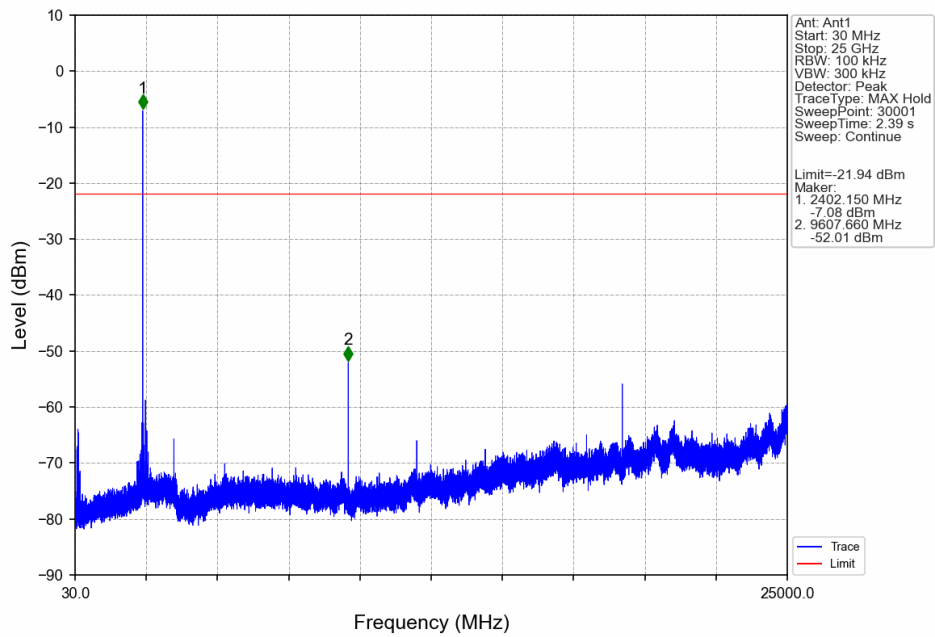
2M_LCH_2402MHz_Ant1_NTNV



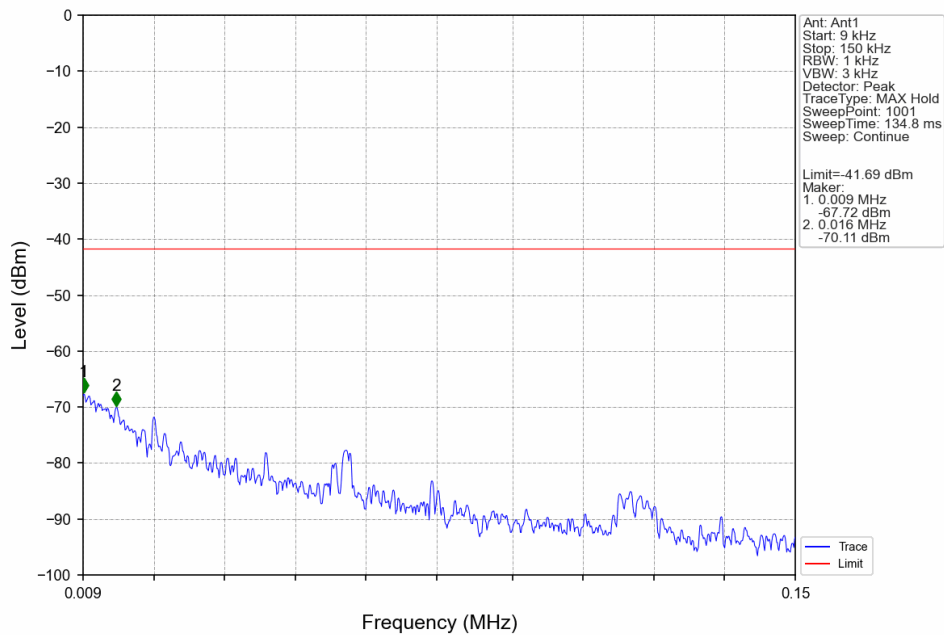
2M_LCH_2402MHz_Ant1_NTNV



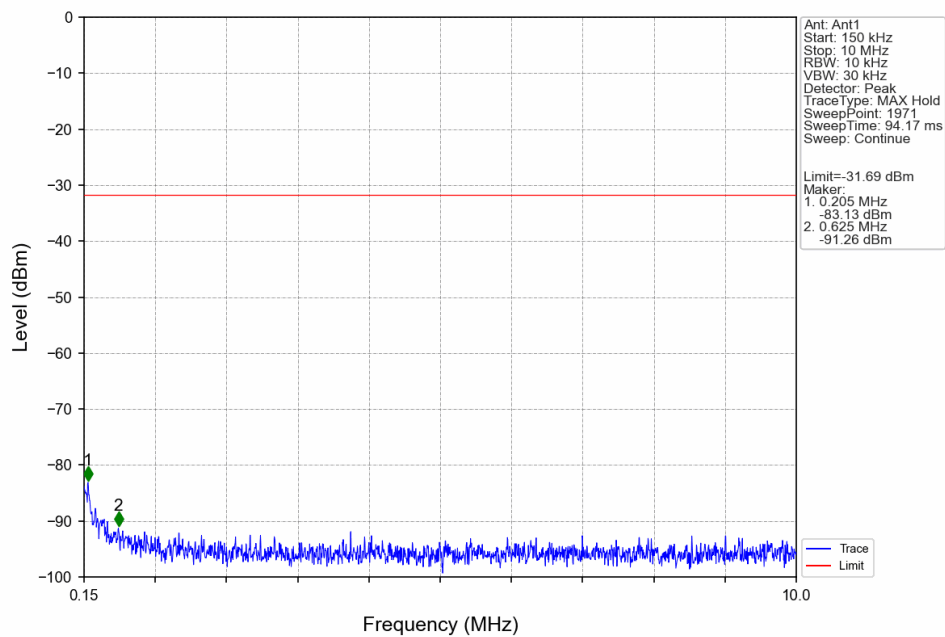
2M_LCH_2402MHz_Ant1_NTNV



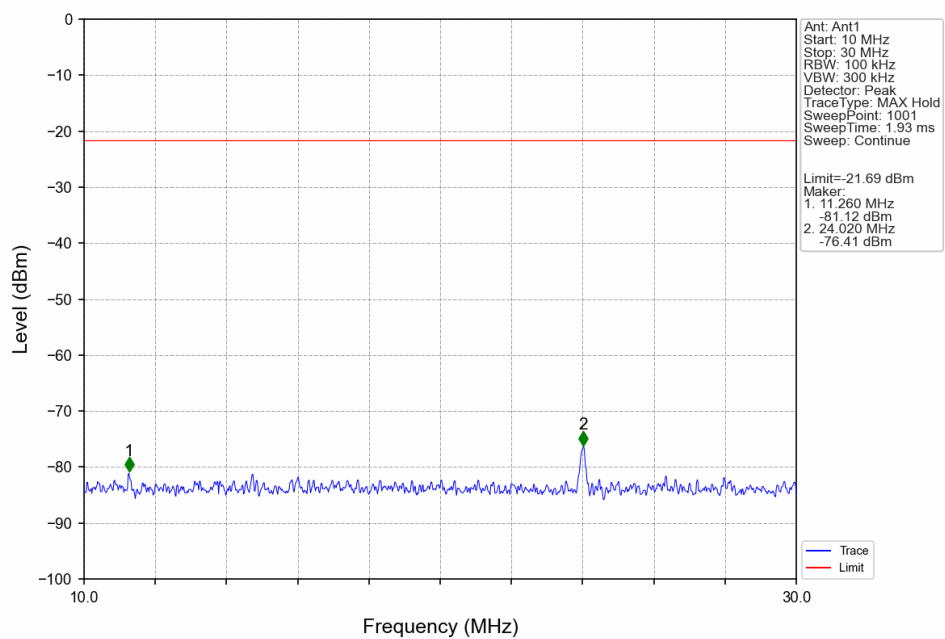
2M_MCH_2440MHz_Ant1_NTNV



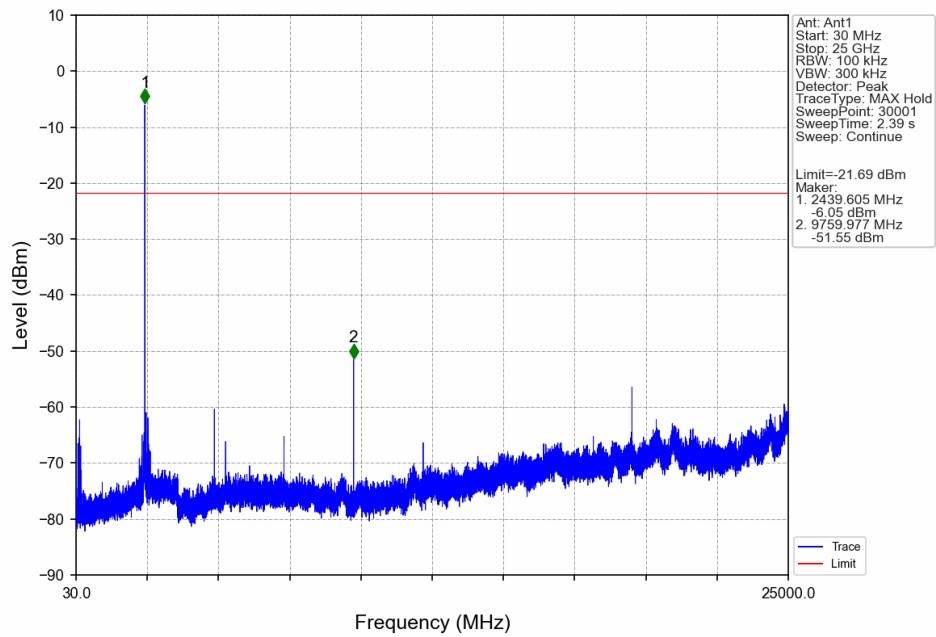
2M_MCH_2440MHz_Ant1_NTNV



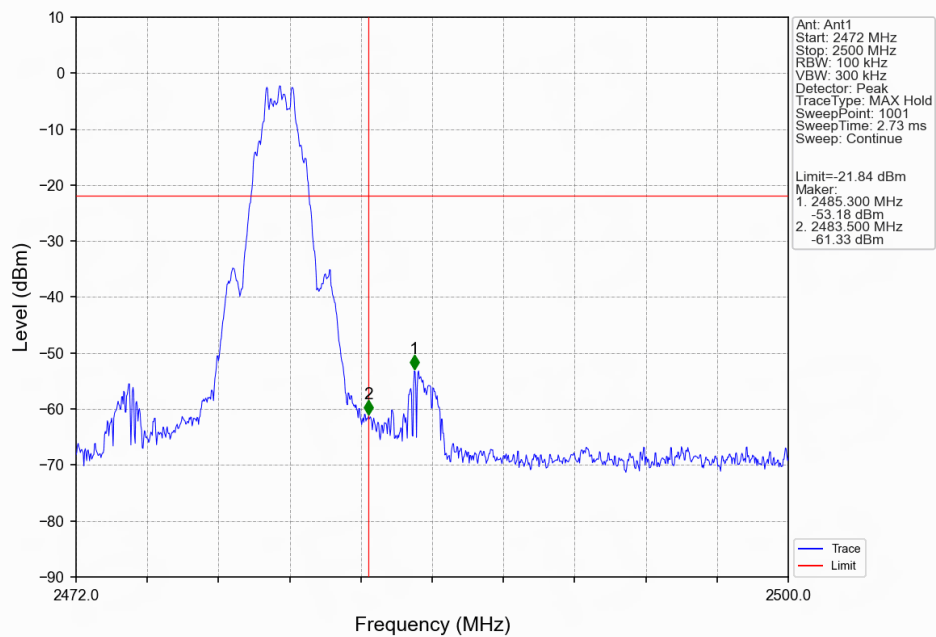
2M_MCH_2440MHz_Ant1_NTNV



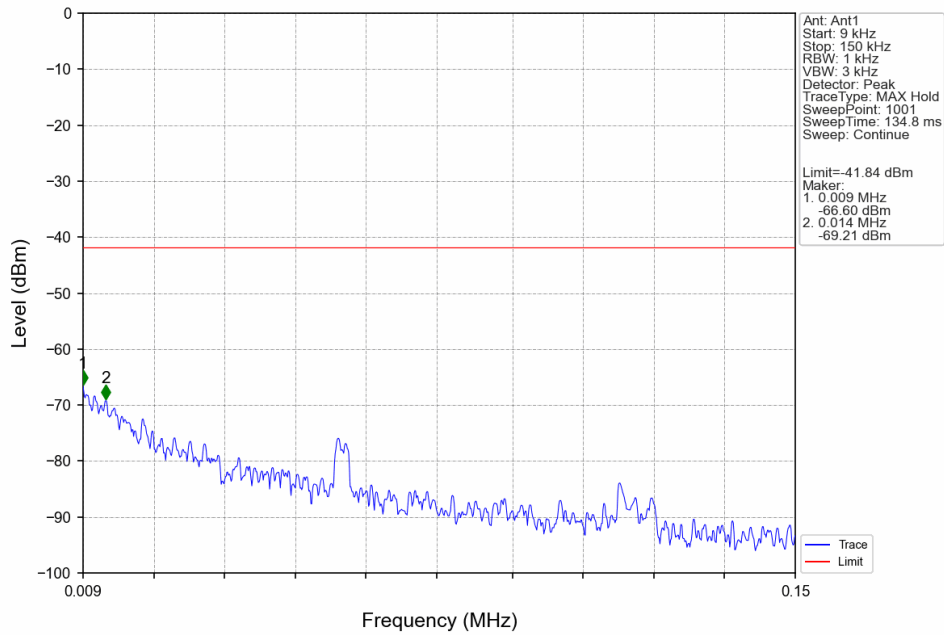
2M_MCH_2440MHz_Ant1_NTNV



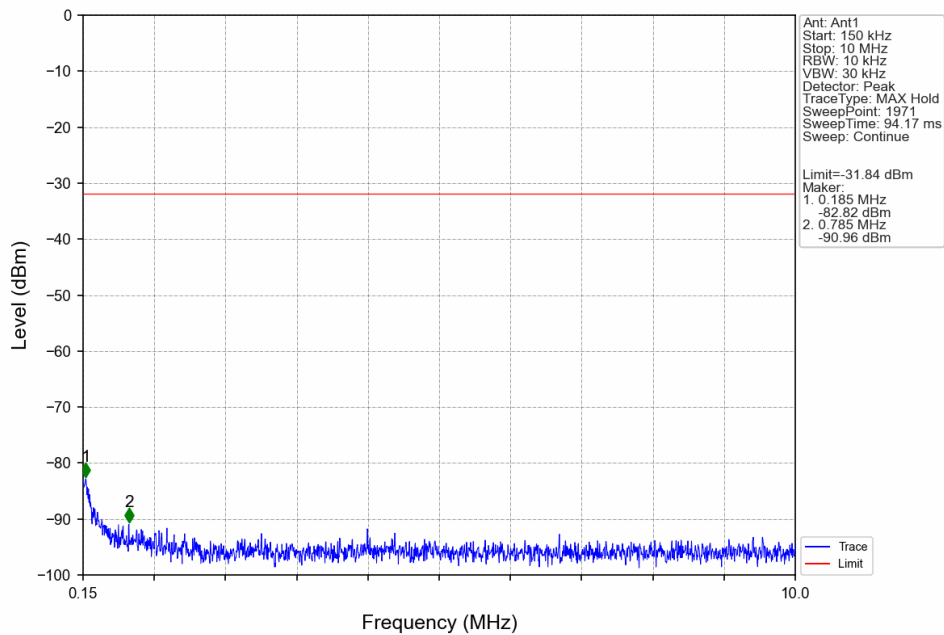
2M_HCH_2480MHz_Ant1_NTNV



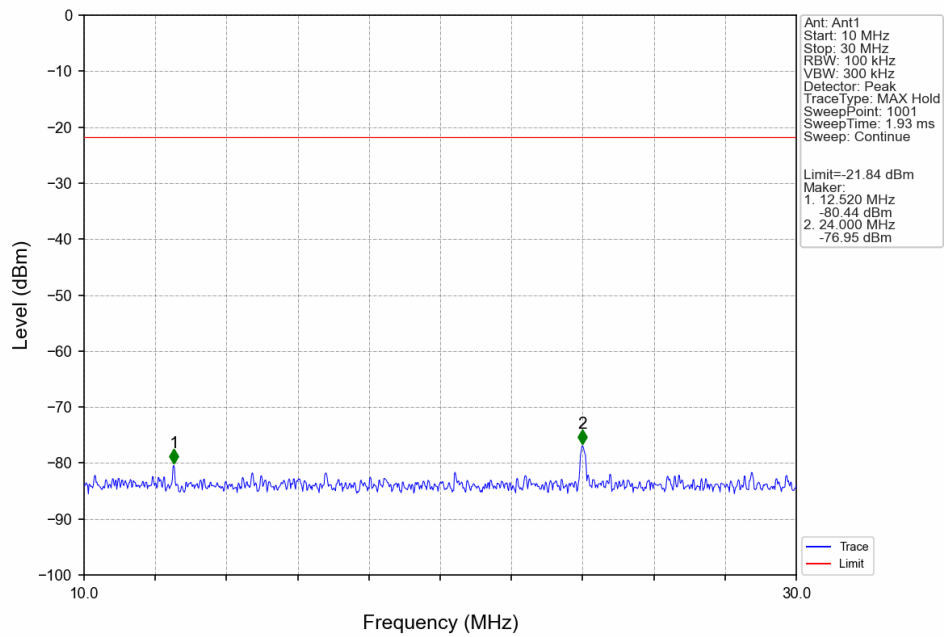
2M_HCH_2480MHz_Ant1_NTNV



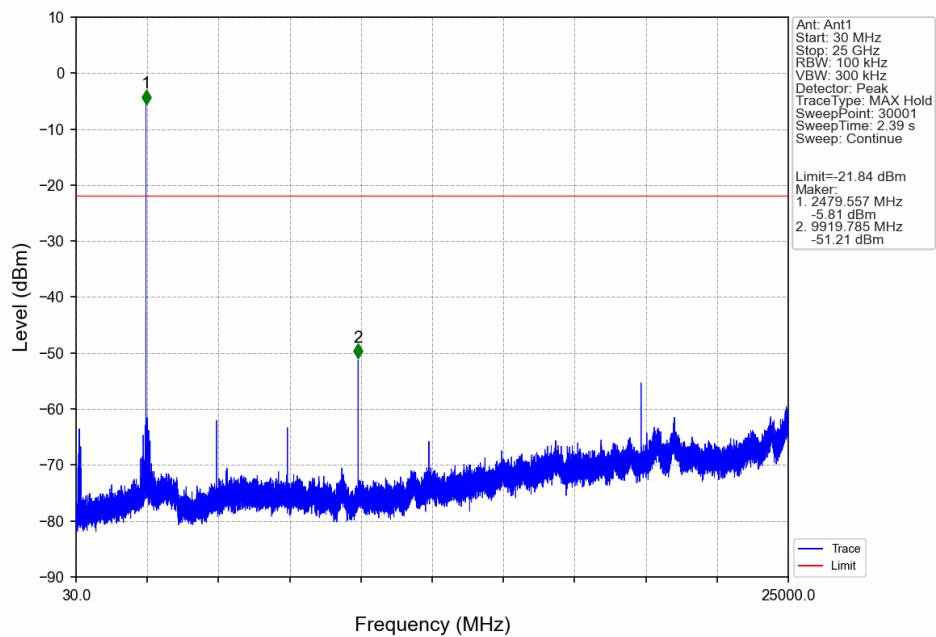
2M_HCH_2480MHz_Ant1_NTNV



2M_HCH_2480MHz_Ant1_NTNV



2M_HCH_2480MHz_Ant1_NTNV



6. Form731

6.1 Test Result

6.1.1 Form731

Lower Freq (MHz)	High Freq (MHz)	MAX Power (W)	MAX Power (dBm)
2402	2480	0.0007	-1.48



BTF Testing Lab (Shenzhen) Co., Ltd.

Plant 101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street,
Bao'an District, Shenzhen, Guangdong, China

www.btf-lab.com

-- END OF REPORT --