RF Test Report

For

Applicant name:	**Nomenta Industries International BV**
Address:	Kenaupark 33-2,2011 MR, Haarlem, Netherlands
EUT name:	Portable Speaker
Brand name:	KOODUU
Model number:	Sensa Play mini
Series model number:	N/A
FCC ID:	2ASCWSPMDPM

Issued By

Company name:	**BTF Testing Lab (Shenzhen) Co., Ltd.**
Address:	101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao’an District, Shenzhen, China

Report number:	BTF250807R00701
Test standards:	47 CFR Part 15.247
Test conclusion:	Pass

Date of sample receipt:	2025-08-07
Test date:	2025-08-08 to 2025-09-04
Date of issue:	2025-09-05

BTF Testing Lab (Shenzhen) Co., Ltd.

Prepared by: Chris Liu

Approved by: Ryan.CJ

Chris Liu / Project engineer

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	2025-09-05	Original

Note:
Once the revision has been made, then previous versions reports are invalid.

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1 Introduction

1.1 Laboratory Location

Test location:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, 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.

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) 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:	Nomenta Industries International BV
Address:	Kenaupark 33-2,2011 MR, Haarlem, Netherlands

2.2 Manufacturer Information

Company name:	AZREE SERVICE & TRADING SDN BHD
Address:	NO, 20A, TKT 1, JALAN CENGKEH OFF JALAN KIM CHUAN, PANDAMARAN, 42000 PELABUHAN KLANG, SELANGOR

2.3 Factory Information

Company name:	AZREE SERVICE & TRADING SDN BHD
Address:	NO, 20A, TKT 1, JALAN CENGKEH OFF JALAN KIM CHUAN, PANDAMARAN, 42000 PELABUHAN KLANG, SELANGOR

2.4 General Description of Equipment under Test (EUT)

EUT name:	Portable Speaker
Under test model name:	Sensa Play mini
Series model name:	N/A
Description of model name differentiation:	N/A
Ratings:	Input: 5.0V⎓2.0A LED 2.5W Li-ion polymer Battery DC 7.4V 2200mAh 16.28Wh

2.5 Technical Information

Operation Frequency:	2402MHz to 2480MHz
Channel numbers:	79
Channel separation:	1MHz
Modulation technology:	GFSK, π/4 DQPSK, 8DPSK
Max. E.I.R.P Power:	3.10dBm
Antenna type:	Internal Antenna
Antenna gain:	0.23dBi

Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461	/	/

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Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

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

3.2 Uncertainty of Test

Measurement	Value
Conducted Emission for LISN (150kHz ~ 30MHz)	±2.45 dB
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±1.5 dB
Time	±5 %
Unwanted Emissions, conducted	±3.0 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
20dB Bandwidth	47 CFR Part 15.247	47 CFR 15.247(a)(1)	Pass
Maximum Conducted Output Power	47 CFR Part 15.247	47 CFR 15.247(b)(1)	Pass
Channel Separation	47 CFR Part 15.247	47 CFR 15.247(a)(1)	Pass
Number of Hopping Frequencies	47 CFR Part 15.247	47 CFR 15.247(a)(1)(iii)	Pass
Dwell Time	47 CFR Part 15.247	47 CFR 15.247(a)(1)(iii)	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

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4 Test Configuration

4.1 Test Equipment List

Conducted Emission at AC power line					
Test Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
EMI Receiver	Rohde & Schwarz	ESCI3	101422	2024-10-25	2025-10-24
V-LISN	Schwarzbeck	NSLK 8127	01073	2024-10-25	2025-10-24
Coaxial Switcher	Schwarzbeck	CX210	CX210	/	/
Pulse Limiter	Schwarzbeck	VTSD 9561-F	00953	/	/
Test Software	Frad	EZ_EMC	Version: EMC-CON 3A1.1+	/	/

20dB Bandwidth Maximum Conducted Output Power Channel Separation Number of Hopping Frequencies Dwell Time Emissions in non-restricted frequency bands					
Test Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	Keysight	N9020A	MY50410020	2024-10-25	2025-10-24
ESG Vector Signal Generator	Agilent	E4438C	MY45094854	2024-10-25	2025-10-24
MXG Vector Signal Generator	Agilent	N5182A	MY46240163	2024-10-25	2025-10-24
Wideband Radio Communication Tester	Rohde&Schwarz	CMW500	161997	2024-10-25	2025-10-24
Temperature Humidity Chamber	ZZCKONG	ZZ-K02A	20210928007	2024-10-25	2025-10-24
DC Power Supply	Tongmen	etm-6050c	20211026123	2024-10-25	2025-10-24
RF Control Unit	Techy	TR1029-1	/	2024-10-25	2025-10-24
RF Sensor Unit	Techy	TR1029-2	/	2024-10-25	2025-10-24
Test Software	TST Pass	/	Version: 2.0	/	/

Band edge emissions (Radiated) Emissions in frequency bands (below 1GHz) Emissions in frequency bands (above 1GHz)					
Test Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
EMI Receiver	Rohde & Schwarz	ESCI7	101032	2024-10-25	2025-10-24
Signal Analyzer	Rohde & Schwarz	FSQ40	100010	2024-10-25	2025-10-24
Log periodic antenna	Schwarzbeck	VULB 9168	01328	2024-10-28	2025-10-27
Preamplifier (30MHz ~ 1GHz)	Schwarzbeck	BBV9744	00246	2024-09-24	2025-09-23
Horn Antenna	Schwarzbeck	BBHA9120D	2597	2024-10-30	2025-10-29
Preamplifier (1GHz ~ 18GHz)	Schwarzbeck	BBV9718D	00008	2024-09-24	2025-09-23
Test Software	Frad	EZ_EMC	Version: FA-03A2 RE+	/	/

4.2 Test Auxiliary Equipment

The EUT has been tested as an independent unit.

4.3 Test Modes

No.	Test Modes
TM1	TX-GFSK (Non-Hopping)
TM2	TX-Pi/4DQPSK (Non-Hopping)
TM3	TX-8DPSK (Non-Hopping)
TM4	TX-GFSK (Hopping)
TM5	TX-Pi/4DQPSK (Hopping)
TM6	TX-8DPSK (Hopping)

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

4.5 Test software

Test software:	Version:	Power Class:
FrequencyTool	v0.3.2	5

5 Evaluation Results (Evaluation)

5.1 Antenna requirement

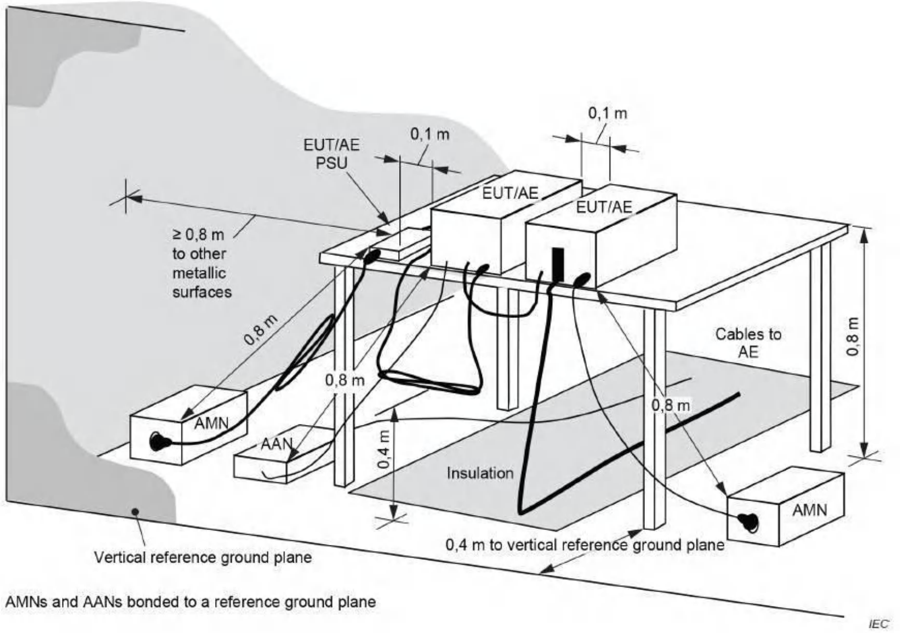
Test Requirement:	Refer to 47 CFR Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.
Operating Environment:	
Temperature:	23.6 °C
Humidity:	49.3 %
Atmospheric Pressure:	1010 mbar
Test voltage:	DC 7.4V From Battery

5.1.1 Conclusion

The Bluetooth antenna is an Internal antenna which permanently attached, and the best case gain of the antenna is -0.68dBi. See product internal photos for details.

6 Radio Spectrum Matter Test Results (RF)

6.1 Conducted Emission at AC power line

<table>
<tr><td>Test Requirement:</td><td>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).</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10-2020 section 6.2</td></tr>
<tr><td>Test Limit:</td><td>
<table>
<tr><td rowspan="2">Frequency of emission (MHz)</td><td colspan="2">Conducted limit (dBμV)</td></tr>
<tr><td>Quasi-peak</td><td>Average</td></tr>
<tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr>
<tr><td>0.5-5</td><td>56</td><td>46</td></tr>
<tr><td>5-30</td><td>60</td><td>50</td></tr>
</table>
*Decreases with the logarithm of the frequency.</td></tr>
<tr><td>Procedure:</td><td>Refer to ANSI C63.10-2020 section 6.2, standard test method for ac power-line conducted emissions from unlicensed wireless devices</td></tr>
<tr><td>Test Setup:</td><td>
</td></tr>
<tr><td colspan="2">Operating Environment:</td></tr>
<tr><td>Temperature:</td><td>23.6 °C</td></tr>
<tr><td>Humidity:</td><td>49.3 %</td></tr>
<tr><td>Atmospheric Pressure:</td><td>1010 mbar</td></tr>
<tr><td>Test voltage:</td><td>DC 7.4V From Battery</td></tr>
</table>

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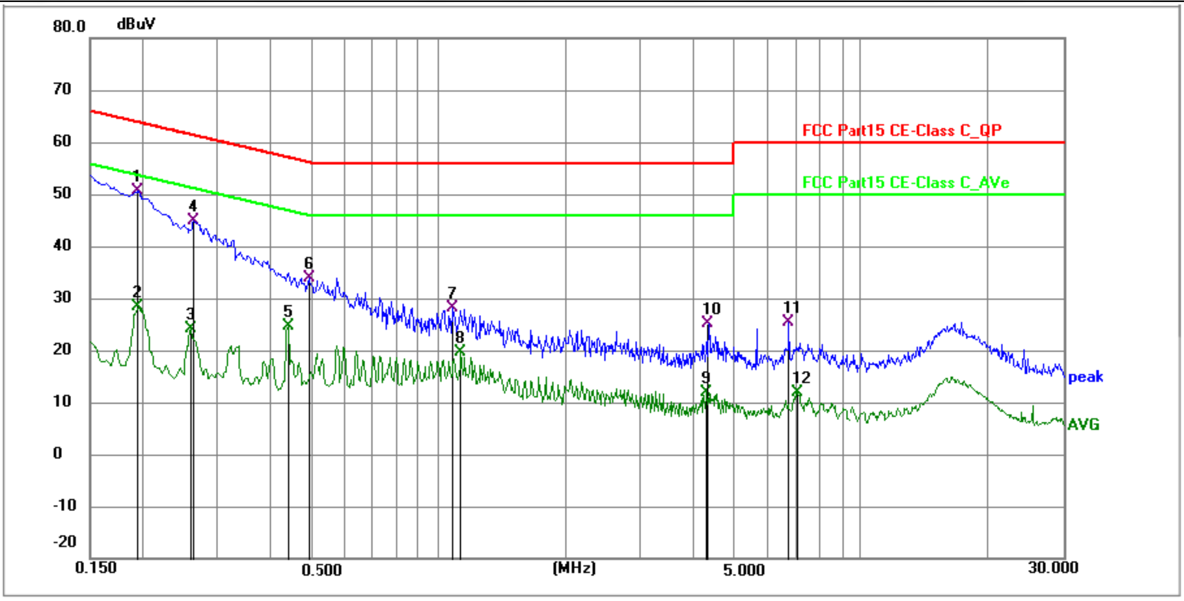
6.1.1 Test Data

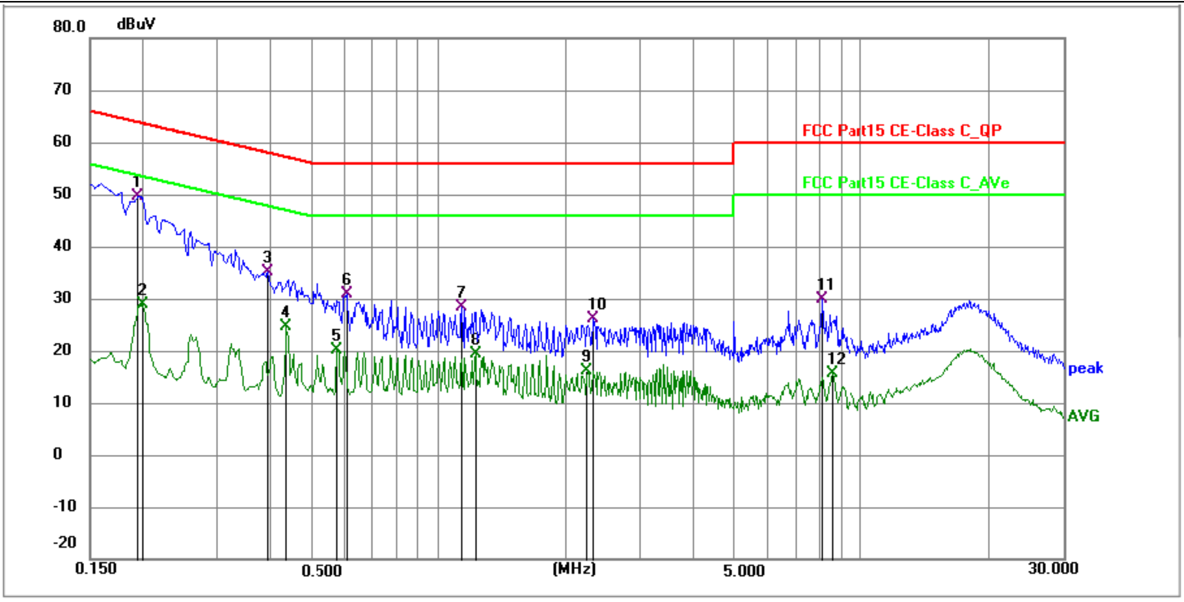
Remark: The report only reflects the test data of worst mode.

TM1 / 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 *	0.1949	39.97	10.65	50.62	63.83	-13.21	QP	P	
2	0.1949	17.67	10.65	28.32	53.83	-25.51	AVG	P	
3	0.2580	13.36	10.66	24.02	51.50	-27.48	AVG	P	
4	0.2625	34.14	10.66	44.80	61.35	-16.55	QP	P	
5	0.4380	13.89	10.67	24.56	47.10	-22.54	AVG	P	
6	0.4920	23.29	10.67	33.96	56.13	-22.17	QP	P	
7	1.0811	17.26	10.84	28.10	56.00	-27.90	QP	P	
8	1.1310	8.77	10.83	19.60	46.00	-26.40	AVG	P	
9	4.2990	0.91	10.85	11.76	46.00	-34.24	AVG	P	
10	4.3573	14.34	10.86	25.20	56.00	-30.80	QP	P	
11	6.7244	13.99	11.42	25.41	60.00	-34.59	QP	P	
12	7.0483	0.29	11.47	11.76	50.00	-38.24	AVG	P	

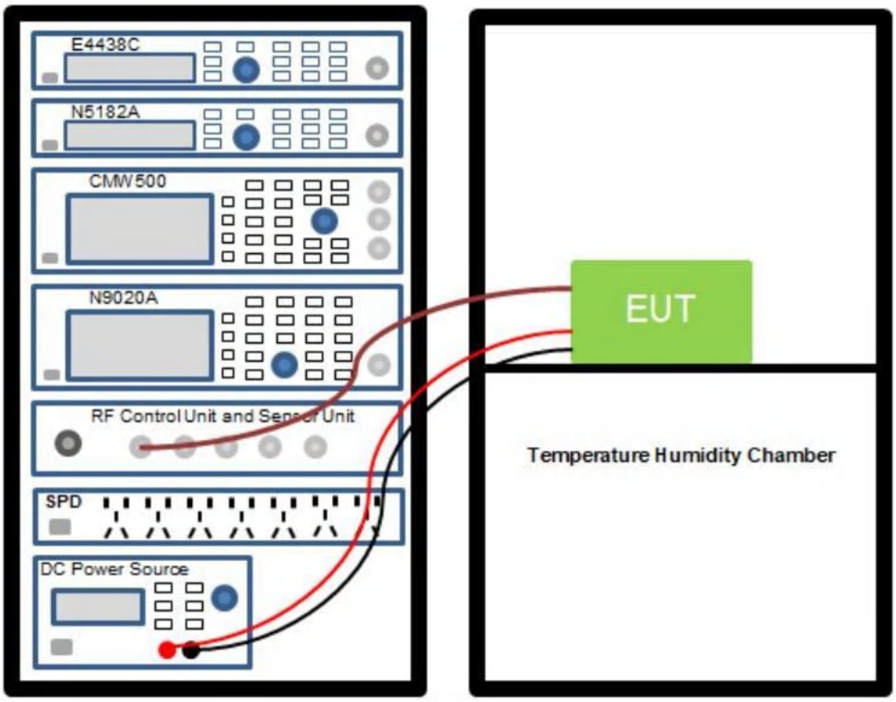
TM1 / Line: Neutral / Band: 2400-2483.5 MHz / BW: 1 / CH: M



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1 *	0.1949	39.19	10.56	49.75	63.83	-14.08	QP	P	
2	0.1995	18.41	10.56	28.97	53.63	-24.66	AVG	P	
3	0.3930	24.54	10.70	35.24	58.00	-22.76	QP	P	
4	0.4334	13.86	10.73	24.59	47.19	-22.60	AVG	P	
5	0.5775	9.39	10.82	20.21	46.00	-25.79	AVG	P	
6	0.6090	19.95	10.83	30.78	56.00	-25.22	QP	P	
7	1.1352	17.41	10.87	28.28	56.00	-27.72	QP	P	
8	1.2255	8.45	10.88	19.33	46.00	-26.67	AVG	P	
9	2.2559	5.27	10.96	16.23	46.00	-29.77	AVG	P	
10	2.3190	15.07	10.95	26.02	56.00	-29.98	QP	P	
11	8.0250	18.52	11.34	29.86	60.00	-30.14	QP	P	
12	8.5020	4.40	11.27	15.67	50.00	-34.33	AVG	P	

6.2 20dB Bandwidth

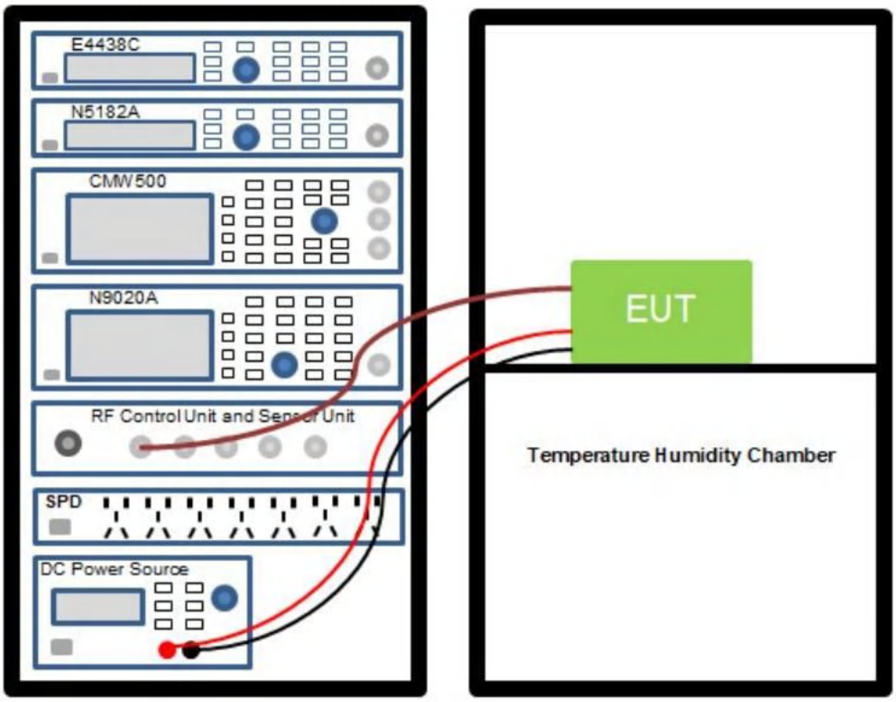
Test Requirement:	47 CFR 15.247(a)(1)
Test Method:	ANSI C63.10-2020, section 7.8.6, For occupied bandwidth measurements, use the procedure in 6.9.3. Frequency hopping shall be disabled for this test. KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 15.215(c), intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.
Procedure:	The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power bandwidth: a) The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW. b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be at least three times the RBW, unless otherwise specified by the applicable requirement. c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.6.2. d) Step a) through step c) might require iteration to adjust within the specified range. e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max-hold mode (until the trace stabilizes) shall be used. f) Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth. g) If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies. h) The occupied bandwidth shall be reported by providing spectral plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).
Test Setup:	

	
Operating Environment:	
Temperature:	23.6 °C
Humidity:	49.3 %
Atmospheric Pressure:	1010 mbar
Test voltage:	DC 7.4V From Battery

6.2.1 Test Data

Please Refer to Appendix for Details.

6.3 Maximum Conducted Output Power

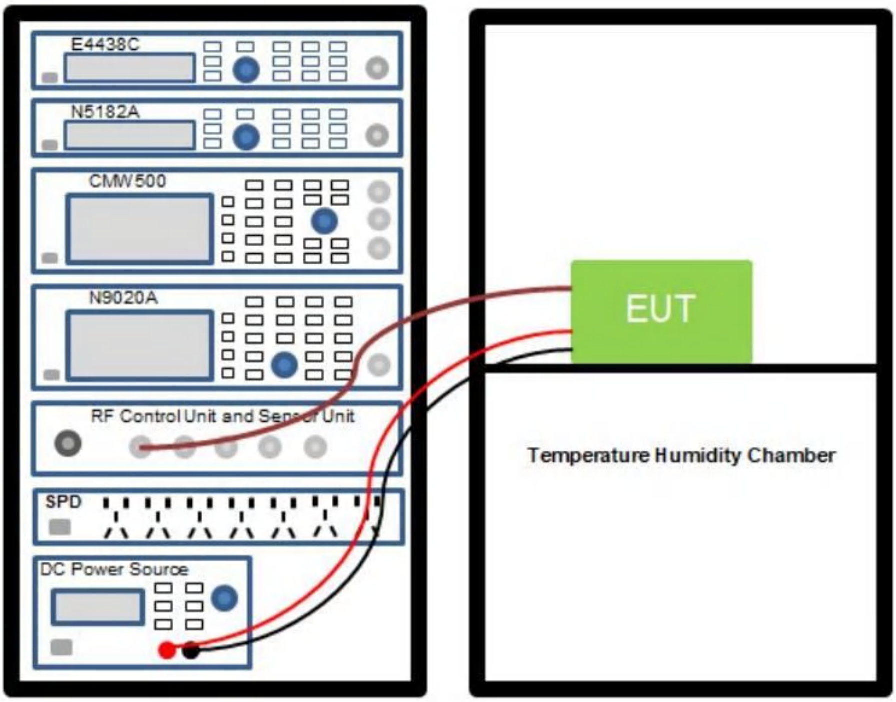
Test Requirement:	47 CFR 15.247(b)(1)
Test Method:	ANSI C63.10-2020, section 7.8.5 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 15.247(b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
Procedure:	This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. Frequency hopping shall be disabled for this test. Use the following spectrum analyzer settings: a) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel. b) RBW > 20 dB bandwidth of the emission being measured. c) VBW ≥ RBW. d) Sweep: No faster than coupled (auto) time. e) Detector function: Peak. f) Trace: Max-hold. g) Allow trace to stabilize. h) Use the marker-to-peak function to set the marker to the peak of the emission. i) The indicated level is the peak output power, after any corrections for external attenuators and cables. j) A spectral plot of the test results and setup description shall be included in the test report. NOTE—A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.
Test Setup:	
Operating Environment:	
Temperature:	23.6 °C

Humidity:	49.3 %
Atmospheric Pressure:	1010 mbar
Test voltage:	DC 7.4V From Battery

6.3.1 Test Data

Please Refer to Appendix for Details.

6.4 Channel Separation

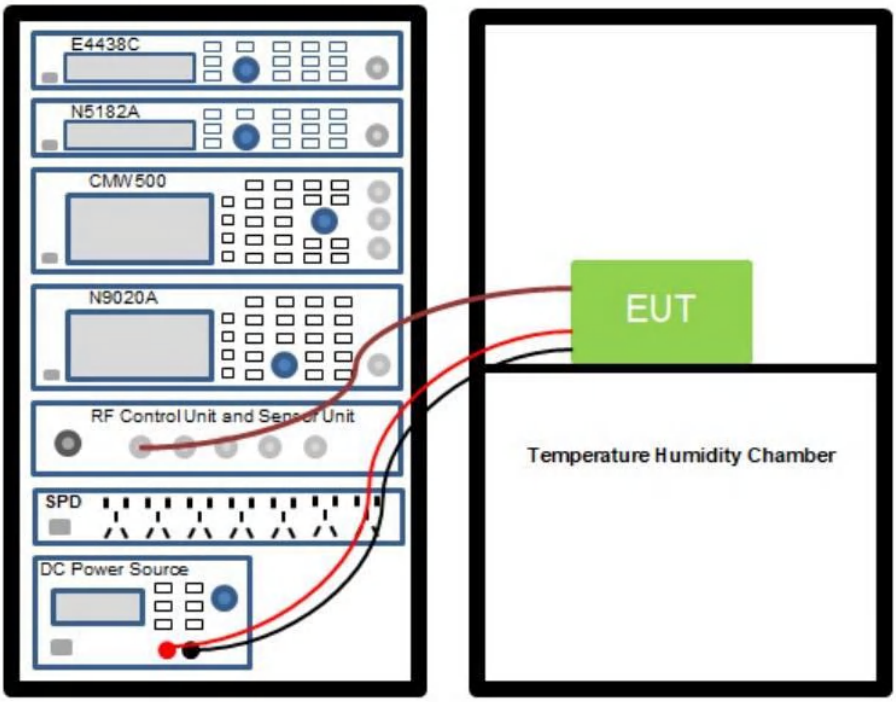
Test Requirement:	47 CFR 15.247(a)(1)
Test Method:	ANSI C63.10-2020, section 7.8.2 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.
Procedure:	The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings: a) Span: Wide enough to capture the peaks of two adjacent channels. b) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel. c) Video (or average) bandwidth (VBW) ≥ RBW. d) Sweep: No faster than coupled (auto) time. e) Detector function: Peak. f) Trace: Max-hold. g) Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Compliance of an EUT with the appropriate regulatory limit shall be determined. A spectral plot of the data shall be included in the test report.
Test Setup:	
Operating Environment:	
Temperature:	23.6 °C
Humidity:	49.3 %
Atmospheric Pressure:	1010 mbar

Test voltage:	DC 7.4V From Battery

6.4.1 Test Data

Please Refer to Appendix for Details.

6.5 Number of Hopping Frequencies

Test Requirement:	47 CFR 15.247(a)(1)(iii)
Test Method:	ANSI C63.10-2020, section 7.8.3 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 15.247(a)(1)(iii), Fequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
Procedure:	The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings: a) Span: The frequency band of operation. Depending on the number of channels the device supports, it could be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen. b) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller. c) VBW ≥ RBW. d) Sweep: No faster than coupled (auto) time. e) Detector function: Peak. f) Trace: Max-hold. g) Allow the trace to stabilize. It might prove necessary to break the span up into subranges to show clearly all of the hopping frequencies. Compliance of an EUT with the appropriate regulatory limit shall be determined for the number of hopping channels. A spectral plot of the data shall be included in the test report.
Test Setup:	
Operating Environment:	
Temperature:	23.6 °C
Humidity:	49.3 %

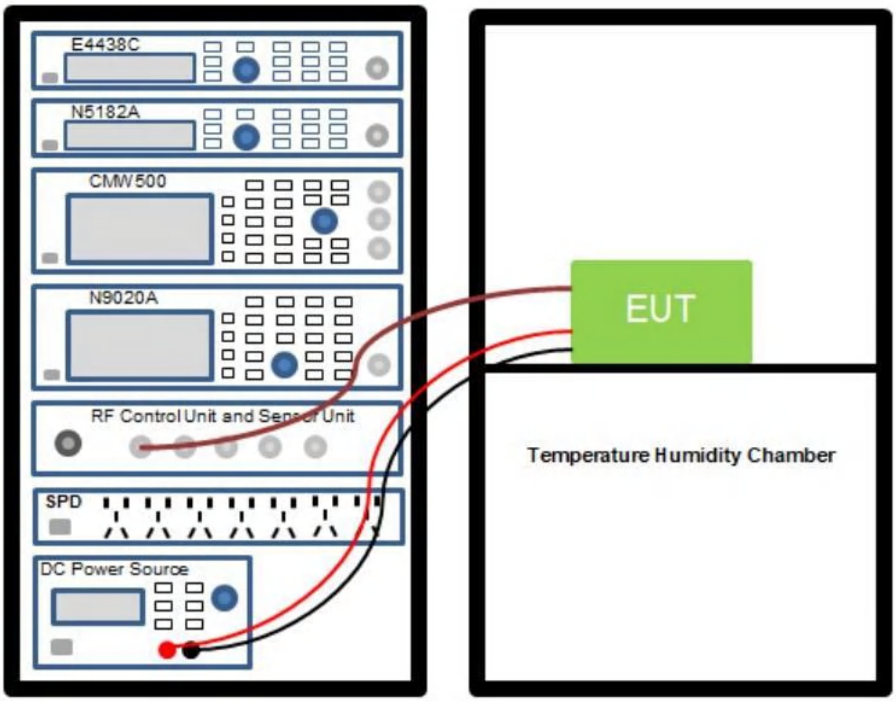
Atmospheric Pressure:	1010 mbar
Test voltage:	DC 7.4V From Battery

6.5.1 Test Data

Please Refer to Appendix for Details.

6.6 Dwell Time

Test Requirement:	47 CFR 15.247(a)(1)(iii)
Test Method:	ANSI C63.10-2020, section 7.8.4 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 15.247(a)(1)(iii), Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
Procedure:	The dwell time per hop on a channel is the time from the start of the first transmission to the end of the last transmission for that hop. If the device has a single transmission per hop then the dwell time is the duration of that transmission. If the device has a multiple transmissions per hop then the dwell time is measured from the start of the first transmission to the end of the last transmission. The time of occupancy is the total time that the device dwells on a channel over an observation period specified in the regulatory requirement. To determine the time of occupancy the spectrum analyzer will be configured to measure both the dwell time per hop and the number of times the device transmits on a specific channel in a given period. The EUT shall have its hopping function enabled. Compliance with the requirements shall be made with the minimum and with the maximum number of channels enabled. If the dwell time per channel does not vary with the number of channels than compliance with the requirements may be based on the minimum number of channels. If the device supports different dwell times per channel (example Bluetooth devices can dwell on a channel for 1, 3 or 5 time slots) then measurements can be limited to the longest dwell time with the minimum number of channels. Use the following spectrum analyzer settings to determine the dwell time per hop: a) Span: Zero span, centered on a hopping channel. b) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected transmission time per hop. c) Sweep time: Set so that the start of the first transmission and end of the last transmission for the hop are clearly captured. Setting the sweep time to be slightly longer than the hopping period per channel (hopping period = 1/hopping rate) should achieve this. d) Use a video trigger, where possible with a trigger delay, so that the start of the transmission is clearly observed. The trigger level might need adjustment to reduce the chance of triggering when the system hops on an adjacent channel. e) Detector function: Peak. f) Trace: Clear-write, single sweep. g) Place markers at the start of the first transmission on the channel and at the end of the last transmission. The dwell time per hop is the time between these two markers. To determine the number of hops on a channel in the regulatory observation period repeat the measurement using a longer sweep time. When the device uses a single hopping sequence the period of measurement should be sufficient to capture at least 2 hops. When the device uses a dynamic hopping sequence, or the sequence varies, the period of measurement may need to capture multiple hops to better determine the average time of occupancy. Count the number of hops on the channel across the sweep time. The average number of hops on the same channel within the regulatory observation

	period is calculated from the number of hops on the channel divided by the spectrum analyzer sweep time multiplied by the regulatory observation period. For example, if three hops are counted with an analyzer sweep time of 500 ms and the regulatory observation period is 10 s, then the number of hops in that ten seconds is 3 / 0.5 × 10, or 60 hops. The average time of occupancy is calculated by multiplying the dwell time per hop by the number of hops in the observation period.
Test Setup:	
Operating Environment:	
Temperature:	23.6 °C
Humidity:	49.3 %
Atmospheric Pressure:	1010 mbar
Test voltage:	DC 7.4V From Battery

6.6.1 Test Data

Please Refer to Appendix for Details.

6.7 Emissions in non-restricted frequency bands

Test Requirement:	47 CFR 15.247(d)
Test Method:	ANSI C63.10-2020 section 7.8.7 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:	7.8.7.1 General considerations To demonstrate compliance with the relative out-of-band emissions requirements conducted spurious emissions shall be measured for the transmit frequencies, per 5.5 and 5.6, and at the maximum transmit powers. Frequency hopping shall be disabled for this test with the exception of measurements at the allocated band-edges which shall be repeated with hopping enabled. Connect the primary antenna port through an attenuator to the spectrum analyzer input; in the results, account for all losses between the unlicensed wireless device output and the spectrum analyzer. The frequency range of testing shall span 30 MHz to 10 times the operating frequency and this may be done in a single sweep or, to aid resolution, across a number of sweeps. The resolution bandwidth shall be 100 kHz, video bandwidth 300 kHz, and a coupled sweep time with a peak detector. The limit is based on the highest in-band level across all channels measured using the same instrument settings (resolution bandwidth of 100 kHz, video bandwidth of 300 kHz, and a coupled sweep time with a peak detector). To help clearly demonstrate compliance a display line may be set at the required offset (typically 20 dB) below the highest in-band level. Where the highest in-band level is not clearly identified in the out-of-band measurements a separate spectral plot showing the in-band level shall be provided. When conducted measurements cannot be made (for example a device with integrated, non-removable antenna) radiated measurements shall be used. The reference level for determining the limit shall be established by maximizing the field strength from the highest power channel and measuring using the resolution and video bandwidth settings and peak detector as described above. The field strength limit for spurious emissions outside of restricted-bands shall then be set at the required offset (typically 20 dB) below the highest in-band level. Radiated measurements will follow the standards measurement procedures described in Clause 6 with the exception that the resolution bandwidth shall be 100 kHz, video bandwidth 300 kHz, and a coupled sweep time with a peak detector. Note that use of wider measurement bandwidths are acceptable for measuring the spurious emissions provided that the peak detector is used and that the measured value of spurious emissions are compared to the highest in-band level measured with the 100 kHz / 300 kHz bandwidth settings to determine compliance. 7.8.7.2 Band-edges Compliance with a relative limit at the band-edges (e.g., −20 dBc) shall be made on the lowest and on the highest channels with frequency hopping disabled and repeated with frequency hopping enabled. For the latter test the hopping sequence shall include the lowest and highest channels.

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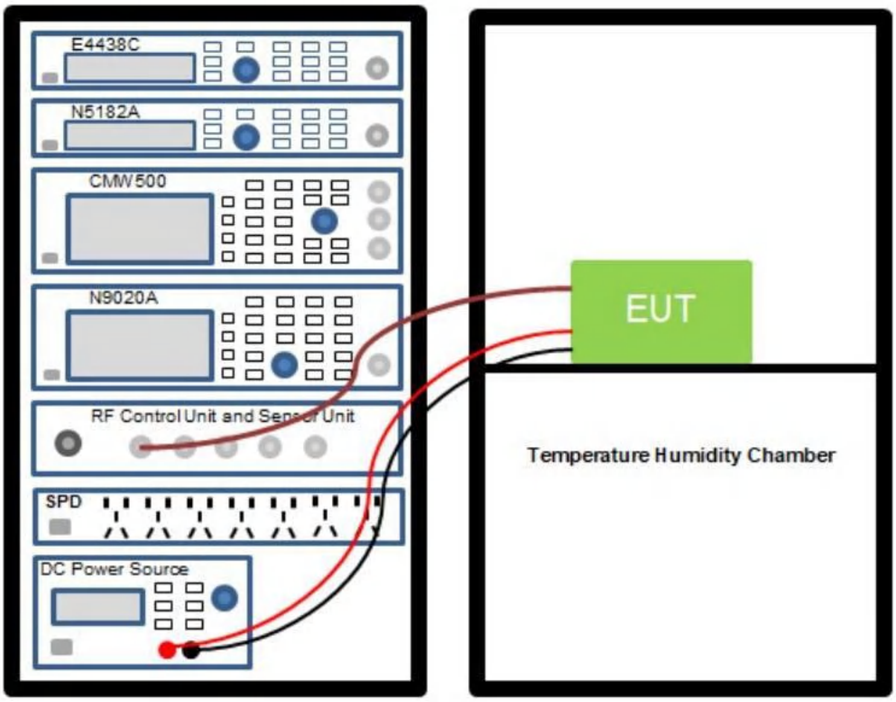
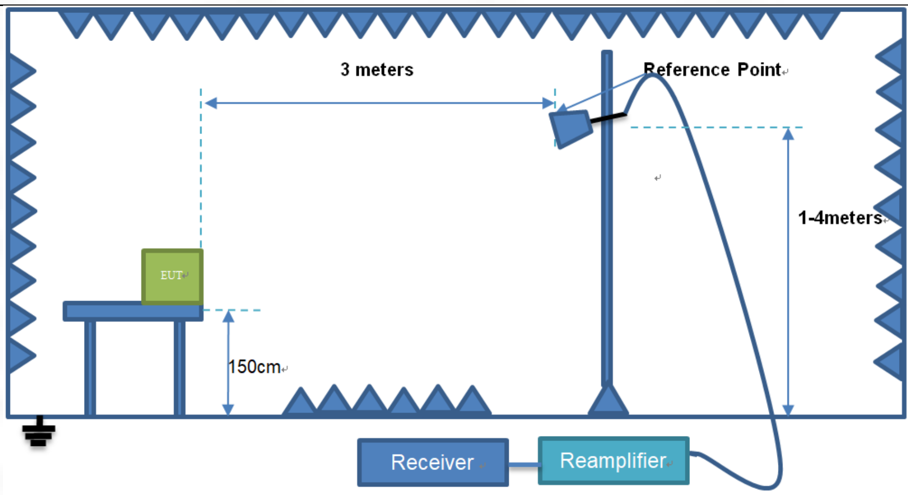
	For measurements with the hopping disabled the analyzer screen shall clearly show compliance with the requirement within 10 MHz of the allocated band-edge. For measurements with the hopping enabled the analyzer screen shall clearly show compliance with the requirement within 10 MHz of both of the allocated band-edges. This could require separate spectral plots for each band-edge.
Test Setup:	
Operating Environment:	
Temperature:	23.6 °C
Humidity:	49.3 %
Atmospheric Pressure:	1010 mbar
Test voltage:	DC 7.4V From Battery

6.7.1 Test Data

Please Refer to Appendix for Details.

6.8 Band edge emissions (Radiated)

<table>
<tr><td>Test Requirement:</td><td>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)).`</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10-2020 section 6.10
KDB 558074 D01 15.247 Meas Guidance v05r02</td></tr>
<tr><td>Test Limit:</td><td>
<table>
<tr><td>Frequency (MHz)</td><td>Field strength (microvolts/meter)</td><td>Measurement distance (meters)</td></tr>
<tr><td>0.009-0.490</td><td>2400/F(kHz)</td><td>300</td></tr>
<tr><td>0.490-1.705</td><td>24000/F(kHz)</td><td>30</td></tr>
<tr><td>1.705-30.0</td><td>30</td><td>30</td></tr>
<tr><td>30-88</td><td>100 **</td><td>3</td></tr>
<tr><td>88-216</td><td>150 **</td><td>3</td></tr>
<tr><td>216-960</td><td>200 **</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>3</td></tr>
</table>
** 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.
</td></tr>
<tr><td>Procedure:</td><td>ANSI C63.10-2020 section 6.10.5.2</td></tr>
<tr><td>Test Setup:</td><td>
</td></tr>
<tr><td colspan="2">Operating Environment:</td></tr>
<tr><td>Temperature:</td><td>23.6 °C</td></tr>
<tr><td>Humidity:</td><td>49.3 %</td></tr>
<tr><td>Atmospheric Pressure:</td><td>1010 mbar</td></tr>
<tr><td>Test voltage:</td><td>DC 7.4V From Battery</td></tr>
</table>

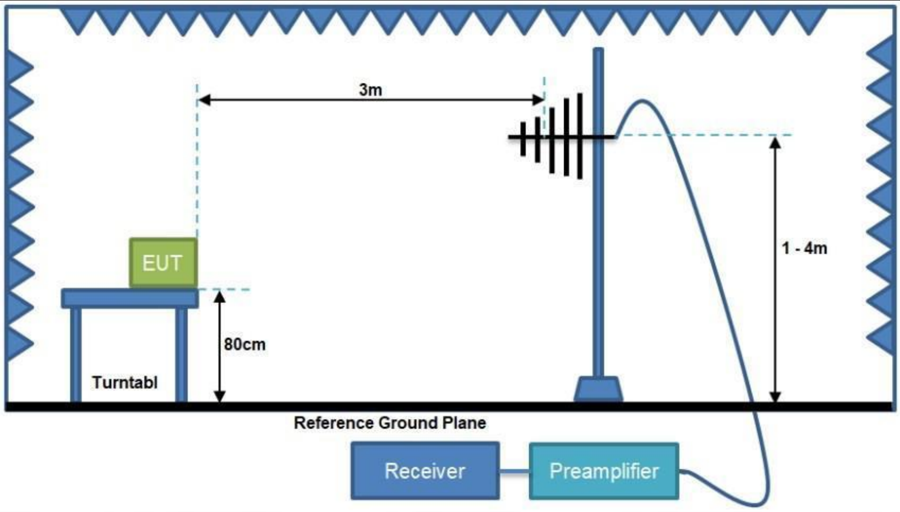
6.8.1 Test Data

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

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	52.13	3.85	55.99	74.00	-18.01	Peak	Pass
2310.00	41.25	3.85	45.10	54.00	-8.90	AVG	Pass
2390.00	51.37	3.91	55.28	74.00	-18.72	Peak	Pass
2390.00	41.02	3.91	44.94	54.00	-9.06	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	51.11	3.85	54.97	74.00	-19.03	Peak	Pass
2310.00	41.26	3.85	45.11	54.00	-8.89	AVG	Pass
2390.00	52.80	3.91	56.72	74.00	-17.28	Peak	Pass
2390.00	42.26	3.91	46.18	54.00	-7.82	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	51.31	3.99	55.30	74.00	-18.70	Peak	Pass
2483.50	41.64	3.99	45.62	54.00	-8.38	AVG	Pass
2500.00	52.00	4.00	56.00	74.00	-18.00	Peak	Pass
2500.00	42.08	4.00	46.08	54.00	-7.92	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	51.73	3.99	55.71	74.00	-18.29	Peak	Pass
2483.50	40.81	3.99	44.80	54.00	-9.20	AVG	Pass
2500.00	51.03	4.00	55.03	74.00	-18.97	Peak	Pass
2500.00	41.26	4.00	45.26	54.00	-8.74	AVG	Pass

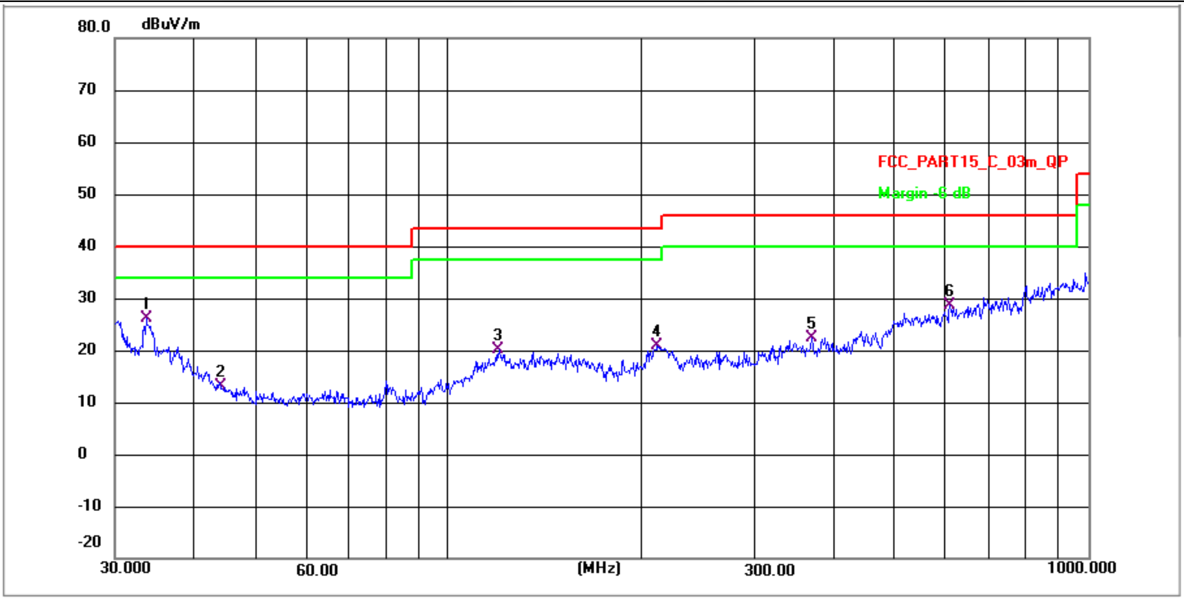
Note:Margin=Level-Limit=Reading+factor-Limit

6.9 Emissions in frequency bands (below 1GHz)

<table>
<tr><td>Test Requirement:</td><td>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)).`</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10-2020 section 6.6.4
KDB 558074 D01 15.247 Meas Guidance v05r02</td></tr>
<tr><td>Test Limit:</td><td>
<table>
<tr><td>Frequency (MHz)</td><td>Field strength (microvolts/meter)</td><td>Measurement distance (meters)</td></tr>
<tr><td>0.009-0.490</td><td>2400/F(kHz)</td><td>300</td></tr>
<tr><td>0.490-1.705</td><td>24000/F(kHz)</td><td>30</td></tr>
<tr><td>1.705-30.0</td><td>30</td><td>30</td></tr>
<tr><td>30-88</td><td>100 **</td><td>3</td></tr>
<tr><td>88-216</td><td>150 **</td><td>3</td></tr>
<tr><td>216-960</td><td>200 **</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>3</td></tr>
</table>
** 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.</td></tr>
<tr><td>Procedure:</td><td>ANSI C63.10-2020 section 6.6.4</td></tr>
<tr><td>Test Setup:</td><td>
</td></tr>
<tr><td colspan="2">Operating Environment:</td></tr>
<tr><td>Temperature:</td><td>23.6 °C</td></tr>
<tr><td>Humidity:</td><td>49.3 %</td></tr>
<tr><td>Atmospheric Pressure:</td><td>1010 mbar</td></tr>
<tr><td>Test voltage:</td><td>DC 7.4V From Battery</td></tr>
</table>

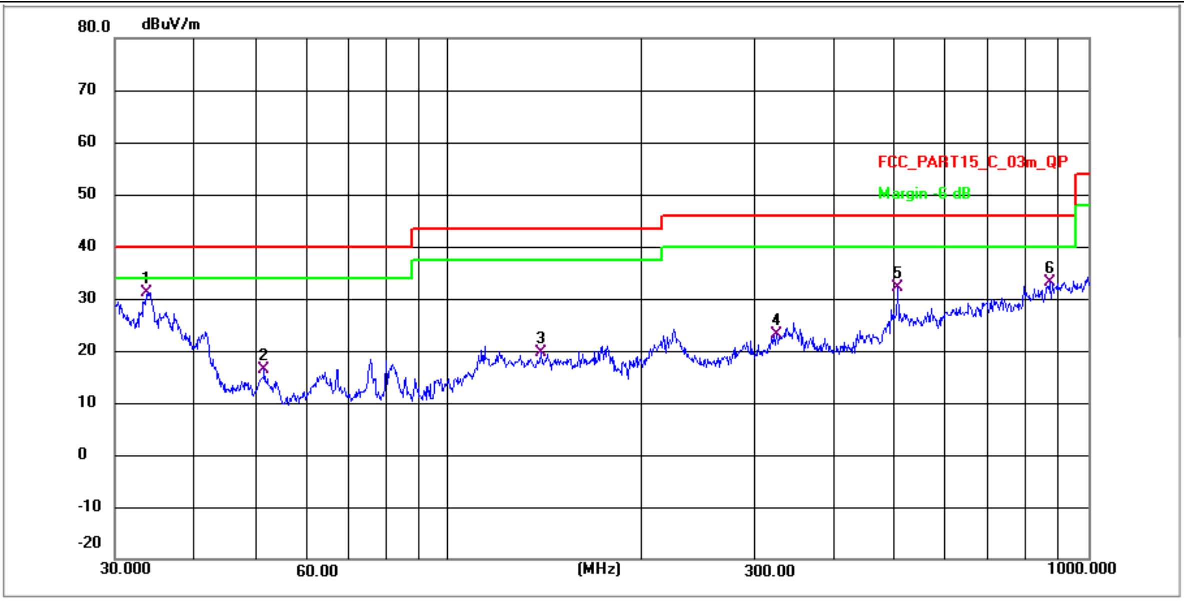
6.9.1 Test Data

TM1 / Polarization: Horizontal / Band: 2400-2483.5 MHz / BW: 1 / CH: L



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 *	33.6213	35.77	-9.68	26.09	40.00	-13.91	QP	P
2	44.0430	22.63	-9.60	13.03	40.00	-26.97	QP	P
3	120.0659	42.35	-22.29	20.06	43.50	-23.44	QP	P
4	212.2695	42.36	-21.41	20.95	43.50	-22.55	QP	P
5	368.7576	42.44	-20.08	22.36	46.00	-23.64	QP	P
6	609.9217	46.85	-18.27	28.58	46.00	-17.42	QP	P

TM1 / Polarization: Vertical / Band: 2400-2483.5 MHz / BW: 1 / CH: L



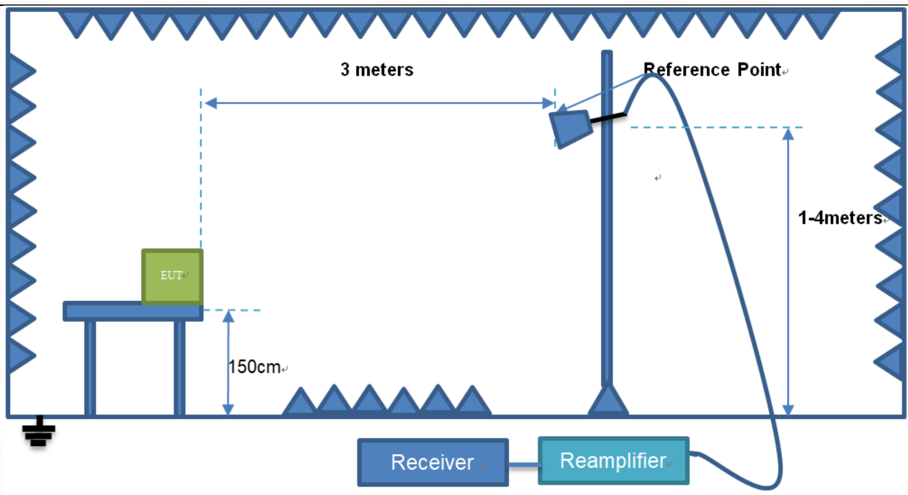
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 *	33.8579	40.86	-9.68	31.18	40.00	-8.82	QP	P
2	51.3005	25.90	-9.53	16.37	40.00	-23.63	QP	P
3	139.8508	41.65	-22.10	19.55	43.50	-23.95	QP	P
4	324.4561	43.60	-20.43	23.17	46.00	-22.83	QP	P
5	504.7062	50.97	-18.96	32.01	46.00	-13.99	QP	P
6	870.6554	49.92	-16.70	33.22	46.00	-12.78	QP	P

6.10 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 section 6.6.4 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	see below

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 section 6.6.4
Test Setup:	

Operating Environment:	
Temperature:	23.6 °C
Humidity:	49.3 %
Atmospheric Pressure:	1010 mbar
Test voltage:	DC 7.4V From Battery

6.10.1 Test Data

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

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	78.54	-48.89	29.66	74.00	-44.34	Peak	Pass
4804.00	68.99	-48.89	20.11	54.00	-33.89	AVG	Pass
7206.00	76.86	-47.02	29.84	74.00	-44.16	Peak	Pass
7206.00	66.34	-47.02	19.32	54.00	-34.68	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	79.10	-48.89	30.21	74.00	-43.79	Peak	Pass
4804.00	68.62	-48.89	19.74	54.00	-34.26	AVG	Pass
7206.00	76.94	-47.02	29.92	74.00	-44.08	Peak	Pass
7206.00	66.73	-47.02	19.71	54.00	-34.29	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
4882.00	78.07	-48.84	29.24	74.00	-44.76	Peak	Pass
4882.00	67.72	-48.84	18.89	54.00	-35.11	AVG	Pass
7323.00	76.42	-46.88	29.54	74.00	-44.46	Peak	Pass
7323.00	66.69	-46.88	19.81	54.00	-34.19	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
4882.00	79.58	-48.84	30.75	74.00	-43.25	Peak	Pass
4882.00	70.01	-48.84	21.18	54.00	-32.82	AVG	Pass
7323.00	75.72	-46.88	28.84	74.00	-45.16	Peak	Pass
7323.00	65.48	-46.88	18.59	54.00	-35.41	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	79.67	-48.79	30.88	74.00	-43.12	Peak	Pass
4960.00	68.68	-48.79	19.89	54.00	-34.11	AVG	Pass

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7440.00	75.65	-46.74	28.91	74.00	-45.09	Peak	Pass
7440.00	64.83	-46.74	18.09	54.00	-35.91	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	78.76	-48.79	29.97	74.00	-44.03	Peak	Pass
4960.00	67.99	-48.79	19.21	54.00	-34.79	AVG	Pass
7440.00	75.11	-46.74	28.37	74.00	-45.63	Peak	Pass
7440.00	65.27	-46.74	18.53	54.00	-35.47	AVG	Pass

Note:Margin=Level-Limit=Reading+factor-Limit

7 Test Setup Photos

Please refer to Appendix I Test Setup Photos.

8 EUT Constructional Details (EUT Photos)

Please refer to Appendix II External Photos and Appendix III Internal Photos.

Appendix

1. Bandwidth

1.1 Test Result

1.1.1 OBW

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	99% Occupied Bandwidth (MHz)		Verdict
					Result	Limit	
GFSK	SISO	2402	DH5	1	0.875	/	Pass
		2441	DH5	1	0.873	/	Pass
		2480	DH5	1	0.878	/	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	1.199	/	Pass
		2441	2DH5	1	1.180	/	Pass
		2480	2DH5	1	1.190	/	Pass
8DPSK	SISO	2402	3DH5	1	1.187	/	Pass
		2441	3DH5	1	1.185	/	Pass
		2480	3DH5	1	1.190	/	Pass

1.1.2 20dB BW

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	20dB Bandwidth (MHz)		Verdict
					Result	Limit	
GFSK	SISO	2402	DH5	1	1.000	/	Pass
		2441	DH5	1	0.955	/	Pass
		2480	DH5	1	0.984	/	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	1.312	/	Pass
		2441	2DH5	1	1.350	/	Pass
		2480	2DH5	1	1.309	/	Pass
8DPSK	SISO	2402	3DH5	1	1.306	/	Pass
		2441	3DH5	1	1.327	/	Pass
		2480	3DH5	1	1.298	/	Pass

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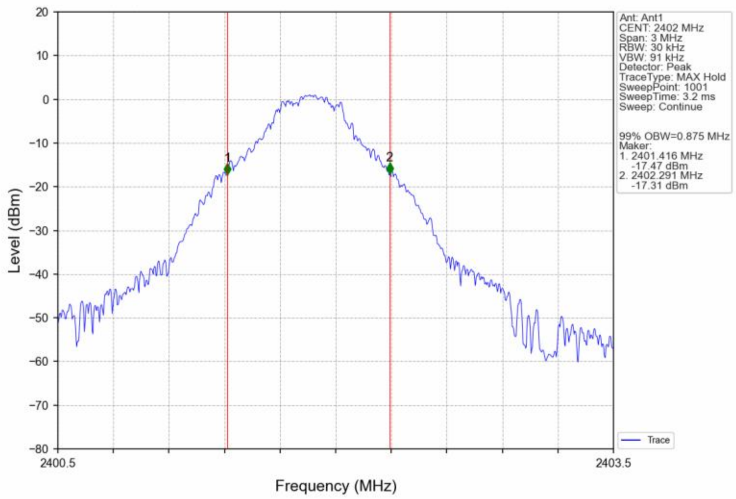
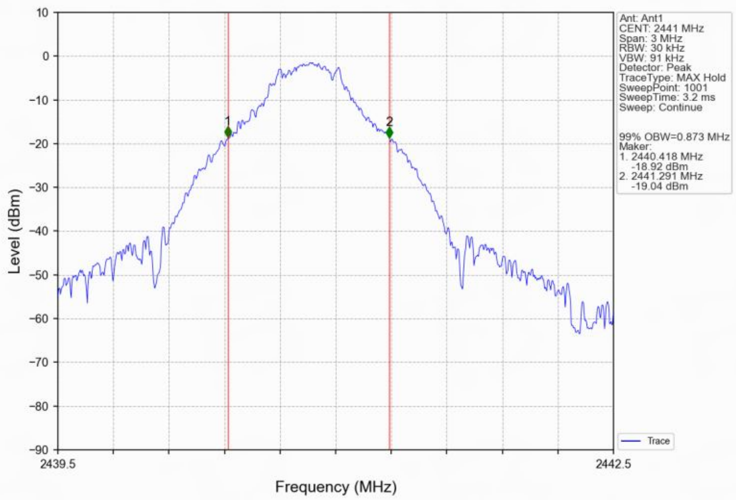
1.2 Test Graph

1.2.1 OBW

GFSK_DH5_LCH_2402MHz_Ant1_NTNV



GFSK_DH5_MCH_2441MHz_Ant1_NTNV



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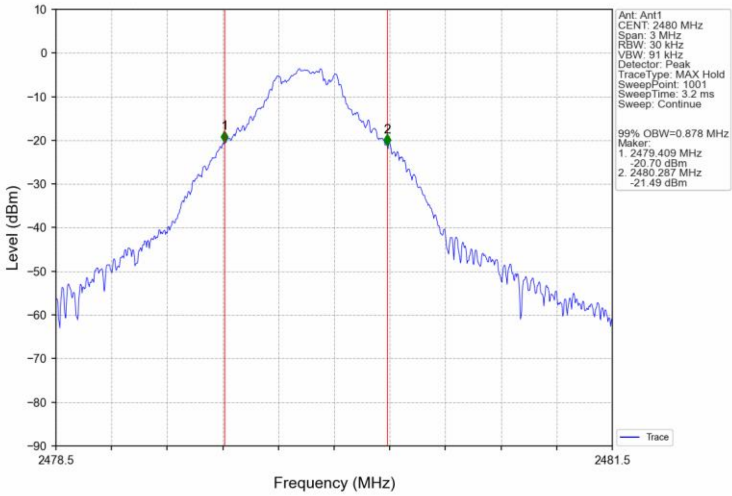
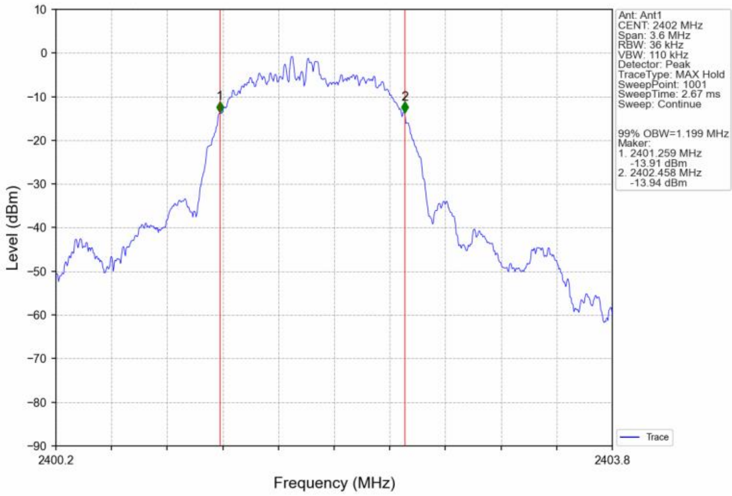
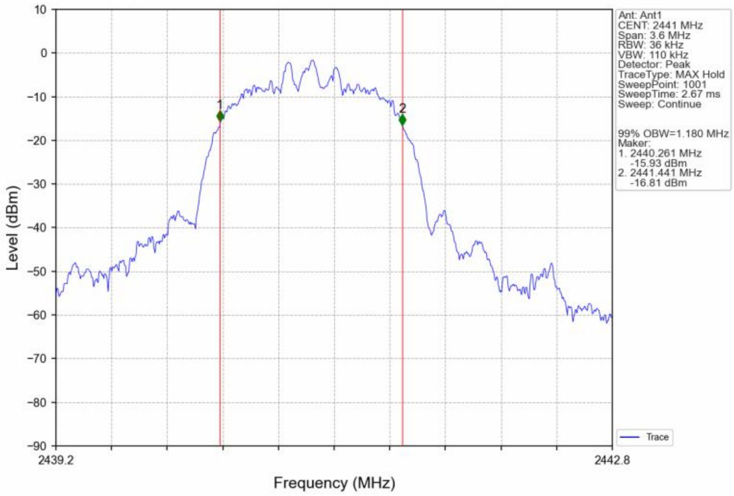
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

GFSK_DH5_HCH_2480MHz_Ant1_NTNV

Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV


Pi/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV

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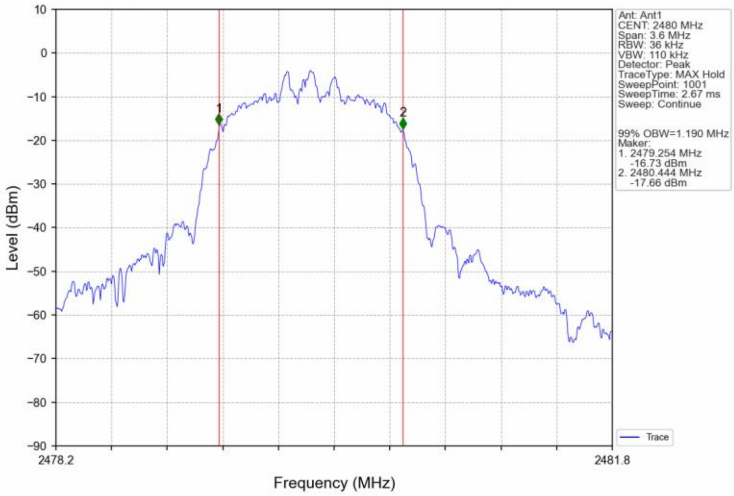
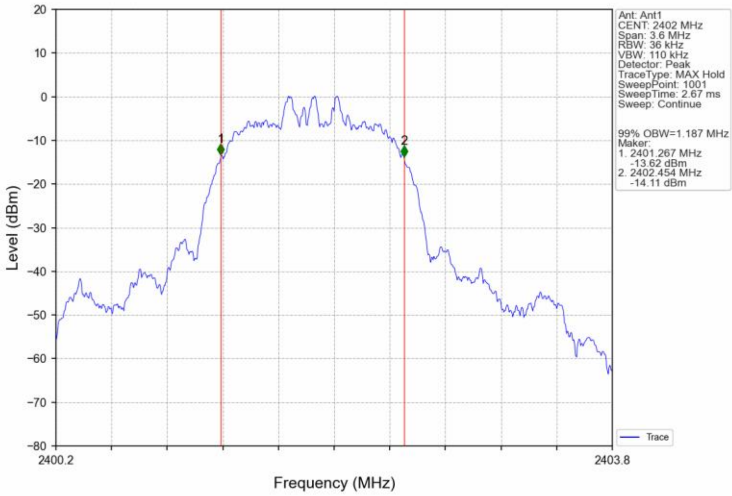
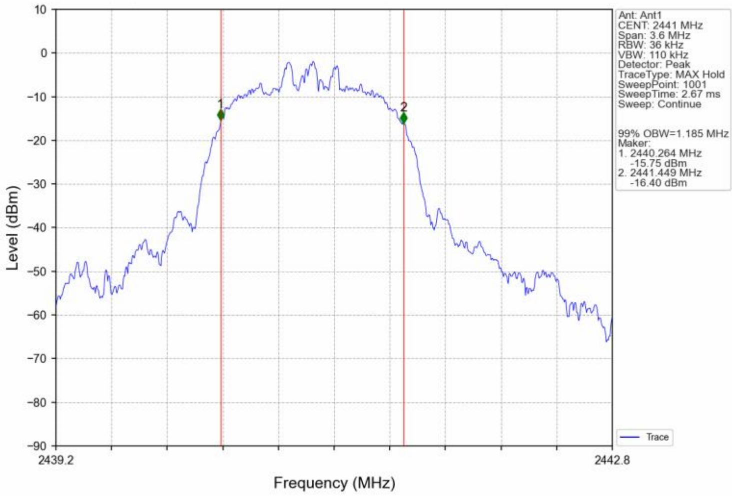
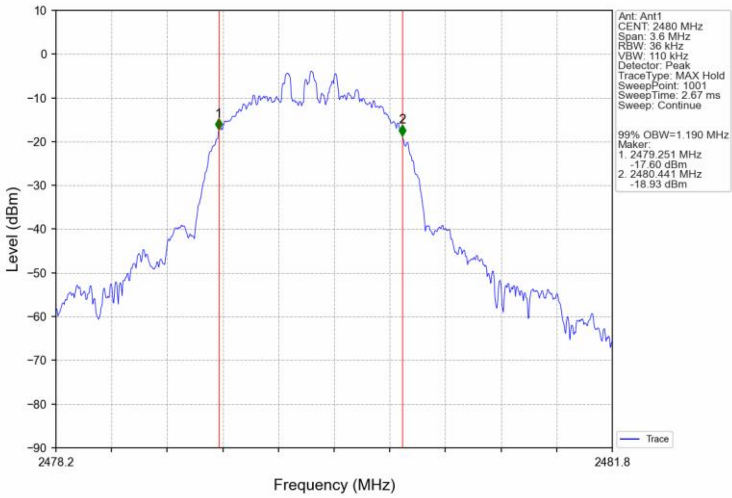


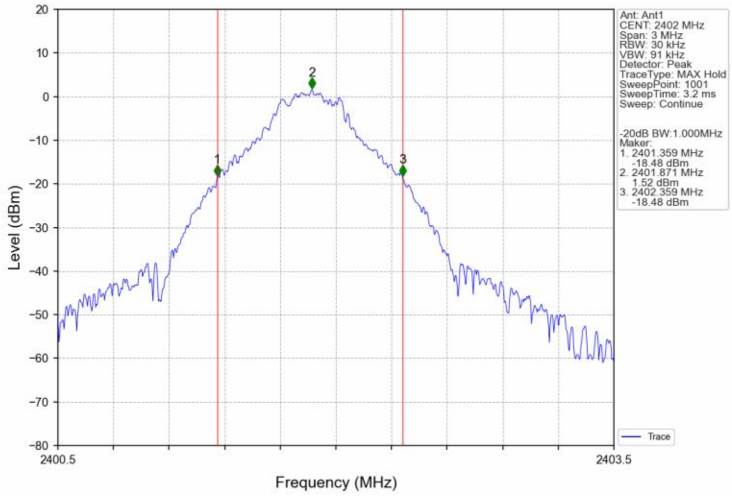
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV


8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV


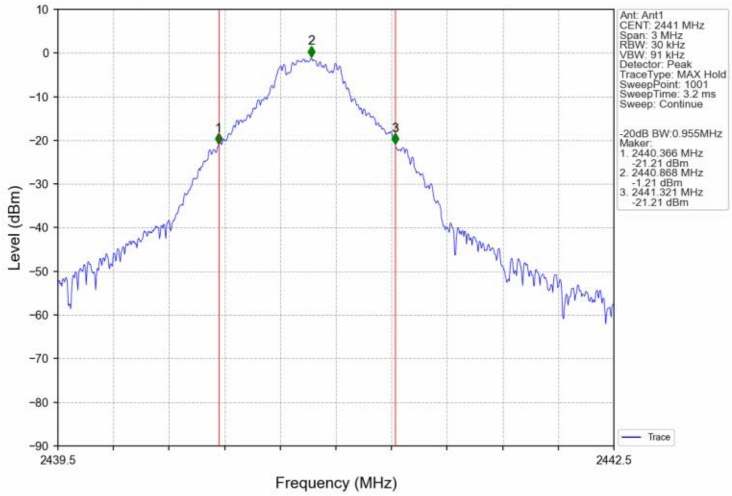
8DPSK_3DH5_HCH_2480MHz_Ant1_NTNV


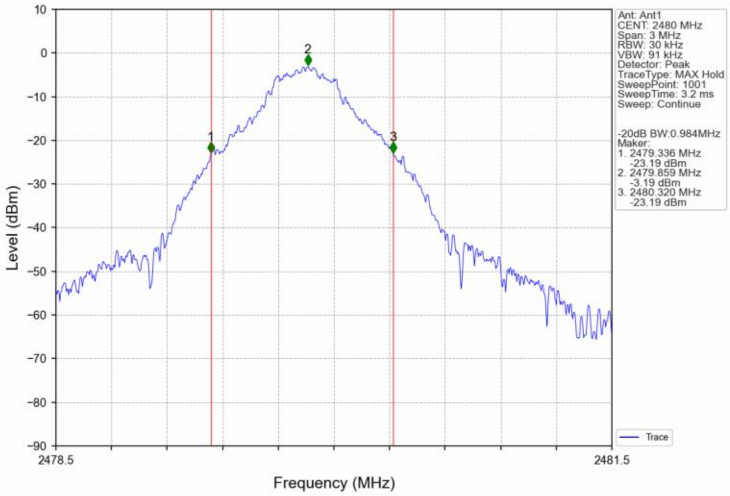
1.2.2 20dB BW

GFSK_DH5_LCH_2402MHz_Ant1_NTNV



GFSK_DH5_MCH_2441MHz_Ant1_NTNV



GFSK_DH5_HCH_2480MHz_Ant1_NTNV

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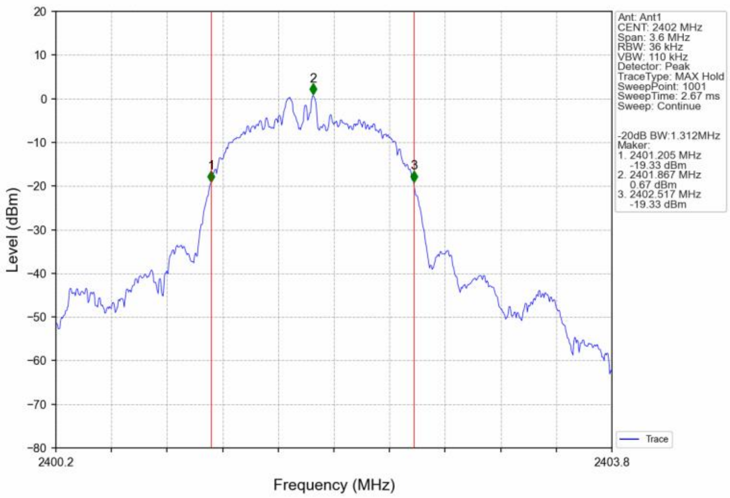
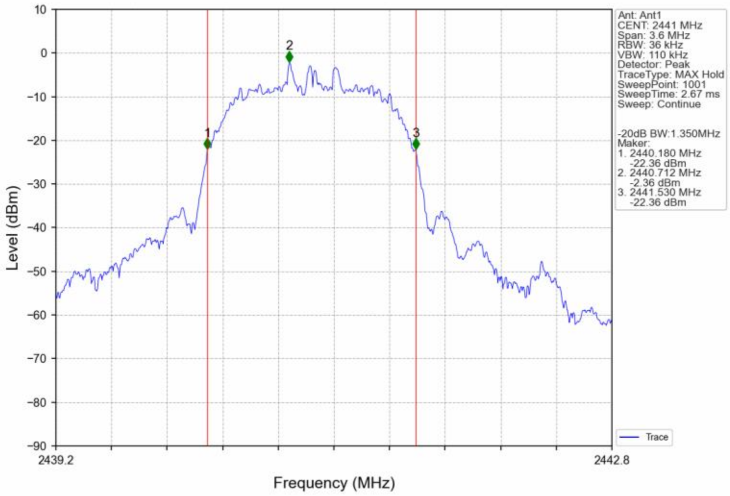
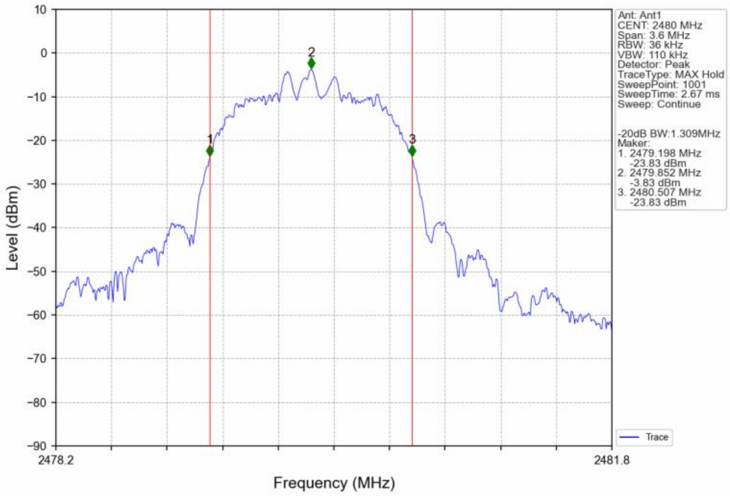
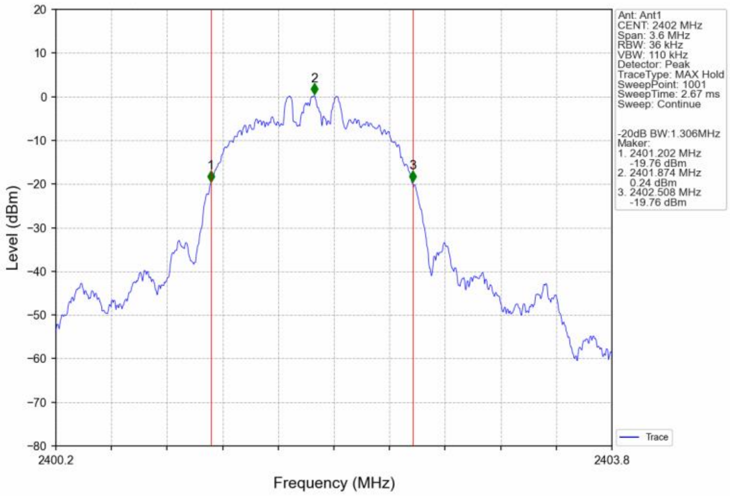
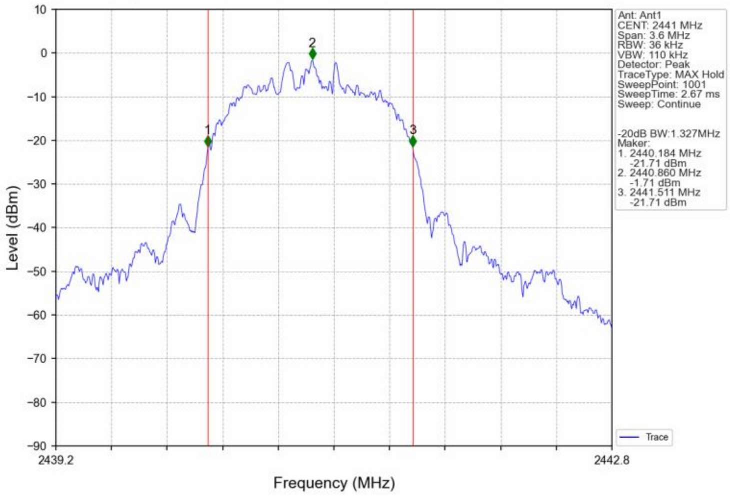


Pi/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV

Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV


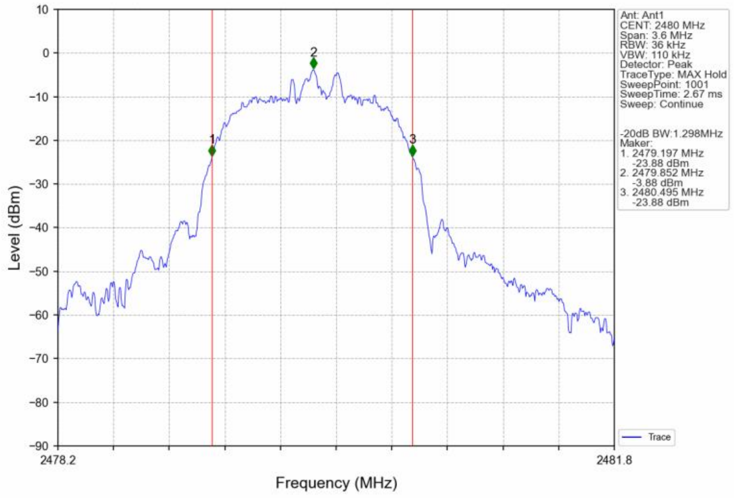
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV



8DPSK_3DH5_HCH_2480MHz_Ant1_NTNV



2. Maximum Conducted Output Power

2.1 Test Result

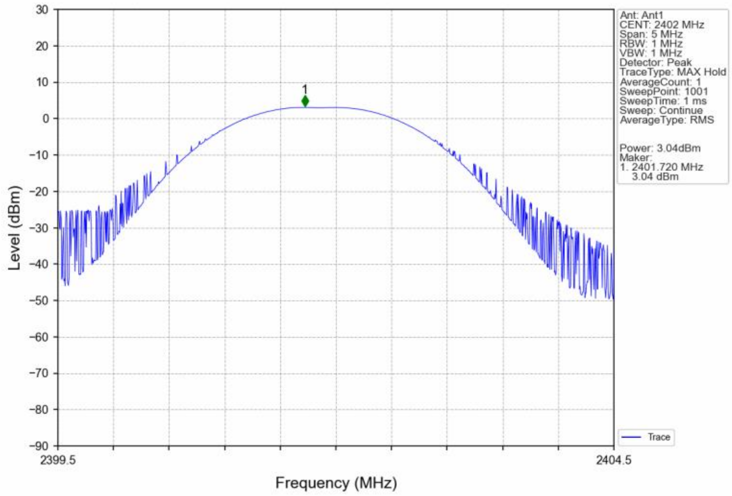
2.1.1 Power

Mode	TX Type	Frequency (MHz)	Packet Type	Maximum Peak Conducted Output Power (dBm)		Verdict
				ANT1	Limit	
GFSK	SISO	2402	DH5	3.04	<=30	Pass
		2441	DH5	0.62	<=30	Pass
		2480	DH5	-1.59	<=30	Pass
Pi/4DQPSK	SISO	2402	2DH5	2.90	<=20.97	Pass
		2441	2DH5	0.54	<=20.97	Pass
		2480	2DH5	-1.68	<=20.97	Pass
8DPSK	SISO	2402	3DH5	3.10	<=20.97	Pass
		2441	3DH5	0.76	<=20.97	Pass
		2480	3DH5	-1.43	<=20.97	Pass
Note1: Antenna Gain: Ant1:0.23dBi;						

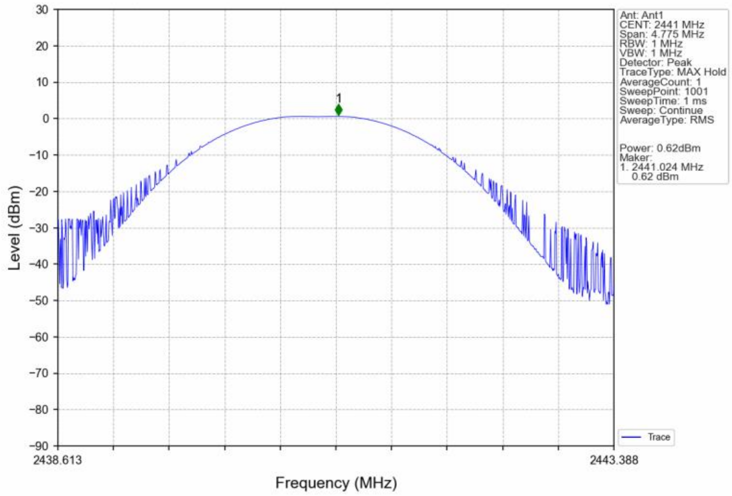
2.2 Test Graph

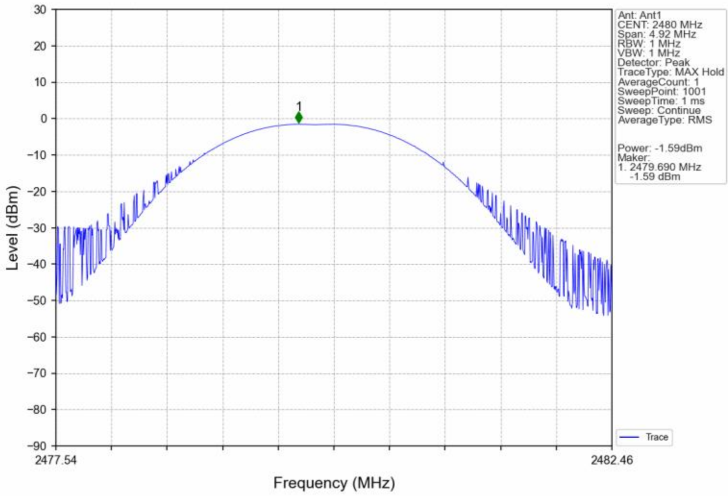
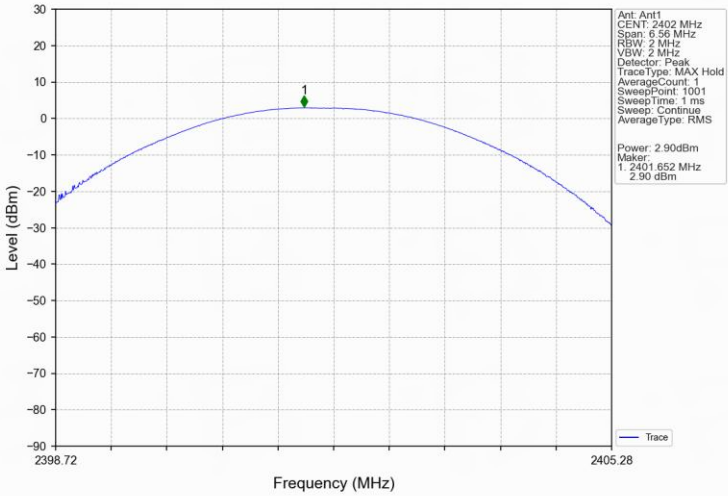
2.2.1 Power

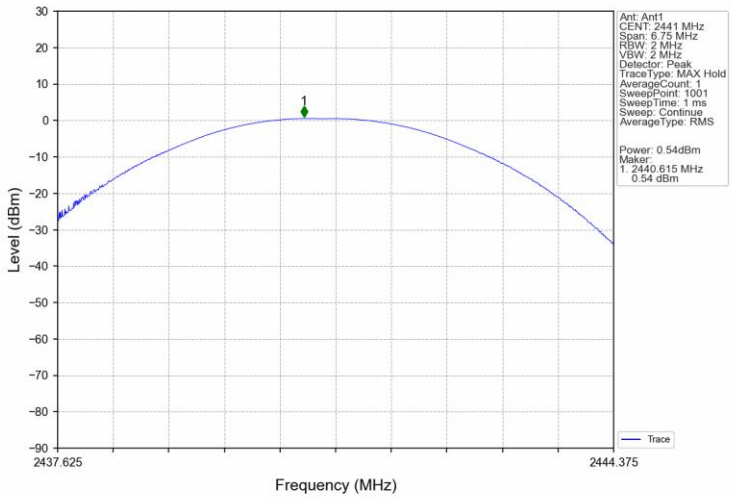
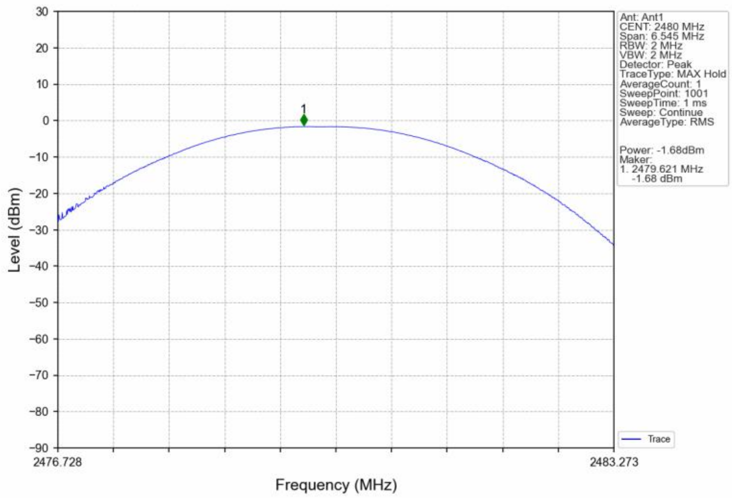
GFSK_DH5_LCH_2402MHz_Ant1_NTNV



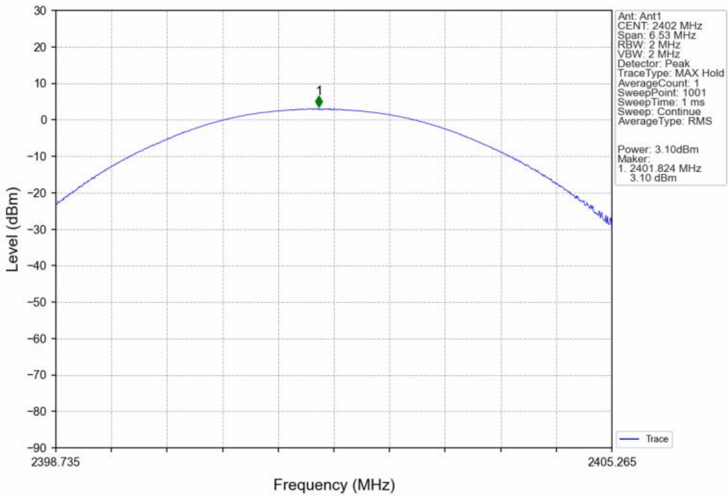
GFSK_DH5_MCH_2441MHz_Ant1_NTNV



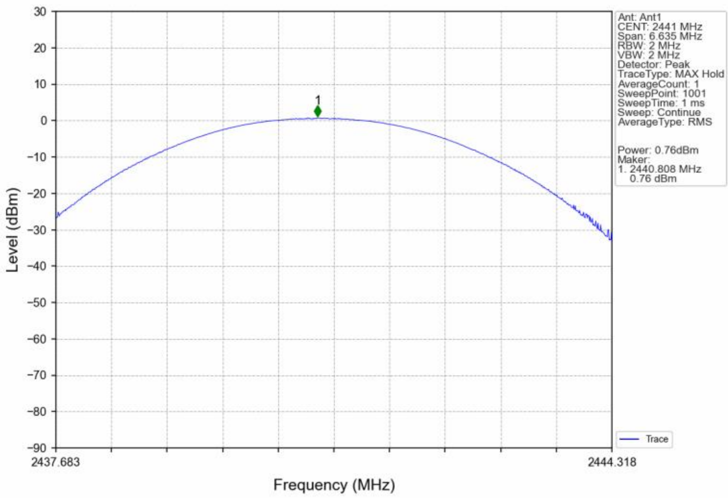
GFSK_DH5_HCH_2480MHz_Ant1_NTNV

Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV


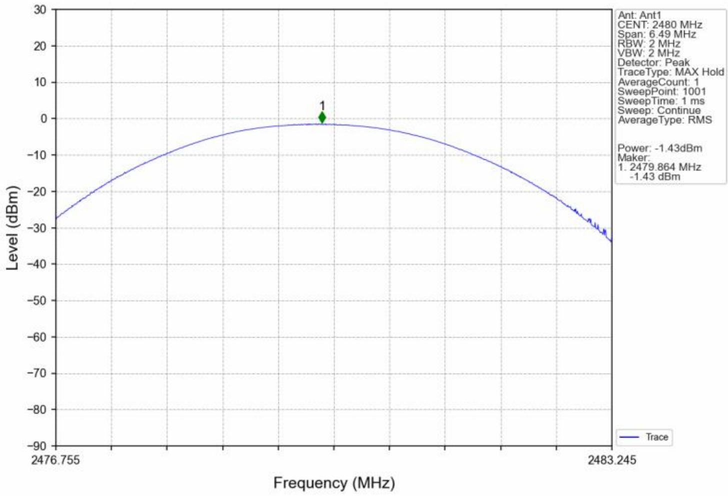
Pi/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV

Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV


8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV



8DPSK_3DH5_HCH_2480MHz_Ant1_NTNV


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3. Carrier Frequency Separation

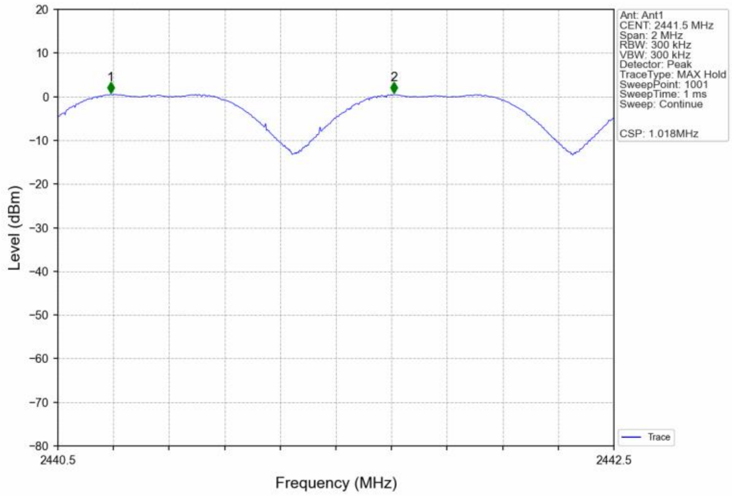
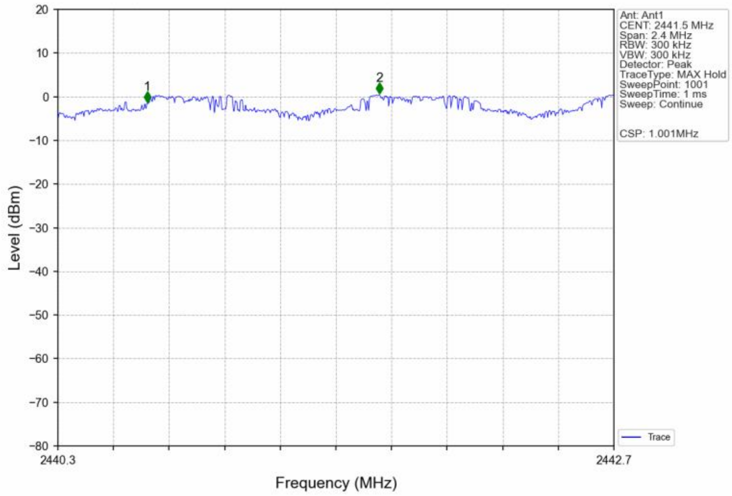
3.1 Test Result

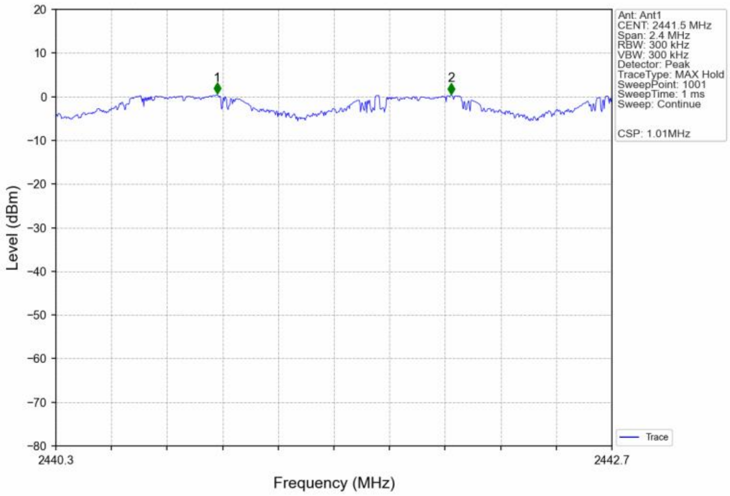
3.1.1 Ant1

Ant1							
Mode	TX Type	Frequency (MHz)	Packet Type	Channel Separation (MHz)	20dB Bandwidth (MHz)	Limit (MHz)	Verdict
GFSK	SISO	HOPP	DH5	1.018	1.000	>=1	Pass
Pi/4DQPSK	SISO	HOPP	2DH5	1.001	1.350	>=0.9	Pass
8DPSK	SISO	HOPP	3DH5	1.010	1.327	>=0.885	Pass

3.2 Test Graph

3.2.1 Ant1

GFSK_DH5_HOPP_Ant1_NTNV

Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV


8DPSK_3DH5_HOPP_Ant1_NTNV


4. Number of Hopping Frequencies

4.1 Test Result

4.1.1 HoppNum

Mode	TX Type	Frequency (MHz)	Packet Type	Num of Hopping Frequencies		Verdict
				ANT1	Limit	
GFSK	SISO	HOPP	DH5	79	>=15	Pass
Pi/4DQPSK	SISO	HOPP	2DH5	79	>=15	Pass
8DPSK	SISO	HOPP	3DH5	79	>=15	Pass

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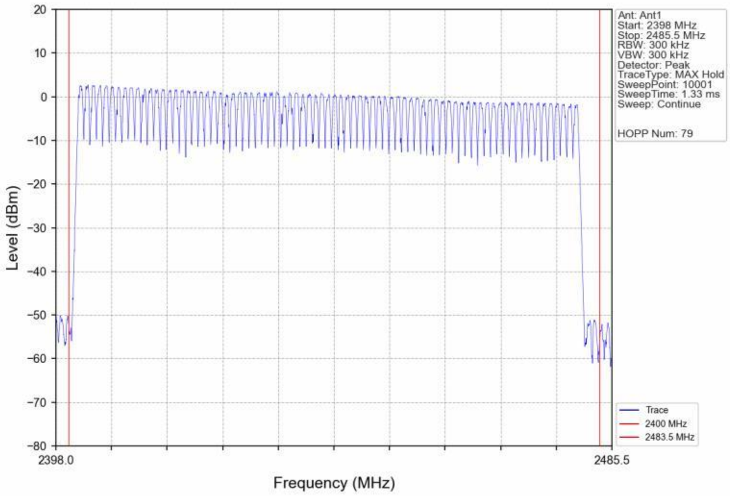
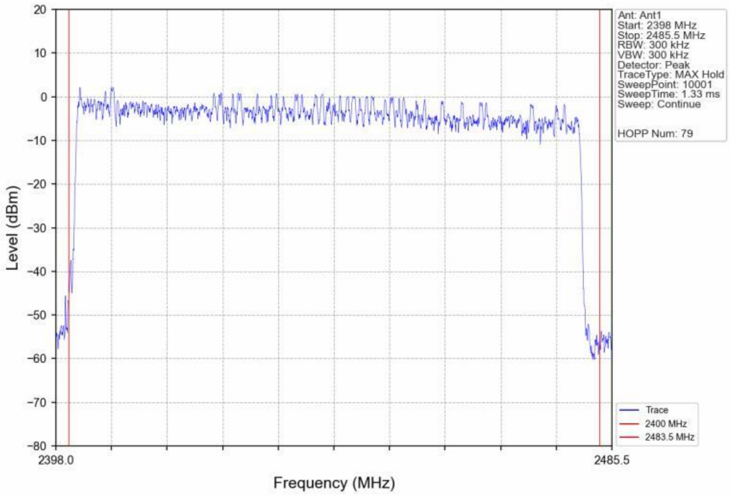
4.2 Test Graph

4.2.1 HoppNum

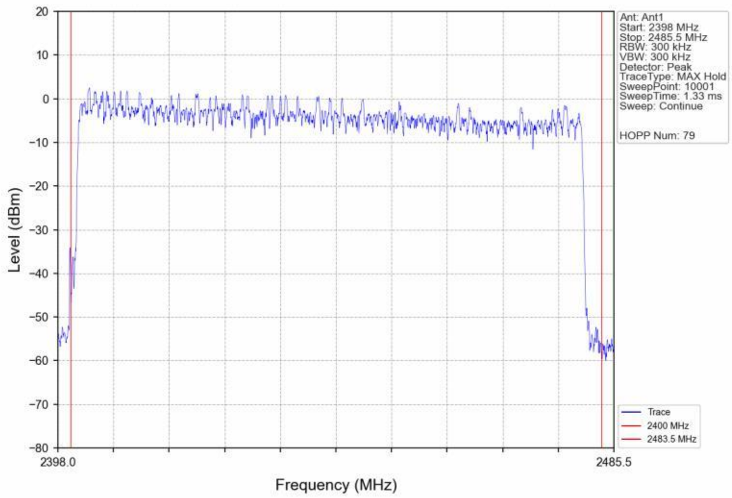
GFSK_DH5_HOPP_Ant1_NTNV



Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV



8DPSK_3DH5_HOPP_Ant1_NTNV



5. Time of Occupancy (Dwell Time)

5.1 Test Result

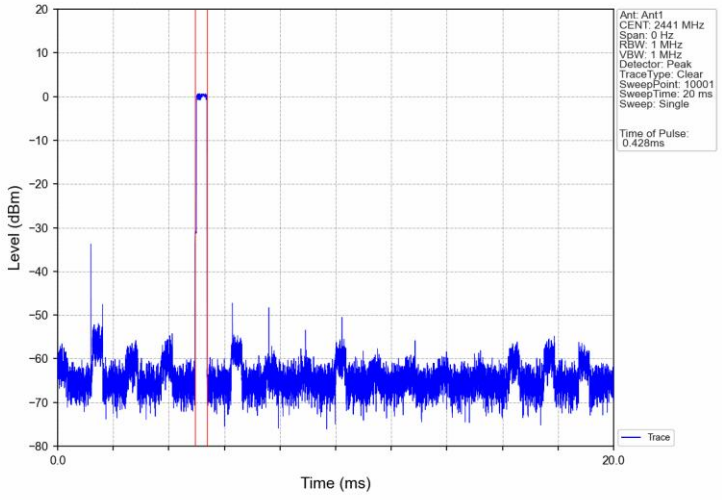
5.1.1 Ant1

Ant1									
Mode	TX Type	Frequency (MHz)	Packet Type	Duration of Single Pulse (ms)	Observation Period (s)	Num of Pulse in Observation Period	Dwell Time (ms)	Limit (ms)	Verdict
GFSK	SISO	HOPP	DH1	0.428	31.600	314	134.392	<=400	Pass
			DH3	1.698	31.600	169	286.962	<=400	Pass
			DH5	2.946	31.600	93	273.978	<=400	Pass
Pi/4DQPSK	SISO	HOPP	2DH1	0.392	31.600	314	123.088	<=400	Pass
			2DH3	1.704	31.600	174	296.496	<=400	Pass
			2DH5	2.952	31.600	102	301.104	<=400	Pass
8DPSK	SISO	HOPP	3DH1	0.390	31.600	314	122.460	<=400	Pass
			3DH3	1.640	31.600	174	285.360	<=400	Pass
			3DH5	2.952	31.600	104	307.008	<=400	Pass

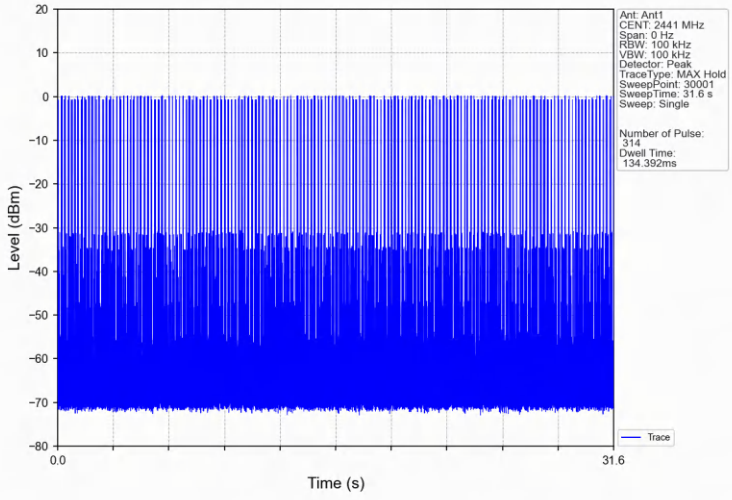
5.2 Test Graph

5.2.1 Ant1

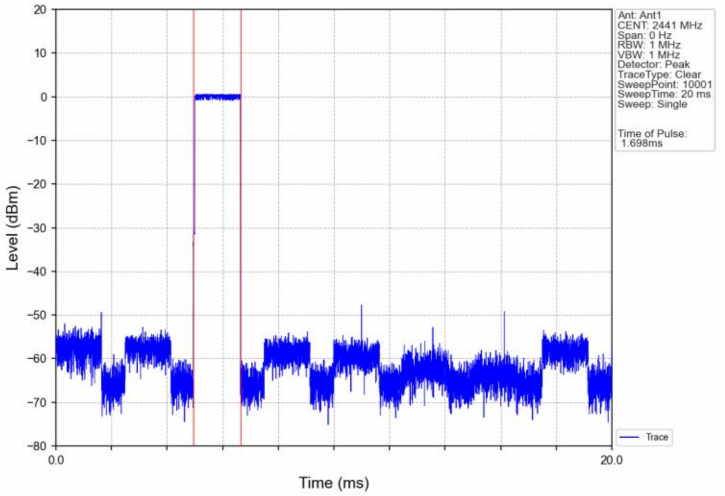
GFSK_DH1_HOPP_Ant1_NTNV



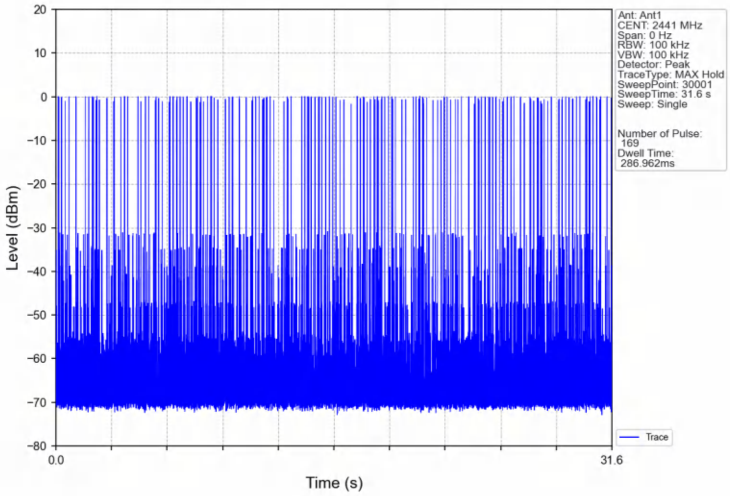
GFSK_DH1_HOPP_Ant1_NTNV



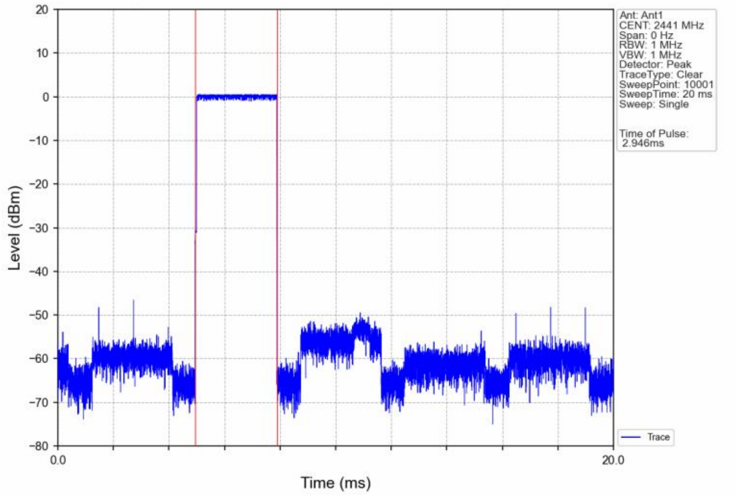
GFSK_DH3_HOPP_Ant1_NTNV



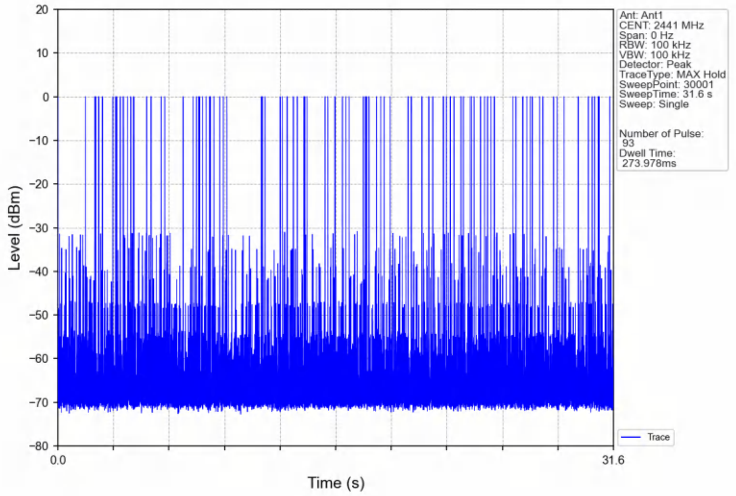
GFSK_DH3_HOPP_Ant1_NTNV

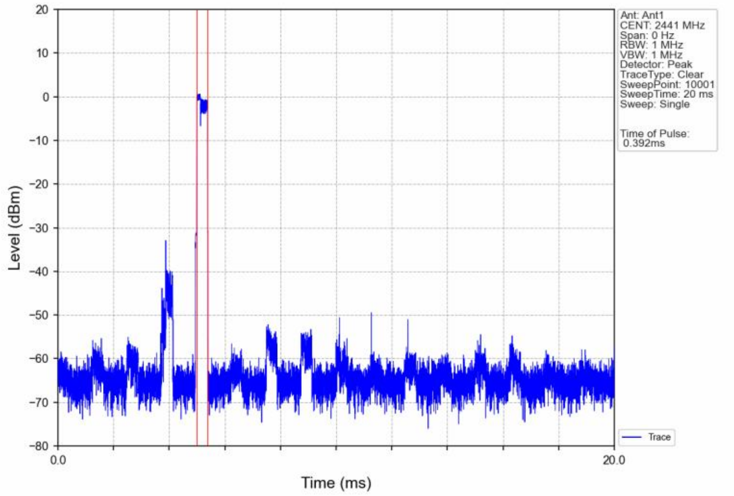


GFSK_DH5_HOPP_Ant1_NTNV



GFSK_DH5_HOPP_Ant1_NTNV



Pi/4DQPSK_2DH1_HOPP_Ant1_NTNV

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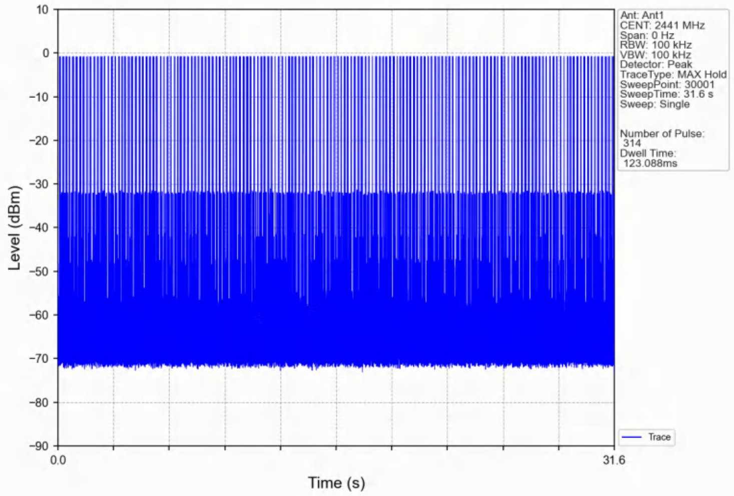
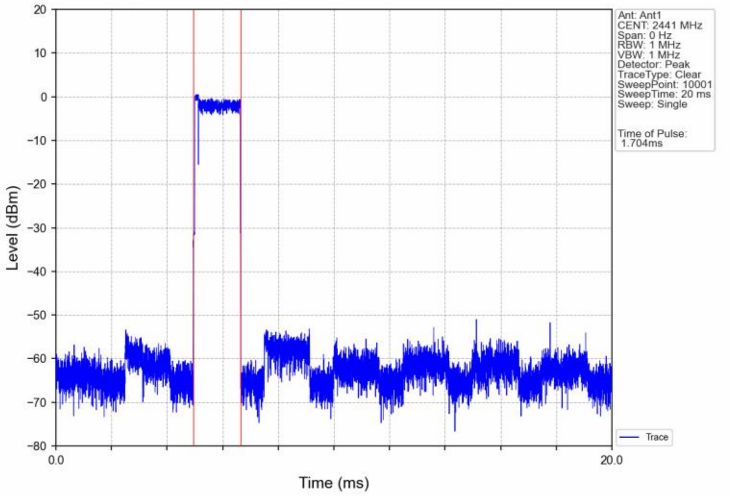
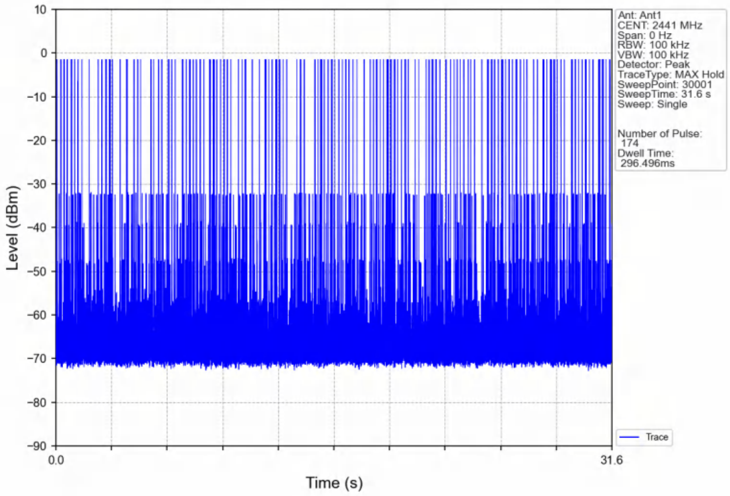


Pi/4DQPSK_2DH3_HOPP_Ant1_NTNV



Pi/4DQPSK_2DH3_HOPP_Ant1_NTNV



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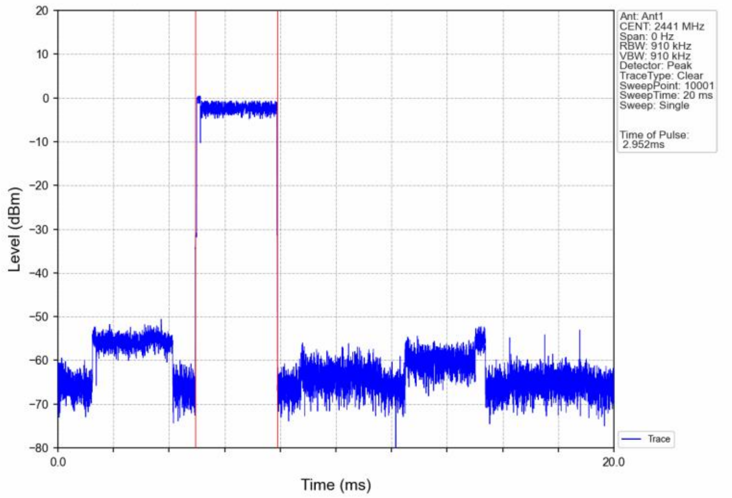
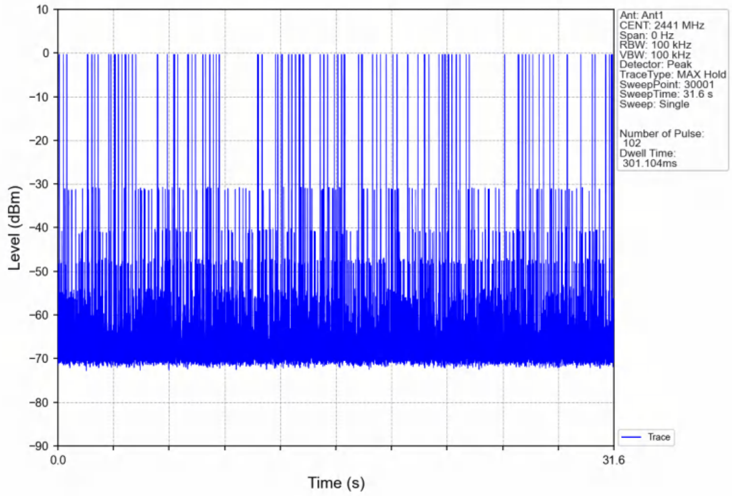
Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV


Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV


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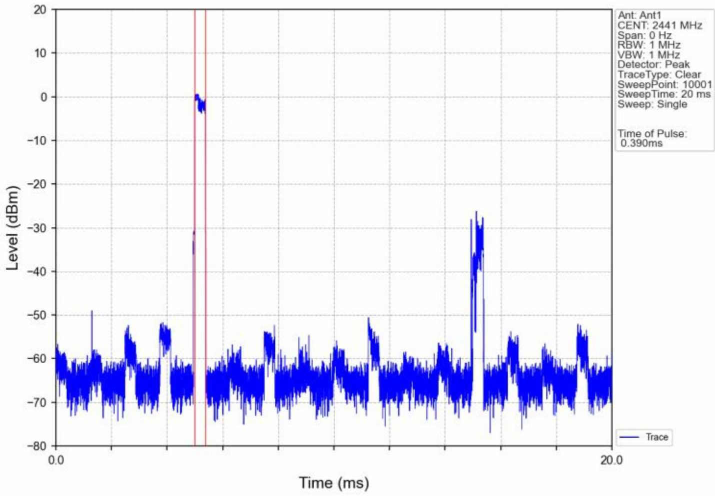
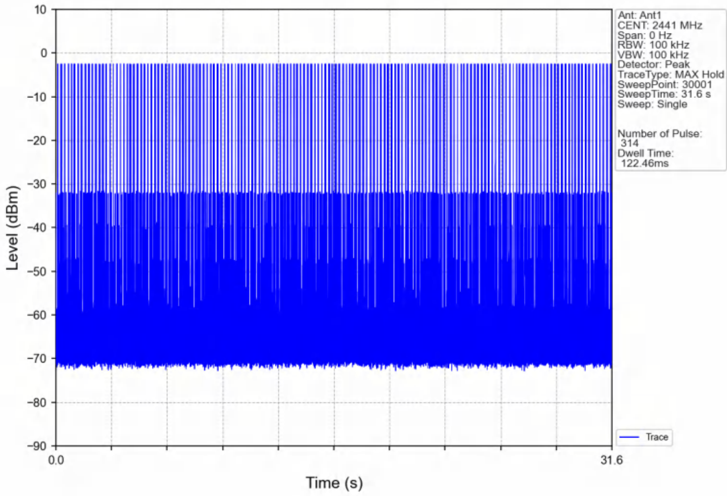
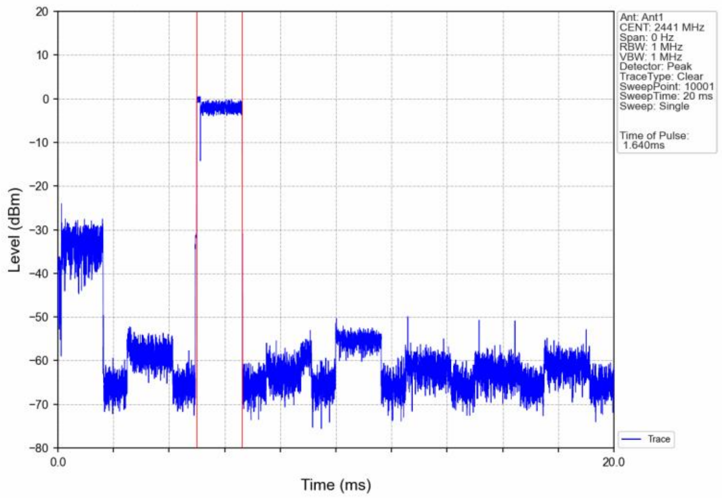
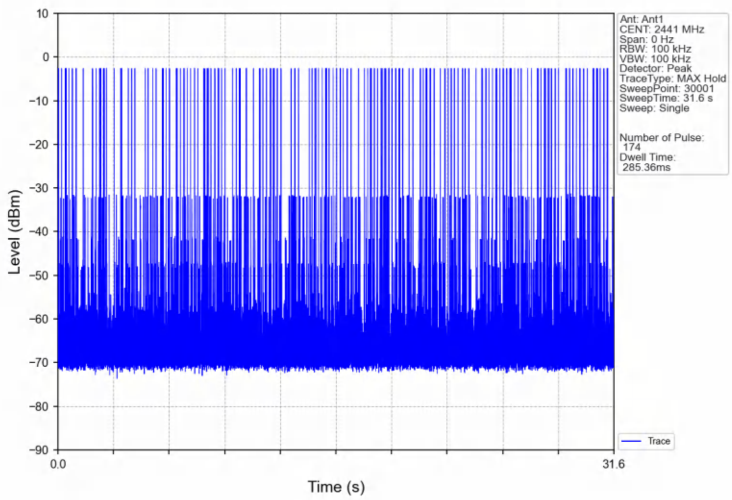
8DPSK_3DH1_HOPP_Ant1_NTNV

8DPSK_3DH1_HOPP_Ant1_NTNV


8DPSK_3DH3_HOPP_Ant1_NTNV



8DPSK_3DH3_HOPP_Ant1_NTNV



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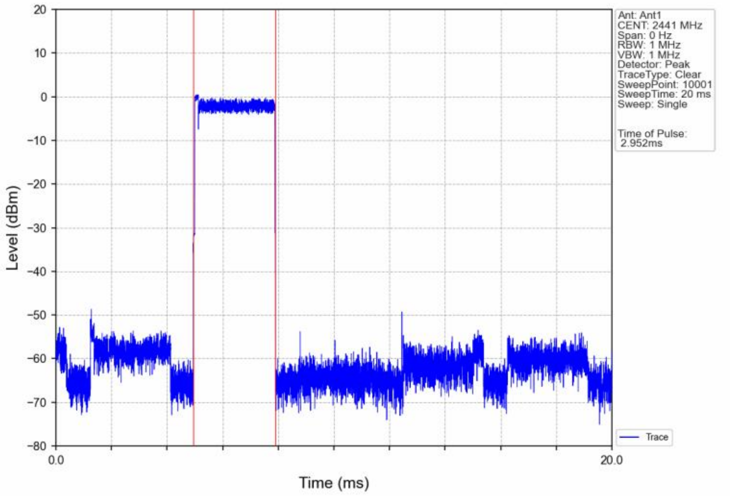
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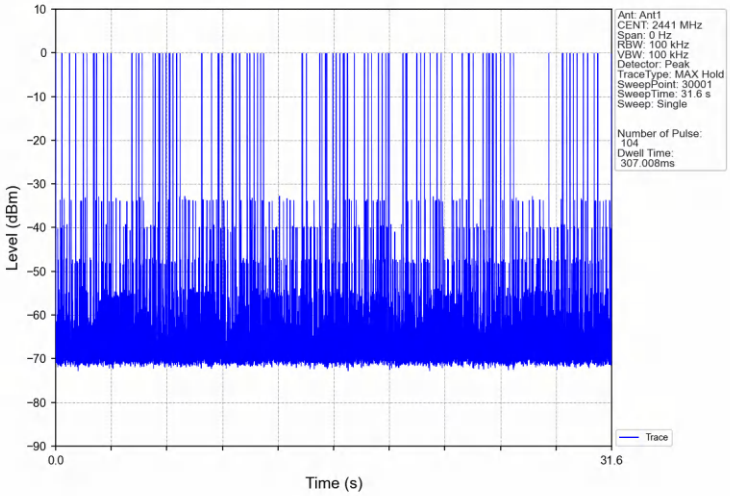


6. Unwanted Emissions In Non-restricted Frequency Bands

6.1 Test Result

6.1.1 Ref

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	Level of Reference (dBm)
GFSK	SISO	2402	DH5	1	2.70
		2441	DH5	1	0.32
		2480	DH5	1	-1.90
		HOPP	DH5	1	2.45
					2.45
Pi/4DQPSK	SISO	2402	2DH5	1	2.37
		2441	2DH5	1	0.19
		2480	2DH5	1	-1.99
		HOPP	2DH5	1	2.27
					2.27
8DPSK	SISO	2402	3DH5	1	2.41
		2441	3DH5	1	0.11
		2480	3DH5	1	-2.07
		HOPP	3DH5	1	2.06
					2.06
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.					

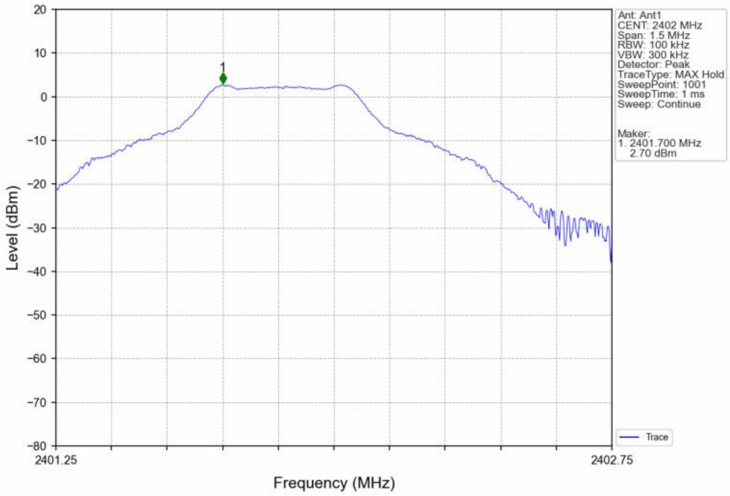
6.1.2 CSE

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
GFSK	SISO	2402	DH5	1	2.70	-17.30	Pass
		2441	DH5	1	0.32	-19.68	Pass
		2480	DH5	1	-1.90	-21.90	Pass
		HOPP	DH5	1	2.45	-17.55	Pass
					2.45	-17.55	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	2.37	-17.63	Pass
		2441	2DH5	1	0.19	-19.81	Pass
		2480	2DH5	1	-1.99	-21.99	Pass
		HOPP	2DH5	1	2.27	-17.73	Pass
					2.27	-17.73	Pass
8DPSK	SISO	2402	3DH5	1	2.41	-17.59	Pass
		2441	3DH5	1	0.11	-19.89	Pass
		2480	3DH5	1	-2.07	-22.07	Pass
		HOPP	3DH5	1	2.06	-17.94	Pass
					2.06	-17.94	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.							

6.2 Test Graph

6.2.1 Ref

GFSK_DH5_LCH_2402MHz_Ant1_NTNV



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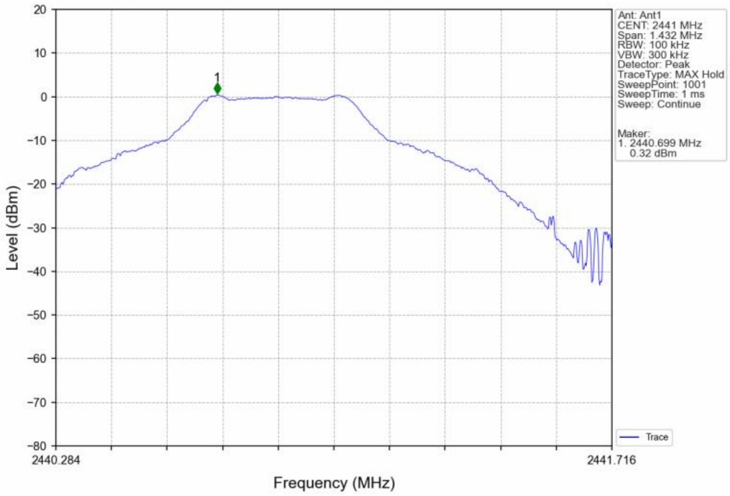

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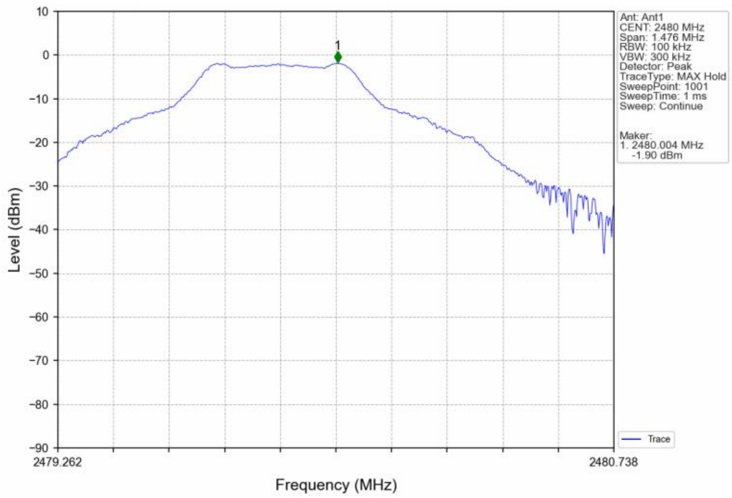
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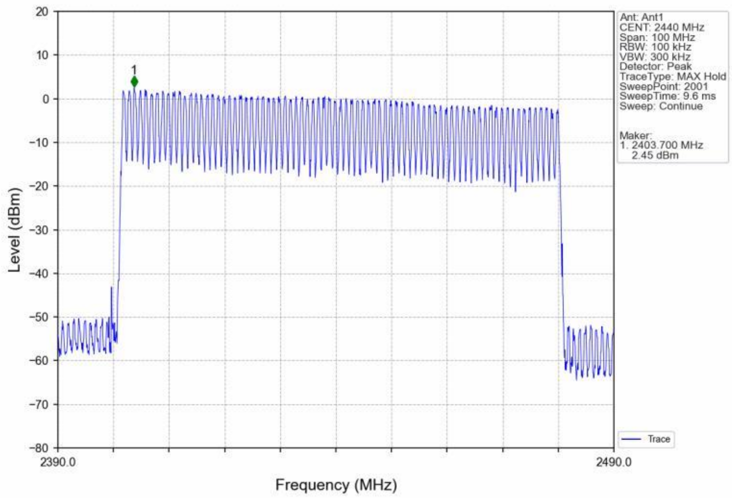

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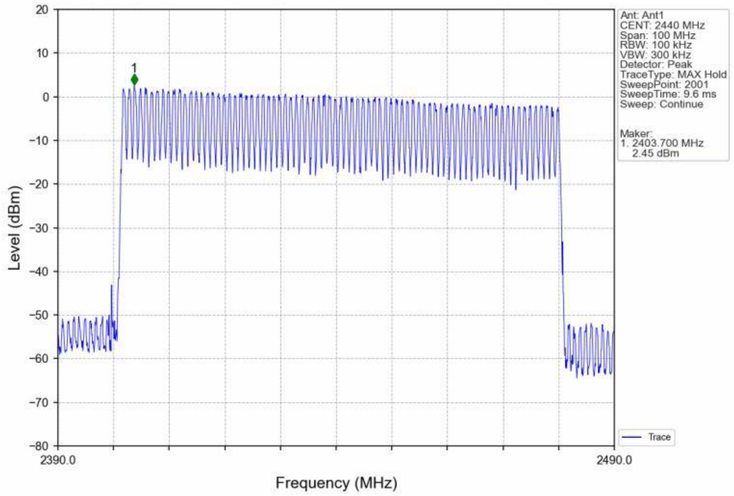

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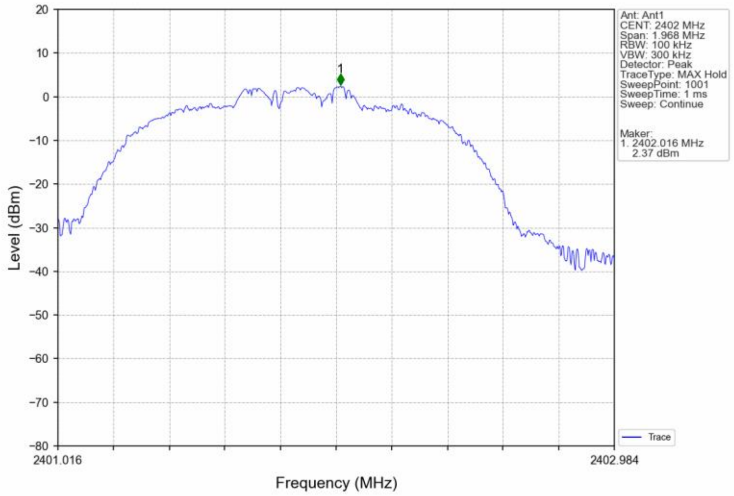

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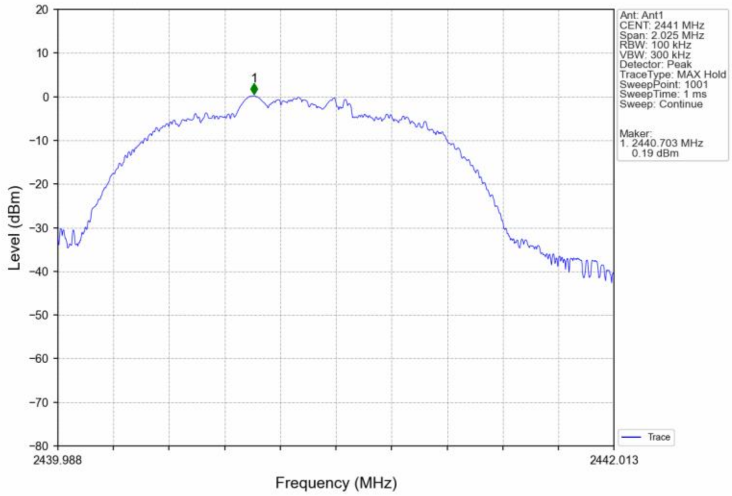

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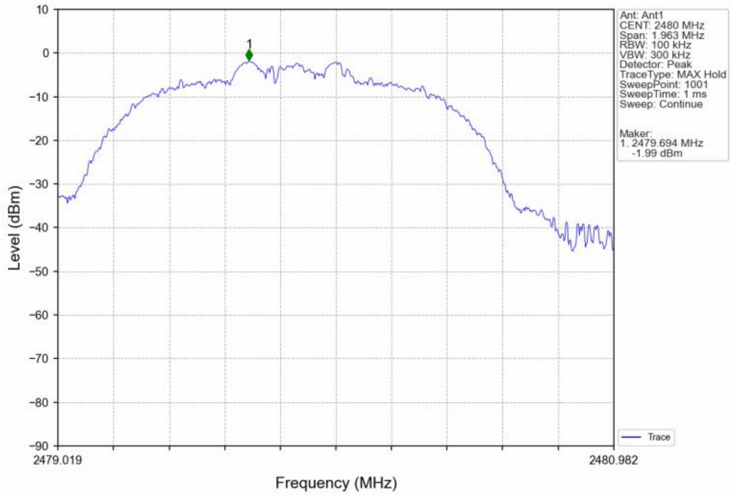

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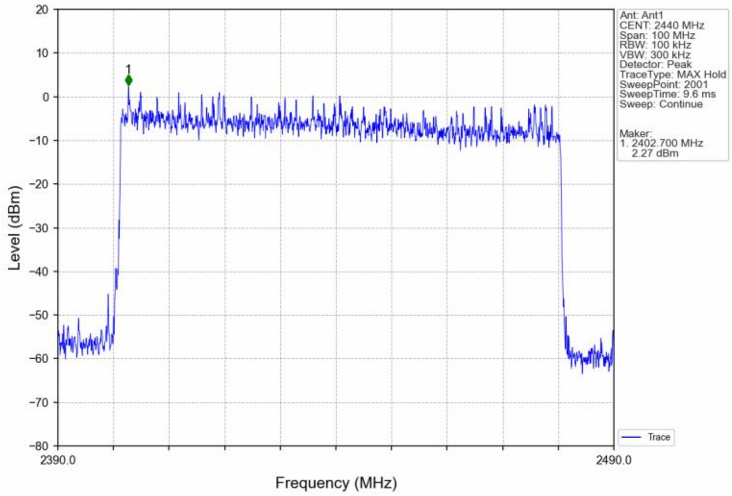

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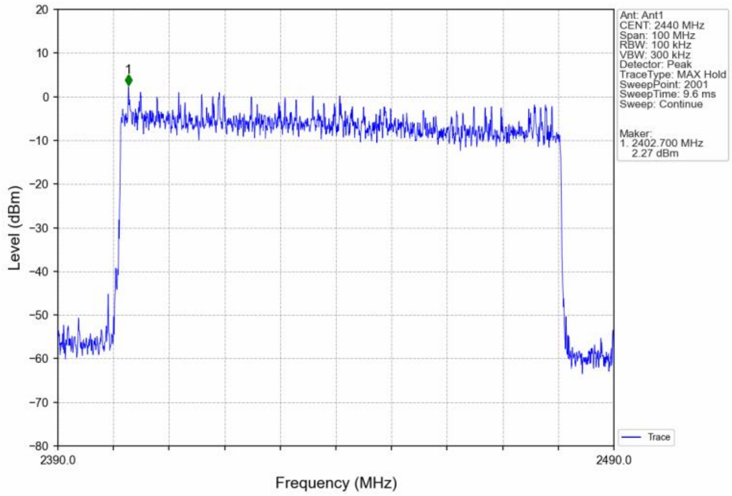

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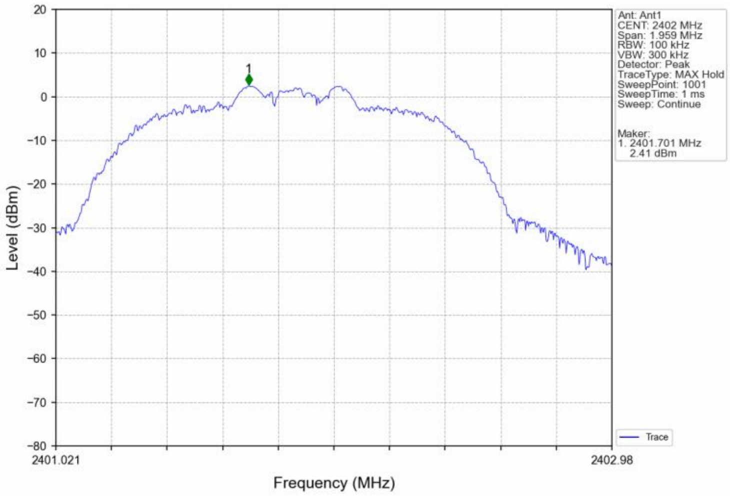
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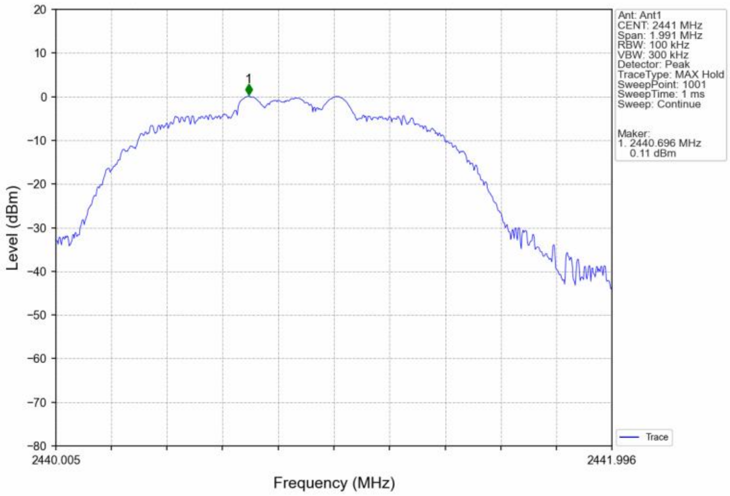

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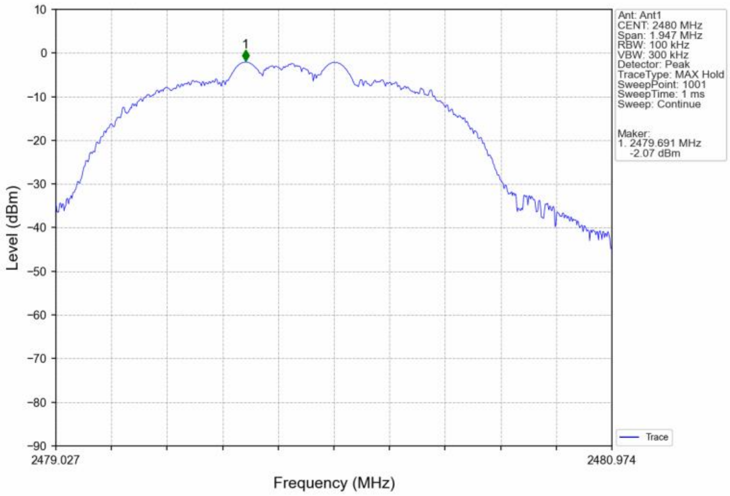
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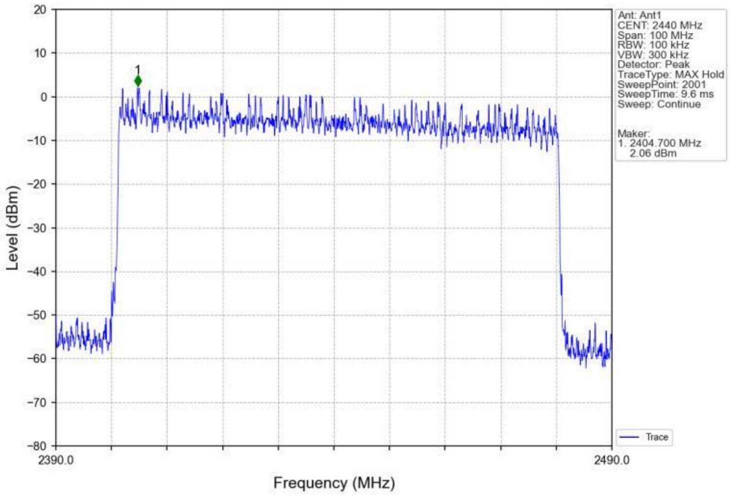

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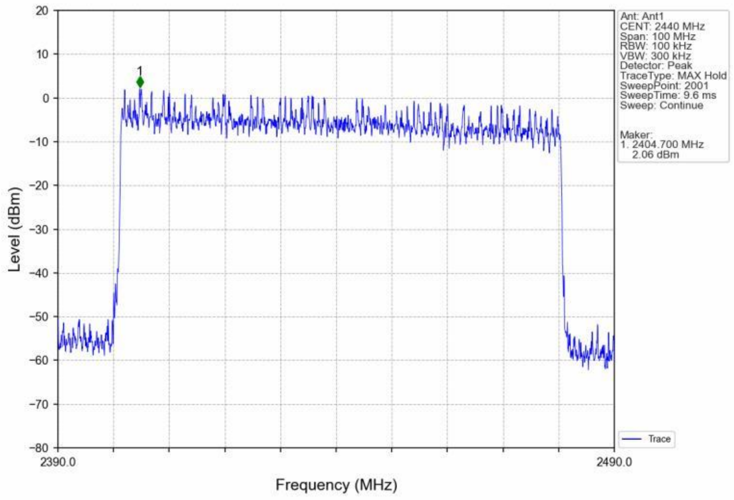

6.2.2 CSE

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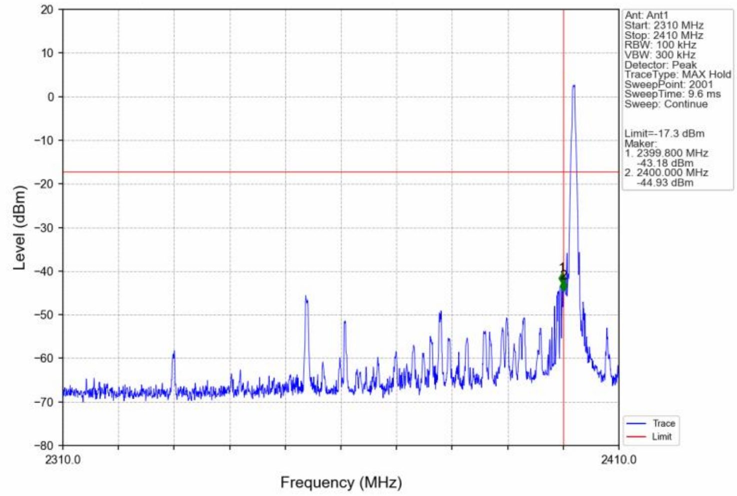
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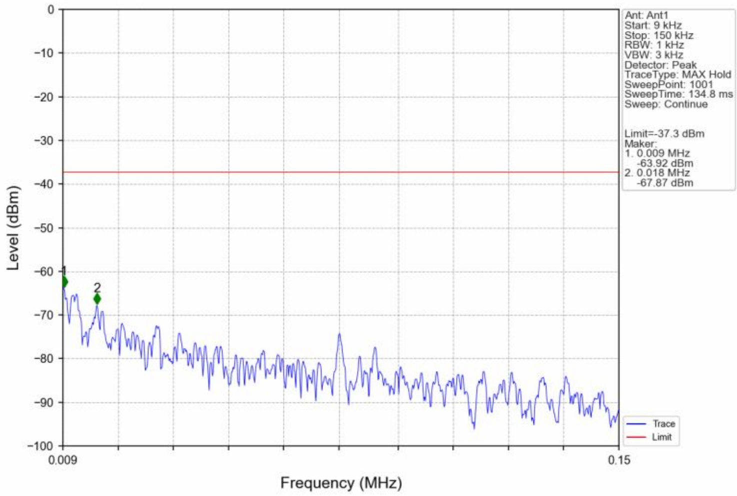

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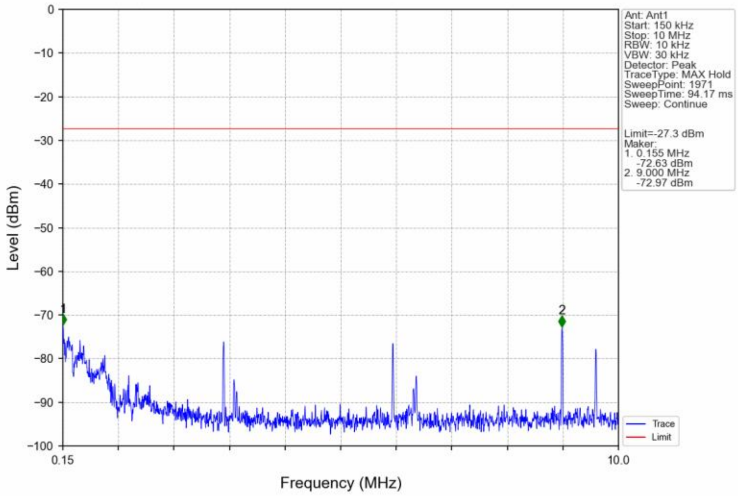

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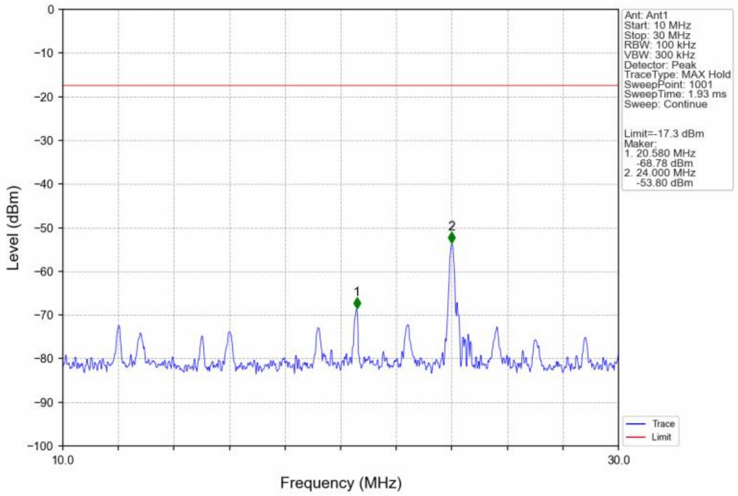

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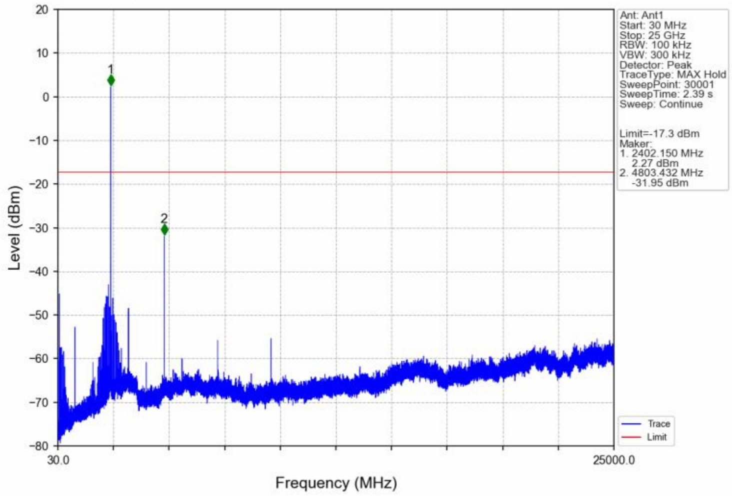
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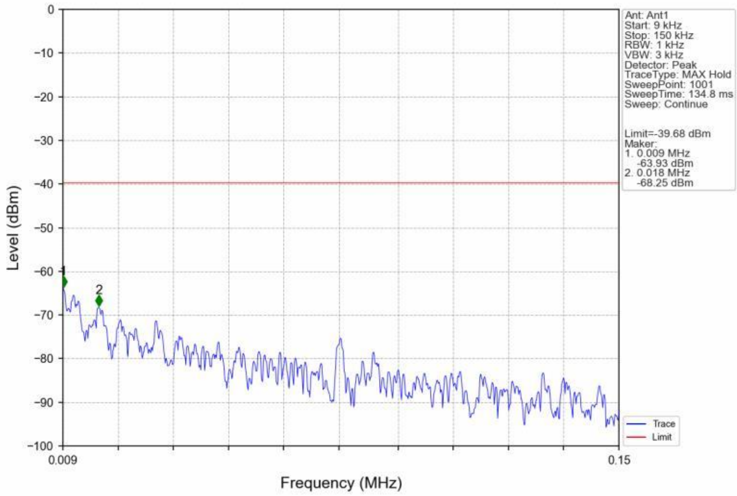

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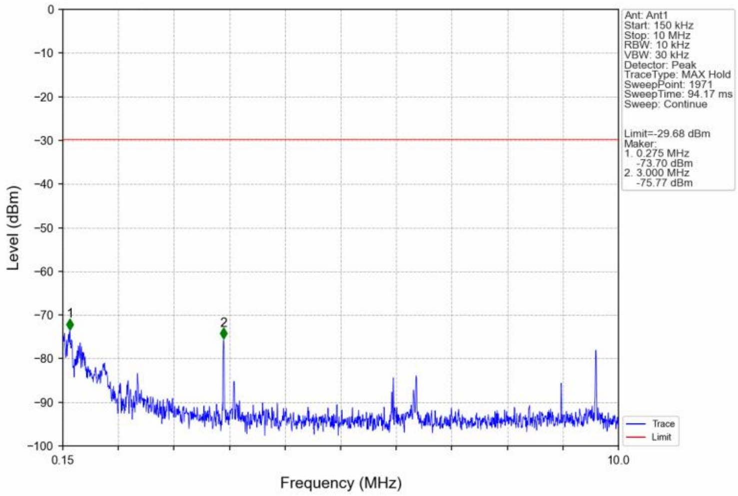

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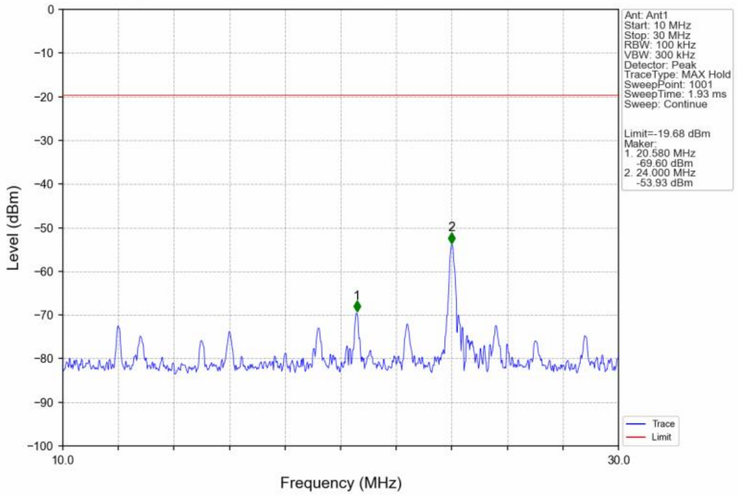

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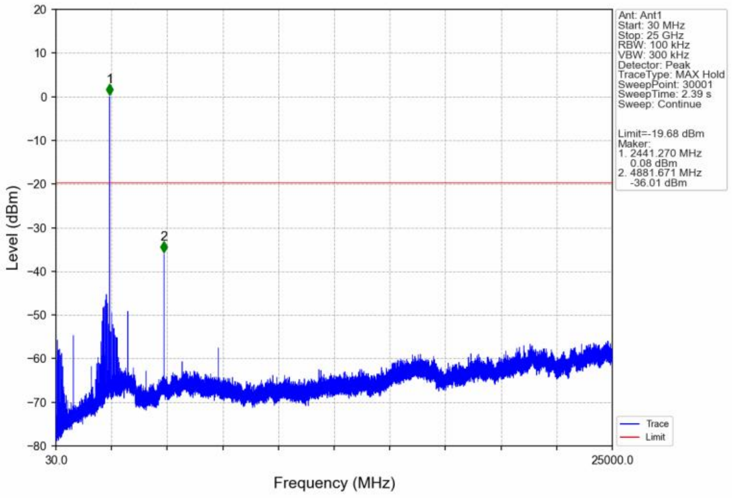
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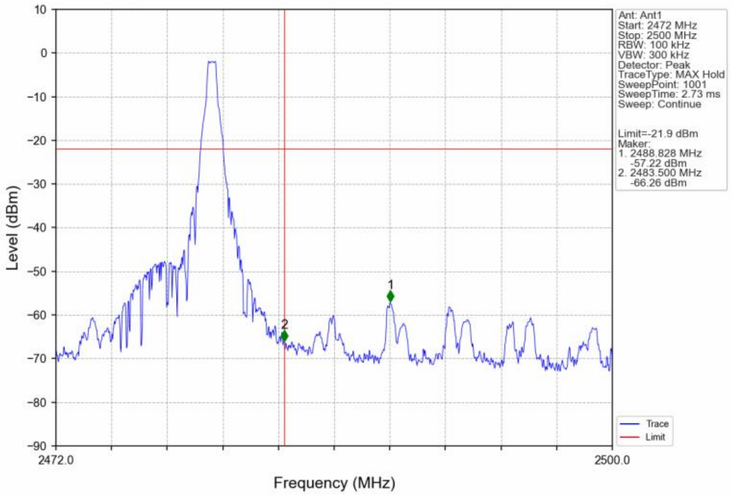

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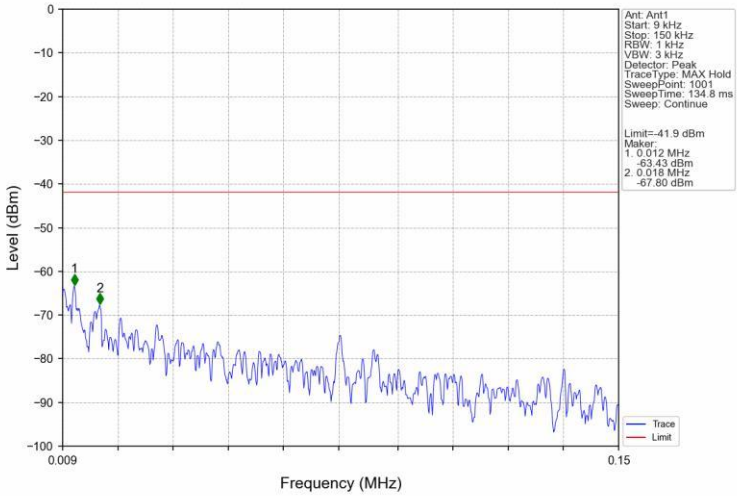

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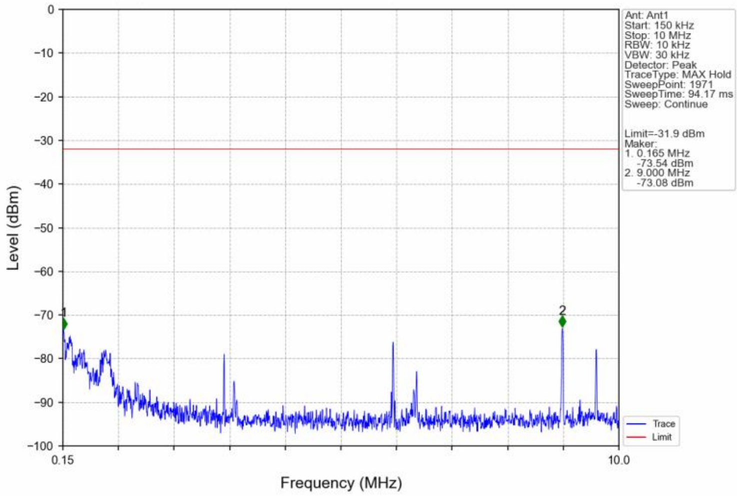

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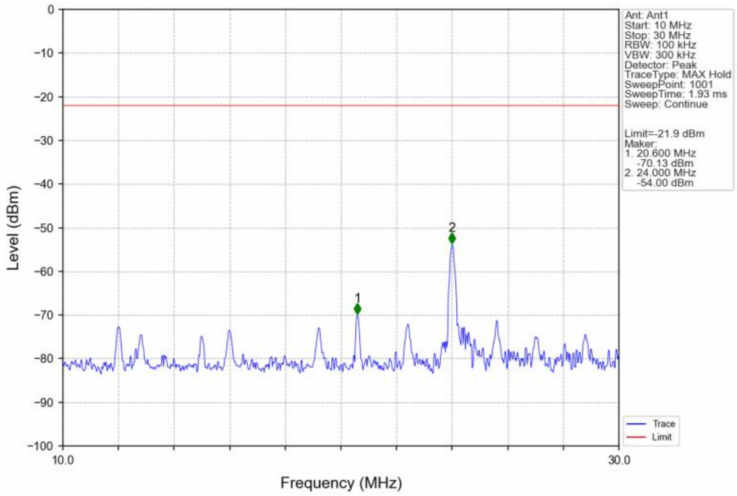

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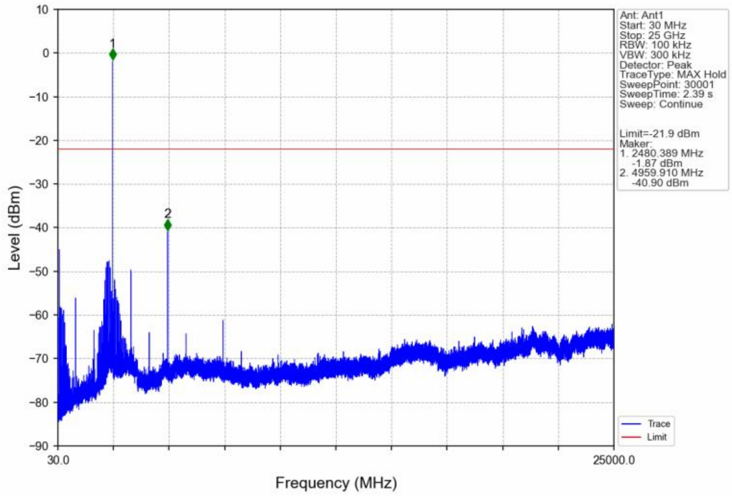

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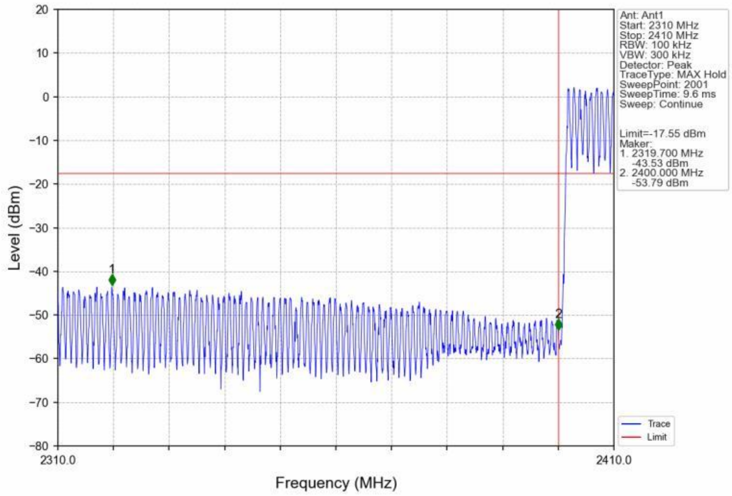

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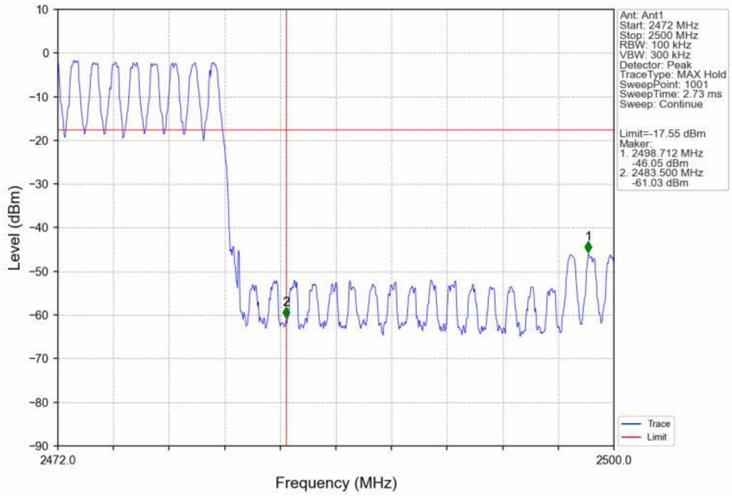

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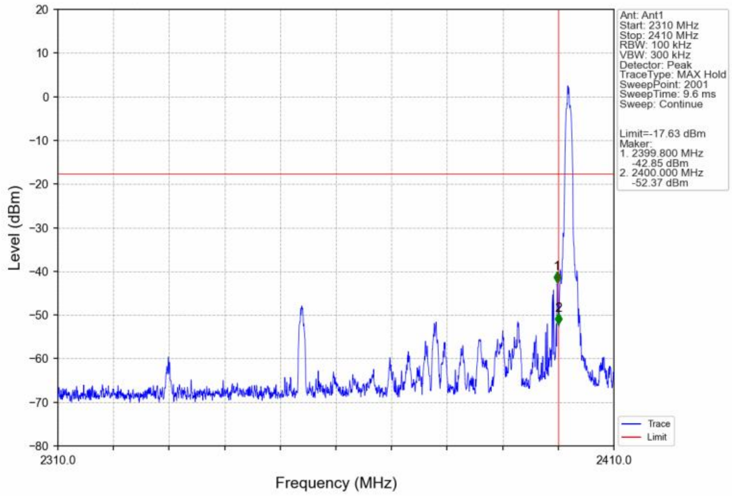

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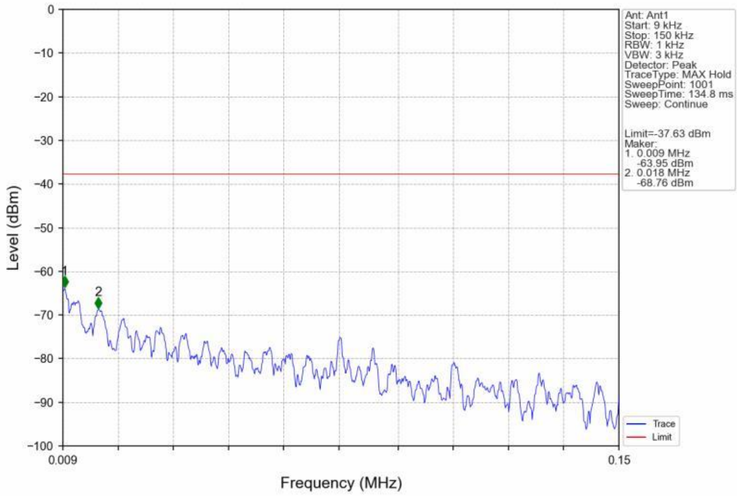

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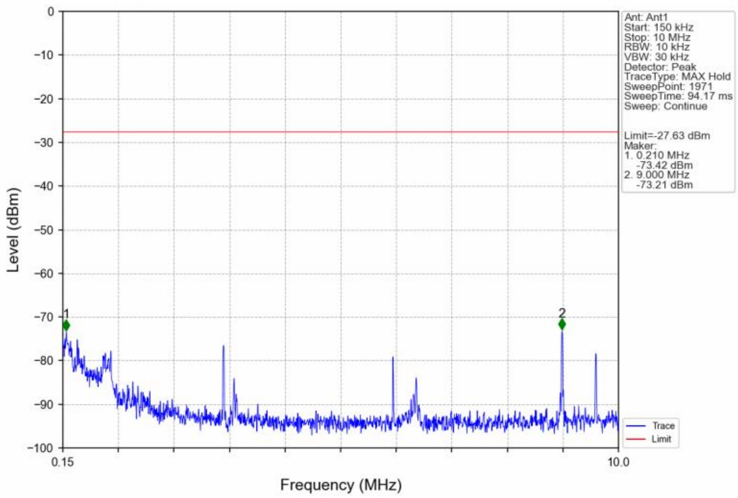

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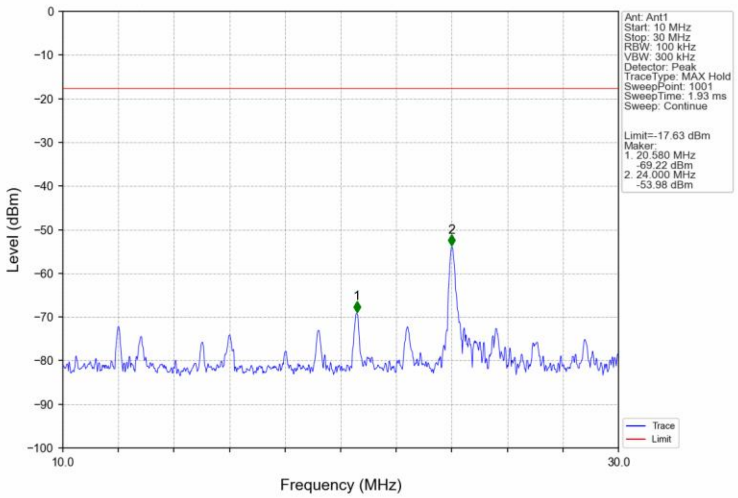

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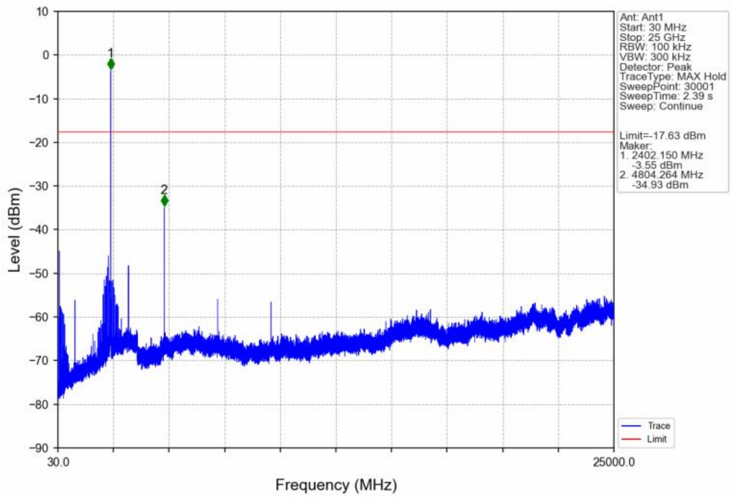
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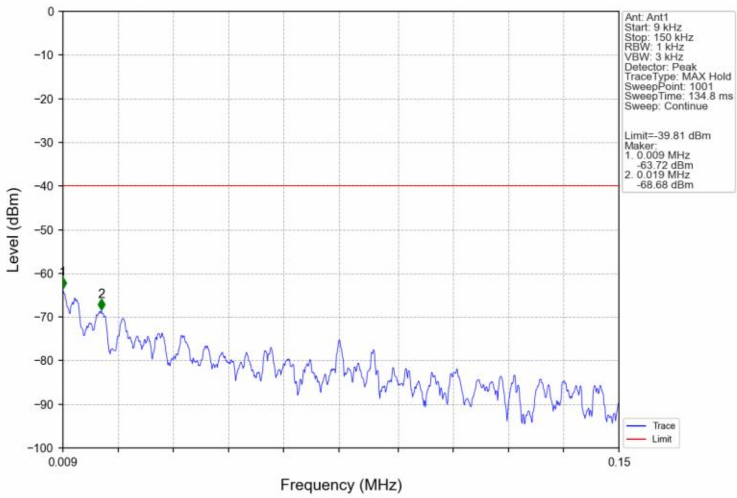

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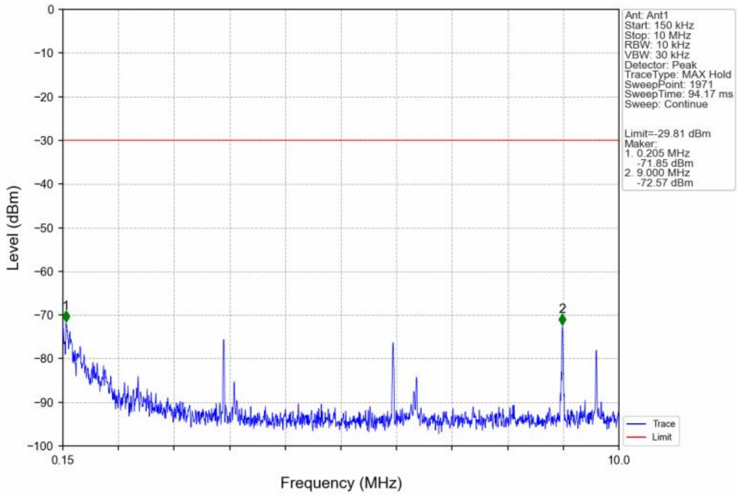

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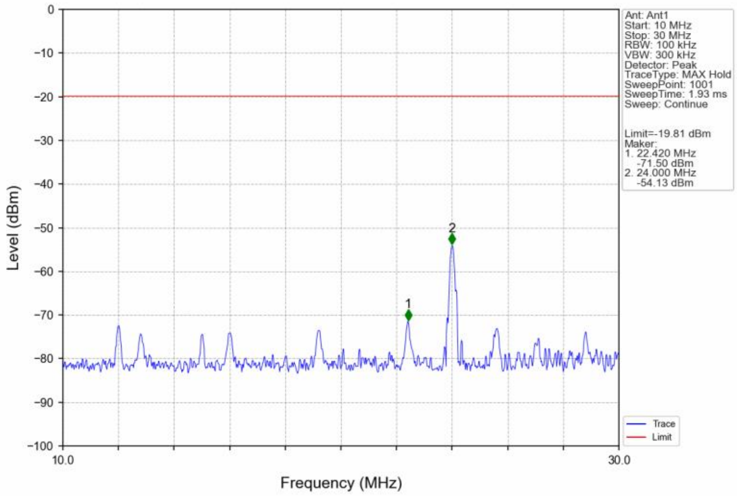

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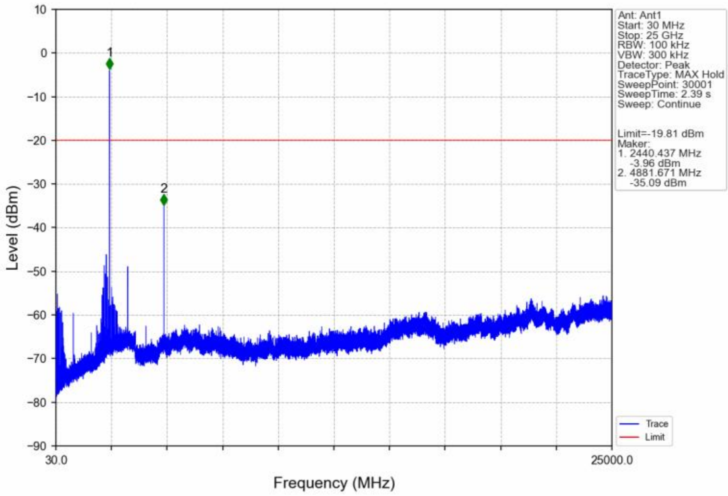

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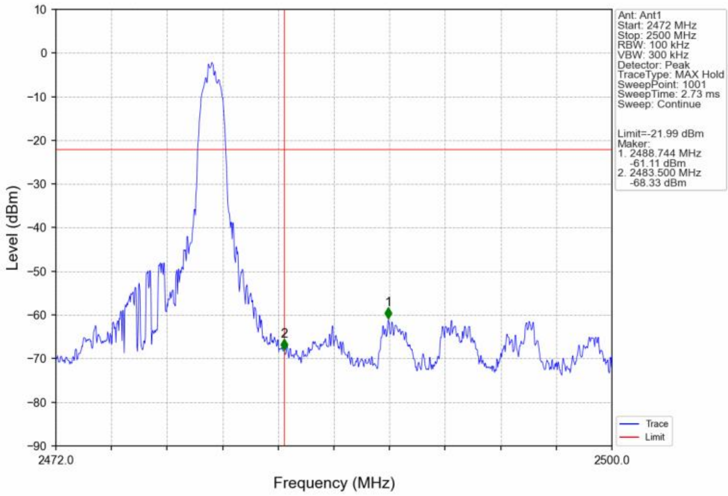

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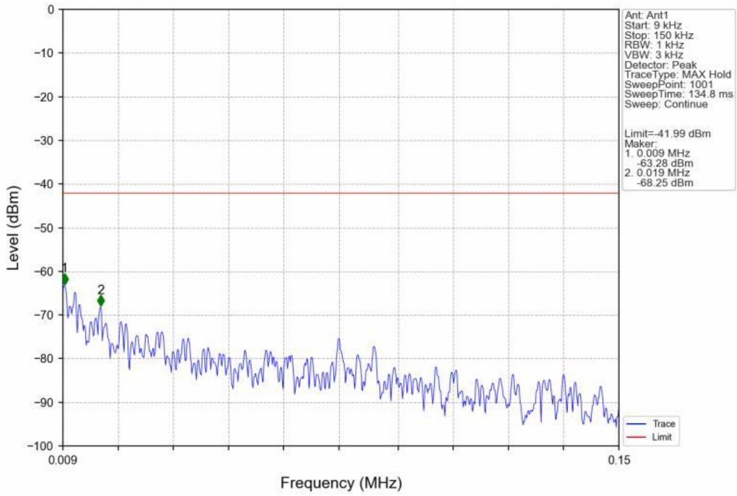

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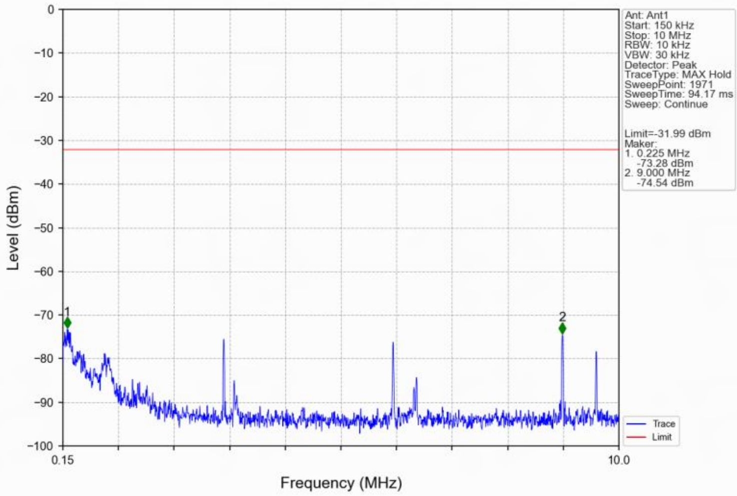

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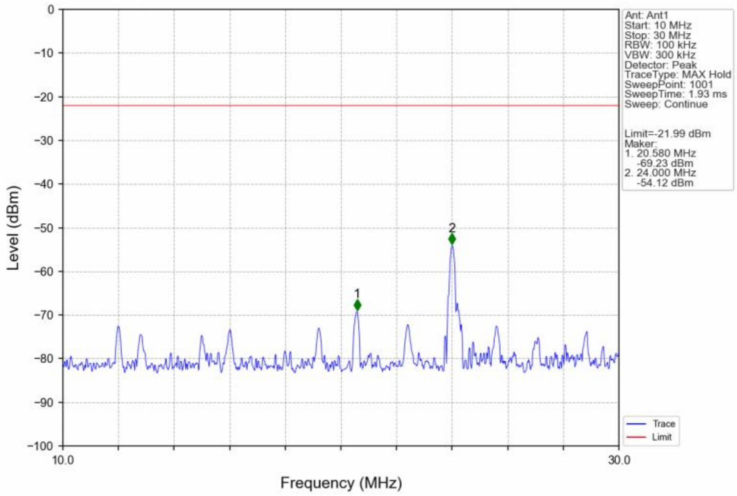
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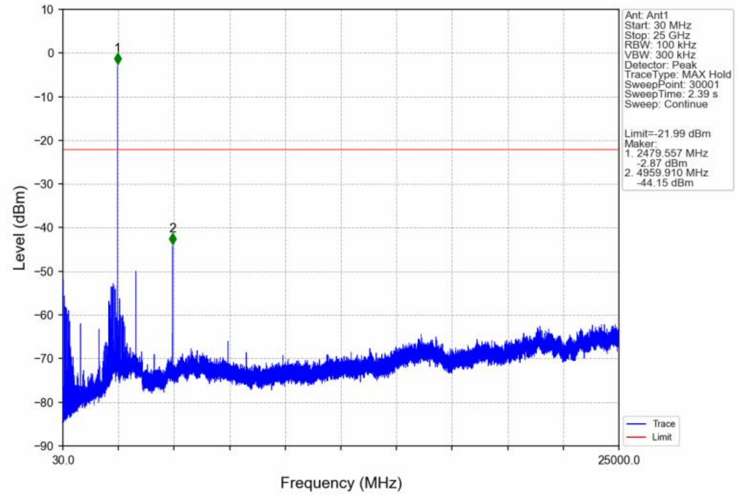

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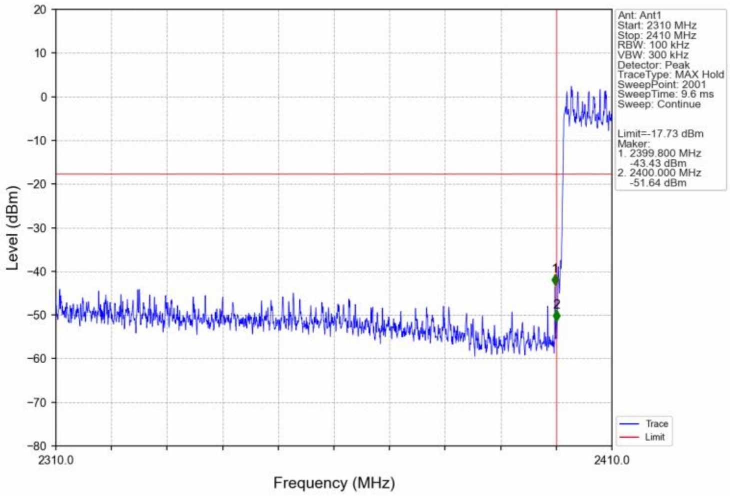

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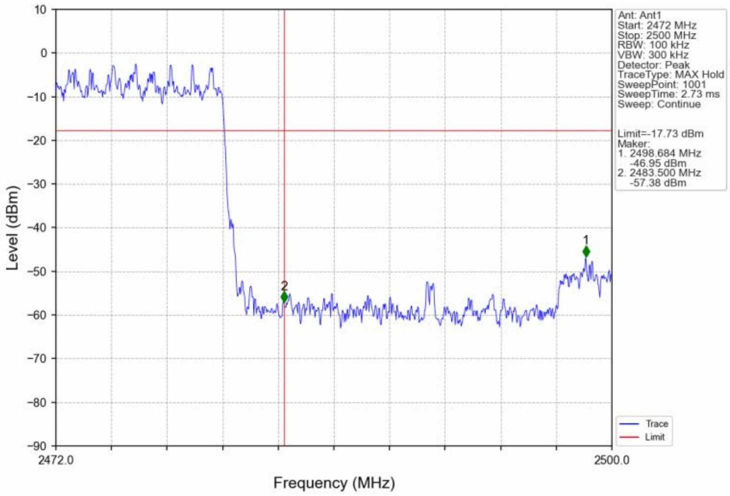

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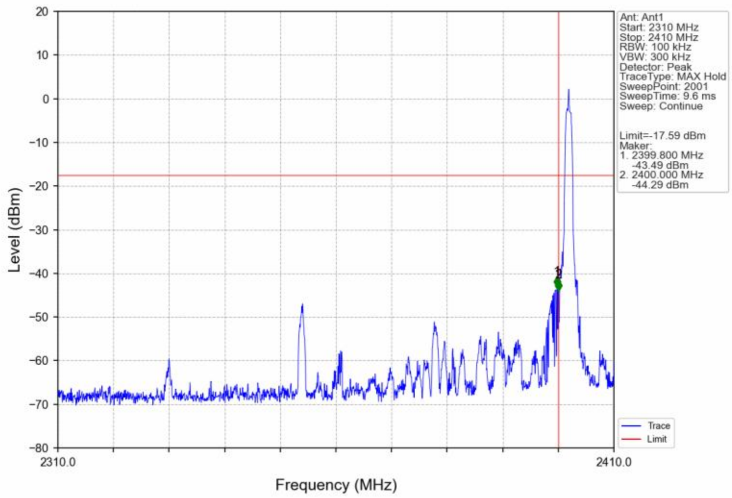
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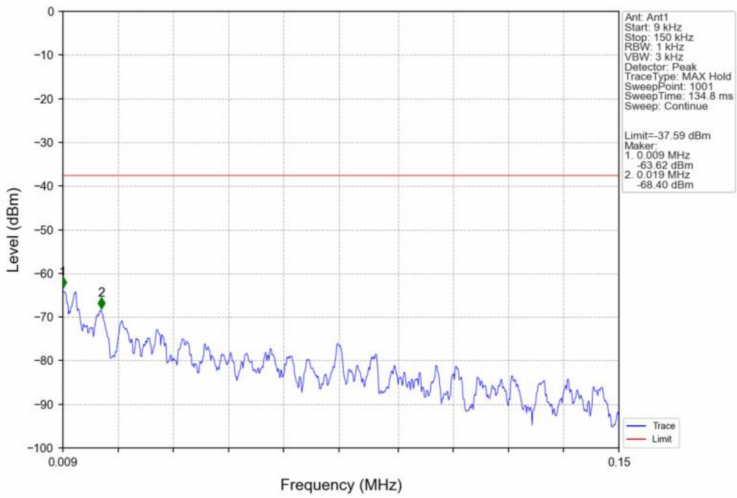

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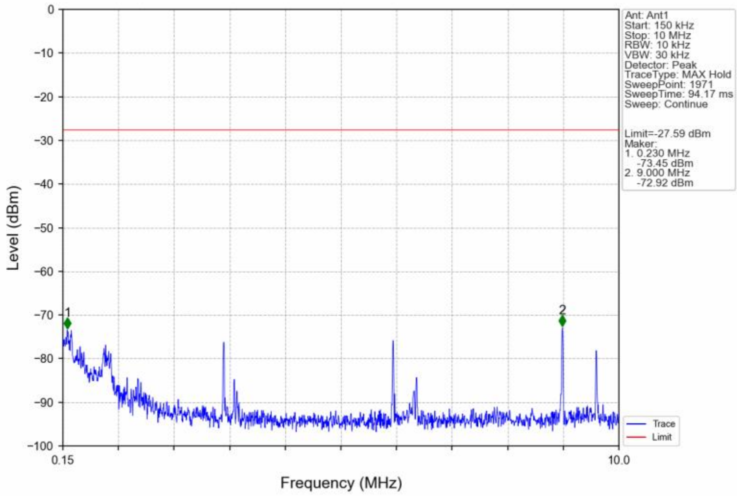

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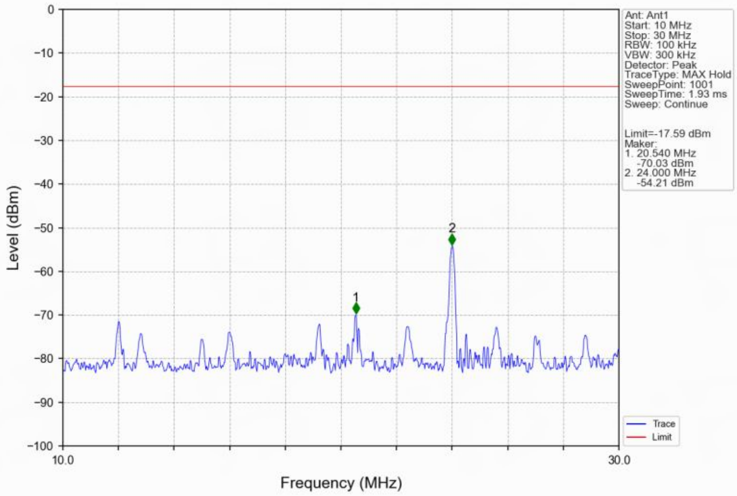

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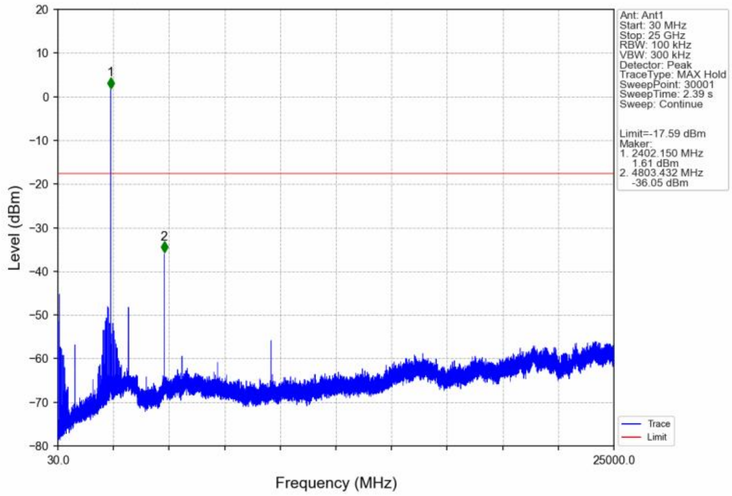
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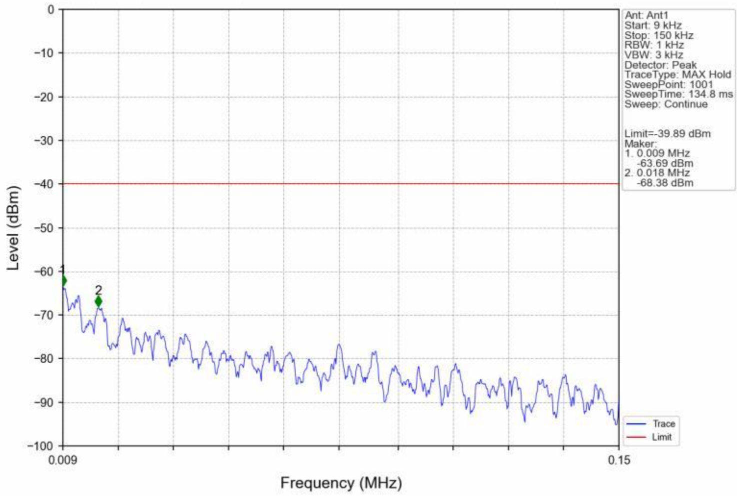

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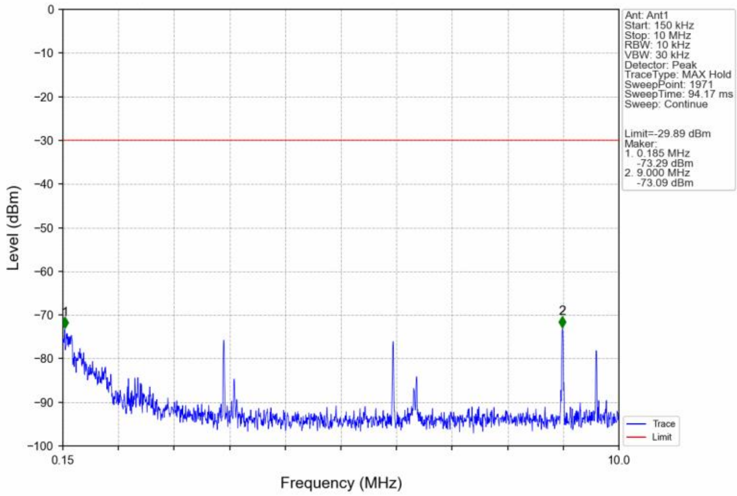

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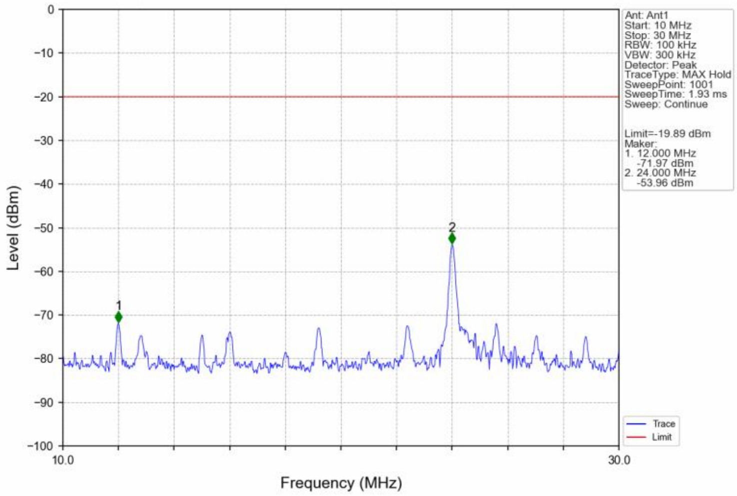

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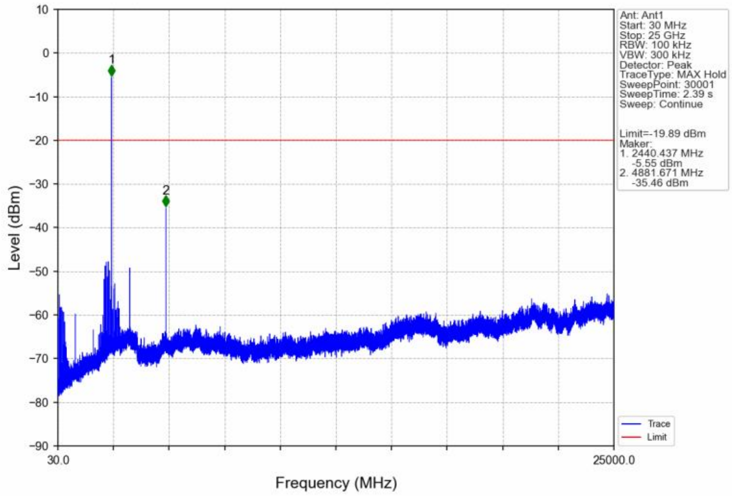
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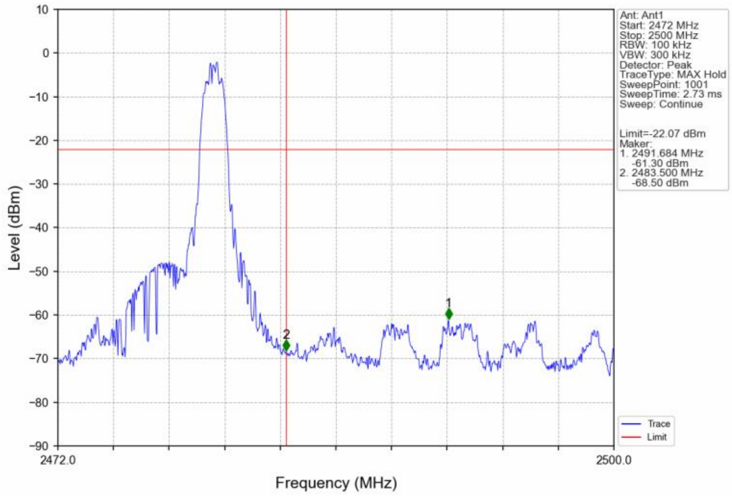

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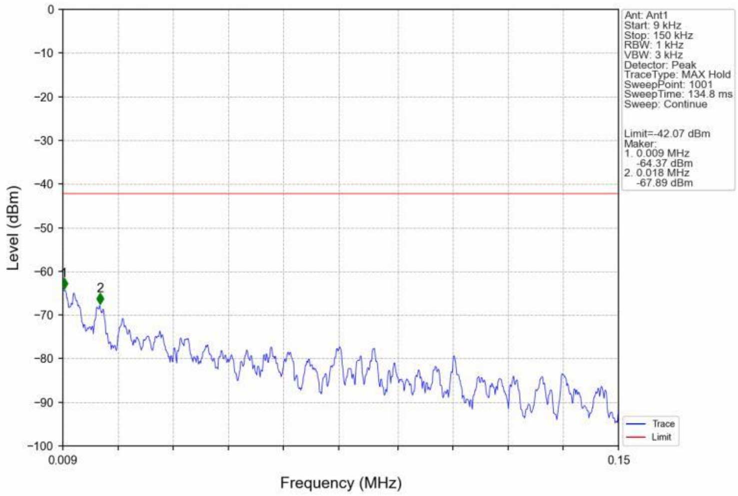
8DPSK_3DH5_HCH_2480MHz_Ant1_NTNV



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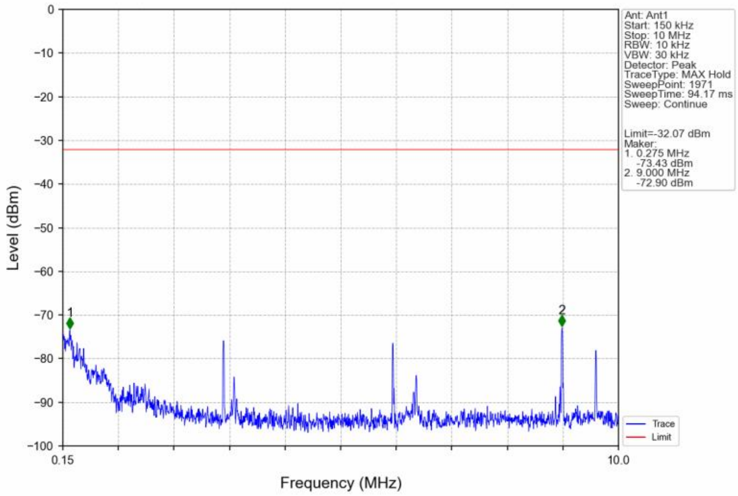

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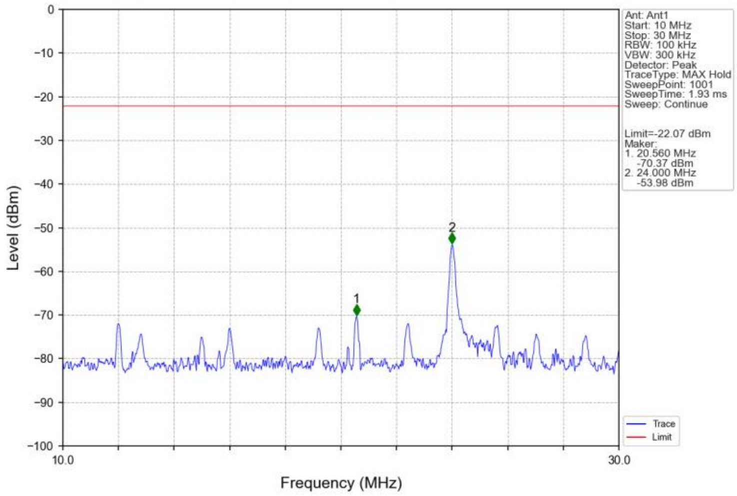

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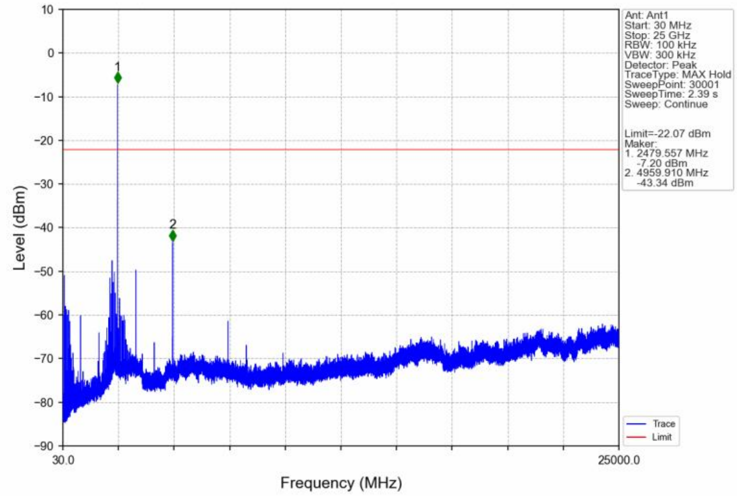

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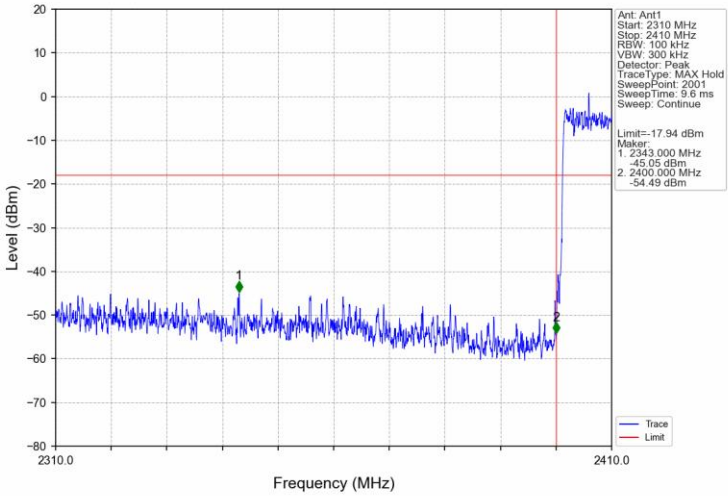

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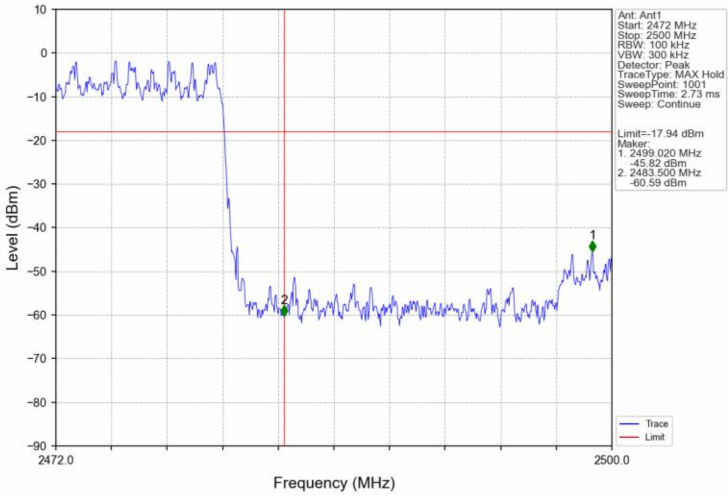

7. Form731

7.1 Test Result

7.1.1 Form731

Lower Freq (MHz)	High Freq (MHz)	MAX Power (W)	MAX Power (dBm)
2402	2480	0.0020	3.10

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-- END OF REPORT --

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