



RF Test Report

For


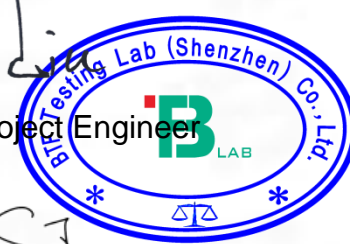
Applicant Name: Shenzhen Yizhita Technology Co., Ltd
Address: 4219, 4th Floor, Phase I, Huiheng Building, No. 138 Gaoxin South 7th Road, Gaoxin Community, Yuehai Street, Nanshan District, Shenzhen China.
EUT Name: Dragonfly R1 light weight wireless mouse
Brand Name: VXE
Model Number: R1 SE
Series Model Number: Refer to section 2

Issued By

Company Name: BTF Testing Lab (Shenzhen) Co., Ltd.
Address: F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China

Report Number: BTF240123R01402
Test Standards: 47 CFR Part 15.247
Test Conclusion: Pass
FCC ID: 2BE9P-R1SE
Test Date: 2024-01-23 to 2024-02-26
Date of Issue: 2024-02-27

Prepared By:


Chris Liu / Project Engineer


Date:

2024-02-27

Approved By:



Ryan.CJ / EMC Manager

Date:

2024-02-27

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Revision History		
Version	Issue Date	Revisions Content
R_V0	2024-02-27	Original
<i>Note: Once the revision has been made, then previous versions reports are invalid.</i>		

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1 Introduction

1.1 Identification of Testing Laboratory

Company Name:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Phone Number:	+86-0755-23146130
Fax Number:	+86-0755-23146130

1.2 Identification of the Responsible Testing Location

Company Name:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Phone Number:	+86-0755-23146130
Fax Number:	+86-0755-23146130
FCC Registration Number:	518915
Designation Number:	CN1330

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.

2 Product Information

2.1 Application Information

Company Name:	Shenzhen Yizhita Technology Co., Ltd
Address:	4219, 4th Floor, Phase I, Huiheng Building, No. 138 Gaoxin South 7th Road, Gaoxin Community, Yuehai Street, Nanshan District, Shenzhen China.

2.2 Manufacturer Information

Company Name:	Dongguan Dianxuntong Electronics Technology Co., Ltd.
Address:	Room 302, Building 1, No. 6 Wende Street, Xiabian, Chang'an Town, Dongguan City, Guangdong Province

2.3 Factory Information

Company Name:	Dongguan Dianxuntong Electronics Technology Co., Ltd.
Address:	Room 302, Building 1, No. 6 Wende Street, Xiabian, Chang'an Town, Dongguan City, Guangdong Province

2.4 General Description of Equipment under Test (EUT)

EUT Name:	Dragonfly R1 light weight wireless mouse
Test Model Number:	R1 SE
Series Model Number:	N/A
Description of Model name differentiation:	N/A
Hardware Version:	DM119_BT V03

2.5 Technical Information

Power Supply:	DC 5V from adaptor or DC 3.7V from battery
Operation Frequency:	2403MHz to 2480MHz
Number of Channels:	16
Modulation Type:	GFSK
Antenna Type:	PCB ANT
Antenna Gain [#] :	-2.39dBi
Note:	#: The antenna gain provided by the applicant, and the laboratory will not be responsible for the accumulated calculation results which covers the information provided by the applicant.
Bluetooth Version:	5.0

All channel was listed on the following table:

Channel number	Freq. (MHz)	Channel number	Freq. (MHz)	Channel number	Freq. (MHz)	Channel number	Freq. (MHz)
0	2403	4	2438	8	2462	12	2470
1	2424	5	2442	9	2464	13	2472
2	2434	6	2454	10	2466	14	2474
3	2436	7	2458	11	2468	15	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

3.2 Uncertainty of Test

Item	Measurement Uncertainty
Conducted Emission (150 kHz-30 MHz)	±2.64dB
Occupied Bandwidth	±69kHz
Transmitter Power, Conducted	±0.87dB
Conducted Spurious Emissions	±0.95dB
Radiated Spurious Emissions (above 1GHz)	1-6GHz: ±3.94dB 6-18GHz: ±4.16dB
Radiated Spurious Emissions (30M - 1GHz)	±4.12dB

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
Occupied Bandwidth	47 CFR Part 15.247	47 CFR 15.215(c)	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), 15.209, 15.205	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

4 Test Configuration

4.1 Test Equipment List

Conducted Emission at AC power line					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Pulse Limiter	SCHWARZBECK	VTSD 9561-F	00953	/	/
Coaxial Switcher	SCHWARZBECK	CX210	CX210	/	/
V-LISN	SCHWARZBECK	NSLK 8127	01073	2023-11-16	2024-11-15
LISN	AFJ	LS16/110VAC	16010020076	2023-11-26	2024-11-15
EMI Receiver	ROHDE&SCHWARZ	ESCI3	101422	2023-11-15	2024-11-14

Occupied Bandwidth Maximum Conducted Output Power Channel Separation Number of Hopping Frequencies Dwell Time Emissions in non-restricted frequency bands					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
RFTest software	/	V1.00	/	/	/
RF Control Unit	Techy	TR1029-1	/	/	/
RF Sensor Unit	Techy	TR1029-2	/	/	/
Programmable constant temperature and humidity box	ZZCKONG	ZZ-K02A	20210928007	2023-11-16	2024-11-15
Adjustable Direct Current Regulated Power Supply	Dongguan Tongmen Electronic Technology Co., LTD	etm-6050c	20211026123	/	/
WIDEBAND RADIO COMMUNICATION TESTER	Rohde & Schwarz	CMW500	161997	2023-11-16	2024-11-15
MXA Signal Analyzer	KEYSIGHT	N9020A	MY50410020	2023-11-16	2024-11-15

Band edge emissions (Radiated) Emissions in frequency bands (below 1GHz) Emissions in frequency bands (above 1GHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Coaxial cable Multiflex 141	Schwarzbeck	N/SMA 0.5m	517386	2023-03-24	2024-03-23
Preamplifier	SCHWARZBECK	BBV9744	00246	/	/
RE Cable	REBES Talent	UF1-SMASMAM-10m	21101566	/	/
RE Cable	REBES Talent	UF2-NMNM-10m	21101570	/	/
RE Cable	REBES Talent	UF1-SMASMAM-1m	21101568	/	/
RE Cable	REBES Talent	UF2-NMNM-1m	21101576	/	/
RE Cable	REBES Talent	UF2-NMNM-2.5m	21101573	/	/
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	/	/
Horn Antenna	SCHWARZBECK	BBHA9170	01157	2023-11-13	2024-11-12
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI7	101032	2023-11-16	2024-11-15
SIGNAL ANALYZER	ROHDE&SCHWARZ	FSQ40	100010	2023-11-16	2024-11-15
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	/	/
Broadband Preamplifier	SCHWARZBECK	BBV9718D	00008	/	/
Horn Antenna	SCHWARZBECK	BBHA9120D	2597	2022-05-22	2024-05-21
EZ EMC	Frad	FA-03A2 RE+	/	/	/
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	/	/
Log periodic antenna	SCHWARZBECK	VULB 9168	01328	2023-11-13	2024-11-12

4.2 Test Auxiliary Equipment

Title	Manufacturer	Model No.	Serial No.
Notebook Computer	ASUS	/	/

4.3 Test Modes

No.	Test Modes	Description
TM1	TX mode	Keep the EUT connect to AC power line and works in continuously transmitting mode with GFSK modulation.

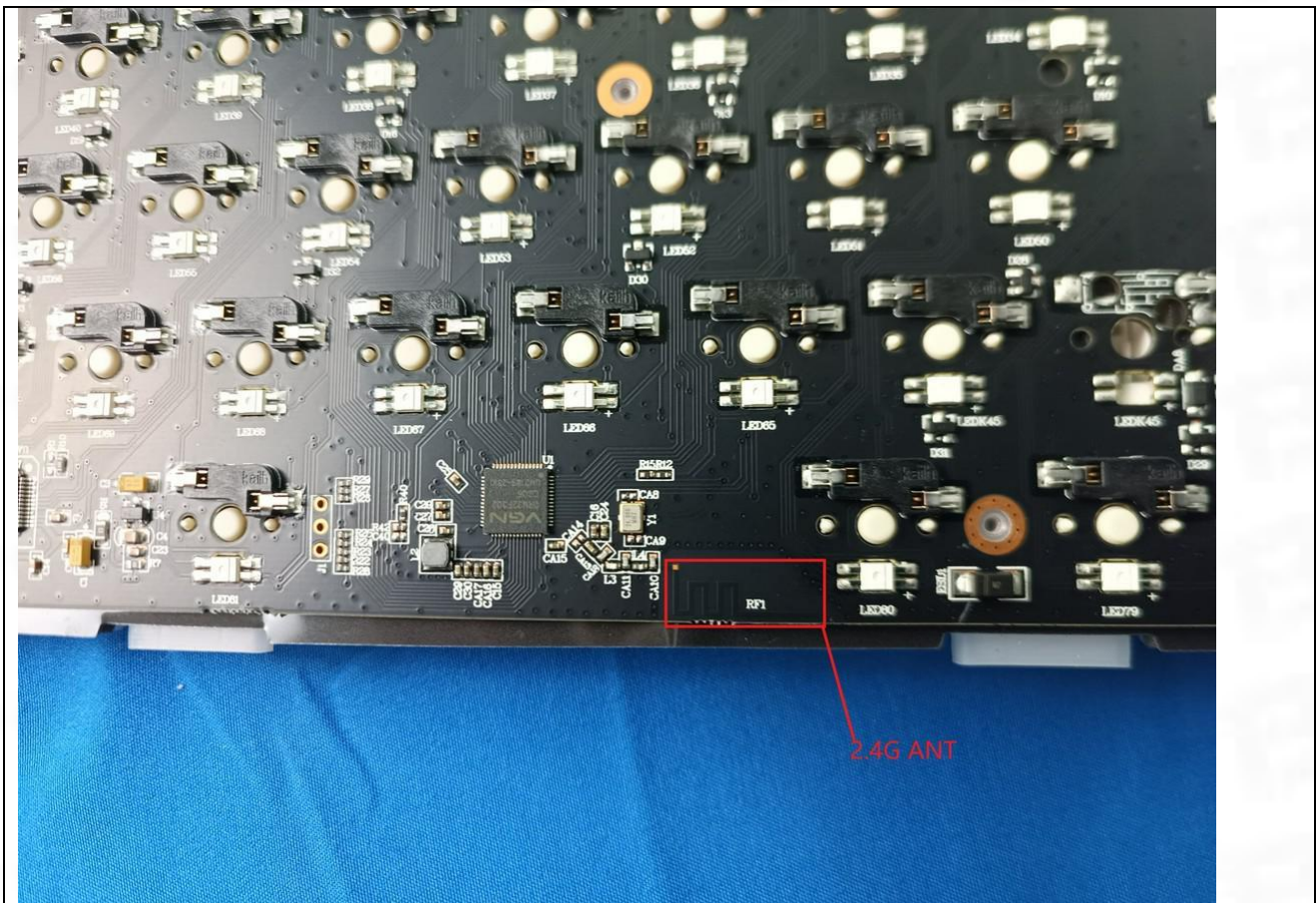
5 Evaluation Results (Evaluation)

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.

5.1.1 Conclusion:



6 Radio Spectrum Matter Test Results (RF)

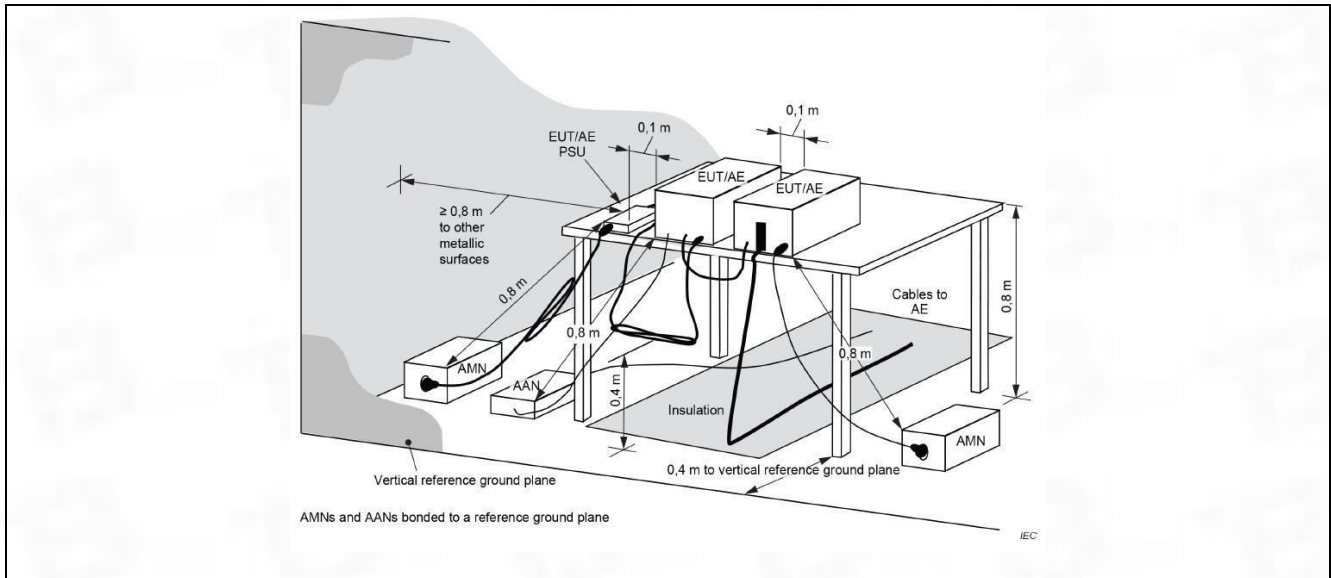
6.1 Conducted Emission at AC power line

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 μ H/50 ohms line impedance stabilization network (LISN).		
Test Method:	ANSI C63.10-2013 section 6.2		
Test Limit:	Frequency of emission (MHz)	Conducted limit (dB μ V)	
		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 C63.10-2013 section 6.2, standard test method for ac power-line conducted emissions from unlicensed wireless devices		

6.1.1 E.U.T. Operation:

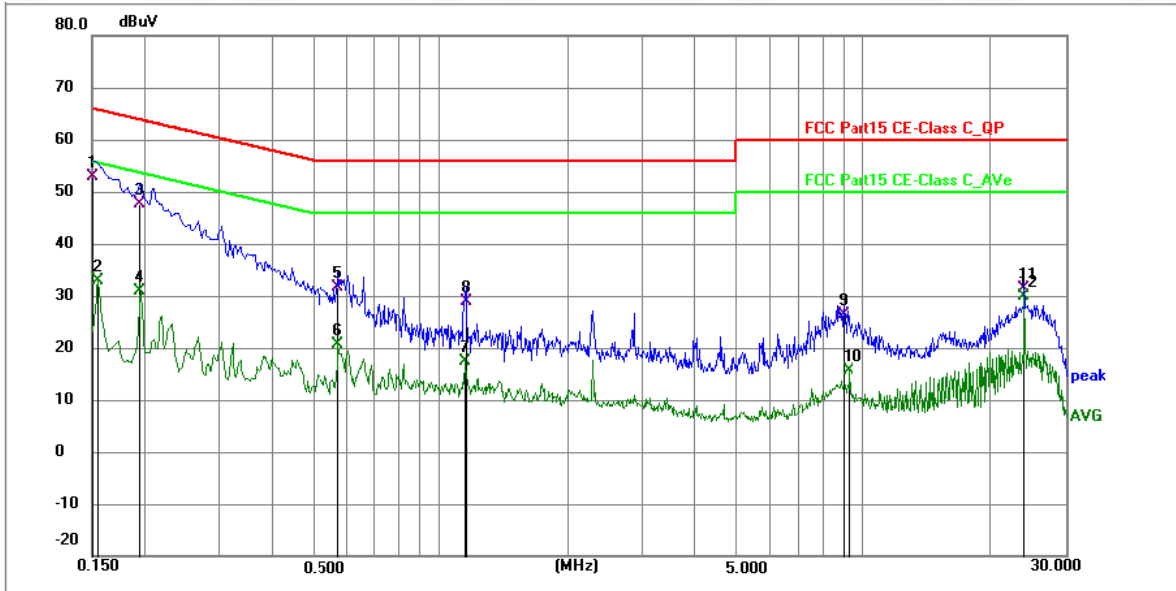
Operating Environment:	
Temperature:	23.6 °C
Humidity:	46.4 %
Atmospheric Pressure:	1010 mbar

6.1.2 Test Setup Diagram:



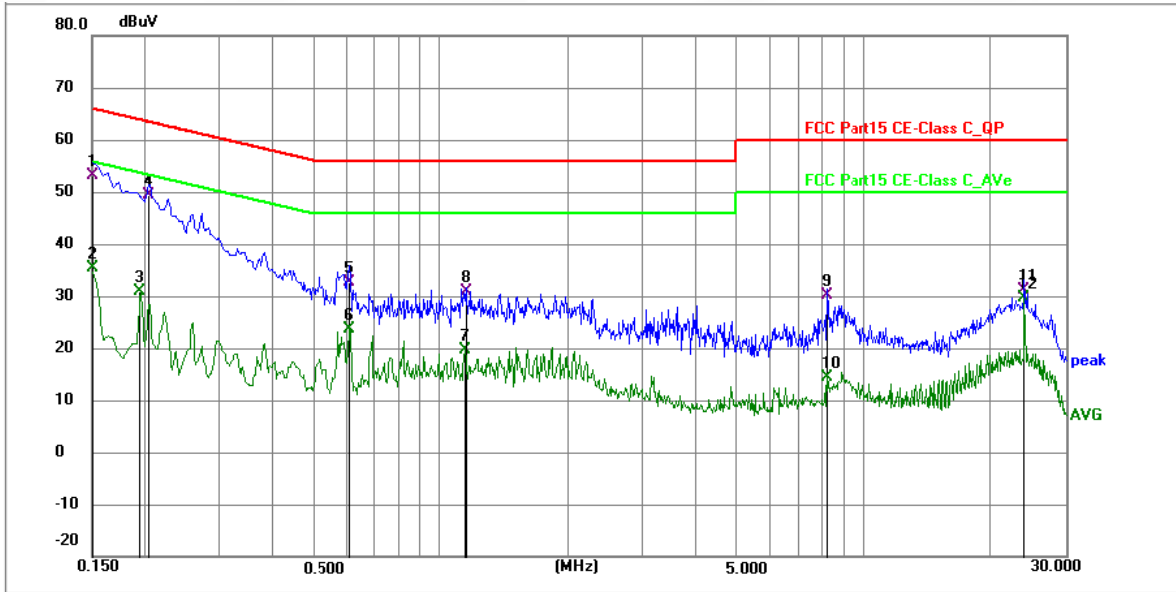
6.1.3 Test Data:

TM1 / Line: Line / Band: 2400-2483.5 MHz / BW: 2 / CH: M



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1 *	0.1500	42.45	10.45	52.90	66.00	-13.10	QP	P	
2	0.1544	22.49	10.46	32.95	55.76	-22.81	AVG	P	
3	0.1949	37.15	10.55	47.70	63.83	-16.13	QP	P	
4	0.1949	20.39	10.55	30.94	53.83	-22.89	AVG	P	
5	0.5730	21.08	10.62	31.70	56.00	-24.30	QP	P	
6	0.5730	10.05	10.62	20.67	46.00	-25.33	AVG	P	
7	1.1445	6.64	10.66	17.30	46.00	-28.70	AVG	P	
8	1.1490	18.24	10.66	28.90	56.00	-27.10	QP	P	
9	8.9520	15.48	10.82	26.30	60.00	-33.70	QP	P	
10	9.2130	4.82	10.83	15.65	50.00	-34.35	AVG	P	
11	24.0135	20.33	11.17	31.50	60.00	-28.50	QP	P	
12	24.0135	18.82	11.17	29.99	50.00	-20.01	AVG	P	

TM1 / Line: Neutral / Band: 2400-2483.5 MHz / BW: 2 / CH: M



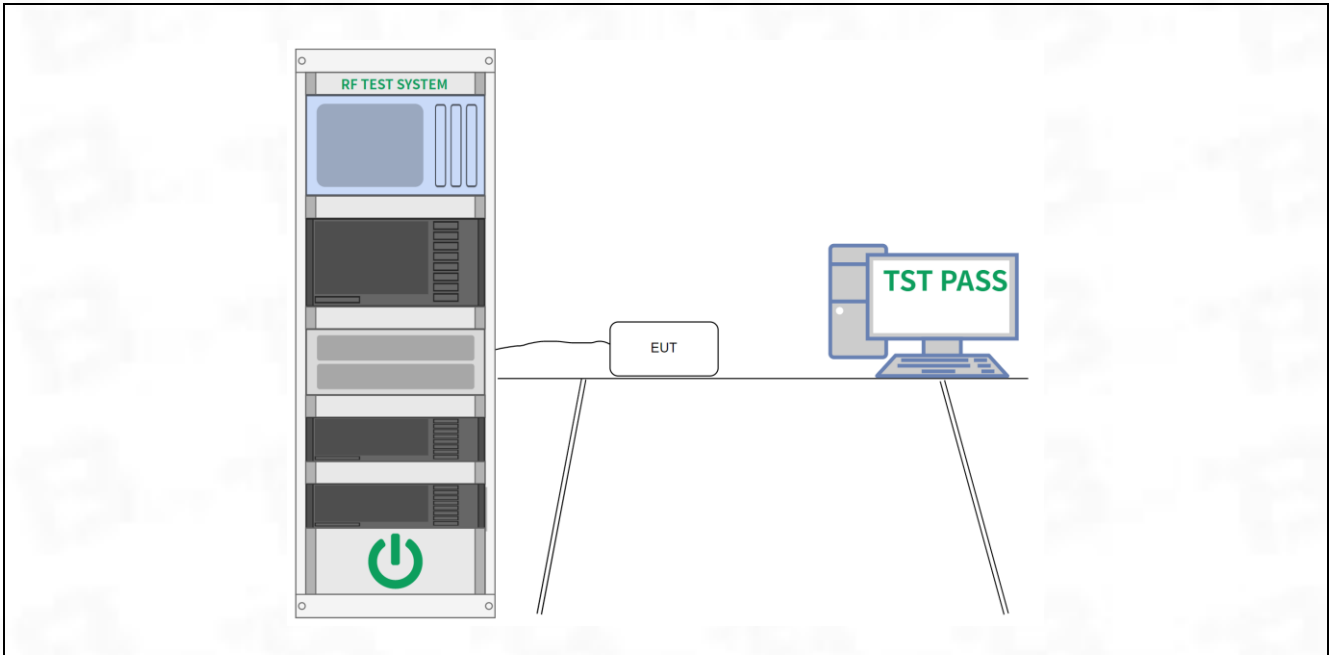
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1 *	0.1500	42.75	10.45	53.20	66.00	-12.80	QP	P	
2	0.1500	24.84	10.45	35.29	56.00	-20.71	AVG	P	
3	0.1949	20.26	10.55	30.81	53.83	-23.02	AVG	P	
4	0.2040	38.94	10.56	49.50	63.45	-13.95	QP	P	
5	0.6090	22.07	10.63	32.70	56.00	-23.30	QP	P	
6	0.6134	13.09	10.64	23.73	46.00	-22.27	AVG	P	
7	1.1445	8.95	10.66	19.61	46.00	-26.39	AVG	P	
8	1.1490	20.24	10.66	30.90	56.00	-25.10	QP	P	
9	8.1823	19.28	10.82	30.10	60.00	-29.90	QP	P	
10	8.1823	3.63	10.82	14.45	50.00	-35.55	AVG	P	
11	24.0135	20.03	11.17	31.20	60.00	-28.80	QP	P	
12	24.0135	18.52	11.17	29.69	50.00	-20.31	AVG	P	

6.2 Occupied Bandwidth

Test Requirement:	47 CFR 15.215(c)
Test Method:	ANSI C63.10-2013, section 7.8.7, For occupied bandwidth measurements, use the procedure in 6.9.2. 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:	<p>a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and five times the OBW.</p> <p>b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW, unless otherwise specified by the applicable requirement.</p> <p>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 4.1.5.2.</p> <p>d) Steps a) through c) might require iteration to adjust within the specified tolerances.</p> <p>e) The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target “-xx dB down” requirement; that is, if the requirement calls for measuring the -20 dB OBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value.</p> <p>f) Set detection mode to peak and trace mode to max hold.</p> <p>g) Determine the reference value: Set the EUT to transmit an unmodulated carrier or modulated signal, as applicable. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).</p> <p>h) Determine the “-xx dB down amplitude” using $[(\text{reference value}) - xx]$. Alternatively, this calculation may be made by using the marker-delta function of the instrument.</p> <p>i) If the reference value is determined by an unmodulated carrier, then turn the EUT modulation ON, and either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise, the trace from step g) shall be used for step j).</p> <p>j) Place 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 “-xx dB down amplitude” determined in step h). If a marker is below this “-xx dB down amplitude” value, then it shall be as close as possible to this value. The occupied bandwidth is the frequency difference between the two markers. Alternatively, set a marker at the lowest frequency of the envelope of the spectral display, such that the marker is at or slightly below the “-xx dB down amplitude” determined in step h). Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth.</p> <p>k) The occupied bandwidth shall be reported by providing 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).</p>

6.2.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.2 °C
Humidity:	48 %
Atmospheric Pressure:	1010 mbar

6.2.2 Test Setup Diagram:**6.2.3 Test Data:**

Please Refer to Appendix for Details.

6.3 Maximum Conducted Output Power

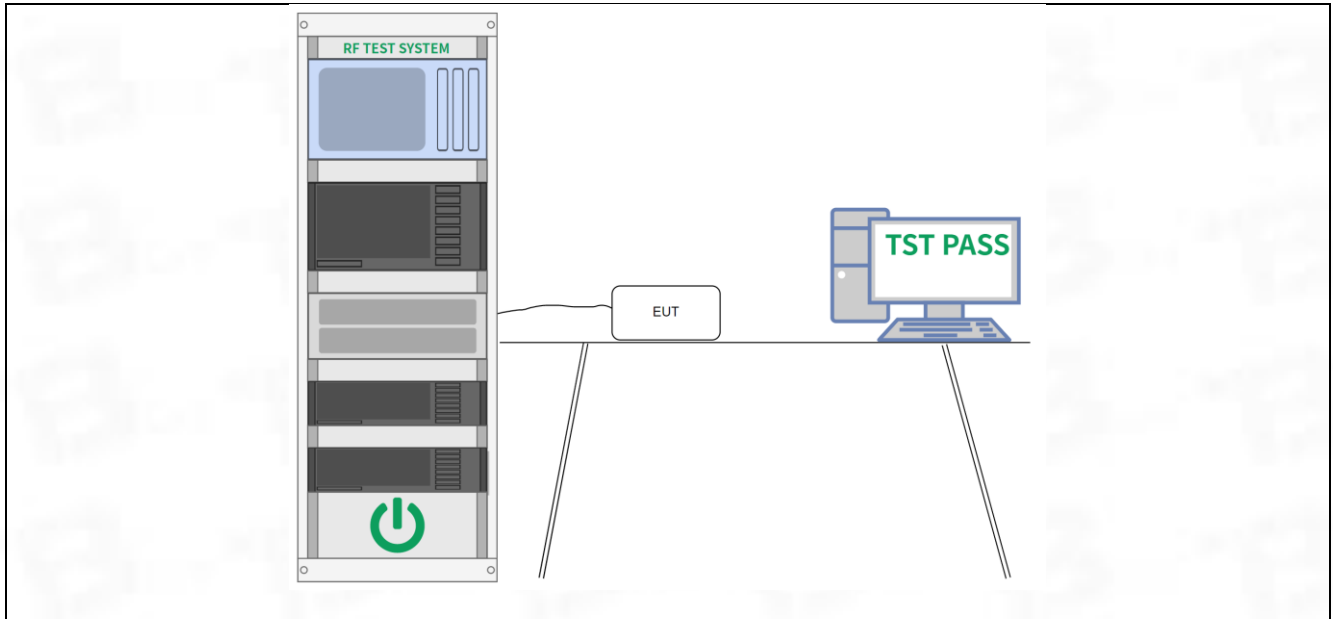
Test Requirement:	47 CFR 15.247(b)(1)
Test Method:	ANSI C63.10-2013, section 7.8.5 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 15.247(b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency 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:	<p>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. The hopping shall be disabled for this test:</p> <ol style="list-style-type: none"> a) Use the following spectrum analyzer settings: <ol style="list-style-type: none"> 1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel. 2) RBW > 20 dB bandwidth of the emission being measured. 3) VBW >= RBW. 4) Sweep: Auto. 5) Detector function: Peak. 6) Trace: Max hold. b) Allow trace to stabilize. c) Use the marker-to-peak function to set the marker to the peak of the emission. d) The indicated level is the peak output power, after any corrections for external attenuators and cables. e) A plot of the test results and setup description shall be included in the test report. <p>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.</p>

6.3.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.2 °C
Humidity:	48 %
Atmospheric Pressure:	1010 mbar

6.3.2 Test Setup Diagram:

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6.3.3 Test Data:

Please Refer to Appendix for Details.

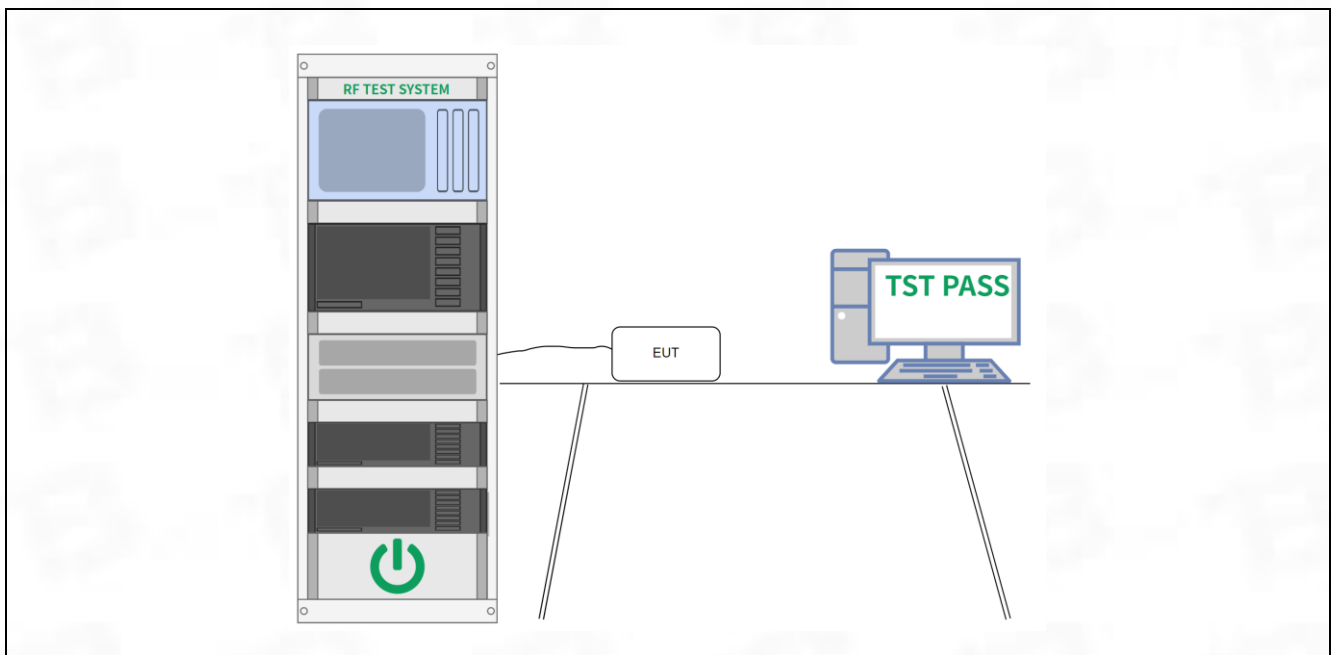
6.4 Channel Separation

Test Requirement:	47 CFR 15.247(a)(1)
Test Method:	ANSI C63.10-2013, 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) \geq RBW. d) Sweep: Auto. 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 plot of the data shall be included in the test report.

6.4.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.2 °C
Humidity:	48 %
Atmospheric Pressure:	1010 mbar

6.4.2 Test Setup Diagram:



6.4.3 Test Data:

Please Refer to Appendix for Details.

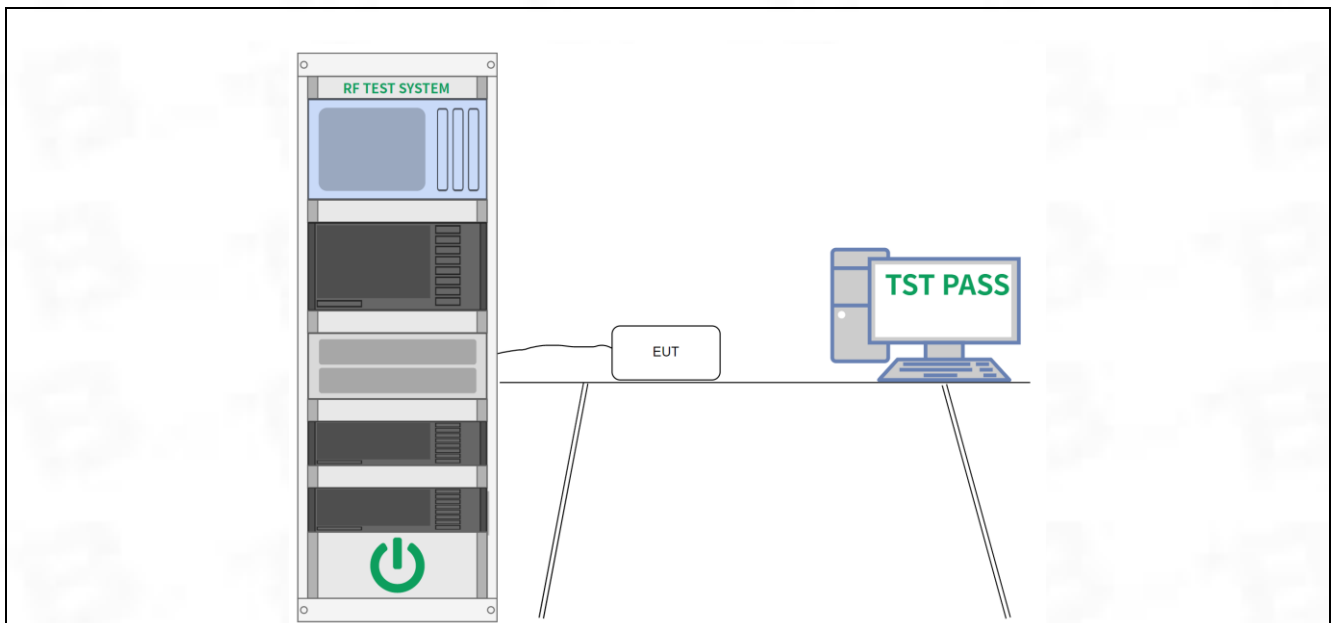
6.5 Number of Hopping Frequencies

Test Requirement:	47 CFR 15.247(a)(1)(iii)
Test Method:	ANSI C63.10-2013, section 7.8.3 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:	<p>The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:</p> <ul style="list-style-type: none"> a) Span: The frequency band of operation. Depending on the number of channels the device supports, it may 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 \geq RBW. d) Sweep: Auto. e) Detector function: Peak. f) Trace: Max hold. g) Allow the trace to stabilize. <p>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 plot of the data shall be included in the test report.</p>

6.5.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.2 °C
Humidity:	48 %
Atmospheric Pressure:	1010 mbar

6.5.2 Test Setup Diagram:



6.5.3 Test Data:

Please Refer to Appendix for Details.

6.6 Dwell Time

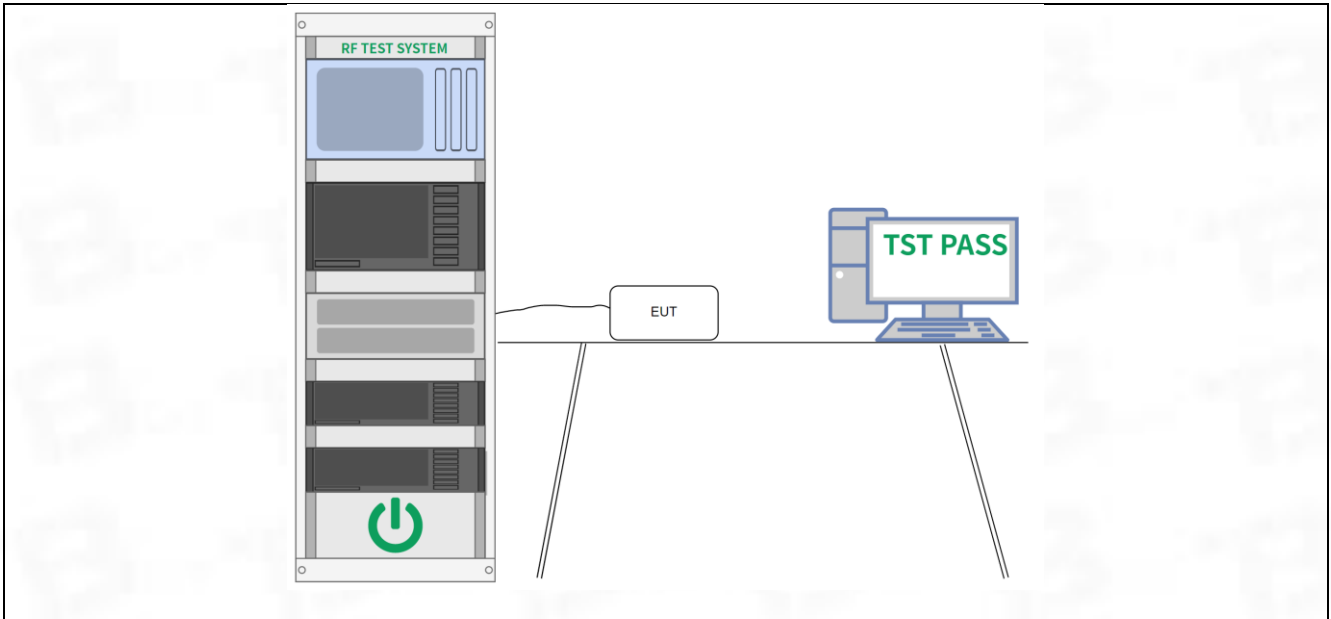
Test Requirement:	47 CFR 15.247(a)(1)(iii)
Test Method:	ANSI C63.10-2013, section 7.8.4 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 15.247(a)(1)(iii), Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any 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:	<p>The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:</p> <ul style="list-style-type: none"> a) Span: Zero span, centered on a hopping channel. b) RBW shall be \leq channel spacing and where possible RBW should be set $\gg 1 / T$, where T is the expected dwell time per channel. c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel. d) Detector function: Peak. e) Trace: Max hold. <p>Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.</p> <p>Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:</p> $(\text{Number of hops in the period specified in the requirements}) = (\text{number of hops on spectrum analyzer}) \times (\text{period specified in the requirements} / \text{analyzer sweep time})$ <p>The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.</p> <p>The measured transmit time and time between hops shall be consistent with the values described in the operational description for the EUT.</p>

6.6.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.2 °C
Humidity:	48 %
Atmospheric Pressure:	1010 mbar

6.6.2 Test Setup Diagram:

--



6.6.3 Test Data:

Please Refer to Appendix for Details.

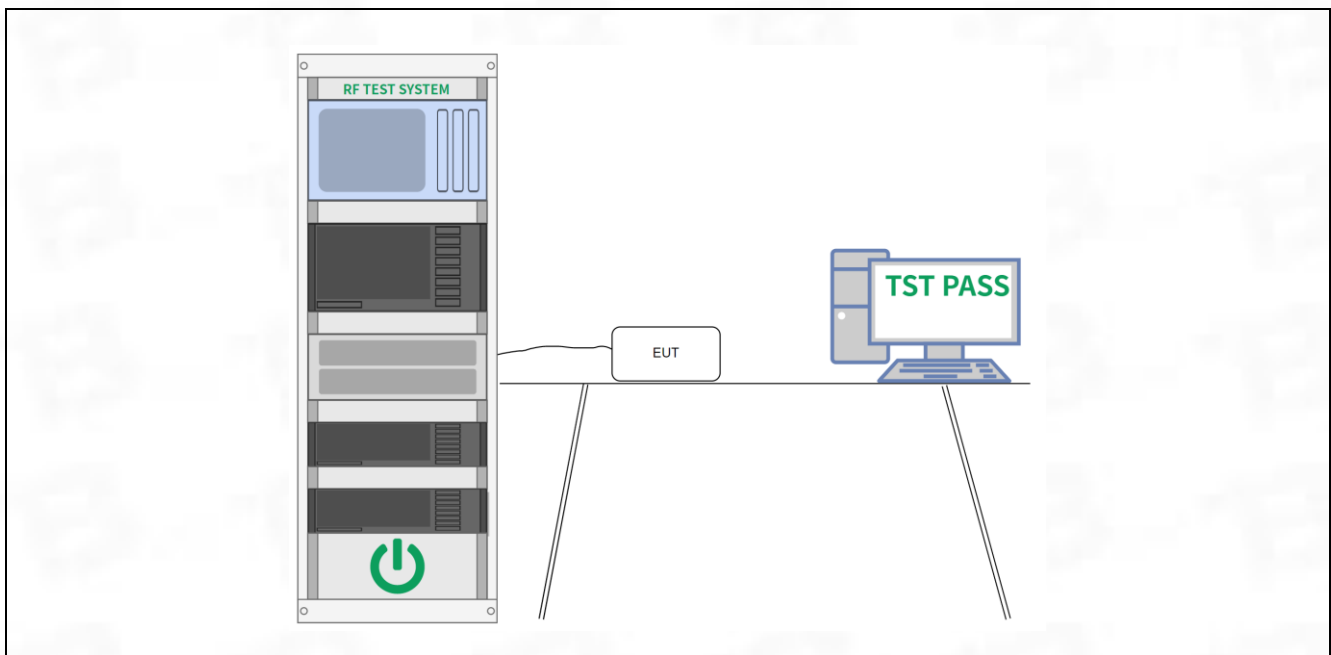
6.7 Emissions in non-restricted frequency bands

Test Requirement:	47 CFR 15.247(d), 15.209, 15.205
Test Method:	ANSI C63.10-2013 section 7.8.8 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:	Conducted spurious emissions shall be measured for the transmit frequency, per 5.5 and 5.6, and at the maximum transmit powers. 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 instrument shall span 30 MHz to 10 times the operating frequency in GHz, with a resolution bandwidth of 100 kHz, video bandwidth of 300 kHz, and a coupled sweep time with a peak detector. The band 30 MHz to the highest frequency may be split into smaller spans, as long as the entire spectrum is covered.

6.7.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.2 °C
Humidity:	48 %
Atmospheric Pressure:	1010 mbar

6.7.2 Test Setup Diagram:



6.7.3 Test Data:

Please Refer to Appendix for Details.

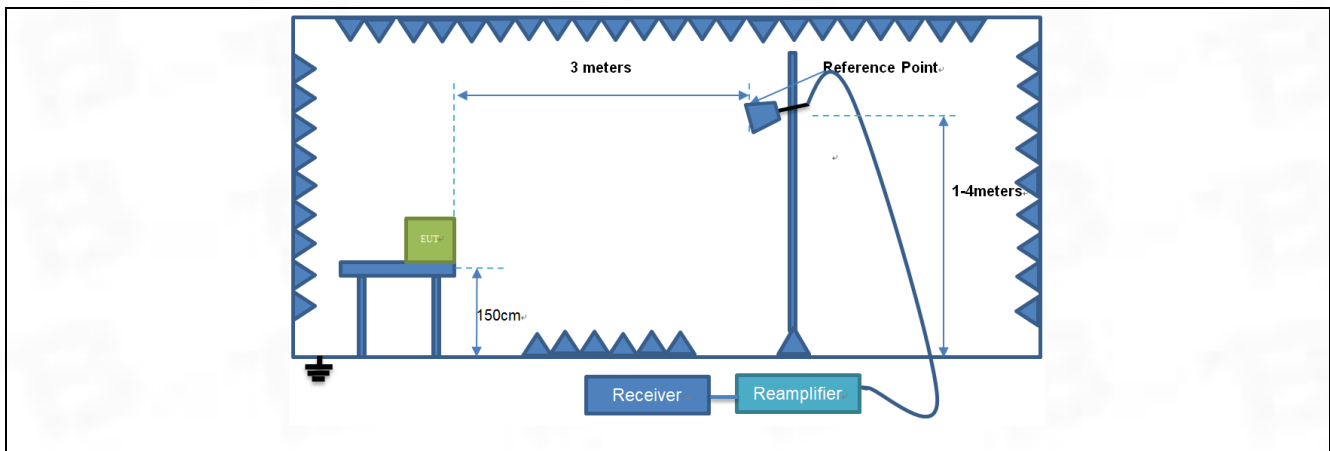
6.8 Band edge emissions (Radiated)

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 C63.10-2013 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
<p>** 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.</p> <p>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.</p>			
Procedure:	ANSI C63.10-2013 section 6.10.5.2		

6.8.1 E.U.T. Operation:

Operating Environment:	
Temperature:	23.6 °C
Humidity:	46.4 %
Atmospheric Pressure:	1010 mbar

6.8.2 Test Setup Diagram:



6.8.3 Test Data:

TM1 / Polarization: Horizontal / Band: 2400-2483.5 MHz / BW: 2 / CH: L

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	2310.000	40.14	-4.39	35.75	74.00	-38.25	peak	P
2	2390.000	41.49	-4.29	37.20	74.00	-36.80	peak	P
3 *	2400.000	52.33	-4.28	48.05	74.00	-25.95	peak	P

TM1 / Polarization: Vertical / Band: 2400-2483.5 MHz / BW: 2 / CH: L

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	2310.000	39.25	-5.79	33.46	74.00	-40.54	peak	P
2	2390.000	40.83	-5.69	35.14	74.00	-38.86	peak	P
3 *	2400.000	53.76	-5.68	48.08	74.00	-25.92	peak	P

TM1 / Polarization: Horizontal / Band: 2400-2483.5 MHz / BW: 2 / CH: H

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 *	2483.500	45.18	-4.19	40.99	74.00	-33.01	peak	P
2	2500.000	41.43	-4.17	37.26	74.00	-36.74	peak	P

TM1 / Polarization: Vertical / Band: 2400-2483.5 MHz / BW: 2 / CH: H

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 *	2483.500	50.88	-5.59	45.29	74.00	-28.71	peak	P
2	2500.000	40.49	-5.57	34.92	74.00	-39.08	peak	P

6.9 Emissions in frequency bands (below 1GHz)

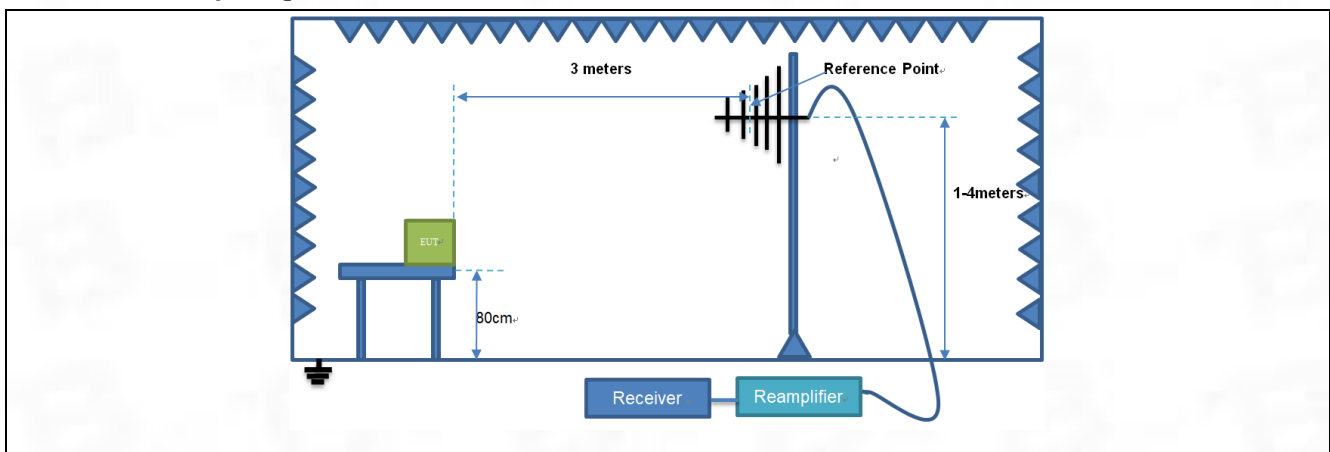
Test Requirement:	Refer to 47 CFR 15.247(d), In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).`		
Test Method:	ANSI C63.10-2013 section 6.6.4 KDB 558074 D01 15.247 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
Procedure:	ANSI C63.10-2013 section 6.6.4		

** 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.

6.9.1 E.U.T. Operation:

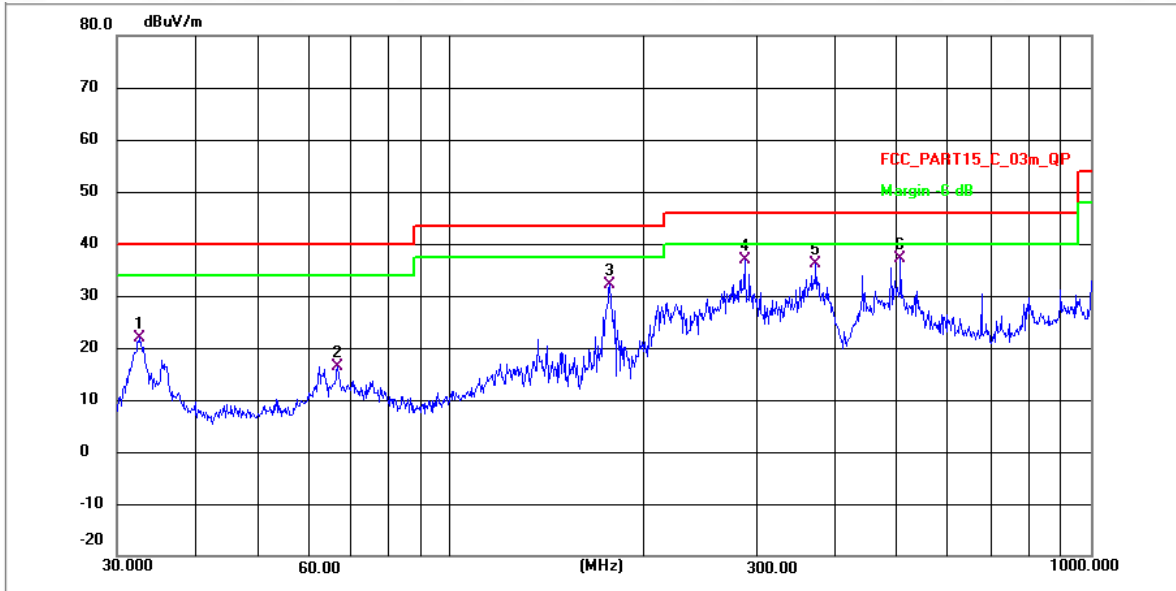
Operating Environment:	
Temperature:	23.6 °C
Humidity:	46.4 %
Atmospheric Pressure:	1010 mbar

6.9.2 Test Setup Diagram:



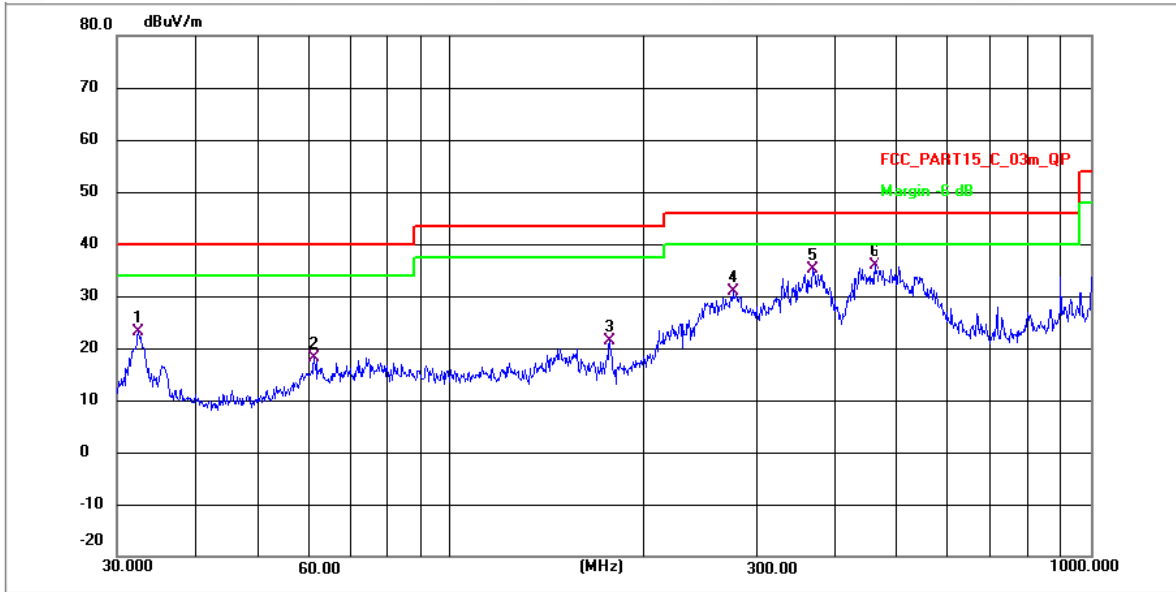
6.9.3 Test Data:

TM1 / Polarization: Horizontal / Band: 2400-2483.5 MHz / BW: 2 / CH: M



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	32.5768	40.27	-18.50	21.77	40.00	-18.23	QP	P
2	66.2662	34.46	-18.13	16.33	40.00	-23.67	QP	P
3	177.1982	59.66	-27.54	32.12	43.50	-11.38	QP	P
4	287.9904	62.37	-25.53	36.84	46.00	-9.16	QP	P
5	371.3528	60.93	-24.86	36.07	46.00	-9.93	QP	P
6 *	504.7062	58.42	-21.19	37.23	46.00	-8.77	QP	P

TM1 / Polarization: Vertical / Band: 2400-2483.5 MHz / BW: 2 / CH: M



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	32.4628	43.73	-20.69	23.04	40.00	-16.96	QP	P
2	61.0245	38.30	-20.14	18.16	40.00	-21.84	QP	P
3	177.5092	35.55	-14.14	21.41	43.50	-22.09	QP	P
4	275.6399	44.34	-13.45	30.89	46.00	-15.11	QP	P
5	368.1116	46.57	-11.41	35.16	46.00	-10.84	QP	P
6 *	460.7271	47.81	-11.93	35.88	46.00	-10.12	QP	P

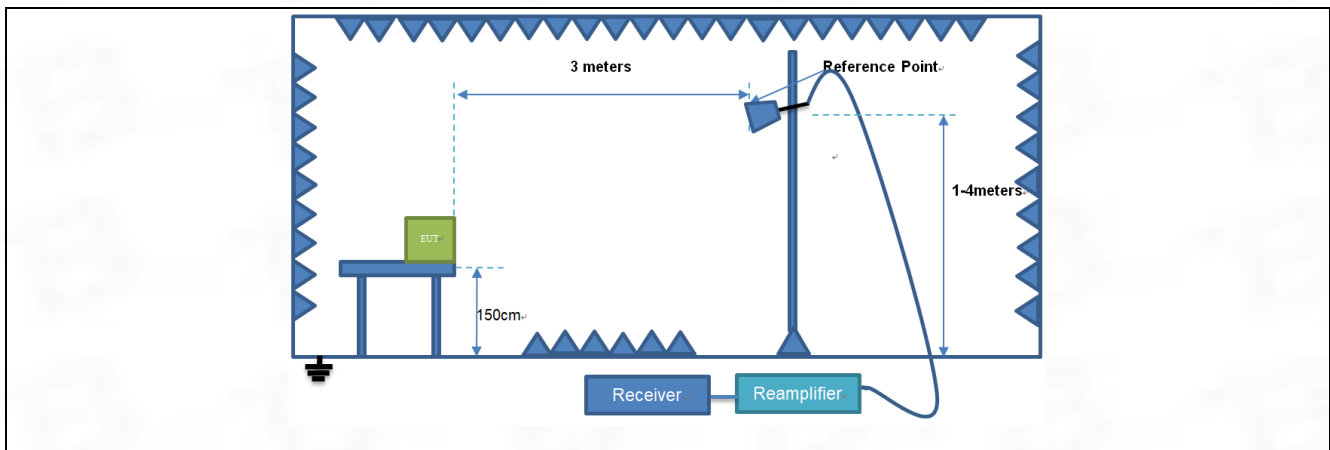
6.10 Emissions in frequency bands (above 1GHz)

Test Requirement:	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 C63.10-2013 section 6.6.4 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
<p>** 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.</p> <p>In the emission table above, the tighter limit applies at the band edges.</p> <p>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.</p>			
Procedure:	ANSI C63.10-2013 section 6.6.4		

6.10.1 E.U.T. Operation:

Operating Environment:	
Temperature:	23.6 °C
Humidity:	46.4 %
Atmospheric Pressure:	1010 mbar

6.10.2 Test Setup Diagram:



6.10.3 Test Data:

TM1 / Polarization: Horizontal / Band: 2400-2483.5 MHz / BW: 2 / CH: L

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	4804.000	68.77	-27.70	41.07	74.00	-32.93	peak	P
2	7206.000	64.00	-24.83	39.17	74.00	-34.83	peak	P
3	9608.000	67.00	-23.78	43.22	74.00	-30.78	peak	P

TM1 / Polarization: Vertical / Band: 2400-2483.5 MHz / BW: 2 / CH: L

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	4804.000	67.64	-27.70	39.94	74.00	-34.06	peak	P
2	7206.000	68.38	-24.83	43.55	74.00	-30.45	peak	P
3	9608.000	66.23	-23.78	42.45	74.00	-31.55	peak	P

TM1 / Polarization: Horizontal / Band: 2400-2483.5 MHz / BW: 2 / CH: M

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	4882.000	67.91	-27.61	40.30	74.00	-33.70	peak	P
2	7323.000	63.14	-24.74	38.40	74.00	-35.60	peak	P
3	9764.000	66.14	-23.69	42.45	74.00	-31.55	peak	P

TM1 / Polarization: Vertical / Band: 2400-2483.5 MHz / BW: 2 / CH: M

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	4882.000	66.43	-27.61	38.82	74.00	-35.18	peak	P
2	7323.000	67.17	-24.74	42.43	74.00	-31.57	peak	P
3	9764.000	65.02	-23.69	41.33	74.00	-32.67	peak	P

TM1 / Polarization: Horizontal / Band: 2400-2483.5 MHz / BW: 2 / CH: H

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	4960.000	69.45	-27.37	42.08	74.00	-31.92	peak	P
2	7440.000	64.68	-24.68	40.00	74.00	-34.00	peak	P
3	9920.000	67.68	-23.99	43.69	74.00	-30.31	peak	P

TM1 / Polarization: Vertical / Band: 2400-2483.5 MHz / BW: 2 / CH: H

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	4960.000	68.32	-27.37	40.95	74.00	-33.05	peak	P
2	7440.000	69.06	-24.68	44.38	74.00	-29.62	peak	P
3	9920.000	66.91	-23.99	42.92	74.00	-31.08	peak	P

7 Test Setup Photos

Conducted Emission at AC power line



Band edge emissions (Radiated)
Emissions in frequency bands (above 1GHz)



Emissions in frequency bands (below 1GHz)



8 EUT Constructional Details (EUT Photos)

Please refer to the test report No. BTF240123R01401

Appendix

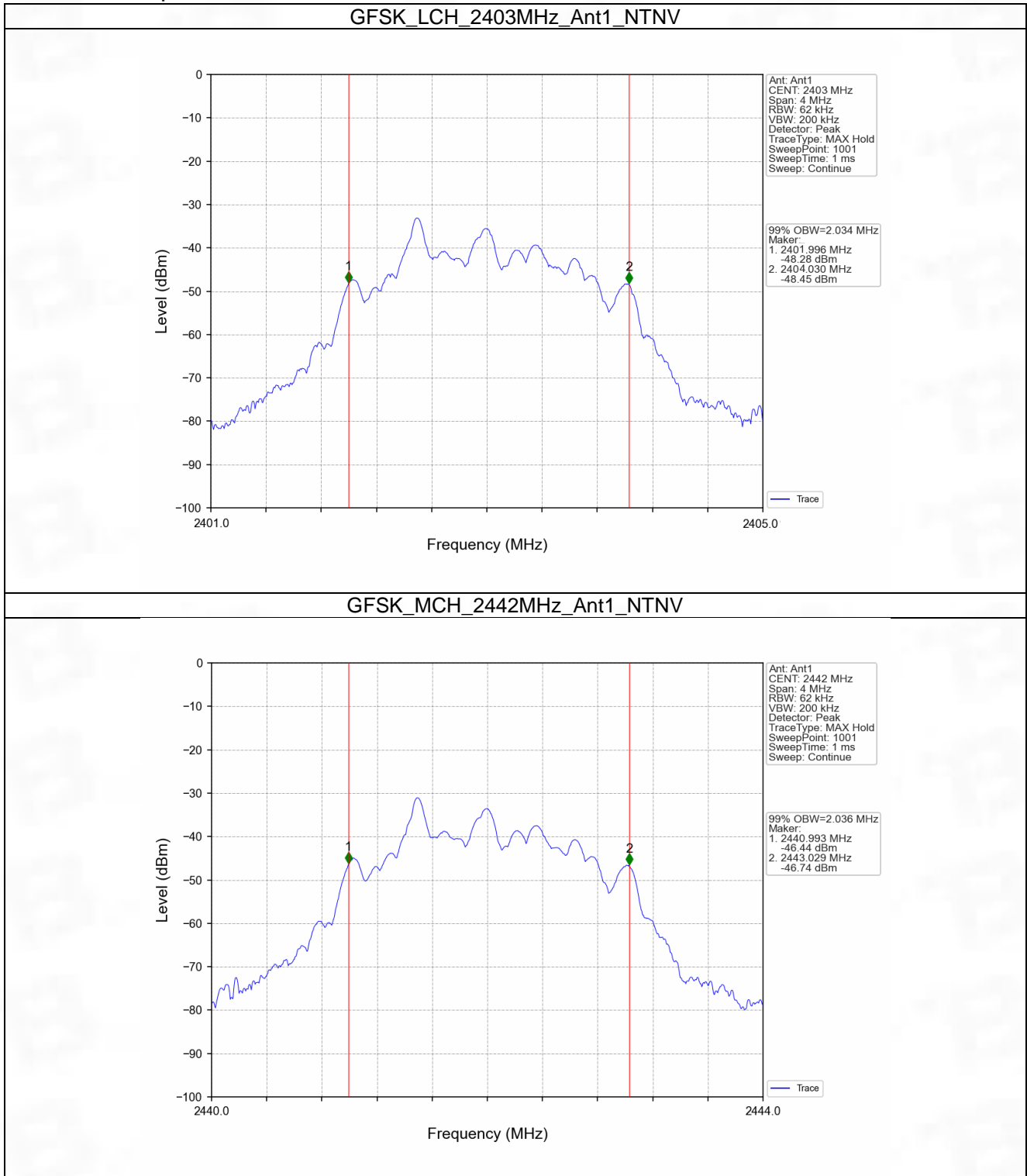
1. Bandwidth

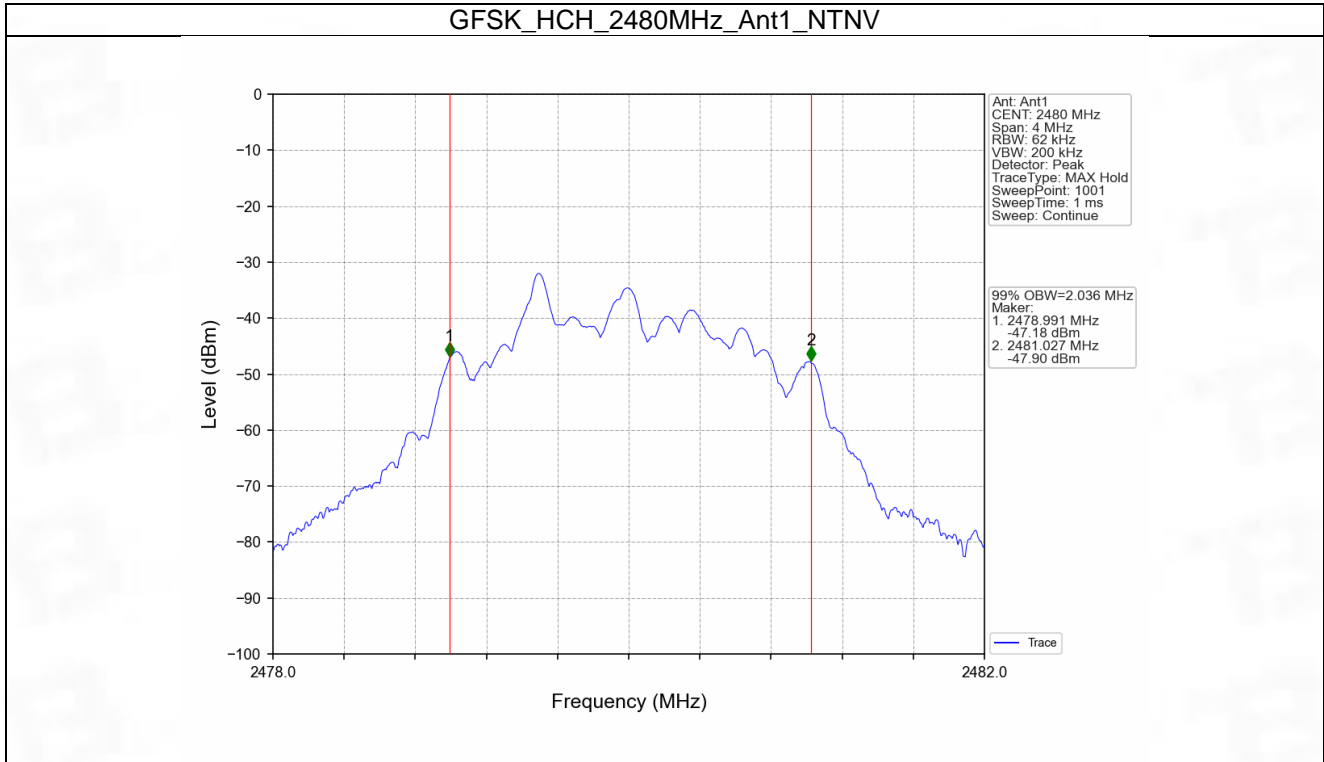
1.1 OBW

1.1.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	99% Occupied Bandwidth (MHz)		Verdict
				Result	Limit	
GFSK	SISO	2403	1	2.034	/	Pass
		2442	1	2.036	/	Pass
		2480	1	2.036	/	Pass

1.1.2 Test Graph



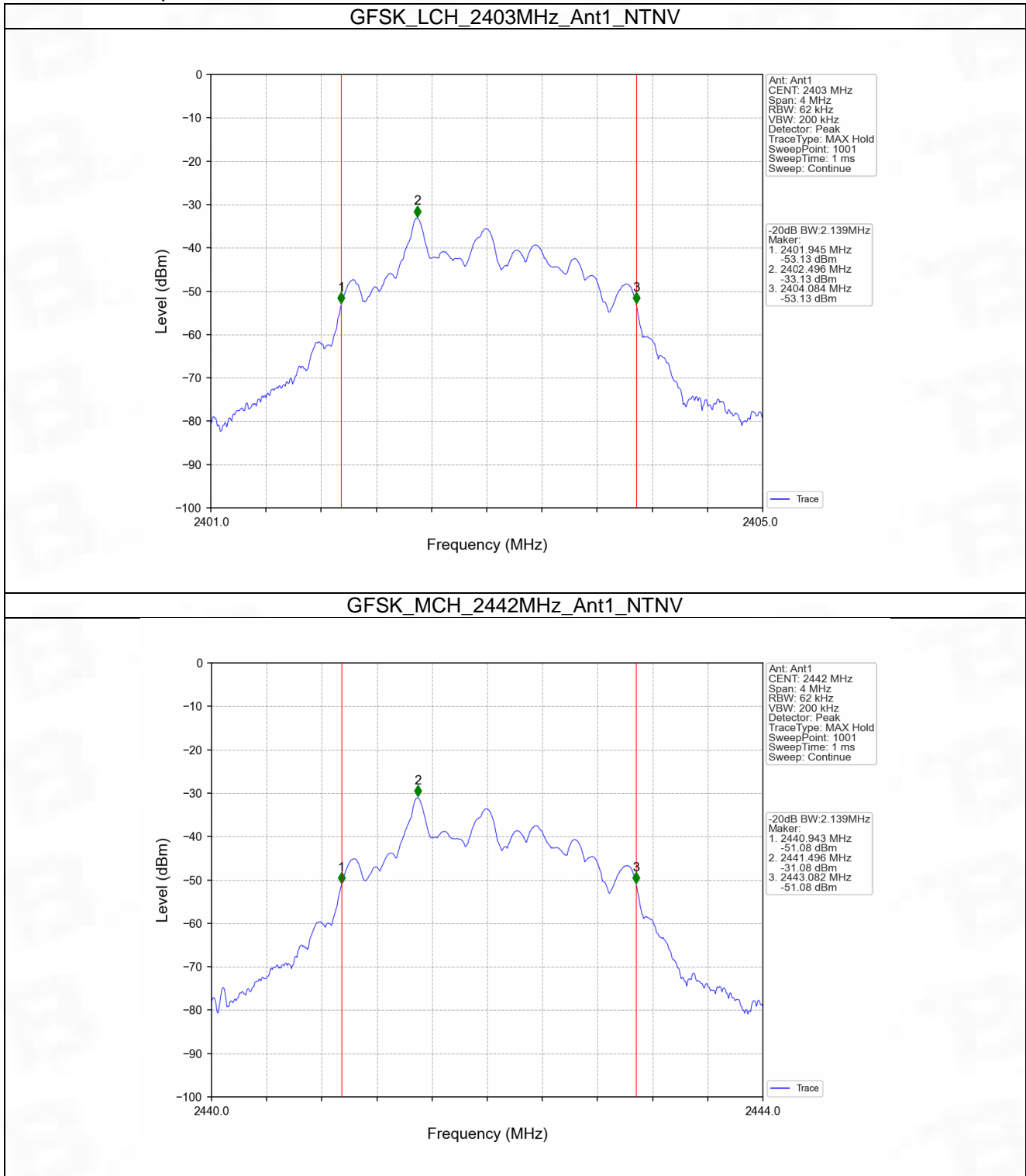


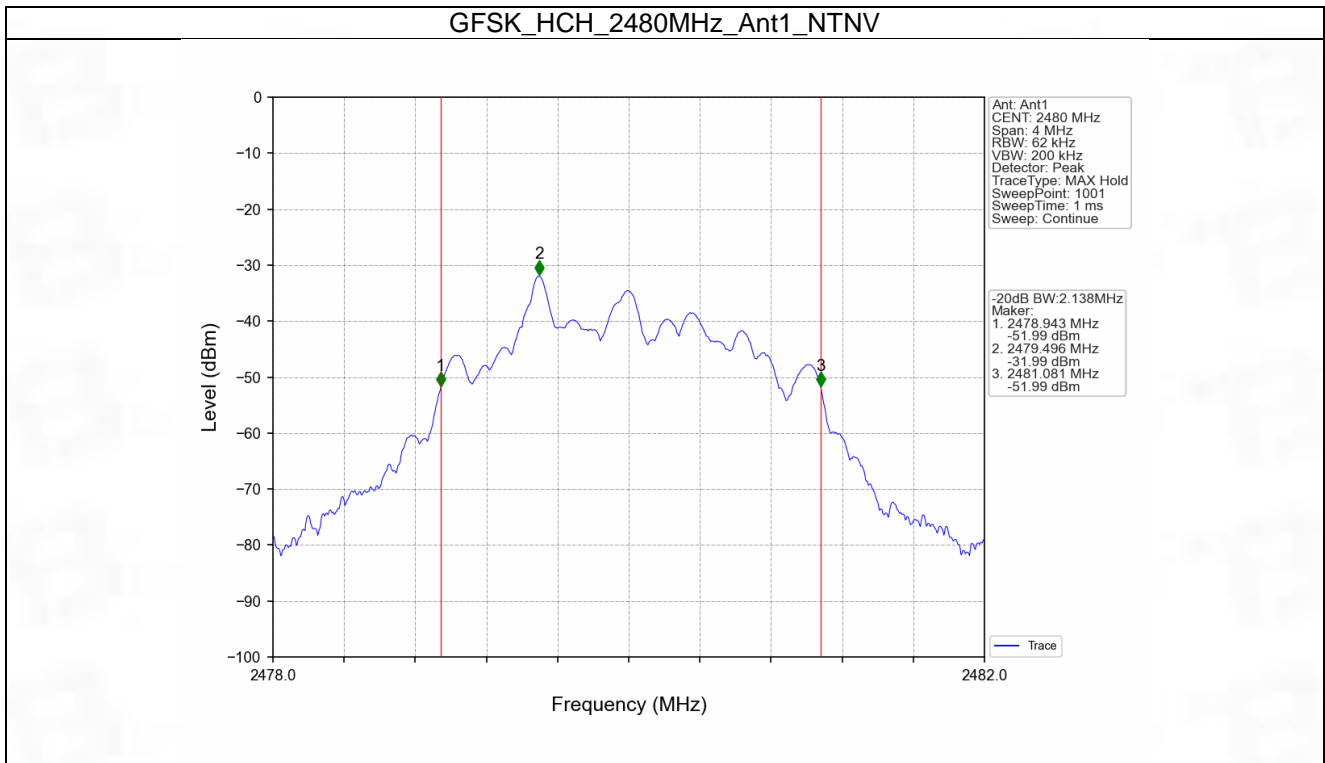
1.2 20dB BW

1.2.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	20dB Bandwidth (MHz)		Verdict
				Result	Limit	
GFSK	SISO	2403	1	2.139	/	Pass
		2442	1	2.139	/	Pass
		2480	1	2.138	/	Pass

1.2.2 Test Graph





2. Maximum Conducted Output Power

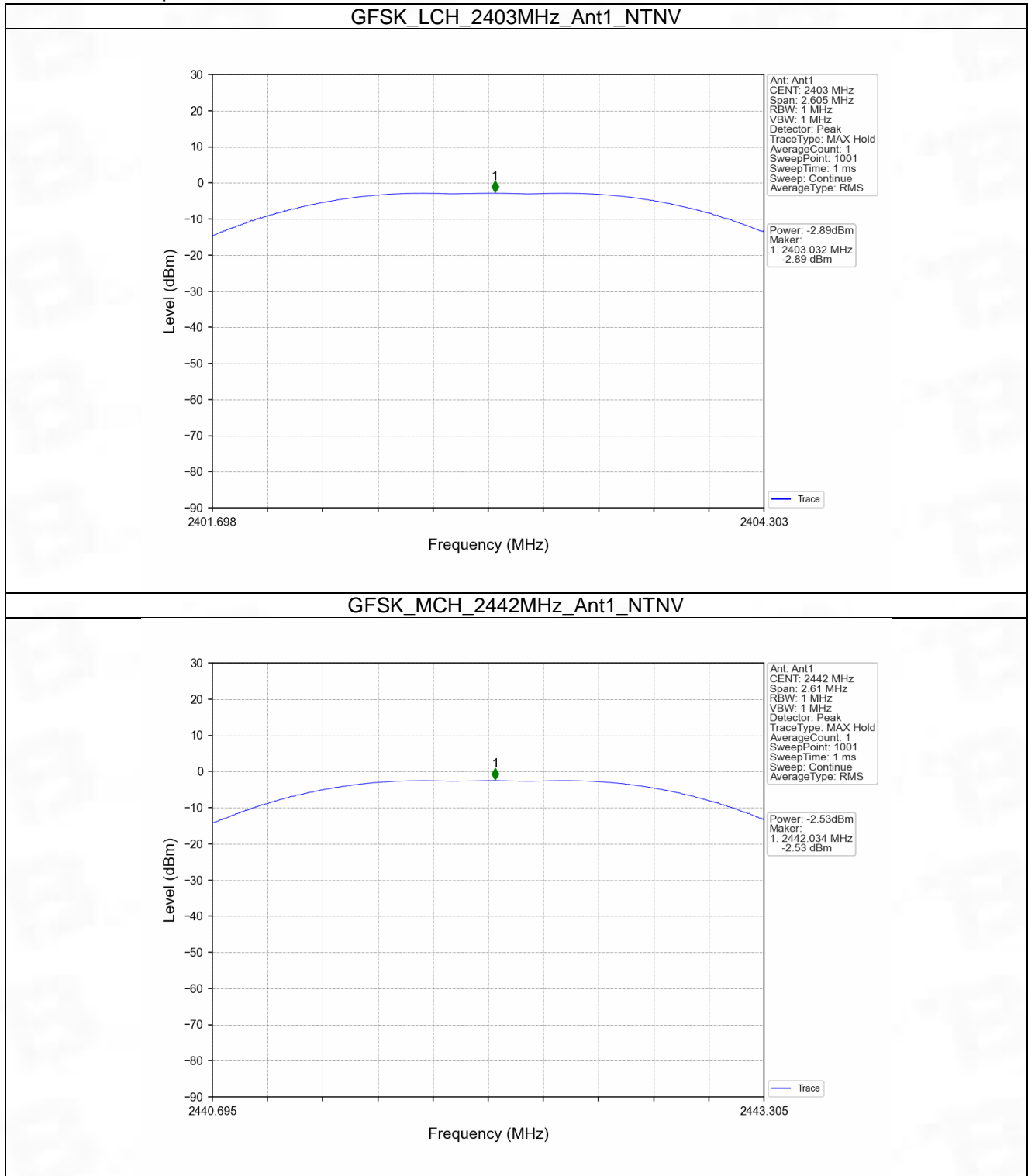
2.1 Power

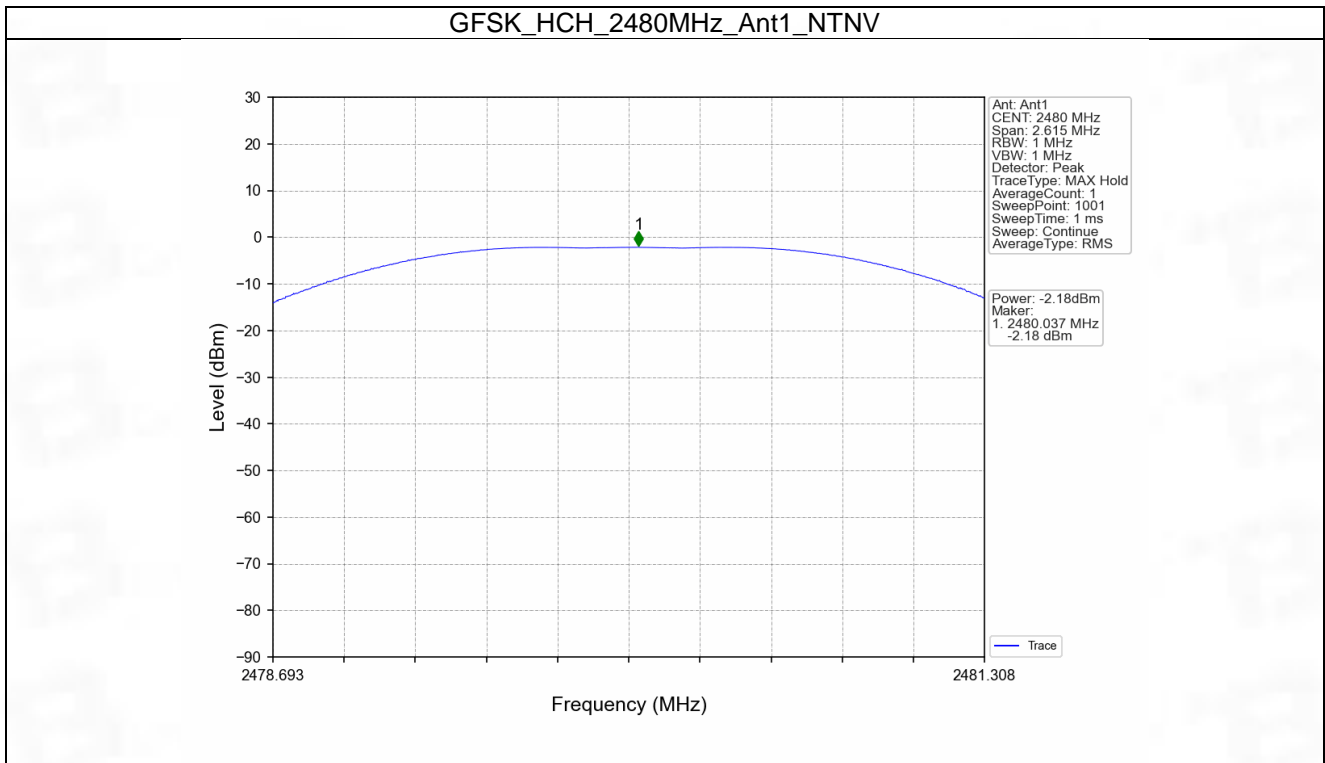
2.1.1 Test Result

Mode	TX Type	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)		Verdict
			ANT1	Limit	
GFSK	SISO	2403	-2.89	≤ 20.97	Pass
		2442	-2.53	≤ 20.97	Pass
		2480	-2.18	≤ 20.97	Pass

Note1: Antenna Gain: Ant1: -2.39dBi;

2.1.2 Test Graph





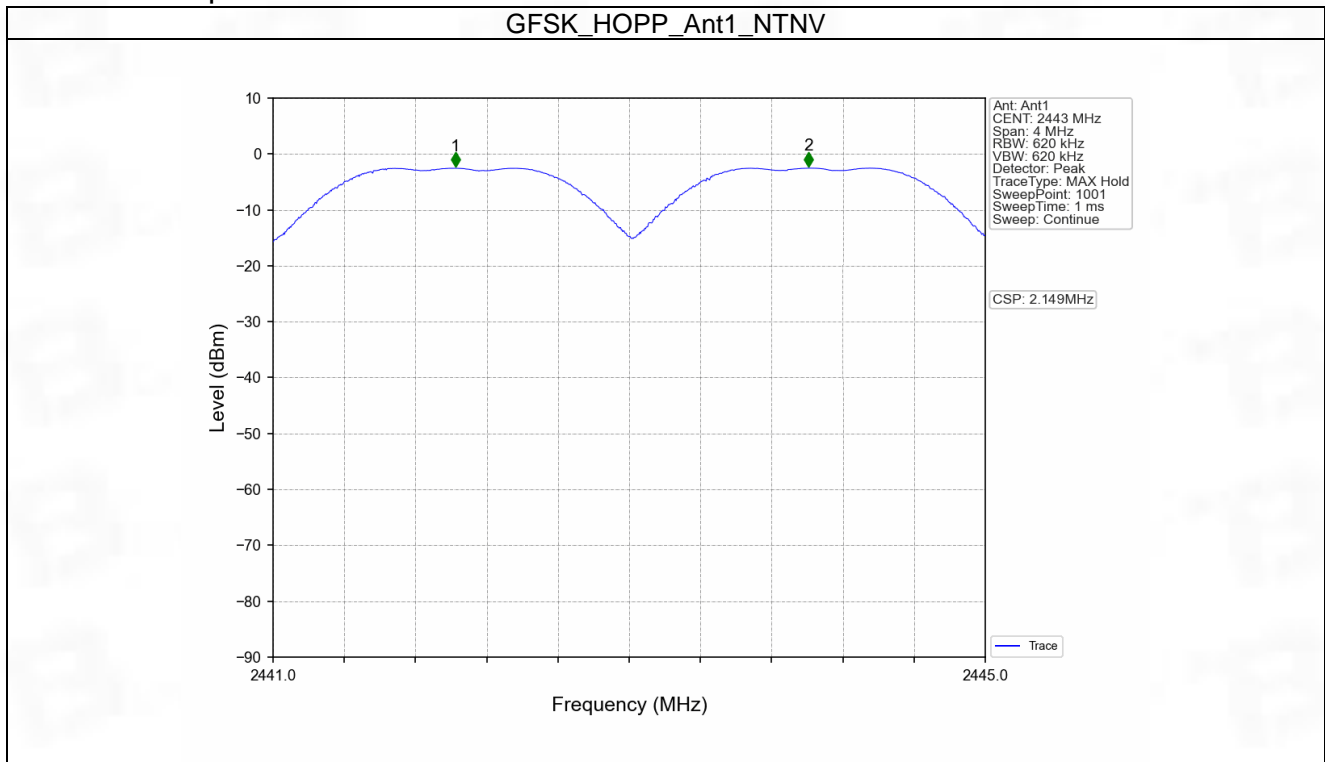
3. Carrier Frequency Separation

3.1 Ant1

3.1.1 Test Result

Ant1						
Mode	TX Type	Frequency (MHz)	Channel Separation (MHz)	20dB Bandwidth (MHz)	Limit (MHz)	Verdict
GFSK	SISO	HOPP	2.149	2.139	≥ 2.139	Pass

3.1.2 Test Graph



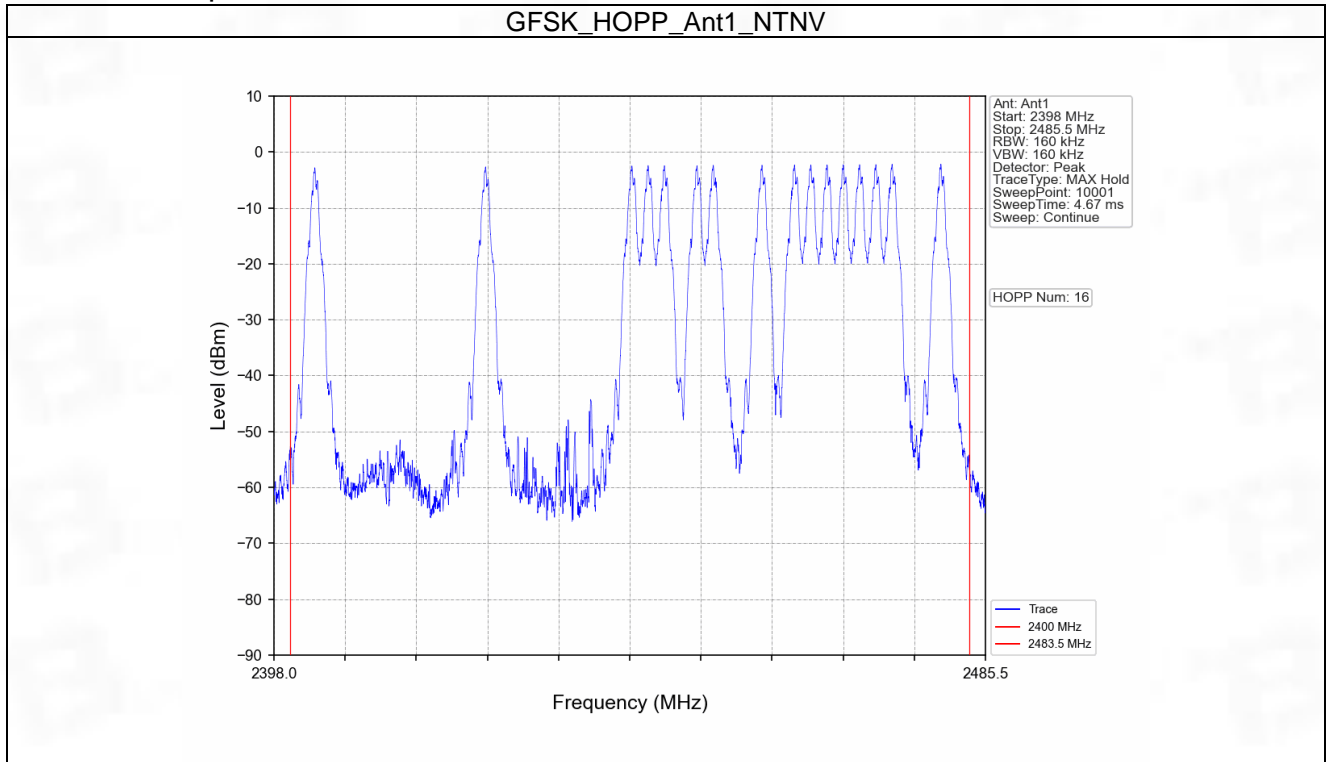
4. Number of Hopping Frequencies

4.1 HoppNum

4.1.1 Test Result

Mode	TX Type	Frequency (MHz)	Num of Hopping Frequencies		Verdict
			ANT1	Limit	
GFSK	SISO	HOPP	16	≥ 15	Pass

4.1.2 Test Graph



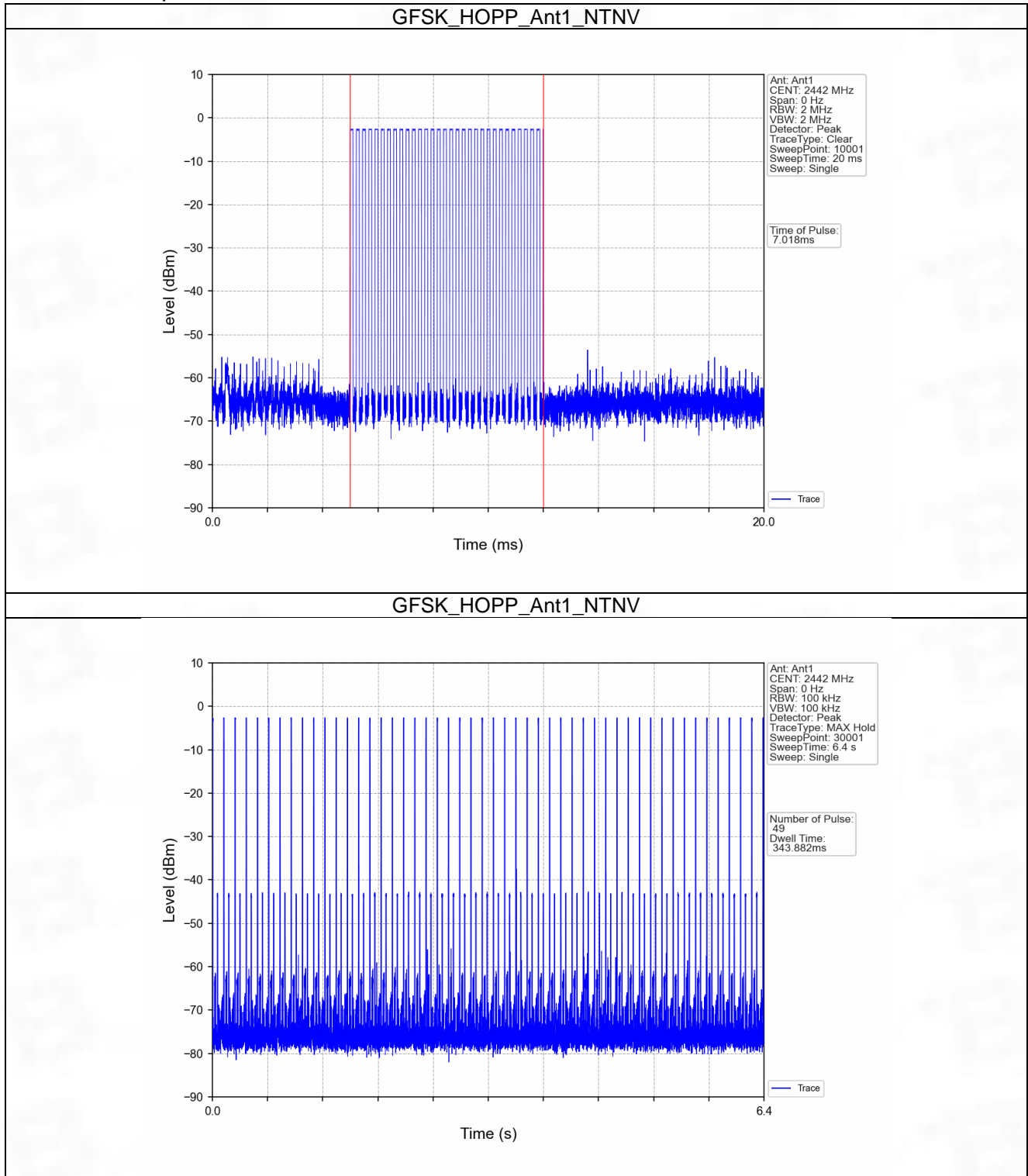
5. Time of Occupancy (Dwell Time)

5.1 Ant1

5.1.1 Test Result

Ant1								
Mode	TX Type	Frequency (MHz)	Duration of Single Pulse (ms)	Observation Period (s)	Num of Pulse in Observation Period	Dwell Time (ms)	Limit (ms)	Verdict
GFSK	SISO	HOPP	7.018	6.400	49	343.882	<=400	Pass

5.1.2 Test Graph



6. Unwanted Emissions In Non-restricted Frequency Bands

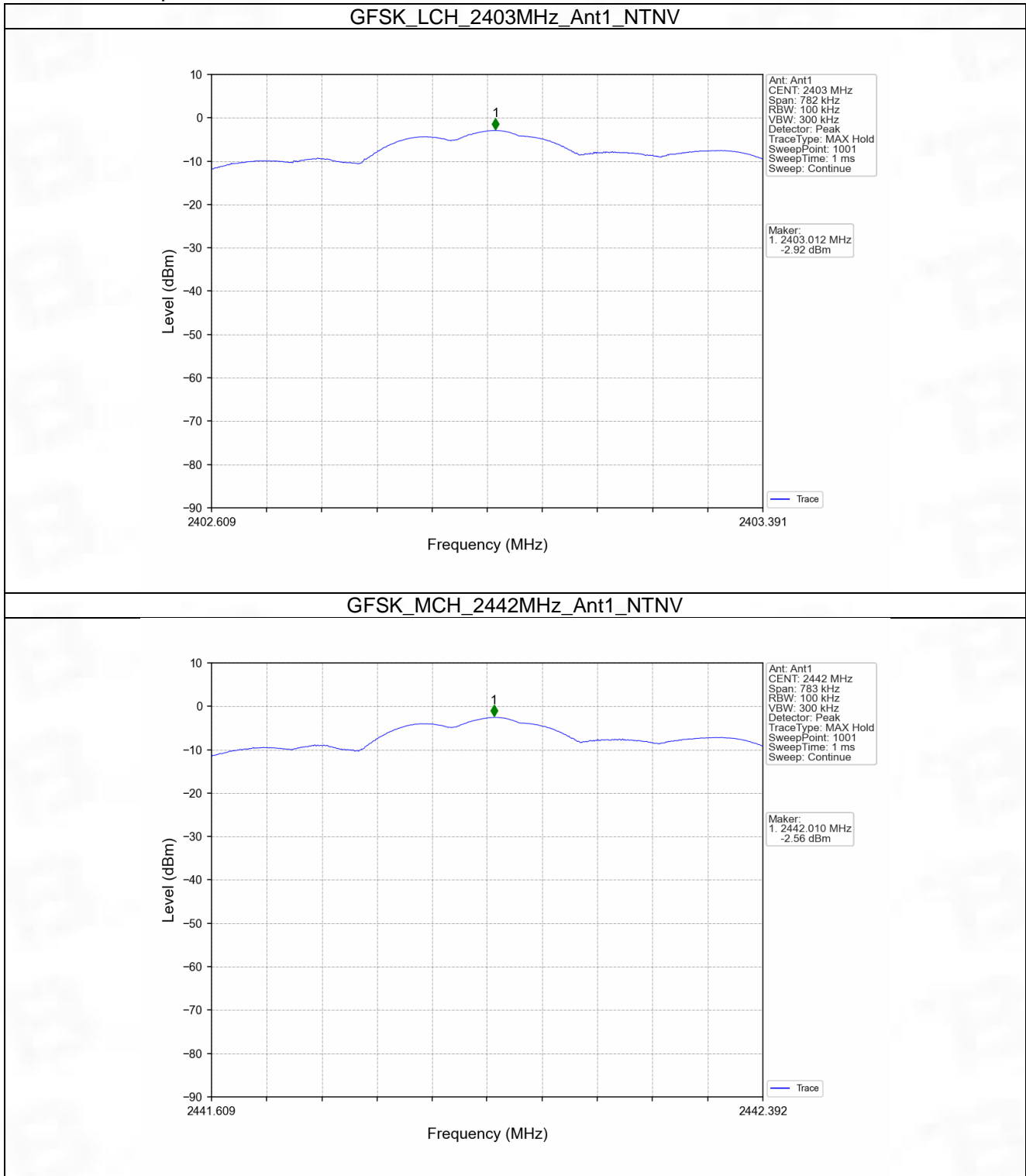
6.1 Ref

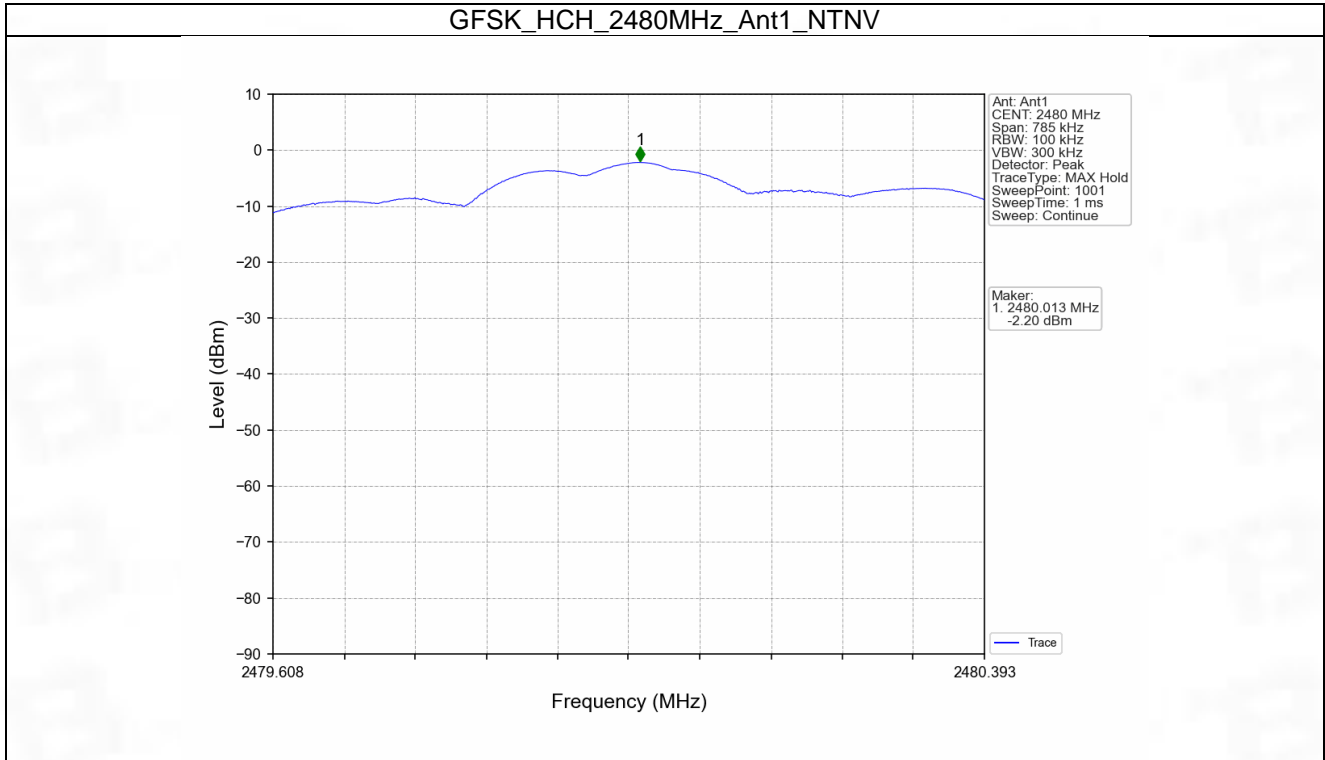
6.1.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)
GFSK	SISO	2403	1	-2.92
		2442	1	-2.56
		2480	1	-2.20

Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2013, the channel contains the maximum PSD level was used to establish the reference level.

6.1.2 Test Graph





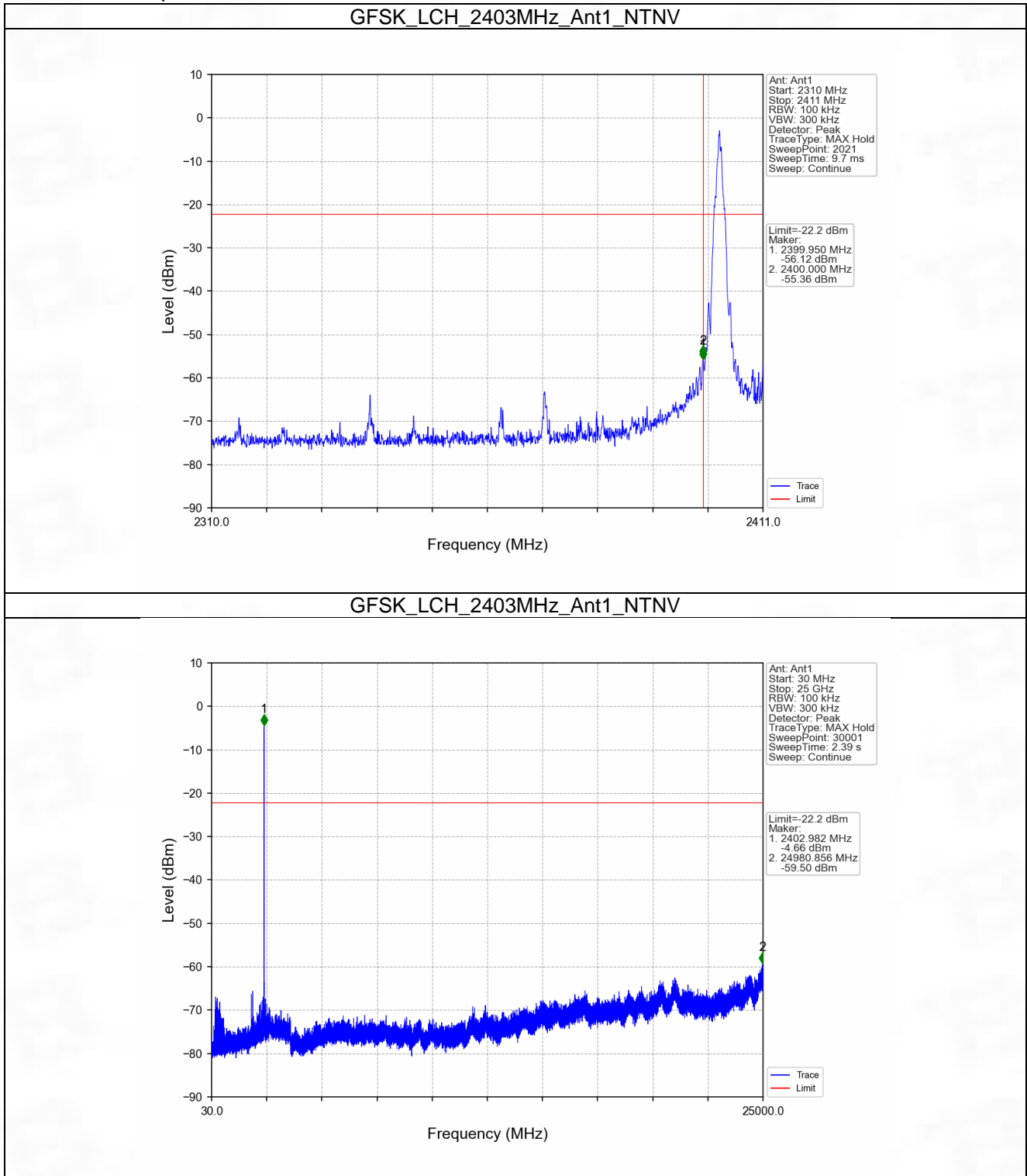
6.2 CSE

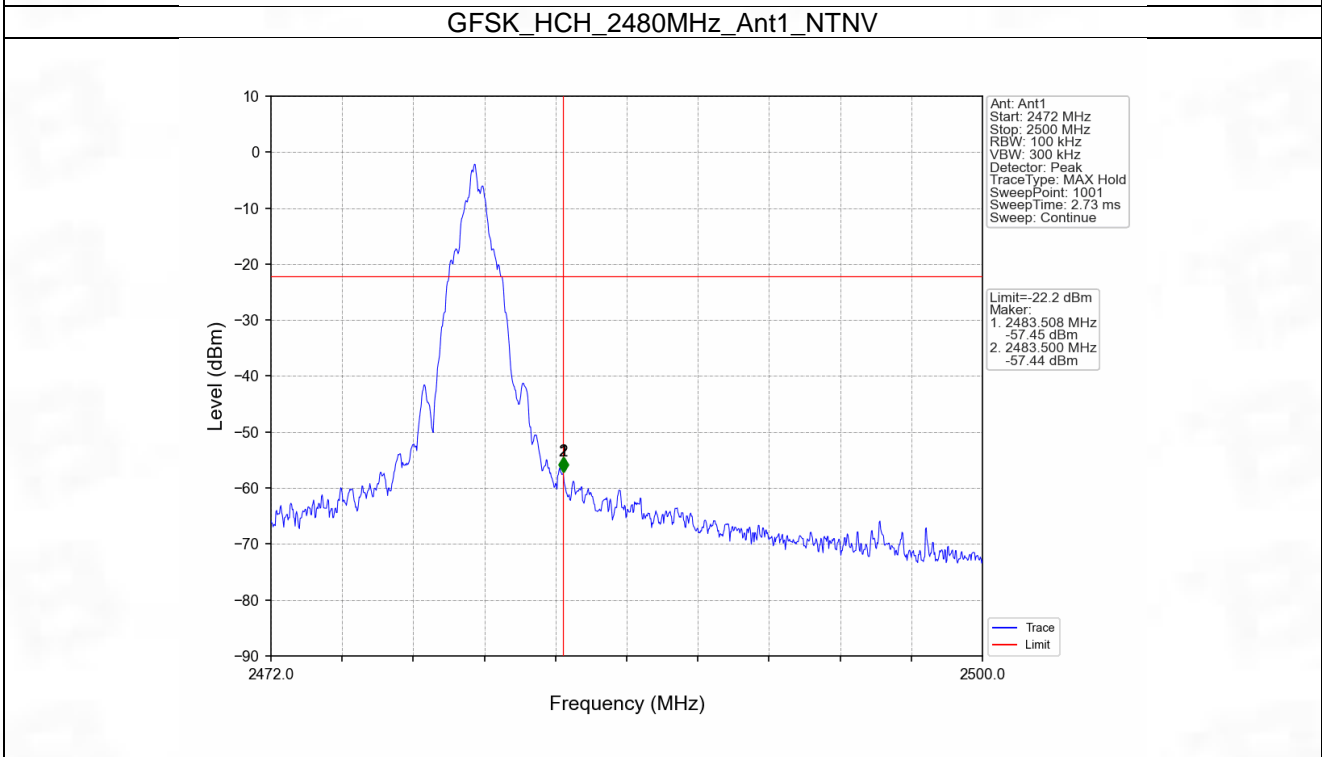
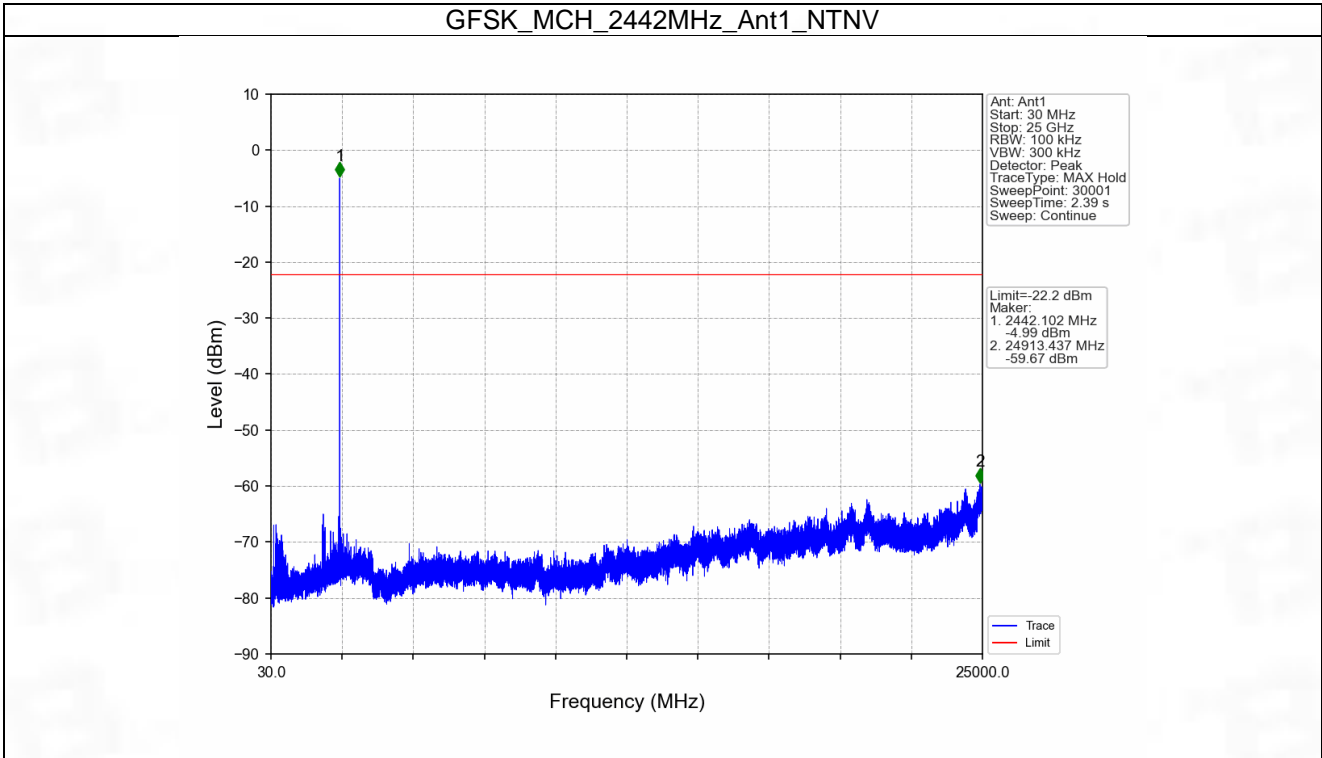
6.2.1 Test Result

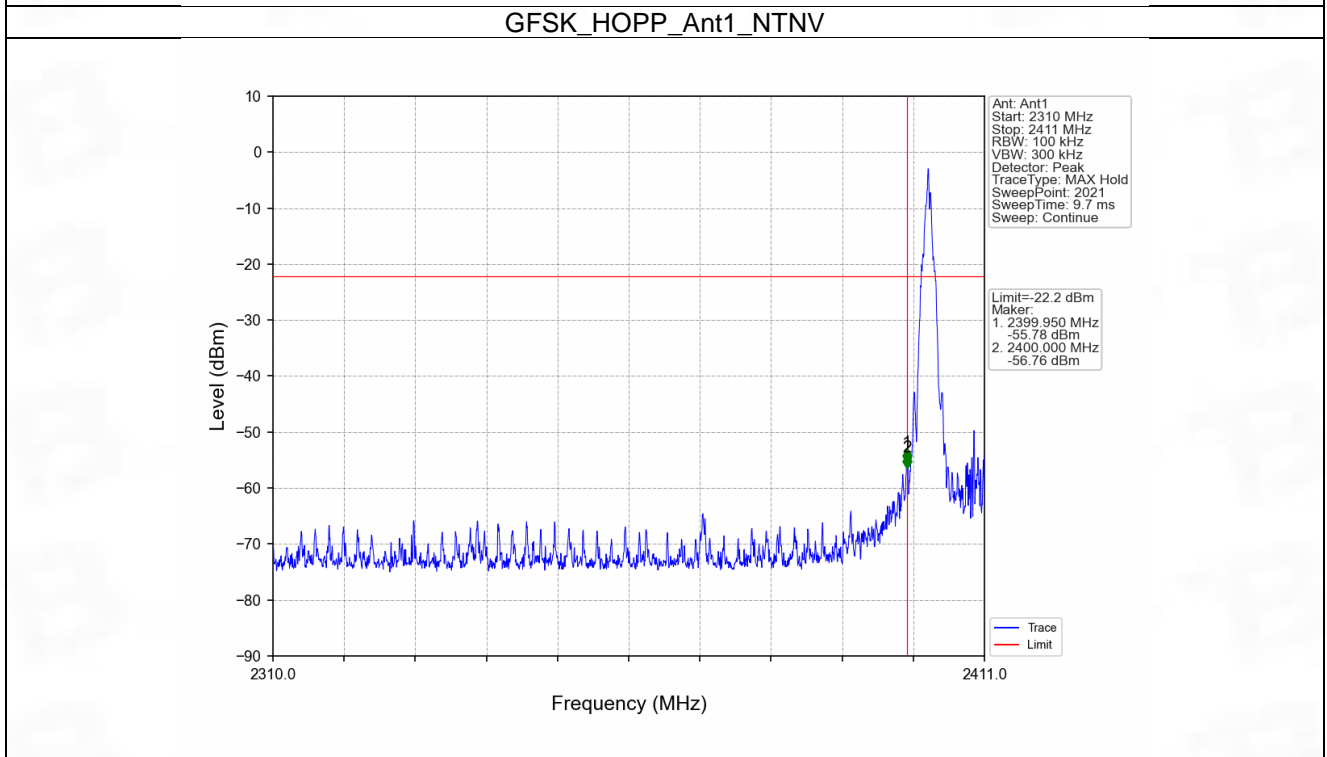
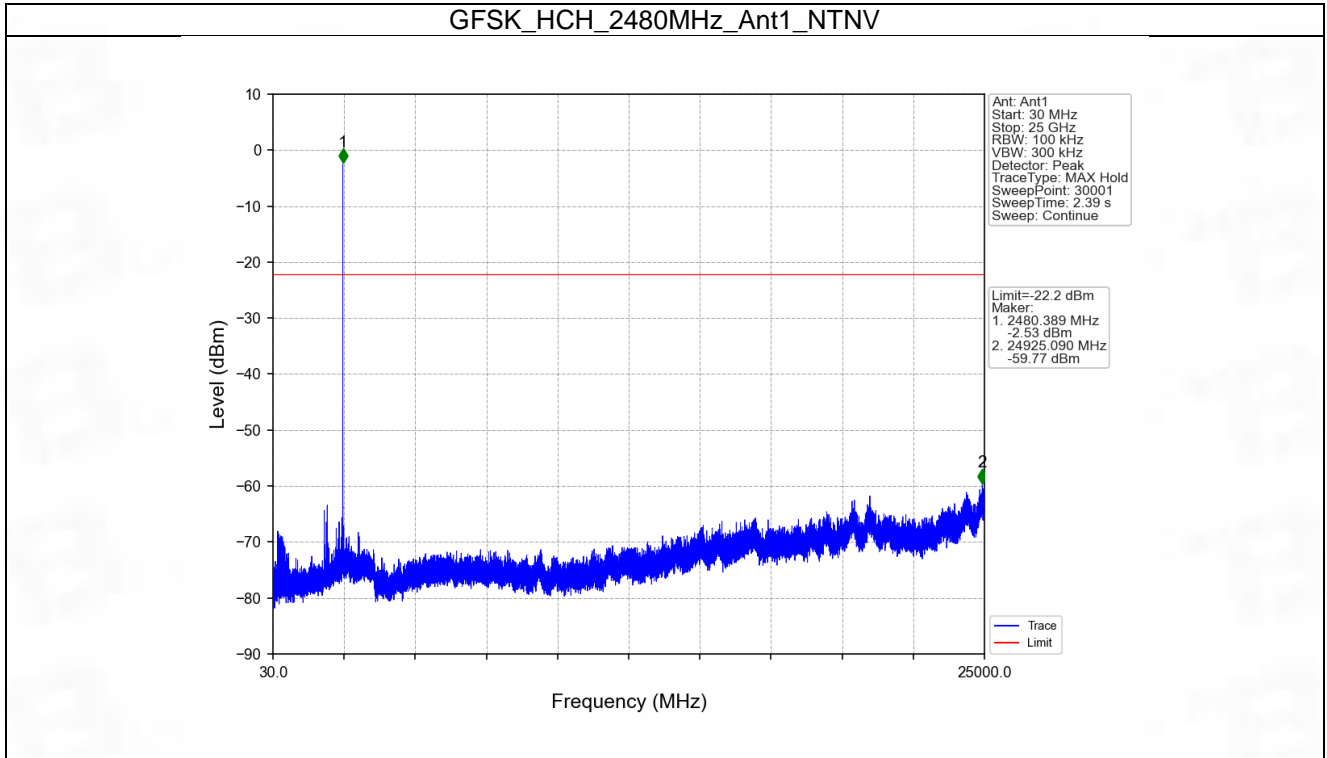
Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
GFSK	SISO	2403	1	-2.20	-22.20	Pass
		2442	1	-2.20	-22.20	Pass
		2480	1	-2.20	-22.20	Pass
		HOPP	1	-2.20	-22.20	Pass
				-2.20	-22.20	Pass

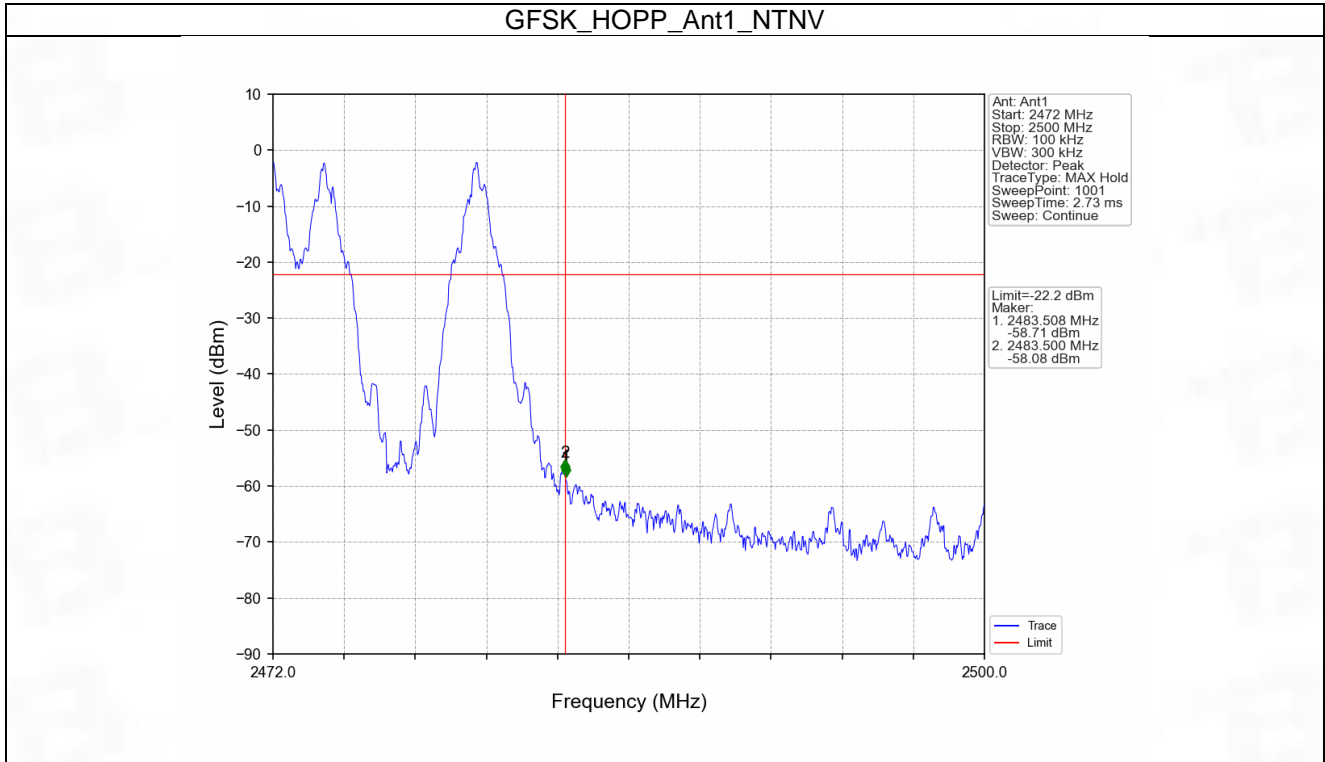
Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2013, the channel contains the maximum PSD level was used to establish the reference level.

6.2.2 Test Graph









7. Form731

7.1 Form731

7.1.1 Test Result

Lower Freq (MHz)	High Freq (MHz)	MAX Power (W)	MAX Power (dBm)
2403	2480	0.0006	-2.18



Test Report Number: BTF240123R01402



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