RF Test Report

For

Applicant Name:	**Fuzhou Geek Cross-Border E-commerce Co., Ltd.**
Address:	Room 1505-73. No.10.Aotou Road, Aofeng Street, Taijiang District, Fuzhou City, Fujian Province. China.
EUT Name:	V87 Mechanical Keyboard
Brand Name:	VGN
Model Number:	V87
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:	BTF240123R00202
Test Standards:	47 CFR Part 15.247
FCC ID:	2BCR5-V87
Test Conclusion:	Pass
Test Date:	2024-01-24 to 2024-02-28
Date of Issue:	2024-02-29

Prepared By: Gavin Cui

Gavin Cui / Project Engineer

Date: 2024-02-29

Approved By: Ryan.CJ

Ryan.CJ / EMC Manager

Date: 2024-02-29

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	2024-02-29	Original
Note: Once the revision has been made, then previous versions reports are invalid.		

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

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BTF Testing Lab (Shenzhen) Co., Ltd.
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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:	Fuzhou Geek Cross-Border E-commerce Co., Ltd.
Address:	Room 1505-73. No.10.Aotou Road, Aofeng Street, Taijiang District, Fuzhou City, Fujian Province. China.

2.2 Manufacturer Information

Company Name:	Dongguan Nuobida Intelligent Technology Co., Ltd
Address:	Building 7, No.1, Junma Road, Chigang ,Humen Town, Dongguan City,Guangdong Province

2.3 Factory Information

Company Name:	Dongguan Nuobida Intelligent Technology Co., Ltd
Address:	Building 7, No.1, Junma Road, Chigang ,Humen Town, Dongguan City,Guangdong Province

2.4 General Description of Equipment under Test (EUT)

EUT Name:	V87 Mechanical Keyboard
Test Model Number:	V87
Series Model Number:	V87 Pro
Description of Model name differentiation:	All the models are identical to each other except for model name.

2.5 Technical Information

Power Supply:	DC 3.7V From Battery or DC 5V
Operation Frequency:	2402MHz to 2480MHz
Number of Channels:	79
Modulation Type:	GFSK
Antenna Type:	PCB Antenna
Antenna Gain[#]:	0.34dBi
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.	

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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
Power Spectral Density	±0.69dB
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 15.247(a)(2)	Pass
Maximum Conducted Output Power	47 CFR Part 15.247	47 CFR 15.247(b)(3)	Pass
Power Spectral Density	47 CFR Part 15.247	47 CFR 15.247(e)	Pass
Emissions in non-restricted frequency bands	47 CFR Part 15.247	47 CFR 15.247(d), 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

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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 Power Spectral Density 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 COMMNUNICATION TESTER	Rohde & Schwarz	CMW500	161997	2023-11-16	2024-11-15
MXA Signal Analyzer	KEYSIGHT	N9020A	MY50410020	2023-11-16	2024-11-15

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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 Preamplilifier	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

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4.2 Test Auxiliary Equipment

The EUT was tested as an independent device.

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.

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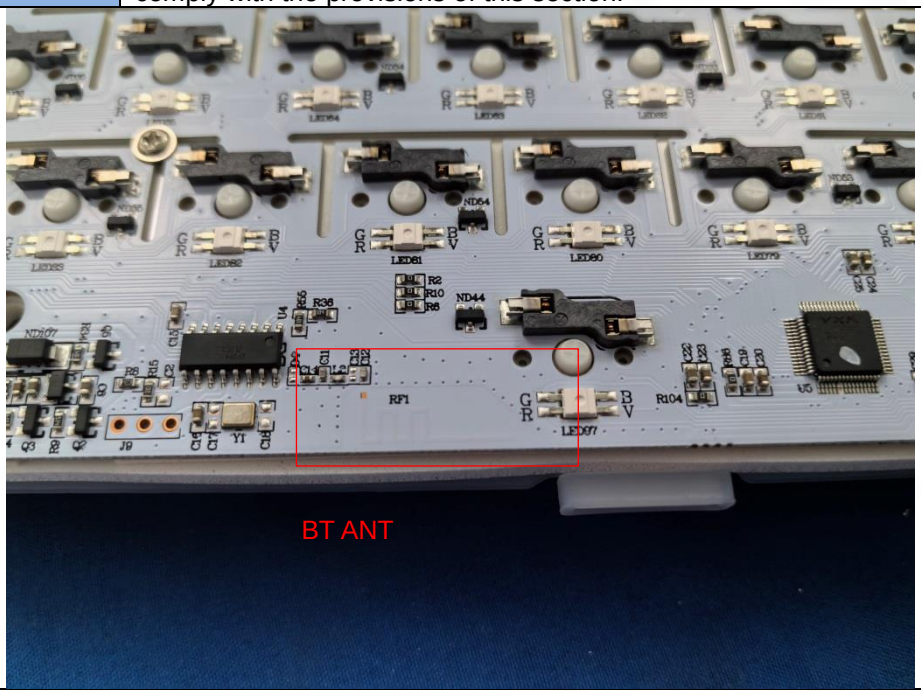
5 Evaluation Results (Evaluation)

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.



6 Radio Spectrum Matter Test Results (RF)

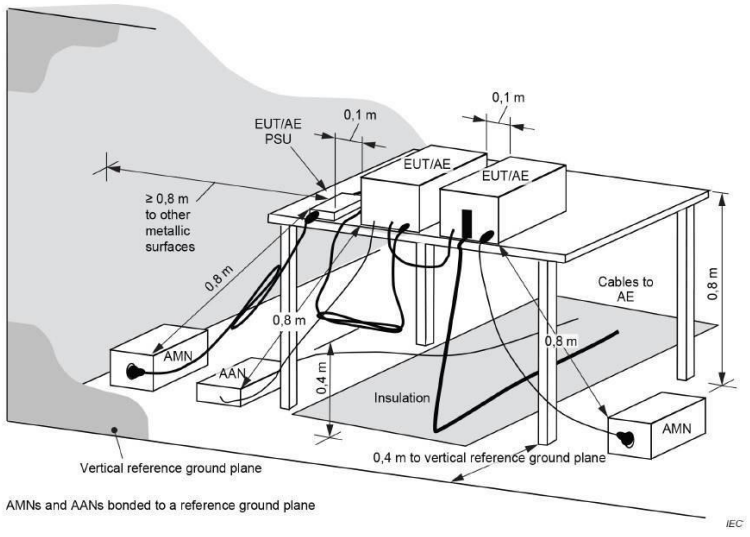
6.1 Conducted Emission at AC power line

Test Requirement:	Refer to 47 CFR 15.207(a), Except as shown in paragraphs (b)and (c)of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN).
Test Method:	ANSI C63.10-2013 section 6.2 ANSI C63.10-2020 section 6.2
Test Limit:	Frequency of emission (MHz) / Conducted limit (dBμV): Quasi-peak / Average 0.15-0.5: 66 to 56* / 56 to 46* 0.5-5: 56 / 46 5-30: 60 / 50 *Decreases with the logarithm of the frequency.
Procedure:	Refer to ANSI C63.10-2013 section 6.2, standard test method for ac power-line conducted emissions from unlicensed wireless devices Refer to ANSI C63.10-2020 section 6.2, standard test method for ac power-line conducted emissions from unlicensed wireless devices

6.1.1 E.U.T. Operation:

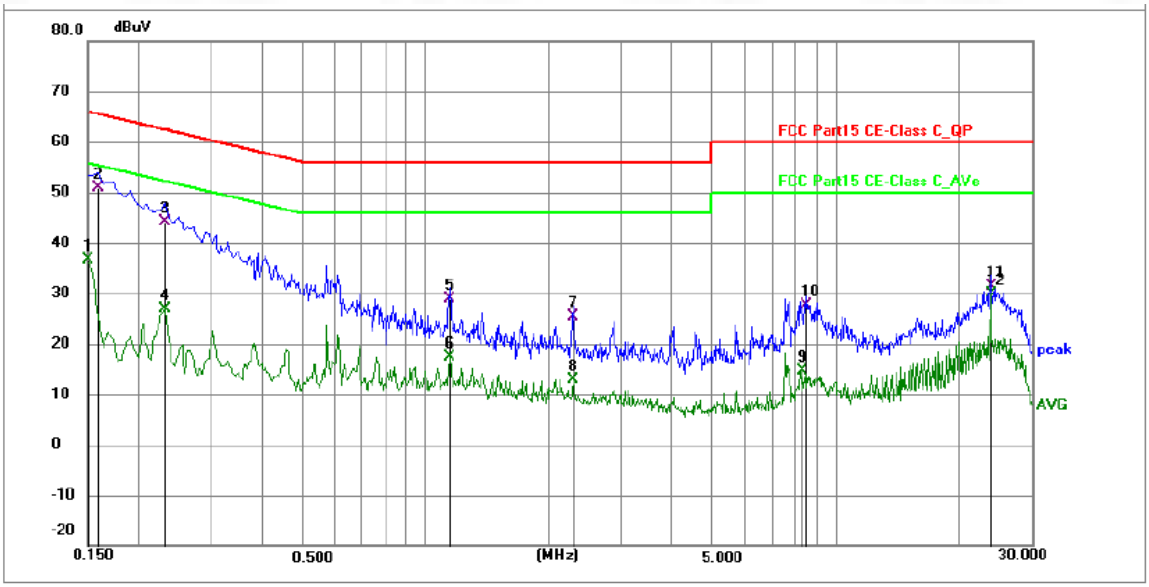
Operating Environment:	
Temperature:	23.9 °C
Humidity:	50.7 %
Atmospheric Pressure:	1010 mbar

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	0.1507	26.13	10.45	36.58	55.96	-19.38	AVG	P	
2 *	0.1590	40.33	10.47	50.80	65.52	-14.72	QP	P	
3	0.2310	33.54	10.56	44.10	62.41	-18.31	QP	P	
4	0.2310	16.24	10.56	26.80	52.41	-25.61	AVG	P	
5	1.1445	18.24	10.66	28.90	56.00	-27.10	QP	P	
6	1.1445	6.63	10.66	17.29	46.00	-28.71	AVG	P	
7	2.2875	14.63	10.67	25.30	56.00	-30.70	QP	P	
8	2.2875	2.13	10.67	12.80	46.00	-33.20	AVG	P	
9	8.2454	3.85	10.81	14.66	50.00	-35.34	AVG	P	
10	8.4750	16.78	10.82	27.60	60.00	-32.40	QP	P	
11	23.8245	20.23	11.17	31.40	60.00	-28.60	QP	P	
12	23.8245	18.76	11.17	29.93	50.00	-20.07	AVG	P	

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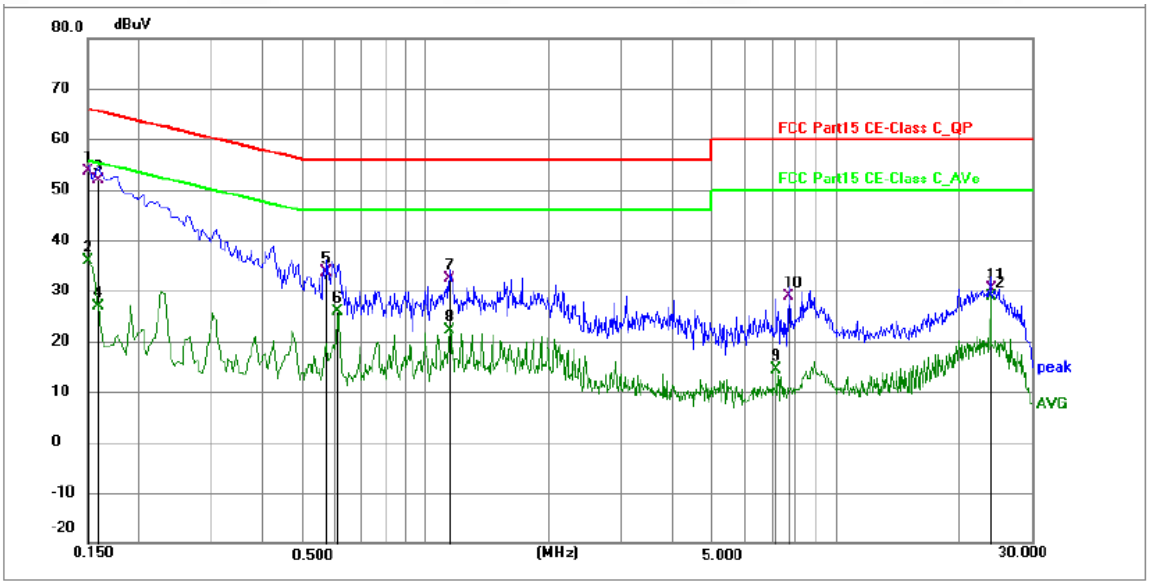
TM1 / Line: Neutral / Band: 2400-2483.5 MHz / BW: 2 / CH: M



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1 *	0.1500	43.25	10.45	53.70	66.00	-12.30	QP	P	
2	0.1500	25.37	10.45	35.82	56.00	-20.18	AVG	P	
3	0.1590	41.43	10.47	51.90	65.52	-13.62	QP	P	
4	0.1590	16.37	10.47	26.84	55.52	-28.68	AVG	P	
5	0.5730	22.98	10.62	33.60	56.00	-22.40	QP	P	
6	0.6134	15.12	10.64	25.76	46.00	-20.24	AVG	P	
7	1.1445	21.64	10.66	32.30	56.00	-23.70	QP	P	
8	1.1445	11.40	10.66	22.06	46.00	-23.94	AVG	P	
9	7.1610	3.69	10.79	14.48	50.00	-35.52	AVG	P	
10	7.6695	18.10	10.80	28.90	60.00	-31.10	QP	P	
11	23.8245	19.23	11.17	30.40	60.00	-29.60	QP	P	
12	23.8245	17.78	11.17	28.95	50.00	-21.05	AVG	P	

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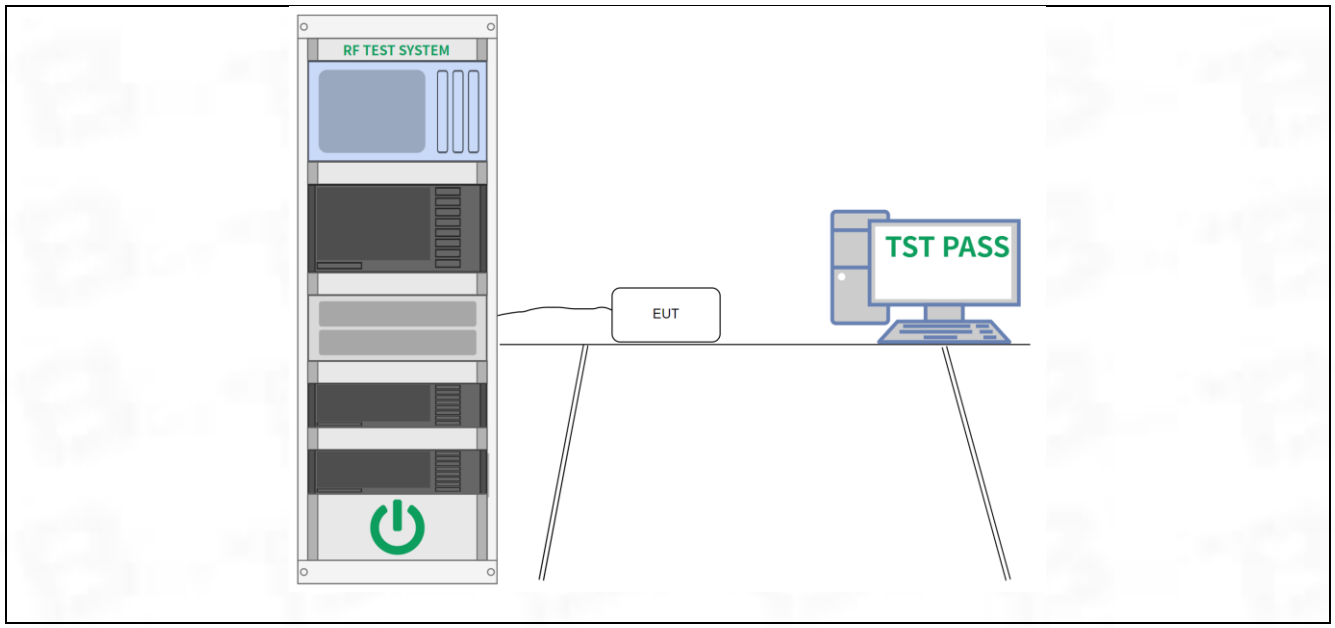
6.2 Occupied Bandwidth

Test Requirement:	47 CFR 15.247(a)(2)
Test Method:	ANSI C63.10-2013, section 11.8 ANSI C63.10-2020, section 11.8 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 15.247(a)(2), Systems using digital modulation techniques may operate in the 902-928 MHz, and 2400-2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.
Procedure:	a) Set RBW = 100 kHz. b) Set the VBW >= [3 × RBW]. c) Detector = peak. d) Trace mode = max hold. e) Sweep = auto couple. f) Allow the trace to stabilize. g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. 11.8.1 Option 1 The steps for the first option are as follows: a) Set RBW = shall be in the range of 1% to 5% of the OBW but not less than 100 kHz. b) Set the VBW ≥ [3 × RBW]. c) Detector = peak. d) Trace mode = max-hold. e) Sweep = No faster than coupled (auto) time. f) Allow the trace to stabilize. g) Measure the maximum width of the emission by placing two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the “−6 dB down amplitude”. If a marker is below this “−6 dB down amplitude” value, then it shall be as close as possible to this value. 11.8.2 Option 2 The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described in 11.8.1 (i.e., RBW = 100 kHz, VBW ≥ 3 × RBW, and peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

6.2.1 E.U.T. Operation:

Operating Environment:	
Temperature:	23.9 °C
Humidity:	50.7 %
Atmospheric Pressure:	1010 mbar

6.2.2 Test Setup Diagram:



6.2.3 Test Data:

Please Refer to Appendix for Details.

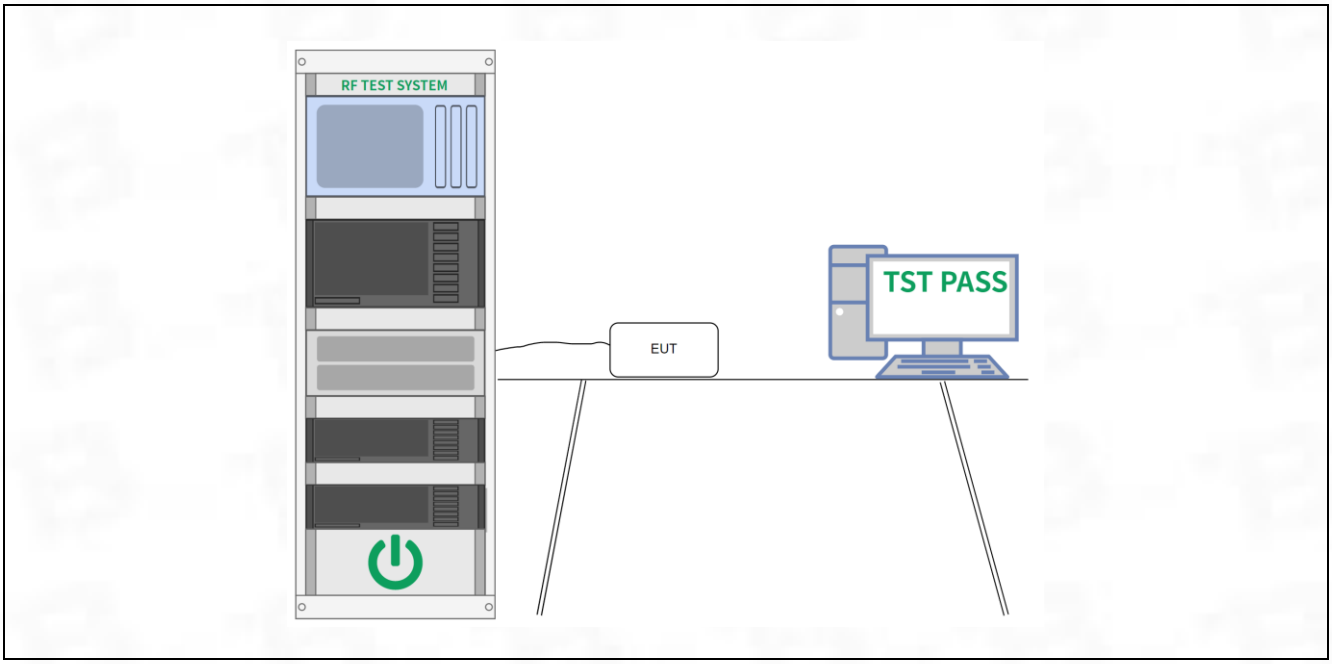
6.3 Maximum Conducted Output Power

Test Requirement:	47 CFR 15.247(b)(3)
Test Method:	ANSI C63.10-2013, section 11.9.1 ANSI C63.10-2020 section 11.9.1 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 15.247(b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.
Procedure:	ANSI C63.10-2013, section 11.9.1 Maximum peak conducted output power ANSI C63.10-2020, section 11.9.1 Maximum peak conducted output power

6.3.1 E.U.T. Operation:

Operating Environment:	
Temperature:	23.9 °C
Humidity:	50.7 %
Atmospheric Pressure:	1010 mbar

6.3.2 Test Setup Diagram:



6.3.3 Test Data:

Please Refer to Appendix for Details.

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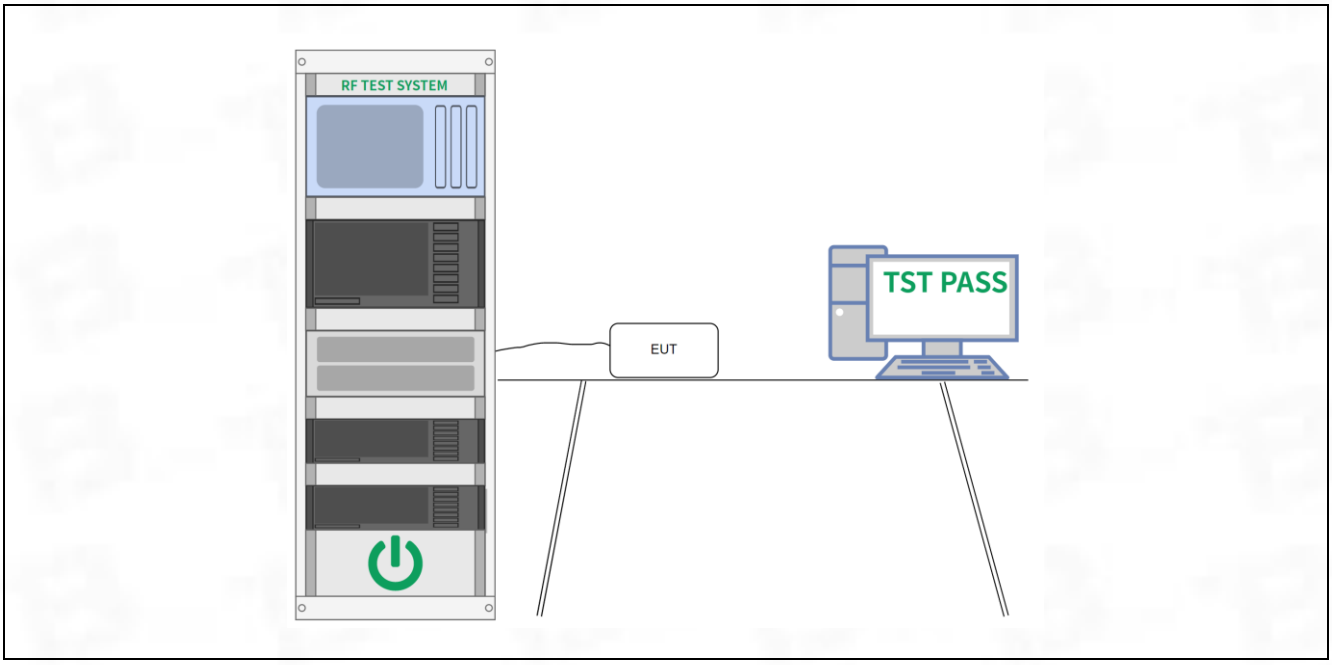
6.4 Power Spectral Density

Test Requirement:	47 CFR 15.247(e)
Test Method:	ANSI C63.10-2013, section 11.10 ANSI C63.10-2020, section 11.10 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 15.247(e), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.
Procedure:	ANSI C63.10-2013, section 11.10, Maximum power spectral density level in the fundamental emission ANSI C63.10-2020, section 11.10, Maximum power spectral density level in the fundamental emission

6.4.1 E.U.T. Operation:

Operating Environment:	
Temperature:	23.9 °C
Humidity:	50.7 %
Atmospheric Pressure:	1010 mbar

6.4.2 Test Setup Diagram:



6.4.3 Test Data:

Please Refer to Appendix for Details.

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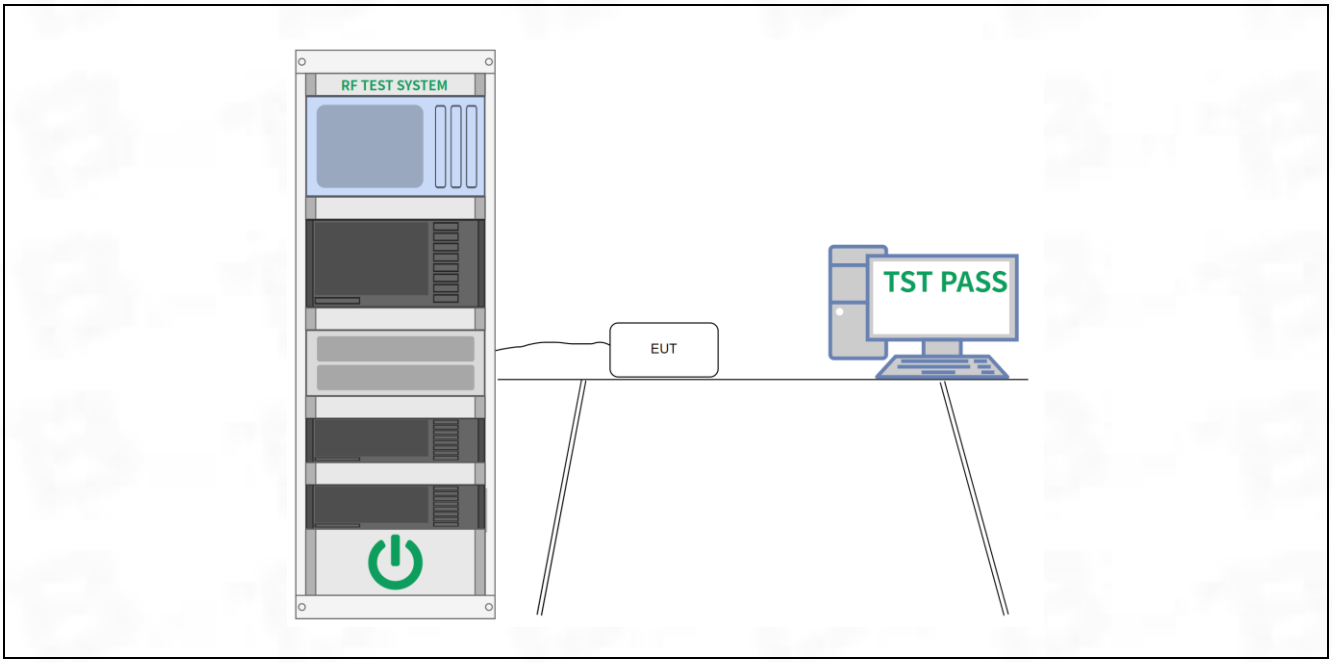
6.5 Emissions in non-restricted frequency bands

Test Requirement:	47 CFR 15.247(d), 15.209, 15.205
Test Method:	ANSI C63.10-2013 section 11.11 ANSI C63.10-2020 section 11.11 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 15.247(d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required.
Procedure:	ANSI C63.10-2013 Section 11.11.1, Section 11.11.2, Section 11.11.3 ANSI C63.10-2020 Section 11.11.1, Section 11.11.2, Section 11.11.3

6.5.1 E.U.T. Operation:

Operating Environment:	
Temperature:	23.9 °C
Humidity:	50.7 %
Atmospheric Pressure:	1010 mbar

6.5.2 Test Setup Diagram:



6.5.3 Test Data:

Please Refer to Appendix for Details.

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6.6 Band edge emissions (Radiated)

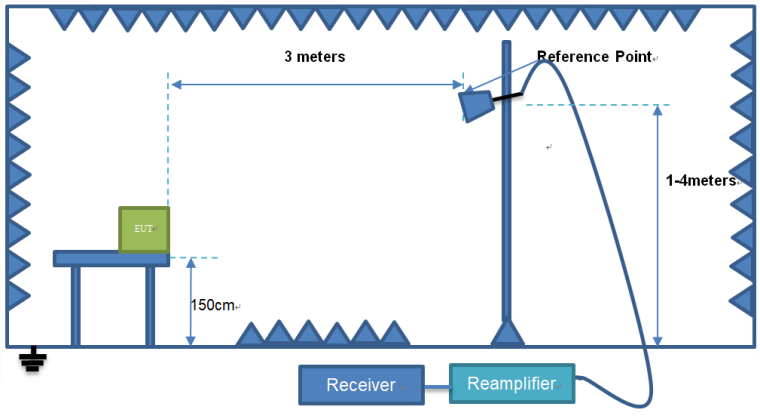
<table>
<tr><td>Test Requirement:</td><td>Refer to 47 CFR 15.247(d), In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).`</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10-2013 section 6.10
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 C63.10-2013 section 6.10.5.2

ANSI C63.10-2020 section 6.10.5.2</td></tr>
</table>

6.6.1 E.U.T. Operation:

Operating Environment:	
Temperature:	23.9 °C
Humidity:	48 %
Atmospheric Pressure:	1010 mbar

6.6.2 Test Setup Diagram:



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6.6.3 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	67.01	-30.59	36.42	74.00	-37.58	peak	P
2	2390.000	66.34	-30.49	35.85	74.00	-38.15	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	66.78	-30.59	36.19	74.00	-37.81	peak	P
2	2390.000	66.51	-30.49	36.02	74.00	-37.98	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	67.57	-30.39	37.18	74.00	-36.82	peak	P
2	2500.000	65.31	-30.37	34.94	74.00	-39.06	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	67.07	-30.39	36.68	74.00	-37.32	peak	P
2 *	2500.000	68.24	-30.37	37.87	74.00	-36.13	peak	P

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6.7 Emissions in frequency bands (below 1GHz)

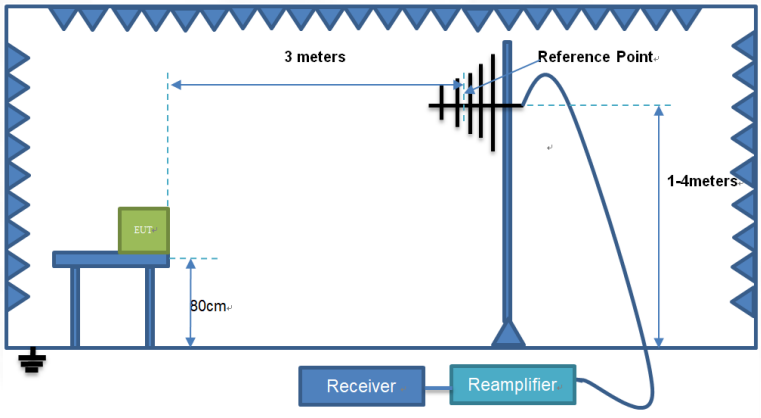
<table>
<tr><td>Test Requirement:</td><td>Refer to 47 CFR 15.247(d), In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).`</td></tr>
<tr><td>Test Method:</td><td>ANSI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

ANSI C63.10-2020 section 6.6.4</td></tr>
</table>

6.7.1 E.U.T. Operation:

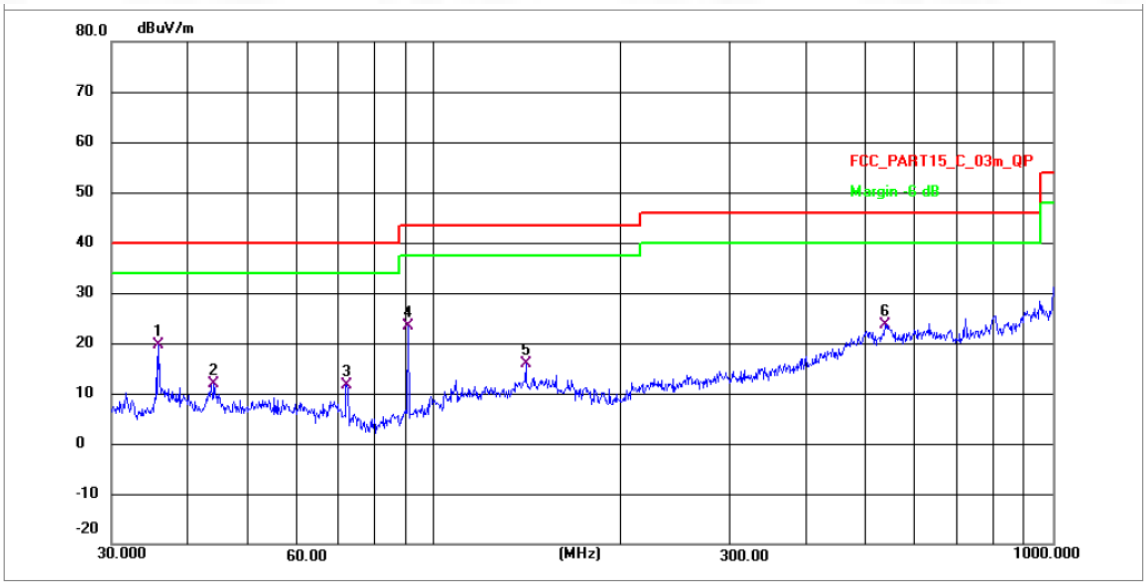
Operating Environment:	
Temperature:	23.9 °C
Humidity:	48 %
Atmospheric Pressure:	1010 mbar

6.7.2 Test Setup Diagram:



6.7.3 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	35.8118	38.15	-18.46	19.69	40.00	-20.31	QP	P
2	44.1202	30.31	-18.35	11.96	40.00	-28.04	QP	P
3	72.2108	29.76	-18.09	11.67	40.00	-28.33	QP	P
4 *	90.6963	53.04	-29.77	23.27	43.50	-20.23	QP	P
5	140.8351	43.74	-27.86	15.88	43.50	-27.62	QP	P
6	536.6473	45.16	-21.52	23.64	46.00	-22.36	QP	P

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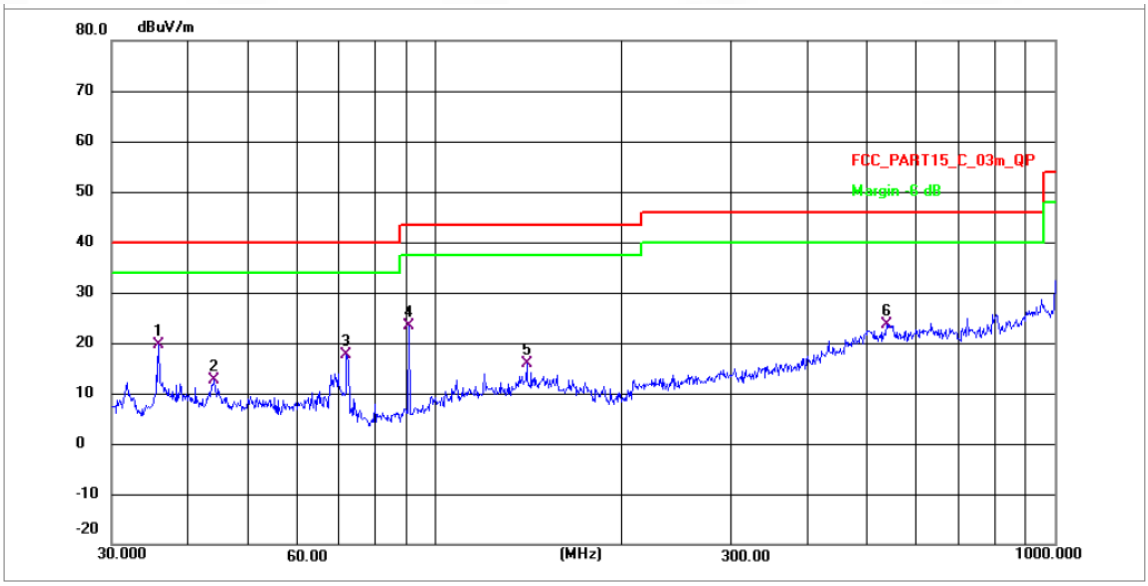
TM1 / Polarization: Vertical / Band: 2400-2483.5 MHz / BW: 2 / CH: L



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	35.8118	40.31	-20.62	19.69	40.00	-20.31	QP	P
2	44.0430	32.99	-20.44	12.55	40.00	-27.45	QP	P
3	71.9581	37.47	-19.96	17.51	40.00	-22.49	QP	P
4 *	90.6963	53.04	-29.77	23.27	43.50	-20.23	QP	P
5	140.8351	43.74	-27.86	15.88	43.50	-27.62	QP	P
6	536.6473	45.16	-21.52	23.64	46.00	-22.36	QP	P

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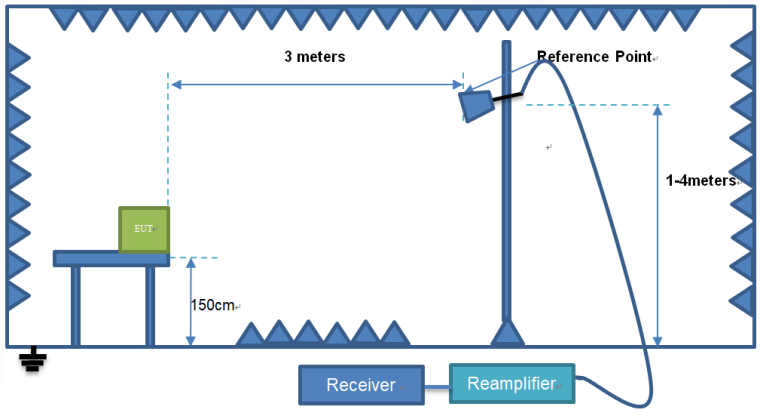
6.8 Emissions in frequency bands (above 1GHz)

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 ANSI C63.10-2020 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 ** 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 C63.10-2013 section 6.6.4 ANSI C63.10-2020 section 6.6.4

6.8.1 E.U.T. Operation:

Operating Environment:	
Temperature:	23.9 °C
Humidity:	48 %
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	5245.335	76.07	-27.16	48.91	74.00	-25.09	peak	P
2	7613.386	73.10	-24.95	48.15	74.00	-25.85	peak	P
3	9649.620	74.04	-23.53	50.51	74.00	-23.49	peak	P
4	12336.967	72.19	-21.80	50.39	74.00	-23.61	peak	P
5	13693.792	72.48	-21.02	51.46	74.00	-22.54	peak	P
6 *	16447.807	71.74	-19.44	52.30	74.00	-21.70	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	5245.335	76.57	-27.16	49.41	74.00	-24.59	peak	P
2	6694.502	76.00	-25.20	50.80	74.00	-23.20	peak	P
3	8382.594	75.14	-25.37	49.77	74.00	-24.23	peak	P
4	10974.124	72.38	-23.49	48.89	74.00	-25.11	peak	P
5 *	13404.009	72.21	-21.04	51.17	74.00	-22.83	peak	P
6	15718.106	72.43	-21.54	50.89	74.00	-23.11	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	4934.998	72.25	-27.55	44.70	74.00	-29.30	peak	P
2	6494.383	69.91	-25.38	44.53	74.00	-29.47	peak	P
3	7985.275	70.52	-25.50	45.02	74.00	-28.98	peak	P
4	11613.769	71.19	-22.86	48.33	74.00	-25.67	peak	P
5 *	14271.648	71.66	-21.14	50.52	74.00	-23.48	peak	P
6	15900.886	71.28	-21.57	49.71	74.00	-24.29	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	4925.024	73.79	-27.58	46.21	74.00	-27.79	peak	P
2	6694.502	72.50	-25.20	47.30	74.00	-26.70	peak	P
3	8668.413	73.63	-24.98	48.65	74.00	-25.35	peak	P
4	9541.456	73.26	-23.29	49.97	74.00	-24.03	peak	P
5	13404.009	72.71	-21.04	51.67	74.00	-22.33	peak	P
6 *	16277.549	73.04	-20.26	52.78	74.00	-21.22	peak	P

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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	4614.925	71.12	-28.46	42.66	74.00	-31.34	peak	P
2	5428.889	74.21	-27.01	47.20	74.00	-26.80	peak	P
3	8013.020	71.95	-25.52	46.43	74.00	-27.57	peak	P
4	10986.819	72.54	-23.47	49.07	74.00	-24.93	peak	P
5	13493.414	71.52	-20.97	50.55	74.00	-23.45	peak	P
6 *	15376.594	72.78	-21.23	51.55	74.00	-22.45	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	4378.433	76.91	-28.84	48.07	74.00	-25.93	peak	P
2	6078.440	75.38	-25.34	50.04	74.00	-23.96	peak	P
3	8578.683	74.40	-25.16	49.24	74.00	-24.76	peak	P
4	9176.319	73.84	-23.92	49.92	74.00	-24.08	peak	P
5	11982.023	72.43	-22.22	50.21	74.00	-23.79	peak	P
6 *	15718.106	72.93	-21.54	51.39	74.00	-22.61	peak	P

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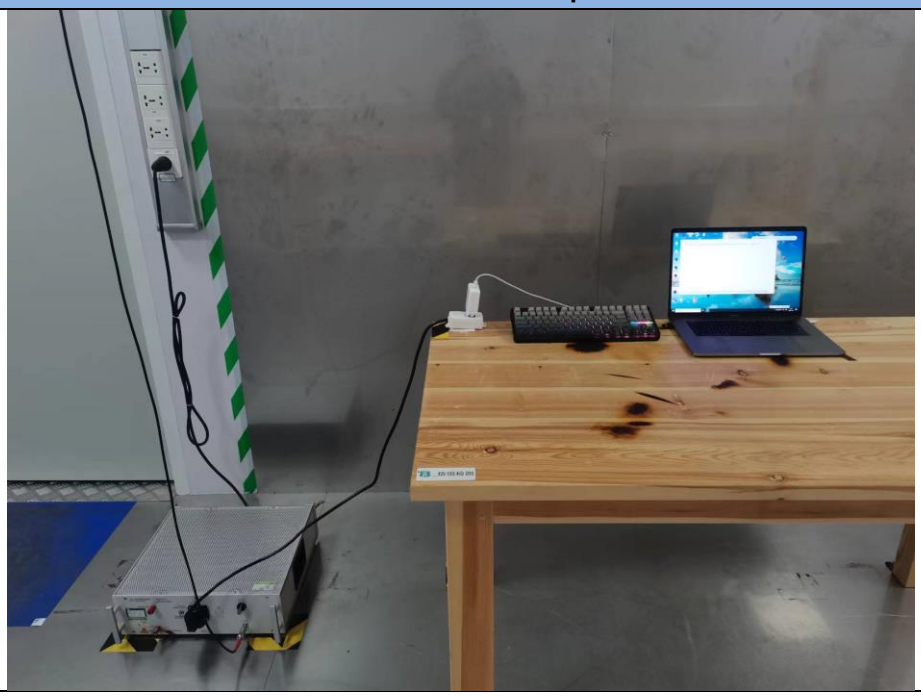
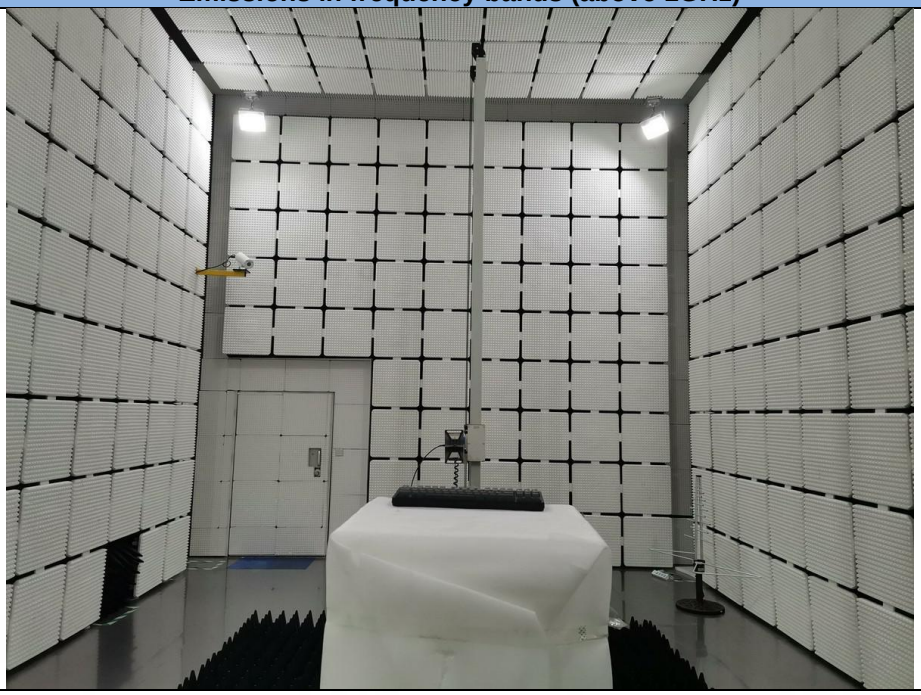
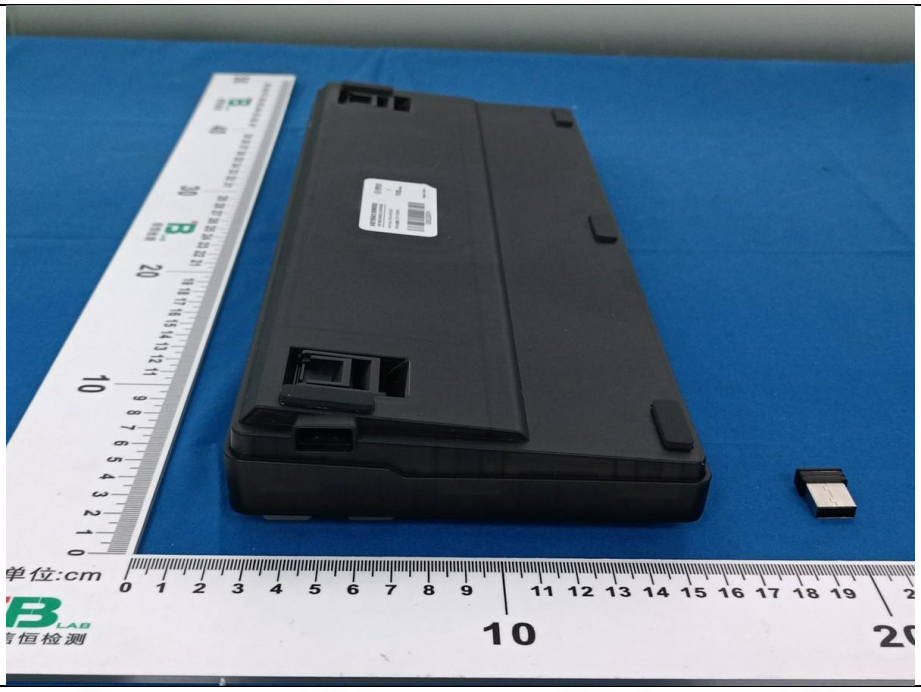
7 Test Setup Photos

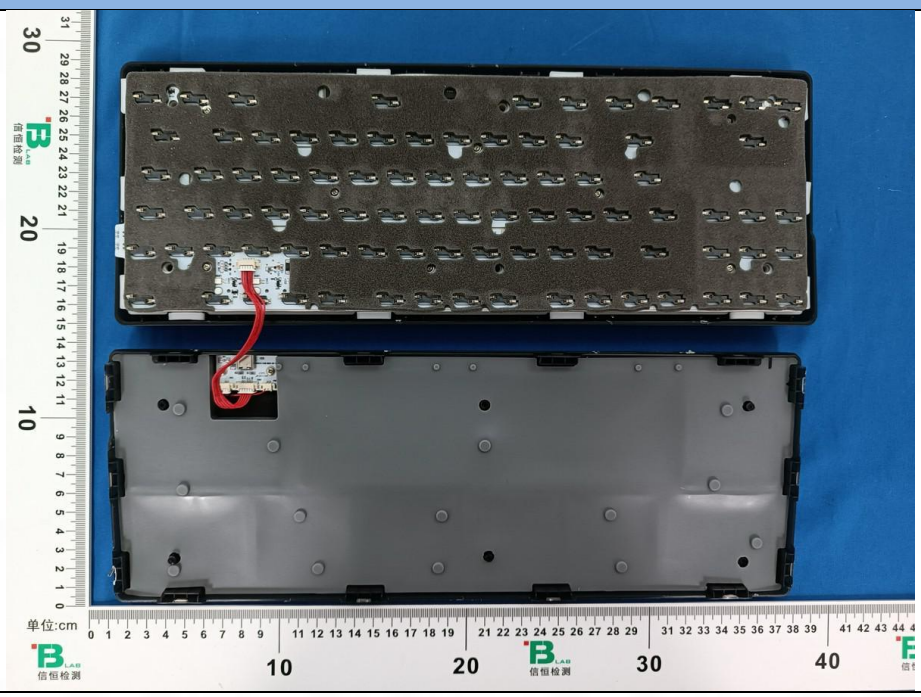
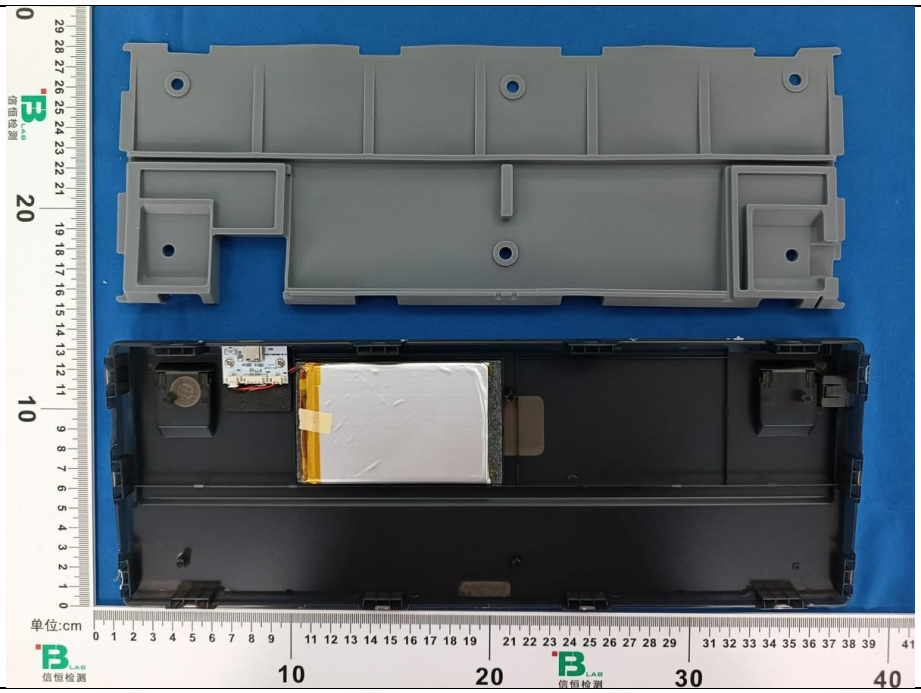
Conducted Emission at AC power line

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


Emissions in frequency bands (below 1GHz)

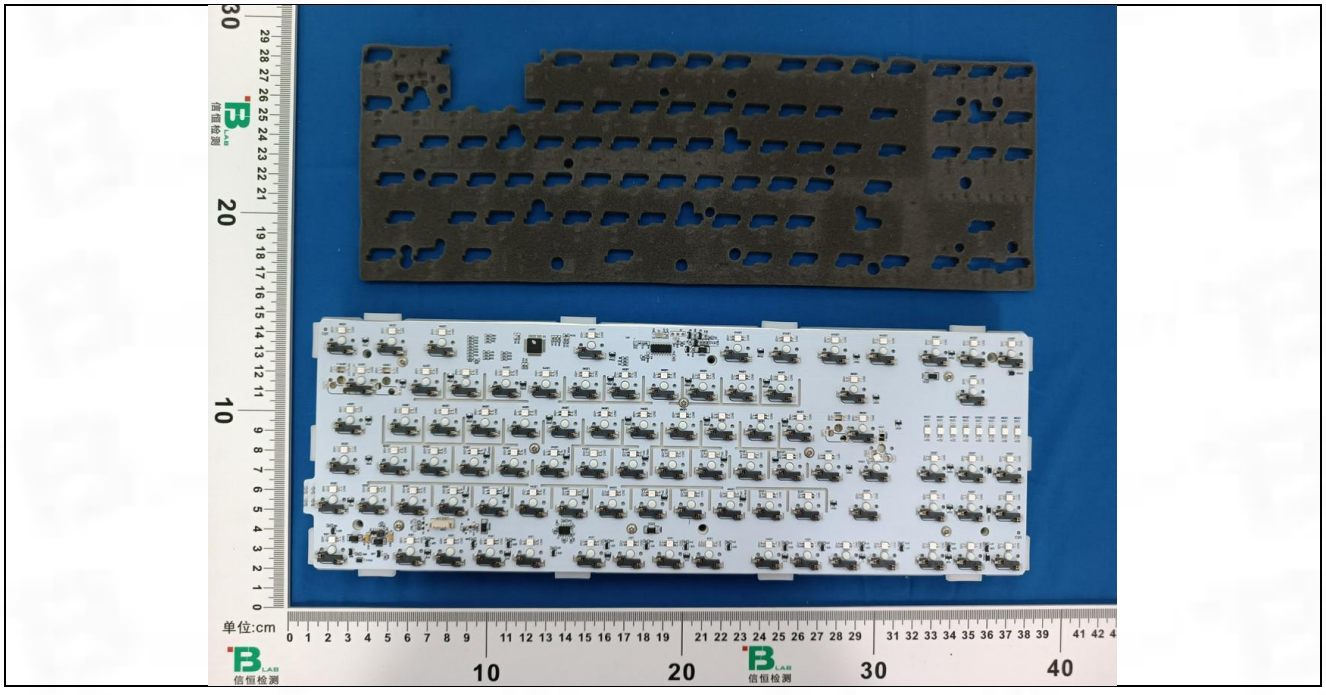

8 EUT Constructional Details (EUT Photos)

External



Internal




单位:cm
10
20
30
40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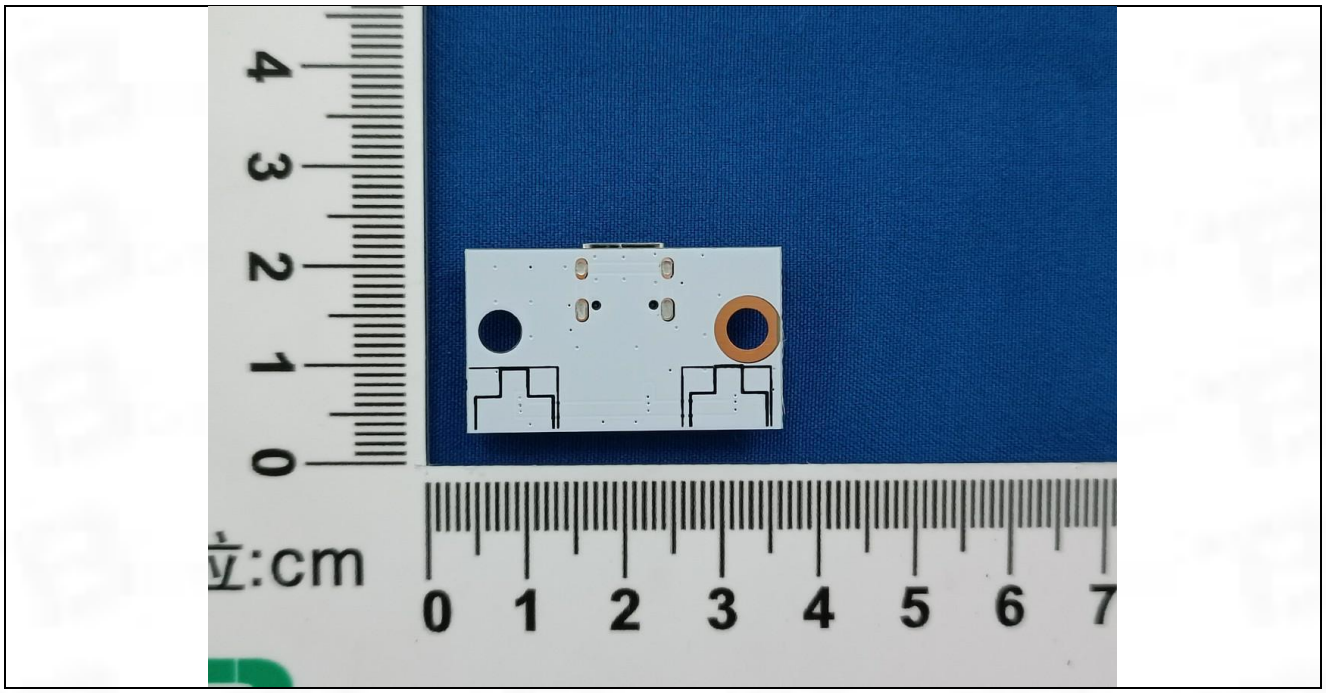

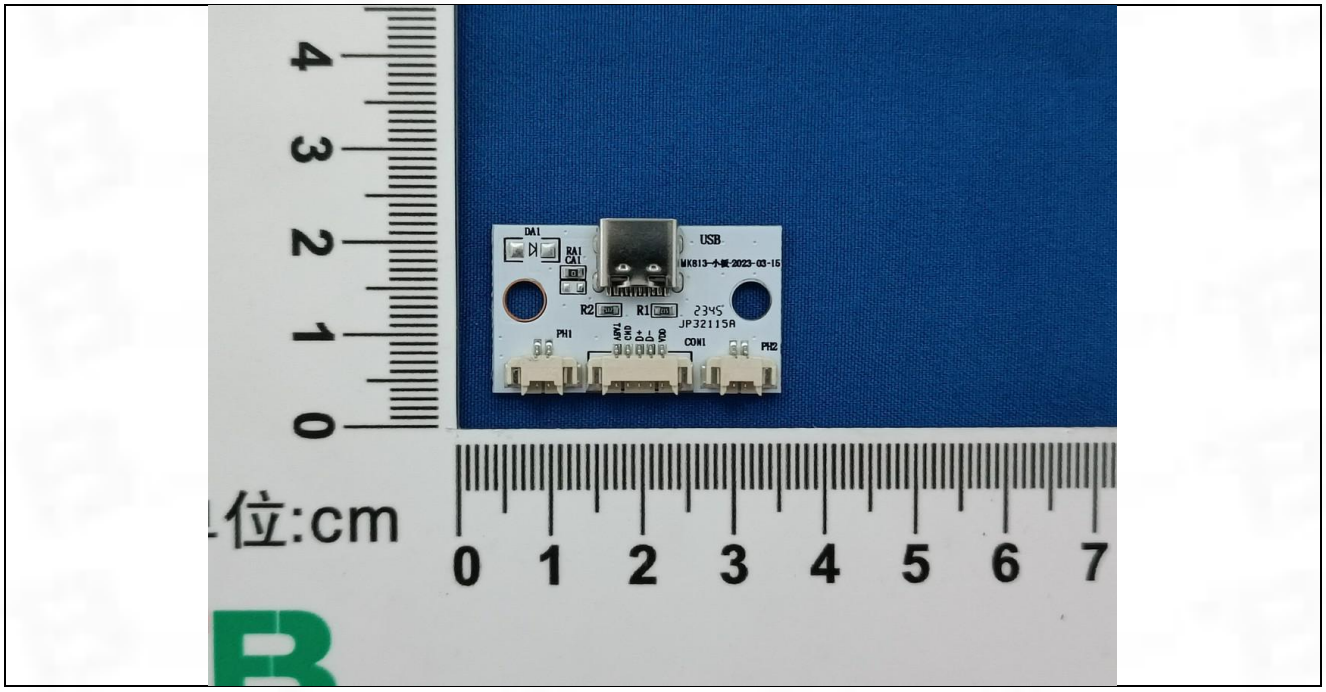

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®JS 606090 3.7 V
4000mAh 14.8Wh
2023H21A53 65488

Appendix

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1. Duty Cycle

1.1 Ant1

1.1.1 Test Result

Ant1							
Mode	TX Type	Frequency (MHz)	T_on (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	Max. DC Variation (%)
GFSK	SISO	2402	0.348	1.262	27.58	5.59	0.03
		2441	0.348	1.263	27.55	5.60	0.03
		2480	0.394	1.262	31.22	5.06	0.02

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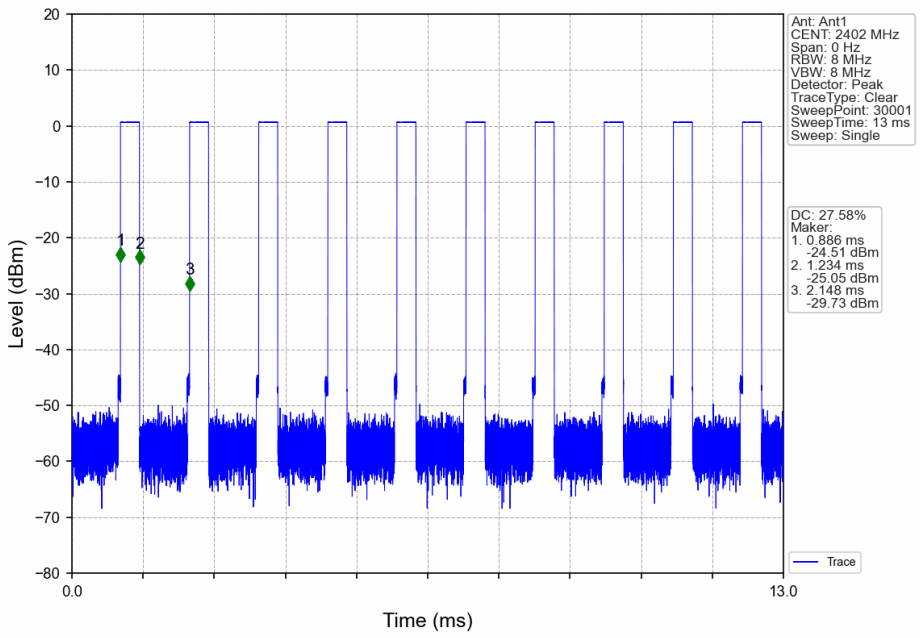
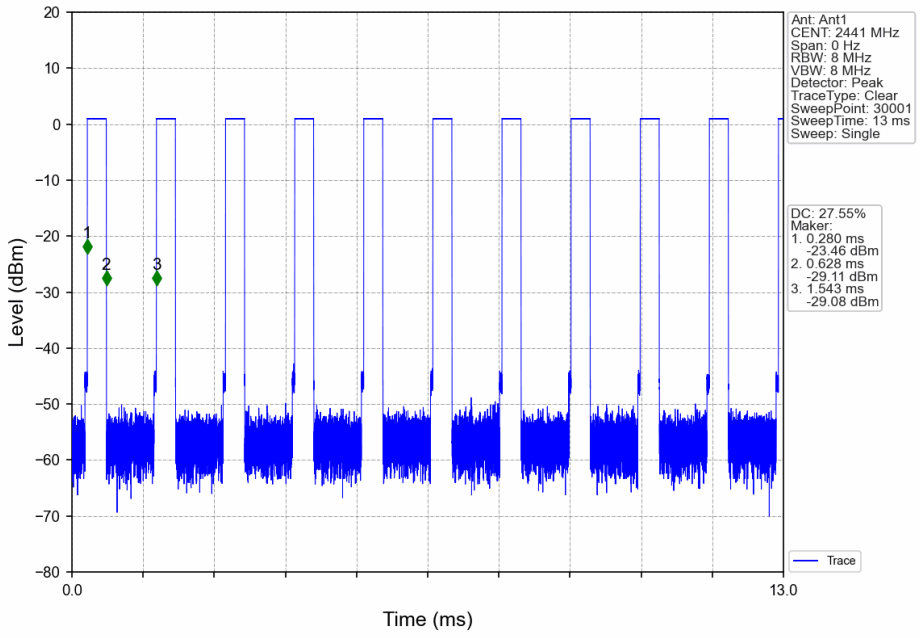
1.1.2 Test Graph

GFSK_LCH_2402MHz_Ant1_NTNV



GFSK_MCH_2441MHz_Ant1_NTNV



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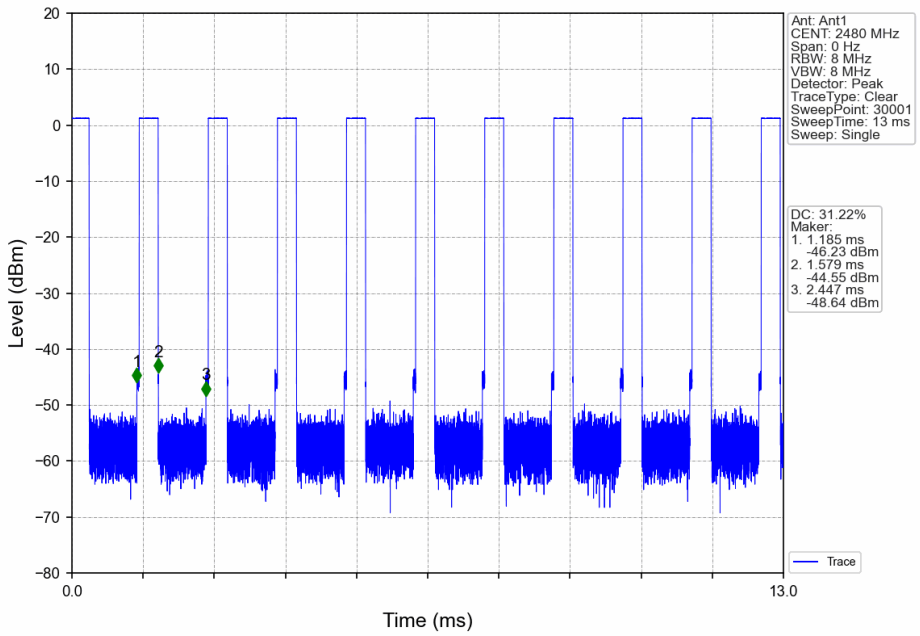
GFSK_HCH_2480MHz_Ant1_NTNV



2. Bandwidth

2.1 OBW

2.1.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	99% Occupied Bandwidth (MHz)		Verdict
				Result	Limit	
GFSK	SISO	2402	1	1.037	/	Pass
		2441	1	1.037	/	Pass
		2480	1	1.036	/	Pass

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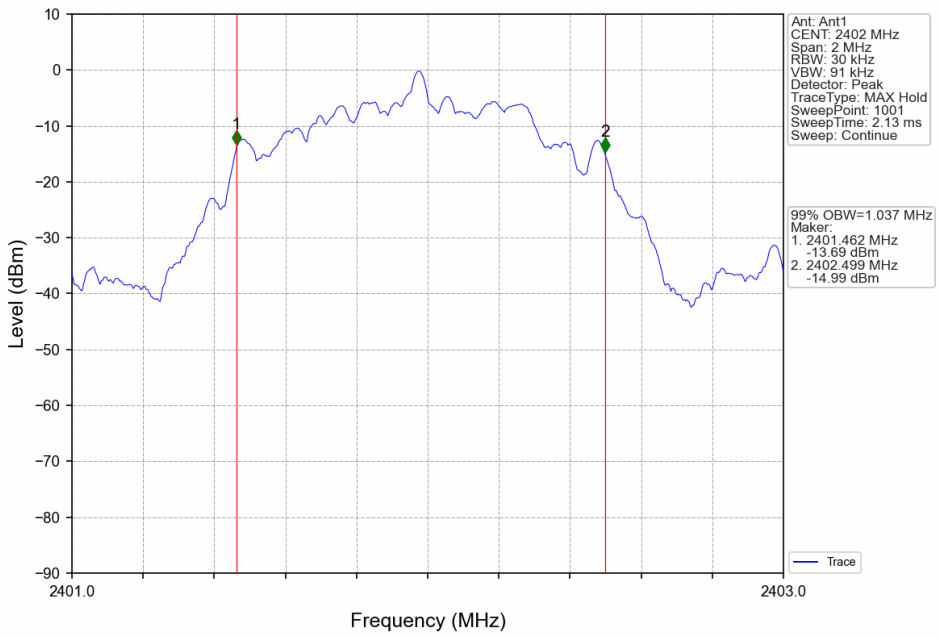
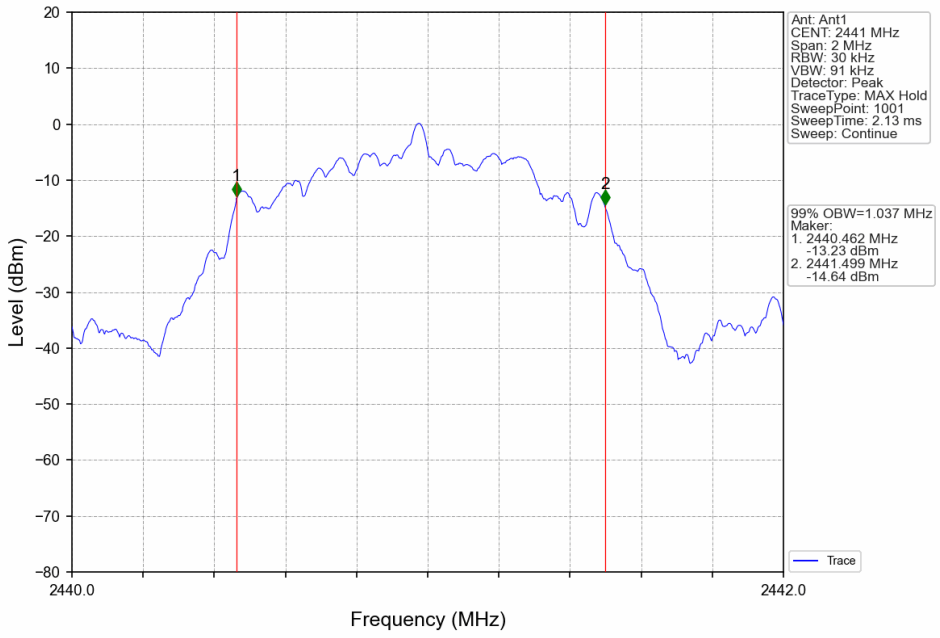
2.1.2 Test Graph

GFSK_LCH_2402MHz_Ant1_NTNV



GFSK_MCH_2441MHz_Ant1_NTNV



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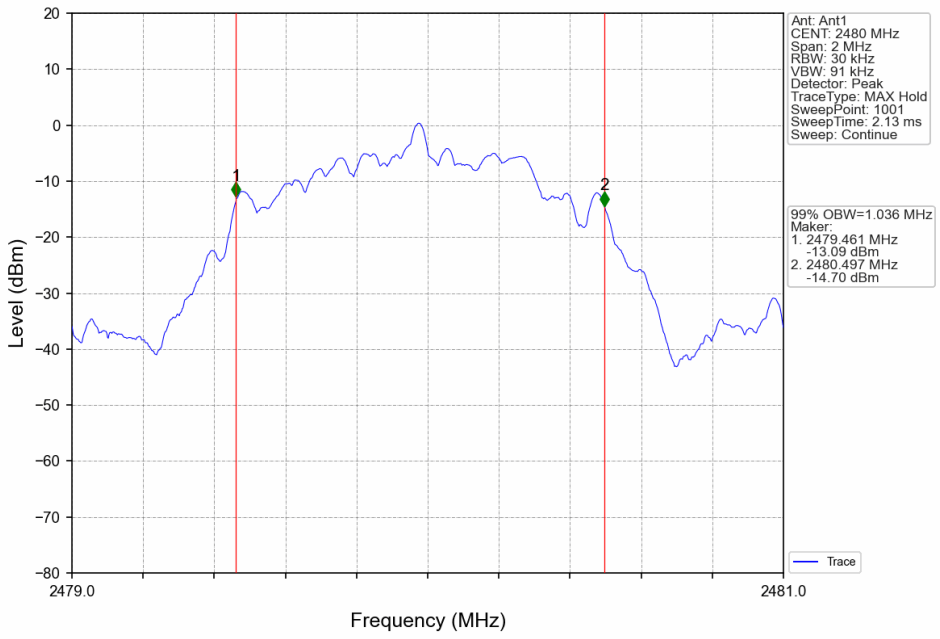
GFSK_HCH_2480MHz_Ant1_NTNV



2.2 6dB BW

2.2.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	6dB Bandwidth (MHz)		Verdict
				Result	Limit	
GFSK	SISO	2402	1	0.683	>=0.5	Pass
		2441	1	0.678	>=0.5	Pass
		2480	1	0.679	>=0.5	Pass

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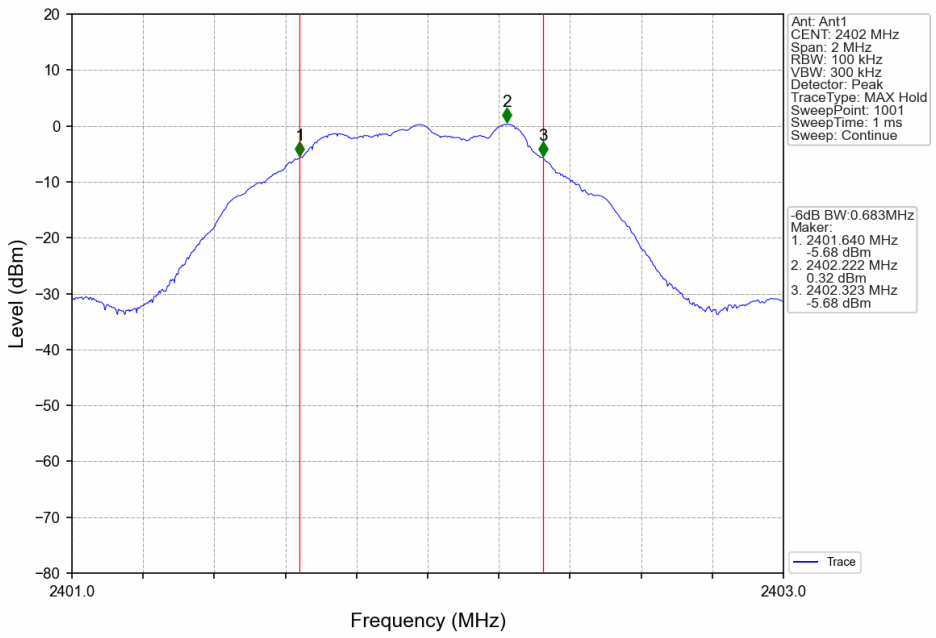
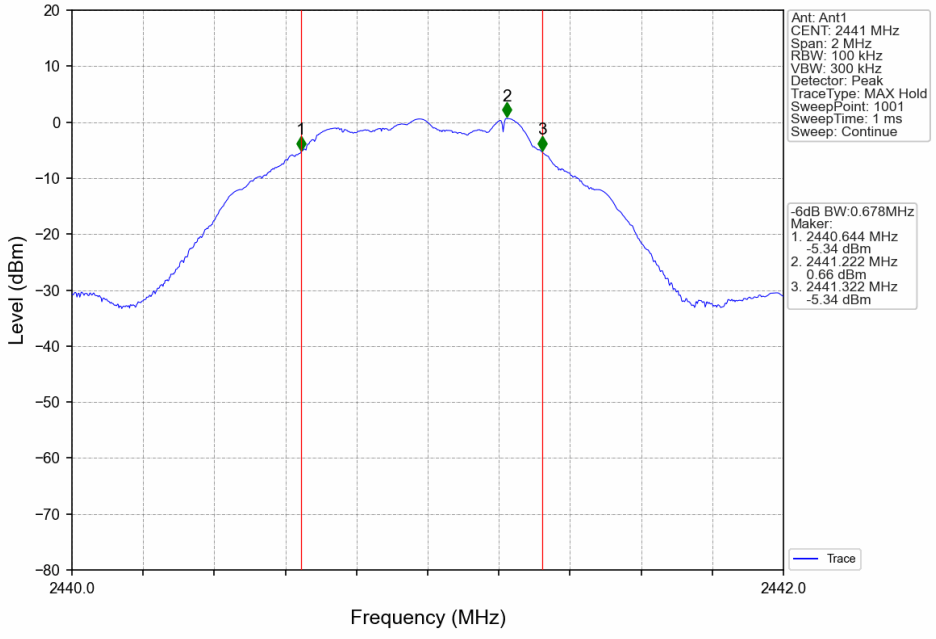
2.2.2 Test Graph

GFSK_LCH_2402MHz_Ant1_NTNV



GFSK_MCH_2441MHz_Ant1_NTNV



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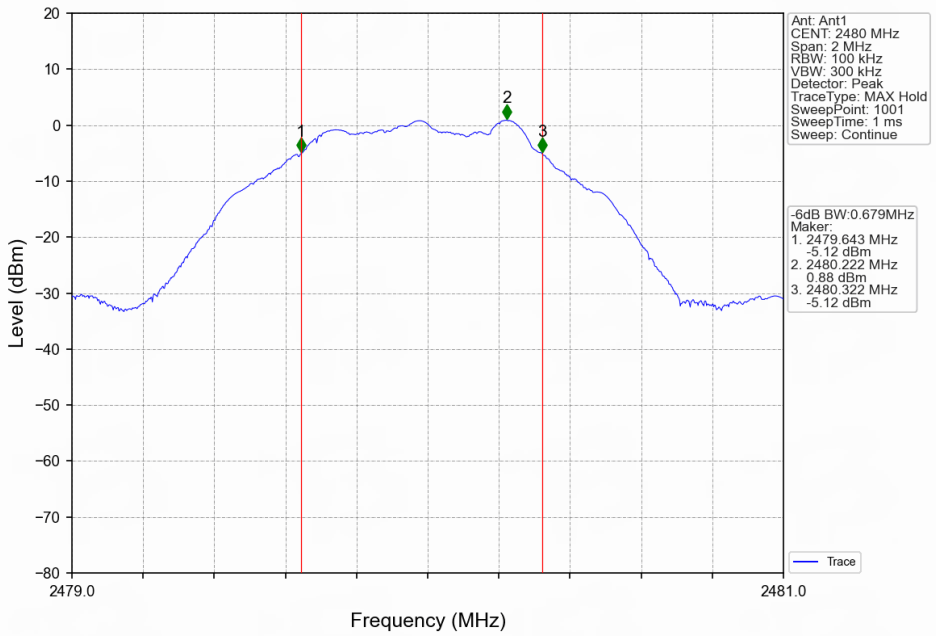
GFSK_HCH_2480MHz_Ant1_NTNV



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3. Maximum Conducted Output Power

3.1 Power

3.1.1 Test Result

Mode	TX Type	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)		Verdict
			ANT1	Limit	
GFSK	SISO	2402	0.64	<=30	Pass
		2441	0.98	<=30	Pass
		2480	1.20	<=30	Pass
Note1: Antenna Gain: Ant1: 0.34dBi;					

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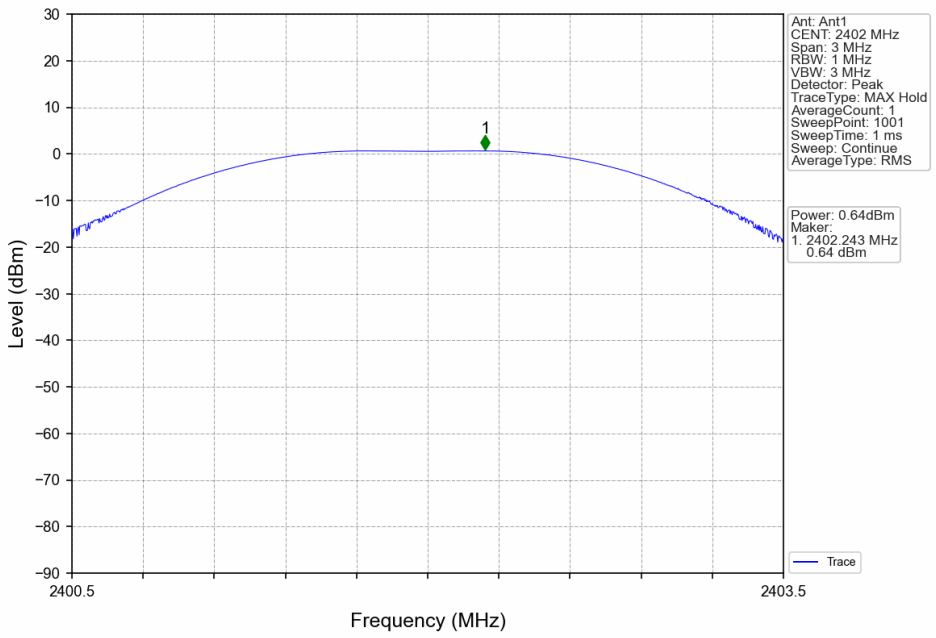
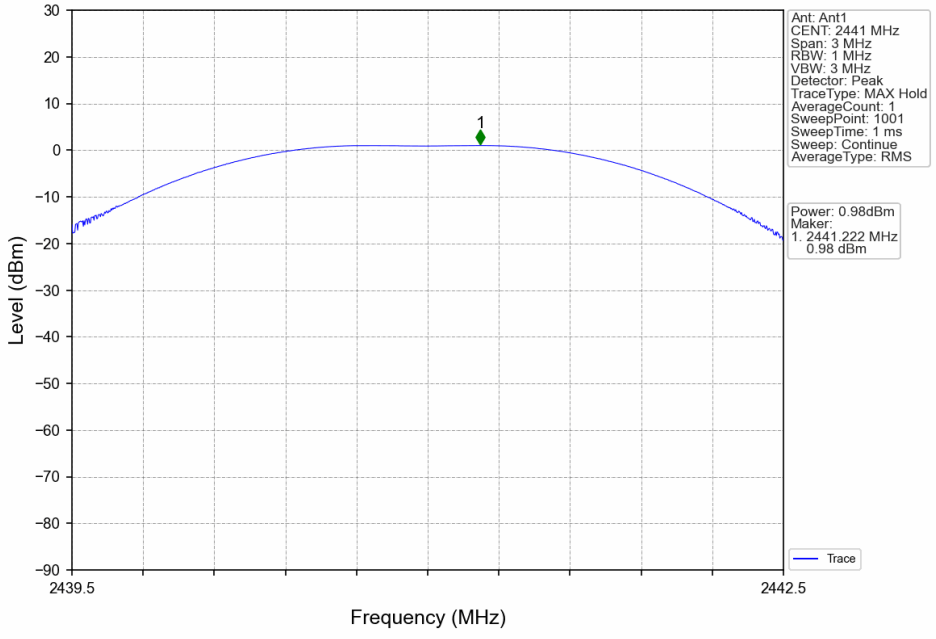
3.1.2 Test Graph

GFSK_LCH_2402MHz_Ant1_NTNV



GFSK_MCH_2441MHz_Ant1_NTNV



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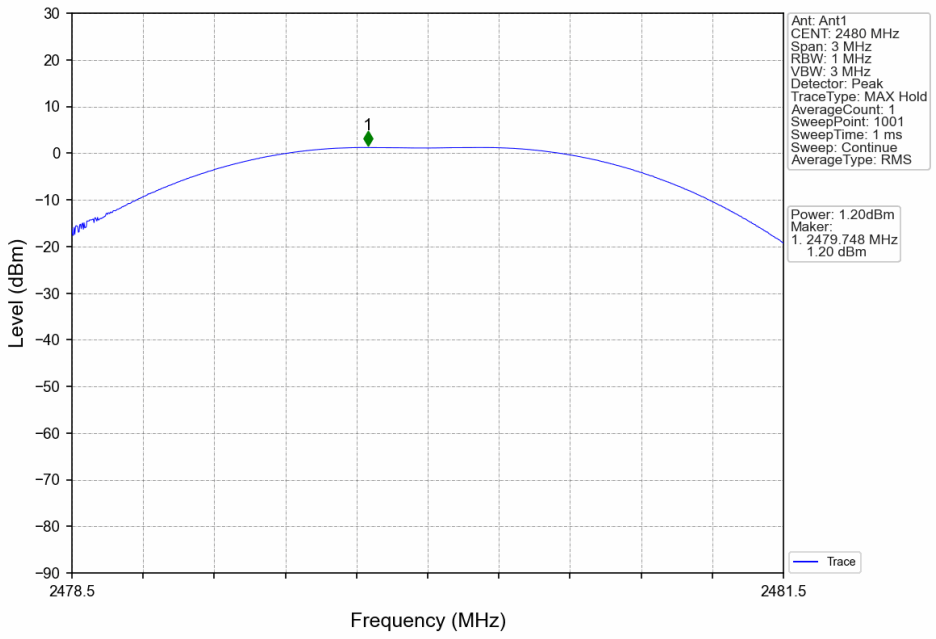
GFSK_HCH_2480MHz_Ant1_NTNV



4. Maximum Power Spectral Density

4.1 PSD

4.1.1 Test Result

Mode	TX Type	Frequency (MHz)	Maximum PSD (dBm/3kHz)		Verdict
			ANT1	Limit	
GFSK	SISO	2402	-13.30	<=8	Pass
		2441	-12.91	<=8	Pass
		2480	-12.77	<=8	Pass
Note1: Antenna Gain: Ant1: 0.34dBi;					

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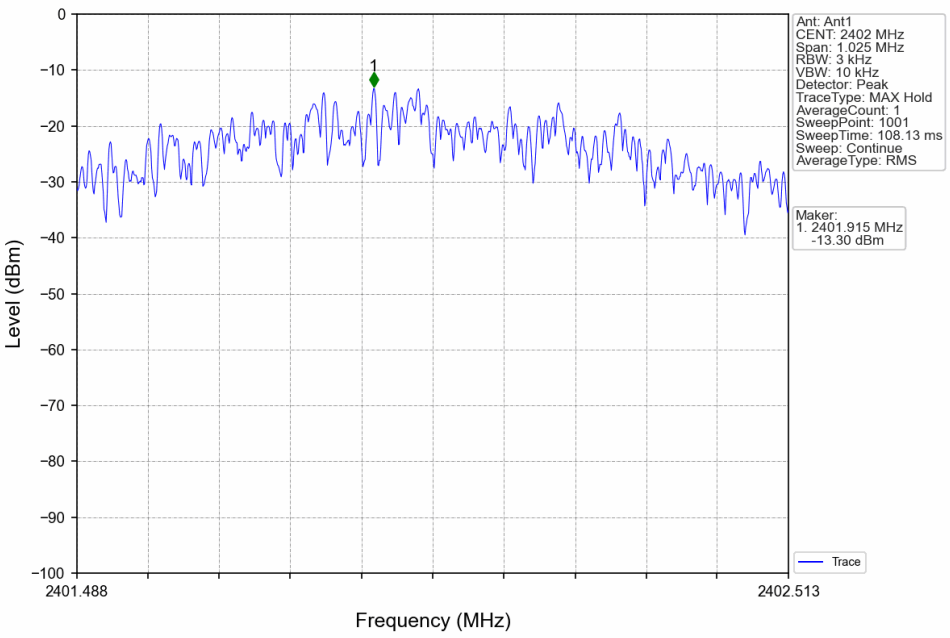
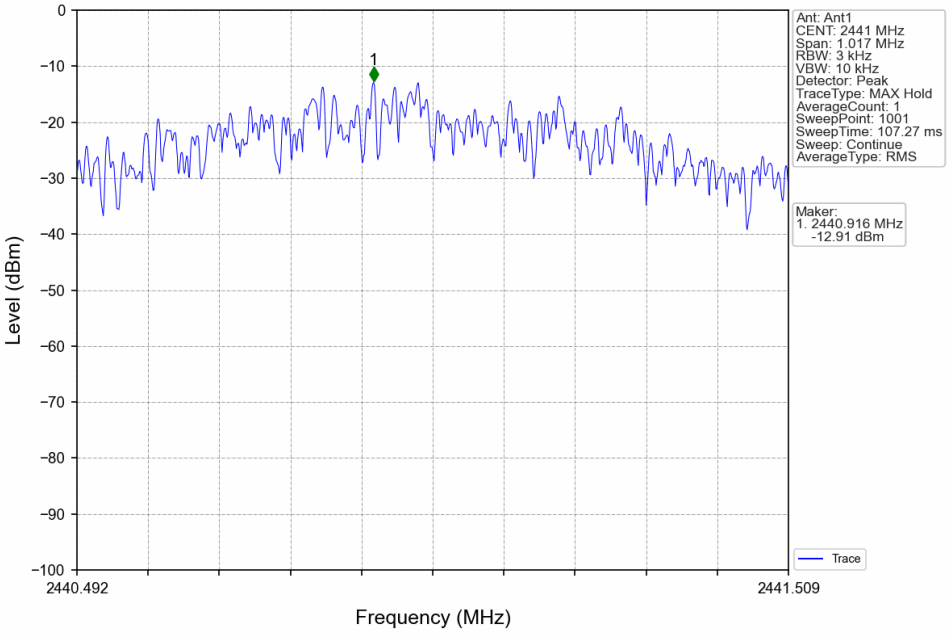
4.1.2 Test Graph

GFSK_LCH_2402MHz_Ant1_NTNV



GFSK_MCH_2441MHz_Ant1_NTNV



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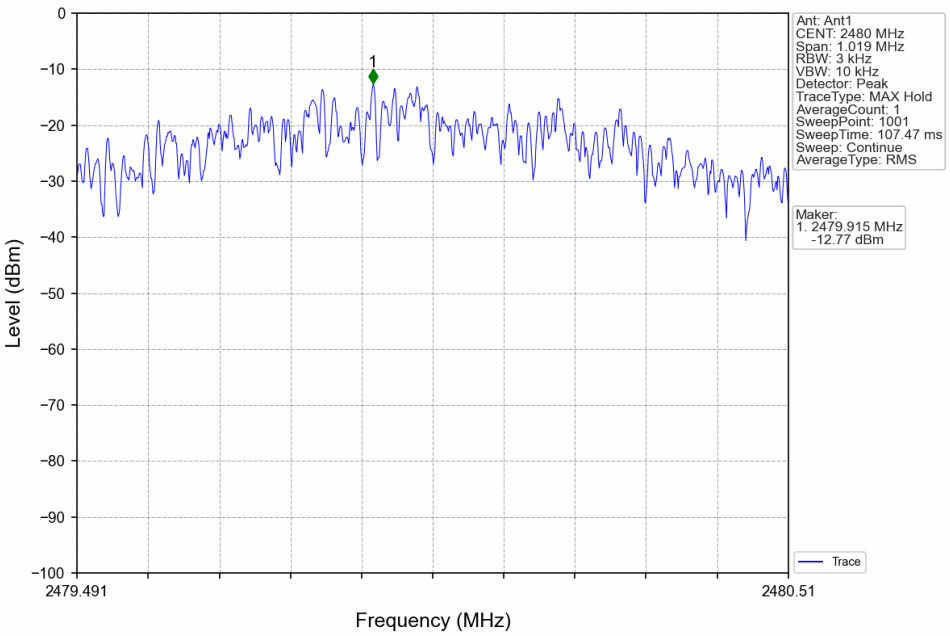
GFSK_HCH_2480MHz_Ant1_NTNV



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5. Unwanted Emissions In Non-restricted Frequency Bands

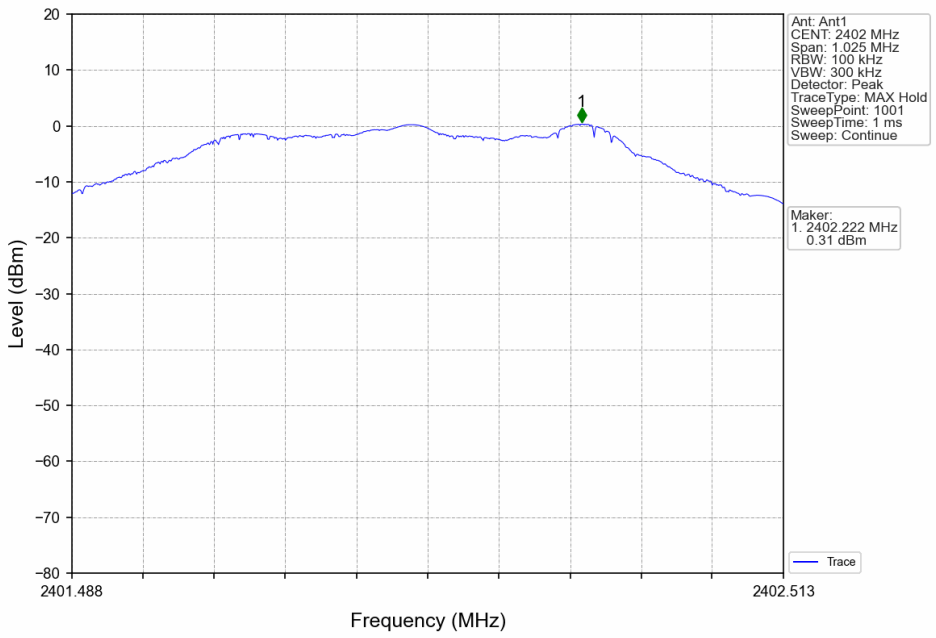
5.1 Ref

5.1.1 Test Result

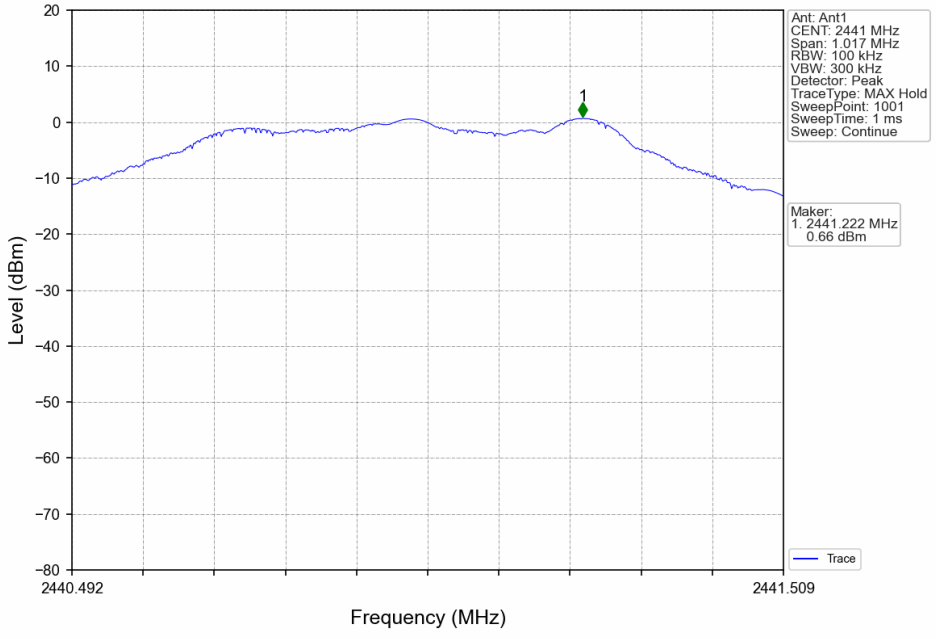
Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)
GFSK	SISO	2402	1	0.31
		2441	1	0.66
		2480	1	0.87
Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2013, the channel contains the maximum PSD level was used to establish the reference level.				

5.1.2 Test Graph

GFSK_LCH_2402MHz_Ant1_NTNV



GFSK_MCH_2441MHz_Ant1_NTNV



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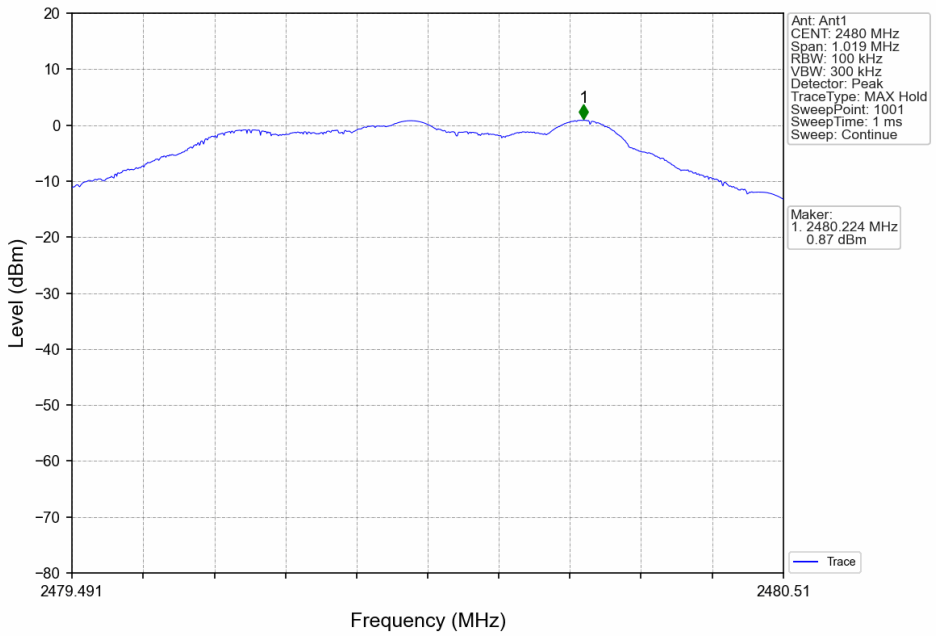
GFSK_HCH_2480MHz_Ant1_NTNV



5.2 CSE

5.2.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
GFSK	SISO	2402	1	0.87	-19.13	Pass
		2441	1	0.87	-19.13	Pass
		2480	1	0.87	-19.13	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.						

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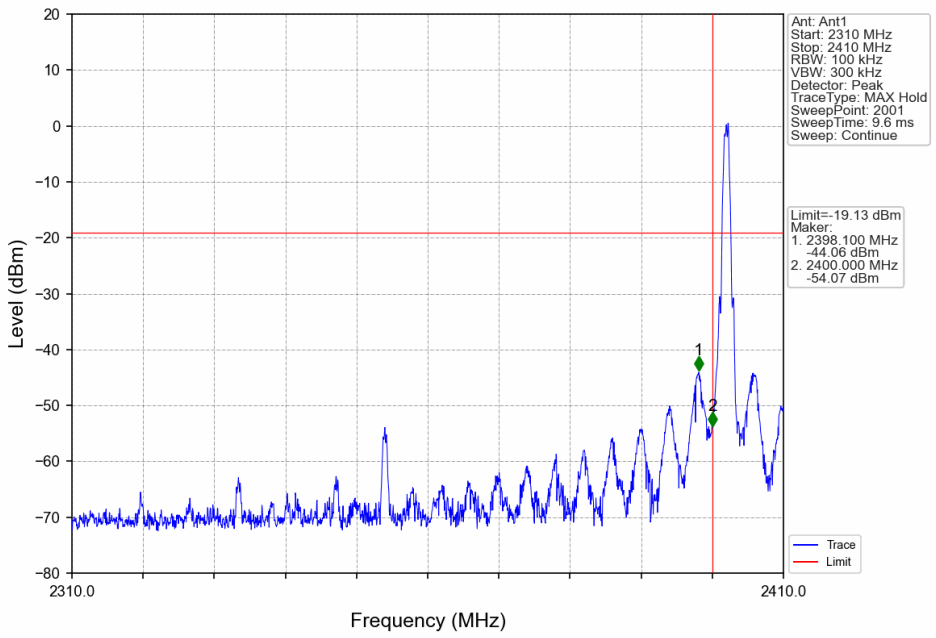
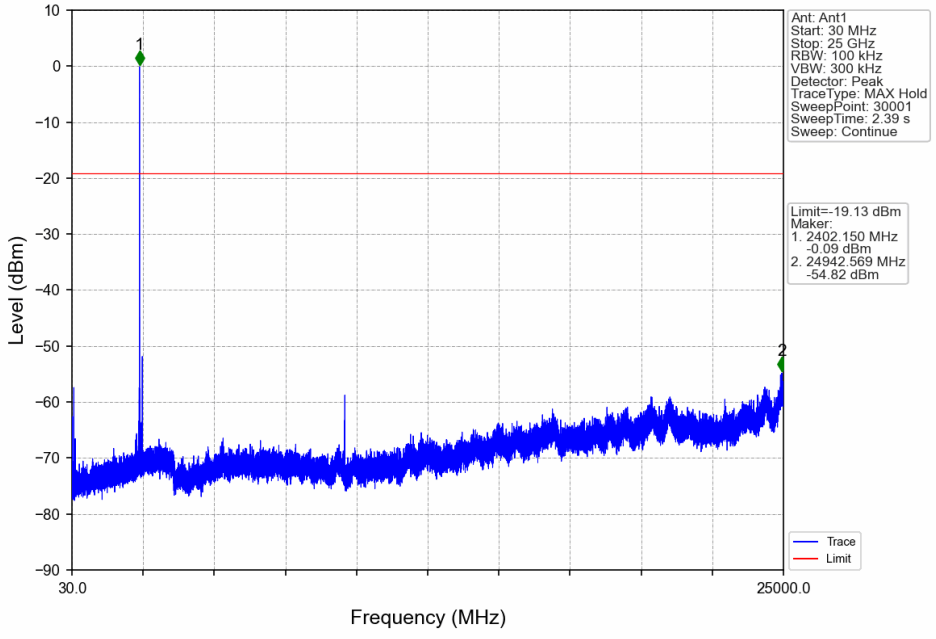
5.2.2 Test Graph

GFSK_LCH_2402MHz_Ant1_NTNV



GFSK_LCH_2402MHz_Ant1_NTNV



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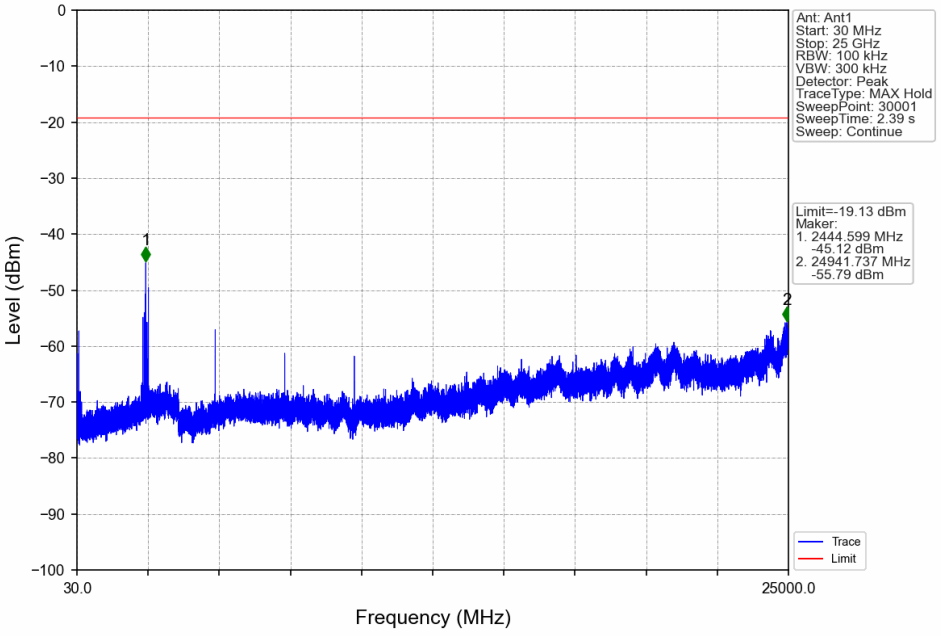
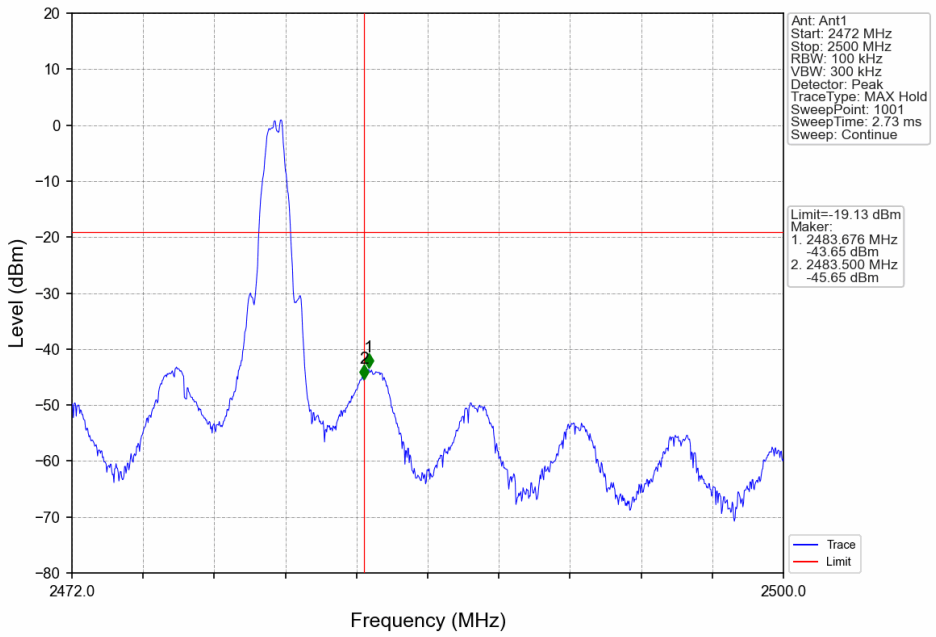
GFSK_MCH_2441MHz_Ant1_NTNV



GFSK_HCH_2480MHz_Ant1_NTNV



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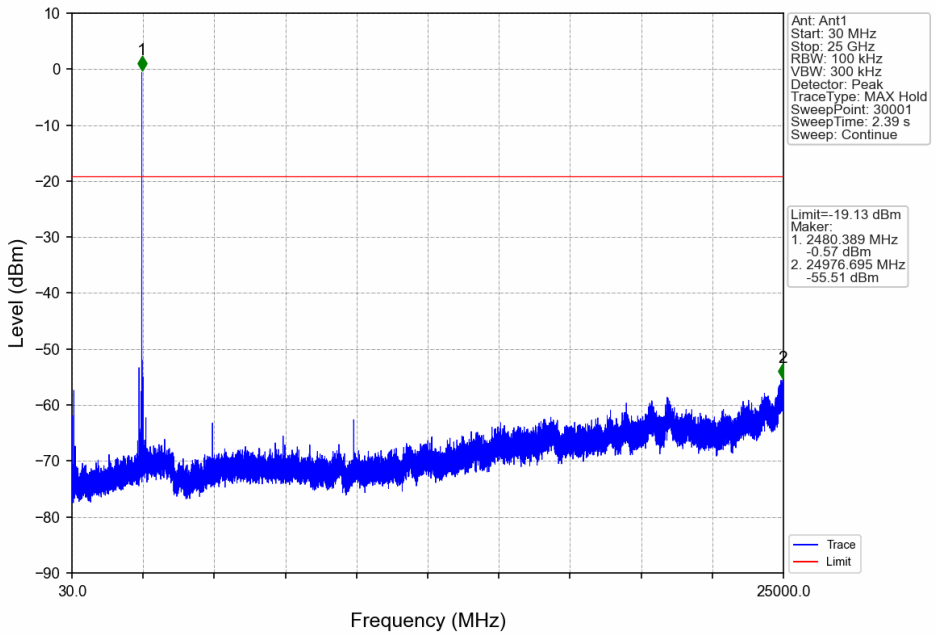
GFSK_HCH_2480MHz_Ant1_NTNV



6. Unwanted Emissions In Restricted Frequency Bands

6.1 RSE

6.1.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	Level of Unwanted Emissions (dBm)		Verdict
				Result	Limit	
GFSK	SISO	2402	1	Refer To Test Graph		Pass
		2441	1	Refer To Test Graph		Pass
		2480	1	Refer To Test Graph		Pass

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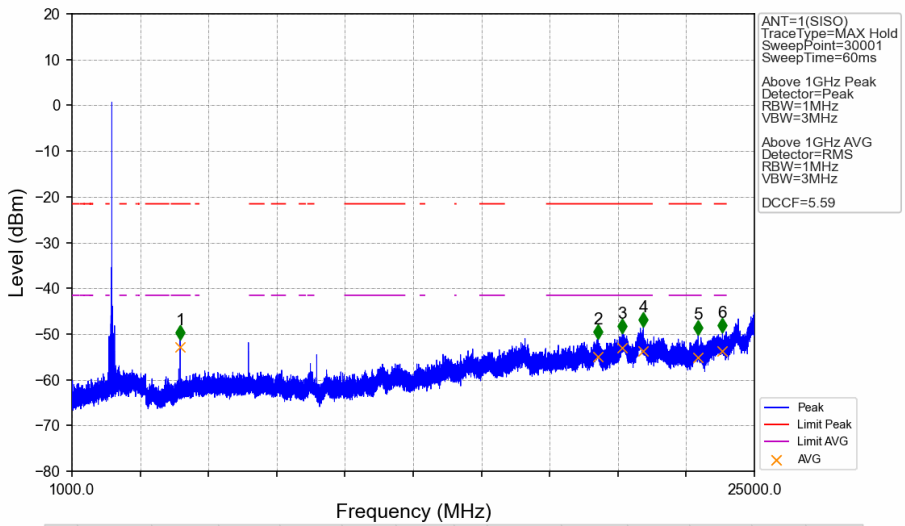
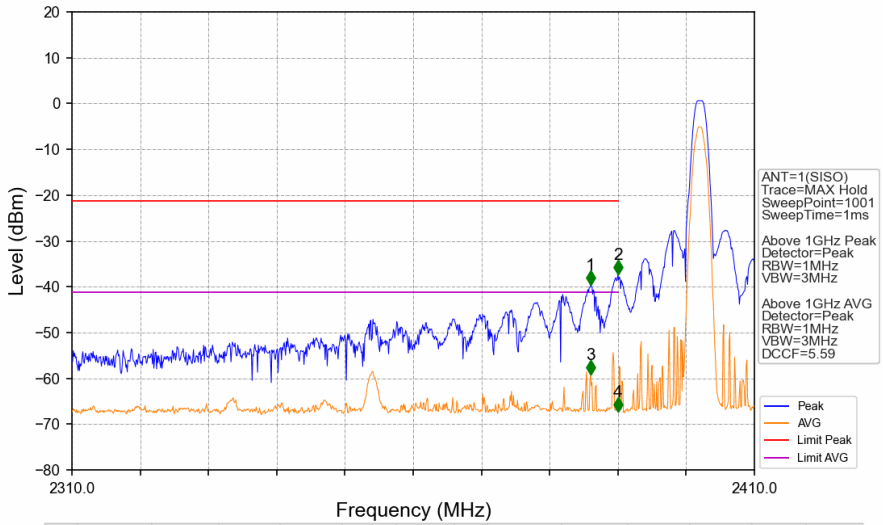
6.1.2 Test Graph

GFSK_LCH_2402MHz_Ant1_NTNV



No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark	No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark
1	4803.2	-51.31	-21.20	29.77	Pass	Peak	7	4803.2	-52.77	-41.20	11.23	Pass	AVG
2	19503.2	-51.11	-21.20	29.57	Pass	Peak	8	19503.2	-54.92	-41.20	13.38	Pass	AVG
3	20355.2	-49.80	-21.20	28.26	Pass	Peak	9	20355.2	-53.06	-41.20	11.53	Pass	AVG
4	21093.6	-48.43	-21.20	26.89	Pass	Peak	10	21093.6	-53.80	-41.20	12.26	Pass	AVG
5	23020.8	-50.13	-21.20	28.59	Pass	Peak	11	23020.8	-55.10	-41.20	13.56	Pass	AVG
6	23876.8	-49.70	-21.20	28.16	Pass	Peak	12	23876.8	-53.68	-41.20	12.14	Pass	AVG

GFSK_LCH_2402MHz_Ant1_NTNV



No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark	No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark
1	2386.000	-39.66	-21.20	18.12	Pass	Peak	3	2386.000	/	-21.20	/	/	AVG
2	2390.000	-37.40	-21.20	15.86	Pass	Peak	4	2390.000	/	-21.20	/	/	AVG

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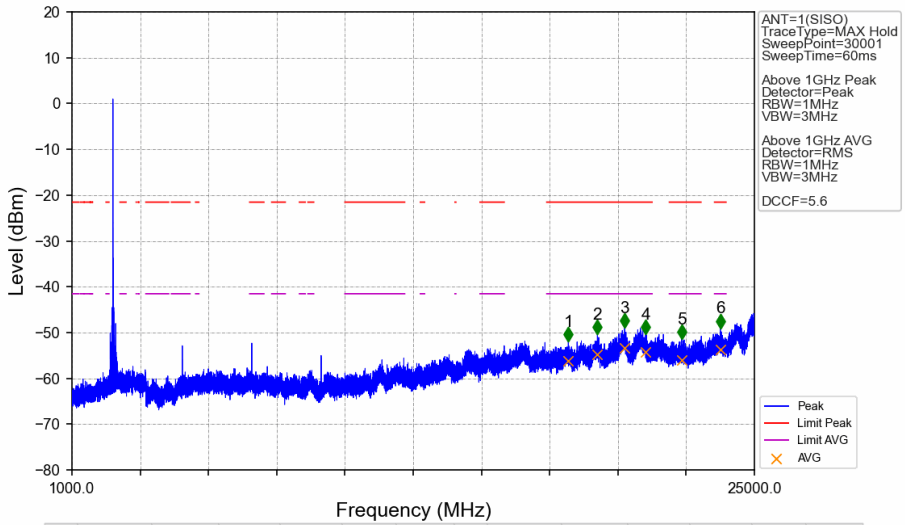
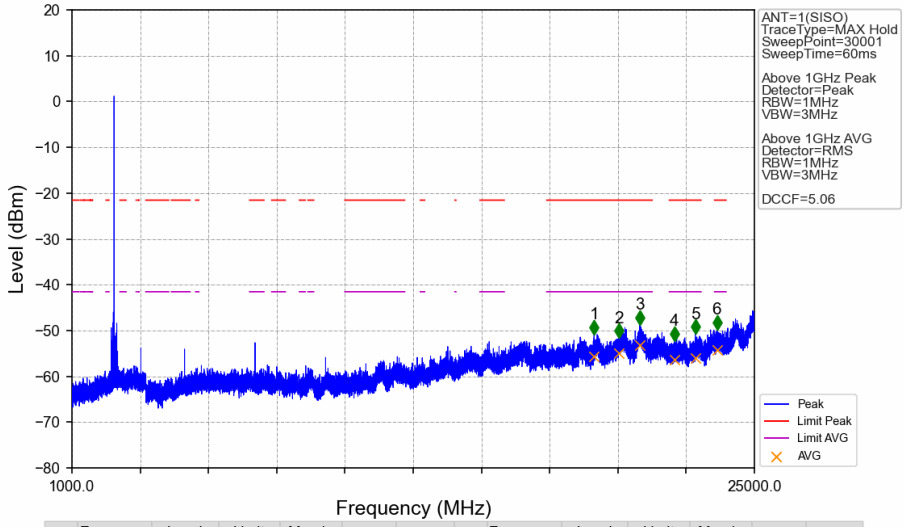
GFSK_MCH_2441MHz_Ant1_NTNV



No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark	No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark
1	18456	-51.94	-21.20	30.40	Pass	Peak	7	18456	-56.26	-41.20	14.72	Pass	AVG
2	19478.4	-50.33	-21.20	28.79	Pass	Peak	8	19478.4	-54.72	-41.20	13.18	Pass	AVG
3	20436	-48.99	-21.20	27.46	Pass	Peak	9	20436	-53.34	-41.20	11.80	Pass	AVG
4	21172.8	-50.44	-21.20	28.90	Pass	Peak	10	21172.8	-54.31	-41.20	12.77	Pass	AVG
5	22440.8	-51.43	-21.20	29.89	Pass	Peak	11	22440.8	-56.01	-41.20	14.47	Pass	AVG
6	23802.4	-49.05	-21.20	27.52	Pass	Peak	12	23802.4	-53.80	-41.20	12.26	Pass	AVG

GFSK_HCH_2480MHz_Ant1_NTNV



No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark	No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark
1	19361.6	-50.84	-21.20	29.30	Pass	Peak	7	19361.6	-55.69	-41.20	14.15	Pass	AVG
2	20245.6	-51.62	-21.20	30.08	Pass	Peak	8	20245.6	-55.00	-41.20	13.46	Pass	AVG
3	20968	-48.69	-21.20	27.15	Pass	Peak	9	20968	-53.15	-41.20	11.61	Pass	AVG
4	22187.2	-52.22	-21.20	30.68	Pass	Peak	10	22187.2	-56.41	-41.20	14.87	Pass	AVG
5	22920	-50.74	-21.20	29.20	Pass	Peak	11	22920	-55.98	-41.20	14.44	Pass	AVG
6	23681.6	-49.75	-21.20	28.21	Pass	Peak	12	23681.6	-54.30	-41.20	12.76	Pass	AVG

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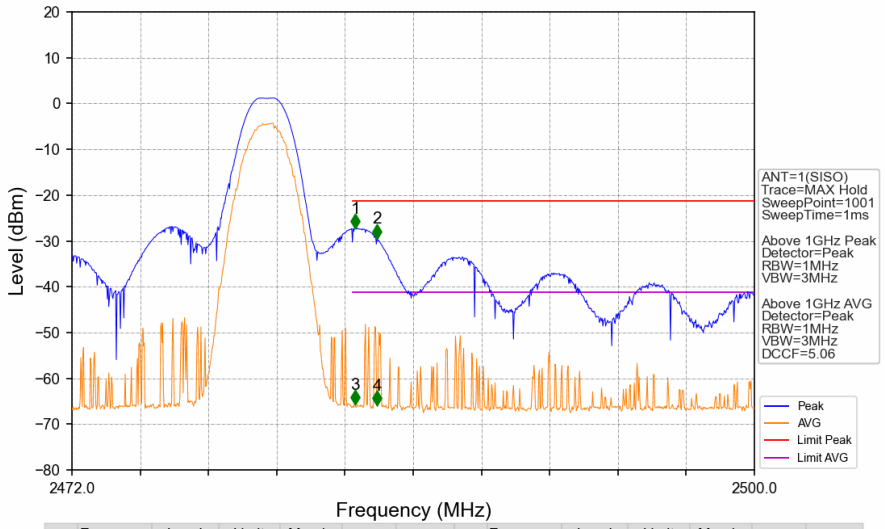
GFSK_HCH_2480MHz_Ant1_NTNV



No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark	No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark
1	2483.620	-27.21	-21.20	5.67	Pass	Peak	3	2483.620	/	-21.20	/	/	AVG
2	2484.516	-29.48	-21.20	7.94	Pass	Peak	4	2484.516	/	-21.20	/	/	AVG

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7. Form731

7.1 Form731

7.1.1 Test Result

Lower Freq (MHz)	High Freq (MHz)	MAX Power (W)	MAX Power (dBm)
2402	2480	0.0013	1.20

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