TEST REPORT

Application No.:	GZCR2404000380AT
Applicant:	Cellular Tracking Technologies LLC
Address of Applicant:	1293 Hornet Road, Suite #1, Rio Grande, New Jersey 08242, United States
Manufacturer:	Cellular Tracking Technologies LLC
Address of Manufacturer:	1293 Hornet Road, Suite #1, Rio Grande, New Jersey 08242, United States
Factory:	Cellular Tracking Technologies LLC
Address of Factory:	1293 Hornet Road, Suite #1, Rio Grande, New Jersey 08242, United States
Product Name:	BluMorpho
Model No.:	BTGPT
Trade Mark:	BluMorpho
Standard(s) :	47 CFR Part 15, Subpart C 15.247
Date of Receipt:	2024-04-18
Date of Test:	2024-05-10 to 2024-06-04
Date of Issue:	2024-06-11
Test Result:	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Ricky Liu
Manager

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Revision Record			
Version	**Report No.**	**Date**	**Remark**
01	GZCR240400038001	2024-06-11	Original

Authorized for issue by:				
		Damon. Guan **Damon Guan/Project Engineer**		
		vico cui **Vico Cui/Reviewer**		

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2 Test Summary

Radio Spectrum Technical Requirement				
Item	**Standard**	**Method**	**Requirement**	**Result**
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)	Pass

Radio Spectrum Matter Part				
Item	**Standard**	**Method**	**Requirement**	**Result**
Radiated Emissions which fall in the restricted bands	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.12	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass **
Radiated Spurious Emissions Below 1GHz		ANSI C63.10 (2013) Section 6.4,6.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions Above 1GHz		ANSI C63.10 (2013) Section 6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass **
Conducted Peak Output Power		ANSI C63.10 (2013) Section 11.9.1	47 CFR Part 15, Subpart C 15.247(b)(3)	Pass
Minimum 6dB Bandwidth		ANSI C63.10 (2013) Section 11.8.1	47 CFR Part 15, Subpart C 15.247a(2)	Pass
Power Spectrum Density		ANSI C63.10 (2013) Section 11.10.2	47 CFR Part 15, Subpart C 15.247(e)	Pass
Conducted Band Edges Measurement		ANSI C63.10 (2013) Section 11.13.3.2	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Spurious Emissions		ANSI C63.10 (2013) Section 11.11	47 CFR Part 15, Subpart C 15.247(d)	Pass

Note:

E.U.T./EUT means Equipment Under Test.

Pass means the test result passed the test standard requirement, please find the detailed decision rule in the report relative section.

**: The EUT passed Radiated Emissions which fall in the restricted bands and Radiated Spurious Emissions Above 1GHz test after modification.

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3 Contents

Page

1 Cover Page **1**

2 Test Summary **3**

3 Contents **4**

4 General Information **6**

4.1 Details of E.U.T. 6
4.2 Description of Support Units 6
4.3 Measurement Uncertainty 6
4.4 Test Location 7
4.5 Test Facility 7
4.6 Deviation from Standards 7
4.7 Abnormalities from Standard Conditions 7

5 Equipment List **8**

6 Radio Spectrum Technical Requirement **10**

6.1 Antenna Requirement 10
6.1.1 Test Requirement: 10
6.1.2 Conclusion 10

7 Radio Spectrum Matter Test Results **11**

7.1 Radiated Emissions which fall in the restricted bands 11
7.1.1 E.U.T. Operation 11
7.1.2 Test Mode Description 11
7.1.3 Test Setup Diagram 12
7.1.4 Measurement Procedure and Data 12
7.2 Radiated Spurious Emissions Below 1GHz 17
7.2.1 E.U.T. Operation 17
7.2.2 Test Mode Description 17
7.2.3 Test Setup Diagram 17
7.2.4 Measurement Procedure and Data 18
7.3 Radiated Spurious Emissions Above 1GHz 21
7.3.1 E.U.T. Operation 21
7.3.2 Test Mode Description 21
7.3.3 Test Setup Diagram 21
7.3.4 Measurement Procedure and Data 22
7.4 Conducted Peak Output Power 29
7.4.1 E.U.T. Operation 29
7.4.2 Test Mode Description 29
7.4.3 Test Setup Diagram 29
7.4.4 Measurement Procedure and Data 29
7.5 Minimum 6dB Bandwidth 30
7.5.1 E.U.T. Operation 30
7.5.2 Test Mode Description 30
7.5.3 Test Setup Diagram 30

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7.5.4 Measurement Procedure and Data 30
7.6 Power Spectrum Density 31
7.6.1 E.U.T. Operation 31
7.6.2 Test Mode Description 31
7.6.3 Test Setup Diagram 31
7.6.4 Measurement Procedure and Data 31
7.7 Conducted Band Edges Measurement 32
7.7.1 E.U.T. Operation 32
7.7.2 Test Mode Description 32
7.7.3 Test Setup Diagram 32
7.7.4 Measurement Procedure and Data 32
7.8 Conducted Spurious Emissions 33
7.8.1 E.U.T. Operation 33
7.8.2 Test Mode Description 33
7.8.3 Test Setup Diagram 33
7.8.4 Measurement Procedure and Data 33

8 Test Setup Photo 34

9 EUT Constructional Details (EUT Photos) 35

10 Appendix 36

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4 General Information

4.1 Details of E.U.T.

Power supply:	Powered by 3V battery refer to section 4.2.
Cable(s):	DC input cable
Operation Frequency:	37 advertising channel: 2402MHz; 38 advertising channel: 2426MHz; 39 advertising channel: 2480MHz
Modulation Type:	GFSK
Number of Channels:	3
Antenna Gain:	-0.30 dBi according to the antenna test report SZOA2407000161AT01

Remark: The information in this section is provided by the applicant or manufacturer, SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
USB Cable (1.0m length)	/	/	/
Tester board	/	/	/
Battery	Offered by applicant	/	/
Note Book Computer	LENOVO	ThinkPad T490	PF1D1MVJ

4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Radiated Emissions which fall in the restricted bands	±5.00dB (30MHz-1GHz; 3m);±4.38dB (30MHz-1GHz; 10m);± 5.12dB (1GHz-6GHz); ±5.38dB (6GHz-18GHz); ±5.61dB(18GHz-40GHz)
Radiated Spurious Emissions Below 1GHz	±5.00dB (3m); ±4.38dB (10m)
Radiated Spurious Emissions Above 1GHz	±5.12dB (1GHz-6GHz); ±5.38dB (6GHz-18GHz); ±5.61dB(18GHz-40GHz)
Conducted Peak Output Power	± 0.75dB
Minimum 6dB Bandwidth	± 3%
Power Spectrum Density	± 2.84dB
Conducted Band Edges Measurement	± 0.75dB
Conducted Spurious Emissions	± 0.75dB

Remark:

The U_{lab} (lab Uncertainty) is less than $U_{cispr/etsi}$ (CISPR/ETSI Uncertainty), so the test results

– compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;

– non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

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4.4 Test Location

All tests were performed at:

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Tel: +86 20 82155555

No tests were sub-contracted.

4.5 Test Facility

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

- **ACMA**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian/New Zealand Regulatory Compliance Mark (RCM).

- **SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO**

Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

- **FCC Recognized Accredited Test Firm(Registration No.: 486818)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation Number: CN5016, Test Firm Registration Number: 486818.

- **ISED (Registration No.: 4620B, CAB identifier: CN0052)**

SGS-CSTC Standards Technical Services Co., Ltd., has been registered by Innovation Science and Economic Development Canada for Wireless Device Testing laboratories to test to Canadian radio equipment requirements. Registration No. 4620B, CAB identifier: CN0052.

- **VCCI (Registration No.: R-12460, C-12584, G-20107 and T-11179)**

The 10m Semi-anechoic chamber, 966 Anechoic Chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-12460, C-12584, G-20107 and T-11179 respectively.

- **CBTL (Lab Code: TL129)**

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2017, the Basic Rules, IECEE 01 and Rules of procedure IECEE 02, and the relevant IECEE CB-Scheme Operational documents.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

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5 Equipment List

Radiated Emissions which fall in the restricted bands					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2023-11-10	2024-11-09
EMI Test Receiver (10Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2023-12-15	2024-12-14
Chamber cable (Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2022-08-24	2024-08-23
Horn Antenna (1GHz-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2022-09-23	2025-09-22
Horn Antenna (14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2023-06-18	2026-06-17
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2023-08-23	2024-08-22
MXE EMI Receiver (10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2023-10-20	2024-10-19
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2023-12-20	2026-12-19
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A

Radiated Spurious Emissions Below 1GHz					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
966 Anechoic Chamber	Shenzhen C.R.T	CRTSGSSAC966	EMC2230	2022-04-12	2025-04-11
EMI Test Receiver(1Hz-8GHz)	Rohde & Schwarz	ESW8	EMC2229	2024-02-19	2025-02-18
Amplifier(9k-1000MHz)	SONOMA	310	EMC2237	2024-03-22	2025-03-21
TRILOG Broadband Antenna（25M-2GHz)	SCHWRZBECK	VULB 9168	EMC2238	2022-04-20	2025-04-19
Coaxial Cable	Mirco-COAX UTIFLEX ve	LA2-C125-8000	EMC2239	2023-06-14	2025-06-13
Test Software E3	Audix	Ver.6.191211	GZE100-81	N/A	N/A
Active Loop Antenna-RED	ETS-Lindgren	6502	EMC2190	2024-04-08	2026-04-07

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Radiated Spurious Emissions Above 1GHz					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2023-11-10	2024-11-09
EMI Test Receiver (10Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2023-12-15	2024-12-14
Chamber cable (Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2022-08-24	2024-08-23
Horn Antenna (1GHz-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2022-09-23	2025-09-22
Horn Antenna (14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2023-06-18	2026-06-17
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2023-11-10	2024-11-09
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2023-08-23	2024-08-22
MXE EMI Receiver (10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2023-10-20	2024-10-19
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2023-12-20	2026-12-19
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A

RF Conducted Test					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
MI CABLE	SGS-EMC	0.8M	EMC2137	2023-11-02	2025-11-01
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2023-08-23	2024-08-22
4X4 Power sensor Unit	TST	TSPS2023R	EMC2226	2023-08-23	2024-08-22
Test Software	TST	V2.0	GZE100-78	N/A	N/A

General used equipment					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
DMM	Fluke	73	EMC0006	2023-06-11	2024-06-10

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6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)

6.1.2 Conclusion

Standard Requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.15.247(b) (4) requirement:The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -0.3 dBi.

Antenna location: Refer to internal photo.

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7 Radio Spectrum Matter Test Results

7.1 Radiated Emissions which fall in the restricted bands

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

Test Method: ANSI C63.10 (2013) Section 11.12

Limit:

Test Distance: 3 m

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
Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.		

7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 25.0 °C Humidity: 55.6 % RH Atmospheric Pressure: 1003 mbar

7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

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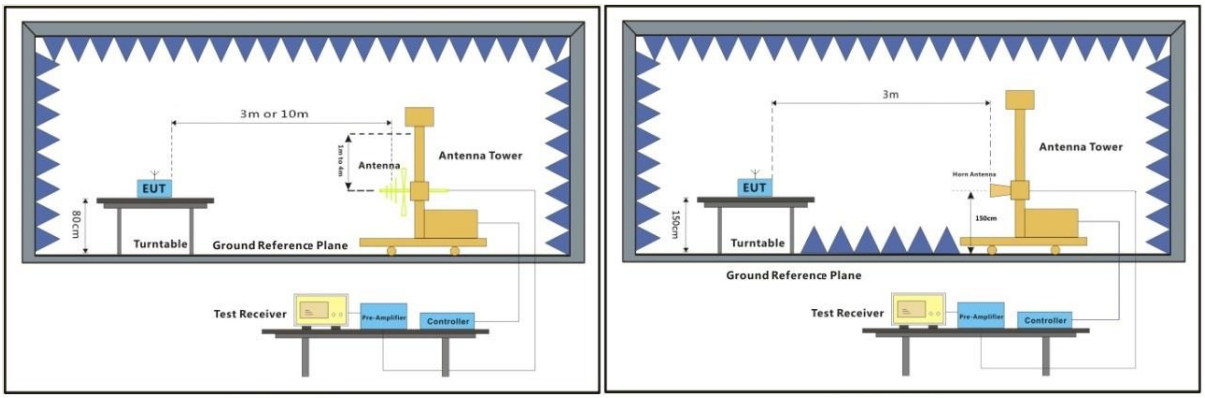
7.1.3 Test Setup Diagram



30MHz-1GHz Above 1GHz

7.1.4 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the Highest channel.

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

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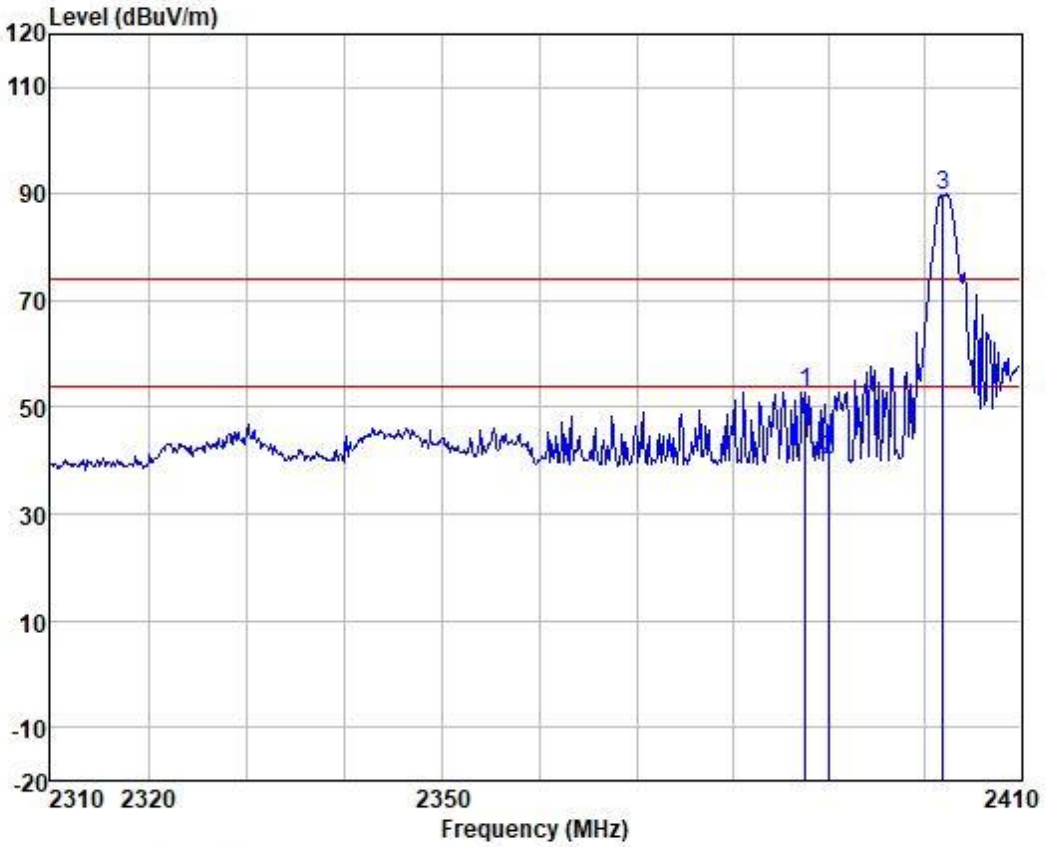
Test Mode: 00; Polarity: Vertical; Modulation: GFSK; Channel:Low



		Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
		MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1		2387.534	58.72	27.68	3.77	37.22	52.95	74.00	-21.05	VERTICAL	peak
2		2390.000	46.02	27.68	3.77	37.21	40.26	74.00	-33.74	VERTICAL	peak
3	*	2402.000	95.59	27.71	3.78	37.21	89.87	74.00	15.87	VERTICAL	peak

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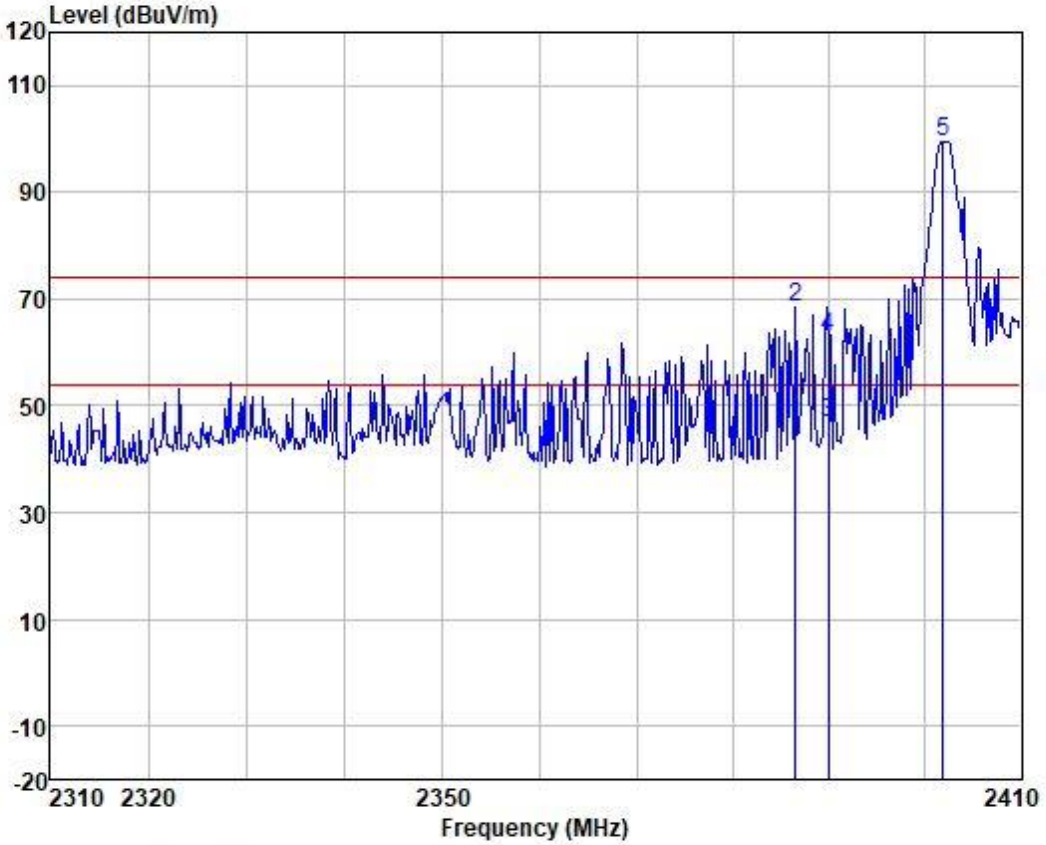
Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:Low



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	2386.522	52.18	27.68	3.77	37.22	46.41	54.00	-7.59	HORIZONTAL	Average
2	2386.522	74.39	27.68	3.77	37.22	68.62	74.00	-5.38	HORIZONTAL	peak
3	2390.000	52.42	27.68	3.77	37.21	46.66	54.00	-7.34	HORIZONTAL	Average
4	2390.000	68.47	27.68	3.77	37.21	62.71	74.00	-11.29	HORIZONTAL	peak
5 *	2402.000	105.20	27.71	3.78	37.21	99.48	74.00	25.48	HORIZONTAL	peak

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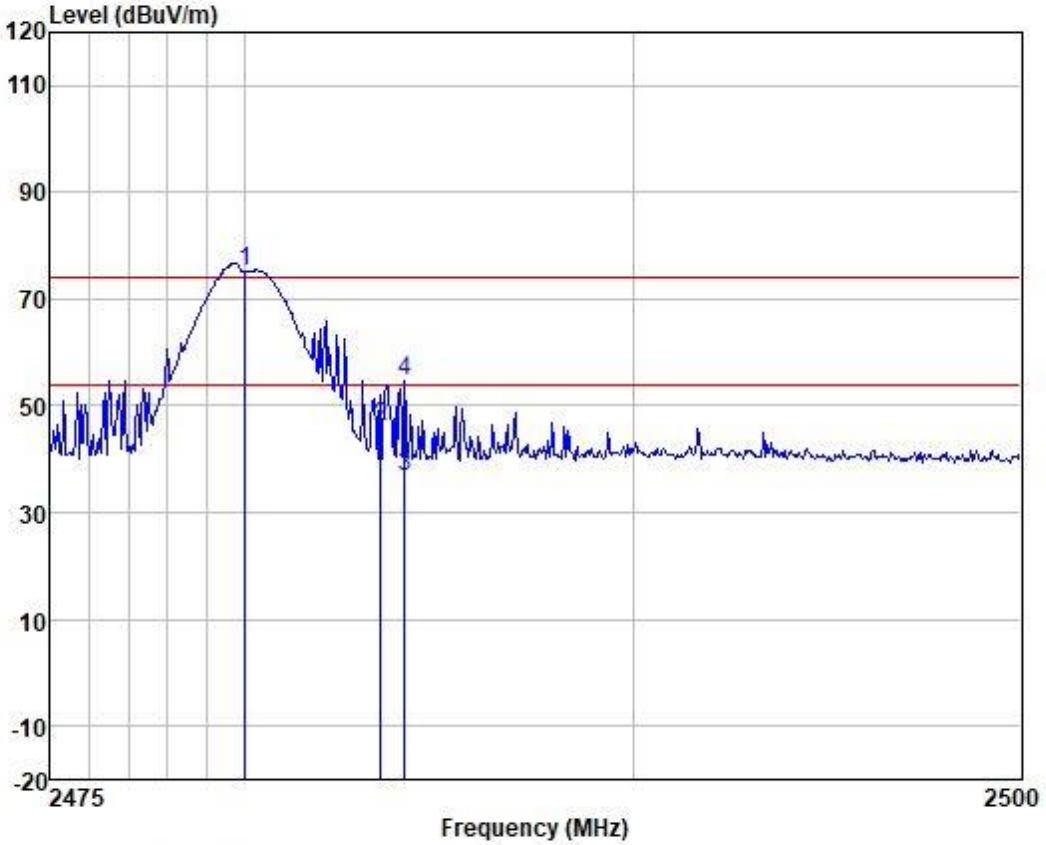
Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:High



		Freq	ReadLevel	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
		MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	*	2480.000	80.76	27.84	3.82	37.19	75.23	74.00	1.23	VERTICAL	peak
2		2483.500	51.46	27.85	3.82	37.19	45.94	74.00	-28.06	VERTICAL	peak
3		2484.121	42.17	27.85	3.82	37.19	36.65	54.00	-17.35	VERTICAL	Average
4		2484.121	60.04	27.85	3.82	37.19	54.52	74.00	-19.48	VERTICAL	peak

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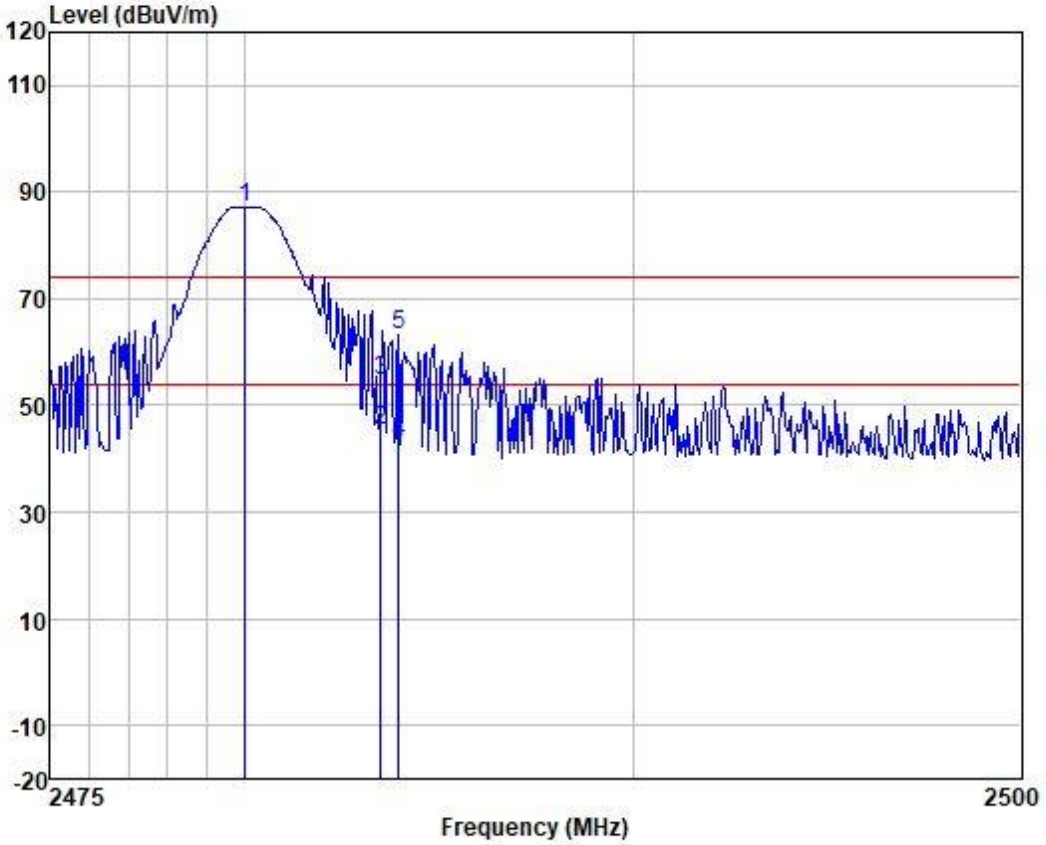
Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:High



		Freq	ReadLevel	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
		MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	*	2480.000	92.57	27.84	3.82	37.19	87.04	74.00	13.04	HORIZONTAL	peak
2		2483.500	51.03	27.85	3.82	37.19	45.51	54.00	-8.49	HORIZONTAL	Average
3		2483.500	60.18	27.85	3.82	37.19	54.66	74.00	-19.34	HORIZONTAL	peak
4		2483.971	48.44	27.85	3.82	37.19	42.92	54.00	-11.08	HORIZONTAL	Average
5		2483.971	68.74	27.85	3.82	37.19	63.22	74.00	-10.78	HORIZONTAL	peak

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7.2 Radiated Spurious Emissions Below 1GHz

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.4,6.5
Limit:
Test Distance: 3 m

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
960-1000	500	3

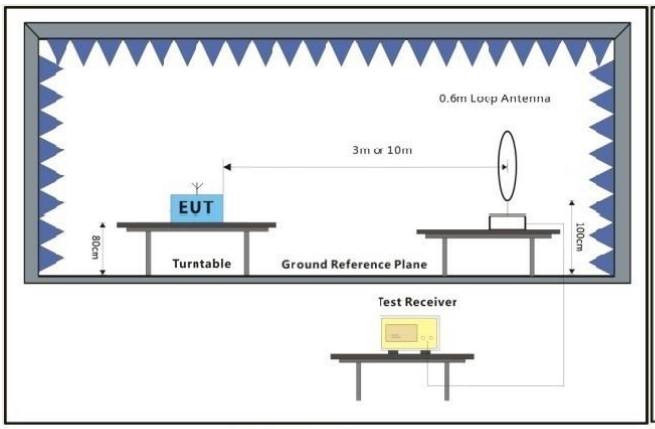
7.2.1 E.U.T. Operation

Operating Environment:
Temperature: 22.4 °C Humidity: 52.7 % RH Atmospheric Pressure: 1008 mbar

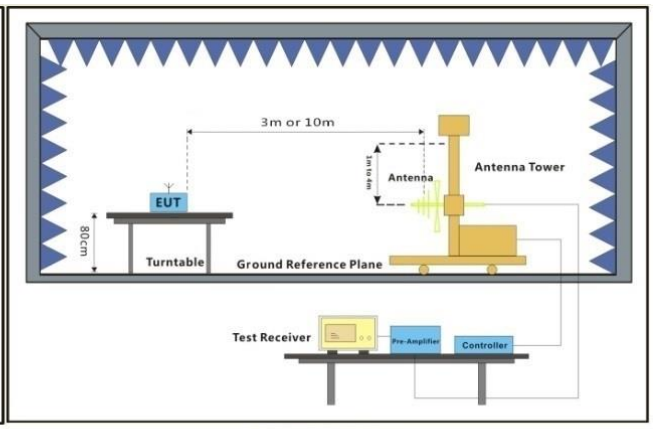
7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.2.3 Test Setup Diagram



Below 30MHz



30MHz-1GHz

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7.2.4 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using quasi-peak method as specified and then reported in a data sheet.

g. Test the EUT in the lowest channel, the middle channel, the Highest channel.

h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

i. Repeat above procedures until all frequencies measured was complete.

Remark:

1. Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

2. Scan from 9kHz to 30MHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

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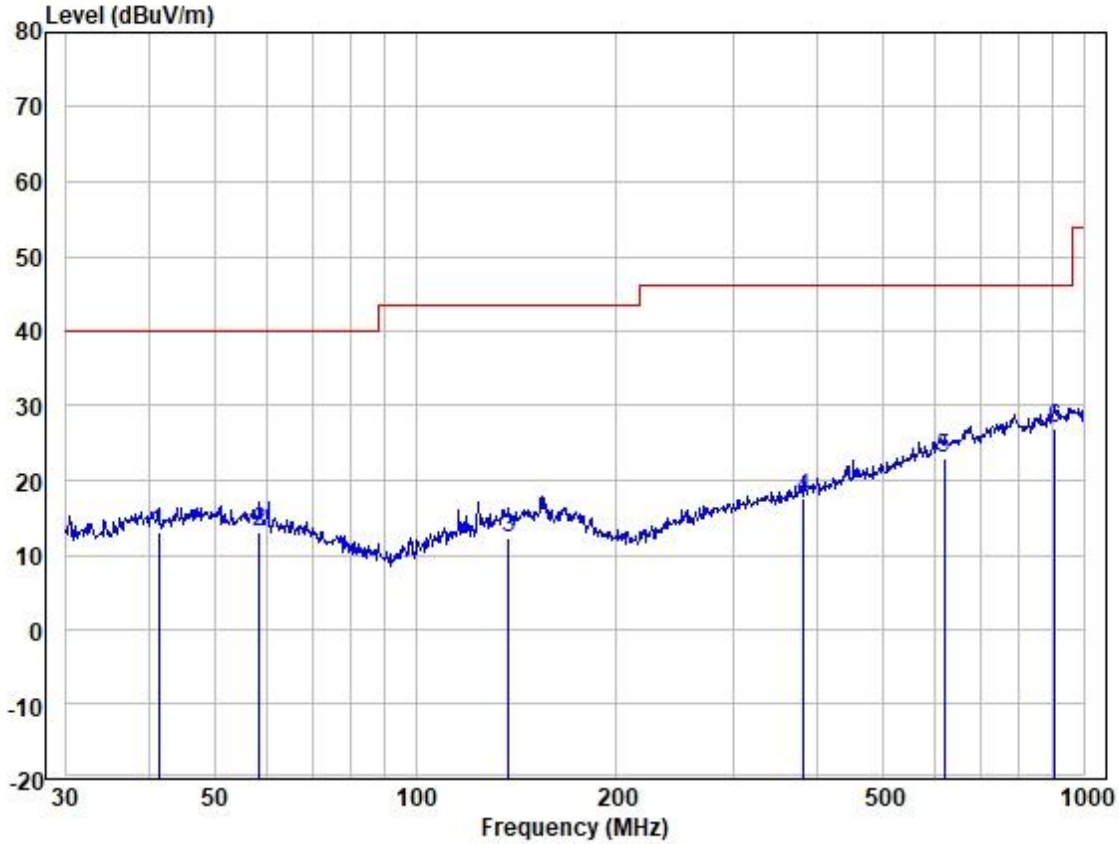
Test Mode: 00; Polarity: Horizontal



Site : 966 Chamber
Job :
Model :
Power :
Test Mode :

	Freq	Read Level	Anterna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/ Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	41.277	26.26	19.23	0.35	32.87	12.97	40.00	-27.03	HORIZONTAL	QP
2	58.407	26.42	18.99	0.41	32.87	12.95	40.00	-27.05	HORIZONTAL	QP
3	137.903	25.80	18.55	0.64	32.81	12.18	43.52	-31.34	HORIZONTAL	QP
4	381.249	28.23	21.02	1.14	32.91	17.48	46.02	-28.54	HORIZONTAL	QP
5	618.537	28.27	26.05	1.44	32.85	22.91	46.02	-23.11	HORIZONTAL	QP
6	906.482	27.62	29.48	1.76	31.96	26.90	46.02	-19.12	HORIZONTAL	QP

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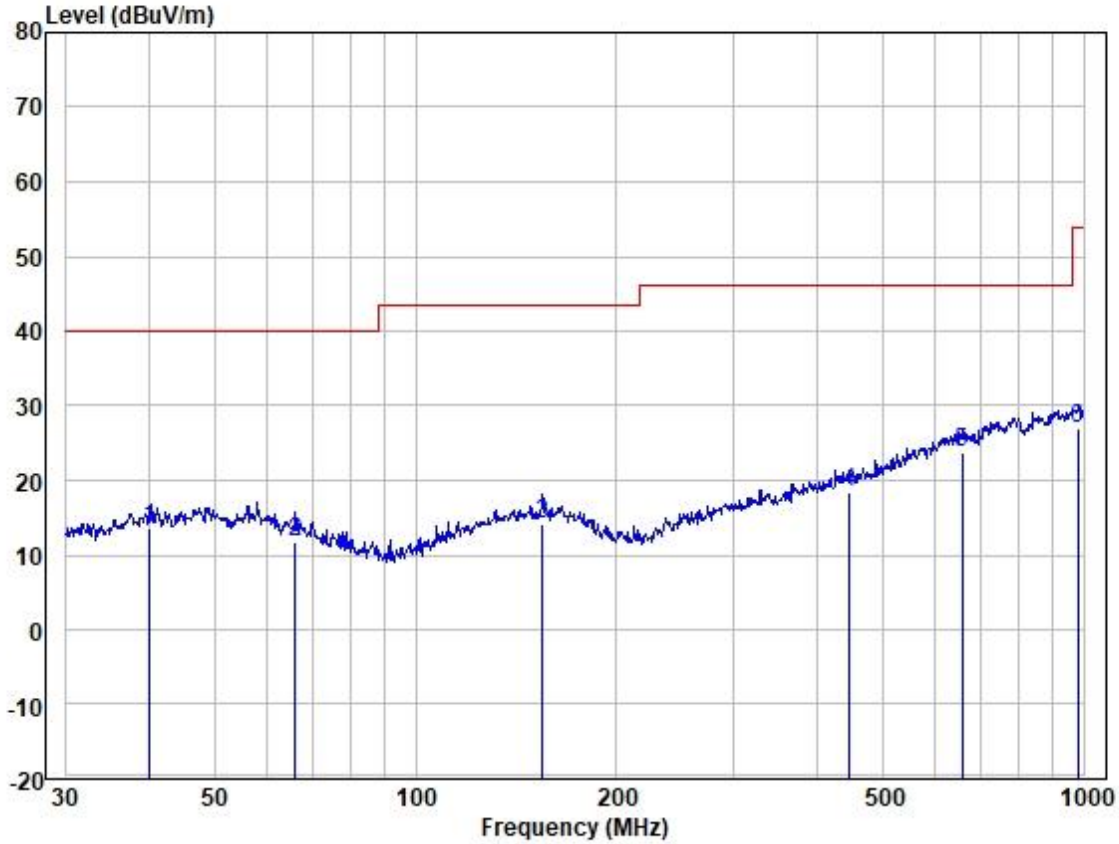
Test Mode: 00; Polarity: Vertical



Site : 966 Chamber
Job :
Model :
Power :
Test Mode :

	Freq	Read Level	Anterna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/ Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	39.994	26.98	19.09	0.35	32.87	13.55	40.00	-26.45	VERTICAL	QP
2	66.034	26.45	17.83	0.44	32.86	11.86	40.00	-28.14	VERTICAL	QP
3	154.821	27.23	19.16	0.69	32.82	14.26	43.52	-29.26	VERTICAL	QP
4	446.414	27.50	22.62	1.21	32.97	18.36	46.02	-27.66	VERTICAL	QP
5	656.530	28.18	26.62	1.50	32.66	23.64	46.02	-22.38	VERTICAL	QP
6	979.180	26.77	29.96	1.83	31.67	26.89	53.98	-27.09	VERTICAL	QP

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7.3 Radiated Spurious Emissions Above 1GHz

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

Test Method: ANSI C63.10 (2013) Section 6.6

Limit:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance(meters)
Above 1000	500	3

7.3.1 E.U.T. Operation

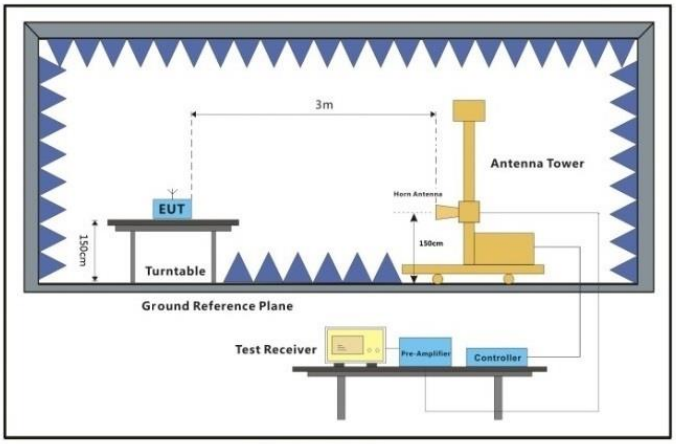
Operating Environment:

Temperature: 25.0 °C Humidity: 55.5 % RH Atmospheric Pressure: 1003 mbar

7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.3.3 Test Setup Diagram



Above 1GHz

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7.3.4 Measurement Procedure and Data

a. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak or average method as specified and then reported in a data sheet.

g. Test the EUT in the lowest channel, the middle channel, the Highest channel.

h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

i. Repeat above procedures until all frequencies measured was complete.

Remark:

1. Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

2. Scan from 1GHz to 25GHz, the disturbance above 18GHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

3. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

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检验检测专用章
Inspection & Testing Services
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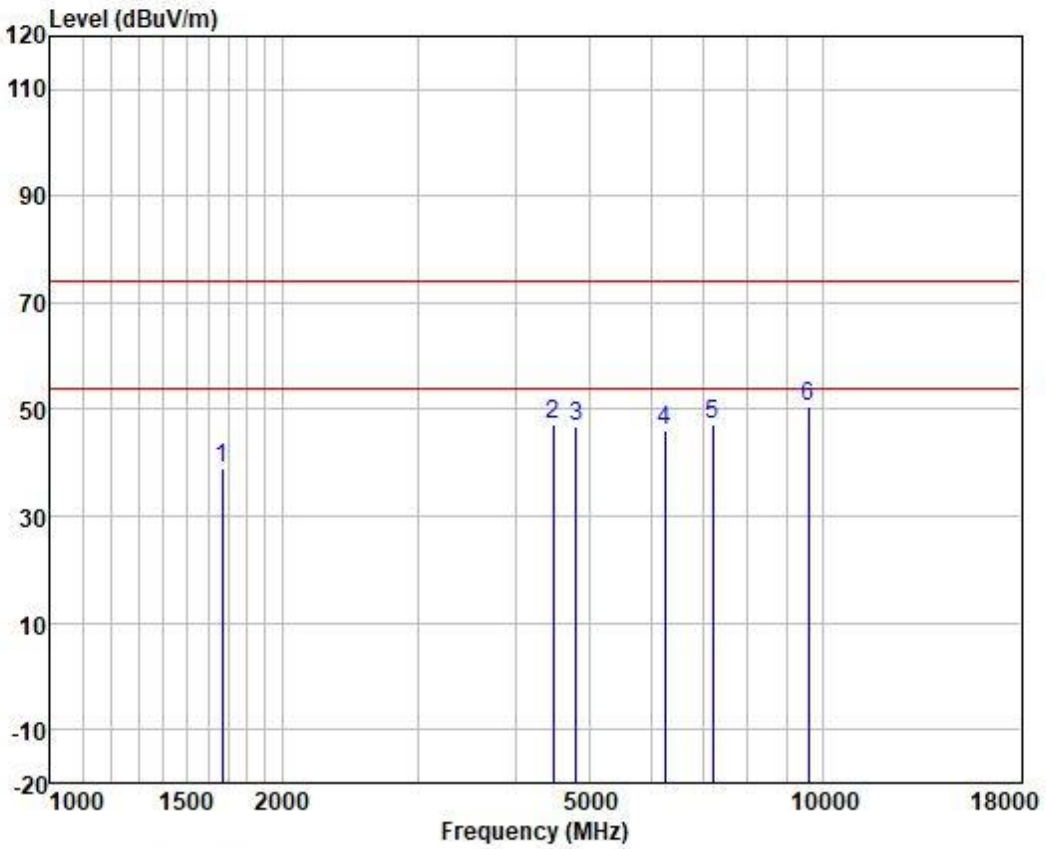
Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:Low



	Freq	ReadLevel	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1672.779	48.24	24.98	3.05	37.41	38.86	74.00	-35.14	VERTICAL	peak
2	4482.150	45.03	34.12	4.78	36.63	47.30	74.00	-26.70	VERTICAL	peak
3	4804.000	44.15	34.16	5.15	36.66	46.80	74.00	-27.20	VERTICAL	peak
4	6249.464	43.21	33.28	6.25	36.81	45.93	74.00	-28.07	VERTICAL	Peak
5	7206.000	41.46	35.63	6.96	36.93	47.12	74.00	-26.88	VERTICAL	peak
6	9608.000	41.02	38.68	7.65	36.82	50.53	74.00	-23.47	VERTICAL	peak

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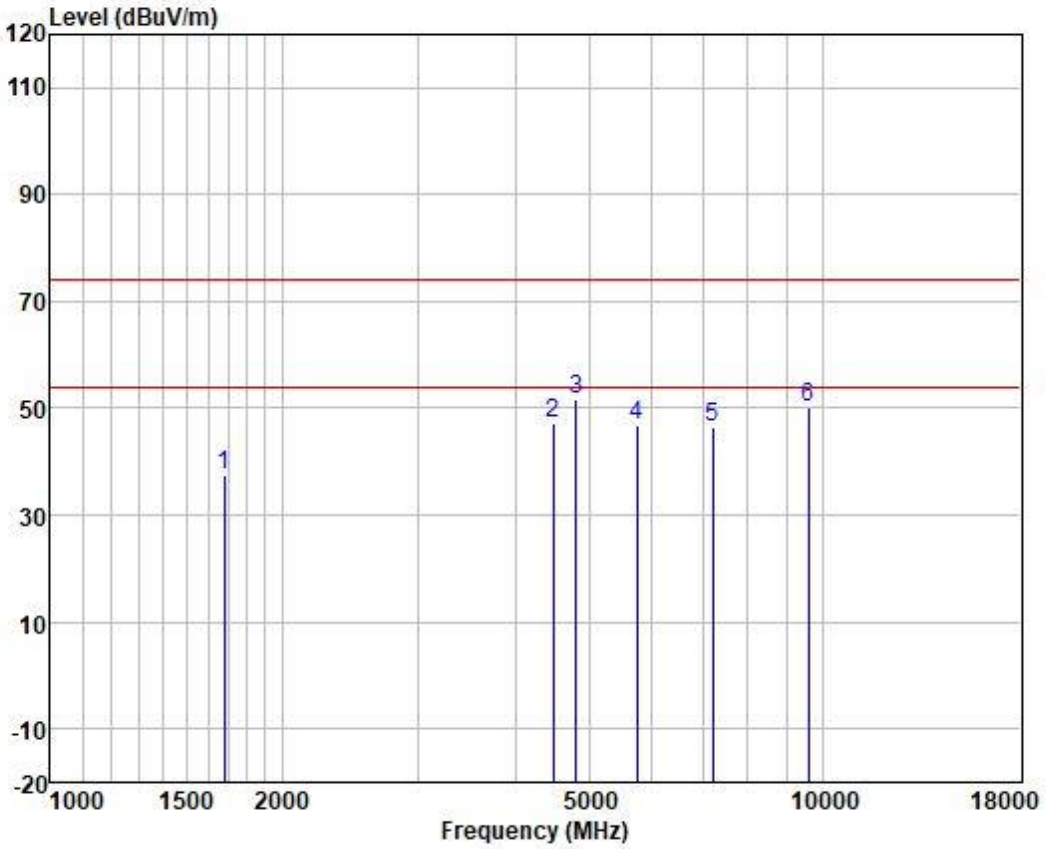
Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:Low



	Freq	ReadLevel	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1682.477	46.98	25.03	3.06	37.40	37.67	74.00	-36.33	HORIZONTAL	peak
2	4482.150	44.91	34.12	4.78	36.63	47.18	74.00	-26.82	HORIZONTAL	peak
3	4804.000	49.09	34.16	5.15	36.66	51.74	74.00	-22.26	HORIZONTAL	peak
4	5746.982	45.26	32.65	5.74	36.79	46.86	74.00	-27.14	HORIZONTAL	peak
5	7206.000	40.68	35.63	6.96	36.93	46.34	74.00	-27.66	HORIZONTAL	peak
6	9608.000	40.63	38.68	7.65	36.82	50.14	74.00	-23.86	HORIZONTAL	peak

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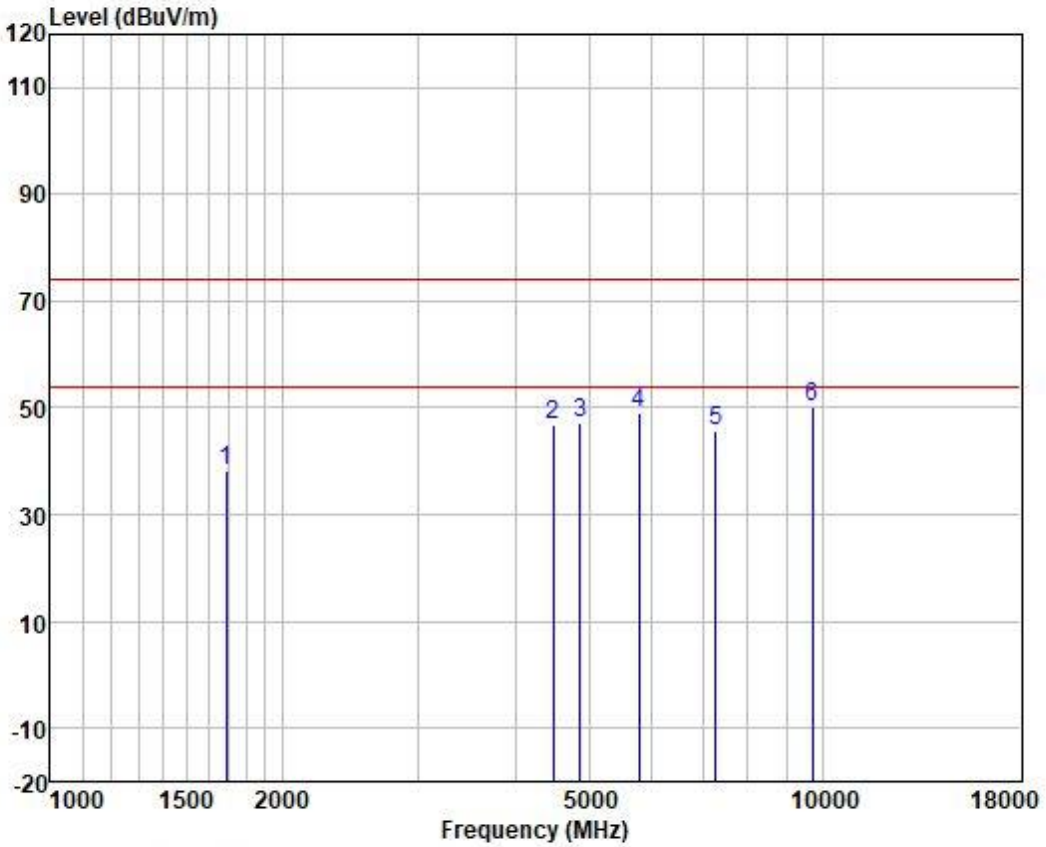
Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:middle



	Freq	ReadLevel	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1692.231	47.50	25.09	3.07	37.40	38.26	74.00	-35.74	VERTICAL	peak
2	4482.150	44.63	34.12	4.78	36.63	46.90	74.00	-27.10	VERTICAL	peak
3	4852.000	44.71	34.15	5.19	36.67	47.38	74.00	-26.62	VERTICAL	peak
4	5780.300	47.51	32.66	5.76	36.79	49.14	74.00	-24.86	VERTICAL	peak
5	7278.000	40.02	35.93	6.85	36.94	45.86	74.00	-28.14	VERTICAL	peak
6	9704.000	40.64	38.75	7.65	36.82	50.22	74.00	-23.78	VERTICAL	peak

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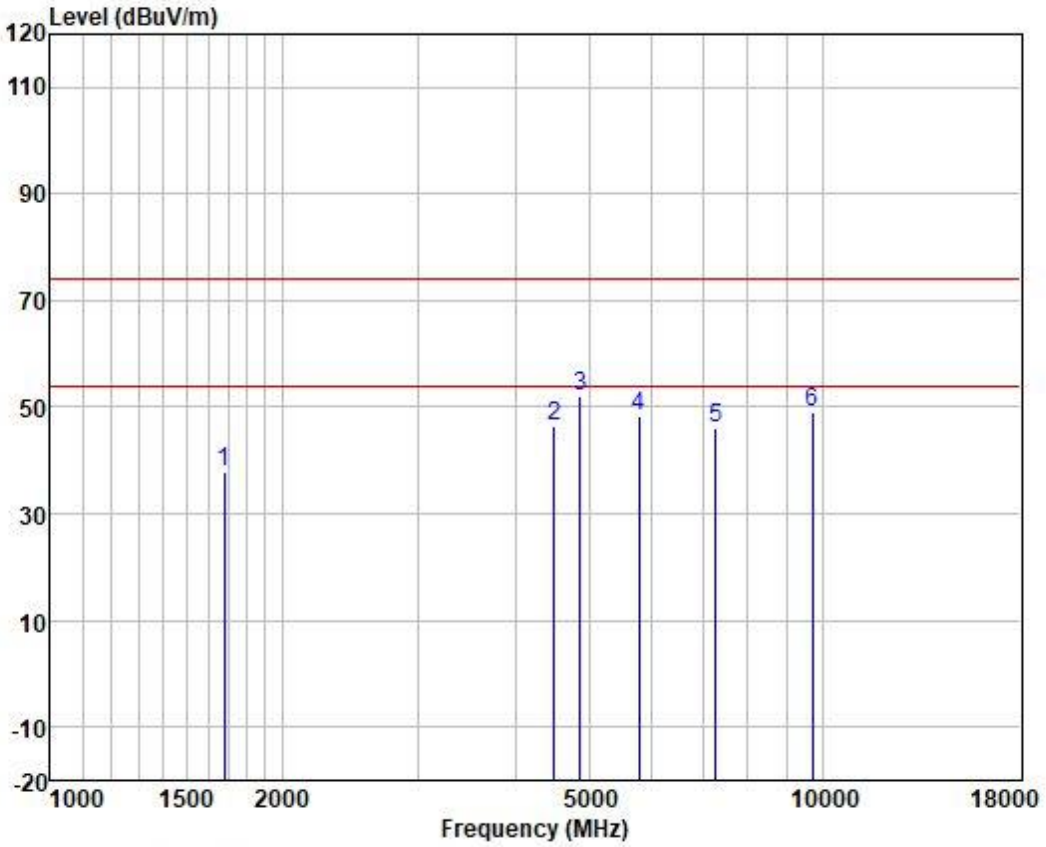

	Freq	ReadLevel	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1682.477	47.09	25.03	3.06	37.40	37.78	74.00	-36.22	HORIZONTAL	peak
2	4495.125	44.27	34.17	4.78	36.63	46.59	74.00	-27.41	HORIZONTAL	peak
3	4852.000	49.44	34.15	5.19	36.67	52.11	74.00	-21.89	HORIZONTAL	peak
4	5780.300	46.58	32.66	5.76	36.79	48.21	74.00	-25.79	HORIZONTAL	peak
5	7278.000	40.33	35.93	6.85	36.94	46.17	74.00	-27.83	HORIZONTAL	peak
6	9704.000	39.37	38.75	7.65	36.82	48.95	74.00	-25.05	HORIZONTAL	peak

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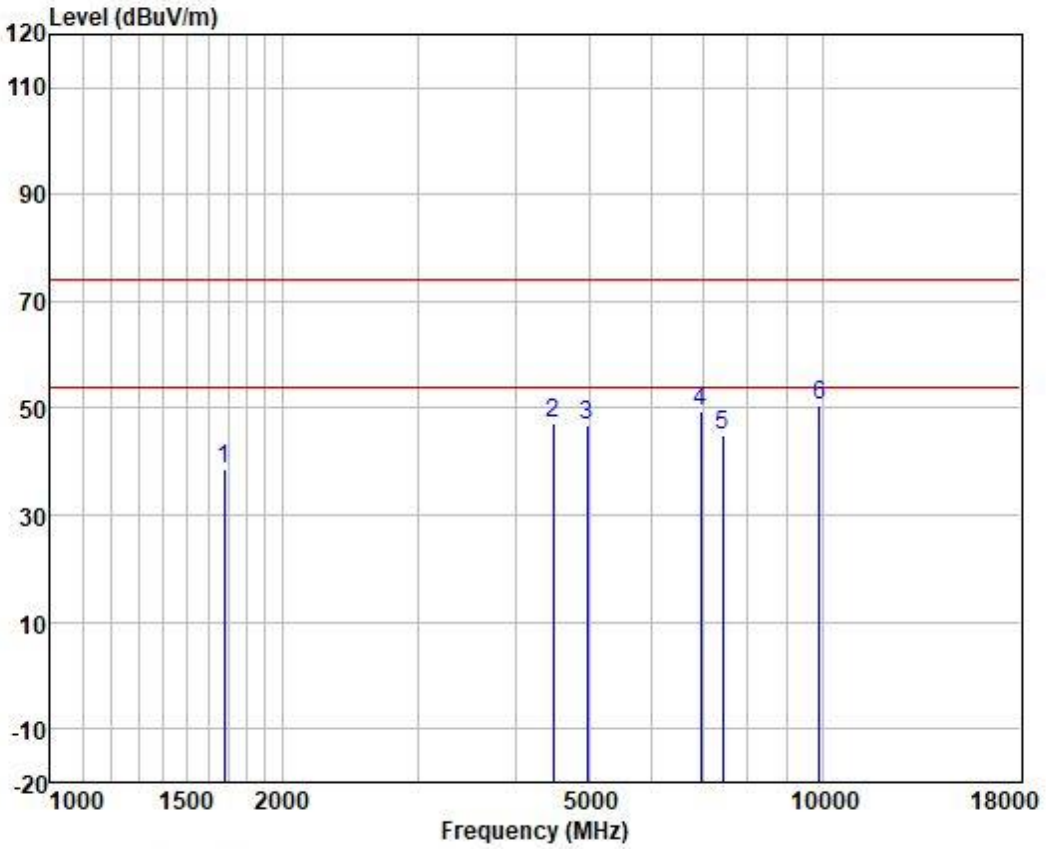

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1682.477	48.03	25.03	3.06	37.40	38.72	74.00	-35.28	VERTICAL	peak
2	4482.150	44.76	34.12	4.78	36.63	47.03	74.00	-26.97	VERTICAL	peak
3	4960.000	43.96	34.15	5.28	36.69	46.70	74.00	-27.30	VERTICAL	peak
4	6954.852	44.12	35.04	7.10	36.89	49.37	74.00	-24.63	VERTICAL	peak
5	7440.000	38.97	36.33	6.72	36.96	45.06	74.00	-28.94	VERTICAL	peak
6	9920.000	40.78	38.95	7.67	36.80	50.60	74.00	-23.40	VERTICAL	peak

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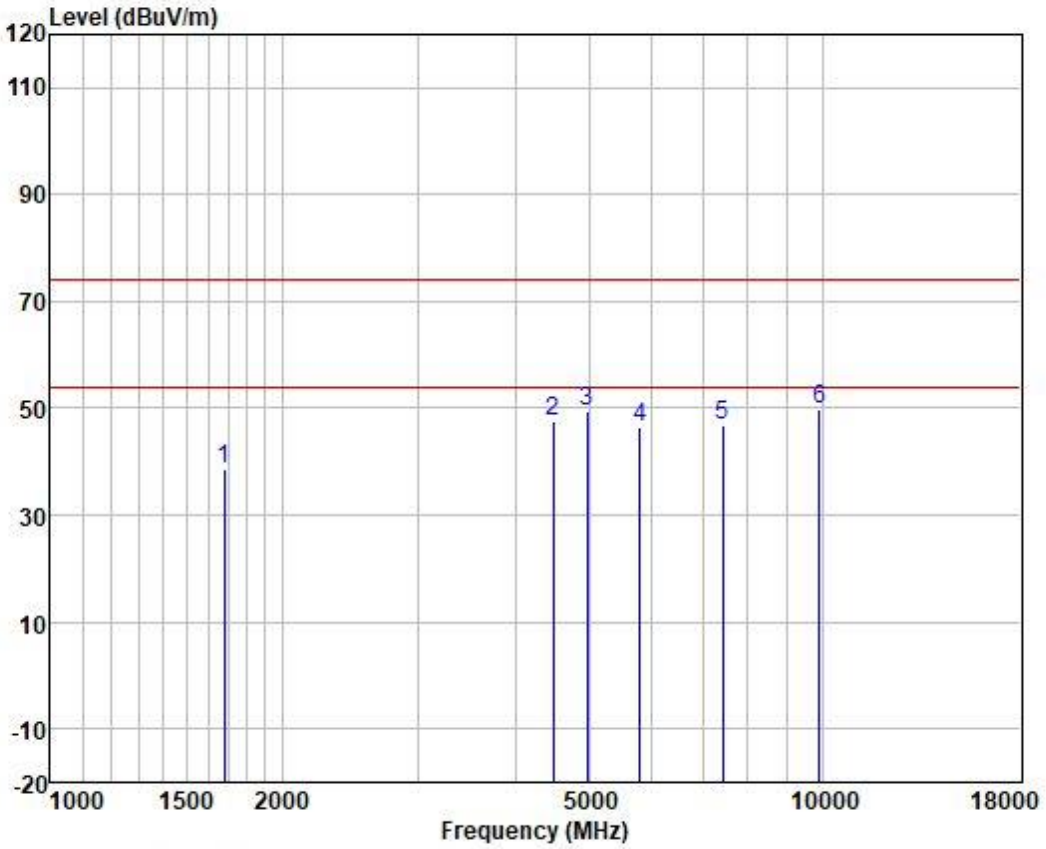
Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:High



	Freq	ReadLevel	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1682.477	47.87	25.03	3.06	37.40	38.56	74.00	-35.44	HORIZONTAL	peak
2	4482.150	45.21	34.12	4.78	36.63	47.48	74.00	-26.52	HORIZONTAL	peak
3	4960.000	46.52	34.15	5.28	36.69	49.26	74.00	-24.74	HORIZONTAL	peak
4	5813.812	44.80	32.67	5.77	36.79	46.45	74.00	-27.55	HORIZONTAL	peak
5	7440.000	40.72	36.33	6.72	36.96	46.81	74.00	-27.19	HORIZONTAL	peak
6	9920.000	40.02	38.95	7.67	36.80	49.84	74.00	-24.16	HORIZONTAL	peak

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7.4 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(3)

Test Method: ANSI C63.10 (2013) Section 11.9.1

Limit:

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for ≥50 hopping channels
	0.25 for 25≤ hopping channels <50
	1 for digital modulation
2400-2483.5	1 for ≥75 non-overlapping hopping channels
	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

7.4.1 E.U.T. Operation

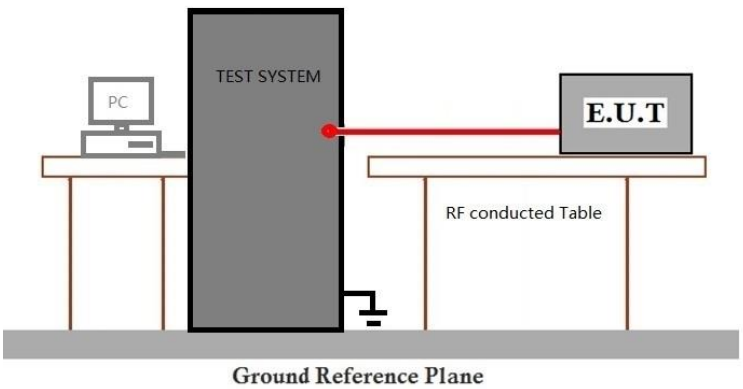
Operating Environment:

Temperature: 21.5 °C Humidity: 65.1 % RH Atmospheric Pressure: 1008 mbar

7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.4.3 Test Setup Diagram



7.4.4 Measurement Procedure and Data

Note: Since the verify power the same operating range bandwidth and smaller power can be covered by the higher power.

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7.5 Minimum 6dB Bandwidth

Test Requirement	47 CFR Part 15, Subpart C 15.247a(2)
Test Method:	ANSI C63.10 (2013) Section 11.8.1
Limit:	≥500 kHz

7.5.1 E.U.T. Operation

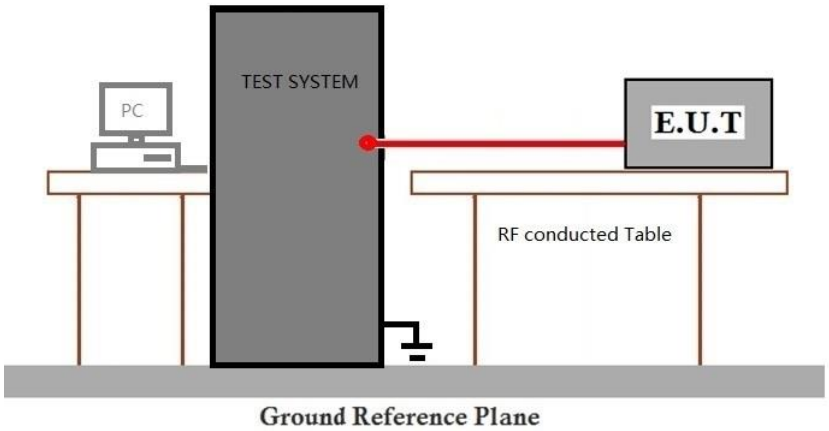
Operating Environment:

Temperature: 21.5 °C Humidity: 65.1 % RH Atmospheric Pressure: 1008 mbar

7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.5.3 Test Setup Diagram



7.5.4 Measurement Procedure and Data

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7.6 Power Spectrum Density

Test Requirement	47 CFR Part 15, Subpart C 15.247(e)
Test Method:	ANSI C63.10 (2013) Section 11.10.2
Limit:	≤8dBm in any 3 kHz band during any time interval of continuous transmission

7.6.1 E.U.T. Operation

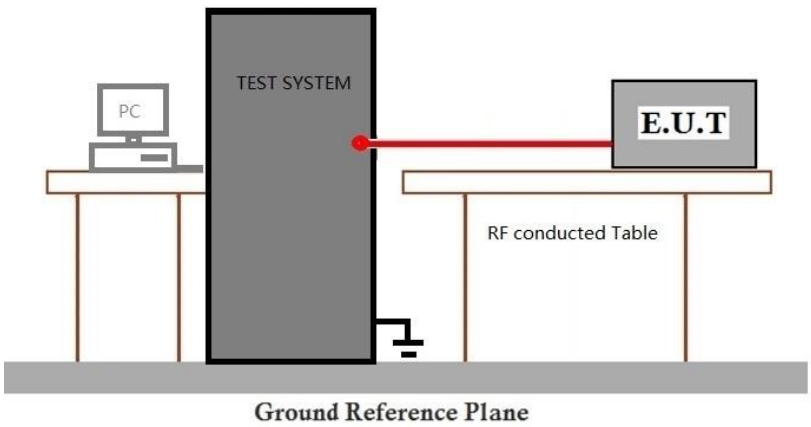
Operating Environment:

Temperature: 21.5 °C Humidity: 65.1 % RH Atmospheric Pressure: 1008 mbar

7.6.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.6.3 Test Setup Diagram



7.6.4 Measurement Procedure and Data

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7.7 Conducted Band Edges Measurement

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)

Test Method: ANSI C63.10 (2013) Section 11.13.3.2

Limit:

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. 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).

7.7.1 E.U.T. Operation

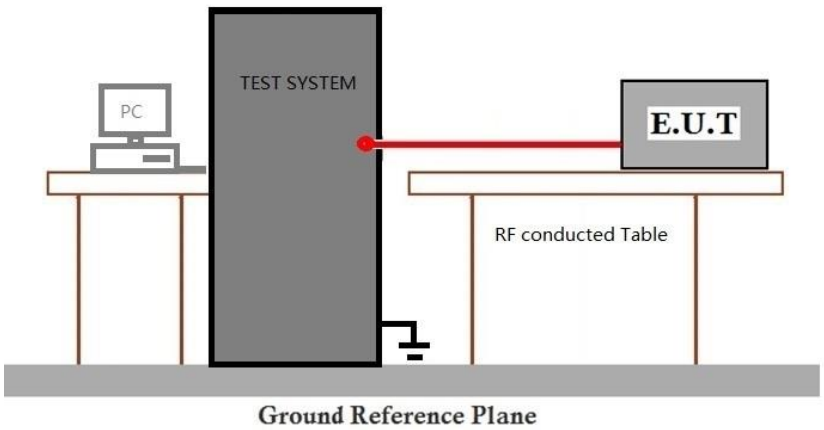
Operating Environment:

Temperature: 21.5 °C Humidity: 65.1 % RH Atmospheric Pressure: 1008 mbar

7.7.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.7.3 Test Setup Diagram



7.7.4 Measurement Procedure and Data

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7.8 Conducted Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)

Test Method: ANSI C63.10 (2013) Section 11.11

Limit:

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. 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).

7.8.1 E.U.T. Operation

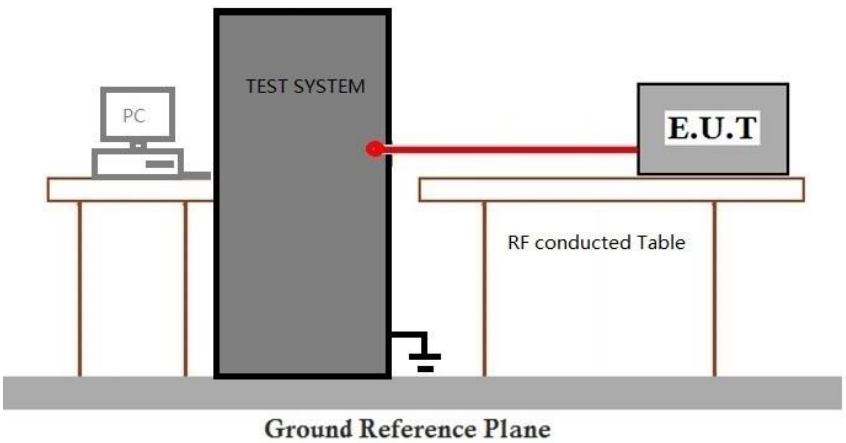
Operating Environment:

Temperature: 21.5 °C Humidity: 65.1 % RH Atmospheric Pressure: 1008 mbar

7.8.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.8.3 Test Setup Diagram



7.8.4 Measurement Procedure and Data

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8 Test Setup Photo

Refer to Appendix - Test Setup Photo for GZCR240400038001

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9 EUT Constructional Details (EUT Photos)

Refer to Appendix - External and Internal Photos for GZCR2404000380AT

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10 Appendix

1. Duty Cycle

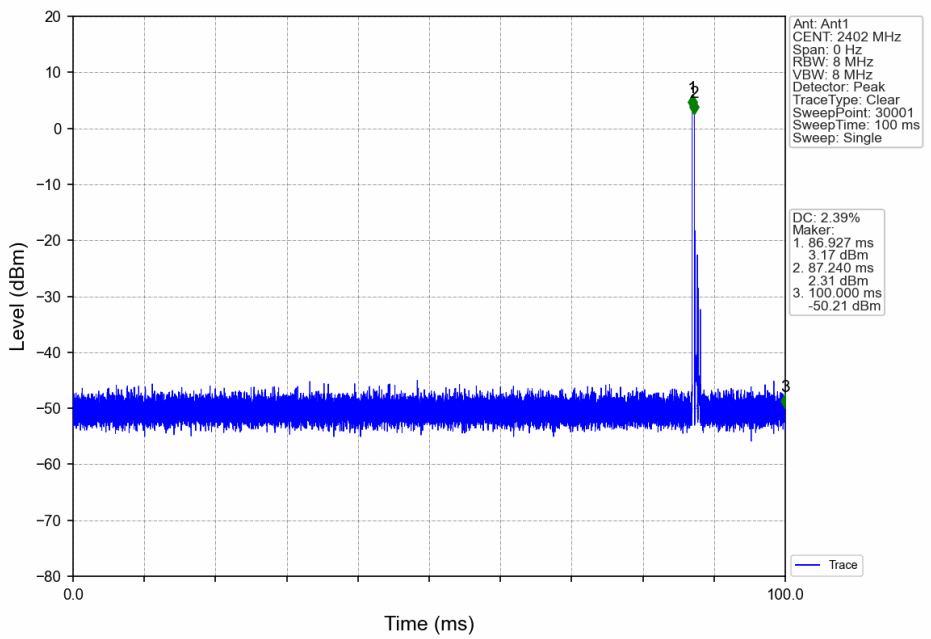
1.1 Ant1

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 (%)
BLE	SISO	2402	0.313	13.073	2.39	16.21	0.00
		2426	0.313	2.773	11.29	9.47	0.00
		2480	0.313	52.843	0.59	22.27	0.00

1.1.2 Test Graph

BLE_LCH_2402MHz_Ant1_NTNV



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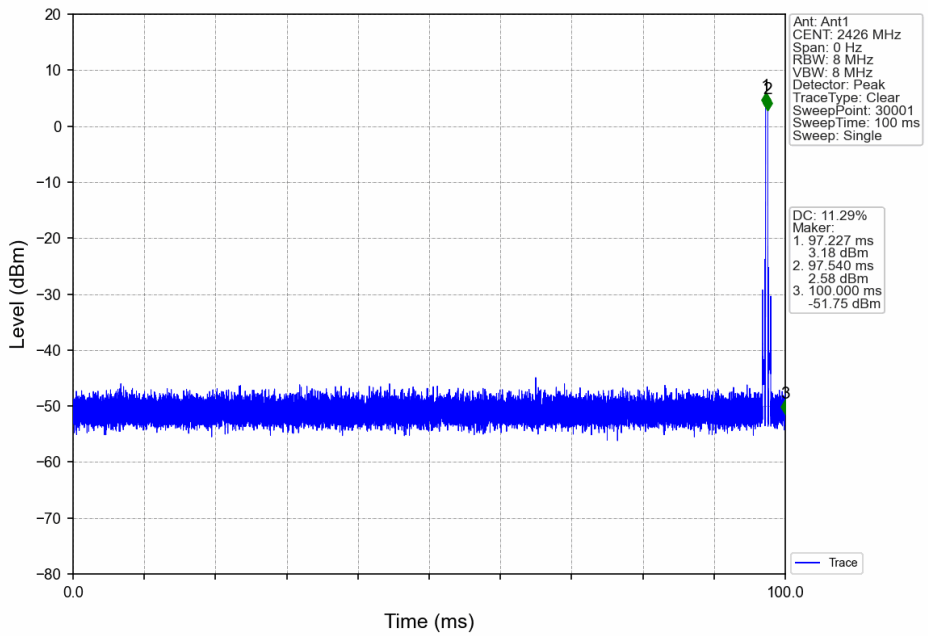
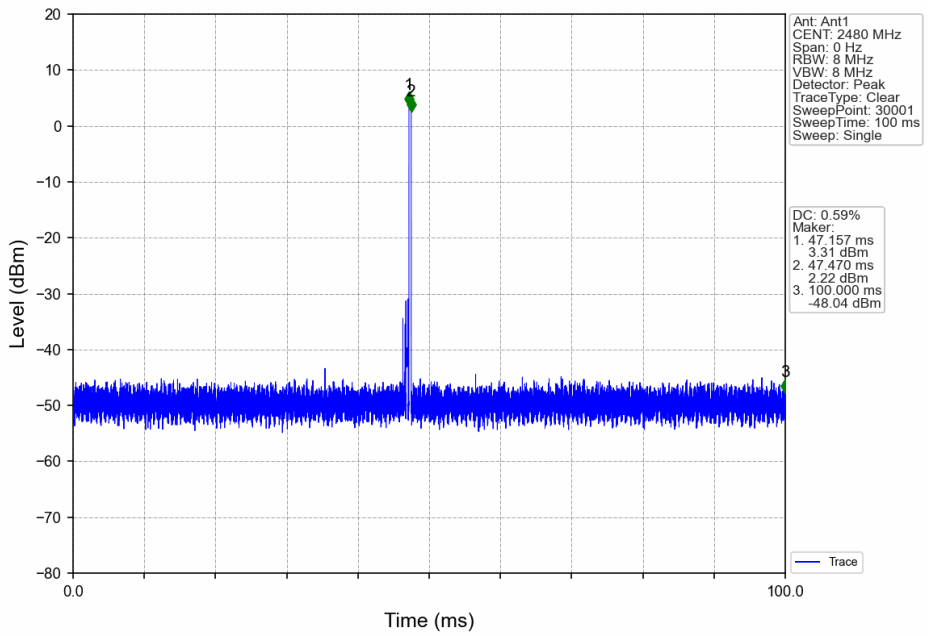
BLE_MCH_2426MHz_Ant1_NTNV



BLE_HCH_2480MHz_Ant1_NTNV



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2. Bandwidth

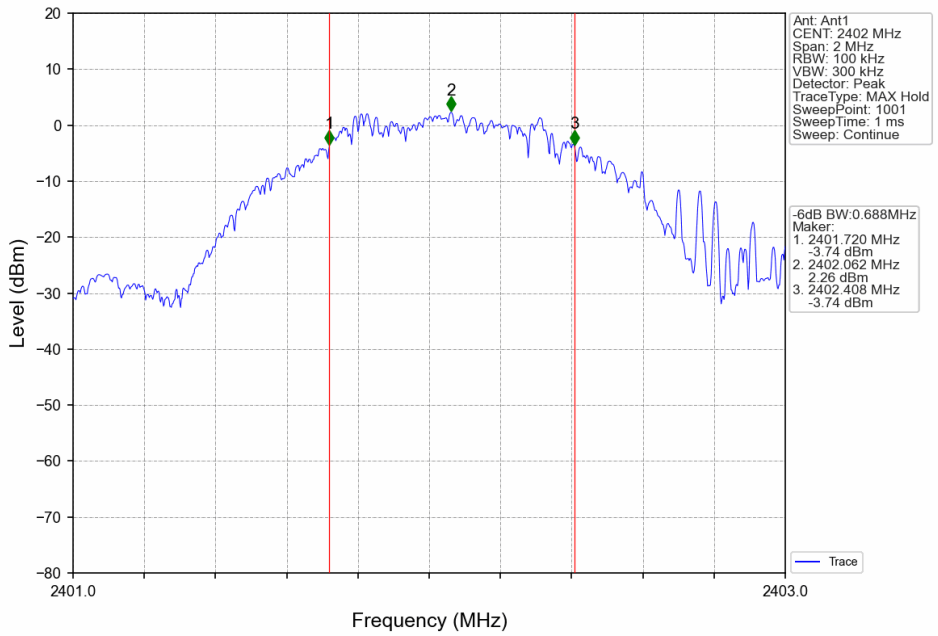
2.1 6dB BW

2.1.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	6dB Bandwidth (MHz)		Verdict
				Result	Limit	
BLE	SISO	2402	1	0.688	>=0.5	Pass
		2426	1	0.652	>=0.5	Pass
		2480	1	0.680	>=0.5	Pass

2.1.2 Test Graph

BLE_LCH_2402MHz_Ant1_NTNV



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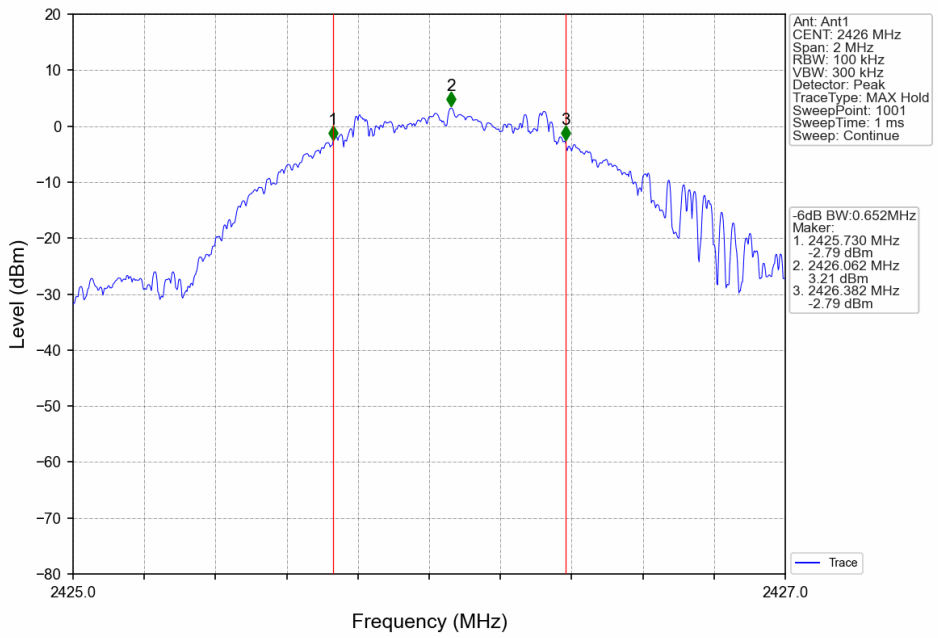
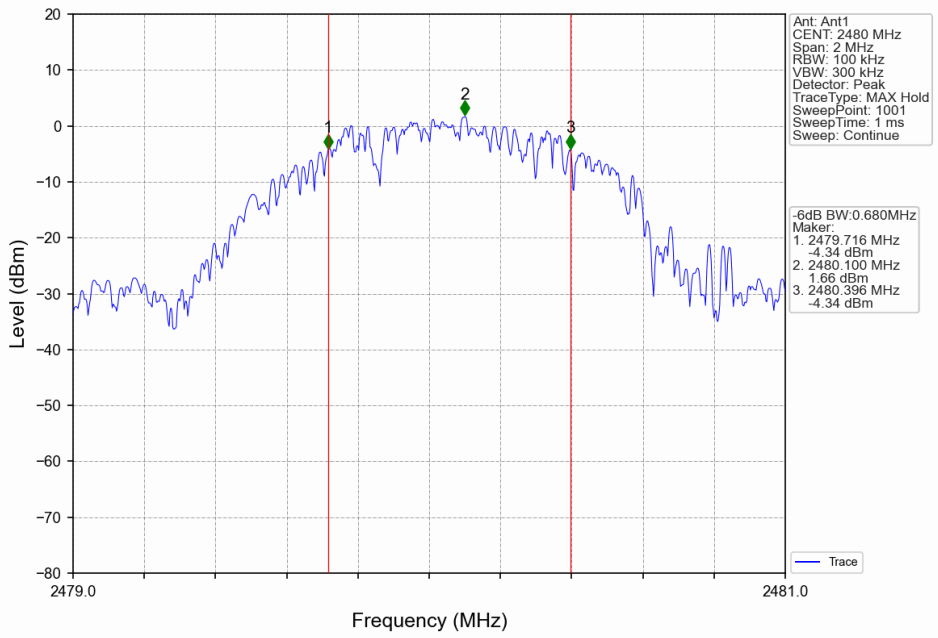
BLE_MCH_2426MHz_Ant1_NTNV



BLE_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	
BLE	SISO	2402	3.33	<=30	Pass
		2426	3.45	<=30	Pass
		2480	3.39	<=30	Pass
Note1: Antenna Gain: Ant1: -0.3 dBi;					

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4. Maximum Power Spectral Density

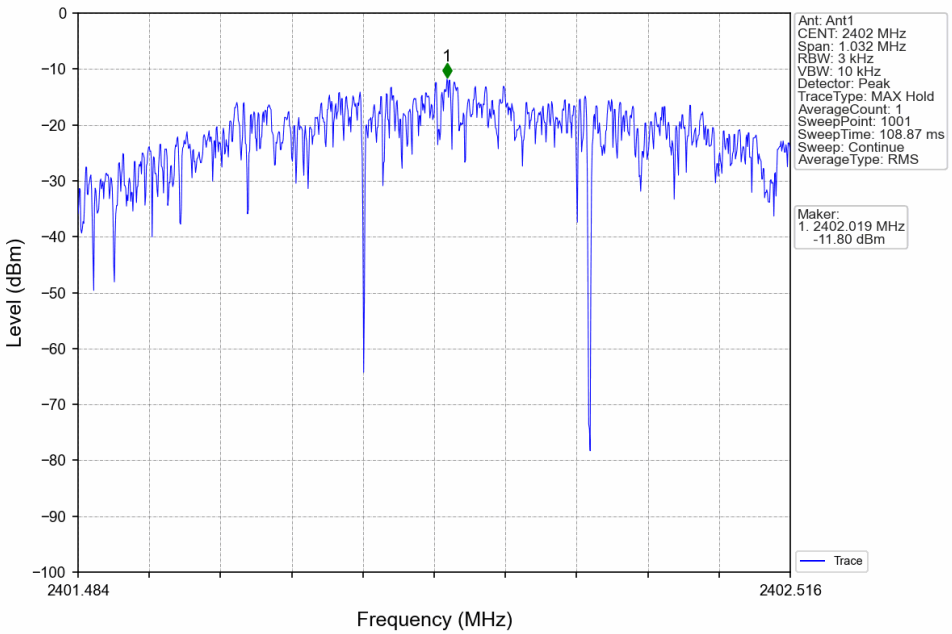
4.1 PSD

4.1.1 Test Result

Mode	TX Type	Frequency (MHz)	Maximum PSD (dBm/3kHz)		Verdict
			ANT1	Limit	
BLE	SISO	2402	-11.80	<=8	Pass
		2426	-9.64	<=8	Pass
		2480	-11.39	<=8	Pass
Note1: Antenna Gain: Ant1: -0.3 dBi;					

4.1.2 Test Graph

BLE_LCH_2402MHz_Ant1_NTNV



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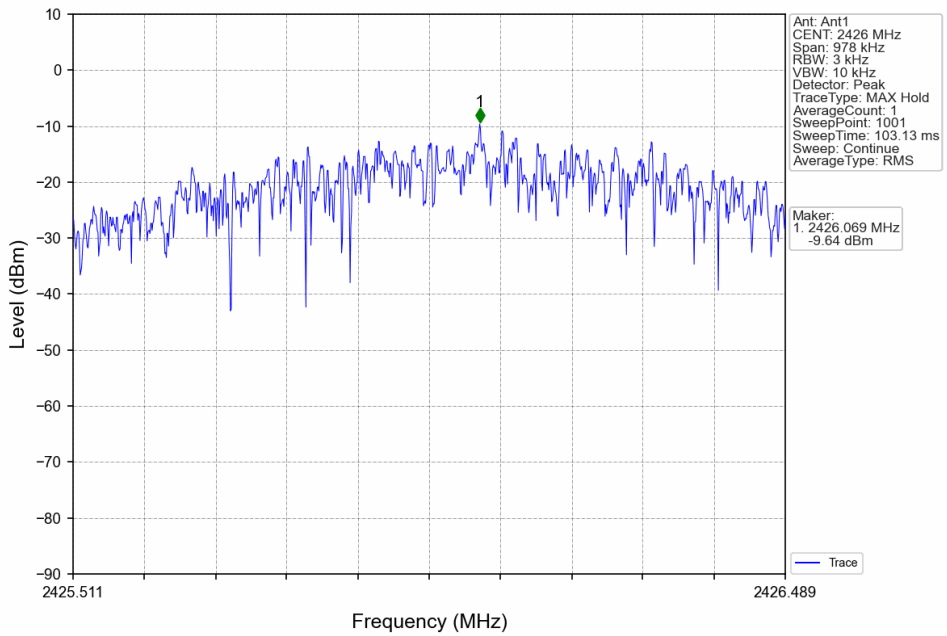
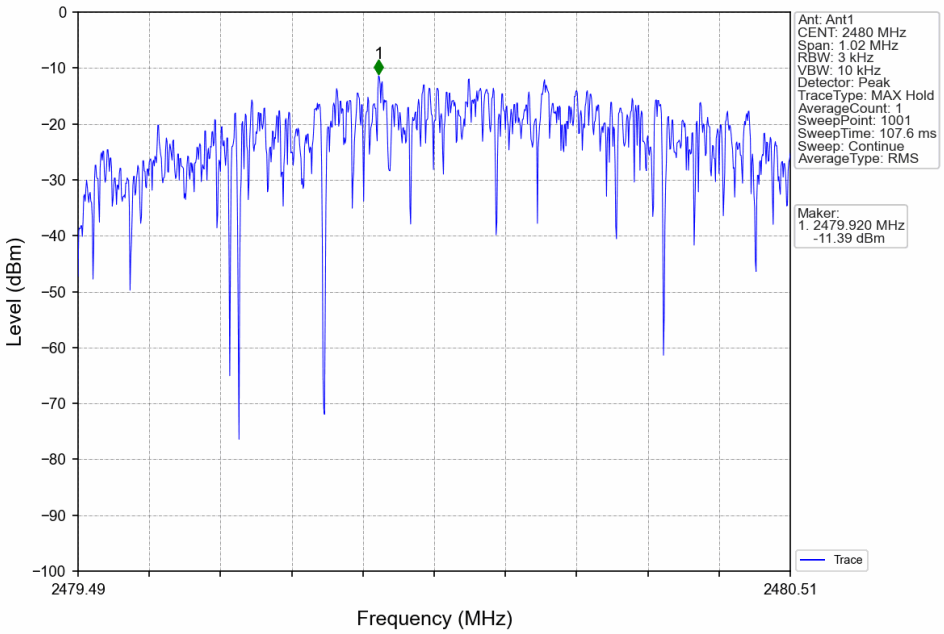


BLE_HCH_2480MHz_Ant1_NTNV



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5. Unwanted Emissions In Non-restricted Frequency Bands

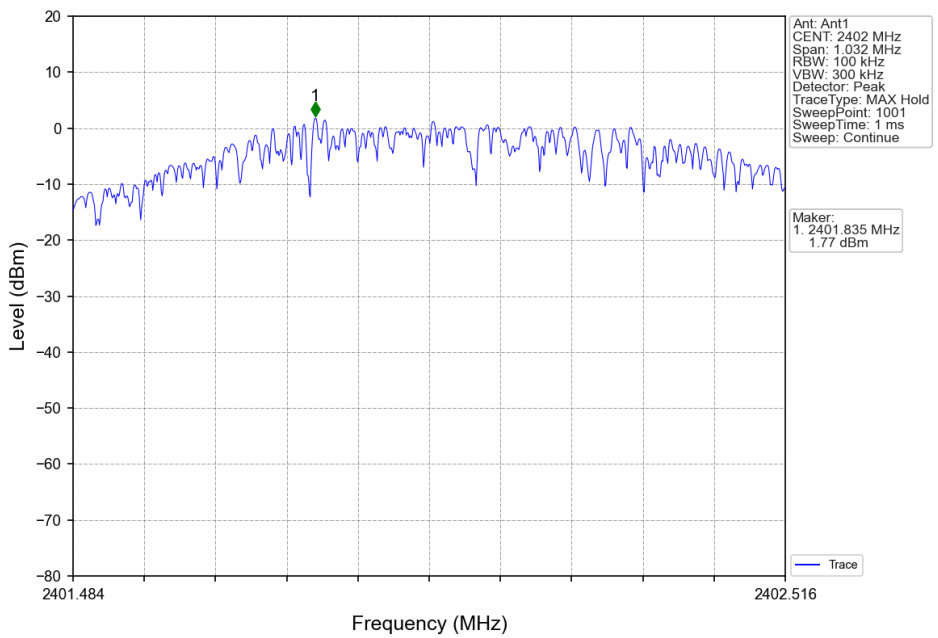
5.1 Ref

5.1.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)
BLE	SISO	2402	1	1.77
		2426	1	2.73
		2480	1	3.09
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

BLE_LCH_2402MHz_Ant1_NTNV



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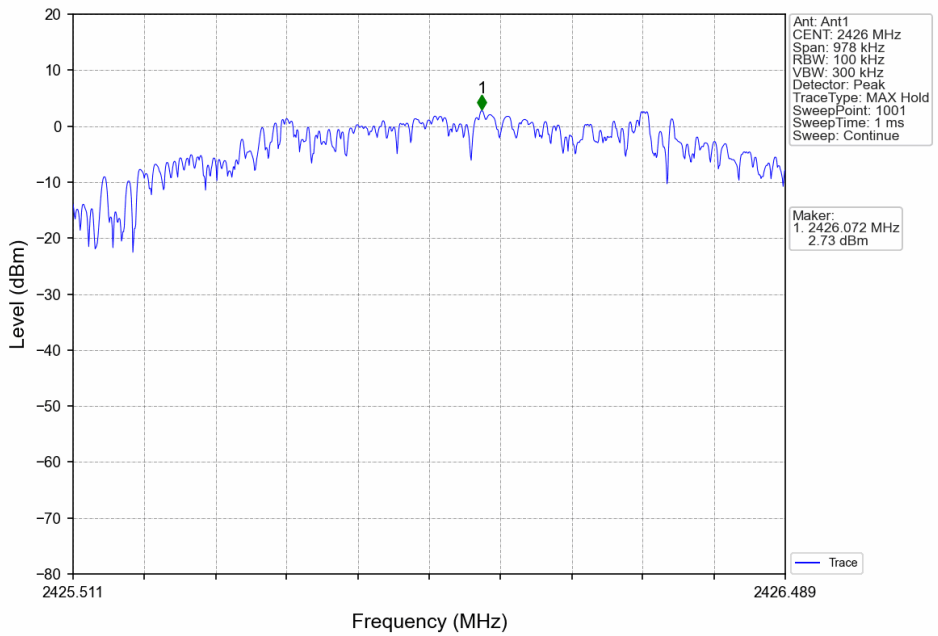
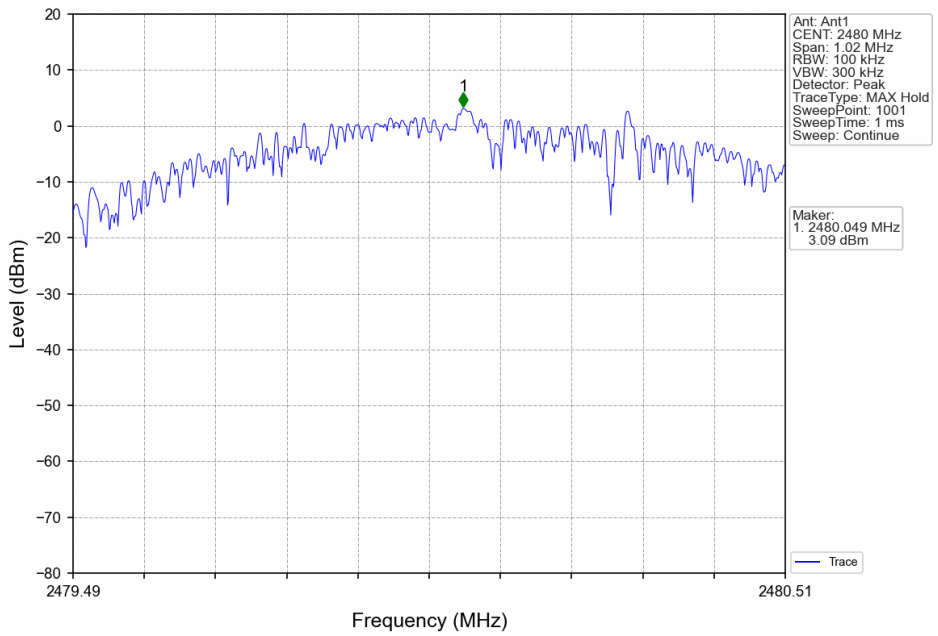
BLE_MCH_2426MHz_Ant1_NTNV



BLE_HCH_2480MHz_Ant1_NTNV



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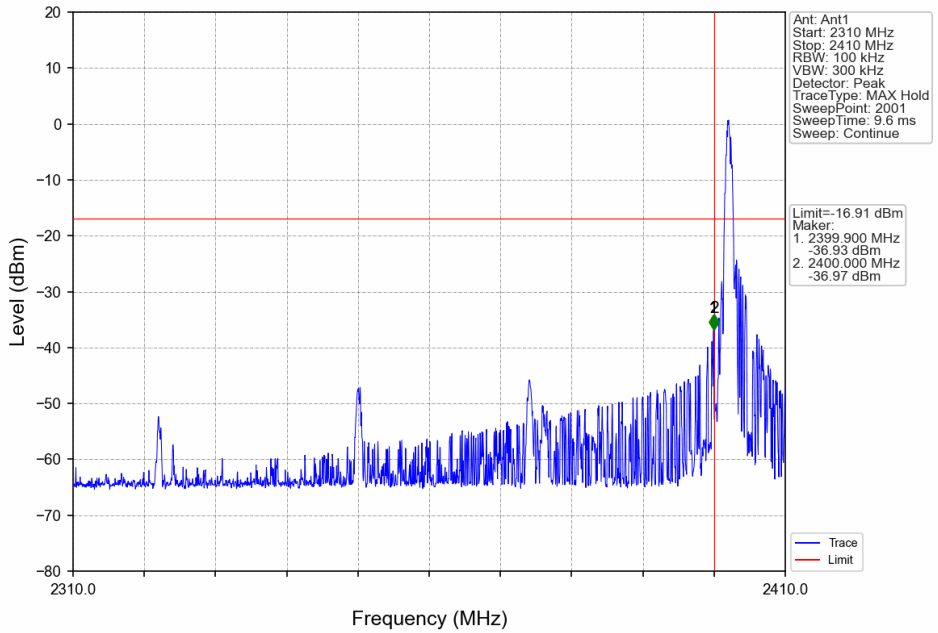
5.2 CSE and Bandedges

5.2.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
BLE	SISO	2402	1	3.09	-16.91	Pass
		2426	1	3.09	-16.91	Pass
		2480	1	3.09	-16.91	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.						

5.2.2 Test Graph

BLE_LCH_2402MHz_Ant1_NTNV



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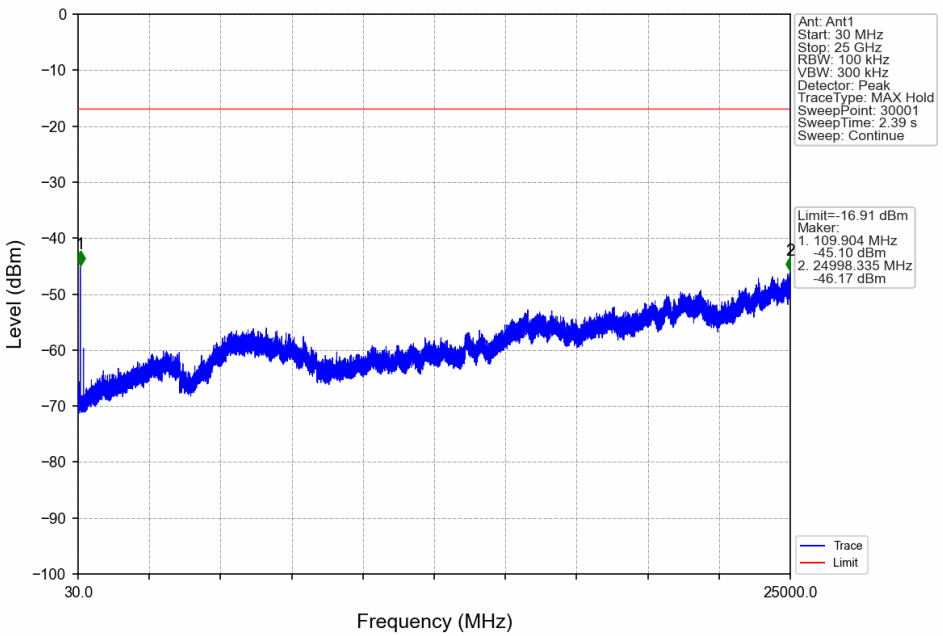

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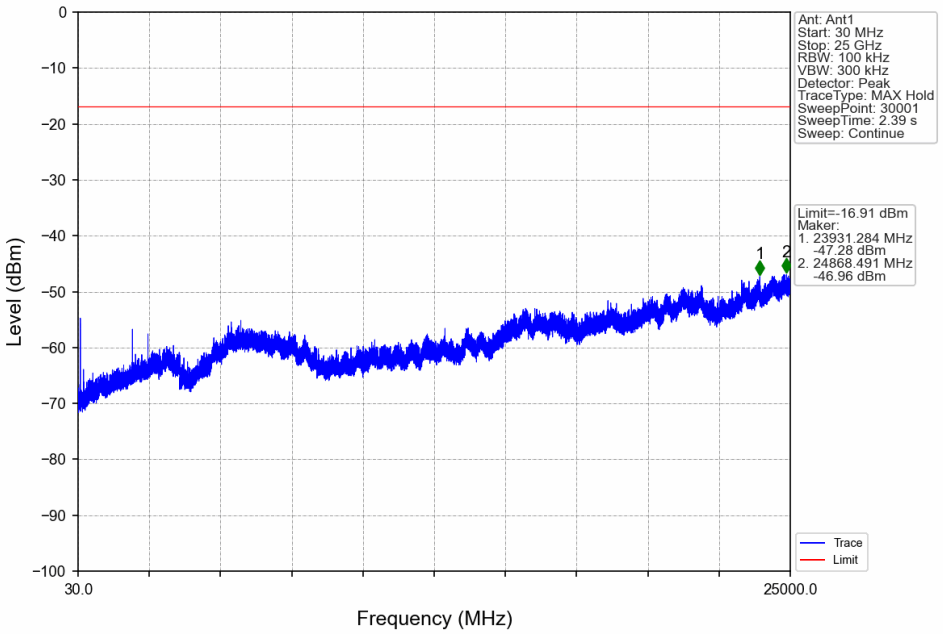

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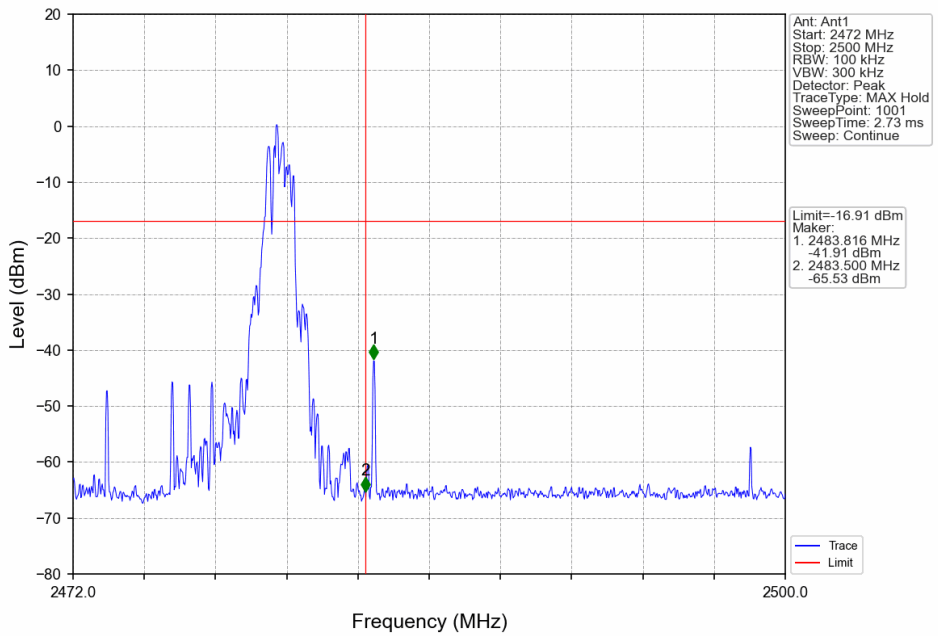

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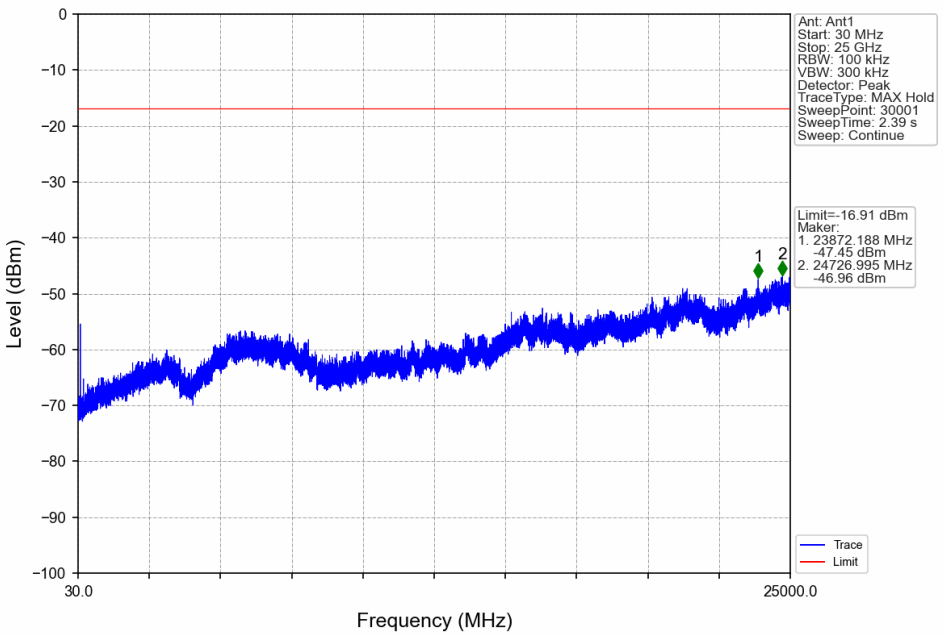

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