

TEST REPORT

Applicant: SHENZHEN 8BITDO TECH CO., LTD.
Address: Room 210, Building 1, Nanhai Ecool, No.6 Xinghua Road, Shekou, Nanshan District, Shenzhen, China
Equipment Type: 8BitDo Ultimate 3E Controller for Xbox
Model Name: 81HF
Brand Name: 8BITDO
FCC ID: 2AOWF-LEOL7X
ISED Number: 29401-LEOL7X
Test Standard: 47 CFR Part 15 Subpart C
RSS-Gen Issue 5
RSS-247 Issue 4
(refer to section 3.1)
Sample Arrival Date: Nov. 17, 2025
Test Date: Nov. 26, 2025 - Apr. 18, 2026
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ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

**Tested by:** Julie Zhu**Checked by:** Li Ganming**Approved by:** Tolan Tu
(Testing Director)

Revision History

Version	Issue Date	Revisions
<u>Rev. 01</u>	<u>Jun. 17, 2026</u>	<u>Initial Issue</u>

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1 GENERAL INFORMATION

1.1 Test Laboratory

Name	Shenzhen BALUN Technology Co., Ltd.
Address	601, Building 2, Intelligent Connected Vehicle Industrial Park, No.55, Xiangshan Road, Luotian Community, Yanluo Sub-district, Bao'an District, Shenzhen
Phone Number	+86 755 6685 0100

1.2 Test Location

Name	Shenzhen BALUN Technology Co., Ltd.
Location	☐ Building 2, Intelligent Connected Vehicle Industrial Park, No.55, Xiangshan Road, Luotian Community, Yanluo Sub-district, Bao'an District, Shenzhen, Guangdong
	☒ 1/F., Building B, Ganghongji High-Tech Intelligent Industrial Park, No.1008, Songbai Road, Yangguang Community, Xili Subdistrict, Nanshan District, Shenzhen, Guangdong
Accreditation Certificate	The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196. The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The CAB identifier number is CN0030.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	SHENZHEN 8BITDO TECH CO., LTD.
Address	Room 210, Building 1, Nanhai Ecool, No.6 Xinghua Road, Shekou, Nanshan District, Shenzhen, China

2.2 Manufacturer Information

Manufacturer	SHENZHEN ONEBITDO TECH CO., LTD.
Address	Room 203, Building 1, Huajian Building, Xinghua Road, Shekou, Shuiwan Community, Zhaoshang Street, Nanshan District, Shenzhen, China

2.3 General Description for Equipment under Test (EUT)

EUT Name	8BitDo Ultimate 3E Controller for Xbox
Model Name Under Test	81HF
Series Model Name	N/A
Description of Model name differentiation	N/A
Serial Number	81HF010 26510 05296
Hardware Version	v1
Software Version	V0
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.4 Technical Information

Network and Wireless connectivity	Bluetooth (BR+EDR+BLE) 2.4G ISM Band
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The requirement for the following technical information of the EUT was tested in this report:

Modulation Technology	FHSS
Modulation Type	GFSK
Product Type	☐ Mobile ☒ Portable ☐ Fix Location
Transfer Rate	1 Mbps
Frequency Range	The frequency range used is 2403 MHz – 2479 MHz; The frequency block is 2400 MHz to 2483.5 MHz.
Number of Channel	77
Tested Channel	1 (2403 MHz), 39 (2441 MHz), 77 (2479 MHz)
Antenna Type	Ceramic Antenna
Antenna Gain	3.49 dBi
Adaptive or Non-Adaptive	Non-Adaptive
The Max RF Output power	-0.50 dBm

All channel was listed on the following table:

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

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 15, Subpart C	Intentional radiators of radio frequency equipment
2	RSS-Gen Issue 5	General Requirements for Compliance of Radio Apparatus
3	RSS-247 Issue 4	Digital Transmission Systems, Frequency Hopping Systems and Licence Exempt Local Area Network Devices in 902-928 MHz, 2400-2483.5 MHz, 5150-5350 MHz, and 5470-5895 MHz bands
4	ANSI C63.10-2020 + Cor. 1-2023 + C63.10a-2024 + Errata to C63.10a-2024	American National Standard for Procedures for Compliance Testing of Unlicensed Wireless Devices
5	KDB 558074 D01 15.247 Meas Guidance v05r02	Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules

3.2 Verdict

No.	Description	FCC Part No.	ISED Part No.	Test Result	Verdict
1	Antenna Requirement	15.203	RSS-247, 6.5 (c)	--	Pass ^{Note 1}
2	Number of Hopping Frequency	15.247(a)	RSS-247, 6.2.3.1 (b)	ANNEX A.1	Pass
3	Peak Output Power and E.I.R.P	15.247(b)	RSS-247, 6.2.3.2	ANNEX A.2	Pass
4	Occupied Bandwidth	15.247(a)	RSS-247, 6.2.1 (a)	ANNEX A.3	Pass
5	Hopping Frequency Separation	15.247(a)	RSS-247, 6.2.3.1 (a)	ANNEX A.4	Pass
6	Time of Occupancy (Dwell time)	15.247(a)	RSS-247, 6.2.3.1 (b)	ANNEX A.5	Pass
7	Conducted Spurious Emission & Authorized-band band-edge	15.247(d)	RSS-247, 6.6	ANNEX A.6	Pass
8	Conducted Emission	15.207	RSS-GEN, 8.8	ANNEX A.7	Pass
9	Radiated Spurious Emission	15.209 15.247(d)	RSS-247, 6.6	ANNEX A.8	Pass
10	Band Edge (Restricted-band band-edge)	15.209 15.247(d)	RSS-247, 6.6	ANNEX A.9	Pass
11	Receiver Spurious Emissions	--	RSS-Gen, 7.3	--	N/A ^{Note 2}

Note ¹: The EUT has a permanently and irreplaceable attached antenna, which complies with the requirement FCC 15.203.

Note ²: Only radio communication receivers operating in stand-alone mode within the band 30-960 MHz, as well as scanner receivers, are subject to Industry Canada requirements, so this test is not applicable.

4 GENERAL TEST CONFIGURATIONS

4.1 Test Environments

During the measurement, the normal environmental conditions were within the listed ranges:

Relative Humidity	33% to 61%	
Atmospheric Pressure	100 kPa to 102 kPa	
Temperature	NT (Normal Temperature)	+20.8℃ to +24.9℃
Working Voltage of the EUT	NV (Normal Voltage)	5 V

4.2 Test Equipment List

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	KEYSIGHT	N9020A	MY54420186	2025.05.21	2026.05.20
Power meter	R&S	NRP8S	101498	2025.07.07	2026.07.06
Spectrum Analyzer	KEYSIGHT	N9020A	MY56060127	2025.02.27	2026.02.26
				2025.12.25	2026.12.24
Test Antenna-Horn	A-INFO	LB-180400KF	J211060273	2024.06.15	2027.06.14
Test Antenna-Bi-Log	Schwarzbeck	VULB 9163	01414	2023.11.03	2026.11.02
Test Antenna-Horn	Schwarzbeck	BBHA 9120D	02459	2023.10.26	2026.10.25
Test Antenna-Loop	Schwarzbeck	FMZB 1513-60	00015	2024.05.07	2026.05.06
Anechoic Chamber	YIHENG	C8-966	107	2024.05.12	2027.05.11
EMI Receiver	Keysight	N9038A	MY55330121	2025.04.16	2026.04.15
				2025.12.26	2026.12.25
Filtering unit	balun	SU319F	LW-SZ19D0001F01	N/A	N/A
Switching unit	BALUN	SU319	LW-SZ19D0001S01	N/A	N/A
EMI Receiver	keysight	N9038B	MY61380132	2025.04.01	2026.03.31
				2025.12.26	2026.12.25
LISN	SCHWARZBECK MESS-ELEKTRONIK	NSLK8127	01009	2025.07.15	2026.07.14
Shielded Enclosure	YiHeng Electronic Co., Ltd	4.3m*2.9m*2.4 m	235	2024.11.05	2027.11.04

4.3 Test Software List

Description	Manufacturer	Software Version	Serial No.	Applicable test Setup
BL410R	BALUN	V2.1.1.488	N/A	The section 4.5.1
BL410E	BALUN	V19.8.28.435	N/A	The section 4.5.2&4.5.3&4.5.4&4.5.5

4.4 Measurement Uncertainty

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 $k=2$.

Parameters	Uncertainty
Occupied Channel Bandwidth	2.8%
RF output power, conducted	1.28 dB
Power Spectral Density, conducted	1.30 dB
Unwanted Emissions, conducted	1.84 dB
All emissions, radiated	5.36 dB
Temperature	0.8°C
Humidity	4%

4.5 Description of Test Setup

4.4.1 For Antenna Port Test

Conducted value (dBm) = Measurement value (dBm) + cable loss (dB)

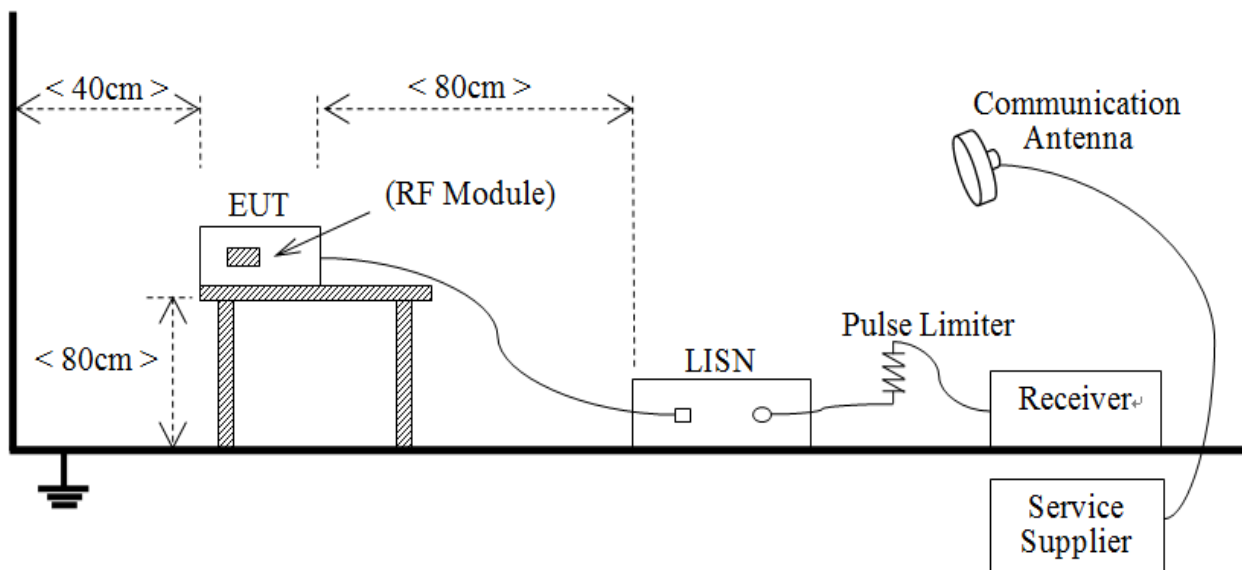
For example: the measurement value is 10 dBm and the cable 0.5dBm used, then the final result of EUT:

Conducted value (dBm) = 10 dBm + 0.5 dB = 10.5 dBm



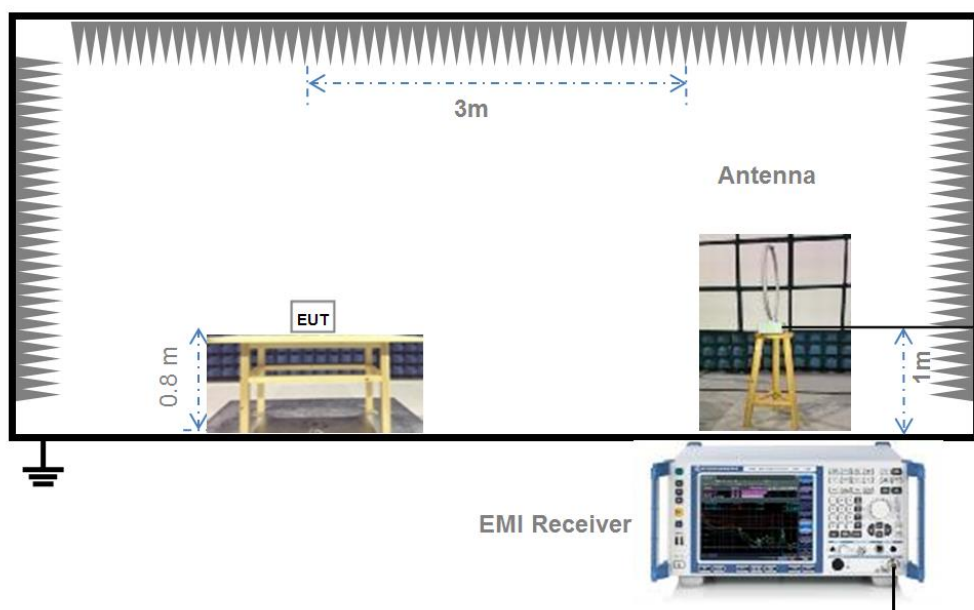
(Diagram 1)

4.4.2 For AC Power Supply Port Test



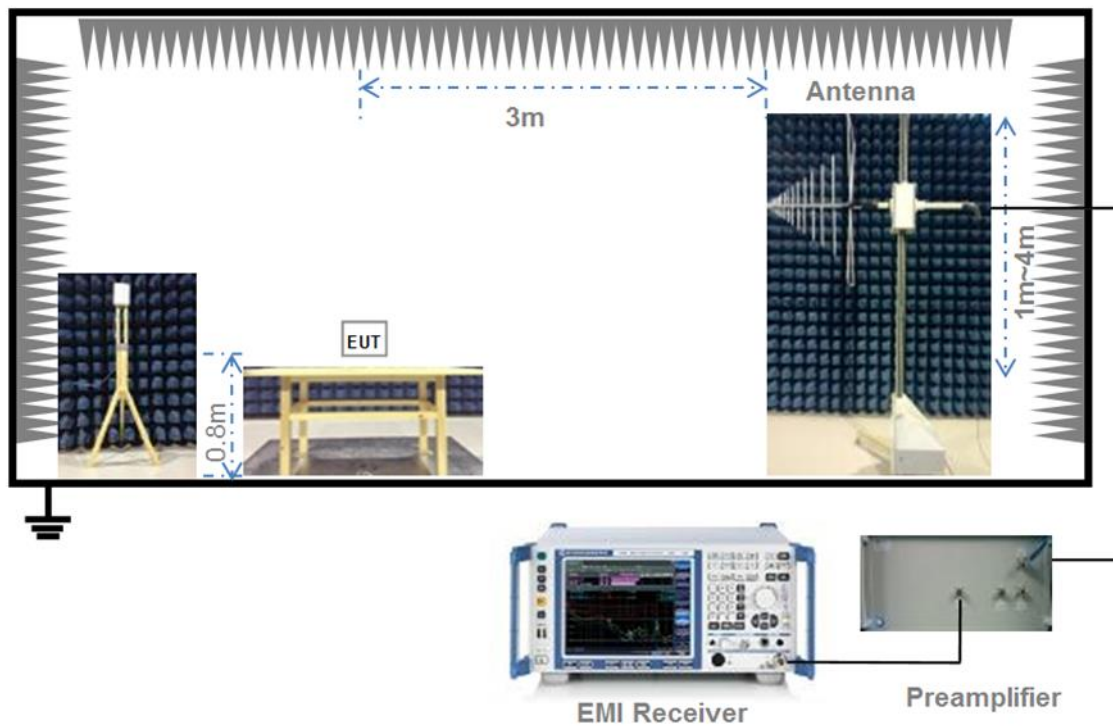
(Diagram 2)

4.4.3 For Radiated Test (Below 30 MHz)



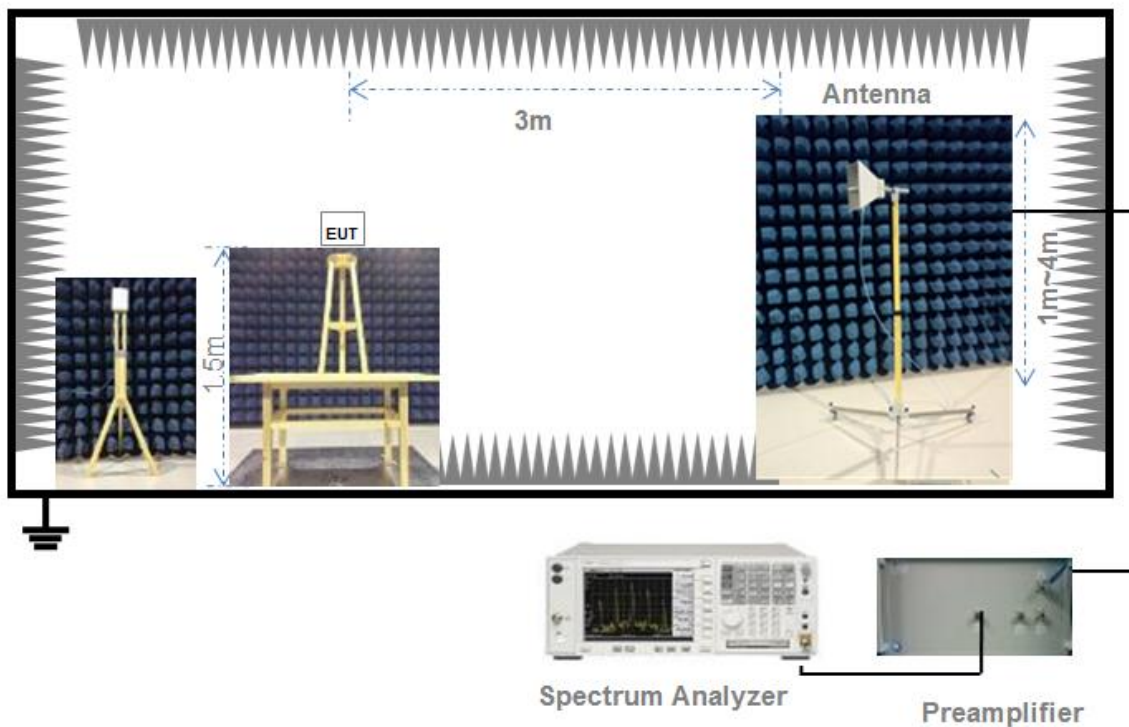
(Diagram 3)

4.4.4 For Radiated Test (30 MHz-1 GHz)



(Diagram 4)

4.4.5 For Radiated Test (Above 1 GHz)



(Diagram 5)

4.6 Measurement Results Explanation Example

4.5.1 For conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

4.5.2 For radiated band edges and spurious emission test:

Per part 15.35(c), the EUT Bluetooth average emission level could be determined by the peak emission level applying duty cycle correction factor, to represent averaging over the whole pulse train.

The average level is derived from the peak level corrected with "Duty cycle correction factor".

Average Emission Level (dBuV/m) = Peak Emission Level (dBuV/m) + Duty cycle correction factor (dB)

Duty cycle correction factor (dB) = $20 * \log (\text{Duty cycle})$.

Duty cycle = on time / 100 milliseconds

On time = dwell time * hopping number in 100 ms

For example: bluetooth with dwell time 2.9 ms and 3 hops in 100 ms, then

Duty cycle correction factor (dB) = $20 * \log ((2.9 * 3) / 100) = -21.21 \text{ dB}$

Following shows an average computation example with duty cycle correction factor = -21.21 dB, and the peak emission level is 45.61 dBuV/m.

Example:

Average Emission Level (dBuV/m) = Peak Emission Level (dBuV/m) + duty cycle correction factor (dB)
= $45.61 + (-21.21) = 24.4 \text{ (dBuV/m)}$

5 TEST ITEMS

5.1 Antenna Requirements

5.1.1 Relevant Standards

FCC §15.203 & 15.247(b); RSS-247,6.5 (c)

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. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. 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 FCC rule.

5.1.2 Antenna Anti-Replacement Construction

The Antenna Anti-Replacement as following method:

Protected Method	Description
The antenna is embedded in the product.	The antenna is welded on the mainboard, can't be replaced by the consumer

Reference Documents	Item
Photo	Please refer to the EUT Photo documents.

5.1.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

5.2 Number of Hopping Frequency

5.2.1 Limit

FCC §15.247(a) (1) (iii); RSS-247, 6.2.3.1(b)

Frequency hopping systems operating in the 2400 MHz to 2483.5 MHz bands shall use at least 15 hopping frequencies.

5.2.2 Test Setup

See section 4.5.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.2.3 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = the frequency band of operation

RBW $\geq$ 1% of the span

VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize

5.2.4 Test Result

Please refer to ANNEX A.1.

5.3 Peak Output Power and E.I.R.P

5.3.1 Test Limit

FCC § 15.247(b)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

RSS-247, 6.2.3.2

The following transmitter output power and e.i.r.p. requirements shall apply:

- a. if the hopset uses 75 or more hopping channels, the maximum peak conducted output power shall not exceed 1.0 W.
- b. if the hopset uses less than 75 hopping channels the maximum peak conducted output power shall not exceed 0.125 W.
- c. the e.i.r.p. shall not exceed 4 W, except as provided in sections 6.5 a) and b).

5.3.2 Test Setup

See section 4.5.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.3.3 Test Procedure

The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.

Use the following spectrum analyzer settings:

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

RBW > the 20 dB bandwidth of the emission being measured

VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

5.3.4 Test Result

Please refer to ANNEX A.2.

5.4 Occupied Bandwidth

5.4.1 Limit

FCC §15.247(a); RSS-247, 6.2.1 (a)

Measurement of the 20dB bandwidth of the modulated signal.

5.4.2 Test Setup

See section 4.5.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.4.3 Test Procedure

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel

RBW $\geq$ 1% of the 20 dB bandwidth

VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

The EUT should be transmitting at its maximum data rate, Allow the trace to stabilize.

5.4.4 Test Result

Please refer to ANNEX A.3.

5.5 Carrier Frequency Separation

5.5.1 Limit

FCC §15.247(a); RSS-247, 6.2.3.1(a)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

5.5.2 Test Setup

See section 4.5.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.5.3 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = wide enough to capture the peaks of two adjacent channels

Resolution (or IF) Bandwidth (RBW) $\geq$ 1% of the span

Video (or Average) Bandwidth (VBW) $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

5.5.4 Test Result

Please refer to ANNEX A.4.

5.6 Time of Occupancy (Dwell time)

5.6.1 Limit

FCC §15.247(a); RSS-247, 6.2.3.1(b)

Frequency hopping systems in the 2400 MHz - 2483.5 MHz band shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

5.6.2 Test Setup

See section 4.5.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.6.3 Test Procedure

The average time of occupancy on any channel within the Period can be calculated with formulas:

$$\{\text{Total of Dwell}\} = \{\text{Pulse Time}\} * \{\text{Number of Hopping Frequency in Period}\}$$

$$\{\text{Period}\} = 0.4\text{s} * \{\text{Number of Hopping Frequency}\}$$

The middle channels are selected to perform testing to record the dwell time of each occupation measured in this channel, which is called Pulse Time here.

5.6.4 Test Result

Please refer to ANNEX A.5

5.7 Conducted Spurious Emission & Authorized-band band-edge

5.7.1 Limit

FCC §15.247(d); RSS-247, 6.6

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.

5.7.2 Test Setup

See section 4.5.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.7.3 Test Procedure

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize

5.7.4 Test Result

Please refer to ANNEX A.6.

5.8 Conducted Emission

5.8.1 Limit

FCC §15.207; RSS-GEN, 8.8

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 within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dB μ V)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
0.50 - 30	60	50

5.8.2 Test Setup

See section 4.5.2 for test setup description for the AC power supply port. The photo of test setup please refer to ANNEX B.

5.8.3 Test Procedure

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

5.8.4 Test Result

Please refer to ANNEX A.7.

5.9 Radiated Spurious Emission

5.9.1 Limit

FCC §15.209&15.247(d); RSS-247, 6.6

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
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

Note:

1. Field Strength (dBμV/m) = $20 \times \log[\text{Field Strength } (\mu\text{V/m})]$.
2. In the emission tables above, the tighter limit applies at the band edges.
3. For Above 1000 MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
4. For above 1000 MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK).

5.9.2 Test Setup

See section 4.5.3 to 4.5.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.9.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz

VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

5.9.4 Test Result

Please refer to ANNEX A.8.

5.10 Band Edge (Restricted-band band-edge)

5.10.1 Limit

FCC §15.209&15.247(d); RSS-247, 6.6

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

5.10.2 Test Setup

See section 4.5.3 to 4.5.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.10.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz

VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

5.10.4 Test Result

Please refer to ANNEX A.9.

ANNEX A TEST RESULT

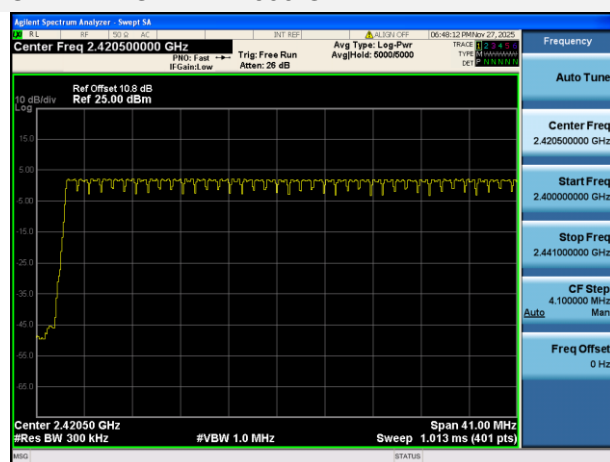
A.1 Number of Hopping Frequency

Test Data

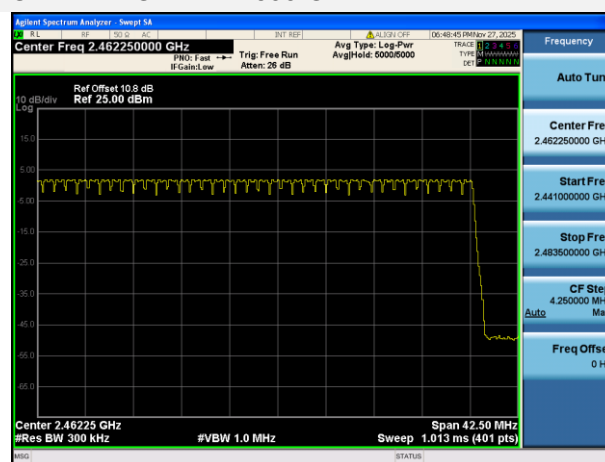
Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Verdict
GFSK	2400 - 2483.5	77	15	Pass

Test Plots

GFSK 2.4 GHz ~ 2.4835 GHz



GFSK 2.4 GHz ~ 2.4835 GHz



A.2 Peak Output Power and E.I.R.P

Peak Power Test Data

Channel	Measured Output Peak Power		Limit		Verdict
	GFSK		dBm	mW	
	dBm	mW			
Low	-0.50	0.89	21	125	Pass
Middle	-0.58	0.87			Pass
High	-0.87	0.82			Pass

E.I.R.P Test Data (For ISSED)

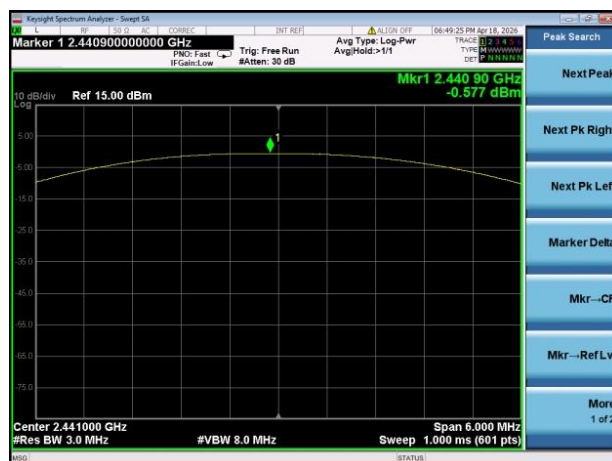
Channel	E.I.R.P		Limit		Verdict
	GFSK		dBm	mW	
	dBm	mW			
Low	2.99	1.99	36	4000	Pass
Middle	2.91	1.95			Pass
High	2.62	1.83			Pass

Test Plots

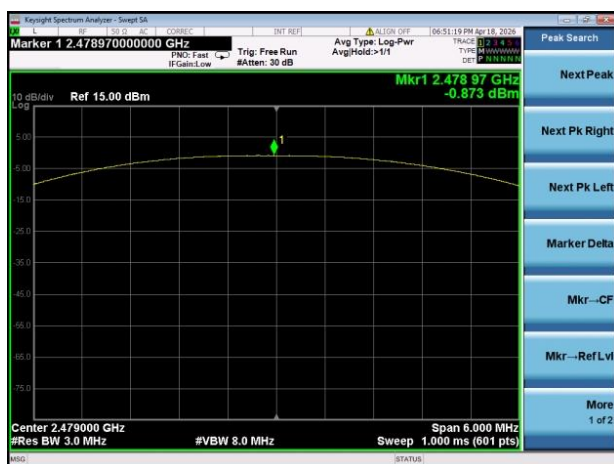
GFSK LOW CHANNEL



GFSK MIDDLE CHANNEL



GFSK HIGH CHANNEL



A.3 Occupied Bandwidth

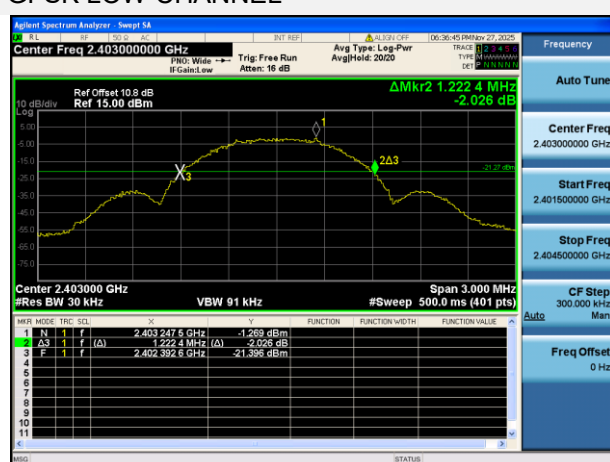
Test Data

GFSK		
Channel	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	1.222400	1.020800
Middle	1.214800	1.024700
High	1.185100	1.014400

Test Plots

20 dB Bandwidth

GFSK LOW CHANNEL



GFSK MIDDLE CHANNEL

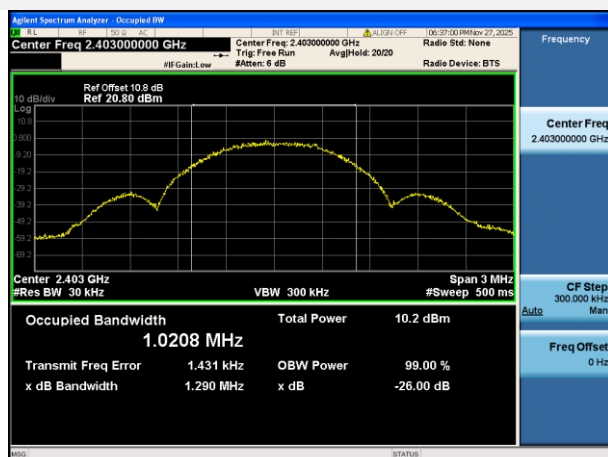


GFSK HIGH CHANNEL

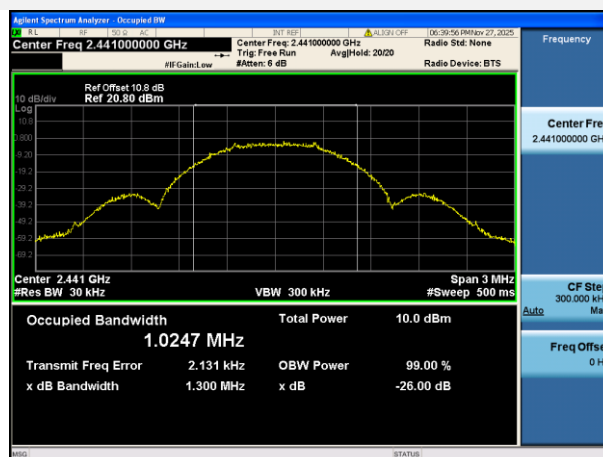


99% Bandwidth

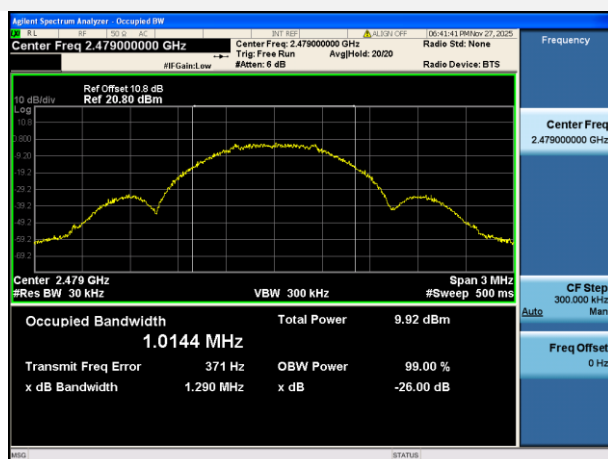
GFSK LOW CHANNEL



GFSK MIDDLE CHANNEL



GFSK HIGH CHANNEL



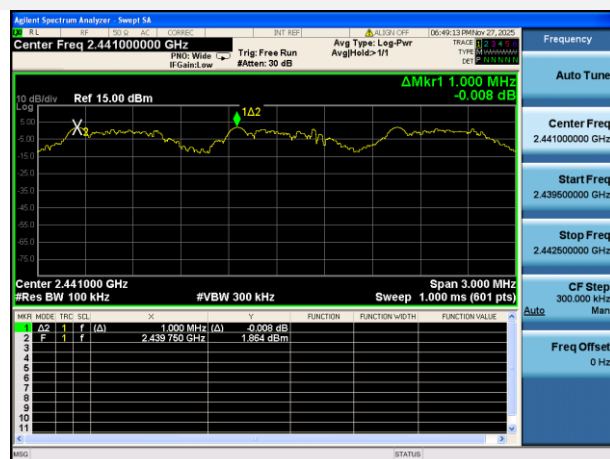
A.4 Hopping Frequency Separation

Test Data

Mode	Frequency separation (MHz)	2/3 of the 20 dB Bandwidth (MHz)	Verdict
GFSK	1.000	0.815	Pass

Test Plots

GFSK



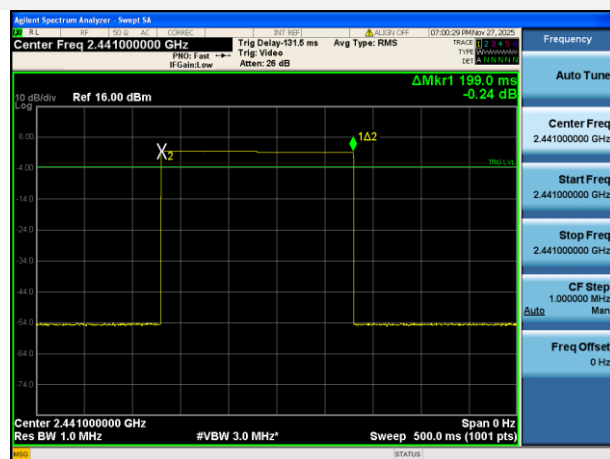
A.5 Time of Occupancy (Dwell time)

Test Data

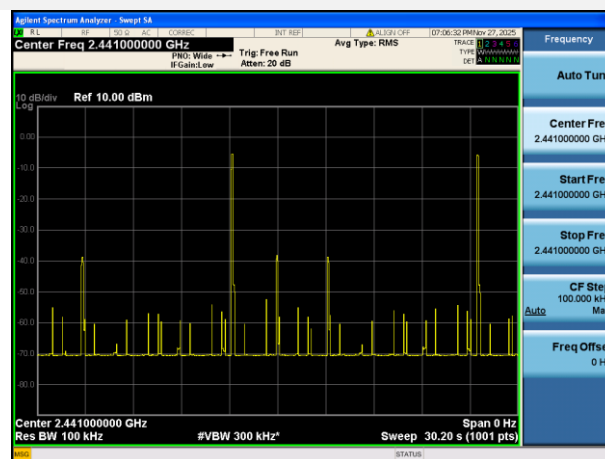
GFSK				
Test Mode	Pulse Width (ms)	Total of Dwell (ms)	Limit (sec)	Verdict
Hopping	199.000	398.000	0.4	Pass

Test Plots

GFSK Pulse Width



GFSK Total of Dwell



A.6 Conducted Spurious Emissions & Authorized-band band-edge

Test Data

GFSK				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-36.88	1.78	-18.22	Pass
Middle	-37.14	1.84	-18.16	Pass
High	-35.95	1.63	-18.37	Pass

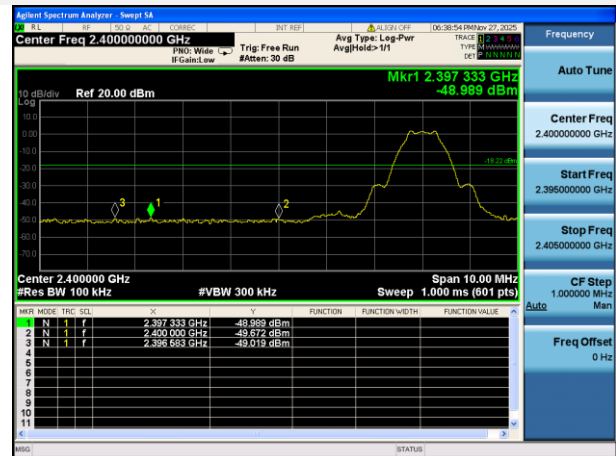
Hopping Mode				
Mode	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
GFSK	-26.56	2.08	-17.92	Pass

Test Plots

GFSK LOW CHANNEL, CARRIER LEVEL

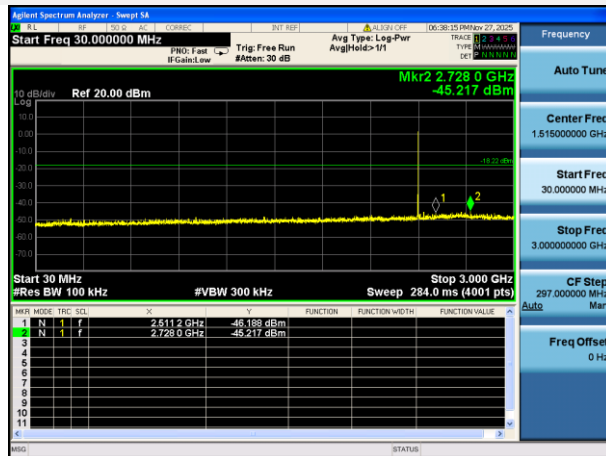


GFSK LOW CHANNEL, BAND EDGE



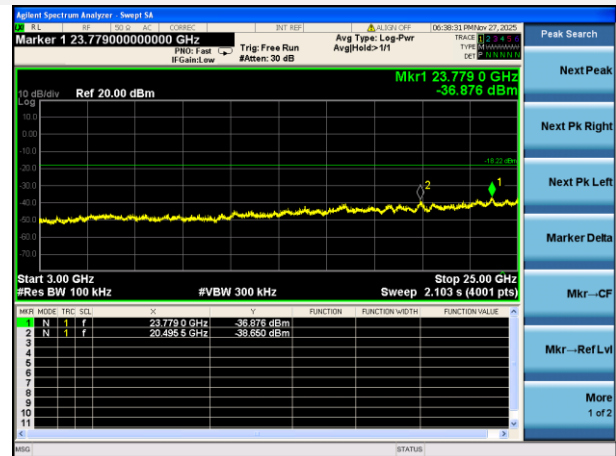
GFSK LOW CHANNEL, SPURIOUS

30 MHz ~ 3 GHz

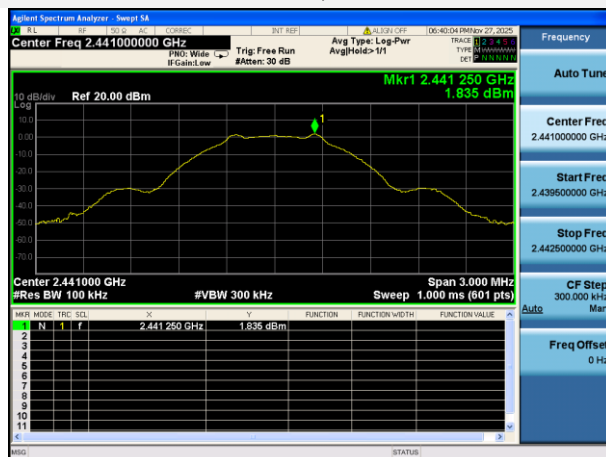


GFSK LOW CHANNEL, SPURIOUS

3 GHz ~ 25 GHz



GFSK MIDDLE CHANNEL, CARRIER LEVEL



Agilent Spectrum Analyzer Screenshot

Start Freq 30.000000 MHz

Ref 20.00 dBm

Mkr2 2.692 4 GHz
-44.448 dBm

Start 30 MHz
#Res BW 100 kHz

#VBW 300 kHz

Sweep 284.0 ms (4001 pts)

Stop 3.000 GHz

MNR	MODE	FREQ	SCN	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	2.692 4 GHz	1	-43.524 dBm				
2	N	2.692 4 GHz	1	-44.448 dBm				

Signal Spectrum Analyzer Screenshot

Marker 1 24.485000000000 GHz

Ref 20.00 dBm

Mkr1 24.485 5 GHz -37.141 dBm

Start 3.00 GHz #RES BW 100 kHz #VBW 300 kHz Sweep 25.00 GHz 2.103 s (4001 pts)

MNR	MODE	FREQ	SPAN	RES BW	VBW	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	24.485 GHz	5 GHz	17.063 GHz	300 kHz			-37.141 dBm
2	N	1	f	17.063 GHz	300 kHz			-40.283 dBm

[illegible]

Agilent Spectrum Analyzer, Sweep 5A

Center Freq 2.483500000 GHz

PRO: Wide L₁ U Galn L Low

Trig: Free Run

Avg Type: Log-Pwr

AvgHold: 1/1

Span 10.00 MHz

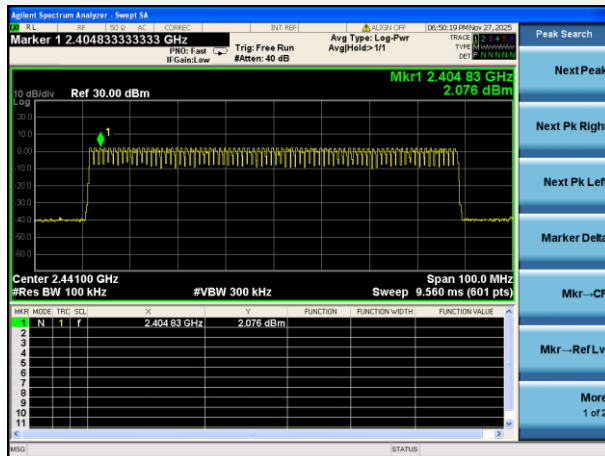
Ref 20.00 dBm

Mkr3 2.485 467 GHz -48.998 dBm

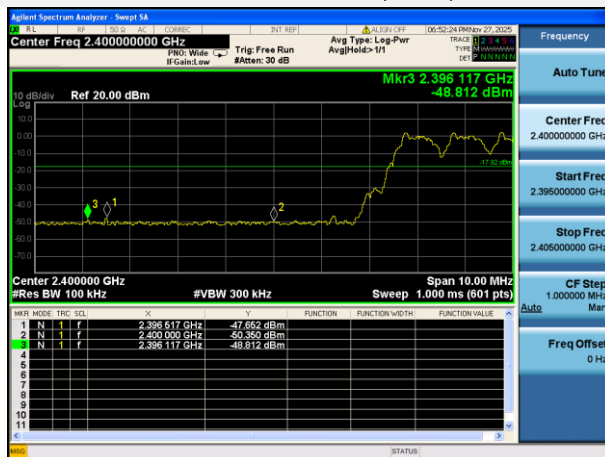
MNR	MODE	TRC	STL	F	F ₁	F ₂	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.483 633 GHz	-49.248 dBm				
2	N	1	f	2.483 500 GHz	-51.186 dBm				
3	N	1	f	2.485 467 GHz	-48.998 dBm				

[illegible][illegible]

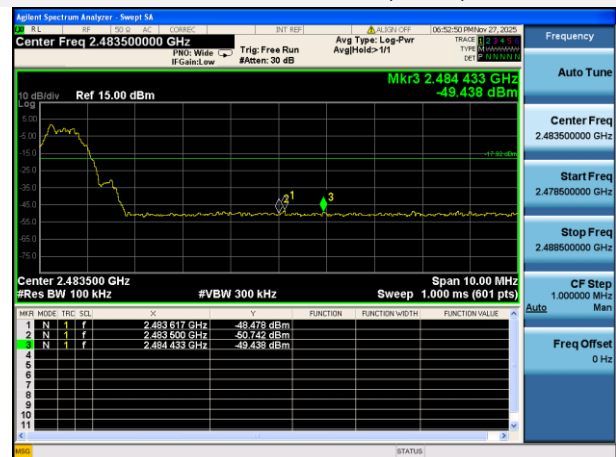
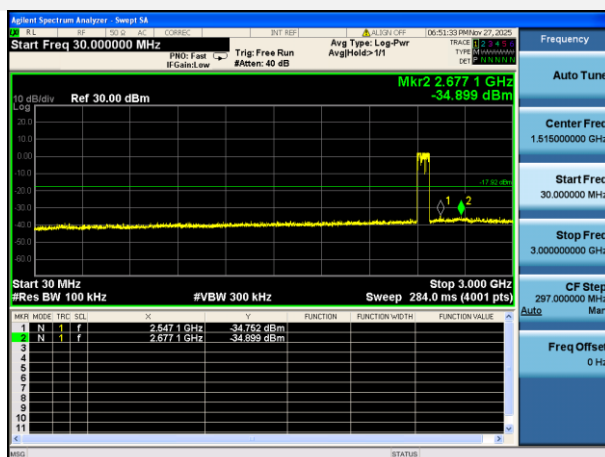
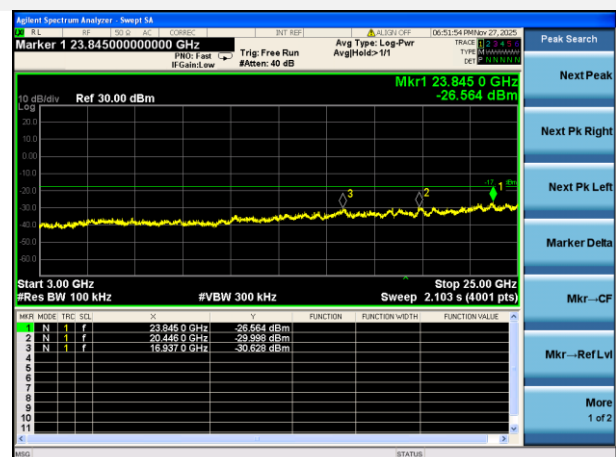
GFSK HOPPING, CARRIER LEVEL



GFSK HOPPING BAND EDGE (LOW)



GFSK HOPPING BAND EDGE (HIGH)

GFSK Hopping Mode, SPURIOUS
30 MHz ~ 3 GHzGFSK Hopping Mode, SPURIOUS
3GHz ~ 25 GHz

A.7 Conducted Emissions

Note¹: The EUT is working in the Normal link mode. All modes have been tested and normal link mode is worst.

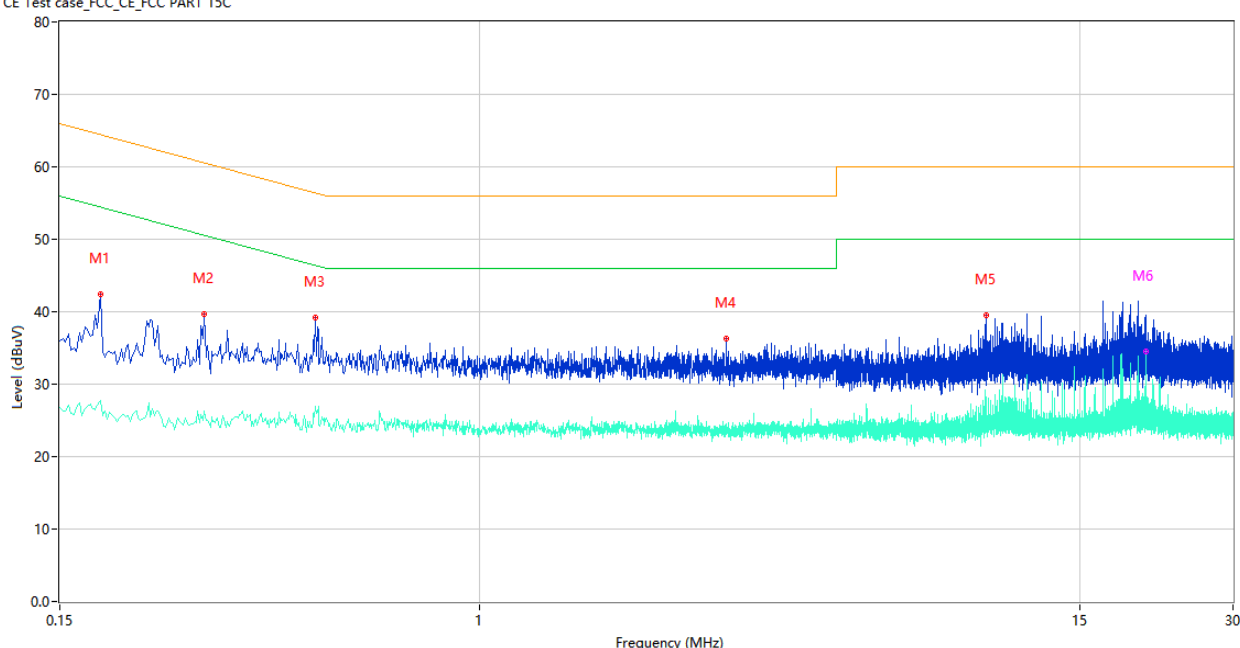
Note²: Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 60 Hz and 240 VAC, 50 Hz) for which the device is capable of operation. So, The configuration 120 VAC, 60 Hz and 240 VAC, 50 Hz were tested respectively, but only the worst configuration (120 VAC, 60 Hz) shown here.

Note³: Results (dBuV) = Original reading level of Spectrum Analyzer (dBuV) + Factor (dB)

Test Data and Plots

PHASE L

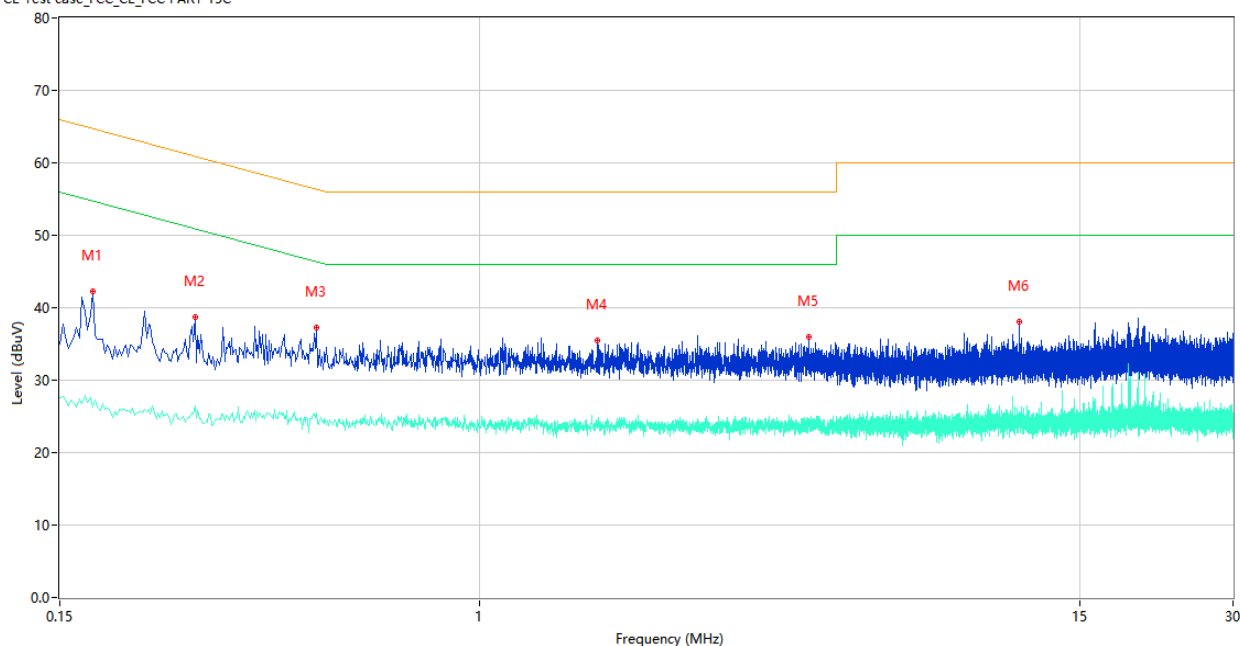
CE Test case_FCC_CE_FCC PART 15C



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.180	42.35	9.85	64.49	22.14	Peak	L	Pass
1**	0.180	27.68	9.85	54.49	26.81	AV	L	Pass
2	0.288	39.61	9.82	60.58	20.97	Peak	L	Pass
2**	0.288	26.34	9.82	50.58	24.24	AV	L	Pass
3	0.476	39.19	10.06	56.41	17.22	Peak	L	Pass
3**	0.476	27.00	10.06	46.41	19.41	AV	L	Pass
4	3.040	36.31	10.18	56.00	19.69	Peak	L	Pass
4**	3.040	24.54	10.18	46.00	21.46	AV	L	Pass
5	9.820	39.53	10.34	60.00	20.47	Peak	L	Pass
5**	9.820	26.02	10.34	50.00	23.98	AV	L	Pass
6	20.278	39.56	11.09	60.00	20.44	Peak	L	Pass
6**	20.278	34.46	11.09	50.00	15.54	AV	L	Pass

PHASE N

CE Test case_FCC_CE_FCC PART 15C



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.174	42.31	9.85	64.77	22.46	Peak	N	Pass
1**	0.174	26.36	9.85	54.77	28.41	AV	N	Pass
2	0.276	38.77	9.82	60.94	22.17	Peak	N	Pass
2**	0.276	26.49	9.82	50.94	24.45	AV	N	Pass
3	0.478	37.30	10.06	56.37	19.07	Peak	N	Pass
3**	0.478	25.44	10.06	46.37	20.93	AV	N	Pass
4	1.698	35.45	10.25	56.00	20.55	Peak	N	Pass
4**	1.698	24.40	10.25	46.00	21.60	AV	N	Pass
5	4.418	35.93	10.30	56.00	20.07	Peak	N	Pass
5**	4.418	23.90	10.30	46.00	22.10	AV	N	Pass
6	11.418	38.07	10.74	60.00	21.93	Peak	N	Pass
6**	11.418	25.25	10.74	50.00	24.75	AV	N	Pass

A.8 Radiated Emission

Note¹: The symbol of “--” in the table which means not application.

Note²: For the test data above 1 GHz, according the ANSI C63.10-2020, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Note³: The EUT is working in the Normal link mode below 1 GHz. All modes have been tested and DH5-Hopping mode is the worst.

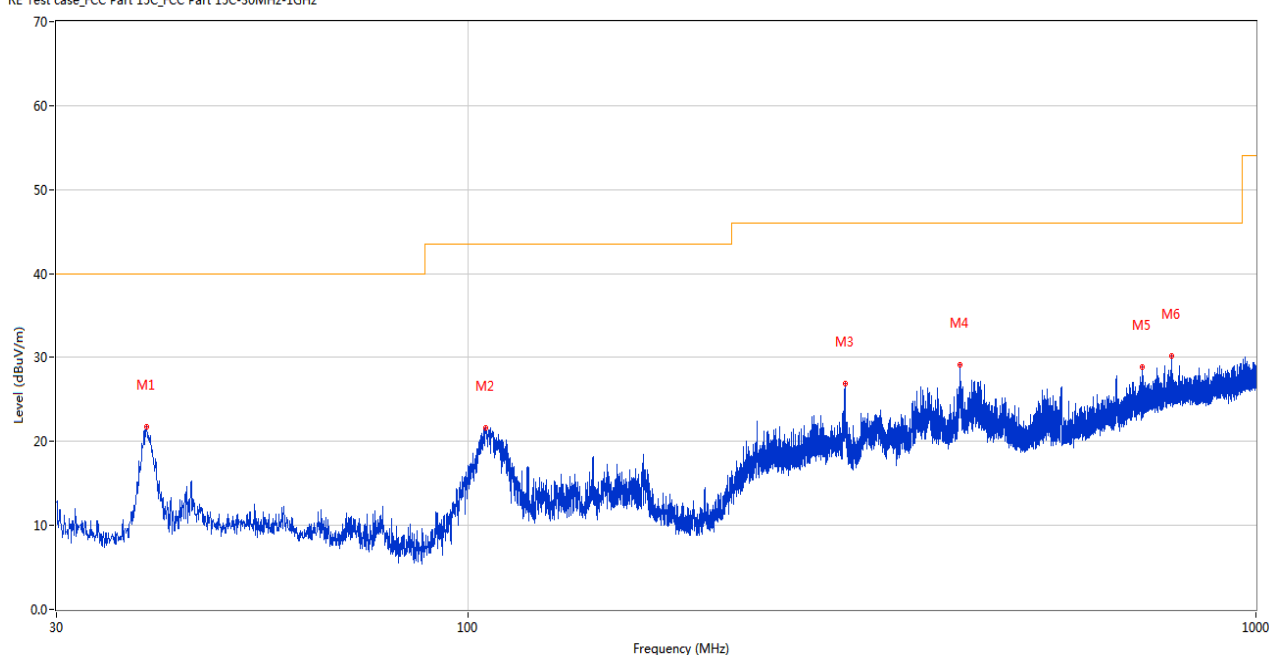
Note⁴: Results (dBuV/m) = Original reading level of Spectrum Analyzer (dBuV/m) + Factor (dB)

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

Test Data and Plots

30 MHz to 1 GHz, ANT H

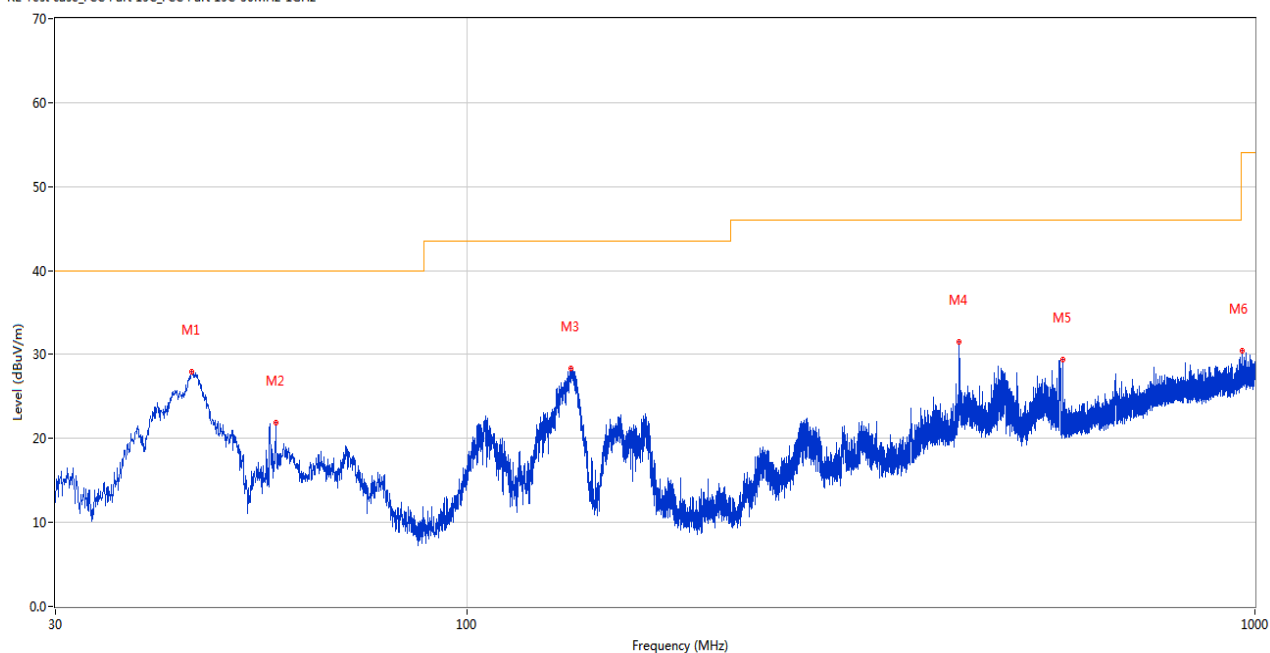
RE Test case_FCC Part 15C_FCC Part 15C-30MHz-1GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	39.069	21.75	-26.33	40.0	18.25	Peak	333.00	100	Horizontal	Pass
2	105.175	21.68	-29.14	43.5	21.82	Peak	360.00	200	Horizontal	Pass
3	300.921	26.85	-23.72	46.0	19.15	Peak	37.00	100	Horizontal	Pass
4	420.958	29.08	-20.13	46.0	16.92	Peak	249.00	200	Horizontal	Pass
5	718.263	28.89	-13.57	46.0	17.11	Peak	170.00	100	Horizontal	Pass
6	781.993	30.23	-11.93	46.0	15.77	Peak	229.00	100	Horizontal	Pass

30 MHz to 1 GHz, ANT V

RE Test case_FCC Part 15C_FCC Part 15C-30MHz-1GHz



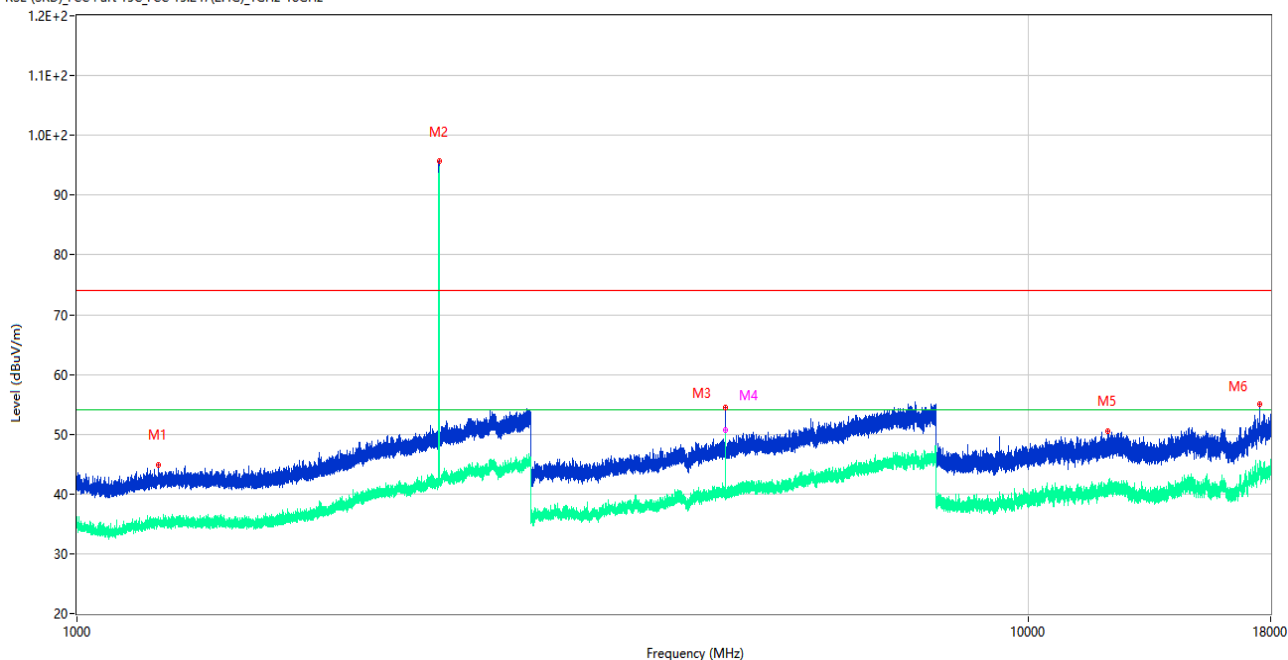
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	44.647	27.93	-25.97	40.0	12.07	Peak	214.00	100	Vertical	Pass
2	57.160	21.94	-26.16	40.0	18.06	Peak	360.00	100	Vertical	Pass
3	135.488	28.36	-25.92	43.5	15.14	Peak	246.00	100	Vertical	Pass
4	421.201	31.56	-20.12	46.0	14.44	Peak	304.00	100	Vertical	Pass
5	569.805	29.45	-16.56	46.0	16.55	Peak	0.00	100	Vertical	Pass
6	964.207	30.48	-9.65	54.0	23.52	Peak	289.00	100	Vertical	Pass

Note¹: The marked spikes near 2400 MHz with circle should be ignored because they are Fundamental signal.

Note²: The spurious from 18GHz-25GHz is noise only, do not show on the report.

GFSK LOW CHANNEL 1 GHz to 18 GHz, ANT H

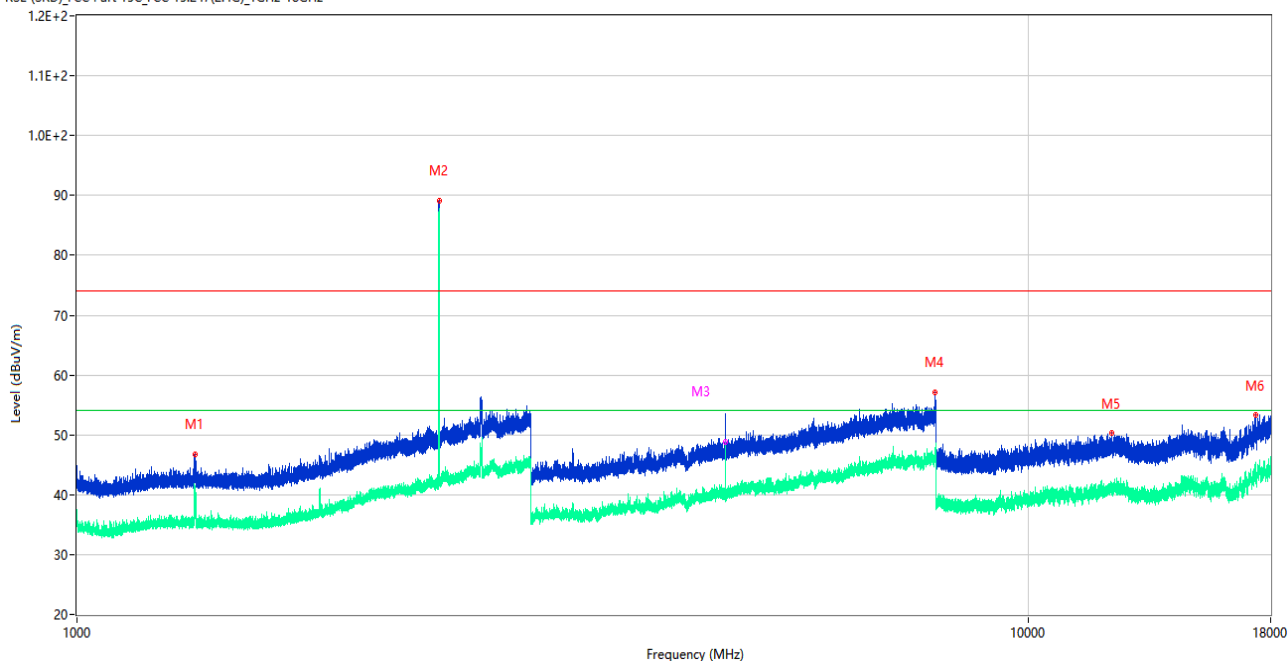
RSE (SRD)_FCC Part 15C_FCC 15.247(2.4G)_1GHz-18GHz



No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1219.200	44.88	74.0	29.12	Peak	201.00	200	Horizontal	Pass
1**	1219.200	34.90	54.0	19.10	AV	201.00	200	Horizontal	Pass
2	2402.500	95.68	74.0	-21.68	Peak	67.00	150	Horizontal	N/A
2**	2402.500	94.50	54.0	-40.50	AV	67.00	150	Horizontal	N/A
3	4805.250	54.44	74.0	19.56	Peak	348.00	200	Horizontal	Pass
3**	4805.250	49.22	54.0	4.78	AV	348.00	200	Horizontal	Pass
4	4805.500	53.73	74.0	20.27	Peak	353.00	150	Horizontal	Pass
4**	4805.500	50.61	54.0	3.39	AV	353.00	150	Horizontal	Pass
5	12124.662	50.51	74.0	23.49	Peak	179.00	400	Horizontal	Pass
5**	12124.662	40.13	54.0	13.87	AV	179.00	400	Horizontal	Pass
6	17533.276	55.07	74.0	18.93	Peak	242.00	150	Horizontal	Pass
6**	17533.276	44.86	54.0	9.14	AV	242.00	150	Horizontal	Pass

GFSK LOW CHANNEL 1 GHz to 18 GHz, ANT V

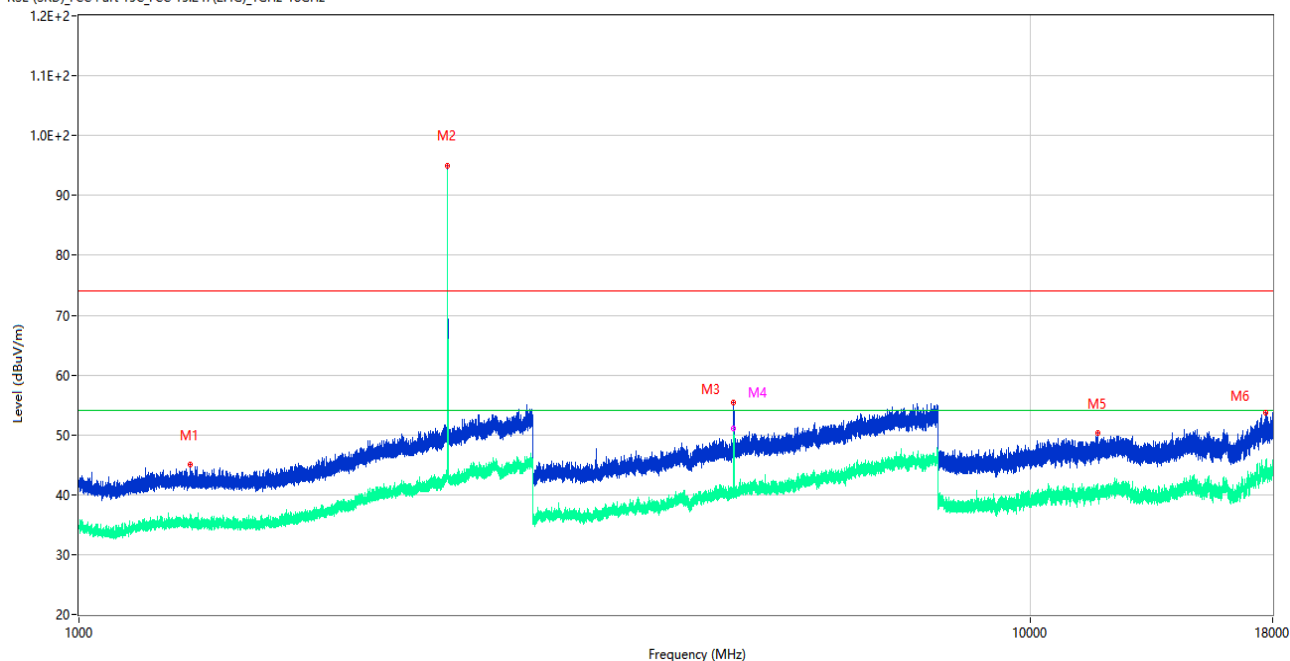
RSE (SRD)_FCC Part 15C_FCC 15.247(2.4G)_1GHz-18GHz



No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1331.800	46.73	74.0	27.27	Peak	196.00	300	Vertical	Pass
1**	1331.800	35.97	54.0	18.03	AV	196.00	300	Vertical	Pass
2	2402.500	89.13	74.0	-15.13	Peak	204.00	100	Vertical	N/A
2**	2402.500	86.01	54.0	-32.01	AV	204.00	100	Vertical	N/A
3	4805.500	52.61	74.0	21.39	Peak	117.00	150	Vertical	Pass
3**	4805.500	48.75	54.0	5.25	AV	117.00	150	Vertical	Pass
4	7987.500	57.18	74.0	16.82	Peak	168.00	300	Vertical	Pass
4**	7987.500	47.51	54.0	6.49	AV	168.00	300	Vertical	Pass
5	12260.513	50.23	74.0	23.77	Peak	145.00	200	Vertical	Pass
5**	12260.513	40.62	54.0	13.38	AV	145.00	200	Vertical	Pass
6	17355.037	53.32	74.0	20.68	Peak	300.00	200	Vertical	Pass
6**	17355.037	44.06	54.0	9.94	AV	300.00	200	Vertical	Pass

GFSK MIDDLE CHANNEL 1 GHz to 18 GHz, ANT H

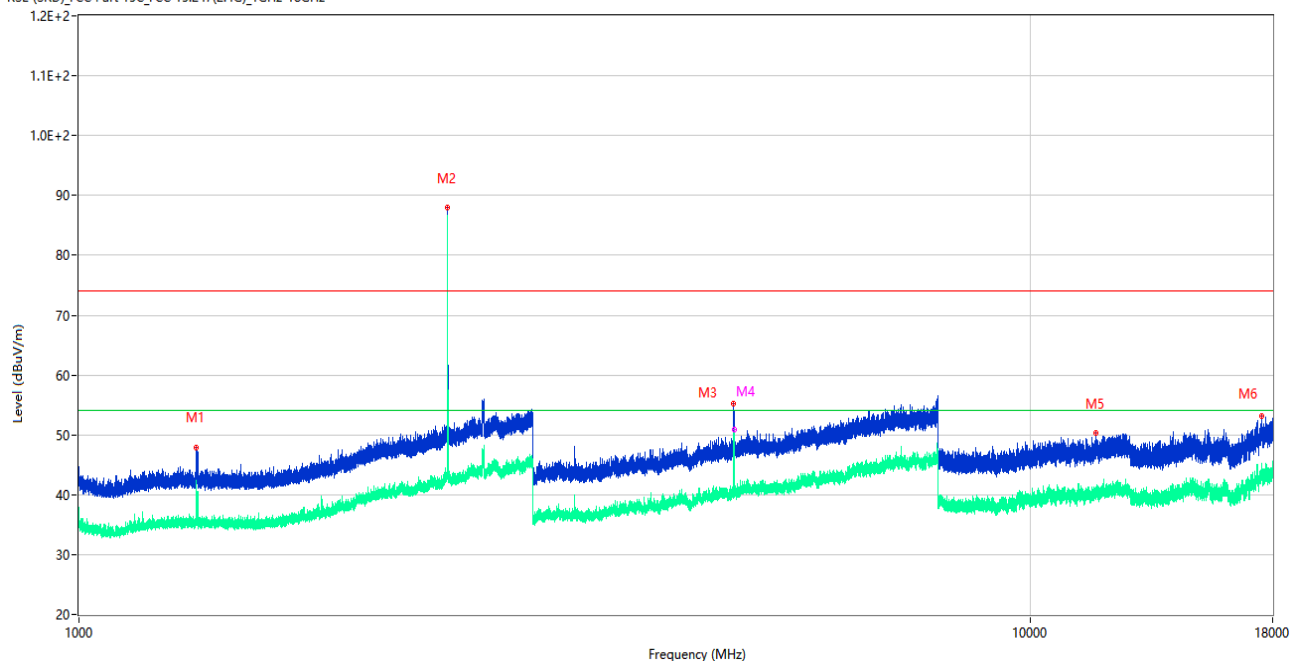
RSE (SRD)_FCC Part 15C_FCC 15.247(2.4G)_1GHz-18GHz



No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1309.700	44.99	74.0	29.01	Peak	10.00	300	Horizontal	Pass
1**	1309.700	35.38	54.0	18.62	AV	10.00	300	Horizontal	Pass
2	2440.500	95.01	74.0	-21.01	Peak	65.00	100	Horizontal	N/A
2**	2440.500	92.21	54.0	-38.21	AV	65.00	100	Horizontal	N/A
3	4881.000	55.34	74.0	18.66	Peak	248.00	150	Horizontal	Pass
3**	4881.000	49.13	54.0	4.87	AV	248.00	150	Horizontal	Pass
4	4881.750	54.22	74.0	19.78	Peak	248.00	150	Horizontal	Pass
4**	4881.750	50.98	54.0	3.02	AV	248.00	150	Horizontal	Pass
5	11786.225	50.31	74.0	23.69	Peak	207.00	400	Horizontal	Pass
5**	11786.225	40.52	54.0	13.48	AV	207.00	400	Horizontal	Pass
6	17718.338	53.75	74.0	20.25	Peak	346.00	150	Horizontal	Pass
6**	17718.338	45.64	54.0	8.36	AV	346.00	150	Horizontal	Pass

GFSK MIDDLE CHANNEL 1 GHz to 18 GHz, ANT V

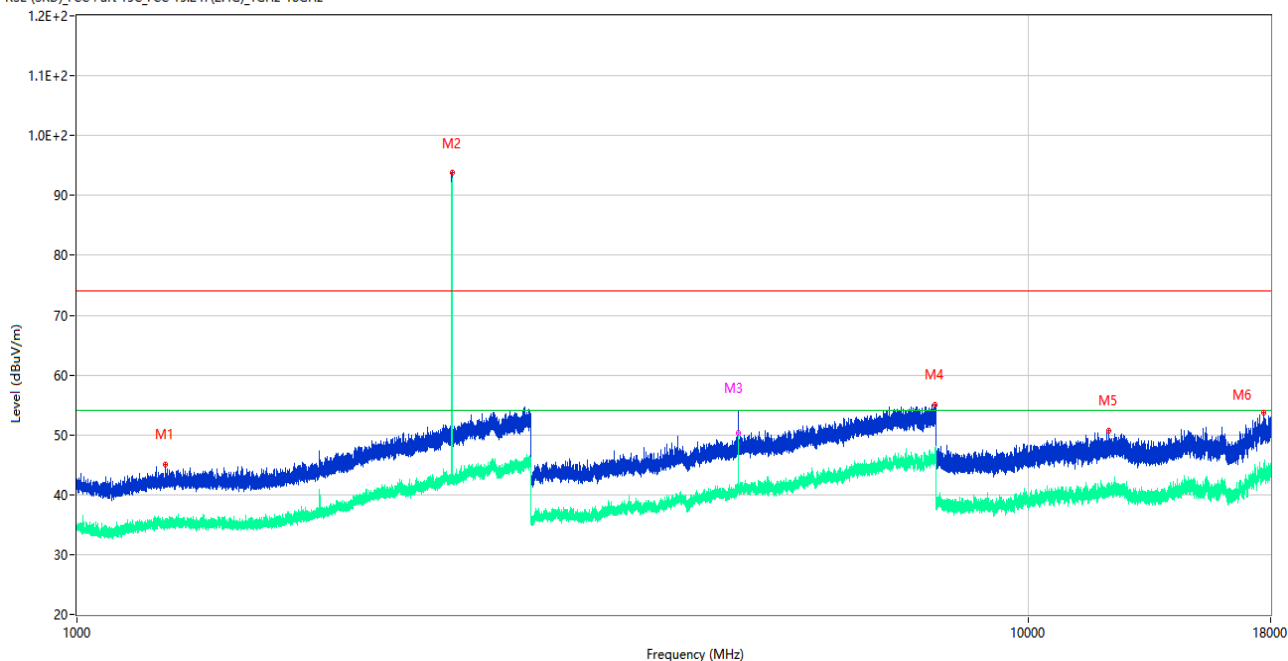
RSE (SRD)_FCC Part 15C_FCC 15.247(2.4G)_1GHz-18GHz



No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1327.700	47.96	74.0	26.04	Peak	189.00	400	Vertical	Pass
1**	1327.700	39.84	54.0	14.16	AV	189.00	400	Vertical	Pass
2	2440.500	87.92	74.0	-13.92	Peak	151.00	100	Vertical	N/A
2**	2440.500	85.01	54.0	-31.01	AV	151.00	100	Vertical	N/A
3	4883.250	55.15	74.0	18.85	Peak	148.00	200	Vertical	Pass
3**	4883.250	49.87	54.0	4.13	AV	148.00	200	Vertical	Pass
4	4883.500	52.94	74.0	21.06	Peak	148.00	150	Vertical	Pass
4**	4883.500	50.80	54.0	3.20	AV	148.00	150	Vertical	Pass
5	11722.812	50.31	74.0	23.69	Peak	114.00	200	Vertical	Pass
5**	11722.812	40.21	54.0	13.79	AV	114.00	200	Vertical	Pass
6	17537.475	53.16	74.0	20.84	Peak	75.00	150	Vertical	Pass
6**	17537.475	43.54	54.0	10.46	AV	75.00	150	Vertical	Pass

GFSK HIGH CHANNEL 1 GHz to 18 GHz, ANT H

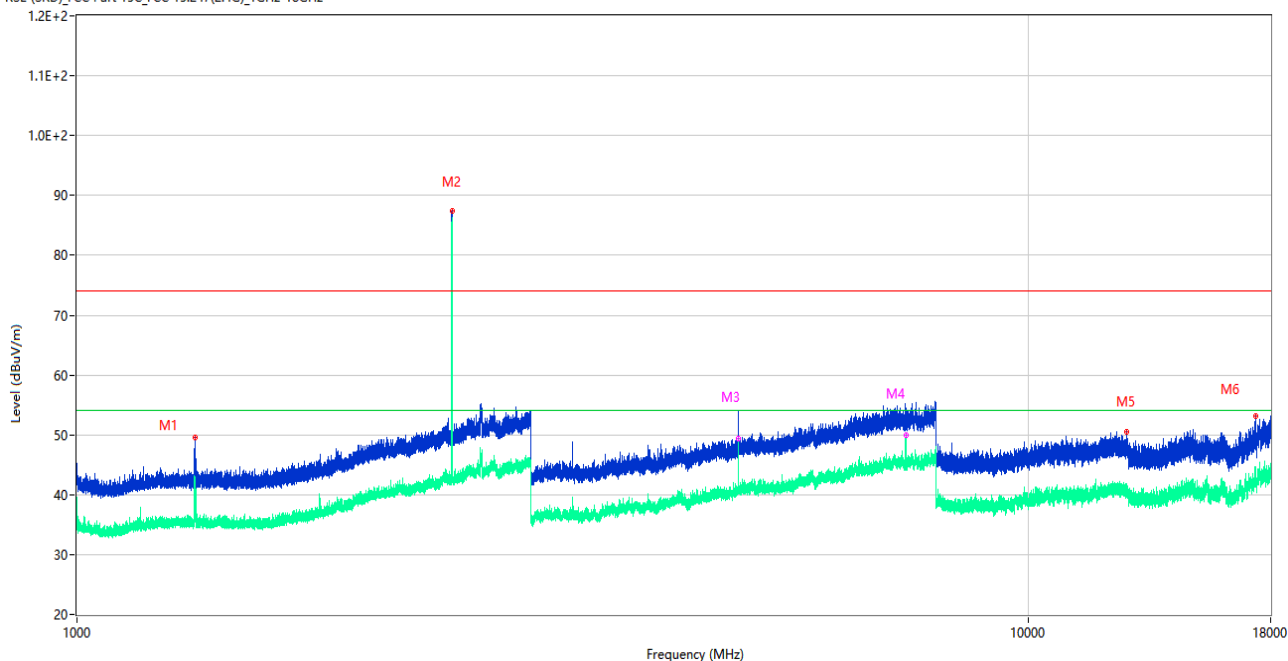
RSE (SRD)_FCC Part 15C_FCC 15.247(2.4G)_1GHz-18GHz



No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1240.100	45.10	74.0	28.90	Peak	115.00	300	Horizontal	Pass
1**	1240.100	35.39	54.0	18.61	AV	115.00	300	Horizontal	Pass
2	2479.500	93.79	74.0	-19.79	Peak	78.00	200	Horizontal	N/A
2**	2479.500	91.89	54.0	-37.89	AV	78.00	200	Horizontal	N/A
3	4959.500	53.44	74.0	20.56	Peak	239.00	150	Horizontal	Pass
3**	4959.500	50.32	54.0	3.68	AV	239.00	150	Horizontal	Pass
4	7989.000	55.08	74.0	18.92	Peak	96.00	300	Horizontal	Pass
4**	7989.000	47.16	54.0	6.84	AV	96.00	300	Horizontal	Pass
5	12157.674	50.77	74.0	23.23	Peak	208.00	300	Horizontal	Pass
5**	12157.674	40.95	54.0	13.05	AV	208.00	300	Horizontal	Pass
6	17711.776	53.68	74.0	20.32	Peak	345.00	150	Horizontal	Pass
6**	17711.776	43.89	54.0	10.11	AV	345.00	150	Horizontal	Pass

GFSK HIGH CHANNEL 1 GHz to 18 GHz, ANT V

RSE (SRD)_FCC Part 15C_FCC 15.247(2.4G)_1GHz-18GHz



No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1330.500	49.56	74.0	24.44	Peak	191.00	300	Vertical	Pass
1**	1330.500	38.28	54.0	15.72	AV	191.00	300	Vertical	Pass
2	2479.500	87.40	74.0	-13.40	Peak	198.00	150	Vertical	N/A
2**	2479.500	86.10	54.0	-32.10	AV	198.00	150	Vertical	N/A
3	4957.250	53.44	74.0	20.56	Peak	150.00	150	Vertical	Pass
3**	4957.250	49.30	54.0	4.70	AV	150.00	150	Vertical	Pass
4	7438.500	54.12	74.0	19.88	Peak	107.00	150	Vertical	Pass
4**	7438.500	49.87	54.0	4.13	AV	107.00	150	Vertical	Pass
5	12712.950	50.57	74.0	23.43	Peak	282.00	400	Vertical	Pass
5**	12712.950	40.32	54.0	13.68	AV	282.00	400	Vertical	Pass
6	17361.863	53.06	74.0	20.94	Peak	37.00	150	Vertical	Pass
6**	17361.863	43.56	54.0	10.44	AV	37.00	150	Vertical	Pass

A.9 Band Edge (Restricted-band band-edge)

Note¹: The lowest and highest channels are tested to verify the band edge emissions. Please refer to the following the plots for emissions values.

Note²: The test data all are tested in the vertical and horizontal antenna which the trace is max hold. So these plots have shown the worst case.

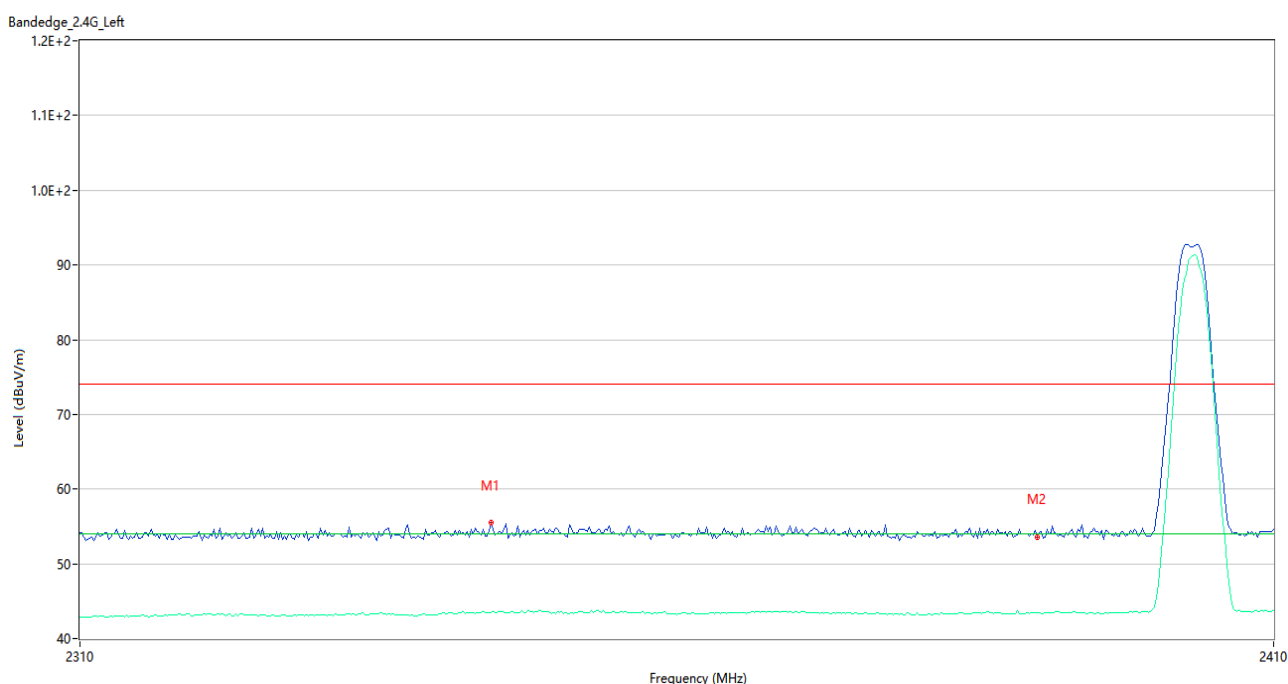
Note³: According the ANSI C63.10-2020, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Note⁴: The Level (dBuV/m) has been corrected by factor.

Note⁵: Both horizontal and vertical directions were pre tested, only the worst configuration has been reported in this report.

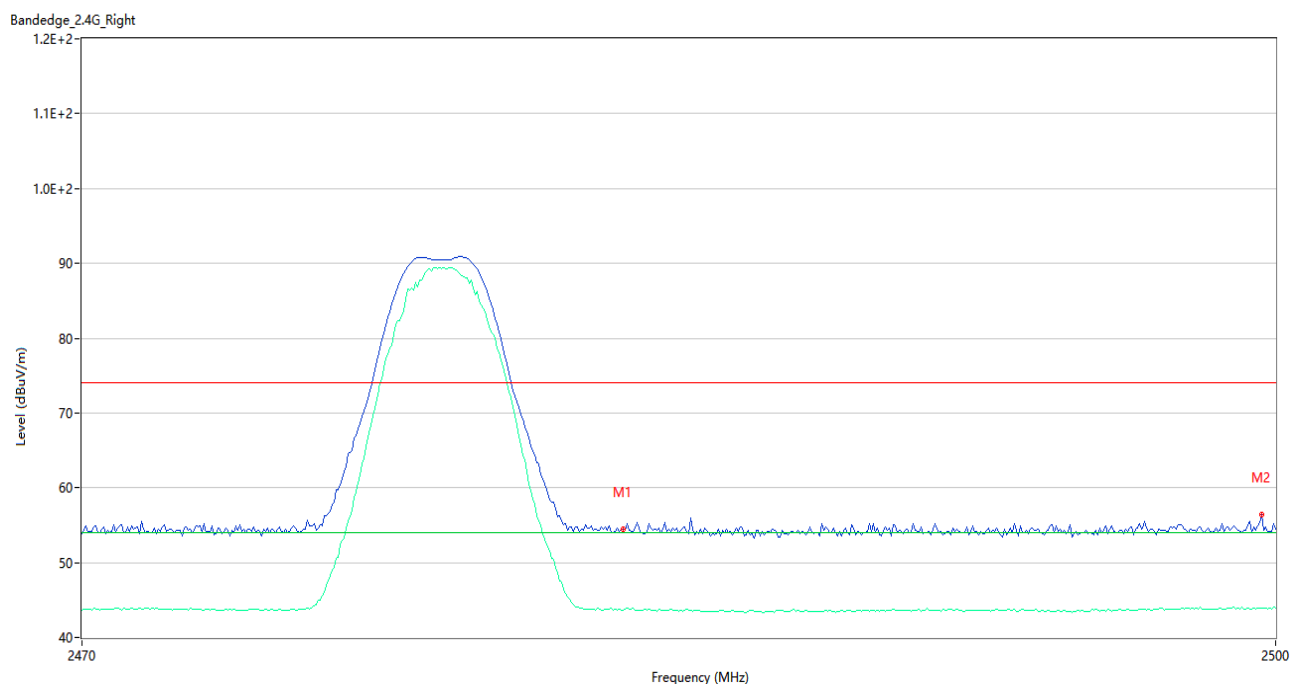
Test Data and Plots

GFSK LOW CHANNEL



No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	2344.000	55.46	74.0	18.54	Peak	138.00	100	Horizontal	Pass
1**	2344.000	43.41	54.0	10.59	AV	138.00	100	Horizontal	Pass
2	2389.833	53.63	74.0	20.37	Peak	48.00	150	Horizontal	Pass
2**	2389.833	43.43	54.0	10.57	AV	48.00	150	Horizontal	Pass

GFSK HIGH CHANNEL



No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	2483.550	54.47	74.0	19.53	Peak	340.00	100	Horizontal	Pass
1**	2483.550	43.68	54.0	10.32	AV	340.00	100	Horizontal	Pass
2	2499.650	56.39	74.0	17.61	Peak	28.00	200	Horizontal	Pass
2**	2499.650	43.88	54.0	10.12	AV	28.00	200	Horizontal	Pass

ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SZ2591027-AR.PDF”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ2591027-AW.PDF”.

ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL-SZ2591027-AI.PDF”.

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--END OF REPORT--