

RF

TEST REPORT

ISSUED BY
Shenzhen BALUN Technology Co., Ltd.



FOR
**Feiyu SCORP Pro 3-Axis Camera Handheld
Stabilizer**

ISSUED TO
Guilin Feiyu Technology Incorporated Company

Plot D-14-1b, Information Industry Park, Guilin National High-tech Zone,
East side of Donghuan Road, Qixing District, Guilin, Guangxi, China



Tested by:

Ye Hongji

Date

Nov. 25, 2021

Approved by:

Liao Jianming
(Technical Director)

Date

Nov. 25, 2021

Report No.: BL-SZ2191039-602

EUT Name: Feiyu SCORP Pro 3-Axis
Camera Handheld Stabilizer

Model Name: Feiyu F4

Brand Name: FeiyuTech

Test Standard: 47 CFR Part 15 Subpart C
(refer section 3.1)

FCC ID: 2AHW7-FEYUF4

Test Conclusion: Pass

Test Date: Oct. 16, 2021~ Nov. 10, 2021

Date of Issue: Nov. 25, 2021

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Revision History

Version	Issue Date	Revisions
<u>Rev. 01</u>	<u>Nov. 25, 2021</u>	<u>Initial Issue</u>

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1 ADMINISTRATIVE DATA (GENERAL INFORMATION)

1.1 Identification of the Testing Laboratory

Company Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100

1.2 Identification of the Responsible Testing Location

Test Location	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196.
Description	All measurement facilities used to collect the measurement data are located at Block B, FL 1, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China 518055

1.3 Laboratory Condition

Ambient Temperature	20°C to 25°C
Ambient Relative Humidity	45% to 55%
Ambient Pressure	100 kPa to 102 kPa

1.4 Announce

- (1) The test report reference to the report template version v2.2.
- (2) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
- (3) The test report is invalid if there is any evidence and/or falsification.
- (4) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.
- (5) This document may not be altered or revised in any way unless done so by BALUN and all revisions are duly noted in the revisions section.
- (6) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.
- (7) The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Guilin Feiyu Technology Incorporated Company
Address	Plot D-14-1b, Information Industry Park, Guilin National High-tech Zone, East side of Donghuan Road, Qixing District, Guilin, Guangxi, China

2.2 Manufacturer Information

Manufacturer	Guilin Feiyu Technology Incorporated Company
Address	Plot D-14-1b, Information Industry Park, Guilin National High-tech Zone, East side of Donghuan Road, Qixing District, Guilin, Guangxi, China

2.3 Factory Information

Factory	Guilin Feiyu Technology Incorporated Company
Address	Plot D-14-1b, Information Industry Park, Guilin National High-tech Zone, East side of Donghuan Road, Qixing District, Guilin, Guangxi, China

2.4 General Description for Equipment under Test (EUT)

EUT Name	Feiyu SCORP Pro 3-Axis Camera Handheld Stabilizer
Model Name Under Test	Feiyu F4
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	V1.0
Software Version	V1.0
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Technical Information

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

Modulation Technology	Wide band modulations other than FHSS
Modulation Type	GFSK
Product Type	☐ Mobile ☒ Portable ☐ Fix Location
Transfer Rate	1 Mbps
Frequency Range	The frequency range used is 2410 MHz – 2470 MHz; The frequency block is 2400 MHz to 2483.5 MHz.
Number of channel	7
Tested Channel	Low channel (2410 MHz), Middle channel(2440 MHz), High channel (2470 MHz)
Antenna Type	PCB Antenna
Antenna Gain	-1.77dBi (In test items related to antenna gain, the final results reflect this figure. This value is provided by the applicant.)
Adaptive or non-adaptive	non-adaptive
The Max RF Output power	-15.12 dBm

Channel List

Number	Frequency (MHz)
1	2410
2	2420
3	2430
4	2440
5	2450
6	2460
7	2470

2.6 Additional Instructions

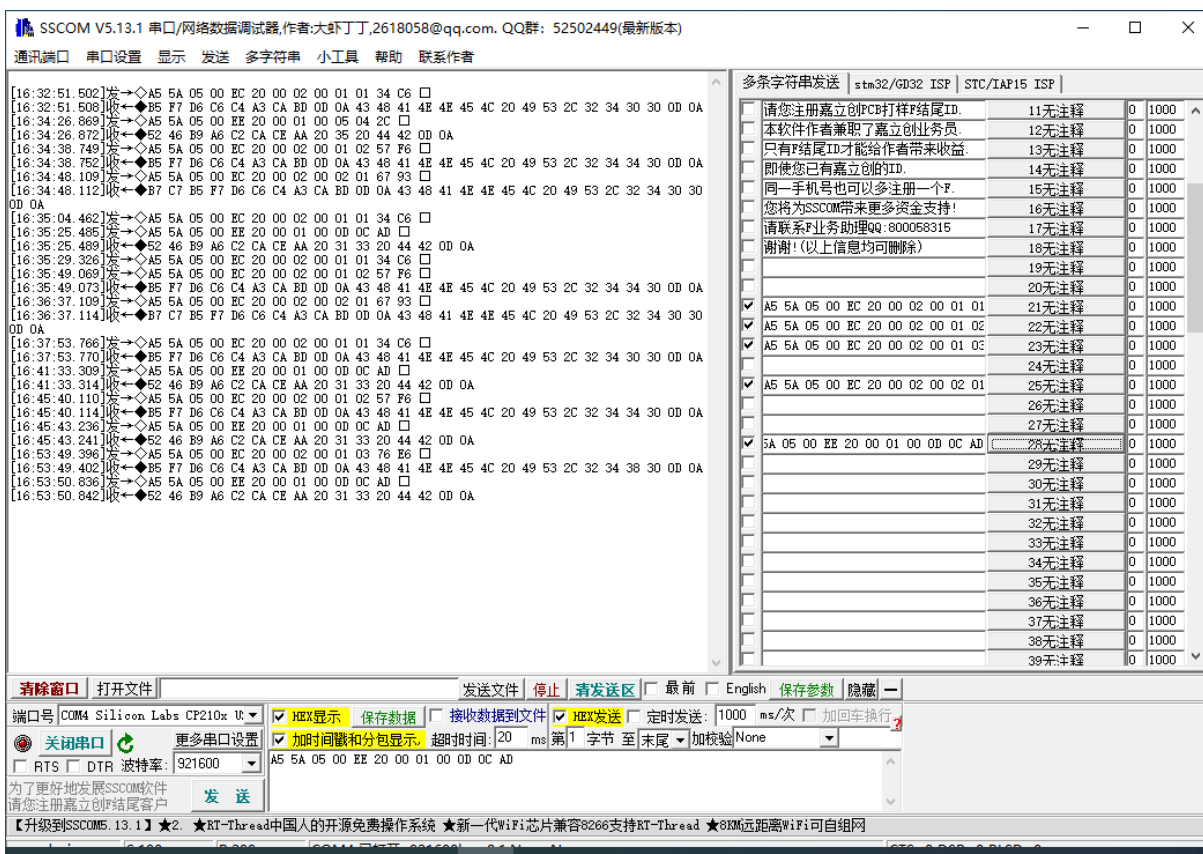
EUT Software Settings:

Mode	☒ Special software is used. The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.
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During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Power level setup in software			
Test Software Version	SSCOM V5.13.1		
Support Units (Software installation media)	Description	Manufacturer	Model
	Notebook	Lenovo	X220
Mode	Frequency (MHz)		Soft Set
GFSK	2410		Power parameter Settings is -10
	2440		
	2470		

Run Software:



3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 15, Subpart C	Miscellaneous Wireless Communications Services
2	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	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

3.2 Verdict

No.	Description	FCC Part No.	Test Result	Verdict
1	Antenna Requirement	15.203	--	Pass ^{Note 1}
2	Number of Hopping Frequency	15.247(a)	ANNEX A.1	Pass
3	Peak Output Power	15.247(b)	ANNEX A.2	Pass
4	Occupied Bandwidth	15.247(a)	ANNEX A.3	Pass
5	Carrier Frequency Separation	15.247(a)	ANNEX A.4	Pass
6	Time of Occupancy (Dwell time)	15.247(a)	ANNEX A.5	Pass
7	Conducted Spurious Emission & Authorized-band band-edge	15.247(d)	ANNEX A.6	Pass
8	Conducted Emission	15.207	ANNEX A.7	Pass
9	Radiated Spurious Emission	15.209 15.247(d)	ANNEX A.8	Pass
10	Band Edge (Restricted-band band-edge)	15.209 15.247(d)	ANNEX A.9	Pass
11	Receiver Spurious Emissions	--	--	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	45% to 55%	
Atmospheric Pressure	100 kPa to 102 kPa	
Temperature	NT (Normal Temperature)	20°C to +25°C
Working Voltage of the EUT	NV (Normal Voltage)	14.8 V

4.2 Test Equipment List

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	ROHDE&SCHWARZ	FSV-40	101544	2021.04.01	2022.03.31
Bluetooth Signaling Unit	ROHDE&SCHWARZ	CMW500	142028	2021.06.01	2022.05.31
EMI Receiver	KEYSIGHT	N9038A	MY53220118	2021.06.01	2022.05.31
EMI Receiver	ROHDE&SCHWARZ	ESRP	101036	2021.06.01	2022.05.31
LISN	SCHWARZBECK	NSLK 8127	8127-687	2021.06.01	2022.05.31
Test Antenna-Loop(9 kHz-30 MHz)	SCHWARZBECK	FMZB 1519	1519-037	2021.04.16	2024.04.15
Test Antenna-Bi-Log(30 MHz-3 GHz)	SCHWARZBECK	VULB 9163	9163-624	2021.08.20	2024.08.19
Test Antenna-Horn(1-18 GHz)	SCHWARZBECK	BBHA 9120D	9120D-1917	2019.07.02	2022.07.01
Test Antenna-Horn (18-40 GHz)	A-INFO	LB-180400KF	J211060273	2021.07.02	2023.07.01
Anechoic Chamber	RAINFORD	9m*6m*6m	N/A	2017.02.21	2022.02.20
Anechoic Chamber	EMC Electronic Co., Ltd	20.10*11.60*7.35m	N/A	2019.08.08	2022.08.07
Shielded Enclosure	ChangNing	CN-130701	130703	--	--

4.3 Description of Test Setup

4.3.1 For Antenna Port Test

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

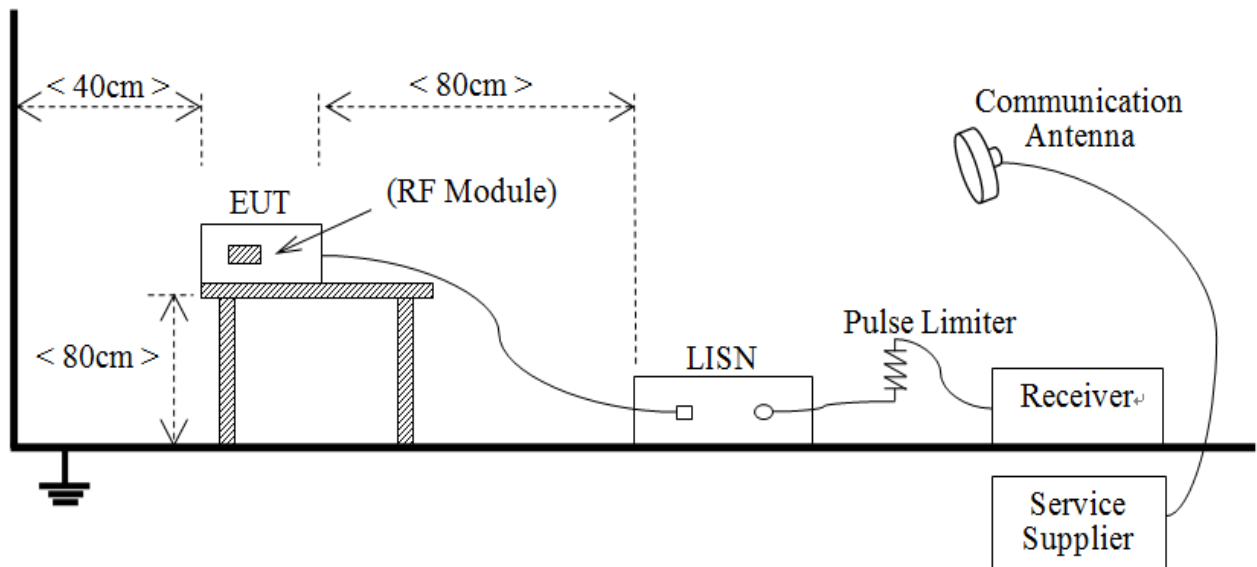
For example: the measurement value is 10 dBm and the cable 0.5dBm used, then the final result of EUT:

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



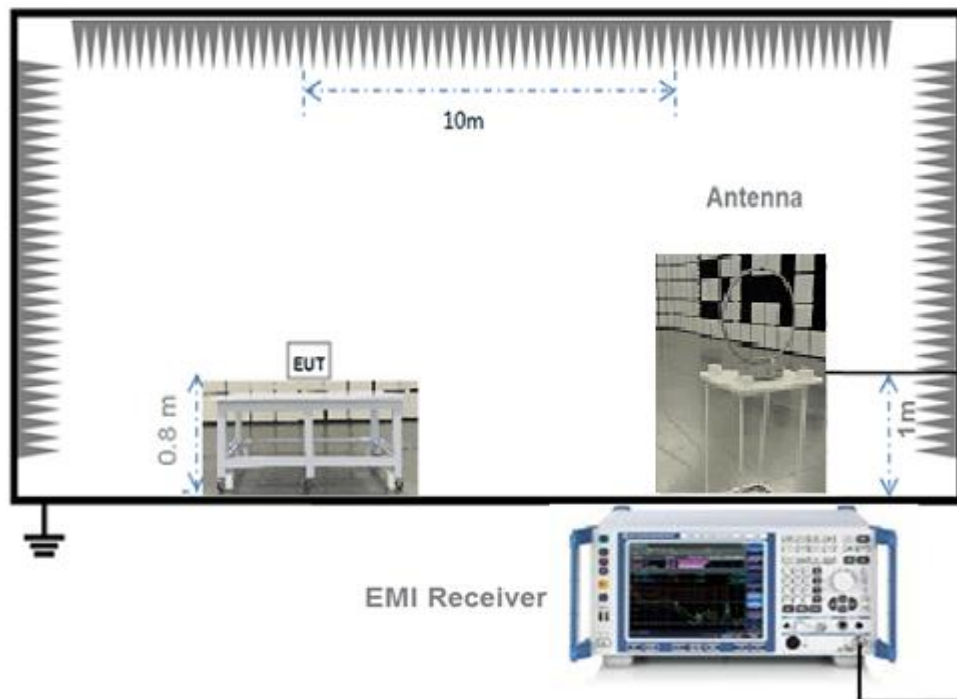
(Diagram 1)

4.3.2 For AC Power Supply Port Test



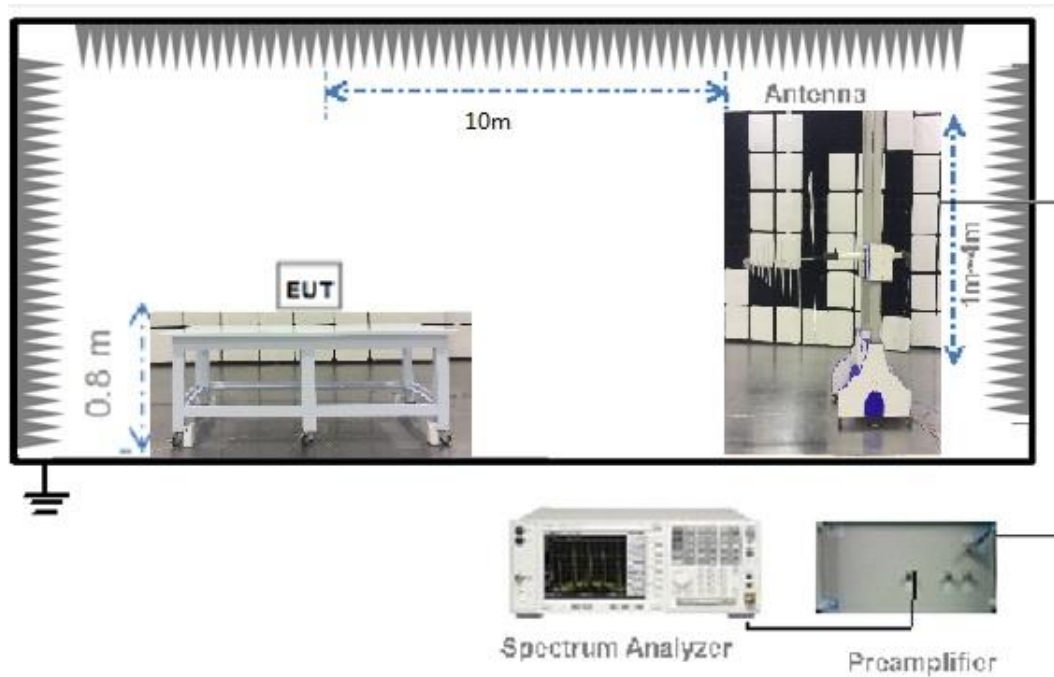
(Diagram 2)

4.3.3 For Radiated Test (Below 30 MHz)



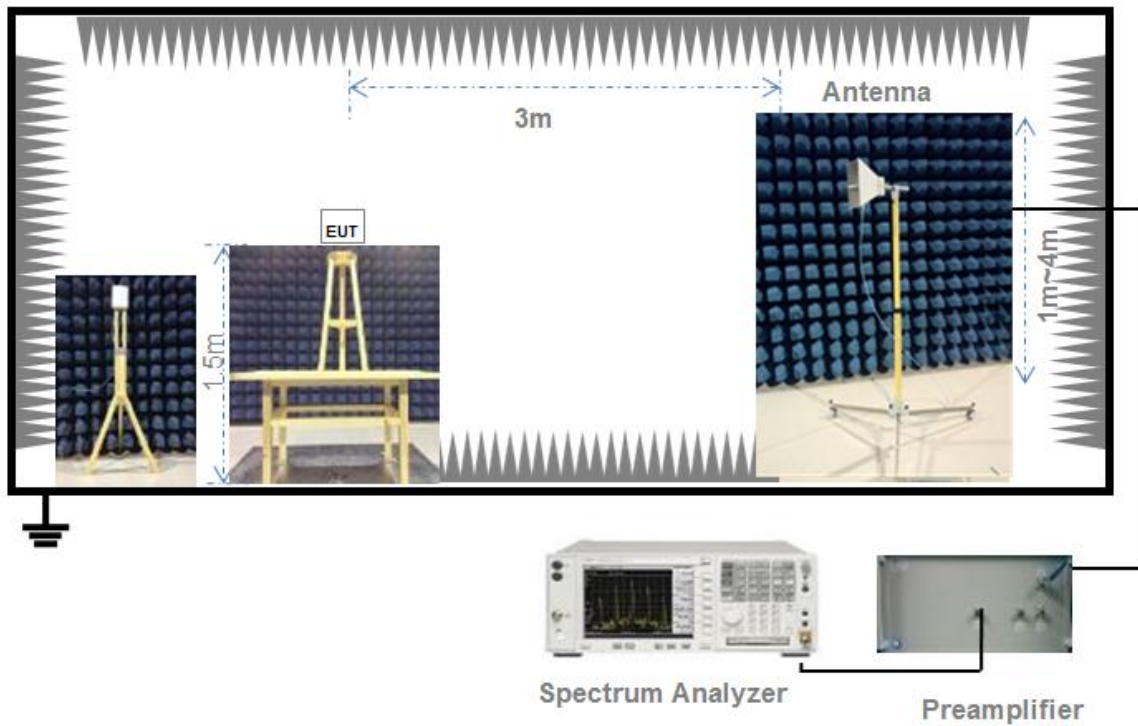
(Diagram 3)

4.3.4 For Radiated Test (30 MHz-1 GHz)



(Diagram 4)

4.3.5 For Radiated Test (Above 1 GHz)



(Diagram 5)

4.4 Measurement Results Explanation Example

4.4.1 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.

4.4.2 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)

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 Peak Output Power

5.2.1 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.

5.2.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.2.3 Test Procedure

The 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.

5.2.4 Test Result

Please refer to ANNEX A.2.

5.3 Occupied Bandwidth

5.3.1 Limit

FCC §15.247(a)

Measurement of the 20dB bandwidth of the modulated signal.

5.3.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.3.3 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.

5.3.4 Test Result

Please refer to ANNEX A.3.

5.4 Carrier Frequency Separation

5.4.1 Limit

FCC §15.247(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.

5.4.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.4.3 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.

5.4.4 Test Result

Please refer to ANNEX A.4.

5.5 Time of Occupancy (Dwell time)

5.5.1 Limit

FCC §15.247(a)

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.

5.5.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.5.3 Test Procedure

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

5.5.4 Test Result

Please refer to ANNEX A.5

5.6 Conducted Spurious Emission & Authorized-band band-edge

5.6.1 Limit

FCC §15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

5.6.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.6.3 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

5.6.4 Test Result

Please refer to ANNEX A.6.

5.7 Conducted Emission

5.7.1 Limit

FCC §15.207

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

5.7.2 Test Setup

See section 4.4.2 for test setup description for the AC power supply port. The photo of test setup please refer to ANNEX B.

5.7.3 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.

5.7.4 Test Result

Please refer to ANNEX A.7.

5.8 Radiated Spurious Emission

5.8.1 Limit

FCC §15.209&15.247(d)

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 ($\mu\text{V/m}$)	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 (dB $\mu\text{V/m}$) = $20 \cdot \log[\text{Field Strength } (\mu\text{V/m})]$.
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: 54dB $\mu\text{V/m}$ @3m (AV) and 74dB $\mu\text{V/m}$ @3m (PK).

5.8.2 Test Setup

See section 4.4.3 to 4.4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.8.3 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.

5.8.4 Test Result

Please refer to ANNEX A.8.

5.9 Band Edge (Restricted-band band-edge)

5.9.1 Limit

FCC §15.209&15.247(d)

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).

5.9.2 Test Setup

See section 4.4.3 to 4.4.5 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.9.

ANNEX A TEST RESULT

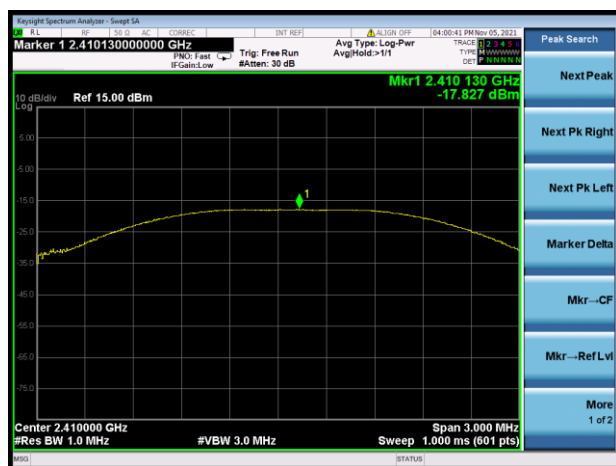
A.1 Peak Output Power

Peak Power Test Data

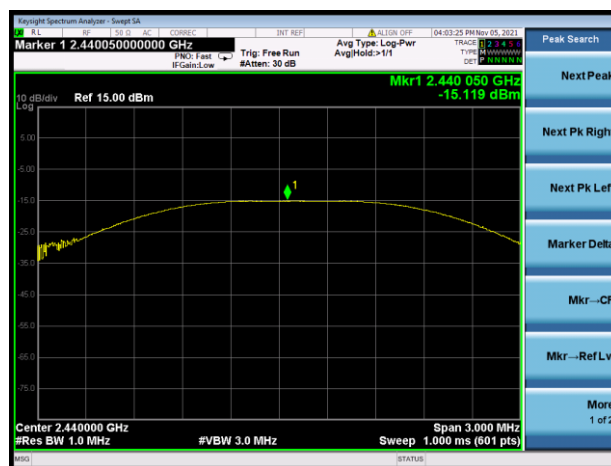
Channel	Measured Output Peak Power		Limit		Verdict
	dBm	mW	dBm	mW	
Low	-17.83	0.02	30	1000	Pass
Middle	-15.12	0.03			Pass
High	-19.64	0.01			Pass

Test plots

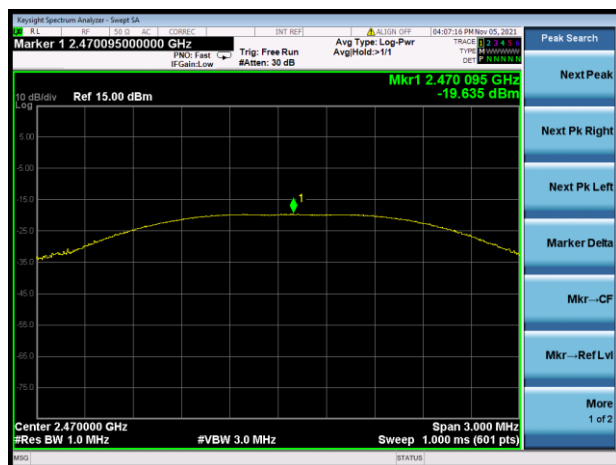
GFSK LOW CHANNEL



GFSK MIDDLE CHANNEL



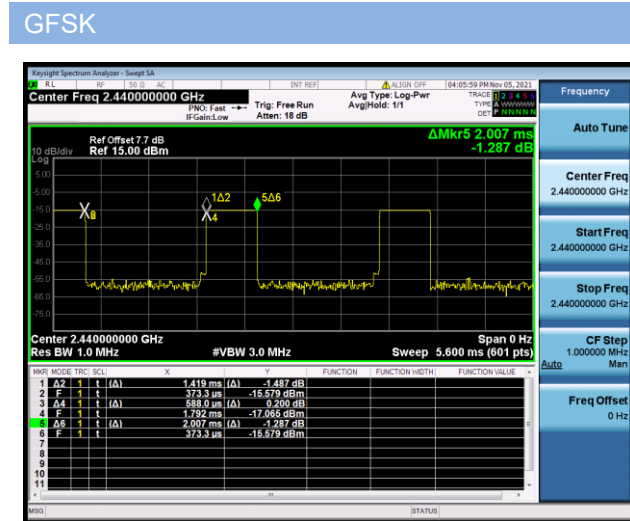
GFSK HIGH CHANNEL



Duty Cycle Test Data

Band	On Time (ms)	On+Off Time (ms)	Duty Cycle (%)
GFSK	0.588	2.007	29.30%

Test plots



A.2 Occupied Bandwidth

Test Data

Test Mode	GFSK		
Channel	6 dB Bandwidth (kHz)	99% Bandwidth (kHz)	6 dB Bandwidth Limits (kHz)
Low Channel	820.000	1058.900	≥500
Middle Channel	795.000	1062.400	≥500
High Channel	840.000	1050.000	≥500

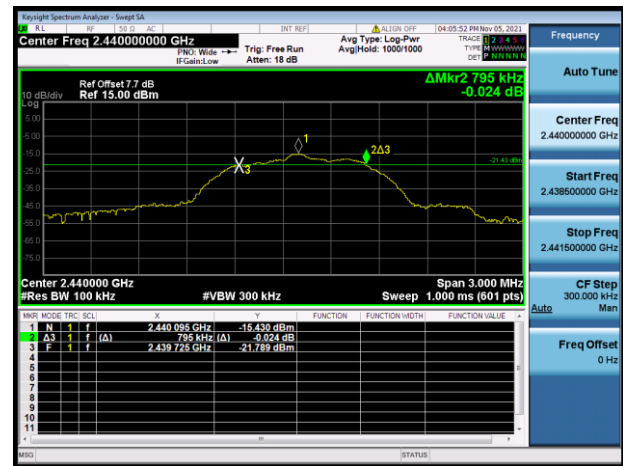
Test plots

6 dB Bandwidth

GFSK LOW CHANNEL



GFSK MIDDLE CHANNEL



GFSK HIGH CHANNEL



99% Bandwidth

GFSK LOW CHANNEL



GFSK MIDDLE CHANNEL



GFSK HIGH CHANNEL



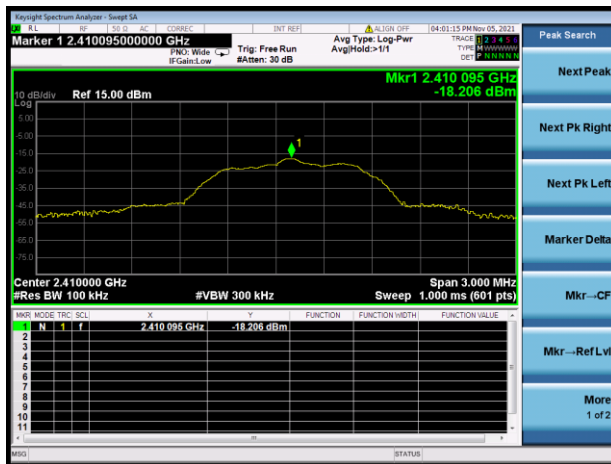
A.3 Conducted Spurious Emissions

Test Data

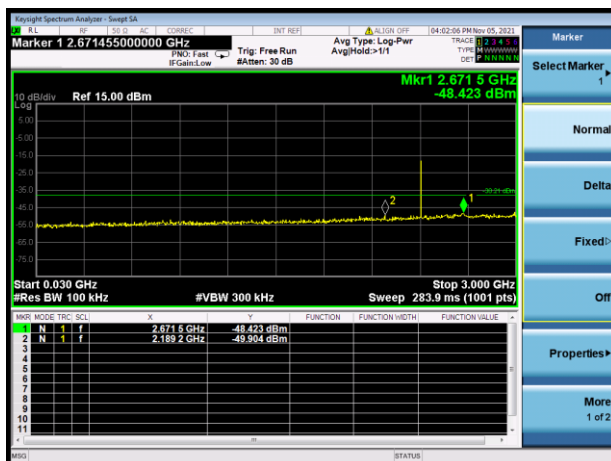
GFSK				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-54.01	-18.21	-38.21	Pass
Middle	-46.67	-15.40	-35.40	Pass
High	-48.33	-20.22	-40.22	Pass

Test Plots

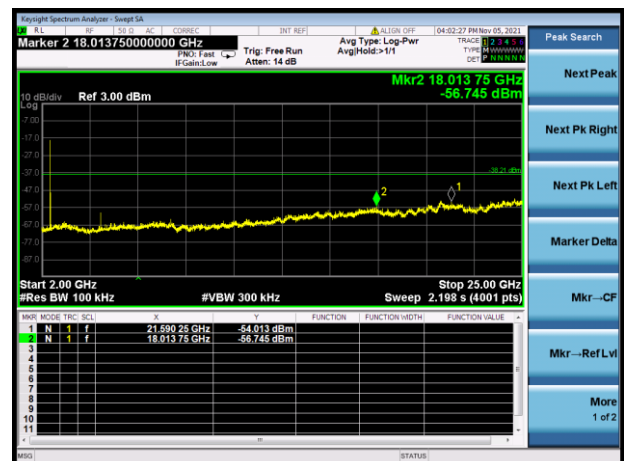
GFSK LOW CHANNEL, CARRIER LEVEL



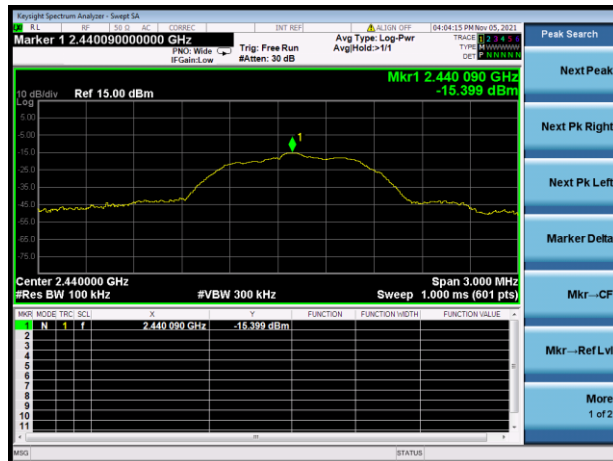
GFSK LOW CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



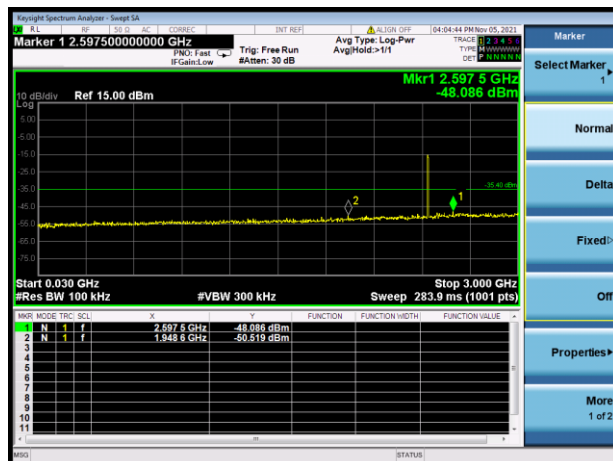
GFSK LOW CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



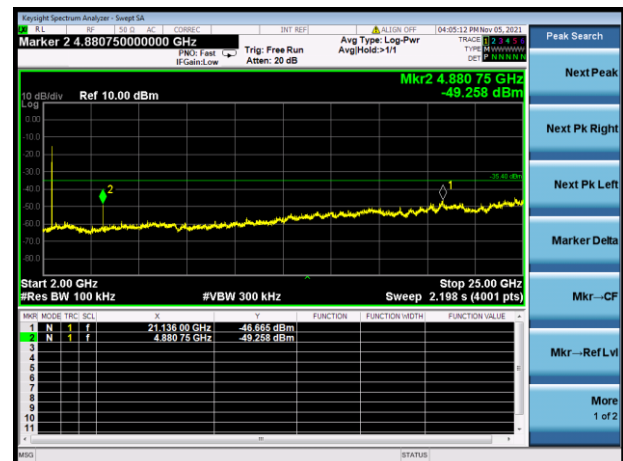
GFSK MIDDLE CHANNEL, CARRIER LEVEL



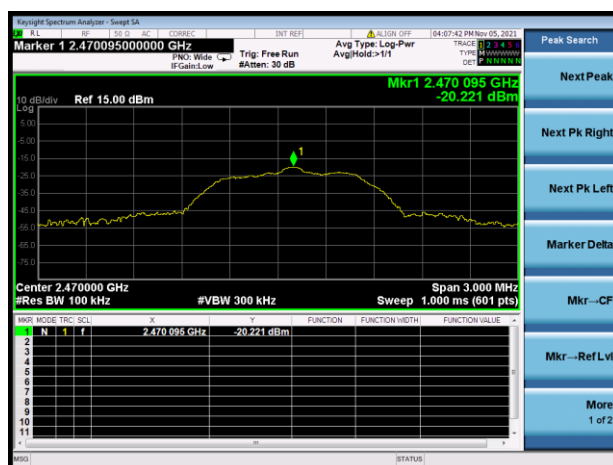
GFSK MIDDLE CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



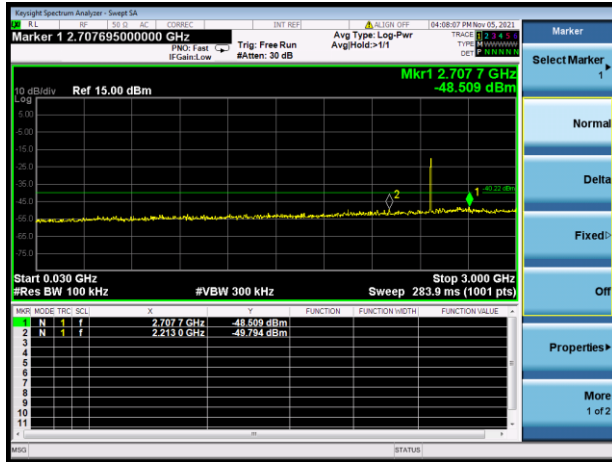
GFSK MIDDLE CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



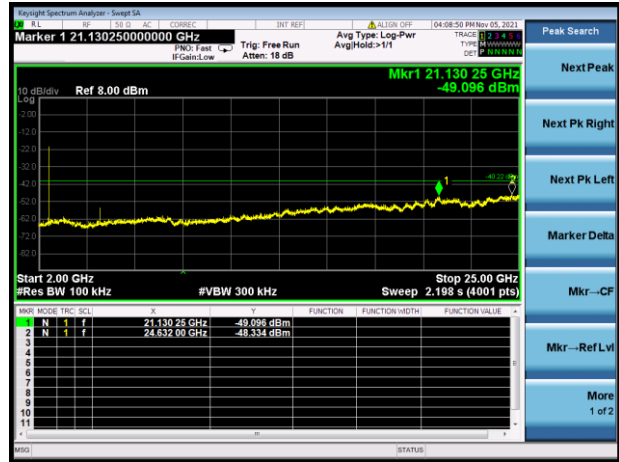
GFSK HIGH CHANNEL, CARRIER LEVEL



GFSK HIGH CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



GFSK HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



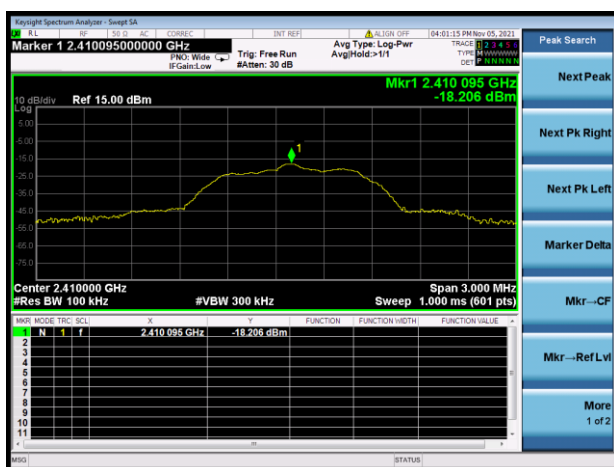
A.4 Band Edge (Authorized-band band-edge)

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

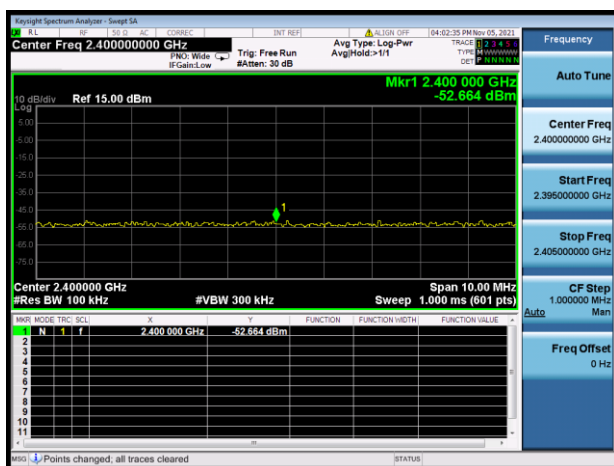
Channel	Measured Max. Band Edge Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low Channel	-52.32	-18.21	-38.21	Pass
High Channel	-58.21	-20.22	-40.22	Pass

Test Plots

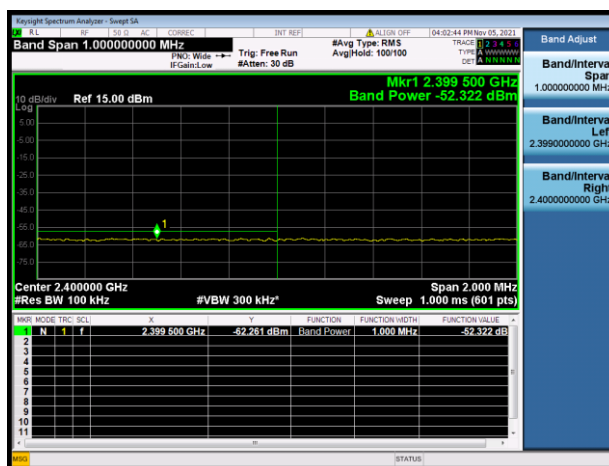
LOW CHANNEL, Carrier level



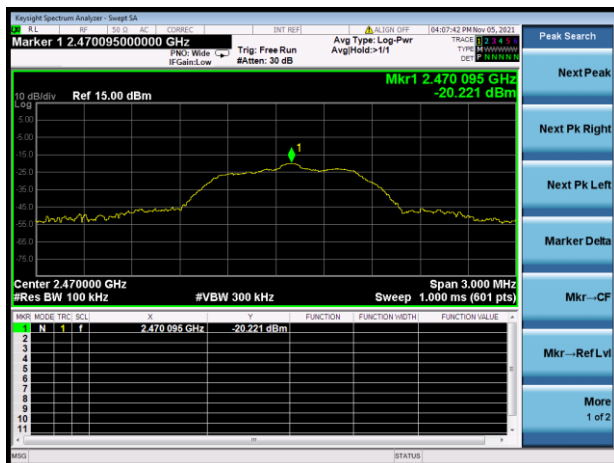
LOW CHANNEL, Reference level



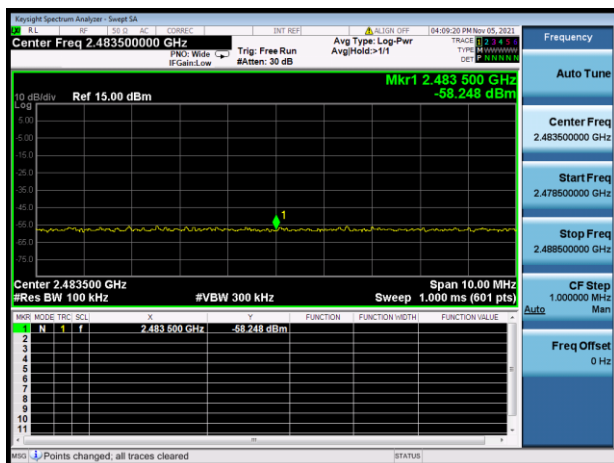
LOW CHANNEL, Band Edge



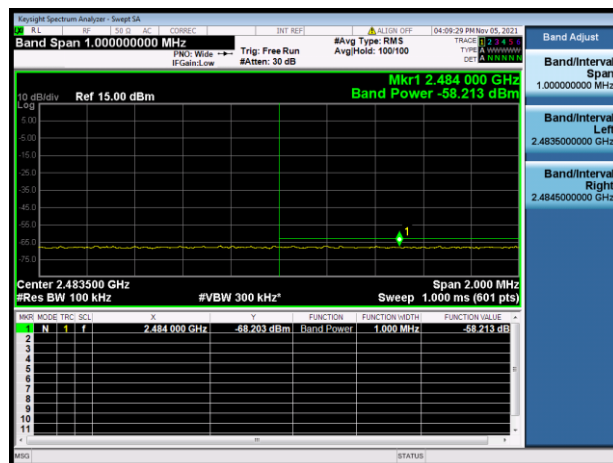
High CHANNEL, Carrier level



HIGH CHANNEL, Reference level



HIGH CHANNEL, Band Edge



A.5 Conducted Emissions

Note ¹: The EUT is working in the Normal link mode. All modes have been tested and normal link mode is worst.

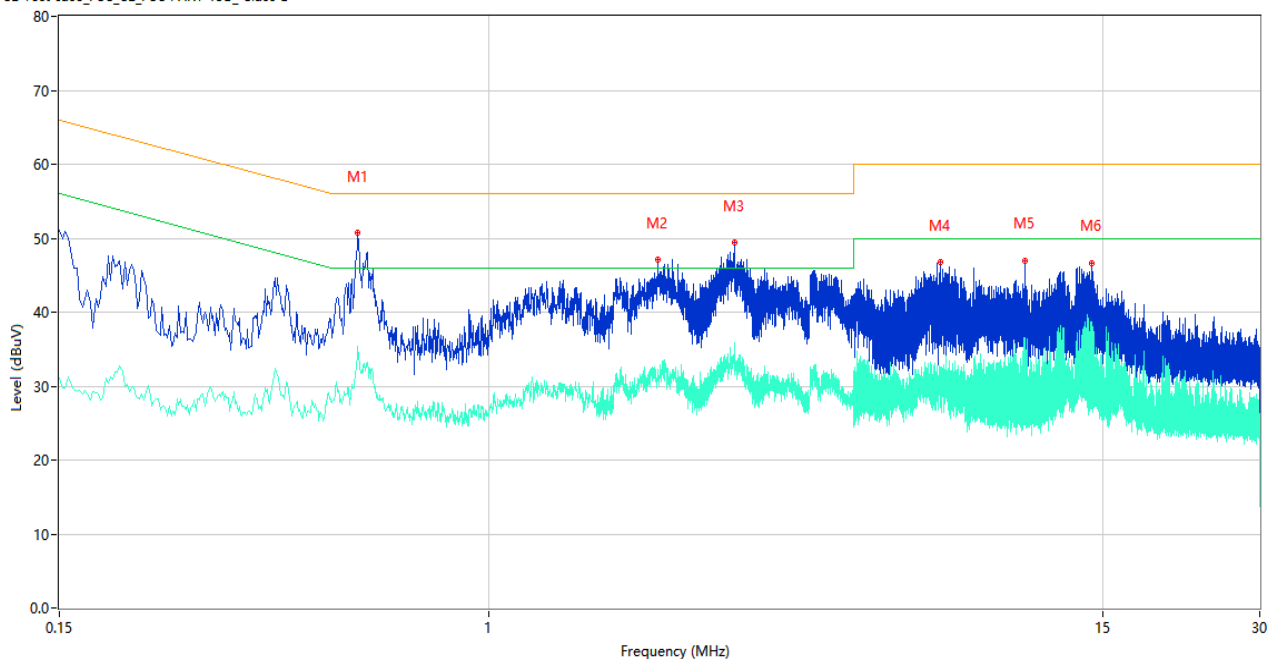
Note ²: Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 60 Hz and 240 VAC, 50 Hz) for which the device is capable of operation. So, The configuration 120 VAC, 60 Hz and 240 VAC, 50 Hz were tested respectively, but only the worst configuration (120 VAC, 60 Hz) shown here.

Note ³: Results (dBuV) = Original reading level of Spectrum Analyzer (dBuV) + Factor (dB)

Test Data and Plots

PHASE L

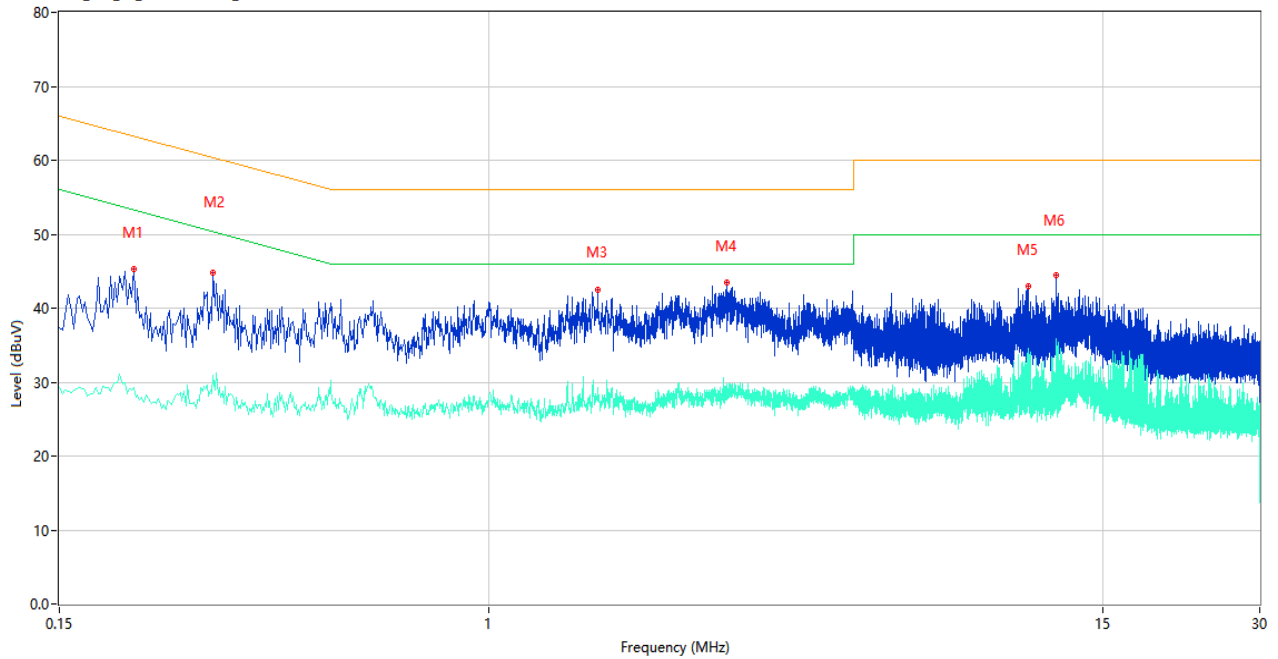
CE Test case_FCC_CE_FCC PART 15B_ Class B



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.560	50.72	10.89	56.00	-5.28	Peak	L	Pass
1**	0.560	35.30	10.89	46.00	-10.70	AV	L	Pass
2	2.102	47.03	10.74	56.00	-8.97	Peak	L	Pass
2**	2.102	30.98	10.74	46.00	-15.02	AV	L	Pass
3	2.948	49.40	10.70	56.00	-6.60	Peak	L	Pass
3**	2.948	33.91	10.70	46.00	-12.09	AV	L	Pass
4	7.316	46.79	10.67	60.00	-13.21	Peak	L	Pass
4**	7.316	32.54	10.67	50.00	-17.46	AV	L	Pass
5	10.628	47.00	10.66	60.00	-13.00	Peak	L	Pass
5**	10.628	31.12	10.66	50.00	-18.88	AV	L	Pass
6	14.300	46.58	10.65	60.00	-13.42	Peak	L	Pass
6**	14.300	38.55	10.65	50.00	-11.45	AV	L	Pass

PHASE N

CE Test case_FCC_CE_FCC PART 15B_ Class B



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.208	45.26	10.95	63.28	-18.02	Peak	N	Pass
1**	0.208	29.20	10.95	53.28	-24.08	AV	N	Pass
2	0.296	44.71	10.88	60.35	-15.64	Peak	N	Pass
2**	0.296	30.99	10.88	50.35	-19.36	AV	N	Pass
3	1.616	42.55	10.73	56.00	-13.45	Peak	N	Pass
3**	1.616	28.69	10.73	46.00	-17.31	AV	N	Pass
4	2.856	43.50	10.71	56.00	-12.50	Peak	N	Pass
4**	2.856	29.45	10.71	46.00	-16.55	AV	N	Pass
5	10.796	42.99	10.66	60.00	-17.01	Peak	N	Pass
5**	10.796	29.70	10.66	50.00	-20.30	AV	N	Pass
6	12.224	44.41	10.68	60.00	-15.59	Peak	N	Pass
6**	12.224	35.94	10.68	50.00	-14.06	AV	N	Pass

A.6 Radiated Spurious Emission

Note ¹: The symbol of “--” in the table which means not application.

Note ²: For the test data above 1 GHz, according the ANSI C63.4-2014, 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.

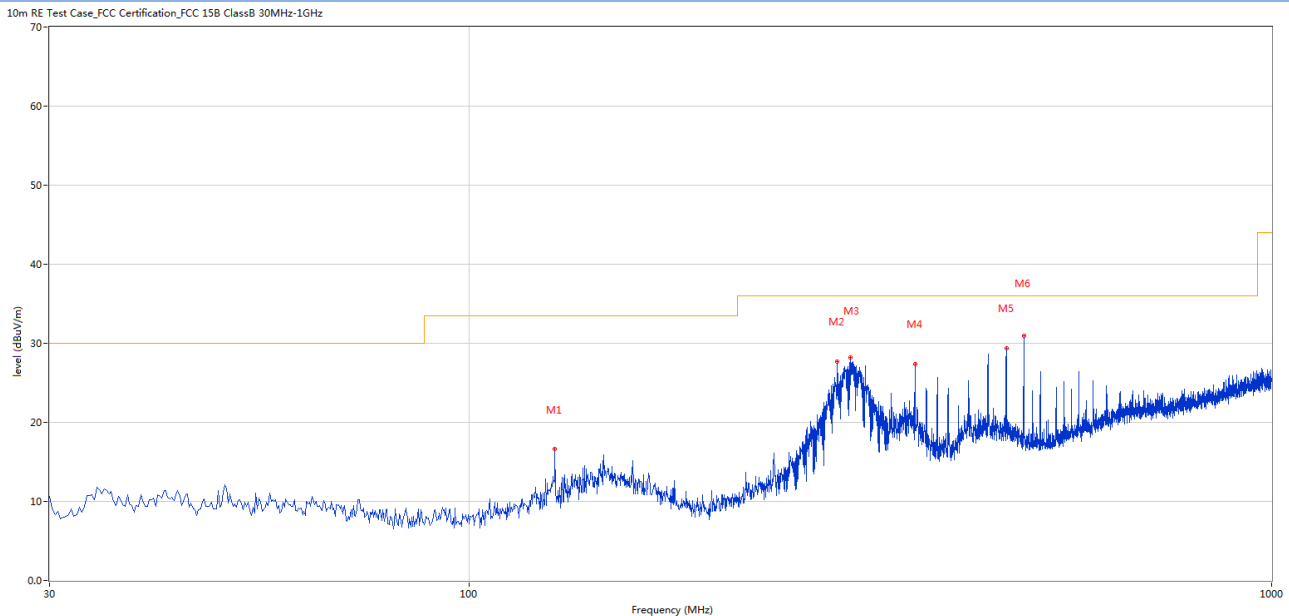
Note ³: The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

Note ⁴: The EUT is working in the Normal link mode below 1 GHz. All modes have been tested and GFSK-Middle channel mode is the worst.

Note ⁵: Results (dBuV/m) = Original reading level of Spectrum Analyzer (dBuV/m) + Factor (dB)

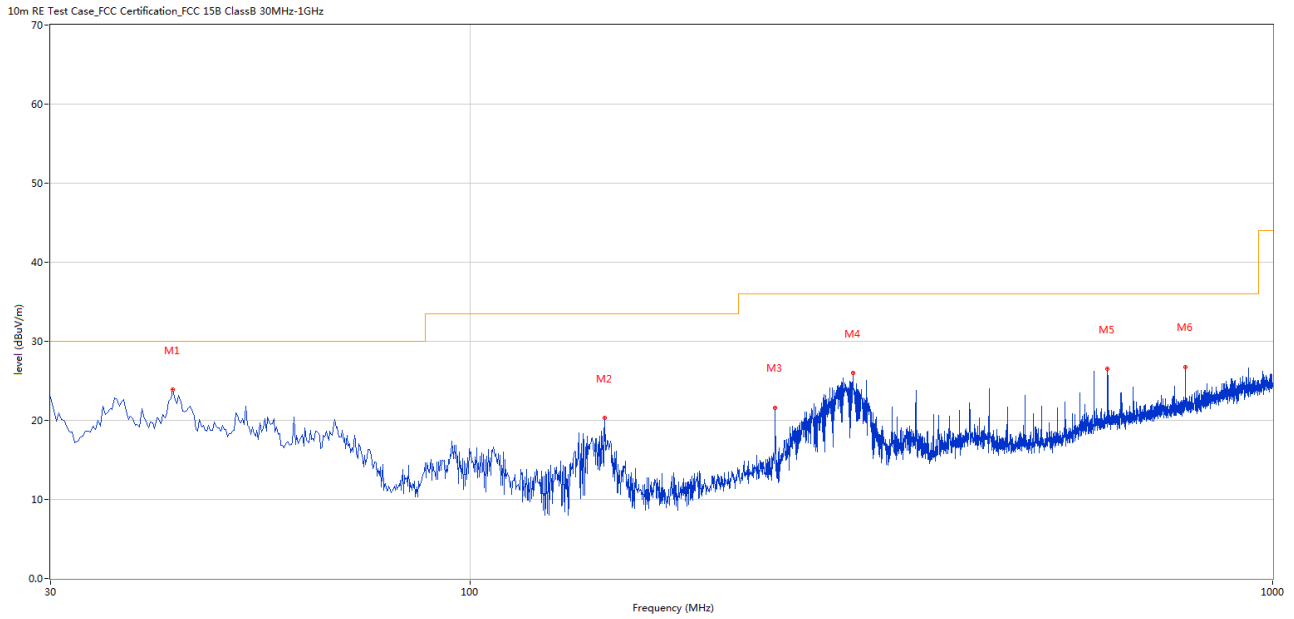
Test Data and Plots

30 MHz to 1 GHz, ANT H



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	127.946	16.60	-27.33	30.0	-13.40	Peak	360.00	200	Horizontal	Pass
2	287.471	27.74	-25.95	37.0	-9.26	Peak	13.00	200	Horizontal	Pass
3	298.865	28.19	-25.63	37.0	-8.81	Peak	199.00	200	Horizontal	Pass
4	359.233	27.41	-24.04	37.0	-9.59	Peak	199.00	200	Horizontal	Pass
5	467.118	29.42	-20.93	37.0	-7.58	Peak	48.00	200	Horizontal	Pass
6	491.120	30.97	-20.57	37.0	-6.03	Peak	33.00	200	Horizontal	Pass

30 MHz to 1 GHz, ANT V



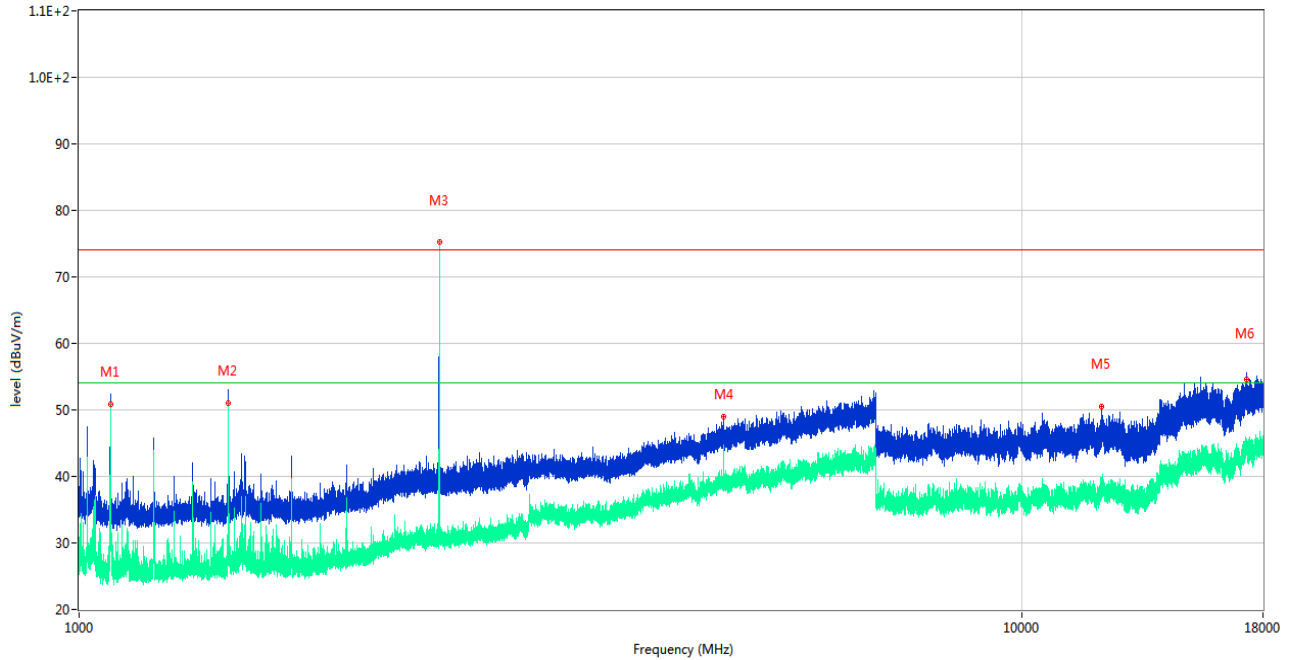
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	42.607	23.84	-26.42	30.0	-6.16	Peak	50.00	100	Vertical	Pass
2	147.098	20.31	-31.49	33.5	-13.19	Peak	100.00	100	Vertical	Pass
3	239.953	21.62	-26.62	36.0	-14.38	Peak	196.00	100	Vertical	Pass
4	299.835	25.96	-25.15	36.0	-10.04	Peak	30.00	100	Vertical	Pass
5	623.007	26.49	-17.37	36.0	-9.51	Peak	94.00	200	Vertical	Pass
6	778.410	26.79	-14.69	36.0	-9.21	Peak	43.00	200	Vertical	Pass

Note 1: The marked spikes near 2400 MHz with circle should be ignored because they are Fundamental signal.

Note 2: The spurious from 18GHz-25GHz is noise only, do not show on the report.

GFSK LOW CHANNEL 1 GHz to 18 GHz, ANT H

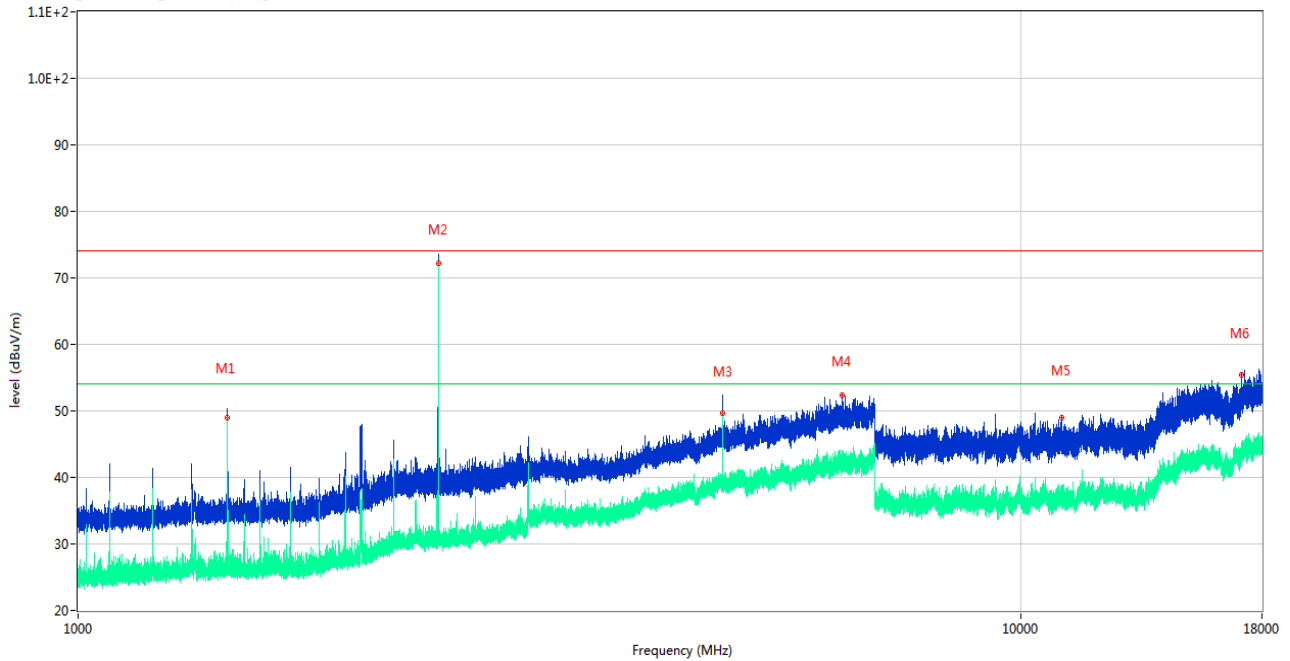
RE Test case_FCC Part 15C_FCC 15.247(2.4G)_1GHz-18GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1080.000	52.32	-14.91	74.0	-21.68	Peak	310.00	150	Horizontal	Pass
1**	1080.000	50.78	-14.91	54.0	-3.22	AV	310.00	150	Horizontal	Pass
2	1440.000	51.84	-14.77	74.0	-22.16	Peak	348.00	150	Horizontal	Pass
2**	1440.000	50.97	-14.77	54.0	-3.03	AV	348.00	150	Horizontal	Pass
3	2410.100	75.39	-10.42	74.0	1.39	Peak	153.00	150	Horizontal	N/A
3**	2410.100	75.17	-10.42	54.0	21.17	AV	153.00	150	Horizontal	N/A
4	4820.000	49.04	-1.31	74.0	-24.96	Peak	238.00	150	Horizontal	Pass
4**	4820.000	41.67	-1.31	54.0	-12.33	AV	238.00	150	Horizontal	Pass
5	12140.500	50.53	19.85	74.0	-23.47	Peak	3.00	150	Horizontal	Pass
5**	12140.500	38.01	19.85	54.0	-15.99	AV	3.00	150	Horizontal	Pass
6	17315.926	54.59	24.38	74.0	-19.41	Peak	31.00	150	Horizontal	Pass
6**	17315.926	44.59	24.38	54.0	-9.41	AV	31.00	150	Horizontal	Pass

GFSK LOW CHANNEL 1 GHz to 18 GHz, ANT V

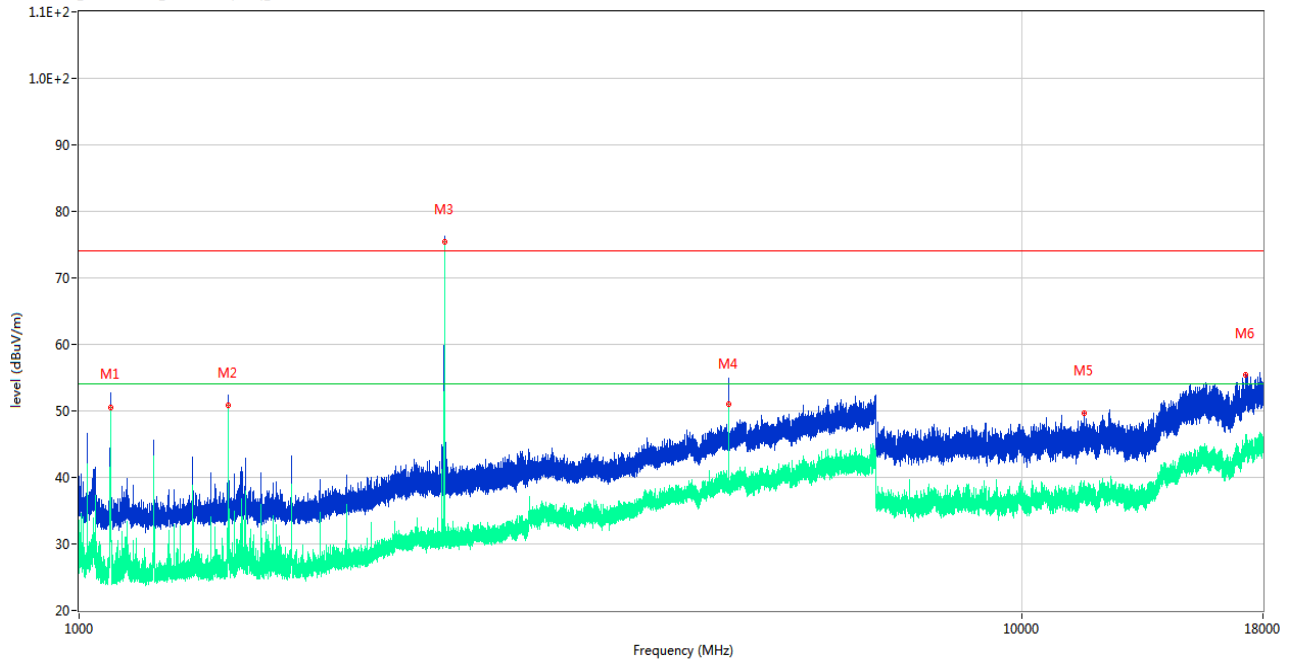
RE Test case_FCC Part 15C_FCC 15.247(2.4G)_1GHz-18GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1440.100	50.13	-14.77	74.0	-23.87	Peak	293.00	150	Vertical	Pass
1**	1440.100	49.00	-14.77	54.0	-5.00	AV	293.00	150	Vertical	Pass
2	2410.300	73.28	-10.41	74.0	-0.72	Peak	172.00	150	Vertical	N/A
2**	2410.300	72.23	-10.41	54.0	18.23	AV	172.00	150	Vertical	N/A
3	4820.400	50.27	-1.35	74.0	-23.73	Peak	99.00	150	Vertical	Pass
3**	4820.400	49.64	-1.35	54.0	-4.36	AV	99.00	150	Vertical	Pass
4	6464.000	52.30	3.46	74.0	-21.70	Peak	250.00	150	Vertical	Pass
4**	6464.000	42.25	3.46	54.0	-11.75	AV	250.00	150	Vertical	Pass
5	11054.325	48.91	18.79	74.0	-25.09	Peak	1.00	150	Vertical	Pass
5**	11054.325	36.54	18.79	54.0	-17.46	AV	1.00	150	Vertical	Pass
6	17121.676	55.35	23.15	74.0	-18.65	Peak	220.00	150	Vertical	Pass
6**	17121.676	45.23	23.15	54.0	-8.77	AV	220.00	150	Vertical	Pass

GFSK MIDDLE CHANNEL 1 GHz to 18 GHz, ANT H

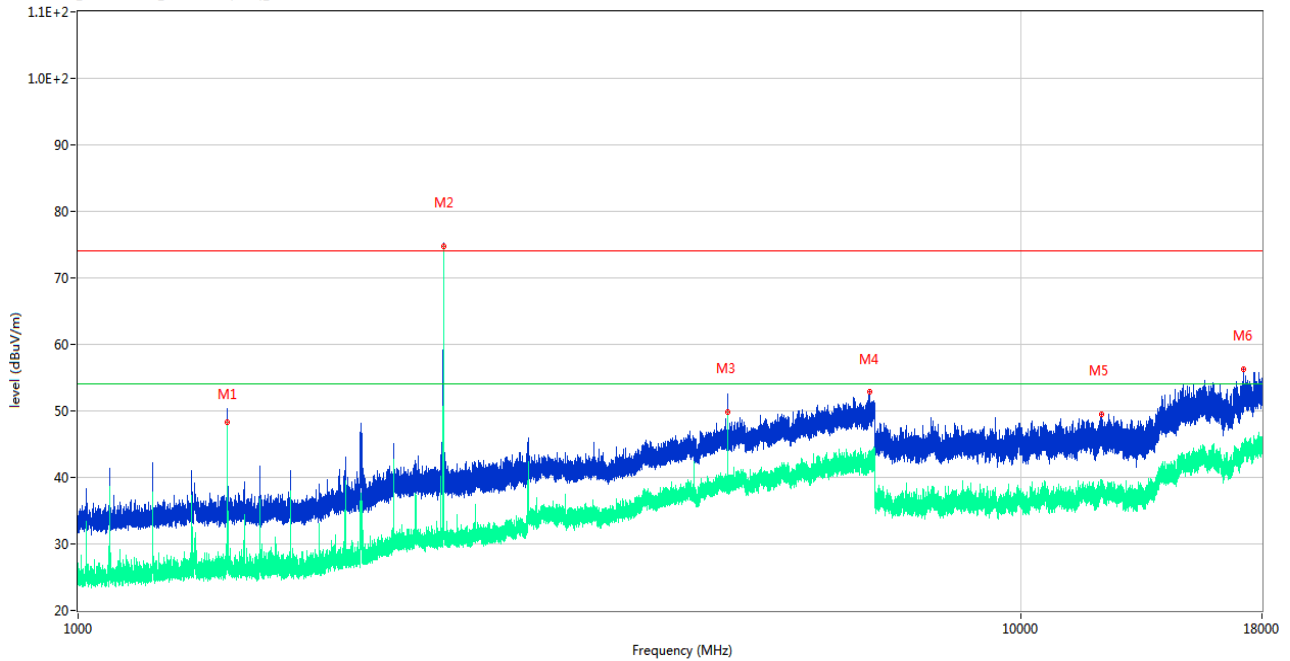
RE Test case_FCC Part 15C_FCC 15.247(2.4G)_1GHz-18GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1080.100	51.95	-14.91	74.0	-22.05	Peak	320.00	150	Horizontal	Pass
1**	1080.100	50.45	-14.91	54.0	-3.55	AV	320.00	150	Horizontal	Pass
2	1440.000	52.44	-14.77	74.0	-21.56	Peak	339.00	150	Horizontal	Pass
2**	1440.000	50.93	-14.77	54.0	-3.07	AV	339.00	150	Horizontal	Pass
3	2439.900	76.29	-10.52	74.0	2.29	Peak	174.00	150	Horizontal	N/A
3**	2439.900	73.32	-10.52	54.0	19.32	AV	174.00	150	Horizontal	N/A
4	4880.600	54.57	-1.22	74.0	-19.43	Peak	158.00	150	Horizontal	Pass
4**	4880.600	50.97	-1.22	54.0	-3.03	AV	158.00	150	Horizontal	Pass
5	11631.625	49.62	20.31	74.0	-24.38	Peak	193.00	150	Horizontal	Pass
5**	11631.625	37.49	20.31	54.0	-16.51	AV	193.00	150	Horizontal	Pass
6	17241.375	55.45	24.21	74.0	-18.55	Peak	88.00	150	Horizontal	Pass
6**	17241.375	43.15	24.21	54.0	-10.85	AV	88.00	150	Horizontal	Pass

GFSK MIDDLE CHANNEL 1 GHz to 18 GHz, ANT V

RE Test case_FCC Part 15C_FCC 15.247(2.4G)_1GHz-18GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1440.200	48.53	-14.76	74.0	-25.47	Peak	291.00	150	Vertical	Pass
1**	1440.200	48.24	-14.76	54.0	-5.76	AV	291.00	150	Vertical	Pass
2	2439.900	75.23	-10.52	74.0	1.23	Peak	158.00	150	Vertical	N/A
2**	2439.900	73.06	-10.52	54.0	19.06	AV	158.00	150	Vertical	N/A
3	4880.600	52.17	-1.22	74.0	-21.83	Peak	217.00	150	Vertical	Pass
3**	4880.600	49.91	-1.22	54.0	-4.09	AV	217.00	150	Vertical	Pass
4	6911.200	52.95	4.62	74.0	-21.05	Peak	335.00	150	Vertical	Pass
4**	6911.200	43.20	4.62	54.0	-10.80	AV	335.00	150	Vertical	Pass
5	12165.800	49.51	20.11	74.0	-24.49	Peak	0.00	150	Vertical	Pass
5**	12165.800	38.40	20.11	54.0	-15.60	AV	0.00	150	Vertical	Pass
6	17192.026	56.20	23.72	74.0	-17.80	Peak	88.00	150	Vertical	Pass
6**	17192.026	43.30	23.72	54.0	-10.70	AV	88.00	150	Vertical	Pass

GFSK HIGH CHANNEL 1 GHz to 18 GHz, ANT H

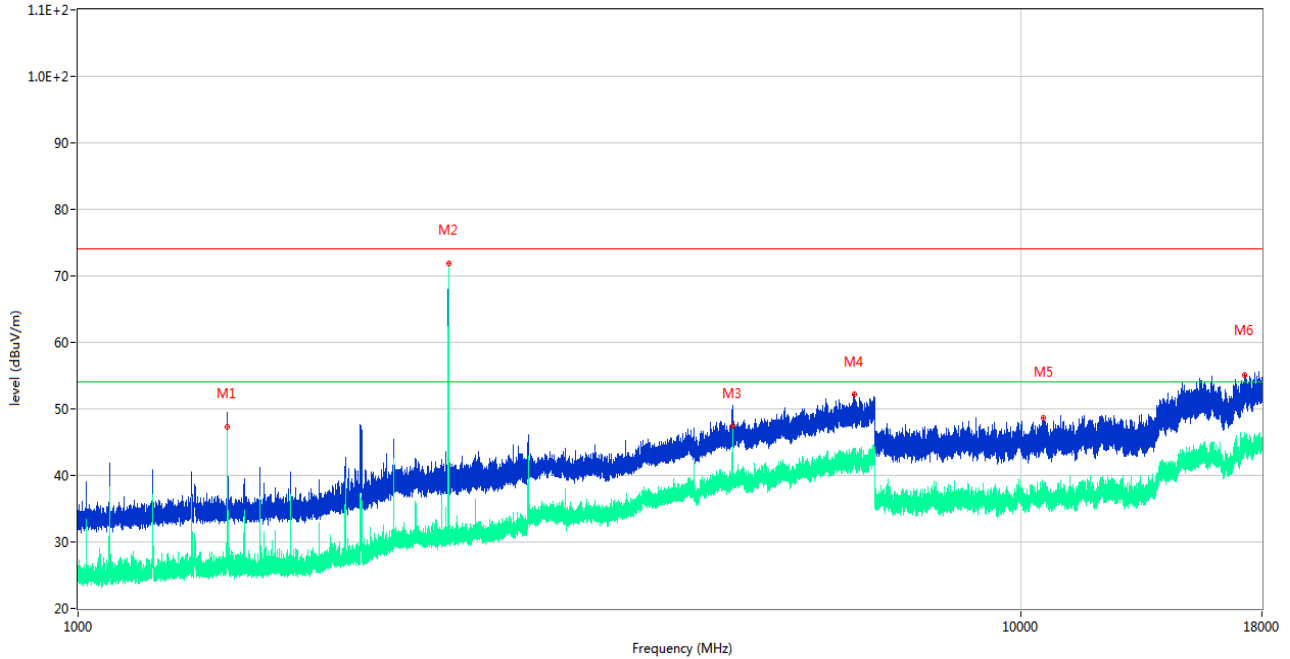
RE Test case_FCC Part 15C_FCC 15.247(2.4G)_1GHz-18GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1080.000	51.90	-14.91	74.0	-22.10	Peak	320.00	150	Horizontal	Pass
1**	1080.000	50.21	-14.91	54.0	-3.79	AV	320.00	150	Horizontal	Pass
2	1439.900	52.90	-14.78	74.0	-21.10	Peak	-2.00	150	Horizontal	Pass
2**	1439.900	50.38	-14.78	54.0	-3.62	AV	-2.00	150	Horizontal	Pass
3	2470.300	72.07	-10.71	74.0	-1.93	Peak	266.00	150	Horizontal	N/A
3**	2470.300	71.55	-10.71	54.0	17.55	AV	266.00	150	Horizontal	N/A
4	4940.400	48.93	-1.36	74.0	-25.07	Peak	150.00	150	Horizontal	Pass
4**	4940.400	47.01	-1.36	54.0	-6.99	AV	150.00	150	Horizontal	Pass
5	10603.525	48.41	18.54	74.0	-25.59	Peak	3.00	150	Horizontal	Pass
5**	10603.525	36.43	18.54	54.0	-17.57	AV	3.00	150	Horizontal	Pass
6	17688.938	56.05	24.44	74.0	-17.95	Peak	363.00	150	Horizontal	Pass
6**	17688.938	44.24	24.44	54.0	-9.76	AV	363.00	150	Horizontal	Pass

GFSK HIGH CHANNEL 1 GHz to 18 GHz, ANT V

RE Test case_FCC Part 15C_FCC 15.247(2.4G)_1GHz-18GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1440.100	49.37	-14.77	74.0	-24.63	Peak	283.00	150	Vertical	Pass
1**	1440.100	47.20	-14.77	54.0	-6.80	AV	283.00	150	Vertical	Pass
2	2470.200	71.81	-10.71	74.0	-2.19	Peak	173.00	150	Vertical	N/A
2**	2470.200	71.80	-10.71	54.0	17.80	AV	173.00	150	Vertical	N/A
3	4940.400	49.90	-1.36	74.0	-24.10	Peak	56.00	150	Vertical	Pass
3**	4940.400	47.39	-1.36	54.0	-6.61	AV	56.00	150	Vertical	Pass
4	6655.400	52.17	4.59	74.0	-21.83	Peak	124.00	150	Vertical	Pass
4**	6655.400	43.74	4.59	54.0	-10.26	AV	124.00	150	Vertical	Pass
5	10556.662	48.58	18.31	74.0	-25.42	Peak	1.00	150	Vertical	Pass
5**	10556.662	36.93	18.31	54.0	-17.07	AV	1.00	150	Vertical	Pass
6	17259.489	55.04	24.24	74.0	-18.96	Peak	201.00	150	Vertical	Pass
6**	17259.489	44.10	24.24	54.0	-9.90	AV	201.00	150	Vertical	Pass

A.7 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.

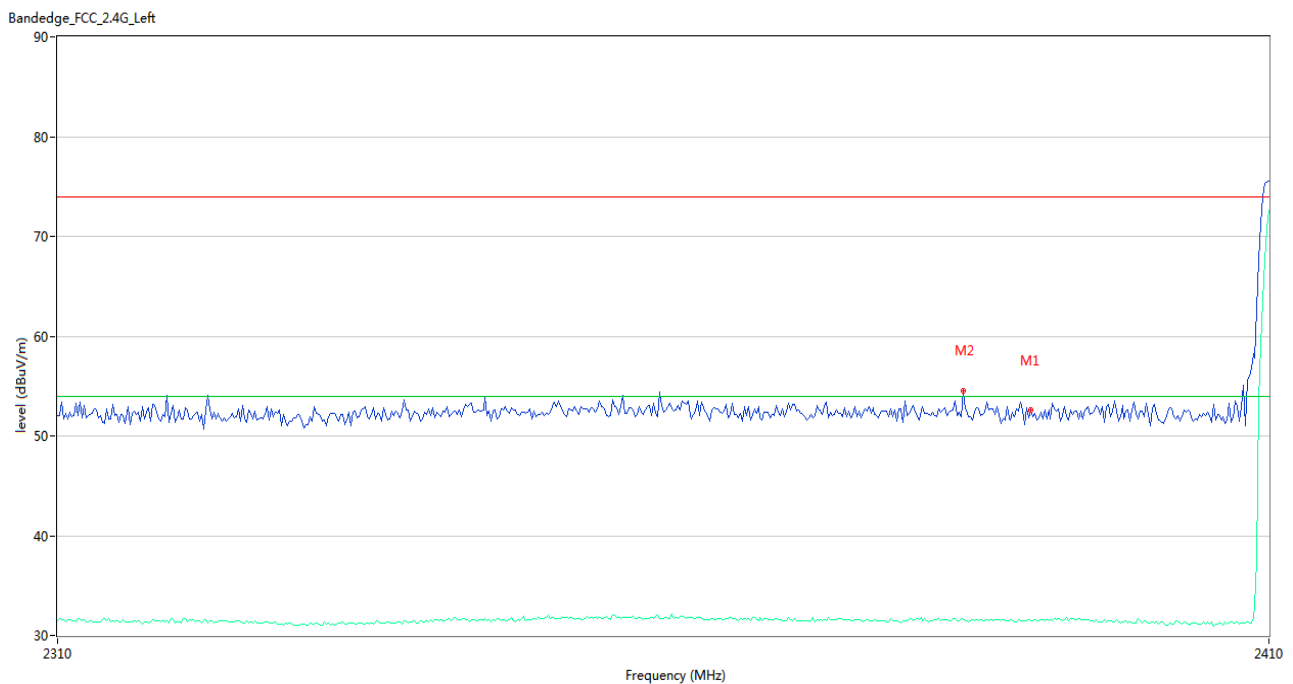
Note²: The test data all are tested in the vertical and horizontal antenna which the trace is max hold. So these plots have shown the worst case.

Note³: According the ANSI C63.10-2013, 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.

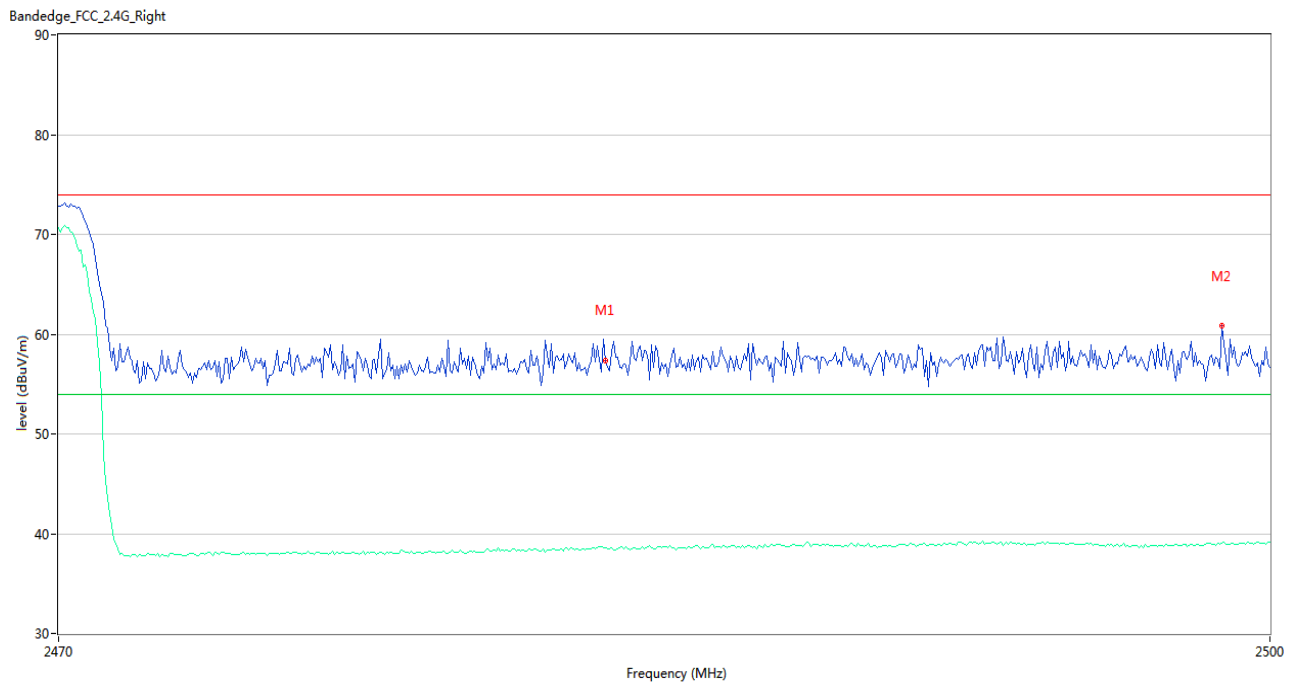
Test Data

GFSK LOW CHANNEL



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	2390.000	52.61	1.54	74.0	-21.39	Peak	307.00	150	Horizontal	Pass
1**	2390.000	31.50	1.54	54.0	-22.50	AV	307.00	150	Horizontal	Pass
2	2384.333	54.54	1.56	74.0	-19.46	Peak	0.00	150	Horizontal	Pass
2**	2384.333	31.57	1.56	54.0	-22.43	AV	0.00	150	Horizontal	Pass

GFSK HIGH CHANNEL,



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	2483.500	57.39	2.04	74.0	-16.61	Peak	232.00	150	Horizontal	Pass
1**	2483.500	38.63	2.04	54.0	-15.37	AV	232.00	150	Horizontal	Pass
2	2498.800	60.82	2.49	74.0	-13.18	Peak	106.00	150	Horizontal	Pass
2**	2498.800	39.05	2.49	54.0	-14.95	AV	106.00	150	Horizontal	Pass

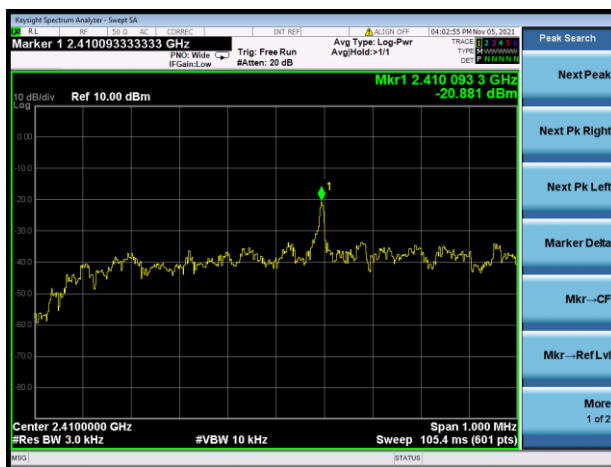
A.8 Power Spectral Density (PSD)

Test Data

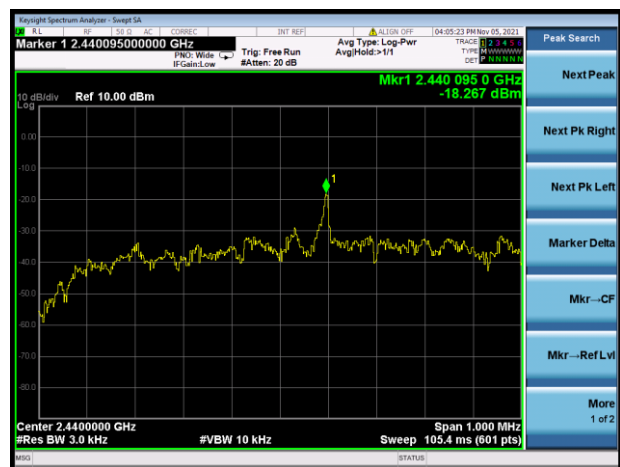
Channel	Spectral power density (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
Low Channel	-20.88	8	Pass
Middle Channel	-18.27	8	Pass
High Channel	-22.36	8	Pass

Test plots

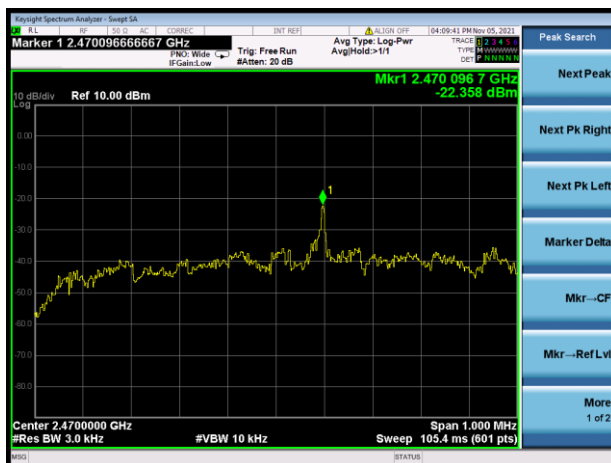
GFSK LOW CHANNEL



GFSK MIDDLE CHANNEL



GFSK HIGH CHANNEL



ANNEX B TEST SETUP PHOTOS

Please refer the document "BL-SZ2191039-AR.PDF".

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document "BL-SZ2191039-AW.PDF".

ANNEX D EUT INTERNAL PHOTOS

Please refer the document "BL-SZ2191039-AI-1.PDF".

--END OF REPORT--