

FCC Part 15C

Measurement and Test Report

For

Guangdong Qingtian Electronic Technology Co.,Ltd.

FCC ID: 2AV6S-888

FCC Rule(s): FCC Part 15.249

Product Description: Remote control unit

Tested Model: 888

Report No.: BSL241131901603RF

Tested Date: Nov. 01~21, 2024

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Guangdong Qingtian Electronic Technology Co.,Ltd.
Address of applicant: No.3, lane 2, beihan industrial zone, nanmen, fengxiang street, chenghai district shantou city, China
Manufacturer: Guangdong Qingtian Electronic Technology Co.,Ltd.
Address of manufacturer: No.3, lane 2, beihan industrial zone, nanmen, fengxiang street, chenghai district shantou city, China

General Description of EUT	
Product Name:	Remote control unit
Trade Name:	/
Model No.:	888
Adding Model(s):	888-1、888-2、888-3、888-4、888-5、888-6、888-7、888-8、888-9、888-10、800、801、802、803、804、805、806、807、777、777-1、777-2、777-3、777-4、777-5、777-6、777-7、777-8、700、701、702、703、704、705、706、707、708、666、666-1、666-2、666-3、666-4、666-5、666-6、666-7、666-8、666A、666B、666C、666D、600、601、602、603、604、605、606、607、608、609、610、999、999-1、999-2、999-3、999-4、999-5、999-6、999-7、999-8、999-9、999-10、900、901、902、903、904、905、906、907
Rated Voltage:	3.7V by battery
Power Adapter Model:	N/A

Technical Characteristics of EUT	
Frequency Range:	2412-2468MHz
Data Rate:	N/A
Modulation:	GFSK
Antenna Type:	PCB antenna
Antenna Gain:	1.51dBi

Operation Frequency each of channel			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412		
2	2440		
3	2468		

1.2 Test Standards

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.249, 15.203, 15.205 and 15.209 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission/immunity, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices, and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. The measurement guide KDB 558074 D01 v05r02 for digital transmission systems shall be performed also.

1.4 Test Facility

BSL Testing Co.,LTD.

1/F, Building B, Xinshidai GR Park, Shiyan Street, Bao'an District, Shenzhen, ShiyanStreet, Bao'an District, Shenzhen,Guangdong,518052,People' s Republic of China

FCC Test Firm Registration Number: 562200

Designation Number: CN1338

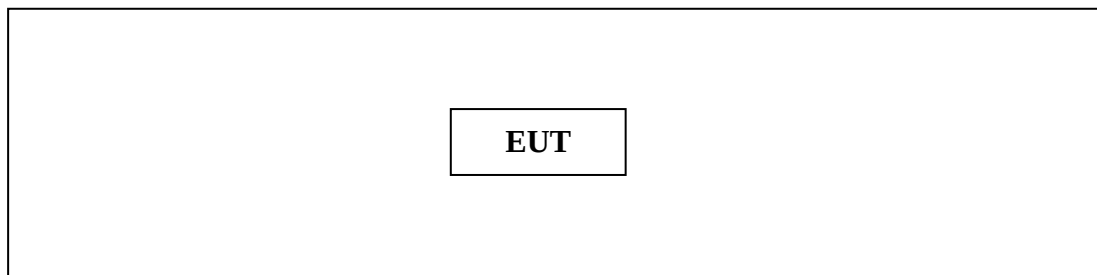
Tel: 400-882-9628

Fax: 86-755-26508703

1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

TX Mode



1.5 EUT Setup and Test Mode

The EUT was operated at continuous transmitting mode that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	Transmitting	Modulation
TM2		
TM3		

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
Occupied Bandwidth	Conducted	$\pm 1.5\%$
Conducted Spurious Emission	Conducted	$\pm 2.17\text{dB}$
Transmission Time	Conducted	$\pm 5\%$
Conducted Emissions	Conducted	$\pm 2.88\text{dB}$
Transmitter Spurious Emissions	Radiated	$\pm 5.1\text{dB}$

1.7 Test Equipment List and Details

Description	Manufacturer	Model	Serial No.	Cal Date	Due. Date
Communication Tester	Rohde & Schwarz	CMW500	100358	2024-10-26	2025-10-25
Spectrum Analyzer	R&S	FSP40	100550	2024-10-26	2025-10-25
Test Receiver	R&S	ESCI7	US47140102	2024-10-26	2025-10-25
Signal Generator	HP	83630B	3844A01028	2024-10-26	2025-10-25
Test Receiver	R&S	ESPI-3	100180	2024-10-26	2025-10-25
Amplifier	Agilent	8449B	4035A00116	2024-10-26	2025-10-25
Amplifier	HP	8447E	2945A02770	2024-10-26	2025-10-25
Signal Generator	IFR	2023A	202307/242	2024-10-26	2025-10-25
Broadband Antenna	SCHAFFNER	2774	2774	2024-10-26	2025-10-25
Biconical and log periodic antennas	ELECTRO-METRIC	EM-6917B-1	171	2024-10-26	2025-10-25
Horn Antenna	R&S	HF906	100253	2024-10-26	2025-10-25
Horn Antenna	EM	EM-6961	6462	2024-10-26	2025-10-25
LISN	R&S	ESH3-Z5	100196	2024-10-26	2025-10-25
LISN	COM-POWER	LI-115	02027	2024-10-26	2025-10-25
3m Semi-Anechoic Chamber	Chengyu Electron	9 (L)*6 (W)* 6 (H)	BSL086	2024-10-26	2025-10-25
Horn Antenna	A-INFOMW	LB-180400KF	BSL088	2024-10-26	2025-10-25
20dB Attenuator	ICPROBING	IATS1	BSL1003	2024-10-26	2025-10-25
POWER DIVIDER	Mini-circuits	PD-2SF-0010	N/A	2024-10-26	2025-10-25
Power Meter	DARE	RPR3006W	15I00041SN O03	2024-10-26	2025-10-25
Loop Antenna	Schwarz beck	FMZB 1516	9773	2024-10-26	2025-10-25
Antenna Tower	SKET	BK-4AT-BS	N/A	N/A	N/A

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 15.203	Antenna Requirement	Compliant
§ 15.207(e)	Conducted Emission	N/A
§ 15.215	20dB Bandwidth Test	Compliant
§15.249	Band Edge Compliance Test	Compliant
§15.249 §15.209	Radiated Emission Test	Compliant

Note: PASS: applicable, N/A: not applicable.

3. Antenna Requirement

3.1 Standard Applicable

According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

3.2 Test Result

This product has a PCB antenna(1.51dBi), fulfill the requirement of this section.

4. Conducted Emissions

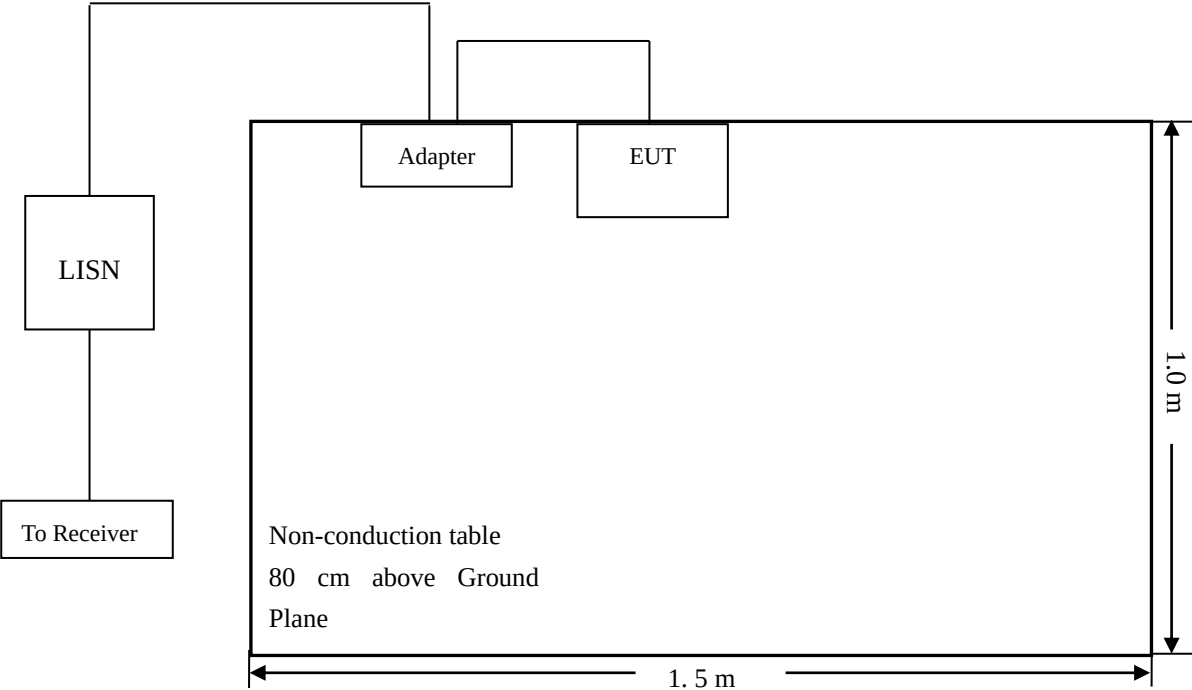
4.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

4.2 Basic Test Setup Block Diagram



4.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

4.4 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

- Start Frequency 150 kHz
- Stop Frequency 30 MHz
- Sweep Speed Auto
- IF Bandwidth..... 10 kHz
- Quasi-Peak Adapter Bandwidth 9 kHz

Quasi-Peak Adapter Mode Normal

4.6 Conducted Emissions Test Data

The equipment is battery powered, so do not test this item

5. Radiated Emissions

5.1 Standard Applicable

According to §15.249(a), In addition to the provisions of § 15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66–40.70	2,250	225
70–130	1,250	125
130–174	¹ 1,250 to 3,750	¹ 125 to 375
174–260	3,750	375
260–470	¹ 3,750 to 12,500	¹ 375 to 1,250
Above 470	12,500	1,250

(1) Linear interpolations.

(2) Emission level (dB)uV = 20 log Emission level uV/m

(3) The smaller limit shall apply at the cross point between two frequency bands.

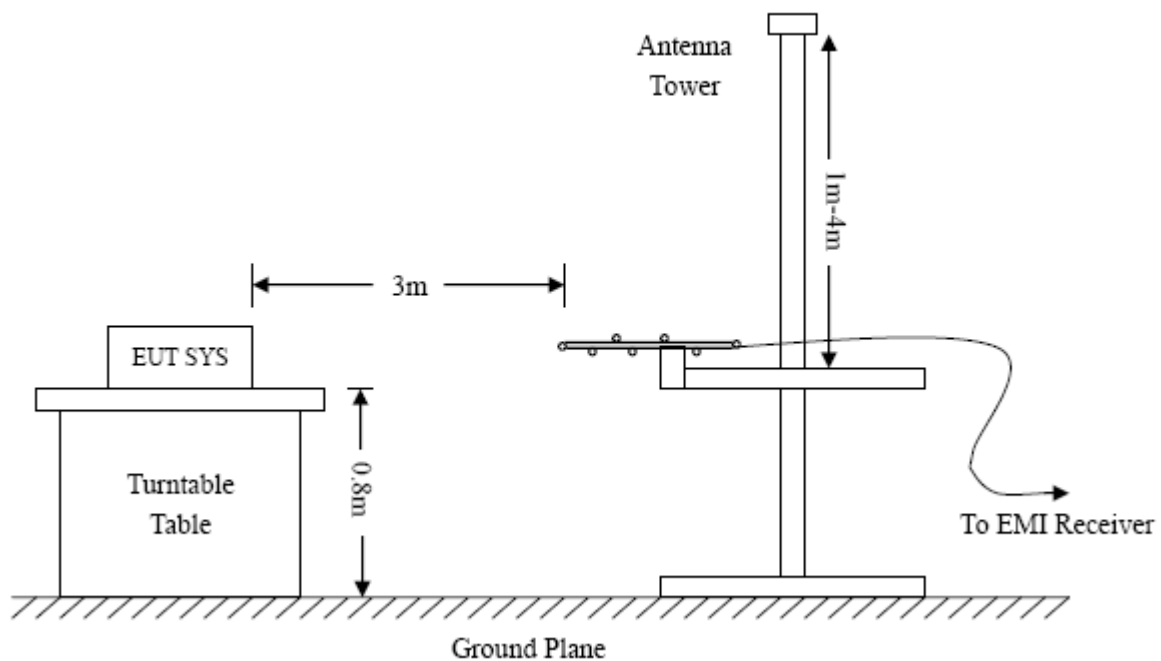
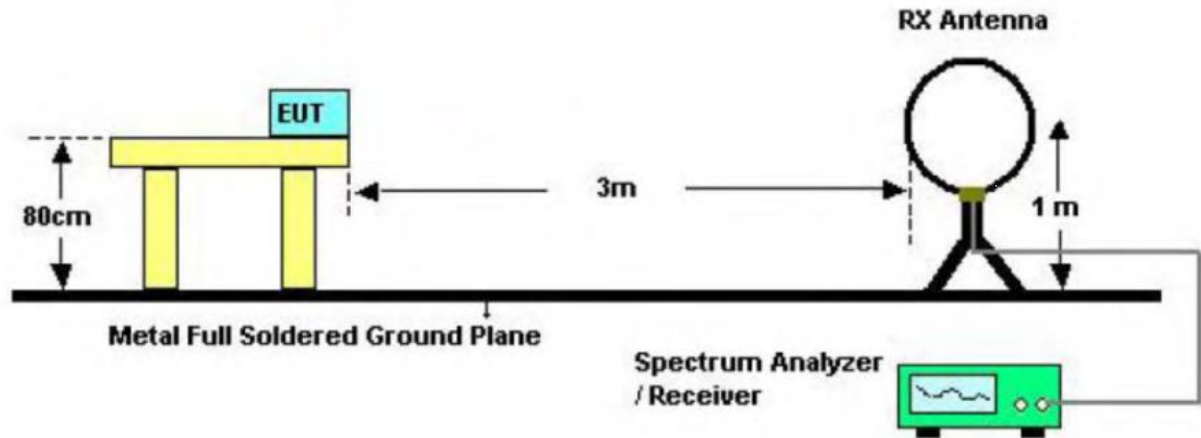
The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

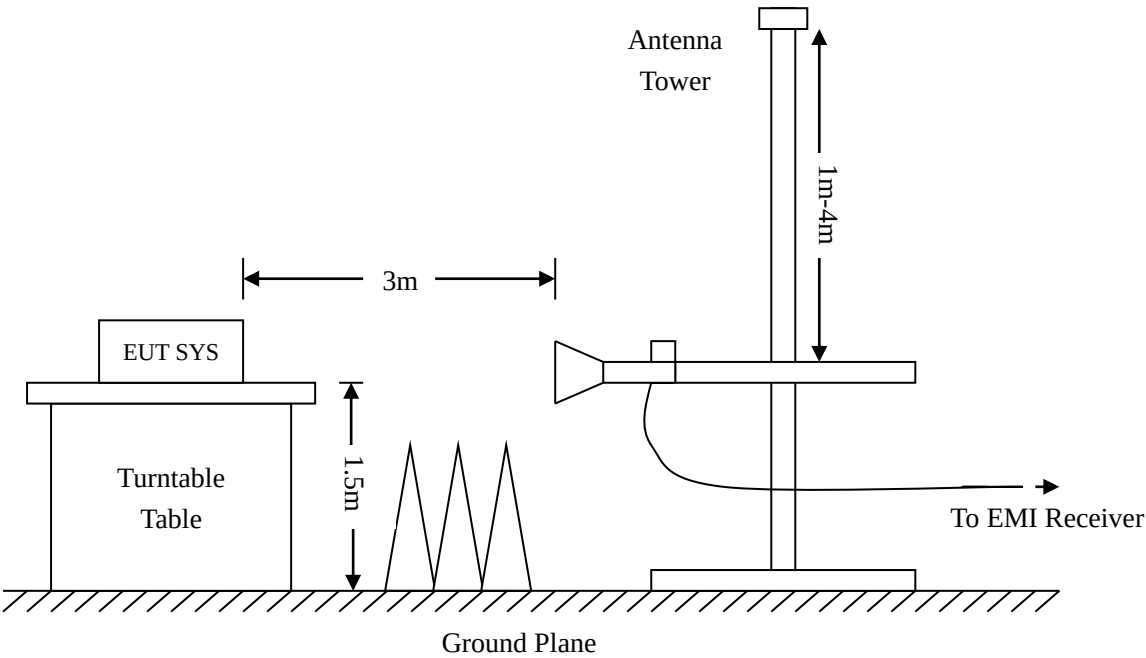
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

Compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

5.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.249(e) and FCC Part 15.209 Limit.





5.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Loss} + \text{Cab. Loss} - \text{Ampl. Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB μ V means the emission is 6dB μ V below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15C Limit}$$

5.4 Environmental Conditions

Temperature:	21° C
Relative Humidity:	50%
ATM Pressure:	1011 mbar

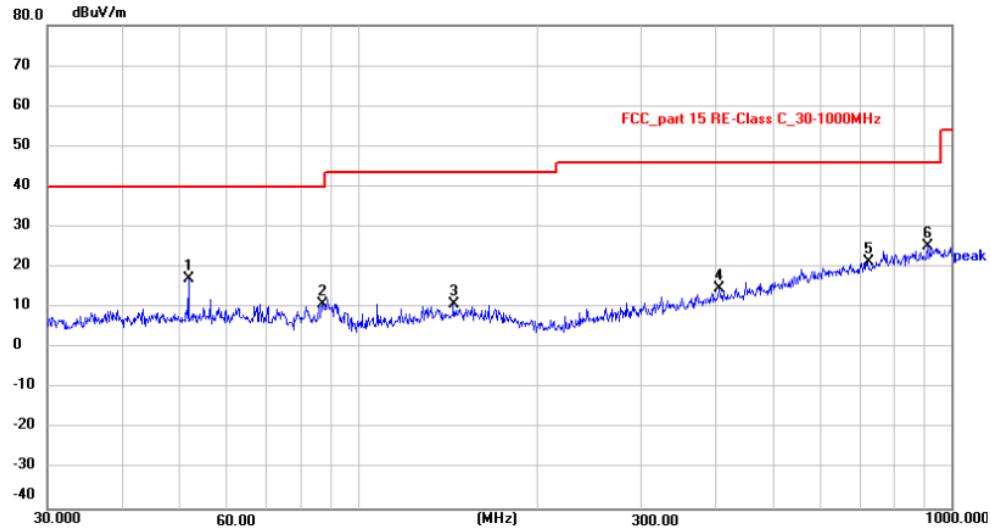
5.5 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.249 standards, and had the worst margin of:

The Worst Test Data Below 1GHz GFSK (CH High) mode:

Plot of Radiated Emissions

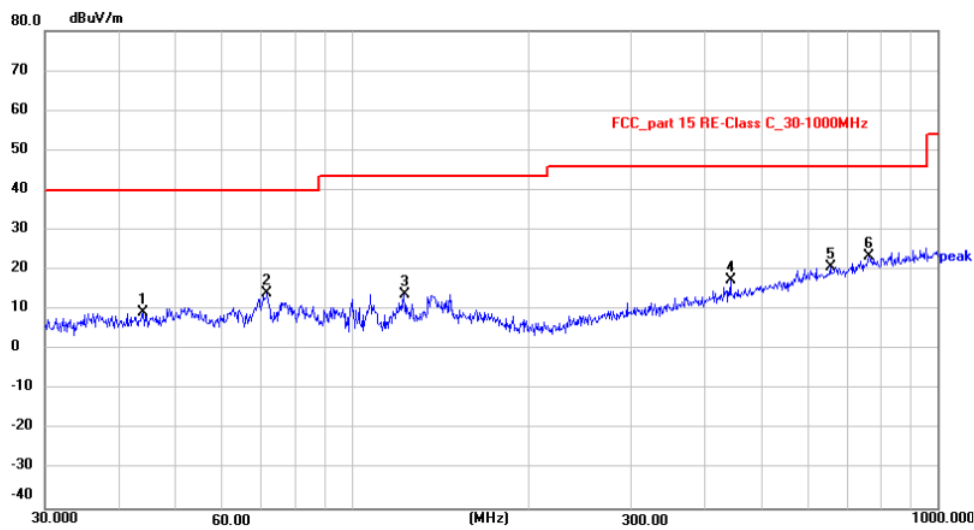
Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	51.8430	33.70	-16.55	17.15	40.00	-22.85	peak
2	87.1117	31.47	-20.64	10.83	40.00	-29.17	peak
3	144.8418	27.16	-16.36	10.80	43.50	-32.70	peak
4	406.0880	27.69	-12.92	14.77	46.00	-31.23	peak
5	721.7259	27.25	-5.99	21.26	46.00	-24.74	peak
6 *	912.8620	28.70	-3.59	25.11	46.00	-20.89	peak

*:Maximum data x:Over limit !:over margin

Test Specification: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	44.1202	25.70	-16.48	9.22	40.00	-30.78	peak
2	71.8320	33.33	-19.03	14.30	40.00	-25.70	peak
3	122.8340	31.67	-17.71	13.96	43.50	-29.54	peak
4	443.2943	29.36	-11.85	17.51	46.00	-28.49	peak
5	656.5300	27.74	-6.98	20.76	46.00	-25.24	peak
6 *	763.3757	28.46	-5.13	23.33	46.00	-22.67	peak

*:Maximum data x:Over limit !:over margin

The Worst Spurious Emissions Above 1GHz

Test channel:	Lowest
---------------	--------

Peak value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2412	86.72	114.00	-27.28	Vertical
4824	39.15	74.00	-34.85	Vertical
7236	36.57	74.00	-37.43	Vertical
9648	31.57	74.00	-42.43	Vertical
2412	85.92	114.00	-28.08	Horizontal
4824	38.61	74.00	-35.39	Horizontal
7236	36.47	74.00	-37.53	Horizontal
9648	31.67	74.00	-42.33	Horizontal

Average value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2412	85.27	94.00	-8.73	Vertical
4824	37.61	54.00	-16.39	Vertical
7236	35.21	54.00	-18.79	Vertical
9648	30.26	54.00	-23.74	Vertical
2412	85.34	94.00	-8.66	Horizontal
4824	38.62	54.00	-15.38	Horizontal
7236	36.47	54.00	-17.53	Horizontal
9648	30.29	54.00	-23.71	Horizontal

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *“*”*, means this data is the too weak instrument of signal is unable to test.
3. *The emission from 9 kHz to 30MHz was pre tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.*
4. *In frequency ranges 18 ~25GHz no any other harmonic emissions detected which are tested to compliance with the limit. No recording in the test report. No any other emissions level which are attenuated less than 20dB below the limit. No recording in the test report.*

Test channel:

Middle

Peak value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2440	87.24	114.00	-26.76	Vertical
4880	39.35	74.00	-34.65	Vertical
7320	37.41	74.00	-36.59	Vertical
9760	31.52	74.00	-42.48	Vertical
2440	86.37	114.00	-27.63	Horizontal
4880	40.15	74.00	-33.85	Horizontal
7320	36.34	74.00	-37.66	Horizontal
9760	31.53	74.00	-42.47	Horizontal

Average value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2440	85.27	94.00	-8.73	Vertical
4880	38.61	54.00	-15.39	Vertical
7320	36.21	54.00	-17.79	Vertical
9760	30.52	54.00	-23.48	Vertical
2440	84.68	94.00	-9.32	Horizontal
4880	36.26	54.00	-17.74	Horizontal
7320	25.16	54.00	-28.84	Horizontal
9760	30.63	54.00	-23.37	Horizontal

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *“*”*, means this data is the too weak instrument of signal is unable to test.
3. *The emission from 9 kHz to 30MHz was pre tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.*
4. *In frequency ranges 18 ~25GHz no any other harmonic emissions detected which are tested to compliance with the limit. No recording in the test report. No any other emissions level which are attenuated less than 20dB below the limit. No recording in the test report.*

Test channel:

Highest

Peak value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2468	84.68	114.00	-29.32	Vertical
4936	39.64	74.00	-34.36	Vertical
7404	37.53	74.00	-36.47	Vertical
9872	31.37	74.00	-42.63	Vertical
2468	84.37	114.00	-29.63	Horizontal
4936	39.27	74.00	-34.73	Horizontal
7404	37.52	74.00	-36.48	Horizontal
9872	31.59	74.00	-42.41	Horizontal

Average value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2468	83.15	94.00	-10.85	Vertical
4936	37.29	54.00	-16.71	Vertical
7404	35.46	54.00	-18.54	Vertical
9872	30.73	54.00	-23.27	Vertical
2468	82.61	94.00	-11.39	Horizontal
4936	37.59	54.00	-16.41	Horizontal
7404	35.47	54.00	-18.53	Horizontal
9872	30.27	54.00	-23.73	Horizontal

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “*”, means this data is the too weak instrument of signal is unable to test.
3. The emission from 9 kHz to 30MHz was pre tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.
4. In frequency ranges 18 ~25GHz no any other harmonic emissions detected which are tested to compliance with the limit. No recording in the test report. No any other emissions level which are attenuated less than 20dB below the limit. No recording in the test report.

6. Out of Band Emissions

6.1 Standard Applicable

According to §15.249 (d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

6.2 Test Procedure

According to the ANSI C63.10-2013 chapter 6.10.5.2:

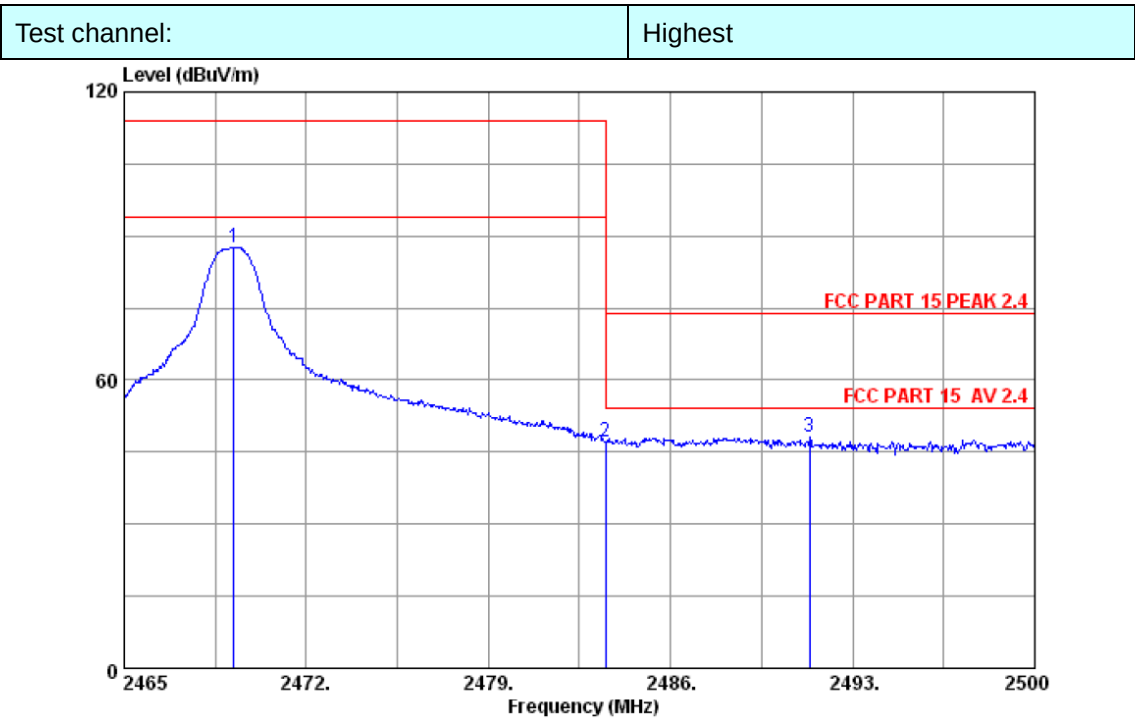
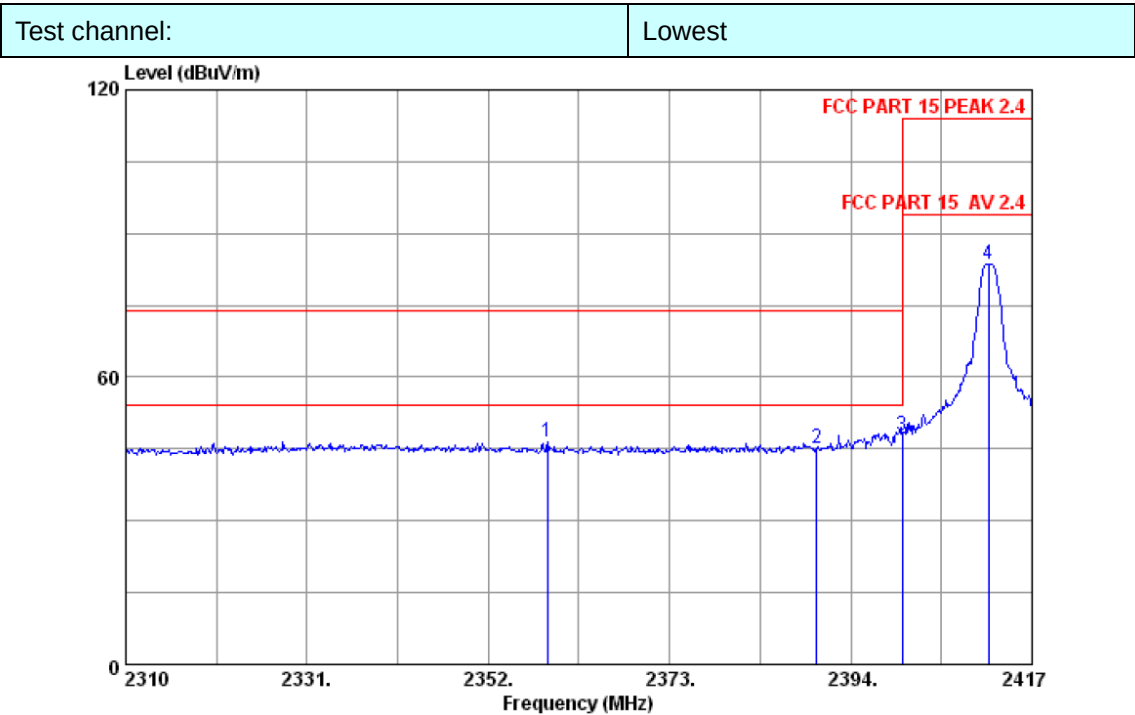
Perform the test as follows:

- 1) Span: Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation.
- 2) Reference level offset: Corrected for gains and losses of test antenna factor, preamp gain and cable loss, so as to indicate field strength, in units of dB μ V/m at 3 m, directly on the instrument display. Alternatively, the reference level offset may be set to zero and calculations shall be provided showing the conversion of raw measured data to the field strength in dB μ V/m at 3 m.
- 3) Reference level: As required to keep the signal from exceeding the maximum spectrum analyzer input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $[10 \log (\text{OBW/RBW})]$ below the reference level. Specific guidance is given in 4.1.5.2.
- 4) Attenuation: Auto (at least 10 dB preferred).
- 5) Sweep time: Coupled.
- 6) Resolution bandwidth: 1 MHz
- 7) Video bandwidth: $3 \times \text{RBW}$
- 8) Detector: Peak
- 9) Trace: Max hold for final measurement.

6.3 Environmental Conditions

Temperature:	23°C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

6.4 Summary of Test Results/Plots



Bandedge (Radiated)**GFSK**

Channel	Freq.(MHz)	Level(dBuV/m)	Limit(dBuV/m)	Margin(dB)	Detector	Polarization
LOW (2412MHz)	2400.0	47.80	74.00	-26.20	Peak	Vertical
	2390.0	45.16	74.00	-29.84	Peak	Vertical
	2358.9	46.26	74.00	-27.74	Peak	Vertical
HIGH (2468MHz)	2483.5	47.12	74.00	-26.88	Peak	Vertical
	2491.3	47.90	74.00	-26.10	Peak	Vertical
	--	--	--	--	--	

Remark: 1. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

7. 20dB Bandwidth

7.1 Standard Applicable

Test Requirement: 47 CFR Part 15, Subpart C 15.215

Test Method: ANSI C63.10 (2013) Section 6.9

Limit: N/A

7.2 Test Procedure

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

7.3 Environmental Conditions

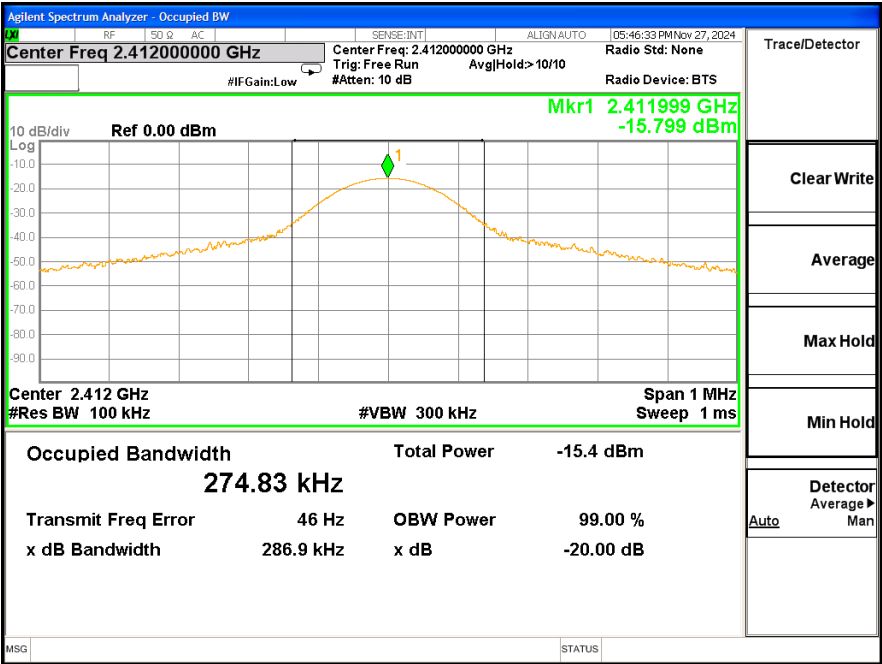
Temperature:	25° C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

7.4 Summary of Test Results/Plots

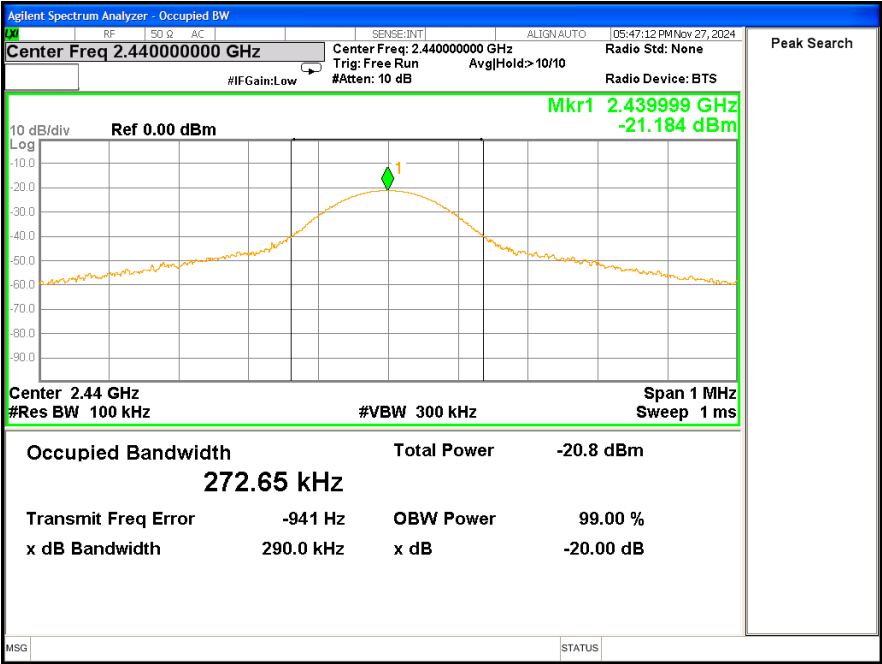
Test Mode	Test Channel MHz	20 dB Bandwidth kHz	Results
GFSK	2412	278.9	PASS
	2440	273.4	PASS
	2468	215.2	PASS

Please refer to the following test plots:

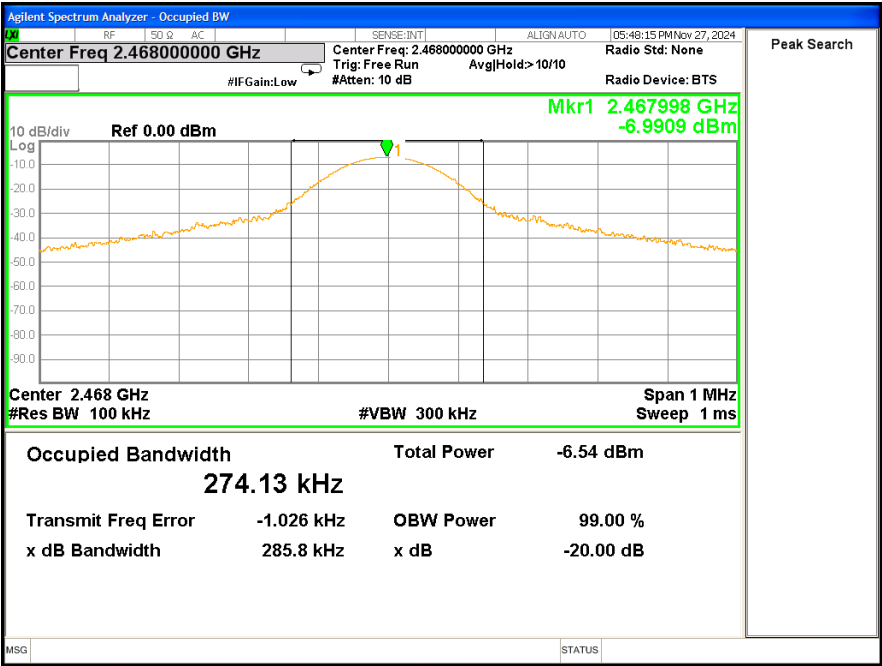
Low Channel:



Middle Channel:



High Channel:



****END REPORT****