RF Test Report

For

Applicant name:	**FOXX Development Inc.**
Address:	3480 Preston Ridge Road, Suite500, Alpharetta, GA 30005, USA
EUT name:	Smart Phone
Brand name:	FOXX, MIRO, FOXXD
Model number:	S13
Series model number:	N/A
FCC ID:	2AQRM-S13

Issued By

Company name:	**BTF Testing Lab (Shenzhen) Co., Ltd.**
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Report number:	BTF250210R00901
Test standards:	FCC CFR Title 47 Part 15 Subpart C (§15.247)
Test conclusion:	Pass
Date of sample receipt:	2025-04-18
Test date:	2025-04-19 to 2025-05-15
Date of issue:	2025-05-15
Test by:	Sean He Sean He / Tester
Prepared by:	Chris Liu Chris Liu / Project engineer
Approved by:	Olic Huang Olic Huang/EMC manager

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Revision History		
Version	Issue date	Revisions content
R_V0	2025-05-15	Original
Note: *Once the revision has been made, then previous versions reports are invalid.*		

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1 Introduction

1.1 Laboratory Location

Test location:	BTF Testing Lab (Shenzhen) Co., Ltd.
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Phone number:	+86-0755-23146130
Fax number:	+86-0755-23146130

1.2 Laboratory Facility

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

- **FCC - Designation No.: CN1409**
  BTF Testing Lab (Shenzhen) Co., Ltd. has been accredited as a testing laboratory by FCC (Federal Communications Commission). The test firm Registration No. is 518915.
- **CNAS - Registration No.: CNAS L17568**
  BTF Testing Lab (Shenzhen) Co., Ltd. is accredited to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L17568.
- **A2LA - Registration No.: 6660.01**
  BTF Testing Lab (Shenzhen) Co., Ltd. is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories.

1.3 Announcement

(1) The test report reference to the report template version v0.
(2) The test report is invalid if not marked with the signatures of the persons responsible for preparing, reviewing and approving the test report.
(3) The test report is invalid if there is any evidence and/or falsification.
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2 Product Information

2.1 Application Information

Company name:	FOXX Development Inc.
Address:	3480 Preston Ridge Road, Suite500, Alpharetta, GA 30005, USA

2.2 Manufacturer Information

Company name:	FOXX Development Inc.
Address:	3480 Preston Ridge Road, Suite500, Alpharetta, GA 30005, USA

2.3 Factory Information

Company name:	FOXX Development Inc.
Address:	3480 Preston Ridge Road, Suite500, Alpharetta, GA 30005, USA

2.4 General Description of Equipment under Test (EUT)

EUT name	Smart Phone
Under test model name	S13
Series model name	N/A
Description of model name differentiation	N/A
Hardware Version	N/A
Software Version	N/A
Ratingr:	DC 3.89 V From Li-ion Rechargeable battery Model No.:QZ-03301AC00 Input:100-240V~50/60Hz 1.2A Output(PD):5.0V⎓3.0A 15.0W or 9.0V⎓3.0A 27.0W or 12.0V⎓2.5A 30.0W or 15.0V⎓2.0A 30.0W or 20.0V⎓1.5A 30.0W Max (PPS)5.0V-11.0V⎓3.0A 33.0W Max

2.5 Technical Information

Operation frequency:	2402MHz ~ 2480MHz
Channel numbers:	79
Channel separation:	1MHz
Modulation technology:	GFSK, π/4 DQPSK, 8DPSK
Data rate:	1/2/3 Mbits/s
Max. E.I.R.P Power:	5.53 dBm (8DPSK)
Antenna type:	Internal Antenna
Antenna gain:	0.81 dBi (declare by Applicant)
Antenna transmit mode:	SISO (1TX, 1RX)

2.6 Channel list:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	20	2422MHz	40	2442MHz	60	2462MHz
1	2403MHz	21	2423MHz	41	2443MHz	61	2463MHz
…	…	…	…	…	…	…	…
10	2412MHz	30	2432MHz	50	2452MHz	70	2472MHz
11	2413MHz	31	2433MHz	51	2453MHz	71	2473MHz
…	…	…	…	…	…	…	…
18	2420MHz	38	2440MHz	58	2460MHz	78	2480MHz
19	2421MHz	39	2441MHz	59	2461MHz	-	
Remark: Channel 0, 39 & 78 have been tested for GFSK, π/4-DQPSK, 8DPSK modulation mode.							

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3 Test Information

3.1 Test Standards

Identity	Document Title
FCC CFR Title 47 Part 15 Subpart C (§15.247)	Intentional Radiators - Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.
ANSI C63.10-2020	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
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 Summary of Test

Clauses	Test Items	Result
§ 15.203 § 15.247(b)(4)	Antenna Requirement	Pass
§ 15.207	AC Power Line Conducted Emission	Pass
§ 15.247(b)(1)	Conducted Output Power	Pass
§ 15.247(a)(1)	20dB Occupied Bandwidth	Pass
§ 15.247(a)(1)	Carrier Frequencies Separation	Pass
§ 15.247(a)(1)(iii)	Hopping Channel Number	Pass
§ 15.247(a)(1)(iii)	Dwell Time	Pass
§ 15.247(d)	Band-edge Emission Conduction Spurious Emission	Pass
§ 15.205 § 15.247(d)	Emissions in Restricted Frequency Bands	Pass
§ 15.209 § 15.247(d)	Emissions in Non-restricted Frequency Bands	Pass

Remark:

1. Pass: met the requirements.

2. N/A: not applicable.

3.3 Uncertainty of Test

Measurement	Value
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±1.5 dB
Power Spectral Density, conducted	±3.0 dB
Unwanted Emissions, conducted	±3.0 dB
Supply voltages	±3 %
Time	±5 %
Conducted Emission for LISN (9kHz ~ 150kHz)	±2.97 dB
Conducted Emission for LISN (150kHz ~ 30MHz)	±2.45 dB
Radiated Emission (30MHz ~ 1000MHz)	±4.80 dB
Radiated Emission (1GHz ~ 18GHz)	±4.82 dB
The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

3.4 Additions to, deviations, or exclusions from the method

None

3.5 Test Auxiliary Equipment

No.	Description	Manufacturer	Model	Serial Number	Certification
1	N/A	N/A	N/A	N/A	N/A

3.6 Test Equipment List

Radiated test method					
Test Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
EMI Receiver	Rohde &Schwarz	ESCI7	101032	2024/10/25	2025/10/24
Signal Analyzer	Rohde & Schwarz	FSQ40	100010	2024/10/25	2025/10/24
Log periodic antenna	Schwarzbeck	VULB 9168	01328	2024/10/28	2025/10/27
Preamplifier (30MHz ~ 1GHz)	Schwarzbeck	BBV9744	00246	2024/09/24	2025/09/23
Horn Antenna (1GHz ~18GHz)	Schwarzbeck	BBHA9120D	2597	2024/10/30	2025/10/29
Horn Antenna (15GHz ~ 40GHz)	SCHWARZBECK	BBHA9170	1157	2024/10/24	2025/10/23
Preamplifier (1GHz ~ 40GHz)	TST Pass	LNA10180G45	246	2024/09/24	2025/09/23
Test Software	Frad	EZ_EMC	Version: FA-03A2 RE+		

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Conducted Emission Test					
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
EMI Receiver	Rohde & Schwarz	ESCI3	101422	2024/10/25	2025/10/24
V-LISN	Schwarzbeck	NSLK 8127	01073	2024/10/25	2025/10/24
Coaxial Switcher	Schwarzbeck	CX210	CX210	/	/
Pulse Limiter	Schwarzbeck	VTSD 9561-F	00953	/	/
Test Software	Frad	EZ_EMC	Version: EMC-CON 3A1.1+		

Conducted test method					
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	Keysight	N9020A	MY50410020	2024/10/25	2025/10/24
ESG Vector Signal Generator	Agilent	E4438C	MY45094854	2024/10/25	2025/10/24
MXG Vector Signal Generator	Agilent	N5182A	MY46240163	2024/10/25	2025/10/24
Wideband Radio Communication Tester	Rohde&Schwarz	CMW500	161997	2024/10/25	2025/10/24
Temperature Humidity Chamber	ZZCKONG	ZZ-K02A	20210928007	2024/10/25	2025/10/24
DC Power Supply	Tongmen	etm-6050c	20211026123	2024/10/25	2025/10/24
RF Control Unit	Techy	TR1029-1	/	2024/10/25	2025/10/24
RF Sensor Unit	Techy	TR1029-2	/	2024/10/25	2025/10/24
Test Software	TST Pass	/	Version: 2.0		

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4 Test Configuration

4.1 Environment Condition

Selected Values During Tests		
Temperature	Relative Humidity	Ambient Pressure
Normal: +15°C to +35°C Extreme: -30°C to +50°C	20% to 75%	86 kPa to 106 kPa

4.2 Test mode

Transmitting mode:	Keep the EUT in continuously transmitting mode with modulation
Hopping mode:	Keep the EUT in normal hopping mode
Remark: Per-scan all kind of data rate, and report only reflects the test data of worst data rate mode.	

4.3 Test Channel of EUT

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Lowest channel		Middle channel		Highest channel	
Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	2402	39	2441	78	2480

4.4 Test software

Test software:	Engineering mode	Version:	1.0
Power Class:	7		

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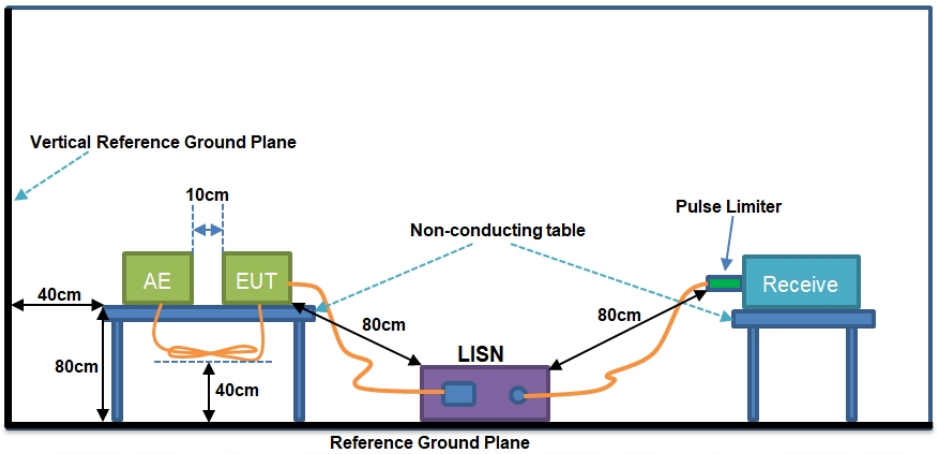
4.5 Test procedure

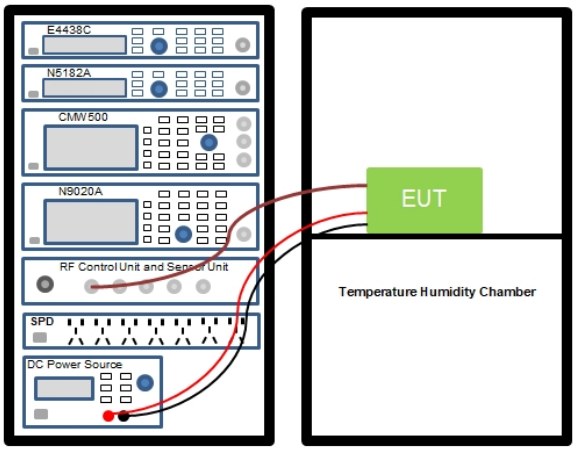
AC Power Line Conducted Emission
The EUT is connected to the power mains through a LISN which provides 50 Ω/50 μH of coupling impedance for the measuring instrument. The test frequency range is from 150 kHz to 30 MHz. The maximum conducted interference is searched using Peak (PK), Quasi-peak (QP) and Average (AV) detectors; the emission levels that are 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.
Radiated test method
For below 1GHz: 1. The EUT was placed on the tabletop of a rotating table 0.8 m the ground at a 3 m semi anechoic chamber. The measurement distance from the EUT to the receiving antenna is 3 m. 2. EUT works in each mode of operation that needs to be tested. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations. 3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data. **For above 1GHz:** 1. The EUT was placed on the tabletop of a rotating table 1.5 m the ground at a 3 m semi anechoic chamber. The measurement distance from the EUT to the receiving antenna is 3 m. 2. EUT works in each mode of operation that needs to be tested. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations. 3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.
Conducted test method
1. The Bluetooth antenna port of EUT was connected to the test port of the test system through an RF cable. 2. The EUT is keeping in continuous transmission mode and tested in all modulation modes. 3. Open the test software, prepare a test plan, and control the system through the software. After the test is completed, the test report is exported through the test software.

4.6 Test Setup Block

1) Conducted emission measurement:

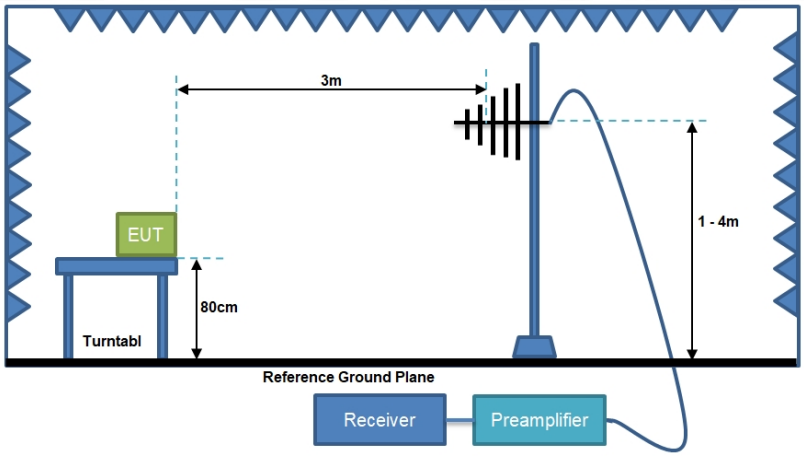


2) Conducted test method:

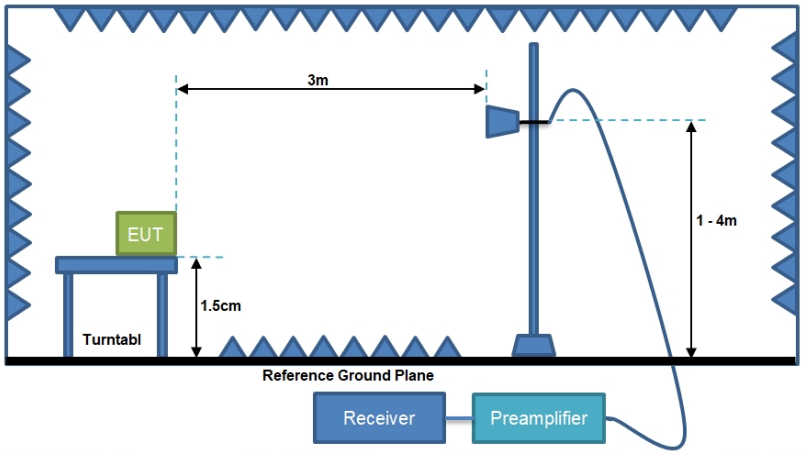


3) Radiated test method:

Below 1GHz



Above 1GHz



5 Technical requirements specification

5.1 Summary of Test Result

Test Items	Limit	Test data	Verdict
Antenna Requirement	Please refer to §15.203 and §15.247(b)(4)	See Section 5.2	Pass
AC Power Line Conducted Emission	Please refer to §15.207	See Section 5.3	Pass
Conducted Output Power	Non-overlapping hopping channels: 1 watts (30dBm). All other frequency hopping systems: 0.125 watts (21dBm).	See Appendix-BT	Pass
20dB Occupied Bandwidth	Within authorization band	See Appendix-BT	Pass
Carrier Frequencies Separation	a) 0.025MHz or the 20dB bandwidth (whichever is greater). b) 0.025MHz or two-thirds of the 20dB bandwidth (whichever is greater).	See Appendix-BT	Pass
Hopping Channel Number	At least 15 channels.	See Appendix-BT	Pass
Dwell Time	Not be greater than 0.4 seconds.	See Appendix-BT	Pass
Band-edge Emission Conduction Spurious Emission	Please refer to §15.247(d)	See Appendix-BT	Pass
Emissions in Restricted Frequency Bands	Please refer to §15.205	See section 5.4	Pass
Emissions in Non-restricted Frequency Bands	Please refer to §15.209 and §15.247(d)	See section 5.5	Pass

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5.2 Antenna Requirement

§15.203 requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

§15.247(b) (4) requirement:

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

E.U.T Antenna:	The Bluetooth antenna is an Internal antenna which permanently attached, and the best case gain of the antenna is 0.81dBi. See product internal photos for details.

5.3 AC Power Line Conducted Emission

Test Requirement:	Except as shown in paragraphs (b)and (c)of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN).
Test Method:	Refer to ANSI C63.10-2020 section 6.2, standard test method for ac power-line conducted emissions from unlicensed wireless devices
Test Limit:	

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

5.3.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.3 °C
Humidity:	47.8 %
Atmospheric Pressure:	1010 hpa
Test Voltage	AC 120V 60Hz

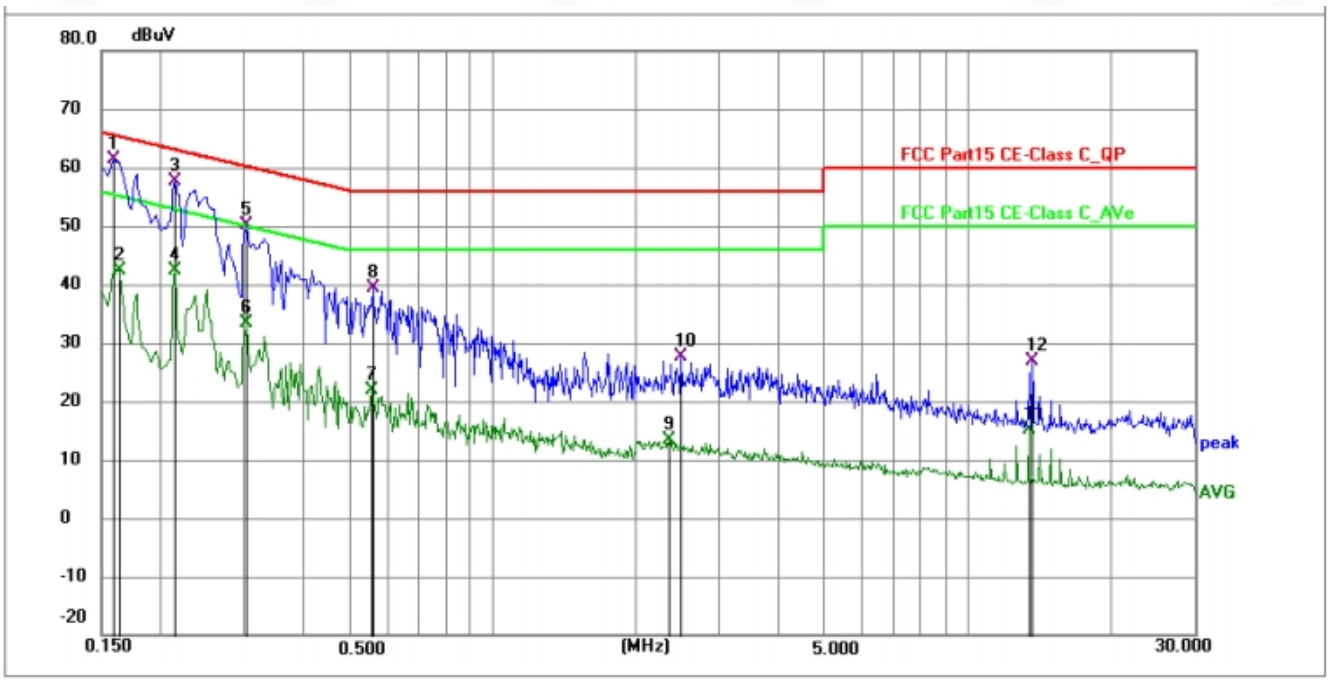
5.3.2 Test Setup

See section 4.5 for test setup description. The photo of test setup please refer to Appendix I Test Setup Photos

5.3.3 Test Data:

Remark: During the test, pre-scan GFSK, π/4-DQPSK, 8DPSK modulation mode, found GFSK modulation was worse case mode. The report only reflects the test data of worst mode.

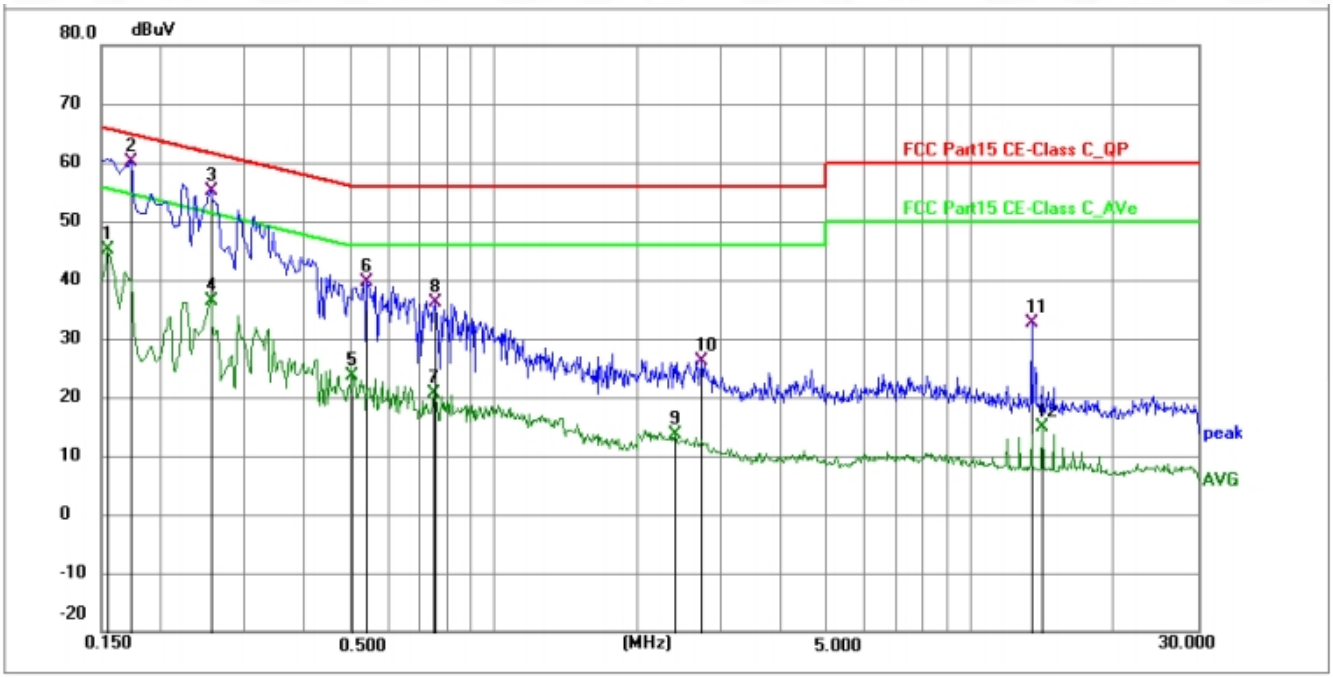
Test phase: L phase



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1 *	0.1590	50.94	10.47	61.41	65.52	-4.11	QP	P	
2	0.1635	31.93	10.48	42.41	55.28	-12.87	AVG	P	
3	0.2130	46.96	10.56	57.52	63.09	-5.57	QP	P	
4	0.2130	31.74	10.56	42.30	53.09	-10.79	AVG	P	
5	0.3030	39.47	10.57	50.04	60.16	-10.12	QP	P	
6	0.3030	22.86	10.57	33.43	50.16	-16.73	AVG	P	
7	0.5550	11.36	10.61	21.97	46.00	-24.03	AVG	P	
8	0.5594	28.84	10.61	39.45	56.00	-16.55	QP	P	
9	2.3504	2.78	10.67	13.45	46.00	-32.55	AVG	P	
10	2.4990	16.93	10.67	27.60	56.00	-28.40	QP	P	
11	13.4382	4.34	10.90	15.24	50.00	-34.76	AVG	P	
12	13.6230	15.96	10.91	26.87	60.00	-33.13	QP	P	

Note:Margin=Level-Limit=Reading+factor-Limit

Test phase: N phase



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.1544	34.72	10.46	45.18	55.76	-10.58	AVG	P	
2 *	0.1723	49.56	10.49	60.05	64.85	-4.80	QP	P	
3	0.2535	44.51	10.56	55.07	61.64	-6.57	QP	P	
4	0.2535	25.80	10.56	36.36	51.64	-15.28	AVG	P	
5	0.5051	13.01	10.58	23.59	46.00	-22.41	AVG	P	
6	0.5413	29.10	10.60	39.70	56.00	-16.30	QP	P	
7	0.7485	9.98	10.69	20.67	46.00	-25.33	AVG	P	
8	0.7530	25.47	10.69	36.16	56.00	-19.84	QP	P	
9	2.4000	3.02	10.67	13.69	46.00	-32.31	AVG	P	
10	2.7284	15.54	10.67	26.21	56.00	-29.79	QP	P	
11	13.4340	21.82	10.83	32.65	60.00	-27.35	QP	P	
12	14.1810	4.01	10.82	14.83	50.00	-35.17	AVG	P	

Note:Margin=Level-Limit=Reading+factor-Limit

5.4 Occupied Bandwidth

Test Requirement:	Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is

	contained within the frequency band designated in the rule section under which the equipment is operated.
Test Method:	Occupied bandwidth—relative measurement procedure
Test Limit:	Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.
Procedure:	a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and five times the OBW. b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW, unless otherwise specified by the applicable requirement. c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2. d) Steps a) through c) might require iteration to adjust within the specified tolerances. e) The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target "−xx dB down" requirement; that is, if the requirement calls for measuring the −20 dB OBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value. f) Set detection mode to peak and trace mode to max hold. g) Determine the reference value: Set the EUT to transmit an unmodulated carrier or modulated signal, as applicable. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value). h) Determine the "−xx dB down amplitude" using [(reference value) − xx]. Alternatively, this calculation may be made by using the marker-delta function of the instrument. i) If the reference value is determined by an unmodulated carrier, then turn the EUT modulation ON, and either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise, the trace from step g) shall be used for step j). j) Place two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the "-xx dB down amplitude" determined in step h). If a marker is below this "−xx dB down amplitude" value, then it shall be as close as possible to this value. The occupied bandwidth is the frequency difference between the two markers. Alternatively, set a marker at the lowest frequency of the envelope of the spectral display, such that the marker is at or slightly below the "-xx dB down amplitude" determined in step h). Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth. k) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

5.4.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.3 °C
Humidity:	45.2 %
Atmospheric Pressure:	1010 hpa

5.4.2 Test Setup

See section 4.5 for test setup description. The photo of test setup please refer to Appendix I Test Setup Photos

5.4.3 Test Data:

Please Refer to Appendix-EDR for Details.

5.5 Maximum Conducted Output Power

Test Requirement:	For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
Test Method:	Output power test procedure for frequency-hopping spread-spectrum (FHSS) devices
Test Limit:	For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
Procedure:	This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test: a) Use the following spectrum analyzer settings: 1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel. 2) RBW > 20 dB bandwidth of the emission being measured. 3) VBW >= RBW. 4) Sweep: Auto. 5) Detector function: Peak. 6) Trace: Max hold. b) Allow trace to stabilize. c) Use the marker-to-peak function to set the marker to the peak of the emission. d) The indicated level is the peak output power, after any corrections for external attenuators and cables. e) A plot of the test results and setup description shall be included in the test report. NOTE—A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.

5.5.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.3 °C
Humidity:	45.2 %
Atmospheric Pressure:	1010 hpa

5.5.2 Test Setup

See section 4.5 for test setup description. The photo of test setup please refer to Appendix I Test Setup Photos

5.5.3 Test Data:

Please Refer to Appendix-EDR for Details.

5.6 Channel Separation

Test Requirement:	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 operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 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.
Test Method:	Carrier frequency separation
Test Limit:	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 operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 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.
Procedure:	The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings: a) Span: Wide enough to capture the peaks of two adjacent channels. b) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel. c) Video (or average) bandwidth (VBW) ≥ RBW. d) Sweep: Auto. e) Detector function: Peak. f) Trace: Max hold. g) Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Compliance of an EUT with the appropriate regulatory limit shall be determined. A plot of the data shall be included in the test report.

5.6.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.3 °C
Humidity:	45.2 %
Atmospheric Pressure:	1010 hpa

5.6.2 Test Setup

See section 4.5 for test setup description. The photo of test setup please refer to Appendix I Test Setup Photos

5.6.3 Test Data:

Please Refer to Appendix-EDR for Details.

5.7 Number of Hopping Frequencies

Test Requirement:	Fequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 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.
Test Method:	Number of hopping frequencies
Test Limit:	Fequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 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.
Procedure:	The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings: a) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen. b) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller. c) VBW ≥ RBW. d) Sweep: Auto. e) Detector function: Peak. f) Trace: Max hold. g) Allow the trace to stabilize. It might prove necessary to break the span up into subranges to show clearly all of the hopping frequencies. Compliance of an EUT with the appropriate regulatory limit shall be determined for the number of hopping channels. A plot of the data shall be included in the test report.

5.7.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.3 °C
Humidity:	45.2 %
Atmospheric Pressure:	1010 hpa

5.7.2 Test Setup

See section 4.5 for test setup description. The photo of test setup please refer to Appendix I Test Setup Photos

5.7.3 Test Data:

Please Refer to Appendix-EDR for Details.

5.8 Dwell Time

Test Requirement:	Fequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 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.
Test Method:	Time of occupancy (dwell time)
Test Limit:	Fequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 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.
Procedure:	The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings: a) Span: Zero span, centered on a hopping channel. b) RBW shall be <= channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel. c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel. d) Detector function: Peak. e) Trace: Max hold. Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time. Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation: (Number of hops in the period specified in the requirements) = (number of hops on spectrum analyzer) × (period specified in the requirements / analyzer sweep time) The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation. The measured transmit time and time between hops shall be consistent with the values described in the operational description for the EUT.

5.8.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.3 °C
Humidity:	45.2 %
Atmospheric Pressure:	1010 hpa

5.8.2 Test Setup

See section 4.5 for test setup description. The photo of test setup please refer to Appendix I Test Setup Photos

5.8.3 Test Data:

Please Refer to Appendix-EDR for Details.

5.9 Emissions in non-restricted frequency bands

Test Requirement:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required.
Test Method:	Conducted spurious emissions test methodology
Test Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required.
Procedure:	Conducted spurious emissions shall be measured for the transmit frequency, per 5.5 and 5.6, and at the maximum transmit powers. Connect the primary antenna port through an attenuator to the spectrum analyzer input; in the results, account for all losses between the unlicensed wireless device output and the spectrum analyzer. The instrument shall span 30 MHz to 10 times the operating frequency in GHz, with a resolution bandwidth of 100 kHz, video bandwidth of 300 kHz, and a coupled sweep time with a peak detector. The band 30 MHz to the highest frequency may be split into smaller spans, as long as the entire spectrum is covered.

5.9.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.3 °C
Humidity:	45.2 %
Atmospheric Pressure:	1010 hpa
Test Voltage	DC 5V

5.9.2 Test Setup

See section 4.5 for test setup description. The photo of test setup please refer to Appendix I Test Setup Photos

5.9.3 Test Data:

Please Refer to Appendix-EDR for Details.

5.10 Band edge emissions (Radiated)

<table>
<tr><td>Test Requirement:</td><td>In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).`</td></tr>
<tr><td>Test Method:</td><td>Radiated emissions tests</td></tr>
<tr><td>Test Limit:</td><td>
<table>
<tr><td>Frequency (MHz)</td><td>Field strength (microvolts/meter)</td><td>Measurement distance (meters)</td></tr>
<tr><td>0.009-0.490</td><td>2400/F(kHz)</td><td>300</td></tr>
<tr><td>0.490-1.705</td><td>24000/F(kHz)</td><td>30</td></tr>
<tr><td>1.705-30.0</td><td>30</td><td>30</td></tr>
<tr><td>30-88</td><td>100 **</td><td>3</td></tr>
<tr><td>88-216</td><td>150 **</td><td>3</td></tr>
<tr><td>216-960</td><td>200 **</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>3</td></tr>
</table>
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g.,
§§ 15.231 and 15.241.</td></tr>
<tr><td>Procedure:</td><td>ANSI C63.10-2020 section 6.10.5.2</td></tr>
</table>

5.10.1 E.U.T. Operation:

Operating Environment:	
Temperature:	25 °C
Humidity:	49.5 %
Atmospheric Pressure:	1010 hpa
Test Voltage	DC 5V

5.10.2 Test Setup

See section 4.5 for test setup description. The photo of test setup please refer to Appendix I Test Setup Photos

5.10.3 Test Data:

Remark: During the test, pre-scan GFSK, π/4-DQPSK, 8DPSK modulation mode, found GFSK modulation was worse case mode. The report only reflects the test data of worst mode.

Test Mode: GFSK

Test Channel: Lowest channel, Test Polarization: Vertical

Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
2310.00	51.29	3.85	55.15	74.00	-18.85	Peak	Pass
2310.00	40.56	3.85	44.41	54.00	-9.59	AVG	Pass
2390.00	51.75	3.91	55.67	74.00	-18.33	Peak	Pass
2390.00	41.31	3.91	45.22	54.00	-8.78	AVG	Pass

Test Channel: Lowest channel, Test Polarization: Horizontal

Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
2310.00	51.84	3.85	55.69	74.00	-18.31	Peak	Pass
2310.00	42.25	3.85	46.10	54.00	-7.90	AVG	Pass
2390.00	51.52	3.91	55.43	74.00	-18.57	Peak	Pass
2390.00	40.55	3.91	44.47	54.00	-9.53	AVG	Pass

Test Channel: Highest channel, Test Polarization: Vertical

Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
2483.50	51.28	3.99	55.26	74.00	-18.74	Peak	Pass
2483.50	40.88	3.99	44.87	54.00	-9.13	AVG	Pass
2500.00	51.65	4.00	55.65	74.00	-18.35	Peak	Pass
2500.00	42.03	4.00	46.03	54.00	-7.97	AVG	Pass

Test Channel: Highest channel, Test Polarization: Horizontal

Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
2483.50	51.05	3.99	55.04	74.00	-18.96	Peak	Pass
2483.50	41.13	3.99	45.11	54.00	-8.89	AVG	Pass
2500.00	52.30	4.00	56.30	74.00	-17.70	Peak	Pass
2500.00	42.42	4.00	46.42	54.00	-7.58	AVG	Pass

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5.11 Emissions in restricted frequency bands (below 1GHz)

Test Requirement:	In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).`
Test Method:	Radiated emissions tests
Test Limit:	

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100 **	3
88-216	150 **	3
216-960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g.,

§§ 15.231 and 15.241.

Procedure:	ANSI C63.10-2020 section 6.6.4

5.11.1 E.U.T. Operation:

Operating Environment:	
Temperature:	25 °C
Humidity:	49.5 %
Atmospheric Pressure:	1010 hpa
Test Voltage	DC 5V

5.11.2 Test Setup

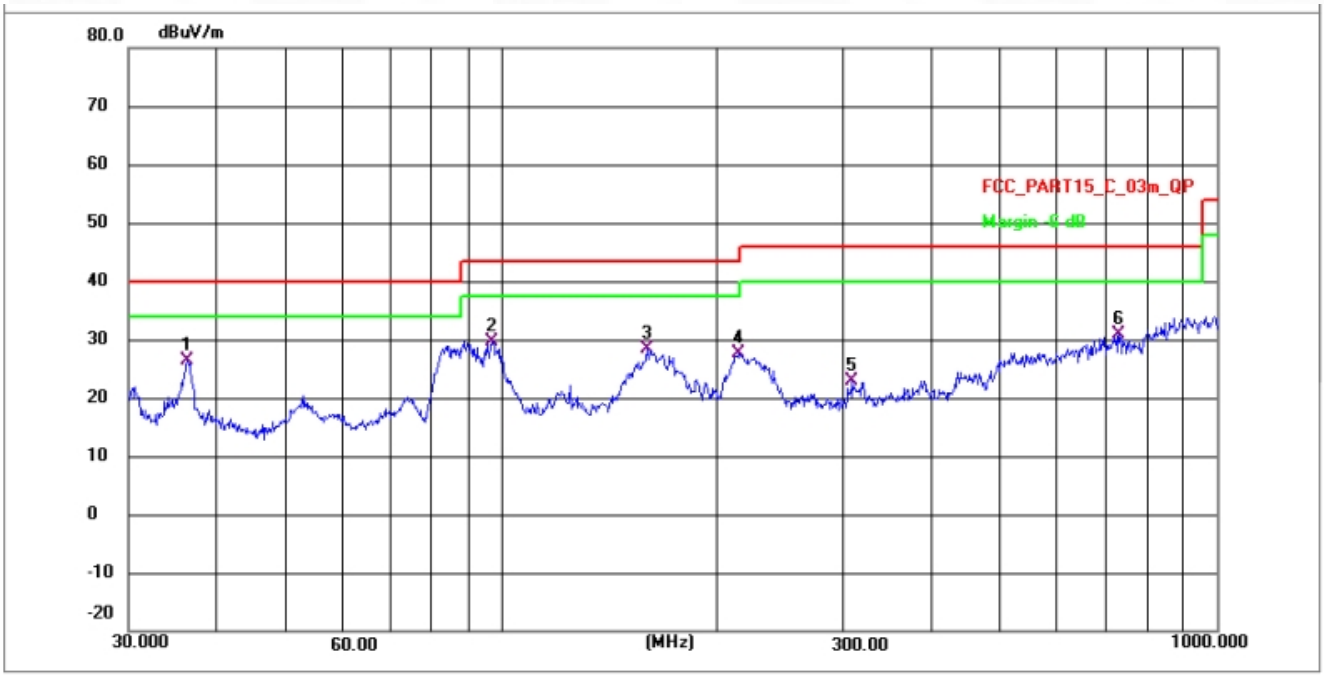
See section 4.5 for test setup description. The photo of test setup please refer to Appendix I Test Setup Photos

5.11.3 Test Data:

Remark: During the test, pre-scan GFSK, π/4-DQPSK, 8DPSK modulation mode, found GFSK modulation was worse case mode. The report only reflects the test data of worst mode.

For below 1GHz:

Test antenna polarization: Vertical (30 MHz to 1 GHz)



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 *	36.3176	36.06	-9.66	26.40	40.00	-13.60	QP	P
2	96.9447	52.15	-22.51	29.64	43.50	-13.86	QP	P
3	159.5045	50.35	-21.92	28.43	43.50	-15.07	QP	P
4	214.8907	49.10	-21.39	27.71	43.50	-15.79	QP	P
5	308.9125	43.41	-20.55	22.86	46.00	-23.14	QP	P
6	730.6381	48.66	-17.69	30.97	46.00	-15.03	QP	P

Note:Margin=Level-Limit=Reading+factor-Limit

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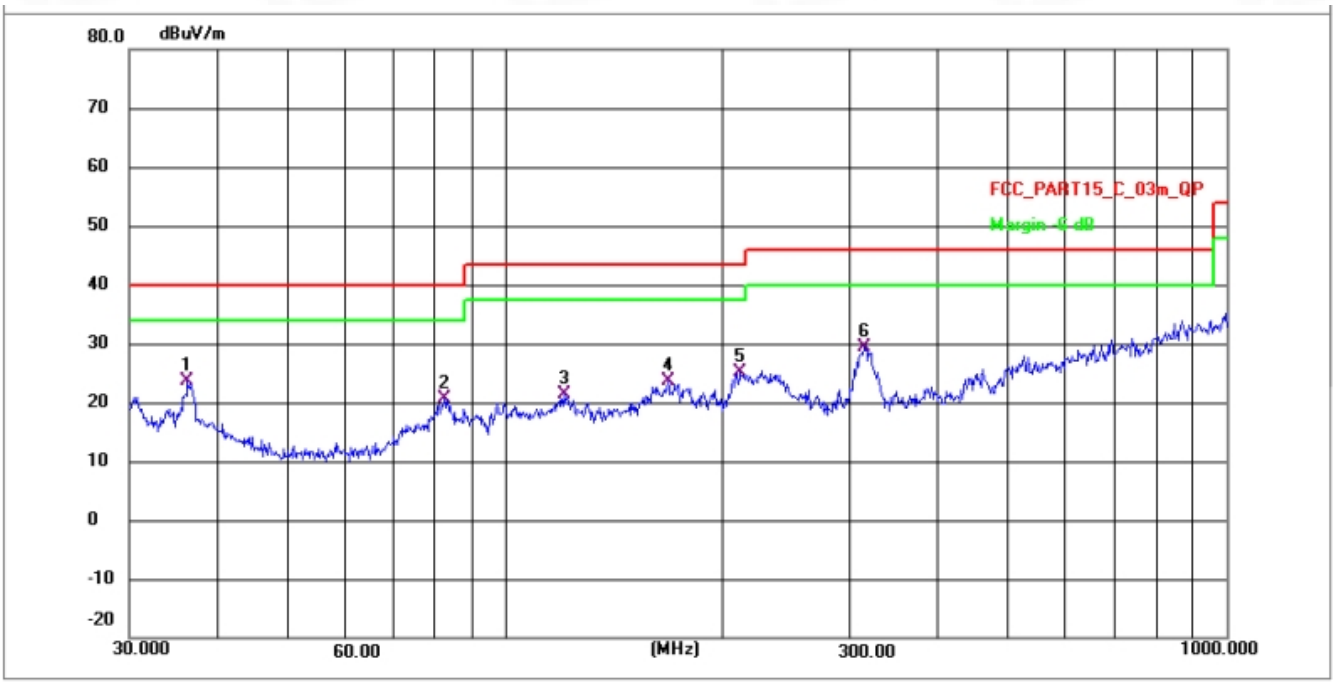
Test antenna polarization: Horizontal (30 MHz to 1 GHz)



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 *	36.2540	33.35	-9.66	23.69	40.00	-16.31	QP	P
2	82.0705	43.38	-22.74	20.64	40.00	-19.36	QP	P
3	120.4876	43.69	-22.28	21.41	43.50	-22.09	QP	P
4	167.8242	45.58	-21.84	23.74	43.50	-19.76	QP	P
5	212.2694	46.64	-21.41	25.23	43.50	-18.27	QP	P
6	314.9281	49.98	-20.50	29.48	46.00	-16.52	QP	P

Note:Margin=Level-Limit=Reading+factor-Limit

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5.12 Emissions in restricted frequency bands (above 1GHz)

Test Requirement:	In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).`
Test Method:	Radiated emissions tests
Test Limit:	

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100 **	3
88-216	150 **	3
216-960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g.,

§§ 15.231 and 15.241.

Procedure:	ANSI C63.10-2020 section 6.6.4

5.12.1 E.U.T. Operation:

Operating Environment:	
Temperature:	25 °C
Humidity:	49.5 %
Atmospheric Pressure:	1010 hpa
Test Voltage	DC 5V

5.12.2 Test Setup

See section 4.5 for test setup description. The photo of test setup please refer to Appendix I Test Setup Photos

5.12.3 Test Data:

For above 1GHz:

Test Mode: GFSK

Test Channel: Lowest channel, Test Polarization: Vertical

Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
4804.00	77.85	-48.89	28.96	74.00	-45.04	Peak	Pass
4804.00	67.85	-48.89	18.96	54.00	-35.04	AVG	Pass
7206.00	76.31	-47.02	29.29	74.00	-44.71	Peak	Pass
7206.00	65.32	-47.02	18.30	54.00	-35.70	AVG	Pass

Test Channel: Lowest channel, Test Polarization: Horizontal

Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
4804.00	79.27	-48.89	30.38	74.00	-43.62	Peak	Pass
4804.00	68.61	-48.89	19.73	54.00	-34.27	AVG	Pass
7206.00	76.21	-47.02	29.19	74.00	-44.81	Peak	Pass
7206.00	66.46	-47.02	19.44	54.00	-34.56	AVG	Pass

Test Channel: Middle channel, Test Polarization: Vertical

Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
4882.00	78.72	-48.84	29.88	74.00	-44.12	Peak	Pass
4882.00	68.30	-48.84	19.47	54.00	-34.53	AVG	Pass
7323.00	74.96	-46.88	28.07	74.00	-45.93	Peak	Pass
7323.00	64.60	-46.88	17.71	54.00	-36.29	AVG	Pass

Test Channel: Middle channel, Test Polarization: Horizontal

Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
4882.00	78.18	-48.84	29.35	74.00	-44.65	Peak	Pass
4882.00	67.36	-48.84	18.52	54.00	-35.48	AVG	Pass
7323.00	76.24	-46.88	29.36	74.00	-44.64	Peak	Pass
7323.00	66.24	-46.88	19.36	54.00	-34.64	AVG	Pass

Test Channel: Highest channel, Test Polarization: Vertical

Frequency	Reading	Factor	Level	Limit	Marging	Detector	Result

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(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		
4960.00	78.83	-48.79	30.04	74.00	-43.96	Peak	Pass
4960.00	69.21	-48.79	20.42	54.00	-33.58	AVG	Pass
7440.00	74.93	-46.74	28.18	74.00	-45.82	Peak	Pass
7440.00	65.38	-46.74	18.64	54.00	-35.36	AVG	Pass
Test Channel: Highest channel, Test Polarization: Horizontal							
Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
4960.00	79.38	-48.79	30.60	74.00	-43.40	Peak	Pass
4960.00	69.08	-48.79	20.30	54.00	-33.70	AVG	Pass
7440.00	76.76	-46.74	30.02	74.00	-43.98	Peak	Pass
7440.00	67.11	-46.74	20.36	54.00	-33.64	AVG	Pass

Note:Margin=Level-Limit=Reading+factor-Limit

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6 Test Setup Photos

Please refer to the Appendix I Test Setup Photos

7 EUT Constructional Details (EUT Photos)

Please refer to the Appendix II External Photos &Appendix III External Photos

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