RF Test Report

For

Applicant name:	**Shanghai Dengyuan Information Technology Co., LTD.**
Address:	Room 201, 2nd Floor, Building 4,No.399, Dongye Road, Dongjing Town, Songjiang District, Shanghai
EUT name:	Label printer
Brand name:	KAYSION
Model number:	SK45
Series model number:	N/A
FCC ID:	2BNON-SK45

Issued By

Company name:	**BTF Testing Lab (Shenzhen) Co., Ltd.**
Address:	101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Report number:	BTF250423R00701
Test standards:	FCC CFR Title 47 Part 15 Subpart C (§15.247)
Test conclusion:	Pass
Date of sample receipt:	2025-04-23
Test date:	2025-04-24 to 2025-05-16
Date of issue:	2025-05-17
Test by:	Sean.He Sean He / Tester
Prepared by:	Chris Liu Chris Liu / Project engineer
Approved by:	Ryan.CJ / EMC Manager

Note: All the test results in this report only related to the testing samples. Which can be duplicated completely for the legal use with approval of applicant; it shall not be reproduced except in full without the written approval of BTF Testing Lab (Shenzhen) Co., Ltd., All the objections should be raised within thirty days from the date of issue. To validate the report, you can contact us.

Revision History		
Version	Issue date	Revisions content
R_V0	2025-05-17	Original
Note: *Once the revision has been made, then previous versions reports are invalid.*		

Table of Contents

1 Introduction 5
1.1 Laboratory Location 5
1.2 Laboratory Facility 5
1.3 Announcement 5
2 Product Information 6
2.1 Application Information 6
2.2 Manufacturer Information 6
2.3 Factory Information 6
2.4 General Description of Equipment under Test (EUT) 6
2.5 Technical Information 6
3 Test Information 7
3.1 Test Standards 7
3.2 Summary of Test 7
3.3 Uncertainty of Test 8
3.4 Additions to, deviations, or exclusions from the method 8
3.5 Test Auxiliary Equipment 8
3.6 Test Equipment List 8
4 Test Configuration 10
4.1 Environment Condition 10
4.2 Test mode 10
4.3 Test Channel of EUT 10
4.4 Channel List: 10
4.5 Test software 10
4.6 Test procedure 11
4.7 Test Setup Block 12
5 Technical requirements specification 14
5.1 Summary of Test Result 14
5.2 Antenna Requirement 15
5.3 AC Power Line Conducted Emission 16
5.3.1 E.U.T. Operation: 16
5.3.2 Test Data: 17
5.4 Emissions in Restricted Frequency Bands 19
5.4.1 E.U.T. Operation: 19
5.4.2 Test Data: 20
5.5 Emissions in Non-restricted Frequency Bands (below 1GHz) 21
5.5.1 E.U.T. Operation: 21
5.5.2 Test Data: 22
5.6 Emissions in restricted frequency bands (above 1GHz) 24
5.6.1 E.U.T. Operation: 24
5.6.2 Test Data: 25
6 Occupied Bandwidth 27
6.1.1 E.U.T. Operation: 27
6.1.2 Test Setup 27
6.1.3 Test Data: 27
7 Maximum Conducted Output Power 28
7.1.1 E.U.T. Operation: 28
7.1.2 Test Setup 28
7.1.3 Test Data: 28
8 Power Spectral Density 29
8.1.1 E.U.T. Operation: 29
8.1.2 Test Setup 29
8.1.3 Test Data: 29
9 Emissions in non-restricted frequency bands 30

Total or partial reproduction of this document without permission of the Laboratory is not allowed.

BTF Testing Lab (Shenzhen) Co., Ltd.
101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

9.1.1 E.U.T. Operation: 30
9.1.2 Test Setup 30
9.1.3 Test Data: 30
10 Test Setup Photos 31
11 EUT Constructional Details (EUT Photos) 31

1 Introduction

1.1 Laboratory Location

Test location:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
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.

(4) This document may not be altered or revised in any way unless done so by BTF and all revisions are duly noted in the revisions section.

(5) 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.

(6) The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.

Total or partial reproduction of this document without permission of the Laboratory is not allowed.

BTF Testing Lab (Shenzhen) Co., Ltd.
101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

2 Product Information

2.1 Application Information

Company name:	Shanghai Dengyuan Information Technology Co., LTD.
Address:	Room 201, 2nd Floor, Building 4,No.399, Dongye Road, Dongjing Town, Songjiang District, Shanghai

2.2 Manufacturer Information

Company name:	Shanghai Dengyuan Information Technology Co., LTD.
Address:	Room 201, 2nd Floor, Building 4,No.399, Dongye Road, Dongjing Town, Songjiang District, Shanghai

2.3 Factory Information

Company name:	Shanghai Dengyuan Information Technology Co., LTD.
Address:	Room 201, 2nd Floor, Building 4,No.399, Dongye Road, Dongjing Town, Songjiang District, Shanghai

2.4 General Description of Equipment under Test (EUT)

EUT name	Label printer
Under test model name	SK45
Series model name	N/A
Description of model name differentiation	N/A
Hardware Version	N/A
Software Version	N/A
Power supply:	Input: DC 24V⎓2.5A
Adapter	Model No.:EA060-2400-2500 Input: AC100-240V, 50/60Hz 1.5A Output: 24.0V⎓2.5A

2.5 Technical Information

Operation frequency:	2402MHz ~ 2480MHz
Channel numbers:	40
Channel separation:	2MHz
Modulation technology:	GFSK
Data rate:	1 Mbps (LE 1M PHY), 2 Mbps (LE 2M PHY)
Max. Conducted Power:	1.14 dBm (2 Mbps (LE 2M PHY))
Antenna type:	PCB Antenna
Antenna gain:	2.0 dBi (declare by Applicant)
Antenna transmit mode:	SISO (1TX, 1RX)

Total or partial reproduction of this document without permission of the Laboratory is not allowed.

BTF Testing Lab (Shenzhen) Co., Ltd.
101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

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)(3)	Conducted Output Power	Pass
§ 15.247(a)(2)	6dB Emission Bandwidth 99% Occupied Bandwidth	Pass
§ 15.247(e)	Power Spectral Density	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.

Total or partial reproduction of this document without permission of the Laboratory is not allowed.

BTF Testing Lab (Shenzhen) Co., Ltd.
101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

3.3 Uncertainty of Test

Measurement	Value
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
Radiated Emission (18GHz ~ 40GHz)	±4.94dB
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±1.5 dB
Power Spectral Density, conducted	±3.0 dB
Unwanted Emissions, conducted	±3.0 dB
Temperature	±3 °C
Supply voltages	±3 %
Time	±5 %
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+		

Total or partial reproduction of this document without permission of the Laboratory is not allowed.

BTF Testing Lab (Shenzhen) Co., Ltd.
101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

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	2024/10/25	2025/10/24
Pulse Limiter	Schwarzbeck	VTSD 9561-F	00953	2024/10/25	2025/10/24
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		

Total or partial reproduction of this document without permission of the Laboratory is not allowed.

BTF Testing Lab (Shenzhen) Co., Ltd.
101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

4 Test Configuration

4.1 Environment Condition

Selected Values During Tests			
Temperature	Test Voltage	Relative Humidity	Ambient Pressure
Normal: +15°C to +35°C	24Vdc	20% to 75%	86 kPa to 106 kPa

4.2 Test mode

Transmitting mode:	Keep the EUT in continuously transmitting mode with modulation

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	2442	78	2480

4.4 Channel List:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	10	2422MHz	20	2442MHz	30	2462MHz
1	2404MHz	11	2424MHz	21	2444MHz	31	2464MHz
…	…	…	…	…	…	…	…
8	2418MHz	18	2438MHz	28	2458MHz	38	2478MHz
9	2420MHz	19	2440MHz	29	2460MHz	39	2480MHz
Remark: Channel 0, 19 & 39 have been tested.							

4.5 Test software

Test software:	EspRFTestTool_v3.6_Manual	Version:	v3.6
Power Class:	0		

Total or partial reproduction of this document without permission of the Laboratory is not allowed.

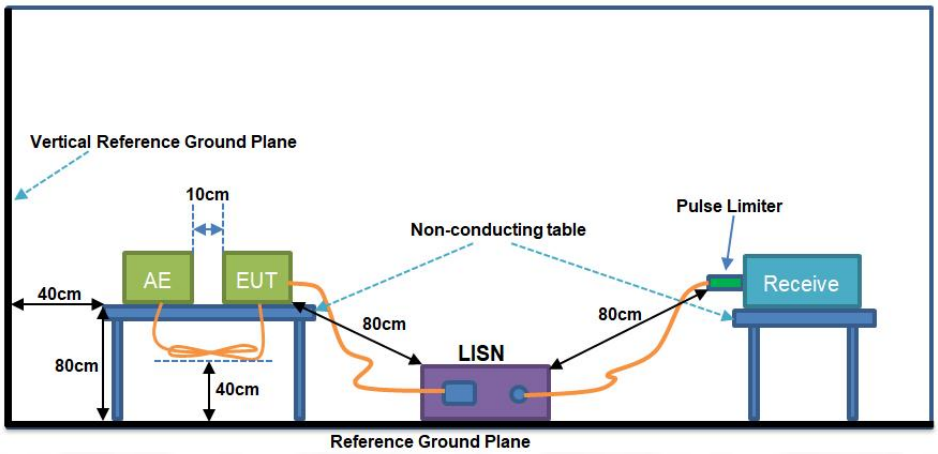
BTF Testing Lab (Shenzhen) Co., Ltd.
101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

4.6 Test procedure

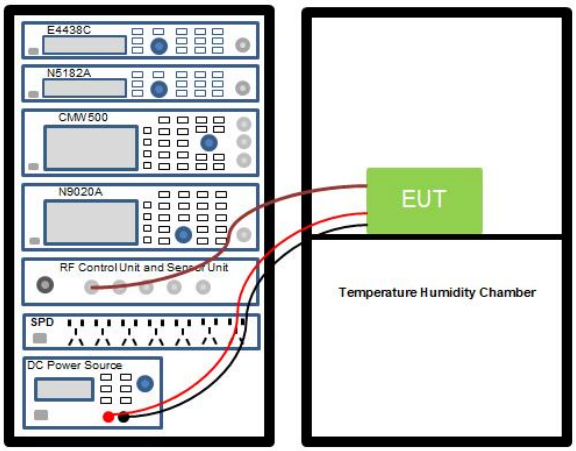
AC Power Line Conducted Emission
The EUT is connected to the power mains through a LISN which provides 50 Ω/50 μH of coupling impedance for the measuring instrument. The test frequency range is from 150 kHz to 30 MHz. The maximum conducted interference is searched using Peak (PK), Quasi-peak (QP) and 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.

4.7 Test Setup Block

1) Conducted emission measurement:

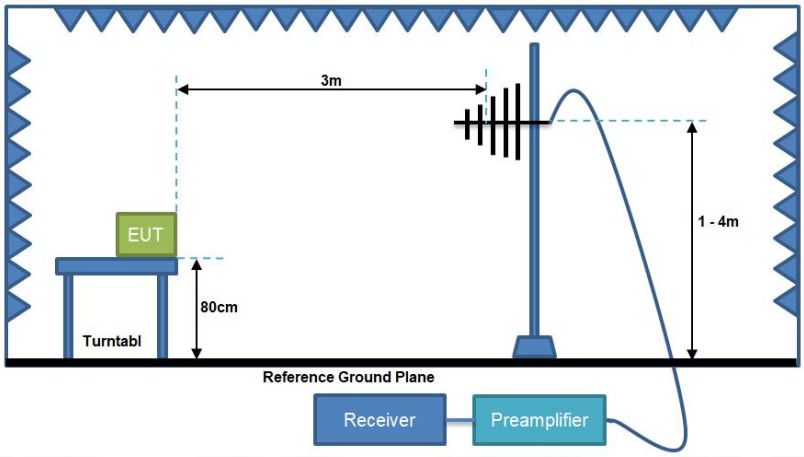


2) Conducted test method:

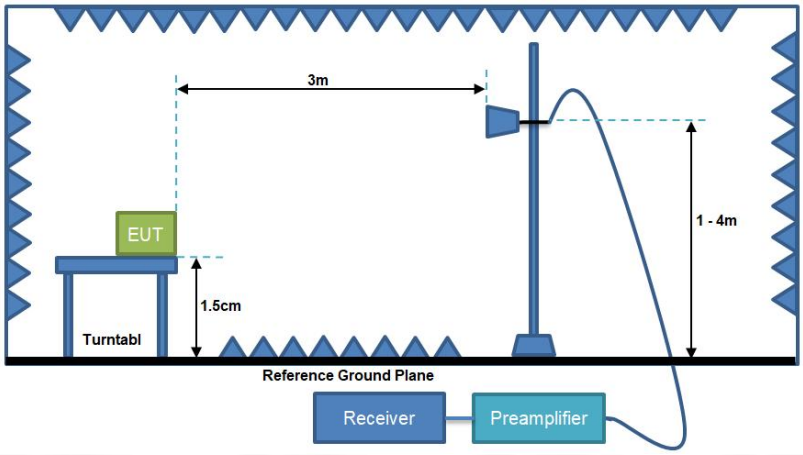


3) Radiated test method:

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	For systems using digital modulation: 1 Watts (30 dBm).	See Appendix-BLE	Pass
6dB Emission Bandwidth 99% Occupied Bandwidth	The minimum 6 dB bandwidth shall be at least 500 kHz.	See Appendix-BLE	Pass
Power Spectral Density	For digitally modulated systems, the power spectral density shall not be greater than 8 dBm in any 3 kHz.	See Appendix-BLE	Pass
Band-edge Emission Conduction Spurious Emission	Please refer to §15.247(d)	See Appendix-BLE	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

Total or partial reproduction of this document without permission of the Laboratory is not allowed.

BTF Testing Lab (Shenzhen) Co., Ltd.
101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

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 PCB antenna which permanently attached, and the best case gain of the antenna is 2.0 dBi. 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

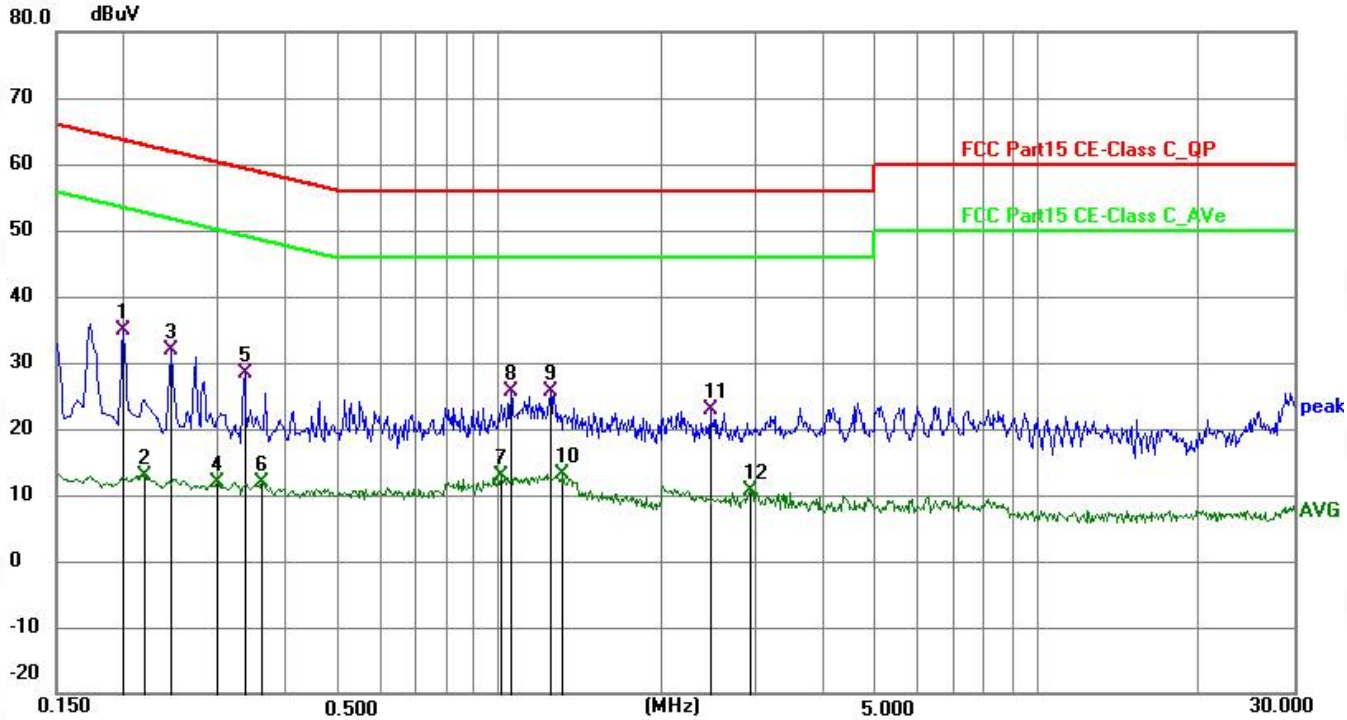
*Decreases with the logarithm of the frequency.

5.3.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.4 °C
Humidity:	46.7 %
Atmospheric Pressure:	1010 hpa
Test Voltage	AC 120V 60Hz
Test Engineer	Zero Zeng

5.3.2 Test Data:

Test phase: L phase



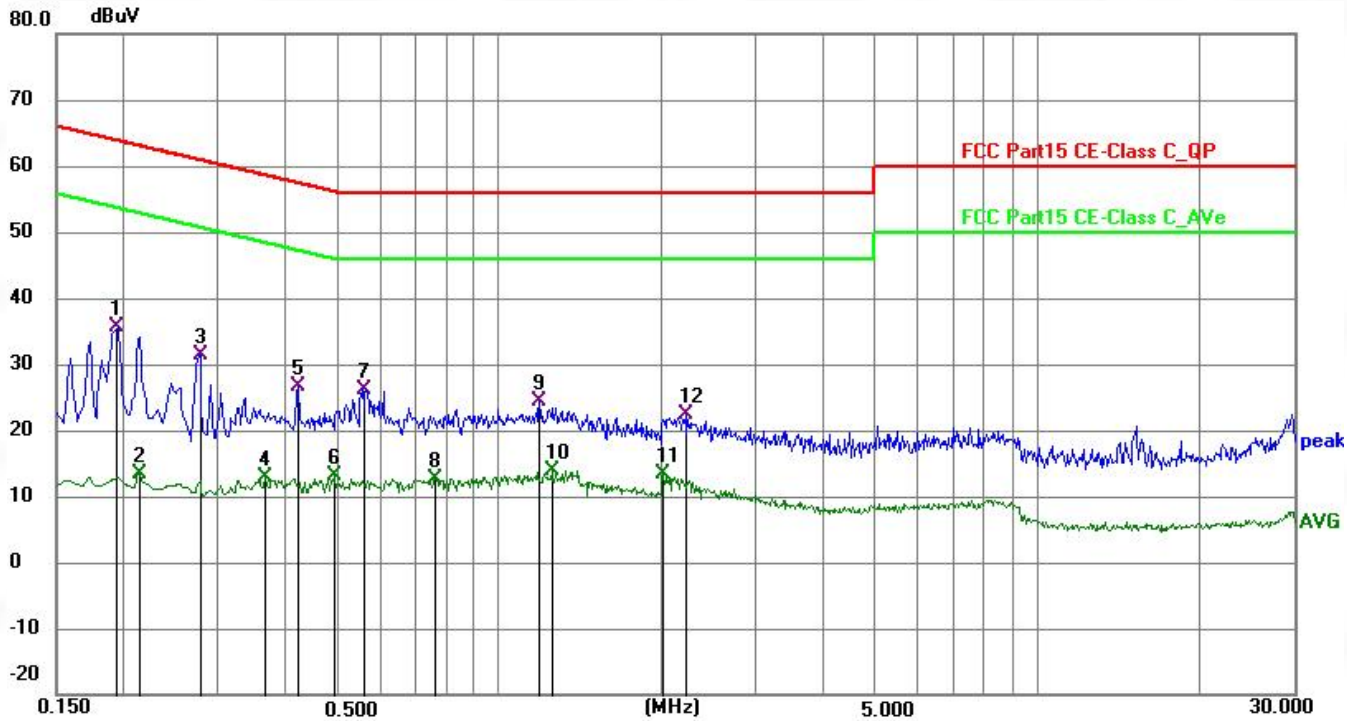
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1 *	0.1995	24.33	10.66	34.99	63.63	-28.64	QP	P	
2	0.2174	2.33	10.66	12.99	52.92	-39.93	AVG	P	
3	0.2444	21.27	10.66	31.93	61.95	-30.02	QP	P	
4	0.2983	1.17	10.66	11.83	50.29	-38.46	AVG	P	
5	0.3345	17.83	10.67	28.50	59.34	-30.84	QP	P	
6	0.3613	1.29	10.67	11.96	48.70	-36.74	AVG	P	
7	1.0050	2.03	10.86	12.89	46.00	-33.11	AVG	P	
8	1.0500	14.72	10.85	25.57	56.00	-30.43	QP	P	
9	1.2435	14.78	10.81	25.59	56.00	-30.41	QP	P	
10	1.3153	2.40	10.80	13.20	46.00	-32.80	AVG	P	
11	2.4674	12.12	10.69	22.81	56.00	-33.19	QP	P	
12	2.9174	-0.13	10.73	10.60	46.00	-35.40	AVG	P	

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

Total or partial reproduction of this document without permission of the Laboratory is not allowed.

BTF Testing Lab (Shenzhen) Co., Ltd.
101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

Test phase: N phase



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1 *	0.1949	24.99	10.56	35.55	63.83	-28.28	QP	P	
2	0.2130	2.84	10.57	13.41	53.09	-39.68	AVG	P	
3	0.2760	20.86	10.61	31.47	60.94	-29.47	QP	P	
4	0.3660	2.24	10.68	12.92	48.59	-35.67	AVG	P	
5	0.4200	15.93	10.72	26.65	57.45	-30.80	QP	P	
6	0.4920	2.45	10.76	13.21	46.13	-32.92	AVG	P	
7	0.5639	15.44	10.81	26.25	56.00	-29.75	QP	P	
8	0.7620	1.75	10.89	12.64	46.00	-33.36	AVG	P	
9	1.1895	13.45	10.88	24.33	56.00	-31.67	QP	P	
10	1.2523	3.01	10.89	13.90	46.00	-32.10	AVG	P	
11	2.0130	2.31	10.98	13.29	46.00	-32.71	AVG	P	
12	2.2244	11.31	10.97	22.28	56.00	-33.72	QP	P	

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

Total or partial reproduction of this document without permission of the Laboratory is not allowed.

BTF Testing Lab (Shenzhen) Co., Ltd.
101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

5.4 Emissions in Restricted Frequency Bands

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 6.10.5.2

5.4.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.6 °C
Humidity:	54.8 %
Atmospheric Pressure:	1010 hpa
Test Voltage	DC 24V
Test Engineer	Zero Zeng

Total or partial reproduction of this document without permission of the Laboratory is not allowed.

BTF Testing Lab (Shenzhen) Co., Ltd.
101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

5.4.2 Test Data:

Remark: During the test, pre-scan 1 Mbps (LE 1M PHY), 2 Mbps (LE 2M PHY) mode, found 2 Mbps (LE 2M PHY) was worse case mode. The report only reflects the test data of worst mode.

Test Mode: 2 Mbps (LE 2M PHY)

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	50.96	3.85	54.81	74.00	-19.19	Peak	Pass
2310.00	40.78	3.85	44.63	54.00	-9.37	AVG	Pass
2390.00	52.56	3.91	56.48	74.00	-17.52	Peak	Pass
2390.00	41.89	3.91	45.80	54.00	-8.20	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	52.30	3.85	56.15	74.00	-17.85	Peak	Pass
2310.00	42.58	3.85	46.44	54.00	-7.56	AVG	Pass
2390.00	52.01	3.91	55.92	74.00	-18.08	Peak	Pass
2390.00	42.00	3.91	45.91	54.00	-8.09	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	51.08	3.99	55.07	74.00	-18.93	Peak	Pass
2483.50	41.54	3.99	45.53	54.00	-8.47	AVG	Pass
2500.00	52.84	4.00	56.84	74.00	-17.16	Peak	Pass
2500.00	41.97	4.00	45.97	54.00	-8.03	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	50.80	3.99	54.78	74.00	-19.22	Peak	Pass
2483.50	40.87	3.99	44.85	54.00	-9.15	AVG	Pass
2500.00	51.22	4.00	55.22	74.00	-18.78	Peak	Pass
2500.00	40.40	4.00	44.40	54.00	-9.60	AVG	Pass

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

Total or partial reproduction of this document without permission of the Laboratory is not allowed.

BTF Testing Lab (Shenzhen) Co., Ltd.
101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

5.5 Emissions in Non-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.

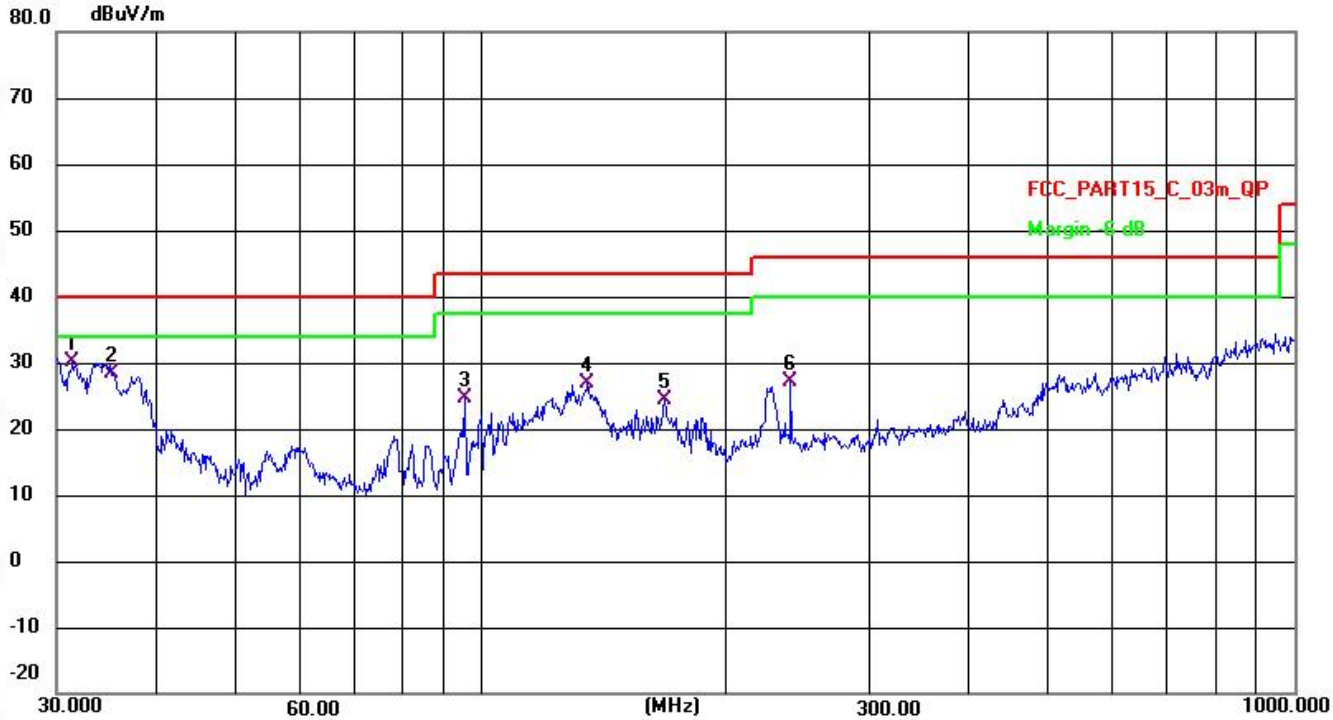
Procedure:	ANSI C63.10-2020 section 6.6.4

5.5.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.6 °C
Humidity:	54.8 %
Atmospheric Pressure:	1010 hpa
Test Voltage	DC 24V
Test Engineer	Zero Zeng

5.5.2 Test Data:

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



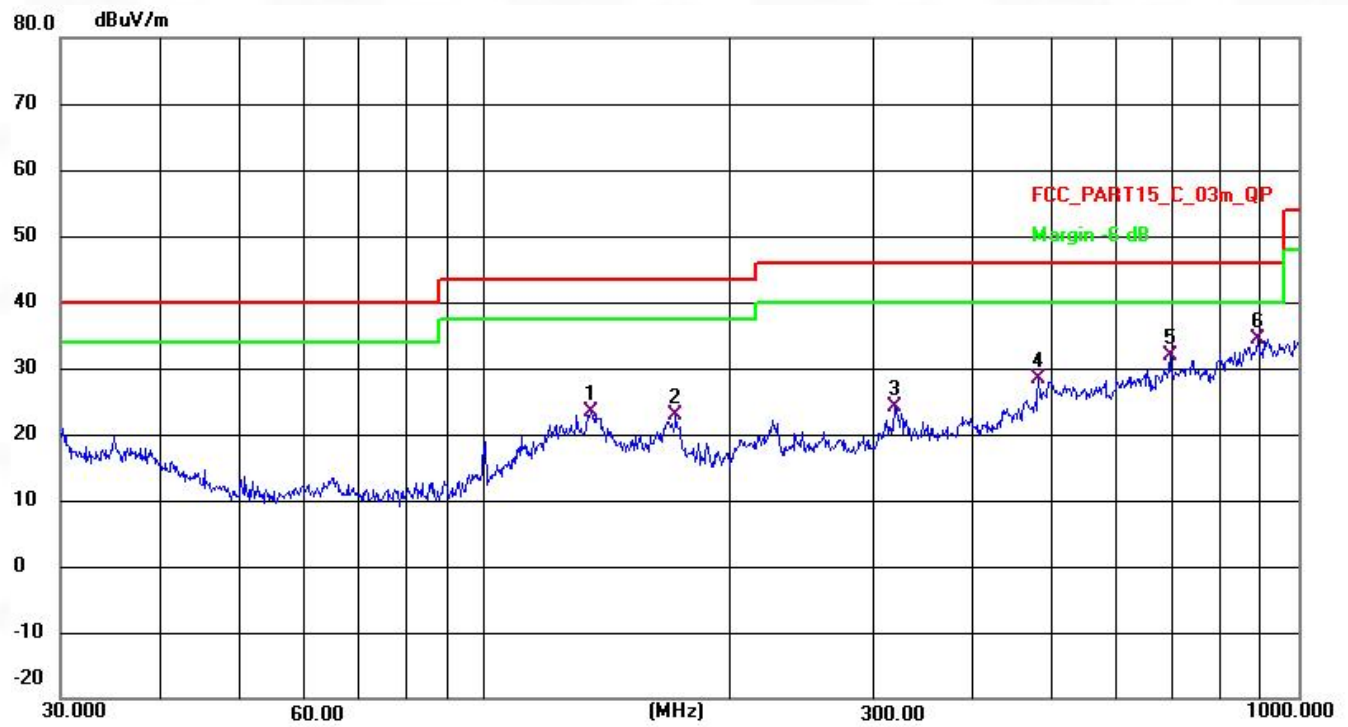
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 *	31.5095	39.92	-9.70	30.22	40.00	-9.78	QP	P
2	35.1894	37.98	-9.68	28.30	40.00	-11.70	QP	P
3	95.4270	47.21	-22.54	24.67	43.50	-18.83	QP	P
4	135.2688	48.99	-22.14	26.85	43.50	-16.65	QP	P
5	168.1187	46.10	-21.83	24.27	43.50	-19.23	QP	P
6	239.9873	48.29	-21.15	27.14	46.00	-18.86	QP	P

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

Total or partial reproduction of this document without permission of the Laboratory is not allowed.

BTF Testing Lab (Shenzhen) Co., Ltd.
101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

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	135.2688	45.60	-22.14	23.46	43.50	-20.04	QP	P
2	171.6933	44.60	-21.81	22.79	43.50	-20.71	QP	P
3	319.9370	44.50	-20.46	24.04	46.00	-21.96	QP	P
4	480.5276	47.45	-19.15	28.30	46.00	-17.70	QP	P
5	696.8567	49.39	-17.63	31.76	46.00	-14.24	QP	P
6 *	892.2909	50.70	-16.34	34.36	46.00	-11.64	QP	P

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

Total or partial reproduction of this document without permission of the Laboratory is not allowed.

BTF Testing Lab (Shenzhen) Co., Ltd.
101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

5.6 Emissions in restricted frequency bands (above 1GHz)

<table>
<tr><td>Test Requirement:</td><td colspan="3">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 colspan="3">Radiated emissions tests</td></tr>
<tr><td rowspan="9">Test Limit:</td><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>
<tr><td colspan="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.</td></tr>
<tr><td>Procedure:</td><td colspan="3">ANSI C63.10-2020 section 6.6.4</td></tr>
</table>

5.6.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.6 °C
Humidity:	54.8 %
Atmospheric Pressure:	1010 hpa
Test Voltage	DC 24V
Test Engineer	Zero Zeng

5.6.2 Test Data:

Remark: During the test, pre-scan 1M, 2M mode, found 2M was worse case mode. The report only reflects the test data of worst mode.

Test Mode: 2 Mbps (LE 2M PHY)

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	79.70	-48.89	30.81	74.00	-43.19	Peak	Pass
4804.00	69.19	-48.89	20.31	54.00	-33.69	AVG	Pass
7206.00	75.24	-47.02	28.22	74.00	-45.78	Peak	Pass
7206.00	64.74	-47.02	17.71	54.00	-36.29	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	78.84	-48.89	29.95	74.00	-44.05	Peak	Pass
4804.00	69.06	-48.89	20.18	54.00	-33.82	AVG	Pass
7206.00	75.33	-47.02	28.31	74.00	-45.69	Peak	Pass
7206.00	64.45	-47.02	17.42	54.00	-36.58	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
4884.00	79.73	-48.83	30.89	74.00	-43.11	Peak	Pass
4884.00	70.13	-48.83	21.30	54.00	-32.70	AVG	Pass
7326.00	74.99	-46.88	28.11	74.00	-45.89	Peak	Pass
7326.00	64.18	-46.88	17.30	54.00	-36.70	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
4884.00	78.52	-48.83	29.69	74.00	-44.31	Peak	Pass
4884.00	67.97	-48.83	19.13	54.00	-34.87	AVG	Pass
7326.00	75.95	-46.88	29.07	74.00	-44.93	Peak	Pass
7326.00	65.17	-46.88	18.29	54.00	-35.71	AVG	Pass

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

Total or partial reproduction of this document without permission of the Laboratory is not allowed.

BTF Testing Lab (Shenzhen) Co., Ltd.
101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

Test Channel: Highest channel, Test Polarization: Vertical							
Frequency (MHz)	Reading (dBμV)	Factor (dB)	Level (dBμV/m)	Limit (dBμV/m)	Marging (dB)	Detector	Result
4960.00	80.05	-48.79	31.26	74.00	-42.74	Peak	Pass
4960.00	70.20	-48.79	21.42	54.00	-32.58	AVG	Pass
7440.00	76.54	-46.74	29.80	74.00	-44.20	Peak	Pass
7440.00	65.75	-46.74	19.00	54.00	-35.00	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	79.03	-48.79	30.25	74.00	-43.75	Peak	Pass
4960.00	68.08	-48.79	19.29	54.00	-34.71	AVG	Pass
7440.00	76.53	-46.74	29.79	74.00	-44.21	Peak	Pass
7440.00	66.41	-46.74	19.67	54.00	-34.33	AVG	Pass
Note:Margin=Level-Limit=Reading+factor-Limit							

Total or partial reproduction of this document without permission of the Laboratory is not allowed.

BTF Testing Lab (Shenzhen) Co., Ltd.
101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

6 Occupied Bandwidth

Test Requirement:	Systems using digital modulation techniques may operate in the 902-928 MHz, and 2400-2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.
Test Method:	DTS bandwidth
Test Limit:	Section (a)(2), Systems using digital modulation techniques may operate in the 902-928 MHz, and 2400-2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.
Procedure:	a) Set RBW = 100 kHz. b) Set the VBW >= [3 × 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.

6.1.1 E.U.T. Operation:

Operating Environment:	
Temperature:	23.7 °C
Humidity:	53.4 %
Atmospheric Pressure:	1010 hpa
Test Voltage	DC 24V
Test Engineer	Sean He

6.1.2 Test Setup

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

6.1.3 Test Data:

Please See Appendix-BLE

7 Maximum Conducted Output Power

Test Requirement:	For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.
Test Method:	Maximum peak conducted output power
Test Limit:	For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.
Procedure:	ANSI C63.10-2020, section 11.9.1 Maximum peak conducted output power

7.1.1 E.U.T. Operation:

Operating Environment:	
Temperature:	23.7 °C
Humidity:	53.4 %
Atmospheric Pressure:	1010 hpa
Test Voltage	DC 24V
Test Engineer	Sean He

7.1.2 Test Setup

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

7.1.3 Test Data:

Please See Appendix-BLE

Total or partial reproduction of this document without permission of the Laboratory is not allowed.

BTF Testing Lab (Shenzhen) Co., Ltd.
101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

8 Power Spectral Density

Test Requirement:	For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.
Test Method:	Maximum power spectral density level in the fundamental emission
Test Limit:	For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

8.1.1 E.U.T. Operation:

Operating Environment:	
Temperature:	23.7 °C
Humidity:	53.4 %
Atmospheric Pressure:	1010 hpa
Test Voltage	DC 24V
Test Engineer	Sean He

8.1.2 Test Setup

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

8.1.3 Test Data:

Please See Appendix-BLE

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:	Emissions in nonrestricted frequency bands
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:	ANSI C63.10-2020 Section 11.11.1, Section 11.11.2, Section 11.11.3

9.1.1 E.U.T. Operation:

Operating Environment:	
Temperature:	23.7 °C
Humidity:	53.4 %
Atmospheric Pressure:	1010 hpa
Test Voltage	DC 24V
Test Engineer	Sean He

9.1.2 Test Setup

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

9.1.3 Test Data:

Please See Appendix-BLE

10 Test Setup Photos

Please refer to Appendix I Test Setup Photos.

11 EUT Constructional Details (EUT Photos)

Please refer to Appendix II External Photos and Appendix III Internal Photos.

Total or partial reproduction of this document without permission of the Laboratory is not allowed.

BTF Testing Lab (Shenzhen) Co., Ltd.
101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

BTF Testing Lab (Shenzhen) Co., Ltd.

101/201/301, Building 1, Block 2, Tantou Industrial Park,Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China

www.btf-lab.com

--END OF REPORT--