RF Test Report

For

Applicant name:	**Linklike (Shenzhen) Technology Co., Ltd.**
Address:	RM1709, BLK C, Zhantao Technology BLDG, Minzhi Avenue, Minzhi ST, Longhua DIST, Shenzhen, China
EUT name:	LINKLIKE Free12
Brand name:	LINKLIKE
Model number:	LNOW1

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:	BTF240919R00101
Test standards:	FCC CFR Title 47 Part 15 Subpart C (§15.247)
FCC ID:	2AR3E-LNOW1
Test conclusion:	Pass
Date of sample receipt:	2024-09-19
Test date:	2024-09-19 to 2024-09-27
Date of issue:	2024-09-28
Test by:	Ssxx.guo/ Tester
Prepared by:	Aria Zhang / 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	2024-09-28	Original
Note: *Once the revision has been made, then previous versions reports are invalid.*		

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Email: info@btf-lab.com Tel: +86-755-23146130 http://www.btf-lab.com

1 Introduction

1.1 Laboratory Location

Test location:	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
Description:	All measurement facilities used to collect the measurement data are located at F101,201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, 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.: CN1330**
  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.
- **ISED – CAB identifier.: CN0135**
  The 3m Semi-anechoic chamber of BTF Testing Lab (Shenzhen) Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 27844.
- **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.

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2 Product Information

2.1 Application Information

Company name:	Linklike (Shenzhen) Technology Co., Ltd.
Address:	RM1709, BLK C, Zhantao Technology BLDG, Minzhi Avenue, Minzhi ST, Longhua DIST, Shenzhen, China

2.2 Manufacturer Information

Company name:	Linklike (Shenzhen) Technology Co., Ltd.
Address:	RM1709, BLK C, Zhantao Technology BLDG, Minzhi Avenue, Minzhi ST, Longhua DIST, Shenzhen, China

2.3 Factory Information

Company name:	Linklike (Shenzhen) Technology Co., Ltd.
Address:	RM1709, BLK C, Zhantao Technology BLDG, Minzhi Avenue, Minzhi ST, Longhua DIST, Shenzhen, China

2.4 General Description of Equipment under Test (EUT)

EUT name	LINKLIKE Free12
Under test model name	LNOW1
Power supply:	DC 4.2V from battery
Ratings:	input: 5V 0.4A Earphone: 50mAh/0.19Wh Charging Case: 550mAh/2.04Wh

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. E.I.R.P Power:	-2.15 dBm
Antenna type:	FPC Antenna
Antenna gain:	-0.98 dBi (declare by Applicant)
Antenna transmit mode:	SISO (1TX, 1RX)

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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)(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.

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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)	±5.25 dB
Radiated Emission (18GHz ~ 40GHz)	±5.35 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

Description	Manufacturer	Model	Serial No.	Length	Description
Power Adapter	SHENGZHEN FUSGIGANG TECHOLOGY CO., LTD.	AS06012A-0501000EUU	/	/	/

3.6 Test Equipment List

Conducted Emission Test					
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
EMI Receiver	Rohde & Schwarz	ESCI3	101422	2023/11/15	2024/11/14
V-LISN	Schwarzbeck	NSLK 8127	01073	2023/11/16	2024/11/15
Coaxial Switcher	Schwarzbeck	CX210	CX210	/	/
Pulse Limiter	Schwarzbeck	VTSD 9561-F	00953	/	/
Test Software	Frad	EZ_EMC	Version: EMC-CON 3A1.1+		

Radiated test method					
Test Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
EMI Receiver	Rohde & Schwarz	ESCI7	101032	2023/11/16	2024/11/15
Signal Analyzer	Rohde & Schwarz	FSQ40	100010	2023/11/16	2024/11/15
Log periodic antenna	Schwarzbeck	VULB 9168	01328	2023/11/13	2024/11/12
Preamplifier (30MHz ~ 1GHz)	Schwarzbeck	BBV9744	00246	2023/11/13	2024/11/12
Horn Antenna	Schwarzbeck	BBHA9120D	2597	2023/11/13	2024/11/12
Preamplifier (1GHz ~ 18GHz)	TST	LNA10180G45	TS2215007	2023/11/13	2024/11/12
Test Software	Frad	EZ_EMC	Version: FA-03A2 RE+		

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Conducted test method					
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	Keysight	N9020A	MY50410020	2023/11/16	2024/11/15
ESG Vector Signal Generator	Agilent	E4438C	MY45094854	2023/11/16	2024/11/15
MXG Vector Signal Generator	Agilent	N5182A	MY46240163	2023/11/16	2024/11/15
Wideband Radio Communication Tester	Rohde&Schwarz	CMW500	161997	2023/11/16	2024/11/15
Temperature Humidity Chamber	ZZCKONG	ZZ-K02A	20210928007	2023/11/16	2024/11/15
DC Power Supply	Tongmen	etm-6050c	20211026123	2023-11-16	2024-11-15
RF Control Unit	Techy	TR1029-1	/	2023/11/11	2024/11/12
RF Sensor Unit	Techy	TR1029-2	/	2023/11/11	2024/11/12
Test Software	TST Pass	/	Version: 2.0		

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4 Test Configuration

4.1 Environment Condition

Selected Values During Tests			
Temperature	Test Voltage	Relative Humidity	Ambient Pressure
Normal: +15°C to +35°C	DC 4.2V	20% to 75%	100 kPa to 102 kPa

4.2 Test mode

Transmitting mode:	Keep the EUT in continuously transmitting mode with modulation
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	2442	78	2480

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4.4 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.

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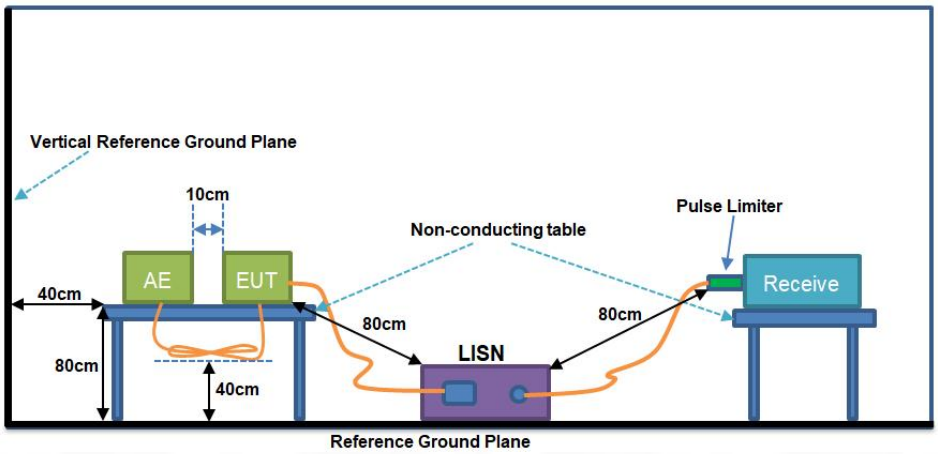
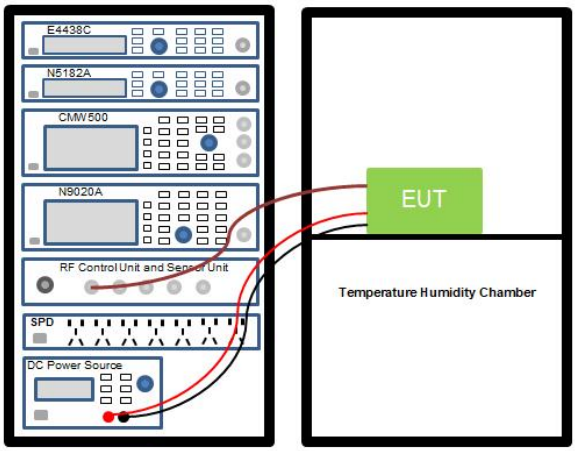
4.5 Test Setup Block

1) Conducted emission measurement:

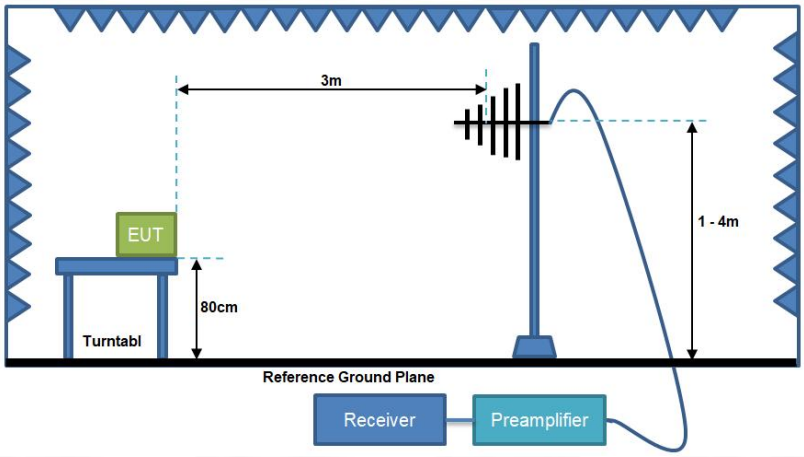


2) Conducted test method:

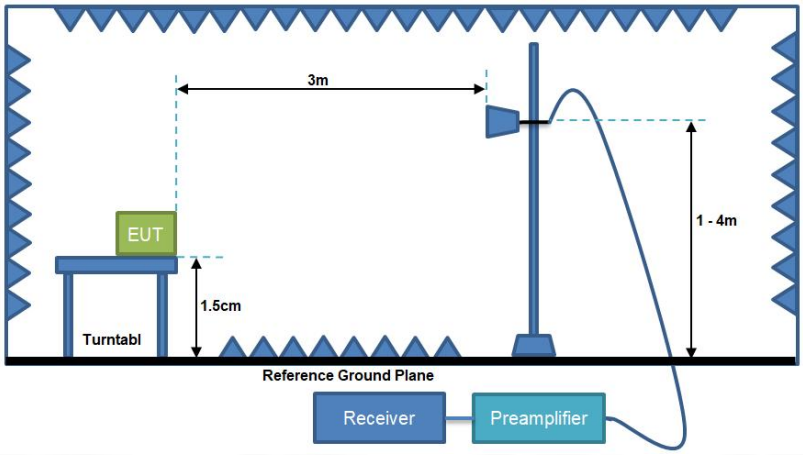


3) Radiated test method:

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

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5.2 Antenna Requirement

§15.203 requirement:

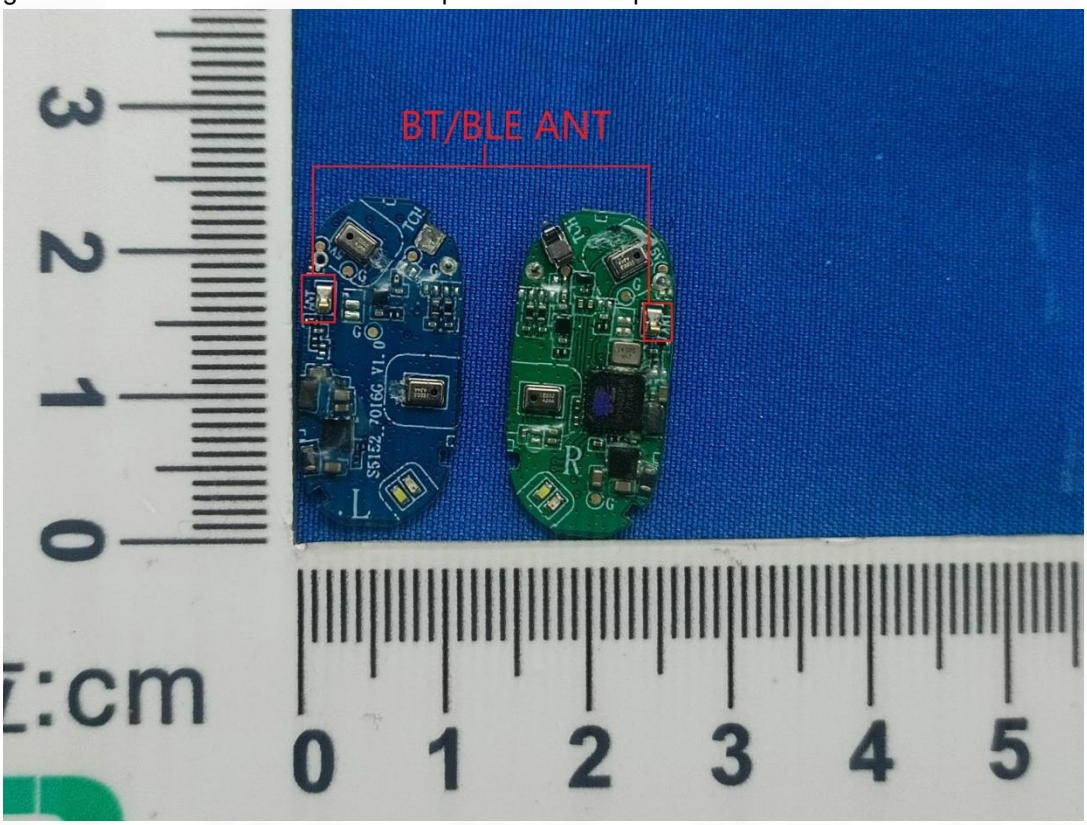
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit 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:

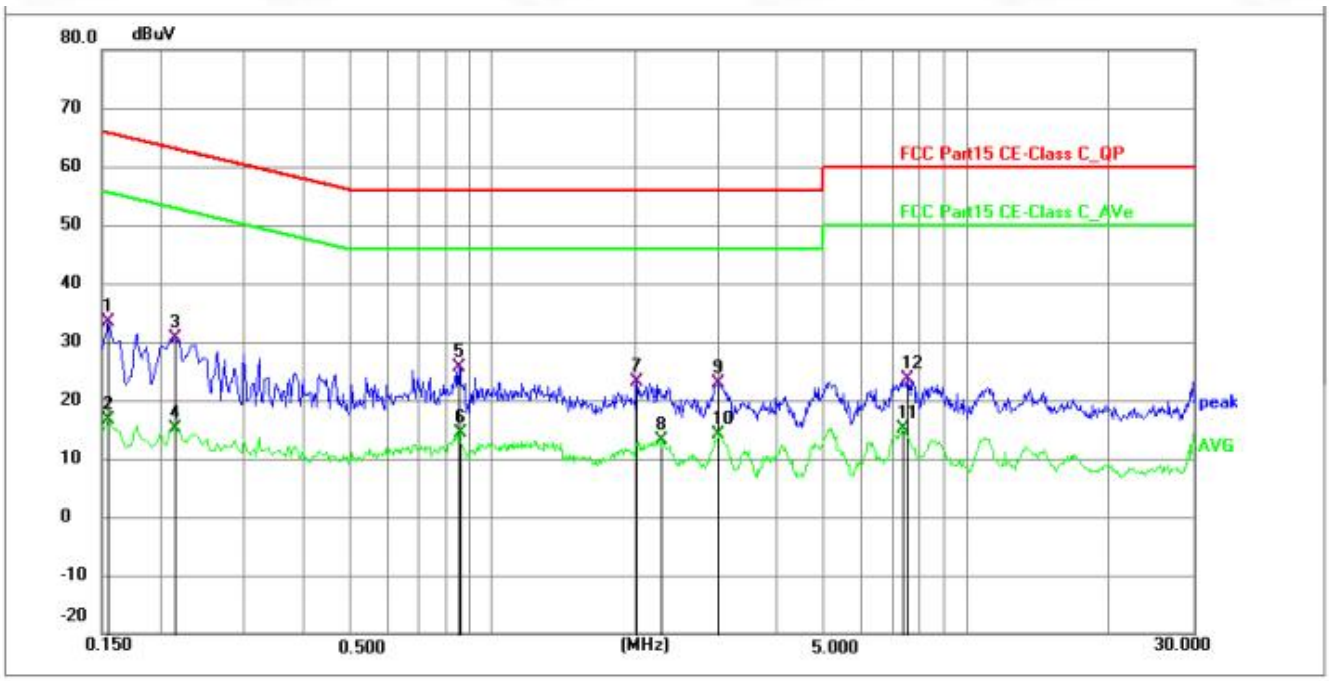
The Bluetooth antenna is an FPC antenna which permanently attached, and the best case gain of the antenna is -0.98 dBi. See product internal photos for details.



5.3 AC Power Line Conducted Emission

Remark: During the test, pre-scan 1 Mbps (LE 1M PHY), 2 Mbps (LE 2M PHY) mode, found 1 Mbps (LE 1M PHY) 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	0.1544	22.82	10.46	33.28	65.76	-32.48	QP	P	
2	0.1544	6.28	10.46	16.74	55.76	-39.02	AVG	P	
3	0.2130	19.95	10.56	30.51	63.09	-32.58	QP	P	
4	0.2130	4.63	10.56	15.19	53.09	-37.90	AVG	P	
5 *	0.8520	14.84	10.68	25.52	56.00	-30.48	QP	P	
6	0.8565	3.68	10.68	14.36	46.00	-31.64	AVG	P	
7	2.0175	12.34	10.68	23.02	56.00	-32.98	QP	P	
8	2.2740	2.40	10.67	13.07	46.00	-32.93	AVG	P	
9	2.9895	12.08	10.68	22.76	56.00	-33.24	QP	P	
10	2.9940	3.45	10.68	14.13	46.00	-31.87	AVG	P	
11	7.3320	4.22	10.79	15.01	50.00	-34.99	AVG	P	
12	7.5075	12.85	10.80	23.65	60.00	-36.35	QP	P	

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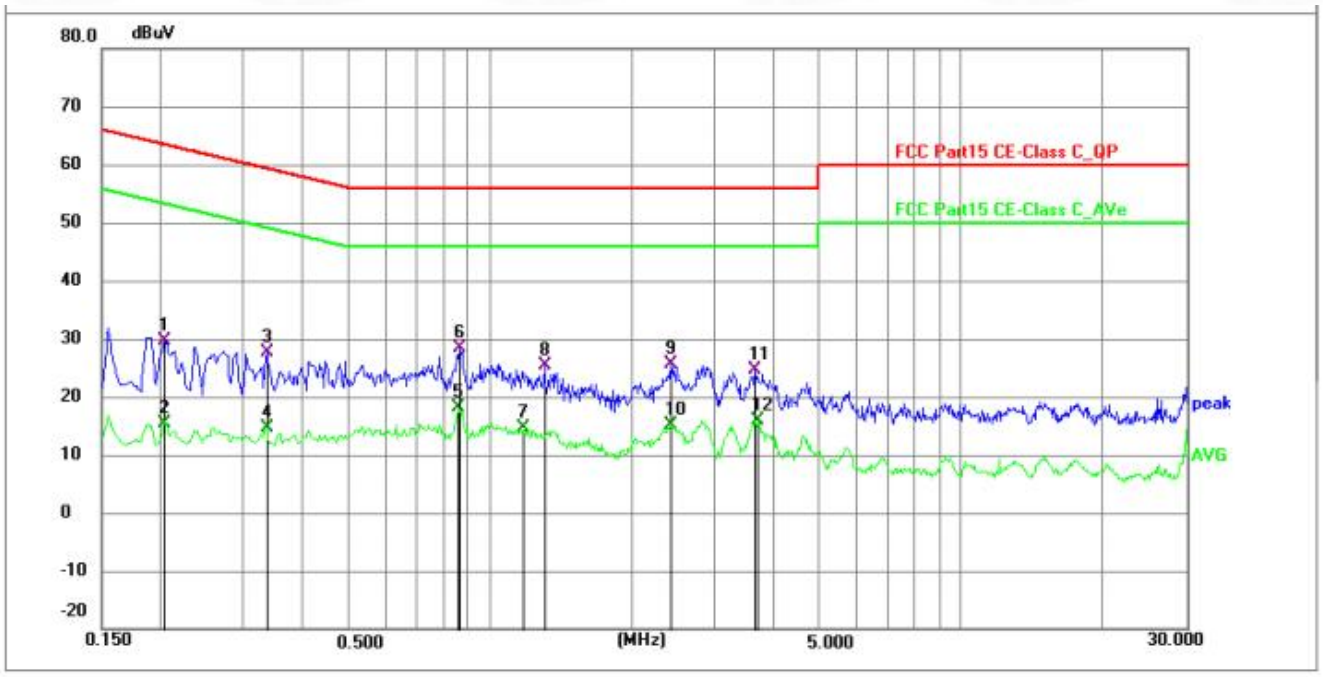
Test phase: N phase



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.2040	19.16	10.56	29.72	63.45	-33.73	QP	P	
2	0.2040	4.94	10.56	15.50	53.45	-37.95	AVG	P	
3	0.3345	17.04	10.57	27.61	59.34	-31.73	QP	P	
4	0.3345	4.02	10.57	14.59	49.34	-34.75	AVG	P	
5	0.8610	7.44	10.68	18.12	46.00	-27.88	AVG	P	
6 *	0.8655	17.76	10.68	28.44	56.00	-27.56	QP	P	
7	1.1849	3.87	10.66	14.53	46.00	-31.47	AVG	P	
8	1.3064	14.82	10.66	25.48	56.00	-30.52	QP	P	
9	2.4134	14.91	10.67	25.58	56.00	-30.42	QP	P	
10	2.4134	4.49	10.67	15.16	46.00	-30.84	AVG	P	
11	3.6554	13.86	10.65	24.51	56.00	-31.49	QP	P	
12	3.6825	5.15	10.65	15.80	46.00	-30.20	AVG	P	

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5.4 Emissions in Restricted Frequency Bands

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

Frequency	Reading Level	Correct Factor	Measurement	Limits	Over	Detector	Polarization
(MHz)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	Peak/AVG	H/V
GFSK – Low band-edge							
(MHz)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	Peak/AVG	H/V
2310	92.20	-49.61	42.59	74	-31.41	Peak	V
2310	79.60	-49.61	29.99	54	-24.01	AVG	V
2390	89.31	-49.5	39.81	74	-34.19	Peak	V
2390	79.25	-49.5	29.75	54	-24.25	AVG	V
2310	89.35	-49.61	39.74	74	-34.26	Peak	H
2310	79.57	-49.61	29.96	54	-24.04	AVG	H
2390	89.11	-49.5	39.61	74	-34.39	Peak	H
2390	79.31	-49.5	29.81	54	-24.19	AVG	H
GFSK – High band-edge							
2483.5	90.65	-49.5	41.15	74	-32.85	Peak	V
2483.5	72.50	-49.5	23.00	54	-31.00	AVG	V
2500	81.31	-49.49	31.82	74	-42.18	Peak	V
2500	72.20	-49.49	22.71	54	-31.29	AVG	V
2483.5	81.60	-49.5	32.10	74	-41.90	Peak	H
2483.5	72.30	-49.5	22.80	54	-31.20	AVG	H
2500	81.32	-49.49	31.83	74	-42.17	Peak	H
2500	72.14	-49.49	22.65	54	-31.35	AVG	H

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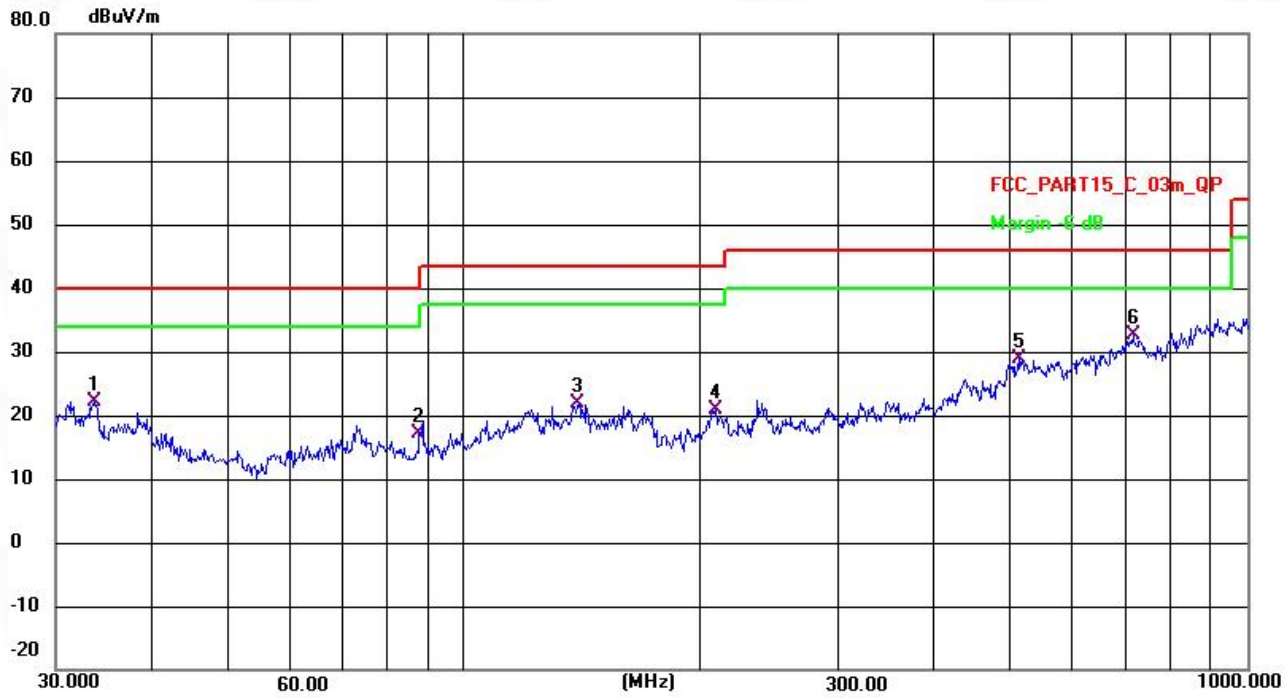
5.5 Emissions in Non-restricted Frequency Bands

Remark: During the test, pre-scan 1 Mbps (LE 1M PHY), 2 Mbps (LE 2M PHY) mode, found 1 Mbps (LE 1M PHY) 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	33.6802	31.79	-9.68	22.11	40.00	-17.89	QP	P
2	87.7245	39.70	-22.66	17.04	40.00	-22.96	QP	P
3	140.0961	44.00	-22.10	21.90	43.50	-21.60	QP	P
4	210.0481	42.21	-21.44	20.77	43.50	-22.73	QP	P
5	510.9386	47.81	-18.92	28.89	46.00	-17.11	QP	P
6 *	715.4265	50.23	-17.66	32.57	46.00	-13.43	QP	P

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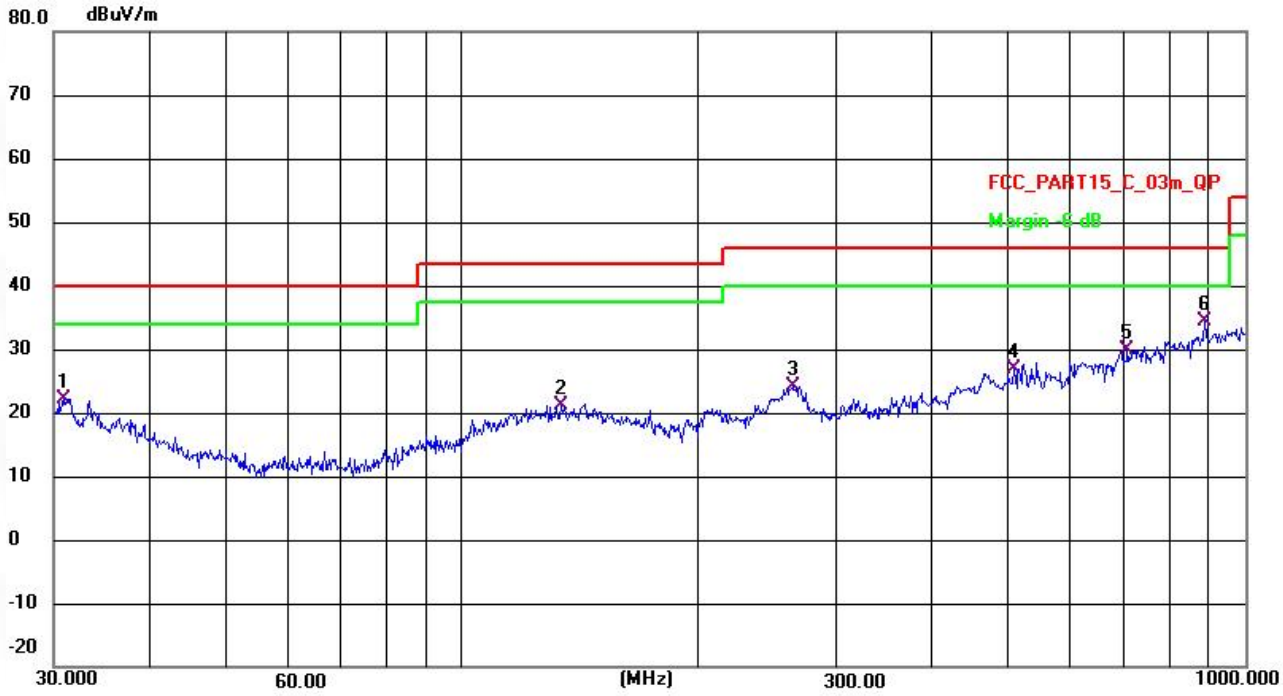
Test antenna polarization: Horizontal (30 MHz to 1 GHz)



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	30.9072	31.97	-9.73	22.24	40.00	-17.76	QP	P
2	133.8531	43.28	-22.15	21.13	43.50	-22.37	QP	P
3	265.2102	45.11	-20.92	24.19	46.00	-21.81	QP	P
4	506.4790	45.71	-18.95	26.76	46.00	-19.24	QP	P
5	707.9400	47.58	-17.64	29.94	46.00	-16.06	QP	P
6 *	890.7277	50.80	-16.37	34.43	46.00	-11.57	QP	P

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For above 1GHz:

Frequency	Reading Level	Correct Factor	Measurement	Limits	Over	Detector	Polarization
(MHz)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	Peak/AVG	H/V
BLE - 2402 MHz TX mode							
4804	90.63	-48.88	41.75	74.00	-32.25	Peak	V
4804	75.65	-48.88	26.77	54.00	-27.23	AVG	V
7206	89.33	-47.21	42.12	74.00	-31.88	Peak	V
7206	75.77	-47.21	28.56	54.00	-25.44	AVG	V
9608	89.19	-45.57	43.62	74.00	-30.38	Peak	V
9608	75.41	-45.57	29.84	54.00	-24.16	AVG	V
4804	89.50	-48.88	40.62	74.00	-33.38	Peak	H
4804	75.81	-48.88	26.93	54.00	-27.07	AVG	H
7206	89.69	-47.21	42.48	74.00	-31.52	Peak	H
7206	75.37	-47.21	28.16	54.00	-25.84	AVG	H
9608	89.69	-45.57	44.12	74.00	-29.88	Peak	H
9608	76.02	-45.57	30.45	54.00	-23.55	AVG	H
BLE - 2440MHz TX mode							
4880	91.75	-48.83	42.92	74.00	-31.08	Peak	V
4880	76.05	-48.83	27.22	54.00	-26.78	AVG	V
7320	89.77	-46.89	42.88	74.00	-31.12	Peak	V
7320	75.25	-46.89	28.36	54.00	-25.64	AVG	V
9760	89.46	-45.51	43.95	74.00	-30.05	Peak	V
9760	75.46	-45.51	29.95	54.00	-24.05	AVG	V
4880	89.56	-48.83	40.73	74.00	-33.27	Peak	H
4880	75.84	-48.83	27.01	54.00	-26.99	AVG	H
7320	89.64	-46.89	42.75	74.00	-31.25	Peak	H
7320	75.97	-46.89	29.08	54.00	-24.92	AVG	H
9760	89.29	-45.51	43.78	74.00	-30.22	Peak	H
9760	75.45	-45.51	29.94	54.00	-24.06	AVG	H
BLE - 2480 MHz TX mode							
4960	91.92	-48.78	43.14	74.00	-30.86	Peak	V
4960	76.10	-48.78	27.32	54.00	-26.68	AVG	V
7440	89.50	-46.75	42.75	74.00	-31.25	Peak	V
7440	75.45	-46.75	28.70	54.00	-25.30	AVG	V
9920	89.69	-45.45	44.24	74.00	-29.76	Peak	V
9920	75.98	-45.45	30.53	54.00	-23.47	AVG	V
4960	89.27	-48.78	40.49	74.00	-33.51	Peak	H
4960	75.40	-48.78	26.62	54.00	-27.38	AVG	H
7440	89.61	-46.75	42.86	74.00	-31.14	Peak	H
7440	75.76	-46.75	29.01	54.00	-24.99	AVG	H
9920	89.57	-45.45	44.12	74.00	-29.88	Peak	H
9920	75.46	-45.45	30.01	54.00	-23.99	AVG	H

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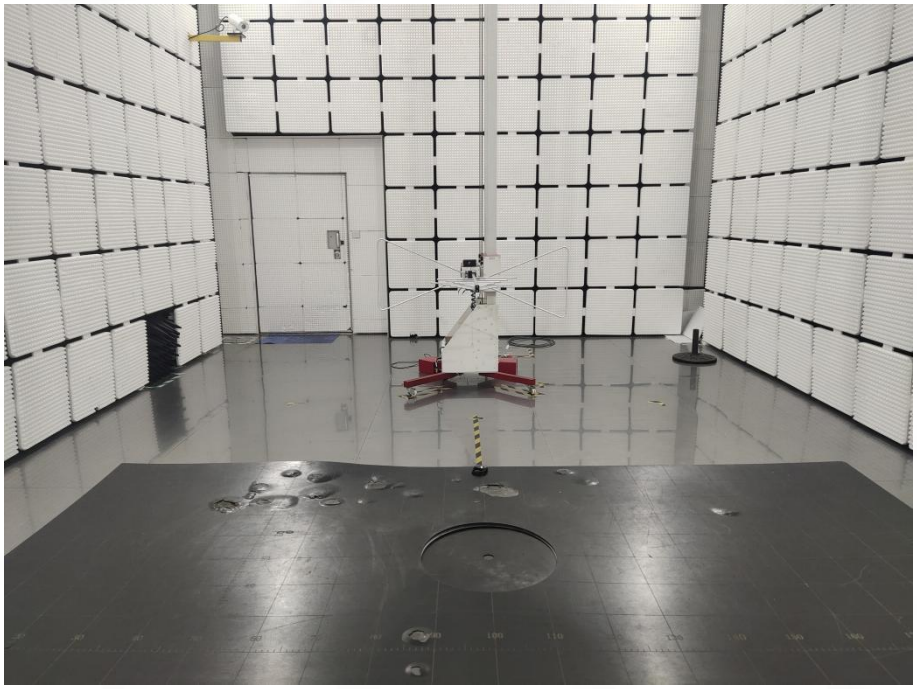
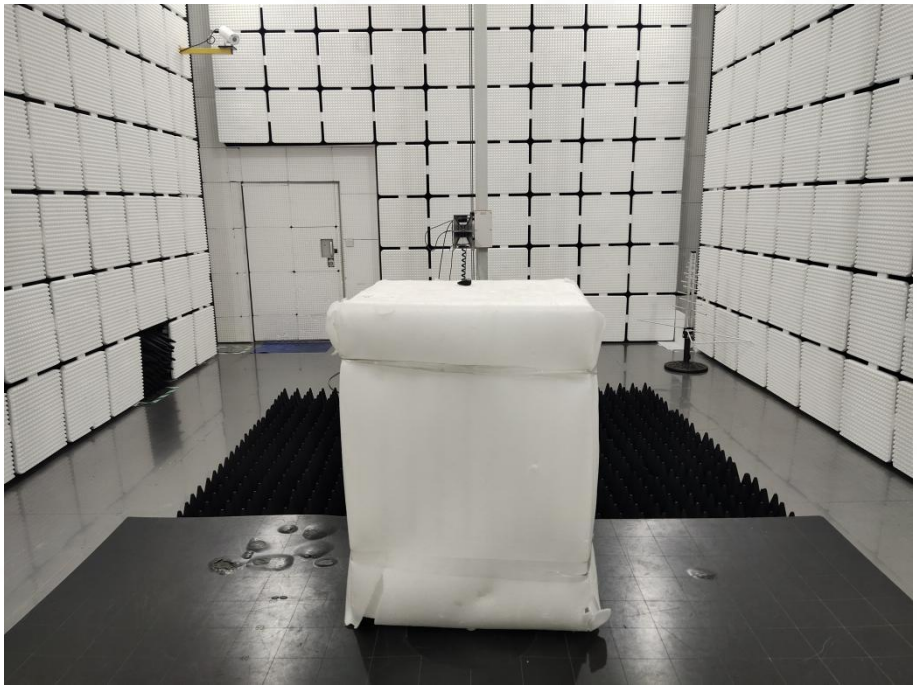
6 Test Setup Photos

Radiated test method



30 MHz – 1 GHz



Above 1 GHz

Conducted Emission Test

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