FCC TEST REPORT

FCC ID: 2BDEQ-HKS145

Product	:	Wireless Remote Controller
Model Name	:	HK-S-145
Brand	:	Momentum
Report No.	:	PTC24053109001E-FC01

Prepared for

Dongguan Huikang Motor Mfg. Co., Ltd.

No.12, North Guanhuang Road, Gaobu Town, Dongguan City, Guangdong, China 523285

Prepared by

Precise Testing & Certification Co., Ltd.

Building 1, No. 6, Tongxin Road, Dongcheng Street, Dongguan, Guangdong, China

1 TEST RESULT CERTIFICATION

Applicant's name	:	Dongguan Huikang Motor Mfg. Co., Ltd.
Address	:	No.12, North Guanhuang Road, Gaobu Town, Dongguan City, Guangdong, China 523285
Manufacture's name	:	Dongguan Huikang Motor Mfg. Co., Ltd.
Address	:	No.12, North Guanhuang Road, Gaobu Town, Dongguan City, Guangdong, China 523285
Product name	:	Wireless Remote Controller
Model name	:	HK-S-145
Standards	:	FCC Part15 Subpart C, Paragraph 15.249
Test procedure	:	ANSI C63.10: 2013
Test Date	:	Jun. 28, 2024 to Jul. 05, 2024
Date of Issue	:	Jul. 26, 2024
Test Result	:	Pass

This device described above has been tested by PTC, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.
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Test Engineer:

Jack Zhou / Engineer

Technical Manager:

Simon Pu / Manager

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2 Test Summary

Standard Section	Test Item	Result
15.203	Antenna Requirement	PASS
15.207	Conducted Emission	PASS
15.249	Radiated Emission	PASS
15.215(c)	20dB Bandwidth	PASS
15.249(d)	Band Edge	PASS
Remark: “N/A” is an abbreviation for Not Applicable.		

Remark:N/A

2.1 Test Site

Precise Testing & Certification Co., Ltd.

Address: Building 1, No. 6, Tongxin Road, Dongcheng Street, Dongguan, Guangdong, China

FCC Registration Number: 790290

A2LA Certificate No.: 4408.01

IC Registration Number: 12191A

FCC Designation Number: CN1219

3 General Information

3.1 General Description of E.U.T.

Product Name	:	Wireless Remote Controller
Model Name	:	HK-S-145
Operation Frequency	:	2480MHz
Modulation	:	GFSK
Number of Channels	:	1
Antenna installation	:	PCB antenna
Antenna Gain	:	2.36 dBi
Power supply	:	Input: DC 5V Output: Li-ion Battery : 802050 Rated Voltage: 3.7V Capacity:800mAh 2.96Wh
Hardware version	:	N/A
Software version	:	N/A
Test Sample No.	:	PTC24053109001E-1/2, PTC24053109001E-2/2

3.2 Channel List

The EUT has been tested under its typical operating condition. Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting. Only the worst case data were reported.

The EUT has been associated with peripherals pursuant to ANSI C63.10-2013 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation (9 KHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

The details of test channels and bandwidth were for RF conductive measurement.

Channel number	Frequency(MHz)
1CH	2480

4 Equipment During Test

4.1 Equipments List

RF Conducted Test

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Last Calibration	Calibration Interval
MXG Signal Analyzer	Agilent	N9020A	SER MY5111038	10Hz-26.5GHz	Aug.17, 2023	1 Year
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	Aug.17, 2023	1 Year
Power Meter	Anritsu	ML2495A	0949003	300MHz-40GHz	Aug.17, 2023	1 Year
Power Sensor	Anritsu	MA2411B	0917017	300MHz-40GHz	Aug.17, 2023	1 Year
Test S/W	Tonscend	JS1120-3	/	/	/	/

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Last Calibration	Calibration Interval
EMI Test Receiver	Rohde&Schwarz	ESPI7	101671	9KHz-7GHz	Aug. 17,2023	1 Year
Loop Antenna	Schwarzbeck	FMZB 1519	192	9 KHz -30MHz	Aug. 17,2023	1 Year
Bilog Antenna	SCHWARZBECK	VULB9160	9160-3355	25MHz-2GHz	Aug. 17,2023	1 Year
Preamplifier (low frequency)	SCHWARZBECK	BBV 9475	9745-0013	1MHz-1GHz	Aug. 17,2023	1 Year
Cable	IMRO	AK-9515E(9m)	Cable-L	9KHz-3GHz	Aug. 17,2023	1 Year
Spectrum Analyzer	Rohde&Schwarz	FSV40	6625-01-588-5515	9KHz-40GHz	Aug. 17,2023	1 Year
Horn Antenna	SCHWARZBECK	9120D	9120D-1246	1GHz-18GHz	Aug. 17,2023	1 Year
Power Amplifier	ZHINAN	ZN3380C	15002	1GHz-26.5GHz	Aug. 17,2023	1 Year
Horn Antenna	SCHWARZBECK	BBHA 9170	9170-1066	15GHz-40GHz	Jul. 19, 2024	1 Year

Amplifier	SCHWARZBECK	BBV 9721	9721-205	18GHz-40GHz	Jul. 19, 2024	1 Year
Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	Aug. 17,2023	1 Year
RF Cable	R&S	R204	R21X	1GHz-40GHz	Aug. 17,2023	1 Year
Test S/W	Tonscend	TS+	/	/	/	/

Conducted Emissions

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Date	Calibration Interval
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	9KHz-3GHz	Aug. 17, 2023	1 Year
Artificial Mains Network	Rohde&Schwarz	ENV216	102453	9KHz-300MHz	Aug. 17, 2023	1 Year
Artificial Mains Network	Rohde&Schwarz	ENV216	101342	9KHz-300MHz	Aug. 17, 2023	1 Year
Limiter	R&S	ESH3-Z2	0357.8810.54-102808-NB	0Hz-30MHz	Aug. 16,2023	1 Year
RF Switch	DIAMOND ANTENNA	CX-210	/	0.09MHz-6GHz	Mar. 22,2024	1 Year
Test S/W	Tonscend	JS32-CE	/	/	/	/

4.2 Measurement Uncertainty

Parameter	Uncertainty
RF output power, conducted	±1.0dB
Power Spectral Density, conducted	±2.2dB
Radio Frequency	± 1 x 10^{-6}
Bandwidth	± 1.5 x 10^{-6}
Time	±2%
Duty Cycle	±2%
Temperature	±1°C
Humidity	±5%
DC and low frequency voltages	±3%
Conducted Emissions (150kHz~30MHz)	±3.64dB
Radiated Emission(30MHz~1GHz)	±5.03dB
Radiated Emission(1GHz~25GHz)	±4.74dB
Radiated Emission(9KHz~30MHz)	±3.15dB

4.3 Description of Support Units

Equipment	Model No.	Series No.
Adapter	Model: PS65B150Y3000S	N/A

5 Conducted Emission

Test Requirement	:	FCC CFR 47 Part 15 Section 15.207
Test Method	:	ANSI C63.10: 2013
Test Result	:	PASS
Frequency Range	:	150kHz to 30MHz
Class/Severity	:	Class B

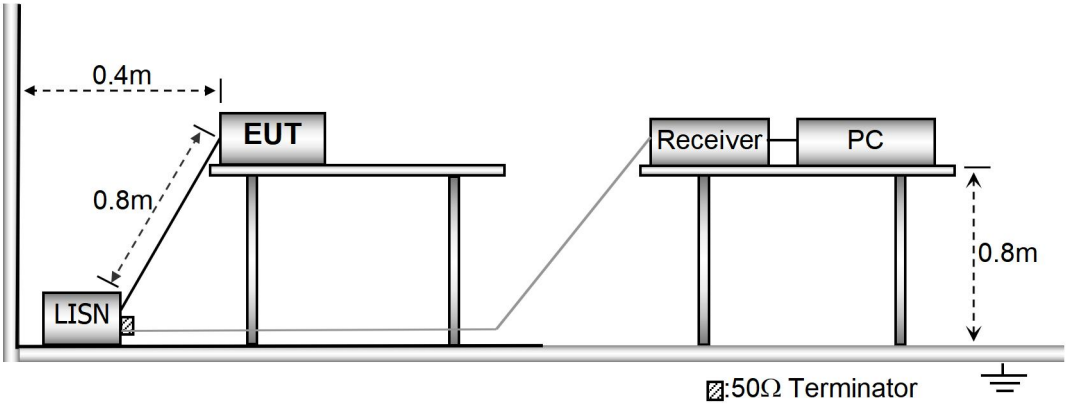
5.1 E.U.T. Operation

Operating Environment :

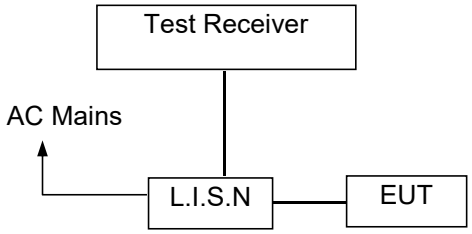
Temperature	:	25.5 °C
Humidity	:	51 % RH
Atmospheric Pressure	:	101.2kPa

5.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2013.



5.3 Test SET-UP (Block Diagram of Configuration)



5.4 Measurement Procedure

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured was complete.

5.5 Conducted Emission Limit

Conducted Emission

Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

Note:
1. The lower limit shall apply at the transition frequencies
2.The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

5.6 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

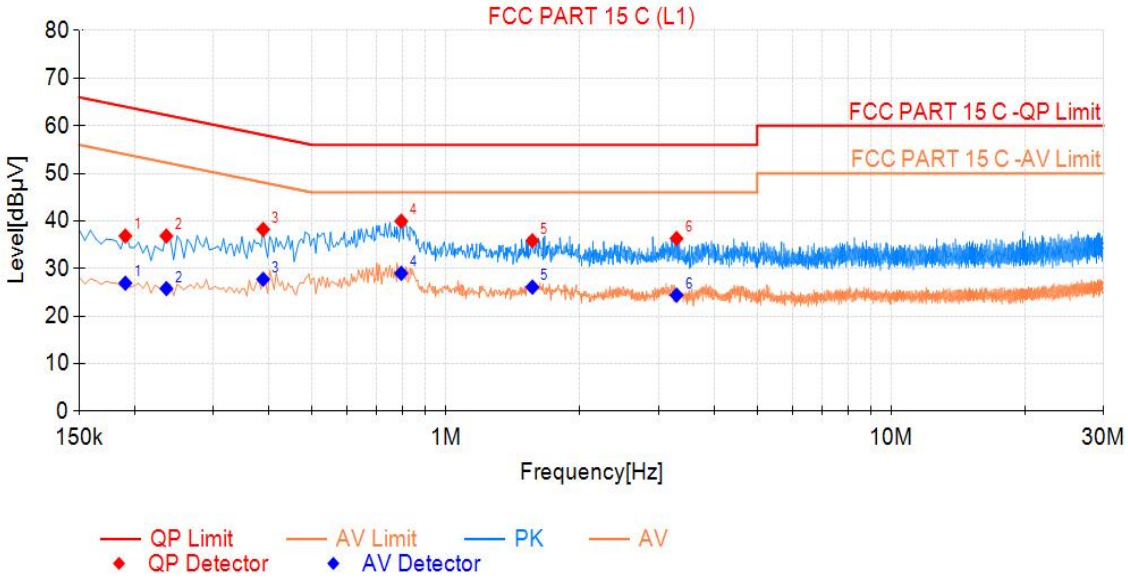
5.7 Conducted Emission Test Result

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10-2013 on Conducted Emission Measurement.

The bandwidth of test iSurpass Smart Gateway (ESCI) set at 9kHz.

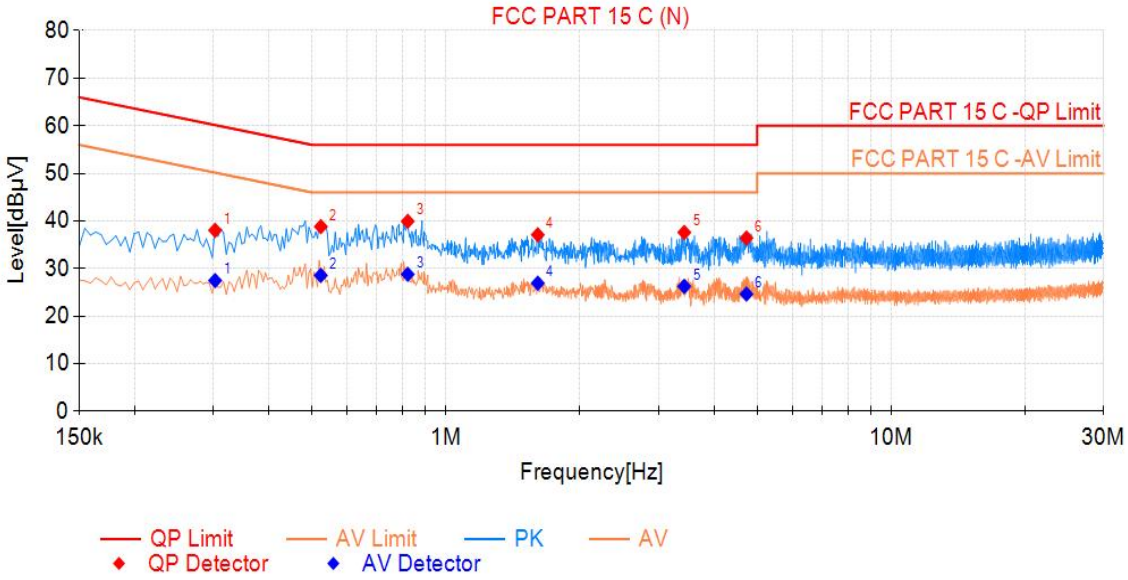
The frequency range from 150kHz to 30MHz is checked.

Line -120V/60Hz:



Final Data List											
NO.	Freq. [MHz]	QP Reading	Factor [dB]	QP Value	QP Limit	QP Margin	AV Reading	AV Value	AV Limit	AV Margin	Verdict
1	0.191	17.68	19.16	36.84	64.01	27.17	7.77	26.93	54.01	27.08	PASS
2	0.236	17.71	19.13	36.84	62.25	25.41	6.66	25.79	52.25	26.46	PASS
3	0.389	18.92	19.32	38.24	58.10	19.86	8.43	27.75	48.10	20.35	PASS
4	0.794	20.69	19.27	39.96	56.00	16.04	9.74	29.01	46.00	16.99	PASS
5	1.563	16.55	19.29	35.84	56.00	20.16	6.82	26.11	46.00	19.89	PASS
6	3.296	17.01	19.32	36.33	56.00	19.67	5.09	24.41	46.00	21.59	PASS

Neutral -120V/60Hz:



Final Data List											
NO.	Freq. [MHz]	QP Reading	Factor [dB]	QP Value	QP Limit	QP Margin	AV Reading	AV Value	AV Limit	AV Margin	Verdict
1	0.303	18.89	19.15	38.04	60.16	22.12	8.33	27.48	50.16	22.68	PASS
2	0.524	19.64	19.18	38.82	56.00	17.18	9.39	28.57	46.00	17.43	PASS
3	0.821	20.69	19.25	39.94	56.00	16.06	9.56	28.81	46.00	17.19	PASS
4	1.608	17.85	19.25	37.10	56.00	18.90	7.68	26.93	46.00	19.07	PASS
5	3.431	18.38	19.22	37.60	56.00	18.40	7.04	26.26	46.00	19.74	PASS
6	4.731	17.16	19.27	36.43	56.00	19.57	5.38	24.65	46.00	21.35	PASS

6 Radiated Emission and Band Edge

6.1 Test Standard and Limit

Test Standard	FCC Part15 C Section 15.209 and 15.205				
Test Limit	Frequency (MHz)	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz~0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz~88MHz	100	40.0	Quasi-peak	3
	88MHz~216MHz	150	43.5	Quasi-peak	3
	216MHz~960MHz	200	46.0	Quasi-peak	3
	960MHz~1000MHz	500	54.0	Quasi-peak	3
	Above 1000MHz	500	54.0	Average	3
		-	74.0	Peak	3

Remark:

(1)The lower limit shall apply at the transition frequency.

(2) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

Test Standard	FCC Part15 C Section 15.249					
Test Limit	Frequency (MHz)	Field Strength of fundamental ((millivolts /meter)	Field Strength of Harmonics (microvolts/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	2400~2483.5	50	-	114.0	Peak	3
	2400~2483.5	50	-	94.0	Average	3
	2400~2483.5	-	500	74.0	Peak	3
	2400~2483.5	-	500	54.0	Average	3

Remark:

(1) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

6.2 Test Setup

Figure 1. Below 30MHz

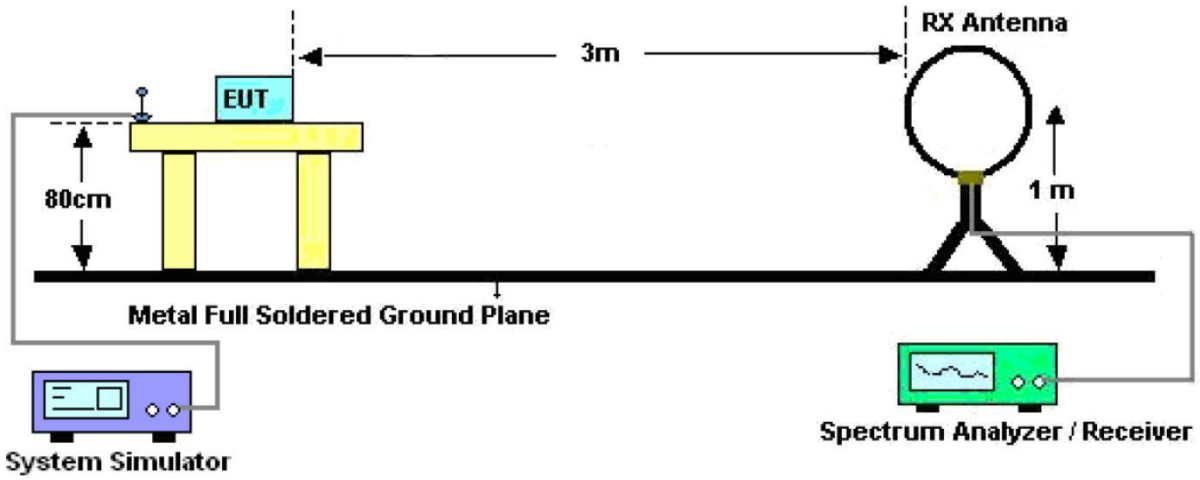


Figure 2. 30MHz to 1GHz

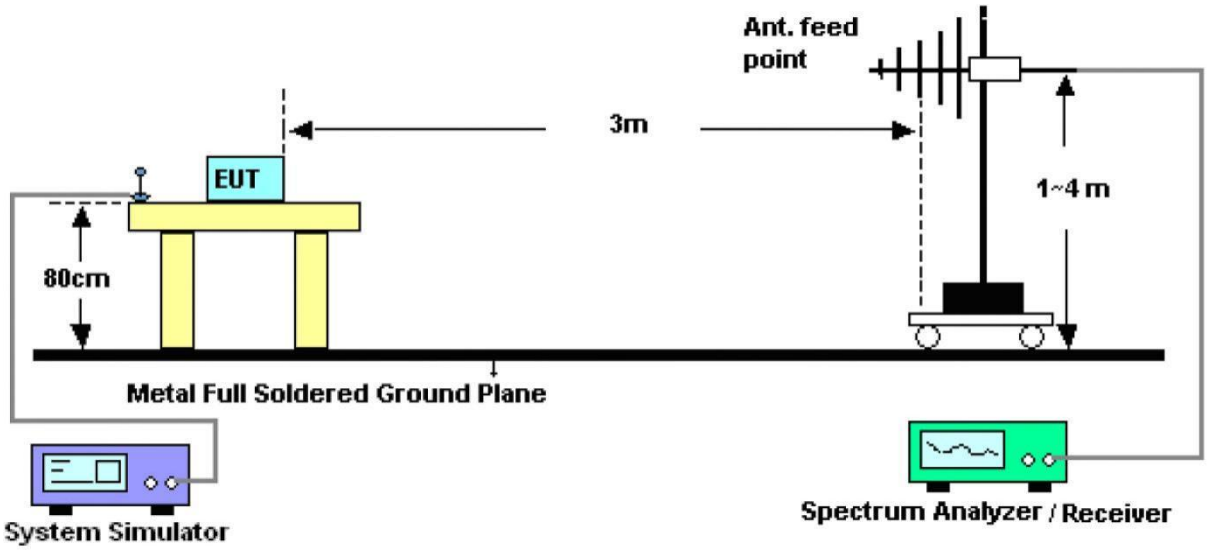
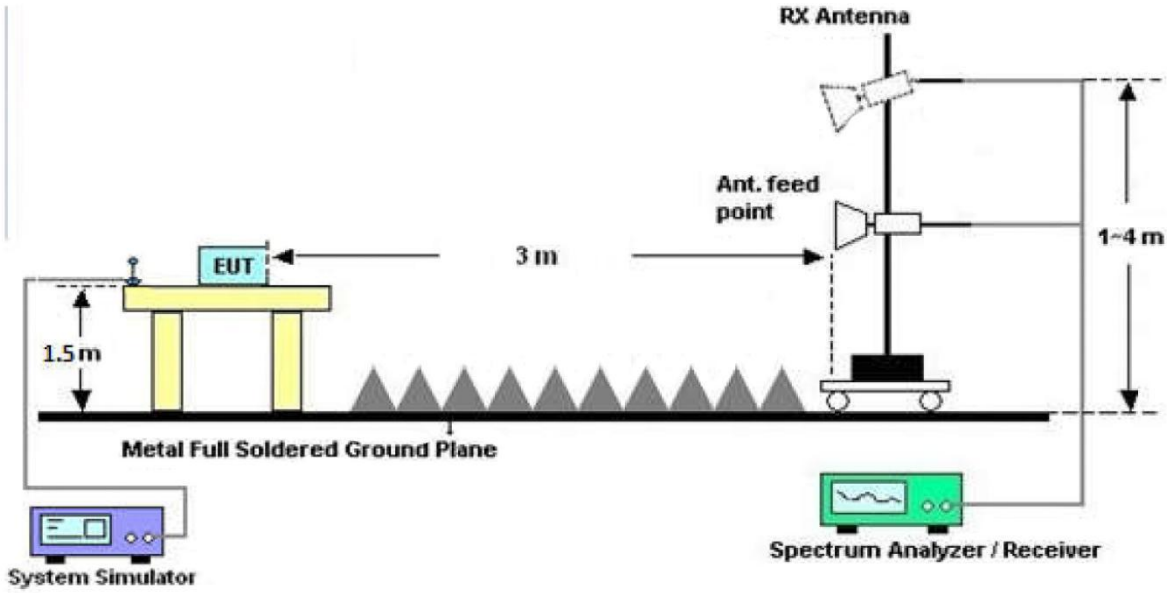


Figure 3. Above 1 GHz



6.3 Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.

For above 1GHz: The EUT is placed on a turntable, which is 1.5m above the ground plane.

The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Rotated the EUT through three orthogonal axes to determine the maximum emissions, both horizontal and vertical polarization of the antenna are set on test. The EUT is tested in 9*6*6 Chamber. The device is evaluated in xyz orientation.

For the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

For 9kHz to 150kHz, Set the spectrum analyzer as:

RBW = 200Hz, VBW =1kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 150kHz to 30MHz, Set the spectrum analyzer as:

RBW = 9KHz, VBW =30kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 30MHz to 1000MHz, Set the spectrum analyzer as:

RBW = 100kHz, VBW =300kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

.

For above 1GHz,Set the spectrum analyzer as:

RBW =1MHz, VBW =1MHz, Detector= Peak, Trace mode= Max hold, Sweep- auto couple.

RBW =1MHz, VBW =10Hz, Detector= Average, Trace mode= Max hold, Sweep- auto couple.

6.4 Test Data

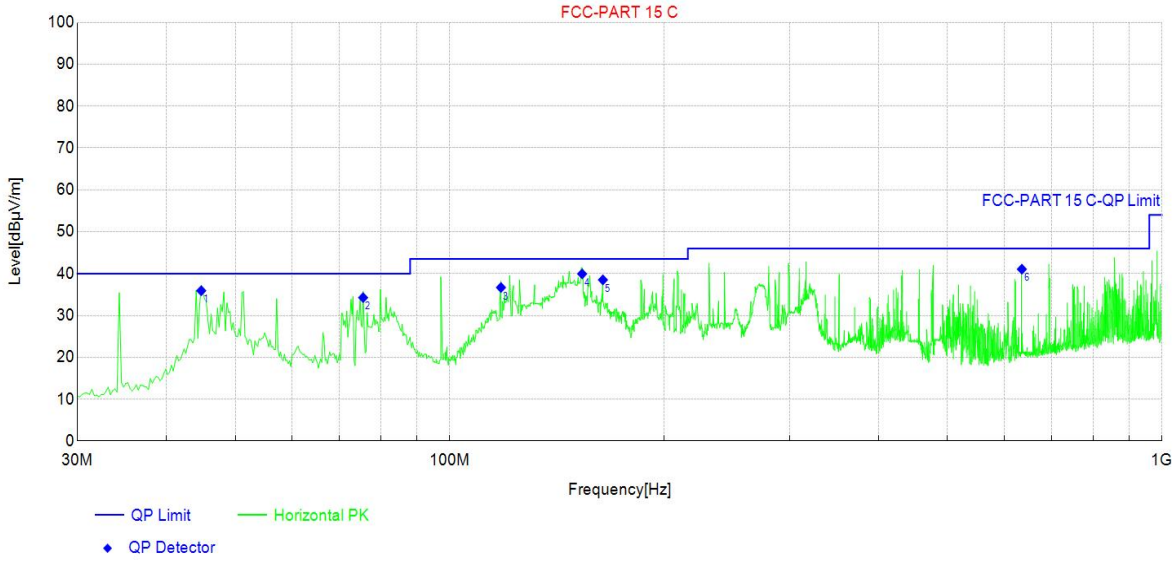
PASS

During the test, Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis is the worst case.

The test results of 9kHz-30MHz was attenuated more than 20dB below the permissible limits, so the results don't record in the report.

During the test, pre-scan all the modes, only the worst case is recorded in the report.

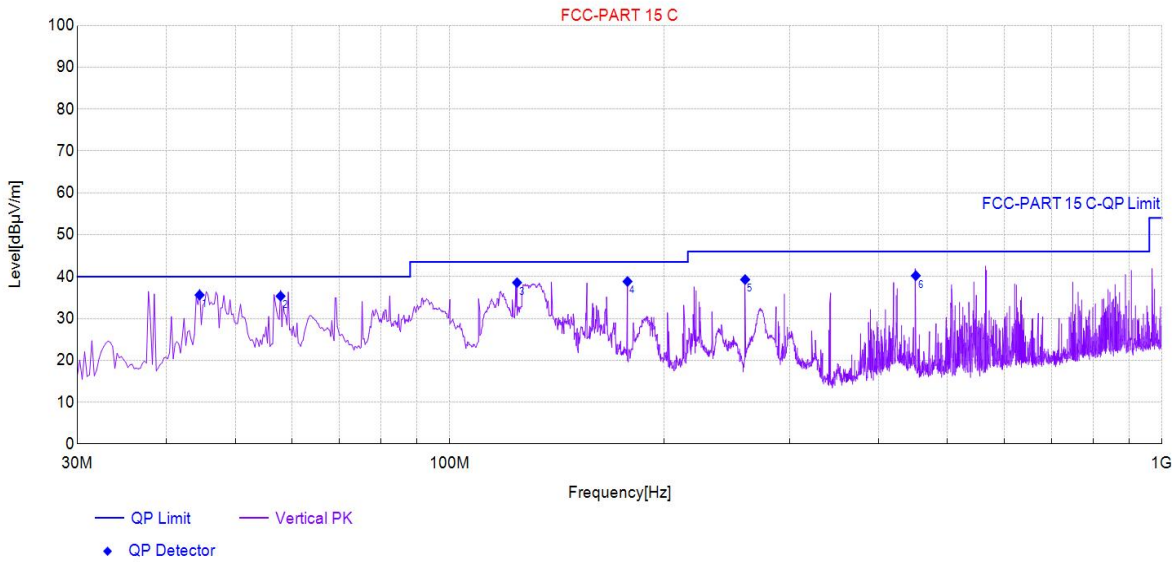
Antenna Polarization: Horizontal



Final Data List[QP]										
NO.	Freq. [MHz]	QP Reading [dBµV]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	44.79	52.41	-16.49	35.92	40.00	4.08	200	13	Horizontal	PASS
2	75.59	54.08	-19.81	34.27	40.00	5.73	100	355	Horizontal	PASS
3	118.03	54.55	-17.87	36.68	43.50	6.82	200	359	Horizontal	PASS
4	153.43	55.19	-15.25	39.94	43.50	3.56	100	182	Horizontal	PASS
5	164.10	54.09	-15.58	38.51	43.50	4.99	200	215	Horizontal	PASS
6	635.77	48.37	-7.31	41.06	46.00	4.94	100	339	Horizontal	PASS

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

Antenna Polarization: Vertical



Final Data List[QP]										
NO.	Freq. [MHz]	QP Reading [dBµV]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	44.55	52.12	-16.51	35.61	40.00	4.39	100	206	Vertical	PASS
2	57.89	52.63	-17.29	35.34	40.00	4.66	100	276	Vertical	PASS
3	124.33	55.75	-17.19	38.56	43.50	4.94	100	241	Vertical	PASS
4	177.68	56.44	-17.60	38.84	43.50	4.66	100	14	Vertical	PASS
5	259.89	56.07	-16.77	39.30	46.00	6.70	100	263	Vertical	PASS
6	451.22	51.04	-10.82	40.22	46.00	5.78	100	320	Vertical	PASS

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

Test Frequency 1GHz-25GHz

Test Mode: 2480MHz									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.	Detector
2480	92.30	31.65	2.23	36.07	90.11	114	-23.89	V	Peak
2480	84.96	31.65	2.23	36.07	82.77	94	-11.23	V	AVG
4960	49.78	35.06	2.6	34.93	52.51	74	-21.49	V	Peak
4960	37.90	35.06	2.6	34.93	40.63	54	-13.37	V	AVG
7440	46.58	36.19	3.12	35.11	50.78	74	-23.22	V	Peak
7440	36.32	36.19	3.12	35.11	40.52	54	-13.48	V	AVG
2480	92.65	31.65	2.23	36.07	90.46	114	-23.54	H	Peak
2480	84.82	31.65	2.23	36.07	82.63	94	-11.37	H	AVG
4960	49.50	35.06	2.6	34.93	52.23	74	-21.77	H	Peak
4960	36.01	35.06	2.6	34.93	38.74	54	-15.26	H	AVG
7440	47.85	36.19	3.12	35.11	52.05	74	-21.95	H	Peak
7440	36.00	36.19	3.12	35.11	40.20	54	-13.80	H	AVG

Note: Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Emission Level = Reading + Factor
Margin=Emission Level-Limit

Spurious Emission in Restricted Band 2483.5-2500MHz

Test Mode: 2480MHz									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over (dB)	Polarity H/V	Test Value
2390	47.53	29.28	3.53	34.03	46.31	74	-27.69	H	Peak
2400	41.16	29.30	3.56	34.03	39.99	74	-34.01	H	Peak
2390	48.55	29.28	3.53	34.03	47.33	74	-26.67	V	Peak
2400	41.54	29.30	3.56	34.03	40.37	74	-33.63	V	Peak
2390	38.57	29.28	3.53	34.03	37.35	54	-16.65	H	AV
2400	33.49	29.30	3.56	34.03	32.32	54	-21.68	H	AV
2390	39.84	29.28	3.53	34.03	38.62	54	-15.38	V	AV
2400	32.19	29.30	3.56	34.03	31.02	54	-22.98	V	AV

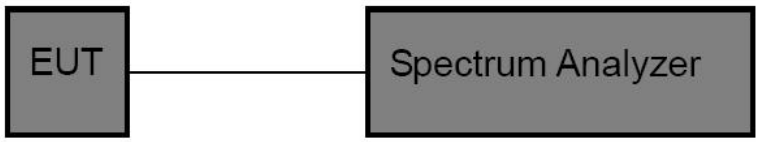
Test Mode: 2480MHz									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over (dB)	Polarity H/V	Test Value
2483.5	47.13	29.28	3.53	34.03	45.91	74	-28.09	H	Peak
2500	40.00	29.30	3.56	34.03	38.83	74	-35.17	H	Peak
2483.5	47.42	29.28	3.53	34.03	46.20	74	-27.80	V	Peak
2500	41.83	29.30	3.56	34.03	40.66	74	-33.34	V	Peak
2483.5	38.52	29.28	3.53	34.03	37.30	54	-16.70	H	AV
2500	33.73	29.30	3.56	34.03	32.56	54	-21.44	H	AV
2483.5	39.69	29.28	3.53	34.03	38.47	54	-15.53	V	AV
2500	32.58	29.30	3.56	34.03	31.41	54	-22.59	V	AV

7 20dB Bandwidth Test

7.1 Test Standard and Limit

Test Standard	FCC Part15 C Section 15.249

7.2 Test Setup



7.3 Test Procedure

1. Place the EUT on the table and set it in the transmitting mode.

2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

3. Set the spectrum analyzer as:

RBW = 30kHz, VBW≥3*RBW =100kHz,

Detector= Average

Trace mode= Max hold.

Sweep- auto couple.

4. Mark the peak frequency and –20dB (upper and lower) frequency.

5. Repeat until all the rest channels are investigated.

7.4 Test Data

Test Item	:	20dB Bandwidth	Test Mode	:	TX
Test Voltage	:	DC 3.7V	Temperature	:	22.4℃
Test Result	:	PASS	Humidity	:	55%RH

Frequency (MHz)	Bandwidth (MHz)	Result
2480MHZ	3.890	PASS

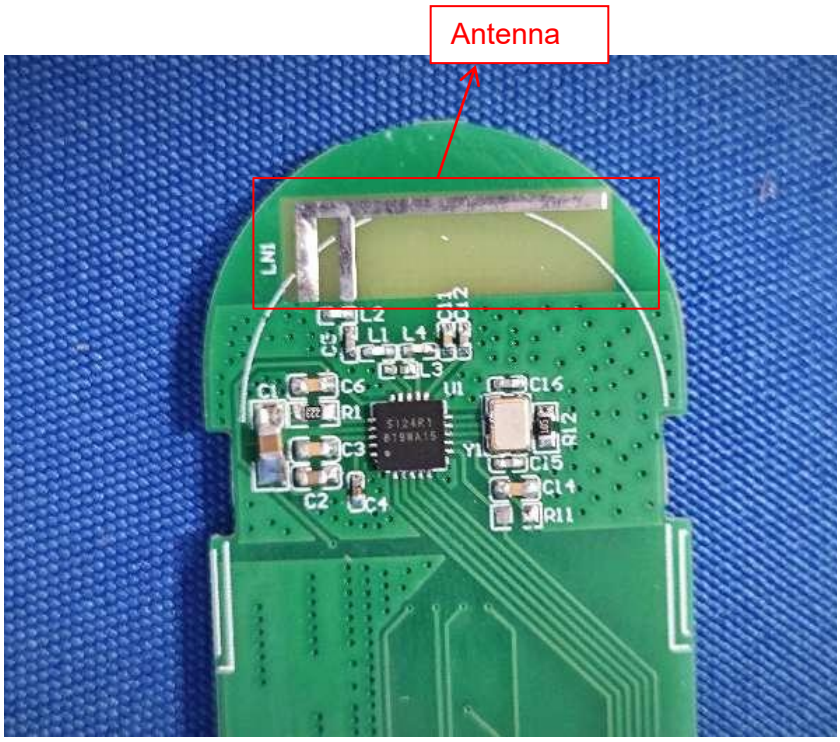
8 Antenna Requirement

8.1 Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203
Requirement	1) 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.

8.2 Antenna Connected Construction

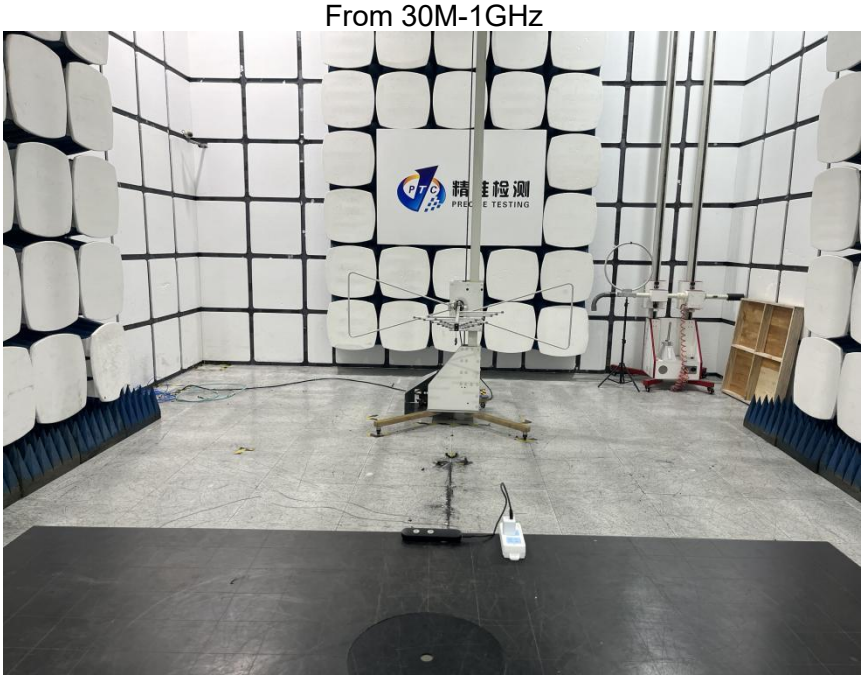
The antenna is a PCB Antenna which permanently attached,and the best case gain of the antenna is 2.36 dBi. It complies with the standard requirement.



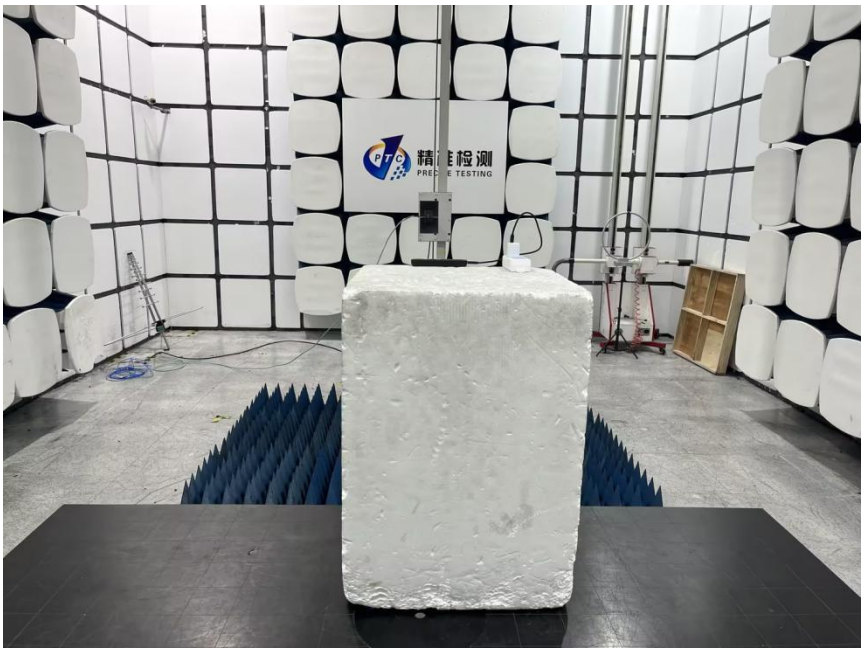
9 TEST SETUP PHOTOGRAPH

Conducted Emissions

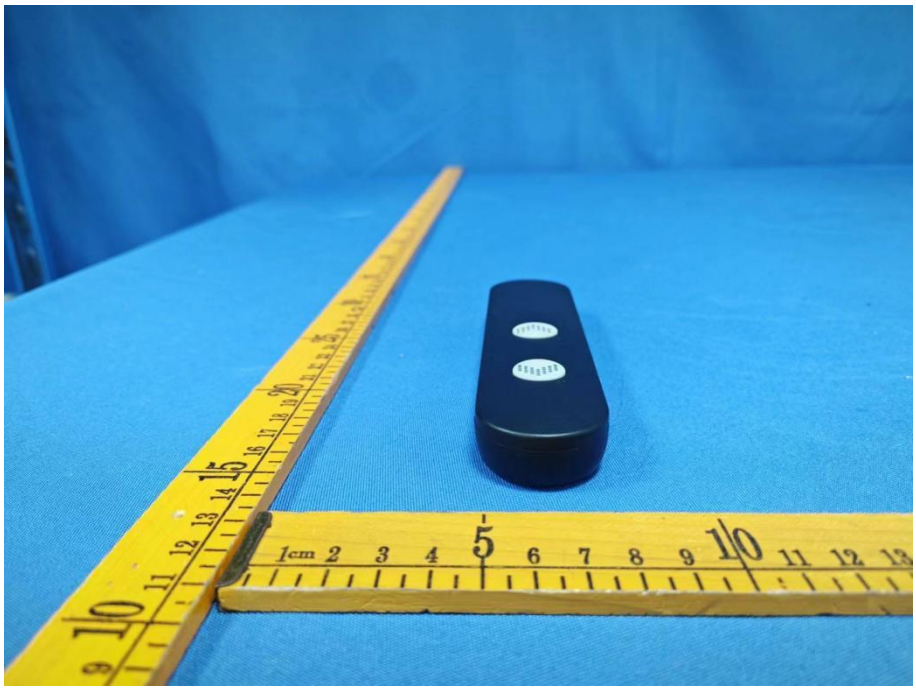
Radiated Emissions
From 30M-1GHz

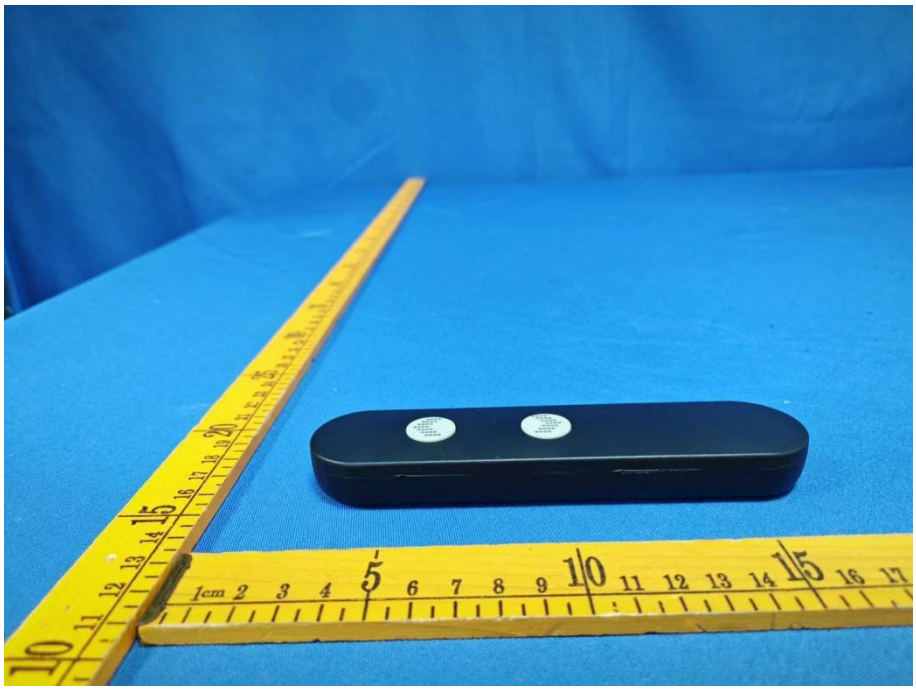


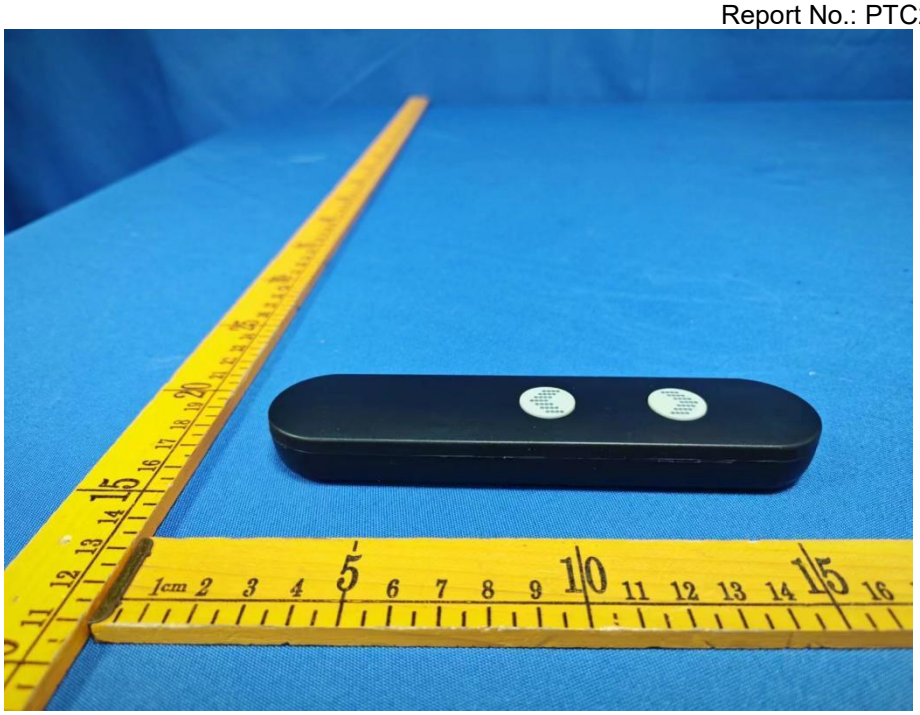
Above 1GHz

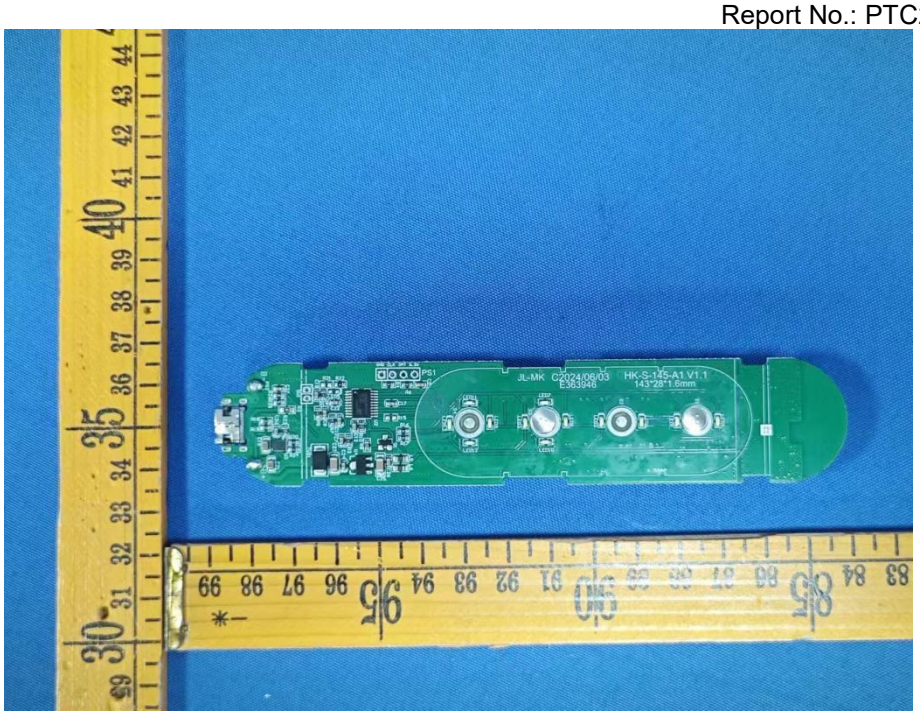


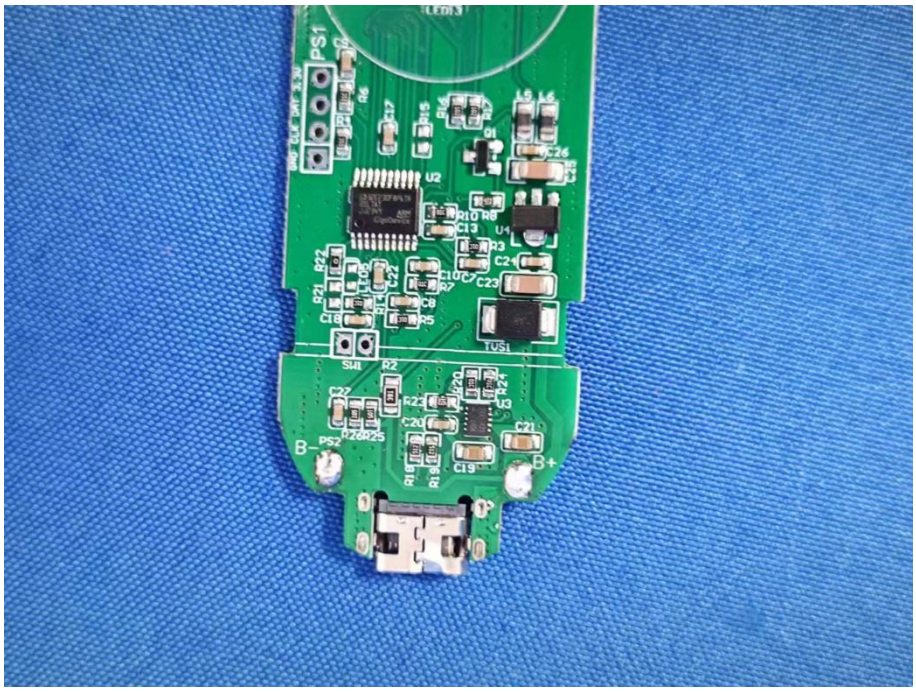
10 EUT PHOTOGRAPH

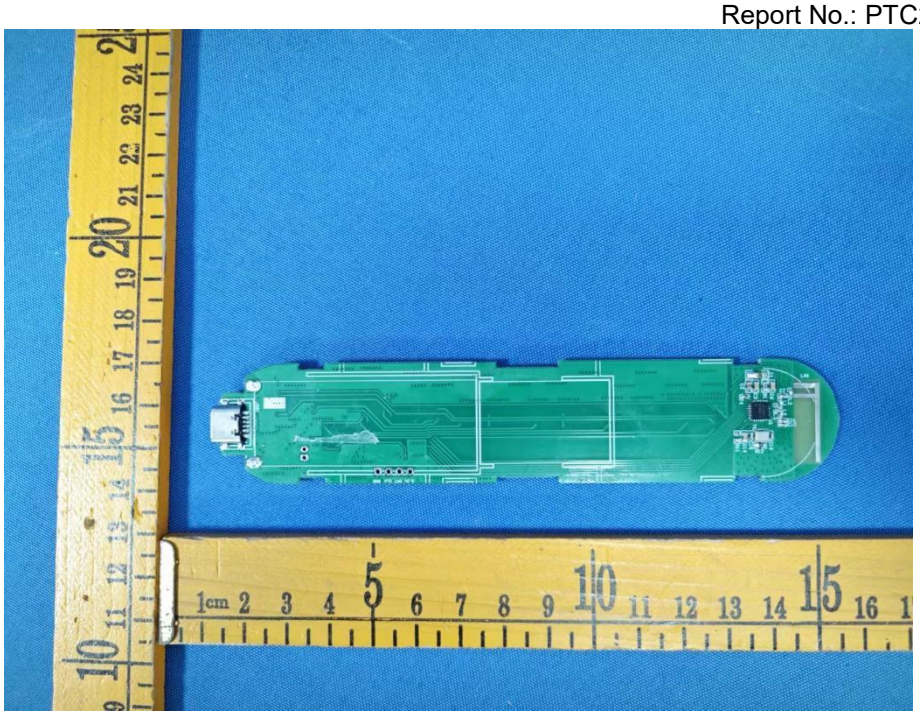


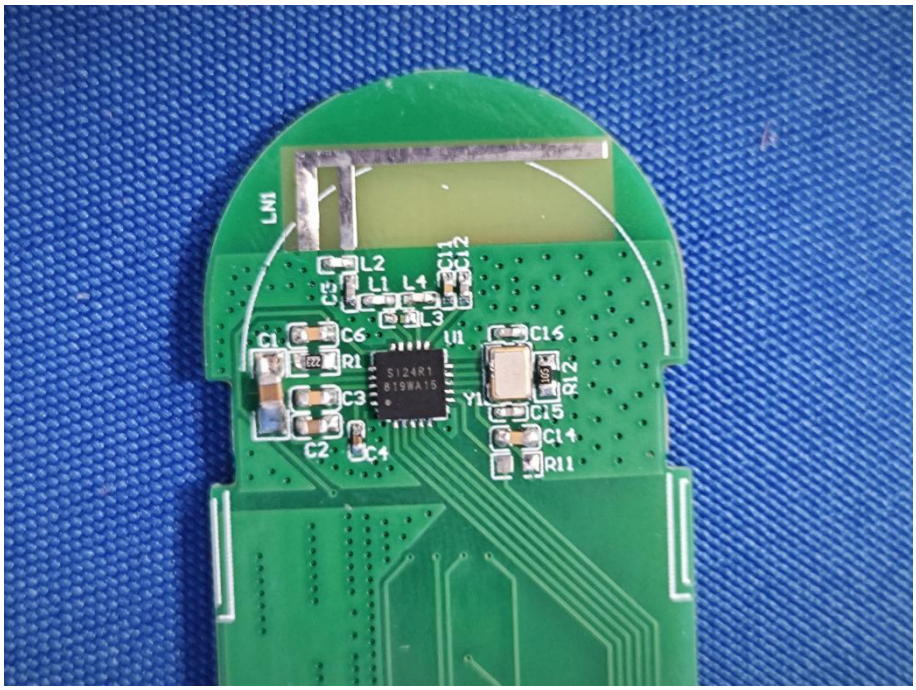



1cm 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16


JL-MK C2024/06/03
E383948
HK-S-145-A1 V1.1
143*28*1.6mm


PS1
U2
U4
TVS1
SW1
B-
B+




LN1
L2
C5
L1
L4
C11
C12
L3
C1
C6
R1
U1
C16
R12
S124R1
819WA15
C3
Y1
C15
C2
C4
C14
R11

********THE END REPORT********