FCC TEST REPORT

FCC ID: 2AQURZW97M

Product Name	:	Outdoor Double Plug
Model Name	:	ZW97M
Brand Name	:	Minoston
Report No.	:	PTC23110803302E-FC01

Prepared for

NIE-TECH Co., Ltd

Jinlian commercial center 9001, Jinxiu road No.2, Changan Town,Dongguan City, GuangDongProv.,

CHINA

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	:	NIE-TECH Co., Ltd
Address	:	Jinlian commercial center 9001, Jinxiu road No.2, Changan Town,Dongguan City, GuangDongProv., CHINA
Manufacture's name	:	NIE-TECH Co., Ltd
Address	:	Jinlian commercial center 9001, Jinxiu road No.2, Changan Town,Dongguan City, GuangDongProv., CHINA
Product name	:	Outdoor Double Plug
Model name	:	ZW97M
Standards	:	FCC Part15 Subpart C, Paragraph 15.249
Test procedure	:	ANSI C63.10: 2013
Test Date	:	Nov. 29, 2023 to Dec. 19, 2023
Date of Issue	:	Dec. 21, 2023
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
Remark: “N/A” is an abbreviation for Not Applicable.		

3 TEST FACILITY

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

4 General Information

4.1 General Description of E.U.T.

Product Name	:	Outdoor Double Plug
Model Name	:	ZW97M
Additional model	:	N/A
Operating frequency	:	908.40MHz,908.42 MHz,916.00MHz
Numbers of Channels	:	3 Channels
Antenna Type	:	PCB antenna
Antenna Gain	:	-6.16 dBi
Type of Modulation	:	2FSK for 908.40MHz 2FSK for 908.42MHz 2GFSK for 916.00MHz
Power supply	:	Input: AC 120V/60Hz Output:AC120V 15A
Hardware Version	:	V1
Software Version	:	V1
Test sample No.	:	PTC23110803302E-1/6, PTC23110803302E-2/6, PTC23110803302E-3/6, PTC23110803302E-5/6

4.2 Test Mode

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Channel	Frequency (MHz)	Modulation
Mode 1	CH0	908.40	2FSK
Mode 2	CH1	908.42	2FSK
Mode 3	CH2	916.00	2GFSK

For Conducted Emission	
Final Test Mode	Description
Mode 1	CH0
Mode 2	CH1
Mode 3	CH2

For Radiated Emission	
Final Test Mode	Description
Mode 1	CH0
Mode 2	CH1
Mode 3	CH2

Note:

1. The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.

4.3 List of Channels

Channel	Frequency (MHz)	Modulation
CH0	908.40	2FSK
CH1	908.42	2FSK
CH2	916.00	2GFSK

5 Equipment During Test

5.1 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-30GHz	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.

Radiated 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
Loop Antenna	Schwarzbeck	FMZB 1519	012	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	Schwarzbeck	PLF-100	549489	9KHz-3GHz	Aug. 17,2023	1 Year
Spectrum Analyzer	Agilent	E4407B	MY45109572	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, 2023	1 Year
Amplifier	SCHWARZBECK	BBV 9721	9721-205	18GHz-40GHz	Jul. 19, 2023	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
Test S/W	Tonscend	JS32-CE	/	/	/	/

5.2 Measurement Uncertainty

Radiation Uncertainty	:	Ur = 3.9 dB (Horizontal)
		Ur = 3.8 dB (Vertical)
Bandwidth	:	±1.5 x 10-6
Conduction Uncertainty	:	Uc = 3.4 dB

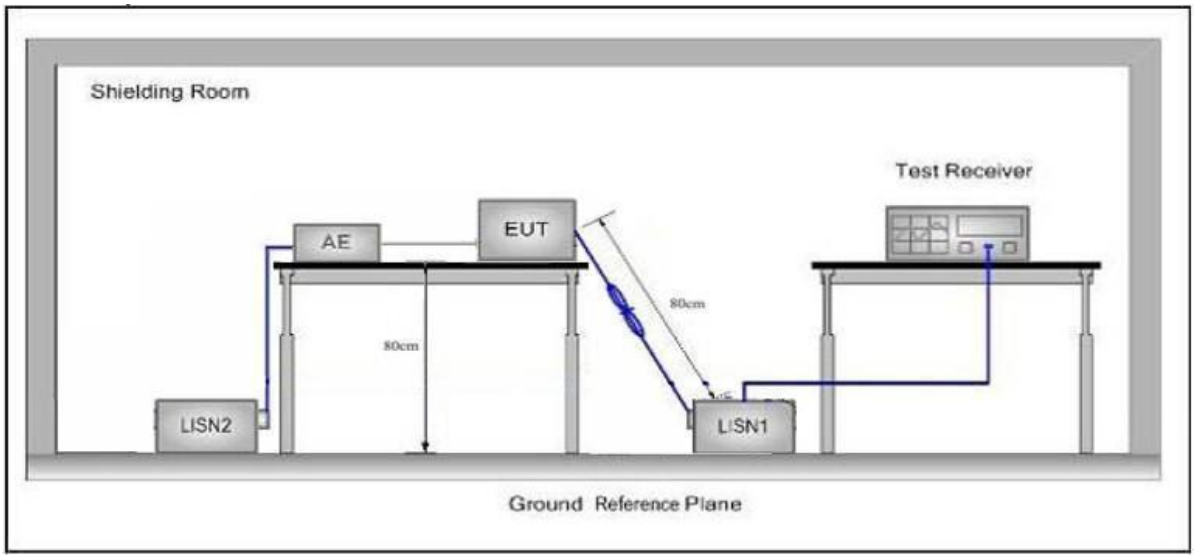
5.3 Description of Support Units

Equipment	Model No.	Series No.
Incandescent lamp	N/A	N/A

6 Test Standard and Limit

Test Standard	FCC Part15 Section 15.207		
Test Limit	Frequency	Maximum RF Line Voltage (dBuV)	
		Quasi-peak Level	Average Level
	150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
	500kHz~5MHz	56	46
	5MHz~30MHz	60	50
Remark: (1) *Decreasing linearly with logarithm of the frequency. (2) The lower limit shall apply at the transition frequency.			

6.1. Test Setup



6.2. Test Procedure

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.

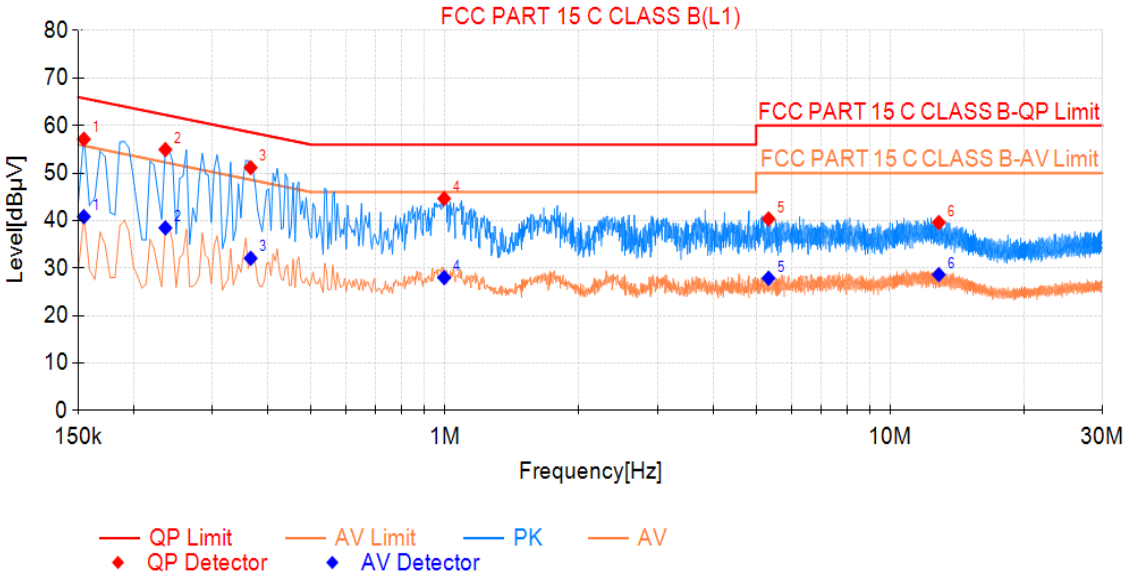
6.3. Test Data

Test Mode: CH1

Power Source: AC 120V/60Hz

Polarization: LINE

Temp.(℃)/Hum.(%RH): 24.5℃/52%RH



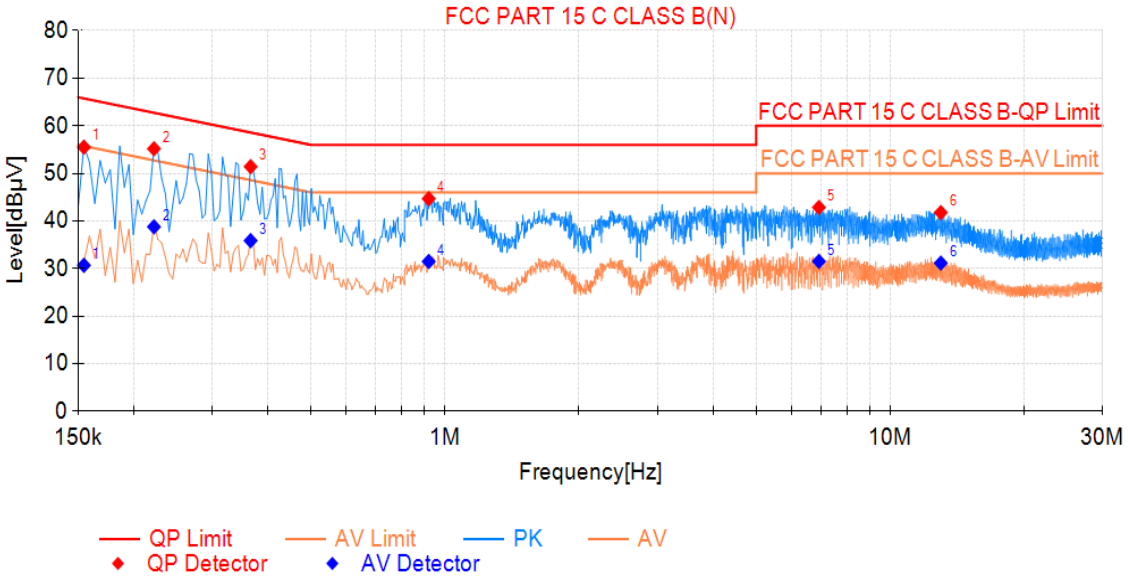
Final Data List								
NO.	Freq. [MHz]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.155	57.15	65.75	8.60	40.84	55.75	14.91	PASS
2	0.236	54.96	62.25	7.29	38.47	52.25	13.78	PASS
3	0.366	51.16	58.59	7.43	32.07	48.59	16.52	PASS
4	0.996	44.63	56.00	11.37	28.00	46.00	18.00	PASS
5	5.330	40.36	60.00	19.64	27.87	50.00	22.13	PASS
6	12.858	39.60	60.00	20.40	28.64	50.00	21.36	PASS

Test Mode: CH1

Power Source: AC 120V/60Hz

Polarization: NEUTRAL

Temp.(℃)/Hum.(%RH): 24.5℃/52%RH



Final Data List								
NO.	Freq. [MHz]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.155	55.52	65.75	10.23	30.69	55.75	25.06	PASS
2	0.222	55.19	62.74	7.55	38.78	52.74	13.96	PASS
3	0.366	51.42	58.59	7.17	35.87	48.59	12.72	PASS
4	0.920	44.68	56.00	11.32	31.49	46.00	14.51	PASS
5	6.918	42.86	60.00	17.14	31.52	50.00	18.48	PASS
6	12.993	41.78	60.00	18.22	31.15	50.00	18.85	PASS

Note:1. All test mode have been tested. Only the worst case have been recorded in the report.

2.QP Margin[dB]= QP Limit[dBµV]- QP Value[dBµV], AV Margin[dB]= AV Limit[dBµV]- AV Value[dBµV].

7 . Radiated Emission and Band Edge

7.1. 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)
	902~928	50	-	94.0	Quasi-peak	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.

7.2. Test Setup

Figure 1. Below 30MHz

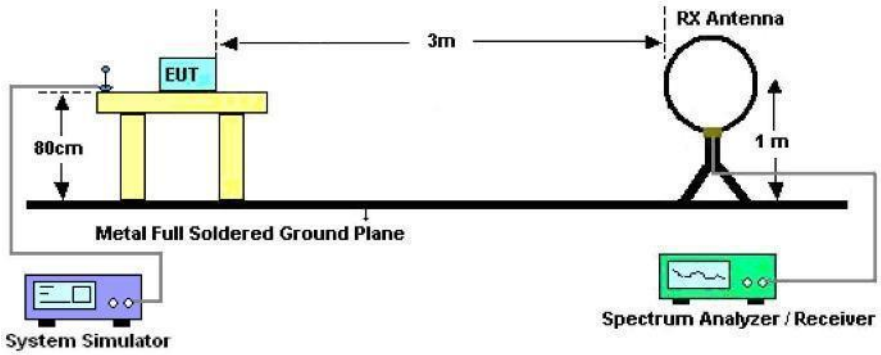


Figure 2. 30MHz to 1GHz

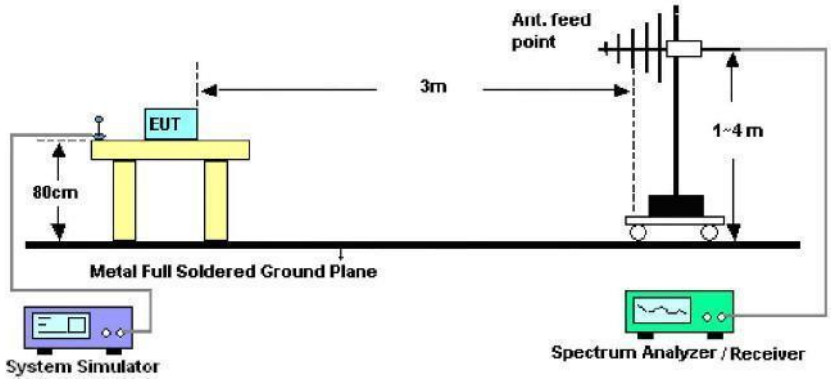
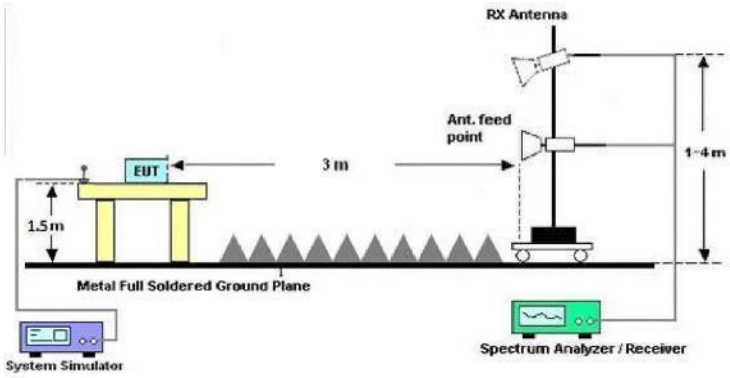


Figure 3. Above 1 GHz



7.3. 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.

7.4. 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, and found the CH 01 channel which is the worst case, only the worst case is recorded in the report

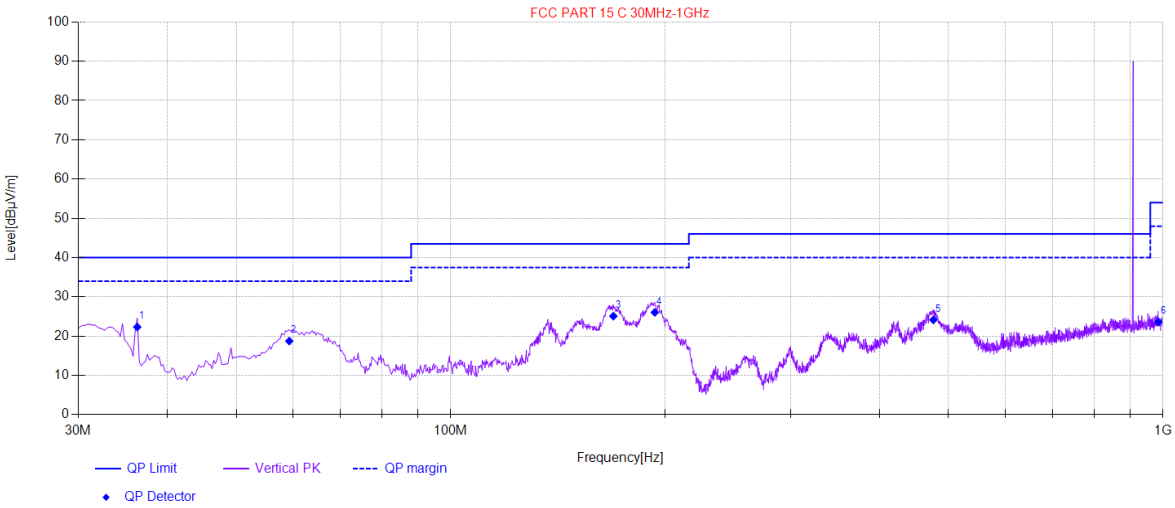
Test Results (30~1000MHz)

Test Mode: CH1

Power Source: AC 120V/60Hz

Polarization: Vertical

Temp.(℃)/Hum.(%RH): 24.5℃/52%RH



Final Data List[QP]								
NO.	Freq. [MHz]	QP Reading [dBμV/m]	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Polarity	Verdict
1	36.31	40.24	-17.92	22.32	40.00	17.68	Vertical	PASS
2	59.34	36.49	-17.74	18.75	40.00	21.25	Vertical	PASS
3	169.20	42.32	-17.23	25.09	43.50	18.41	Vertical	PASS
4	193.45	44.83	-18.79	26.04	43.50	17.46	Vertical	PASS
5	475.96	35.08	-10.94	24.14	46.00	21.86	Vertical	PASS
6	985.45	25.28	-1.66	23.62	54.00	30.38	Vertical	PASS

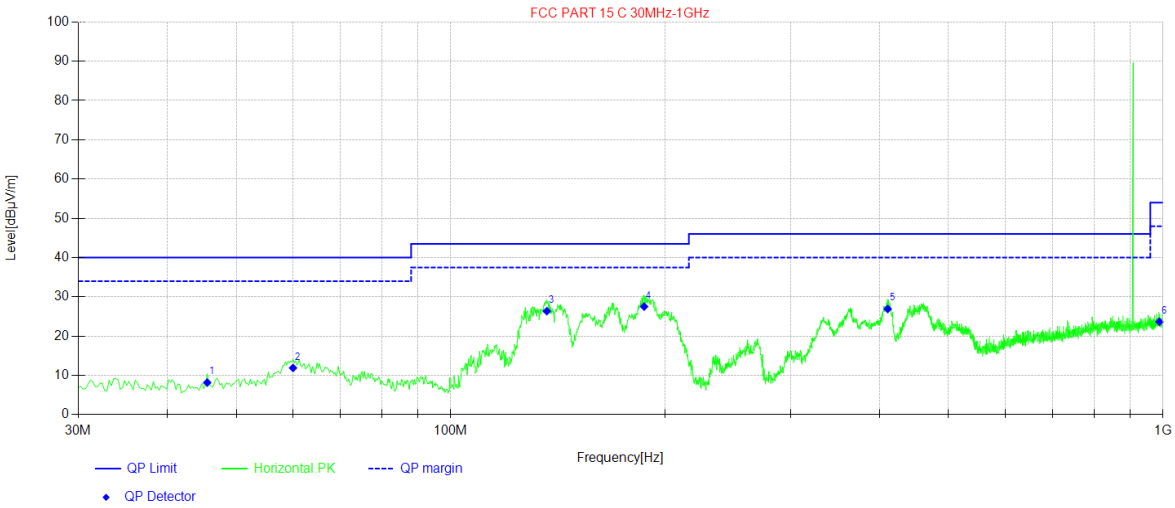
Test Results (30~1000MHz)

Test Mode: CH1

Power Source: AC 120V/60Hz

Polarization: Horizontal

Temp.(℃)/Hum.(%RH): 24.5℃/52%RH



Final Data List[QP]								
NO.	Freq. [MHz]	QP Reading [dBμV/m]	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Polarity	Verdict
1	45.52	26.1	-17.93	8.17	40.00	31.83	Horizontal	PASS
2	60.07	29.58	-17.68	11.90	40.00	28.10	Horizontal	PASS
3	136.46	43.05	-16.69	26.36	43.50	17.14	Horizontal	PASS
4	186.90	45.58	-18.05	27.53	43.50	15.97	Horizontal	PASS
5	410.73	39.12	-12.20	26.92	46.00	19.08	Horizontal	PASS
6	988.36	25.31	-1.65	23.66	54.00	30.34	Horizontal	PASS

Note: 1. All test mode have been tested. Only the worst case have been recorded in the report.

2. QP Margin[dB]= QP Limit[dBμV/m]- QP Value[dBμV/m], QP Value[dBμV/m]= QP Reading[dBμV]+ Factor[dB/m].

Test Frequency 1GHz-10GHz

CH0:

Frequency	Antenna	Reading	Cable Loss	Ant Factor	Amplifier	Level	Limits	Margin	Det.
(MHz)	Pol.	(dBuV)	(dB)	(dB/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	Mode
1816.80	H	47.37	6.58	34.04	34.09	53.90	74	20.10	PK
1816.80	H	30.58	6.58	34.04	34.09	37.11	54	16.89	AV
2725.20	H	41.80	7.73	37.11	34.79	51.85	74	22.15	PK
2725.20	H	34.45	7.73	37.11	34.79	44.50	54	9.50	AV
1816.80	V	41.19	6.58	35.28	34.09	48.96	74	25.04	PK
1816.80	V	25.56	6.58	35.28	34.09	33.33	54	20.67	AV
2725.20	V	39.30	7.73	39.31	34.79	51.55	74	22.45	PK
2725.20	V	24.70	7.73	39.31	34.79	36.95	54	17.05	AV

Fundamental

Frequency	Antenna	Reading	Factor	Results	Limits	Det.
(MHz)	Pol.	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Mode
908.40	H	86.39	3.01	89.4	94	QP
908.40	V	86.39	3.01	89.4	94	QP

Note: 1. The testing has been conformed to 10*908.40MHz=9084MHz.

2. All other emissions more than 30dB below the limit.

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

CH1:

Frequency	Antenna	Reading	Cable Loss	Ant Factor	Amplifier	Level	Limits	Margin	Det.
(MHz)	Pol.	(dBuV)	(dB)	(dB/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	Mode
1816.84	H	46.54	6.58	34.04	34.09	53.07	74	20.93	PK
1816.84	H	31.23	6.58	34.04	34.09	37.76	54	16.24	AV
2725.26	H	40.95	7.73	37.11	34.79	51.00	74	23.00	PK
2725.26	H	33.74	7.73	37.11	34.79	43.79	54	10.21	AV
1816.84	V	43.47	6.58	35.28	34.09	51.24	74	22.76	PK
1816.84	V	26.49	6.58	35.28	34.09	34.26	54	19.74	AV
2725.26	V	38.78	7.73	39.31	34.79	51.03	74	22.97	PK
2725.26	V	22.43	7.73	39.31	34.79	34.68	54	19.32	AV

Fundamental

Frequency	Antenna	Reading	Factor	Results	Limits	Det.
(MHz)	Pol.	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Mode
908.42	H	86.79	3.01	89.80	94	QP
908.42	V	86.86	3.01	89.87	94	QP

Note: 1. The testing has been conformed to 10*908.42MHz=9084.2MHz.

2. All other emissions more than 30dB below the limit.

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

CH2:

Frequency	Antenna	Reading	Cable Loss	Ant Factor	Amplifier	Level	Limits	Margin	Det.
(MHz)	Pol.	(dBuV)	(dB)	(dB/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	Mode
1832.00	H	45.54	6.58	34.04	34.09	52.07	74	21.93	PK
1832.00	H	29.81	6.58	34.04	34.09	36.34	54	17.66	AV
2748.00	H	41.47	7.73	37.11	34.79	51.52	74	22.48	PK
2748.00	H	32.75	7.73	37.11	34.79	42.80	54	11.2	AV
1832.00	V	40.91	6.58	35.28	34.09	48.68	74	25.32	PK
1832.00	V	26.19	6.58	35.28	34.09	33.96	54	20.04	AV
2748.00	V	38.75	7.73	39.31	34.79	51.00	74	23	PK
2748.00	V	22.60	7.73	39.31	34.79	34.85	54	19.15	AV

Fundamental

Frequency	Antenna	Reading	Factor	Results	Limits	Det.
(MHz)	Pol.	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	Mode
916.00	H	87.14	3.01	90.15	94	QP
916.00	V	87.15	3.01	90.16	94	QP

Note: 1. The testing has been conformed to 10*916.00MHz=9160MHz.

2. All other emissions more than 30dB below the limit.

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

Radiated Restricted Band:

Test Mode: Channel 908.4MHz							
Frequency (MHz)	Read Level (dBuV)	Corr. Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarity H/V	Detector
902	24.85	-2.97	21.88	46	24.12	H	Peak
928	23.55	-2.51	21.04	46	24.96	H	Peak
902	23.76	-2.97	20.79	46	25.21	V	Peak
928	24.32	-2.51	21.81	46	24.19	V	Peak

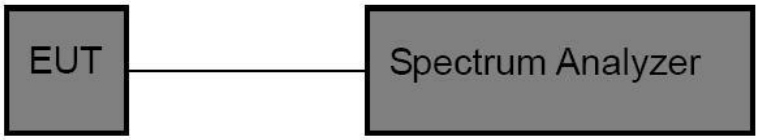
Test Mode: Channel 916MHz							
Frequency (MHz)	Read Level (dBuV)	Corr. Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarity H/V	Detector
902	24.63	-2.97	21.66	46	24.34	H	Peak
928	23.49	-2.51	20.98	46	25.02	H	Peak
902	23.52	-2.97	20.55	46	25.45	V	Peak
928	24.66	-2.51	22.15	46	23.85	V	Peak

8. 20dB Bandwidth Test

8.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.249

8.2. Test Setup



8.3. 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.

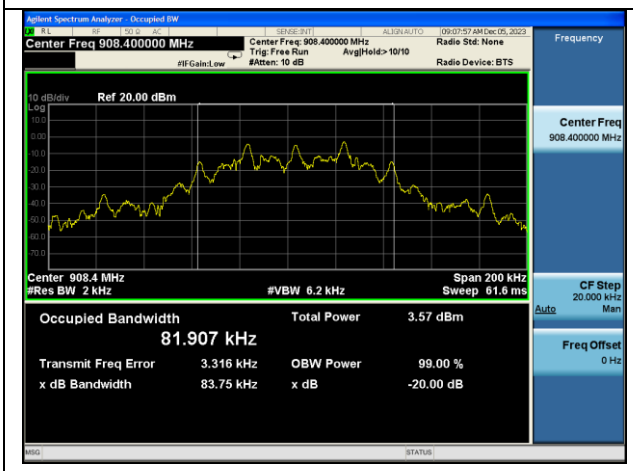
8.4. Test Data

Test Item	:	20dB Bandwidth	Test Mode	:	Mode 1/2/3
Test Voltage	:	AC 120V/60Hz	Temperature	:	22.4℃
Test Result	:	PASS	Humidity	:	55%RH

Channel	Frequency (MHz)	20dB Bandwidth(kHz)	Modulation	Result
CH0	908.40	83.75	2FSK	PASS
CH1	908.42	66.54	2FSK	PASS
CH2	916.00	111.5	2GFSK	PASS

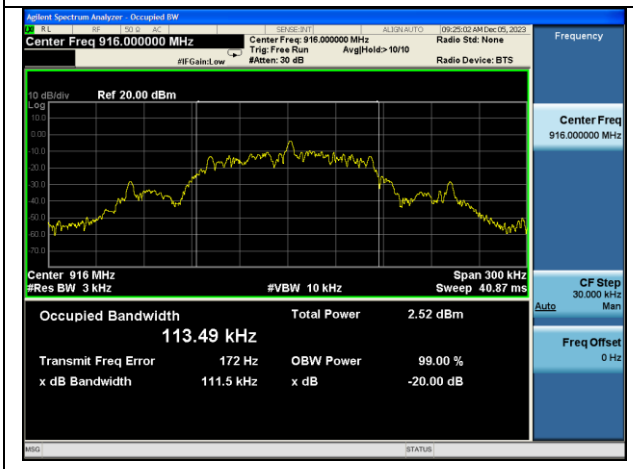
Test Graphs:

CH0



CH1

CH2



9. Antenna Requirement

9.1. Test Standard and Requirement

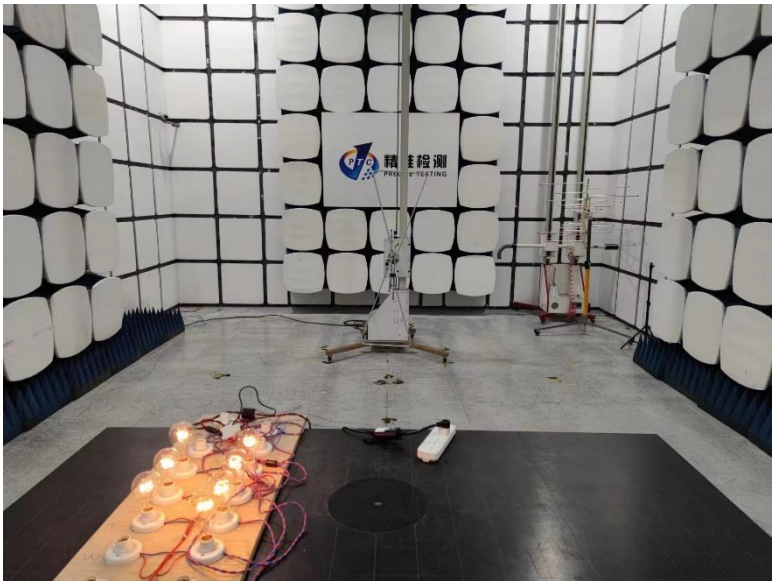
Test Standard	FCC Part15 Section 15.203
Requirement	1) 15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique 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.

9.2. Antenna Connected Construction

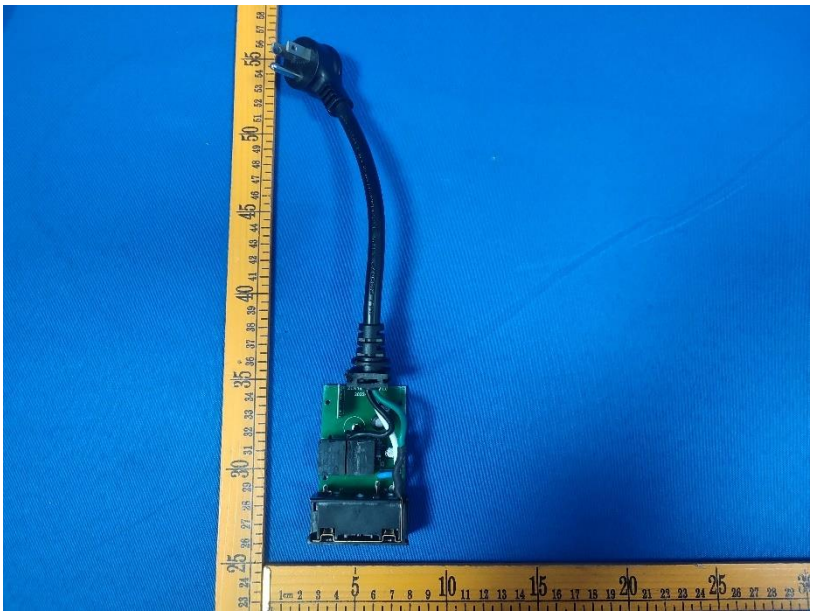
The antenna is a internal permanent antenna which permanently attached, and the best case gain of the antenna is -6.16 dBi. It complies with the standard requirement.

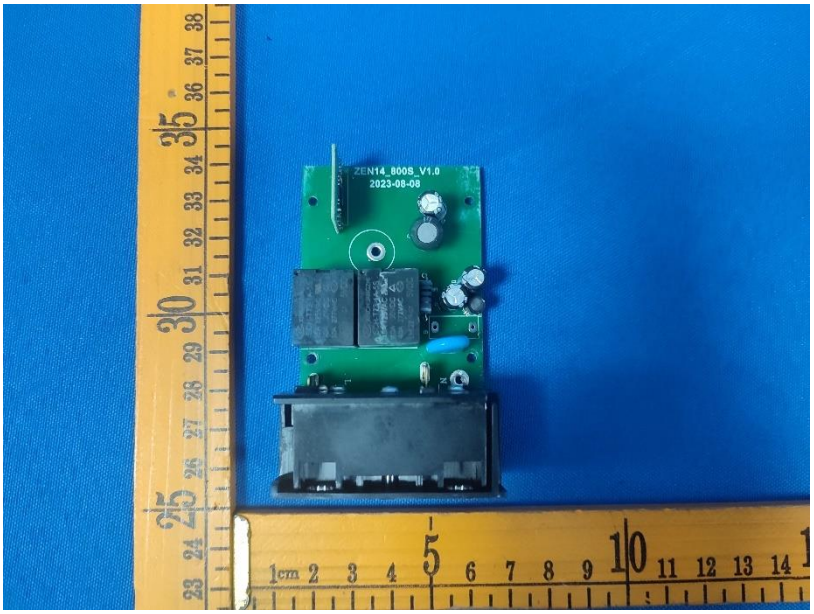
10 APPENDIX I -- PHOTOGRAPH

Test photo

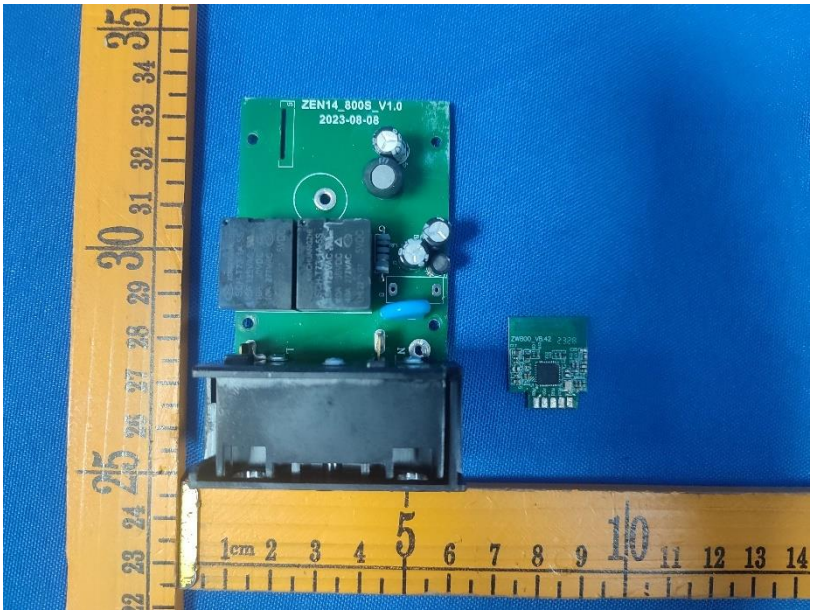
CONDUCTED EMISSION TEST
RADIATED EMISSION TEST 

Eut photo




ZEN14_800S_V1.0
2023-08-08

N_OUT
L_OUT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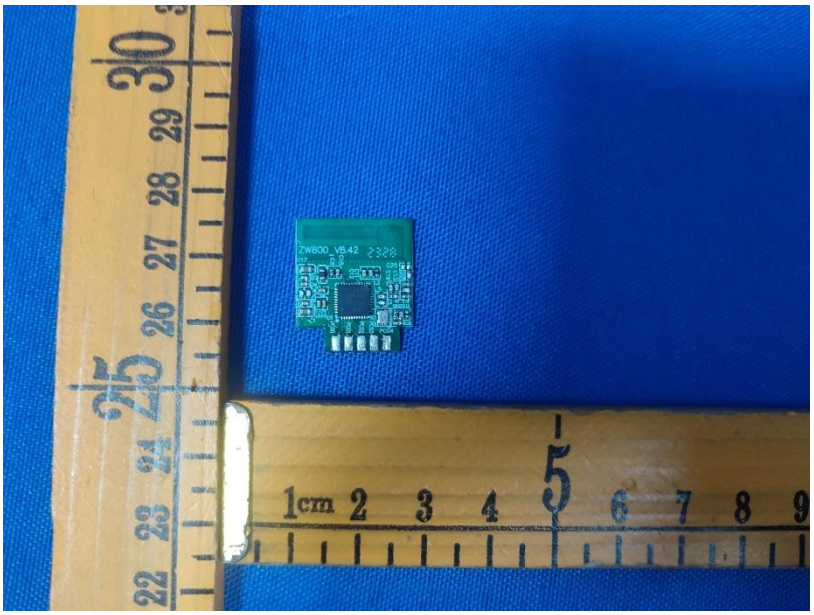
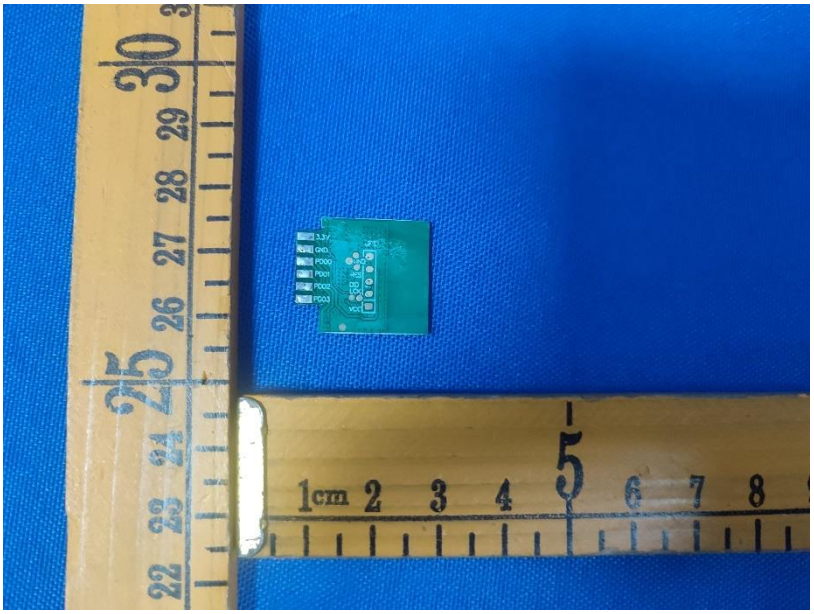
2023-08-08





---------- End of Report ----------