Testing
NVLAP LAB CODE 600222-0

MEASUREMENT REPORT

FCC CFR Title 47 Part 15 Subpart B

Report No.: S20241010265301E04

Issue Date: 12-xx-2024

Applicant:	L&S Lighting Equipment (Shanghai) Co.,Ltd
Address:	Building NO.1,Lane 255 Longpan Road,Malu Town, Jiading District ;Shanghai China
FCC ID:	2BD9AS05051-4052
Product:	matter controller
Model No.:	LITE MT; LITE MT RP; LITE BT1
Trade Mark:	L&S
FCC Rule Part(s):	CFR Title 47 Part 15 Subpart B
Test Procedure(s):	ANSI C63.4: 2014
Result:	Pass
Item Receipt Date:	Oct. 23, 2024
Test Date:	Nov. 11, 2024

K_主检”、“K_审核”、“K_批准

Compiled By

(Qianlan Sang)
Senior Test Engineer

Approved By

(Line Chen)
Engineer Manager

The test results relate only to the samples test.
This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2014. Test results reported herein relate only to the item(s) tested.
The test report shall not be reproduced except in full without the written approval of Fangguang Inspection & Testing Co. Ltd
The test report must not be used by the client to claim product certifications, approval, or endorsement by NVLAP, NIST or any agency of U.S. Government.

Revision History

Report No.	Version	Description	Issue Date
S20241010265301E04	Rev. 01	/	12-xx-2024

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Description Page

1. General Information

Applicant:	L&S Lighting Equipment (Shanghai) Co.,Ltd
Applicant Address:	Building NO.1,Lane 255 Longpan Road,Malu Town, Jiading District ;Shanghai China
Manufacturer:	L&S Lighting Equipment (Shanghai) Co.,Ltd
Manufacturer Address:	Building NO.1,Lane 255 Longpan Road,Malu Town, Jiading District ;Shanghai China
Factory:	Suzhou KainengJingxin Electronics Co.,LTD
Factory Address:	Building 7, Group 28, Anhu Village, Hengfan Street, East Taihu Lake Ecotourism Resort (Taihu New Town), Wujiang District, Suzhou City
Test Site:	Fangguang Inspection & Testing Co. Ltd
Lab ID:	CN5037
Test Site Address:	No.8 Ningyun Rd., Xinwu District Wuxi,Jiangsu 214000 China
Test Device Serial No.:	N/A ☐ Production ☒Pre-Production ☐ Engineering

2. INTRODUCTION

2.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

2.2. Fangguang Test Location

These measurement tests were performed at the Fangguang Inspection and testing Co.,Ltd. located at No.8 Ningyun Rd., Xinwu District Wuxi,Jiangsu 214000 China. The detailed description of the measurement facility was found to be in compliance with the requirements of ANSI C63.4-2014.

3. PRODUCT INFORMATION

3.1. Equipment Description

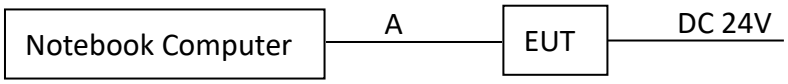
Product Name:	matter controller
Main Test Model:	LITE MT
Additional Model:	LITE MT RP; LITE BT1
Model Description:	LITE MT, LITE MT RP and LITE BT1 are identical to each other in all aspects, Schematic, Hardware version, structure and internal photos are same, only different as below: LITE MT RP has a reverse polarity of output terminal compared to LITE MT. LITE BT1 has a updated software compared to LITE MT.
Trade Mark:	L&S
Input Voltage Range:	DC 24V 6.25A
Wi-Fi Specification:	802.11b/g/n-HT20/n-HT40
Bluetooth Version:	5.1
Software Version:	1.10
Hardware Version:	1.0
Note:	This information is provided by the Customer and its authenticty is the responsibility of the Customer.

3.2. Configuration of Tested System

The **matter controller** was tested per the guidance FCC CFR Title 47 Part 15 Subpart B and ANSI C63.4: 2014 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

3.3. Test Mode

Test Mode	
EMI Mode	Mode 1: operation in BLE/WiFi mode, power supply by DC 24V

Connection Diagram (Mode 1)	
	
Signal Cable Type	
A	Serial port board

3.4. Description of Auxiliary Equipment

The types for all equipments, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product		Manufacturer	Model No.	Serial No.	Power Cord
1	Notebook Computer	Dell	/	/	/
2	Serial port board	/	/	/	/

3.5. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

3.6. Calculation with all conversion and correction factors used

For AC Line Conducted Emissions Test:

Measure Level (dBμV) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB)

For Radiated Emissions Below 1GHz Test:

Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m).

For Radiated Emissions Above 1GHz Test:

Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB).

4. DESCRIPTION OF TEST

4.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical Equipment in the Range of 9kHz to 18GHz (ANSI C63.4-2014) was used in the measurement of the **matter controller.**

Deviation from measurement procedure…….....None

4.2. AC Line Conducted Emissions

The line-conducted facility is located inside an shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150 kHz to 30 MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or resolution, clock or data exchange speed, scrolling H pattern to the EUT and/or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site.

4.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30 MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30 MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 0.8 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB beam-width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

5. LIST OF USED TEST EQUIPMENT

Conducted Emissions

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR3	FWXGJC-2016-181	1 year	2025/03/07
Two-Line V-Network	R&S	ENV 216	FWXGJC-2016-182	1 year	2025/04/28
Thermohygrometer	Yuhuaze	HTC-1	FWXDA-2016-385	1 year	2025/02/25

Radiated Emission

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Bi-Log Antenna	R&S	HL562E	FWXGJC-2016-267-06	1 year	2025/03/02
Broadband Horn Antenna	R&S	HF907	FWXGJC-2016-267-07	1 year	2025/07/26
EMI Receiver	R&S	ESR26	FWXGJC-2016-267-01	1 year	2025/07/26
Pre-Amplifier	R&S	SCU-18D	FWXGJC-2016-267-05	1 year	2025/07/23
Hygrothermograph	Mittel	HTC-1	FWXDA-2016-386	1 year	2025/02/25
Anechoic Chamber	Aimuke	EMCCT-3	FWXGJC-2016-270	3 year	2026/04/05

Test Software	Manufacturer	Version	Asset No.	Function
EMI Test Software	tonscend	V2.5.2.4	FWXWA-2018-004	RE
EMC32	R&S	9.26.00	/	CE

6. MEASUREMENT UNCERTAINTY

Where relevant, the following test 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.

AC Conducted Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 2.68dB
Radiated Emission Measurement(Below 1GHz)
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 4.01dB
Radiated Emission Measurement(1GHz~18GHz)
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 4.97dB
Radiated Emission Measurement(18GHz~40GHz)
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 5.32dB

7. TEST RESULT

7.1. Summary

FCC Part Section(s)	Test Description	Test Result
FCC CFR Title 47 Part 15 Subpart B 15.107, ANSI C63.4: 2014	Conducted Emissions	NA
FCC CFR Title 47 Part 15 Subpart B 15.109, ANSI C63.4: 2014	Radiated Emissions	Pass

7.2. Conducted Emission Measurement

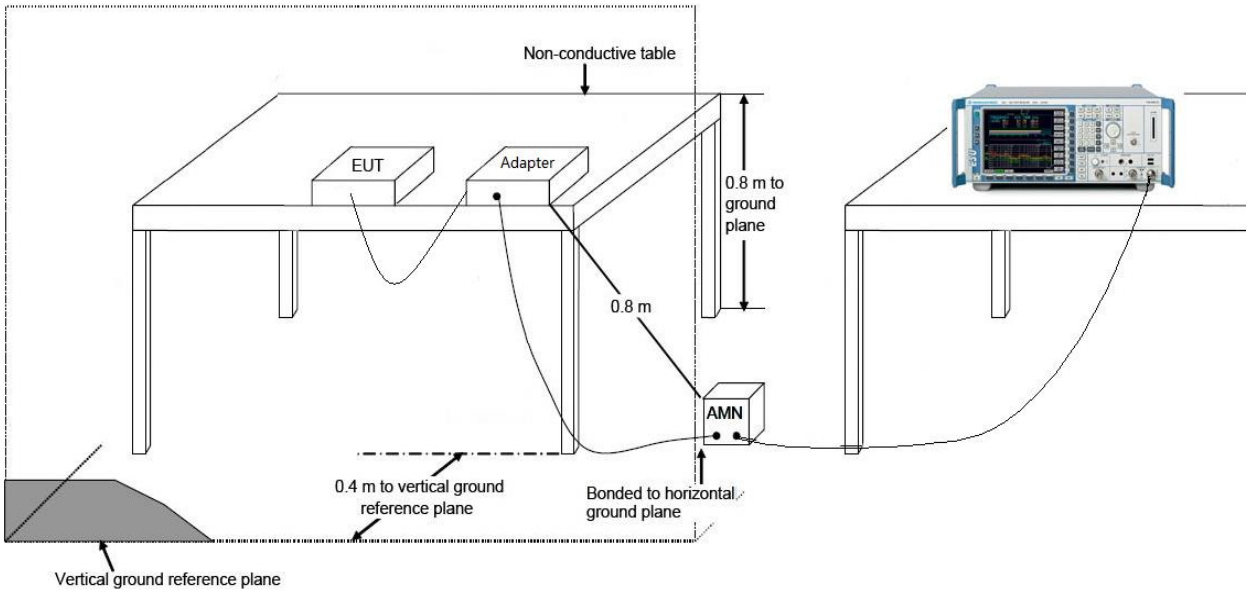
7.2.1.Test Limit

FCC Part 15.107 Class B Limits		
Frequency (MHz)	QP (dBμV)	AV (dBμV)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

7.2.2.Test Setup



7.2.3.Test Result of Conducted Emissions

Not Applicable. The device is only powered by DC 24V.

7.3. Radiated Emission Measurement

7.3.1.Test Limit

FCC Part 15.109 Class B Limits		
Frequency (MHz)	Distance (m)	Level (dBμV/m)
30 - 88	3	40
88 - 216	3	43.5
216 - 960	3	46
Above 960	3	54

Note 1: The lower limit shall apply at the transition frequency.

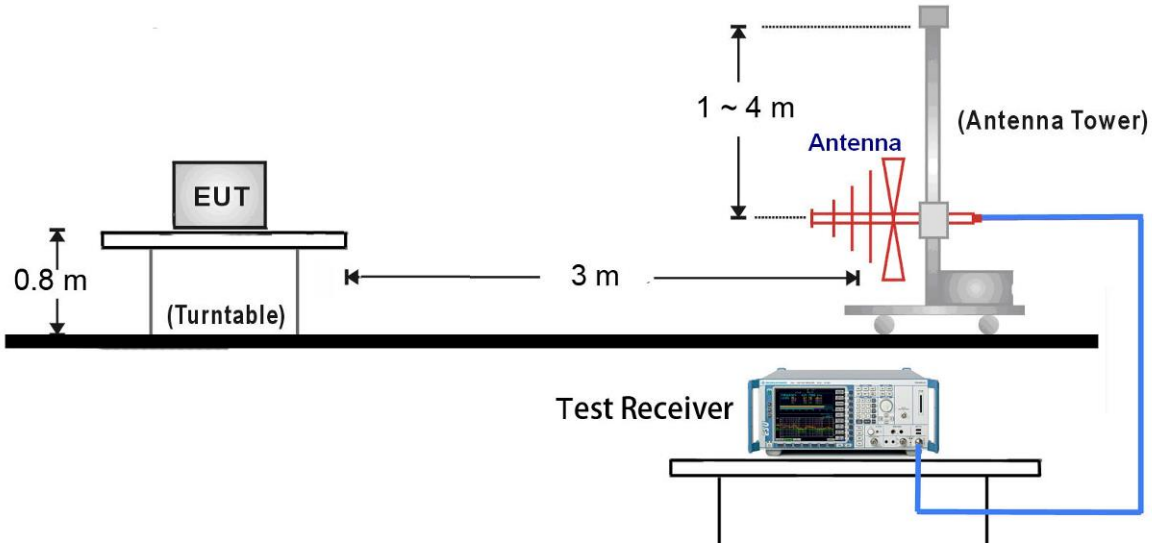
Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

Note 3: E field strength (dBμV/m) = 20 log E field strength (uV/m)

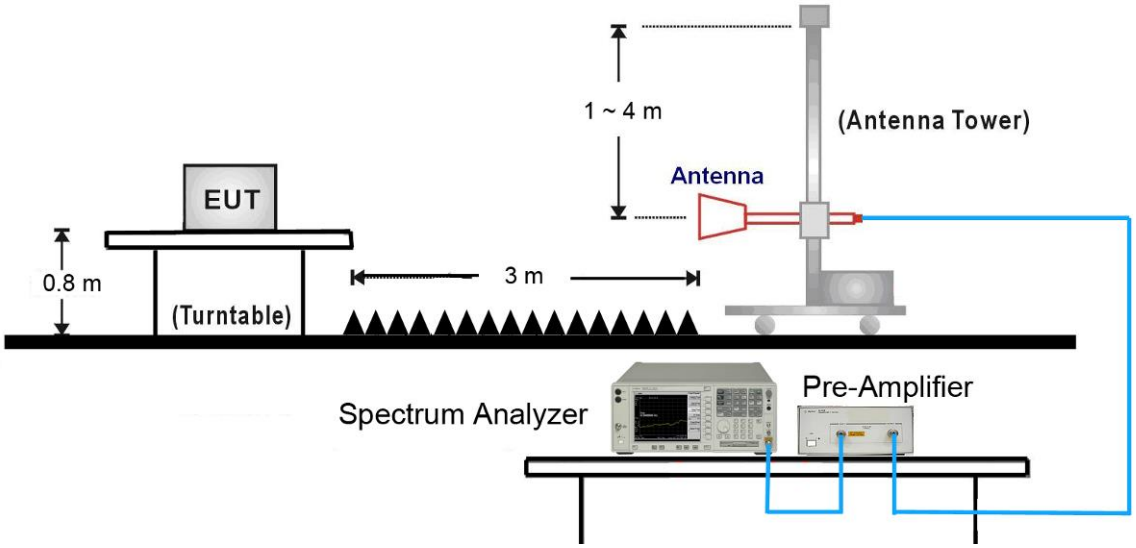
Note 4: On any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

7.3.2.Test Setup

30MHz ~ 1GHz Test Setup:



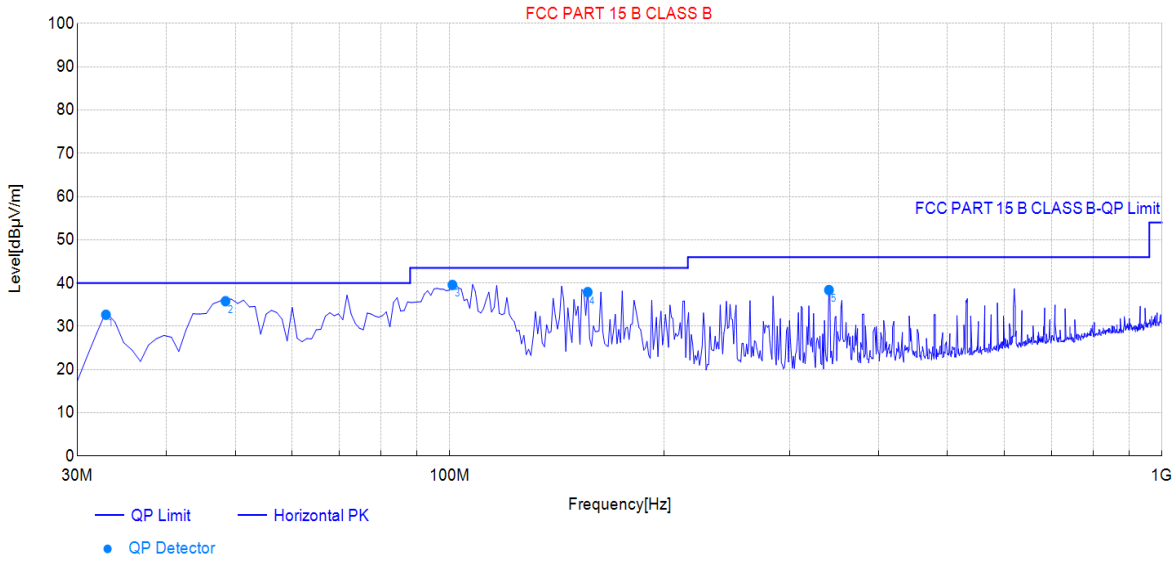
1GHz ~18GHz Test Setup:



7.3.3.Test Result of Radiated Emissions

EUT:	matter controller	Polarity:	Horizontal
Model:	LITE MT	Power Supply:	DC 24V
Environment:	Temp: 18.5℃; Humi:49%	Engineer:	Hongyuan Wang
Remark	Operation Mode: Mode 1		

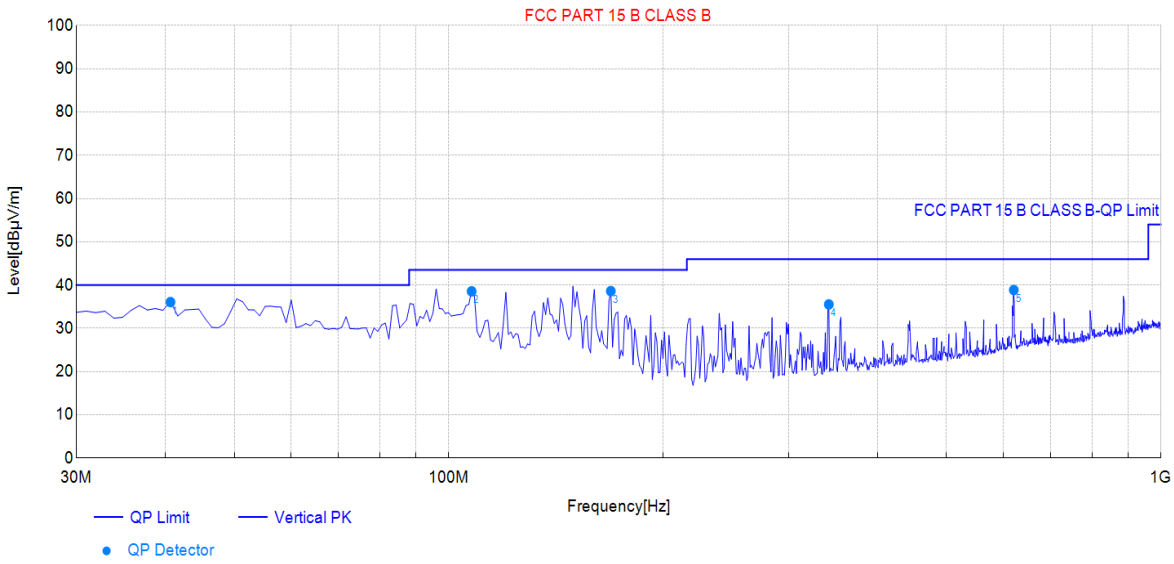
Test Graph



Final Data List								
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	32.91	14.05	32.68	40.00	7.32	100	360	Horizontal
2	48.45	14.54	35.81	40.00	4.19	200	26	Horizontal
3	100.88	11.61	39.57	43.50	3.93	200	86	Horizontal
4	156.23	15.71	37.91	43.50	5.59	200	262	Horizontal
5	340.71	16.15	38.39	46.00	7.61	100	321	Horizontal

EUT:	matter controller	Polarity:	Vertical
Model:	LITE MT	Power Supply:	DC 24V
Environment:	Temp: 18.5℃; Humi:49%	Engineer:	Hongyuan Wang
Remark	Operation Mode: Mode 1		

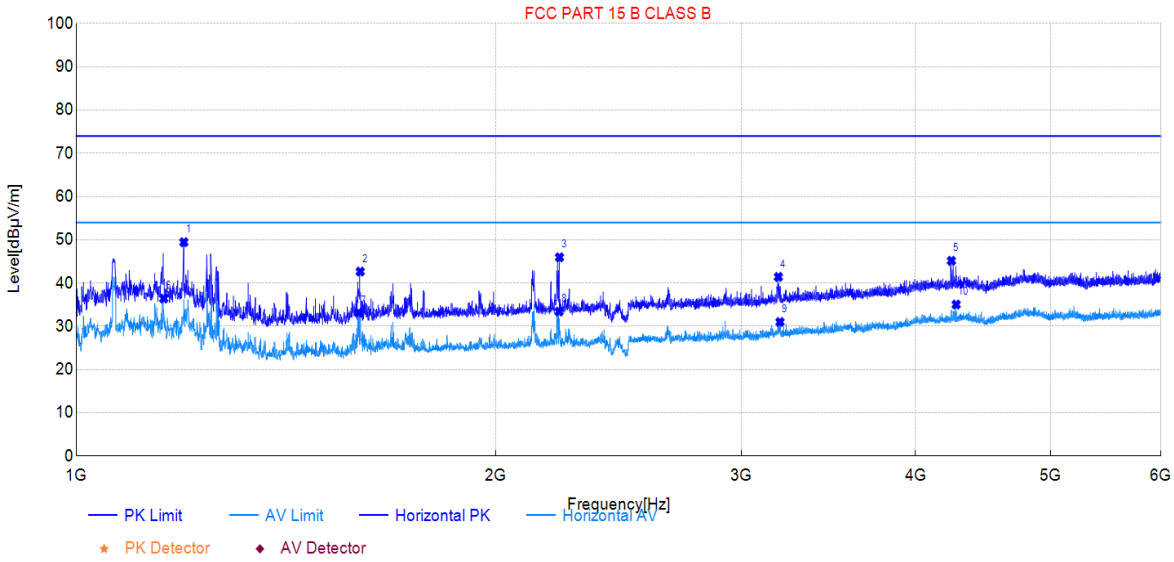
Test Graph



Final Data List								
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	40.68	14.88	36.08	40.00	3.92	100	328	Vertical
2	107.68	12.39	38.56	43.50	4.94	100	262	Vertical
3	168.85	14.80	38.61	43.50	4.89	100	358	Vertical
4	341.68	16.16	35.53	46.00	10.47	100	187	Vertical
5	621.32	21.97	38.87	46.00	7.13	100	76	Vertical

EUT:	matter controller	Polarity:	Horizontal
Model:	LITE MT	Power Supply:	DC 24V
Environment:	Temp: 18.5℃; Humi:49%	Engineer:	Hongyuan Wang
Remark	Operation Mode: Mode 1		

Test Graph

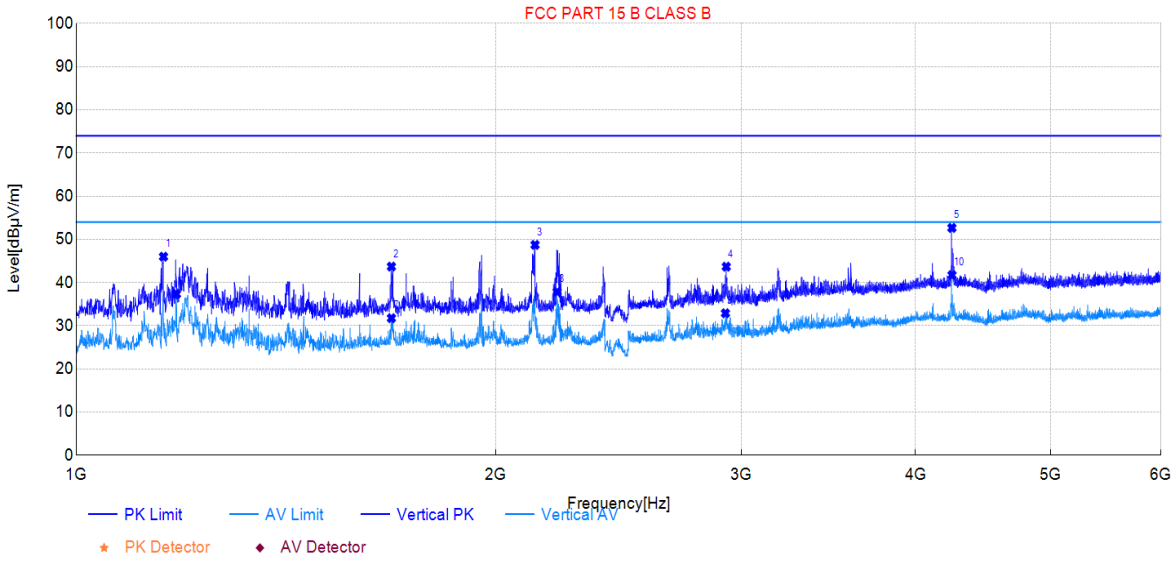


Suspected Data List

NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1194.52	49.45	-23.48	74.00	24.55	100	130	Horizontal
2	1598.56	42.65	-21.10	74.00	31.35	100	21	Horizontal
3	2221.62	45.95	-17.13	74.00	28.05	100	81	Horizontal
4	3189.22	41.42	-13.66	74.00	32.58	100	75	Horizontal
5	4244.32	45.15	-7.83	74.00	28.85	100	81	Horizontal
6	1155.52	36.42	-23.62	54.00	17.58	100	92	Horizontal
7	1594.56	33.12	-21.12	54.00	20.88	100	136	Horizontal
8	2220.12	33.41	-17.13	54.00	20.59	100	97	Horizontal
9	3197.72	30.99	-13.62	54.00	23.01	100	305	Horizontal
10	4277.83	35.03	-7.69	54.00	18.97	100	86	Horizontal

EUT:	matter controller	Polarity:	Vertical
Model:	LITE MT	Power Supply:	DC 24V
Environment:	Temp: 18.5℃; Humi:49%	Engineer:	Hongyuan Wang
Remark	Operation Mode: Mode 1		

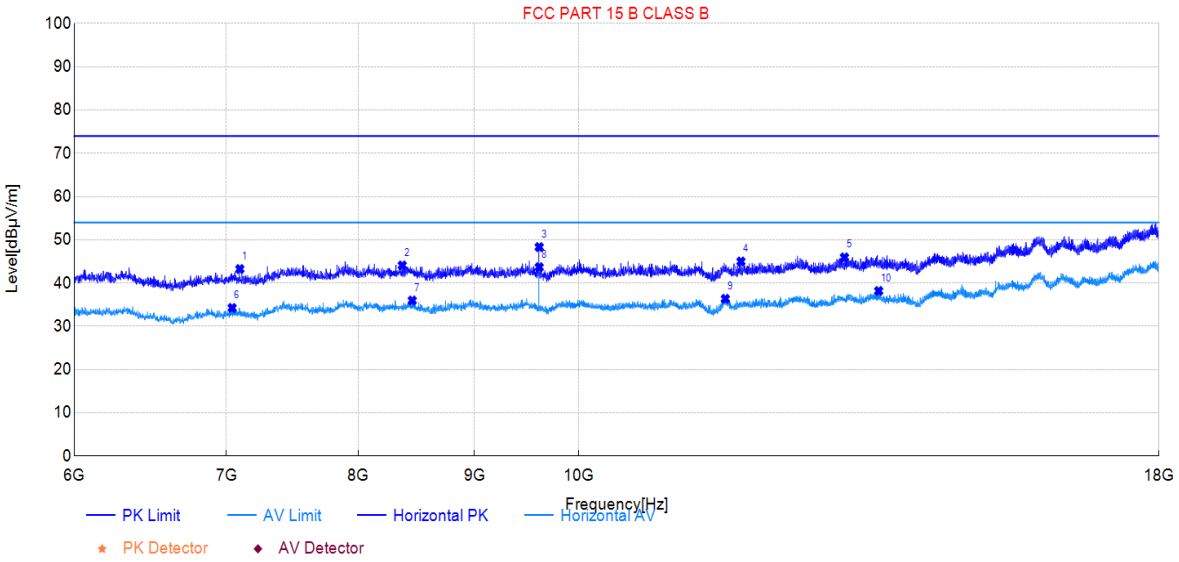
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1155.02	45.99	-22.62	74.00	28.01	100	135	Vertical
2	1683.07	43.70	-19.81	74.00	30.30	100	263	Vertical
3	2133.61	48.72	-17.29	74.00	25.28	100	124	Vertical
4	2926.19	43.68	-14.57	74.00	30.32	100	360	Vertical
5	4247.82	52.66	-7.81	74.00	21.34	100	80	Vertical
6	1180.02	37.34	-22.54	54.00	16.66	100	124	Vertical
7	1683.07	31.75	-19.81	54.00	22.25	100	162	Vertical
8	2213.12	37.85	-17.06	54.00	16.15	100	102	Vertical
9	2922.19	32.89	-14.58	54.00	21.11	100	97	Vertical
10	4248.32	41.73	-7.80	54.00	12.27	100	80	Vertical

EUT:	matter controller	Polarity:	Horizontal
Model:	LITE MT	Power Supply:	DC 24V
Environment:	Temp: 18.5℃; Humi:49%	Engineer:	Hongyuan Wang
Remark	Operation Mode: Mode 1		

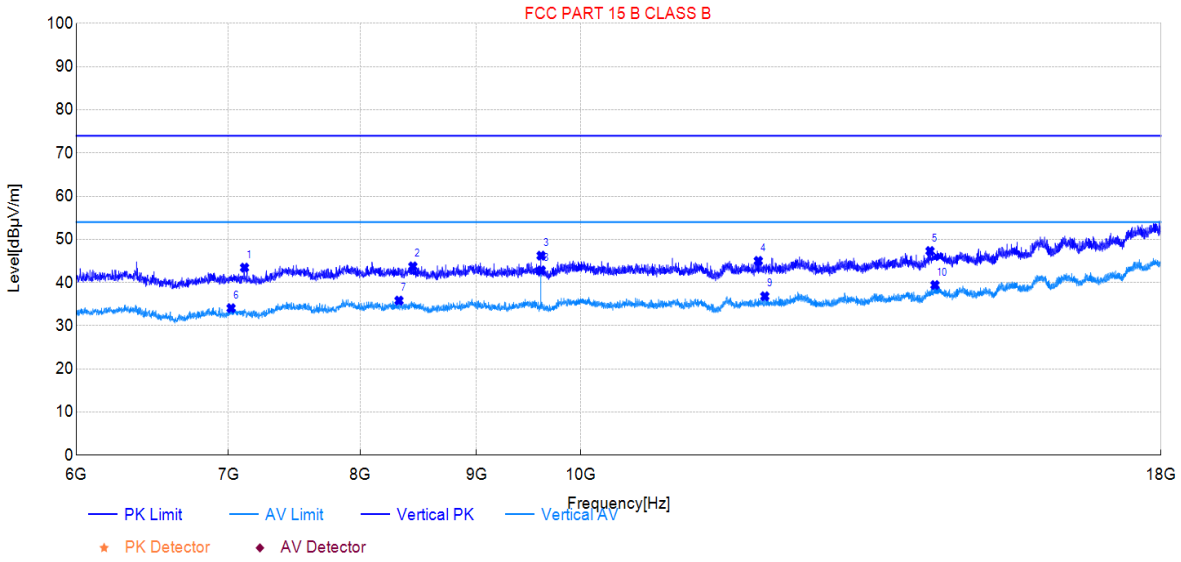
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	7095.71	43.24	-4.24	74.00	30.76	100	85	Horizontal
2	8364.24	44.09	-1.06	74.00	29.91	100	0	Horizontal
3	9608.76	48.32	-0.30	74.00	25.68	100	28	Horizontal
4	11786.98	44.99	1.21	74.00	29.01	100	231	Horizontal
5	13090.31	45.94	2.86	74.00	28.06	100	355	Horizontal
6	7040.50	34.25	-4.59	54.00	19.75	100	283	Horizontal
7	8449.44	35.97	-1.30	54.00	18.03	100	260	Horizontal
8	9608.76	43.67	-0.30	54.00	10.33	100	91	Horizontal
9	11602.16	36.36	1.48	54.00	17.64	100	11	Horizontal
10	13551.16	38.17	3.21	54.00	15.83	100	0	Horizontal

EUT:	matter controller	Polarity:	Vertical
Model:	LITE MT	Power Supply:	DC 24V
Environment:	Temp: 18.5℃; Humi:49%	Engineer:	Hongyuan Wang
Remark	Operation Mode: Mode 1		

Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	7114.91	43.45	-4.21	74.00	30.55	100	206	Vertical
2	8437.44	43.74	-1.22	74.00	30.26	100	156	Vertical
3	9607.56	46.23	-0.17	74.00	27.77	100	152	Vertical
4	11971.80	45.01	1.42	74.00	28.99	100	190	Vertical
5	14246.02	47.30	4.78	74.00	26.70	100	100	Vertical
6	7018.90	34.06	-4.74	54.00	19.94	100	5	Vertical
7	8319.83	35.82	-1.13	54.00	18.18	100	329	Vertical
8	9608.76	42.82	-0.19	54.00	11.18	100	152	Vertical
9	12051.01	36.82	1.52	54.00	17.18	100	167	Vertical
10	14316.83	39.42	5.37	54.00	14.58	100	106	Vertical

8. CONCLUSION

The data collected relate only the item(s) tested and show that the **matter controller** has been tested to comply with the requirements specified in §15.107 / §15.109 of the FCC CFR Title 47 Part 15 Subpart B.

9. APPENDIX A. PHOTOGRAPHS OF EUT

Photo 1: General view

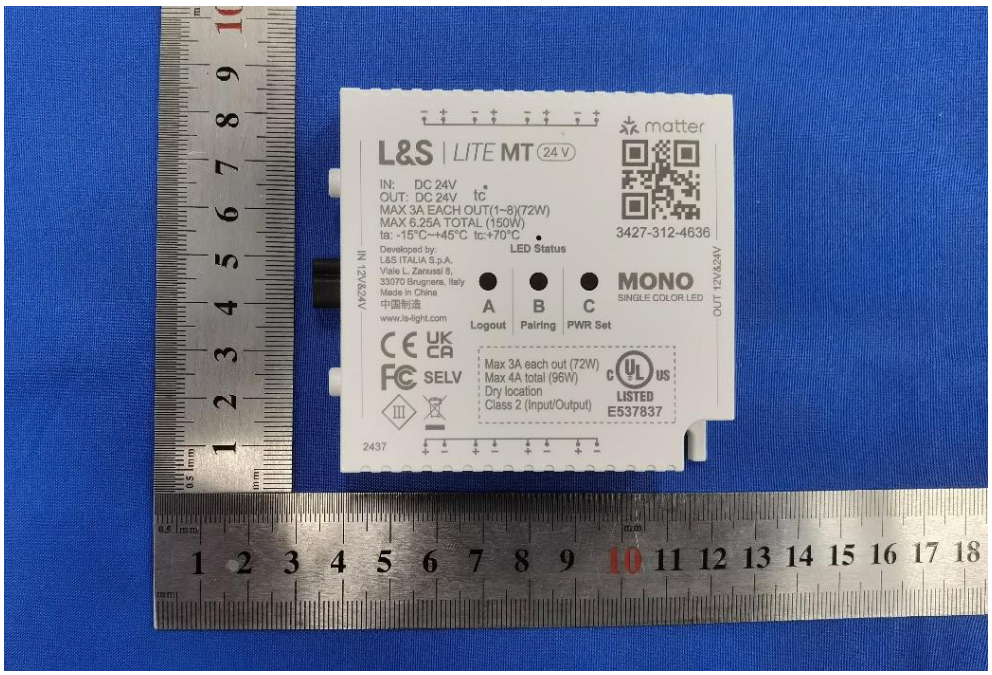


Photo 2: The product view

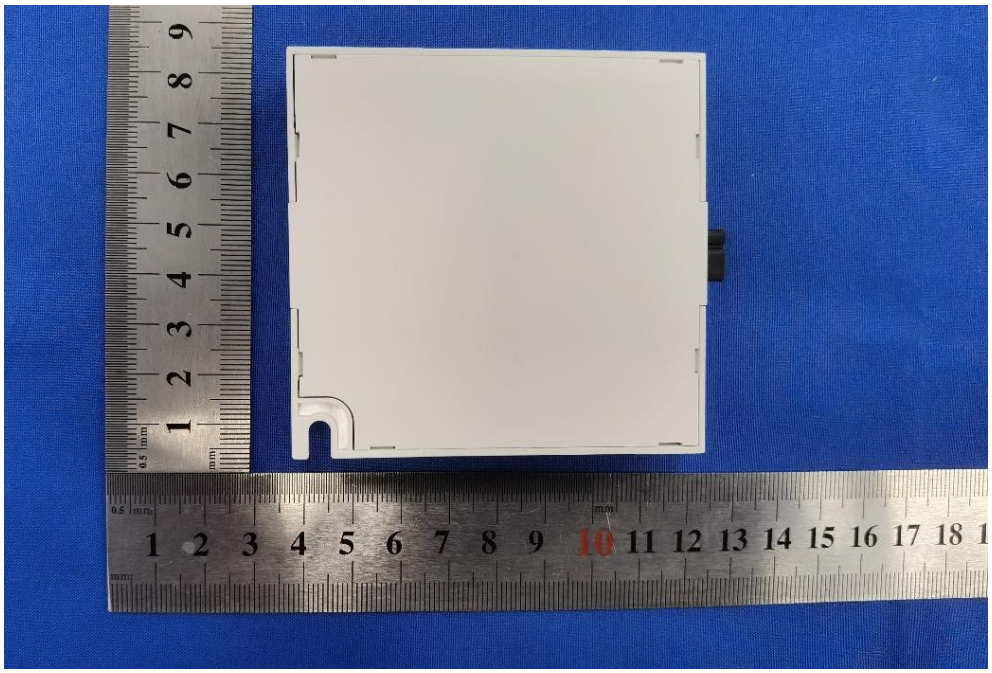


Photo 3: The product view

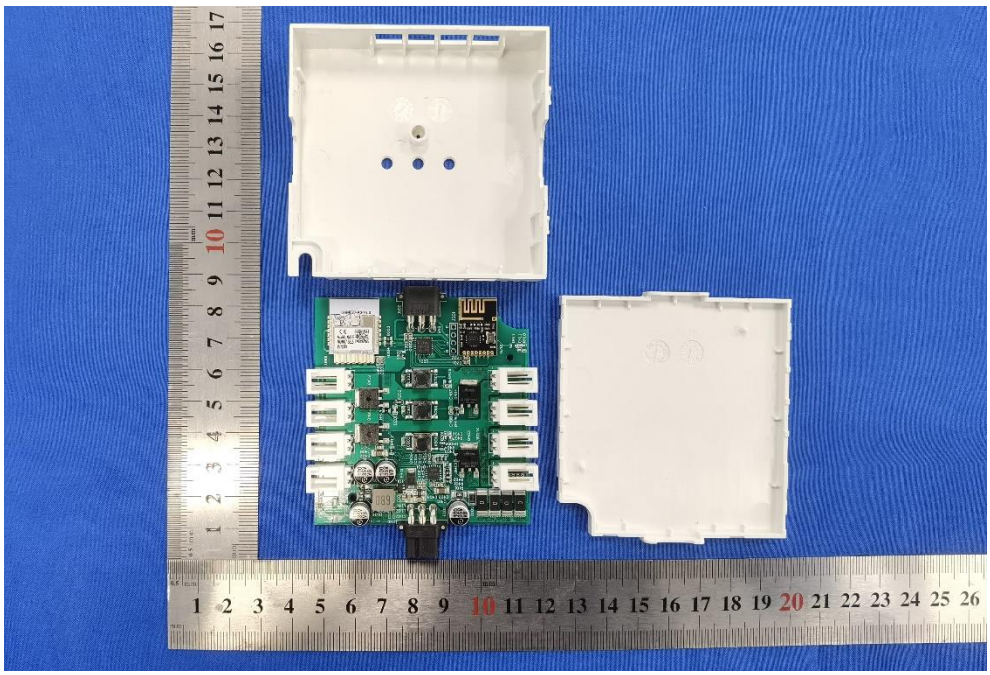


Photo 4: Internal View

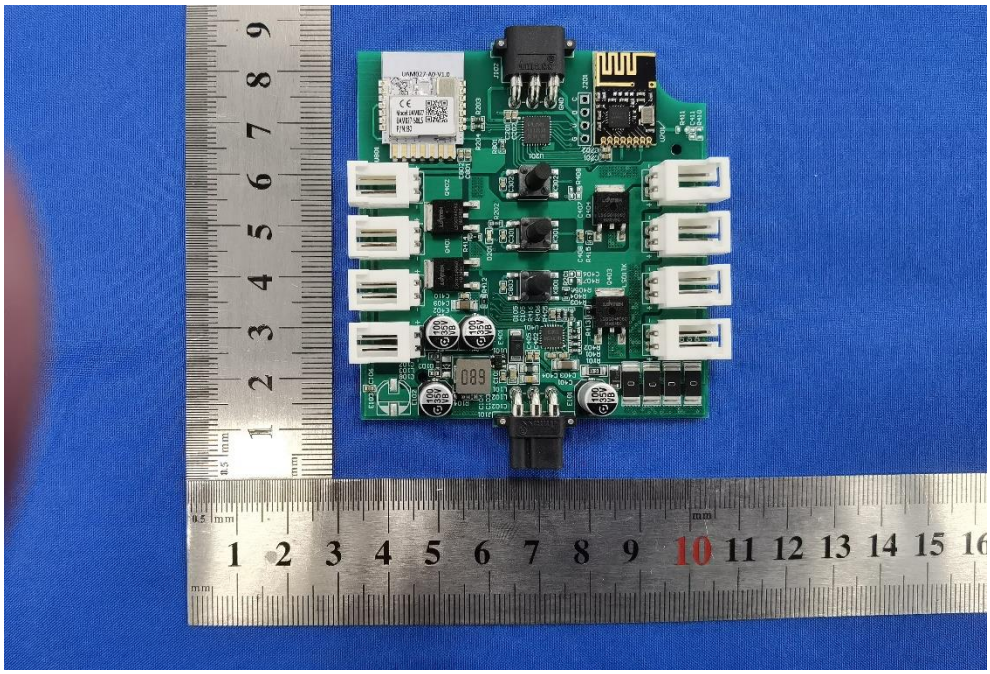


Photo 5: Internal View for PCB

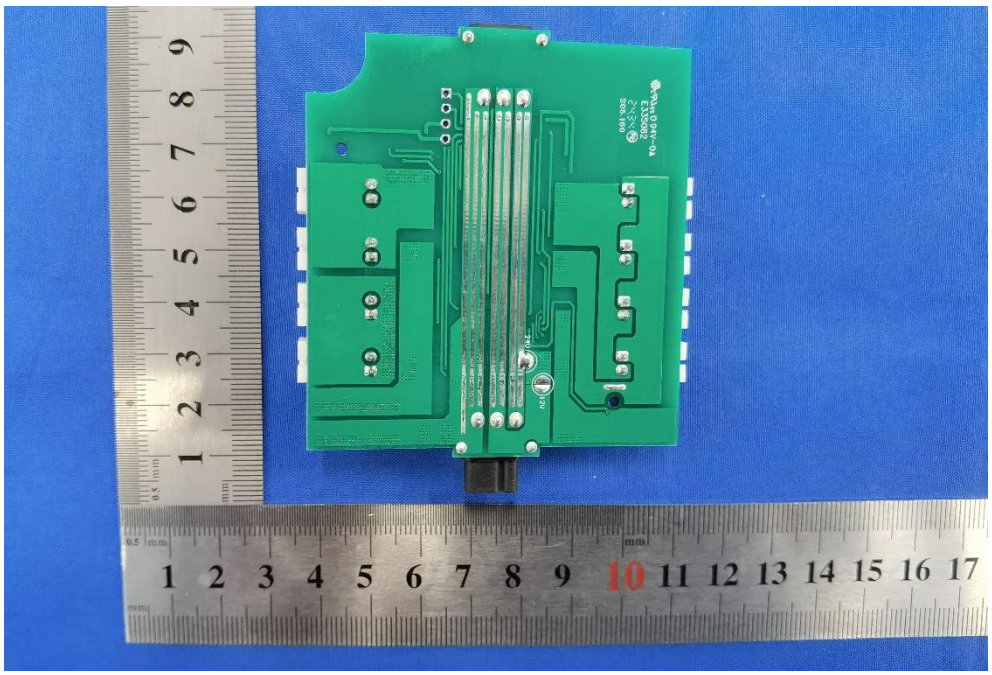
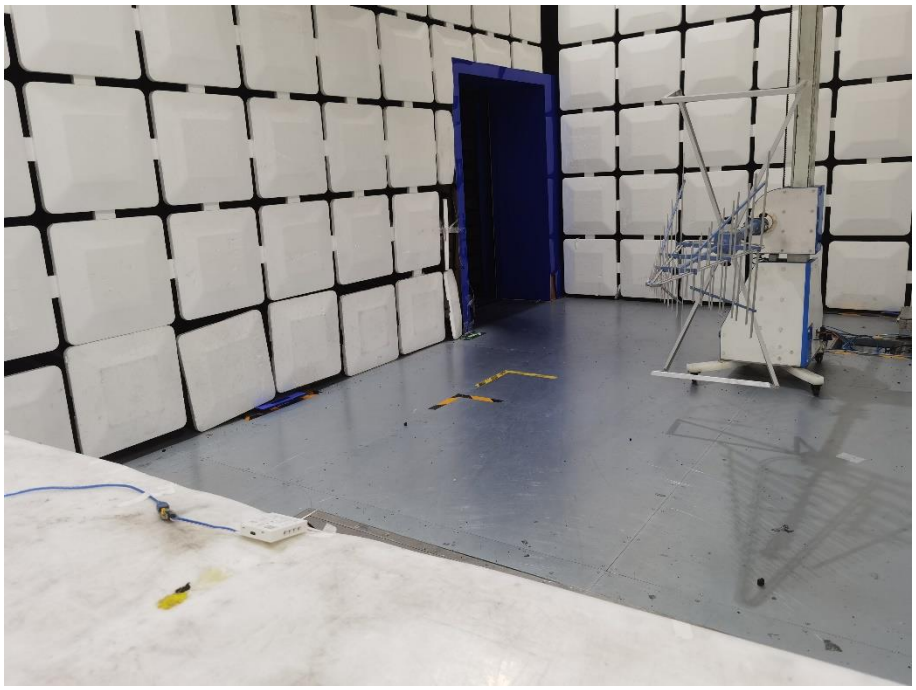
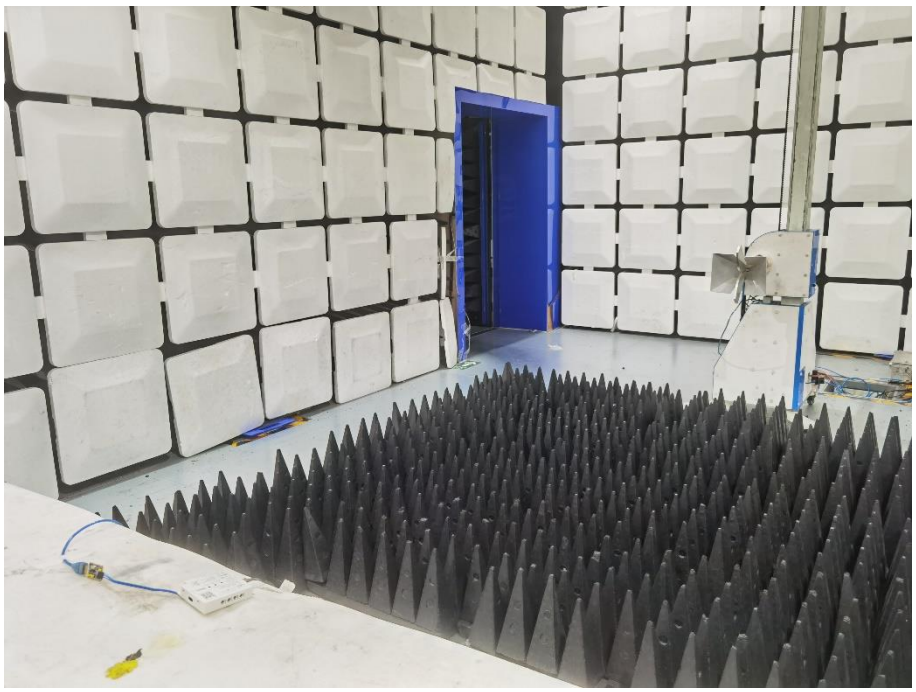


Photo 6: Internal View for PCB

10. APPENDIX B: PHOTOGRAPH OF THE TEST ARRANGEMENT



RE (30M~1GHz)



RE (1G~18GHz)

The End