EMC TEST REPORT

Applicant	:	Guangzhou Felicity Solar Technology Co., Ltd.
Address	:	No.2, Donghua Huaye Road, Renhe Town, Baiyun Area, Guangzhou
Manufacturer	:	Guangzhou Felicity Solar Technology Co., Ltd.
Address	:	No.2, Donghua Huaye Road, Renhe Town, Baiyun Area, Guangzhou
Factory	:	Guangzhou Felicity Solar Technology Co., Ltd.
Address	:	No.2, Donghua Huaye Road, Renhe Town, Baiyun Area, Guangzhou
Product Name	:	Lithium iron phosphate battery
Brand Name	:	Felicitysolar
Model No.	:	FLA48250-EU
Standard	:	EN IEC 61000-6-1:2019 EN IEC 61000-6-2:2019 EN IEC 61000-6-3:2021 EN IEC 61000-6-4:2019
Date of Receiving Samples	:	Refer to page 4 of the report
Date of Test	:	Refer to page 4 of the report
Date of Report	:	May 12, 2025

This Test Report is Issued Under the Authority of :

Prepared by

Leo Xiao

Leo Xiao / Engineer

Approved & Authorized Signer

Han Song / Authorized Signatory

This report shows that above equipment is technically compliant with the requirements of the standards above. All test results in this report apply only to the tested sample(s). Without prior written approval of Shenzhen Nore Testing Center Co., Ltd, this report shall not be reproduced except in full.

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Shenzhen, Guangdong, 518057, China

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Revision History of This Test Report

Report Number	Description	Issued Date
SZNTC2403197EV00	Initial Issue	2024-04-16
SZNTC2408084EV00	Derivative version 1	2024-08-19
SZNTC2408084EV01	Derivative version 2	2025-01-16
SZNTC2505016EV00	Derivative version 3	2025-05-12
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Derivative version 1:
1. This report is a derivative version. The original report number was SZNTC2403197EV00. Compared to the original report, the new report changes the applicant, manufacturer, factory, product name, model, and trademark.

2. Through the evaluation of the above differences, there is no need to retest. All the data is from the original report.

Derivative version 2:
1. This report is a derivative version. The original report number was SZNTC2408084EV00. Compared to the original report, the new report changes the product name.

2. Through the evaluation of the above differences, there is no need to retest. All the data is from the original report.

Derivative version 3:
1. This report is a derivative version. The original report number was SZNTC2408084EV01. Compared to the original report, the new report changes the product model.

2. Through the evaluation of the above differences, there is no need to retest. All the data is from the original report.

1. SUMMARY OF TEST RESULTS

The E.U.T. has been tested according to the following specifications:

EMISSION			
Standard	**Test Type**	**Verdict**	**Remarks**
EN IEC 61000-6-3:2021 EN IEC 61000-6-4:2019	Conducted Emission Measurement	N/A	See note 1
	Radiated Emission Measurement	PASS	Meet the requirements of the Residential Environment Limit
EN IEC 61000-3-2:2019+ A1:2021 EN 61000-3-12:2011	Harmonic current emission Measurement	N/A	See note 3
EN 61000-3-3:2013+ A1:2019+A2:2021 EN IEC 61000-3-11:2019	Voltage Fluctuations & Flicker Measurement	N/A	See note 3
IMMUNITY (EN IEC 61000-6-2:2019)			
Basic Standard	**Test Type**	**Verdict**	**Results (Performance Criterion)**
IEC 61000-4-2:2008	Electrostatic Discharge Test	PASS	A
IEC 61000-4-3:2006+ A1:2007+A2:2010	Radio-Frequency Electromagnetic Field Test	PASS	A
IEC 61000-4-4:2012	Fast Transients Test	PASS	A
IEC 61000-4-5:2005	Surges Test	N/A	See note 1
IEC 61000-4-6:2013	Radio-Frequency Common Mode Test	PASS	A
IEC 61000-4-8:2009	Power-Frequency Magnetic Field Test	N/A	See note 2
IEC 61000-4-11:2004 IEC 61000-4-34:2005+ A1:2009	Voltage dips and Interruptions Test	N/A	See note 3
Note: 1: The device is used with an inverter, MPPT charger or UPS, so there is no need to evaluate the DC Port. 2: Applicable only to equipment containing devices susceptible to magnetic fields. 3: Only applicable to AC power supply devices.			

2. TEST UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the Product 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.

Test item	Uncertainty
Radiated Emission Measurement (30-1000MHz)	3.9dB
Remark: As U_{lab} in all applicable tests listed above are less than U_{cispr} according to CISPR16-4-2, compliance is deemed to occur if no measured disturbance exceeds the disturbance limit; non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.	

3. GENERAL INFORMATION

3.1. Product Information

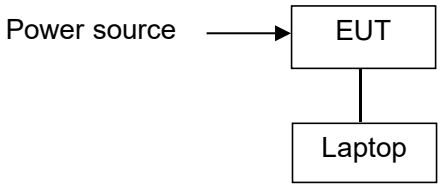
Product Name:	Lithium iron phosphate battery
Model No.:	FLA48250-EU
Classification of Equipment:	Such equipment would fulfill the tighter emission requirements of the residential environment as well as the severe immunity requirements of the industrial environment.
Highest internal frequency:	Below 108 MHz (Highest internal frequency below 108MHz, radiation test frequency range 30MHz-1000MHz)
Typical arrangement:	Tabletop
Rating:	Model: FLA48250-EU Nominal Voltage: 51.2V Energy: 15kWh Operating Voltage: 44.8-57.6V Recommend Charge/Discharge Current: ≤150A Recommend Charge/Discharge Power: ≤7500W Scalability: Up to 15 units in parallel Communication: RS485 / CAN Cycle Life: ≥6,000@25°C,80%DOD Charging Temperature Range: 0-55°C Discharging Temperature Range: -20-55°C
Cable:	The communication line used in test is a shielded line which is a combination of USB to RS232 line, RS232 to RS485 converter and RS485 line. The USB to RS232 line is 1.5m length. The RS485 line is 2.08m length.
Sample No.:	SZNTC2403197EV00-001
Remark:	All the information above is provided by the manufacturer. More detailed feature of the EUT please refers to the user manual.

3.2. Description of Support Device

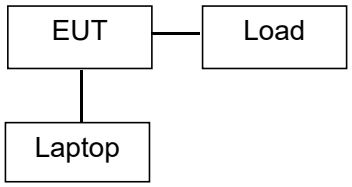
No.	Equipment	Manufacturer	M/N	S/N	Cable Specification
1	DC Source	ITECH	IT6018PV-1500-40	N/A	---
2	Laptop	Lenovo	XB-20210630LNPM	N/A	---

3.3. Block Diagram of Test Setup

Charging Mode:



Discharging Mode:



Remark: The dashed line indicates a power-off connection.

3.4. Test Mode

No.	Test Mode	Remark
1.	Charging Mode	Charged by Power source
2.	Discharging Mode	Connect cement resistor to discharge

3.5. Test Conditions

No.	Test Item	Test Mode	Test Voltage	Tested by	Remarks
1.	Conducted Emission - AC power input port	---	---	---	---
2.	Conducted Emission - AC power output port	---	---	---	---
3.	Conducted Disturbances - Wired network port or signal / control port	---	---	---	---
4.	Radiated Emission	1-2	DC 51.2V	LXJ	See note 1, 4
5.	Harmonic Current Emission	---	---	---	---
6.	Voltage Fluctuations & Flicker	---	---	---	---
7.	Electrostatic Discharges (ESD)	1-2	DC 51.2V	CRB	See note 2, 4
8.	Radio-Frequency Electromagnetic Field	1-2	DC 51.2V	Chance	See note 1, 4
9.	Fast transients test	1-2	DC 51.2V	CRB	See note 1, 4
10.	Surges	---	---	---	---
11.	Radio-Frequency Common Mode Test	1-2	DC 51.2V	Chance	See note 1, 4
12.	Power Frequency Magnetic Field	---	---	---	---
13.	Voltage dips and interruptions	---	---	---	---

Note:
1. The testing climatic conditions for temperature, humidity, and atmospheric pressure are within: 15~35°C, 30~70%, 86~106kPa.
2. The testing climatic conditions for temperature, humidity, and atmospheric pressure are within: 15~35°C, 30~60%, 86~106kPa.
3. Only the worst data were recorded on the report.
4. Only the most stringent limits were recorded on the report.
（This product is suitable for industrial environment, also suitable for residential environment, we use most stringent standards EN IEC 61000-6-3 and EN IEC 61000-6-2 for testing.）

3.6. Sample Calculations

Conducted Emission						
Freq. (MHz)	**Factor (dB/m)**	**Reading (dBuV)**	**Level (dBuV)**	**Limit (dBuV)**	**Margin (dB)**	**Detector**
0.2260	11.56	12.50	24.06	66.00	-41.94	AVG

Where,
Freq. = Emission frequency in MHz
Reading = Spectrum Analyzer/Receiver Reading
Factor = Insertion loss of LISN + Cable Loss
Level = Reading + Factor
Limit = Limit stated in standard
Over = Level - Limit
Detector = Reading for Quasi-Peak / Average / Peak

Radiated Emission						
Freq. (MHz)	**Factor (dB/m)**	**Reading (dBuV)**	**Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Detector**
75.9773	-17.06	59.36	42.30	49.00	-6.70	QP

Where,
Freq. = Emission frequency in MHz
Reading = Spectrum Analyzer/Receiver Reading
Factor = Antenna Factor + Cable Loss - Pre-amplifier
Level = Reading + Factor
Limit = Limit stated in standard
Over = Margin, which calculated by Level - Limit
Detector = Reading for Quasi-Peak / Average / Peak

3.7. Test Facility

Test Site:	Shenzhen Nore Testing Center Co., Ltd.
Accreditations and Authorizations:	The Laboratory is accredited by CNAS (ILAC Member) according to ISO/IEC 17025:2017 with registration number L11038 and valid until May 17, 2030.
Test Site Location:	South, No. 1, Building 10, Maqueling Industrial Zone, Nanshan Shenzhen, Guangdong, 518057, China
Subcontractor:	Dongguan Nore Testing Center Co.,Ltd.
Site Location:	Building D, Gaosheng Science and Technology Park, Hongtu Road, Nancheng District, Dongguan City, Guangdong Province, China
Test Items:	Radio-Frequency Electromagnetic Field Radio-Frequency Common Mode Test
Remark:	The subcontractor is CNAS qualified.

3.8. Abnormalities from Standard Conditions

None.

4. MEASURING DEVICES AND TEST EQUIPMENT

4.1. For Radiated Emission Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
☒	Test Receiver	Rohde & Schwarz	ESPI-7	100006	Mar. 22, 2024	1 Year
☒	Loop Antenna	ZHINAN	ZN30900C	16036	Mar. 23, 2024	2 Year
☒	Composite logarithmic antenna	SCHWARZBECK	VULB 9163	1633	Mar. 23, 2024	2 Year
☒	Horn Antenna	SCHWARZBECK	BBHA 9120 D	01884	Mar. 23, 2024	2 Year
☒	Power Amplifier	HP	HP 8447D	2443A04646	Mar. 23, 2024	1 Year
☒	Power Amplifier	KSYET	PAM-118	443007	Mar. 22, 2024	1 Year
☒	Test Software	EZ	EZ-EMC (Ver. CT3A11)	N/A	N/A	N/A

4.2. For Electrostatic Discharge Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
☒	ESD Tester	HAEFELY	ONYX16	1811981	Mar. 23, 2024	1 Year

4.3. For Radio-Frequency Electromagnetic Field Test

(Dongguan Nore Testing Center Co., Ltd.)

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal. Interval	Cal. Interval
☒	Signal Generator	Agilent	N5181A	MY47070160	Mar. 13, 2024	1 Year
☒	RF Switch	SKET	N/A	N/A	N/A	N/A
☒	Power Amplifier	SKET	HAP801000M_250W	201804008	N/A	N/A
☒	Power Amplifier	SKET	HAP0103G_75W	201804009	N/A	N/A
☒	Power Amplifier	SKET	HAP0306G_50W	201804010	N/A	N/A
☒	Power Meter	Agilent	E4419B	GB40201469	Mar. 13, 2024	1 Year
☒	Power Sensor	Agilent	E9304A	MY41498919	Mar. 13, 2024	1 Year
☒	Power Sensor	Agilent	E9300A	US39211259	Mar. 13, 2024	1 Year
☒	E-Field Probe	Narda	EP-601	N/A	Mar. 23, 2024	1 Year
☒	Antenna	Schwarzbeck	STLP 9129	9129071	N/A	N/A
☒	Audio Analyzer	Rohde & Schwarz	UPV	100894	Mar. 13, 2024	1 Year
☒	Test Software	SKET	SKET_RS	N/A	N/A	N/A

4.4. For Fast Transients Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
☒	Burst Tester	HAEFELY	AXOS5	177723	Mar. 22, 2024	1 Year
☒	Coupling Clamp	HAEFELY	N/A	N/A	Mar. 22, 2024	1 Year
☒	Test Software	VNC	VNC Viewer 5.0.5	N/A	N/A	N/A

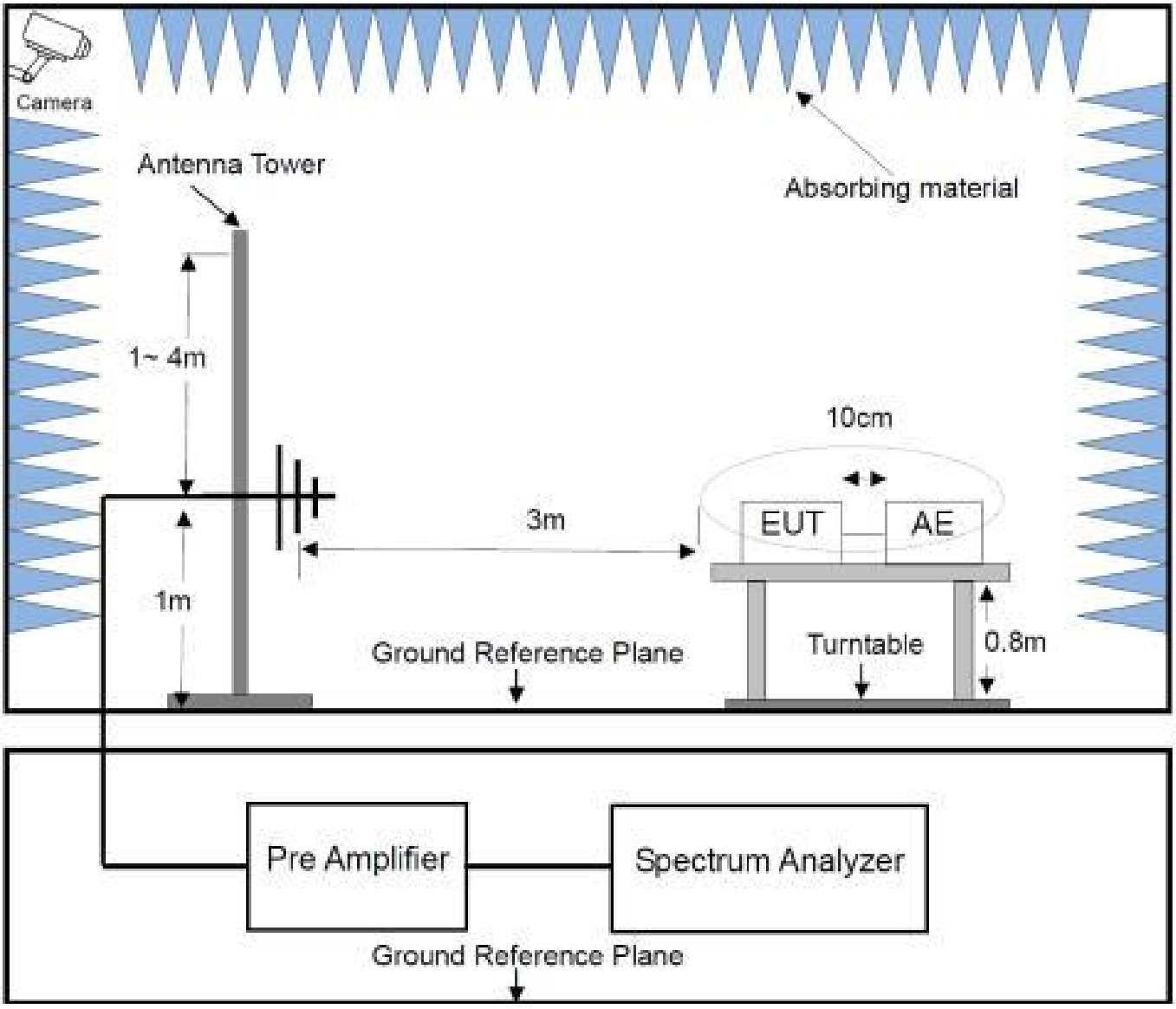
4.5. For Radio-Frequency Common Mode Test

(Dongguan Nore Testing Center Co., Ltd.)

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal. Interval	Cal. Interval
☒	Signal generator	IFR	2023A	2023051280	Mar. 13, 2024	1 Year
☒	Power Amplifier	SCHAFFNER	CBA9425	1022	N/A	N/A
☒	6dB 50Watt Attenuator	SCHAFFNER	ATN6025	N/A	Mar. 13, 2024	1 Year
☒	CDN	Lioncel	CDN-M3-16	0170703	Mar. 13, 2024	1 Year
☒	CDN	Lioncel	CDN-M2-16	0170708	Mar. 13, 2024	1 Year
☒	CDN	CDSI	ADN-M5/AF5	8105001	Mar. 13, 2024	1 Year
☒	EM Clamp	CDSI	EMCL-22	8192007	Mar. 13, 2024	1 Year
☒	Directional Coupler	SCHAFFNER	255	19184	Mar. 13, 2024	1 Year
☒	Audio Analyzer	Rohde & Schwarz	UPV	100894	Mar. 13, 2024	1 Year
☒	Test Software	EZ	EZ_CS	N/A	N/A	N/A

5. RADIATED EMISSION MEASUREMENT

5.1. Block Diagram of Test Setup



5.2. Limit of Radiated Emission Measurement

☒ Below 1 GHz:

Frequency range MHz	Quasi-peak limits dB(μV/m)		Distance (m)	Detector type / Bandwidth
	☒ Residential Environment	☐ Industrial Environment		
30 to 230	40	50	3	120 KHz
230 to 1000	47	57	3	120 KHz
Note: The lower limit shall apply at the transition frequency.				

☐ Above 1 GHz:

Frequency range MHz	☐ Residential Environment		☐ Industrial Environment		Distance (m)	Detector type / Bandwidth
	Peak limits dB(μV/m)	Average limits dB(μV/m)	Peak limits dB(μV/m)	Average limits dB(μV/m)		
1000 to 3000	70	50	76	56	3	1MHz
3000 to 6000	74	54	80	60	3	1MHz

Required highest frequency for radiated measurement

Highest internal frequency* (F_x)	Highest measured frequency
$F_x \leq 108$ MHz	1 GHz
108 MHz < $F_x \leq 500$ MHz	2 GHz
500 MHz < $F_x \leq 1$ GHz	5 GHz
$F_x > 1$ GHz	5 × F_x up to a maximum of 6 GHz
Note 1. F_x is highest fundamental frequency generated or used within the EUT or highest frequency at which it operates. 2. Where the F_x is not known, tests are performed up to 6 GHz.	

5.3. Test Procedure

a. The EUT was placed on a rotatable wooden table top 0.8m above ground.

b. The EUT was set 3m away from the receiving antenna which was mounted on the top of a variable height antenna tower.

c. Configure the EUT and support devices as per section 5.1.

d. All cables and support devices were positioned as per EN IEC 61000-6-3.

e. Connect mains power port of the EUT to the outlet socket under the turntable and connect all other support devices to other outlet socket under the turntable.

f. Turn on the EUT and all support devices, and make it run stably.

g. Set the detector and measurement bandwidth of test-receiver system as per EN IEC 61000-6-3.

h. Scan the frequency range from 30MHz to 1000MHz for radiation emissions checking.

i. Emissions were scanned and measured rotating the EUT from 0 to 360 degrees and positioning the antenna from 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.

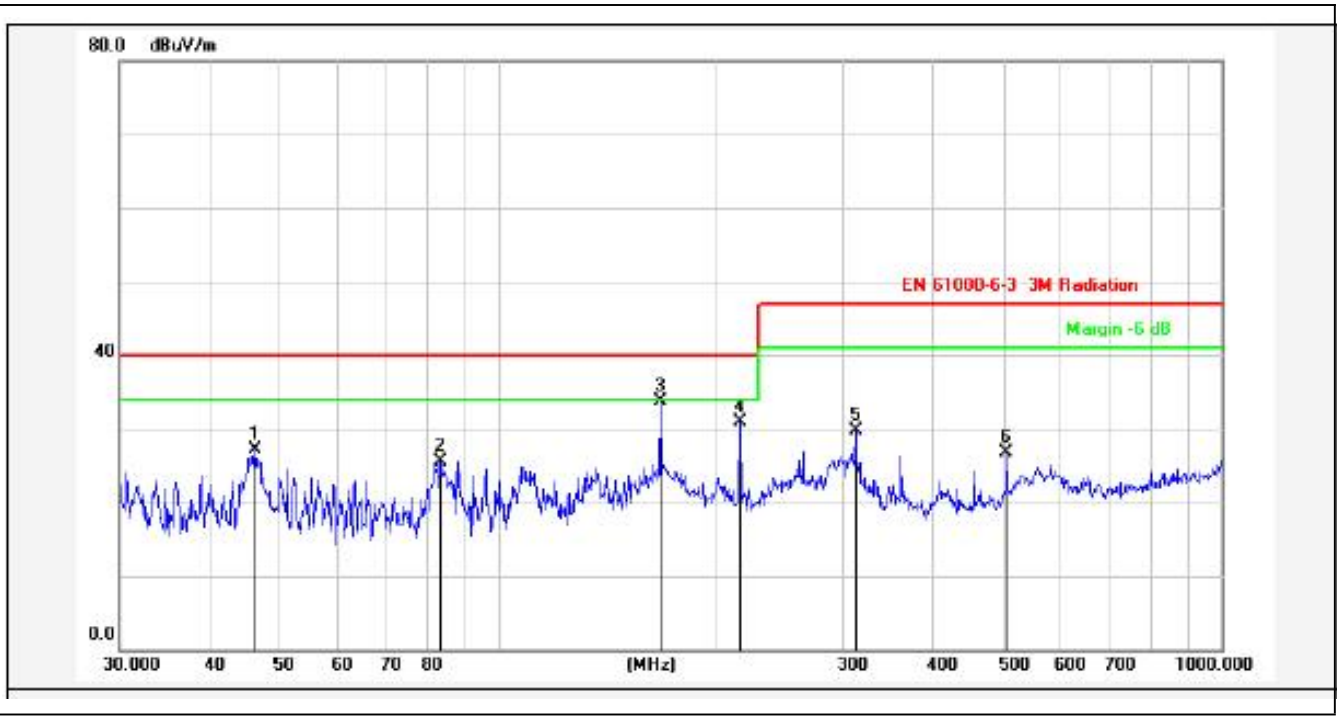
j. Repeat the above scans in each mode and channel and record the test data.

5.4. Test Results

PASS.

Please refer to the following pages.

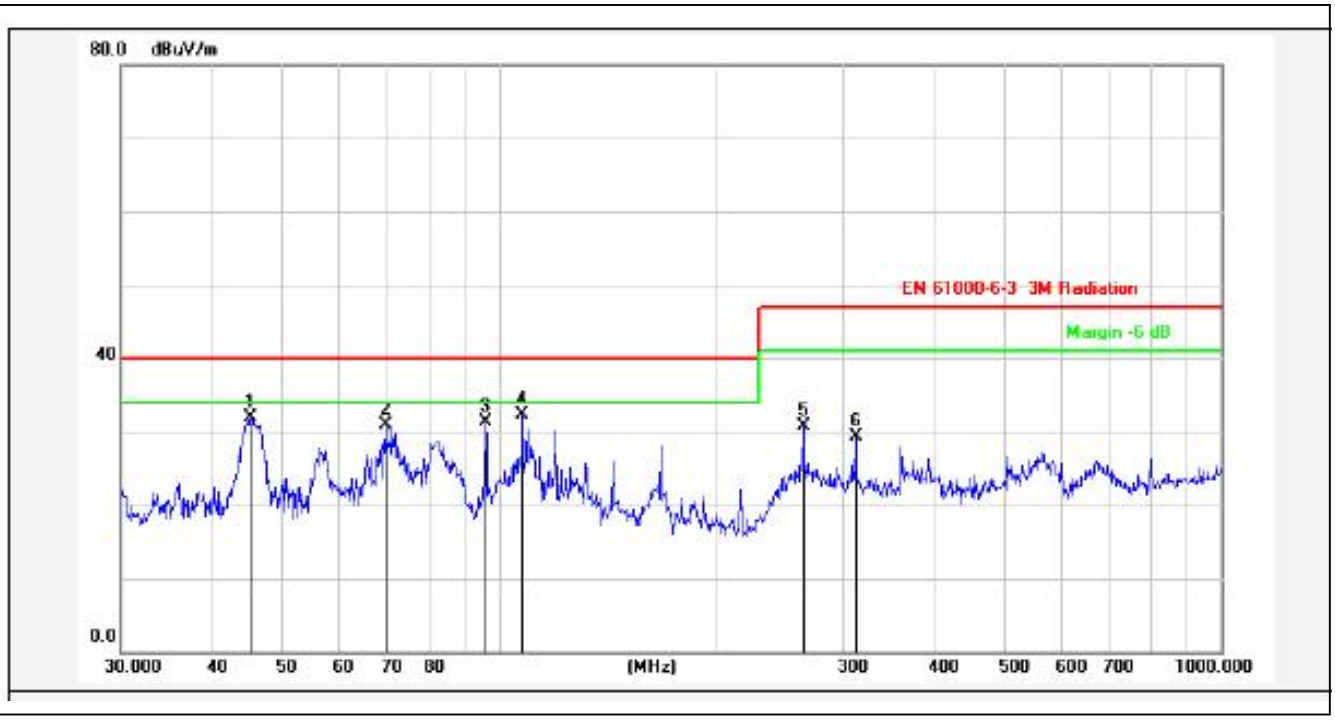
E.U.T:	Lithium iron phosphate battery	Model Name:	FLA48250-EU
Temperature:	23.5°C	Relative Humidity:	58%
Pressure :	1031hPa	Test Voltage :	DC 51.2V
Test Mode :	Discharging mode	Ant. Polarization:	Horizontal
Test Date:	2024-04-11		



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	46.1779	-10.46	37.53	27.07	40.00	-12.93	peak			P	
2	83.2298	-15.65	41.09	25.44	40.00	-14.56	peak			P	
3	167.8243	-15.09	48.76	33.67	40.00	-6.33	peak			P	
4	216.0240	-12.60	43.46	30.86	40.00	-9.14	peak			P	
5	312.1794	-10.15	39.93	29.78	47.00	-17.22	peak			P	
6	504.7062	-6.05	32.78	26.73	47.00	-20.27	peak			P	

Remark: The PEAK value is lower than the QP value limit, it can be judged as PASS without further testing the QP value.

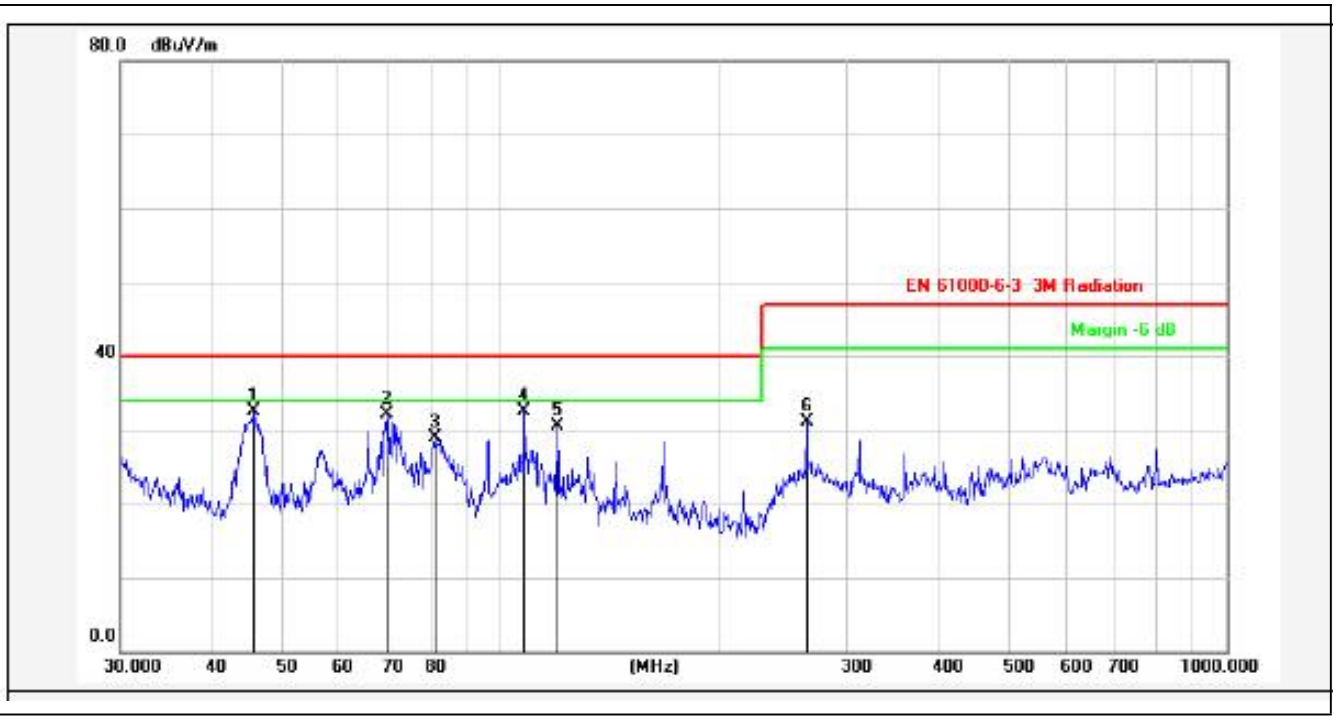
E.U.T:	Lithium iron phosphate battery	Model Name:	FLA48250-EU
Temperature:	23.5°C	Relative Humidity:	58%
Pressure :	1031hPa	Test Voltage :	DC 51.2V
Test Mode :	Discharging mode	Ant. Polarization:	Vertical
Test Date:	2024-04-11		



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	45.3755	-10.47	42.33	31.86	40.00	-8.14	peak			P	
2	69.6005	-14.34	45.19	30.85	40.00	-9.15	peak			P	
3	95.7622	-12.70	43.93	31.23	40.00	-8.77	peak			P	
4	107.8877	-12.11	44.49	32.38	40.00	-7.62	peak			P	
5	263.8190	-11.38	42.11	30.73	47.00	-16.27	peak			P	
6	312.1794	-10.15	39.40	29.25	47.00	-17.75	peak			P	

Remark: The PEAK value is lower than the QP value limit, it can be judged as PASS without further testing the QP value.

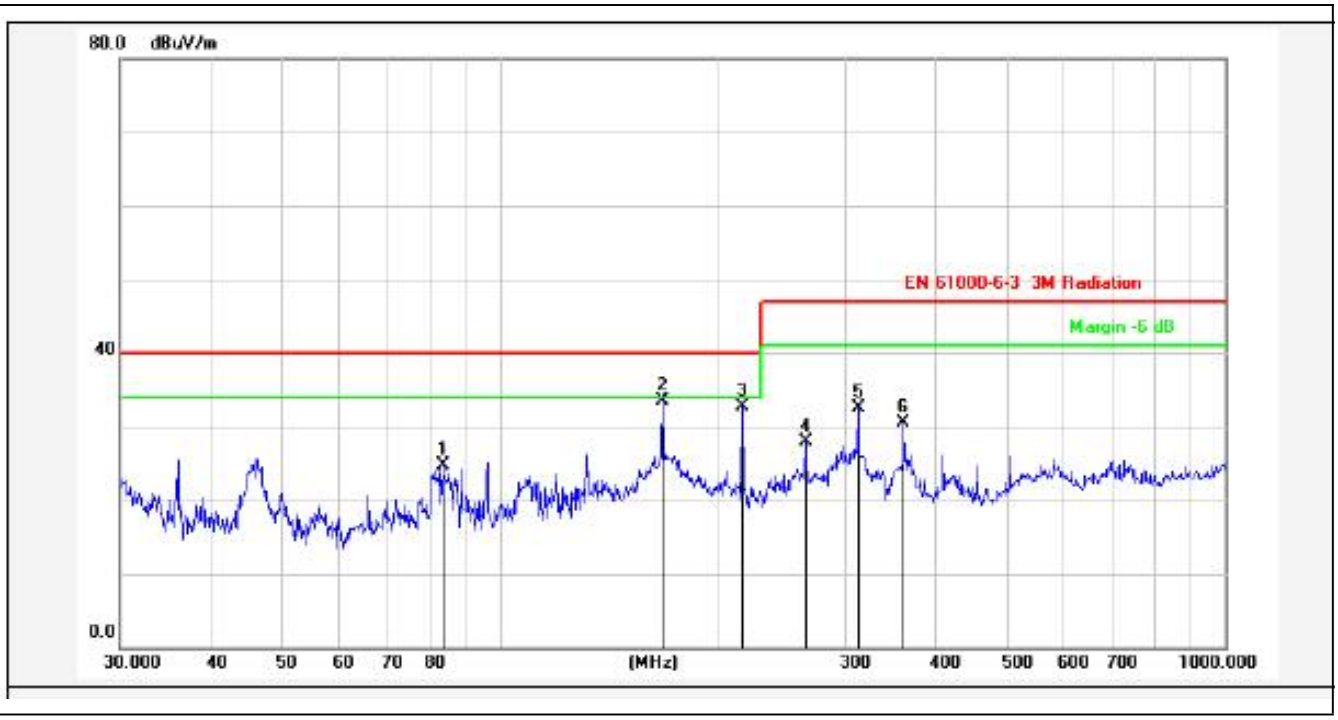
E.U.T:	Lithium iron phosphate battery	Model Name:	FLA48250-EU
Temperature:	23.5°C	Relative Humidity:	58%
Pressure :	1031hPa	Test Voltage :	DC 51.2V
Test Mode :	Charging mode	Ant. Polarization:	Vertical
Test Date:	2024-04-11		



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	45.8553	-10.46	42.89	32.43	40.00	-7.57	peak			P	
2	69.6005	-14.34	46.40	32.06	40.00	-7.94	peak			P	
3	81.2117	-16.06	44.94	28.88	40.00	-11.12	peak			P	
4	107.8877	-12.11	44.62	32.51	40.00	-7.49	peak			P	
5	119.8556	-13.80	44.21	30.41	40.00	-9.59	peak			P	
6	263.8190	-11.38	42.49	31.11	47.00	-15.89	peak			P	

Remark: The PEAK value is lower than the QP value limit, it can be judged as PASS without further testing the QP value.

E.U.T:	Lithium iron phosphate battery	Model Name:	FLA48250-EU
Temperature:	23.5°C	Relative Humidity:	58%
Pressure :	1031hPa	Test Voltage :	DC 51.2V
Test Mode :	Charging mode	Ant. Polarization:	Horizontal
Test Date:	2024-04-11		



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	83.5222	-15.60	40.26	24.66	40.00	-15.34	peak			P	
2	167.8243	-15.09	48.69	33.60	40.00	-6.40	QP			P	
3	216.0240	-12.60	45.28	32.68	40.00	-7.32	peak			P	
4	263.8190	-11.38	39.31	27.93	47.00	-19.07	peak			P	
5	312.1794	-10.15	42.64	32.49	47.00	-14.51	peak			P	
6	360.4476	-9.14	39.60	30.46	47.00	-16.54	peak			P	

Remark: The PEAK value is lower than the QP value limit, it can be judged as PASS without further testing the QP value.

6. PERFORMANCE CRITERIA FOR IMMUNITY

The performance criteria are referred to the test standard: EN IEC 61000-6-2

A functional description and a definition of specific performance criteria, during or as a consequence of immunity testing of equipment under test (EUT), shall be provided by the manufacturer and noted in the test report.

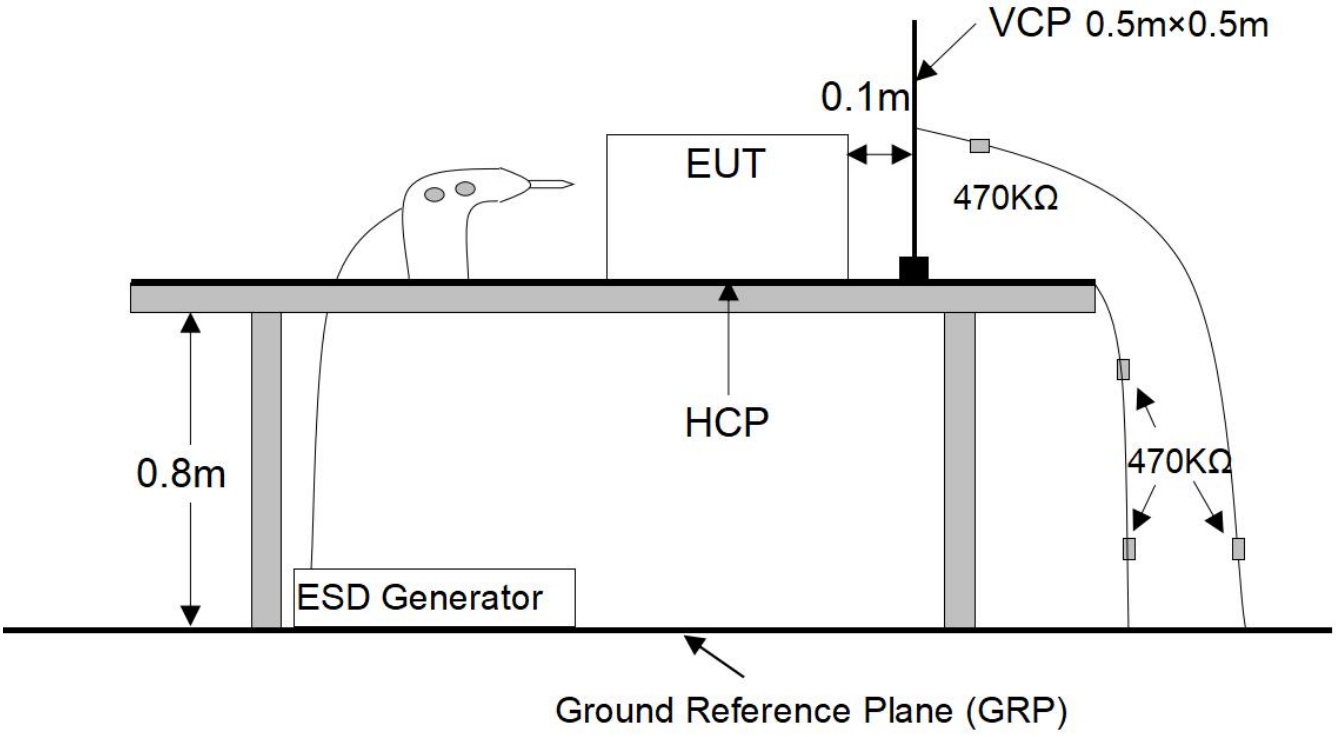
Performance criterion A: The EUT shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the EUT is used as intended. If the performance level is not specified by the manufacturer, this may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

Performance criterion B: The EUT shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the EUT is used as intended. The performance level may be replaced by a permissible loss of performance. However, during the test degradation of performance is allowed but no change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

Performance criterion C: Temporary loss of function is allowed during the test, provided the function is self-recoverable or can be restored by the operation of the controls. If, as a result of the application of the tests defined in this standard, the EUT becomes dangerous or unsafe, it shall be deemed to have failed the test.

7. ELECTROSTATIC DISCHARGE TEST

7.1. Block Diagram of Test Setup



7.2. Test Standard and Severity Levels

a. Test Standard:

Product standard	EN IEC 61000-6-2
Basic standard	IEC 61000-4-2
Performance criterion	B

b. Severity Levels:

Level	Test Voltage Contact Discharge (KV)	Test Voltage Air Discharge (KV)
1.	±2	±2
2.	±4	±4
3.	±6	±8
4.	±8	±15
X	Special	Special

7.3. Test Procedure

Air Discharge:

Air discharges at slots and apertures and insulating surfaces. On those parts of the EUT where it is not possible to perform contact discharge testing, the equipment should be investigated to identify user accessible points where breakdown may occur. Such points are tested using the air discharge method. This investigation should be restricted to those are normally handled by the user. A minimum of 10 single air discharges shall be applied to the selected test point for each such area.

Contact Discharge:

Contact discharges to the conductive surfaces and coupling planes. The EUT shall be exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. One of the test points shall be subjected to at least 20 indirect discharges to the center of the front edge of the Horizontal Coupling Plane (HCP). The remaining three test points shall each receive at least 20 direct contact discharges. If no direct contact test points are available, then at least 200 indirect discharges shall be applied in the indirect mode. Test shall be performed at a maximum repetition rate of one discharge per second.

a. The EUT was placed on a wooden table 0.8m height from the ground.
b. The EUT was located 0.1m minimum from all side of the HCP (dimensions 1.6m x0.8m).
c. Configure the EUT and support devices as per section 7.1.
d. The support units were located 30cm away from the EUT, but direct support unit was/were located at same location as EUT on the HCP and keep at a distance of 10cm with EUT.
e. Turn on the EUT and all support devices, and make it run stably.
f. The time interval between two successive single discharges was at least 1 second. Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
g. Air discharges were applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator was removed from the EUT and re-triggered for a new single discharge. The test was repeated until all discharges were complete.
h. At least ten single discharges (in the most sensitive polarity) were applied at the front edge of each HCP opposite the center point of each unit of the EUT and 0.1 meters from the front of the EUT. The long axis of the discharge electrode was in the plane of the HCP and perpendicular to its front edge during the discharges.

i. At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the Vertical Coupling Plane (VCP) in sufficiently different positions that the four faces of the EUT were completely illuminated. The VCP (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the EUT.

j. Repeat the above steps in each mode and record the test result.

7.4. Test Results

PASS.

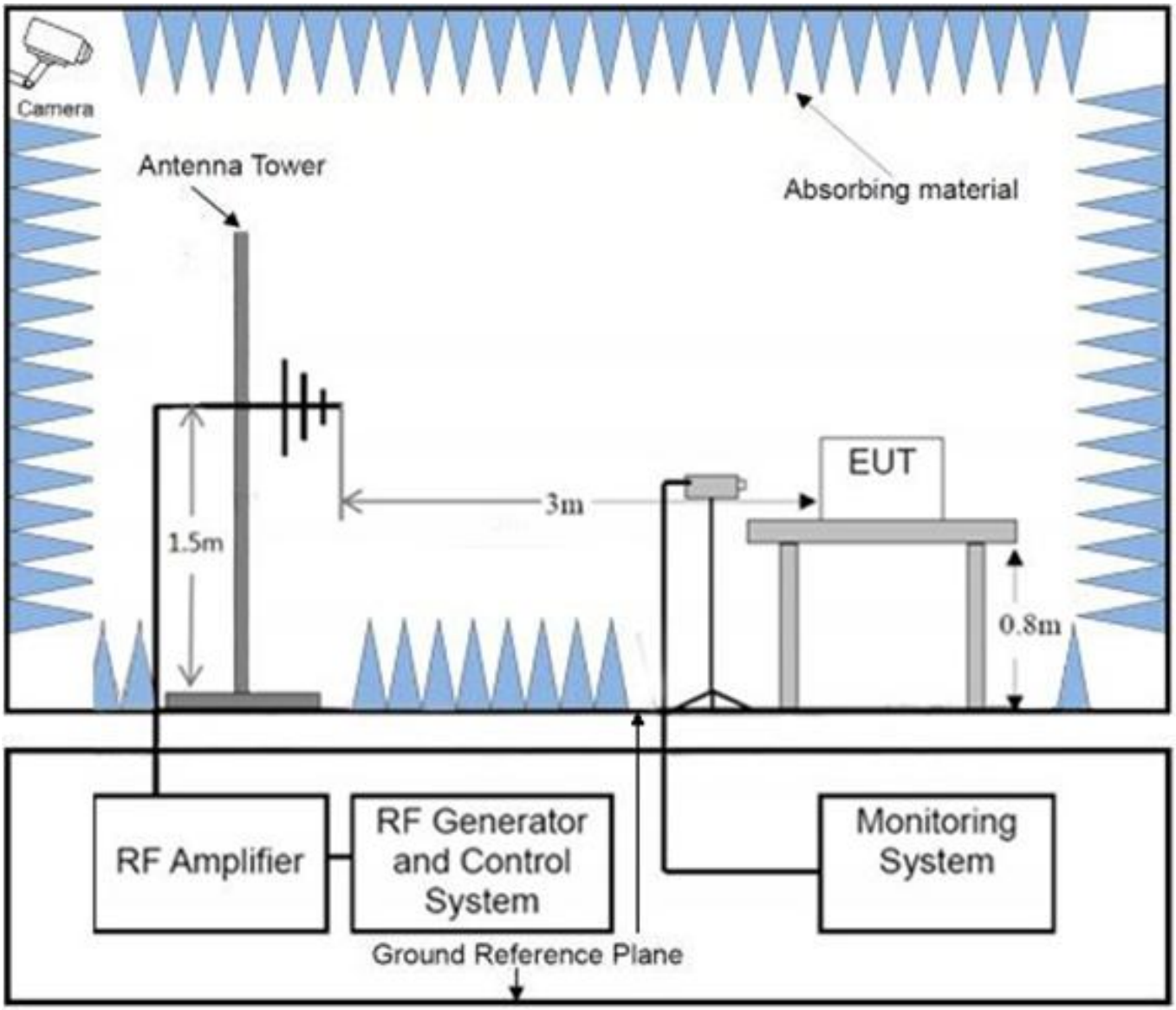
Please refer to the following page.

Electrostatic Discharge Test Results			
Ambient Condition:	Temp.: 24.0°C	R.H.: 53%	Air Pressure : 103.2 kPa
Test Specifications	Test level:	±4 KV for Contact Discharge ± 8 KV for Air Discharge	
	Discharge impedance:	330ohm / 150pF	
	No. of discharges:	10 times at each test point for each polarity at least	
	Polarity:	Positive / Negative	
	Discharge mode:	Single	
	Interval time of discharges:	≥1s	
Required Performance Criterion	B		
Tested Mode	Charging Mode Discharging Mode		

Test Point	Kind A-Air Discharge C-Contact Discharge	Result (Performance Criterion)
Screen	A	A
RS485 port	A	A
Metal Case	C	A
Screw	C	A
Function button	C	A
Indirect Discharge (HCP)	C	A
Indirect Discharge (VCP)	C	A
Note: No performance degradation or other exceptions occurred during and after the test.		
Test Engineer: CRB		Test Date: 2024.03.29

8. RADIO-FREQUENCY ELECTROMAGNETIC FIELD TEST

8.1. Block Diagram of Test Setup



8.2. Test Standard and Severity Levels

a. Test Standard

Product standard	EN IEC 61000-6-2
Basic standard	IEC 61000-4-3
Performance criterion	A

b. Severity Levels

Level	Field Strength (V/m)
1.	1
2.	3
3.	10
4.	30
X	Special

8.3. Test Procedure

a. The testing was performed in a fully anechoic chamber.

b. The EUT and necessary support devices were placed on a turn table which is 0.8 meter above ground.

c. EUT was set 3 meter away from the transmitting antenna which is mounted on an antenna tower.

d. Configure the EUT and support devices as per section 8.1.

e. Turn on the EUT and all support devices, and make it run stably.

f. Set horizontal and vertical polarization of the antenna to test. Each of the four sides of EUT must be faced this transmitting antenna and measured individually.

g. Repeat the above steps in each mode and record the test result.

8.4. Test Results

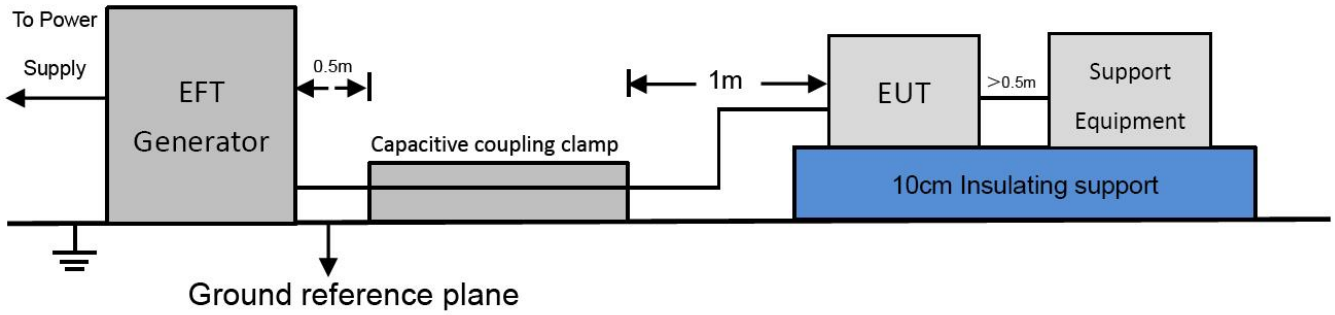
PASS.

Please refer to the following page.

Radio-Frequency Electromagnetic Field Test Results				
Ambient Condition	Temp.: 27.9°C		R.H.: 59.2%	Air Pressure: 101.5kPa
Test Specifications	Fielded Strength:		10V/m, 3V/m	
	Modulation:		1kHz sine wave, 80%AM	
	Frequency Size:		1% of preceding frequency value	
	Dwell Time:		1s	
	Mode:		Swept test	
Required Performance Criterion	A			
Tested mode	Charging Mode Discharging Mode			
Frequency (MHz)	Level (V/m)	Antenna polarity	Side	Result (Performance Criterion)
80-1000	10	Horizontal/ Vertical	Front	A
			Left	A
			Right	A
			Back	A
1400-6000	3	Horizontal/ Vertical	Front	A
			Left	A
			Right	A
			Back	A
Note: No performance degradation or other exceptions occurred during and after the test.				
Test Engineer: Chance				Test Date: 2024.03.30

9. FAST TRANSIENTS TEST

9.1. Block Diagram of Test Setup



9.2. Test Standard and Severity Levels

a. Test Standard

Product standard	EN IEC 61000-6-2
Basic standard	IEC 61000-4-4
Performance criterion	B

b. Severity level

Open circuit output test voltage and repetition rate of the impulses				
Level	Power ports, earth port (PE)		Signal data and control ports	
	Voltage peak kV	Repetition frequency kHz	Voltage peak kV	Repetition frequency kHz
1.	0.5	5 or 100	0.25	5 or 100
2.	1.0	5 or 100	0.5	5 or 100
3.	2.0	5 or 100	1.0	5 or 100
4.	4.0	5 or 100	2.0	5 or 100
X	Special	Special	Special	Special

Note 1: The use of 5 kHz repetition rates is traditional, however, 100 kHz is closer to reality. Product committees should determine which frequencies are relevant for specific products or product types.
Note 2: With some products, there may be no clear distinction between power ports and signal ports, in which case it is up to product committees to make this determination for test purposes.
Note 3: “X” can be any level, above, below or in between the others. The level shall be specified in the dedicated equipment specification.

9.3. Test Procedure

a. The EUT was placed on the insulating support 0.1m above the reference ground plane.

b. Configure the EUT and support devices as per section 9.1.

c. Turn on the EUT and all support devices, and make it run stably.

d. For input and output AC power port of the EUT, the EUT was connected to the power mains by using a coupling device which couples the EFT interference signal to AC power lines. The coaxial output of the EFT generator to the terminals on the EUT should not exceed 0.5 meter. Both polarities of the test voltage should be applied during compliance test and the duration of the test is 2 minutes.

e. For signal ports of the EUT, the EUT was connected to the power mains, and the signal line through a coupling device which couples the EUT interference signal to signal line. Both polarities of the test voltage should be applied during compliance test and the duration of the test is 2 minutes.

f. Repeat the above steps in each mode and record the test result.

9.4. Test Results

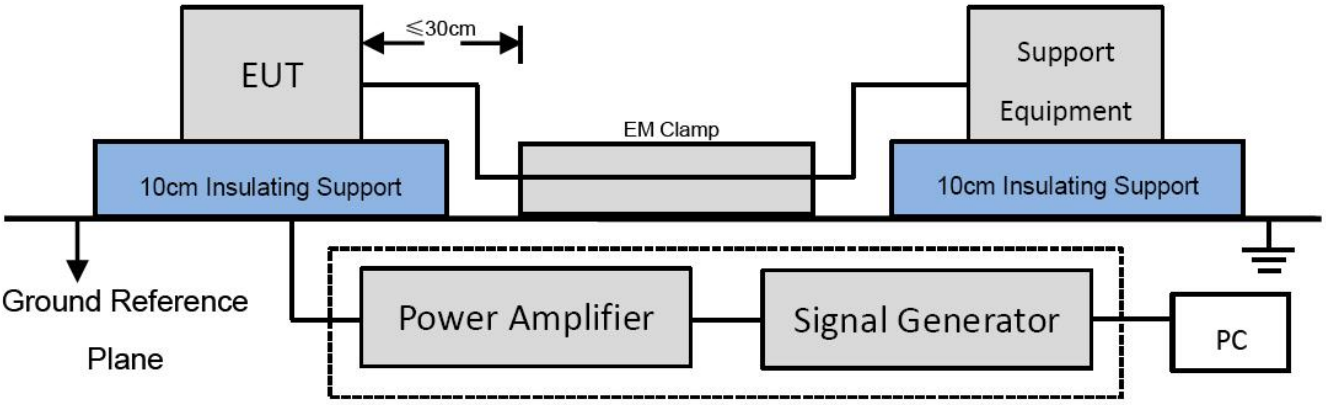
PASS.

Please refer to the following page.

Fast Transients Test Results			
Ambient Condition	Temp.: 22.6°C	R.H.: 53%	Air Pressure: 103.2 kPa
Test Specifications	Test Level:	1.0 kV for signal port	
	Repetition Frequency:	5kHz;	
	Duration:	15ms	
	Period:	300ms	
	Impulse wave shape:	5/50ns (Tr/Th)	
	Test Duration:	2min	
Required Performance Criterion	B		
Test mode	Charging Mode Discharging Mode		
Coupling mode and port	☐ AC Power ☐ DC port ☒ Signal line		
	☒ Capacitive ☐ Direct		
Test Line	Test Voltage	Result (Performance Criterion)	
RS485 port	±1KV	A	
Note: No performance degradation or other exceptions occurred during and after the test.			
Test Engineer: CRB		Test Date: 2024.03.29	

10. RADIO-FREQUENCY COMMON MODE TEST

10.1. Block Diagram of Test Setup



10.2. Test Standard and Severity Levels

a. Test Standard

Product standard	EN IEC 61000-6-2
Basic standard	IEC 61000-4-6
Performance criterion	A

b. Severity level

Level	Field Strength (V)
1.	1
2.	3
3.	10
X	Special

10.3. Test Procedure

a. The EUT was placed on the insulating support 0.1m above the ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane about 0.3m from EUT. Cables between CDN and EUT are as short as possible, and their height above the ground reference plane shall be between 30 and 50 mm (where possible).

b. Configure the EUT and support devices as per section 10.1.

c. Turn on the EUT and all support devices, and make it run stably.

d. The disturbance signal described below is injected to EUT through CDN.

e. The frequency range is swept from 150KHz to 80 MHz using 10V, and with the disturbance signal 80% amplitude modulated with a 1kHz sine wave. The rate of sweep shall not exceed 1.5*10-3decades/s. Where the frequency is swept incrementally, the step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value.

f. Repeat the above steps in each mode and record the test result.

10.4. Test Results

PASS.

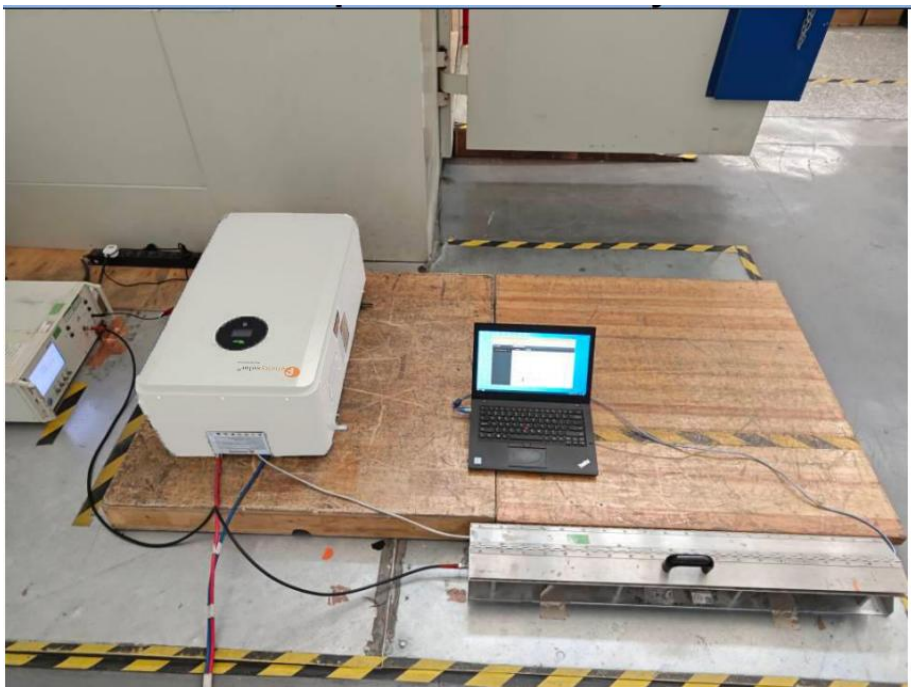
Please refer to the following page.

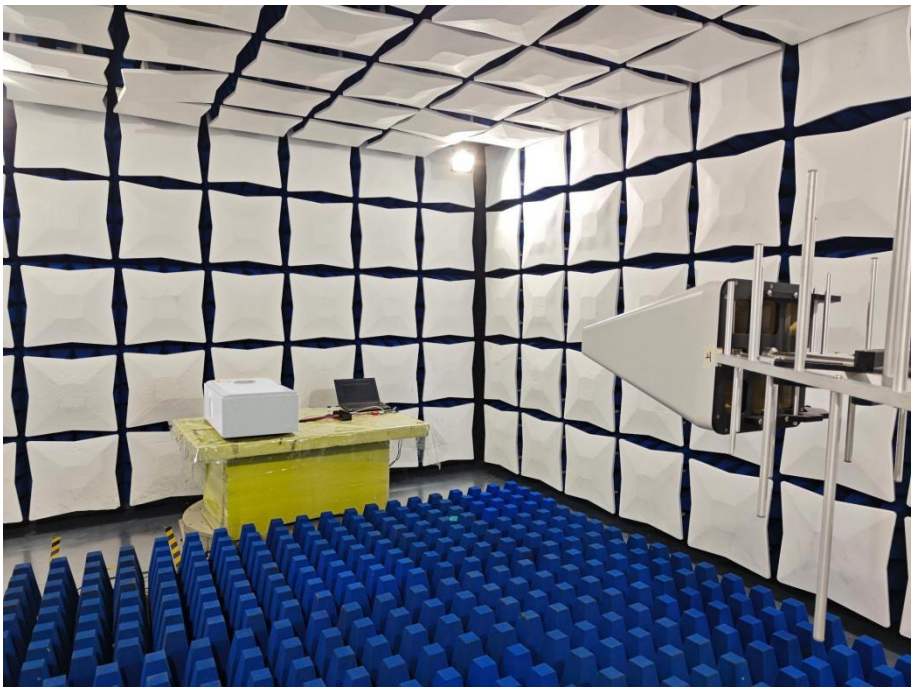
Radio-Frequency Common Mode Test Results			
Ambient Condition	Temp.: 27.6°C	R.H.: 58.5%	Air Pressure:101.2 kPa
Test Specifications	Test Level:	10V	
	Modulation:	1kHz sine wave, 80%AM	
	Step Size:	1% of preceding frequency value	
	Dwell Time:	1s	
	Mode:	Swept test	
Required Performance Criterion	A		
Test mode	Charging Mode Discharging Mode		
Test Port	Frequency (MHz)	Level(V)	Result (Performance Criterion)
RS485 port	0.15~80	10	A
Note: No performance degradation or other exceptions occurred during and after the test.			
Test Engineer: Chance			Test Date: 2024.03.30

APPENDIX I-PHOTOS OF TEST SETUP

Set-up for Radiated Emission

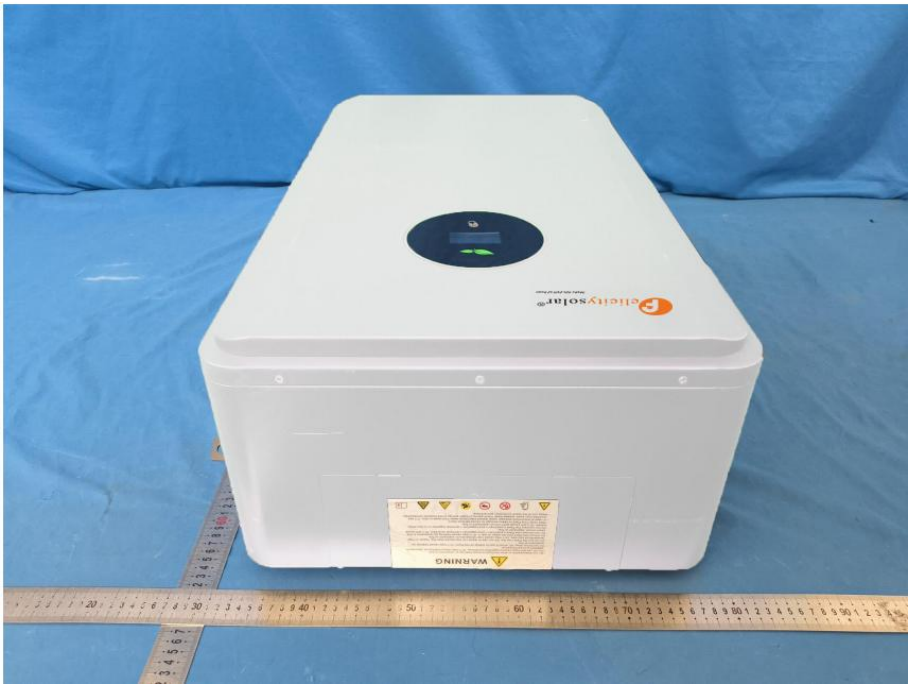
Set-up for Electrostatic Discharge Test

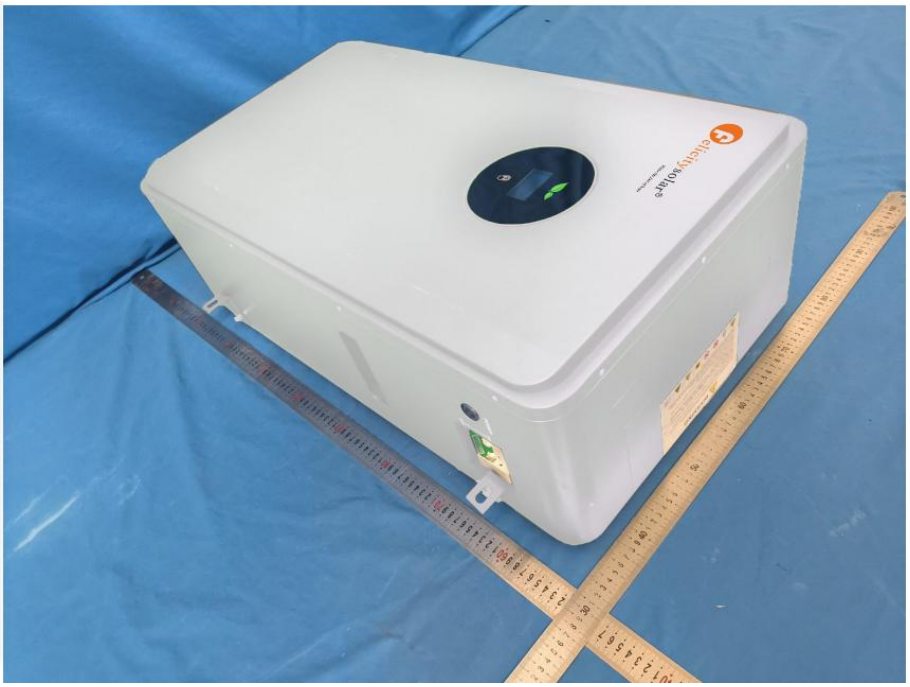
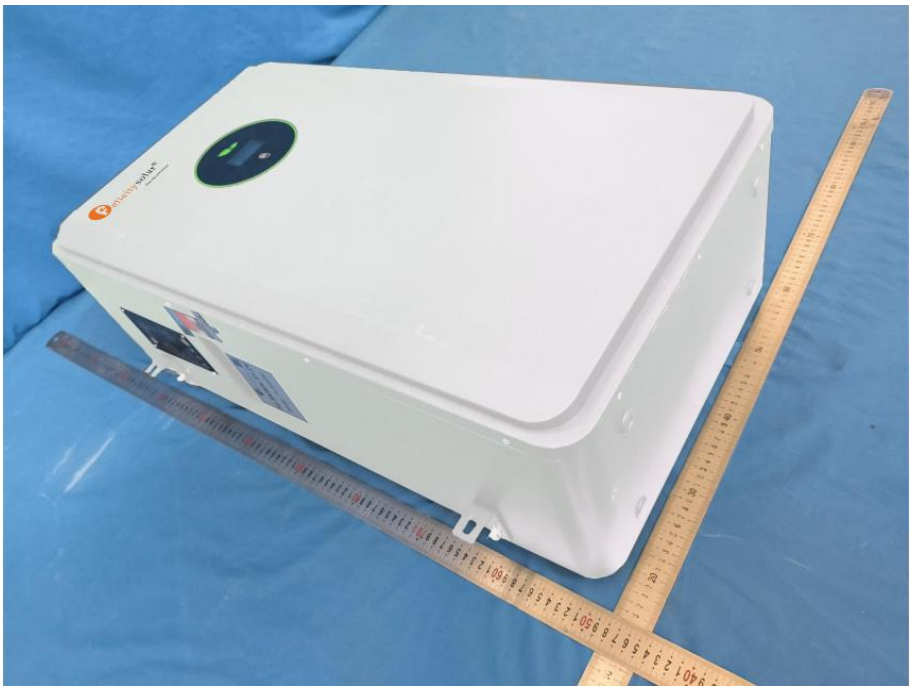

Set-up for Fast Transients Test

Set-up Radio-Frequency Common Mode Test

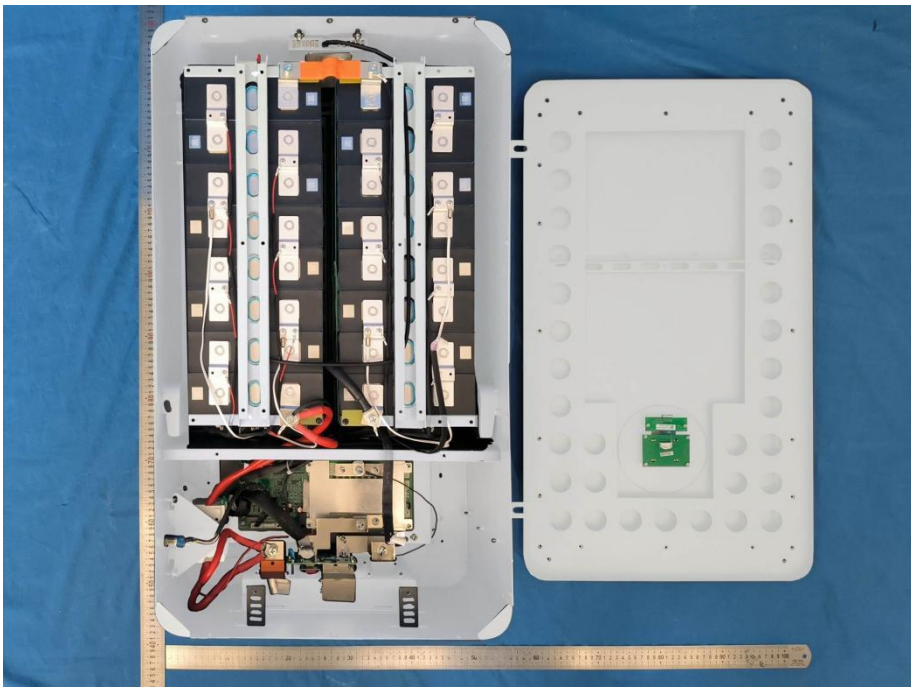
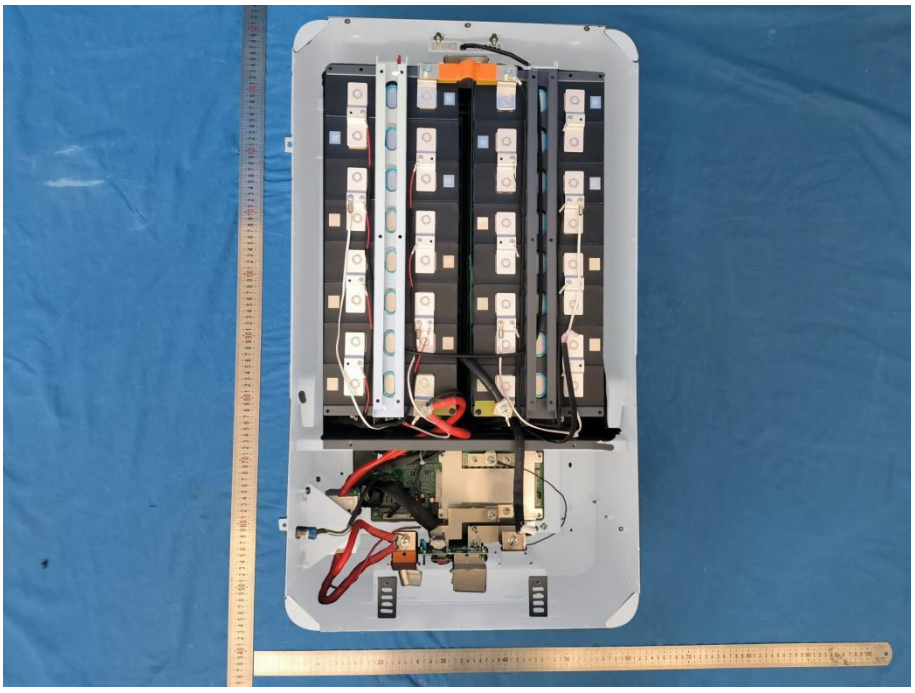

Set-up Radio-Frequency Electromagnetic Field Test


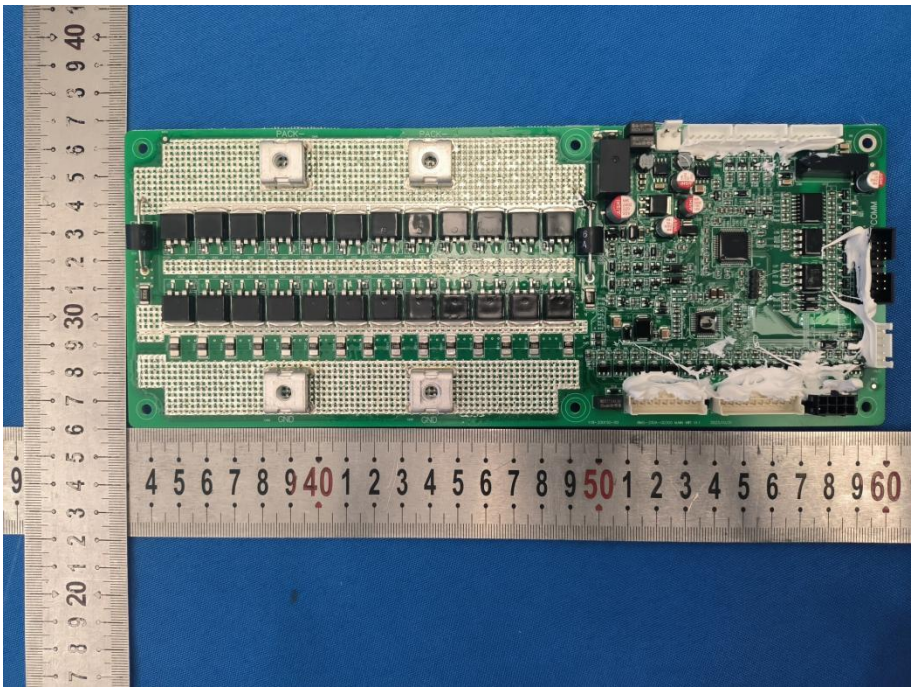
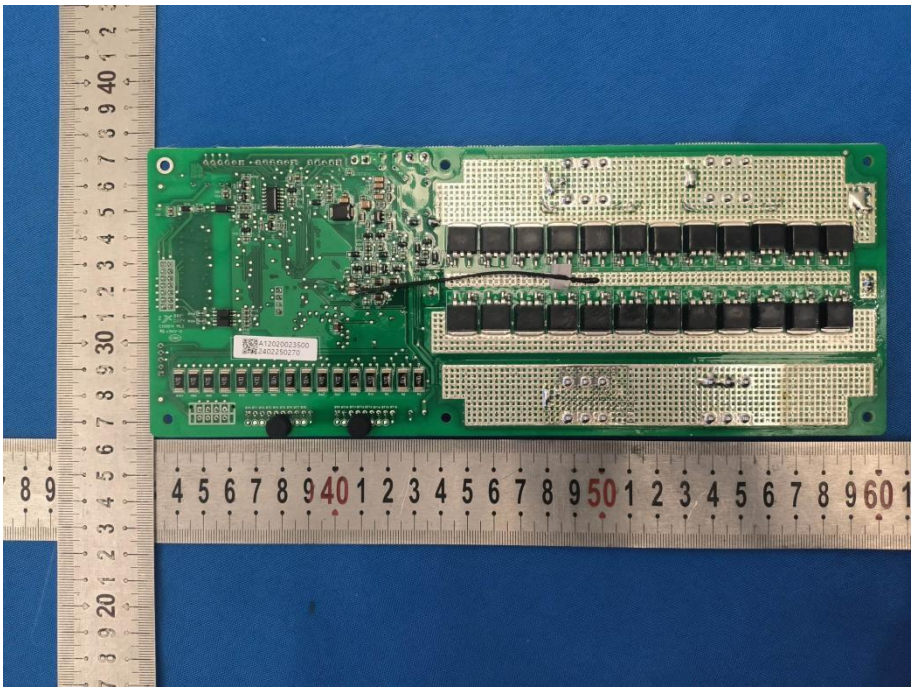
APPENDIX I-PHOTOS OF TUT

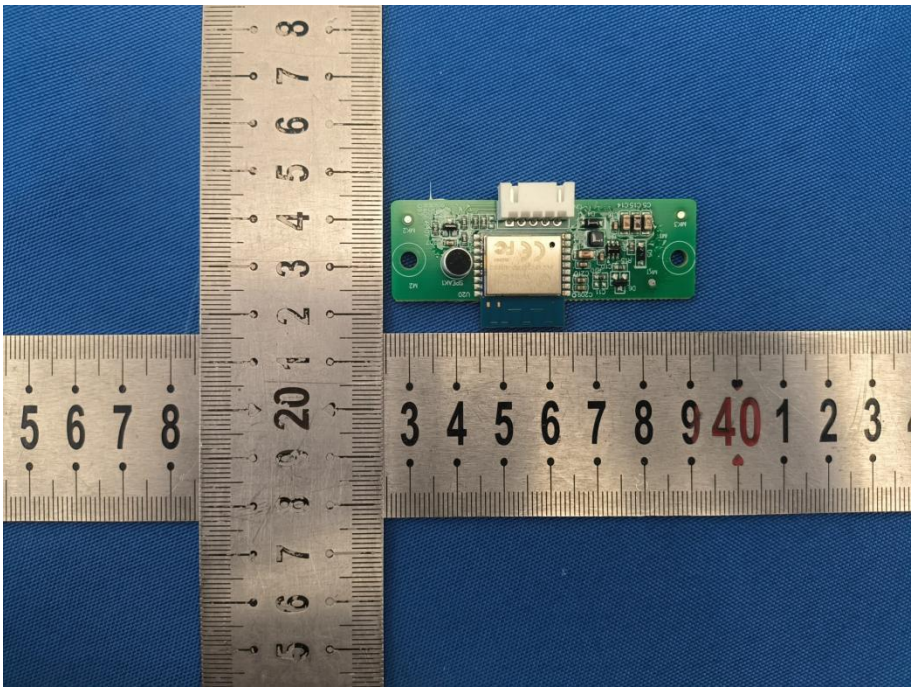
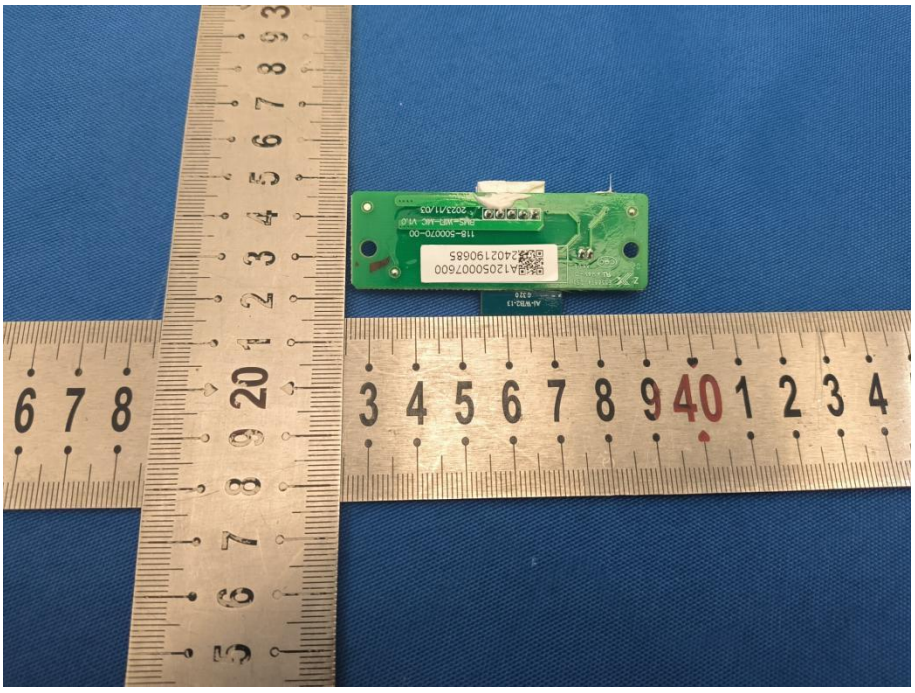
Over View -1

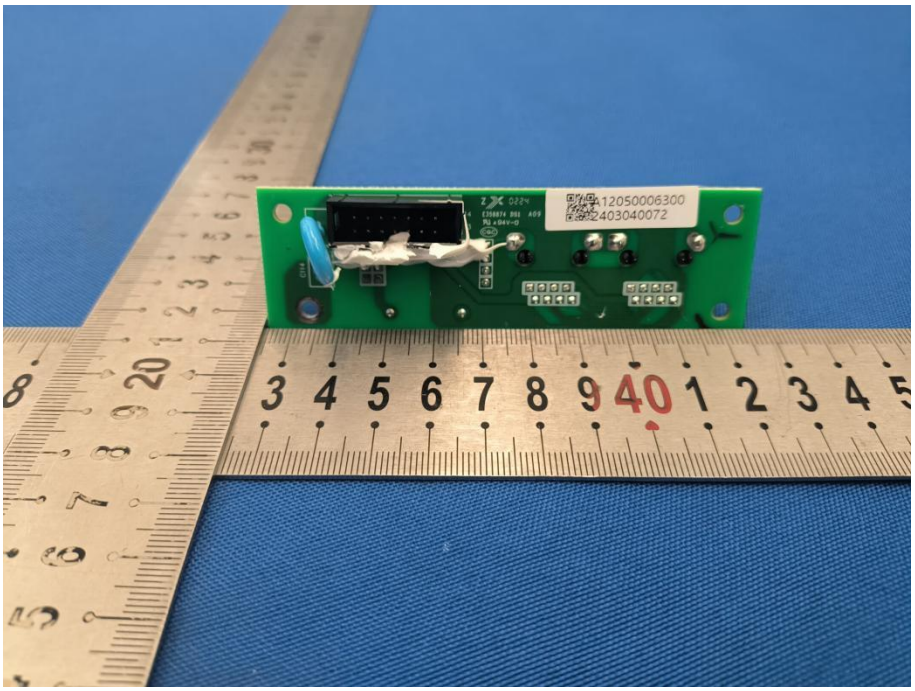
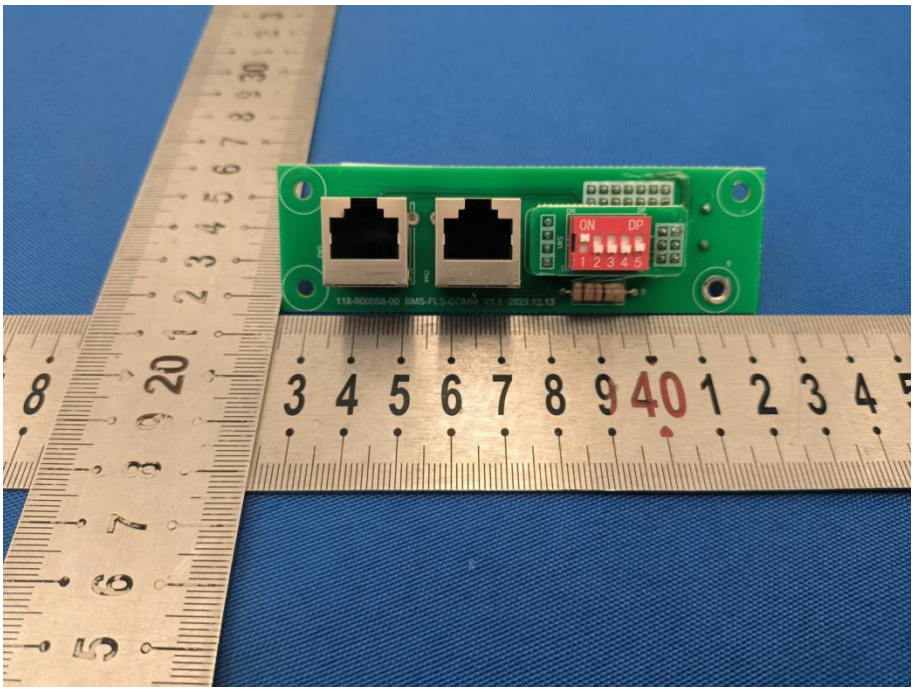
Over View -2


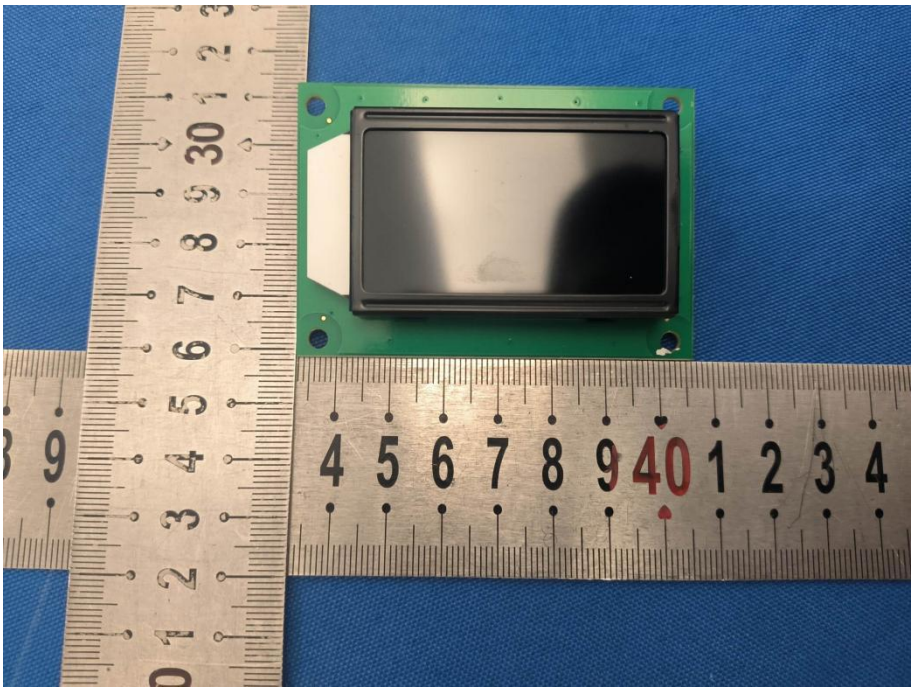
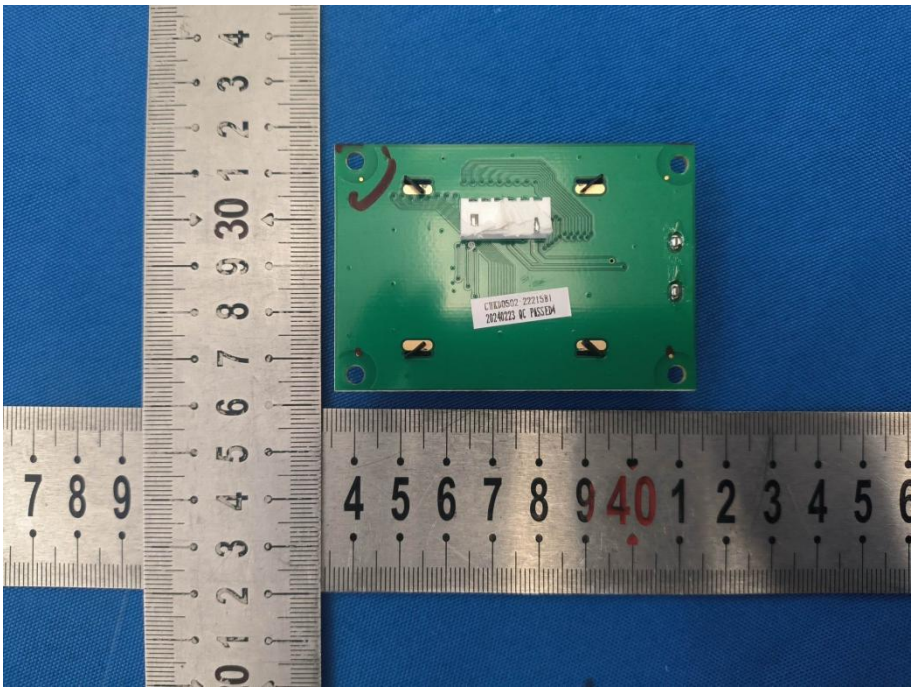
Over View -3

Over View -4


Internal View -1

Internal View -2


PCB View -1

PCB View -2


PCB View -3

PCB View -4


PCB View -5

PCB View -6


PCB View -7

PCB View -8


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