

Test Report No.: TWR2304040 001 **Page 1 of 1**

Applicant: Shenzhen Atess Power Technology Co., Ltd.
2nd Floor, No.23 Zhulongtian Road, Shuitian Community, Shiyan
Street, Baoan District, Shenzhen, Guangdong, P.R. China

Factory: Shenzhen Atess Power Technology Co., Ltd.

Order No.: Q062663 **Date of receipt:** 24th 04. 2023

Device under Test: LiFePO4 Lithium-ion Battery

Model No.: ESS-BM-51.2-280R

Serial No.: Engineering sample of ESS-BM-51.2-280R

Place of Testing: Dongguan BALUN Technology Co., Ltd.

Room 104, 204, 205, Building 1, No. 6, Industrial South Road,
Songshan Lake District, Dongguan, Guangdong, China

Test Specification: EN IEC 61000-6-2:2019, EN IEC 61000-6-4:2019
IEC 61000-6-2:2016, IEC 61000-6-4:2018

Technical Administrator:

Evelyn Hu



Date: 25th 04. 2023

Signature:

Reviewer:

Christo Chi



Date: 25th 04. 2023

Signature

Remark notes:

- This report consists of 1 page of cover page, and 1 EMC reports from Dongguan BALUN Technology Co., Ltd. (Report No. BL- DG2310611-401)

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TEST REPORT

Applicant: Shenzhen Atess Power Technology Co., Ltd

Address: 2nd Floor, No.23 Zhulongtian Road, Shuitian Community, Shiyan Street, Baoan District, Shenzhen, Guangdong, P.R. China

EUT Name: LiFePO4 Lithium-ion Battery

Model Name: ESS-BM-51.2-280R

Brand Name:  Atess

Test Standard: EN IEC 61000-6-2:2019, EN IEC 61000-6-4:2019, IEC 61000-6-2:2016, IEC 61000-6-4:2018

Sample Arrival Date: Jan. 30, 2023

Test Date: Mar. 01, 2023 - Mar. 09, 2023

Date of Issue: Apr. 21, 2023

ISSUED BY:

Dongguan BALUN Testing Technology Co., Ltd.

Tested by: Yongqing Chen

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Approved by: Simon Qi

Yongqing Chen

Tao Zheng

Simon Qi

Revision History

Version	Issue Date	Revisions Content
<u>Rev. 01</u>	<u>Apr. 21, 2023</u>	<u>Initial Issue</u>

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1. GENERAL INFORMATION

1.1. Test Laboratory

Name	Dongguan BALUN Testing Technology Co., Ltd.
Address	Room 104, 204, 205, Building 1, No. 6, Industrial South Road, Songshan Lake District, Dongguan, Guangdong Province, P. R. China

1.2. Test Location

Name	Dongguan BALUN Testing Technology Co., Ltd.
Location	Room 104, 204, 205, Building 1, No. 6, Industrial South Road, Songshan Lake District, Dongguan, Guangdong Province, P. R. China

2. PRODUCT INFORMATION

2.1. Applicant Information

Applicant	Shenzhen Atess Power Technology Co., Ltd
Address	2nd Floor, No.23 Zhulongtian Road, Shuitian Community, Shiyan Street, Baoan District, Shenzhen, Guangdong, P.R. China

2.2. Manufacturer Information

Manufacturer	Shenzhen Atess Power Technology Co., Ltd
Address	2nd Floor, No.23 Zhulongtian Road, Shuitian Community, Shiyan Street, Baoan District, Shenzhen, Guangdong, P.R. China

2.3. Factory Information

Factory	Shenzhen Atess Power Technology Co., Ltd
Address	2nd Floor, No.23 Zhulongtian Road, Shuitian Community, Shiyan Street, Baoan District, Shenzhen, Guangdong, P.R. China

2.4. General Description for Equipment under Test (EUT)

EUT Name	LiFePO4 Lithium-ion Battery
Model Name Under Test	ESS-BM-51.2-280R
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	BCU: V3.20 BMU: V2.1
Software Version	BCU: V6.1 BMU: V1.0

Parameter table:

Cell Performance Parameters	Cell Type	Lithium Iron Phosphate
	Cell Model	CB71173204EB-280Ah
	Rated Voltage/Capacity	3.2V/280Ah
	Voltage Range	2.5V~3.65V
	Maximum Charging Current	1C
	Maximum Discharging Current	1C
	Recommended Range of SOC Use	10%~90%
	Charging Operating	0~55°C
	Discharging Operating	-20~55°C
	Cell Size	H207*W174*T71.5mm
	Internal Resistance	≤0.3mΩ
	Weight	5.4±0.15Kg

Battery Performance Parameters	Model	ESS-BM-51.2-280R
	Battery Box	16S1P
	Normal Voltage	51.2V
	Normal Capacity	280Ah
	Rated Energy	14.336KWh
	Standard Charge And Discharge	0.5C/140A
	Maximum Charge And Discharge	1C/280A
	AC Internal Resistance	≤8mΩ
	Size	804.35mm(L)*523mm(W)* 231.5mm(H)
	Weight	113±5kg

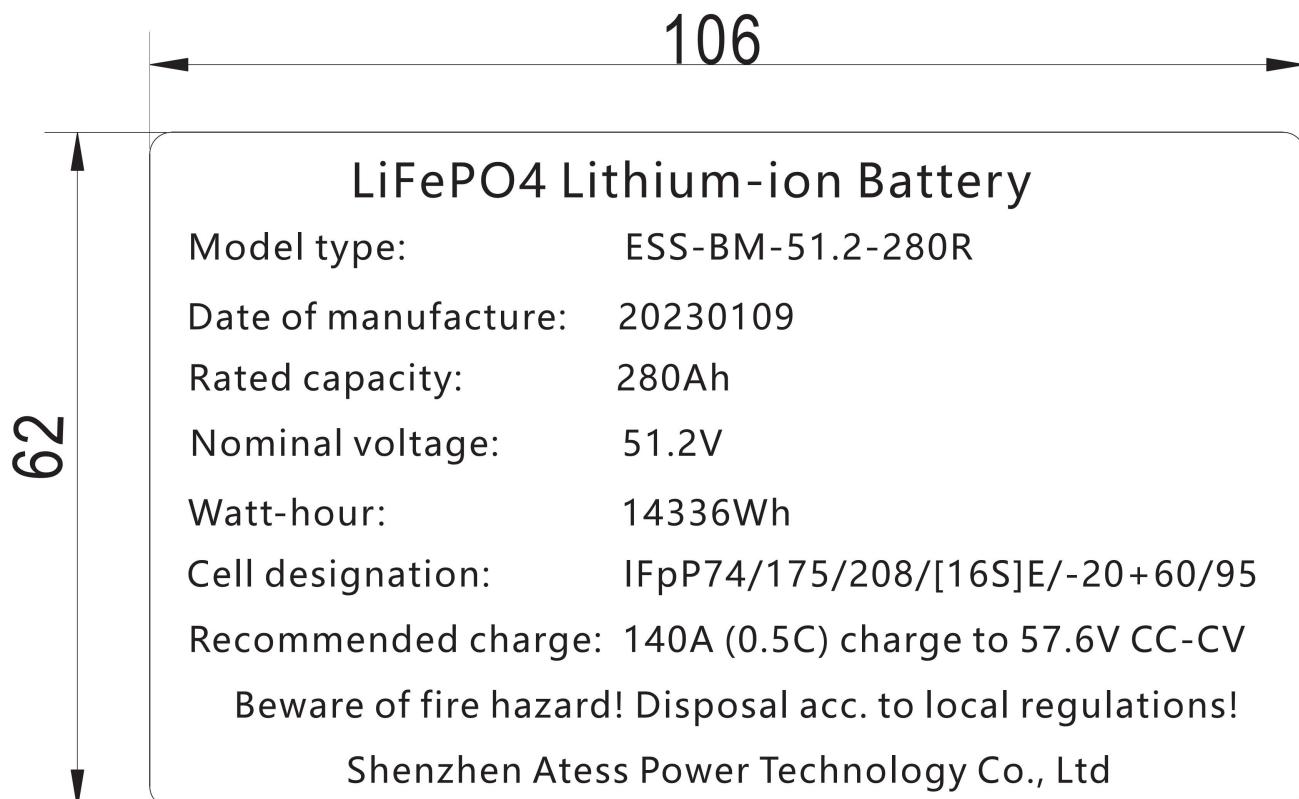
2.5. Ancillary Equipment

Ancillary Equipment 1	USB CAN	
	Brand Name	OLiPower
	Model	USBCAN-II
	Cable length	1.5m
	Serial No.	N/A

2.6. Technical Information

Interfaces present on the EUT	AC Ports	No AC ports.
	DC Ports	From DC power supply to EUT.
	Telecom Port	No Telecom Ports.
	Signal Ports	CAN, which cable length is less than 3m.
About the Product		The equipment is LiFePO4 Lithium-ion Battery, the above EUT information was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

Labels:



3. SUMMARY OF TEST RESULTS

3.1. Test Standards

No.	Identity	Document Title
1	EN IEC 61000-6-2:2019	Electromagnetic compatibility (EMC) --Part 6-2: Generic standards -- Immunity standard for industrial environments
2	IEC 61000-6-2:2016	
3	EN IEC 61000-6-4:2019	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
4	IEC 61000-6-4:2018	

3.2. Verdict

No.	Base Standard	Description		Test Verdict	Result	Remark
Emission						
1	IEC 61000-6-4:2018; EN IEC 61000-6-4:2019	Radiated Emission	Below 1 GHz	P	Annex A.1	--
			Above 1 GHz	N		Note 1
2	IEC 61000-6-4:2018; EN IEC 61000-6-4:2019	Conducted Emission	AC Ports	N	Annex A.2	Note 2
			Telecom Ports	N		Note 3
Immunity						
3	IEC 61000-4-2:2008	Electrostatic Discharge Immunity		P	Annex A.3	--
4	IEC 61000-4-3:2006 +A1:2007+A2:2010	Radiated RF Electromagnetic Field Immunity		P	Annex A.4	--
5	IEC 61000-4-4:2012	Electrical Fast Transient/Burst Immunity	AC Ports	N	Annex A.5	Note 2
			DC Ports	P		--
			Signal Ports	N		Note 4
6	IEC 61000-4-5:2014	Surge Immunity	AC Ports	N	Annex A.6	Note 2
			DC Ports	P		--
			Signal Ports	N		Note 5
7	IEC 61000-4-6:2013	Immunity to Conducted Disturbances Induced by RF Fields	AC Ports	N	Annex A.7	Note 2
			DC Ports	P		--
			Signal Ports	N		Note 4
8	IEC 61000-4-8:2009	Power-frequency magnetic field		P	Annex A.8	--
9	IEC 61000-4-11:2004	Voltage Dips and Short Interruptions Immunity	AC Ports	N	Annex A.9	Note 2

Note 1: The highest frequency of the internal sources of the EUT is less than 108 MHz, the measurement shall be made below 1 GHz.

Note 2: AC power port is a port at which a conductor or cable carrying the primary electrical power needed for the operation (functioning) of an apparatus or associated apparatus is connected to the apparatus. The EUT does not have AC port according to above definition.

Note 3: Telecommunications/network port is a point of connection for voice, data and signaling transfers intended to interconnect widely dispersed systems via such means as direct connection to multi-user telecommunications networks, local area networks and similar networks. A port generally intended for interconnection of components of an ITE system under test and used in accordance with its functional specifications, is not considered to be a telecommunication port. The EUT does not have telecommunication port according to above definition.

Note 4: Signal/control port is a port at which a conductor or cable intended to carry signals is connected to the equipment. Applicable only to ports interfacing with cables whose total length according to the manufacturer's functional specification may exceed 3 m. The signal ports cable length of EUT is less than 2m.

Note 5: Signal/control port is a port at which a conductor or cable intended to carry signals is connected to the equipment. Applicable only to ports interfacing with cables whose total length according to the manufacturer's functional specification may exceed 30 m. The signal ports cable length of EUT is less than 2m.

This report judges the test conclusions:

- | | |
|---------------------------------------|---|
| —Not applicable for this test product | N |
| —Meet requirements | P |
| —Does not meet the requirements | F |

3.3. Test Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Measurement	Value
Radiated emissions (30 MHz-1 GHz)	4.76 dB

4. GENERAL TEST CONFIGURATIONS

4.1. Test Environments

Test items	Voltage	Temperature	Relative Humidity	Ambient Pressure	Test Date	Test Engineer
Radiated Emission	DC 51V~55V	25.0°C	55%	101.0kPa	Mar. 01, 2023	Yongqing Chen
Electrostatic Discharge Immunity		25.5°C	51%	101.7kPa	Mar. 09, 2023	
Radiated RF Electromagnetic Field Immunity		25.2°C	54%	102.3kPa	Mar. 09, 2023	
Electrical Fast Transient/Burst Immunity		25.2°C	53%	102.1kPa	Mar. 05, 2023	
Surge Immunity		25.5°C	51%	102.4kPa	Mar. 07, 2023	
Immunity to Conducted Disturbances Induced by RF Fields		25.4°C	52%	102.0kPa	Mar. 03, 2023	
Power-frequency magnetic field		25.3°C	52%	101.9kPa	Mar. 05, 2023	

4.2. Test Equipment List

Radiated Emission Test For Frequency Below 1 GHz						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	Keysight	N9038B	MY61380118	2022.06.17	2023.06.16	✓
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9163	9163-01202	2021.12.01	2024.11.30	✓
Anechoic Chamber	YIHENG ELECTRONIC	12.0m*7.0m*7.5m	YHEMC018	2022.02.14	2025.02.13	✓
Description	Manufacturer	Name		Version		
Test Software	BALUN	BL410-E		V19.319		

Electrostatic Discharge Immunity Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
ESD Test System	SCHLODER	SESD 30000	607339	2023.03.08	2024.03.07	✓

Radiated RF Electromagnetic Field Immunity Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
Anechoic Chamber	YIHENG ELECTRONIC	12.0m*7.0m*7.5m	YHEMC018	2022.02.14	2025.02.13	✓
Signal Generator	ROHDE&SCHWARZ	N5181A	MY50141978	2023.03.08	2024.03.07	✓
Power Amplifier	rflight	NTWPA-00810200E	18093198	2023.03.03	2024.03.02	✓
Power Amplifier	rflight	NTWPA-1060100E	18093195	2023.03.03	2024.03.02	✓
Power Meter	Agilent	E4417A	GB41292042	2023.03.08	2024.03.07	✓
Field Strength Meter	Narda	EP601	511WX51129	2023.03.08	2024.03.07	✓
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9163	9163-01202	2021.12.01	2024.11.30	✓
Test Antenna-Horn	SCHWARZBECK	BBHA 9120D	9120D-1986	2022.12.07	2025.12.06	✓
Description	Manufacturer	Name		Version		
Test Software	BALUN	BL410-E		V19.319		

Electrical Fast Transient/Burst Immunity Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EFT Test System	HTEC	HEFT 51	1331011	2023.02.28	2024.03.01	✓
EFT coupling network	HTEC	ECDN 51	150601	2022.09.08	2023.09.07	✓

Transients and Surges Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
SURGE Generator (AC/DC Ports)	HTEC	HCWG 70	151601	2022.06.29	2023.06.28	✓
SURGE coupling network (AC/DC Ports)	HTEC	SCDN303P7	151602	2023.02.28	2024.03.01	✓

Immunity to Conducted Disturbances Induced by RF Fields						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
Conducted Disturbances Test System	Schloder GmbH	CDG 6000	18901932-0101	2022.09.08	2023.09.07	✓
CDN	SCHLODER	CDN M2+3-32	18901802-0110	2022.09.08	2023.09.07	✓

Power Frequency Magnetic Fields Immunity						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
Magnetic Field Tester	HEAFELY	HPFMF 1000	183102	2023.02.28	2024.03.01	✓

4.3. Test Enclosure list

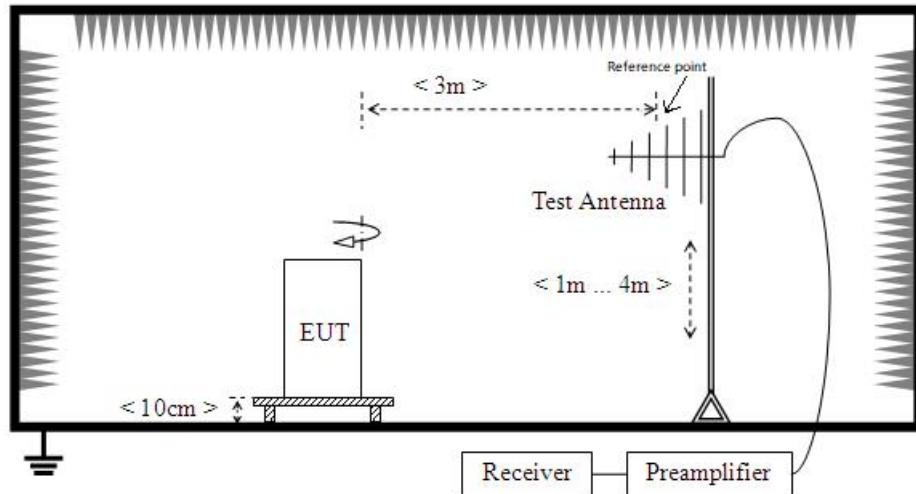
Name	Manufacturer	Model	Serial No.	Length	Description
DC Source	WKDY	WPLA-150KW	W20180626011	N/A	N/A
DC Electronic load	ITECH	IT8830B	600243011716730002	N/A	N/A

4.4. Test Configurations

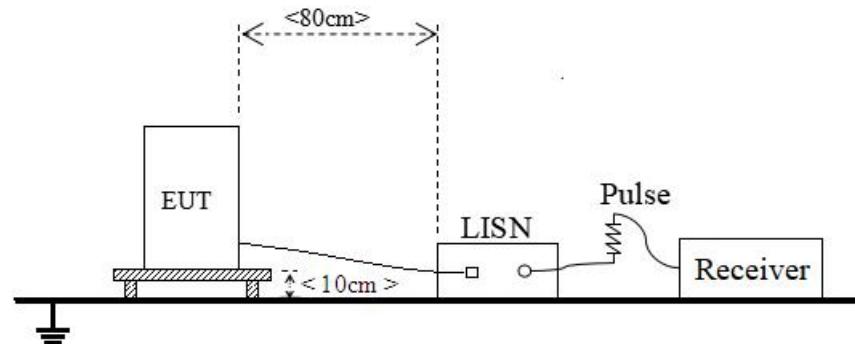
Test Configurations (TC) No.	Description
TC01	<u>Charging(100% Load)</u> EUT+DC Source+USB CAN
TC02	<u>Charging(50% Load)</u> EUT+DC Source+USB CAN
TC03	<u>Discharge(100% Load)</u> EUT+DC Electronic load+USB CAN
TC04	<u>Discharge(50% Load)</u> EUT+DC Electronic load+USB CAN
TC05	<u>Charging(10% Load)</u> EUT+DC Source+USB CAN
TC06	<u>Discharge(10% Load)</u> EUT+DC Electronic load+USB CAN
TC07	<u>Standby</u> EUT+USB CAN

4.5. Description of Test Setup

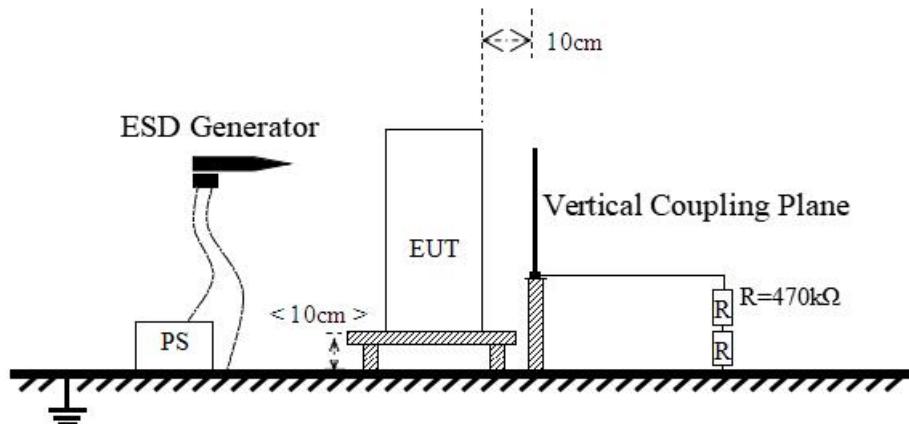
Test Setup 1 For Radiated Emission Test (30 MHz-1 GHz)

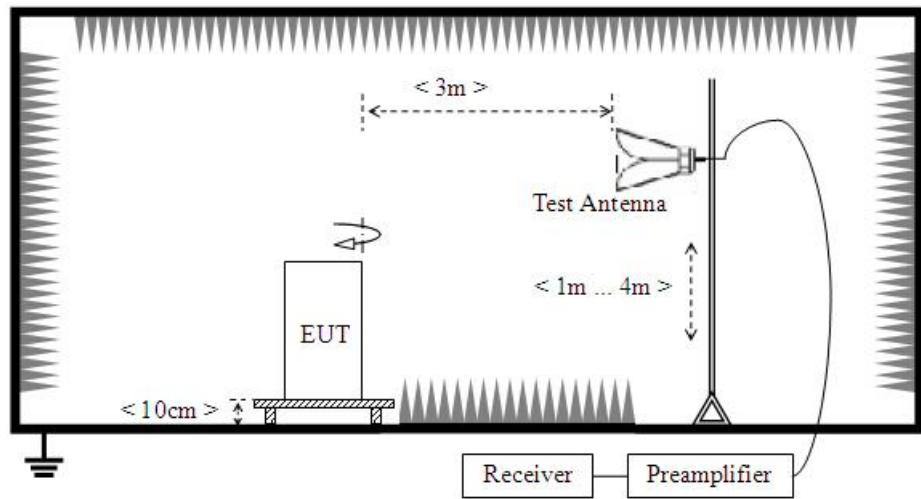
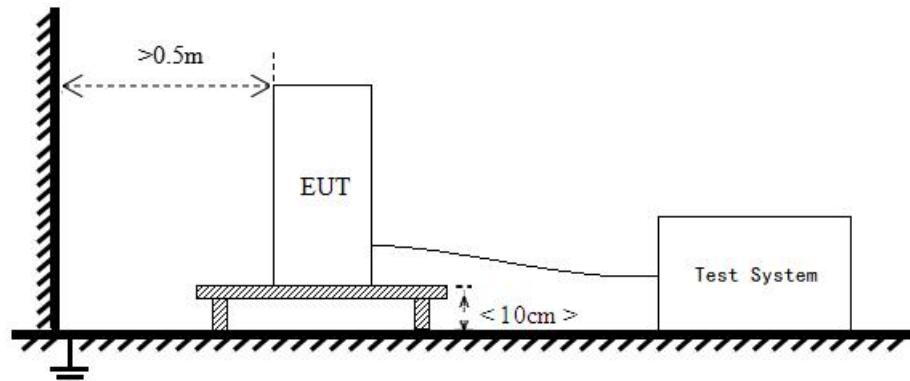
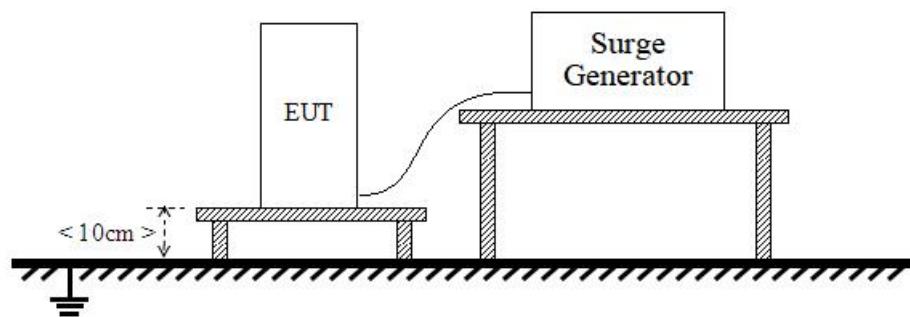


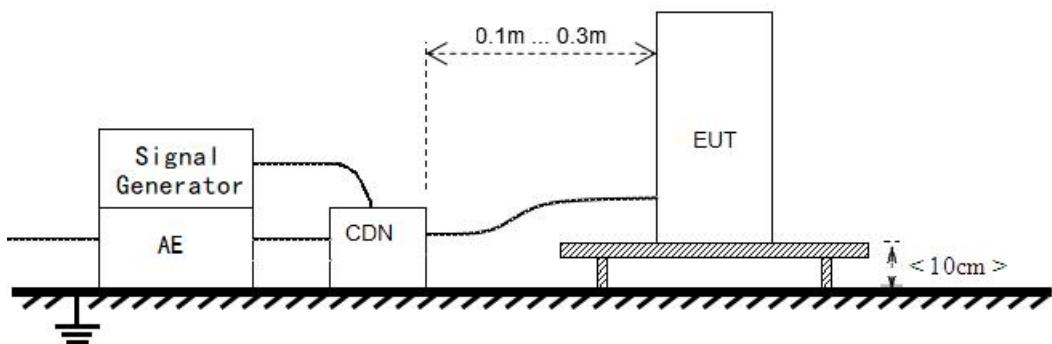
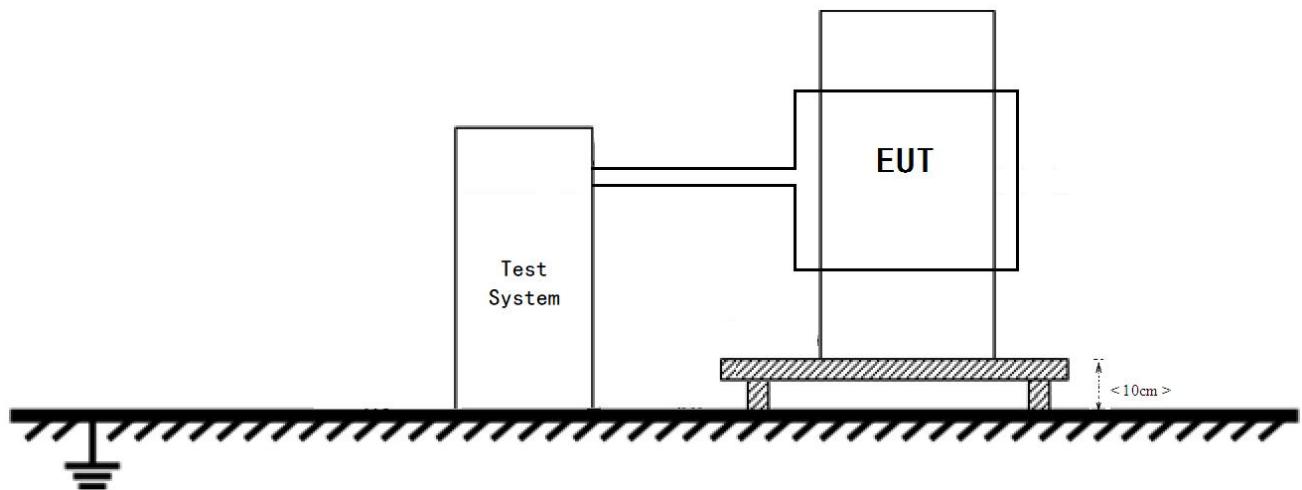
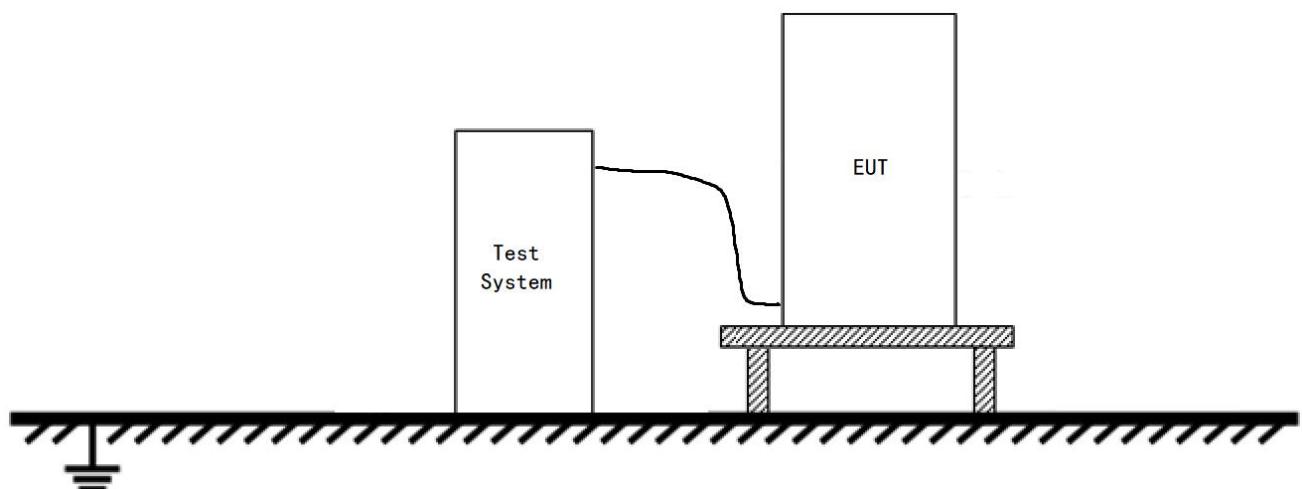
Test Setup 2 For Conducted disturbance voltage at mains terminals Test



Test Setup 3 For Electrostatic Discharge Immunity Test



Test Setup 4 For Radiated Immunity TestTest Setup 5 For Electrical Fast Transient / Burst Immunity TestTest Setup 6 For Surge Immunity Test

Test Setup 7 For Immunity to Conducted Disturbances Induced By RF Fields TestTest Setup 8 Power Frequency Magnetic FieldsTest Setup 9 For Voltage Dips and Short Interruptions Immunity Test

4.6. Test Conditions

Test Case	Test Conditions	
Radiated Emission	Test Setup	Test Setup 1
	Test Configuration	TC01, TC02, TC03, TC04, TC07
Electrostatic Discharge Immunity	Test Setup	Test Setup 3
	Test Configuration	TC05, TC06
Radiated RF Electromagnetic Field Immunity	Test Setup	Test Setup 4
	Test Configuration	TC05, TC06
Electrical Fast Transient/Burst Immunity	Test Setup	Test Setup 5
	Test Configuration	TC05, TC06
Surge Immunity	Test Setup	Test Setup 6
	Test Configuration	TC05, TC06
Immunity to Conducted Disturbances Induced by RF Fields	Test Setup	Test Setup 7
	Test Configuration	TC05, TC06
Power-frequency magnetic field	Test Setup	Test Setup 8
	Test Configuration	TC05, TC06
Note: Based on client request, all normal using modes of the normal function were tested but only the worst test data of the worst mode is reported by this report. The Charging(100% Load) is the worst test mode in this report.		

5. TEST ITEMS

5.1. Emission Tests

5.1.1. Radiated Emission

5.1.1.1. Limit

Frequency range (MHz)	Distance (at 3 m)	Distance (at 10 m)
	Quasi-Peak Limit (dB μ V/m)	Quasi-Peak Limit (dB μ V/m)
30 - 230	50	40
230 - 1000	57	47

Frequency range (MHz)	Distance (at 3 m)	
	Peak Limit (dB μ V/m)	Average Limit (dB μ V/m)
1000-3000	76	56
3000-6000	80	60

NOTE:

- 1) If the highest internal frequency of the EUT is less than 108MHz, the measurement shall only be made up to 1GHz; If the highest internal frequency of the EUT is between 108MHz and 500MHz, the measurement shall only be made up to 2GHz; If the highest internal frequency of the EUT is between 500MHz and 1GHz, the measurement shall only be made up to 5GHz; If the highest internal frequency of the EUT is above 1GHz, the measurement shall be made up to 6GHz; Where the highest internal frequency is not known, tests shall be performed up to 6GHz.
- 2) At transitional frequencies the lower limit applies.

5.1.1.2. Test Procedure

All Radiated Emission tests were performed in the azimuth plane. And test data and plots are recorded in this test report.

An initial pre-scan was performed in the chamber using the EMI Receiver in peak detection mode. Quasi-peak measurements were conducted based on the peak sweep graph. The EUT was measured by Bi-Log antenna with 2 orthogonal polarities.

5.1.2. Conducted Emission

5.1.2.1. Test Limit

AC Port

Frequency range (MHz)	Quasi-peak (dBuV)	Average (dBuV)
0.15 - 0.50	79	66
0.50 - 30	73	60

NOTE:

- 1) The lower limit shall apply at the band edges.

Telecom Port

Frequency range (MHz)	Quasi-peak (dBuV)	Average (dBuV)
0.15 - 0.50	97-87	84-74
0.50 - 30	87	74

NOTE:

- 1) The lower limit shall apply at the band edges.
- 2) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50 MHz.
- 3) The current and voltage disturbance limits are derived for use with an impedance stabilization network (ISN) which presents a common mode (asymmetric mode) impedance of 150 Ω to telecommunication port under test.

Discontinuous disturbances

The click limit Lq is calculated by increasing the relevant quasi-peak limit L for continuous disturbances (as given in AC Port quasi-peak limit) by:

Frequency (MHz)	Click rate N	
	Click limit Lq (dB) N < 0,2	Click limit Lq (dB) 0,2 ≤ N < 30
0.15 - 30	AC Port quasi-peak limit + 44	AC Port quasi-peak limit + 20 lg (30/N)

5.1.2.2. Test Procedure

The EUT is connected to the power mains through a LISN which provides 50 Ω/50 µH or 150 Ω of coupling impedance for the measuring instrument. The test frequency range is from 150 kHz to 30 MHz. The maximum conducted interference is searched using Peak (PK), Quasi-peak (QP) and Average (AV) detectors; the emission levels that are more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Telecommunication port was checked to find out the maximum conducted emission.

5.2. Immunity Tests

5.2.1. Test Performance Criteria for Immunity Test

5.2.1.1. General Performance Criteria

Type	Description
Criterion A	The apparatus 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 apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. 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 apparatus if used as intended.
Criterion B	The apparatus 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 apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. 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 apparatus if used as intended.
Criterion C	Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

5.2.2. Electrostatic Discharge Immunity

5.2.2.1. Test Specification

Specification	Value
Basic Standard	IEC 61000-4-2:2008
Discharge Impedance	330 Ohm / 150 pF
Discharge Voltage	Air Discharge: 2 kV; 4 kV; 8 kV; Contact Discharge: 2 kV; 4 kV
Polarity	Positive / Negative
Number of Discharge	Minimum 20 times at each test point
Discharge Mode	Single discharge
Discharge Period	1 second minimum

5.2.2.2. Test Procedure

1. Electrostatic discharges are applied only to those points and surfaces of the EUT that are accessible to users during normal operation.
2. The test is performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.
3. The time interval between two successive single discharges is at least 1 second.
4. The ESD generator is held perpendicularly to the surface to which the discharge is applied and the return cable is at least 0.2 meters from the EUT.
5. Contact discharges are applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
6. Air discharges are 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 is removed from the EUT and re-triggered for a new single discharge. The test is repeated until all discharges were completed.
7. At least ten single discharges (in the most sensitive polarity) are applied to the Horizontal Coupling Plane at points on each side of the EUT. The ESD generator is positioned vertically at a distance of 0.1 meters from the EUT with the discharge electrode touching the HCP.
8. At least ten single discharges (in the most sensitive polarity) are applied to the center of one vertical edge of the Vertical Coupling Plane in sufficiently different positions that the four faces of the EUT were completely illuminated. The VCP (dimensions 0.5 m*0.5 m) is placed vertically to and 0.1 meters from the EUT.

5.2.3. Radio Frequency Electromagnetic Field Immunity

5.2.3.1. Test Specification

Specification	Value	
Basic Standard	IEC 61000-4-3:2006+A1:2007+A2:2010	
Frequency Range	80 MHz to 1000 MHz	1.4 GHz to 6.0 GHz
Field Strength	10 V/m (unmodulated, r.m.s)	3 V/m (unmodulated, r.m.s)
Modulation	1 kHz sine wave, 80%, AM modulation	
Frequency Step	1% of fundamental	
Polarity of Antenna	Horizontal and Vertical	
Test Distance	3 m	
Antenna Height	1.5 m	
Dwell Time	3 seconds	

5.2.3.2. Test Procedure

1. The testing is performed in a fully anechoic chamber. The transmit antenna is located at a distance of 3 meters from the EUT.
2. The test signal is 80% amplitude modulated with a 1 kHz sine wave.
3. The frequency range is swept from 80 MHz to 1000 MHz and 1400 MHz to 6000 MHz with the exception of the exclusion band for transmitters, receivers and duplex transceivers. The rate of sweep does not exceed 1.5×10^{-3} decade/s. Where the frequency range is swept incrementally, the step size is 1% of fundamental.
4. The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
5. The field strength level is 10 V/m for 80 MHz to 1000MHz, 3 V/m for 1400 MHz to 6000 MHz.
6. The test is performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides, but only the worst side data is reported in this report.

5.2.4. Electrical Fast Transient / Burst Immunity

5.2.4.1. Test Specification

Specification	Value	
Basic Standard	IEC 61000-4-4:2012	
Test Voltage	AC Power Port: 2 kV.	
	DC Power Port: 1 kV.	
	Signal Port: 1 kV.	
Polarity	Positive / Negative	
Impulse Frequency	5 kHz	100 kHz
Impulse Wave Shape	5/50 ns	
Burst Duration	15 ms	0.75 ms
Burst Period	300 ms	
Test Duration	> 1 min	

NOTE:

- 1) The signal ports tests apply only to ports interfacing with cables whose total length according to the manufacturer's functional specification may exceed 3 m.
- 2) The DC ports test not applicable to input ports intended for connection to a battery or a rechargeable battery which must be removed or disconnected from the apparatus for recharging.
- 3) The EUT with a DC power input port intended for use with an AC-DC power adaptor shall be tested on the AC power input of the AC-DC power adaptor specified by the manufacturer or where none is so specified, using a typical AC-DC power adaptor.
- 4) The test applicable to DC power input ports and signal ports intended to be connected permanently to cables longer than 3 m.

5.2.4.2. Test Procedure

1. The EUT is tested with 2000 V discharges to the AC power input leads, 1000 V for signal port and DC port.
2. Both positive and negative polarity discharges are applied.
3. The length of the "hot wire" from the coaxial output of the EFT generator to the terminals on the EUT should not exceed 1 m.
4. The duration time of each test sequential is 1min.
5. The transient / burst waveform is in accordance with IEC 61000-4-4:2012, 5/50 ns.

5.2.5. Surge Immunity

5.2.5.1. Test Specification

Specification		Value				
Ports class		AC Power Port	DC Power Port	Signal Port		
Basic Standard		IEC 61000-4-5:2014				
Waveform		Voltage: 1.2/50 μ s; Current: 8/20 μ s				
Test Voltage	line to ground	0.5 kV, 1 kV, 2 kV;	0.5 kV, 1 kV	0.5 kV, 1 kV		
	line to line	0.5 kV, 1 kV	0.5 kV	/		
Polarity		Positive / Negative				
Phase Angle		0°, 90°, 180°, 270°	N/A			
Repetition Rate		60 seconds				
Times		5 times per condition				

NOTE:

- 1) The Signal ports test not applicable to ports interfacing with long distance lines which inside a building is longer than 30 m, or which leaves the building (including a line installed outdoors).
- 2) Signal ports directly connected to AC power network shall be treated as AC power ports.
- 3) The DC ports test not applicable to input ports intended for connection to a battery or a rechargeable battery which must be removed or disconnected from the apparatus for recharging.
- 4) The EUT with a DC power input port intended for use with an AC-DC power adaptor shall be tested on the AC power input of the AC-DC power adaptor specified by the manufacturer or where none is so specified, using a typical AC-DC power adaptor.

5.2.5.2. Test Procedure

The EUT and the auxiliary equipment are placed on a table of 0.8 m heights above a metal ground reference plane. The size of ground plane is greater than 1 m*1 m and project beyond the EUT by at least 0.1 m on all sides. The ground plane is connected to the protective earth. The length of power cord between the coupling device and the EUT is less than 2 meters (provided by the manufacturer).

The EUT is connected to the power mains through a coupling device that directly couples the surge interference signal. The surge noise is applied synchronized to the voltage phase at the zero crossing and the peak value of the AC voltage wave (positive and negative).

The surges are applied line to line and line(s) to earth. When testing line to earth the test voltage is applied successively between each of the lines and earth. Set up to the test level specified increased the test voltage. All lower levels including the selected test level are tested. The polarity of each surge level included positive and negative test pulses.

5.2.6. Immunity to Conducted Disturbances Induced by RF Fields

5.2.6.1. Test Specification

Specification	Value		
Basic Standard	IEC 61000-4-6:2013		
Frequency Range	0.15 MHz – 80 MHz		
Test Voltage	10 V (unmodulated, r.m.s)		
Modulation	1 kHz sine wave, 80% AM		
Frequency Step	1% of fundamental		
Coupled Cable	AC Power Line	DC Power Line	Signal Line
Coupling Device	CDN-M1/2/3/4/5, Capacitive clamp		

NOTE:

- 1) The DC port and Signal port only apply to ports interfacing with cables whose total length according to the manufacturers functional specification may exceed 3 m.
- 2) The test level can also be defined as the equivalent current into a 150 Ω load at signal ports.

5.2.6.2. Test Procedure

The EUT shall be tested within its intended operating and climatic conditions.

The test shall be performed with the test generator connected to each of the coupling and decoupling devices in turn, while the other non-excited RF input ports of the coupling devices are terminated by a 150 Ohm load resistor.

The test signal is 80% amplitude modulated with a 1 kHz sine wave.

The frequency range is swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80% amplitude. The sweep rate shall not exceed 1.5×10^{-3} decades/s. The step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value where the frequency is swept incrementally.

The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised, and able to respond. Sensitive frequencies such as clock frequencies and harmonics or frequencies of dominant interest, shall be analyzed separately.

Attempts should be made to fully exercise the EUT during test, and to fully interrogate all exercise modes selected for susceptibility.

5.2.7. Power Frequency Magnetic Fields Immunity

5.2.7.1. Test Specification

Specification	Value
Basic Standard	IEC 61000-4-8:2009
Field Frequency	50/60 Hz
Test Level	30 A/m
Polarity	Horizontal and Vertical
Test Duration	5 min

NOTE:

- 1) The test shall be carried out at the frequencies appropriate to the power supply frequency. Equipment intended for use in areas supplied only at one of these frequencies need only be tested at that frequency.
- 2) Applicable only to apparatus containing devices susceptible to magnetic fields.

5.2.7.2. Test Procedure

The EUT shall be subjected to the test magnetic field by using the induction coil of standard dimensions (1 m*1 m) and shown in Section 15.1. The induction coil shall then be rotated by 90° in order to expose the EUT to the test field with different orientations.

5.2.8. Voltage Dips and Short Interruptions Immunity

5.2.8.1. Test Specification

AC Ports

Specification	Value
Basic Standard	IEC 61000-4-34:2005+A1:2009
Frequency	50/60Hz
Voltage Dips	100% reduction: 20 ms 60% reduction: 200/240 ms 30% reduction: 500/600 ms
Voltage Interruptions	100% reduction: 5000/6000 ms
Voltage Phase Angle	0°

NOTE:

- 1) Applicable only to AC input ports.

5.2.8.2. Test Procedure

The power cord is used as supplied by the manufacturer. The EUT was connected to the line output of the Voltage Dips and Interruption Generator.

The EUT is tested for a) 100% voltage dip of supplied voltage with duration of 20 ms; b) 60% voltage dip of supplied voltage with duration of 200 or 240 ms; c) 30% voltage dip of supplied voltage and duration 500 or 600 ms. Both of the dip tests are carried out for a sequence of three voltage dips with intervals of 10 seconds.

100% voltage interruption of supplied voltage with duration of 5000 or 6000 ms is followed, which is a sequence of three voltage interruptions with intervals of 10 seconds.

Voltage reductions occur at 0 degrees crossover point of the voltage waveform. The performance of the EUT is checked after the voltage dip or interruption.

ANNEX A TEST RESULTS

A.1 Radiated Emission

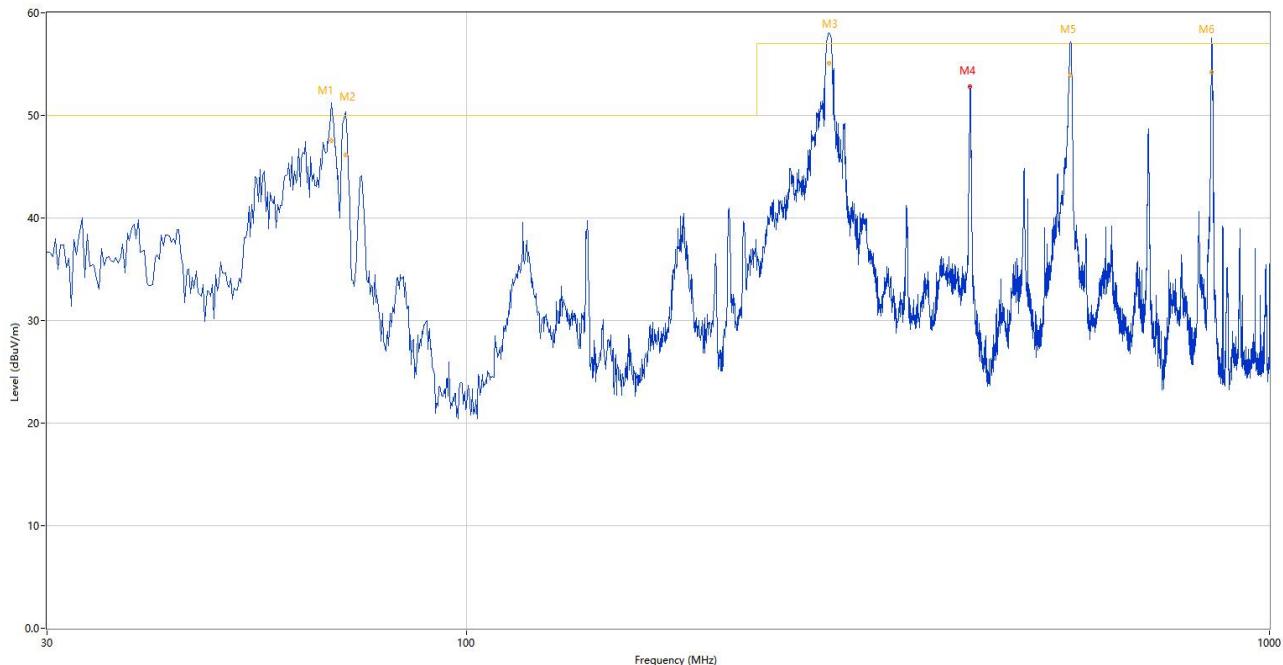
Note 1: The symbol of “--” in the table which means not application.

Note 2: Measurements shall be made with a quasi-peak measuring receiver in the frequency range 30 MHz to 1000 MHz. To reduce the testing time, a peak measuring receiver may be used instead of a quasi-peak measuring receiver. In case of dispute, measurement with a quasi-peak measuring receiver will take precedence.

Test Data and Plots- (Below 1 GHz)

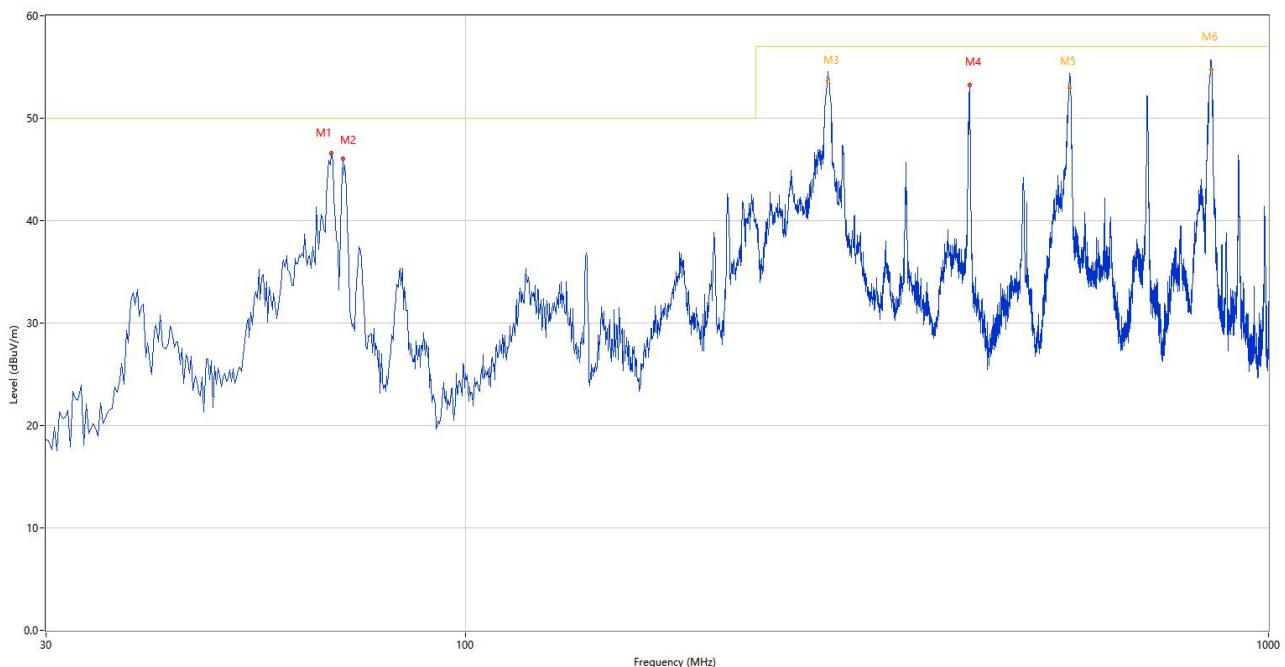
The worst test mode: Charging(100% Load)

A.1.1 Test Antenna Vertical, 30 MHz – 1 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1*	67.830	47.28	-28.63	50.0	-2.72	QP	172.00	100	Vertical	P
2*	70.770	46.11	-29.73	50.0	-3.89	QP	209.00	200	Vertical	P
3*	282.745	54.67	-24.93	57.0	-2.33	QP	131.00	100	Vertical	P
4	423.820	52.76	-21.23	57.0	-4.24	Peak	253.00	100	Vertical	P
5*	564.530	53.79	-18.41	57.0	-3.21	QP	0.00	100	Vertical	P
6*	847.468	53.94	-12.60	57.0	-3.06	QP	50.00	100	Vertical	P

A.1.2 Test Antenna Horizontal, 30 MHz – 1 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	68.073	46.58	-29.02	50.0	-3.42	Peak	68.00	200	Horizontal	P
2	70.255	46.04	-29.94	50.0	-3.96	Peak	25.00	300	Horizontal	P
3*	282.382	53.48	-24.83	57.0	-3.52	QP	129.00	100	Horizontal	P
4	424.305	53.29	-21.22	57.0	-3.71	Peak	171.00	200	Horizontal	P
5*	564.773	52.95	-18.40	57.0	-4.05	QP	251.00	100	Horizontal	P
6*	847.830	54.62	-12.65	57.0	-2.38	QP	332.00	100	Horizontal	P

A.2 Conducted Emission

Note: Not Applicable.

A.3 Electrostatic Discharge Immunity

Test Points	Discharge Level (kV)	Discharge Mode	Number of Discharge	Met Criteria	Required Criteria	Verdict
VCP	±2, ±4	Connect discharge	100	A	B	P
①Metal screw	±2, ±4	Connect discharge	800	A	B	P
②RJ45 interface	±2, ±4	Connect discharge	40	A	B	P
③Led light	±2, ±4, ±8	Air discharge	60	A	B	P
④Screen	±2, ±4, ±8	Air discharge	80	A	B	P

A.4 Radio Frequency Electromagnetic Field Immunity

Antenna Polarity	Frequency (MHz)	Side	Field Strength (V/m)	Met Criteria	Required Criteria	Verdict
Vertical	80 - 1000	Front, Back, Left, Right	10	A	A	P
Horizontal	80 - 1000	Front, Back, Left, Right	10	A	A	P
Vertical	1400 - 6000	Front, Back, Left, Right	3	A	A	P
Horizontal	1400 - 6000	Front, Back, Left, Right	3	A	A	P

A.5 Electrical Fast Transient/Burst Immunity

Test Data (DC Power Port)

Burst Parameters	5/50ns	Pulse Frequency	5kHz	Pulse group action time	15ms		Burst interval	300ms	
			100kHz		0.75ms				
Test Port	Coupling Line			Polarity	Test Level (kV)	Met Criteria	Required Criteria	Verdict	
DC Port	P+ & P- & PE			+ / -	0.5, 1	A	B	P	

A.6 Surge Immunity

Test Data (DC Power Port)

Times	5 times for positive and negative		Time interval		60s		
Test Port	Coupling Line	Polarity	Test Level (kV)	Test Waveform	Met Criteria	Required Criteria	Verdict
DC Port	P+ to P-	+ / -	0.5	1.2/50us	A	B	P
DC Port	P+ to PE, P- to PE	+ / -	0.5, 1	1.2/50us	A	B	P

A.7 Immunity to Conducted Disturbances Induced by RF Fields

Test Data (DC Power Port)

Test Port	Frequency (MHz)	Test Level (V)	Met Criteria	Required Criteria	Verdict
DC Port	0.15 - 80	10	A	A	P

A.8 Power Frequency Magnetic Fields Immunity

Test direction	Test Level (A/m)	Met Criteria	Required Criteria	Verdict
X, Y, Z	30	A	A	P

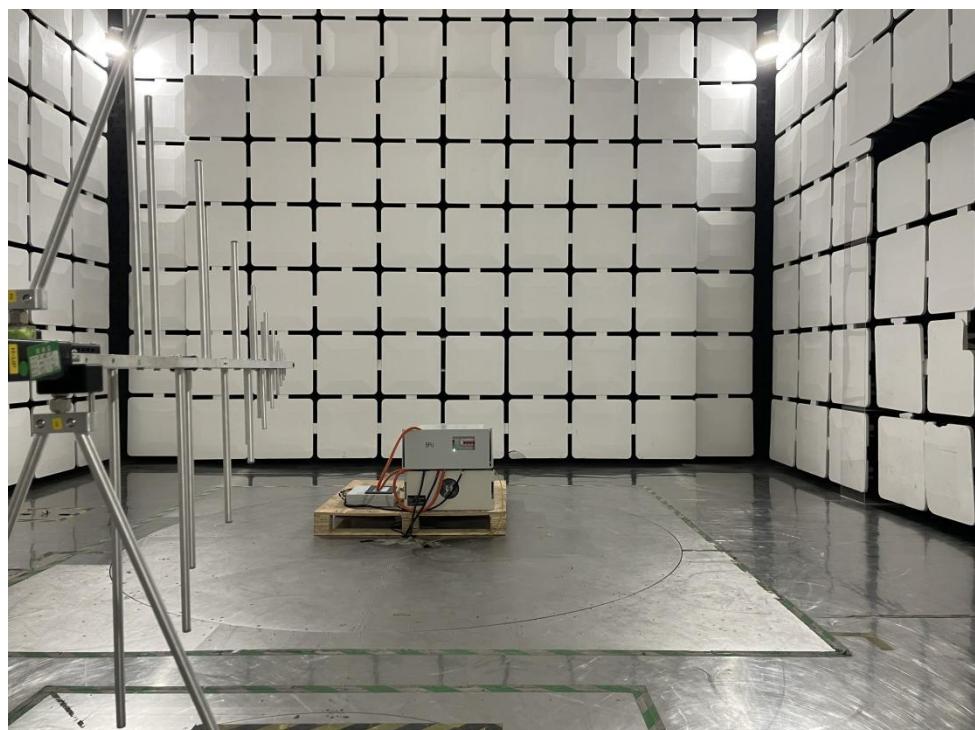
A.9 Voltage Dips and Short Interruptions Immunity

Note:Not Applicable.

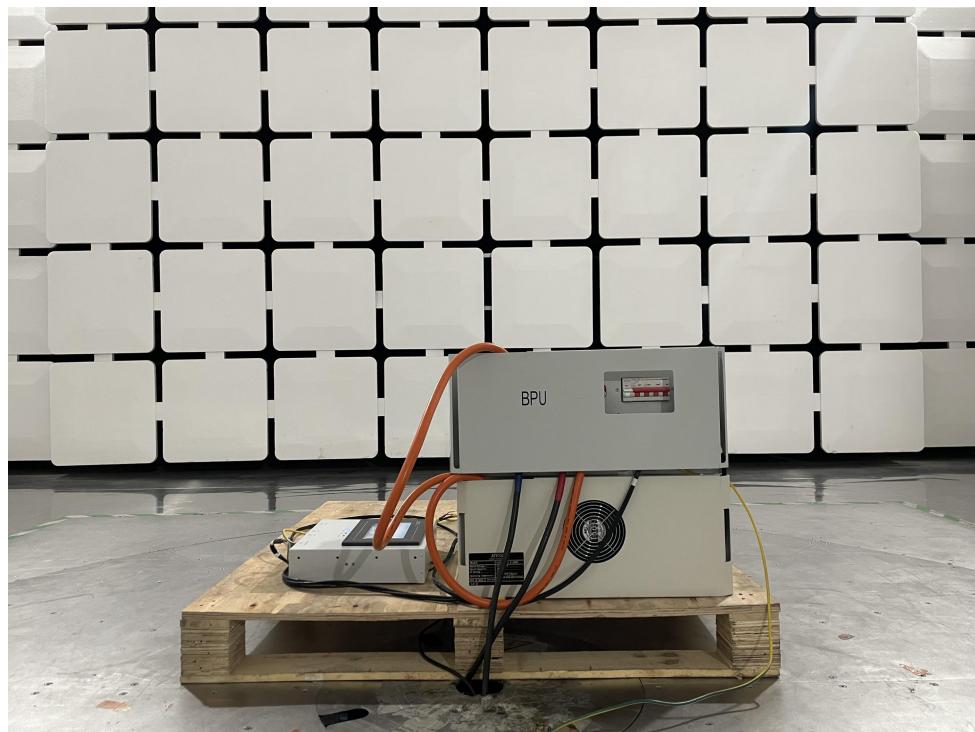
ANNEX B TEST SETUP PHOTOS

B.1 Radiated Emission

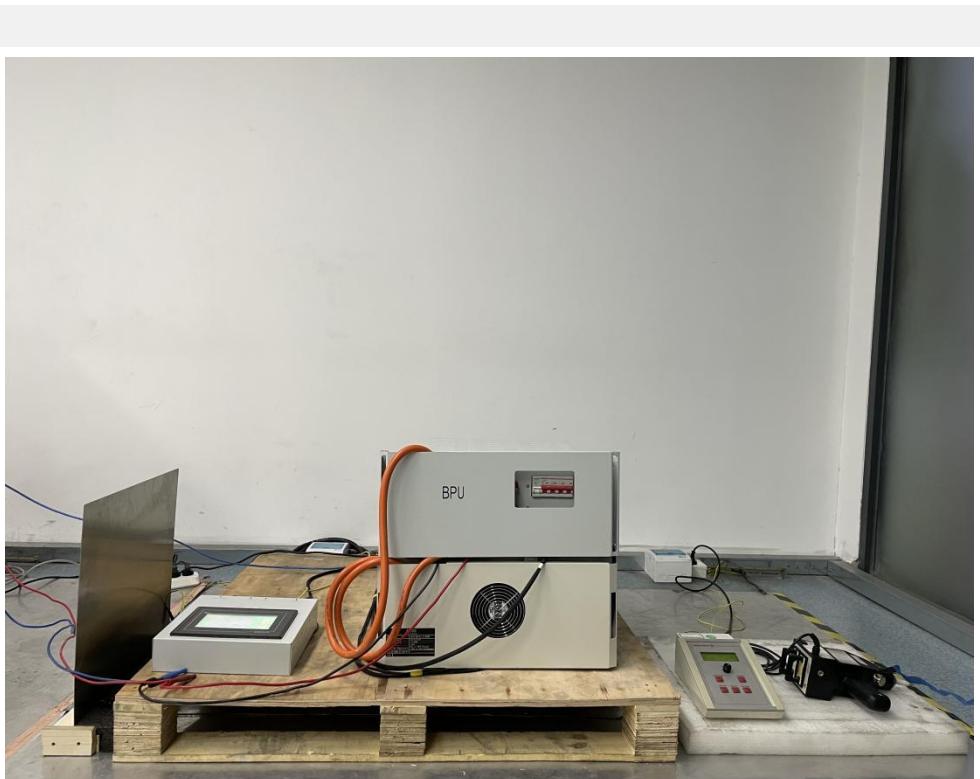
30MHz~1000MHz

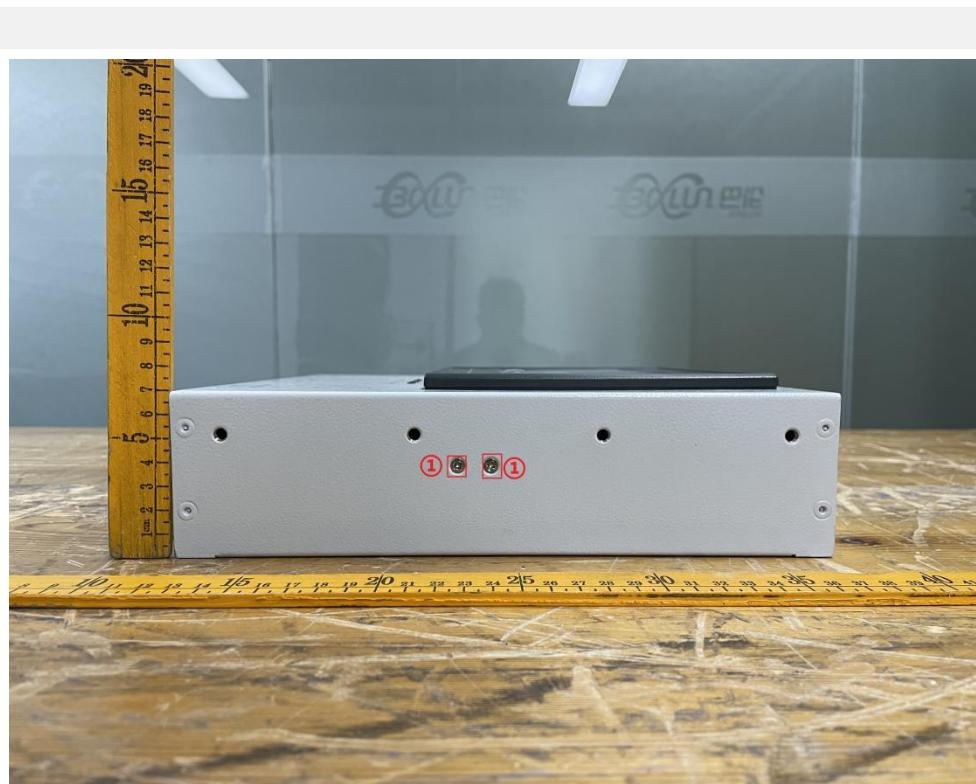


Close-up photo



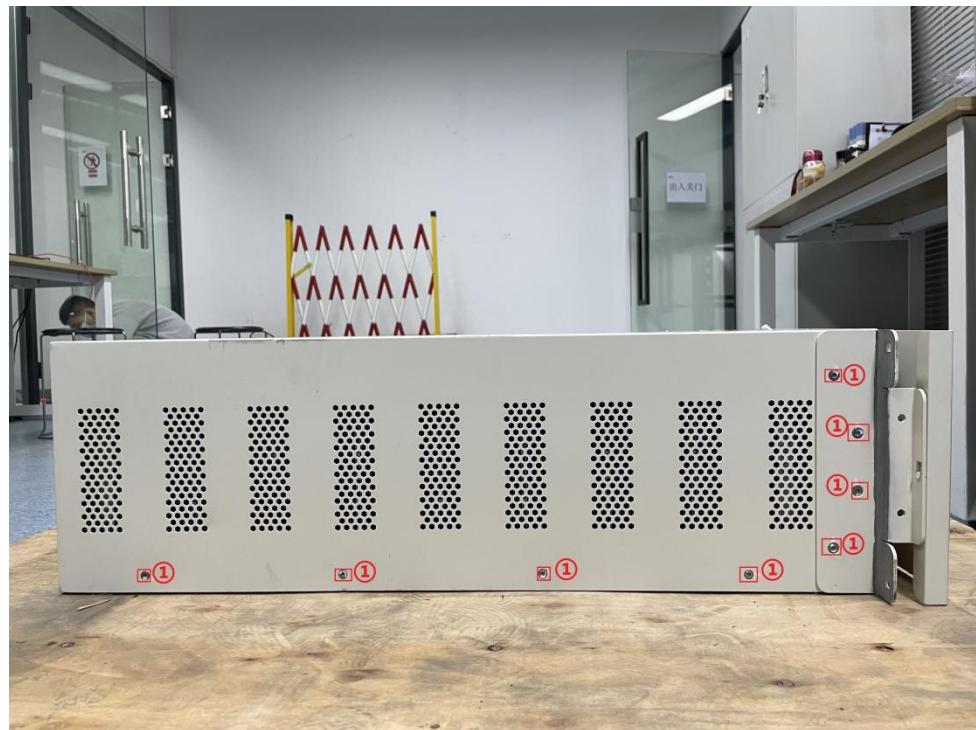
B.2 Electrostatic Discharge Immunity

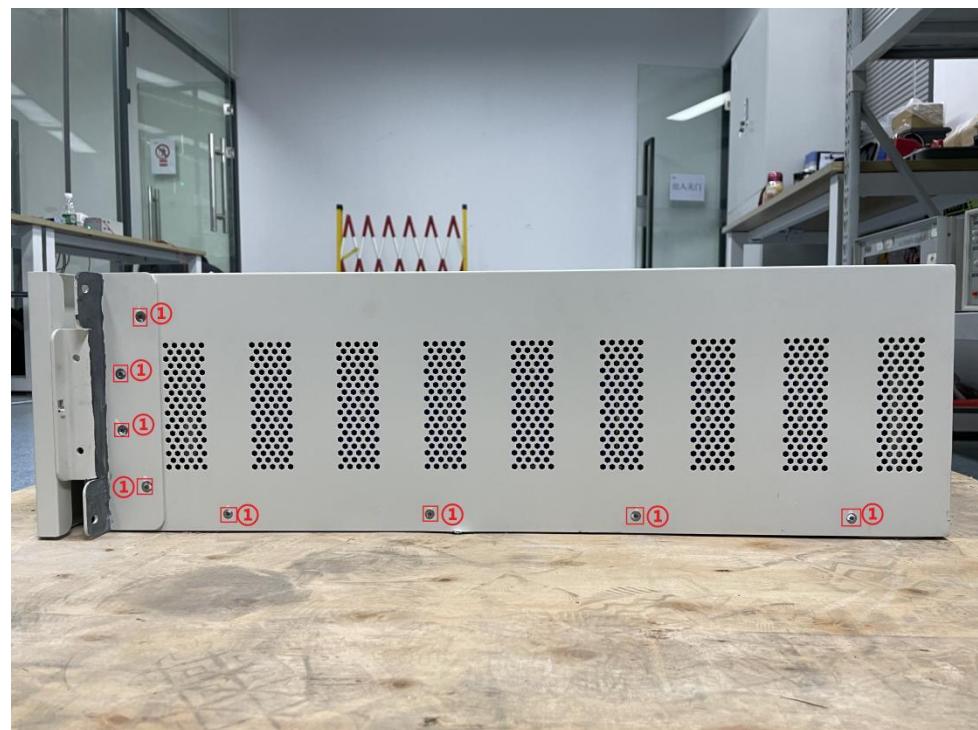






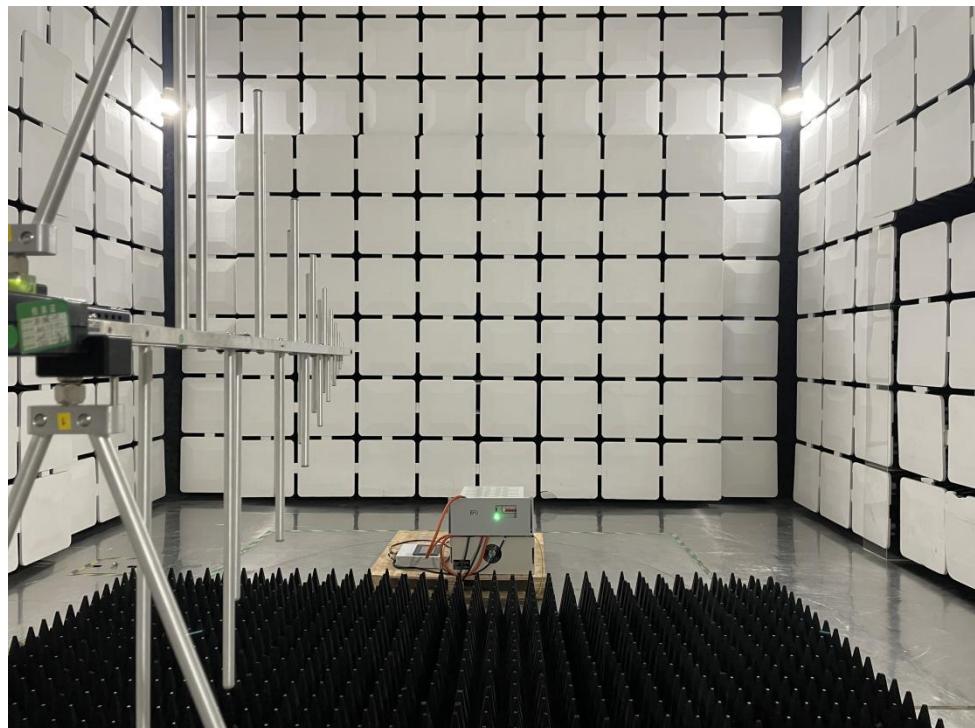




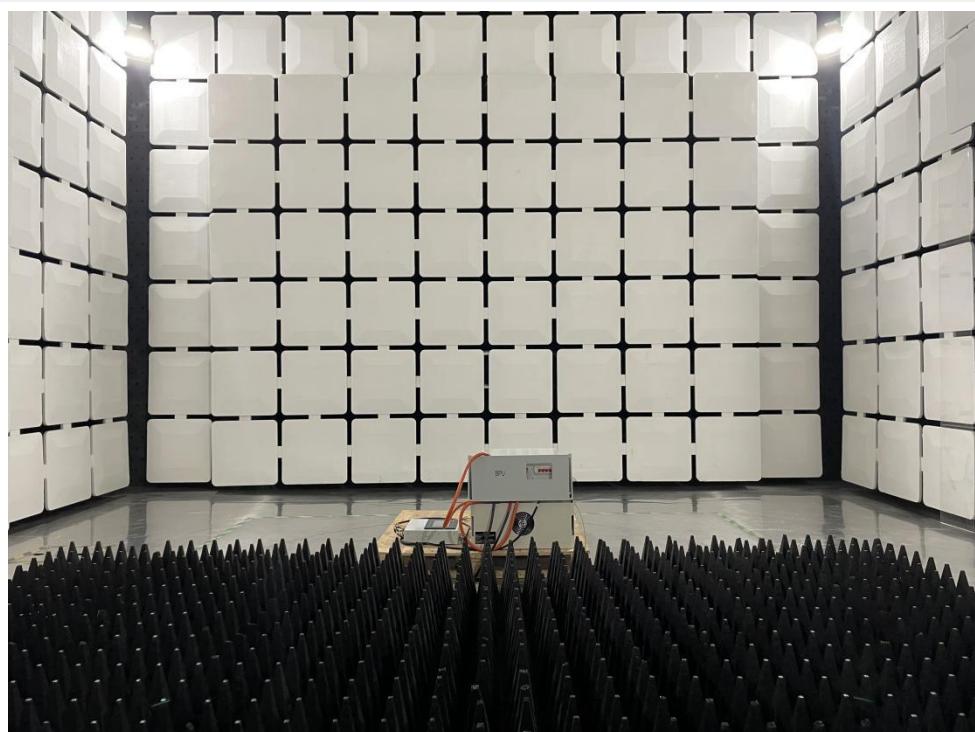


B.3 Radio Frequency Electromagnetic Field Immunity

RS_Below 1GHz



Close-up photo

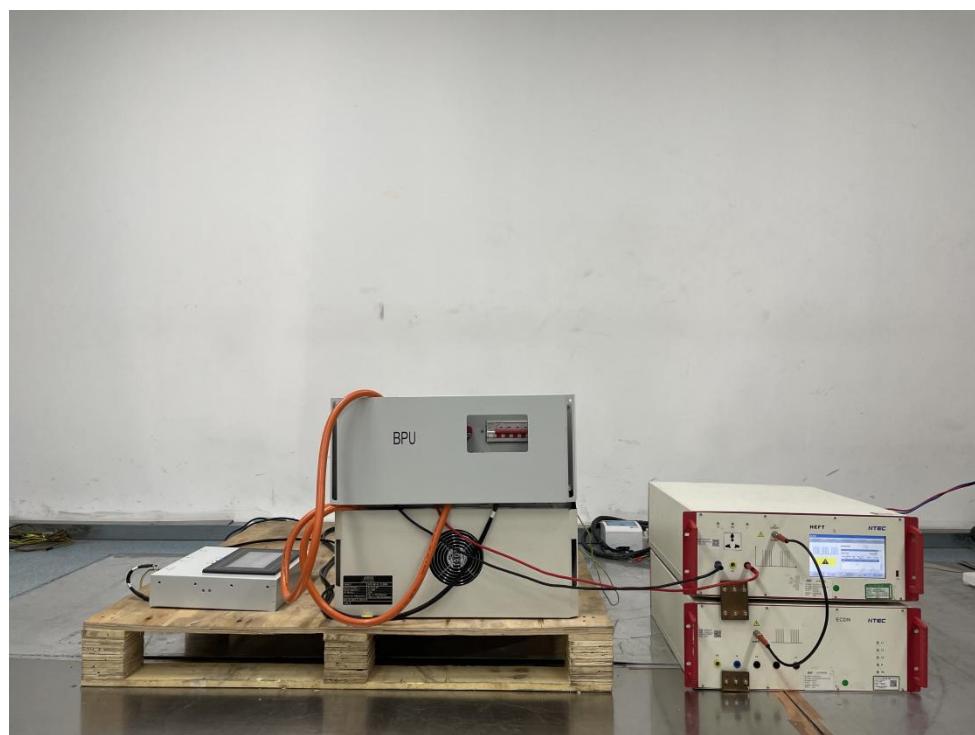


RS_Above 1GHz



B.4 Electrical Fast Transient/Burst Immunity

DC Port



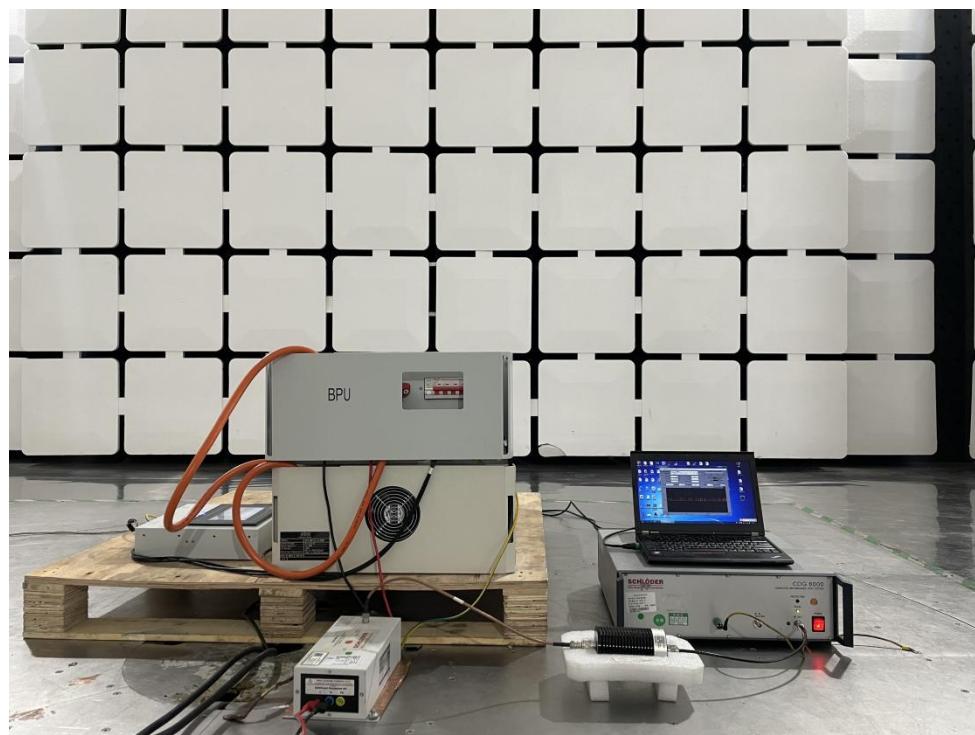
B.5 Surge Immunity

DC Port

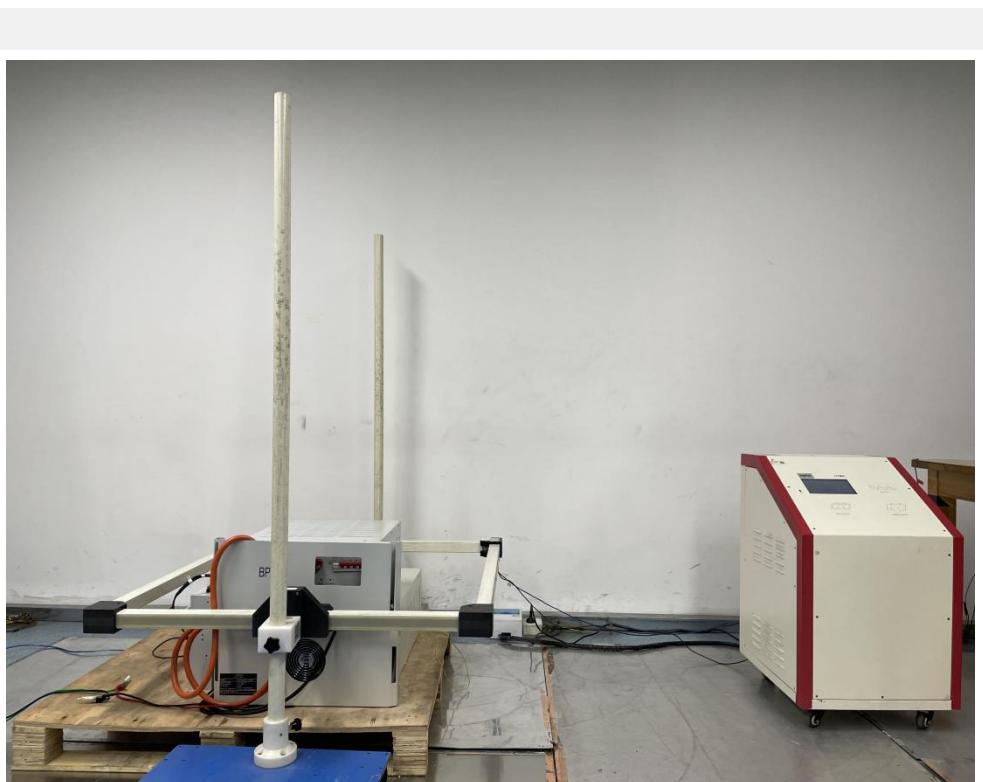


B.6 Immunity to Conducted Disturbances Induced by RF Fields

DC Port

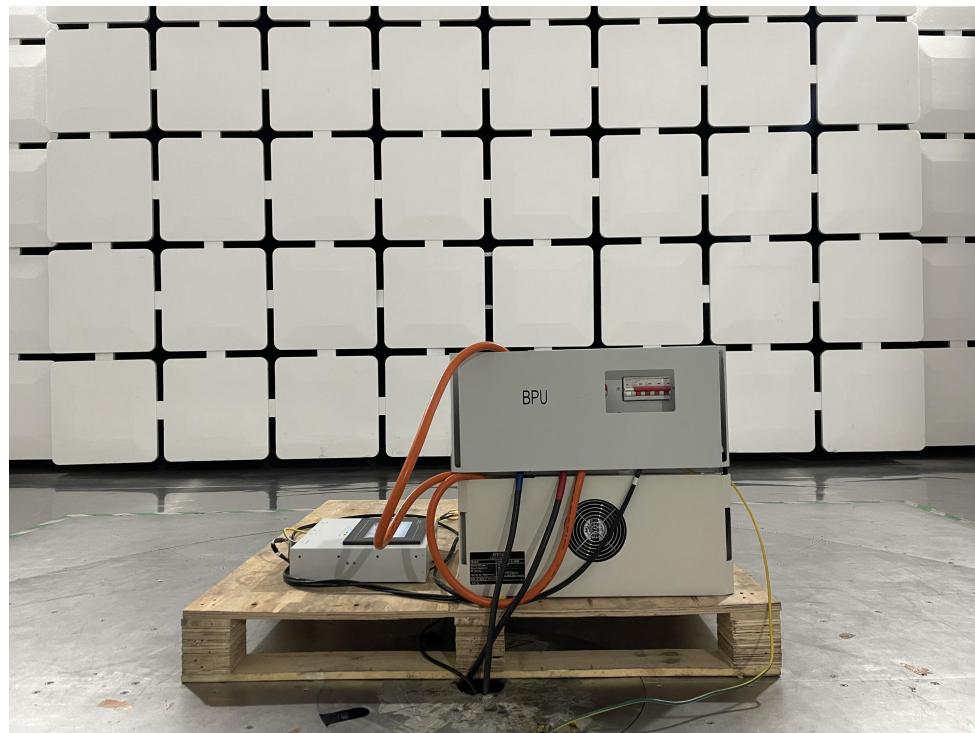


B.7 Power Frequency Magnetic Fields Immunity



ANNEX C EUT EXTERNAL PHOTOS

Front (Model:ESS-BM-51.2-280R)



Front (Display)



Left (Display)



Right (Display)



Top (Display)



Bottom (Display)



Front (Battery Module)



Back (Battery Module)



Left (Battery Module)



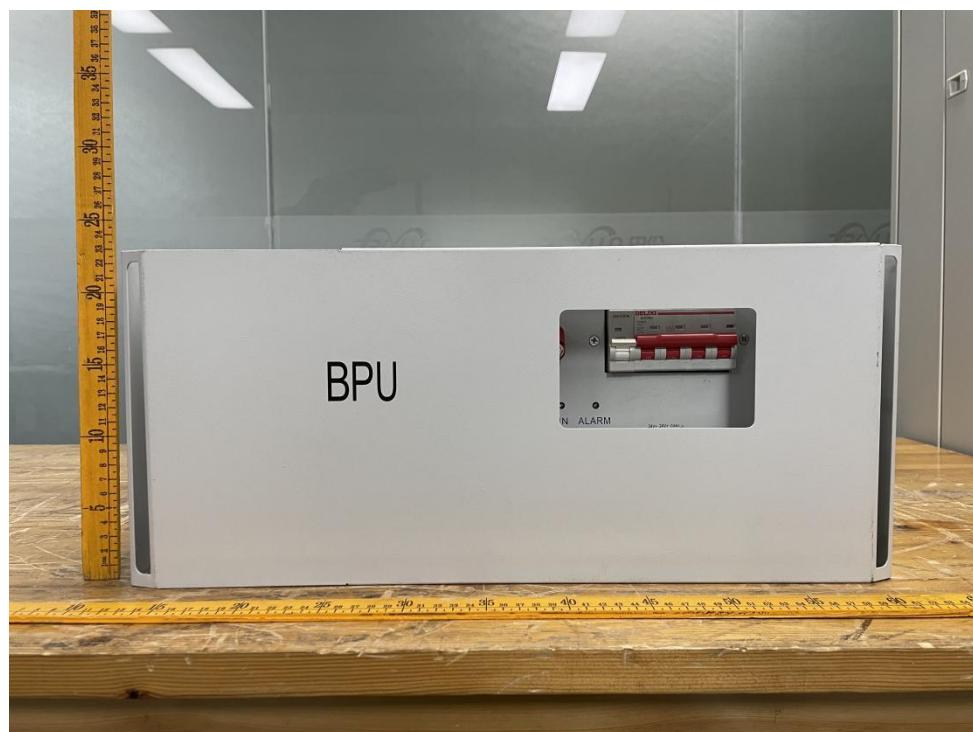
Right (Battery Module)



Top (Battery Module)



Front (Battery Power Unit)



Front (Battery Power Unit)



Back (Battery Power Unit)



Left (Battery Power Unit)



Right (Battery Power Unit)



Top (Battery Power Unit)

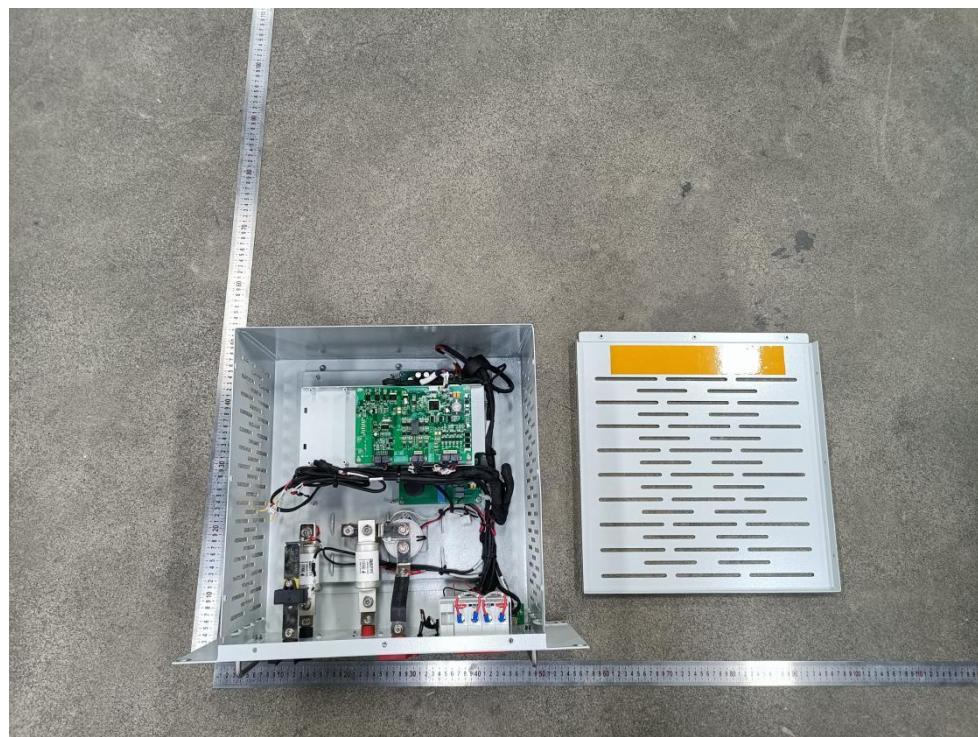


Bottom (Battery Power Unit)

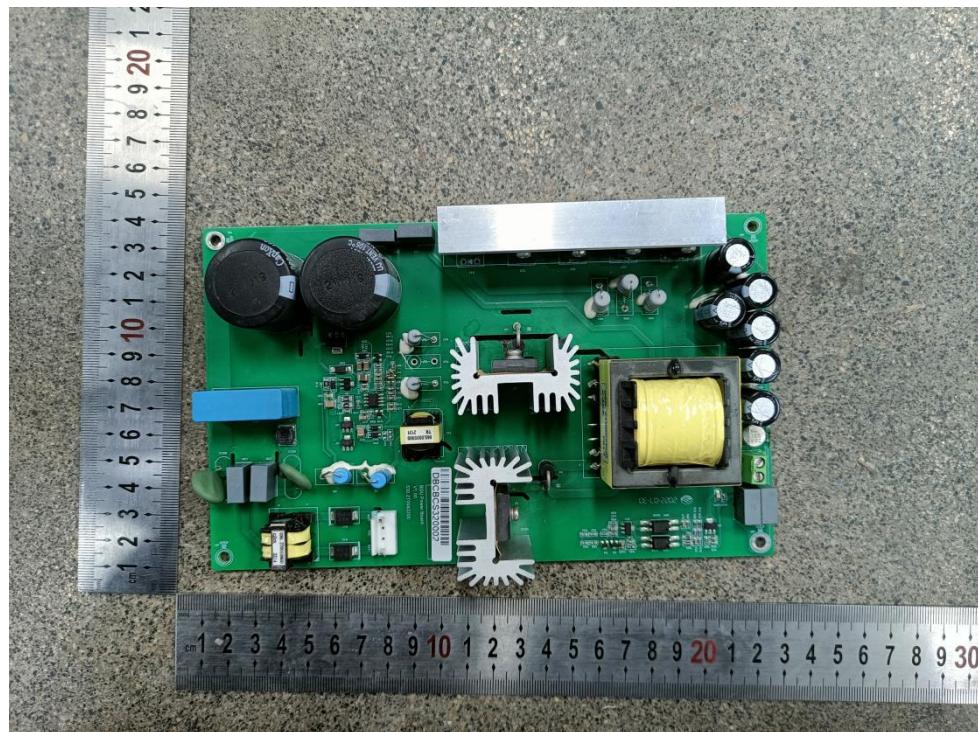


ANNEX D EUT INTERNAL PHOTOS

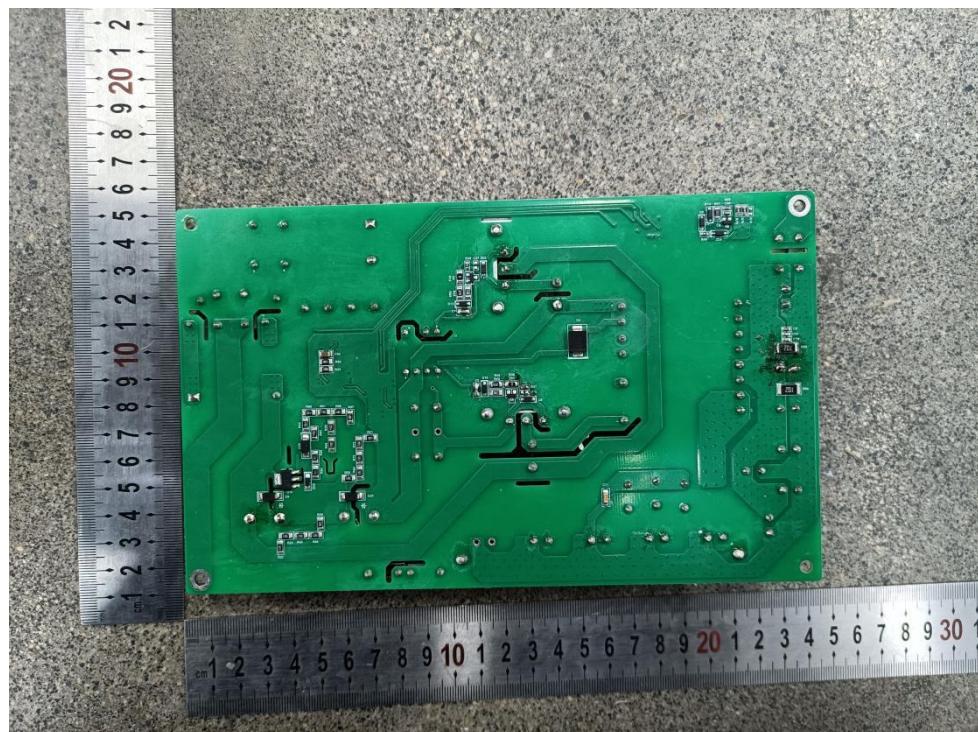
Internal (Battery Power Unit)



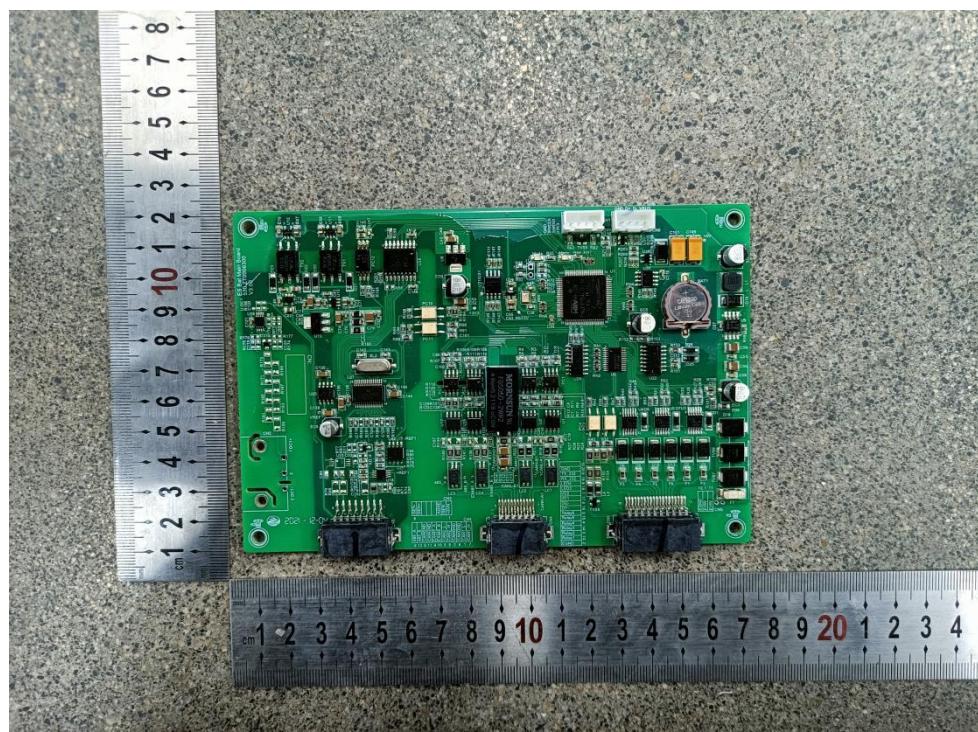
The front view of the mainboard 1 (Battery Power Unit)



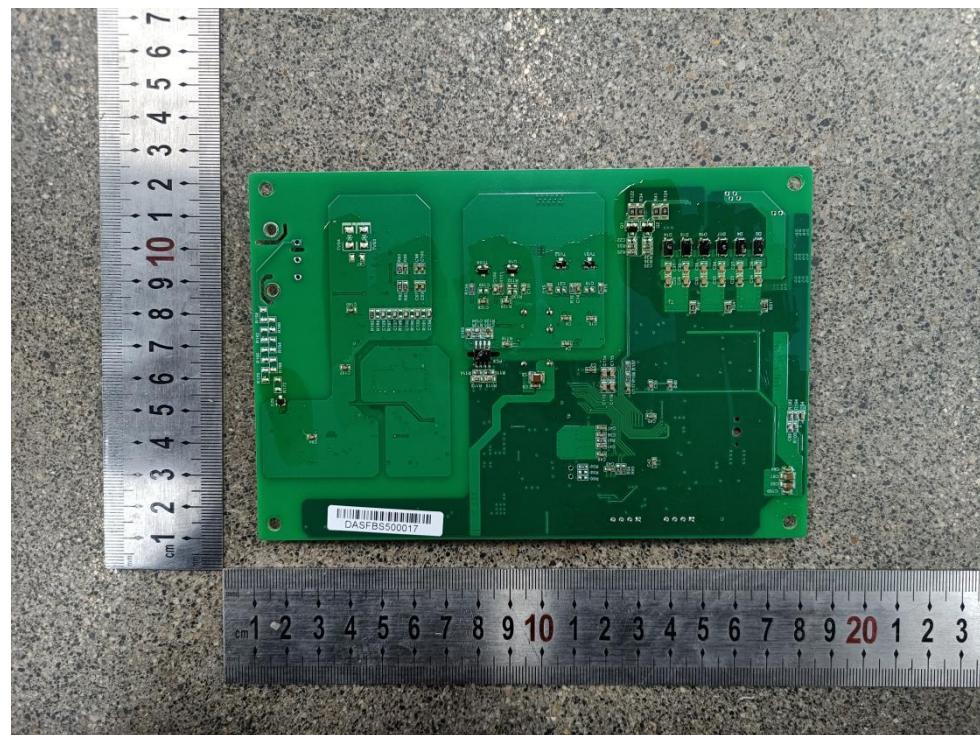
The back view of the mainboard 1 (Battery Power Unit)



The front view of the mainboard 2 (Battery Power Unit)



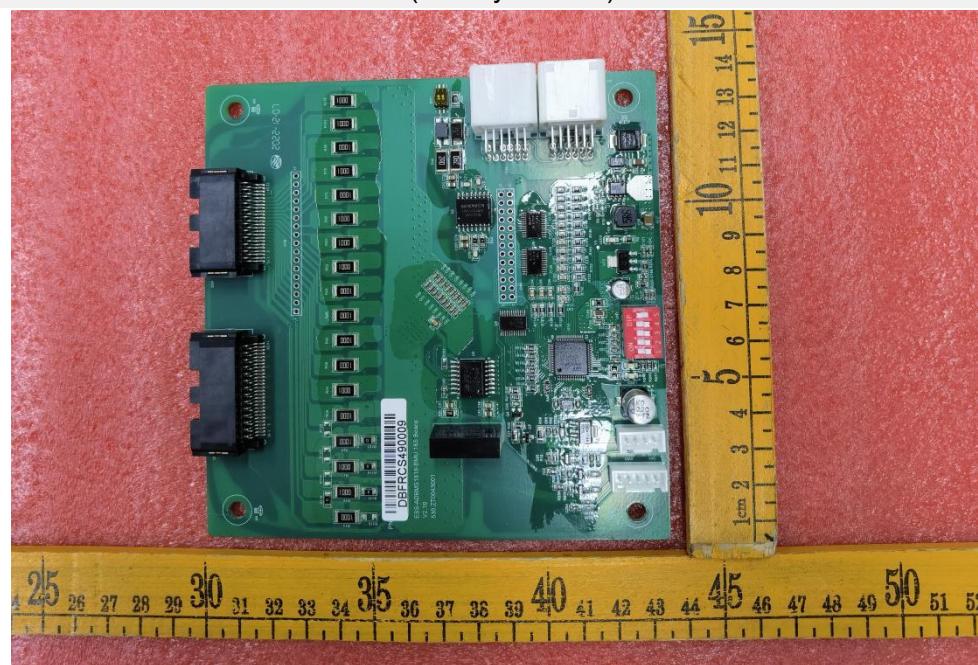
The back view of the mainboard 2 (Battery Power Unit)



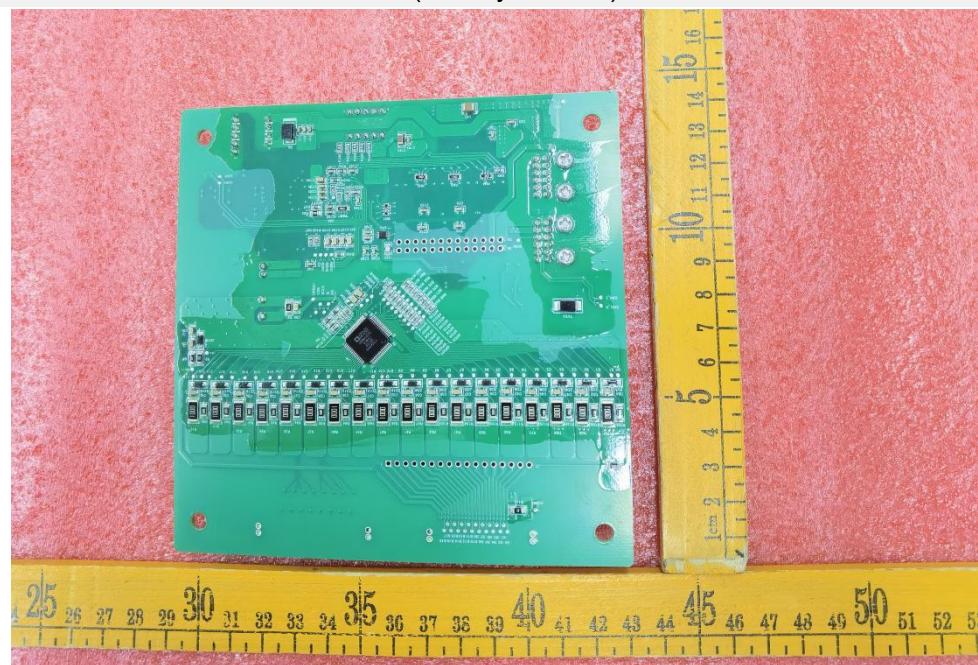
Internal (Battery Module)

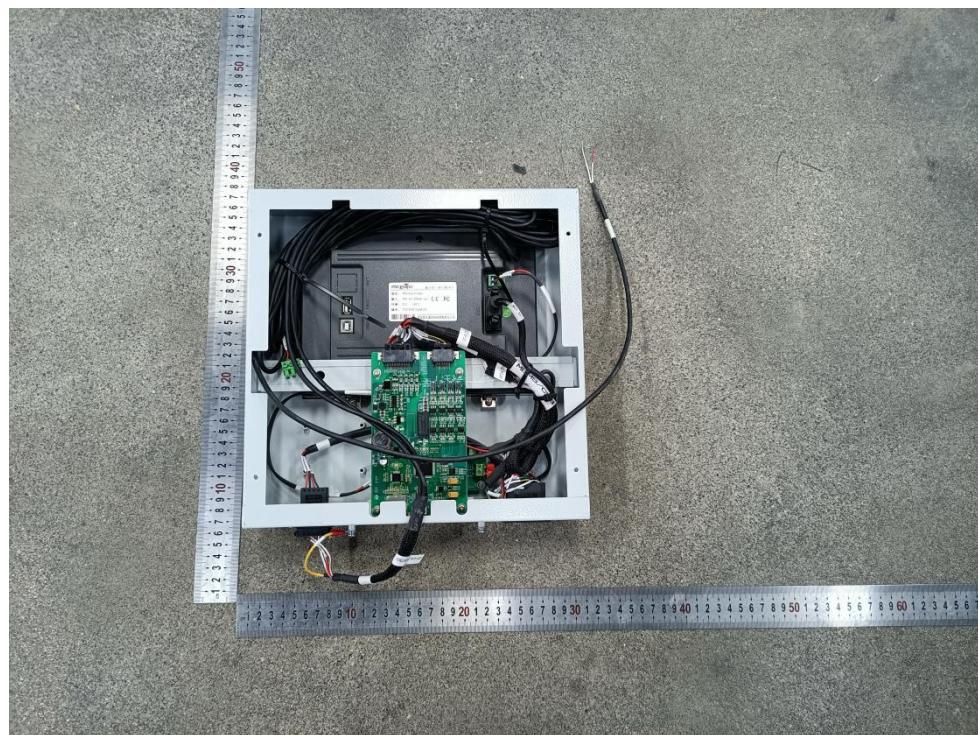
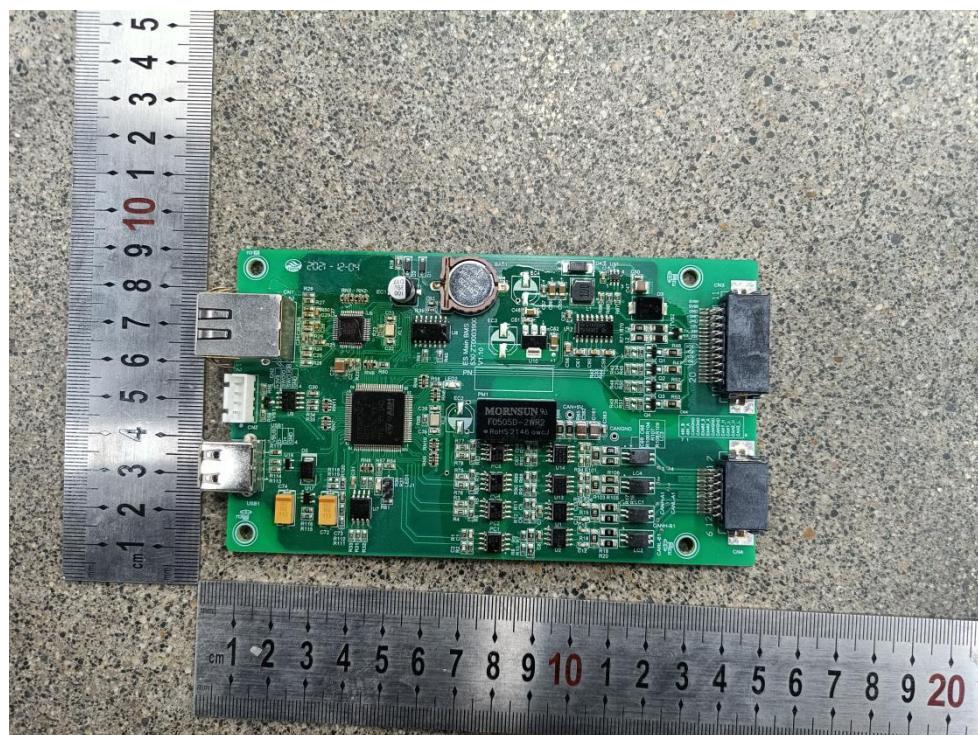


The front view of the mainboard (Battery Module)

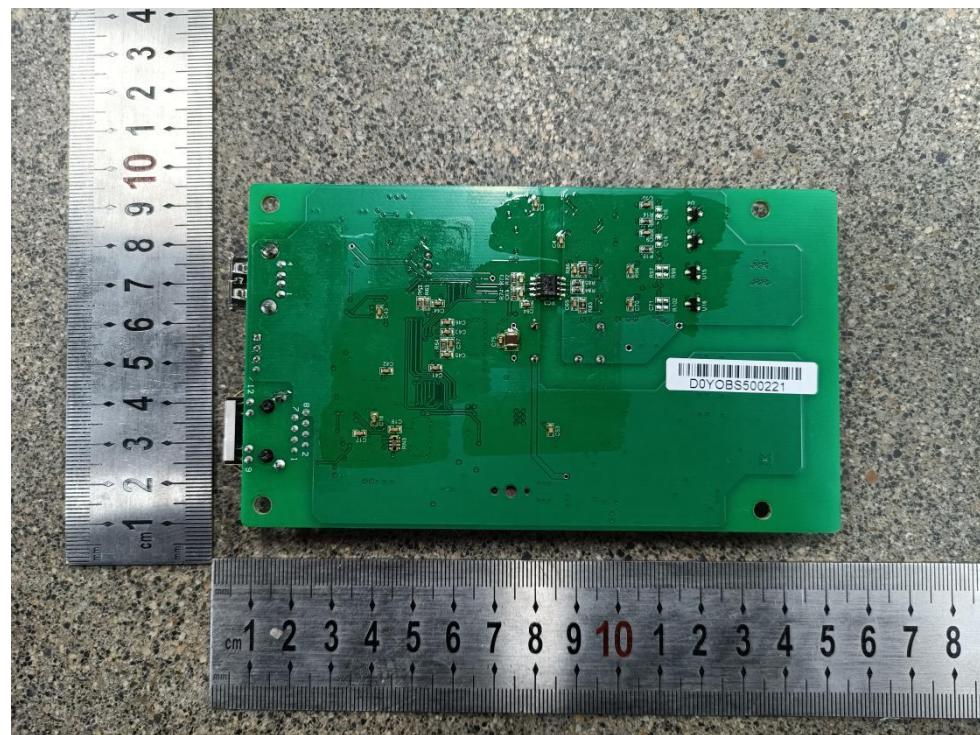


The back view of the mainboard (Battery Module)

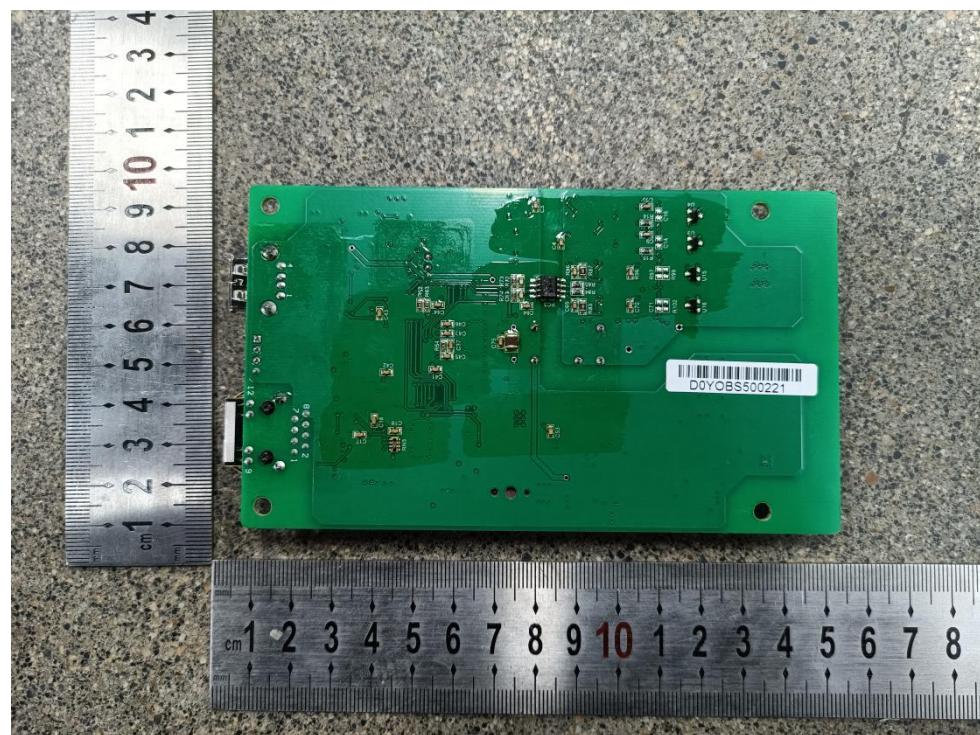


Internal (Display)**The front view of the mainboard (Display)**

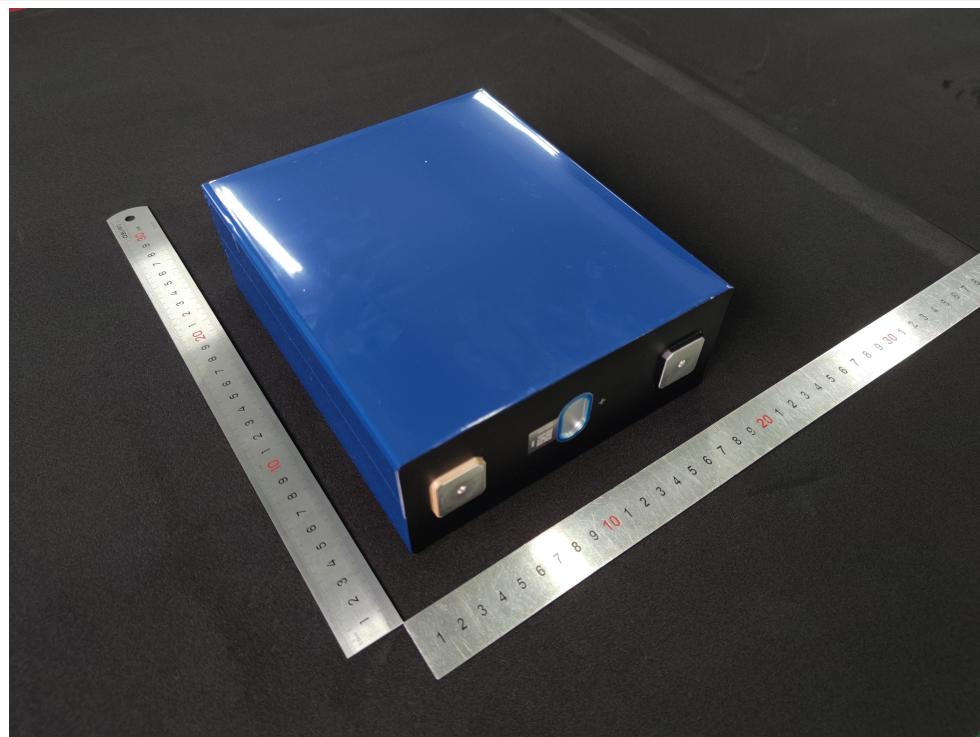
The back view of the mainboard (Display)



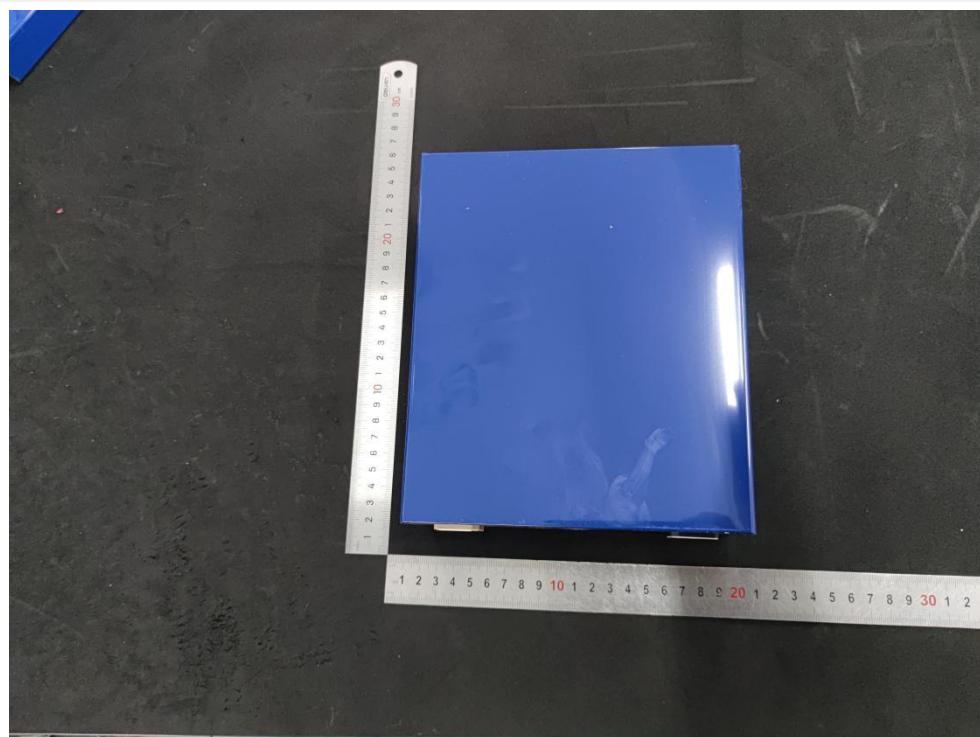
The back view of the mainboard (Display)



Cell



Cell



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