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Test Report No.: TWR2302014 001 Page 1 of 1

Applicant: Eyacht Energy., Ltd.
2nd Floor, Building 1, Yinrul Technology Park, Chuangxin Avenue No. 90, High-tech District, Hefei City, Anhui, P.R. China

Factory: Eyacht Energy., Ltd.

Order No.: Q062494 **Date of receipt:** 13th 02. 2023

Device under Test: Lithium-ion battery

Model No.: GroundHV-7.5K, GroundHV-10k, GroundHV-12.5K, GroundHV-15K, GroundHV-17.5K, GroundHV-20K

Serial No.: Engineering Sample

Place of Testing: Dongguan BALUN Testing Technology Co., Ltd.
Room 104, 204, 205, Building 1, No. 6, Industrial South Road, Songshan Lake District, Dongguan, Guangdong Province, P. R. China 523808

Test Specification: EN IEC 61000-6-1:2019
EN IEC 61000-6-3:2021

Technical Administrator:
Evelyn Hu

Date: 23th 02. 2023 Signature:

Reviewer:
Christo Chi

Date: 23th 02. 2023 Signature

Remark notes:
This report consists of 1 page of cover page, and 1 EMC reports from Dongguan BALUN Testing Co., Ltd. (Report No. BL-DG22A1025-401)

中国认可
国际互认
检测
TESTING
CNAS L14701

TEST REPORT

Applicant:	Eyacht Energy., LTD.
Address:	2nd Floor, Building 1, Yinrui Technology Park, Chuangxin Avenue No. 90, High-tech District, Hefei City, Anhui, P.R. China
EUT Name：	Lithium-ion battery
Model Name Under Test：	GroundHV-10K, GroundHV-20K
Series Model Name：	GroundHV-7.5K, GroundHV-10K, GroundHV-12.5K, GroundHV-15K, GroundHV-17.5K, GroundHV-20K
Brand Name:	N/A
Test Standard:	EN IEC 61000-6-1:2019, EN IEC 61000-6-3:2021
Sample Arrival Date:	Oct. 31, 2022
Test Date：	Jan. 09, 2023 - Jan. 12, 2023
Date of Issue:	Feb. 08, 2023

ISSUED BY:

Dongguan BALUN Testing Technology Co., Ltd.

Tested by: Yongqing Chen

Checked by: Tao Zheng

Approved by: Simon Qi

Revision History

Version	Issue Date	Revisions Content
Rev. 01	Feb. 08, 2023	Initial Issue

TABLE OF CONTENTS

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	Eyacht Energy., LTD.
Address	2nd Floor, Building 1, Yinrui Technology Park, Chuangxin Avenue No. 90, High-tech District, Hefei City, Anhui, P.R. China

2.2. Manufacturer Information

Manufacturer	Eyacht Energy., LTD.
Address	2nd Floor, Building 1, Yinrui Technology Park, Chuangxin Avenue No. 90, High-tech District, Hefei City, Anhui, P.R. China

2.3. Factory Information

Factory	Eyacht Energy., LTD.
Address	2nd Floor, Building 1, Yinrui Technology Park, Chuangxin Avenue No. 90, High-tech District, Hefei City, Anhui, P.R. China

2.4. General Description for Equipment under Test (EUT)

EUT Name	Lithium-ion battery
Model Name Under Test	GroundHV-10K, GroundHV-20K
Series Model Name	GroundHV-7.5K, GroundHV-10K, GroundHV-12.5K, GroundHV-15K, GroundHV-17.5K, GroundHV-20K
Description of Model name differentiation	This series of products consist of the same specifications and different numbers of batteries connected in series to form different models, and the rest are exactly the same. Dongguan BALUN Testing Technology Co., Ltd. is not responsible for the authenticity of the above statements.
Hardware Version	HYS-MBMS-EV-V2.3
Software Version	S00102201030007

Parameter table:

Item	Specifications		
	GroundHV-7.5K	GroundHV-10K	GroundHV-12.5K
Battery Type	LiFePO4		
Typical Capacity (Ah)	52Ah		
Typical Voltage (V)	144V	192V	240V
Connection	1P45S	1P60S	1P75S
Voltage Working Range (V)	114.7V-159.7V (Single cell: 2.55V-3.55V)	153V-213V (Single cell: 2.55V-3.55V)	191.2V-266.2V (Single cell: 2.55V-3.55V)
Working Temperature(°C)	Charge: 0°C~+55°C, Discharge: -20°C~+55°C		
Storage Temperature(°C)	-20°C~+35°C		
Nominal Capacity (kWh)	7.488kWh	9.984kWh	12.48kWh
Max. Charge Current(A)	35A		
Max. Discharge Current(A)	35A		
Cycle Life	>6000 (25°C ,0.5C ,90%DOD)		
Capacity Retention	≥95% (25°C ,0.5C, 500 cycle)		
SOC Accuracy	<8%		
Weight(kg)	~80kg	~105kg	~129kg
Dimensions(mm, L x W x H)	606x220x730mm	606x220x900mm	606x220x1070mm
IP Grade	IP65		
Transportation SOC	30%		
Cooling	Nature		

Item	Specifications		
	GroundHV-15K	GroundHV-17.5K	GroundHV-20K
Battery Type	LiFePO4		
Typical Capacity (Ah)	52Ah		
Typical Voltage (V)	288V	336V	384V
Connection	1P90S	1P105S	1P120S
Voltage Working Range (V)	230V-319V (Single cell: 2.55V-3.55V)	267.7V-372.7V (Single cell: 2.55V-3.55V)	306V-426V (Single cell: 2.55V-3.55V)
Working Temperature(°C)	Charge: 0°C~+55°C, Discharge: -20°C~+55°C		
Storage Temperature(°C)	-20°C~+35°C		
Nominal Capacity (kWh)	14.976kWh	17.472kWh	19.968kWh
Max. Charge Current(A)	35A		
Max. Discharge Current(A)	35A		
Cycle Life	>6000 (25°C ,0.5C ,90%DOD)		
Capacity Retention	≥95% (25°C ,0.5C, 500 cycle)		
SOC Accuracy	<8%		
Weight(kg)	~152.3kg	~176.2kg	~199.5kg
Dimensions(mm, L x W x H)	606x220x1240mm	606x220x1410mm	606x220x1580mm
IP Grade	IP65		
Transportation SOC	30%		
Cooling	Nature		

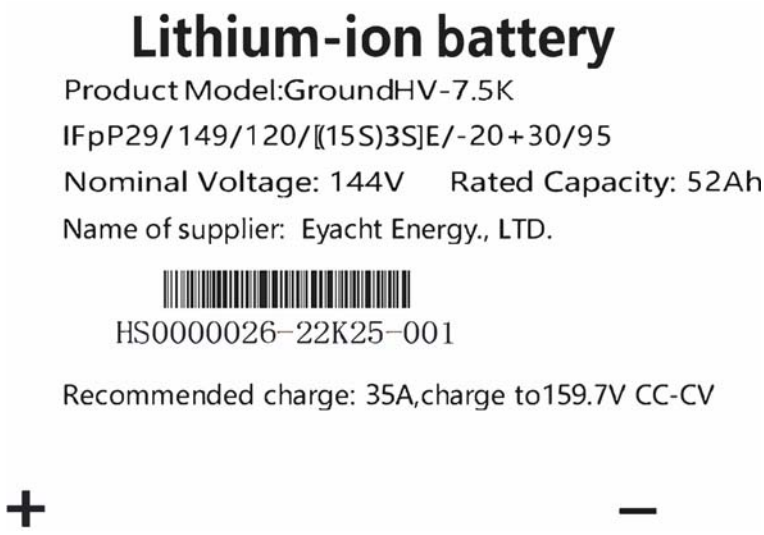
2.5. Ancillary Equipment

Ancillary Equipment 1	RJ45 Cable	
	Brand Name	N.A
	Model No.	N.A
	Cable length	2.0m

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	RS-485, which cable length is less than 3m.
About the Product		The equipment is 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:


Lithium-ion battery
Product Model:GroundHV-7.5K
IFpP29/149/120/[(15S)3S]E/-20+30/95
Nominal Voltage: 144V Rated Capacity: 52Ah
Name of supplier: Eyacht Energy., LTD.
HS0000026-22K25-001
Recommended charge: 35A,charge to159.7V CC-CV
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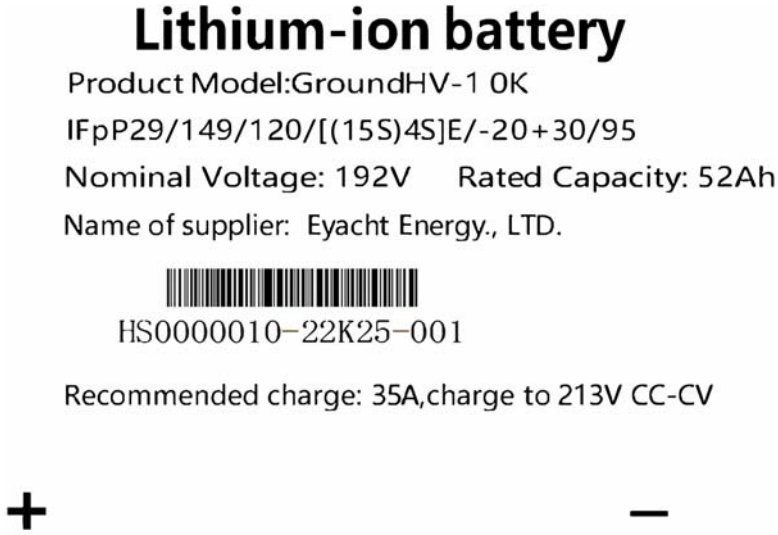
Lithium-ion battery
Product Model:GroundHV-1 0K
IFpP29/149/120/[(15S)4S]E/-20+30/95
Nominal Voltage: 192V Rated Capacity: 52Ah
Name of supplier: Eyacht Energy., LTD.
HS0000010-22K25-001
Recommended charge: 35A,charge to 213V CC-CV
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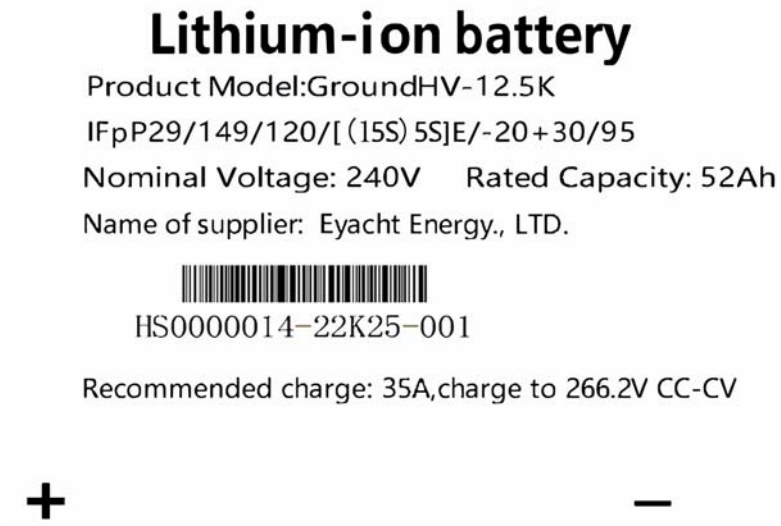
Lithium-ion battery
Product Model:GroundHV-12.5K
IFpP29/149/120/[(15S) 5S]E/-20+30/95
Nominal Voltage: 240V Rated Capacity: 52Ah
Name of supplier: Eyacht Energy., LTD.
HS0000014-22K25-001
Recommended charge: 35A,charge to 266.2V CC-CV
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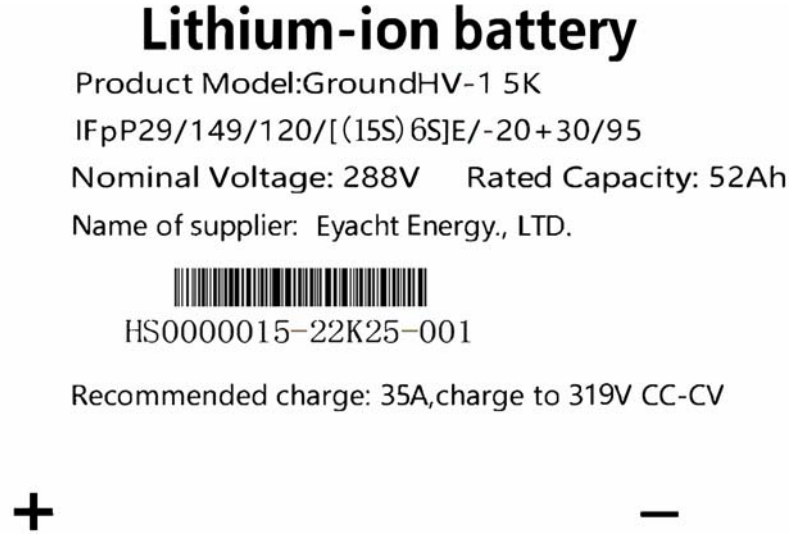
Lithium-ion battery
Product Model:GroundHV-1 5K
IFpP29/149/120/[(15S) 6S]E/-20+30/95
Nominal Voltage: 288V Rated Capacity: 52Ah
Name of supplier: Eyacht Energy., LTD.
HS0000015-22K25-001
Recommended charge: 35A,charge to 319V CC-CV
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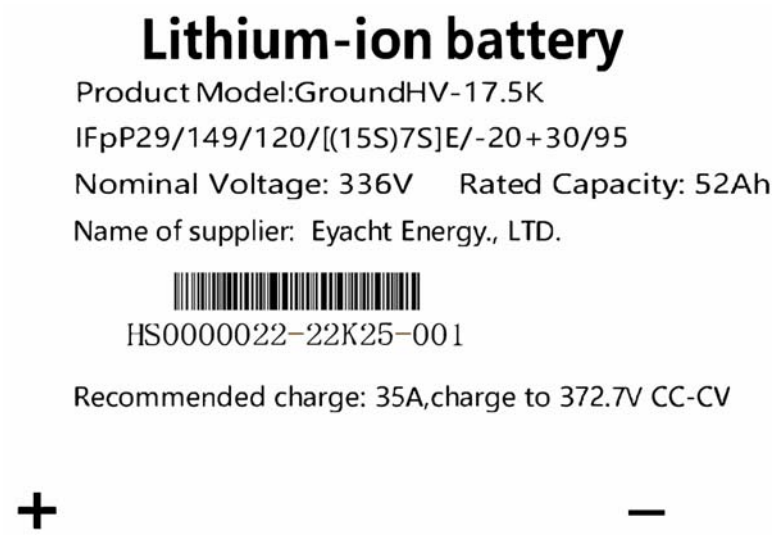
Lithium-ion battery
Product Model:GroundHV-17.5K
IFpP29/149/120/[(15S)7S]E/-20+30/95
Nominal Voltage: 336V Rated Capacity: 52Ah
Name of supplier: Eyacht Energy., LTD.
HS0000022-22K25-001
Recommended charge: 35A,charge to 372.7V CC-CV
+
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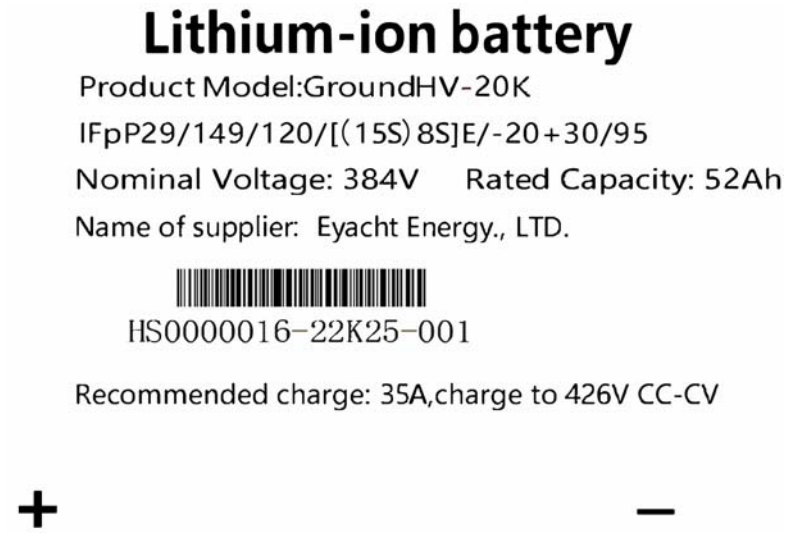
Lithium-ion battery
Product Model:GroundHV-20K
IFpP29/149/120/[(15S) 8S]E/-20+30/95
Nominal Voltage: 384V Rated Capacity: 52Ah
Name of supplier: Eyacht Energy., LTD.
HS0000016-22K25-001
Recommended charge: 35A,charge to 426V CC-CV
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3. SUMMARY OF TEST RESULTS

3.1. Test Standards

No.	Identity	Document Title
1	EN IEC 61000-6-1:2019	Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity standard for residential, commercial and light-industrial environments
2	EN IEC 61000-6-3:2021	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard in residential environments

3.2. Verdict

No.	Base Standard	Description		Test Verdict	Result	Remark
Emission						
1	EN IEC 61000-6-3:2021	Radiated Emission	Below 1 GHz	P	Annex A.1	--
			Above 1 GHz	N		Note 1
2	EN IEC 61000-6-3:2021	Conducted Emission	AC Ports	N	Annex A.2	Note 2
			DC Ports	N		Note 3
			Telecom Ports	N		Note 4
3	EN IEC 61000-6-3:2021	Harmonic Current Emissions		N	Annex A.3	Note 2
4	EN IEC 61000-6-3:2021	Voltage Fluctuations & Flicker		N	Annex A.4	Note 2
Immunity						
5	IEC 61000-4-2:2008	Electrostatic Discharge Immunity		P	Annex A.5	--
6	IEC 61000-4-3:2006 +A1:2007+A2:2010	Radiated RF Electromagnetic Field Immunity		P	Annex A.6	--
7	IEC 61000-4-4:2012	Electrical Fast Transient/Burst Immunity	AC Ports	N	Annex A.7	Note 2
			DC Ports	P		--
			Signal Ports	N		Note 5
8	IEC 61000-4-5:2014	Surge Immunity	AC Ports	N	Annex A.8	Note 2
			DC Ports	P		--
			Signal Ports	N		Note 6
9	IEC 61000-4-6:2013	Immunity to Conducted Disturbances Induced by RF Fields	AC Ports	N	Annex A.9	Note 2
			DC Ports	P		--
			Signal Ports	N		Note 5
10	IEC 61000-4-8:2009	Power-frequency magnetic field		P	Annex A.10	--
11	IEC 61000-4-11:2004 IEC 61000-4-34:2005 +A1:2009	Voltage Dips and Short Interruptions Immunity	AC Ports	N	Annex A.11	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: Applicable only to ports intended for connection to
-a local DC power network, or
-a local battery by a connecting cable exceeding a length of 30 m.
The EUT is a Lithium-ion battery, which does not intended for connection to a local DC distribution network or a remote battery by manufacturer's declaration.

Note 4: 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 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 3 m. The signal ports cable length of EUT is less than 2m.

Note 6: 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 395V~420V	24.9℃	56%	101.3kPa	Jan. 09, 2023	Yongqing Chen
Electrostatic Discharge Immunity	DC 195V~200V	25.4℃	55%	101.3kPa	Jan. 10, 2023	Yongqing Chen
Radiated RF Electromagnetic Field Immunity	DC 395V~410V	24.7℃	53%	101.6kPa	Jan. 11, 2023	Yongqing Chen
Electrical Fast Transient/Burst Immunity	DC 195V~200V	24.8℃	50%	101.1kPa	Jan. 10, 2023	Yongqing Chen
Surge Immunity	DC 195V~200V	25.2℃	51%	101.4kPa	Jan. 12, 2023	Yongqing Chen
Immunity to Conducted Disturbances Induced by RF Fields	DC 395V~410V	25.1℃	52%	101.5kPa	Jan. 09, 2023	Yongqing Chen
Power-frequency magnetic field	DC 195V~200V	25.4℃	52%	101.2kPa	Jan. 11, 2023	Yongqing Chen

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	2022.03.01	2023.02.28	√

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	2022.03.29	2025.02.13	√
Signal Generator	ROHDE&SCHWARZ	N5181A	MY50141978	2022.03.29	2023.03.28	√
Power Amplifier	rflight	NTWPA-00810200E	18093198	2022.03.04	2023.03.03	√
Power Amplifier	rflight	NTWPA-1060100E	18093195	2022.03.04	2023.03.03	√
Power Meter	Agilent	E4417A	GB41292042	2022.03.29	2023.03.28	√
Field Strength Meter	Narda	EP601	511WX51129	2022.04.14	2023.04.13	√
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	2022.03.29	2023.03.28	√
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	2022.02.28	2023.02.27	√

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	TESEQ	CDN M5	A2560005	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	2022.02.28	2023.02.27	√

4.3. Test Enclosure list

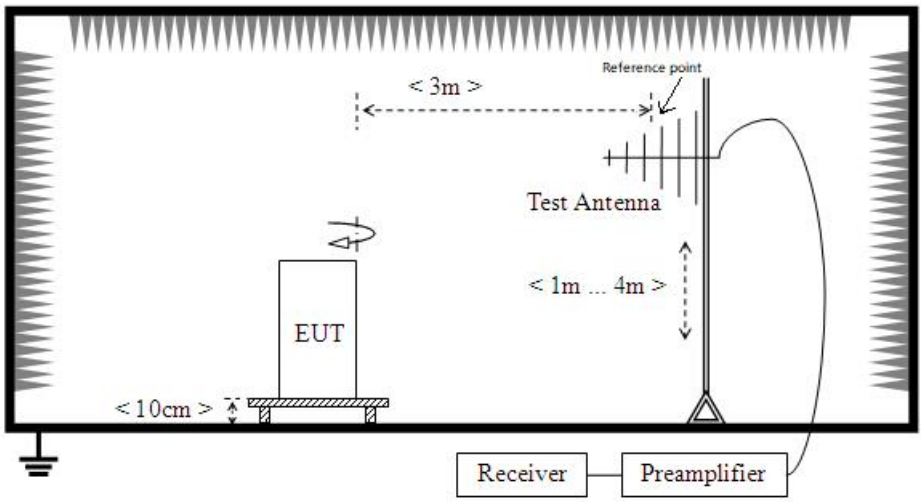
Name	Manufacturer	Model	Serial No.	Length	Description
DC Source	WKDY	WPLA-150KW	W20180626011	N/A	N/A
DC Electronic Load	ITECH	IT8830B	600243011716730002	N/A	N/A

4.4. Test Configurations

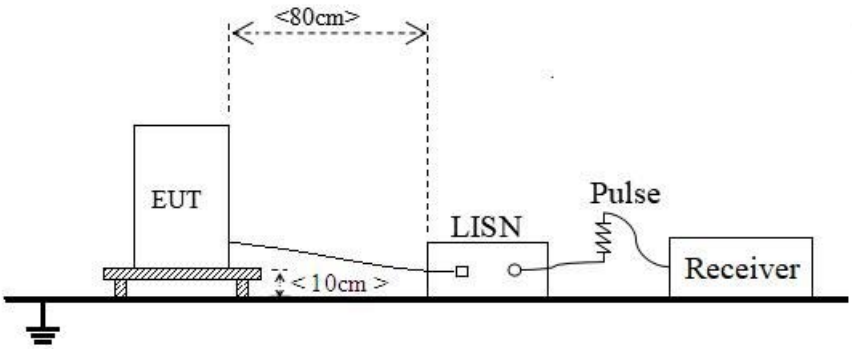
Test Configurations (TC) No.	Description
TC01	Charging(100% Load) EUT+DC Source+RJ45 Cable
TC02	Charging(50% Load) EUT+DC Source+RJ45 Cable
TC03	Discharge(100% Load) EUT+DC Electronic Load+RJ45 Cable
TC04	Discharge(50% Load) EUT+DC Electronic Load+RJ45 Cable
TC05	Standby EUT+RJ45 Cable

4.5. Description of Test Setup

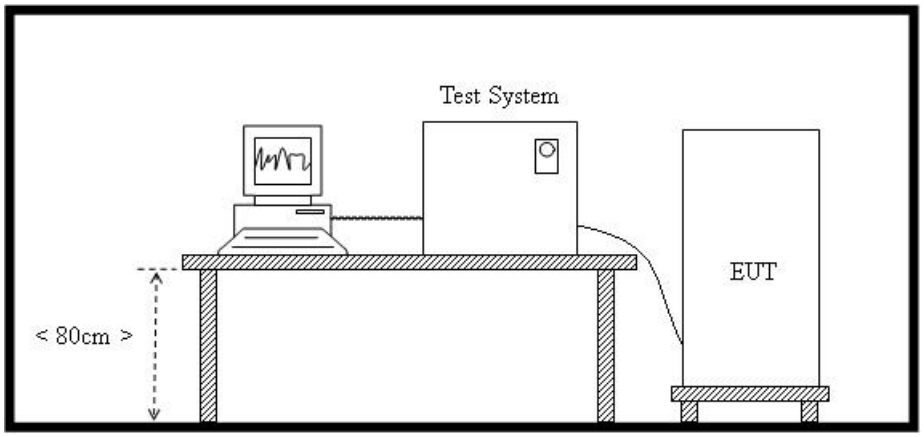
Test Setup 1 For Radiated Emission Test (30 MHz-1 GHz)



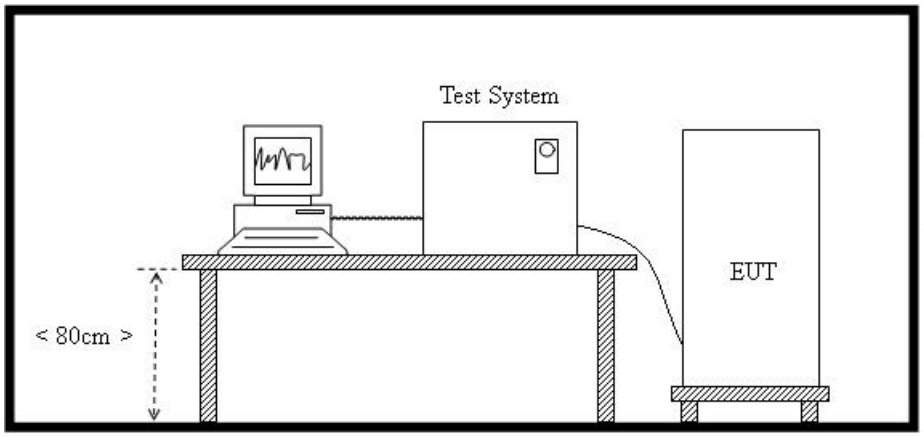
Test Setup 2 For Conducted disturbance voltage at mains terminals Test



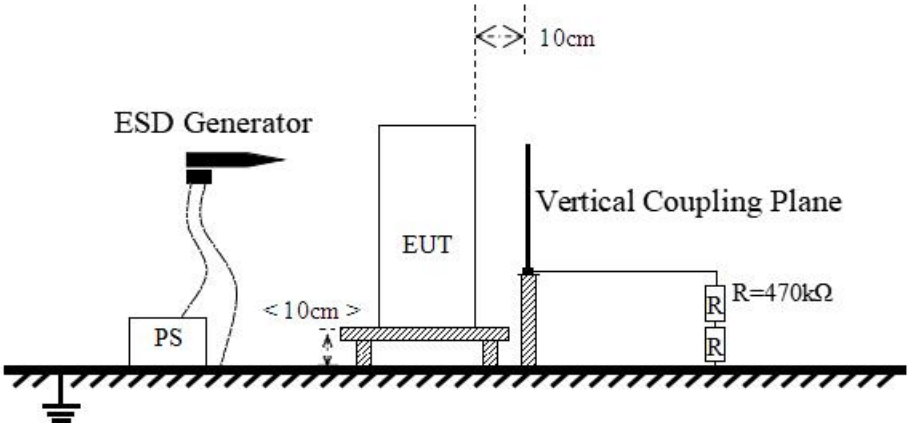
Test Setup 3 For Harmonic Current Emissions Measurement Test



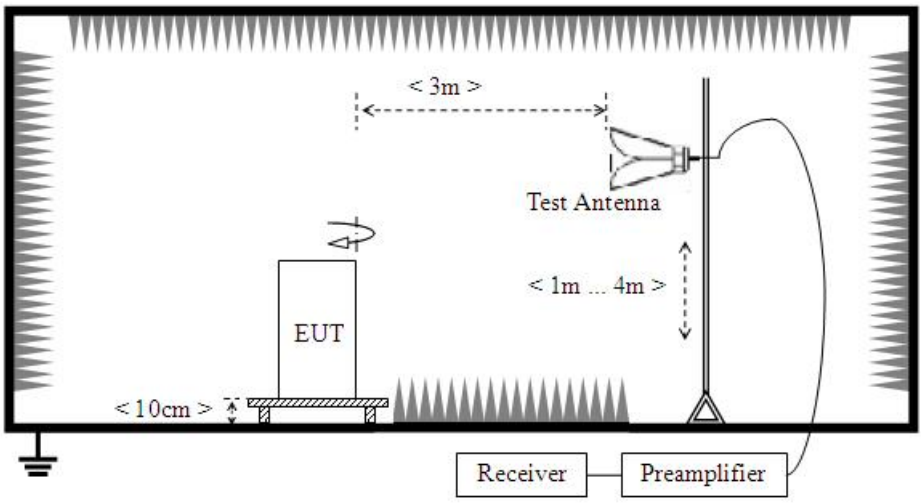
Test Setup 4 For Voltage Fluctuations and Flicker Measurement Test



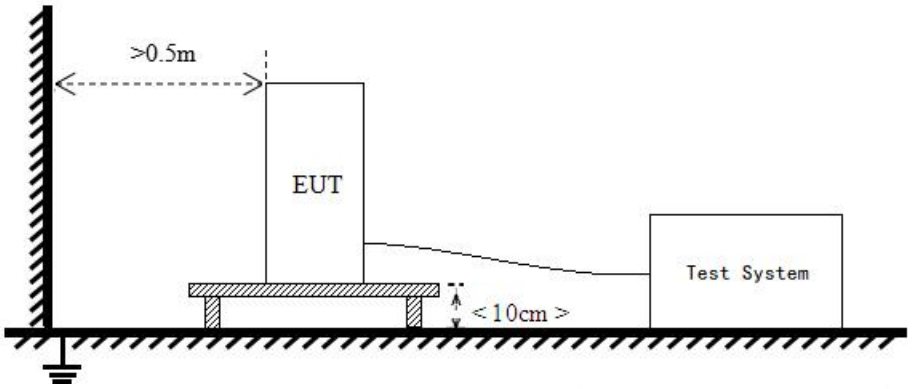
Test Setup 5 For Electrostatic Discharge Immunity Test



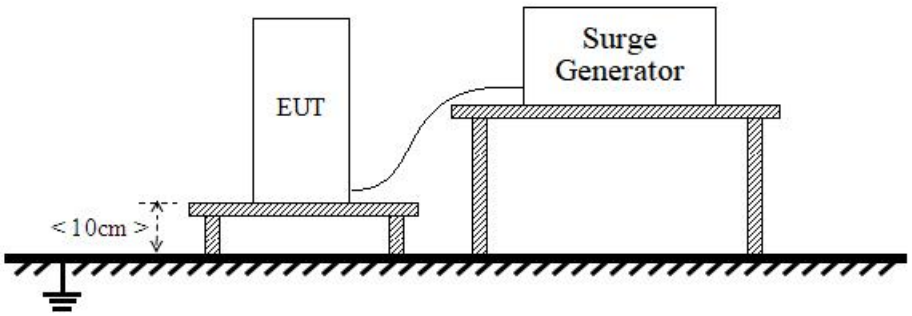
Test Setup 6 For Radiated Immunity Test



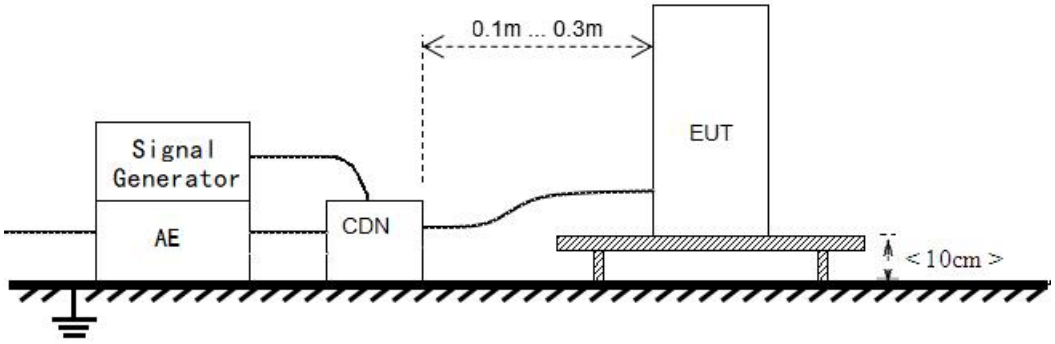
Test Setup 7 For Electrical Fast Transient / Burst Immunity Test



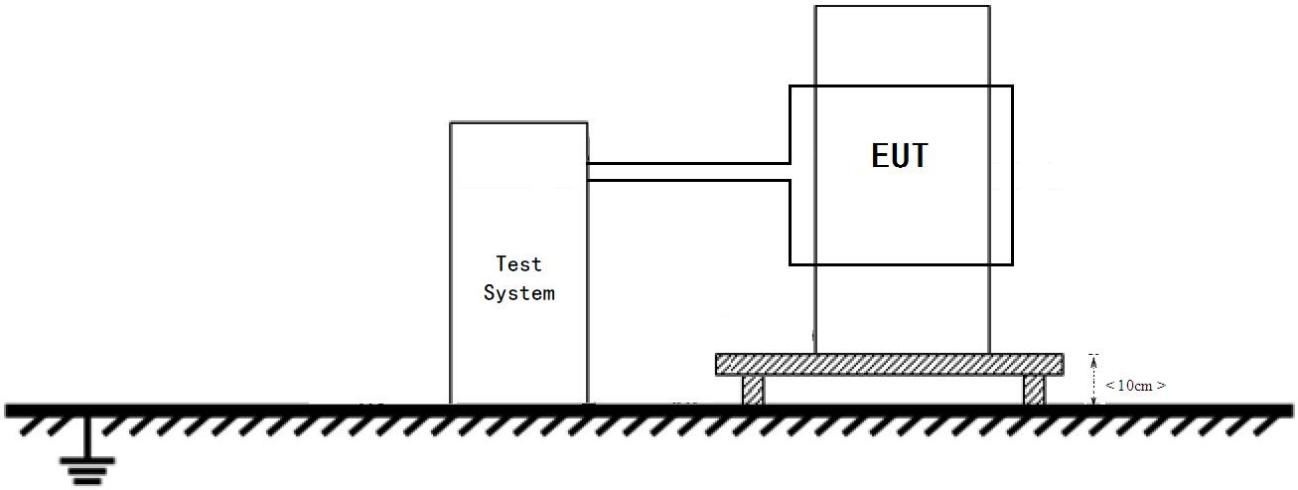
Test Setup 8 For Surge Immunity Test



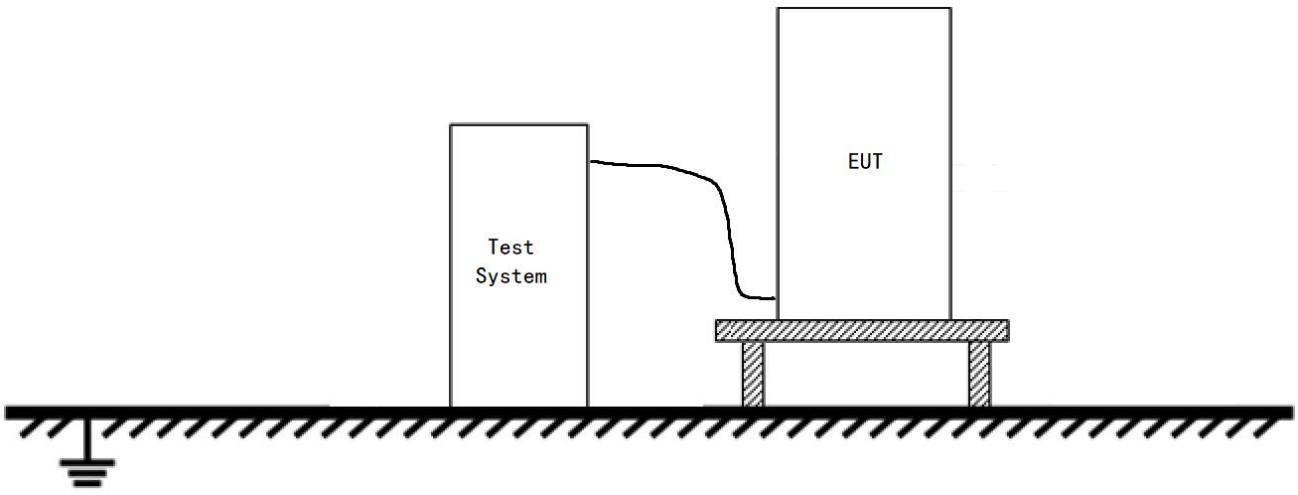
Test Setup 9 For Immunity to Conducted Disturbances Induced By RF Fields Test



Test Setup 10 Power Frequency Magnetic Fields



Test Setup 11 For Voltage Dips and Short Interruptions Immunity Test



4.6. Test Conditions

Test Case	Test Conditions	
Radiated Emission	Test Model	GroundHV-20K
	Test Setup	Test Setup 1
	Test Configuration	TC01, TC02, TC03, TC04, TC05
Electrostatic Discharge Immunity	Test Model	GroundHV-10K
	Test Setup	Test Setup 3
	Test Configuration	TC02, TC04
Radiated RF Electromagnetic Field Immunity	Test Model	GroundHV-20K
	Test Setup	Test Setup 4
	Test Configuration	TC02, TC04
Electrical Fast Transient/Burst Immunity	Test Model	GroundHV-10K
	Test Setup	Test Setup 5
	Test Configuration	TC02, TC04
Surge Immunity	Test Model	GroundHV-10K
	Test Setup	Test Setup 6
	Test Configuration	TC02, TC04
Immunity to Conducted Disturbances Induced by RF Fields	Test Model	GroundHV-20K
	Test Setup	Test Setup 7
	Test Configuration	TC02, TC04
Power-frequency magnetic field	Test Model	GroundHV-10K
	Test Setup	Test Setup 8
	Test Configuration	TC02, TC04
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 Discharge(50% 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 (dBμV/m)	Quasi-Peak Limit (dBμV/m)
30 - 230	40	30
230 - 1000	47	37

Frequency range (MHz)	Distance (at 3 m)	
	Peak Limit (dBμV/m)	Average Limit (dBμV/m)
1000-3000	70	50
3000-6000	74	54

NOTE:

1) For apparatus containing devices operating at frequencies less than 9kHz measurements only need to be performed up to 230MHz.

2) 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.

3) 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	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:

1) The lower limit shall apply at the band edges.
2) The limit decreases linearly with the logarithm for the frequency in the range 0.15 - 0.50 MHz.
3) It is tested under the low voltage which is for the distribution of AC electric power, the upper limit is generally accepted to be 1000 V.

DC Port

Frequency range (MHz)	Quasi-peak (dBuV)	Average (dBuV)
V - AN		
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	84-74	74-64
0.50 - 30	74	64

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.

5.1.3. Harmonic Current Emissions (≤16A)

5.1.3.1. Limit

For each harmonic order, all 1.5s smoothed r.m.s. harmonic current values, as defined as follows, shall be either:

a) Less than or equal to 150% of the applicable limits, or

b) Less than or equal to 200% of the applicable limits under the following conditions, which apply all together:

1) The EUT belongs to Class A for harmonics;

2) The excursion beyond 150% of the applicable limits lasts less than 10%of the test observation period or in total 10min (within the test observation period), whichever is smaller, and

3) The average value of the harmonic current, taken over the entire test observation period, is less than 90% of the applicable limits.

Harmonic currents less than 0.6% of the input current measured under the test conditions, or less than 5mA, whichever is greater, are disregarded.

For the 21st and higher odd order harmonica, the average value obtained for each individual odd harmonic over the full observation period, calculated from the 1.5s smoothed r.m.s., may exceed the applicable limits by 50% provided that the following conditions are met:

- The measured partial odd harmonic current does not exceed the partial odd harmonic current which can be calculated from the applicable limits;
- All 1.5s smoothed r.m.s. individual harmonic current values shall be less than or equal to 150% of the applicable limits.

Note: These exemptions (the use of the partial odd harmonic current for the average values and the 200% short term limit for single 1.5s smoothed values) are mutually exclusive and cannot be together.

Limits for Class A equipment				Limits for Class D equipment		
odd harmonic		Even harmonics		Harmonic order (n)	Maximum permissible harmonic current per watt mA/W	Maximum permissible harmonic current A
Harmonic order (n)	Maximum permissible harmonic current A	Harmonic order (n)	Maximum permissible harmonic current A			
3	2.30	2	1.08	3	3.4	2.30
5	1.14	4	0.43	5	1.9	1.14
7	0.77	6	0.30	7	1.0	0.77
9	0.40	8≤n≤40	0.23*(8/n)	9	0.5	0.40
11	0.33			11	0.35	0.33
13	0.21			15≤n≤39 (odd harmonics only)	3.85/n	0.15*(15/n)
15≤n≤39	0.15*(15/n)					
Note: For Class B equipment, the harmonics of the input current shall not exceed the values given in Table “limits for Class A equipment” multiplied by a factor of 1.5.						

For the purpose of harmonic current limitation, equipment is classified as follows:(Note: Class C equipment requirement not include in this standard.)

Class A:

– balanced three-phase equipment;

– household appliances, excluding equipment identified as class D;

– tools, excluding portable tools;

– dimmers for incandescent lamps;

– audio equipment.

Equipment not specified in one of the three other classes shall be considered as class A equipment.

Class B:

– portable tools;

– arc welding equipment which is not professional equipment.

Class C:

– lighting equipment.

Class D:

Equipment having a specified power according to 6.2.2 less than or equal to 600 W, of the following types:

– personal computers and personal computer monitors;

– television receivers.

5.1.3.2. Test Procedure

The EUT is placed on the top of a wooden table 0.8m above the ground and operated to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn.

The correspondent test program of test instrument to measure the current harmonics emanated from EUT is chosen. The measure time shall be not less than the necessary for the EUT to be exercised.

5.1.4. Harmonic Current Emissions (＞16A)

5.1.4.1. Limit

S_{SC}

value of the three-phase short-circuit power calculated from the nominal interphase system voltage $U_{nominal}$ and the line impedance Z of the system at the PCC:

$$S_{SC}=U^2_{normimal}/Z$$

where Z is the system impedance at the power frequency

S_{equ}

value calculated from the rated current I_{equ} of the piece of equipment stated by the manufacturer and the rated voltage Up (single phase) or U_l (interphase) as follows:

$S_{equ} = U_p I_{equ}$ for single-phase equipment and the single-phase part of hybrid equipment

$S_{equ} = U_i I_{equ}$ for interphase equipment

$S_{equ} = \sqrt{3}\ U_i I_{equ}$ for balanced three-phase equipment and the three-phase part of hybrid equipment

$S_{equ} = \sqrt{3}\ U_i I_{equ\ max}$ for unbalanced three-phase equipment

S_{sce}

characteristic value of a piece of equipment defined as follows:

$R_{sce} = S_{SC}/(3\ S_{equ})$ for single-phase equipment and the single-phase part of hybrid equipment

$R_{sce} = S_{SC}/(2\ S_{equ})$ for interphase equipment

$R_{sce} = S_{SC}/(S_{equ})$ for all three-phase equipment and the three-phase part of hybrid equipment

The limits given apply to 230/400 V, 50 Hz systems. The limits for the other systems will be added in a future edition of this standard.

NOTE 1 In some non-European countries, the proposed methodology cannot be applied because the short-circuit power data is not always available.

The harmonic current limits specified in the tables apply to each of the line currents and not to current in the neutral conductor.

For equipment with multiple rated currents, an assessment is made for each current.

As an example (for the same equipment):

Rated voltage: 230 V single phase, rated current: x A per phase, assessment and test at 230 V.

Rated voltage: 400 V three phase, rated current: y A per phase, assessment and test at 400 V.

The harmonic current limits are specified in Tables 2 to 5

Equipment complying with the harmonic current emission limits corresponding to R_{sce} = 33 is suitable for connection at any point of the supply system.

NOTE 2 Values are based on a minimum value of Rsce = 33. Short-circuit ratios less than 33 are not considered.

NOTE 3 In order to reduce the depth of commutation notches of converters, a short-circuit ratio higher than 33 may be necessary.

For equipment not complying with the harmonic current emission limits corresponding to R_{sce} = 33, higher emission values are allowed, under the assumption that the short-circuit ratio R_{sce} is greater than 33. It is expected that this will apply to the majority of equipment with input current above 16 A per phase. See requirement for product documentation in Clause 6.

Table 2 is applied to equipment other than balanced three-phase equipment and Tables 3, 4 and 5 are applied to balanced three-phase equipment.

Table 3 may be used for any balanced three-phase piece of equipment.

Table 4 may be used with balanced three-phase equipment if any one of these conditions is met.
a) The 5th and 7th harmonic currents are each less than 5 % of the reference current during the whole test observation period.
b) The design of the piece of equipment is such that the phase angle of the 5th harmonic current has no preferential value over time and can take any value in the whole interval [0°，360°]
c) The phase angle of the 5th harmonic current related to the fundamental phase-to-neutral voltage (see 3.16) is in the range of 90 ° to 150 ° during the whole test observation period.

Table 5 may be used with balanced three-phase equipment if any one of these conditions is met:
d) The 5th and 7th harmonic currents are each less than 3 % of the reference current during the whole test observation period.
e) The design of the piece of equipment is such that the phase angle of the 5th harmonic current has no preferential value over time and can take any value in the whole interval [0 °, 360 °].
f) The phase angle of the 5th harmonic current related to the fundamental phase-to-neutral voltage (see 3.16) is in the range of 150 ° to 210 ° during the whole test observation period.

Table 3, Table 4 or Table 5 can be applied to hybrid equipment in one of the following circumstances:
a) hybrid equipment having a maximum 3rd harmonic current of less than 5 % of the reference current，or
b) there is provision in the construction of hybrid equipment to separate the balanced three- phase and the single-phase or interphase loads for the measurement of supply currents, and when the current is being measured, the part of the equipment being measured draws the same current as under normal operating conditions. In that case, the relevant limits shall be applied separately to the single-phase or interphase part and to the balanced three-phase part. Table 3, Table 4 or Table 5 applies to the current of the balanced three- phase part, even if the rated current of the balanced three-phase part is less than or equal to 16 A per phase. Table 2 applies to the current of the single-phase or interphase part, but if the rated current of the single-phase or interphase part is less than or equal to 16 A, the manufacturer may apply the relevant limits of IEC 61000-3-2 to the single-phase or interphase part instead of the limits stated in Table 2.

For verification purposes, when circumstance b) above applies, the manufacturer shall state in the product documentation the rated current and give in the test report the measured and specified values of the input current as defined in 4.1, for each separate load. The value of R_{sce} for this type of hybrid equipment is determined as follows:
• the minimum R_{sce} value is first determined for each of the two loads, using the reference current of the considered part for the calculation of the harmonic current emissions to be compared to the limit values given in Tables 2 to 5; in case IEC 61000-3-2 is applied to the single-phase or interphase part instead of

Table 2 limits, the minimum R_{sce} value for this part is deemed to be equal to 33;

• then, for each of the two parts, the minimum value of S_{sc} is calculated from its minimum R_{sce} value and its rated current (see 3.11 and 3.14);

• finally, the value of R_{sce} for the hybrid equipment is determined from the highest of both minimum values of S_{sc} and the rated apparent power of the whole hybrid equipment.

Table 2 Current emission limits for equipment other than balanced three-phase equipment

Minimum R_{sce}	Admissible individual harmonic current I_h/I_{ref} [a] %						Admissible harmonic parameters %	
	I_3	I_5	I_7	I_9	I_{11}	I_{13}	THC/I_{ref}	$PWHC/I_{ref}$
33	21.6	10.7	7.2	3.8	3.1	2	23	23
66	24	13	8	5	4	3	26	26
120	27	15	10	6	5	4	30	30
250	35	20	13	9	8	6	40	40
≥350	41	24	15	12	10	8	47	47
The relative values of even harmonics up to order 12 shall not exceed 16/h %. Even harmonics above order 12 are taken into account in THC and PWHC in the same way as odd order harmonics. Linear interpolation between successive R_{sce} values is permitted. a: I_{ref}=reference current; I_h=harmonica current component.								

Table 3 Current emission limits for balanced three-phase equipment

Minimum R_{sce}	Admissible individual harmonic current I_h/I_{ref} [a] %				Admissible harmonic parameters %	
	I_5	I_7	I_{11}	I_{13}	THC/I_{ref}	$PWHC/I_{ref}$
33	10.7	7.2	3.1	2	13	22
66	14	9	5	3	16	25
120	19	12	7	4	22	28
250	31	20	12	7	37	38
≥350	40	25	15	10	48	46
The relative values of even harmonics up to order 12 shall not exceed 16/h %. Even harmonics above order 12 are taken into account in THC and PWHC in the same way as odd order harmonics. Linear interpolation between successive R_{sce} values is permitted. a: I_{ref}=reference current; I_h=harmonica current component.						

Table 4 Current emission for balanced three-phase equipment under specified conditions(a,b,c)

Minimum R_{sce}	Admissible individual harmonic current I_h/I_{ref} [a] %				Admissible harmonic parameters %	
	I_5	I_7	I_{11}	I_{13}	THC/I_{ref}	$PWHC/I_{ref}$
33	10.7	7.2	3.1	2	13	22
≥120	40	25	15	10	48	46
The relative values of even harmonics up to order 12 shall not exceed 16/h %. Even harmonics above order 12 are taken into account in THC and PWHC in the same way as odd order harmonics. Linear interpolation between successive R_{sce} values is permitted. a: I_{ref}=reference current; I_h=harmonica current component.						

Table 5 Current emission for balanced three-phase equipment under specified conditions(d,e,f)

Minimum R_{sce} = 33	Admissible individual harmonic current I_h/I_{ref} [a] %												Admissible harmonic parameters %	
--	I_5	I_7	I_{11}	I_{13}	I_{17}	I_{19}	I_{23}	I_{25}	I_{29}	I_{31}	I_{35}	I_{37}	THC/I_{ref}	$PWHC/I_{ref}$
33	10.7	7.2	3.1	2	2	1.5	1.5	1.5	1	1	1	1	13	22
≥250	25	17.3	12.1	10.7	8.4	7.8	6.8	6.5	5.4	5.2	4.9	4.7	35	70
For R_{sce} equal to 33, the relative values of even harmonics up to order 12 shall not exceed 16/h %. The relative values of all harmonics from I_{14} to I_{40} not listed above shall not exceed 1% of I_{ref}. For R_{sce}≥250, the relative values of even harmonics up to order 12 shall not exceed 16/h %. The relative values of all harmonics from I_{14} to I_{40} not listed above shall not exceed 3% of I_{ref}. Linear interpolation between both R_{sce} values is permitted. a: I_{ref}=reference current; I_h=harmonica current component.														

5.1.5. Voltage Fluctuations and Flicker

5.1.5.1. Limit

The following limits apply:

- The value of P_{st} shall not be greater than 1.0;
- The value of P_{lt} shall not be greater than 0.65;
- T_{max}, the accumulated time value of d(t) with a deviation exceeding 3.3% during a single voltage change at the EUT terminals, shall not exceed 500ms;
- The maximum relative steady-state voltage change, dc, shall not exceed 3.3%;
- The maximum relative voltage change d_{max}, shall not exceed:

a) 4% without additional conditions;

b) 6% for equipment which is:

— switched manually, or

— switched automatically more frequently than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds), or manual restart, after a power supply interruption.

Note: The cycling frequency is further limited by the P_{st} and P_{lt} limits.

c) 7% for equipment which is:

— attended whilst in use, or

— switched on automatically, or is intended to be switched on manually, no more than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds) or manual restart, after a power supply interruption.

In the case of equipment having several separately controlled circuits with limits b) and c) shall apply only if there is delayed or manual restart after a power supply interruption; for all equipment with automatic switching which is energized immediately on restoration of supply after a power supply interruption, limits a) shell apply; for all equipment with manual switching, limits b) or c) shall apply depending on the rate of switching.

P_{st} and P_{lt} requirement shall not be applied to voltage changes caused by manual switching.

The limits shall not be applied to voltage changes associated with emergency switching or emergency interruptions.

5.1.5.2. Test Procedure

During the Flicker measurement, the measure time shall include that part of whole operation changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours. The test specifications refer the next table.

No.	Specification	Value
1	Test Frequency	50 Hz
2	Test Voltage	230 VAC
3	Waveform	Sine
4	Test Time	10 minutes for Pst; 2 hours for Plt

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	3 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 3 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: 1 kV.	
	DC Power Port: 0.5 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 μs; Current: 8/20 μs		
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	3 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	3 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 61000-4-11:2004; 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

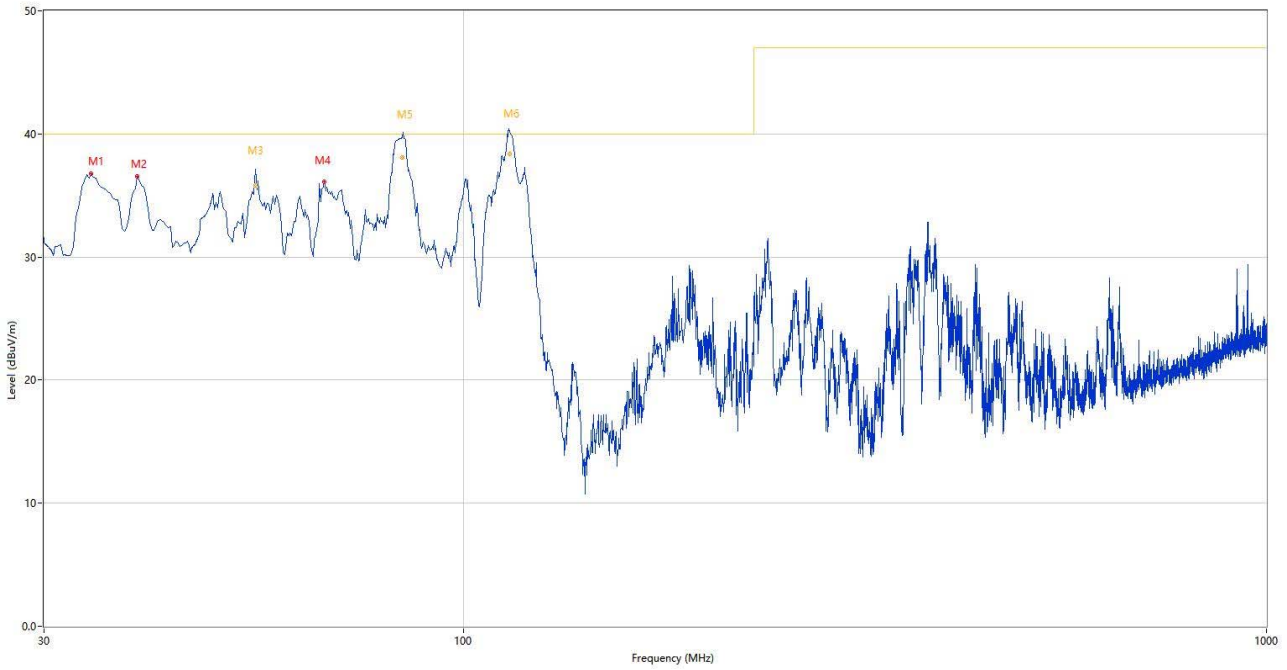
Note 1: The symbol of "--" in the table which means not application.

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)

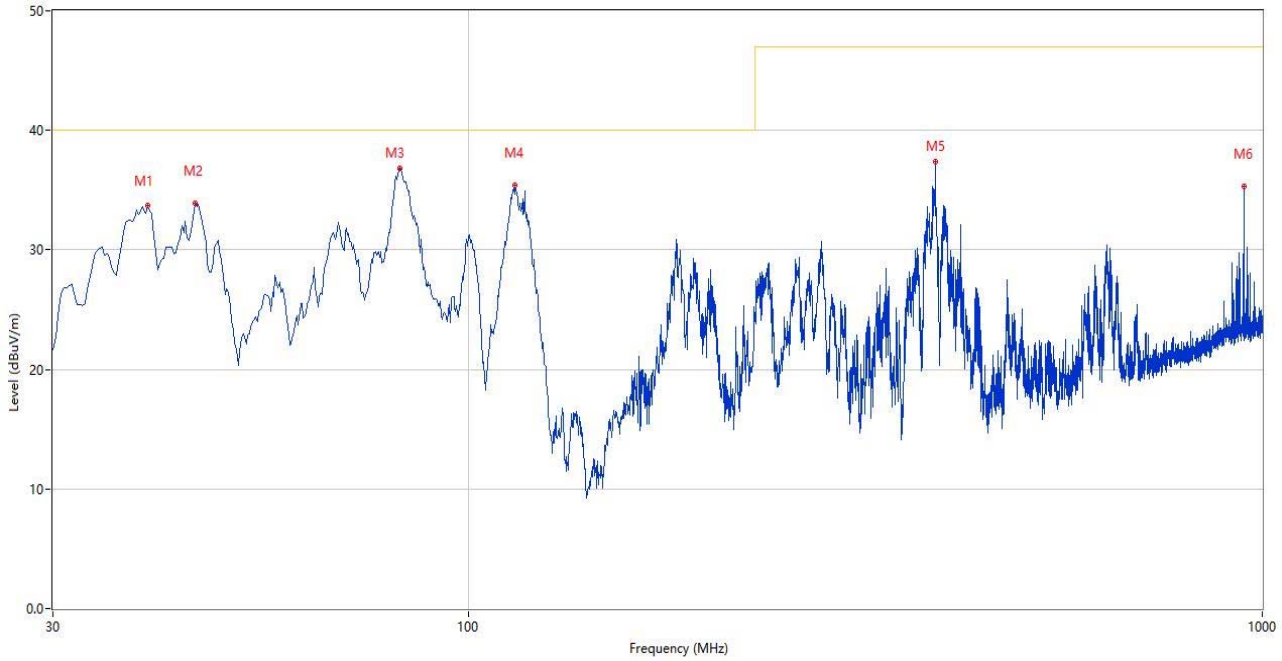
The worst test mode: Discharge(50% Load)

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	34.365	36.73	-29.04	40.0	-3.27	Peak	239.00	100	Vertical	P
2	39.215	36.49	-27.28	40.0	-3.51	Peak	302.00	100	Vertical	P
3*	54.977	35.80	-26.19	40.0	-4.20	QP	118.00	100	Vertical	P
4	67.103	36.11	-28.63	40.0	-3.89	Peak	118.00	100	Vertical	P
5*	84.077	37.29	-30.77	40.0	-2.71	QP	118.00	100	Vertical	P
6*	113.905	37.94	-28.19	40.0	-2.06	QP	321.00	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	39.458	33.74	-27.22	40.0	-6.26	Peak	70.00	200	Horizontal	P
2	45.278	33.87	-26.03	40.0	-6.13	Peak	254.00	200	Horizontal	P
3	82.137	36.85	-31.31	40.0	-3.15	Peak	214.00	200	Horizontal	P
4	114.632	35.42	-28.33	40.0	-4.58	Peak	96.00	300	Horizontal	P
5	387.445	37.41	-22.11	47.0	-9.59	Peak	210.00	100	Horizontal	P
6	948.833	35.28	-10.84	47.0	-11.72	Peak	129.00	100	Horizontal	P

A.2 Conducted Emission

Note:Not Applicable.

A.3 Harmonic Current Emissions

Note:Not Applicable.

A.4 Voltage Fluctuations & Flicker

Note:Not Applicable.

A.5 Electrostatic Discharge Immunity

Test Points	Discharge Level (kV)	Discharge Mode	Number of Discharge	Met Criteria	Required Criteria	Verdict
HCP	±2, ±4	Connect discharge	100	A	B	P
VCP	±2, ±4	Connect discharge	100	A	B	P
①Metal screw	±2, ±4	Connect discharge	1480	A	B	P
②Battery breaker	±2, ±4	Connect discharge	20	A	B	P
③Button	±2, ±4	Connect discharge	20	A	B	P
④Led light	±2, ±4, ±8	Air discharge	20	A	B	P

A.6 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	3	A	A	P
Horizontal	80 - 1000	Front, Back, Left, Right	3	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.7 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- & GND			+ / -	0.5	A	B	P

A.8 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

A.9 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	3	A	A	P

A.10 Power Frequency Magnetic Fields Immunity

Test direction	Test Level (A/m)	Met Criteria	Required Criteria	Verdict
X, Y, Z	3	A	A	P

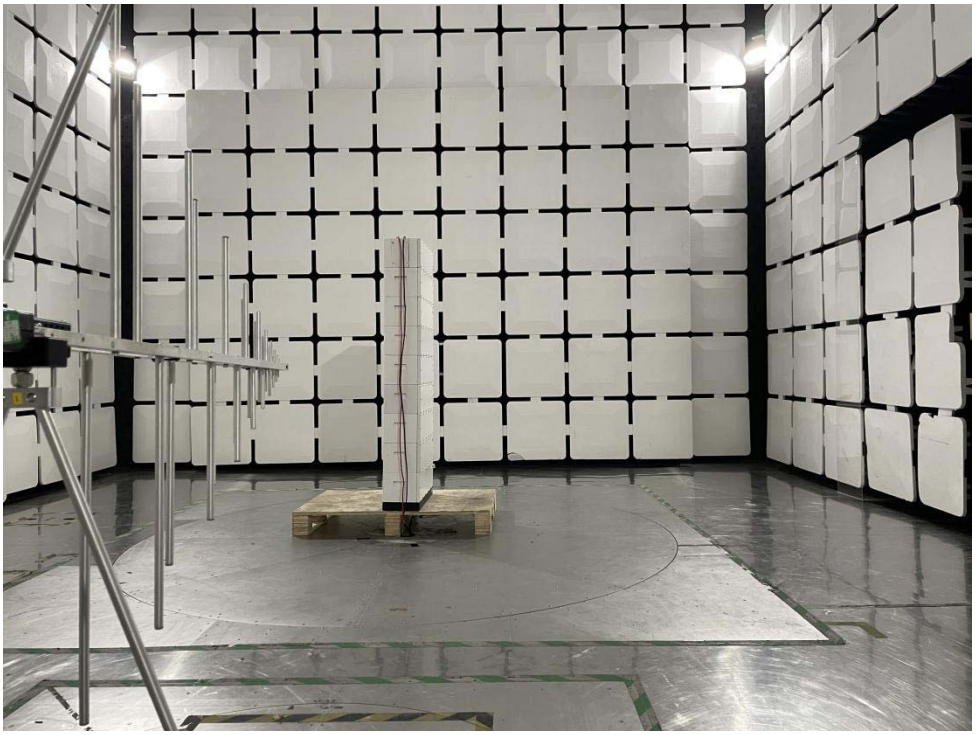
A.11 Voltage Dips and Short Interruptions Immunity

Note:Not Applicable.

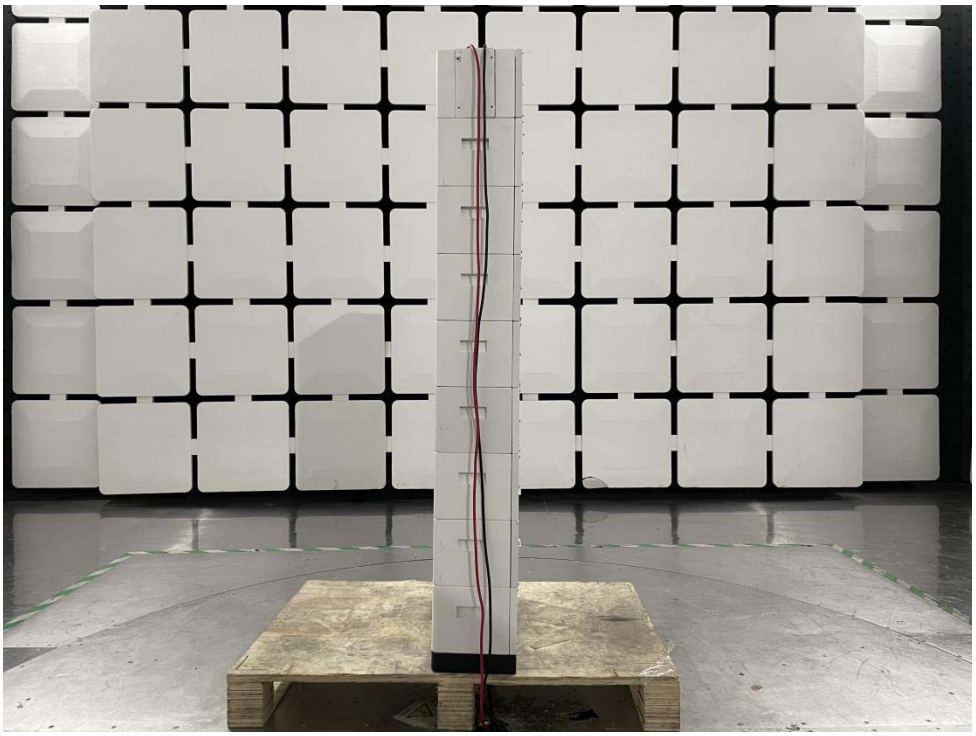
ANNEX B TEST SETUP PHOTOS

B.1 Radiated Emission

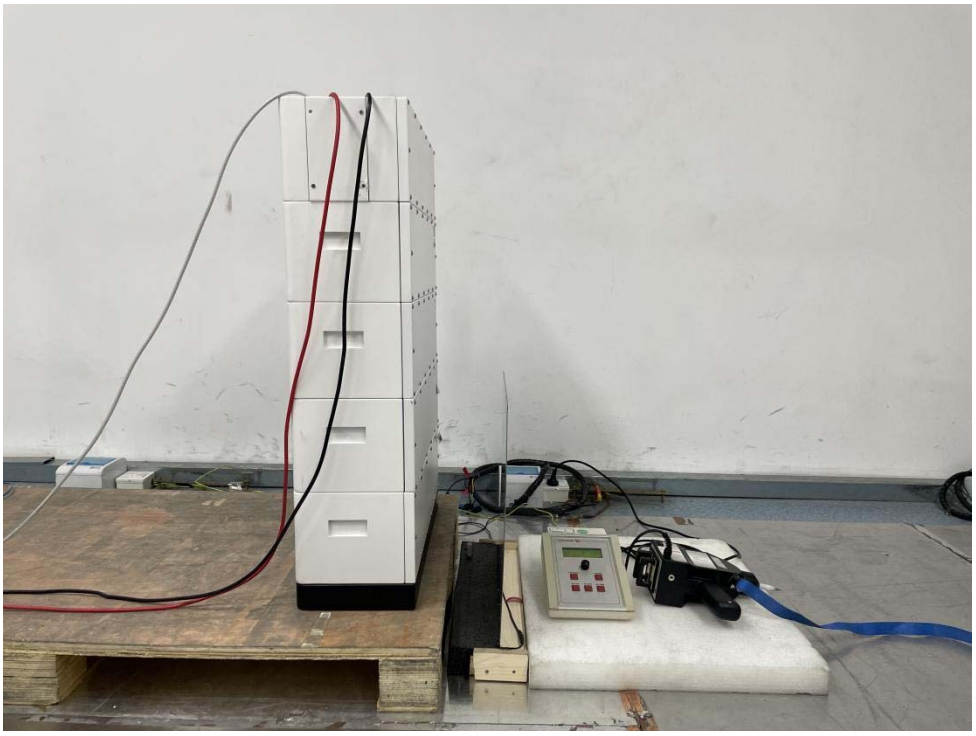
30MHz~1000MHz



Close-up photo



B.2 Electrostatic Discharge Immunity

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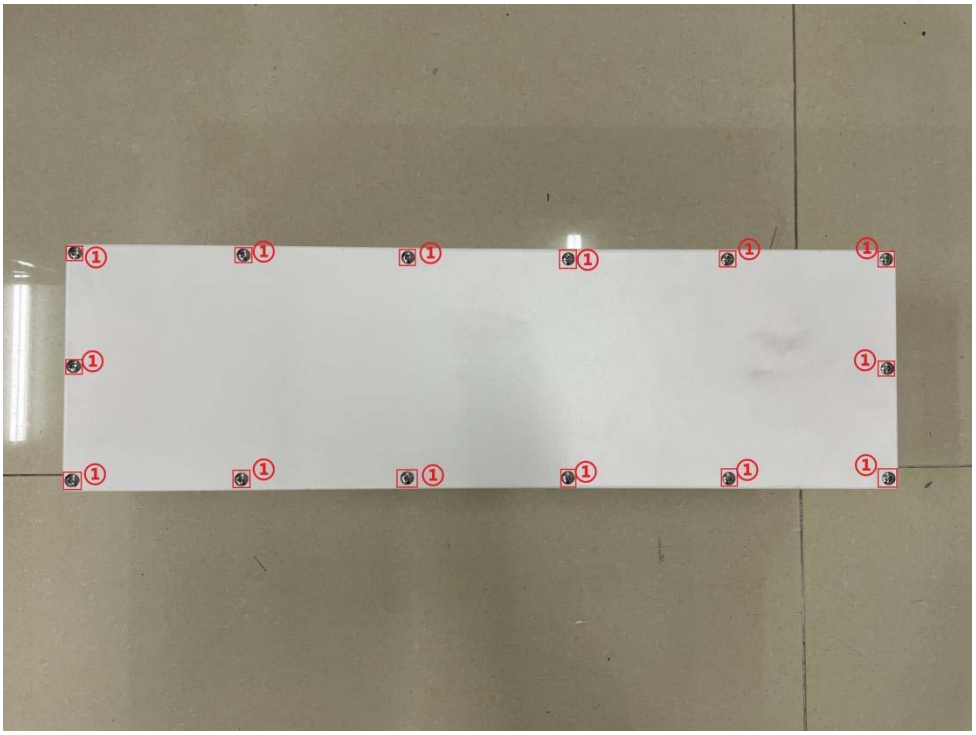
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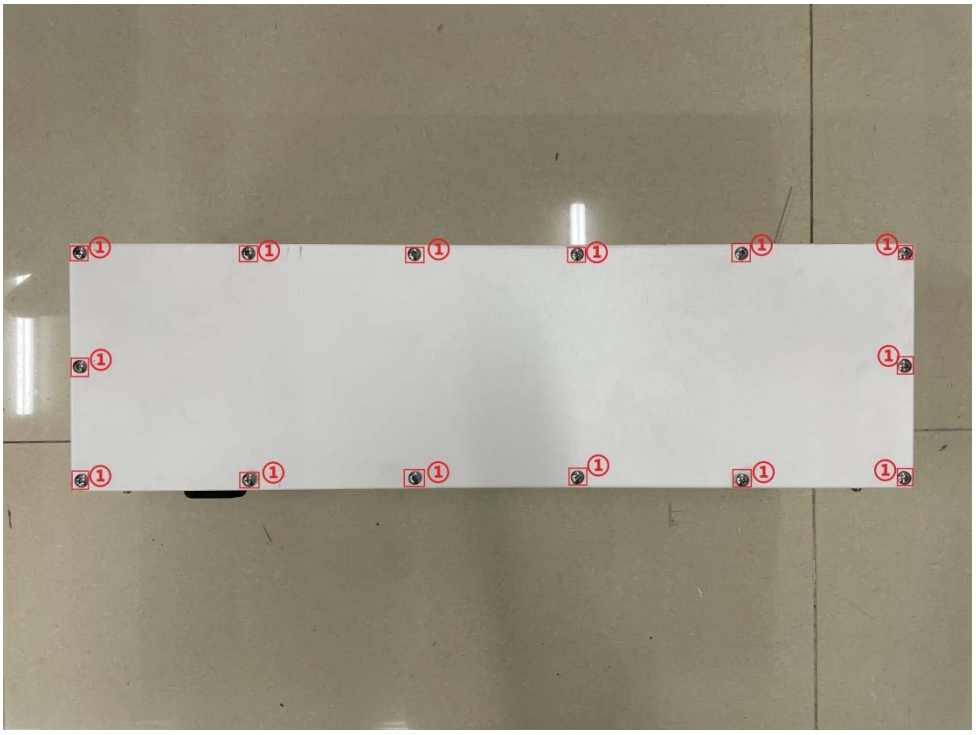
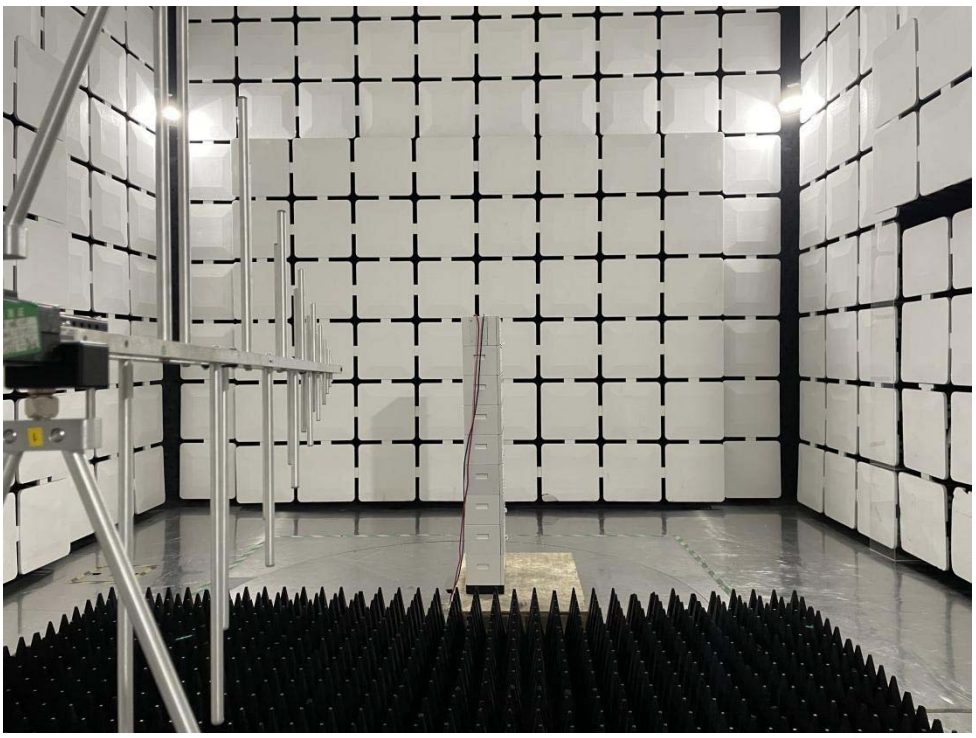
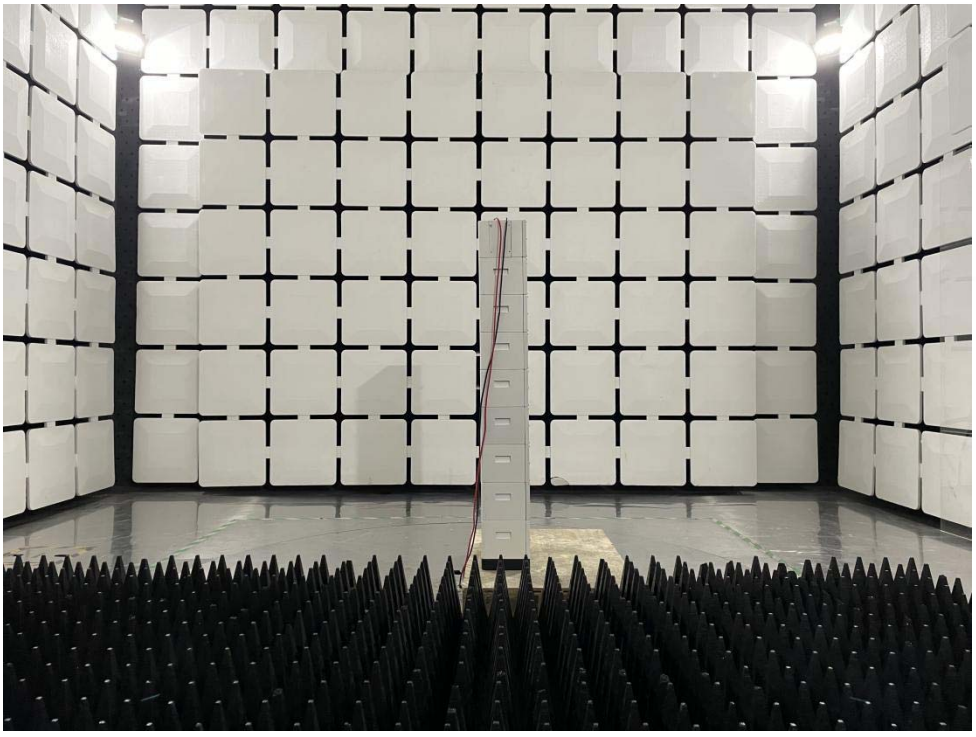


B.3 Radio Frequency Electromagnetic Field Immunity

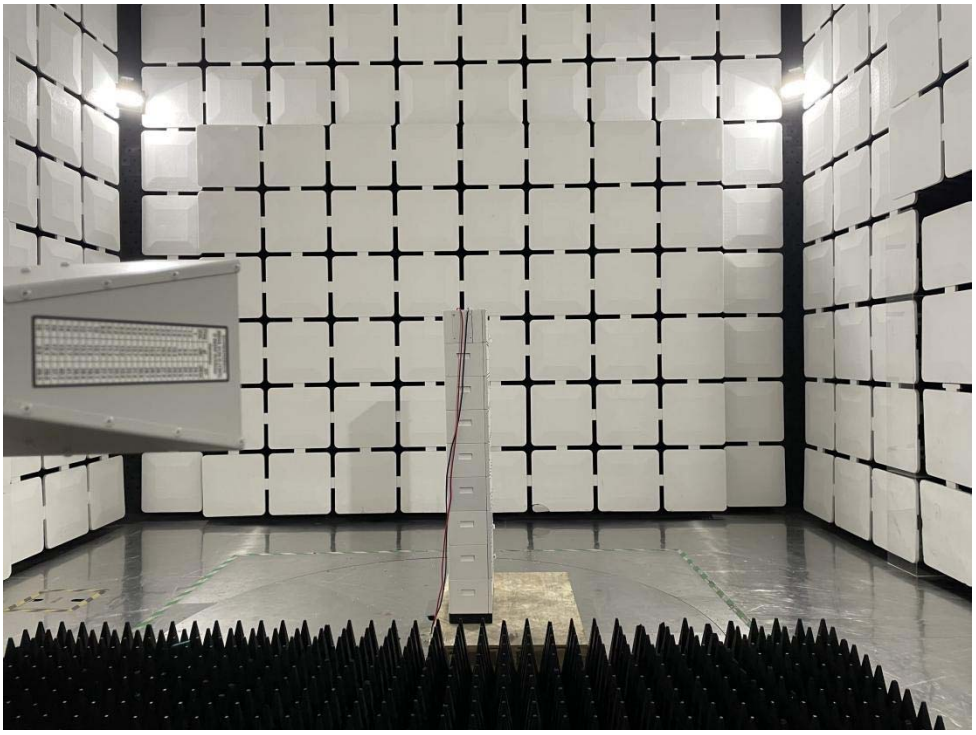
RS_Below 1GHz



Close-up photo



RS_Above 1GHz



B.4 Electrical Fast Transient/Burst Immunity

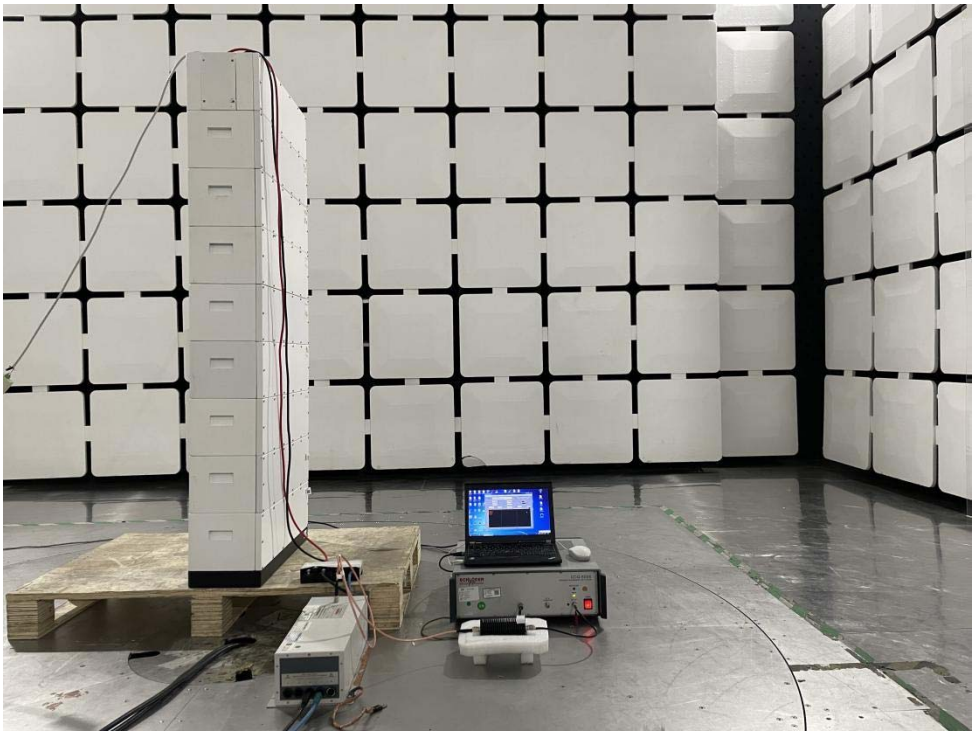
DC Port

B.5 Surge Immunity

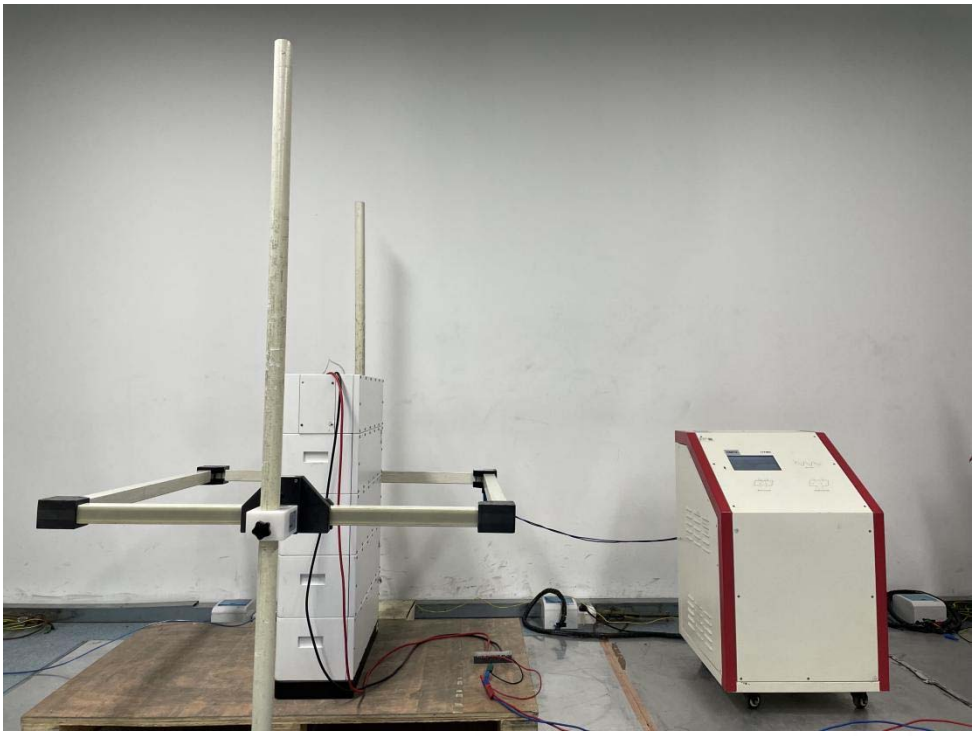
DC Port

B.6 Immunity to Conducted Disturbances Induced by RF Fields

DC Port



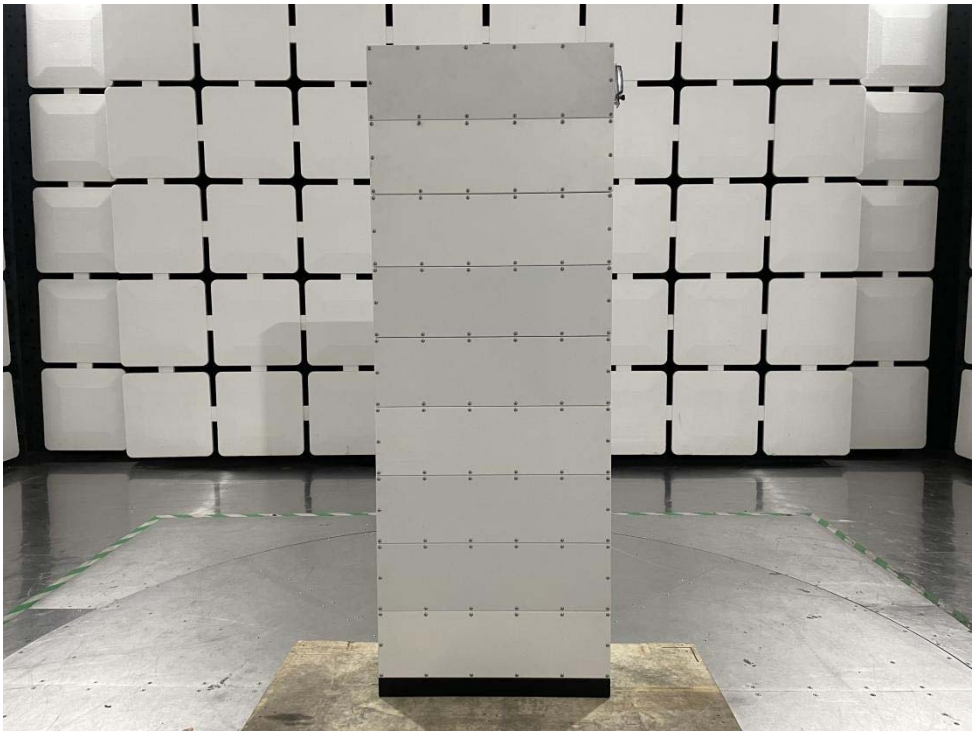
B.7 Power Frequency Magnetic Fields Immunity



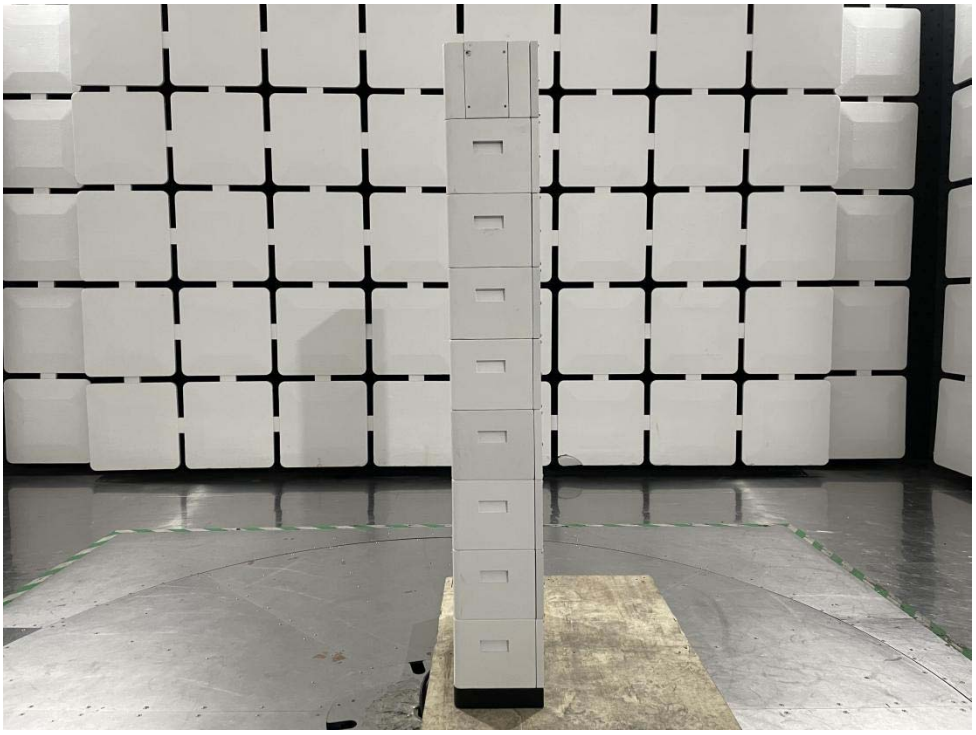
ANNEX C EUT EXTERNAL PHOTOS

Front (Model:GroundHV-20K)

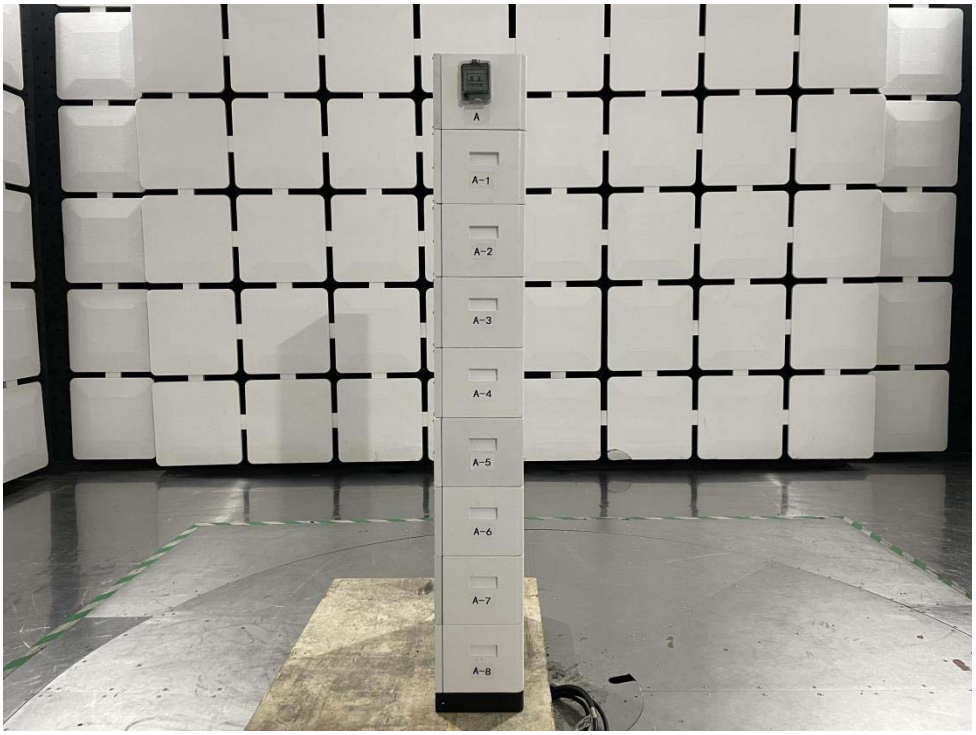
Back (Model:GroundHV-20K)



Left (Model:GroundHV-20K)

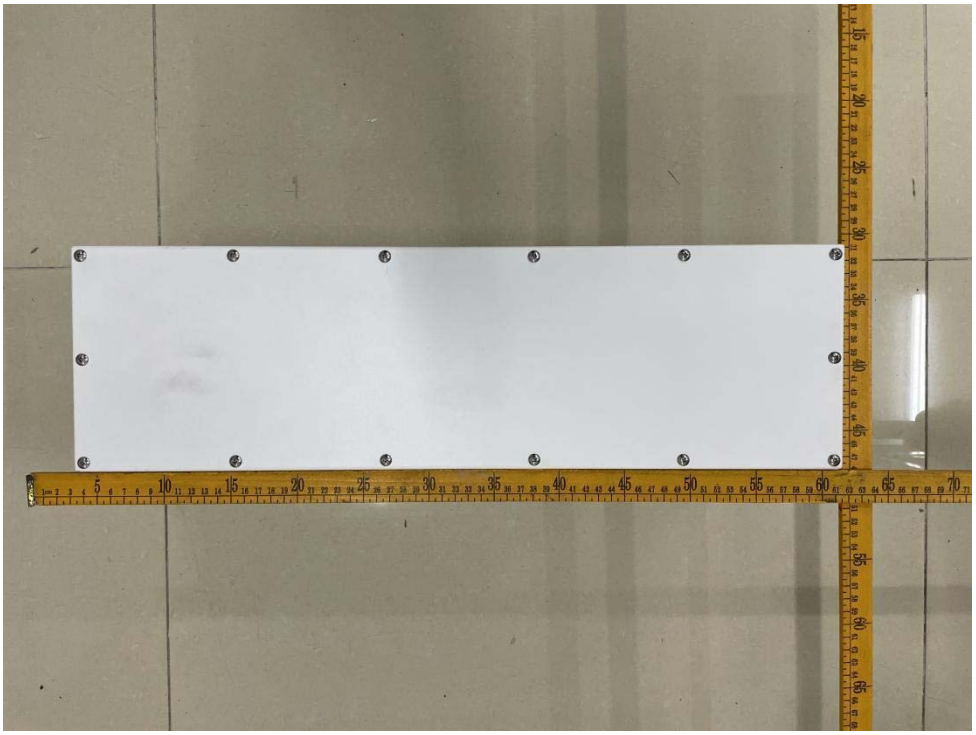


Right (Model:GroundHV-20K)



Front (High Voltage Box)

Back (High Voltage Box)



Left (High Voltage Box)

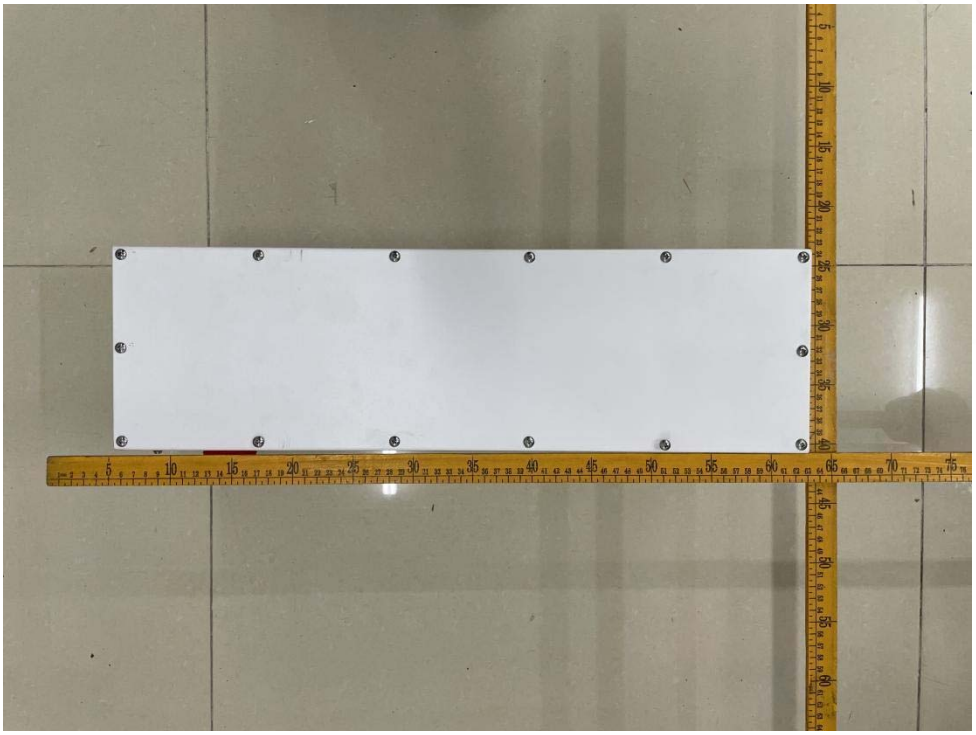
Right (High Voltage Box)

Top (High Voltage Box)

Bottom (High Voltage Box)

Front (Battery Pack)

Back (Battery Pack)



Left (Battery Pack)

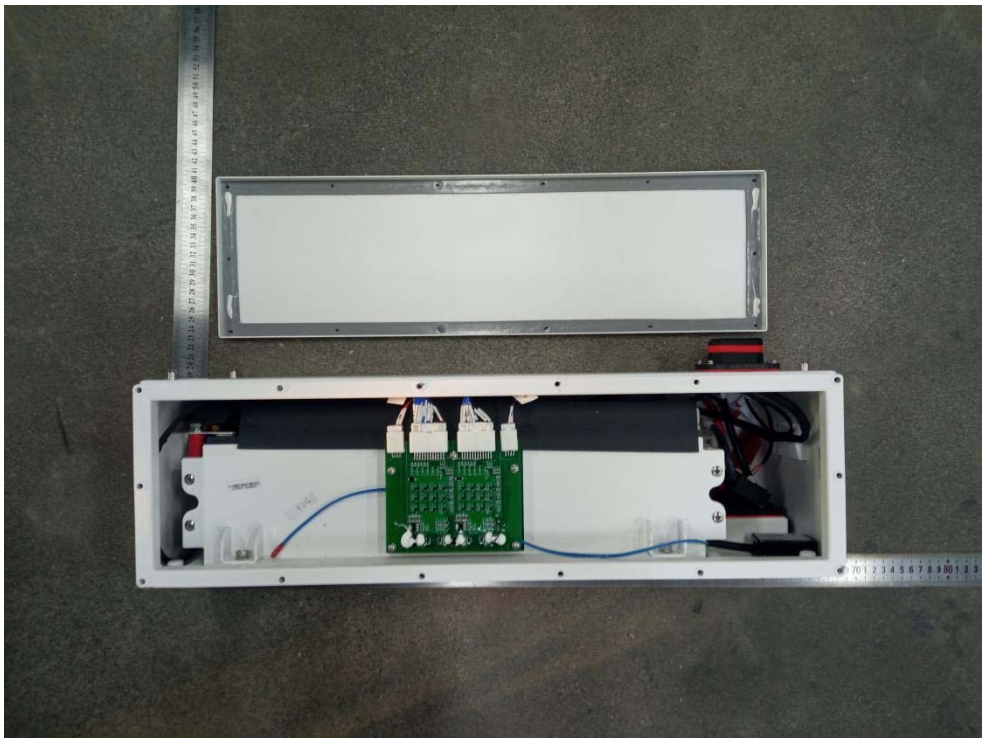
Right (Battery Pack)

Top (Battery Pack)

Bottom (Battery Pack)

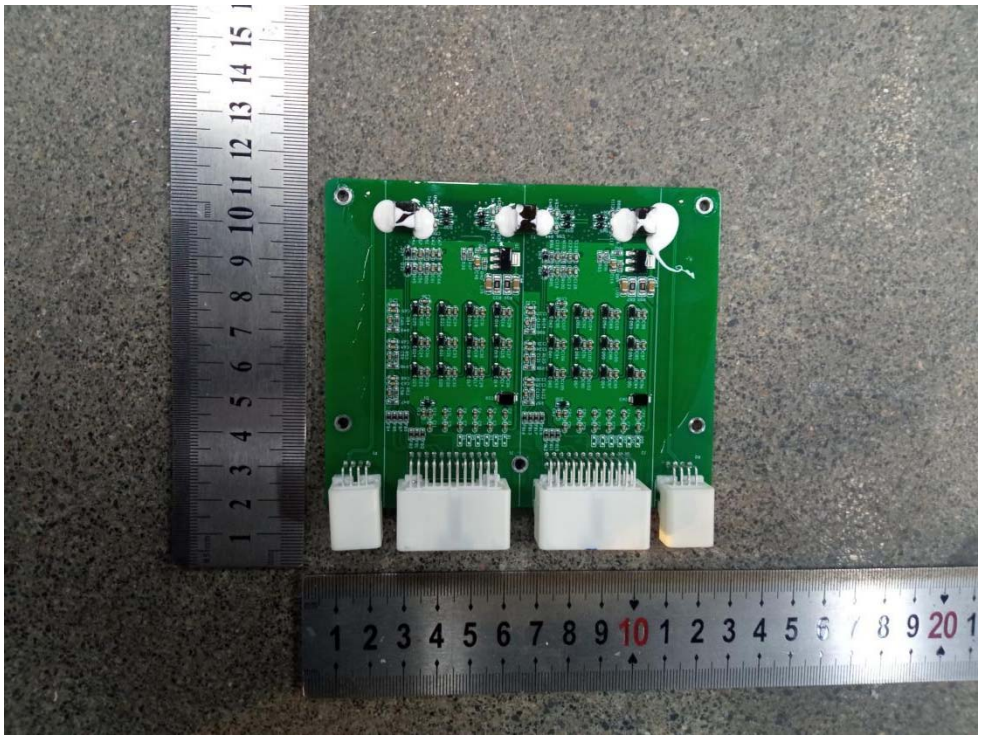
ANNEX D EUT INTERNAL PHOTOS

Internal (Battery Pack)

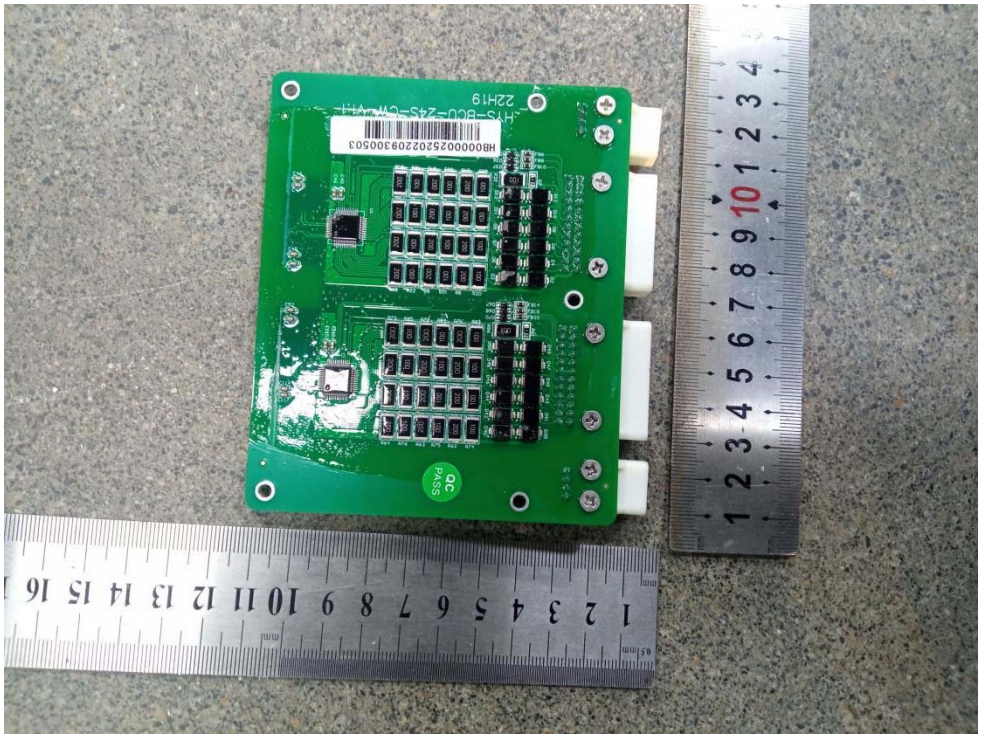


Internal (High Voltage Box)

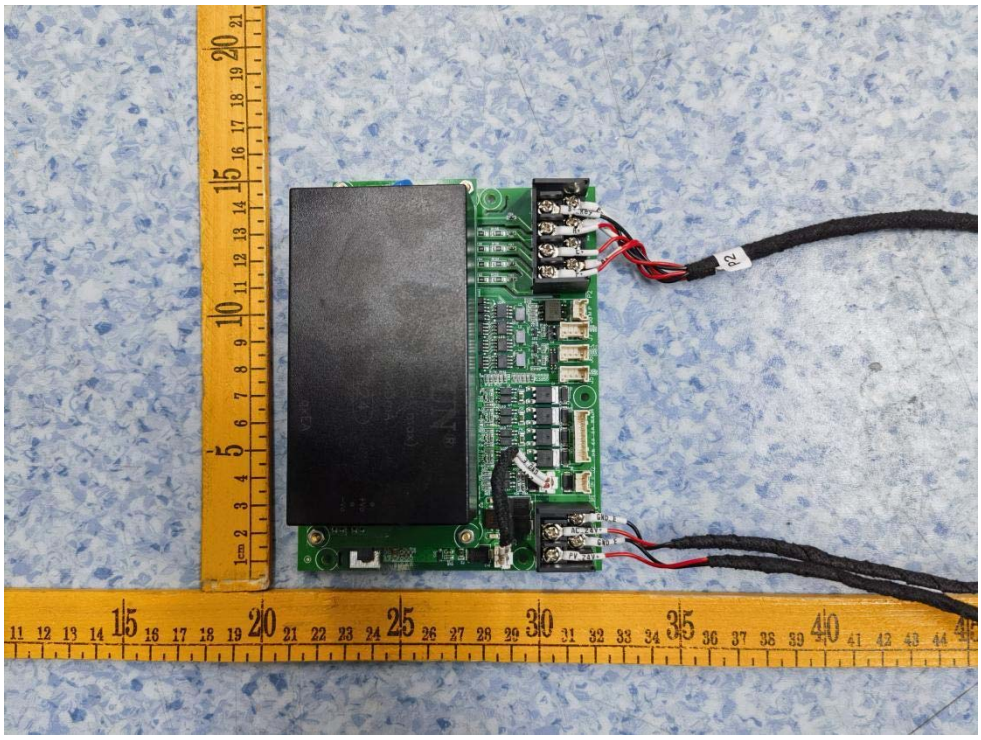
The front view of the mainboard (Battery Pack)



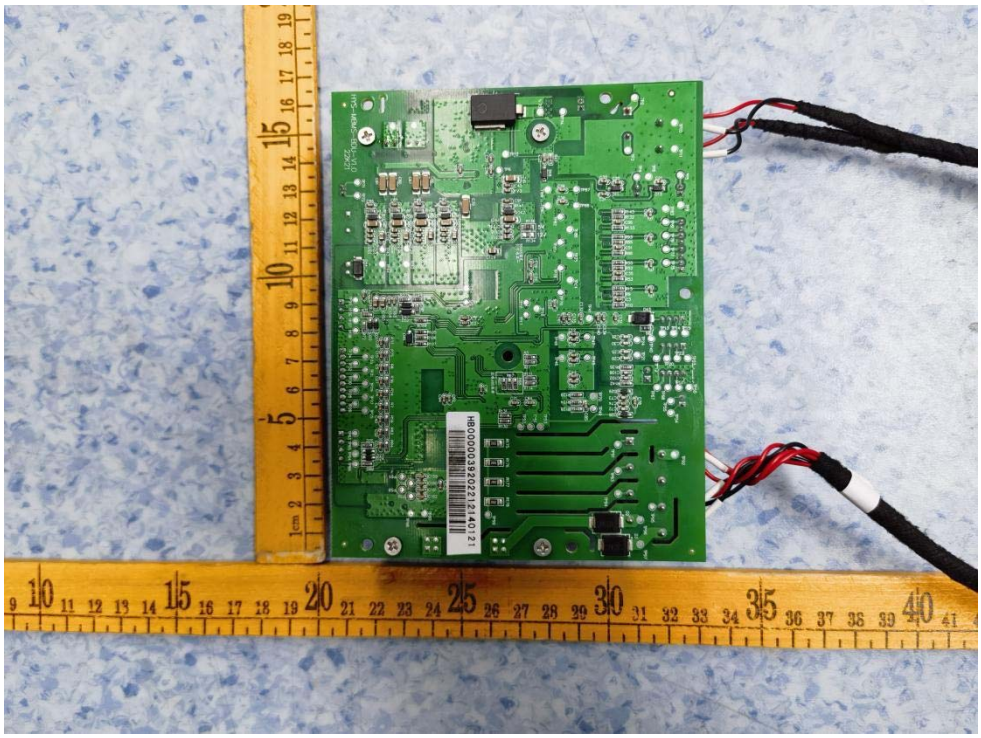
The back view of the mainboard (Battery Pack)



The front view of the mainboard (High Voltage Box)



The back view of the mainboard (High Voltage Box)



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--END OF REPORT--