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This report will not be used for social proof function in China market.

Test report No:
6193794.50

TEST REPORT
Electromagnetic Compatibility (EMC)

Identification of item tested	Rechargeable Li-ion Battery
Trademark	HaiLei
Model and /or type reference	ATOM HS-15.36, ATOM HS-20.48, ATOM HS-25.6, ATOM HS-30.72, ATOM HS-35.84, ATOM HS-40.96
Ratings	See model list
Applicant´s name / address	Shenzhen Hailei New Energy Co., Ltd. Room 101, Building A, No.7, Xiusheng 1st road, Xiuxin Community, Kengzi street, Pingshan district, Shenzhen City, Guangdong Province, China
Test method requested, standard	EN IEC 61000-6-1:2019 EN IEC 61000-6-3:2021
Verdict Summary	IN COMPLIANCE
Tested by (name / position & signature)	Lei Chen Senior Project Manager
Approved by (name / position & signature)	Adrian Shi Technical Supervisor
Date of issue	2024-08-22
Report template No	TRF_EN61000-6-3_EN61000-6-1_EMC V1.0

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COMPETENCES AND GUARANTEES

Xingsheng Certification Service (Suzhou) Co., Ltd. is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, Xingsheng Certification Service (Suzhou) Co., Ltd. has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

GENERAL CONDITIONS

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or Competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA.

UNCERTAINTY

For all measurements where guidance for the calculation of the instrumentation uncertainty of a measurement is specified in EN 55016-4-2 (CISPR 16-4-2), EN/IEC 61000-4 series or a product standard, the measurement instrumentation uncertainty has been calculated and applied in accordance with these standards.

Uncertainties have been calculated according to the Xingsheng Certification Service (Suzhou) Co., Ltd. internal document. The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%. Refer to the Annex 1 for furter information.

The measurement result is considered in conformance with the requirement if it is within the prescribed limit, It is not necessary to calculate the uncertainty associated with the measurement result.

ENVIRONMENTAL CONDITIONS

The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment. The climatic conditions during the tests were within the following limits:

Ambient temperature	15 °C – 35 °C
Relative Humidity air	30% - 60%
Atmospheric pressure	86 kPa – 106 kPa

If explicitly required in the basic standard or applied product / product family standard the climatic values are recorded and documented separately in this test report.

POSSIBLE TEST CASE VERDICTS

Test case does not apply to test object	N/A
Test object does meet requirement	P (Pass) / PASS
Test object does not meet requirement	F (Fail) / FAIL
Not measured	N/M

DEFINITION OF SYMBOLS USED IN THIS TEST REPORT

☒ Indicates that the listed condition, standard or equipment is applicable for this report/test/EUT.				
☐ Indicates that the listed condition, standard or equipment is not applicable for this report/test/EUT.				
Decimal separator used in this report	☐	Comma (,)	☒	Point (.)

ABBREVIATIONS

For the purposes of the present document, the following abbreviations apply:

EUT : Equipment Under Test
QP : Quasi-Peak
CAV : CISPR Average
AV : Average
CDN : Coupling Decoupling Network
SAC : Semi-Anechoic Chamber
OATS : Open Area Test Site
BW : Bandwidth
AM : Amplitude Modulation
PM : Pulse Modulation
HCP : Horizontal Coupling Plane
VCP : Vertical Coupling Plane
U_N : Nominal voltage
Tx : Transmitter
Rx : Receiver

N/A : Not Applicable
N/M : Not Measured
TEM : Transverse Electromagnetic Mode

DOCUMENT HISTORY

Report nr.	Date	Description
6183534.50	2024-08-22	First release.

REMARKS AND COMMENTS

The equipment under test (EUT) meet the essential requirements of the stated standard(s)/test(s).

The test results relate only to the samples tested.

This report shall not be reproduced, except in full, without the written approval.

According to the declaration from manufacturer, all models are listed below.

Model List

Model	ATOM HS-15.36	ATOM HS-20.48	ATOM HS-25.6	ATOM HS-30.72	ATOM HS-35.84	ATOM HS-40.96
Battery Chemistry	LiFeO4					
Nominal Voltage	153.6VDC	204.8VDC	256.0VDC	307.2VDC	358.4VDC	409.6VDC
Battery Capacity	100Ah	100Ah	100Ah	100Ah	100Ah	100Ah
Nominal Energy	15.36KWh	20.48KWh	25.6KWh	30.72KWh	35.84KWh	40.96KWh
Output Power	15.36KW	20.48KW	25.6KW	30.72KW	35.84KW	40.96KW
Operating Voltage Range	134.4V~ 172.8V	179.2V~ 230.4V	224V~ 288V	268.8V~ 345.6V	313.6V~ 403.2V	358.4V~ 460.8V
Recommended Charge / Discharge Current	50A	50A	50A	50A	50A	50A
Max. Charge / Discharge Current (Peak)	100A	100A	100A	100A	100A	100A

After review, all test were carried out on the following models ATOM HS-40.96. The test results stated in this report are also representative for other models.

1 GENERAL INFORMATION

1.1 General Description of the Item(s)

Description of the item .....:	Rechargeable Li-ion Battery
Model / Type number .....:	ATOM HS-15.36, ATOM HS-20.48, ATOM HS-25.6, ATOM HS-30.72, ATOM HS-35.84, ATOM HS-40.96
Serial number .....:	Not provided
Trademark.....:	Hailei
Manufacturer.....:	Shenzhen Hailei New Energy Co., Ltd. Room 101, Building A, No.7, Xiusheng 1st road, Xiuxin Community, Kengzi street, Pingshan district, Shenzhen City, Guangdong Province, China

Rated power supply .....:	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☐	AC:	☐	☐	☐	☐	☐
	☒	DC: 412 V					
	☐	Battery:					
Rated Power .....:	40.6 KW						
Clock frequencies .....:	80 MHz						
Other parameters.....:	N/A						
Software version .....:	Not provided						
Hardware version.....:	Not provided						
Dimensions in cm (W x H x D)....:	Not provided						
Mounting position.....:	☐	Table top equipment					
	☐	Wall/Ceiling mounted equipment					
	☒	Floor standing equipment					
	☐	Hand-held equipment					
	☐	Other:					

Intended use of the Equipment Under Test (EUT)
Energy storage system for residential environment, providing electricity for home users.

No	Module/parts of test item	Type	Manufacturer
/	/	/	/
/	/	/	/

No	Documents as provided by the applicant - Description	File name	Issue date
/	/	/	/

Copy of marking plate:
N/A

1.2 The environment(s) in which the EUT is intended to be used

The equipment under test (EUT) is intended to be used in the following environment(s):

☒	Residential (domestic) environment.
☒	Commercial and light-industrial environment.
☐	Industrial environment.

1.3 Test date

Test Location	Xingsheng Certification Service (Suzhou) Co., Ltd. Building 1, Xinjia Village Industrial Zone, Changqiao Street, Wuzhong District, Suzhou, Jiangsu Province, China.
Date (start)	2024-06-20
Date (finish)	2024-08-21

1.4 Classification according to EN 55032

For the Equipment Under Test (EUT) the following classification is applicable.

☐	Class A	All ITE equipment that satisfies Class A limits but not Class B limits. Such equipment should not be restricted in its sale but the following warning shall be included in the instruction for use. *Warning - This is a class A product. In a domestic environment this product may cause interference in which case the user may be required to take adequate measures.*
☒	Class B	Equipment intended primarily for use in the domestic environment and may include portable equipment, telecom terminal equipment powered by a telecom network and personal computers and auxiliary connected equipment.

2 DESCRIPTION OF TEST SETUP

2.1 Operating mode(s) used for tests

During the tests the following operating mode(s) has(have) been used.

Operating mode	Operating mode description	Used for testing	
		Emission	Immunity
1	Discharging mode	☒	☒
2			
Supplemental information: According to the manufacturer's request, only discharging mode was tested.			

2.2 Port(s) of the EUT

Port name and description	Connected to / Termination	Cable		
		Length used during test [m]	Attached during test	Shielded
DC port	Bi-directional OIWER SUPPLT	2.12	☒	☐
			☐	☐
Supplemental information:				

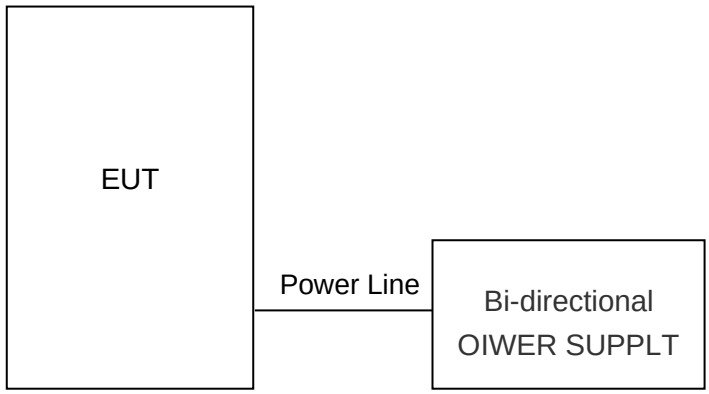
2.3 Support / Auxiliary equipment / unit / software for the EUT

The EUT has been tested with the following auxiliary equipment / unit / software:

Auxiliary equipment / unit / software	Type / Version	Manufacturer	Supplied by
Bi-directional OIWER SUPPLT	IT6018C-1500-40	ITECH	Lab
Supplemental information:			

2.4 Test Configuration / Block diagram used for tests

EUT is connected to a Bi-directional OIWER SUPPLT, and automatically enters a charging/discharging state, and the related parameters are monitored by the upper computer.

Bock diagram:


3 VERDICT SUMMARY SECTION

This chapter presents an overview of standards and results. Refer to the next chapters for details of measured test results and applied test levels.

3.1 Standards

Standard	Year	Description
EN IEC 61000-6-1	2021	Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity standard for residential, commercial and light-industrial environments
EN IEC 61000-6-3	2019	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for equipment in residential environments
EN 55016-2-1 +A1	2014 2017	Methods of measurement of disturbances and immunity - Conducted disturbance measurements.
EN 55016-2-3	2017	Methods of measurement of disturbances and immunity - Radiated disturbance measurements.
EN 55032 +A11	2015 2020	Electromagnetic compatibility of multimedia equipment - Emission requirements
EN 55014-1 +A11	2017 2020	Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission.
EN 61000-3-12	2011	Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase.
EN IEC 61000-3-11	2019	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems - Equipment with rated current ≤ 75 A and subject to conditional connection.
EN 61000-4-2	2009	Electrostatic discharge immunity test.
EN 61000-4-3 +A1 +A2	2006 2008 2010	Radiated, radio-frequency, electromagnetic field immunity test.
EN 61000-4-4	2012	Electrical fast transient/burst immunity test.
EN 61000-4-5	2014	Surge immunity test.
EN 61000-4-6	2014	Immunity to conducted disturbances, induced by radio-frequency fields.
EN 61000-4-8	2010	Power frequency magnetic field immunity test.
EN 61000-4-11	2004	Voltage dips, short interruptions and voltage variations immunity tests.
EN 61000-4-20	2010	Emission and immunity testing in transverse electromagnetic (TEM) waveguides.

3.2 Deviation(s) from the Standard(s) / Test Specification(s)

The following deviation(s) was / were made from the published requirements of the listed standards: N/A.

3.3 Overview of results

EMISSION TESTS – EN 61000-6-3			
Requirement – Test case	**Basic standard(s)**	**Verdict**	**Remark**
Conducted disturbance voltage at AC power port(s)	EN 55016-2-1	N/A	See 1)
Conducted disturbance voltage at DC power port(s)	EN 55016-2-1	PASS	---
Conducted disturbance voltage at Telecommunications / network port(s)	EN 55016-2-1	N/A	See 2)
Radiated electromagnetic disturbances (30 MHz to 1000 MHz)	EN 55016-2-3	PASS	---
Radiated electromagnetic disturbances (above 1 GHz)	EN 55016-2-3	N/A	See 5)
Discontinuous disturbance (clicks) on AC power leads	EN 55014-1	N/A	See 6)
Control principle shall be allowed for the application according to the clause 6.1	EN 61000-3-2 EN 61000-3-12	N/A	See 1)
Harmonic current emissions	EN 61000-3-2 EN 61000-3-12	N/A	See 1)
Voltage changes, voltage fluctuations and flicker	EN 61000-3-3 EN 61000-3-11	N/A	See 1)

Supplementary information:

1) The EUT does not have a AC power port.

2) The wired network port of the EUT is only for parallel connection of batteries, not connected to the external network, so it does not need to perform the test item.

3) Since the rated power of the EUT is less then 75 Watts harmonics test is not applicable.

4) The EUT is regarded as a professional equipment with a total rated power greater than 1 KW. The test is not applicable.

5) The highest internal frequency of the EUT is less than 108 MHz.

6) Exemptions from click measurements applicable (clause 4.2.3).

IMMUNITY TESTS – EN 61000-6-1			
Requirement – Test case	**Basic standard(s)**	**Verdict**	**Remark**
Electrostatic discharge	EN 61000-4-2	PASS	---
Radio-frequency electromagnetic fields	EN 61000-4-3	PASS	---
Electrical Fast Transients	EN 61000-4-4	PASS	---
Surge transient	EN 61000-4-5	PASS	---
Injected currents (radio-frequency common mode)	EN 61000-4-6	PASS	---
Power frequency magnetic fields	EN 61000-4-8	PASS	---
Voltage dips and short interruptions	EN 61000-4-11 EN 61000-4-34	N/A	See 3)

Supplementary information:

1) The test is not applicable as the apparatus does not contain any components susceptible to this low-frequency magnetic fields.

2) Not applicable because no test requirements have been specified for DC/battery powered apparatus.

3) The EUT does not have a AC power port.

4 EMISSION TEST RESULTS

4.1	**Conducted disturbance voltage – DC power port(s)**	**VERDICT: PASS**

Standard	EN 61000-6-3
Basic standard(s)	EN 55016-2-1

Limits

Frequency range [MHz]	Limit: QP [dB(µV)[1)]]	Limit: AV [dB(µV) [1)]]	IF BW	Detector(s)
0,15 - 0,50	79	66	9 KHz	QP, CAV
0,50 - 30	73	60	9 KHz	QP, CAV

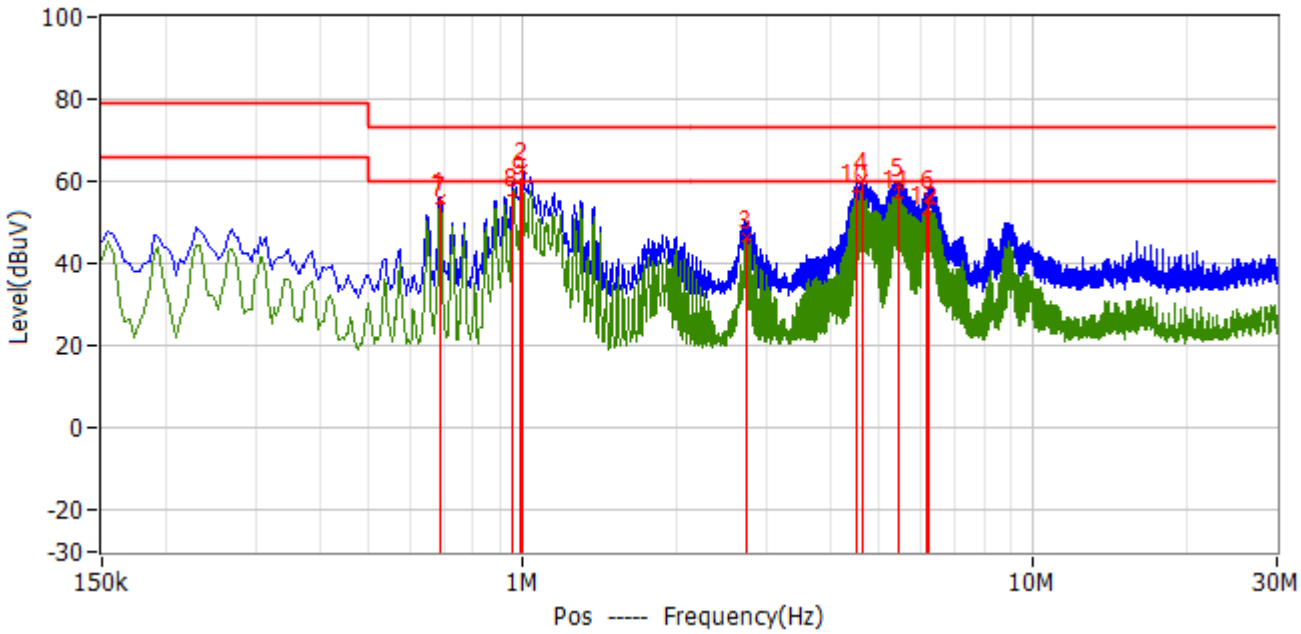
[1)] At the transition frequency, the lower limit applies.
[2)] Applicable only to ports intended for connection to a local DC power network, or a local battery by a connecting cable exceeding a length of 30 m.

Performed measurements

Port under test			Terminal			
☒	DC mains port		☒	Positive (+)	☒	Negative (-)
☐	Other:		☐	Positive (+)	☐	Negative (-)
Voltage – Input [V_{DC}]	---					
Voltage – Output [V_{DC}]	412 Vdc					
Test method applied	☒	Artificial mains network as specified EN 55016-1-2				
	☐	Artificial Network (AN) as specified in CISPR 25 Annex D				
Test setup	☐	Table top	☐	Artificial hand applied		
	☒	Floor standing	☐	Other:		
	Refer to the Annex 3 for test setup photo(s).					
Operating mode(s) used	Mode 1					
Remark	---					

See next page.

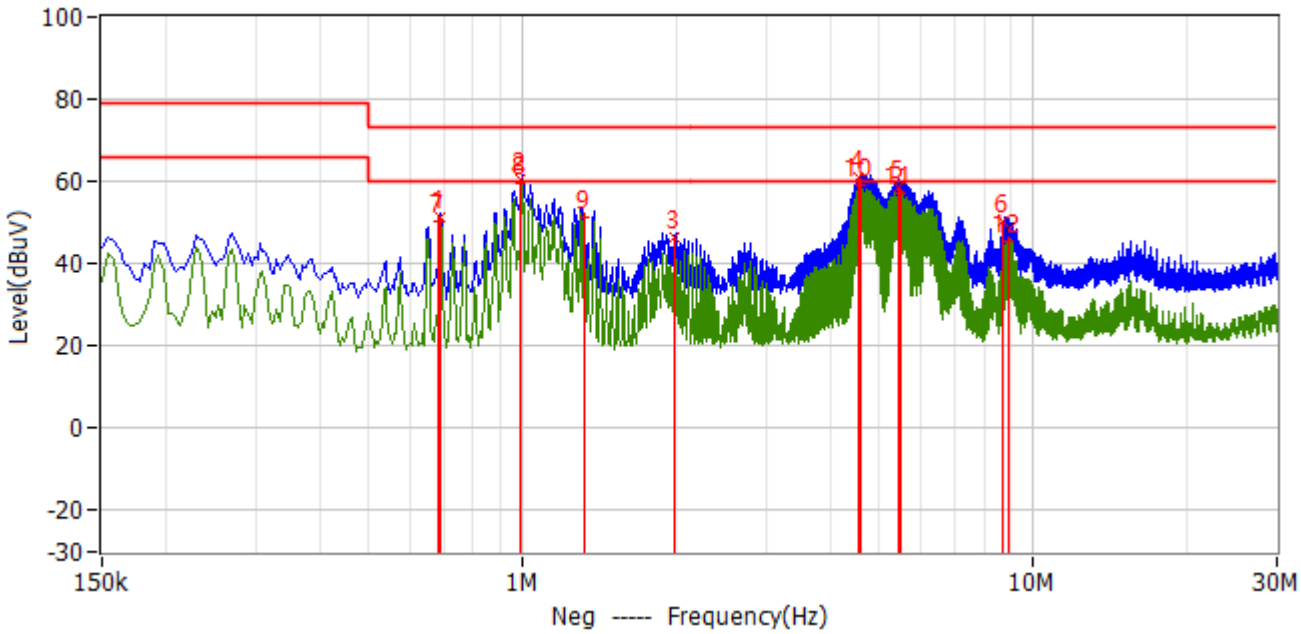
Measurement data	Port under test	DC mains port
Operating mode / voltage	Mode 1 / DC 412 V	



No.	Frequency	Limit dBuV	Level dBuV	Delta dB	Reading dBuV	Factor dB	Detector	Pole
1	690.000kHz	73.0	55.5	-17.5	25.5	30.0	QP	Pos
2	998.000kHz	73.0	63.2	-9.8	33.1	30.1	QP	Pos
3	2.750MHz	73.0	46.4	-26.6	16.3	30.1	QP	Pos
4	4.646MHz	73.0	60.6	-12.4	30.5	30.1	QP	Pos
5	5.446MHz	73.0	59.2	-13.8	29.1	30.1	QP	Pos
6	6.210MHz	73.0	56.4	-16.6	26.3	30.1	QP	Pos
7	690.000kHz	60.0	54.5	-5.5	24.5	30.0	CAV	Pos
8	958.000kHz	60.0	56.9	-3.1	26.8	30.1	CAV	Pos
9	986.000kHz	60.0	59.6	-0.4	29.5	30.1	CAV	Pos
10	4.526MHz	60.0	57.6	-2.4	27.5	30.1	CAV	Pos
11	5.446MHz	60.0	56.4	-3.6	26.3	30.1	CAV	Pos
12	6.174MHz	60.0	52.2	-7.8	22.1	30.1	CAV	Pos

Remark	---

Measurement data	Port under test	DC mains port
Operating mode / voltage	Mode 1 / DC 412 V	



No.	Frequency	Limit dBuV	Level dBuV	Delta dB	Reading dBuV	Factor dB	Detector	Pole
1	690.000kHz	73.0	51.1	-21.9	21.1	30.0	QP	Neg
2	986.000kHz	73.0	60.6	-12.4	30.5	30.1	QP	Neg
3	1.978MHz	73.0	46.3	-26.7	16.3	30.0	QP	Neg
4	4.558MHz	73.0	61.1	-11.9	31.0	30.1	QP	Neg
5	5.458MHz	73.0	58.7	-14.3	28.6	30.1	QP	Neg
6	8.734MHz	73.0	50.5	-22.5	20.3	30.2	QP	Neg
7	682.000kHz	60.0	50.3	-9.7	20.3	30.0	CAV	Neg
8	986.000kHz	60.0	59.4	-0.6	29.3	30.1	CAV	Neg
9	1.318MHz	60.0	51.5	-8.5	21.5	30.0	CAV	Neg
10	4.582MHz	60.0	59.1	-0.9	29.0	30.1	CAV	Neg
11	5.490MHz	60.0	57.3	-2.7	27.2	30.1	CAV	Neg
12	8.982MHz	60.0	45.3	-14.7	15.1	30.2	CAV	Neg

Remark	---

4.2 **Radiated electromagnetic disturbances (30 – 1000 MHz)**	**VERDICT: PASS**

Standard	EN 61000-6-3
Basic standard(s)	EN 55016-2-3
Test method	Antenna method according to EN 55016-2-3 standard.
Supplementary information:	

Limits

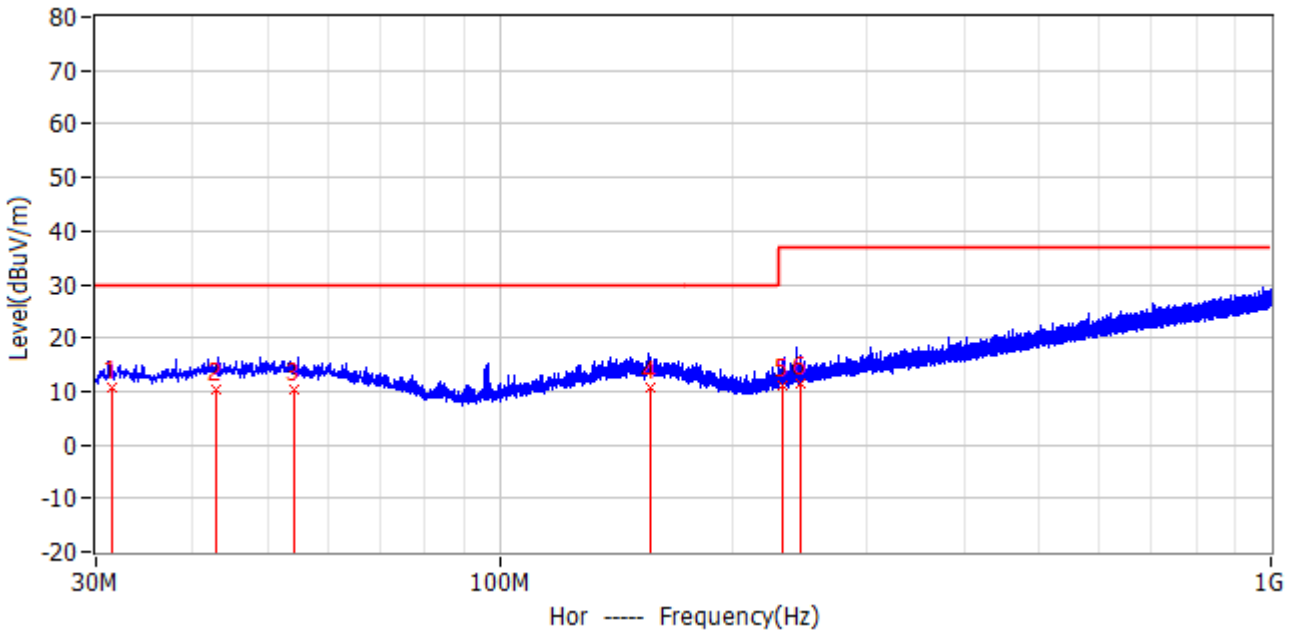
Frequency	Limit: QP [dB(μV/m)[1)]]			IF BW	Detector
[MHz]	@3 m.	@5 m.	@10 m.		
30 - 230	40	36	30	120 KHz	QP
230 - 1000	47	43	37	120 KHz	QP
[1)] At the transition frequency, the lower limit applies.					

Performed measurements

Port under test	Enclosure	
Voltage – Mains [V]	DC 412 V	
Frequency – Mains [Hz]	N/A	
Test method applied	☐	OATS or SAC with measurement distance [m]: 3 m.
	☐	OATS or SAC with measurement distance [m]: 5 m.
	☒	OATS or SAC with measurement distance [m]: 10 m.
Test setup	☐	Equipment on a table of 80 cm height
	☒	Equipment on the floor (insulated from ground plane)
	☐	Other:
	Refer to the Annex 3 for test setup photo(s).	
Operating mode(s) used	Mode 1	
Remark	---	

See next page.

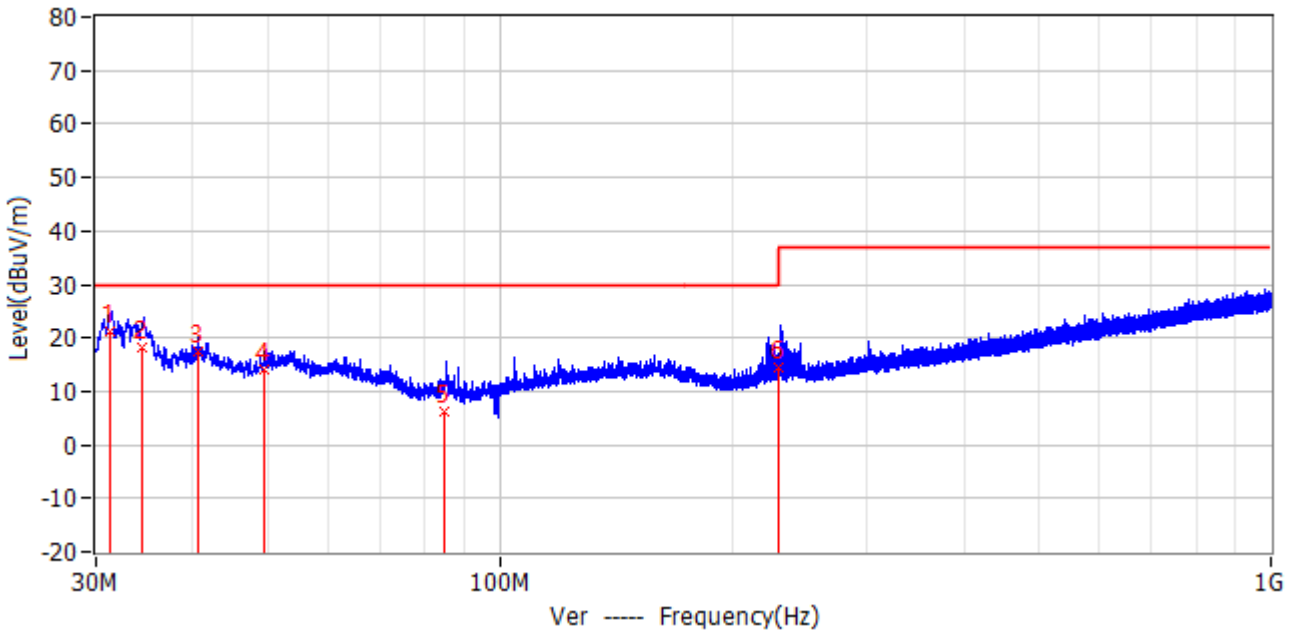
Measurement data	☒	**Horizontal**	☐	**Vertical**
Operating mode / voltage / frequency used during the test		Mode 1 / DC 412 V		



No.	Frequency	Limit dBuV/m	Level dBuV/m	Delta dB	Reading dBuV	Factor dB/m	Detector	Polar	Height cm	Angle deg
1	31.414MHz	30.0	10.8	-19.2	22.8	-12.0	QP	Hor	300.0	22.4
2	42.811MHz	30.0	10.4	-19.6	21.0	-10.6	QP	Hor	300.0	131.5
3	54.319MHz	30.0	10.3	-19.7	20.7	-10.4	QP	Hor	161.3	300.1
4	156.689MHz	30.0	10.8	-19.2	20.5	-9.7	QP	Hor	100.0	238.1
5	233.489MHz	37.0	10.9	-26.1	22.5	-11.6	QP	Hor	200.0	45.0
6	245.004MHz	37.0	11.4	-25.6	22.2	-10.8	QP	Hor	200.0	35.0

Remark	---

Measurement data	☐	**Horizontal**	☒	**Vertical**
Operating mode / voltage / frequency used during the test		Mode 1 / DC 412 V		



No.	Frequency	Limit dBuV/m	Level dBuV/m	Delta dB	Reading dBuV	Factor dB/m	Detector	Polar	Height cm	Angle deg
1	31.268MHz	30.0	21.1	-8.9	32.8	-11.7	QP	Ver	100.0	0.0
2	34.344MHz	30.0	18.1	-11.9	29.3	-11.2	QP	Ver	200.0	227.0
3	40.794MHz	30.0	17.4	-12.6	28.0	-10.6	QP	Ver	100.0	156.0
4	49.574MHz	30.0	14.0	-16.0	24.3	-10.3	QP	Ver	236.0	0.0
5	84.684MHz	30.0	6.4	-23.6	21.8	-15.4	QP	Ver	100.0	249.0
6	229.988MHz	30.0	14.3	-15.7	25.7	-11.4	QP	Ver	100.0	244.0

Remark	---

4.3	**Radiated electromagnetic disturbances (above 1 GHz)**	**VERDICT:**	**N/A**

Standard		EN 61000-6-3
Basic standard(s)		EN 55016-2-3
Test method		Antenna method according to EN 55016-2-3 standard.
Required highest frequency for radiated measurement		
Highest internal frequency [f_x]		Highest measured frequency
☒	$f_x \leq 108$ MHz	1 GHz
☐	108 MHz < $f_x \leq 500$ MHz	2 GHz
☐	500 MHz < $f_x \leq 1$ GHz	5 GHz
☐	$f_x \geq 1$ GHz	5x f_x or up to 6 GHz

Limits

Frequency [GHz]	Limit: PK@3m.[dB(µV/m)[1)]]	Limit: AV@3m.[dB(µV/m)[1)]]	IF BW	Detector
1 - 3	70	50	1 MHz	PK, CAV
3 - 6	74	54	1 MHz	PK, CAV

[1)] At the transition frequency, the lower limit applies.

Performed measurements

Port under test		Enclosure
Voltage – Mains [V]		---
Frequency – Mains [Hz]		---
Test method applied	☐	Absorber-lined OATS or SAC with measurement distance [m]: 3 m.
	☐	Absorber-lined OATS or SAC with measurement distance [m]: 1 m.
Test setup	☐	Equipment on a table of 80 cm height
	☐	Equipment on the floor (insulated from ground plane)
	☐	Other:
	Refer to the Annex 3 for test setup photo(s).	
Operating mode(s) used		---
Remark		---

See next page.

Measurement data	☐	**Horizontal**	☐	**Vertical**
Operating mode / voltage / frequency used during the test		---		

The highest internal frequency of the EUT is less than 108 MHz, so the test item is not required.

Remark	---

5 IMMUNITY TEST RESULTS

5.1 Performance (Compliance) criteria

[Source: EN/IEC 61000-6-1]

Performance 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.

Performance 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.

Performance criterion C: Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

5.1.1 Performance criteria related to immunity tests

Immunity test	Performance criteria
Electrostatic discharge	B
Radio-frequency electromagnetic fields	A
Fast transients	B
Surge transient	B
Injected currents (radio-frequency common mode)	A
Power frequency magnetic field immunity	A
Voltage dips and short interruptions	B, C

5.1.2 Manufacturer defined performance criteria

Not provided.

5.2 Monitored – Checked Functions / Parameters

During the immunity tests the following functions of the EUT has/have been monitored/checked.

☐	Motor speed	☐	Display data
☐	Switching	☐	Data storage
☐	Standby mode	☐	Sensor functions
☐	Temperature	☐	Audible signals
☐	Power consumption	☒	Others: DC mains current & volage
☐	AC mains input current	☐	Others:
☐	Timing	☐	Others:
☐	Illumination	☐	Others:
Supplementary information :			

Immunity test	**Monitored - Checked function(s)/parameter(s) during / after the test**	**Method**
Electrostatic discharge	PASS	Visual
Radio-frequency electromagnetic fields	PASS	Visual
Fast transients	PASS	Visual
Surge transient	PASS	Visual
Injected currents (radio-frequency common mode)	PASS	Visual
Power frequency magnetic field immunity	PASS	Visual
Voltage dips and short interruptions	/	/
Supplementary information :		

5.3 Electrostatic discharge immunity — VERDICT: PASS

Electrostatic discharges (ESD) are the result of persons or objects that accumulate static electricity due to for instance walking on synthetic carpets. The ESD can influence the operation of equipment or damage its electronics, either by a direct discharge or indirectly by coupling or radiation. Both effects are simulated during the tests.

Requirements

Standard	EN 61000-6-1							
Basic standard	EN 61000-4-2							
Port under test	Enclosure							
Air discharges	☒	±2 kV	☒	±4 kV	☒	±8 kV	☐	kV
Contact discharges	☒	±2 kV	☒	±4 kV	☐	±8 kV	☐	kV
Number of discharges	≥ 10 per polarity with ≥ 1 sec interval.							
Performance criterion	B; During the test degradation is allowed. No change of operating state or stored data is allowed. Refer to the chapter 5.1 for details.							

Performed tests

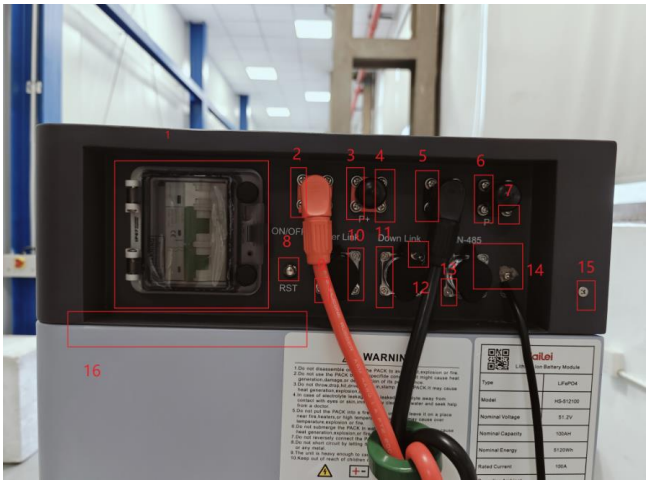
Set-up	☐	Table-top	☒	Floor standing
Ambient temperature [°C]	24		Relative Humidity air [%]	57
Voltage – Mains [V]	DC 412 V			
Frequency – Mains [Hz]	/			
Operating mode(s) used	Mode 1			

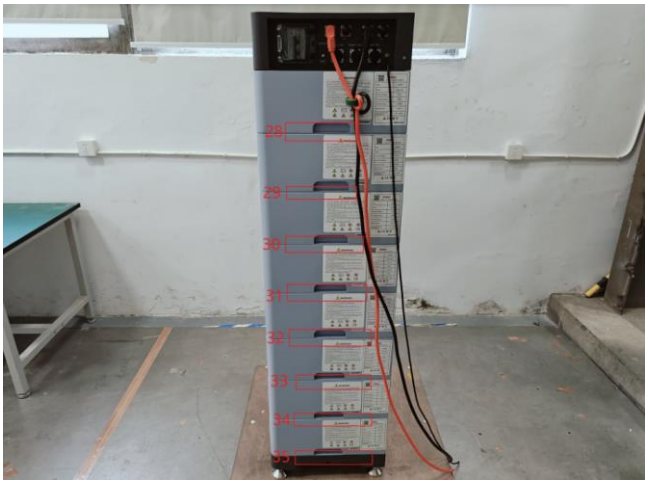
	Test Point (Location of discharge, see also photo)	Test Voltage [kV] & Polarity	Coupling type	# of applied discharges / polarity	Discharge interval [s]
☒	Points on conductive surface as indicated in the picture below.	±2 / ±4	Contact	10	1
☒	Points on non-conductive surface as indicated in the picture below.	±2 / ±4 / ±8	Air	10	1
☐	HCP top side.	±2 / ±4	Contact	10	1
☐	HCP bottom side.	±2 / ±4	Contact	10	1
☒	VCP right side.	±2 / ±4	Contact	10	1
☒	VCP left side.	±2 / ±4	Contact	10	1
☒	VCP front side.	±2 / ±4	Contact	10	1
☒	VCP rear side.	±2 / ±4	Contact	10	1

Observation(s)	During the test no loss of performance was observed. After the test the EUT functioned as intended. No unacceptable loss of performance or data was observed.

Supplementary information:

Photo of selected test points





Supplementary information:

Air discharges: 1.16.18.19.20.21.22.23.24.25.26.27.28.29.30.31.32. 33.34.35.36.37.38.39.40.41.42.43. 44.45.46.47.48.49.50.51.52.53

Contact discharges: 2.3.4.5.6.7.8.9.10.11.12.13.14.15.17

5.4	**Radio-frequency electromagnetic fields immunity**	**VERDICT: PASS**

During the test it is verified if the equipment under test (EUT) has sufficient immunity against radiated electromagnetic fields. Industrial electromagnetic sources, walkie-talkies, radio transmitters, television transmitters and telecommunication equipment including cellular telephones and other emitting devices can generate these fields.

Requirements

Standard	EN 61000-6-1			
Basic standard	EN 61000-4-3			
Port under test	Enclosure			
Frequency range	Test level	Modulation	Dwell time	Step size
80 – 1000 MHz	3 V/m	80% AM (1kHz)	≥ 0,5 s	≤ 1%
1400 – 6000 MHz	3 V/m	80% AM (1kHz)	≥ 0,5 s	≤ 1%
Supplementary information:				

Performed tests

Test method	☒	EN 61000-4-3	☐	EN 61000-4-20		
Test set-up	☐	Equipment on the table (0,8 m height)				
(see annex 3 for photo)	☒	Equipment standing on floor (0,05 – 0,15 m height)				
Voltage – Mains [V]	DC 412 V			Frequency – Mains [Hz]	/	
Operating mode(s) used	Mode 1					
Frequency range (applied)	Antenna Polarization	Test level (applied)		Modulation (applied)	Dwell time (applied)	Remark
80 – 1000 MHz	H	3 V/m		80% AM (1kHz)	3 s	---
(step size 1%)	V	3 V/m		80% AM (1kHz)	3 s	---
1400 – 6000 MHz	H	3 V/m		80% AM (1kHz)	3 s	---
(step size 1%)	V	3 V/m		80% AM (1kHz)	3 s	---
Exposed side of the EUT	☒	Front (0°)	☒	Right (90°)	☐	Top
	☒	Rear (180°)	☒	Left (270°)	☐	Bottom
Observation(s)	During the test no loss of performance was observed. After the test the EUT functioned as intended. No unacceptable loss of performance or data was observed.					
Supplementary information:						

5.5 **Electrical Fast Transients immunity**	**VERDICT: PASS**

The EFT immunity test simulates disturbances by bursts of very short transients caused for example by switching off loads such as an AC motor or bouncing relay contacts. The transients are likely to disturb electronics but less likely to cause damage.

Requirements

Standard		EN IEC 61000-6-1		
Basic standard		EN 61000-4-4		
Pulse characteristics		5/50 ns		
Port under test		Test level	Repetition frequency	Duration
☐	AC input-output port	± 1 kV	5 KHz	≥1 min. / polarity
☒	DC input-output port [2)]	± 0.5 kV	5 KHz	≥1 min. / polarity
☐	Signal ports [1)]	± 0.5 kV	5 KHz	≥1 min. / polarity

[1)] Only applicable to ports interfacing with cables whose total length may exceed 3 m.

[2)] 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. Apparatus 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. The test is applicable to DC power input ports intended to be connected permanently to cables longer than 3 m.

Performed tests

Voltage – Mains [V]	DC 412 V			
Frequency – Mains [Hz]	/			
Operating mode(s) used	Mode 1			
Test Set-up (see annex 3 for photo)	☒	Equipment standing on floor at (0,1 ± 0,01) m above ground plane		
	☐	Equipment on the table (0,1 ± 0,01) m above ground plane		
	☐	Artificial hand applied. Location refer to chapter 9.		
Coupling	☒	Common mode	☐	Other:

Port under test	Test Voltage &Polarity	Repetition Frequency	Test duration / polarity	Injection method			
DC output port	± 0.5 kV	5 KHz	1 min.	☒	CDN	☐	Clamp
Observation(s)	During the test no loss of performance was observed. After the test the EUT functioned as intended. No unacceptable loss of performance was observed.						
Supplementary information:							

5.6	**Surge transient immunity**	**VERDICT: PASS**

The surge transient immunity test simulates the surges that are caused by over-voltages due to indirect (induced) lightning transients. The pulse is a slow transient with high-energy contents and due to its long duration may cause damage to an unprotected EUT.

Requirements

Standard		EN IEC 61000-6-1		
Basic standard		EN 61000-4-5		
Pulse characteristics		1,2/50µs Voltage; 8/20µs Current		
Repetition rate		≥ 60 secs. (for each test level and phase angle)		
Number of pulses		5 pulses (at each polarity and phase angle)		
Port		Test level & Polarity & Coupling		Phase angle [°]
		Line to Line [1]	Line to Earth [1]	
☐	AC input-output port	± 1 kV	± 2 kV	0, 90, 180, 270
☒	DC input-output port [2]	± 0.5 kV	± 1 kV	---
☐	Signal port [3] [4]	N/A	± 1 kV	---

[1] In addition to the specified test level, all lower test levels as detailed in EN 61000-4-5 should also be satisfied.

[2] 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. Apparatus 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. DC ports, which are not intended to be connected to a DC distribution network are treated as signal ports.

[3] Only in case of long distance lines, > 30 m.

[4] Where normal functioning cannot be achieved because of the impact of the CDN on the EUT, this test is not required.

Performed tests

Voltage – Mains [V]	DC 412 V
Frequency – Mains [Hz]	/
Operating mode(s) used	Mode 1
Repetition rate	60 secs. (for each test level and phase angle)
Number of pulses	5 pulses (at each polarity and phase angle)

Port under test		Coupling	Test level & Polarity	Phase angle [°]	Remark
☒	DC output port	Line to Line	± 0.5 kV	---	---
☐	---	---	---	---	---
Observation(s)		During the test no loss of performance was observed. After the test the EUT functioned as intended. No unacceptable loss of performance was observed.			
Supplementary information:					

5.7 Injected currents (RF common mode) immunity — VERDICT: PASS

During this test the immunity of the equipment for induced or conducted electromagnetic fields is checked. Fields generated by radio and other transmitters cause RF voltages in long cables like the mains network. This test reproduces these induced disturbing voltages by injecting them to the EUT via the cabling.

Requirements

Standard		EN 61000-6-1			
Basic standard		EN 61000-4-6			
Frequency range		0,15 – 80 MHz			
Port under test		Test level, *Uo*	Modulation	Step size	Dwell time
☐	AC input-output port	3 V	80% AM (1kHz)	≤ 1%	≥ 0,5 s
☒	DC input-output port [1)]	3 V	80% AM (1kHz)	≤ 1%	≥ 0,5 s
☐	Signal port [1)]	3 V	80% AM (1kHz)	≤ 1%	≥ 0,5 s
[1)] Only applicable to ports interfacing with cables whose total length, may exceed 3 m.					

Performed tests

Test method (applied)	Frequency range (applied)		Modulation (applied)	Step size (applied)
EN 61000-4-6	0,15 – 80 MHz		80% AM (1kHz)	1%
Voltage – Mains [V]	DC 412 V		Frequency – Mains [Hz]	/
Operating mode(s) used	Mode 1			
Test set-up (see annex 3 for photo)	☒	Equipment standing on floor at (0,1 ± 0,01) m above ground plane.		
	☐	Equipment on the table (0,1 ± 0,01) m above ground plane.		
	☐	Artificial hand applied. Location refer to Annex 3.		
Port under test	Test Level (applied	Injection method	Dwell time (applied)	Remark
DC output port	3 V	Current clamp	3 s	/
Observation(s)	During the test no loss of performance was observed. After the test the EUT functioned as intended. No unacceptable loss of performance was observed.			
Supplementary information:				

5.8	**Power frequency magnetic field immunity**	**VERDICT: PASS**

Magnetic fields caused by for example nearby mains frequency transformers may disturb equipment with sensitivity for these type of disturbances such as CRT monitors.

Requirements

Standard	EN 61000-6-1
Basic standard	EN 61000-4-8
Port under test	Enclosure
Field strength	3 A/m
Test Frequency	50 / 60 Hz
Notes: Applicable only to apparatus containing devices susceptible to magnetic fields.	

Performed tests

Reason for not performing the test	☐	The test is not applicable as the apparatus does not contain any components susceptible to this low-frequency magnetic fields.
Voltage – Mains [V]	DC 412 V	
Frequency – Mains [Hz]	/	
Operating mode(s) used	Mode 1	
Test set-up (see annex 3 for photo)	☒	Single Coil. Dimensions: 1 m x 1 m
	☐	Single Coil. Dimensions: 2 m x 2 m
	☐	Homogeneous field (Helmholtz coil). Dimensions: 1 m x 1 m
	☐	0,1 m above metal surface

Axis under test		Tested Field strength	Test Frequency	Test Duration	Remark
☒	X-axis	3 A/m	50 / 60 Hz	60 S	---
☒	Y-axis	3 A/m	50 / 60 Hz	60 S	---
☒	Z-axis	3 A/m	50 / 60 Hz	60 S	---
Observation(s)		During the test no loss of performance was observed. After the test the EUT functioned as intended. No unacceptable loss of performance was observed.			
Supplementary information:					

6 IDENTIFICATION OF THE EQUIPMENT UNDER TEST

The photographs show the tested device.

7 ANNEX 1 - MEASUREMENT UNCERTAINTIES

The table(s) below show(s) measurment uncertainties of the EMC test set-ups. The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Emission tests		**Uncertainty**
Radiated emissions; (Hor.)	30 MHz – 200 MHz	5.02dB
	200 MHz – 1000 MHz	5.16dB
	1000 MHz – 18000 MHz	5.02dB
Radiated emissions; (Vert.)	30 MHz –200 MHz	6.36dB
	200 MHz – 1000 MHz	6.30dB
	1000 MHz – 18000 MHz	5.08dB
Conducted Emissions from the AC/DC mains power ports	0.15MHz –30MHz	3.24dB
Harmonic	/	2.10%
Flicker	/	1.80%

Immunity tests		**Uncertainty**
Electrostatic discharge		Rise Time: 6.4 % Peak Current: 6 % Current at 30 ns: 6 % Current at 60 ns: 6 %
Radio frequency electromagnetic field	80 MHz –6000MHz	1.98dB
Fast transients		Voltage: 4 % Time: 2 %
Surges		Voltage: 4 % Time: 2 %
Radio frequency common mode		CDN: 1.59dB EM Clamp: 2.20dB Current clamp: 2.14dB Direct injection: 1.50dB
Power frequency magnetic fields		Voltage: 10 %
Voltage dips and short interruptions		Voltage: 4 % Time: 2 %

8 ANNEX 2 – USED EQUIPMENT

Location: Xingsheng Certification Service (Suzhou) Co., Ltd.

Conducted disturbance voltage

Equipment	Manufacturer	Model No.	Serial No.	Cal. due date
EMI Test Receiver	R&S	ESR3	103071	2025/5/6
Coaxial Cable	XH	RG 223	SR1-1	2025/5/6
V-LISN	Schwarzbeck	NNLK 8129	00390	2025/5/6
PVDC	Schwarzbeck	PVDC8301	8301-00126	2025/3/26

Radiated Emission

Equipment	Manufacturer	Model No.	Serial No.	Cal. due date
EMI Test Receiver	R&S	ESR7	102683	2025/5/6
EMI Test Receiver	R&S	ESR3	103070	2025/5/6
TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	01524	2024/12/25
Coaxial Cable	XH	RG 214	AC1-L	2024/11/16
Coaxial Cable	XH	RG 214	AC1-R	2024/11/16
TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	01589	2024/12/25
Preamplifier	Schwarzbeck	BBV 9744	00371	2024/9/26
Preamplifier	Schwarzbeck	BBV 9744	00364	2024/9/26
Attenuator	SHX	TS2-6-1-B	220601221	2024/12/25
Attenuator	SHX	TS2-6-1-B	220601223	2024/12/25

ESD

Equipment	Manufacturer	Model No.	Serial No.	Cal. due date
Temperature/Humidity Meter	Anymetre	TH605F	002212260647	2025/5/8
Air Gauge	XLY	BARO	N/A	2025/5/9
Electrostatic Simulator	AMETEK	ESD NX30	P2347281702	2025/3/27

Radio-frequency electromagnetic field

Equipment	Manufacturer	Model No.	Serial No.	Cal. due date
RF Signal Generator	R&S	SMB100B	104436	2025/1/2
Average Power Sensor	R&S	NRP6A	104318	2025/5/6
Average Power Sensor	R&S	NRP6A	104319	2025/5/6
Power Amplifier	RFLIGHT	NTWPA-00810500	22123354	2025/5/6
Power Amplifier	RFLIGHT	NTWPA-1060200P	23013003	2025/5/6
Swictch	XH	RFSW606P	/	N/A
Stacked Double Log.-Per.-Antenna	Schwarzbeck	STLP 9129	03055	N/A
Coaxial Cable	XH	A81	AC1-S	N/A

Electrical fast transients & Surges

Equipment	Manufacturer	Model No.	Serial No.	Cal. due date
Compact Immunity Test System	3C TEST	CCS 500(1234500)	ES014000522027	2025/5/24
CDN for EFT/Burst and Surge Immunity Tests	3C TEST	SEPN 15200T	ES066002022005	2025/5/24

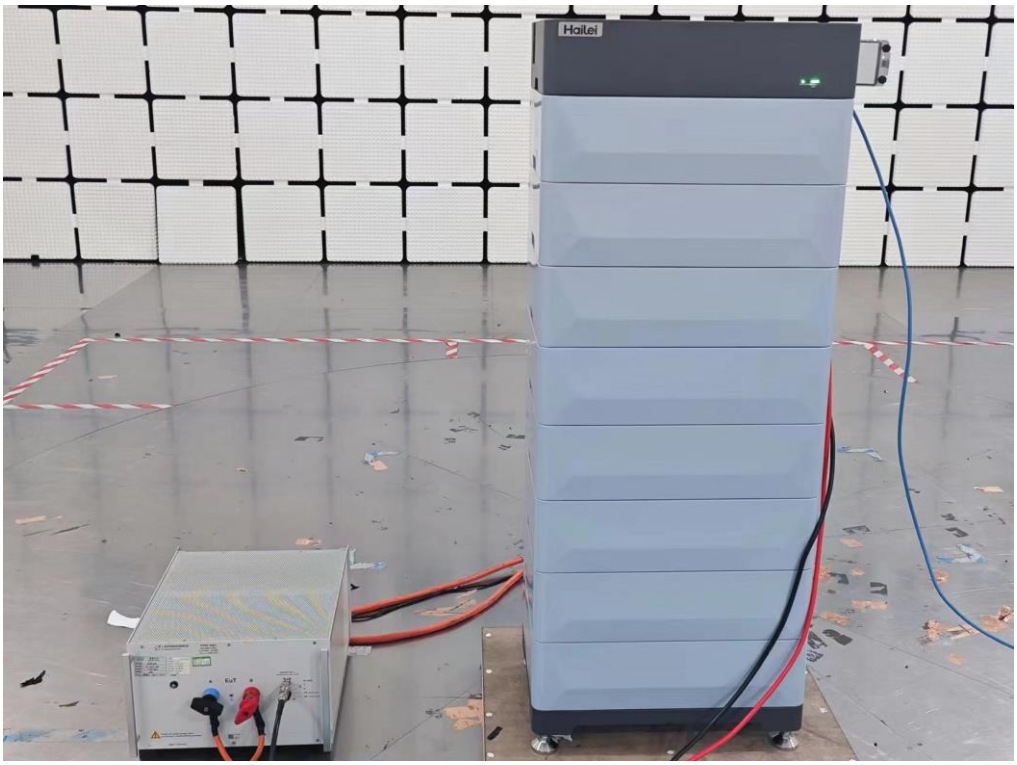
Radio-frequency continuous conducted

Equipment	Manufacturer	Model No.	Serial No.	Cal. due date
Conducted Immunity Test System	3C TEST	CST 1075	ES096000122015	2025/5/6
CDN	3C TEST	CDN M2M3	ES064002622019	2025/5/6
6dB Attenuator	3C TEST	AT80-6dB-1G-NF-NF-A	AT8023010217	2025/3/22

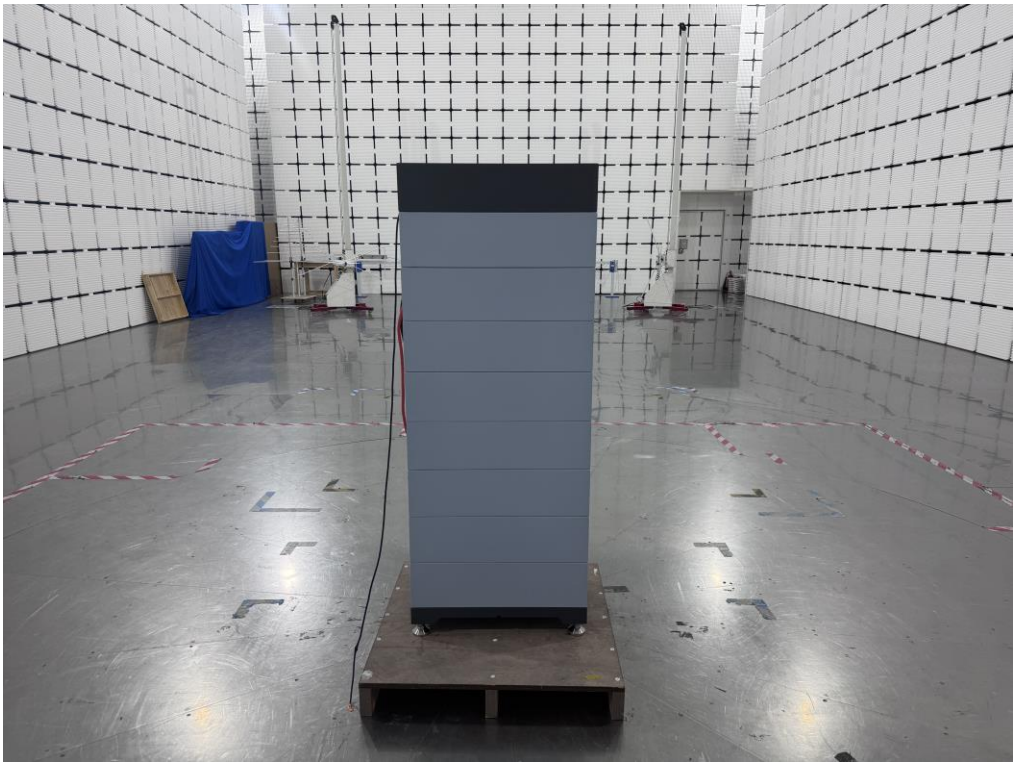
Power-frequency magnetic field

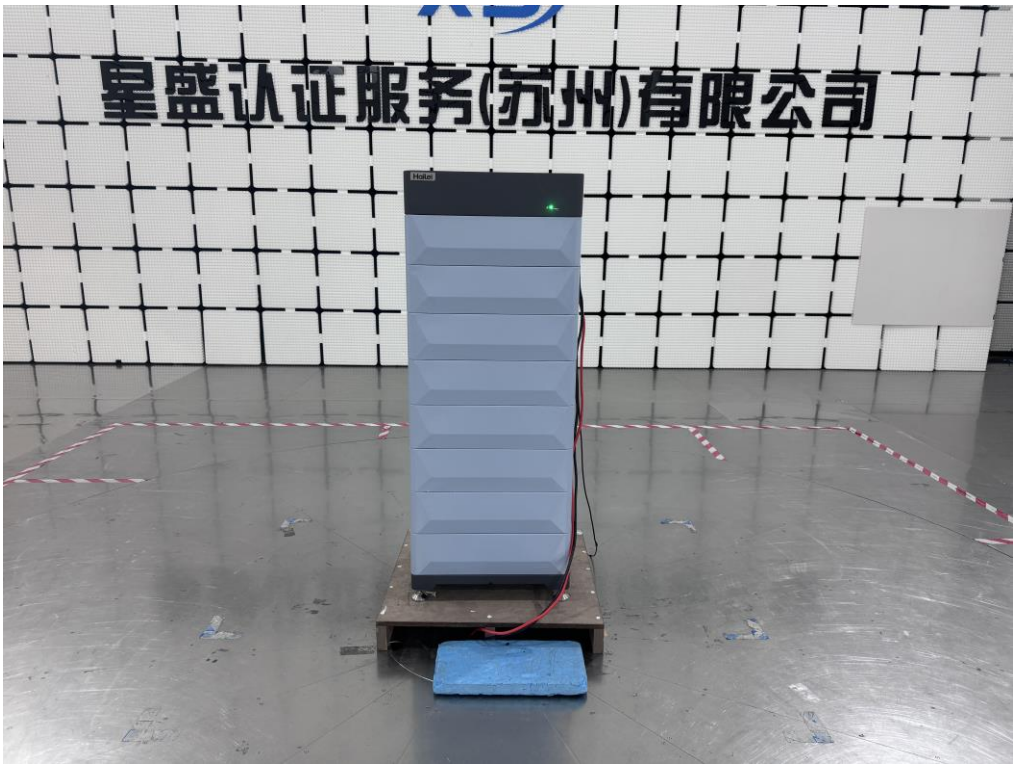
Equipment	Manufacturer	Model No.	Serial No.	Cal. due date
Power Fail and Power Frequency Magnetic Module	3C TEST	VMT 2216SV	ES047000222002	2025/5/24
Power Frequency Magnetic Field Coil	3C TEST	TCXS113	TCXS22045969	2024/9/26
Compact Immunity Test System	3C TEST	CCS 600(1234567)	ES014000323003	2025/5/24

9 ANNEX 3 - TEST PHOTOS

Conducted disturbance


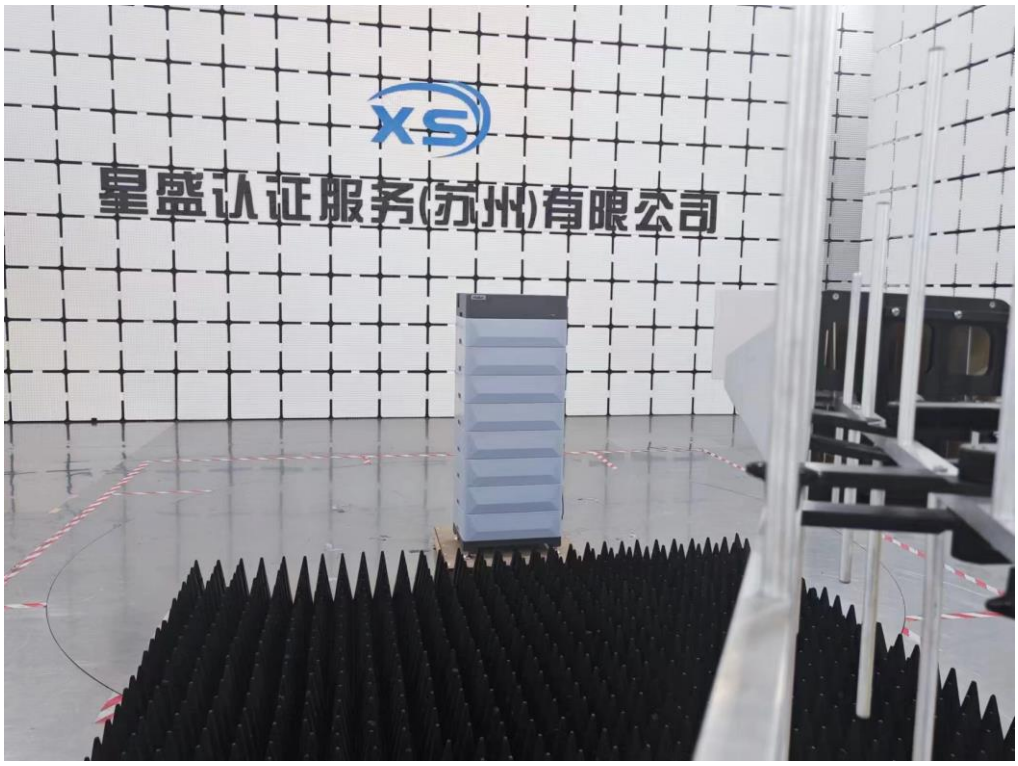
Radiated electromagnetic disturbances (30 MHz to 1000 MHz)





Electrostatic Discharge Immunity

Radiated EM Field Immunity



Electrical fast transient (EFT) / Burst transients immunity

Surge transients immunity

Conducted RF disturbances immunity

Power frequency magnetic fields

--- END ---