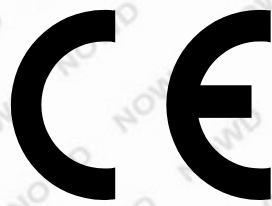


CE EMC Test Report



For

SHENZHEN LITHPOWER TECHNOLOGY CO.,LTD.

Rm 701-702, Huaifeng Int. Business Bldg, No.4018 Bao'an Ave., Yantian Community, Xixiang St., Bao'an Dist., Shenzhen

Product : LiFePo4 Battery Pack

Trade Name : N/A

Model No : LFP 12-180

Serial Model : N/A

Prepared By : Nowd Testing Services Co., Ltd.

5A, Building 29B, Yintian Industrial Zone, Yantian Community, Xixiang Street, Bao'an District, Shenzhen, China

Tel : (86) 755-27830065

Fax : (86) 755-27830095

Report No. : NTS2502156E

Date of Test : Feb. 18, 2025

Date of Rep. : Feb. 21, 2025

TEST REPORT DECLARATION

Applicant : SHENZHEN LITHPOWER TECHNOLOGY CO.,LTD.
Address : Rm 701-702,Huafeng Int. Business Bldg,No.4018 Bao'an Ave., Yantian Community, Xixiang St.,Bao'an Dist., Shenzhen
Manufacturer : SHENZHEN LITHPOWER TECHNOLOGY CO.,LTD.
Address : Rm 701-702,Huafeng Int. Business Bldg,No.4018 Bao'an Ave., Yantian Community, Xixiang St.,Bao'an Dist., Shenzhen
EUT Description : LiFePo4 Battery Pack
Trademark : N/A
Model No. : LFP 12-180
Serial Model : N/A
Power Supply : DC 12.8V, 180AH
Standards : EN 55032: 2015+A11: 2020+A1: 2020
EN 55035: 2017+A11: 2020
EN IEC 61000-3-2: 2019+ A1: 2021+A2: 2024
EN 61000-3-3: 2013+ A1: 2019+A2: 2021

This device described above has been tested by NTS and the test results show that the equipment under test (EUT) is in compliance with the 2014/30/EU requirements. And it is applicable only to the tested sample identified in the report.

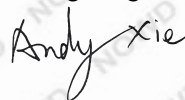
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Prepared by:



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Testing Engineer

Reviewed by:



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Approved by:



somnus
Authorized Signatory



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TEST SUMMARY

Description of Test	Result
§5.1 Conducted Emission	N/A
§6 Radiated Emission	Compliant
EN61000-3-2 Harmonic Current Emission	N/A
EN61000-3-3 Voltage Fluctuation And Flicker	N/A
Electrostatic Discharge Immunity (ESD) in accordance with IEC 61000-4-2	Compliant
Radiated RF-Electromagnetic Field Immunity in accordance with IEC 61000-4-3	Compliant
Electrical Fast Transient/Burst (EFT/B) immunity in accordance with IEC 61000-4-4	N/A
Surge immunity test immunity in accordance with IEC 61000-4-5	N/A
Immunity to conducted disturbances in accordance with IEC 61000-4-6	N/A
Power-frequency magnetic field Immunity in accordance with IEC 61000-4-8	N/A
Voltage Dips/Interruptions immunity test in accordance with IEC 61000-4-11	N/A

TEST FACILITY

Test Firm : Nowd Testing Services Co., Ltd.
Address : 5A, Building 29B, Yintian Industrial Zone, Yantian Community,
Xixiang Street, Bao'an District, Shenzhen, China.

MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$ · where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$ · providing a level of confidence of approximately **95 %**.

Conducted Emission Uncertainty = $\pm 2.23\text{dB}$

Radiated Emission Uncertainty = $\pm 4.26\text{dB}$



NOWD

GENERAL INFORMATION

GENERAL DESCRIPTION OF EUT

EUT Description:	LiFePo4 Battery Pack	
Model No.:	LFP 12-180	
Adding Model:	N/A	
Model Difference	N/A	
Product Description	The EUT is a LiFePo4 Battery Pack.	
	Operating frequency:	N/A
	Connecting I/O port:	N/A
Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual.		
Power Source	DC power	
Power Rating	DC 12.8V, 180AH	

DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	ON

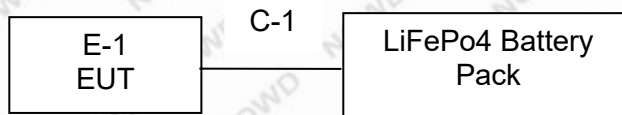
For Conducted Test	
Final Test Mode	Description
Mode 1	ON

For Radiated Test	
Final Test Mode	Description
Mode 1	ON

For EMS Test	
Final Test Mode	Description
Mode 1	ON

DESCRIPTION OF TEST SETUP

Mode 1:



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DESCRIPTION TEST PERIPHERAL AND EUT PERIPHERAL

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	LiFePo4 Battery Pack	N/A	LFP 12-180	N/A	EUT

Item	Shielded Type	Ferrite Core	Length	Note
C-1	NO	NO	150cm	Phone Cable

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
- (3) “YES” means “shielded” “with core”; “NO” means “unshielded” “without core”.

MEASUREMENT INSTRUMENTS LIST

CONDUCTED TEST SITE

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2024-07-17	2025-07-16
L.I.S.N	Schwarz beck	NSLK8126	8126-224	2024-07-17	2025-07-16
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2024-07-17	2025-07-16
AMN	EMCO	3825/2	11967C	2024-07-17	2025-07-16
Power Divider	Weinschel	1506A	PM204	2024-07-17	2025-07-16
Current Probe	FCC	F-33-4	091684	2024-07-17	2025-07-16

RADIATED TEST SITE

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	R&S	FSP	836079/035	2024-07-17	2025-07-16
EMI Test Receiver	R&S	ESVB	825471/005	2024-07-17	2025-07-16
Positioning Controller	C&C	CC-C-1F	N/A	2024-07-17	2025-07-16
RF Switch	EM	EMSW18	SW060023	2024-07-17	2025-07-16
Pre-amplifier	Agilent	8447F	3113A06717	2024-07-17	2025-07-16
Pre-amplifier	Compliance Direction	PAP-0118	24002	2024-07-17	2025-07-16
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2024-07-17	2025-07-16
Horn Antenna	ETS	3117	00086197	2024-07-17	2025-07-16

HARMONICS AND FILCK

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Harmonic & Flicker	EM TEST	DPA500	0303-04	July 16, 2025
2	AC Power Source	EM TEST	ACS500	0203-01	July 16, 2025

ESD

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	ESD TEST GENERATOR	SCHAFFNER	NSG438	859	July 16, 2025

RS

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Signal Generator	R&S	SMT 06	832080/007	July 16, 2025
2	Log-Bicon Antenna	Schwarzbeck	VULB9161	4022	July 16, 2025
3	Power Amplifier	AR	150W1000M1	320946	July 16, 2025
4	Microwave Horn Antenna	AR	AT4002A	321467	July 16, 2025
5	Power Amplifier	AR	25S1G4A	308598	July 16, 2025

SURGE, EFT/BURST, VOLTAGE INTERRUPTION/DIPS

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Surge Generator	EVERFINE	EMS61000-5 A	1101002	July 16, 2025
2	DIPS Generator	EVERFINE	EMS61000-1 1K	1011002	July 16, 2025
	EFT/B Generator	EVERFINE	EMS61000-4 A-V2	1012005	July 16, 2025

INJECTION CURRENT

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Signal Generator	IFR	2023A	202301/368	July 16, 2025
2	Power Amplifier	AR	75A250AM1	0320709	July 16, 2025
3	CDN	FCC	FCC-801-M2	06043	July 16, 2025
4	EM Clamp	FCC	F-203I-23MM	504	July 16, 2025

2.4.8 MF

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Generator	EVERFINE	EMS61000-8 K	1007001	July 16, 2025

EMC EMISSION TEST

CONDUCTED EMISSION MEASUREMENT

POWER LINE CONDUCTED EMISSION (Frequency Range 150KHz-30MHz)

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *
0.50 -5.0	73.00	60.00	56.00	46.00
5.0 -30.0	73.00	60.00	60.00	50.00

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

TELECOMMUNICATION PORT CONDUCTED EMISSION(VOLTAGE LIMITS)

(Frequency Range 150KHz-30MHz)

FREQUENCY (MHz)	☒ Class A (dBμV)		☐ Class B (dBμV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 -0.5	97 - 87 *	84 - 74 *	84 - 74 *	74 - 64 *
0.5 -30.0	87.00	74.00	74.00	64.00

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.
- (3) When the EUT has the telecommunication terminal, this test is performed.

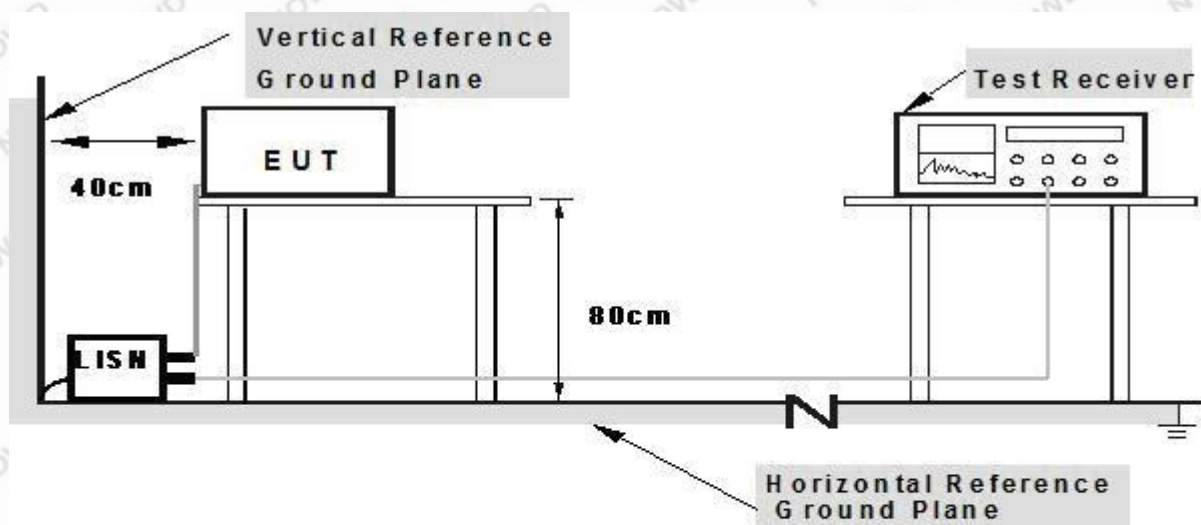
The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

TEST PROCEDURE

- The EUT was placed 0.4 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- LISN at least 80 cm from nearest part of EUT chassis.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

TEST SETUP



Note: 1. Support units were connected to second LISN.

2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

TEST RESULTS

EUT :	LiFePo4 Battery Pack	Model Name. :	LFP 12-180
Temperature :	24 °C	Relative Humidity :	65%
Pressure :	1010hPa	Test Date :	N/A
Test Mode :	N/A	Phase :	N/A
Test Voltage :	N/A		

Product uses DC power supply, do not apply this test



NOWD

RADIATED EMISSION MEASUREMENT

LIMITS OF RADIATED EMISSION MEASUREMENT

(Below 1000MHz)

FREQUENCY (MHz)	Class A		Class B	
	At 10m	At 3m	At 10m	At 3m
	dBuV/m	dBuV/m	dBuV/m	dBuV/m
30 – 230	40	50	30	40
230 – 1000	47	57	37	47

LIMITS OF RADIATED EMISSION MEASUREMENT

(Above 1000MHz)

FREQUENCY (MHz)	Class A (at 3m) dBuV/m		Class B (at 3m) dBuV/m	
	Peak	Avg	Peak	Avg
1000-3000	76	56	70	50
3000-6000	80	60	74	54

Notes:

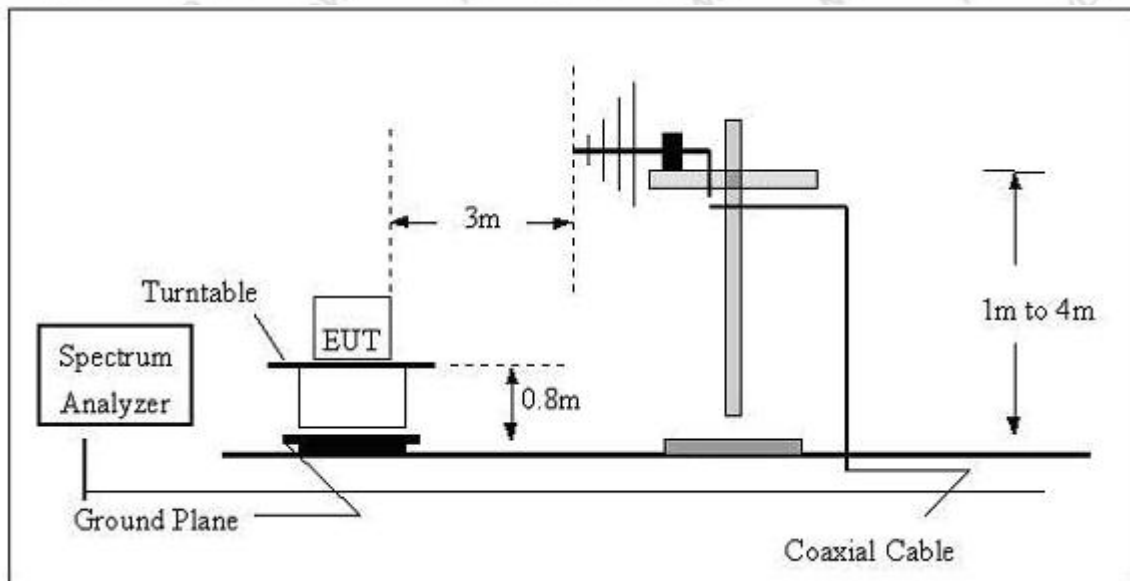
- (1) The limit for radiated test was performed according to as following:
CISPR 22.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

TEST PROCEDURE

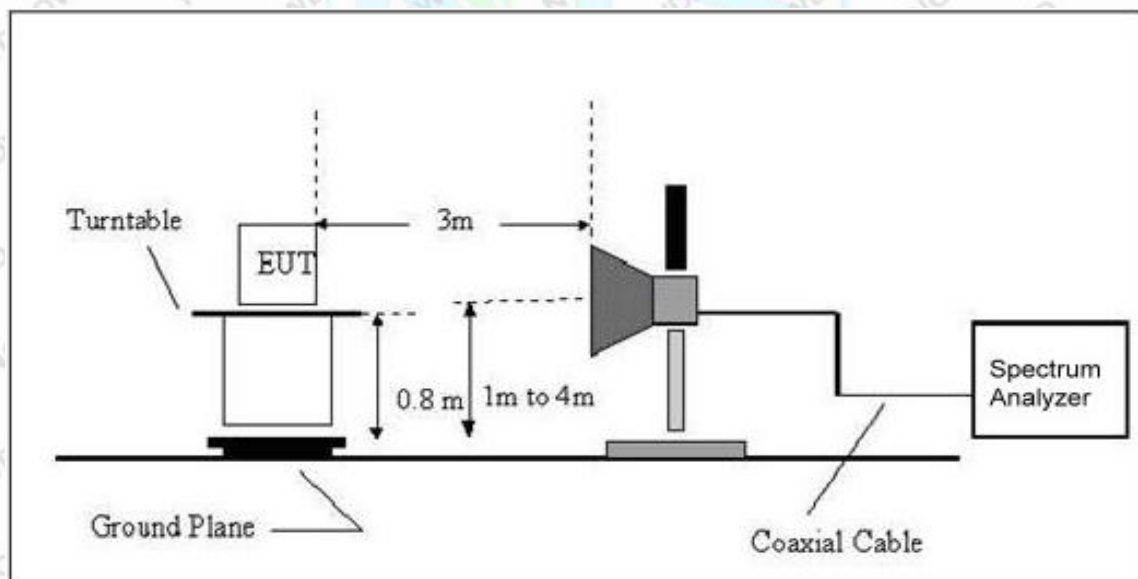
- a. The measuring distance of at 10 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- b. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured, above 1G Average detector mode will be instead.
- e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP(AV) Limits and then no additional QP Mode measurement performed.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

TEST SETUP

(A) Radiated Emission Test Set-Up Frequency Below 1 GHz



(B) Radiated Emission Test Set-Up Frequency Above 1GHz



EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of **2.3** Unless otherwise a special operating condition is specified in the follows during the testing.

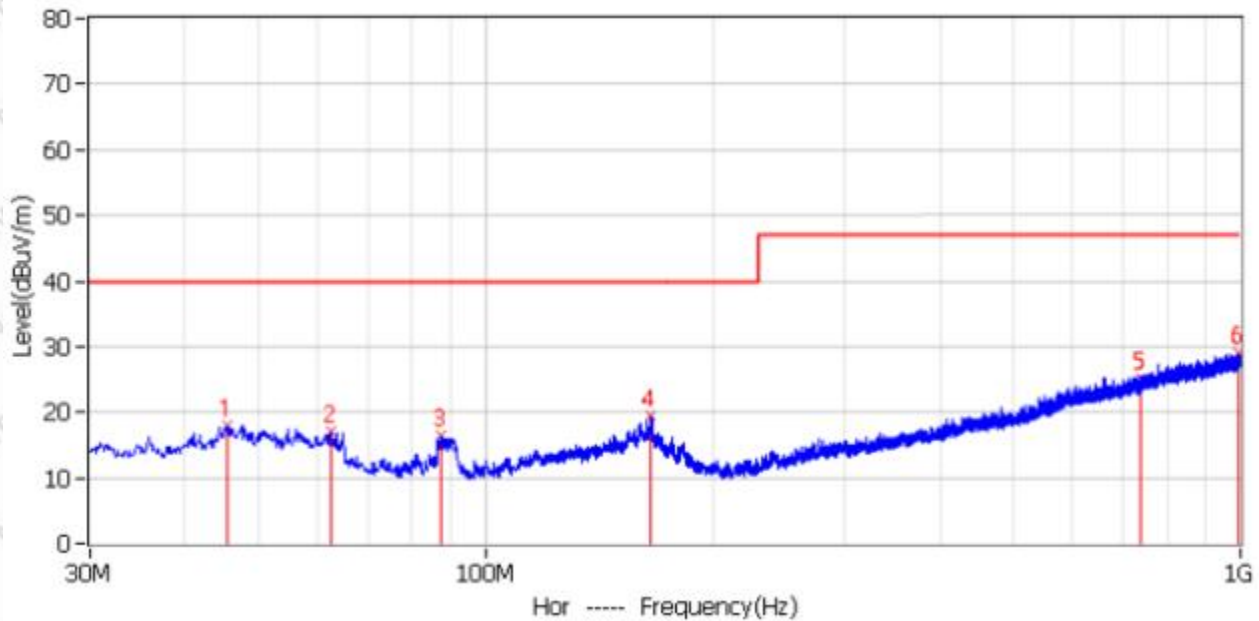
TEST RESULTS

EUT :	LiFePo4 Battery Pack	Model Name :	LFP 12-180
Temperature :	24 °C	Relative Humidity :	65%
Pressure :	1010 hPa	Test Date :	2025-02-21
Test Mode :	Mode 1	Polarization :	Horizontal
Test Power :	DC 12.8V		

No.	Frequency	Level dBuV/m	Factor dB/m	Limit dBuV/m	Margin dB	Detector	Height cm	Height cm	Angle deg
1*	45.520MHz	18.0	18.4	40.0	-22.0	PK	Hor	200.0	309.0
2*	62.374MHz	17.0	17.2	40.0	-23.0	PK	Hor	200.0	295.0
3*	87.594MHz	16.5	12.0	40.0	-23.5	PK	Hor	200.0	101.0
4*	165.436MHz	19.5	15.8	40.0	-20.5	PK	Hor	200.0	288.0
5*	737.736MHz	25.3	24.6	47.0	-21.7	PK	Hor	200.0	0.0
6*	995.635MHz	29.2	27.4	47.0	-17.8	PK	Hor	200.0	177.0

Remark:

Factor = Antenna Factor + Cable Loss.

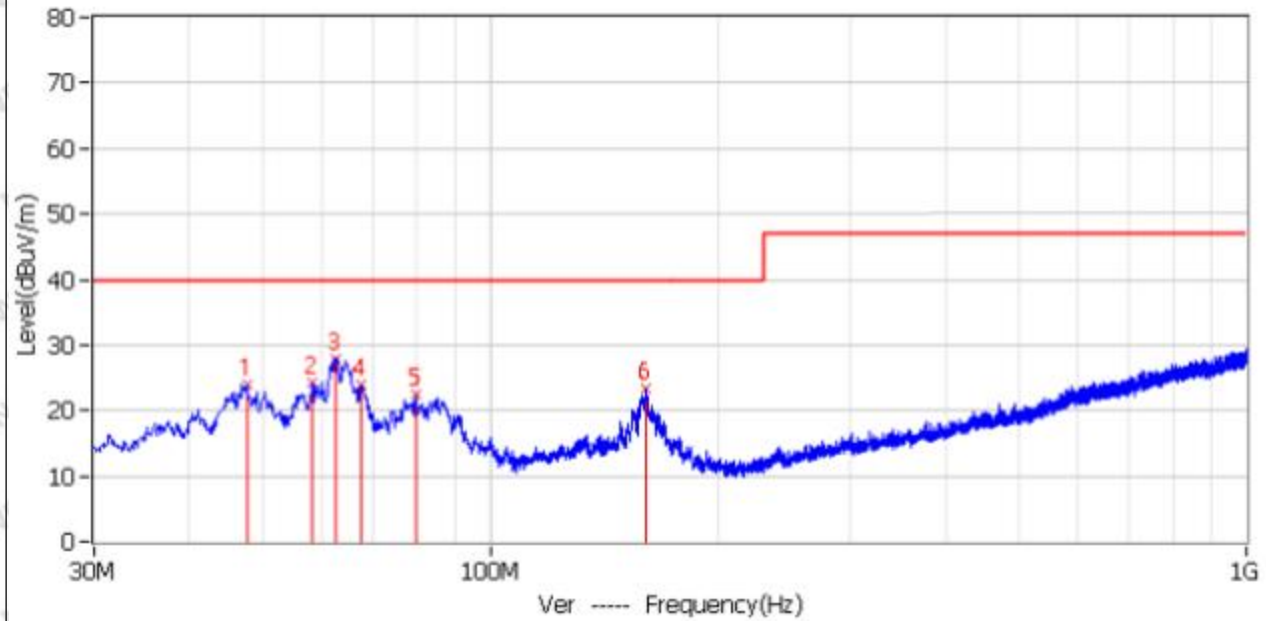


EUT :	LiFePo4 Battery Pack	Model Name :	LFP 12-180
Temperature :	24 °C	Relative Humidity :	65%
Pressure :	1010 hPa	Test Date :	2025-02-21
Test Mode :	Mode 1	Polarization :	Vertical
Test Power :	DC 12.8V		

No.	Frequency	Level dBuV/m	Factor dB/m	Limit dBuV/m	Margin dB	Detector	Height cm	Height cm	Angle deg
1*	47.703MHz	23.9	18.4	40.0	-16.1	PK	Ver	100.0	233.0
2*	58.373MHz	24.2	17.7	40.0	-15.8	PK	Ver	100.0	301.0
3*	62.616MHz	27.9	17.2	40.0	-12.1	PK	Ver	100.0	316.0
4*	67.588MHz	24.0	13.6	40.0	-16.0	PK	Ver	100.0	145.0
5*	79.713MHz	22.4	12.4	40.0	-17.6	PK	Ver	100.0	84.0
6*	161.071MHz	23.5	16.0	40.0	-16.5	PK	Ver	100.0	260.0

Remark:

Factor = Antenna Factor + Cable Loss.



TEST RESULTS(1000~6000MHz)

EUT :	LiFePo4 Battery Pack	Model Name :	LFP 12-180
Temperature :	24 ℃	Relative Humidity :	65%
Pressure :	1010 hPa	Test Date :	N/A
Test Mode :	N/A	Polarization :	N/A
Test Power :	N/A		

Remark:

The frequency of the product is lower than 108MHz, it does not apply



NOWD

HARMONICS CURRENT

LIMITS OF HARMONICS CURRENT(CLASS A & CLASS D)

Table 1 – Limits for Class A equipment

Harmonic order (n)	Maximum permissible harmonic current (A)
Odd harmonics	
3	2.3
5	1.14
7	0.77
9	0.4
11	0.33
13	0.21
$15 \leq n \leq 39$	$0.15 \cdot (15/n)$
Even harmonics	
2	1.08
4	0.43
6	0.30
$8 \leq n \leq 40$	$0.23 \cdot (8/n)$

Table 2 – Limits for Class D equipment

Harmonic order (n)	Maximum permissible harmonic current per watt (mA/W)	Maximum permissible harmonic current (A)
3	3.4	2.30
5	1.9	1.14
7	1.0	0.77
9	0.5	0.40
11	0.35	0.33
$13 \leq n \leq 39$ (odd harmonics only)	$3.85/n$	See table 1

Note: Reference standard of the two tables above: EN61000-3-2.

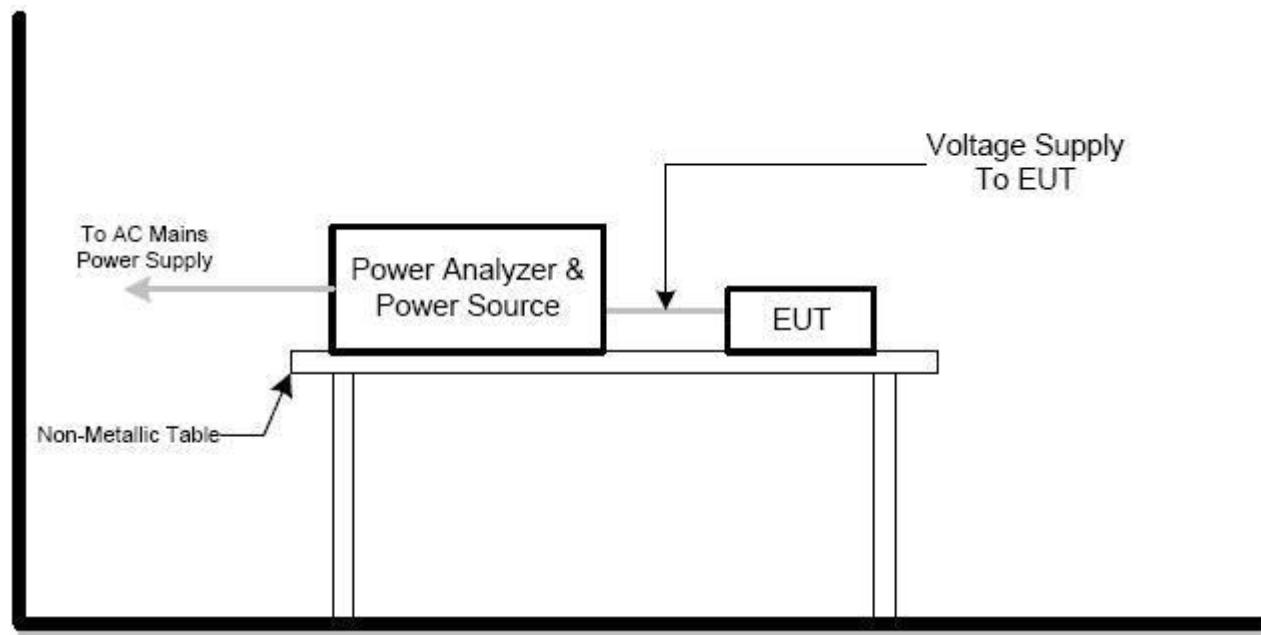
TEST PROCEDURE

- The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the maximum harmonic components under normal operating conditions.
- The classification of EUT is according to section 5 of EN 61000-3-2. The EUT is classified as follows:
 Class A: Balanced three-phase equipment, Household appliances excluding equipment as Class D, Tools excluding portable tools, Dimmers for incandescent lamps, audio equipment, equipment not specified in one of the three other classes.
 Class B: Portable tools. Portable tools.; Arc welding equipment which is not professional equipment.
 Class C: Lighting equipment.
 Class D: Equipment having a specified power less than or equal to 600 W of the following types: Personal computers and personal computer monitors and television receivers.
- 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 time necessary for the EUT to be exercised.

EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of **2.3** Unless otherwise a special operating condition is specified in the follows during the testing.

TEST SETUP



TEST RESULTS

EUT :	LiFePo4 Battery Pack	Model Name :	LFP 12-180
Temperature :	24 °C	Relative Humidity :	65%
Pressure :	1010 hPa	Test Date :	N/A
Test Mode :	N/A		
Test Power :	N/A		

Note: The active input power of the EUT is **10 W**. No limits apply for equipment with an active input power up to and including 75W



NOWD

VOLTAGE FLUCTUATION AND FLICKERS

LIMITS OF VOLTAGE FLUCTUATION AND FLICKERS

Test items	Limits(EN61000-3-3)	Descriptions
P_{st}	$\leq 1.0, T_p=10\text{min}$	short-term flicker indicator
P_{lt}	$\leq 0.65, T_p=2\text{h}$	long-term flicker indicator
d_c	$\leq 3.3\%$	relative steady-state voltage change
d_{max}	$\leq 4\%$ (or 6% ^{Note(1)} , 7% ^{Note(2)})	maximum relative voltage change:
$d_{(t)}$	$\leq 3.3\%$, more than 500ms	relative voltage change characteristic

Note:

1. 6 % for equipment which is:
 - a. switched manually, or
 - b. 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.
2. 7 % for equipment which is
 - a. attended whilst in use (for example: hair dryers, vacuum cleaners, kitchen equipment such as mixers, garden equipment such as lawn mowers, portable tools such as electric drills), or
 - b. 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.

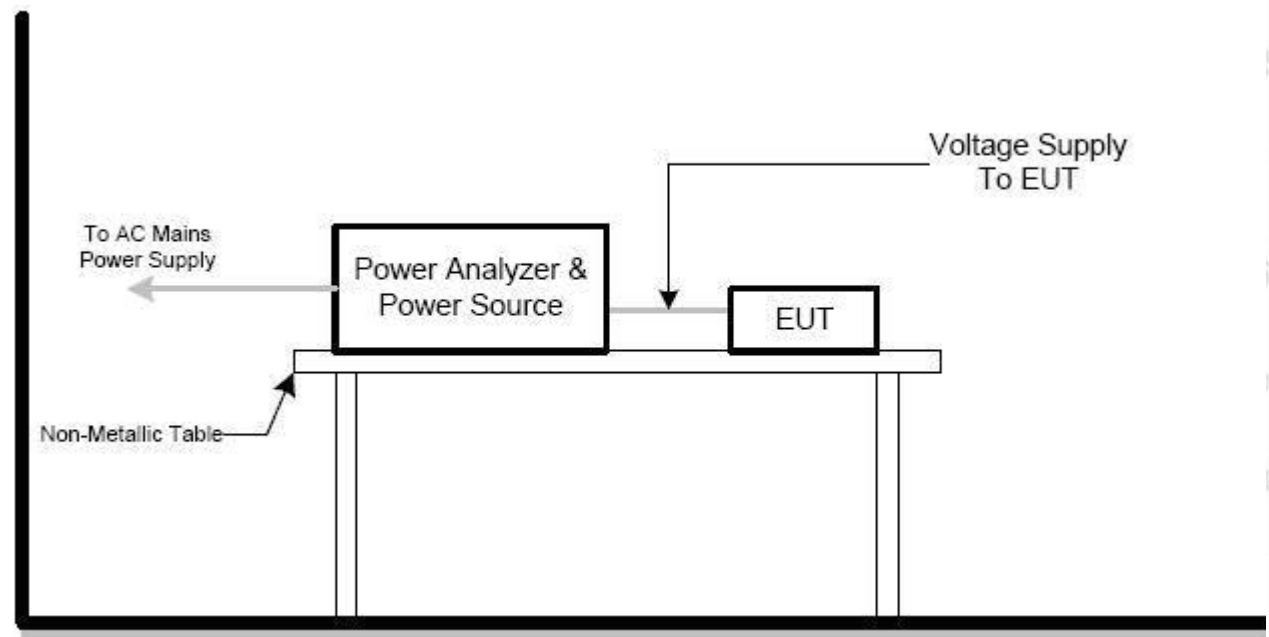
TEST PROCEDURE

- a. Harmonic Current Test:
Test was performed according to the procedures specified in Sub-clause 6.2 of IEC/EN 61000-3-2 depend on which standard adopted for compliance measurement.
- b. Fluctuation and Flickers Test:
Tests was performed according to the Test Conditions/Assessment of Voltage Fluctuations specified in Clause 6.0/4.0 of IEC/EN 61000-3-3 depend on which standard adopted for compliance measurement.
- c. All types of harmonic current and/or voltage fluctuation in this report are assessed by direct measurement using flicker-meter.

EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of **2.3** Unless otherwise a special operating condition is specified in the follows during the testing.

TEST SETUP



NOWD

TEST RESULTS

EUT :	LiFePo4 Battery Pack	Model Name :	LFP 12-180
Temperature :	24 °C	Relative Humidity :	65%
Pressure :	1010 hPa	Test Date :	N/A
Test Mode :	N/A		
Test Power :	N/A		

Product uses DC power supply, do not apply this test



NOWD

EMC IMMUNITY TEST

STANDARD COMPLIANCE/SERVIRITY LEVEL/CRITERIA

Tests Standard No.	TEST SPECIFICATION	Test Mode Test Ports	Perform. Criteria
1. ESD IEC/EN 61000-4-2	8KV air discharge 4KV contact discharge	Direct Mode	B
	4KV HCP discharge 4KV VCP discharge	Indirect Mode	B
2. RS IEC/EN 61000-4-3	80 MHz to 1000 MHz, 1000Hz, 80%, AM modulated	Enclosure	A
3. EFT/Burst IEC/EN 61000-4-4	5/50ns Tr/Th 5KHz Repetition Freq.	Power Supply Port	B
	5/50ns Tr/Th 5KHz Repetition Freq.	CTL/Signal Data Line Port	B
4. Surges IEC/EN 61000-4-5	1.2/50(8/20) Tr/Th us	L-N	B
	1.2/50(8/20) Tr/Th us	L-PE N-PE	B
5 Injected Current IEC/EN 61000-4-6	0.15 MHz to 80 MHz, 1000Hz 80 % , AM Modulated 150Ω source impedance	CTL/Signal Port	A
	0.15 MHz to 80 MHz, 1000Hz 80 % , AM Modulated 150Ω source impedance	AC Power Port	A
	0.15 MHz to 80 MHz, 1000Hz 80 % , AM Modulated 150Ω source impedance	DC Power Port	A
6. Power Frequency Magnetic Field IEC/EN 61000-4-8	50 Hz,	Enclosure	A
7. Volt. Interruptions Volt. Dips IEC/EN 61000-4-11	Voltage dip 100%	AC Power Port	B
	Voltage dip 30%		C
	Interruption 100%		C

GENERAL PERFORMANCE CRITERIA

According to **EN 55024** standard, the general performance criteria as following:

Criterion A	The equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the equipment 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, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.
Criterion B	After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test.
Criterion C	Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

GENERAL PERFORMANCE CRITERIA TEST SETUP

The EUT tested system was configured as the statements of **2.3** Unless otherwise a special operating condition is specified in the follows during the testing.

ESD TESTING

TEST SPECIFICATION

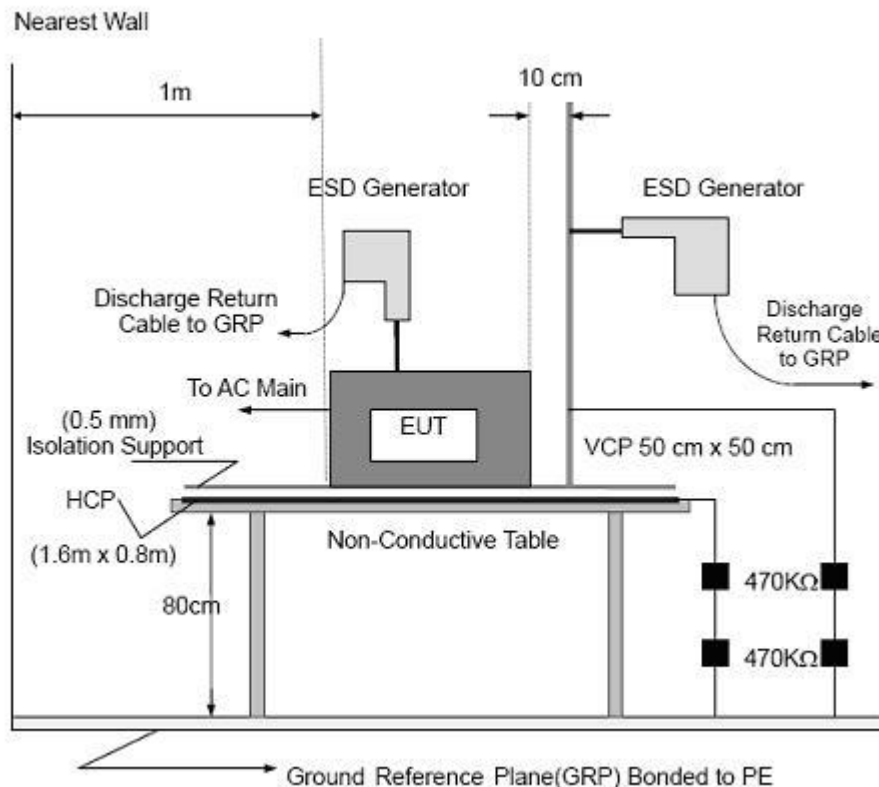
Basic Standard:	IEC/EN 61000-4-2
Discharge Impedance:	330 ohm / 150 pF
Required Performance	B
Discharge Voltage:	Air Discharge : 2kV/4kV/8kV (Direct) Contact Discharge : 2kV/4kV (Direct/Indirect)
Polarity:	Positive & Negative
Number of Discharge:	Air Discharge: min. 20 times at each test point Contact Discharge: min. 200 times in total
Discharge Mode:	Single Discharge
Discharge Period:	1 second minimum

TEST PROCEDURE

The test generator necessary to perform direct and indirect application of discharges to the EUT in the following manner:

- a. Contact discharge was applied to conductive surfaces and coupling planes of the EUT.
During the test, it was performed with single discharges. For the single discharge time between successive single discharges was at least 1 second. The EUT shall be exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. One of the test points shall be subjected to at least 50 indirect discharges to the center of the front edge of the horizontal coupling plane. The remaining three test points shall each receive at least 50 direct contact discharges.
If no direct contact test points are available, then at least 200 indirect discharges shall be applied in the indirect mode. Test shall be performed at a maximum repetition rate of one discharge per second.
Vertical Coupling Plane (VCP):
The coupling plane, of dimensions 0.5m x 0.5m, is placed parallel to, and positioned at a distance 0.1m from, the EUT, with the Discharge Electrode touching the coupling plane. The four faces of the EUT will be performed with electrostatic discharge.
Horizontal Coupling Plane (HCP):
The coupling plane is placed under to the EUT. The generator shall be positioned vertically at a distance of 0.1m from the EUT, with the Discharge Electrode touching the coupling plane. The four faces of the EUT will be performed with electrostatic discharge.
- b. Air discharges at insulation surfaces of the EUT.
It was at least ten single discharges with positive and negative at the same selected point.

TEST SETUP



Note:

TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table 0.8 meters high standing on the Ground Reference Plane. The GRP consisted of a sheet of aluminum at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system. A Horizontal Coupling Plane (1.6m x 0.8m) was placed on the table and attached to the GRP by means of a cable with 940k total impedance. The equipment under test, was installed in a representative system as described in section 7 of IEC /EN 61000-4-2, and its cables were placed on the HCP and isolated by an insulating support of 0.5mm thickness. A distance of 1-meter minimum was provided between the EUT and the walls of the laboratory and any other metallic structure.

FLOOR-STANDING EQUIPMENT

The equipment under test was installed in a representative system as described in section 7 of IEC/EN 61000-4-2, and its cables were isolated from the Ground Reference Plane by an insulating support of 0.1-meter thickness. The GRP consisted of a sheet of aluminum that is at least 0.25mm thick, and 2.5meters square connected to the protective grounding system and extended at least 0.5 meters from the EUT on all sides.

TEST RESULTS

EUT :	LiFePo4 Battery Pack	Model Name :	LFP 12-180
Temperature :	25 °C	Relative Humidity :	45%
Pressure :	1010 hPa	Test Date :	2025-02-21
Test Mode :	Mode 1		
Test Power :	DC 12.8V		

Mode	Air Discharge								Contact Discharge								Criterion	Result
Test level (kV)	4		8		10		15		2		4		6		8			
Test Location	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-		
HCP									A	A	A	A					B	PASS
VCP									A	A	A	A						PASS
C1	A	A	A	B														PASS
C2	A	A	B	B														PASS
C3	A	A	B	B														PASS

Note:

- 1) +/- denotes the Positive/Negative polarity of the output voltage.
- 2) Test condition:
Direct / Indirect (HCP/VCP) discharges: Minimum 50 times (Positive/Negative) at each point. Air discharges: Minimum 10 times (Positive/Negative) at each point.
- 3) Test location(s) in which discharge (Air and contact discharge) to be applied illustrated by photos shown in next page(s)
- 4) The Indirect (HCP/VCP) discharges description of test point as following:
1.left side 2.right side 3.front side 4.rear side
- 5) N/A - denotes test is not applicable in this test report

RS TESTING

TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-3
Required Performance	A
Frequency Range:	80 MHz - 1000 MHz
Field Strength:	3 V/m
Modulation:	1kHz 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:	at least 3 seconds

TEST PROCEDURE

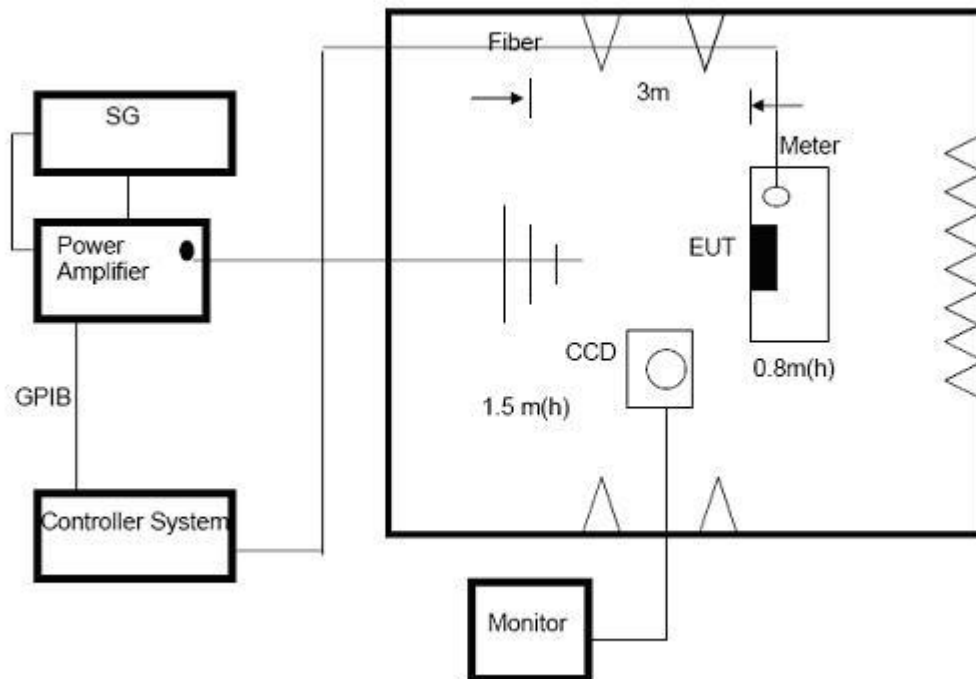
The EUT and support equipment, which are placed on a table that is 0.8 meter above ground and the testing was performed in a fully-anechoic chamber.

The testing distance from antenna to the EUT was 3 meters.

The other condition as following manner:

- The frequency range is swept from 80 MHz to 1000 MHz, & 1400MHz - 2700MHz with the signal 80%amplitude modulated with a 1kHz sine wave. The rate of sweep did not exceed 1.5x 10⁻³ decade/s. Where the frequency range is swept incrementally, the step size was 1% of fundamental.
- Sweep Frequency 900 MHz, with the Duty Cycle:1/8 and Modulation: Pulse 217 Hz(if applicable)
- The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
- The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

TEST SETU



Note:

TABLE-TOP EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC/EN 61000-4-3 was placed on a non-conductive table 0.8 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

FLOOR-STANDING EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC/EN 61000-4-3 was placed on a non-conductive wood support 0.1 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

TEST RESULTS

EUT :	LiFePo4 Battery Pack	Model Name :	LFP 12-180
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1010 hPa	Test Date :	2025-02-21
Test Mode :	Mode 1		
Test Power :	DC 12.8V		

Frequency Range (MHz)	RF Field Position	R.F. Field Strength	Azimuth	Perform. Criteria	Results	Judgment
80MHz - 1000MHz	H / V	3 V/m (rms) AM Modulated 1000Hz, 80%	Front	A	A	PASS
			Rear			
			Left			
			Right			

Note:

- 1) N/A - denotes test is not applicable in this test report.
- 2) Criteria A: There was no change operated with initial operating during the test.
- 3) Criteria B: The EUT function loss during the test, but self-recoverable after the test.
- 4) Criteria C: The system shut down during the test.

EFT/ BURST TESTING**TEST SPECIFICATION**

Basic Standard:	IEC/EN 61000-4-4
Required Performance	B
Test Voltage:	Power Line : 1 kV Signal/Control Line : 0.5 KV
Polarity:	Positive & Negative
Impulse Frequency:	5 kHz
Impulse Wave shape :	5/50 ns
Burst Duration:	15 ms
Burst Period:	300 ms
Test Duration:	Not less than 1 min.

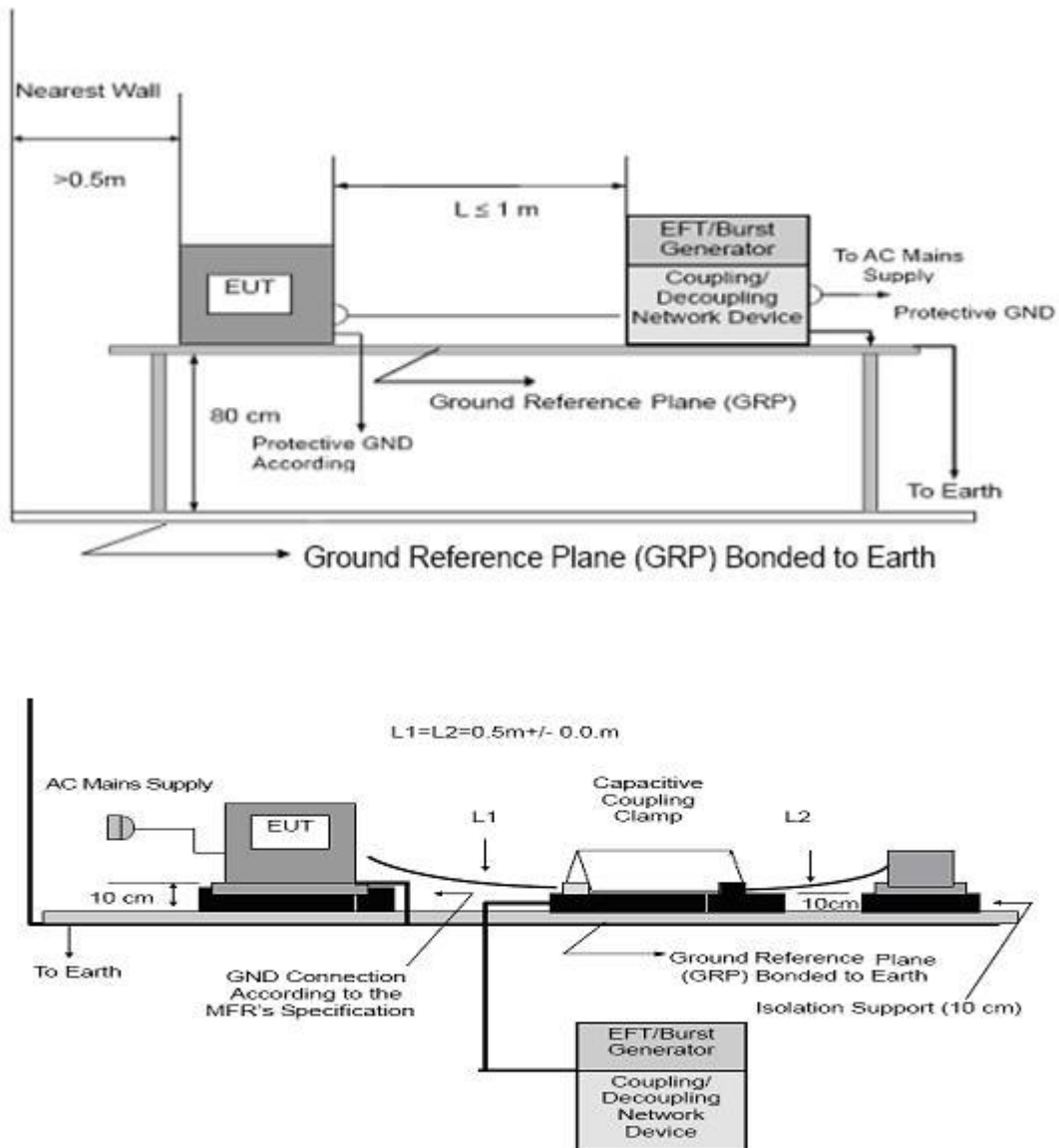
TEST PROCEDURE

The EUT and support equipment, are placed on a table that is 0.8 meter above a metal ground plane measured 1m*1m min. and 0.65mm thick min.

The other condition as following manner:

- The length of power cord between the coupling device and the EUT should not exceed 1 meter.
- Both positive and negative polarity discharges were applied.
- The duration time of each test sequential was 1 minute

TEST SETUP



Note:

TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table (0.8m high) standing on the Ground Reference Plane. The GRP consisted of a sheet of aluminum (at least 0.25mm thick and 2.5m square) connected to the protective grounding system. A minimum distance of 0.5m was provided between the EUT and the walls of the laboratory or any other metallic structure.

FLOOR-STANDING EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC/EN 61000-4-4 and its cables, were isolated from the Ground Reference Plane by an insulating support that is 0.1-meter thick. The GRP consisted of a sheet of aluminum (at least 0.25mm thick and 2.5m square) connected to the protective grounding system.

TEST RESULTS

EUT :	LiFePo4 Battery Pack	Model Name :	LFP 12-180
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1010 hPa	Test Date :	N/A
Test Mode :	N/A		
Test Power :	N/A		

Product uses DC power supply, do not apply this test

Note:

- 1) +/- denotes the Positive/Negative polarity of the output voltage.
- 2) N/A - denotes test is not applicable in this test report
- 3) Criteria A: There was no change operated with initial operating during the test.
- 4) Criteria B: The EUT function loss during the test, but self-recoverable after the test.
- 5) Criteria C: The system shut down during the test.



NOWD

SURGE TESTING

TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-5
Required Performance	B
Wave-Shape:	Combination Wave 1.2/50 us Open Circuit Voltage 8 /20 us Short Circuit Current
Test Voltage:	Power Line : 0.5 kV, 1 kV, 2 kV
Surge Input/Output:	L-N, L-PE, N-PE
Generator Source:	2 ohm between networks
Impedance:	12 ohm between network and ground
Polarity:	Positive/Negative
Phase Angle:	0 /90/180/270°
Pulse Repetition Rate:	1 time / min. (maximum)
Number of Tests:	5 positive and 5 negative at selected points

TEST PROCEDURE

a. For EUT power supply:

The surge is to be applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave. The power cord between the EUT and the coupling/decoupling networks shall be 2meters in length (or shorter).

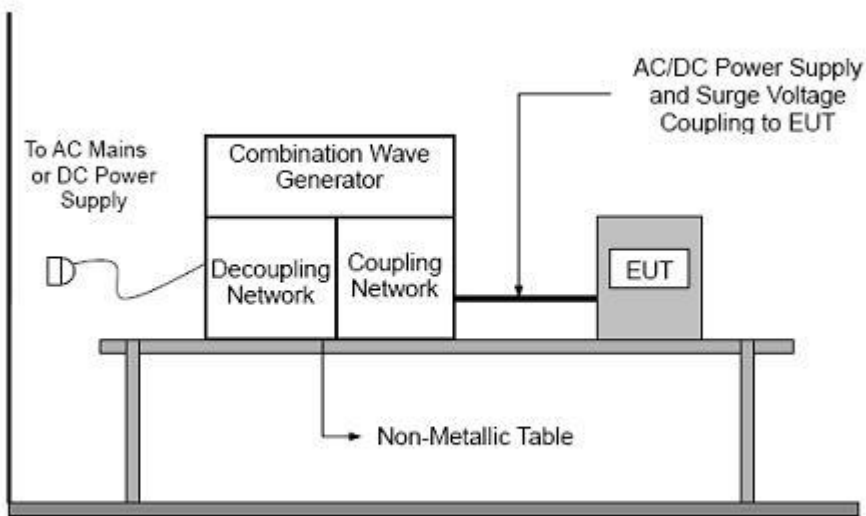
b. For test applied to unshielded unsymmetrically operated interconnection lines of EUT:

The surge is applied to the lines via the capacitive coupling. The coupling /decoupling networks shall not influence the specified functional conditions of the EUT. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter).

c. For test applied to unshielded symmetrically operated interconnection /telecommunication lines of EUT:

d. The surge is applied to the lines via gas arrestors coupling. Test levels below the ignition point of the coupling arrestor cannot be specified. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter).

TEST SETUP



NOWD

TEST RESULTS

EUT :	LiFePo4 Battery Pack	Model Name :	LFP 12-180
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1010 hPa	Test Date :	N/A
Test Mode :	N/A		
Test Power :	N/A		

Product uses DC power supply, do not apply this test

Note:

- 1) Polarity and Numbers of Impulses : 5 Pst / Ngt at each tested mode
- 2) N/A - denotes test is not applicable in this Test Report
- 3) Criteria A: There was no change operated with initial operating during the test.
- 4) Criteria B: The EUT function loss during the test, but self-recoverable after the test.
- 5) Criteria C: The system shut down during the test.



NOWD

INJECTION CURRENT TESTING

TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-6
Required Performance	A
Frequency Range:	0.15 MHz - 80 MHz
Field Strength:	3 Vr.m.s.
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of fundamental
Dwell Time:	at least 3 seconds

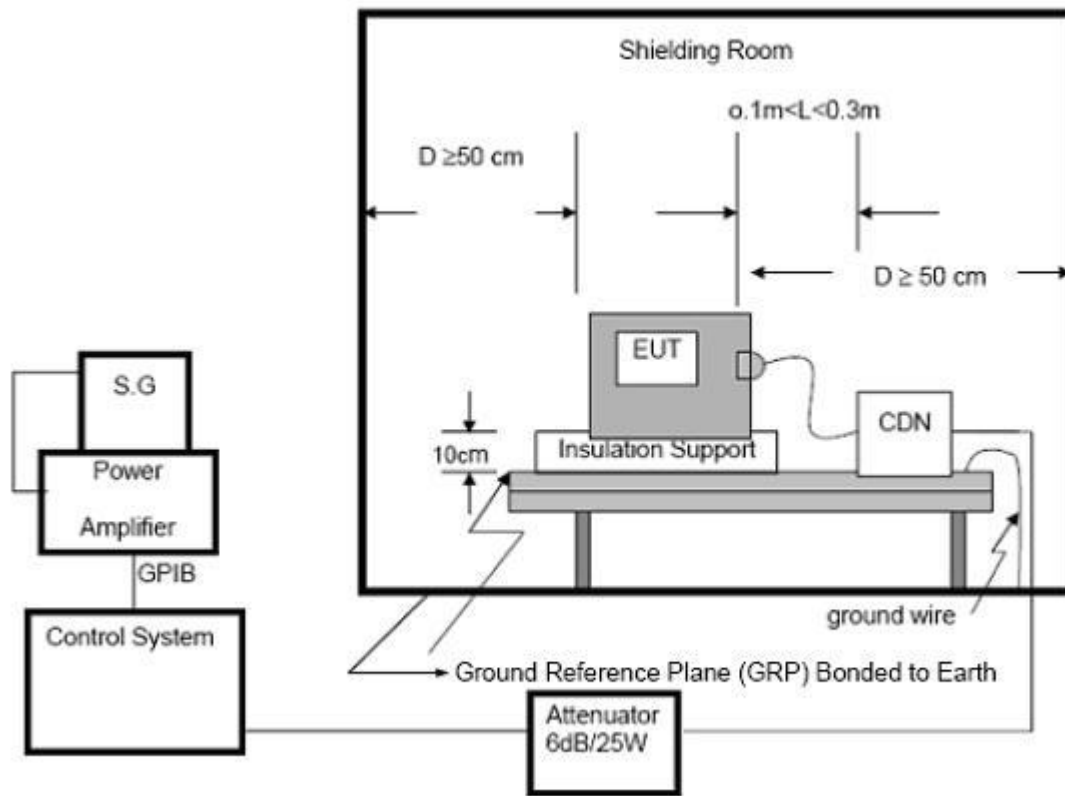
TEST PROCEDURE

The EUT and support equipment, are placed on a table that is 0.8 meter above a metal ground plane measured 1m*1m min. and 0.65mm thick min.

The other condition as following manner:

- The frequency range is swept from 150 KHz to 80 MHz, with the signal 80%amplitude modulated with a 1kHz sine wave. The rate of sweep did not exceed 1.5×10^{-3} decade/s. Where the frequency range is swept incrementally, the step size was 1% of fundamental.
- The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.

TEST SETUP



NOTE:

FLOOR-STANDING EQUIPMENT

The equipment to be tested is placed on an insulating support of 0.1 meters height above a ground reference plane. All relevant cables shall be provided with the appropriate coupling and decoupling devices at a distance between 0.1 meters and 0.3 meters from the projected geometry of the EUT on the ground reference plane.

TEST RESULTS

EUT :	LiFePo4 Battery Pack	Model Name :	LFP 12-180
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1010 hPa	Test Date :	N/A
Test Mode :	N/A		
Test Power :	N/A		

Product uses DC power supply, do not apply this test

Note:

- 1) N/A - denotes test is not applicable in this Test Report.
- 2) Criteria A: There was no change operated with initial operating during the test.
- 3) Criteria B: The EUT function loss during the test, but self-recoverable after the test.
- 4) Criteria C: The system shut down during the test.



NOWD

POWER FREQUENCY MAGNETIC FIELD TESTING

TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-8
Required Performance	A
Frequency Range:	50Hz
Field Strength:	1 A/m
Observation Time:	1 minute
Inductance Coil:	Rectangular type, 1mx1m

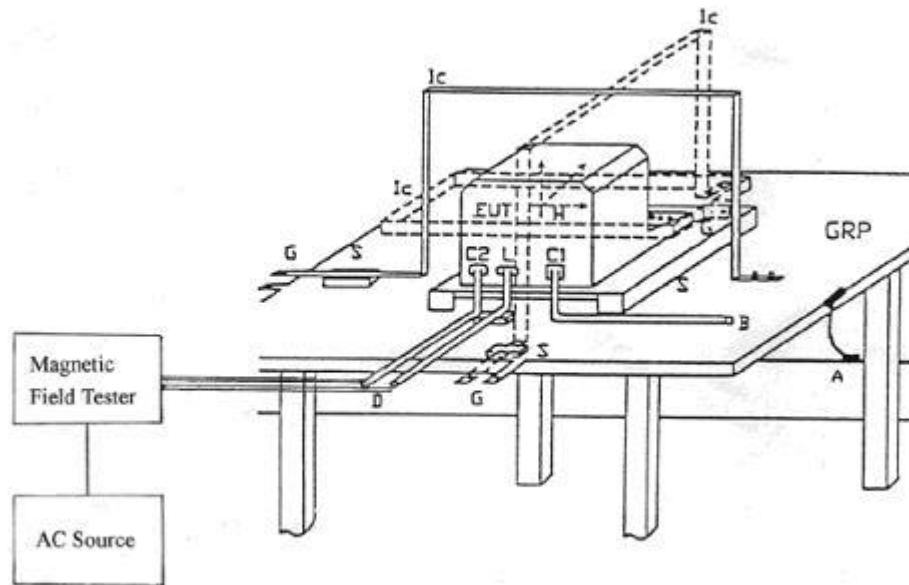
TEST PROCEDURE

The EUT and support equipment, are placed on a table that is 0.8 meter above a metal ground plane measured 1m*1m min. and 0.65mm thick min.

The other condition as following manner:

- The equipment cabinets shall be connected to the safety earth directly on the GRP via the earth terminal of the EUT.
- The cables supplied or recommended by the equipment manufacturer shall be used. 1 meter of all cables used shall be exposed to the magnetic field.

TEST SETUP



Note:

TABLE-TOP EQUIPMENT

The equipment shall be subjected to the test magnetic field by using the induction coil of standard dimension (1 m x 1 m). The induction coil shall then be rotated by 90 degrees in order to expose the EUT to the test field with different orientations.

FLOOR-STANDING EQUIPMENT

The equipment shall be subjected to the test magnetic field by using induction coils of suitable dimensions. The test shall be repeated by moving and shifting the induction coils, in order to test the whole volume of the EUT for each orthogonal direction. The test shall be repeated with the coil shifted to different positions along the side of the EUT, in steps corresponding to 50 % of the shortest side of the coil. The induction coil shall then be rotated by 90 degrees in order to expose the EUT to the test field with different orientations.

TEST RESULTS

EUT :	LiFePo4 Battery Pack	Model Name :	LFP 12-180
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1010 hPa	Test Date :	N/A
Test Mode :	N/A		
Test Power :	N/A		

Product uses DC power supply, do not apply this test

Note:

- 1) N/A - denotes test is not applicable in this test report
- 2) Criteria A: There was no change operated with initial operating during the test.
- 3) Criteria B: The EUT function loss during the test, but self-recoverable after the test.
- 4) Criteria C: The system shut down during the test.



NOWD

VOLTAGE INTERRUPTION/DIPS TESTING

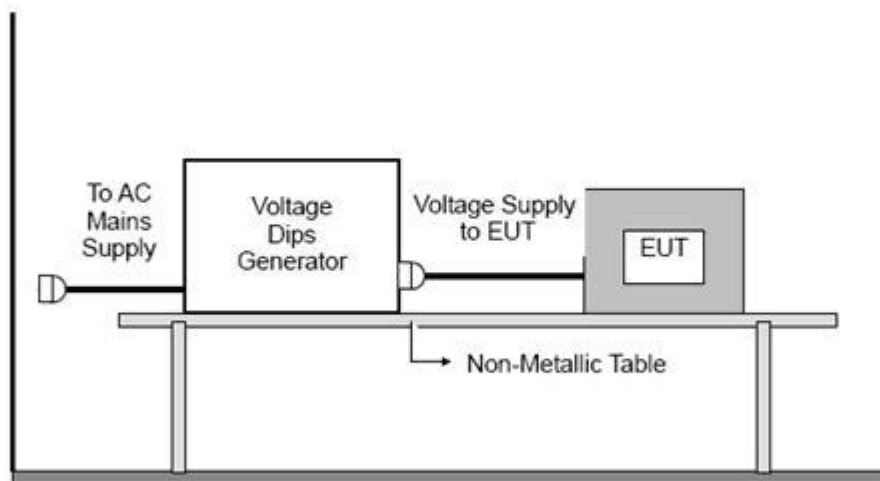
TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-11
Required Performance	B (For 100% Voltage Dips) C (For 30% Voltage Dips) C (For 100% Voltage Interruptions)
Test Duration Time:	Minimum three test events in sequence
Interval between Event:	Minimum ten seconds
Phase Angle:	0°/45°/90°/135°/180°/225°/270°/315°/360°
Test Cycle:	3 times

TEST PROCEDURE

The EUT shall be tested for each selected combination of test levels and duration with a sequence of three dips/interruptions with intervals of 10 s minimum (between each test event). Each representative mode of operation shall be tested. Abrupt changes in supply voltage shall occur at zero crossings of the voltage waveform.

TEST SETUP



TEST RESULTS

EUT :	LiFePo4 Battery Pack	Model Name :	LFP 12-180
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1010 hPa	Test Date :	N/A
Test Mode :	N/A		
Test Power :	N/A		

Product uses DC power supply, do not apply this test

Note:

- 1). N/A - denotes test is not applicable in this test report.
- 2) Criteria A: There was no change operated with initial operating during the test.
- 3) Criteria B: The EUT function loss during the test, but self-recoverable after the test.
- 4) Criteria C: The system shut down during the test.



NOWD

ATTACHMENT PHOTOGRAPHS OF EUT

Photo 1

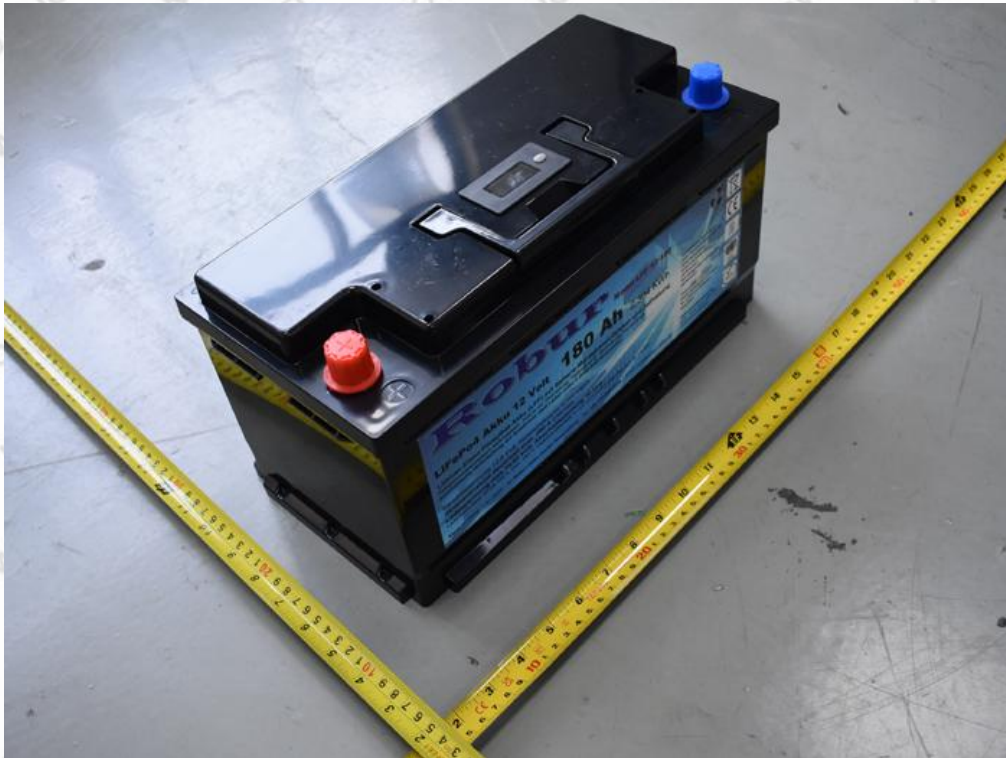


Photo 2

