

TEST REPORT

ST/SG/AC.10/11/Rev.8

APPLICANT
Samsung SDI Co., Ltd.

REPORT NO.
HCT-BA-2407-RE003-R1

DATE OF ISSUE
Oct. 18, 2024

Tested by
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Applicant	Samsung SDI Co., Ltd. 150-20, Gongse-ro, Giheung-gu, Yongin-si, Gyeonggi-do, Republic of Korea
Product Name Model Name	Rechargeable Li-ion Battery VCA-SBTA95
Date of Test	Initial Release: Feb. 03, 2021 to Mar. 09, 2021 Revision-1: Jul. 17, 2024 to Jul. 19, 2024 Revision-2: N/A
Location of Test	☒ Permanent Testing Lab ☐ On Site Testing Lab (Address : 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 KOREA)
Test Standard Used	ST/SG/AC.10/11/Rev.8
Test Results	Refer to the test results
Manufacturer Rating	Elentec Vietnam Energy Co., LTD DC 25.2 V, 2.2 Ah, 55.44 Wh

REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	Mar. 10, 2021	Initial Release (Report No.: HCT-BA-2103-RE001)
1	Aug. 01, 2024	Revision-1 (Report No.: HCT-BA-2407-RE003) - Test Standard updated (from ST/SG/AC.10/11/Rev.6/Amend.1 to ST/SG/AC.10/11/Rev.8) - Test T.7 evaluated additionally due to C-FET changes. - Test T.1 to Test T.5 and 1.2 m drop test are evaluated in the previous report (HCT- BA-2103-RE001).
2	Oct. 17, 2024	Revision-1 (Report No.: HCT-BA-2407-RE003-R1) - Addition of model: VCA-SBTD95

Notice

Content

The results shown in this test report only apply to the sample(s), as received, provided by the applicant, unless otherwise stated.

The test results have only been applied with the test methods required by the standard(s).

The laboratory is not accredited for the test results marked *.

Information provided by the applicant is marked **.

Test results provided by external providers are marked ***.

When confirmation of authenticity of this test report is required, please contact www.hct.co.kr

The test results in this test report are not associated with the ((KS Q) ISO/IEC 17025) accreditation by KOLAS (Korea Laboratory Accreditation Scheme) / A2LA (American Association for Laboratory Accreditation) that are under the ILAC (International Laboratory Accreditation Cooperation) Mutual Recognition Agreement (MRA).

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1. Test Regulations

The results in this report apply only to sample tested.

The tests were performed according to the following regulations:

Test Standard	ST/SG/AC.10/11/Rev.8
Test Method	Manual of Tests and Criteria, Part III, Sub-Section 38.3 Lithium metal, lithium ion and sodium ion batteries

2. Test Location

2.1 Test Laboratory

Company Name	HCT CO.,LTD.
Address	74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 KOREA
Telephone	82+31-645-6300
Fax	82+31-645-6401
E-mail	HCT_safety@hct.co.kr
Website	www.hct.co.kr

2.2 Test Facilities

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

Korea	National Radio Research Agency (Designation No. KR0032)
	KOLAS (Testing No. KT197)
USA	FCC (Registration No. 90661)
Canada	Industry Canada (Company Code. 5944A)
Japan	VCCI (Member No. 264)

3. Application details

3.1 Details of applicant

Name: Samsung SDI Co., Ltd.
Address: 150-20, Gongse-ro, Giheung-gu, Yongin-si, Gyeonggi-do, Republic
of Korea
Contact.....: Haneul Kim
Telephone.....: +82-31-8006-3723

3.2 Manufacturer

Name: Samsung SDI Co., Ltd.
Address: 150-20, Gongse-ro, Giheung-gu, Yongin-si, Gyeonggi-do, Republic
of Korea
Contact.....: Haneul Kim
Telephone.....: +82-31-8006-3723
E-mail: hn95.kim@samsung.com
Website: <http://www.samsungsdi.co.kr>

3.3 Factory

Name: Elentec Vietnam Energy Co., LTD
Address: Lot 44D, QuangMinh Industrial Zone, MeLinh, Hanoi, Vietnam

4. Test item

Product name: Rechargeable Li-ion Battery

Product classification: ☐ Cells not transported separately from a battery
☐ Cells
☐ Single cell batteries
☒ Small batteries
☐ Large batteries
☐ Others

Trade Mark.....: 

Model / Type reference: VCA-SBTA95 / 7INR19/65

Add Model / Type reference.....: VCA-SBTD95 / 7INR19/65

* Add model is the same as the basic model. Except for model name.

Serial number: N/A

Ratings.....: DC 25.2 V, 2.2 Ah, 55.44 Wh

Weight.....: Approx. 485.5 g

Sample quantity: 8 EA

5. Technical information

5.1 Test items and summary of results

No.	Test items	Criteria	Results
1	Test T.1: Altitude simulation	- There is no leakage, no venting, no disassembly, no rupture and no fire. - The open circuit voltage of each test cell or battery after testing is not less than 90 % of its voltage immediately prior to this procedure.	Pass
2	Test T.2: Thermal test	- There is no leakage, no venting, no disassembly, no rupture and no fire. - The open circuit voltage of each test cell or battery after testing is not less than 90 % of its voltage immediately prior to this procedure.	Pass
3	Test T.3: Vibration	- There is no leakage, no venting, no disassembly, no rupture and no fire during the test and after the test. - The open circuit voltage of each test cell or battery directly after testing in its third perpendicular mounting position is not less than 90 % of its voltage immediately prior to this procedure.	Pass
4	Test T.4: Shock	- There is no leakage, no venting, no disassembly, no rupture and no fire. - The open circuit voltage of each test cell or battery after testing is not less than 90 % of its voltage immediately prior to this procedure.	Pass
5	Test T.5: External short circuit	- Their external temperature does not exceed 170 °C and there is no disassembly, no rupture and no fire during the test and within six hours after the test.	Pass
6	Test T.7: Overcharge	- There is no disassembly and no fire during the test and within seven days after the test.	Pass
7	1.2 m Drop Test	- Without damage to cells or batteries contained therein; - Without shifting of the contents so as to allow battery to battery (or cell to cell) contact; - Without release of contents	Pass

5.2 Test environment

** Unless specified otherwise in the individual tests shall be conducted under the following ambient conditions.*

Temperature: (20 ± 5) °C

Relative humidity: Not specified

Air pressure: Not specified

Altitude of test laboratory: 133 m

5.3 Test instrument list

Reg. No.	Description	Model	Serial No.	Manufacturer	Cal. Due
BA-0138	Hygrometer (Thermometer)	608-H1	83238626	TESTO	2025-06-28
BA-0057	Regulated DC Power supply	PAS40-9	LM003166	KIKUSUI	2025-01-18
BA-0093	True RMS Digital Multimeter	TY720	JKT1338	YOKOGAWA	2024-08-09
BA-0157	DC Power supply	PAS40-9	KD001206	KIKUSUI	2024-09-27
BA-0131	Memory Hilogger	LR8401-20	190111917	HIOKI	2025-01-24
BA-0060	Shunt	RSR-1(10A, 50mV)	N/A	RARA	2024-08-02
BA-0061	Shunt	RSR-1(10A, 50mV)	N/A	RARA	2025-04-29
BA-0107	Stop Watch	HS-3	N/A	CASIO	2025-06-26
BA-0042	Automatic Battery Cycler	TBCDS-6030	TBCDS-6030- 1505-05	TECC	2025-06-14

6. Test results

6.1 Possible test case verdict

Test case does not apply to the test object..... :	N/A
Test object does meet the requirement..... :	P (Pass)
Test object does not meet the requirement :	F (Fail)

6.2 Test requirements

Sub-section 38.3 Lithium metal, lithium ion and sodium ion batteries			
Clause	Requirement + Test	Result - Remark	Verdict
38.3.3	When a cell or battery type is to be tested under this sub-section, the number and condition of cells and batteries of each type to be tested are as follows:		
38.3.3.1	Testing of lithium cells and batteries		P
	(a) When testing primary lithium cells and batteries under tests T.1 to T.5 the following shall be tested in the quantity indicated:		N/A
	(i) ten cells in undischarged states;		N/A
	(ii) ten cells in fully discharged states;		N/A
	(iii) four small batteries in undischarged states;		N/A
	(iv) four small batteries in fully discharged states;		N/A
	(v) four large batteries in undischarged states; and		N/A
	(vi) four large batteries in fully discharged states.		N/A
	(b) When testing rechargeable lithium cells and batteries under tests T.1 to T.5 the following shall be tested in the quantity indicated:		P
	(i) five cells at first cycle, in fully charged states;		N/A
	(ii) five cells after 25 cycles ending in fully charged states;		N/A
	(iii) four small batteries at first cycle, in fully charged states;		P

Sub-section 38.3 Lithium metal, lithium ion and sodium ion batteries			
Clause	Requirement + Test	Result - Remark	Verdict
	(iv) four small batteries after 25 cycles ending in fully charged states;		P
	(v) two large batteries at first cycle, in fully charged states; and		N/A
	(vi) two large batteries after 25 cycles ending in fully charged states.		N/A
	(c) When testing primary and rechargeable lithium cells under test T.6, the following shall be tested in the quantity indicated:		N/A
	(i) for primary cells, five cells in undischarged states and five cells in fully discharged states;		N/A
	(ii) for component cells of primary batteries, five cells in undischarged states and five cells in fully discharged states;		N/A
	(iii) for rechargeable cells, five cells at first cycle at 50% of the design rated capacity and five cells after 25 cycles ending at 50% of the design rated capacity; and		N/A
	(iv) for component cells of rechargeable batteries, five cells at first cycle at 50% of the design rated capacity and five cells after 25 cycles ending at 50% of the design rated capacity.		N/A
	(d) When testing rechargeable lithium batteries or rechargeable single cell batteries under test T.7, the following shall be tested in the quantity indicated:		P
	(i) four small batteries at first cycle, in fully charged states;		P
	(ii) four small batteries after 25 cycles ending in fully charged states;		P
	(iii) two large batteries at first cycle, in fully charged states; and		N/A
	(iv) two large batteries after 25 cycles ending in fully charged states.		N/A
	Batteries or single cell batteries not equipped with battery overcharge protection that are designed for use only as a component in a another battery, vehicle, or in equipment, which affords such protection, are not subject to the requirements of this test.		N/A

Sub-section 38.3 Lithium metal, lithium ion and sodium ion batteries			
Clause	Requirement + Test	Result - Remark	Verdict
	(e) When testing primary and rechargeable lithium cells and component cells under test T.8, the following shall be tested in the quantity indicated:		N/A
	(i) ten primary cells in fully discharged states;		N/A
	(ii) ten primary component cells in fully discharged states;		N/A
	(iii) ten rechargeable cells, at first cycle in fully discharged states;		N/A
	(iv) ten rechargeable component cells, at first cycle in fully discharged states;		N/A
	(v) ten rechargeable cells after 25 cycles ending in fully discharged states; and		N/A
	(vi) ten rechargeable component cells after 25 cycles ending in fully discharged states.		N/A
	(f) When testing a lithium battery assembly in which the aggregate lithium content of all anodes, when fully charged, is not more than 500 g, or in the case of a lithium ion battery, with a Watt-hour rating of not more than 6 200 Wh, that is assembled from batteries that have passed all applicable tests, one assembled battery in a fully charged state shall be tested under tests T.3, T.4 and T.5, and, in addition, test T.7 in the case of a rechargeable battery.		N/A
	(g) When lithium batteries that have passed all applicable tests are electrically connected to form a battery in which the aggregate lithium content of all anodes, when fully charged, is more than 500 g, or in the case of a lithium ion battery, with a Watt-hour rating of more than 6 200 Wh, the assembled battery does not need to be tested if the assembled battery is of a type that has been verified as preventing:		N/A
	(i) Overcharge;		N/A
	(ii) Short circuits; and		N/A
	(iii) Over discharge between the batteries		N/A

Sub-section 38.3 Lithium metal, lithium ion and sodium ion batteries			
Clause	Requirement + Test	Result - Remark	Verdict
	Note:		
	For an assembled lithium battery not equipped with overcharge protection that is designed for use only as a component in another battery, in equipment, or in a vehicle, which affords such protection: - the overcharge protection shall be verified at the battery, equipment or vehicle level, as appropriate, and - the use of charging systems without overcharge protection shall be prevented through a physical system or process controls.		N/A
	Note:		

Sub-section 38.3 Lithium metal, lithium ion and sodium ion batteries			
Clause	Requirement + Test	Result - Remark	Verdict
38.3.4	Procedure		
	Tests T.1 to T.5 shall be conducted in sequence on the same cell or battery. Tests T.6 and T.8 shall be conducted using not otherwise tested cells or batteries. Test 7 may be conducted using undamaged batteries previously used in tests T.1 to T.5 for purposes of testing on cycled batteries.		P
38.3.4.1	<i>Test T.1: Altitude simulation</i>		P
38.3.4.1.1	Purpose		—
	This test simulates air transport under low-pressure conditions.		—
38.3.4.1.2	Test procedure		P
	Test cells and batteries shall be stored at a pressure of 11.6 kPa or less for at least six hours at ambient temperature (20 ± 5) °C.		P
38.3.4.1.3	Requirement		P
	Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90 % of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.	See appended table T.1	P
38.3.4.2	<i>Test T.2: Thermal test</i>		P
38.3.4.2.1	Purpose		—
	This test assesses cell and battery seal integrity and internal electrical connections. The test is conducted using rapid and extreme temperature changes.		—
38.3.4.2.2	Test procedure		P

Sub-section 38.3 Lithium metal, lithium ion and sodium ion batteries			
Clause	Requirement + Test	Result - Remark	Verdict
	Test cells and batteries are to be stored for at least six hours at a test temperature equal to 72 ± 2 °C, followed by storage for at least six hours at a test temperature equal to -40 ± 2 °C. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated until 10 total cycles are complete, after which all test cells and batteries are to be stored for 24 hours at ambient temperature (20 ± 5 °C).		P
	For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.		N/A
38.3.4.2.3	Requirement		P
	Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90 % of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.	See appended table T.2	P

Sub-section 38.3 Lithium metal, lithium ion and sodium ion batteries			
Clause	Requirement + Test	Result - Remark	Verdict
38.3.4.3	<i>Test T.3: Vibration</i>		P
38.3.4.3.1	Purpose		—
	This test simulates vibration during transport.		—
38.3.4.3.2	Test procedure		P
	Cells and batteries are firmly secured to the platform of the vibration machine without distorting the cells in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell. One of the directions of vibration must be perpendicular to the terminal face. The logarithmic frequency sweep shall differ for cells and batteries with a gross mass of not more than 12 kg (cells and small batteries), and for batteries with a gross mass of more than 12 kg (large batteries).		P
	For cells and small batteries: from 7 Hz a peak acceleration of 1 g _n is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 8 g _n occurs (approximately 50 Hz). A peak acceleration of 8 g _n is then maintained until the frequency is increased to 200 Hz.		P
	For large batteries: from 7 Hz a peak acceleration of 1 g _n is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 2 g _n occurs (approximately 25 Hz). A peak acceleration of 2 g _n is then maintained until the frequency is increased to 200 Hz.		N/A
38.3.4.3.3	Requirement		P

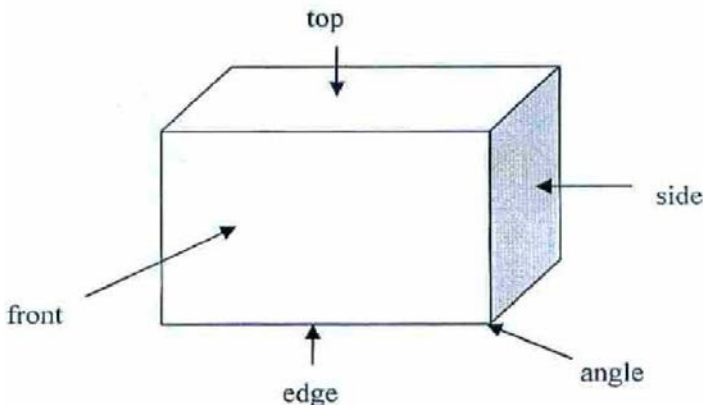
Sub-section 38.3 Lithium metal, lithium ion and sodium ion batteries			
Clause	Requirement + Test	Result - Remark	Verdict
	Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire during the test and after the test and if the open circuit voltage of each test cell or battery directly after testing in its third perpendicular mounting position is not less than 90 % of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.	See appended table T.3	P

Sub-section 38.3 Lithium metal, lithium ion and sodium ion batteries				
Clause	Requirement + Test	Result - Remark	Verdict	
38.3.4.4	Test T.4: Shock		P	
38.3.4.4.1	Purpose		—	
	This test assesses the robustness of cells and batteries against cumulative shocks.		—	
38.3.4.4.2	Test procedure		P	
	Test cells and batteries shall be secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test battery.		P	
	Each cell shall be subjected to a half-sine shock of peak acceleration of 150 g _n and pulse duration of 6 milliseconds. Each cell or battery shall be subjected to three shocks in the positive direction and to three shocks in the negative direction in each of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.			
	Battery	Minimum peak acceleration		Pulse duration
	Small batteries	150 g _n or result of formula $Acceleration(g_n) = \sqrt{\left(\frac{100850}{mass^*}\right)}$ whichever is smaller		6 ms
* Mass is expressed in kilograms				

Sub-section 38.3 Lithium metal, lithium ion and sodium ion batteries				
Clause	Requirement + Test	Result - Remark	Verdict	
	large cells may be subjected to a half-sine shock of peak acceleration of 50 g _n and pulse duration of 11 milliseconds. Each battery shall be subjected to a half-sine shock of peak acceleration depending on the mass of the battery. The pulse duration shall be 6 milliseconds for small batteries and 11 milliseconds for large batteries. The formulas below are provided to calculate the appropriate minimum peak accelerations. Each cell or battery shall be subjected to three shocks in the positive direction and to three shocks in the negative direction in each of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.		N/A	
	Battery	Minimum peak acceleration		Pulse duration
	Large batteries	50 g _n or result of formula $Acceleration(g_n) = \sqrt{\left(\frac{30000}{mass *}\right)}$ whichever is smaller		11 ms
	* Mass is expressed in kilograms			
38.3.4.4.3	Requirement		P	
	Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90 % of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.	See appended table T.4	P	

Sub-section 38.3 Lithium metal, lithium ion and sodium ion batteries			
Clause	Requirement + Test	Result - Remark	Verdict
38.3.4.5	<i>Test T.5: External short circuit</i>		P
38.3.4.5.1	Purpose		—
	This test simulates an external short circuit.		—
38.3.4.5.2	Test procedure		P
	The cell or battery to be tested shall be shall be heated for a period of time necessary to reach a homogeneous stabilized temperature of 57 ± 4 °C, measured on the external case. This period of time depends on the size and design of the cell or battery and should be assessed and documented. If this assessment is not feasible, the exposure time shall be at least 6 hours for small cells and small batteries, and 12 hours for large cells and large batteries. Then the cell or battery at 57 ± 4 °C shall be subjected to one short circuit condition with a total external resistance of less than 0.1 ohm. This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to 57 ± 4 °C, or in the case of the large batteries, has decreased by half of the maximum temperature increase observed during the test and remains below that value. The short circuit and cooling down phases shall be conducted at least at ambient temperature.		P
38.3.4.5.3	Requirement		P
	Cells and batteries meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly, no rupture and no fire during the test and within six hours after the test.	See appended table T.5	P

Sub-section 38.3 Lithium metal, lithium ion and sodium ion batteries			
Clause	Requirement + Test	Result - Remark	Verdict
38.3.4.7	<i>Test T.7: Overcharge</i>		P
38.3.4.7.1	Purpose		—
	This test evaluates the ability of a rechargeable battery or a single cell rechargeable battery to withstand an overcharge condition.		—
38.3.4.7.2	Test procedure		P
	The charge current shall be twice the manufacturer's recommended maximum continuous charge current. The minimum voltage of the test shall be as follows: (a) when the manufacturer's recommended charge voltage is not more than 18 V, the minimum voltage of the test shall be the lesser of two times the maximum charge voltage of the battery or 22 V. (b) when the manufacturer's recommended charge voltage is more than 18 V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage. Tests are to be conducted at ambient temperature. The duration of the test shall be 24 hours.		P
38.3.4.7.3	Requirement		P
	Rechargeable batteries meet this requirement if there is no disassembly and no fire during the test and within seven days after the test.	See appended table T.7	P

Recommendations on the Transport of Dangerous Goods Model Regulations (ST/SG/AC.10/1/Rev.23)			
1.2 m drop test			
Clause	Requirement + Test	Result - Remark	Verdict
Special Provision 188 and, PI 965 Section IB / PI 966, PI 967 Section II	1.2 m Drop Test		P
	Test procedure		P
	The package of batteries is dropped from 1.2 m in any orientation. The test floor is concrete floor. 		P
	Requirement		P
	This package is capable of withstanding a 1.2 m drop test in any orientation without damage to cells or batteries contained therein, without shifting of the contents so as to allow battery to battery contact and without release of contents.	See appended table 1.2 m Drop Test	P

6.3 Tables

<i>T.1: Altitude simulation</i>								P
Sample no.	Prior to the test		After the test		Variation		Allowed	
	Mass <i>M</i> [g]	Open voltage [V]	Mass <i>M</i> [g]	Open voltage [V]	Mass <i>M</i> loss [%]	Open voltage [%]	Mass <i>M</i> loss [%]	Open voltage [%]
First cycle – 1	485.9	29.081	485.9	28.990	0.00	99.69	0.1	90
First cycle – 2	486.1	29.116	486.1	29.020	0.00	99.67	0.1	90
First cycle – 3	485.0	29.076	485.0	28.994	0.00	99.72	0.1	90
First cycle – 4	484.6	29.077	484.5	28.994	0.02	99.71	0.1	90
25 cycles – 1	485.8	29.055	485.8	29.009	0.00	99.84	0.1	90
25 cycles – 2	485.2	28.996	485.2	28.956	0.00	99.86	0.1	90
25 cycles – 3	485.4	29.027	485.3	28.980	0.02	99.84	0.1	90
25 cycles – 4	485.6	29.060	485.6	29.010	0.00	99.83	0.1	90
Supplementary information: There is no leakage, no venting, no disassembly, no rupture and no fire. The open circuit voltage of each test cell or battery after testing is not less than 90 % of its voltage immediately prior to this procedure.								

<i>T.2: Thermal test</i>								P
Sample no.	Prior to the test		After the test		Variation		Allowed	
	Mass <i>M</i> [g]	Open voltage [V]	Mass <i>M</i> [g]	Open voltage [V]	Mass <i>M</i> loss [%]	Open voltage [%]	Mass <i>M</i> loss [%]	Open voltage [%]
First cycle – 1	485.9	28.990	485.8	28.660	0.02	98.86	0.1	90
First cycle – 2	486.1	29.020	486.1	28.665	0.00	98.78	0.1	90
First cycle – 3	485.0	28.994	485.0	28.660	0.00	98.85	0.1	90
First cycle – 4	484.5	28.994	484.5	28.656	0.00	98.83	0.1	90
25 cycles – 1	485.8	29.009	485.8	28.662	0.00	98.80	0.1	90
25 cycles – 2	485.2	28.956	485.1	28.648	0.02	98.94	0.1	90
25 cycles – 3	485.3	28.980	485.3	28.656	0.00	98.88	0.1	90
25 cycles – 4	485.6	29.010	485.6	28.663	0.00	98.80	0.1	90
Supplementary information: There is no leakage, no venting, no disassembly, no rupture and no fire. The open circuit voltage of each test cell or battery after testing is not less than 90 % of its voltage immediately prior to this procedure.								

T.3: Vibration								P
Sample no.	Prior to the test		After the test		Variation		Allowed	
	Mass <i>M</i> [g]	Open voltage [V]	Mass <i>M</i> [g]	Open voltage [V]	Mass <i>M</i> loss [%]	Open voltage [%]	Mass <i>M</i> loss [%]	Open voltage [%]
First cycle – 1	485.8	28.660	485.8	28.646	0.00	99.95	0.1	90
First cycle – 2	486.1	28.665	486.1	28.651	0.00	99.95	0.1	90
First cycle – 3	485.0	28.660	485.0	28.646	0.00	99.95	0.1	90
First cycle – 4	484.5	28.656	484.5	28.643	0.00	99.95	0.1	90
25 cycles – 1	485.8	28.662	485.8	28.647	0.00	99.95	0.1	90
25 cycles – 2	485.1	28.648	485.1	28.635	0.00	99.95	0.1	90
25 cycles – 3	485.3	28.656	485.3	28.643	0.00	99.95	0.1	90
25 cycles – 4	485.6	28.663	485.5	28.649	0.02	99.95	0.1	90
Supplementary information: There is no leakage, no venting, no disassembly, no rupture and no fire during the test and after the test. The open circuit voltage of each test cell or battery directly after testing in its third perpendicular mounting position is not less than 90 % of its voltage immediately prior to this procedure.								

T.4: Shock								P
Sample no.	Prior to the test		After the test		Variation		Allowed	
	Mass <i>M</i> [g]	Open voltage [V]	Mass <i>M</i> [g]	Open voltage [V]	Mass <i>M</i> loss [%]	Open voltage [%]	Mass <i>M</i> loss [%]	Open voltage [%]
First cycle – 1	485.8	28.646	485.8	28.646	0.00	100.00	0.1	90
First cycle – 2	486.1	28.651	486.1	28.651	0.00	100.00	0.1	90
First cycle – 3	485.0	28.646	485.0	28.646	0.00	100.00	0.1	90
First cycle – 4	484.5	28.643	484.5	28.643	0.00	100.00	0.1	90
25 cycles – 1	485.8	28.647	485.7	28.647	0.02	100.00	0.1	90
25 cycles – 2	485.1	28.635	485.1	28.635	0.00	100.00	0.1	90
25 cycles – 3	485.3	28.643	485.3	28.643	0.00	100.00	0.1	90
25 cycles – 4	485.5	28.649	485.5	28.649	0.00	100.00	0.1	90
Supplementary information: There is no leakage, no venting, no disassembly, no rupture and no fire. The open circuit voltage of each test cell or battery after testing is not less than 90 % of its voltage immediately prior to this procedure. Applied to test acceleration: 150 g_n								

<i>T.5: External short circuit</i>				P
Sample no.	Initial open circuit voltage [V]	Resistance load [mΩ]	Measured maximum temperature [°C]	Allowed
				Maximum temperature [°C]
First cycle – 1	28.646	93.0	58.05	170
First cycle – 2	28.651	90.0	57.85	170
First cycle – 3	28.646	78.0	57.65	170
First cycle – 4	28.643	85.0	57.85	170
25 cycles – 1	28.647	93.0	57.90	170
25 cycles – 2	28.635	90.0	58.10	170
25 cycles – 3	28.643	78.0	57.80	170
25 cycles – 4	28.649	85.0	58.00	170
Supplementary information: Their external temperature does not exceed 170 °C and there is no disassembly, no rupture and no fire during the test and within six hours of after the test.				

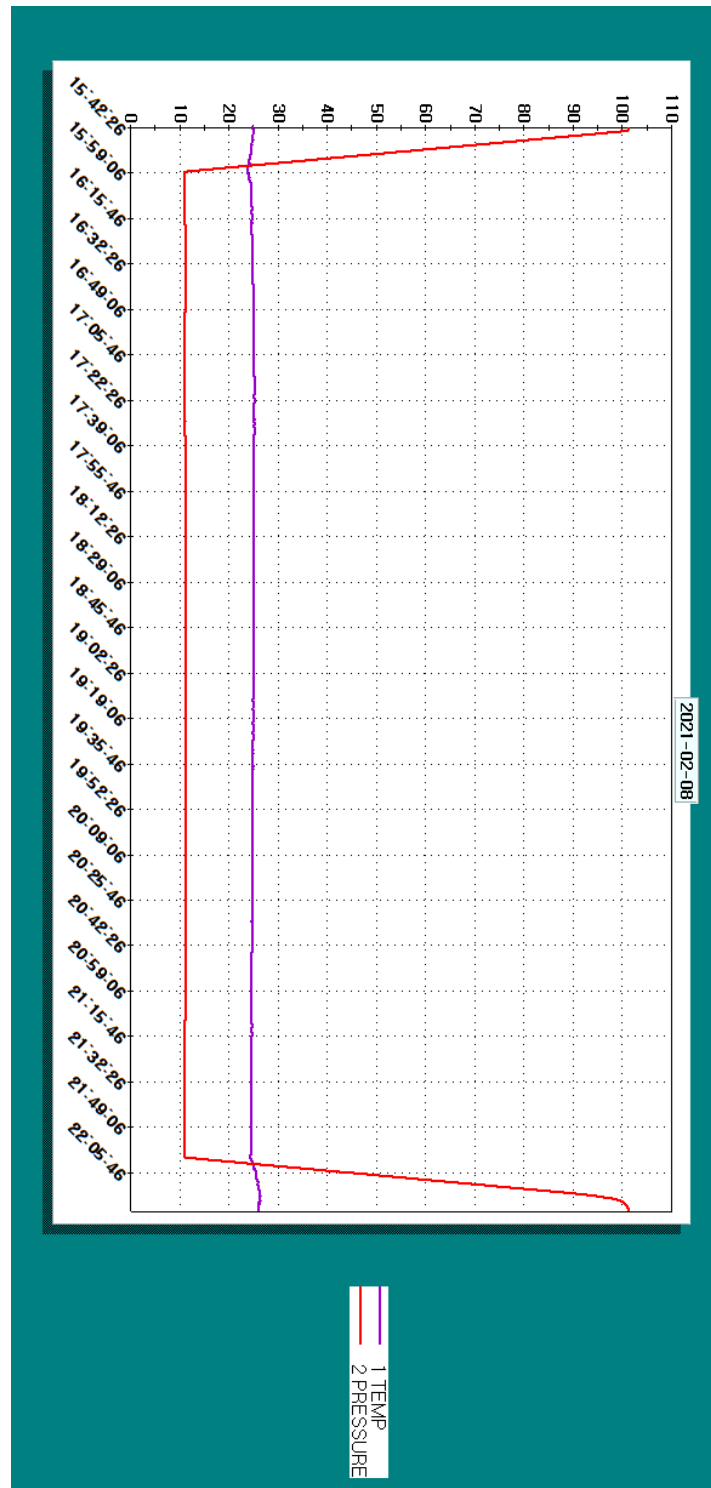
T.7: Overcharge				P
Sample no.	Initial open circuit voltage [V]	Measured maximum overcharge voltage [V]	Measured maximum overcharge current [A]	Measured maximum temperature [°C]
First cycle – 5	28.829	35.725	0.025	23.50
First cycle – 6	28.830	35.725	0.018	23.80
First cycle – 7	28.834	35.735	0	20.15
First cycle – 8	28.837	35.724	0	20.26
25 cycles – 5	28.862	35.730	0.022	24.20
25 cycles – 6	28.862	35.735	0.023	23.20
25 cycles – 7	28.864	35.739	0.002	21.06
25 cycles – 8	28.866	35.723	0.003	21.83
Supplementary information: There is no disassembly and no fire during the test and within seven days after the test. Applied to test voltage 35.712 V.				

1.2 m <i>Drop Test</i>		P
Drop position	Test status	Test conclusion
Front	Not damaged and not shifting and not release of contents	Pass
Top	Not damaged and not shifting and not release of contents	Pass
Side	Not damaged and not shifting and not release of contents	Pass
Edge	Not damaged and not shifting and not release of contents	Pass
Angle	Not damaged and not shifting and not release of contents	Pass

Packaging dimensions (W * L * H) (cm)	Packing weight prior to the test (kg)	Packing weight after the test (kg)
45.5 * 30.5 * 19.5	10.875	10.875

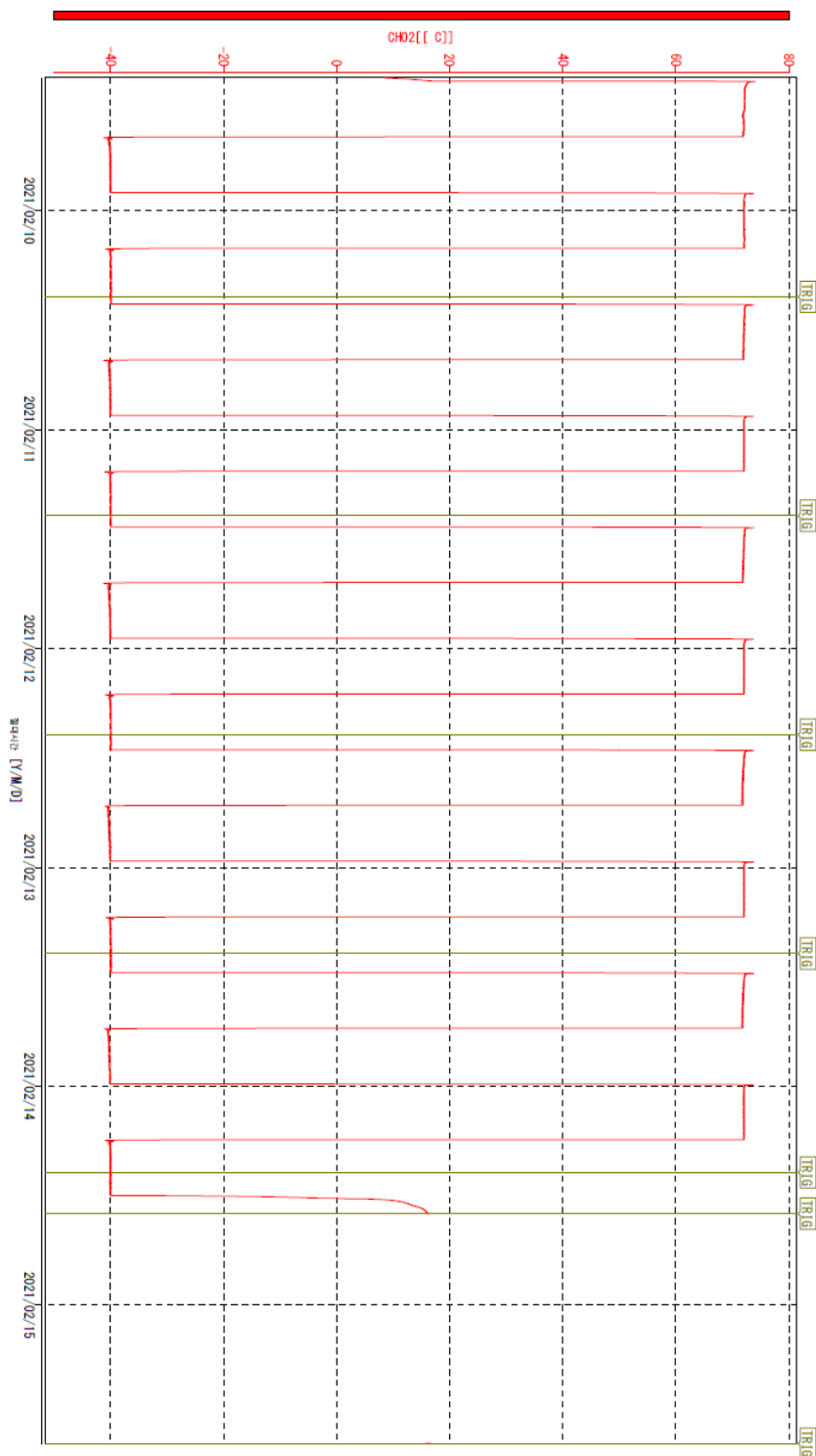
6.4 Profiles

< Test T.1: Altitude simulation >



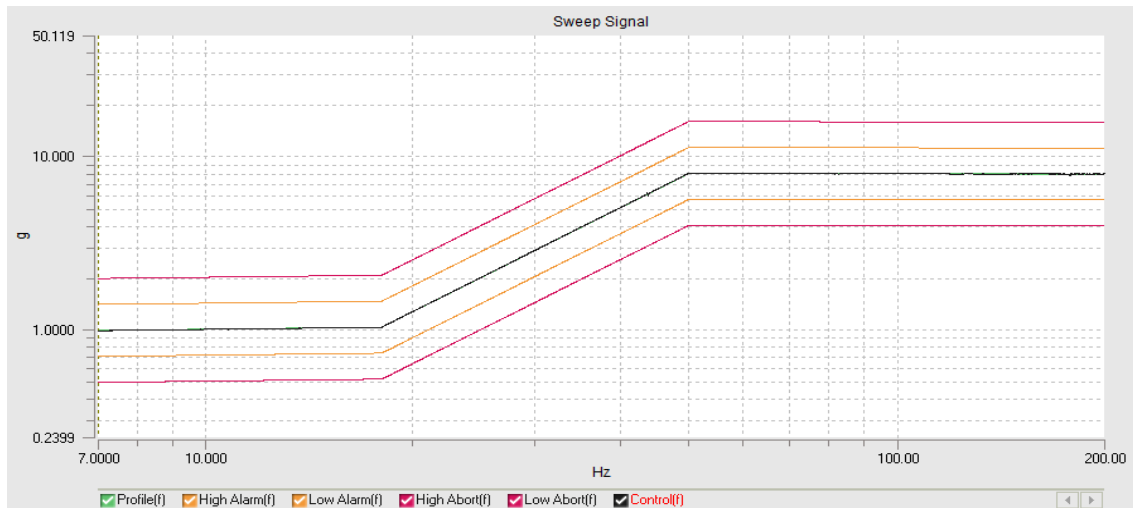
< Test T.2: Thermal test >

Feb. 09, 2021 to Feb. 14, 2021



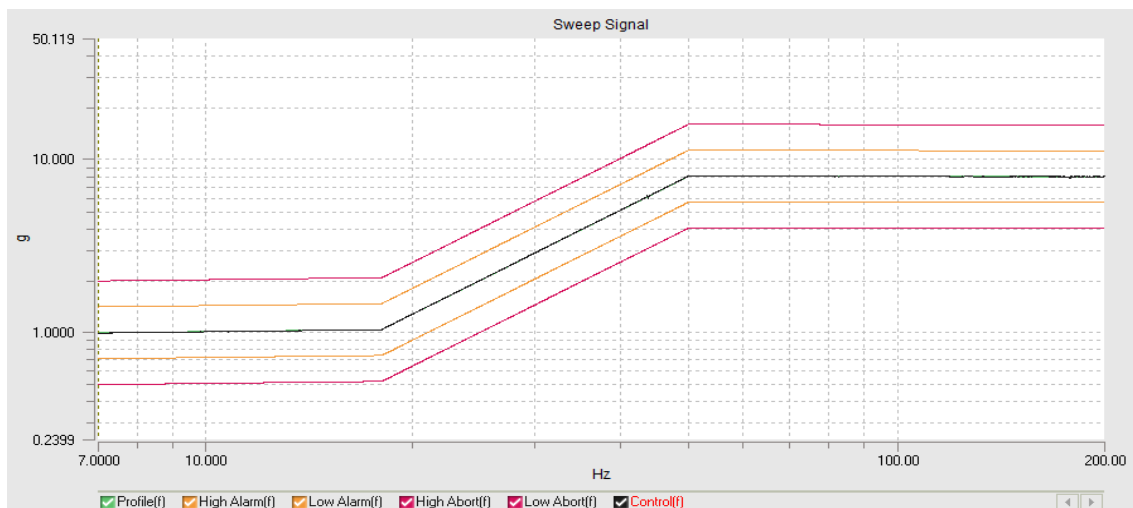
< Test T.3: Vibration - X axis >

Feb. 25, 2021



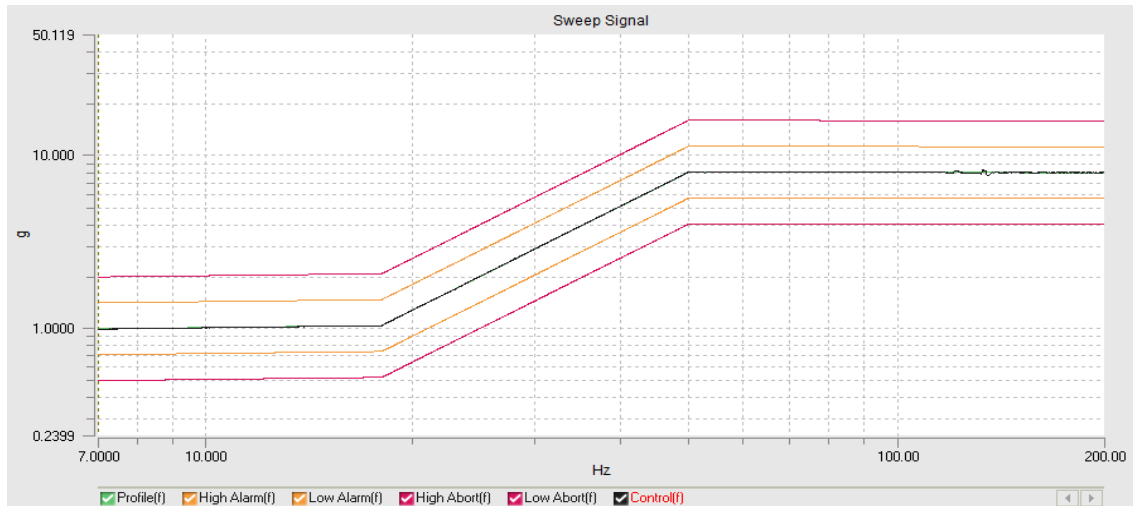
< Test T.3: Vibration - Y axis >

Feb. 25, 2021



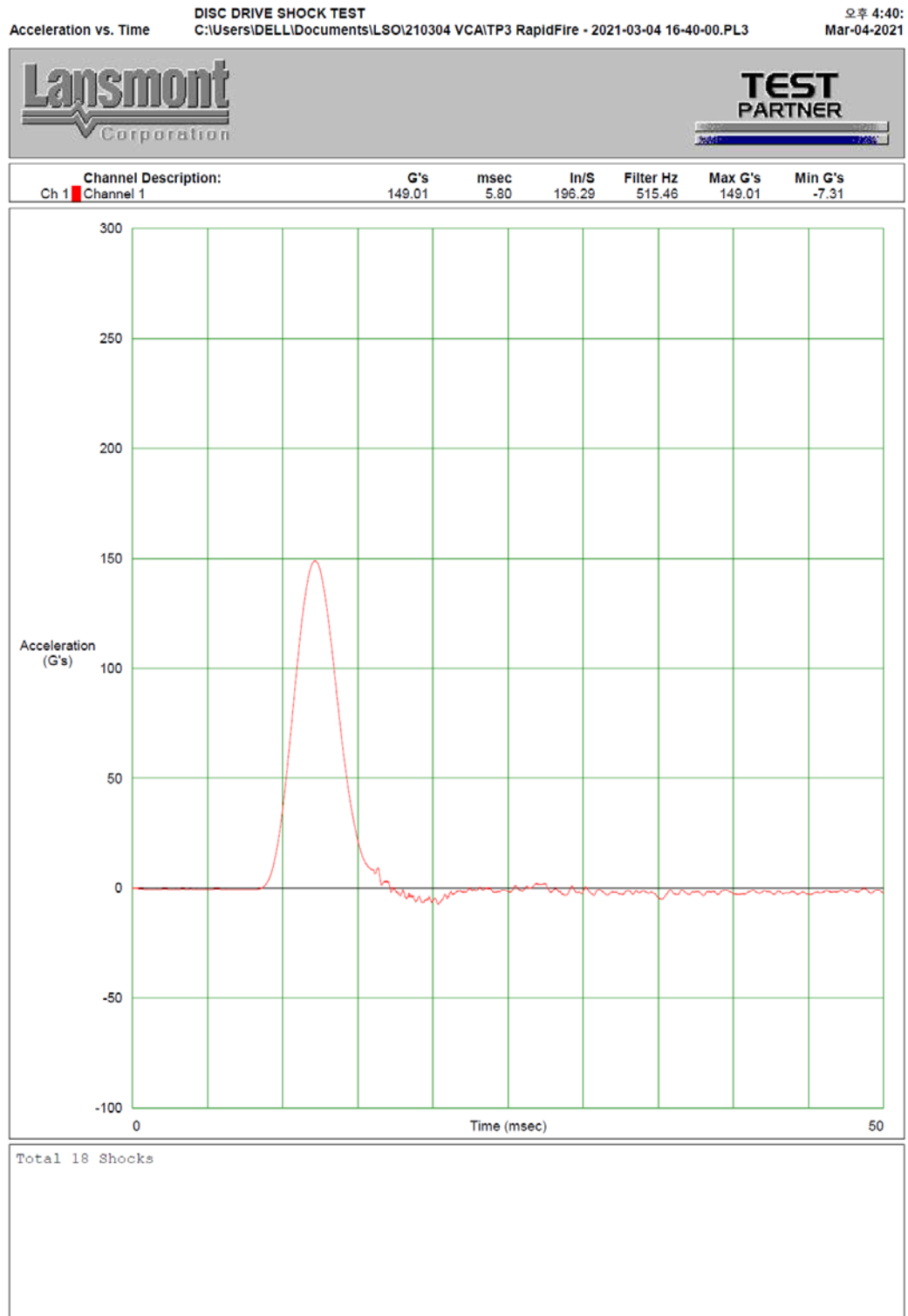
< Test T.3: Vibration - Z axis >

Feb. 25, 2021

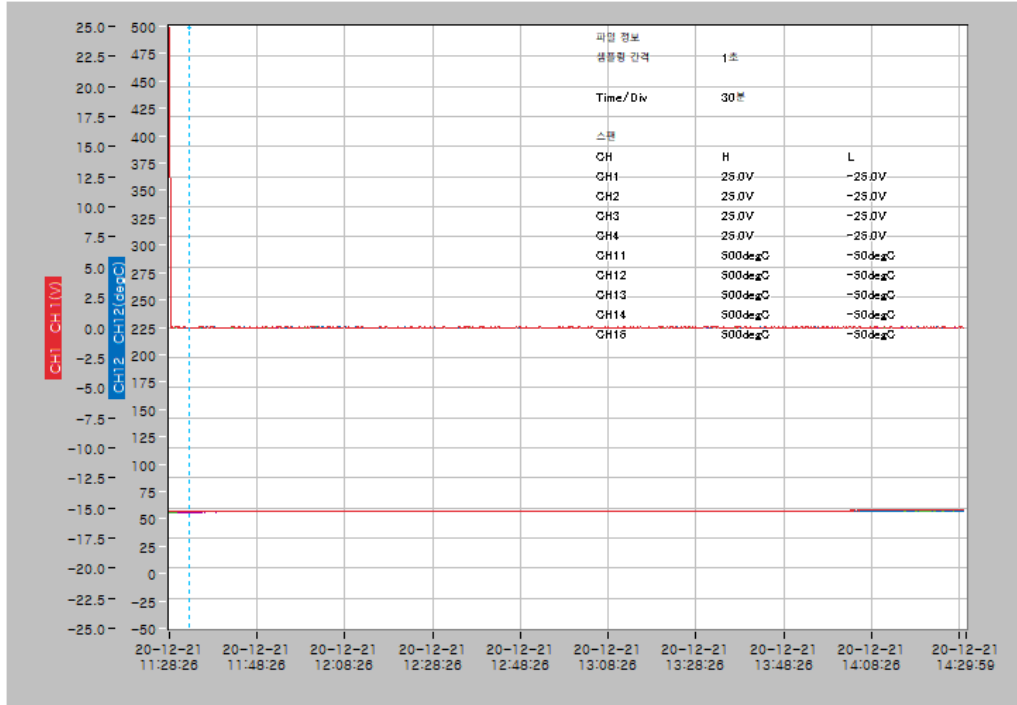


< Test T.4: Shock >

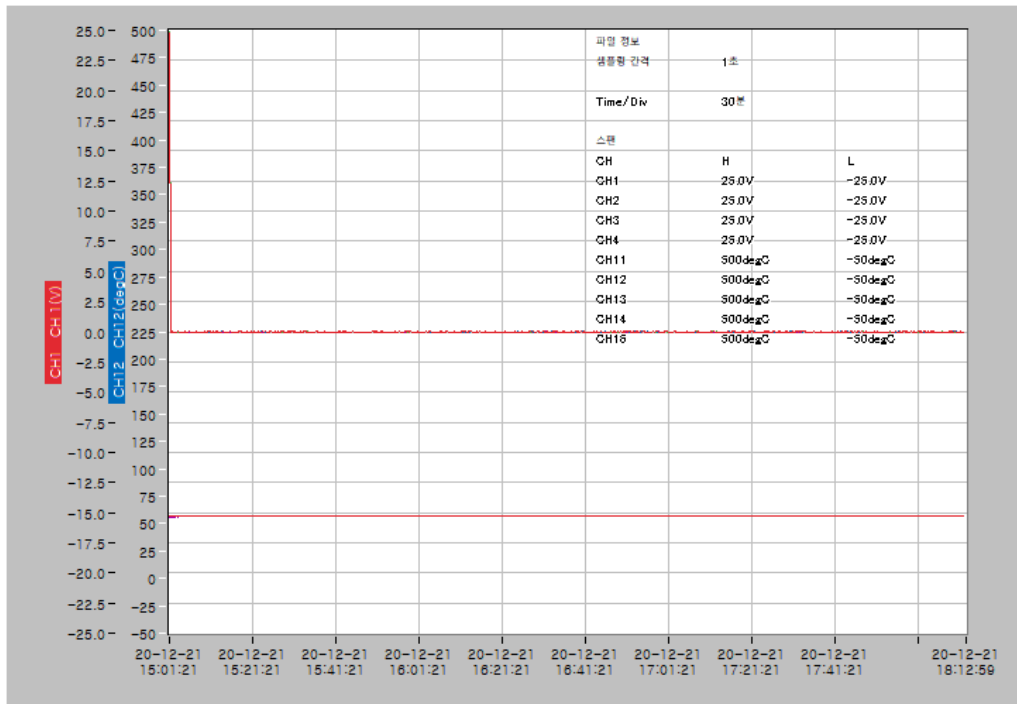
Mar. 04, 2021



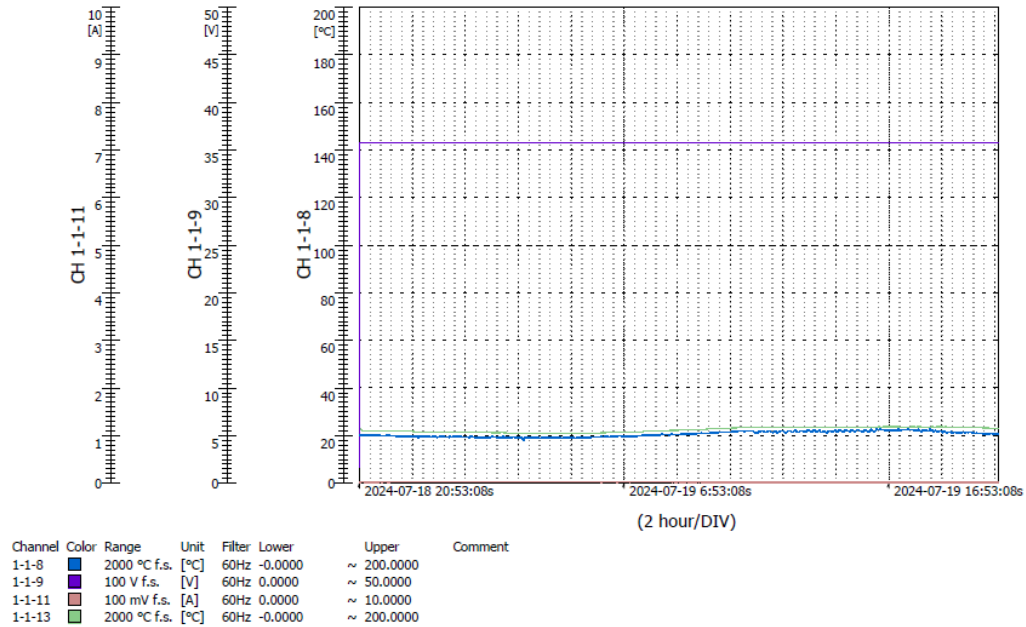
< Test T.5: External short circuit - First cycle >



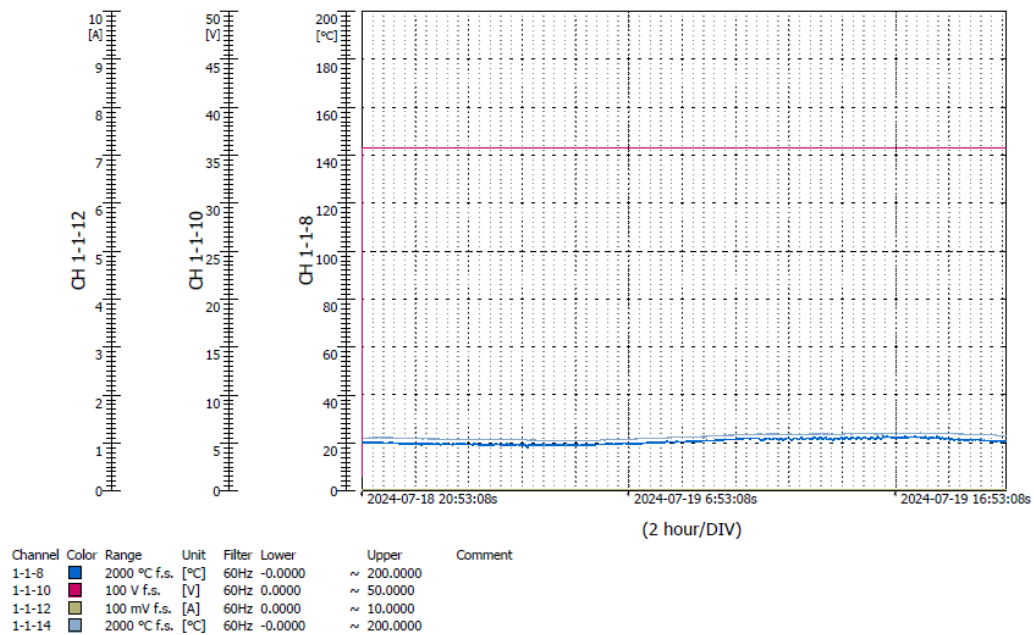
< Test T.5: External short circuit - 25 Cycles >



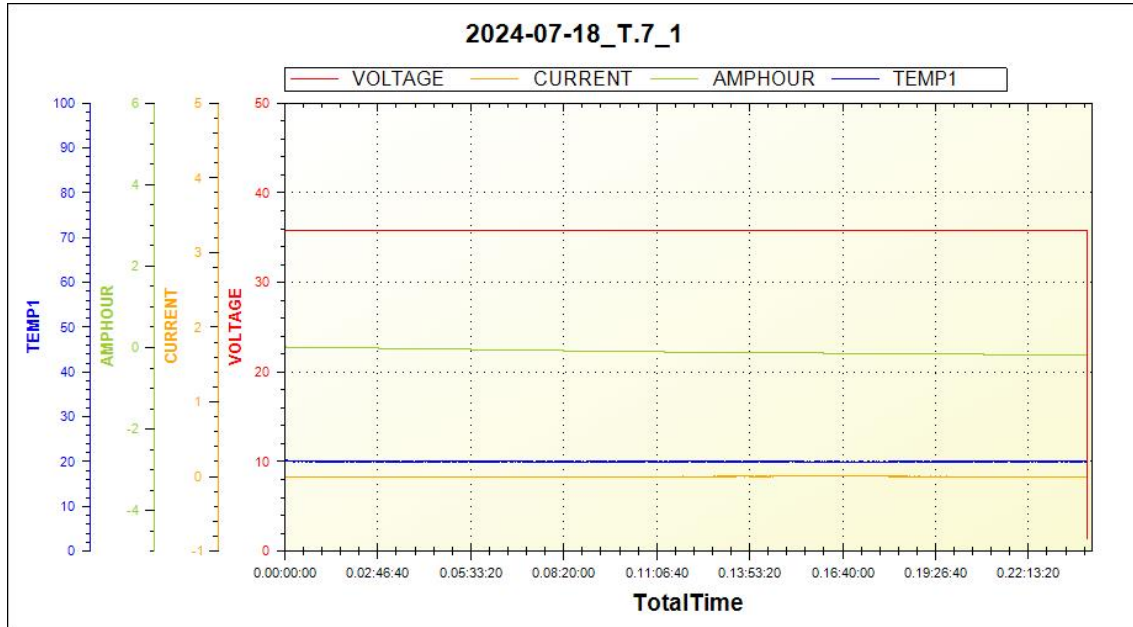
< Test T.7: Overcharge - First Cycle - 1 >



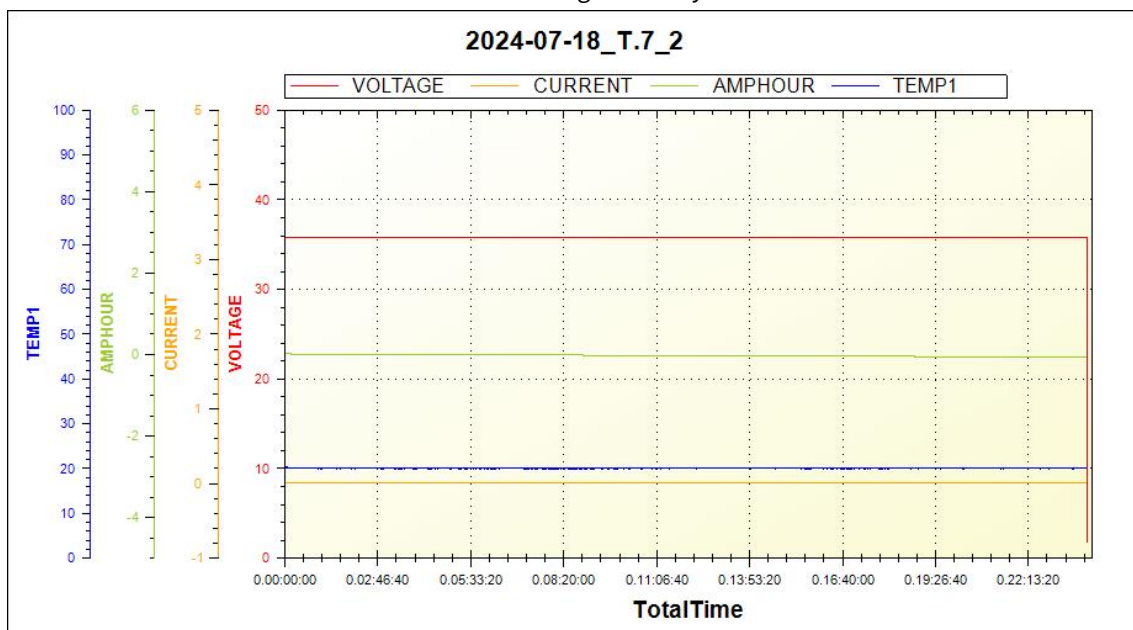
< Test T.7: Overcharge - First Cycle - 2 >



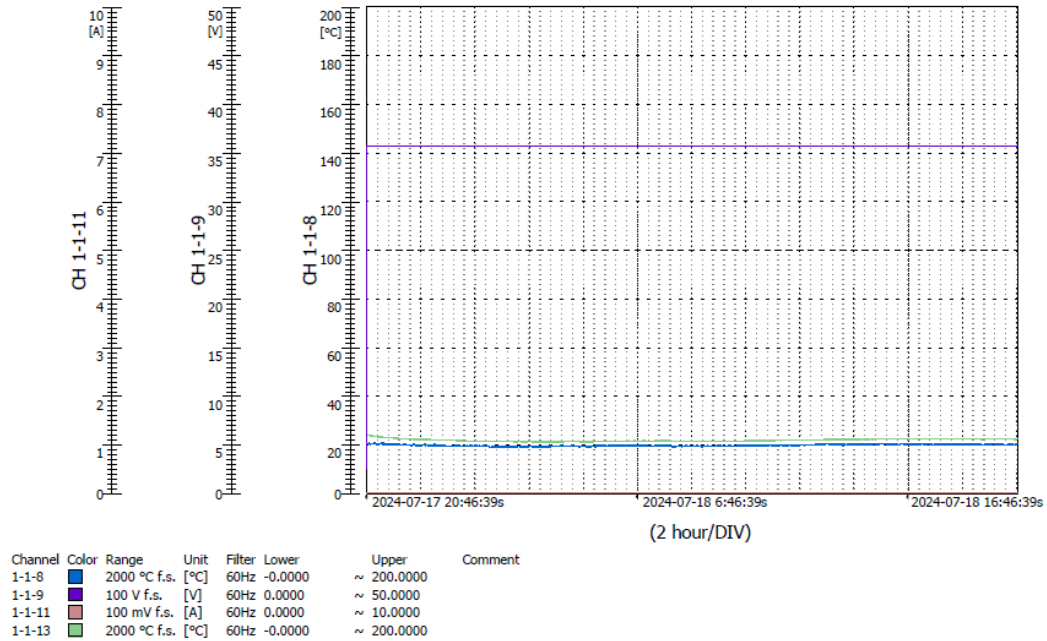
< Test T.7: Overcharge - First Cycle - 3 >



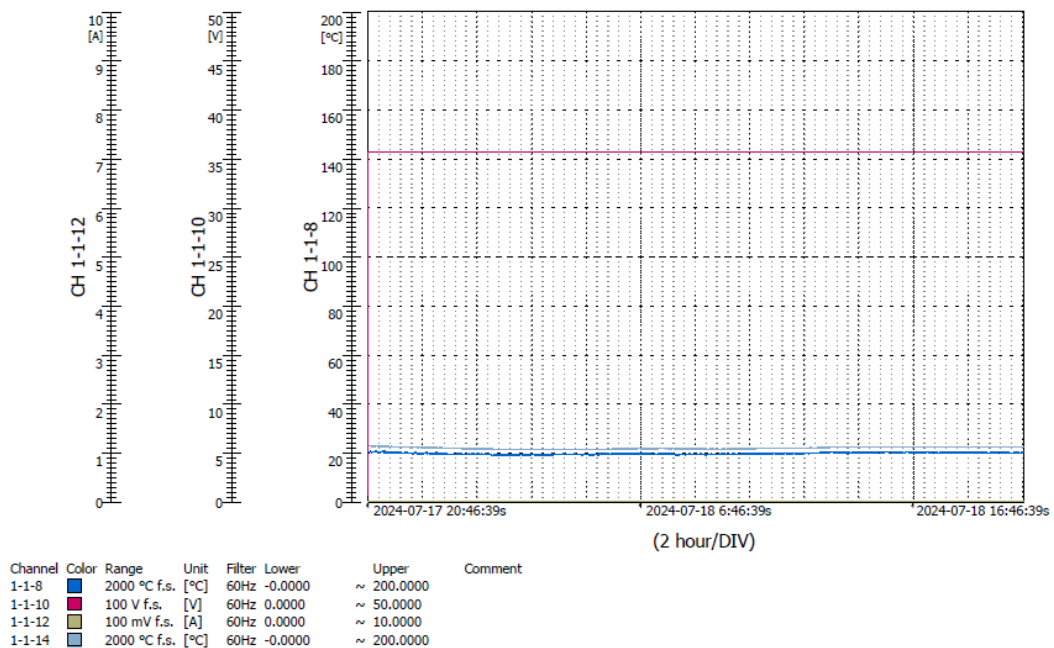
< Test T.7: Overcharge - First Cycle - 4 >



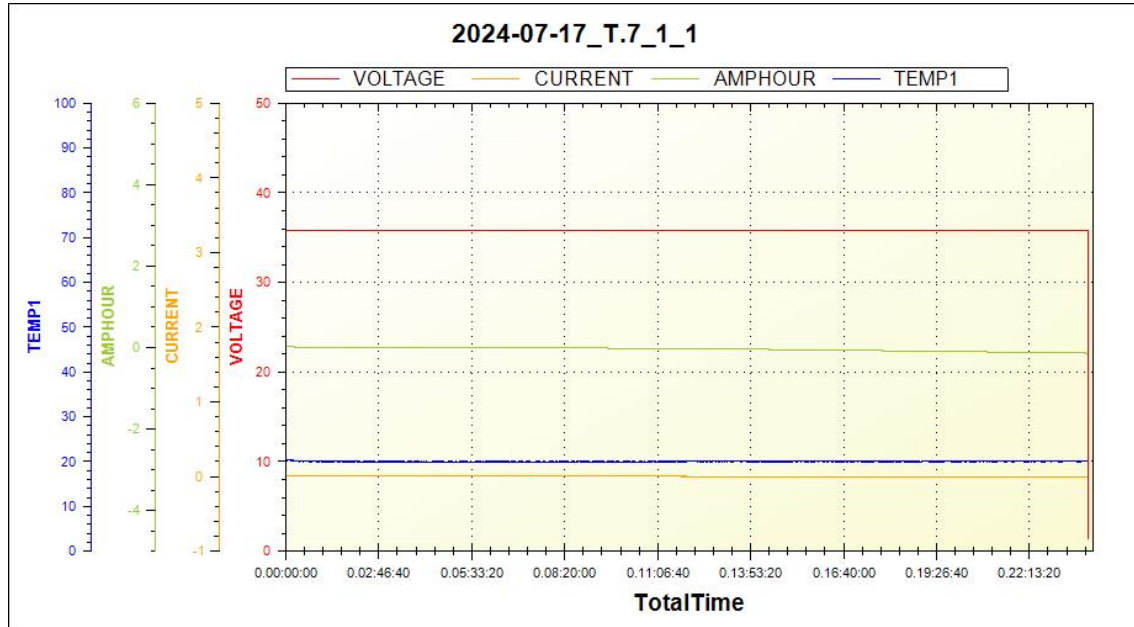
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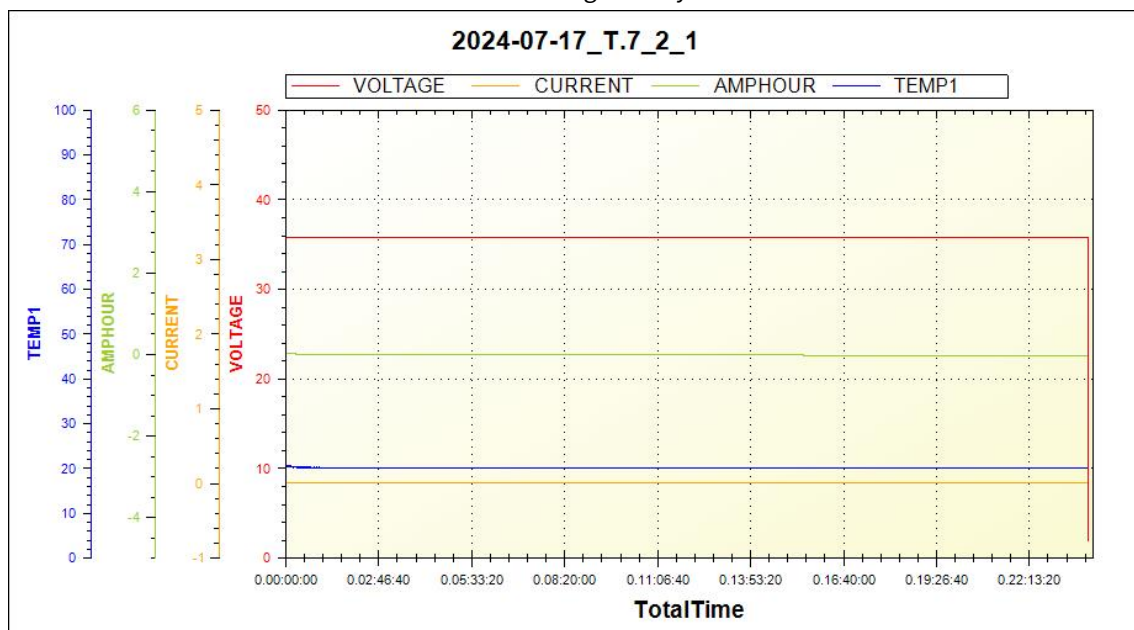
< Test T.7: Overcharge - 25 Cycles - 2 >



< Test T.7: Overcharge - 25 Cycles - 3 >



< Test T.7: Overcharge - 25 Cycles - 4 >



< Drop Test : Prior to the test >

March 09, 2021



< Drop Test : After the test >

March 09, 2021



7. Documentations

7.1 Specifications

Specification NO.	PB5541P102A	Revision	Ver 2.0
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1. Scope

This Product Specification ('Specification' hereinafter) covers the requirements for the rechargeable lithium-ion battery pack ('pack' hereinafter) manufactured and supplied by SAMSUNG SDI Co., Ltd. to SAMSUNG Electronics Co., Ltd. for its product.

The pack contains lithium-ion battery cells, safety devices, a protection circuit and fuel gauge module.

2. Descriptions and Model

2.1 Description	Rechargeable Lithium-ion battery pack
2.2 Battery Cells Configuration	7S1P
2.3 Battery Cell	INR18650-25S2
2.4 Model name	VCA-SBTD95 (VS9500 JET 3.5)
2.5 Cell maker	SAMSUNG SDI Co., Ltd
2.6 Case and spray maker	YG Tech
2.7 Battery pack assembler	SAMSUNG SDI Co., Ltd

3. Ratings

	Item	Specification	Remarks
3.1	Rated Capacity 2 (Normal mode)	Min 2,200mAh	Charge: 29.12V ¹⁾ , 1.2A, 100mA cut-off at 25°C Discharge : 58W CP, 18.2V cut off at 25°C
3.2	Nominal Voltage	25.2V	3.6V/cell
3.3	End of Discharge Voltage	18.2V	2.6V/cell
3.4	Charging Method	CC-CV	
	Charging Voltage ¹⁾	29.12V±0.15V	This voltage is applied across the stacked cells (4.16V/Cell) * Charger voltage: 29.76V±0.15V @100mA
	Standard Charging Current	1.20A	Cut Off 100mA
	Max. Charge Current	1.25A	
3.5	Charging Time	210min	
3.6	Max. Discharge Current	35A (32A)	Limit the current to 32A in the motor.
3.7	Internal Impedance	65~137 mΩ	1kHz AC Method
3.8	Weight	Max 490g	Based on cell weight : per 48g Weight except cells(7ea) : Max 154g
3.9	Standard Charge Temperature	0 to 50 °C	Release Condition : 45°C
	Standard Discharge Temperature	0 to 83 °C	Release Condition : 60°C

1) It is the voltage applied across the stacked cell not pack. The voltage across pack include diode Vf because there is the diode in the charging path. So charger voltage is 29.76V±0.1V@100mA (Charging voltage + Diode drop 0.64V)

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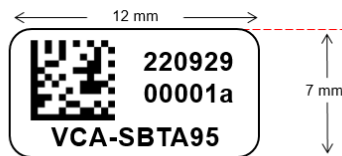
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7.2 Marking plate



2. Hard-Pack Barcode (CT Label) – VS9500 JET 3.0

2.1) Hard-Pack Barcode (CT Label) Definition



Serial No. Specification content displayed		
220929	Production Date	YYMMDD
00001	Serial No.	00001~99999
a	Revision Pack	MP-A,B,C,D; SPL-a
VCA-SBTA95	Model No.	SEC Code

※ Recommended Label size	
1. Length	: 12 mm
2. Width	: 7 mm
3. Thickness	: 0.05 mm
※ Material	: PET
※ Barcode type	: 2D
※ Font:	: Arial ; Font size: 4

[example]



2.2) Hard-Pack Barcode 2D Sample

※ BARCODE Configuration: VCA-SBTA68EP20100100001a

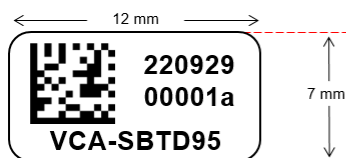
Serial No. Specification 2D barcode		
VCA-SBTD95	Model No.	SEC Code
EP	Maker	EPC: EP, SDI: SD
22	Production Year	19 = 2019, 20 = 2020, 21 = 2021
09	Production Month	01~12
29	Production Day	01~31
00001	Serial No.	00001~99999 (It should be recounted from 1 next month)
a	Revision	MP-A,B,C,D; SPL-a

< VCA-SBTA95 >





2.1) Hard-Pack Barcode (CT Label) Definition



Serial No. Specification content displayed		
220929	Production Date	YYMMDD
00001	Serial No.	00001~99999
a	Revision Pack	MP-A,B,C,D; SPL-a
VCA-SBTD95	Model No.	SEC Code

※ Recommended Label size
1. Length : 12 mm
2. Width : 7 mm
3. Thickness : 0.05 mm
※ Material : PET
※ Barcode type : 2D
※ Font: : Arial ; Font size: 4

[example]



2.2) Hard-Pack Barcode 2D Sample

※ BARCODE Configuration: VCA-SBTA68EP20100100001a

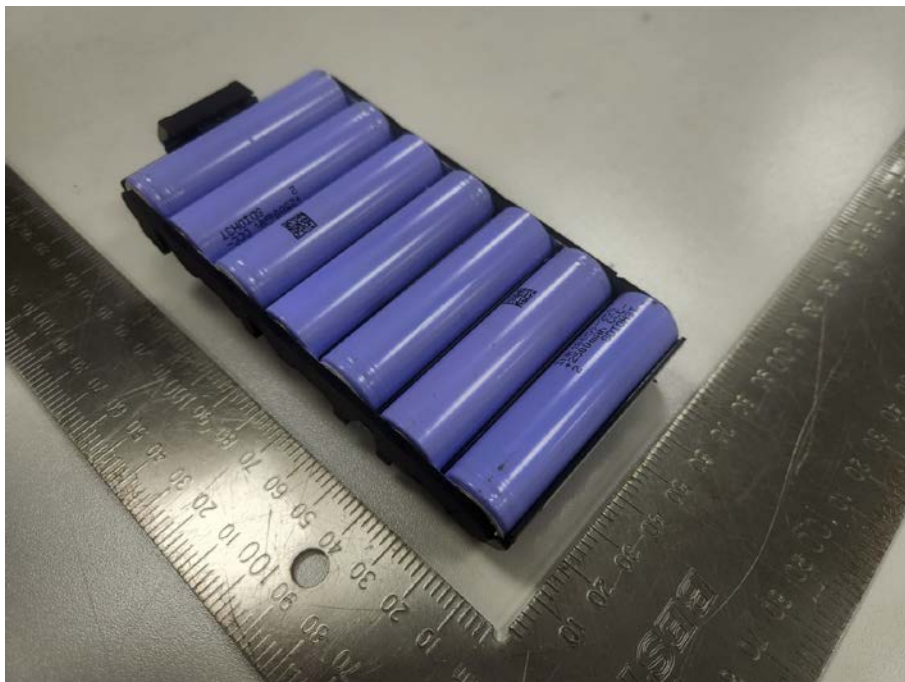
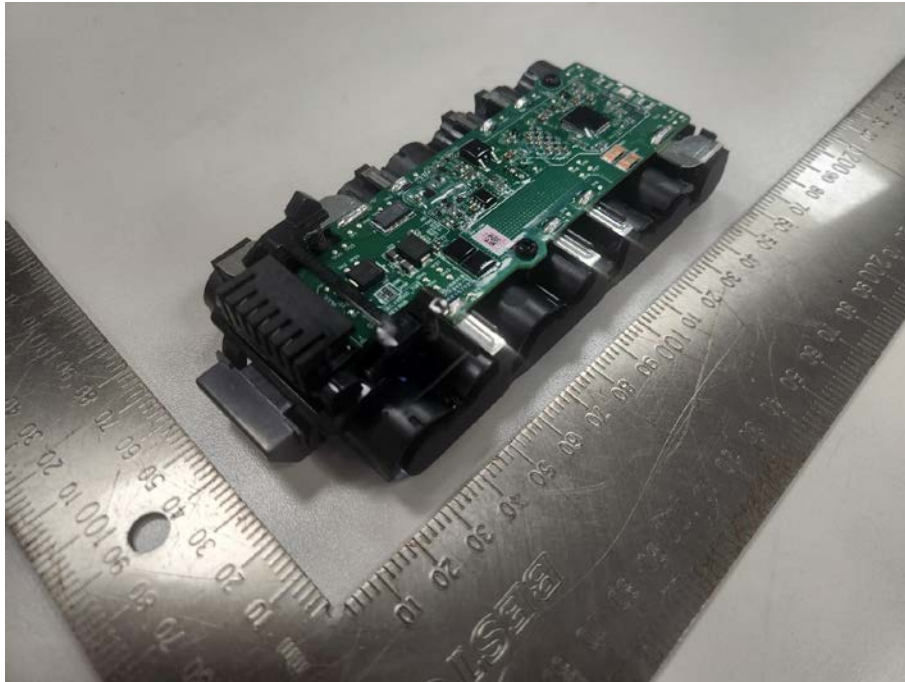
Serial No. Specification 2D barcode		
VCA-SBTD95	Model No.	SEC Code
EP	Maker	EPC: EP, SDI: SD
22	Production Year	19 = 2019, 20 = 2020, 21 =2021
09	Production Month	01~12
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a	Revision	MP-A,B,C,D; SPL-a

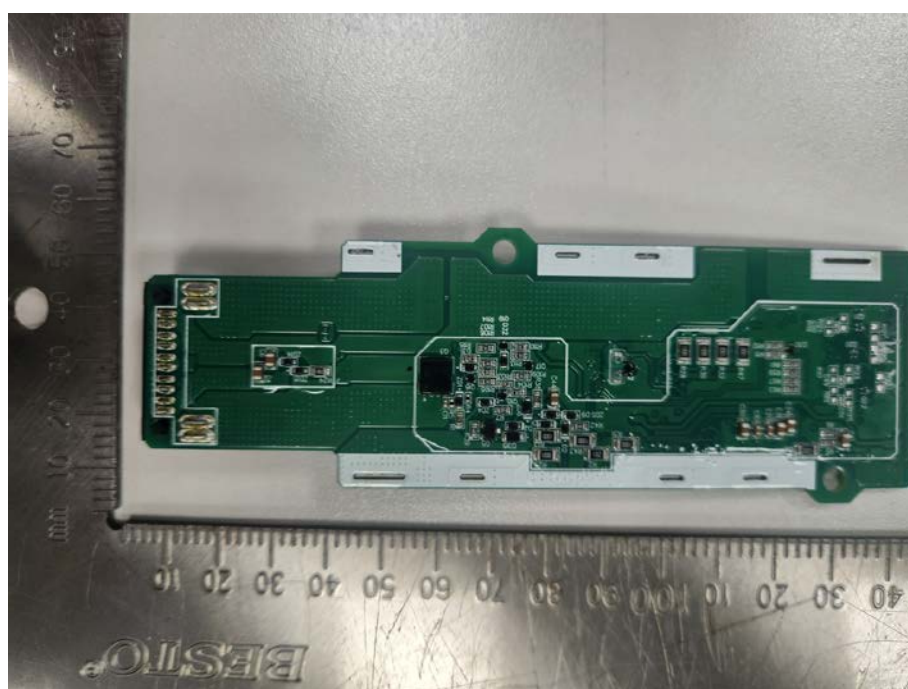
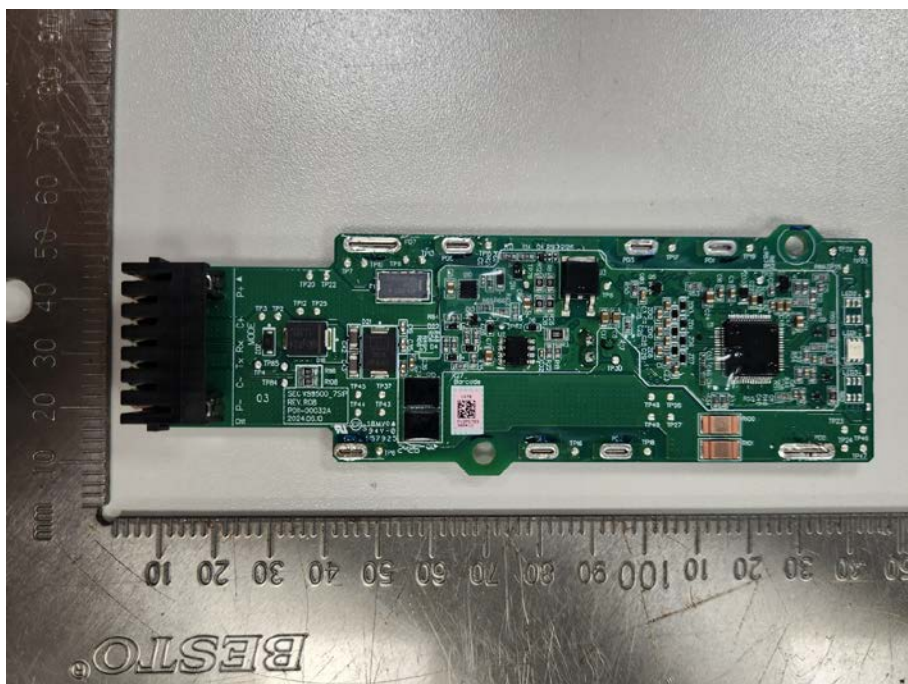


< VCA-SBTD95 >

7.3 Pictures







- End -