

### TEST REPORT

#### ST/SG/AC.10/11 Rev.5/Amend.2 Section 38.3

#### AMENDMENTS TO THE FIFTH REVISED EDITION OF THE RECOMMENDATIONS ON THE TRANSPORT OF DANGEROUS GOODS, MANUAL OF TEST AND CRITERIA

(Section 38.3: Lithium batteries)

Report reference No. ....: STR14129217S-2

Tested by (name+ signature) .....: 张士杰 / Jesse Zhang

张士杰 Jesse Zhang

Compiled by (+ signature) .....: 刘雪娟 / Snow Liu

刘雪娟 Snow Liu

Approved by (+ signature) .....: 吴 烁 / Roy Wu

吴烁 Roy Wu

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Testing laboratory .....: Shenzhen SEM.Test Technology Co., Ltd.

Address .....: 1/F, Building A, Hongwei Industrial Park, Liuxian 2<sup>nd</sup> Road, Bao'an District, Shenzhen, P.R.C (518101)

Testing location .....: As above

Applicant .....: GlobTek, Inc.

Address .....: 186 Veterans Dr. Northvale, NJ 07647 USA

Manufacturer .....: GlobTek (Suzhou) Co., Ltd.

Address .....: Building 4, No.76 Jinling East Road, Suzhou Industrial Park, Suzhou, Jiangsu, China

Standard .....: **ST/SG/AC.10/11Rev.5/Amend.2 Section 38.3**

Test procedure .....: Type approved

Procedure deviation .....: N.A.

Non-standard test method .....: N.A.

**This test report is specially limited to the above client company and product model only, It may not be duplicated without prior written consent of SEM. Test.**

Product Name .....: Lithium-Ion Battery Pack

Trademark .....: GlobTek

Model/type reference .....: BL1880F6835661S5PG9T

Ratings .....: 3.7V, 34.78Wh(9400mAh)



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Clause	Requirement – Test	Result - Remark	Verdict				
<b>38.3.4</b>	<b>Procedure</b>		<b>P</b>				
	Test 1 to 5 must be conducted in sequence on the same cell or battery.		P				
	Test 6 and 8 should be conducted using not otherwise tested cells or batteries.		P				
	Test 7 may be conducted using undamaged batteries previously used in tests 1 to 5 for purposes of testing on cycled batteries.		P				
<b>38.3.4.1</b>	<b>Test 1: Altitude Simulation</b>		<b>P</b>				
38.3.4.1.1	Purpose		P				
	This test simulates air transport under low-pressure conditions.		-				
38.3.4.1.2	Test procedure		P				
	stored at a pressure	11.6 kPa	-				
	ambient temperature (20 ± 5°C)	24°C	-				
	Stored times( ≥ 6 hours)	8 hours	-				
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.	No leakage, no venting, no disassembly, no rupture and no fire. Battery after testing is not less than 90% of its voltage immediately prior to this procedure.	P				
Group	No.	Mass M of Test Battery (g)			OCV (V)		
		M1 (before the test)	M2 (after the test)	Mass Loss limit (0.1%)	OCV1 (before the test)	OCV2 (after the test)	OCV (≥90%)
Group A (at first cycle, in fully charged states)	01	176.200	176.194	0.003%	4.195	4.194	99.976%
	02	177.005	176.999	0.003%	4.193	4.192	99.976%
	03	174.181	174.177	0.002%	4.196	4.194	99.952%
	04	176.605	176.594	0.006%	4.192	4.191	99.976%
Group B (after fifty cycles ending in fully charged states)	05	175.189	175.185	0.002%	4.195	4.194	99.976%
	06	174.150	174.142	0.005%	4.194	4.192	99.952%
	07	173.270	173.267	0.002%	4.193	4.192	99.976%
	08	175.021	175.008	0.007%	4.194	4.193	99.976%
<b>Remark</b>							
1. Mass loss (%)=(M1-M2)/M1*100% (Where M <sub>1</sub> is the mass before the test and M <sub>2</sub> is the mass after the test). 2. Leakage means the visible escape of electrolyte or other material from a cell or battery or the loss of material (except battery casing, handling devices or labels) from a cell or battery such that the loss of mass exceeds the values in Table. 3. The OCV of each test cell after testing is not less than 90% of its voltage immediately prior to this procedure. 4. Ambient temperature: 24°C							

**Conclusion:**

**Lithium-Ion Battery Pack had passed altitude simulation test.**

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Clause	Requirement – Test	Result - Remark	Verdict				
38.3.4.2	<b>Test 2: Thermal Test</b>		<b>P</b>				
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				
	Test temperature and stored hours	1) $72 \pm 2^{\circ}\text{C}$ , $\geq 6\text{h}$ 2) $-40 \pm 2^{\circ}\text{C}$ , $\geq 6\text{h}$	-				
	The maximum time interval	Between test temperature extremes is 30 minutes.	-				
	Test times	repeated 10 times	-				
	After which all test cells and batteries are to be stored for 24 hours at ambient temperature ( $20 \pm 5^{\circ}\text{C}$ )	$24^{\circ}\text{C}$	-				
	For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.	Small battery	N				
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.	No leakage, no venting, no disassembly, no rupture and no fire. Battery after testing is not less than 90% of its voltage immediately prior to this procedure.	P				
Group	No.	Mass M of Test Battery (g)			OCV (V)		
		M1 (before the test)	M2 (after the test)	Mass Loss limit (0.1%)	OCV1 (before the test)	OCV2 (after the test)	OCV ( $\geq 90\%$ )
Group A (at first cycle, in fully charged states)	01	176.194	176.041	0.087%	4.194	4.111	98.021%
	02	176.999	176.872	0.072%	4.192	4.102	97.853%
	03	174.177	174.076	0.058%	4.194	4.116	98.140%
	04	176.594	176.439	0.088%	4.191	4.114	98.163%
Group B (after fifty cycles ending in fully charged states)	05	175.185	175.048	0.078%	4.194	4.075	97.163%
	06	174.142	173.978	0.094%	4.192	4.119	98.259%
	07	173.267	173.110	0.091%	4.192	4.083	97.400%
	08	175.008	174.850	0.090%	4.193	4.109	97.997%
<b>Remark</b>							
1. Mass loss (%)=(M1-M2)/M1*100% (Where M <sub>1</sub> is the mass before the test and M <sub>2</sub> is the mass after the test). 2. Leakage means the visible escape of electrolyte or other material from a cell or battery or the loss of material (except battery casing, handling devices or labels) from a cell or battery such that the loss of mass exceeds the values in Table. 3. The OCV of each test cell after testing is not less than 90% of its voltage immediately prior to this procedure. 4. Ambient temperature: $24^{\circ}\text{C}$							

**Conclusion:**

**Lithium-Ion Battery Pack had passed thermal test.**

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Clause	Requirement – Test	Result - Remark	Verdict				
<b>38.3.4.3</b>	<b>Test 3: Vibration</b>		<b>P</b>				
38.3.4.3.1	Purpose		P				
	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.		P				
	Duration	15min	-				
	Frequency range	7Hz.....200Hz.....7Hz	-				
	Amplitude	0.8mm	-				
	This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell.		-				
38.3.4.3.3	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.	There is no leakage, no venting, no disassembly, no rupture and no fire.	P				
Group	No.	Mass M of Test Battery (g)			OCV (V)		
		M1 (before the test)	M2 (after the test)	Mass Loss limit (0.1%)	OCV1 (before the test)	OCV2 (after the test)	OCV (≥90%)
Group A (at first cycle, in fully charged states)	01	176.041	176.040	0.001%	4.111	4.111	100.0%
	02	176.872	176.872	0.000%	4.102	4.102	100.0%
	03	174.076	174.076	0.000%	4.116	4.116	100.0%
	04	176.439	176.435	0.002%	4.114	4.114	100.0%
Group B (after fifty cycles ending in fully charged states)	05	175.048	175.048	0.000%	4.075	4.075	100.0%
	06	173.978	173.978	0.000%	4.119	4.116	99.927%
	07	173.110	173.110	0.000%	4.083	4.081	99.951%
	08	174.850	174.850	0.000%	4.109	4.109	100.0%
<b>Remark</b>							
1. Mass loss (%)=(M1-M2)/M1*100% (Where M <sub>1</sub> is the mass before the test and M <sub>2</sub> is the mass after the test). 2. Leakage means the visible escape of electrolyte or other material from a cell or battery or the loss of material (except battery casing, handling devices or labels) from a cell or battery such that the loss of mass exceeds the values in Table. 3. The OCV of each test cell after testing is not less than 90% of its voltage immediately prior to this procedure. 4. Ambient temperature: 24°C							

**Conclusion:**

**Lithium-Ion Battery Pack had passed vibration test.**

**ST/SG/AC.10/11 Rev.5/Amend.2 Section 38.3**

Clause	Requirement – Test	Result - Remark	Verdict				
<b>38.3.4.4</b>	<b>Test 4: Shock</b>		<b>P</b>				
38.3.4.4.1	Purpose		P				
	This test simulates possible impacts during transport.		-				
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.	This is small batteries.	-				
	a half-sine shock of peak acceleration	150 g <sub>n</sub>	-				
	Pulse duration	6ms	-				
	the positive direction followed	three times shocks	-				
	Each cell or battery shall be subjected to three shocks in the positive direction followed by three shocks in the negative direction of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.		-				
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.	There is no leakage, no venting, no disassembly, no rupture and no fire.	P				
Group	No.	Mass M of Test Battery (g)			OCV (V)		
		M1 (before the test)	M2 (after the test)	Mass Loss limit (0.1%)	OCV1 (before the test)	OCV2 (after the test)	OCV (≥90%)
Group A (at first cycle, in fully charged states)	01	176.040	176.040	0.000%	4.111	4.111	100.0%
	02	176.872	176.872	0.000%	4.102	4.102	100.0%
	03	174.076	174.076	0.000%	4.116	4.116	100.0%
	04	176.435	176.435	0.000%	4.114	4.114	100.0%
Group B (after fifty cycles ending in fully charged states)	05	175.048	175.048	0.000%	4.075	4.075	100.0%
	06	173.978	173.975	0.002%	4.116	4.116	100.0%
	07	173.110	173.110	0.000%	4.081	4.081	100.0%
	08	174.850	174.850	0.000%	4.109	4.109	100.0%
<b>Remark</b>							
<ol style="list-style-type: none"> <li>Mass loss (%)=(M1-M2)/M1*100% (Where M<sub>1</sub> is the mass before the test and M<sub>2</sub> is the mass after the test).</li> <li>Leakage means the visible escape of electrolyte or other material from a cell or battery or the loss of material (except battery casing, handling devices or labels) from a cell or battery such that the loss of mass exceeds the values in Table.</li> <li>The OCV of each test cell after testing is not less than 90% of its voltage immediately prior to this procedure.</li> <li>Ambient temperature: 24°C</li> </ol>							

**Conclusion:**

**Lithium-Ion Battery Pack had passed shock test.**

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Clause	Requirement – Test	Result - Remark	Verdict	
<b>38.3.4.5</b>	<b>Test 5: External Short Circuit</b>		<b>P</b>	
38.3.4.5.1	Purpose		P	
	This test simulates an external short circuit.		P	
38.3.4.5.2	Test procedure		P	
	The cell or battery to be tested shall be temperature stabilized so that its external case temperature reaches $55 \pm 2^{\circ}\text{C}$ .		-	
	Short circuit condition with a total External resistance of less than 0.1ohm.		-	
	This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to $55 \pm 2^{\circ}\text{C}$ .		-	
38.3.4.5.3	Requirement		P	
	Cells and batteries meet this requirement if their external temperature does not exceed $170^{\circ}\text{C}$ and there is no disassembly, no rupture and no fire during the test and within six hours after this test.	Battery external temperature does not exceed $170^{\circ}\text{C}$ , and there is no disassembly, no fire during the test and within six hours after this test.	P	
Group	No.	External Highest Temperature ( $^{\circ}\text{C}$ )	Criteria	Result
Group A (at first cycle, in fully charged states)	01	55.1	Battery external temperature does not exceed $170^{\circ}\text{C}$ , and there is no disassembly, no rupture and no fire during the test and within six hours after this test.	P
	02	55.5		P
	03	55.9		P
	04	55.7		P
Group B (after fifty cycles ending in fully charged states)	05	55.2		P
	06	55.5		P
	07	55.4		P
	08	55.3		P
Ambient temperature: $23^{\circ}\text{C}$				

**Conclusion:**

**Lithium-Ion Battery Pack had passed external short circuit test.**

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Clause	Requirement – Test	Result - Remark	Verdict	
38.3.4.6	<b>Test 6: Impact / Crush</b>	The test sample Component cell of rechargeable batteries.	P	
38.3.4.6.1	Purpose		P	
	These tests simulate mechanical abuse from an impact or crush that may result in an internal short circuit.		P	
38.3.4.6.2	Test procedure – Impact (applicable to cylindrical cells not less than 18.0 mm in diameter)		N	
	The sample cell or component cell is to be placed on a flat smooth surface. A 15.8 mm ± 0.1mm diameter, at least 6 cm long, or the longest dimension of the cell, whichever is greater, Type 316 stainless steel bar is to be placed across the centre of the sample. A 9.1 kg ± 0.1 kg mass is to be dropped from a height of 61 ± 2.5 cm at the intersection of the bar and sample in a controlled manner using a near frictionless, vertical sliding track or channel with minimal drag on the falling mass. The vertical track or channel used to guide the falling mass shall be oriented 90 degrees from the horizontal supporting surface.		N	
	The test sample is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8 mm ± 0.1mm diameter curved surface lying across the centre of the test sample. Each sample is to be subjected to only a single impact.		N	
38.3.4.6.3	Test Procedure – Crush (applicable to prismatic, pouch, coin/button cells and cylindrical cells less than 18.0 mm in diameter)		P	
	A cell or component cell is to be crushed between two flat surfaces. The crushing is to be gradual with a speed of approximately 1.5 cm/s at the first point of contact. The crushing is to be continued until the first of the three options below is reached.		P	
	The applied force reaches 13 kN ± 0.78 kN;	<input checked="" type="checkbox"/> Reach this condition	P	
	The voltage of the cell drops by at least 100 mV;	<input type="checkbox"/> Reach this condition	P	
	The cell is deformed by 50% or more of its original thickness.	<input type="checkbox"/> Reach this condition	P	
38.3.4.6.4	Requirement		P	
	Cells and component cells meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly and no fire during the test and within six hours after this test.	After the test, The, component Cells external temperature does not exceed 170°C and there is no disassembly and no fire during the test and within six hours after this test.	P	
Group	No.	Component cells external temperature (°C)	Criteria	Result
Group C at first cycle at 50% of the design rated capacity	09	22.9	The component Cells external temperature does not exceed 170°C and there is no disassembly and no fire during the test and within six hours after this test.	P
	10	22.8		P
	11	23.1		P
	12	23.1		P





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	13	22.7		P
Ambient temperature: 24.0°C				

**Conclusion:**

**Lithium-Ion Battery Pack had passed Crush test.**

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Clause	Requirement – Test	Result - Remark	Verdict
38.3.4.7	<b>Test 7: Overcharge</b>		<b>P</b>
38.3.4.7.1	Purpose		P
	This test evaluates the ability of a rechargeable battery to withstand an overcharge condition.		-
38.3.4.7.2	Test procedure		P
	The charge current	2×9400mA=18800mA, Twice the manufacturer's recommended maximum continuous charge current.	P
	The minimum voltage of the test:		P
	a) The minimum voltage of the test (The manufacturer's recommended charge voltage is not more than 18V).	2×4.2V=8.4V	P
	b) The minimum voltage of the test (The manufacturer's recommended charge voltage is more than 18V).		N
	Ambient temperature.	24°C	-
	The duration of the test.	24 hours	-
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.	There is no disassembly and no fire during the test and within seven days after the test.	P
Group	No.	Criteria	Result
Group D (at first cycle, in fully charged states)	14	There is no disassembly and no fire during the test and within seven days after the test.	P
	15		P
	16		P
	17		P
Group E (after fifty cycles ending in fully charged states)	18		P
	19		P
	20		P
	21		P
Ambient temperature: 24°C			

**Conclusion:**

**Lithium-Ion Battery Pack had passed overcharge test.**

**ST/SG/AC.10/11Rev.5/Amend.2 Section 38.3**

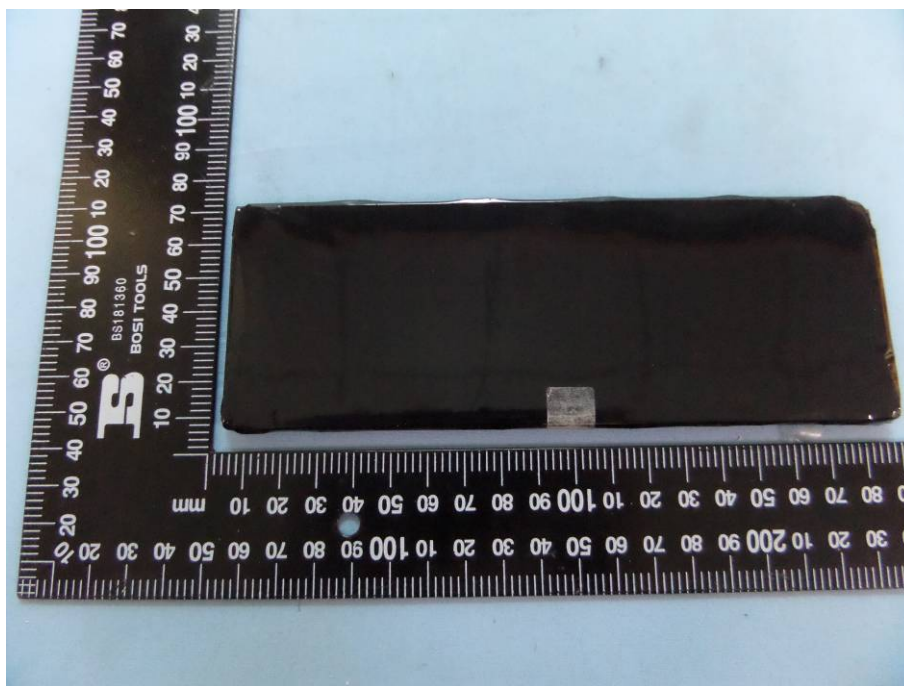
Clause	Requirement – Test	Result - Remark	Verdict
<b>38.3.4.8</b>	<b>Test 8: Forced discharge</b>		<b>P</b>
38.3.4.8.1	Purpose		P
	This test evaluates the ability of a primary or a rechargeable cell to withstand a forced discharge condition.		P
38.3.4.8.2	Test procedure		P
	Each cell shall be forced discharged at ambient temperature by connecting it in series with a 12 V DC, power supply at an initial current equal to the maximum discharge current specified by the manufacturer.		P
	The specified discharge current is to be obtained by connecting a resistive load of the appropriate size and rating in series with the test cell, Each cell shall be forced discharged for a time interval (in hours) equal to its rated capacity divided by the initial test current (in ampere).		P
38.3.4.8.3	Requirement		P
	Primary or rechargeable cells meet this requirement if there is no disassembly and no fire during the test within seven days after the test.	There is no disassembly and no fire during the test within seven days after the test.	P
Group	No.	Criteria	Result
Group F (at first cycle in fully discharged states)	22	There is no disassembly and no fire during the test within seven days after the test.	P
	23		P
	24		P
	25		P
	26		P
	27		P
	28		P
	29		P
	30		P
	31		P
Group G (after 50 cycles ending in fully discharged states)	32		P
	33		P
	34		P
	35		P
	36		P
	37		P
	38		P
	39		P
	40		P
	41		P
Ambient temperature: 24.0°C			

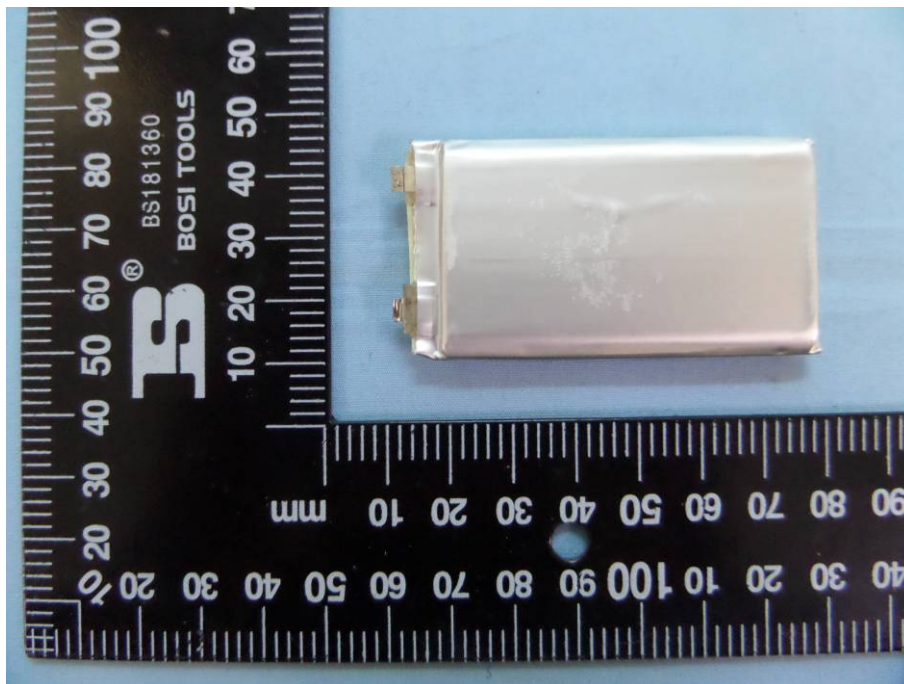
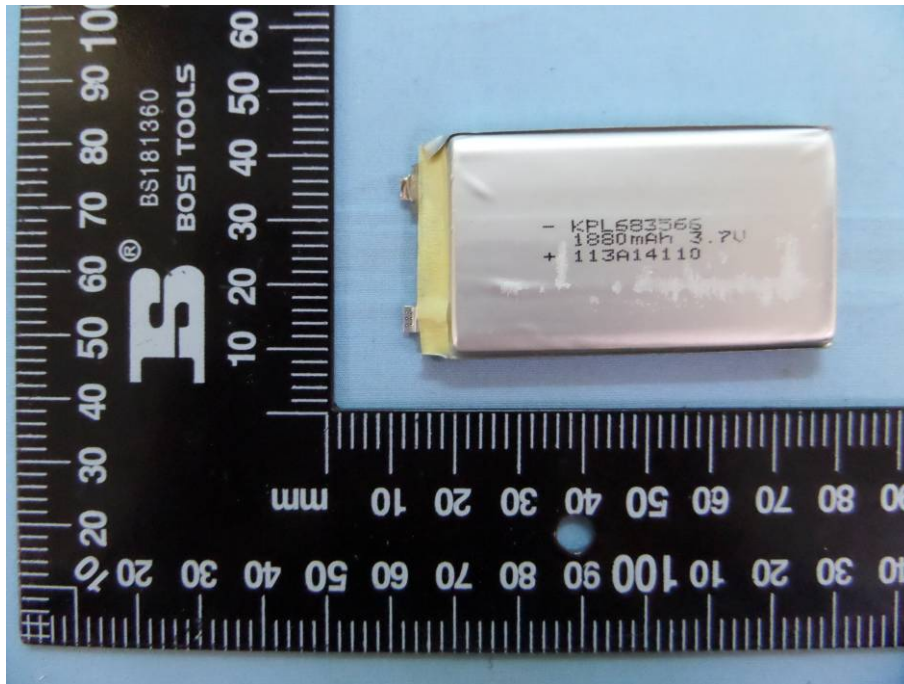
**Conclusion:**

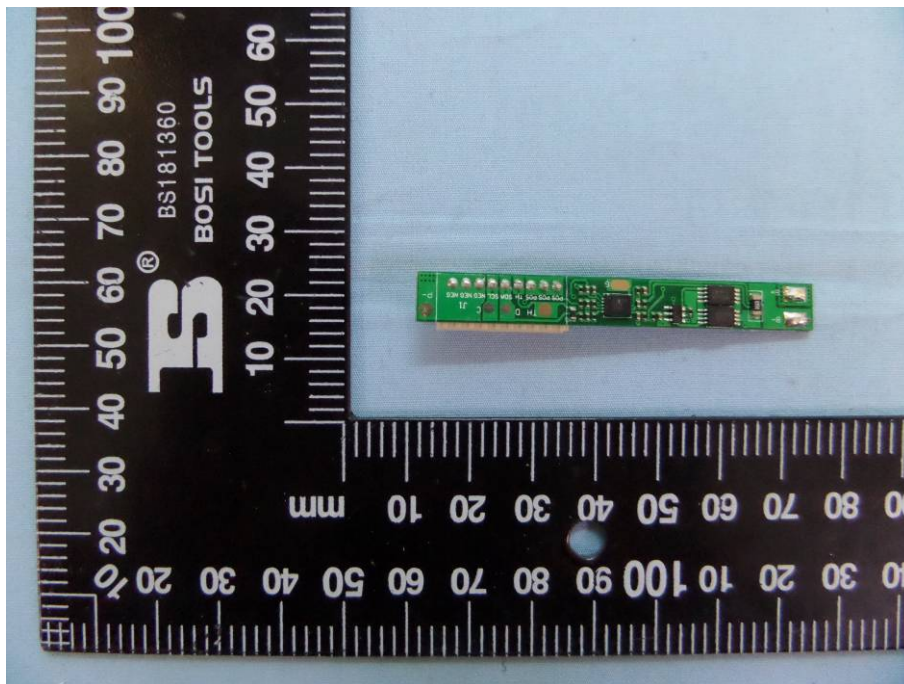
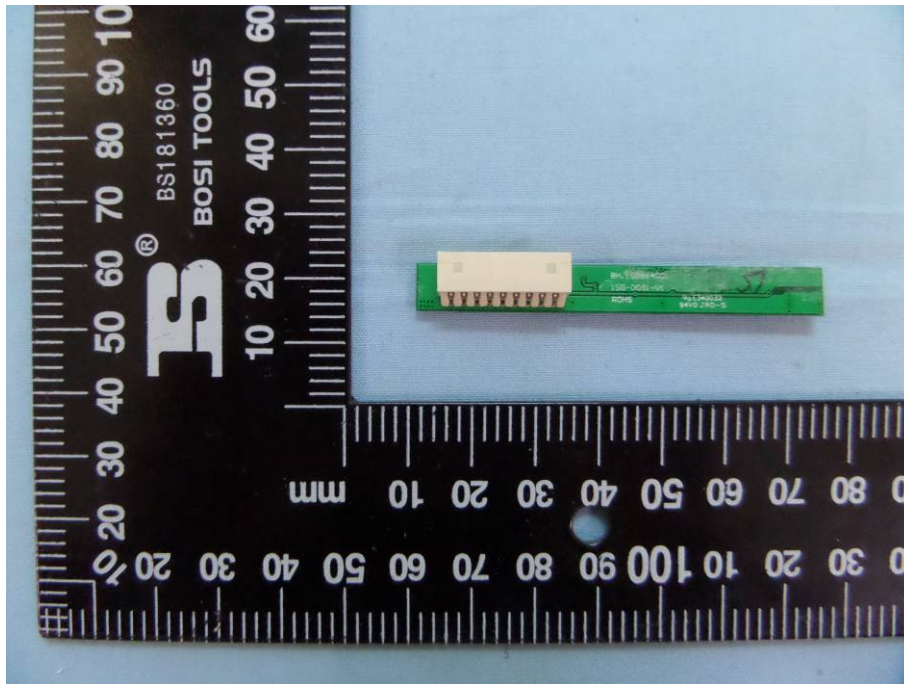
**Lithium-Ion Battery Pack had passed Forced discharge test.**

### Photos

Model: BL1880F6835661S5PG9T







**\*\*\* End of Report \*\*\***