TEST REPORT

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

AMENDMENTS TO THE FIFTH REVISED EDITION OF THE RECOMMEI TRANSPORT OF DANGEROUS GOODS, MANUAL OF TEST AN

(Section 38.3: Lithium batteries)

Report reference No. .....:	STR14048353S
Tested by (name+ signature) .....:	Snow Liu
Approved by (+ signature) .....:	Ailis Ma
Date of issue .....:	May 08, 2014
Testing laboratory .....:	Shenzhen SEM.Test Technology Co., Ltd.
Address .....:	1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road, Bao'an District, Shenzhen, P.R.C (518101)
Testing location .....:	As above
Applicant .....:	AIPO International Co., Ltd
Address .....:	Floor 5, Block A, No.8 East Zone, Shangxue Technology Industrial Park, Bantian, Buji Town, Longgang District, Shenzhen, China
Manufacturer .....:	Linyi Yingbeite Battery Co., Ltd.
Address .....:	Yingbeite Industrial Park, Taiping Street, Hedong District, Linyi City, Shandong Province
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 .....:	Li-ion battery
Trademark .....:	----
Model/type reference .....:	EB602030P
Ratings .....:	3.7V, 1.11Wh(300mAh)
Max. charge voltage .....:	4.25V
Max. charge current .....:	300mA
Standard charge current .....:	300mA

Max. discharge current .....:	600mA
Standard discharge current .....:	60mA
Overcharge protection voltage .....:	4.30±0.05V
Over discharge protection voltage ..:	2.3±0.1V
Shape of cell .....:	☐ Cylindrical cell (not less than 18.0 mm in diameter) ☐ Cylindrical cell (less than 18.0 mm in diameter) ☒ Prismatic cell ☐ Coin cell/Button cell ☐ Pouch cell

Particulars: test item vs. test requirements

Classification ..... :	☐ Lithium metal batteries ☐ Lithium metal cells ☐ Lithium ion batteries ☒ Lithium ion cells
Samples Type ..... :	☐ Large battery ☐ Large cell ☐ Small battery ☐ Small cell ☒ Single cell battery
Dimension ..... :	L : 30.7mm W: 19.9mm T : 5.8mm
Mass of apparatus ..... :	6.3g

Possible test case verdicts:

- test case does not apply to the test object ..... :	N(.A.)
- test object does meet the requirement ..... :	P(ass)
- test object does not meet the requirement ..... :	F(ail)

Testing:

Date of receipt of test item ..... :	Apr. 23, 2014
Date(s) of performance of test ..... :	Apr. 24, 2014- May 08, 2014

Test Conclusion:

The Li-ion battery submitted by AIPO International Co., Ltd is tested according to Section 38.3 of Amendments to the Fifth Revised Edition of the Recommendations on the Transport of Dangerous Goods, Manual of Test and Criteria (ST/SG/AC.10/11/Rev.5/Amend.2).

Test Result: Pass.

ST/SG/AC.10/11Rev.5/Amend.2 Section 38.3			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
38.3.4	**Procedure**		**P**
	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.		N
38.3.4.1	**Test 1: Altitude Simulation**		**P**
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℃)	24℃	-
	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 (0.2%)	OCV1 (before the test)	OCV2 (after the test)	OCV (≥90%)
Group A (at first cycle, in fully charged states)	01	6.311	6.309	0.032%	4.196	4.190	99.857%
	02	6.347	6.347	0.000%	4.195	4.191	99.905%
	03	6.169	6.169	0.000%	4.196	4.192	99.905%
	04	6.387	6.387	0.000%	4.195	4.191	99.905%
	05	6.354	6.354	0.000%	4.195	4.190	99.881%
	06	6.419	6.419	0.000%	4.195	4.192	99.928%
	07	6.137	6.137	0.000%	4.195	4.192	99.928%
	08	6.273	6.273	0.000%	4.194	4.190	99.905%
	09	6.206	6.205	0.016%	4.195	4.192	99.928%
	10	6.277	6.277	0.000%	4.195	4.192	99.928%

Remark

1. Mass loss (%)=(M1-M2)/M1*100% (Where M_1 is the mass before the test and M_2 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.

Conclusion:

Li-ion battery had passed altitude simulation test.

ST/SG/AC.10/11Rev.5/Amend.2 Section 38.3			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
38.3.4.2	**Test 2: Thermal Test**		**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
	Test temperature and stored hours	1) 72±2℃, ≥6h 2) -40±2℃, ≥6h	-
	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±5℃).	24℃	-
	For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.	Small cell	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 (0.2%)	OCV1 (before the test)	OCV2 (after the test)	OCV (≥90%)
Group A (at first cycle, in fully charged states)	01	6.309	6.300	0.143%	4.190	4.084	97.470%
	02	6.347	6.346	0.016%	4.191	3.976	94.870%
	03	6.169	6.163	0.097%	4.192	4.031	96.159%
	04	6.387	6.382	0.078%	4.191	4.024	96.015%
	05	6.354	6.347	0.110%	4.190	3.981	95.012%
	06	6.419	6.414	0.078%	4.192	3.949	94.203%
	07	6.137	6.131	0.098%	4.192	4.040	96.374%
	08	6.273	6.267	0.096%	4.190	3.991	95.251%
	09	6.205	6.196	0.145%	4.192	4.011	95.682%
	10	6.277	6.267	0.159%	4.192	4.078	97.281%

Remark

1. Mass loss (%)=(M1-M2)/M1*100% (Where M_1 is the mass before the test and M_2 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℃

Conclusion:

Li-ion battery had passed thermal test.

ST/SG/AC.10/11Rev.5/Amend.2 Section 38.3			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
38.3.4.3	**Test 3: Vibration**		**P**
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 (0.2%)	OCV1 (before the test)	OCV2 (after the test)	OCV (≥90%)
Group A (at first cycle, in fully charged states)	01	6.300	6.300	0.000%	4.084	4.084	100.0%
	02	6.346	6.345	0.016%	3.976	3.976	100.0%
	03	6.163	6.163	0.000%	4.031	4.031	100.0%
	04	6.382	6.382	0.000%	4.024	4.024	100.0%
	05	6.347	6.347	0.000%	3.981	3.980	99.975%
	06	6.414	6.414	0.000%	3.949	3.949	100.0%
	07	6.131	6.131	0.000%	4.040	4.038	99.950%
	08	6.267	6.267	0.000%	3.991	3.991	100.0%
	09	6.196	6.195	0.016%	4.011	4.011	100.0%
	10	6.267	6.267	0.000%	4.078	4.078	100.0%

Remark

1. Mass loss (%)=(M1-M2)/M1*100% (Where M_1 is the mass before the test and M_2 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℃

Conclusion:

Li-ion battery had passed vibration test.

ST/SG/AC.10/11Rev.5/Amend.2 Section 38.3			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
38.3.4.4	**Test 4: Shock**		**P**
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 cells.	-
	a half-sine shock of peak acceleration	150 g_n	-
	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 (0.2%)	OCV1 (before the test)	OCV2 (after the test)	OCV (≥90%)
Group A (at first cycle, in fully charged states)	01	6.300	6.300	0.000%	4.084	4.084	100.0%
	02	6.345	6.345	0.000%	3.976	3.976	100.0%
	03	6.163	6.163	0.000%	4.031	4.030	99.975%
	04	6.382	6.382	0.000%	4.024	4.024	100.0%
	05	6.347	6.347	0.000%	3.980	3.980	100.0%
	06	6.414	6.414	0.000%	3.949	3.949	100.0%
	07	6.131	6.131	0.000%	4.038	4.038	100.0%
	08	6.267	6.267	0.000%	3.991	3.991	100.0%
	09	6.195	6.195	0.000%	4.011	4.011	100.0%
	10	6.267	6.267	0.000%	4.078	4.077	99.975%

Remark

1. Mass loss (%)=(M1-M2)/M1*100% (Where M_1 is the mass before the test and M_2 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℃

Conclusion:

Li-ion battery had passed shock test.

ST/SG/AC.10/11Rev.5/Amend.2 Section 38.3			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
38.3.4.5	**Test 5: External Short Circuit**		**P**
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±2℃.		-
	Short circuit condition with a total External resistance of less than 0.1ohm.		-
	The cell or battery must be observed for a further six hours for the test to be concluded.		-
	This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to 55±2℃.		-
38.3.4.5.3	Requirement		P
	Cells and batteries meet this requirement if their external temperature does not exceed 170℃ and there is no disassembly, no rupture and no fire during the test and within six hours after this test.	Cells external temperature does not exceed 170℃, and there is no disassembly, no fire during the test and within six hours after this test.	P

Group	**No.**	**External Highest Temperature (℃)**	**Criteria**	**Result**
Group A (at first cycle, in fully charged states)	01	72.3	Cells external temperature does not exceed 170℃, and there is no disassembly, no rupture and no fire during the test and within six hours after this test.	P
	02	55.4		P
	03	55.1		P
	04	55.3		P
	05	55.3		P
	06	56.4		P
	07	56.8		P
	08	56.1		P
	09	55.8		P
	10	56.0		P
Ambient temperature: 23℃				

Conclusion:

Li-ion battery had passed external short circuit test.

ST/SG/AC.10/11 Rev.5/Amend.2 Section 38.3			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
38.3.4.6	**Test 6: Impact / Crush**	This is rechargeable cells.	**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;	☒Reach this condition	P
	The voltage of the cell drops by at least 100 mV;	☐ Reach this condition	P
	The cell is deformed by 50% or more of its original thickness.	☐ 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℃ 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 (℃)**	**Criteria**	**Result**
Group B (at first cycle at 50% of the design rated capacity)	11	28.2	The Cells external temperature does not exceed 170℃ and there is no disassembly and no fire during the test and within six hours after this test.	P
	12	31.0		P
	13	27.5		P
	14	28.2		P

	15	28.5		P
Ambient temperature: 24.0℃				

Conclusion:

Li-ion battery had passed Crush test.

ST/SG/AC.10/11 Rev.5/Amend.2 Section 38.3			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
38.3.4.7	**Test 7: Overcharge**		**P**
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	2×600mA=1200mA, 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).	2×4.25V=8.5V	P
	b) The minimum voltage of the test (The manufacturer's recommended charge voltage is more than 18V).		N
	Ambient temperature.	24℃	-
	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 C (at first cycle, in fully charged states)	16	There is no disassembly and no fire during the test and within seven days after the test.	P
	17		P
	18		P
	19		P
Group D (after fifty cycles ending in fully charged states)	20		P
	21		P
	22		P
	23		P
Ambient temperature: 24℃			

Conclusion:

Li-ion battery had passed overcharge test.

ST/SG/AC.10/11Rev.5/Amend.2 Section 38.3			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
38.3.4.8	**Test 8: Forced discharge**		**P**
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

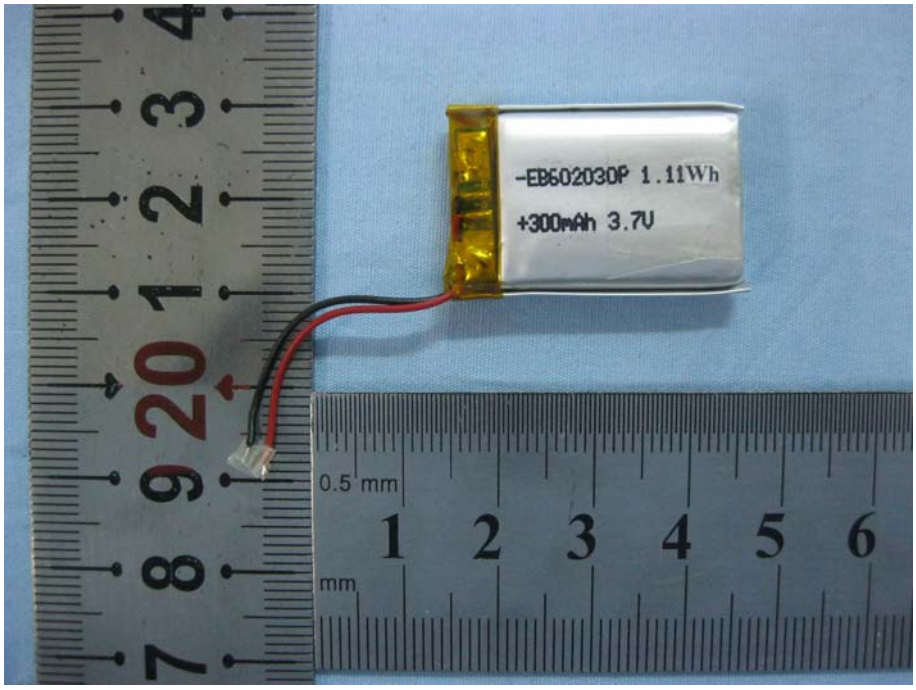
Group	**No.**	**Status**	**Criteria**
Group E (at first cycle in fully discharged states)	24	OK	There is no disassembly and no fire during the test within seven days after the test.
	25	OK	
	26	OK	
	27	OK	
	28	OK	
	29	OK	
	30	OK	
	31	OK	
	32	OK	
	33	OK	
Group F (after 50 cycles ending in fully discharged states)	34	OK	
	35	OK	
	36	OK	
	37	OK	
	38	OK	
	39	OK	
	40	OK	
	41	OK	
	42	OK	
	43	OK	
Ambient temperature: 24.0℃			

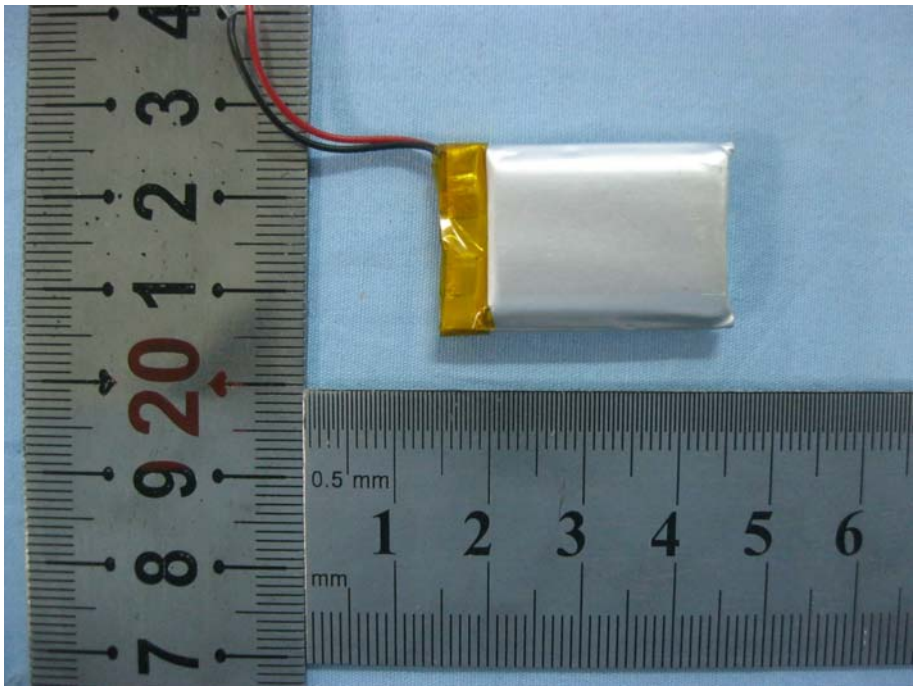
Conclusion:

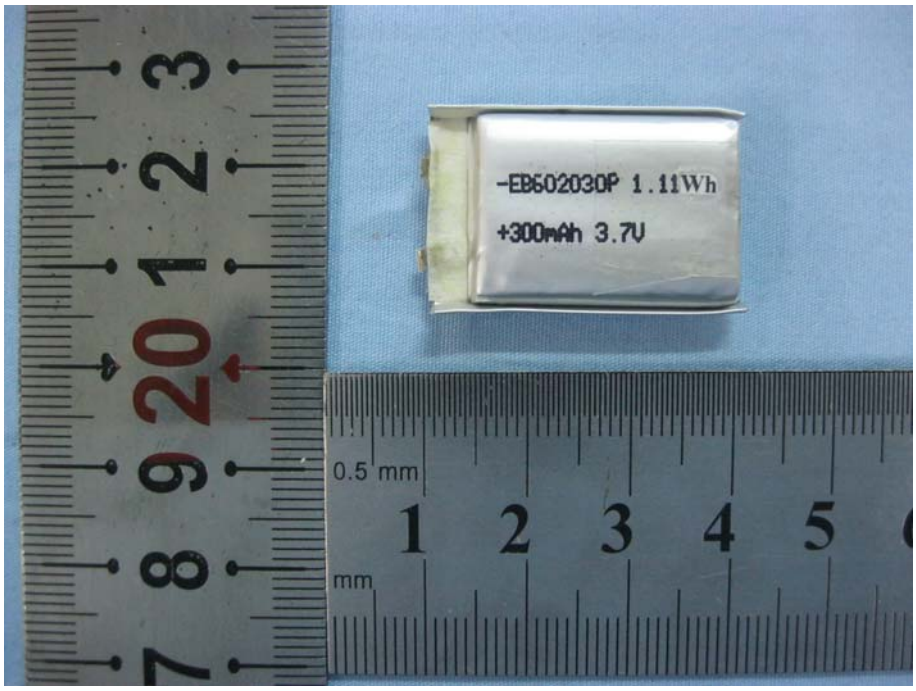
Li-ion battery had passed Forced discharge test.

Photos

Model: EB602030P



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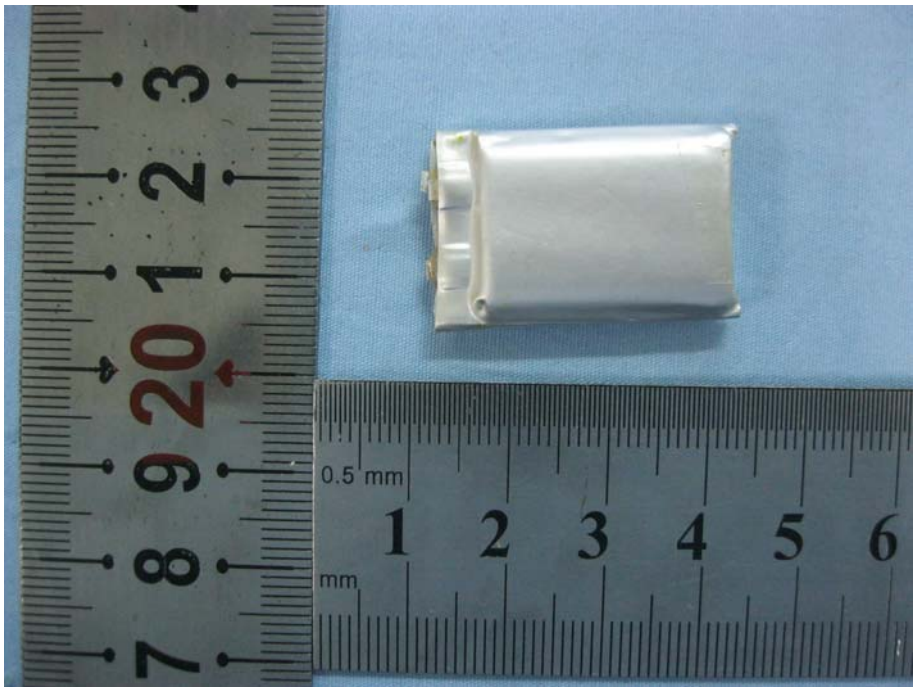
mm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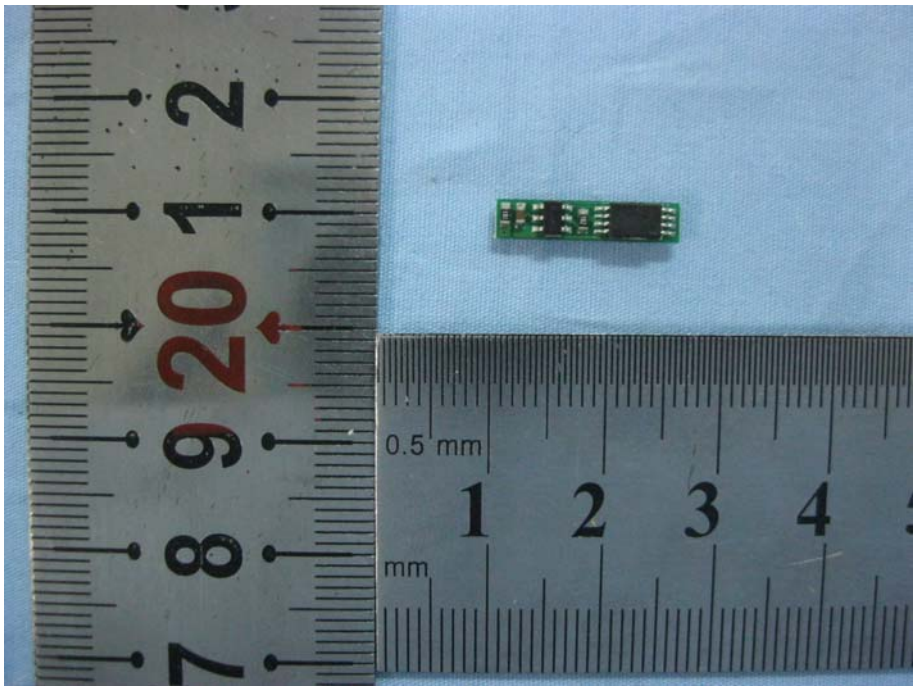

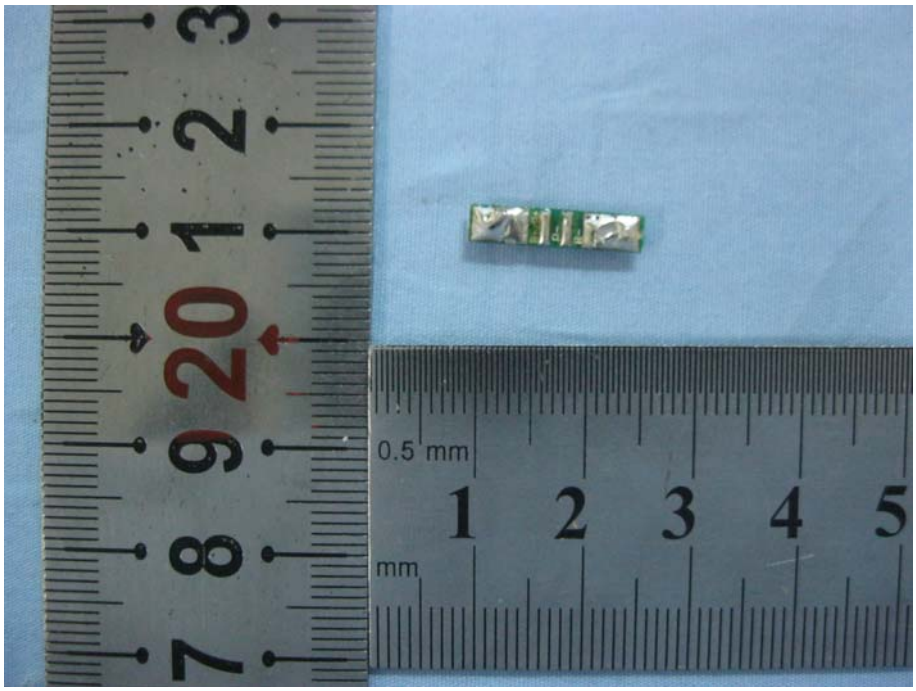

***** End of Report *****