TEST REPORT

IEC 62133: 2012 (2nd Edition)

Secondary cells and batteries containing alkaline or other non-acid electrolytes

Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications

Report reference No.	TCT160613B005
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Address	1F, Building 1, Yibaolai Industrial Park, Qiaotou Village, Fuyong Town, Baoan District, Shenzhen, Guangdong, P.R.C (518101)
Testing location	As above
Applicant's name	
Address	
Manufacturer's name	
Address	
Test specification	
Standard	IEC 62133: 2012 (2nd Edition)
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 TCT Testing Technology.

Test item description	Li- ion Cell
Trade Mark	----
Model/type reference	6160100PL
Ratings	3.7V, 18.5Wh(5000mAh)

Particulars: test item vs. test requirements	
Classification ..... :	☐ Li-ion Battery ☒ Nickel Battery
Dimension ..... :	L: 100.5mm W:60.0mm T: 6.1mm
Shape ..... :	☒Prismatic ☐Pouch ☐Coin/button ☐Cylindrical
Mass of apparatus ..... :	74.73g
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 ..... :	Jun. 13, 2016
Date(s) of performance of test ..... :	Jun. 13, 2016 - Jun. 24, 2016

General remarks:

"(see remark #)" refers to a remark appended to the report,

"(see appended table)" refers to a table appended to the report,

Throughout this report a comma is used as the decimal separator,

The test results presented in this report relate only to the object tested,

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Clause numbers between brackets refer to clauses in IEC 62133(Optional remark).

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General product information:

The cells and batteries have been tested and evaluated according to their specified working conditions (as given below), which are provided by client;

Details information of the battery and the cell built in the battery, as following:

Product	Li-ion Cell
Model No.	6160100PL
Nominal voltage	3.7V
Rated capacity	5000mAh
Charge method	Charging the battery with 0.2C (1000mA) constant current, 4.2V until current reaches 50mA
Max. Charging Current	2500mA
Max. Charging voltage	4.2V
End of discharge voltage	3.0V
Dimension	100.5*60.0*6.1mm
Weight	74.73g

Tests are made with the number of batteries specified in IEC 62133 Table 1.

Tests Performed (name of test and test clause):

Tests are made with the number of samples specified in Table 2 of IEC 62133:2012(2nd Edition).

Test items:

Cl.6 type test conditions

Cl.8.1 Charging procedures for test purposes

Cl.8.2.1 Continuous charging at constant voltage (cells)

Cl.8.3.1 External short circuit(cell)

Cl.8.3.2 External short circuit(battery)

Cl.8.3.3 Free fall

Cl.8.3.4 Thermal abuse (cells)

Cl.8.3.5 Crush(cells)

Cl.8.3.6 Over-charging of battery

Cl.8.3.7 Forced discharge (cells)

Cl.8.3.8 Transport test

Cl.8.3.9 Forced internal short circuit (cells)

Testing Location:

Shenzhen TCT Testing Technology Co., Ltd.

1F, Building 1, Yibaolai Industrial Park, Qiaotou Village, Fuyong Town, Baoan District, Shenzhen, Guangdong, P.R.C (518101)

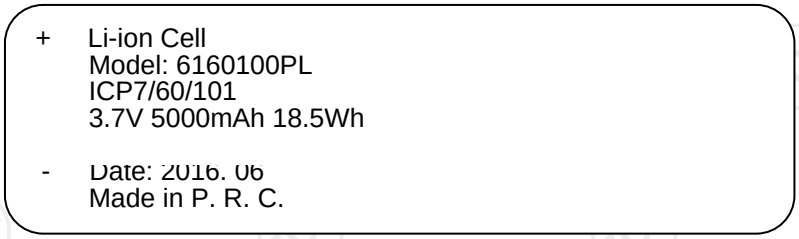
Test conclusion:

The Li-ion Cell submitted by Shenzhen DZH Battery Co., Ltd. are tested according to IEC 62133: 2012 (2nd Edition) Secondary cells and batteries containing alkaline or other non-acid electrolytes Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications.

Test result: Pass.

Remarks: The artwork below may be only a draft. at put into market, The use of certification marks on a product;

Copy of marking plate:



IEC 62133: 2012			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
5	**General safety considerations**		**P**
	Cells and batteries subject to intended use be safe and continue to function in all respects	Refer to the following clauses.	P
	Cells and batteries subject to reasonably foreseeable misuse do not present significant hazards.	Refer to the following clauses.	P
5.1	General		P
5.2	Insulation and wiring		P
	–Insulation Resistance between an accessible metal case (excluding electrical contacts) and positive terminals ≥ 5MΩ.	No accessible metal case exists;	N/A
	Internal wiring and insulation are sufficient to withstand maximum anticipated current, voltage and temperature requirements		P
	Orientation of wiring maintains adequate creepage and clearance distances between conductors. Mechanical integrity of internal connections is sufficient to accommodate conditions of reasonably foreseeable misuse.		P
5.3	Venting		P
	Battery cases and cells incorporate a pressure relief mechanism or are constructed so that they relieve excessive internal pressure at a value and rate that will preclude rupture, explosion and self-ignition.		P
	Encapsulation used to support cells within an outer casing does not cause the battery to overheat during normal operation no inhibit pressure relief.	Without encapsulation.	N/A
5.4	Temperature/voltage/current management		P
	The batteries are designed such that abnormal temperature rise conditions are prevented.		P
	Means is provided to limit current to safe levels during charge and discharge.		P
	The batteries are designed such that within temperature, voltage and current limits specified by the cell manufacturer.		P
	Batteries provided with specifications and charging instructions for equipment manufacturers so that associated chargers are designed to maintain charging within the temperature, voltage and current limits specified;	See battery specifications;	P
5.5	Terminal contacts		P
	Terminals have a clear polarity marking on the external surface of the battery	"+" for positive polarity and "-" for negative polarity marking on the label near the terminal	P

IEC 62133: 2012			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
	The size and shape of the terminal contacts ensure that they can carry the maximum anticipated current.		P
	External terminal contact surfaces are formed from conductive materials with good mechanical strength and corrosion resistance.		P
	Terminal contacts are arranged to minimize the risk of short circuits.		P
	the external connector prevents reverse polarity connections, Battery packs with keyed external connectors designed for connection to specific end products need not be marked with polarity marking;		N/A
5.6	Assembly of cells into batteries	Only one cell	N/A
5.6.1	If there is more than one battery housed in a single battery case, cells used in the assembly of each battery have closely matched capacities, be of the same design, be of the same chemistry and be from the same manufacturer		N/A
	Each battery has an independent control and protection		N/A
	Manufacturers of cells make recommendations about current, voltage and temperature limits so that the battery manufacturer/designer may ensure proper design and assembly		N/A
	Batteries that are designed for the selective discharge of a portion of their series connected cells incorporate separate circuitry to prevent the cell reversal caused by uneven discharges		N/A
	Protective circuit components are added as appropriate and consideration given to the enddevice application		N/A
	When testing a battery, the manufacturer of the battery provides a test report confirming the compliance according to this standard		N/A
5.6.2	Design recommendation for lithium system only		P
	For the battery consisting of a single cell or a single cellblock: - Charging voltage of the cell does not exceed the upper limit of the charging voltage specified in Clause 8.1.2, Table 4;		P

IEC 62133: 2012			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
	- Charging voltage of the cell does not exceed the different upper limit of the charging voltage determined through Clause 8.1.2, NOTE 1.		N/A
	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks: - The voltages of any one of the single cells or single cellblocks does not exceed the upper limit of the charging voltage, specified in Clause 8.1.2, Table 4, by monitoring the voltage of every single cell or the single cellblocks;		N/A
	- The voltages of any one of the single cells or single cellblocks does not exceed the different upper limit of the charging voltage, determined through Clause 8.1.2, NOTE 1, by monitoring the voltage of every single cell or the single cellblocks		N/A
	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks: - Charging is stopped when the upper limit of the charging voltage, specified in Clause 8.1.2, Table 4, is exceeded for any one of the single cells or single cellblocks by measuring the voltage of every single cell or the single cellblocks;		N/A
	- Charging is stopped when the upper limit of the different charging voltage, determined through Clause 8.1.2, NOTE 1, is exceeded for any one of the single cells or single cellblocks by measuring the voltage of every single cell or the single cellblocks		N/A
5.7	Quality plan		P
	The manufacturer has prepared a quality plan defining the procedures for the inspection of materials, components, cells and batteries and which covers the process of producing each type of cell and battery.	The manufacturer has ISO 9001:2008 certificate and such quality plan.	P

IEC 62133: 2012			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
6	**Type test conditions**		**P**
	Tests were conducted with the number of cells or batteries as outlined in Table 2 of IEC 62133 with cells or batteries that were not more than six months old.	Tests are made with the number of batteries specified in Table 2. battery are not more than six months old.	P
	Unless noted otherwise in the test methods, testing was conducted in an ambient of 20°C ± 5°C.	Tests are carried out at 20°C ± 5°C.	P
8	**Specific requirements and tests**		**P**
8.1	Charging procedure for test purposes		P
8.1.1	First procedure		-
	Test is carried out at 20°C±5°C. Charging method declared by the manufacturer.		P
	Prior to charging, the battery shall have been discharged at 20 °C ± 5 °C at a constant current of 0,2 *I*t A down to a specified final voltage.		P
8.1.2	Second procedure		-
	For clause 8.3.1, 8.3.2, 8.3.4, 8.3.5, and 8.3.9 charging procedure After stabilization for 1 to 4 hours respectively at ambient temperature of highest test temperature and lowest test temperature, as specified in Table 4		-
	cells are charged by using the upper limited charging voltage and maximum charging current, until the charging current is reduced to 0,05 *I*t A, using a constant voltage charging method.		-
	- Upper limit charging voltage	4.25V/cell	-
	- Maximum charging current Specified by the manufacturer of cells	2500mA	-
	Charging temp. Upper limit	45℃	-
	Charging temp. Lower limit	-5℃	-

IEC 62133: 2012							
Clause	**Requirement – Test**			**Result - Remark**			**Verdict**
8.2	Intended use						**P**
8.2.1	Continuous charging at constant voltage (cells)						P
	Fully charged cells are subjected for 7 days to a charge as specified by the manufacturer.						P
	Results:: No fire, no explosion, no leakage			See below table;			P
Sample No.	Model	Recommended Charging Method, CC, CV, or CC/CV	Recommended Charging Voltage Vc, Vdc	Recommended Charging Current Irec, A	OCV at Start of Test, Vdc	Results	P
C01	6160100PL	CC/CV	4.2	1.0	4.17	NF,NE	P
C02	6160100PL	CC/CV	4.2	1.0	4.19	NF,NE	P
C03	6160100PL	CC/CV	4.2	1.0	4.18	NF,NE	P
C04	6160100PL	CC/CV	4.2	1.0	4.18	NF,NE	P
C05	6160100PL	CC/CV	4.2	1.0	4.17	NF,NE	P

supplementary information:

- NF: No Fire
- NE: No Explosion
- NL: No Leakage
- Fire: the emission of flames from a cell or battery.
- Explosion: failure that occurs when a cell container or battery case opens violently and major components are forcibly expelled.
- Leakage: visible escape of liquid electrolyte.

8.2.2	Moulded case stress at high ambient temperature (battery)		N/A
	Fully charged batteries according to the first procedure in 8.1.1, the batteries were placed in an air-circulating oven at a temperature of 70°C ± 2°C for 7 hours. Afterwards, they are removed and allowed to return to room temperature.		N/A
	Results: no physical distortion of the battery casing resulting in exposure if internal components.		N/A
Sample No.			N/A
Status	No evidence of mechanical damage No physical distortion of the battery case resulting in exposure of internal components.		

IEC 62133: 2012			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**

8.3	Reasonably foreseeable misuse						P
8.3.1	External short circuit (cell)						P
	Fully charged each cell according to the second procedure in 8.1.2;						P
	Fully charged cells were subjected to a short circuit test at 20°C ± 5°C.						P
	The external resistance of 80±20 mΩ.						P
	The cells were tested for 24 h or until the case temperature declined by 20% of the maximum temperature rise.						P
	Results: no fire, no explosion.						P
	After the test				See below		P
Sample No.	Ambient temperature (At 20°C ± 5ºC)	OCV at start of test (Vdc)	Max. External Temperature (°C)	Resistance of Circuit (mΩ)	Charging temp. Upper limit (°C)	Results	P
C06	25.0	4.22	109.6	73	45	P	P
C07	25.0	4.21	113.5	72	45	P	P
C08	25.0	4.22	115.2	75	45	P	P
C09	25.0	4.23	114.8	74	45	P	P
C10	25.0	4.21	108.9	75	45	P	P
Sample No.	Ambient temperature (At 20°C ± 5ºC)	OCV at start of test (Vdc)	Max. External Temperature (°C)	Resistance of Circuit (mΩ)	Charging temp. Lower limit (°C)	Results	P
C11	25.0	4.18	112.3	73	-5	P	P
C12	25.0	4.17	106.5	72	-5	P	P
C13	25.0	4.18	109.5	75	-5	P	P
C14	25.0	4.19	105.9	74	-5	P	P
C15	25.0	4.18	107.6	74	-5	P	P

supplementary information

- NF: No Fire
- NE: No Explosion
- Fire: the emission of flames from a cell or battery.
- Explosion: failure that occurs when a cell container or battery case opens violently and major components are forcibly expelled.

IEC 62133: 2012							
Clause	**Requirement – Test**				**Result - Remark**		**Verdict**
8.3.2	External short circuit (battery)						N/A
	Fully charged each battery according to the second procedure in 8.1.2;						N/A
	Fully charged batteries were subjected to a short circuit test at 55°C ± 5°C.						N/A
	The external resistance of 80±20 mΩ.						N/A
	The battery pack were tested for 24 h or until the case temperature declined by 20% of the maximum temperature rise.						N/A
	In case of rapid decline in short circuit current, the battery pack should remain on test for an additional one hour after the current reaches a low end steady state condition. This typically refers to a condition where the per cell voltage (series cells only) of the battery is below 0,8 V and is decreasing by less than 0,1 V in a 30-minute period.						N/A
	Results: no fire, no explosion.						N/A
	After the test				See below		N/A
Sample No.	Ambient temperature (At 55°C ± 5ºC)	OCV at start of test (Vdc)	Max. External Temperature (°C)	Resistance of Circuit (mΩ)	Charging temp. Upper limit (°C)	Results	N/A
Sample No.	Ambient temperature (At 55°C ± 5ºC)	OCV at start of test (Vdc)	Max. External Temperature (°C)	Resistance of Circuit (mΩ)	Charging temp. Lower limit (°C)	Results	N/A
supplementary information - NF: No Fire - NE: No Explosion - Fire: the emission of flames from a cell or battery. - Explosion: failure that occurs when a cell container or battery case opens violently and major components are forcibly expelled.							

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IEC 62133: 2012			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
8.3.3	Free fall		P
	Ambient temperature of 20±5℃		
	Fully charged cells or batteries were dropped 3 times from a height of 1.0 m onto a concrete floor.	Three times	
	After the test, the cell or battery shall be put on rest for a minimum of one hour and then a visual inspection shall be performed.		
	Results: no fire, no explosion		

Sample No.	C16	C17	C18
Status	NF, NE	NF, NE	NF, NE
Sample No.	B11	B12	B13
Status	NF, NE	NF, NE	NF, NE

supplementary information:
- NF: No Fire
- NE: No Explosion
- Fire: the emission of flames from a cell or battery.
- Explosion: failure that occurs when a cell container or battery case opens violently and major components are forcibly expelled.

8.3.4	Thermal abuse (cells)		P
	Fully charged cells were placed in a gravity or circulating air-convention oven. The oven temperature was raised at a rate of 5°C/min ± 2°C/min to a temperature of 130°C ± 2°C. The cell remained at that temperature for 10 minutes before the test was terminated.		
	Results: no fire, no explosion		

After the test (Charging temp. Upper limit 45°C)

Sample No.	C19	C20	C21	C22	C23
Status	NF, NE	NF, NE	NF, NE	NF, NE	NF, NE

After the test (Charging temp. Lower limit -5°C)

Sample No.	C24	C25	C26	C27	C28
Status	NF, NE	NF, NE	NF, NE	NF, NE	NF, NE

supplementary information:
- NF: No Fire
- NE: No Explosion
- Fire: the emission of flames from a cell or battery.
- Explosion: failure that occurs when a cell container or battery case opens violently and major components are forcibly expelled.

IEC 62133: 2012			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
8.3.5	Crush (cells)		P
	Each fully charged cell, charged according to the second procedure at the upper limit charging temperature in 8.1.2, is immediately transferred and crushed between two flat surfaces in an ambient temperature.		P
	Fully charged cells were crushed between two flat surfaces with a hydraulic ram exerting a force of 13 kN ± 1 kN.		P
	The crushing is performed in a manner that will cause the most adverse result.	See below	P
	- Once the maximum force has been applied,		P
	- or an abrupt voltage drop of one-third of the original voltage has been obtained,		N/A
	- or 10 % of deformation has occurred compared to the initial dimension, the force is released (whichever condition occurs first should be the indication that the force should be released).		N/A
	A cylindrical or prismatic cell was crushed with its longitudinal axis parallel to the flat surfaces of the crushing apparatus. Test only the wide side of prismatic cells.		P
	Results: no fire, no explosion.		P

After the test (Charging temp. Upper limit 45°C)

Sample No.	C29	C30	C31	C32	C33
Status	NF, NE	NF, NE	NF, NE	NF, NE	NF, NE

supplementary information:

- NF: No Fire
- NE: No Explosion
- Fire: the emission of flames from a cell or battery.
- Explosion: failure that occurs when a cell container or battery case opens violently and major components are forcibly expelled.

IEC 62133: 2012							
Clause	**Requirement – Test**				**Result - Remark**		**Verdict**
8.3.6	Over-charging of battery						N/A
	The test shall be carried out in an ambient temperature of +20 ° C ± 5 ° C.						N/A
	Each test battery shall be discharged at a constant current of 0,2 I_t A, to a final discharge voltage specified by the manufacturer.						N/A
	A discharged battery was charged from a power supply of 5.0V per cell or not to exceed the maximum voltage supplied by the recommended charger, at a charging current of 2.0 It A. Total Time of Charging: The test shall be continued until the temperature of the outer casing reaches steady state conditions (less than 10 °C change in 30-minute period) or returns to ambient.						N/A
	Results: no fire, no explosion.						N/A
	After the test				No fire, no explosion.		N/A
Sample no.	Model	OCV at start of test (Vdc)	Maximum Charging Current (2.0 It A)	Maximum Charging Voltage (Vdc)	Total Time of Charging (h)	temperature of the outer casing (°C)	Results

supplementary information:
- NF: No Fire
- NE: No Explosion
- Fire: the emission of flames from a cell or battery.
- Explosion: failure that occurs when a cell container or battery case opens violently and major components are forcibly expelled.

Remark: Total time of charging ≤0.1h means the PCB protection in a flash.

IEC 62133: 2012			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**

8.3.7	Forced discharge (cells)				P
	A discharged cell is subjected to a reverse charge at 1 It A for 90 min.				P
	Results: no fire, no explosion				P
Sample no.	Model	OCV before application of reverse charge (Vdc)	Measured Reverse Charge It (A)	Total Time for Reversed Charge Application (Min)	Results
C39	6160100PL	3.33	5.0	90	P
C40	6160100PL	3.31	5.0	90	P
C41	6160100PL	3.28	5.0	90	P
C42	6160100PL	3.33	5.0	90	P
C43	6160100PL	3.34	5.0	90	P

supplementary information:
- NF: No Fire
- NE: No Explosion
- Fire: the emission of flames from a cell or battery.
- Explosion: failure that occurs when a cell container or battery case opens violently and major components are forcibly expelled.

IEC 62133: 2012			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
8.3.8	Transport test		P
	Regulations concerning international transport of lithium ion batteries are based on the UN Recommendations on the Transport of Dangerous Goods. Testing requirements are defined in the UN Manual of Tests & Criteria.	The battery had passed ST/SG/AC.10/11 Rev.5/ Amend.1+Amend.2 Section 38.3 test	P
	Testing laboratory	Shenzhen TCT Testing Technology Co., Ltd.	P
8.3.9	Design evaluation – Forced internal short circuit (cells)		P
	The cells complied with national requirement for:	Only applicable to France, Japan, Korea and Switzerland;	---
	1) Number of samples		P
	This test shall be carried out on five secondary (rechargeable) lithium-ion cells.		P
	2) Charging procedure		P
	i) Conditioning charge and discharge		P
	ii) Storage procedure		P
	iii) Ambient temperature		P
	iv) Charging procedure for forced internal short test		P
	3) Pressing the winding core with nickel particle		P
	No fire.		P

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IEC 62133: 2012			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**

8.3.9	TABLE: Forced internal short circuit (cells)					**P**
Model	Chamber ambient, (°C)	OCV at start of test, (Vdc)	Particle location 1)	Maximum applied pressure, (N)	Voltage drop, (mV)	Results
6160100PL	45	4.21	1	400	1	P
6160100PL	45	4.22	1	400	3	P
6160100PL	45	4.22	1	400	2	P
6160100PL	45	4.23	2	400	3	P
6160100PL	45	4.21	2	400	2	P
6160100PL	10	4.18	1	400	3	P
6160100PL	10	4.16	1	400	2	P
6160100PL	10	4.17	1	400	3	P
6160100PL	10	4.18	2	400	3	P
6160100PL	10	4.15	2	400	1	P

9	**Information for safety**		
	Information is provided to equipment manufacturers in the form of instructions to minimize and mitigate hazards associated with the cells or batteries in accordance with guidelines outlined in informative Annex B.		
	Information is provided to end-users in the form of instructions to minimize and mitigate hazards associated with the batteries in accordance with guidelines outlined in informative Annex C.		

10	**Marking**		
10.1	Cell marking	See below	
	Rechargeable Li or Li-ion	Li-ion	
	Battery designation	Li-ion Cell	
	Polarity of terminal	On the battery	
	Date of manufacture	See labeling	
	Name or identification of the manufacturer or supplier	Shenzhen DZH Battery Co., Ltd.	
	Nominal voltage(V)	3.7V	
	Rated Capacity (mAh)	5000mAh	

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IEC 62133: 2012			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
10.2	Battery marking		N/A
	Rechargeable Li or Li-ion		N/A
	Battery designation		N/A
	Polarity of terminal		N/A
	Date of manufacture		N/A
	Name or identification of the manufacturer or supplier		N/A
	Nominal voltage(V)		N/A
	Rated Capacity (mAh)		N/A
	Caution statement		N/A
10.3	Other information		
	Disposal instructions are marked on the battery or supplied in the information packaged with the battery.	See Specification book	
	Recommended charging instruction are marked on the battery or supplied in the information packaged with the battery.	See Specification book	

11	**Packaging**		
	Cells or batteries were provided with packaging that was adequate to avoid mechanical damage during transport, handling and stacking. The materials and pack design was chosen to prevent the development of unintentional electrical conduction, corrosion of the terminal and ingress of moisture.		

Photos

Model: 6160100PL

Photo 1 Over view

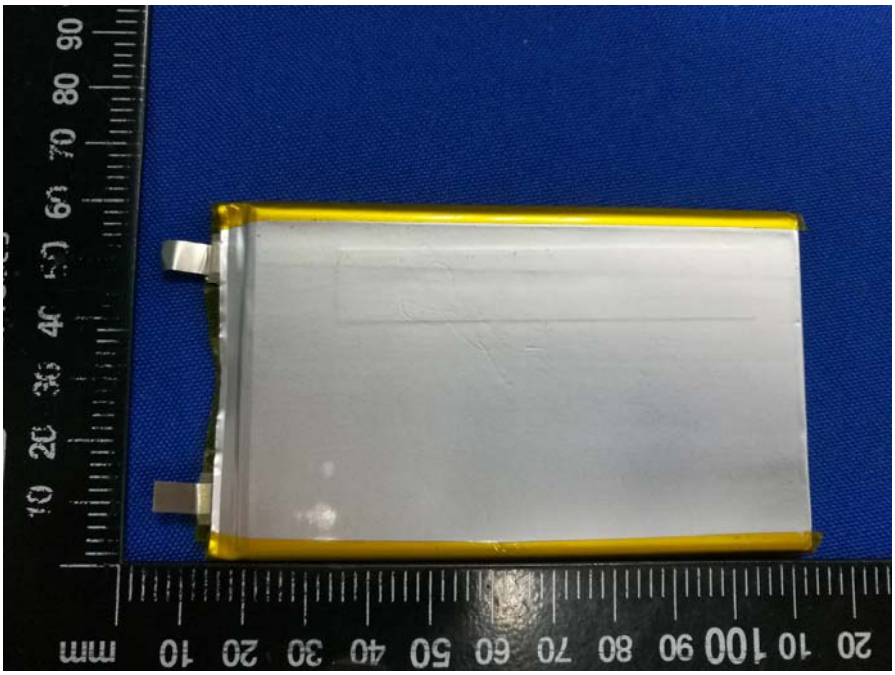

Photo 2 Over view

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