Battery Test Report

Report No.: AGC01085181204TA01

Samples	Li-Polymer Battery
Model	X19
Applicant	Shenzhen Huafurui Technology Co., Ltd.
Issue Date	Dec. 29, 2018

深圳市鑫宇环检测有限公司

Attestation of Global Compliance (Shenzhen) Co., Ltd.

IEC 62133:2012

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.	:	AGC01085181204TA01
Tested by (+ signature)	:	Xu Ren
Reviewed by (+ signature)	:	Xue Jiajia
Approved by (+signature)	:	Matte He
Date of issue	:	Dec. 29, 2018
Contents	:	Total 21 pages.

Testing laboratory

Name	:	Attestation of Global Compliance (Shenzhen) Co., Ltd.
Address	:	2/F., Building 2, No.1-No.4, Chaxi Sanwei Technical Industrial Park, Gushu, Xixiang, Bao'an District, Shenzhen, Guangdong, China
Testing location	:	Same as above.

Applicant

Name	:	Shenzhen Huafurui Technology Co., Ltd.
Address	:	Unit 1401 &1402, 14/F, Jin qi zhi gu mansion (No. 4 building of Chong wen Garden), Crossing of the Liu xian street and Tang ling road, Tao yuan street, Nan shan district, Shenzhen, Guangdong province, China

Manufacturer

Name	:	Zhongshan Tianmao Battery Co., Ltd.
Address	:	No. 208, Qianjin 1st Road, Xinqianjin Village, Tanzhou Town, Zhongshan City

Test specification

Standard	:	IEC 62133:2012
Test procedure	:	Type test
Procedure deviation	:	N/A
Non-standard test method	:	N/A

Test Report Form/blank test report

Test Report Form No.	:	AGC62133B1
Test Report Form(s) Originator	:	AGC
Master TRF	:	Dated 2015-04

Test item	
Product designation	Li-Polymer Battery
Brand name	CUBOT
Test model	X19
Rating(s)	3.8V, 4000mAh, 15.2Wh
Test item particulars	
Classification of installation and use	N/A
Supply connection	DC connector
Recommend charging method declared by the manufacturer	800mA constant current charge to 4.35V, then constant voltage 4.35V charge till charged current declines to 20mA
Discharge current(0.2I_tA)	800mA
Specified final voltage	3.0V
Chemistry	☐ nickel systems ☒ lithium systems
Recommend of charging limit for lithium system	
Upper limit charging voltage per cell	4.35V
Maximum charging current	4000mA
Charging temperature upper limit	45℃
Charging temperature lower limit	0℃
Polymer cell electrolyte type	☐ gel polymer ☐ solid polymer ☒ N/A
Test case verdicts	
Test case does not apply to the test object	N (/A)
Test item does meet the requirement	P (ass)
Test item does not meet the requirement	F (ail)
Testing	
Date of receipt of test item	Jan.02, 2018
Date(s) of performance of test	Jan.02, 2018- Jan.17, 2018
Attachment	
Attachment A	Photos of product

General remarks

This report shall not be reproduced except in full without the written approval of the testing laboratory.
The test results presented in this report relate only to the item tested.
"(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 point is used as the decimal separator.
☒ The product fulfils the requirements of EN62133: 2013.

Report Revise Record:

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Dec. 29, 2018	Valid	Original report

Note: The original test report Ref. A001B20180103080 (dated Jan.17, 2018), changed model, no further testing necessary.

General product information

The main features of the battery are shown as below (clause 8.1.1):

Model	Nominal capacity	Nominal voltage	Nominal Charge Current	Nominal Discharge Current	Maximum Charge Current	Maximum Discharge Current	Maximum Charge Voltage	Cut-off Voltage
X19	4000mAh	3.8V	800mA	800mA	4000mA	4000mA	4.35V	3.0V

The main features of the battery are shown as below (clause 8.1.2):

Model	Upper limit charge voltage	Taper-off Current	Lower charge temperature	Upper charge temperature
X19	4.35V	200mA	0℃	45℃

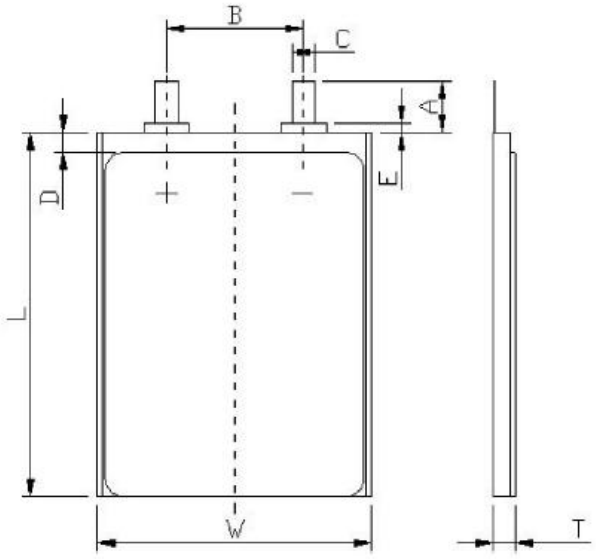
The main features of the cell are shown as below (clause 8.1.1):

Model	Nominal capacity	Nominal voltage	Nominal Charge Current	Nominal Discharge Current	Maximum Charge Current	Maximum Discharge Current	Maximum Charge Voltage	Cut-off Voltage
TMB 436290PPV	4000mAh	3.8V	800mA	800mA	4000mA	4000mA	4.35V	3.0V

The main features of the cell are shown as below (clause 8.1.2):

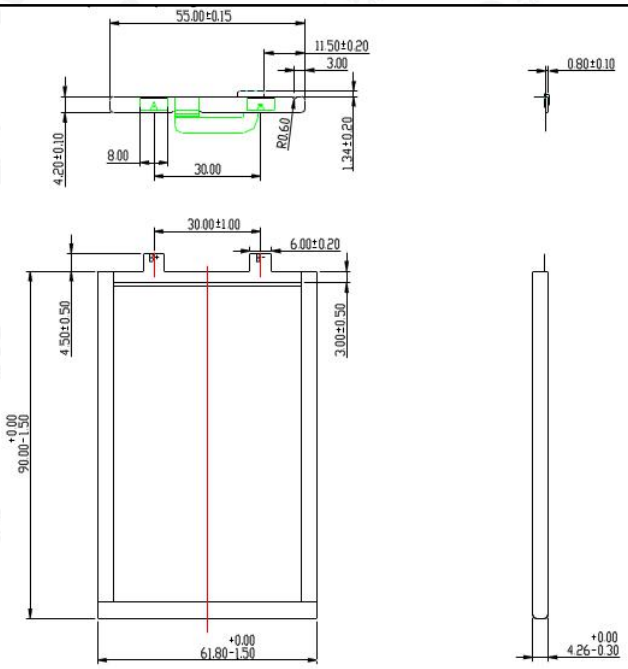
Model	Upper limit charge voltage	Taper-off current	Lower charge temperature	Upper charge temperature
TMB 436290PPV	4.35V	200mA	0℃	45℃

Construction



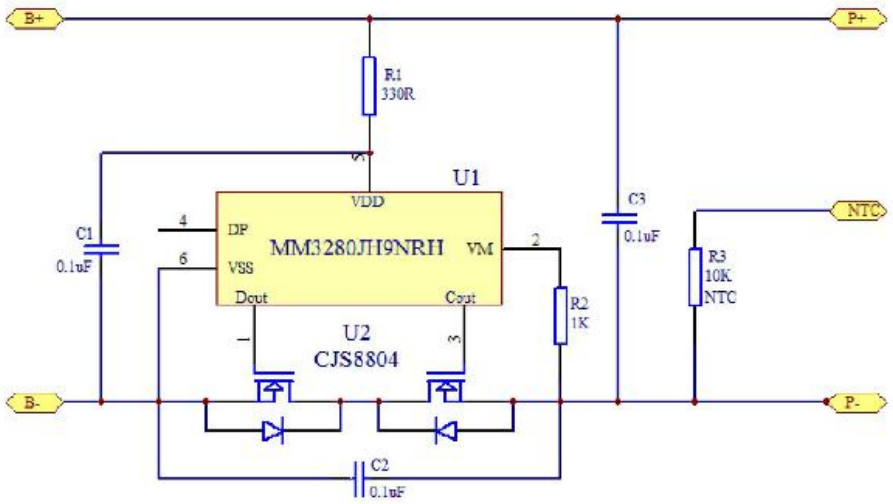
Thickness	4.3mm
Width	61.8mm
Height	90.0mm

Cell



Battery

Circuit diagram



Copy of marking plate

This is reference label, final label should be including the content of it.

+ -
CUBOT
Li-Polymer Battery
X19
3.8V, 4000mAh, 15.2Wh
1ICP5/62/90 Date: YYYY-MM-DD

Remark: YYYYMMDD represents the manufacture date

IEC 62133:2012			
Clause	Requirement – Test	Result – Remark	Verdict
4	**Parameter measurement tolerances**		**P**
	Parameter measurement tolerances	Comply with relevant requirements.	P

5	**General safety considerations**		P
5.1	General		P
5.2	Insulation and wiring		P
	The insulation resistance between the positive terminal and externally exposed metal surfaces of the battery (excluding electrical contact surfaces) is not less than 5 MΩ	Not metal case exists.	N
	Insulation resistance (MΩ) ..... :		—
	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		P
	Mechanical integrity of internal connections accommodates 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	Venting mechanism exists on the narrow side of pouch cell.	P
	Encapsulation used to support cells within an outer casing does not cause the battery to overheat during normal operation nor inhibit pressure relief		N
5.4	Temperature/voltage/current management		P
	Batteries are designed such that abnormal temperature rise conditions are prevented	Overcharge, over discharge,over current and short-circuit proof circuit used in this battery. See tests of clause 8.	P
	Batteries are designed to be within temperature, voltage and current limits specified by the cell manufacturer	See above.	P
	Batteries are 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	The charging limits specified in the user manual.	P
5.5	Terminal contacts		P
	Terminals have a clear polarity marking on the external surface of the battery	DC connector used.	P
	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

IEC 62133:2012			
Clause	Requirement – Test	Result – Remark	Verdict
	Terminal contacts are arranged to minimize the risk of short circuits		P
5.6	Assembly of cells into batteries		P
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	Single cell battery.	N
	Each battery has an independent control and protection		N
	Manufacturers of cells make recommendations about current, voltage and temperature limits so that the battery manufacturer/designer may ensure proper design and assembly		N
	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
	Protective circuit components are added as appropriate and consideration given to the end-device application		N
	When testing a battery, the manufacturer of the battery provides a test report confirming the compliance according to this standard		N
5.6.2	Design recommendation for lithium systems 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; or		N
	- Charging voltage of the cell does not exceed the different upper limit of the charging voltage determined through Clause 8.1.2, NOTE 1.	Charging voltage:4.35V, not exceed 4.35V specified in clause 8.1.2, NOTE 1.	P
	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; or	Single cell battery.	N
	- 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
	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; or		N
	- 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		N

IEC 62133:2012			
Clause	Requirement – Test	Result – Remark	Verdict
	or single cellblocks by measuring the voltage of every single cell or the single cellblocks		
5.7	Quality plan		P
	The manufacturer prepares and implements a quality plan that defines procedures for the inspection of materials, components, cells and batteries and which covers the whole process of producing each type of cell or battery	Complied. Quality plan provided.	P

6	**Type test conditions**		**P**
	Tests were made with the number of cells or batteries specified in Table 1 for nickel-cadmium and nickel-metal hydride systems and Table 2 for lithium systems, using cells or batteries that are not more than six months old	Complied. Lithium system.	P
	Unless noted otherwise in the test methods, testing was conducted in an ambient of 20℃±5℃	Tests are carried out at 20°C± 5°C.	P

7	**Specific requirements and tests (nickel systems)**		**N**
7.1	Charging procedure for test purposes	Not applicable for Lithium system.	N
7.2	Intended use		N
7.2.1	Continuous low-rate charging (cells)		N
	Results: No fire. No explosion		N
7.2.2	Vibration		N
	Results: No fire. No explosion. No leakage		N
7.2.3	Moulded case stress at high ambient temperature (batteries)		N
	Oven temperature (℃)		N
	Results: No physical distortion of the battery casing resulting in exposure if internal components		N
7.2.4	Temperature cycling		N
	Results: No fire. No explosion. No leakage		N
7.3	Reasonably foreseeable misuse		N
7.3.1	Incorrect installation (cells)		N
	The test was carried out using: - Four fully charged cells of the same brand, type, size and age connected in series, with one of them reversed; or		N
	- A stabilized dc power supply.		N
	Results: No fire. No explosion		N
7.3.2	External short circuit		N
	The cells or batteries were tested until one of the following occurred: - 24 hours elapsed; or		N
	- The case temperature declined by 20% of the maximum temperature rise		N

IEC 62133:2012			
Clause	Requirement – Test	Result – Remark	Verdict
	Results: No fire. No explosion		N
7.3.3	Free fall		N
	Results: No fire. No explosion		N
7.3.4	Mechanical shock (crash hazard)		N
	Results: No fire. No explosion. No leakage.		N
7.3.5	Thermal abuse (cells)		N
	Oven temperature (℃) ..... :		—
	Results: No fire. No explosion.		N
7.3.6	Crushing of cells		N
	The crushing force was released upon: - The maximum force of 13 kN ±1 kN has been applied; or		N
	- An abrupt voltage drop of one-third of the original voltage has been obtained		N
	The cell is prismatic type and a second set of samples was tested, rotated 90° around longitudinal axis compared to the first set		N
	Results: No fire. No explosion		N
7.3.7	Low pressure (cells)		N
	Chamber pressure (kPa) ..... :		—
	Results: No fire. No explosion. No leakage.		N
7.3.8	Overcharge		N
	Results: No fire. No explosion.		N
7.3.9	Forced discharge (cells)		N
	Results: No fire. No explosion.		N

8	**Specific requirements and tests (lithium systems)**		**P**
8.1	Charging procedures for test purposes		P
8.1.1	First procedure: This charging procedure applied to tests other than those specified in 8.1.2		P
8.1.2	Second procedure: This charging procedure applied to the tests of 8.3.1, 8.3.2, 8.3.4, 8.3.5, and 8.3.9		P
	If a cell's specified upper and/or lower charging temperature exceeds values for the upper and/or lower limit test temperatures of Table 4, the cells were charged at the specified values plus 5℃ for the upper limit and minus 5℃ for the lower limit	Charge temperature range 0-45℃ declared. -5℃ used for the lower limit. 45℃ used for the upper limit.	P
	A valid rationale was provided to ensure the safety of the cell (see Figure A.1) ..... :		P
	For a different upper limit charging voltage (i.e. other than for lithium cobalt oxide systems at 4.25 V), the applied upper limit charging voltage and upper limit	4.35V applied.	P

IEC 62133:2012			
Clause	Requirement – Test	Result – Remark	Verdict
	charging temperatures were adjusted accordingly		
	A valid rationale was provided to ensure the safety of the cell (see Figure A.1) ..... :		P
8.2	Intended use		P
8.2.1	Continuous charging at constant voltage (cells)	Tested complied.	P
	Results: No fire. No explosion	(See Table 8.2.1)	P
8.2.2	Moulded case stress at high ambient temperature (battery)	No moulded case exists.	N
	Oven temperature (℃) ..... :		—
	Results: No physical distortion of the battery casing resulting in exposure if internal components		N
8.3	Reasonably foreseeable misuse		P
8.3.1	External short circuit (cell)		P
	The cells were tested until one of the following occurred: - 24 hours elapsed; or		N
	- The case temperature declined by 20% of the maximum temperature rise		P
	Results: No fire. No explosion	(See Table 8.3.1)	P
8.3.2	External short circuit (battery)		P
	The cells were tested until one of the following occurred: - 24 hours elapsed; or		P
	- The case temperature declined by 20% of the maximum temperature rise		N
	In case of rapid decline in short circuit current, the battery pack remained on test for an additional one hour after the current reached a low end steady state condition		N
	Results: No fire. No explosion	(See Table 8.3.2)	P
8.3.3	Free fall		P
	Results: No fire. No explosion.	No fire. No explosion.	P
8.3.4	Thermal abuse (cells)		P
	The cells were held at 130±2℃ for: - 10 minutes; or	Tested complied.	P
	- 30 minutes for large cells (gross mass of more than 500 g as defined in IEC 62281)		N
	Oven temperature (℃) ..... :	130℃	—
	Gross mass of cell (g)..... :	<500g, small cell.	—
	Results: No fire. No explosion.	No fire. No explosion.	P
8.3.5	Crush (cells)		P
	The crushing force was released upon: - The maximum force of 13 kN±1 kN has been applied; or	Tested complied.	P
	- An abrupt voltage drop of one-third of the original voltage has been obtained; or		N
	- 10% of deformation has occurred compared to the initial dimension		N

IEC 62133:2012			
Clause	Requirement – Test	Result – Remark	Verdict
	Results: No fire. No explosion.	(See Table 8.3.5)	P
8.3.6	Over-charging of battery		P
	Test was continued until the temperature of the outer casing: - Reached steady state conditions (less than 10℃ change in 30-minute period); or		N
	Returned to ambient		P
	Results: No fire. No explosion	(See Table 8.3.6)	P
8.3.7	Forced discharge (cells)		P
	Results: No fire. No explosion	(See Table 8.3.7)	P
8.3.8	Transport tests		N
	Manufacturer's documentation provided to show compliance with UN Recommendations on Transport of Dangerous Goods		N
8.3.9	Design evaluation – Forced internal short circuit (cells)		N
	The cells complied with national requirement for :		—
	The pressing was stopped upon: - A voltage drop of 50 mV has been detected; or		N
	- The pressing force of 800 N (cylindrical cells) or 400 N (prismatic cells) has been reached		N
	Results: No fire		N

9	**Information for safety**		**P**
	The manufacturer of secondary cells ensures that information is provided about current, voltage and temperature limits of their products.	Cell specifications provided.	P
	The manufacturer of batteries ensures that equipment manufacturers and, in the case of direct sales, end-users are provided with information to minimize and mitigate hazards.	Battery pack specifications provided.	P
	Systems analyses performed by device manufacturers to ensure that a particular battery design prevents hazards from occurring during use of a product		N
	As appropriate, information relating to hazard avoidance resulting from a system analysis is provided to the end user ..... :		N

10	**Marking**		**P**
10.1	Cell marking		N
	Cells marked as specified in the applicable cell standards: IEC 61951-1, IEC 61951-2 or IEC 61960.	The final product is battery.	N
10.2	Battery marking		P
	Batteries marked in accordance with the requirements for	See marking plate on page 5.	P

IEC 62133:2012			
Clause	Requirement – Test	Result – Remark	Verdict
	the cells from which they are assembled.		
	Batteries marked with an appropriate caution statement.		P
10.3	Other information		P
	Storage and disposal instructions marked on or supplied with the battery.	Information for disposal instructions mentioned in manufacturer's specifications.	P
	Recommended charging instructions marked on or supplied with the battery.	Information for recommended charging instructions mentioned in manufacturer's specifications.	P

11	**Packaging**		**P**
	The materials and packaging design are chosen so as to prevent the development of unintentional electrical conduction, corrosion of the terminals and ingress of environmental contaminants.	Adequate package method provided to prevent the development of unintentional electrical conduction, corrosion of the terminals and ingress of environmental contaminants.	P

Annex A	**Charging range of secondary lithium ion cells for safe use**		**P**
A.1	General		P
A.2	Safety of lithium-ion secondary battery	Complied.	P
A.3	Consideration on charging voltage	Complied.	P
A.3.1	General	Charging voltage is 4.35V	P
A.3.2	Upper limit charging voltage	4.35V	P
A.3.2.1	General		P
A.3.2.2	Explanation of safety viewpoint	4.35V applied.	P
A.3.2.3	Safety requirements, when different upper limit charging voltage is applied		P
A.4	Consideration of temperature and charging current		P
A.4.1	General		P
A.4.2	Recommended temperature range		P
A.4.2.1	General		P
A.4.2.2	Safety consideration when a different recommended temperature range is applied	Charging temperature declared by client is: 0-45℃.	P
A.4.3	High temperature range	Not higher than the temperature range specified in this standard.	N
A.4.3.1	General		N
A.4.3.2	Explanation of safety viewpoint		N
A.4.3.3	Safety considerations when specifying charging conditions in high temperature range		N
A4.3.4	Safety consideration when specifying new upper limit in high temperature range		N

IEC 62133:2012			
Clause	Requirement – Test	Result – Remark	Verdict
A.4.4	Low temperature range	Charging low temperature declared by client is: 0℃.	P
A.4.4.1	General		P
A.4.4.2	Explanation of safety viewpoint		P
A.4.4.3	Safety considerations, when specifying charging conditions in low temperature range		P
A.4.4.4	Safety considerations when specifying a new lower limit in the low temperature range	-5℃ applied.	P
A.4.5	Scope of the application of charging current		P
A.5	Sample preparation		N
A.5.1	General		N
A.5.2	Insertion procedure for nickel particle to generate internal short		N
	The insertion procedure carried out at 20℃±5℃ and under -25 ℃ of dew point		N
A.5.3	Disassembly of charged cell		N
A.5.4	Shape of nickel particle		N
A.5.5	Insertion of nickel particle to cylindrical cell		N
A.5.5.1	Insertion of nickel particle to winding core		N
A.5.5.2	Mark the position of nickel particle on the both end of winding core of the separator		N
A.5.6	Insertion of nickel particle to prismatic cell		N

	Table: Critical components information				P
Object/part no.	Manufacturer/ trademark	Type/model	Technical data	Standard	Mark(s) of conformity
PCB	SHEN ZHEN JIRUIDA CIRCUIT TECHNOLOGY CO LTD	JRD-S	V-0, 130°C	--	--
IC	MITSUMI ELECTRIC CO.,LTD	MM3280JH9NRH	VDD: -0.3-12.0V	--	--
IC (Alternative)	Neotec Semiconductor Ltd.	NT1713C–NKAA6	VDD: -0.3--7V; Vdet1: 4.40-4.45V; Vdet2: 2.465-2.535V;	--	--
MOSFET	Panasonic Electronic Technology Co., Ltd	CJS8804	Vdss:20V,Id:7A	--	--
MOSFET (Alternative)	Silikron Semiconductor Co., Ltd	SSF2810EH2	Vdss:20V,Id:8A	--	--
Cell	Zhongshan Tianmao Battery Co., Ltd.	TMB436290PPV	3.8 Vd.c., 4000mAh	--	--
Electrolyte	Shenzhen Capchem Technology Co., Ltd	LBC3045Q19	$LiPF_6$/Dimethyl carbonate /Ethyl acetate /Ethylene carbonate	--	--
Separator	Shenzhen xu ran Electronic Co., Ltd	13μm（7+6）	PE/Al_2O_3 & PVDFtwo layers,	--	--
Positive electrode	Hunan Shanshan new materials Co. Ltd.	LC800D	$LiCoO_2$	--	--
Negative electrode	Jiangxi Zichen Technology Co. Ltd.	G49	Graphite	--	--
Aluminum plastic film	DNP	D—EL40H	113μm:Nylon, Aluminium, CPP	--	--
Supplementary information:—					

7.2.1	Table: Continuous low rate charge (cells)				N
Sample No.	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
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Supplementary information: --					

7.2.2	Table: Vibration	N
Sample No.	OCV at start of test, (Vdc)	Results
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Supplementary information:--		

7.3.1	Table: Incorrect installation(cells)	N
Sample No.	OCV at start of test, (Vdc)	Results
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Supplementary information:--		

7.3.2	Table: External short circuits				N
Sample No.	Ambient (at 20±5℃ or 55± 5℃)	OCV at start of test, (Vdc)	Resistance of circuit, (Ω)	Maximum case temperature rise △T, (℃)	Results
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Supplementary information:--					

7.3.6	Table: Crush		N
Sample No.	OCV at start of test, (Vdc)	OCV at removal of crushing force, (Vdc)	Results
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Supplementary information:--			

7.3.8	Table: Overcharge			N
Sample No.	OCV prior to charging, (Vdc)	Maximum charge current, (A)	Time for charging, (hours)	Results
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Supplementary information:--				

7.3.9	Table: Forced discharge (cells)			N
Sample No.	OCV before application of reverse charge, (Vdc)	Measured reverse charge It, (A)	Time for reversed charge, (minutes)	Results
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--	--	--	--	--
Supplementary information:--				

8.2.1	Table: Continuous charging at constant voltage (cells)			P
Sample No.	Recommended charging voltage Vc, (Vdc)	Recommended charging current Irec, (A)	OCV at start of test, (Vdc)	Results
C1	4.35	0.8	4.32	P
C2	4.35	0.8	4.31	P
C3	4.35	0.8	4.31	P
C4	4.35	0.8	4.32	P
C5	4.35	0.8	4.32	P
Supplementary information:No fire or explosion, No leakage				

8.3.1	Table: External short circuit (cells)				P
Sample No.	Ambient (℃)	OCV at start of test, (Vdc)	Resistance of circuit, (Ω)	Maximum case temperature ~~rise~~ —△T, (℃)	Results
Samples charged at charging temperature upper limit 45℃					
C6	24.2	4.32	0.08	102.5	P
C7	24.2	4.32	0.08	104.1	P
C8	24.2	4.31	0.08	100.2	P
C9	24.2	4.31	0.08	98.7	P
C10	24.2	4.32	0.08	103.5	P
Samples charged at charging temperature lower limit -5℃					
C11	24.3	4.25	0.08	101.7	P
C12	24.3	4.26	0.08	103.2	P
C13	24.3	4.26	0.08	103.5	P
C14	24.3	4.25	0.08	100.0	P
C15	24.3	4.25	0.08	99.3	P
Supplementary information:No fire , no explosion					

8.3.2	Table: External short circuit (battery)				P
Sample No.	Ambient (℃)	OCV at start of test, (Vdc)	Resistance of circuit, (Ω)	Maximum case temperature ~~rise~~ —△T, (℃)	Results
Samples charged at charging temperature upper limit 45℃					
B1	55.1	4.32	0.08	0.2	P
B2	55.1	4.32	0.08	0.3	P
B3	55.1	4.31	0.08	0.2	P
B4	55.1	4.31	0.08	0.2	P
B5	55.1	4.32	0.08	0.2	P

Samples charged at charging temperature lower limit -5℃					
B6	55.3	4.25	0.08	0.2	P
B7	55.3	4.26	0.08	0.1	P
B8	55.3	4.26	0.08	0.2	P
B9	55.3	4.25	0.08	0.2	P
B10	55.3	4.25	0.08	0.2	P
Supplementary information:No fire , no explosion					

8.3.5	Table: Crush(cells)				P
Sample No.	OCV at start of test, (Vdc)	OCV at removal of crushing force, (Vdc)	Width/ diameter of cell before crush, (mm)	Required deformation for crush, (mm)	Results
Samples charged at charging temperature upper limit 45℃					
C31	4.32	4.32	--	--	P
C32	4.31	4.31	--	--	P
C33	4.31	4.31	--	--	P
C34	4.32	4.32	--	--	P
C35	4.32	4.31	--	--	P
Samples charged at charging temperature lower limit -5℃					
C36	4.26	4.26	--	--	P
C37	4.25	4.25	--	--	P
C38	4.25	4.25	--	--	P
C39	4.26	4.25	--	--	P
C40	4.25	4.25	--	--	P
Supplementary information:A 13kN force applied at the wide side of prismatic cells.No voltage abrupt drop occurred. No fire , no explosion					

8.3.6	Table: Over-charging of battery			P
Constant charging current (A)..... :		8A		--
Supply voltage (Vdc)..... :		5V		--
Sample No.	OCV before charging, (Vdc)	Resistance of circuit, (Ω)	Maximum outer casing temperature, (℃)	Results
B11	3.35	--	24.2	P
B12	3.35	--	24.3	P
B13	3.37	--	24.3	P
B14	3.36	--	24.2	P
B15	3.36	--	24.3	P
Supplementary information:No fire , no explosion				

8.3.7	Table: Forced discharge (cells)			P
Sample No.	OCV before application of reverse charge, (Vdc)	Measured Reverse charge It, (A)	Time for reversed charge, (minutes)	Results
C26	3.36	4	90	P
C27	3.35	4	90	P
C28	3.35	4	90	P
C29	3.37	4	90	P
C30	3.36	4	90	P
Supplementary information:No fire , no explosion				

8.3.9	Table: Forced internal short circuit (cells)					N
Sample No.	Chamber ambient（℃）	OCV at start of test, (Vdc)	Particle location[1)]	Maximum applied pressure, (N)	Voltage drop，(mV)	Results
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Supplementary information: --						

Attachment A
Photos of product

Fig. 1 – View of battery

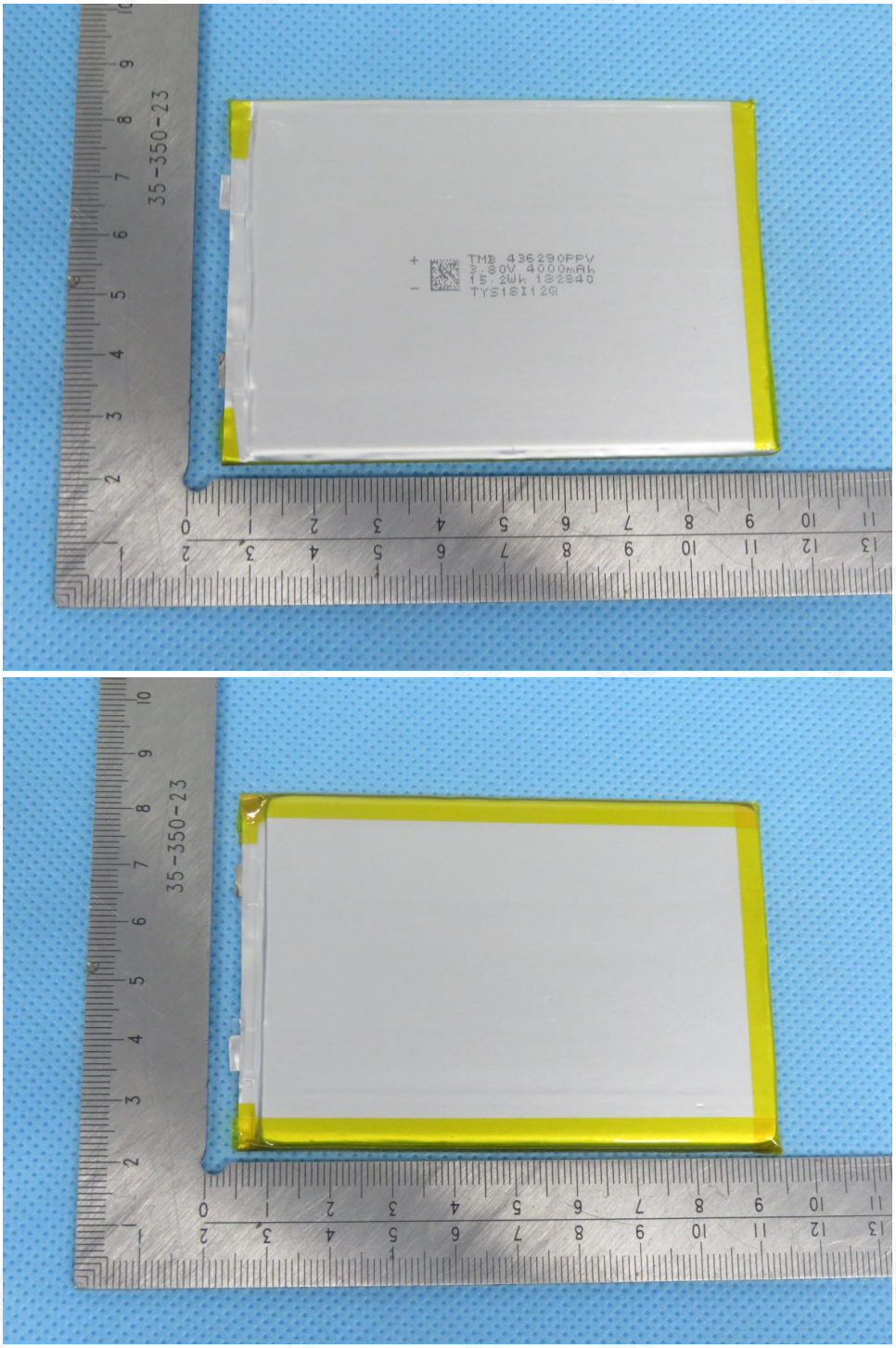

Fig. 2－View of cell

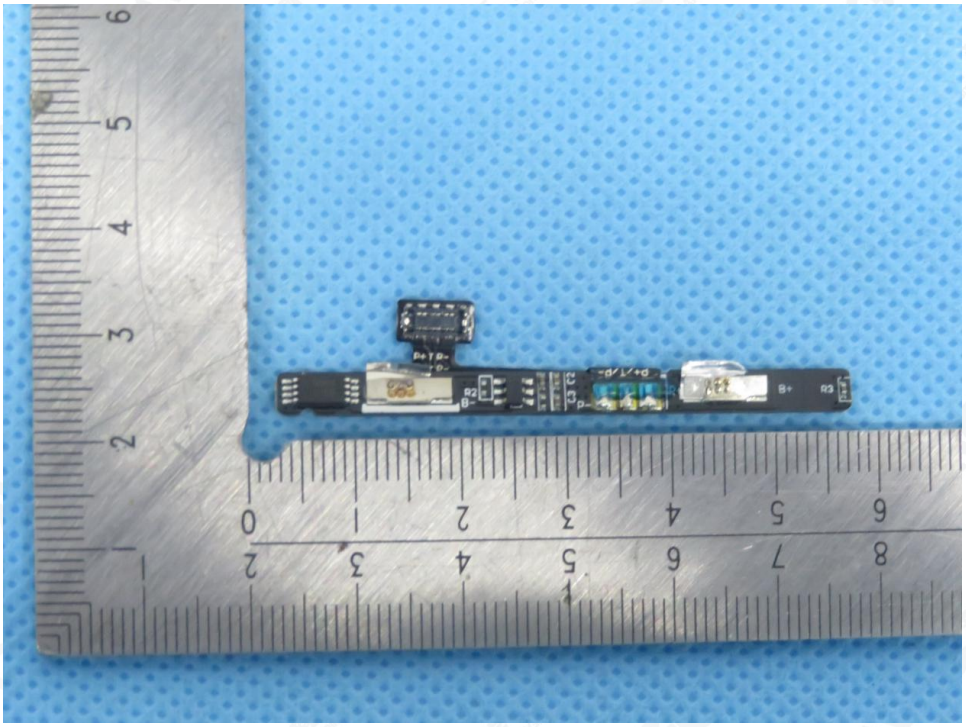

Fig. 3－View of PCB

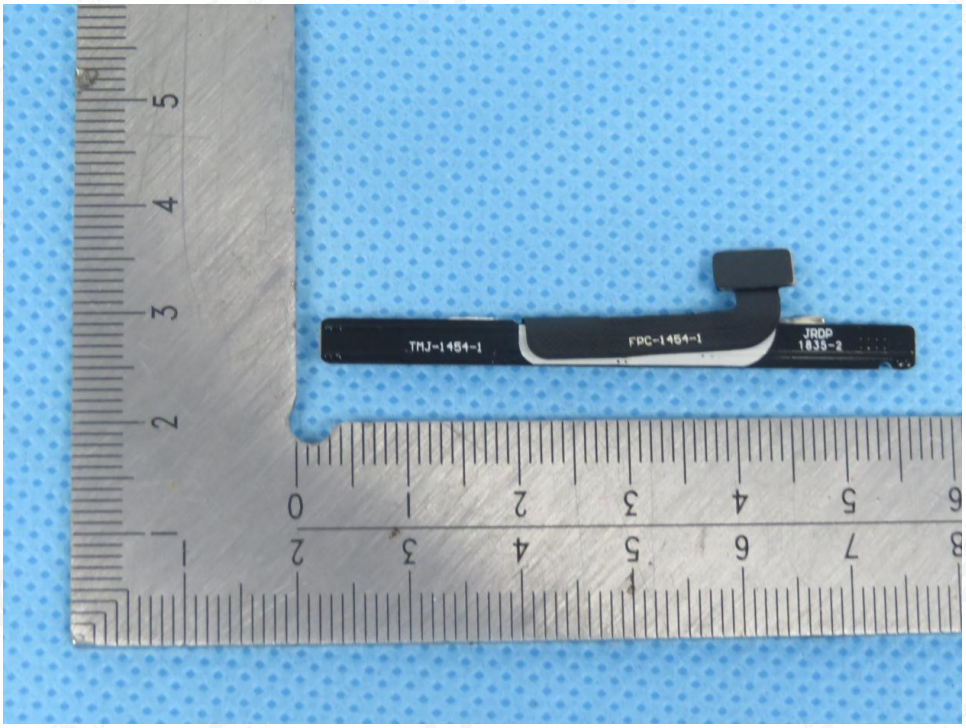

Fig. 4－View of PCB

Test Equipment

No	Name	Model specifications	Device Number	Calibration validity	Using (√)
1	Data Acquisition Instrument	34970A	AGC-BT-E076	2019-11-20	√
2	Battery Testing System	CT-4008-5V6A-S1	AGC-BT-E063	2019-12-04	√
3	Battery Short-circuit Temperature Control Box	XB-OTS-T1	AGC-BT-E010	2019-01-15	√
4	Battery Extrusion Testing Machine	XB-658	AGC-BT-E011	2019-01-15	√
5	Drop Test Machine	XB-OTS-220A	AGC-BT-E013	2019-01-15	√
6	Battery Short Circuit Testing Machine	XB-OTS-Y3	AGC-BT-E009	2019-01-15	√
7	DC Power Supply	PSW30-36	AGC-BT-E045	2019-12-03	√
8	DC Power Supply	PSW30-36	AGC-BT-E046	2019-12-03	√
9	DC Power Supply	TPR-6410D	AGC-BT-E054	2019-12-03	√
10	DC Power Supply	TPR-6410D	AGC-BT-E055	2019-12-03	√
11	DC Power Supply	TPR-6410D	AGC-BT-E056	2019-12-03	√

----END OF REPORT----