TEST REPORT
IEC 62133-2
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 – Part 2: Lithium systems

Report reference No. .....:	ZKS201100378-1
Tested by (name+ signature) .....:	Jacky Sun
Compiled by (name+ signature) .....:	Naia Ni
Approved by (name+ signature) .....:	Ailis Ma
Date of issue .....:	2020-12-10
Total number of pages .....:	26 Pages.
Name of Testing Laboratory preparing the Report .....:	Dongguan ZRLK Testing Technology Co., Ltd.
Applicant's name .....:	Ropla Elektronik sp. z o.o
Address .....:	ul. Wrocławska 1C, 52-200 Suchy Dwór, Poland
Manufacturer's name .....:	Ropla Elektronik sp. z o.o
Address .....:	ul. Wrocławska 1C, 52-200 Suchy Dwór, Poland
Test specification .....:	
Standard.....:	IEC 62133-2:2017
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 Dongguan ZRLK Testing Technology Co., Ltd.

Test item description .....:	Lithium Polymer Battery
Trade Mark .....:	N/A
Model/type reference .....:	LP503040
Ratings .....:	3.7V, 560mAh, 2.072Wh

Particulars: test item vs. test requirements

Classification of installation and use ..... : To be defined in final product

Supply connection ..... : DC connector

Discharge current (0,2 It A) ..... : 112mA

Upper limit charging voltage per cell..... : 4.25V

Charging temperature upper limit..... : 60°C

Charging temperature lower limit..... : 0°C

Shape of Cell ..... :
- ☐ Prismatic
- ☒ Pouch
- ☐ Coin/button
- ☐ Cylindrical

Polymer cell electrolyte type..... :
- ☐ gel polymer
- ☐ solid polymer
- ☒ Other

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 ..... : 2020-11-10

Date(s) of performance of test ..... : 2020-11-10 to 2020-11-30

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,
This report shall not be reproduced except in full without the written approval of the testing laboratory,
Clause numbers between brackets refer to clauses in IEC 62133-2:2017 (Optional remark).

Name and address of factory (ies) ..... : Ropla Elektronik sp. z o.o
ul. Wrocławska 1C, 52-200 Suchy Dwór, Poland

General product information:

The Lithium Polymer Battery is constructed with one Lithium Polymer Cell, and has overcharge, over-discharge, over current and short-circuits protection circuit.

The cells 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	Lithium Polymer Cell	Lithium Polymer Battery
Model No.	503040	LP503040
Nominal voltage	3.7V	3.7V
Rated capacity	560mAh	560mAh

Recommend charging method declared by the manufacturer	Charging the cell with 0.2C (112mA) constant current, 4.2V constant voltage until current reaches 0.01C (5.6mA)	Charging the battery with 0.2C (112mA) constant current, 4.2V constant voltage until current reaches 0.01C (5.6mA)
Maximum charging current	280mA	280mA
Maximum discharge current	560mA	560mA
Maximum charging voltage	4.25V	4.25V
Specified final voltage	3.0V	3.0V

Summary of testing:

Tests Performed (name of test and test clause):

Tests are made with the number of samples specified in Table 1 of IEC 62133-2:2017.

Test items:

cl.5.6.2 Design recommendation;

cl.7.1 Charging procedure for test purposes (for cells and battery);

cl.7.2.1 Continuous charging at constant voltage (cells);

cl.7.3.1 External short-circuit (cell);

cl.7.3.2 External short-circuit (battery);

cl.7.3.3 Free fall (cell and battery);

cl.7.3.4 Thermal abuse (cells);

cl.7.3.5 Crush (cells);

cl.7.3.6 Over-charging of battery;

cl.7.3.7 Forced discharge (cells);

cl.7.3.8 Mechanical tests (batteries)

cl.7.3.9 Design evaluation – Forced internal short-circuit (cells).

The electrolyte type of this cell doesn't belong to polymer, and the additional test cl.7.3.9 was carried out to evaluate the cell.

☒ **The product fulfils the requirements of <u>EN62133-2: 2017</u>**

Testing location:

Dongguan ZRLK Testing Technology Co., Ltd.

Building D, No.2, Jinyuyuan Mansion, No. 18, Industrial West Road, Songshan Lake High-tech Industrial Development Zone, Dongguan, Guangdong, China

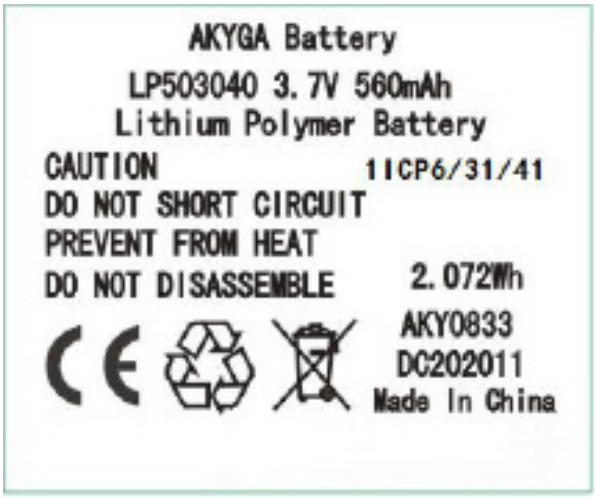
Test conclusion:

The Lithium Polymer Battery submitted by Ropla Elektronik sp. z o.o are tested according to IEC 62133-2 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.

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.



Battery Label

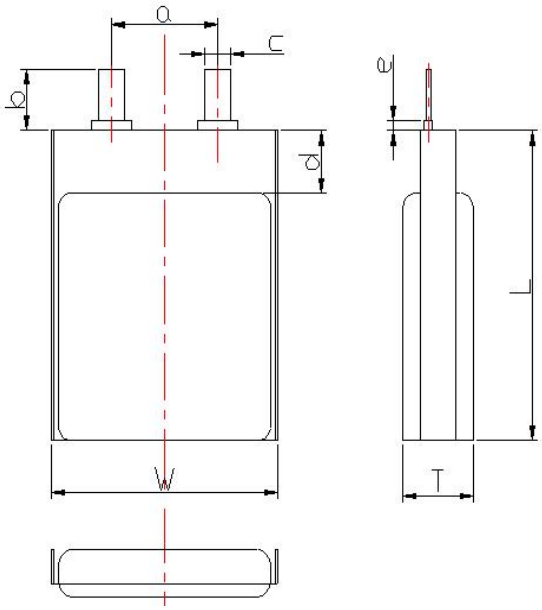
Caution:

1. Keep small cells and batteries which are considered swallowable out of the reach of children
2. Swallowing may lead to burns, perforation of soft tissue, and death. Severe burns can occur within 2 h of ingestion
3. In case of ingestion of a cell or battery, seek medical assistance promptly

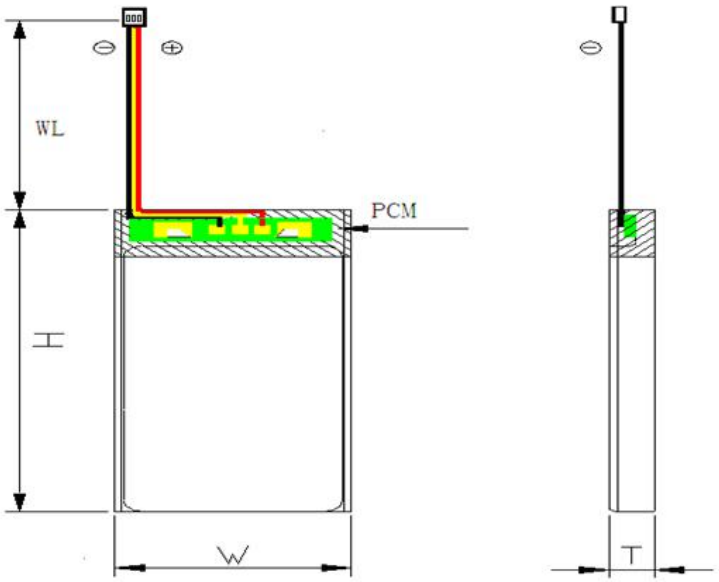
Caution Label

Remark: 1. DC202011 is the code number. “202011” represents the date of manufacture, “2020” represents the year, “11” represents the month.
2. Caution label will be placed on the immediate package.

Construction:

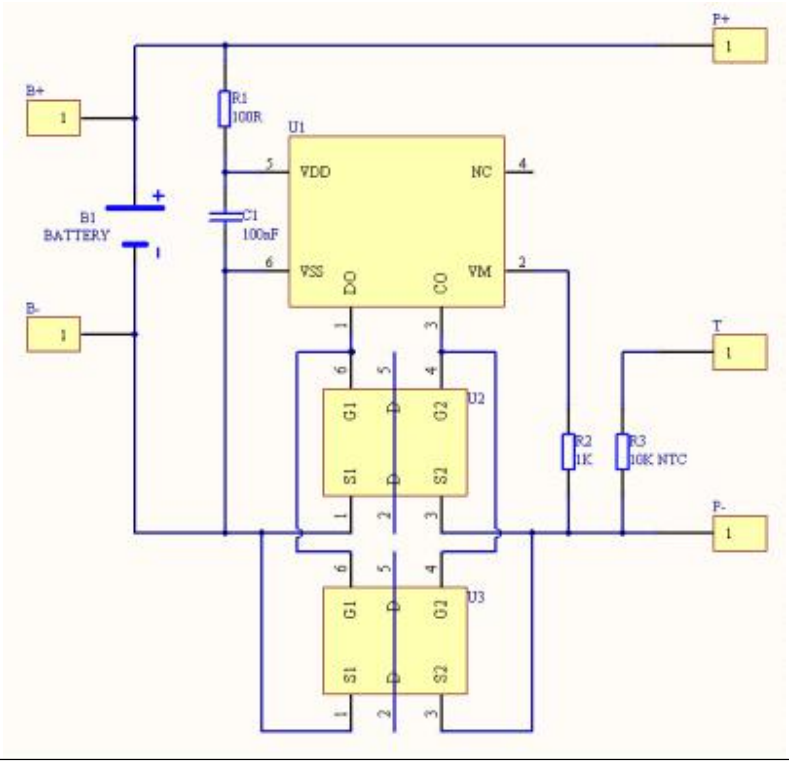


T*W*L=5.5(max)*31.0(max)*40.5(max)
Cell (Unit: mm)



T*W*H=5.5(max)*31.0(max)*42.5(max)
Battery (Unit: mm)

Circuit diagram:



IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

4	**PARAMETER MEASUREMENT TOLERANCES**		P
	Parameter measurement tolerances		P

5	**GENERAL SAFETY CONSIDERATIONS**		P
5.1	**General**		P
	Cells and batteries so designed and constructed that they are safe under conditions of both intended use and reasonably foreseeable misuse		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	No metal surface exists.	N/A
	Insulation resistance (MΩ)..... :		—
	Internal wiring and insulation are sufficient to withstand maximum anticipated current, voltage and temperature requirements		P
	Orientation of wiring maintains adequate clearance and creepage 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/A
5.4	**Temperature, voltage and 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 7.	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 specified 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
	The size and shape of the terminal contacts ensure that they can carry the maximum anticipated current	DC connector complied with the requirements.	P

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	External terminal contact surfaces are formed from conductive materials with good mechanical strength and corrosion resistance	DC connector complied with the requirements.	P
	Terminal contacts are arranged to minimize the risk of short-circuit		P
5.6	**Assembly of cells into batteries**		P
5.6.1	General		P
	Each battery have an independent control and protection for current, voltage, temperature and any other parameter required for safety and to maintain the cells within their operating region	Protective circuit equipped on battery.	P
	This protection may be provided external to the battery such as within the charger or the end devices		N/A
	If protection is external to the battery, the manufacturer of the battery provide this safety relevant information to the external device manufacturer for implementation		N/A
	If there is more than one battery housed in a single battery case, each battery have protective circuitry that can maintain the cells within their operating regions		N/A
	Manufacturers of cells specify current, voltage and temperature limits so that the battery manufacturer/designer may ensure proper design and assembly	Current, voltage and temperature limits specified by cell manufacturer.	P
	Batteries that are designed for the selective discharge of a portion of their series connected cells incorporate circuitry to prevent operation of cells outside the limits specified by the cell manufacturer		N/A
	Protective circuit components added as appropriate and consideration given to the end-device application		P
	The manufacturer of the battery provide a safety analysis of the battery safety circuitry with a test report including a fault analysis of the protection circuit under both charging and discharging conditions confirming the compliance	Safety analysis report provided by manufacturer.	P
5.6.2	Design recommendation		P
	For the battery consisting of a single cell or a single cellblock, it is recommended that the charging voltage of the cell does not exceed the upper limit of the charging voltage specified in Table 2	Charging voltage of cell: 4.25V, not exceed 4.25V specified in Clause 7.1.2, Table 2.	P

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks, it is recommended that the voltages of any one of the single cells or single cellblocks does not exceed the upper limit of the charging voltage, specified in Table 2, 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, it is recommended that charging is stopped when the upper limit of the charging voltage 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
	For batteries consisting of series-connected cells or cell blocks, nominal charge voltage not be counted as an overcharge protection		N/A
	For batteries consisting of series-connected cells or cell blocks, cells have closely matched capacities, be of the same design, be of the same chemistry and be from the same manufacturer		N/A
	It is recommended that the cells and cell blocks not discharged beyond the cell manufacturer's specified final voltage	Final voltage of battery: 3.0V, not exceed the final voltage specified by cell manufacturer.	P
	For batteries consisting of series-connected cells or cell blocks, cell balancing circuitry incorporated into the battery management system		N/A
5.6.3	Mechanical protection for cells and components of batteries		P
	Mechanical protection for cells, cell connections and control circuits within the battery provided to prevent damage as a result of intended use and reasonably foreseeable misuse	Mechanical protection for cell connections and control circuits provided.	P
	The mechanical protection can be provided by the battery case or it can be provided by the end product enclosure for those batteries intended for building into an end product	Build-in batteries, mechanical protection for cells should be provided by end product.	N/A
	The battery case and compartments housing cells designed to accommodate cell dimensional tolerances during charging and discharging as recommended by the cell manufacturer	To be evaluated in final system.	N/A
	For batteries intended for building into a portable end product, testing with the battery installed within the end product considered when conducting mechanical tests		N/A
5.7	**Quality plan**	Complied.	P

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	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	Quality plan provided.	P
5.8	**Battery safety components**		N/A
	According annex F	See TABLE: Critical components information	N/A
6	**TYPE TEST AND SAMPLE SIZE**		P
	Tests are made with the number of cells or batteries specified in Table 1 using cells or batteries that are not more than six months old		P
	Coin cells with resistance ≤ 3 Ω (measured according annex D) are tested according table 1	Not coin cells	N/A
	Unless otherwise specified, tests are carried out in an ambient temperature of 20 °C ± 5 °C		P
	The safety analysis of 5.6.1 identify those components of the protection circuit that are critical for short-circuit, overcharge and overdischarge protection		P
	When conducting the short-circuit test, consideration given to the simulation of any single fault condition that is likely to occur in the protecting circuit that would affect the short-circuit test	See clause 7.3.2.	P
7	**SPECIFIC REQUIREMENTS AND TESTS**		P
7.1	**Charging procedure for test purposes**		P
7.1.1	First procedure		P
	This charging procedure applies to subclauses other than those specified in 7.1.2		P
	Unless otherwise stated in this document, the charging procedure for test purposes is carried out in an ambient temperature of 20 °C ± 5 °C, using the method declared by the manufacturer		P
	Prior to charging, the battery have been discharged at 20 °C ± 5 °C at a constant current of 0,2 It A down to a specified final voltage		P
7.1.2	Second procedure		P
	This charging procedure applies only to 7.3.1, 7.3.4, 7.3.5, and 7.3.9		P

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	After stabilization for 1 h and 4 h, respectively, at ambient temperature of highest test temperature and lowest test temperature, as specified in Table 2, cells are charged by using the upper limit charging voltage and maximum charging current, until the charging current is reduced to 0,05 It A, using a constant voltage charging method	Charge temperature specified by manufacturer: 0-60°C; 60°C used for upper limit tests; 0°C used for lower limit tests.	P
7.2	**Intended use**		P
7.2.1	Continuous charging at constant voltage (cells)	Tested complied.	P
	Fully charged cells are subjected for 7 days to a charge using the charging method for current and standard voltage specified by the cell manufacturer	Charging for 7 days with 112mA and 4.20V.	P
	Results: No fire. No explosion. No leakage..... :	(See appended table 7.2.1)	P
7.2.2	Case stress at high ambient temperature (battery)		N/A
	Oven temperature (°C)..... :		—
	Results: No physical distortion of the battery case resulting in exposure of internal protective components and cells		N/A
7.3	**Reasonably foreseeable misuse**		P
7.3.1	External short-circuit (cell)	Tested complied.	P
	The cells were tested until one of the following occurred:		P
	- 24 hours elapsed; or		N/A
	- The case temperature declined by 20 % of the maximum temperature rise		P
	Results: No fire. No explosion..... :	(See appended table 7.3.1)	P
7.3.2	External short-circuit (battery)	Tested complied.	P
	The batteries were tested until one of the following occurred:		P
	- 24 hours elapsed; or		N/A
	- The case temperature declined by 20 % of the maximum temperature rise		P
	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		P
	A single fault in the discharge protection circuit conducted on one to four (depending upon the protection circuit) of the five samples before conducting the short-circuit test	Shorting single fault conducted on four samples.	P
	A single fault applies to protective component parts such as MOSFET, fuse, thermostat or positive temperature coefficient (PTC) thermistor	Shorting single fault applies on MOSFET U2 (Pin1-Pin3) and U3 (Pin1-Pin3).	P
	Results: No fire. No explosion..... :	(See appended table 7.3.2)	P

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
7.3.3	Free fall	Tested complied.	P
	Results: No fire. No explosion	No fire. No explosion.	P
7.3.4	Thermal abuse (cells)	Tested complied.	P
	Oven temperature (°C)..... :	130	—
	Results: No fire. No explosion	No fire. No explosion.	P
7.3.5	Crush (cells)	Tested complied.	P
	The crushing force was released upon:		P
	- The maximum force of 13 kN ± 0,78 kN has been applied; or		P
	- An abrupt voltage drop of one-third of the original voltage has been obtained		N/A
	Results: No fire. No explosion..... :	(See appended table 7.3.5)	P
7.3.6	Over-charging of battery	Tested complied.	P
	The supply voltage which is:		P
	- 1,4 times the upper limit charging voltage presented in Table A.1 (but not to exceed 6,0 V) for single cell/cell block batteries or	5.95V applied.	P
	- 1,2 times the upper limit charging voltage resented in Table A.1 per cell for series connected multi-cell batteries, and		N/A
	- Sufficient to maintain a current of 2,0 It A throughout the duration of the test or until the supply voltage is reached	1.12A applied.	P
	Test was continued until the temperature of the outer casing:		P
	- Reached steady state conditions (less than 10 °C change in 30-minute period); or		N/A
	- Returned to ambient		P
	Results: No fire. No explosion..... :	(See appended table 7.3.6)	P
7.3.7	Forced discharge (cells)	Tested complied.	P
	If the discharge voltage reaches the negative value of upper limit charging voltage within the testing duration, the voltage is maintained at the negative value of the upper limit charging voltage by reducing the current for the remainder of the testing duration		N/A
	If the discharge voltage does not reach the negative value of upper limit charging voltage within the testing duration, the test is terminated at the end of the testing duration		P
	Results: No fire. No explosion..... :	(See appended table 7.3.7)	P
7.3.8	Mechanical tests (batteries)		P
7.3.8.1	Vibration	Tested complied.	P

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Results: No fire, no explosion, no rupture, no leakage or venting.....:	(See appended table 7.3.8.1)	P
7.3.8.2	Mechanical shock	Tested complied.	P
	Results: No leakage, no venting, no rupture, no explosion and no fire.....:	(See appended table 7.3.8.2)	P
7.3.9	Design evaluation – Forced internal short-circuit (cells)	Tested complied.	P
	The cells complied with national requirement for.....:	France, Japan, Republic of Korea and Switzerland.	—
	The pressing was stopped upon:		P
	- A voltage drop of 50 mV has been detected; or		N/A
	- The pressing force of 800 N (cylindrical cells) or 400 N (prismatic cells) has been reached	400 N for prismatic cells.	P
	Results: No fire.....:	(See appended table 7.3.9)	P
8	**INFORMATION FOR SAFETY**		P
8.1	**General**		P
	Manufacturers of secondary cells ensure that information is provided about current, voltage and temperature limits of their products	Information for safety mentioned in manufacturer's specifications.	P
	Manufacturers of batteries ensure that equipment manufacturers and, in the case of direct sales, end-users are provided with information to minimize and mitigate hazards	Information for safety mentioned in manufacturer's specifications.	P
	Systems analyses performed by device manufacturers to ensure that a particular battery design prevents hazards from occurring during use of a product		N/A
	As appropriate, any information relating to hazard avoidance resulting from a system analysis provided to the end user		N/A
	Do not allow children to replace batteries without adult supervision		P
8.2	**Small cell and battery safety information**	Small cell and battery.	P
	The following warning language is to be provided with the information packaged with the small cells and batteries or equipment using them:		P
	- Keep small cells and batteries which are considered swallowable out of the reach of children		P
	- Swallowing may lead to burns, perforation of soft tissue, and death. Severe burns can occur within 2 h of ingestion		P
	- In case of ingestion of a cell or battery, seek medical assistance promptly		P

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
9	**MARKING**		P
9.1	**Cell marking**	The final product is battery	N/A
	Cells marked as specified in IEC 61960, except coin cells		N/A
	Coin cells whose external surface area is too small to accommodate the markings on the cells show the designation and polarity		N/A
	By agreement between the cell manufacturer and the battery and/or end product manufacturer, component cells used in the manufacture of a battery need not be marked		N/A
9.2	**Battery marking**		P
	Batteries marked as specified in IEC 61960, except for coin batteries	See marking plate on page 4.	P
	Coin batteries whose external surface area is too small to accommodate the markings on the batteries show the designation and polarity. Batteries also marked with an appropriate caution statement	Batteries also marked with an appropriate caution statement.	P
	Terminals have clear polarity marking on the external surface of the battery	DC connector used.	N/A
	Batteries with keyed external connectors designed for connection to specific end products need not be marked with polarity markings if the design of the external connector prevents reverse polarity connections	Keyed external connectors can prevent reverse polarity connections.	P
9.3	**Caution for ingestion of small cells and batteries**	Small cell and battery.	P
	Coin cells and batteries identified as small batteries according to 8.2 include a caution statement regarding the hazards of ingestion in accordance with 8.2		N/A
	When small cells and batteries are intended for direct sale in consumer-replaceable applications, caution for ingestion given on the immediate package		P
9.4	**Other information**		P
	Storage and disposal instructions	Information for storage and disposal instructions mentioned in manufacturer's specifications.	P
	Recommended charging instructions	Information for recommended charging instructions mentioned in manufacturer's specifications.	P
10	**PACKAGING AND TRANSPORT**		P

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Packaging for coin cells not small enough to fit within the limits of the ingestion gauge of Figure 3	Not coin cells.	N/A
	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		P
ANNEX A	**CHARGING AND DISCHARGING 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		P
A.3.2	Upper limit charging voltage	4.25V.	P
A.3.2.1	General		P
A.3.2.2	Explanation of safety viewpoint		N/A
A.3.2.3	Safety requirements, when different upper limit charging voltage is applied	4.25V applied.	N/A
A.4	**Consideration of temperature and charging current**		P
A.4.1	General		P
A.4.2	Recommended temperature range	See A.4.2.2.	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: 0-60°C	N/A
A.4.3	High temperature range	Not higher than the temperature range specific in this standard, 60°C applied for testing.	N/A
A.4.3.1	General		N/A
A.4.3.2	Explanation of safety viewpoint		N/A
A.4.3.3	Safety considerations when specifying charging conditions in the high temperature range		N/A
A.4.3.4	Safety considerations when specifying a new upper limit in the high temperature range		N/A
A.4.4	Low temperature range	Not lower than the temperature range specific in this standard, 0°C applied for testing.	N/A
A.4.4.1	General		N/A
A.4.4.2	Explanation of safety viewpoint		N/A
A.4.4.3	Safety considerations, when specifying charging conditions in the low temperature range		N/A

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict
A.4.4.4	Safety considerations when specifying a new lower limit in the low temperature range		N/A
A.4.5	Scope of the application of charging current		P
A.4.6	Consideration of discharge		P
A.4.6.1	General		P
A.4.6.2	Final discharge voltage and explanation of safety viewpoint	Cell specified final voltage 3.0V.	P
A.4.6.3	Discharge current and temperature range		P
A.4.6.4	Scope of application of the discharging current		P
A.5	**Sample preparation**		P
A.5.1	General		P
A.5.2	Insertion procedure for nickel particle to generate internal short		P
A.5.3	Disassembly of charged cell		P
A.5.4	Shape of nickel particle		P
A.5.5	Insertion of nickel particle in cylindrical cell		N/A
A.5.5.1	Insertion of nickel particle in winding core		N/A
A.5.5.2	Marking the position of the nickel particle on both ends of the winding core of the separator		N/A
A.5.6	Insertion of nickel particle in prismatic cell		P
A.6	**Experimental procedure of the forced internal short-circuit test**		P
A.6.1	Material and tools for preparation of nickel particle		P
A.6.2	Example of a nickel particle preparation procedure		P
A.6.3	Positioning (or placement) of a nickel particle		P
A.6.4	Damaged separator precaution		P
A.6.5	Caution for rewinding separator and electrode		P
A.6.6	Insulation film for preventing short-circuit		P
A.6.7	Caution when disassembling a cell		P
A.6.8	Protective equipment for safety		P
A.6.9	Caution in the case of fire during disassembling		P
A.6.10	Caution for the disassembling process and pressing the electrode core		P
A.6.11	Recommended specifications for the pressing device		P

ANNEX B	**RECOMMENDATIONS TO EQUIPMENT MANUFACTURERS AND BATTERY ASSEMBLERS**	N/A

IEC 62133-2			
Clause	Requirement + Test	Result - Remark	Verdict

ANNEX C	**RECOMMENDATIONS TO THE END-USERS**	N/A

ANNEX D	**MEASUREMENT OF THE INTERNAL AC RESISTANCE FOR COIN CELLS**		N/A
D.1	**General**	Not coin cells.	N/A
D.2	**Method**		N/A
	A sample size of three coin cells is required for this measurement.....:	(See appended table D.2)	N/A
	Coin cells with an internal resistance of less than or equal to 3 Ω are subjected to the testing according to Clause 6 and Table 1		N/A
	Coin cells with an internal resistance greater than 3 Ω require no further testing		N/A

ANNEX E	**PACKAGING AND TRANSPORT**	**N/A**

ANNEX F	**COMPONENT STANDARDS REFERENCES**	**N/A**

	TABLE: Critical components information				P
Object/part no.	**Manufacturer/ trademark**	**Type/model**	**Technical data**	**Standard**	**Mark(s) of conformity [1)]**
Wire	DONGGUAN ZHONGZHENG WIRE & CABLE TECH CO LTD	1571	26AWG, 80°C, 30V	UL 758	UL E336285
Wire (Alternative)	Interchangeable	Interchangeable	Max. 26AWG, Min. 80°C, Min. 30V	UL 758	UL Approved
PCB	SHENZHEN JIUHEYONG ELECTRONICS CO LTD	JHY-D	V-0, 130°C, Min. Thk. 0.47mm	UL 94 UL 796	UL E311990
PCB (Alternative)	Interchangeable	Interchangeable	V-0, Min. 130°C, Min. Thk. 0.47mm	UL 94 UL 796	UL Approved
Protect IC (U1)	Shenzhen Developer Microelectronics Co., Ltd	DPDW01	Overcharge protection voltage: 4.28±0.05V, Overdischarge protection voltage: 3.0±0.10V, T_{opr}: -40°C to +85°C	--	Tested with appliance
MOSFET (U2, U3)	Shenzhen Developer Microelectronics Co., Ltd	DP8205A	V_{DS}: 20V, V_{GS}: ±12V, I_D: 5A (T_J=25°C), T_J: -55~150ºC	--	Tested with appliance
Cell	Ropla Elektronik sp. z o.o	503040	3.7V, 560mAh	IEC 62133-2: 2017	Tested with appliance
-Electrolyte	Dongguan Tianfeng New Material co.,ltd	LBC3038	$LiPF_6$, EC+DMC+EMC	--	--
-Separator	ShenZhen huangtaiyuan electronics tech. co.,ltd	16μm	PP/PE, 16μm(T), Shutdown temperature: 135ºC	--	--
-Negative electrode	Dalian Hongguang material tech. co.,ltd	ZT-18A	Graphite	--	--
-Positive electrode	Jiangmeng Keheng co.,ltd	LCO-1	$LiCoO_2$	--	--
-Aluminium plastic film	Zhejiang Daoming Photo Electric technology CO.,Ltd	DM-L113N	0.113mm(T), Nylon, Al, PP	--	--
Supplementary information: [1)] Provided evidence ensures the agreed level of compliance. See OD-CB2039.					

7.2.1	TABLE: Continuous charging at constant voltage (cells)			P
Sample no.	**Recommended charging voltage Vc (Vdc)**	**Recommended charging current I_{rec} (A)**	**OCV before test (Vdc)**	**Results**
C01	4.20	0.112	4.19	P
C02	4.20	0.112	4.19	P
C03	4.20	0.112	4.19	P
C04	4.20	0.112	4.19	P
C05	4.20	0.112	4.19	P

Supplementary information:
- No fire or explosion
- No leakage

7.3.1	TABLE: External short-circuit (cell)				P
Sample no.	**Ambient T (°C)**	**OCV before test (Vdc)**	**Resistance of circuit (mΩ)**	**Maximum case temperature ~~rise ΔT~~ (°C)**	**Results**
Samples charged at charging temperature upper limit (45°C)					
C06	56.2	4.22	84.0	116.7	P
C07	56.2	4.23	88.0	120.1	P
C08	56.2	4.22	88.0	116.4	P
C09	56.2	4.23	89.0	120.5	P
C10	56.2	4.22	85.0	112.6	P
Samples charged at charging temperature lower limit (10°C)					
C11	54.9	4.15	83.0	124.7	P
C12	54.9	4.16	87.0	127.7	P
C13	54.9	4.15	85.0	125.1	P
C14	54.9	4.16	82.0	123.9	P
C15	54.9	4.15	89.0	119.4	P

Supplementary information:
- No fire or explosion

7.3.2	TABLE: External short-circuit (battery)					P
Sample no.	**Ambient T (°C)**	**OCV before test (Vdc)**	**Resistance of circuit (mΩ)**	**Maximum case temperature ~~rise ΔT~~ (°C)**	**Component single fault condition**	**Results**
B04	24.2	4.19	89.0	118.2	U2 (Pin1-Pin3) S-C	P
B05	24.2	4.19	82.0	119.9	U2 (Pin1-Pin3) S-C	P
B06	24.2	4.18	78.0	121.0	U3 (Pin1-Pin3) S-C	P
B07	24.2	4.19	84.0	126.3	U3 (Pin1-Pin3) S-C	P
B08	24.2	4.18	79.0	24.3	--	P

Remark: S-C: short circuit

Supplementary information:

- No fire or explosion

7.3.5	TABLE: Crush (cells)			P
Sample no.	**OCV before test (Vdc)**	**OCV at removal of crushing force (Vdc)**	**Maximum force applied to the cell during crush (kN)**	**Results**
Samples charged at charging temperature upper limit (45°C)				
C29	4.22	4.21	13.0	P
C30	4.23	4.21	13.0	P
C31	4.22	4.21	13.0	P
C32	4.23	4.22	13.0	P
C33	4.22	4.21	13.0	P
Samples charged at charging temperature lower limit (10°C)				
C34	4.15	4.13	13.0	P
C35	4.16	4.15	13.0	P
C36	4.15	4.14	13.0	P
C37	4.16	4.14	13.0	P
C38	4.15	4.14	13.0	P

Supplementary information:

- No fire or explosion

7.3.6	TABLE: Over-charging of battery			P
Constant charging current (A).....:		1.12		—
Supply voltage (Vdc).....:		5.95		—
Sample no.	**OCV before charging (Vdc)**	**Total charging time (minute)**	**Maximum outer case temperature (°C)**	**Results**
B12	3.37	135	27.6	P
B13	3.37	135	30.4	P
B14	3.35	135	29.6	P
B15	3.34	135	28.0	P
B16	3.35	135	28.5	P
Supplementary information: - No fire or explosion				

7.3.7	TABLE: Forced discharge (cells)			P
Sample no.	**OCV before application of reverse charge (Vdc)**	**Measured reverse charge I_t (A)**	**Lower limit discharge voltage (Vdc)**	**Results**
C39	3.24	0.56	2.4	P
C40	3.24	0.56	2.4	P
C41	3.26	0.56	2.4	P
C42	3.27	0.56	2.4	P
C43	3.28	0.56	2.4	P
Supplementary information: - No fire or explosion				

7.3.8.1	TABLE: Vibration				P
Sample no.	**OCV before test (Vdc)**	**OCV after test (Vdc)**	**Mass before test (g)**	**Mass after test (g)**	**Results**
B17	4.19	4.18	12.845	12.844	P
B18	4.18	4.18	12.933	12.931	P
B19	4.19	4.18	12.899	12.898	P
Supplementary information: - No fire or explosion - No rupture - No leakage - No venting					

7.3.8.2	TABLE: Mechanical shock				P
Sample no.	**OCV before test (Vdc)**	**OCV after test (Vdc)**	**Mass before test (g)**	**Mass after test (g)**	**Results**
B20	4.19	4.18	12.809	12.808	P
B21	4.19	4.18	12.980	12.980	P
B22	4.19	4.18	12.918	12.916	P

Supplementary information:
- No fire or explosion
- No rupture
- No leakage
- No venting

7.3.9	TABLE: Forced internal short circuit (cells)				P
Sample no.	**Chamber ambient T (°C)**	**OCV before test (Vdc)**	**Particle location [1)]**	**Maximum applied pressure (N)**	**Results**
Samples charged at charging temperature upper limit (45°C)					
C44	60	4.21	1	400	P
C45	60	4.22	1	400	P
C46	60	4.22	1	400	P
C47	60	4.22	2	400	P
C48	60	4.22	2	400	P
Samples charged at charging temperature lower limit (10°C)					
C49	0	4.14	1	400	P
C50	0	4.15	1	400	P
C51	0	4.15	1	400	P
C52	0	4.15	2	400	P
C53	0	4.15	2	400	P

Supplementary information:
[1)] Identify one of the following:
1: Nickel particle inserted between positive and negative (active material) coated area.
2: Nickel particle inserted between positive aluminium foil and negative active material coated area.
- No fire or explosion

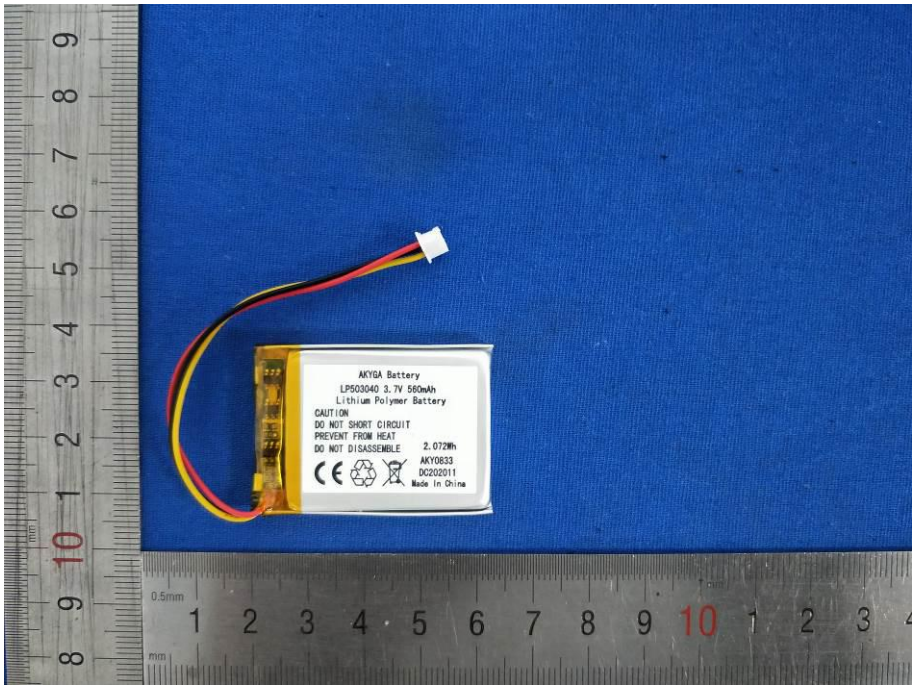
D.2	TABLE: Internal AC resistance for coin cells			N/A
Sample no.	**Ambient T (°C)**	**Store time (h)**	**Resistance Rac (Ω)**	**Results [1)]**
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--

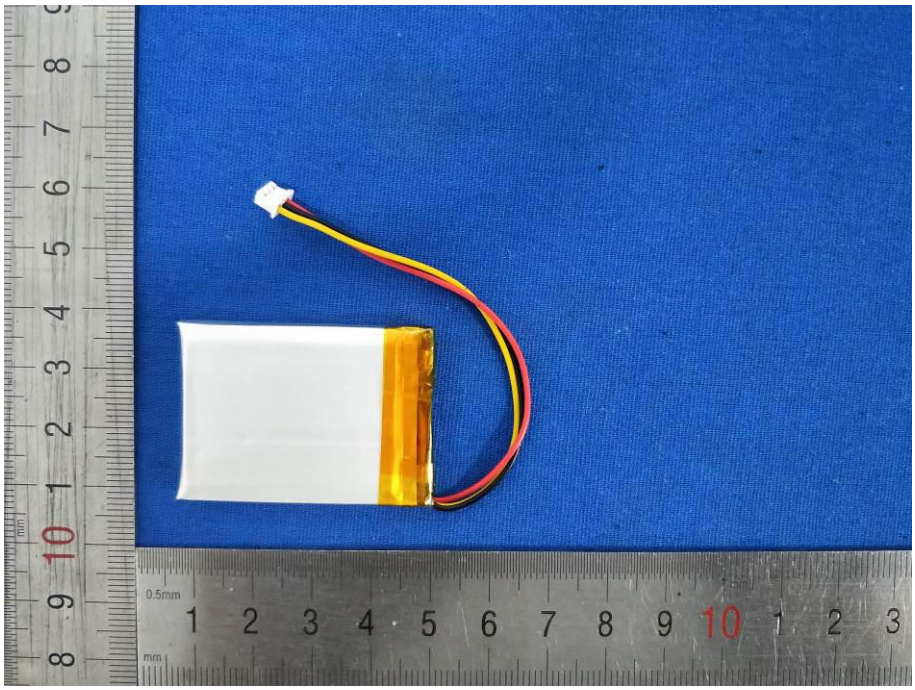
Supplementary information:

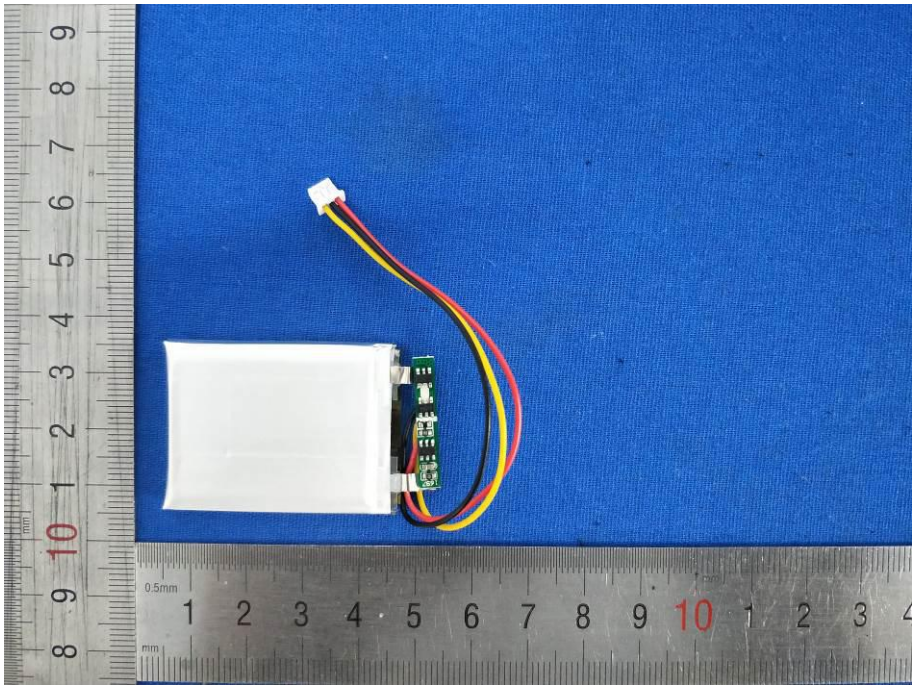
[1)] Coin cells with internal resistance less than or equal to 3 Ω, see test result on corresponding tables

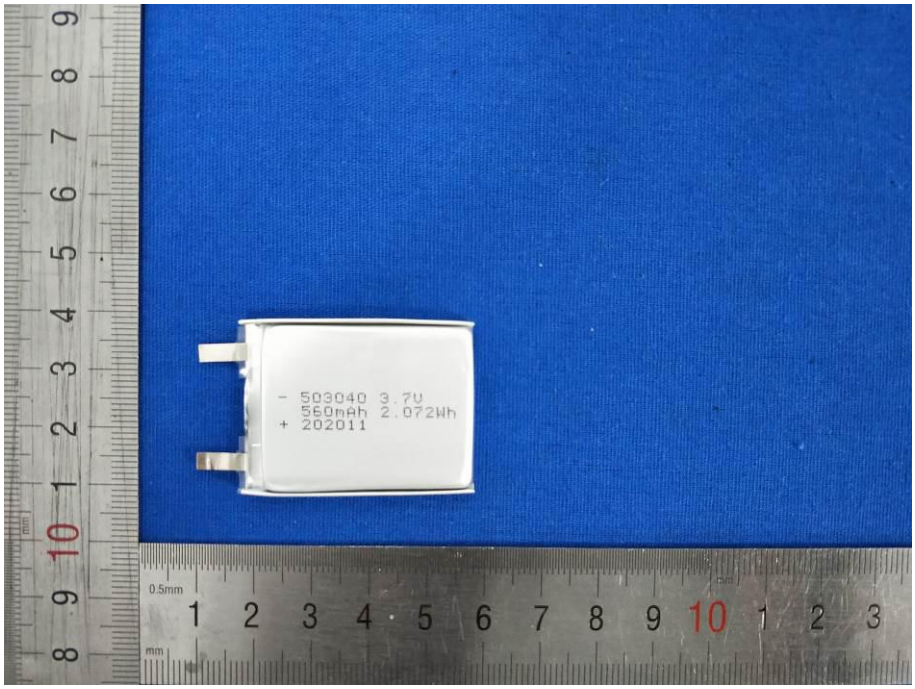
Photos

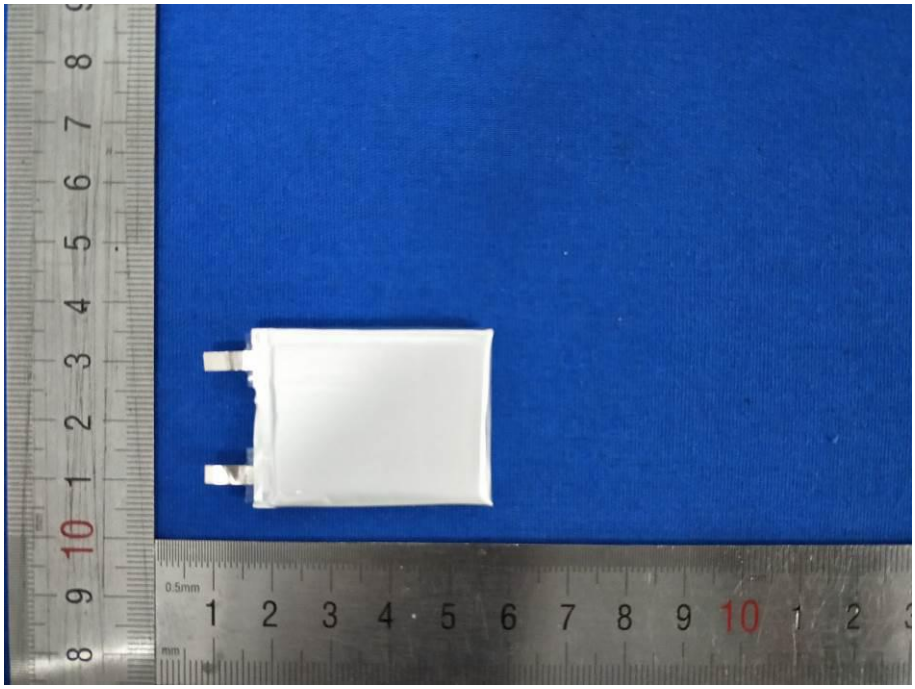
Model: LP503040

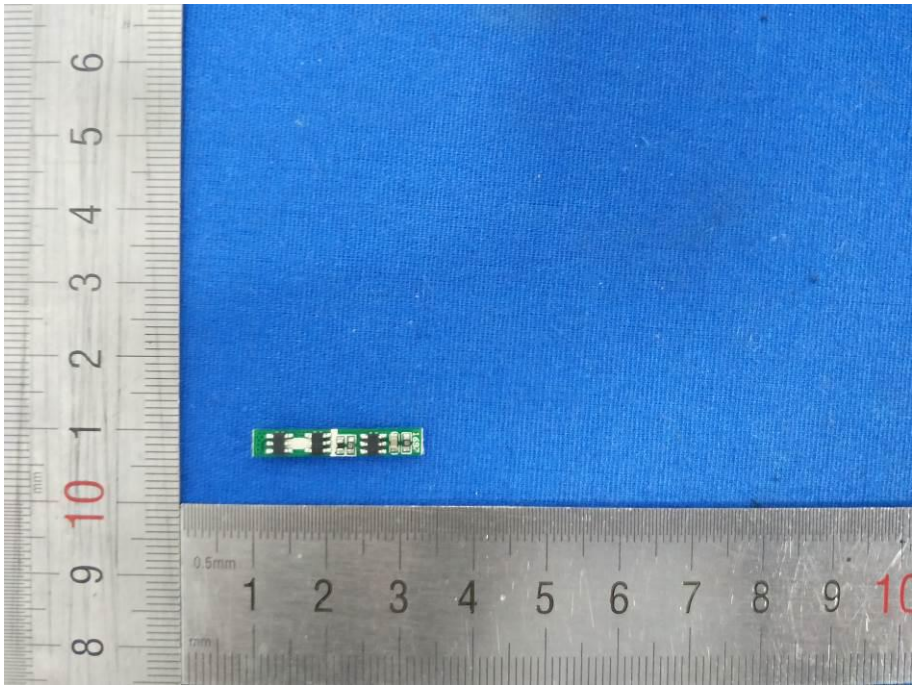


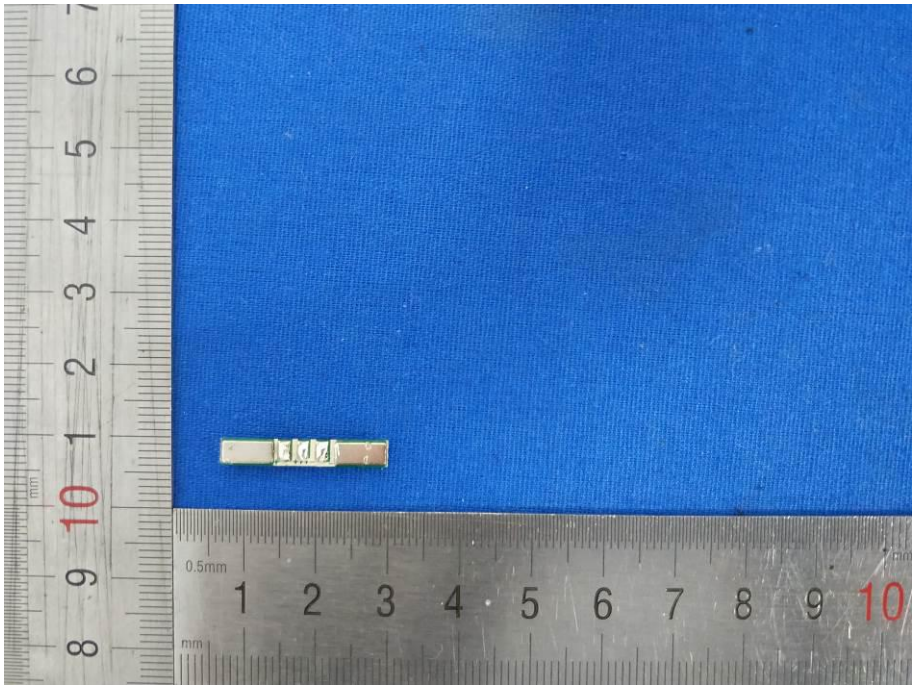





- 503040 3.7V
560mAh 2.072Wh
+ 202011







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