Test Report issued under the responsibility of:

TEST REPORT

UL 2056 Outline of Investigation for Safety of Power Banks

Report Reference No.....:	SZES190901540902
Date of issue.....:	2019-11-19
Total number of pages	30 Pages
Testing Laboratory .....:	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
Testing location .....:	No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China 518057
Tested by (name + signature).....:	Steven Xiao
Approved by (name + signature) .:	Sara Wang
Applicant's name.....:	FosPower INC.
Address .....:	375 Rivertown Drive Ste 500 Woodbury, MN, 55125, America
Test specification:	
Standard.....:	UL 2056, Issue No. 2, dated November 3, 2015 (reference standard UL 2054, Second Edition, Dated October 29, 2004, Rev. date SEPTEMBER 14, 2011)
Test procedure .....:	SGS-CSTC
Non-standard test method.....:	N/A
Test Report Form No.....:	TR_UL2056
Test Report Form(s) Originator .....:	SGS-CSTC
Master TRF .....:	Dated 2018-01

Test item description .....:	Power Bank (Product name: Hand Crank Radio)
Trade Mark .....:	FosPower Inc
Manufacturer .....:	Zhuhai Meding Technology Co., Ltd. Floor 2, Building 3, Zhizao Dajie, Jinhe Road, Hongqi Town, Jinwan District, Zhuhai, Guangdong, China
Factory.....:	Same as manufacturer
Model/Type reference.....:	FOSPWB-2376

Product descriptions .....:	Lithium-Ion 1S1P Power Bank
Model differences .....:	N/A
Electrical Ratings.....:	DC Input: Micro USB: 5 V⎓ 0.45 A Solar Energy Charging: 5 V⎓ 0.03 A DC Output: USB: 5 V⎓ 0.6 A Battery Capacity: 3.7 V, 2000 mAh Output capacity: 750 mAh Class III Charge Temperature Range: 0 ~ 45°C Discharge Temperature Range: -10 ~ 60°C
Remarks / special functions .....:	N/A

Sample tested

Remark: Also refer to appendix photo pages for details.

Copy of Marking plate

Hand Crank Radio
FOSPWB-2376 Capacity:750 mAh
Input: Micro USB: 5 V⎓0.45 A
Solar Energy Charging: 5 V⎓0.03 A
Output: USB: 5 V⎓0.6 A
Battery Capacity: 3.7 V, 2000 mAh
2019-08-15 Zhuhai Meding Technology Co., Ltd.
CAUTION:
Risk of Fire and Burns.
Do Not Open, Crush, Heat Above 60 degree C or Incinerate.
Follow Manufacturer's Instructions.

Remarks

The use of certification marks on a product must be authorized by the respective certification bodies that own these marks.

Critical components information:

Only following safety critical components were evaluated and/or tested, and were confirmed to comply with the standard requirements mentioned in this test report. Use of components not listed here may lead to non-compliance test results, and it's the sole responsibilities of the manufacturer to make sure all products should be produced in consistent way and only approved components can be used.

Object/part no.	Manufacturer/ trademark	Type/model	Technical data	Standard	Mark(s) of conformity
Cell	GUANGXI ZHUO NENG NEW ENERGY TECHNOLOGY CO LTD	INR18650-P2000mAh	3,7 V, 2000 mAh	UL 1642	UR (MH61981)
Control IC (U1)	Taiwan Fujing Semiconductor Co., Ltd.	DW01	Overcharge Detection Voltage: 4,3 ± 0,05 V	*	*
Protect IC (U7)	Taiwan Fujing Semiconductor Co., Ltd.	LP4054	Overcharge Detection Voltage: 4,0 ~ 9,0 V Over-discharge Detection Voltage: 4,1 ~ 4,2 V Operating temperature range: -40 ~ +85°C	*	*
Protect IC (U4)	Taiwan Fujing Semiconductor Co., Ltd.	CE8303	Operating temperature range: -20 ~ +85°C	*	*
MOSFET (U2)	Taiwan Fujing Semiconductor Co., Ltd.	8205	Id: 6 A Vds: 20 V Operating temperature range: -55 ~ +150°C	*	*
PCB	Interchangeable	Interchangeable	Min V-1, 130°C	UL 796	UR
Enclosure (Plastic)	LG Chem (Guangzhou) Engineering Plastics Co Ltd	GN-5007F(#)	PC/ABS, V-0, Min thickness: 1,5 mm, 90 °C	UL 94 UL 746C	UR (E248280)
Internal wire	Interchangeable	Interchangeable	28 AWG, Min 80°C	UL 758	UR

Summary of testing:

This test report shows that submitted sample(s) have been evaluated and tested to comply with applicable standard requirements in Outline of Investigation for Safety of Power Banks, UL 2056, Issue No. 2, Dated November 3, 2015.

When determining the test conclusion, the Measurement Uncertainty of test has been considered.

The issue of this report does not mean SGS have certified the power banks, nor any SGS certification mark can be marked or declared by the manufacturer without prior approval of SGS.

List of Attachments (including a total number of pages in each attachment):

7 Pages of photos.

Amendment history:
Amendment - 1:
The original test Report Ref. No. SZES190901540901 dated 2019-11-11 was modified on 2019-11-18 to include the following additions and/or changes:

- Update the trade mark to FosPower Inc;

After comparing, no additional test was considered necessary.
The original Test Report Ref. No. SZES190901540901 dated 2019-11-11 is not valid.

Tests performed (name of test and test clause):

--	Test clause in UL2056	Reference clause in UL2054	Test item
☐	8.1	9	Short-Circuit Test
☒	8.2, 8.3, 8.4	10	Abnormal Charging Test
☒	8.2, 8.3, 8.5	11	Abusive Overcharge Test
☐	8.1	12	Forced-Discharge Test
☒	8.9	13	Limited Power Source Test
☒	8.6, 8.7, 8.8	13A	Battery Pack Component Temperature Test
☒	8.6, 8.7, 8.8	13B	Battery Pack Surface Temperature Test
☒	8.1	19	250 N Steady Force Test
☒	8.1	20	Mold Stress Relief Test
☒	8.1	21	Drop Impact Test
☒	9	--	Power Input Test
☒	10	--	Overload of Output Ports Test
☒	11	--	Flammability of Photovoltaic Cells Test
☒	12	--	Capacity Verification Test

Possible test case verdicts:	
- test case does not apply to the test object..... :	N/A
- test object does meet the requirement ..... :	P (Pass)
- test object does not meet the requirement ..... :	F (Fail)
Testing ..... :	
Date of receipt of test item ..... :	2019-09-03
Date (s) of performance of tests ..... :	2019-09-11 to 2019-10-17

General remarks:

"(see Enclosure #)" refers to additional information 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.

UL 2056			
Clause	Requirement + Test	Result - Remark	Verdict
1	Scope		--
2	Components	Refer to Critical components information in cover page	P
2.1	Component shall comply with the requirements for that component (Appendix A)		P
2.2	Lithium-ion cells shall comply with either UL1642 or UL62133	Cell was certified to UL1642	P
2.3	Nickel cells shall comply with either UL2054 or UL62133		N/A
3	Unit of measurement		P
4	Undated References		--
5	Reference Publications		--
6	Glossary		P
--	CONSTRUCTION		--
7.1	Power banks shall comply with the requirements in UL 2054	(Refer to Appended table for UL2054 requirements)	P
7.2	The input port from external power supply.		P
7.3	Additional safety standard for built-in dc/dc converter circuitry generates voltage exceeding 42.4 Vac or 60 Vdc (UL60950-1 or UL62368)		N/A
7.4	Construction requirements for power banks with direct plug-in construction		N/A
a).	Additional safety standard for built-in ac/dc power supply (UL60950-1 or UL62368)		N/A
b).	Barrier between the built-in ac/dc power supply and built-in battery pack		N/A
--	PERFORMANCE		--
8.1	Power banks shall comply with requirements of UL2054.	(Refer to Appended table for UL2054 requirements)	P
8.2	For the Abnormal Charging Test and Abusive Overcharge Test in the Standard for Household and Commercial Batteries, UL 2054, 8.3 – 8.5 shall be followed		P
8.3	The tests shall be conducted at the input point of battery protecting circuit.		P
8.4	For the Abnormal Charging Test in UL2054, the following shall be taken as maximum current Ic: Rated maximum charging current of the built-in battery (rather than the power bank).	Refer table 10A for detail.	P
8.5	For the Abusive Overcharge Test in UL2054, the C5 amp rate of the built-in battery (rather than the power bank) shall be taken for the testing purpose.		P

UL 2056			
Clause	Requirement + Test	Result - Remark	Verdict
8.6	For the Battery Pack Component Temperature Test and Battery Pack Surface Temperature Test in the Standard for Household and Commercial Batteries, UL 2054, 8.7 and 8.8 shall be followed.		P
8.7	For output loading temperature test, a fully charged power bank shall be discharged. Any load of the output ports that can be operated at the same time shall be considered to result in maximum temperature rise.	Refer table 13A for detail.	P
8.8	For input loading temperature test, a fully discharged power bank shall be charged in accordance with manufacturer's specifications. Any load of the output ports that can be operated at the same time shall be considered to result in maximum temperature rise.	Refer table 13A for detail.	P
8.9	Each output port shall be a limited power source or Class 2 power source.		P
8.10	Each output port shall be a SELV or ES1 circuit.		P
9	Power input test		P
9.1.1	The current input to a power bank shall not exceed 110% of the marked input current rating of the power bank, when the power bank is operated under the conditions of maximum normal load.	(see appended table 9)	P
9.1.2	Maximum normal load conditions		P
10	Overload of Output Ports Test		P
10.1	Each power output pin of output port shall be overloaded.	(see appended table 10&11)	P
10.2	Fully charge the built-in battery of power bank.		P
10.3	The power bank is covered with one layer of cheesecloth and placed on a softwood board covered with one layer of tissue paper.		P
10.4	Each power output pin of output port shall then be loaded to draw the maximum current, for at least 1 h.		P
10.5	After this test, the cheesecloth and tissue paper shall remain intact.		P
11	Flammability of Photovoltaic Cells Test		P
11.1	Applicable for power bank provided with integral photovoltaic cells as a power source.	(see appended table 10&11)	P
11.2	Fully charge the built-in battery of the power bank		P
11.3	The power bank is covered with one layer of cheesecloth and placed on a softwood board covered with one layer of tissue paper.		P
11.4	The power bank is subjected to single component fault that is likely to occur and which would result in flammability issue of the photovoltaic cells, such as back-feed of battery power, and is kept in this state for 1 h.		P
11.5	After this test, the cheesecloth and tissue paper shall remain intact.		P

UL 2056			
Clause	Requirement + Test	Result - Remark	Verdict
12	Capacity Verification Test		P
12.1	The marked electrical capacity of power bank, measured at the power output pin of output port, shall comply with IEC 61960, clause 7.3.1, Discharge Performance at 20 °C (Rated Capacity), and the modified test method in 12.2	(see appended table 12)	P
12.2	The power bank is discharged at a constant current equal to rated current of the output port, until its voltage is equal to the end-of-discharge voltage of the output port, specified by the manufacturer.		P
--	MARKINGS		--
13.1	Unless otherwise superseded by a requirement in this Outline, power banks shall comply with the requirements in the Standard for Household and Commercial Batteries, UL 2054.	Refer marking plate for detail.	P
13.2	For electrical ratings, the following information shall be provided:		P
a)	Input rating in Vdc or Vac and A. If there are more than one input ports, the rating of each port shall be provided;		P
b)	Output rating in Vdc and A. If there are more than one output ports, it shall include rating of each port and the combined rating (if it is not equal to the summation of all ports); and		P
c)	Electrical capacity in Ah or mAh. If there are more than one output ports/output ratings, either the capacity of each port/rating shall be provided, or the minimum capacity of these ports/ratings shall be provided.		P
--	INSTRUCTIONS		--
14.1	Power banks shall be provided with legible instructions pertaining to the proper selection and replacement of its power supply or charger.		P
14.2	Power banks shall be provided with legible instructions pertaining to a risk of fire or injury to persons associated with the use of the product.		P
14.3	An illustration is allowed with a required instruction to clarify the intent but shall not replace the written instruction.		P
15	Instructions Pertaining to Risk of Fire or Injury to Persons		P
15.1	Headings		P
15.2	Text of the instructions		P
15.3	Numbering of the items		P
15.4	Contents of instructions pertaining to a risk of fire or injury to persons		P

Appended table for UL2054 requirements	--

UL 2056			
Clause	Requirement + Test	Result - Remark	Verdict
4	Construction		P
4.1.1	The casing of the battery pack has the strength and rigidity required.		P
4.1.2	The casing of the enclosure of a battery pack is rigid enough to prevent flexing that would result in damage to the cells or internal protective components		P
4.1.3	For battery packs with plastic outer enclosures, the outer enclosure of the battery shall be designed such that it is not capable of being opened using simple tools, such as a screwdriver.		P
	The enclosure shall be ultrasonically welded, or secured by equivalent means.		P
	Adhesives for securing enclosure shall comply with the adhesive requirements of the Standard UL746C.		N/A
4.1.4	The outer enclosure material of battery pack shall be classed as V-1 or less flammable in the minimum part thickness in accordance with the Standard for Polymeric Material, UL 746C.		P
	Exception: As alternative, outer enclosure material may be subject to UL746C Enclosure Flammability – 20 mm (3/4 inch) Flame test.		N/A
4.1.5	Openings in battery pack enclosure s shall be minimized to prevent damage to cells, connections, and internal circuitry and shorting of electrical spacings within the pack.		P
4.2	Electrolyte		P
4.3	External battery pack connectors	USB connectors	P
4.3.1	An external battery pack connector shall be constructed to prevent inadvertent short circuiting of its terminals unless the pack meets the limited power source requirements.		P
4.3.2	Insulating material for external battery pack connectors, outside the enclosure, shall have a V-2 minimum flame rating unless the pack meets the limited power source requirements.		N/A
	External connectors forming part of the fire enclosure shall be V-1 minimum.		P
4.4	Printed wiring boards		P
4.4.1	Printed wiring boards mounting battery circuit components shall be rated V-1 minimum	V-1 or better	P
4.5	Lithium Ion Systems Only		--
4.5.1	The voltage of each cell or each cellblock consisting of parallel-connected plural cells should not exceed the upper limit of the charging voltage specified by the cell manufacturer.		P

UL 2056			
Clause	Requirement + Test	Result - Remark	Verdict
4.5.2	For the battery consisting of a single cell or a single cellblock, it should be confirmed that the charging voltage of the cell does not exceed the upper limit of the charging voltage specified by the cell manufacturer.		P
4.5.3	For the battery consisting of series-connected plural single cells or series-connected plural cellblocks, it should be confirmed that the voltages of any one of the single cells or single cellblocks does not exceed the upper limit of the charging voltage, specified by the cell manufacturer, by monitoring the voltage of every single cell or the single cellblocks.		N/A
4.5.4	Compliance for 4.5.1 – 4.5.3 can be achieved through analysis of the battery protection circuit or if unable to determine through analysis, than through monitoring values during the test of Section 13A.		P
5	Performance general considered		P
6	Samples considered		P
7	Important test consideration considered		P
8	Temperature measurements considered		P
9	Short-Circuit Test		N/A
9.1-9.6	For cell test only, not applicable to power bank		N/A
9.7	Battery packs shall comply with 9.8 – 9.12.	Single cell battery	N/A
	Exception: not for battery packs consisting of a single approved cell.		N/A
9.8 – 9.9	Each fully charged test sample battery pack, in turn, is to be short-circuited by connecting the positive and negative terminals of the battery with a circuit load having a resistance load of 80±20 mΩ at 20±5°C (68±9°F), and at 55±2°C (131±4°F).		N/A
	The temperature of the battery case is to be recorded during the test. The battery is to discharge until a fire or explosion is obtained, or until it is completely discharged and/or the cell case temperature has returned to±10°C (±18°F) of ambient temperature.		N/A
9.10	Battery pack constructions are to be subjected to a single fault across any protective device in the load circuit of the battery under test. When protective devices actuate during the test, the test shall be repeated with the battery pack connected to the maximum load that does not cause the protective devices to open.		N/A

UL 2056			
Clause	Requirement + Test	Result - Remark	Verdict
9.11	One of the above five test sample battery packs, tested at 20 ±5°C (68 ±9°F) shall be evaluated with the following additional conditions in place. The terminals are to be subjected to a short circuit condition with a minimum length of 16 AWG (1.3 mm2) bare copper wire. (The test is to be conducted on a tissue paper cover soft wood surface and the sample battery pack and bare conductor is to be covered with a single layer of cheesecloth)		N/A
9.12	Results: No fire, no explosion. The temperature of the exterior cell or battery casing shall not exceed 150°C (302°F) for lithium chemistries		N/A
	For result of 9.11, the cheesecloth and tissue paper shall not catch fire.		N/A
10	Abnormal Charging Test	(see appended table 10A)	P
10.1-10.5	Primary batteries only, not applicable to power bank		N/A
10.6-10.9	For cell test only, not applicable to power bank		N/A
10.10	Secondary battery packs shall comply with 10.11 – 10.13		P
10.11	Each battery shall be discharged at a constant current of 0,2C/hour, to a manufacturer specified discharge endpoint voltage.		P
10.12	Each of test sample batteries are to be subjected to the following overcharge conditions, in sequential order.		P
a)	The battery is to be initially charged using a constant current charging mode with a current limit of three times the maximum current Ic, specified by the manufacturer until the maximum specified charger output voltage is reached. At that point, the battery is to be charged with a constant maximum specified charger output voltage and a current limit of three times the maximum current Ic. Charging duration is the time required to reach the manufacturer's specified end-of-charge condition plus seven additional hours. The temperature on the cell casing shall be monitored. A re-settable protective device such as a PTC that actuates during the test shall be allowed to reset and the test shall be resumed, cycling as often as necessary, but no less than 10 times, to complete the test. Automatic reset devices are allowed to cycle during the test. When an over current protective device operates during the test, the test is repeated with the same charging time, but with the battery connected to the maximum load that does not cause the protective devices to operate.		P
b)	The charge condition in accordance with (a) shall be conducted with each single component fault that is likely to occur in the charging circuit and which would result in overcharging of the battery.		P
	Exception No. 1: A protective device determined to be reliable may remain in the circuit without being faulted.		N/A

UL 2056			
Clause	Requirement + Test	Result - Remark	Verdict
	Exception No. 2: For batteries without protective devices, the overcharge condition(s) in (b) do not apply.		N/A
10.13	Results: The samples shall not explode or catch fire. For battery pack samples, tests shall not result in chemical leaks caused by cracking, rupturing or bursting of the cell casing.		P
11	Abusive Overcharge Test	(see appended table 11A)	P
11.1-11.2	Sample batteries were subjected to a constant charging current at 10 times the C5 amp rate using a supply voltage, sufficient to maintain the 10 times C5 amp rate, throughout the duration of the test or until the protective devices actuated. The test was continued until the cell or battery exploded, vented, or the temperature of the internal cell casing reached a steady state condition or returned to ambient.		P
	A PTC or other re-settable protection device operated during the test, it was cycled for a minimum of 10 cycles by resetting it.		N/A
11.3	During the tests, batteries supplied with protective devices shall be subjected to a single component fault using any single fault condition which is likely to occur in the charging circuit and which would result in overcharging of the battery.		P
11.4	Results: The samples shall not explode or catch fire.		P
11.5	At least one of above five samples were subjected to a constant charging current at 5 times the C5 amp rate using a supply voltage, sufficient to maintain the 5 times the C5 amp rate.		P
12	Forced-Discharge Test	Not series connected	N/A
12.1-12.2	For multi-cell series configurations without parallel strings a fully discharged cell is to be force-discharged by connecting it in series with fully charged cells of the same kind. The number of fully charged cells to be connected in series with the discharged cell is to equal the total number of cells in the pack less one.		N/A
12.3-12.4	For multi-cell series configurations with parallel strings, a fully discharged parallel string is to be force-discharged by connecting it in series with fully charged cells of the same kind. The number of fully charged cells to be connected in series with the discharged parallel string is to equal the total number of cells in the pack less the number of cells in the discharged parallel string.		N/A
12.5	Once the completely discharged cells (or string of cells) are connected in series with the specified number of fully charged cells, the resultant battery pack is to be short circuited.		N/A

UL 2056			
Clause	Requirement + Test	Result - Remark	Verdict
12.6	The positive and negative terminals of the sample are to be connected with a copper wire with a resistance load of 80 ±20 m ohms. The battery is to discharge until a fire or explosion is obtained, or until it has reached a completely discharged state and the cell case temperature has returned to ±10°C (±18°F) of ambient temperature.		N/A
12.7	During the tests, batteries supplied with protective devices shall be subjected to a single component fault using any single fault condition which is likely to occur in the discharge circuit and which would result in excessive discharge of the battery.		N/A
12.8	Result: The samples shall not explode or catch fire.		N/A
13	Limited Power Sources Test		P
13.1-13.2	A battery intended to be a limited power source shall comply with one of the following:		P
13.2 a)	The output is inherently limited in compliance with Table 13.1; or **Table 13.1** **Limits for power sources without an overcurrent protective device** Revised Table 13.1 effective November 11, 2011 Output voltage U_{oc}, V d.c.[a] / Output current I_{sc}, amperes[b,c] / Apparent power S, VA[c,d] $U_{oc} \leq 30$ / ≤ 8.0 / ≤ 100 $30 < U_{oc} \leq 60$ / ≤ 150/U_{oc} / ≤ 100 [a] U_{oc} – Open circuit battery voltage with all load circuits disconnected. [b] I_{sc} – Maximum output current with any non-capacitive load, including a short circuit. [c] S(VA) – Maximum output VA with any non-capacitive load including short circuit. [d] Measurement of I_{sc} and S are made 5 s after application of the load if protection is by an electronic circuit or a positive temperature coefficient device, and 60 s in other cases. If multiple protections are provided, such as combination of electronic circuit and positive temperature coefficient device, I_{sc} and S are measured 60 s after the application of the load with or without single fault condition applied.		N/A
13.2 b)	A linear or nonlinear impedance limits the output in compliance with Table 13.1. If a positive temperature coefficient device is used, it shall:		N/A
	1) Comply with the Standard for Thermistor-Type Devices, UL 1434, or		N/A
	2) Pass the tests specified in the Manufacturing Deviation and Drift Section, the Endurance Section, and the Manufacturing Deviation and Drift Section and the Endurance Section in the Annex for Requirements for Controls Using Thermistors of the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1; or		N/A
	3) Meet the requirements in the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1 for a device for Type 2.AL Action.		N/A
13.2 c)	c) A regulating network or an integrated circuit (IC) current limiter, limits the output in compliance with Table 13.1, both under normal operating conditions and after any simulated single fault in the regulating network or IC current limiter (open circuit or short circuit); or	Normal: Uoc = 5,104 V, Isc =1,3 A, max. VA = 3,78 SC U4 pin (2-3): Uoc = 4,197 V, Isc =2,3 A, max. VA = 5,78 SC U2 pin (2-6): Uoc =5,071 V, Isc =4,7 A, max. VA = 4,14	P

UL 2056			
Clause	Requirement + Test	Result - Remark	Verdict
13.2 d)	d) An over-current protective device is used and the output is limited in compliance with Table13.2. **Table 13.2** **Limits for battery sources (with overcurrent protective device)** Table 13.2 revised September 14, 2011 Output Voltage U_{oc}, V d.c.[a] / Output Current I_{sc}, amperes[b,c] / Apparent Power S, VA[b,c] / Current Rating of Overcurrent Protective Device, amperes[e] ≤ 20 / ≤ 1000/U_{oc} / ≤ 250 / ≤ 5 20 < U_{oc} ≤ 30 / ≤ 100/U_{oc} 30 < U_{oc} ≤ 60 / ≤ 100/U_{oc} [a] U_{oc} – Open circuit battery voltage with all load circuits disconnected. [b] I_{sc} – Maximum output current with any non-capacitive load, including a short circuit, measured 60 s after application of the load. [c] S(VA) – Maximum output VA after 60 s of operation with any non-capacitive load including short circuit. [d] Current limiting impedances remain in the circuit during measurement, but overcurrent protective devices are bypassed. [e] The current ratings of overcurrent protective devices are based on fuses and circuit breakers that break the circuit within 120 s with a current equal to 210% of the current rating specified in the table. NOTE – The reason for making measurements with overcurrent protective devices bypassed is to determine the amount of energy that is available to cause possible overheating during the operating time of the overcurrent protective devices.		N/A
	Conclusion……..:	The battery was a Limited Power Sources	--
13A	Battery Pack Component Temperature Test	(see appended table 13A)	P
13A.1	A battery pack with enclosure shall be subjected to a normal temperature test under both input (charging) and output (discharging) conditions. As a result of this testing, temperatures on temperature sensitive components shall not exceed the limits outlined in Table 13A.1. **Table 13A.1** **Normal temperature limits – Component** Part / Maximum Temperature (T_{max}) °C Synthetic rubber or PVC insulation of internal and external wiring – without temperature marking / 75 – with temperature marking / The temperature marking Components, insulation, and thermoplastic materials / [a] Cell casing / [b] [a] Temperatures measured on components and materials shall not exceed the maximum temperature rating for that component or material including internal cells. [b] The cell casing temperature shall not exceed the manufacturer's recommended maximum temperature.		P
13A.2	For the output loading temperature test, a fully charged battery pack shall be subjected to a constant resistive loading across the output terminals of the pack with the output load current set to just below the operating limit of the discharging protection circuit. Temperatures are monitored until thermal stabilization or until the pack is at its specified endpoint voltage, whichever comes first.		P
13A.3	The input loading temperature test shall be conducted on a fully discharged battery pack, discharged at a constant current of 0.2C/1 hour to a manufacturer specified discharge endpoint voltage.		P
13A.4	For the input loading temperature test, a fully discharged sample shall be subjected to a CCCV charging method with the maximum charging voltage not to exceed the manufacturer's recommended maximum charging voltage limits. During the test, the charging current shall not exceed three times the maximum charge current or the operating limit of the charging protection circuit, whichever is less, during the test. Temperatures are monitored until thermal stabilization or until the pack is at its fully charged state, whichever comes first.		P

UL 2056			
Clause	Requirement + Test	Result - Remark	Verdict
13A.5	Temperatures are considered to be stabilized when three successive readings taken at intervals of 10 percent of the previously elapsed duration of the test, but not less than 15 minutes, indicate no further increase.		P
13A.6-13A.7	Temperatures are monitored on surfaces of components using thermocouples. Thermocouples are to consist of 30 AWG wires. Larger size wires may be used, but they shall not exceed 24 AWG and shall not be large enough to result in a heat sink condition on the part under test.		P
13B	Battery Pack surface test	(see appended table 13B)	P
13B.1	A battery pack with enclosure shall be subjected to a normal temperature test under both input (charging) and output (discharging) conditions. As a result of this testing, temperatures on external accessible surfaces of the pack shall not exceed the limits outlined in Table 13B.1. Table 13B.1 Normal temperature limits – Surface Accessible Surfaces / Maximum Temperature (T_{max}) °C: Metal / Plastic[a] Accessible parts held continuously during normal use: 55 / 75 Accessible surfaces held or touched for short periods only: 60 / 85 Accessible surfaces which may be touched: 70 / 95 [a]Temperatures measured on accessible plastic enclosure surfaces shall not exceed the temperature ratings of the materials.		P
13B.2	For the output loading temperature test, a fully charged battery pack shall be subjected to a constant resistive loading across the output terminals of the pack with the output load current set to just below the operating limit of the discharging protection circuit. Temperatures are monitored until thermal stabilization or until the pack is at its specified endpoint voltage, whichever comes first.		P
13B.3	The input loading temperature test shall be conducted on a fully discharged battery pack, discharged at a constant current of 0,2 C/1 hour to a manufacturer specified discharge endpoint voltage.		P
13B.4	For the input loading temperature test, a fully discharged sample shall be subjected to a CCCV charging method with the maximum charging voltage not to exceed the manufacturer's recommended maximum charging voltage limits. During the test, the charging current shall not exceed three times the maximum charge current or the operating limit of the charging protection circuit, whichever is less, during the test. Temperatures are monitored until thermal stabilization or until the pack is at its fully charged state, whichever comes first.		P
13B.5	Temperatures are considered to be stabilized when three successive readings taken at intervals of 10 percent of the previously elapsed duration of the test, but not less than 15 minutes, indicate no further increase.		P

UL 2056			
Clause	Requirement + Test	Result - Remark	Verdict
13B.6-13B.7	Temperatures are monitored on the accessible surfaces of the pack enclosure using thermocouples. Thermocouples are to consists of 30 AWG wires. Larger size wires may be used, but they shall not exceed 24 AWG.		P
13B.8	During the normal temperature test, temperature measurement T shall not exceed (Tmax + Tamb −Tma)		P
14	Crush Test (not applicable to power bank)		N/A
15	Impact Test (not applicable to power bank)		N/A
16	Shock Test (not applicable to power bank)		N/A
17	Vibration Test (not applicable to power bank)		N/A
18	BATTERY ENCLOSURE TESTS - General		P
19	250 N Steady Force Test	(see appended table 19)	P
19.1-19.2	External enclosures of the battery pack are to be subjected to a steady force of 250 10 N (56 2 pounds force) for a period of 5 seconds, applied in turn to the top, bottom and sides of the battery pack enclosure by means of a suitable test tool providing contact over a circular plane surface 30 mm (1.2 inches) in diameter.		P
19.3	Results: The samples shall not explode or catch fire. The outer battery enclosure shall not crack to the extent that the cells or any protective devices are exposed. Openings in the enclosure created as a result of application of the 250 N steady force shall meet the criteria of 4.1.5.		P
19.4	The sample shall be examined 6 hours after testing and shall not vent or leak as described in 5.2.		P
20	Mold Stress Relief Test	(see appended table 20)	P
20.1	Each of three samples are to be placed in a full-draft circulating-air oven maintained at a uniform temperature of 70°C (158°F). The samples are to remain in the oven for 7 hours.		N/A
	Exception: If the maximum temperature, T, recorded on the battery pack thermoplastic enclosure parts, obtained during the normal temperature test of Section 13A exceeds 60°C (140°F), then the oven temperature is to be maintained at a temperature equal to T + 10°C (50°F).	90°C for 7h	P
20.2	To prevent hazards from overheating energized cells, samples shall either be fully discharged prior to conditioning or provided with dummy cells, which are representative of the actual cells.		P

UL 2056			
Clause	Requirement + Test	Result - Remark	Verdict
20.3	After careful removal from the oven and after returning to room temperature following the conditioning described in 20.3, the samples shall show no evidence of mechanical damage that would result in damage to cells or protective circuitry. In addition, the battery enclosures shall not crack, warp, or melt to the extent that the cells or any protective devices are exposed. Openings in the enclosure created as a result of the conditioning shall meet the criteria of 4.1.5.		P
21	Drop Impact Test	(see appended table 21)	P
21.1	Battery packs employing plastic enclosures that are intended for use in 0°C (32°F) temperatures shall be conditioned for 3 hours at 0°C (or temperature specified if lower than 0°C) prior to conducting the drop test, which shall be conducted immediately after removing the samples from the cold conditioning.		P
21.2	Each of three samples is to be dropped from a height of 1 m (3,28 ft) so it strikes a concrete surface in the position that is most likely to produce the adverse results in 21.3. Each sample is to be dropped three times.		P
21.3	Results: The samples shall not explode or catch fire.		P
21.4	The sample shall be examined 6 hours after testing and shall not vent or leak as described in 5.2, and the integrity of the protective devices shall be maintained.		P
21.5	The outer battery enclosure shall not crack to the extent that cells or any protective devices are exposed. Openings in the enclosure created as a result of the drop impact(s) shall meet the criteria of 4.1.5.		P
22	Projectile Test (not applicable to power bank)		N/A
23	Heating Test (not applicable to power bank)		N/A
24	Temperature Cycling Test (not applicable to power bank)		N/A
--	Marking and Instructions		--
25.1	A battery shall be legibly and permanently marked with: a) The manufacturer's name, trade name, or trademark or other descriptive marking by which the organization responsible for the product may be identified; b) A distinctive ("catalog" or "model") number or the equivalent; c) The electrical rating in Vdc and Ah. (Secondary lithium batteries may be marked in Wh rather than Ah); and d) The date or other dating period of manufacture not exceeding any three consecutive months.		P
25.2	When a manufacturer produces the battery at more than one factory, each battery shall have a distinctive marking to identify it as the product of a particular factory.		N/A

UL 2056			
Clause	Requirement + Test	Result - Remark	Verdict
25.3	A battery or the smallest unit package or instructions provided with each battery shall include the following statements or equivalent: a) An attention word, such as “Caution,” “Warning,” or “Danger.” b) A brief description of possible hazards associated with mishandling of the battery, such as burn hazard, fire hazard, explosion hazard. c) A list of actions to take to avoid possible hazards, such as do not crush, disassemble, dispose of in fire, or similar actions, and for primary batteries, do not charge. d) Instructions regarding replacement batteries if the batteries are replaceable by the user.		P
25.3.1	Caution marking for lithium ion battery pack		P
25.4	The manufacturer’s specified charging instructions shall be included for secondary batteries. Primary batteries shall include instructions indicating that the batteries shall not be charged.		P
25.5	A cell or battery that is less than 32 mm (1,25 inches) in diameter by 3,8 mm (0,15 in) thick shall include the following marking or equivalent on the smallest unit package or instructions provided with each cell or battery: Caution – Never put batteries in mouth. If swallowed, contact your physician or local poison control center.		N/A
25.6	Batteries which meet the requirements of the Limited Power Source Test, Paragraph 13.4, may include the Marking “Limited Power Source” or “LPS”.	LPS marking may be optional	P

Table 9	Table: Power Input Test					P
U (V)	**I (A)**	**Irated (A)**	**P (W)**	**Fuse #**	**Ifuse (A)**	**Condition/status**
5,0	0,49	0,45	--	--	--	Charge mode: Micro USB (5 V, 0,45 A)
5,0	0,49	0,45	--	--	--	Charge and play mode: USB (5 V, 0,6 A)
Supplementary information: - The current input did not exceed 110% of the marked input current rating.						

Table 10&11	TABLE: Overload of Output Ports Test / Flammability of Photovoltaic Cells Test					P
	Ambient temperature (°C) ..... :		23,5			—
Component No.	**Fault**	**Supply voltage (V)**	**Test time**	**Fuse #**	**Fuse current (A)**	**Observation**
USB Output terminal	Overload	--	70min	--	--	The max current was 1,0 A. The cheesecloth did remain intact. The tissue paper did remain intact.
Photovoltaic Cell	SC D11	--	60min	--	--	The cheesecloth did remain intact. The tissue paper did remain intact.
Supplementary information: - SC = short circuit						

Table 12	TABLE: Capacity Verification Test			P
Model / Sample No.	**Output Port**	**Rated Current**	**Measured capacity**	**Rated capacity**
FOSPWB-2376 / #30	USB	0,6 A	759,8 mAh	750 mAh
Supplementary information: - The measured capacity did exceed the marked output capacity rating.				

Table 9A	Table: Short Circuit Test				N/A
Model / Sample No.	**Status**	**Ambient (20°C ± 5°C)**	**OCV at start of test, V d.c.**	**Maximum Temperature on Cell Case (Tmax), °C**	**Results**
--	Normal	--	--	--	--
	Single fault	--	--	--	--
Additional condition: The terminals are to be subjected to a short circuit condition with a minimum length of 16 AWG (1.3 mm^2) bare copper wire. The test is to be conducted on a tissue paper covered soft wood surface and the sample battery pack and bare conductor is to be covered with a single layer of cheesecloth.					
Model / Sample No.	**Status**	**Ambient (55°C ± 5°C)**	**OCV at start of test, V d.c.**	**Maximum Temperature on Cell Case (Tmax), °C**	**Results**
--	Normal	--	--	--	--
	Single fault	--	--	--	--

After test:

Table 10A	Table: Abnormal Charging Test						P
Model / Sample No.	**Status**	**Target Maximum Charge Current, Imax, mA**	**Measured Maximum Charge Current Imax, mA**	**Target Maximum Charge Voltage, V dc**	**Measured Maximum Charge Voltage, V dc**	**Maximum Temperature on Cell Case (Tmax), °C**	**Results**
FOSPWB-2376 / #1	Normal	6000	500,0	5,0	5,0	23,5	Pass
FOSPWB-2376 / #2	SC U2 Pin (2-7)	6000	500,0	5,0	5,0	23,4	Pass
FOSPWB-2376 / #3	SC U2 Pin (2-7)	6000	500,0	5,0	5,0	23,4	Pass
FOSPWB-2376 / #4	SC U7 Pin (3-4)	6000	2480,0	5,0	5,0	25,9	Pass
FOSPWB-2376 / #5	SC U7 Pin (3-4)	6000	2480,0	5,0	5,0	24,8	Pass

Supplementary information:
- SC = short circuit

After test:
No fire, no explosion, no result in chemical leaks caused by cracking, rupturing or bursting of the cell casing.

Table 11A	Table: Abusive Overcharge Test					P
Model / Sample No.	**Status**	**Target Charge Current (10 x I(C_5) / 5 x I(C_5)) mA**	**Maximum Measured Charge Current, mA**	**Final Charge Current, mA**	**Maximum Internal Cell Case Temperature, °C**	**Results**
FOSPWB-2376 / #6	Normal	4000	4000,0	0	--*	Pass
FOSPWB-2376 / #7	Single fault: SC U2 Pin (2-7)	2000	2000,0	0	--*	Pass
FOSPWB-2376 / #8	Single fault: SC U2 Pin (2-7)	4000	4000,0	0	--*	Pass
FOSPWB-2376 / #9	Single fault: SC U7 Pin (3-4)	2000	2000,0	0	24,1	Pass
FOSPWB-2376 / #10	Single fault: SC U7 Pin (3-4)	4000	4000,0	0	--*	Pass

Supplementary information:
- SC = short circuit

--* Shut down immediately, No max. temperature was noted.

After test:
No fire, no explosion.

Table 12A	Table: Forced-Discharge Test				N/A
Model / Sample No.	**Status**	**Ambient (20°C ± 5°C)**	**Resistance of Circuit, mΩ**	**Maximum Temperature on Cell Case (Tmax), °C**	**Results**
--	Normal	--	--	--	--
	Single fault	--	--	--	--
After test: --					

Table 13A	Table: Battery Pack Component Temperature Test					P
Condition A: Output loading						
Model / Sample No.	**Temperature Locations**	**Ambient (20°C ± 5°C)**	**Recommended Ambient, °C (Tma)**	**Maximum Recorded Temp, °C**	**Calculated Temp °C**	**Limit °C**
FOSPWB-2376 / #17	PWB (near U7)	24,9	60	56,5	91,6	130
	PWB (near U4)	24,9	60	84,3	119,4	130
	PWB (near U2)	24,9	60	62,4	97,5	130
	Internal cell case	24,9	60	46,7	81,8	100
	Inside surface of battery pack enclosure	24,9	60	44,8	79,9	90
	Internal wire	24,9	60	44,7	79,8	80
Condition B: Input loading						
Model / Sample No.	**Temperature Locations**	**Ambient (20°C ± 5°C)**	**Recommended Ambient, °C (Tma)**	**Maximum Recorded Temp, °C**	**Calculated Temp °C**	**Limit °C**
FOSPWB-2376 / #17	PWB (near U7)	23,9	45	87,8	108,9	130
	PWB (near U4)	23,9	45	86,1	107,2	130
	PWB (near U2)	23,9	45	63,7	84,8	130
	Internal cell case	23,9	45	43,4	64,5	100
	Inside surface of battery pack enclosure	23,9	45	46,4	67,5	90
	Internal wire	23,9	45	40,8	61,9	80

Table 13B	Table: Battery Pack Surface Temperature Test					P
Condition A: Output loading						
Model / Sample No.	**Temperature Locations**	**Ambient (20°C ± 5°C)**	**Recommended Ambient, °C (Tma)**	**Maximum Recorded Temp, °C**	**Calculated Temp °C**	**Limit °C**
FOSPWB-2376 / #17	Non-metallic enclosure surface (Top)	24,9	60	36,5	71,6	85
	Non-metallic enclosure surface (Side)	24,9	60	38,9	74,0	85
	Non-metallic enclosure surface (Bottom)	24,9	60	32,6	67,7	85
Condition B: Input loading						
Model / Sample No.	**Temperature Locations**	**Ambient (20°C ± 5°C)**	**Recommended Ambient, °C (Tma)**	**Maximum Recorded Temp, ° C**	**Calculated Temp °C**	**Limit °C**

FOSPWB-2376 / #17	Non-metallic enclosure surface (Top)	23,9	45	35,9	57,0	85
	Non-metallic enclosure surface (Side)	23,9	45	43,7	64,8	85
	Non-metallic enclosure surface (Bottom)	23,9	45	35,6	56,7	85

Table 19	**Table: 250 N Steady Force Test**			**P**
Model / Sample No.	**Weight Before Test in Grams**	**Weight After Test in Grams**	**Percentage of Weight Loss**	**Results**
FOSPWB-2376 / #18	301,45	301,45	0	Pass
FOSPWB-2376 / #19	299,78	299,78	0	Pass
FOSPWB-2376 / #20	300,62	300,62	0	Pass

After test:
The samples did not explode or catch fire.
The outer battery enclosure did not crack to the extent that the cells or any protective devices were exposed.
The sample was examined 6 hours after testing and did not vent or leak as described in 5.2

Table 20	**Table: Mold Stress Relief Test**	**P**
Model / Sample No..	**Oven Temp, °C**	**Results**
FOSPWB-2376 / #21	90	Pass
FOSPWB-2376 / #22	90	Pass
FOSPWB-2376 / #23	90	Pass

After test:
The samples did show no evidence of mechanical damage that would result in damage to cells or protective circuitry.
Battery enclosures did not crack, warp, or melt to the extent that the cells or any protective devices were exposed.

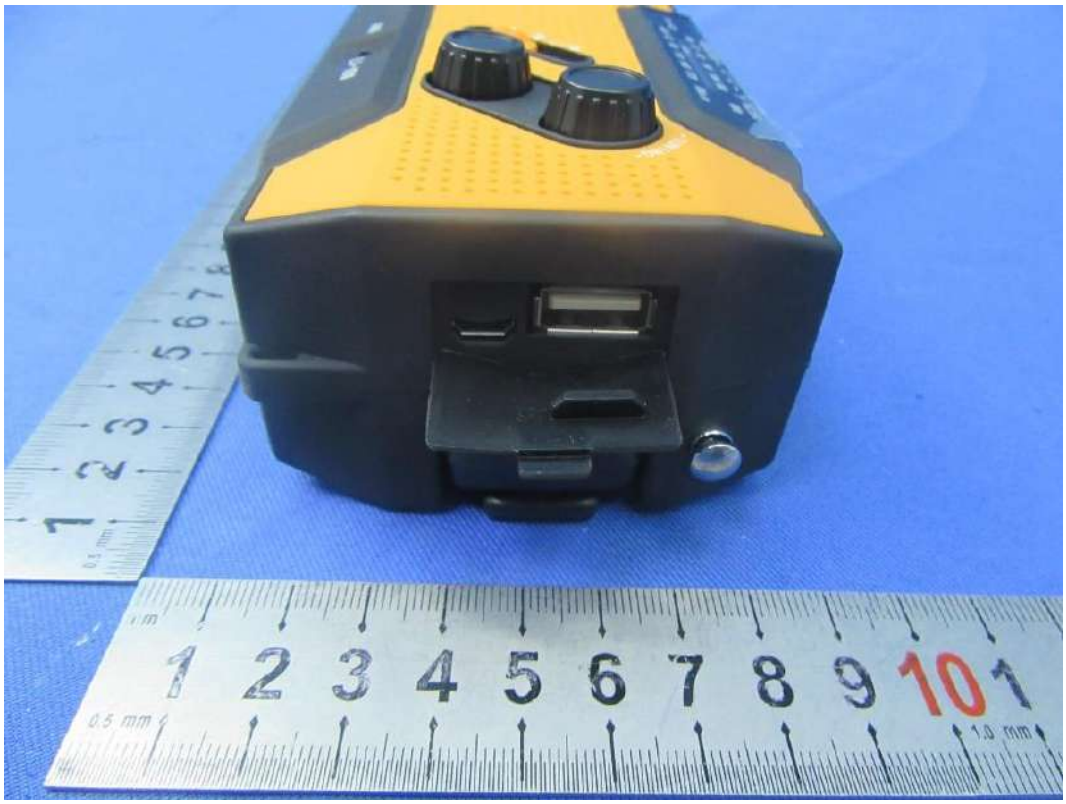
Table 21	**Table: Drop Impact Test**				**P**
Sample No.	**Conditioned temperature, ºC**	**Weight Before Test in Grams**	**Weight After Test in Grams**	**Percentage of Weight Loss**	**Results**
FOSPWB-2376 / #24	-10	301,69	301,69	0	Pass
FOSPWB-2376 / #25	-10	300,82	300,82	0	Pass
FOSPWB-2376 / #26	-10	301,58	301,58	0	Pass

After test:
The samples did not explode or catch fire.
The sample was examined 6 hours after testing and did not vent or leak as described in 5.2, and the integrity of the protective devices were maintained.
The outer battery enclosure did not crack to the extent that cells or any protective devices were exposed.

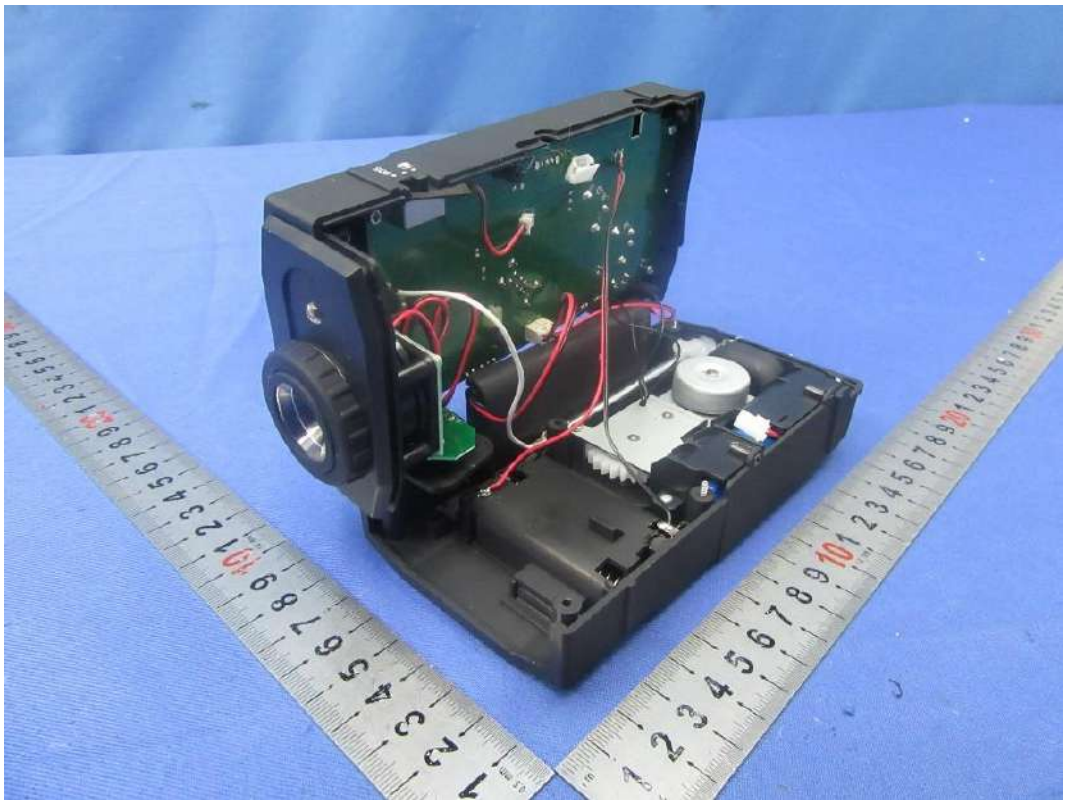
Appendix: Photos

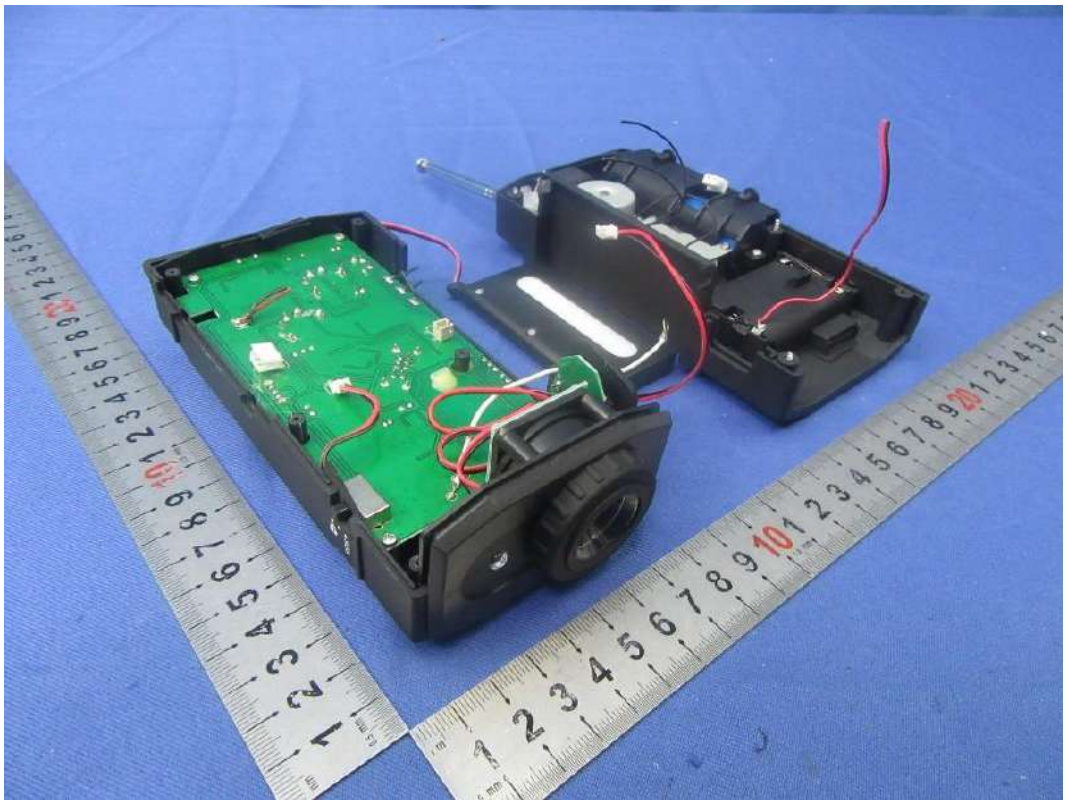
Whole unit

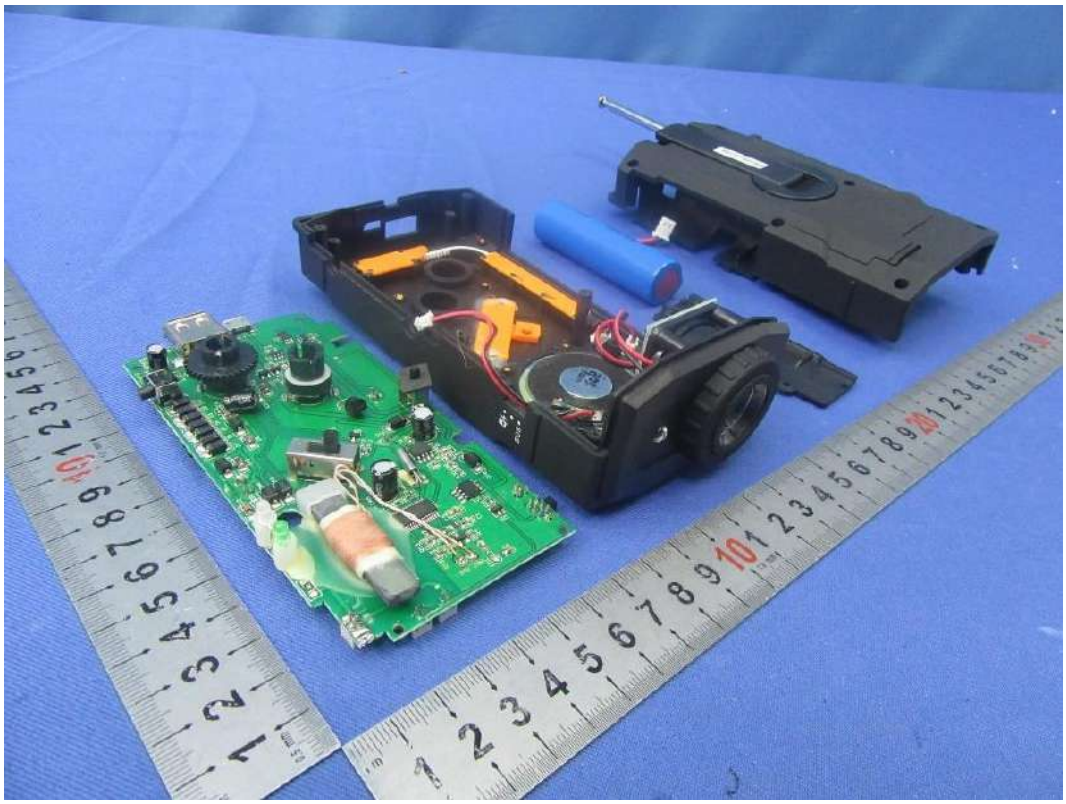

DC IN
USB



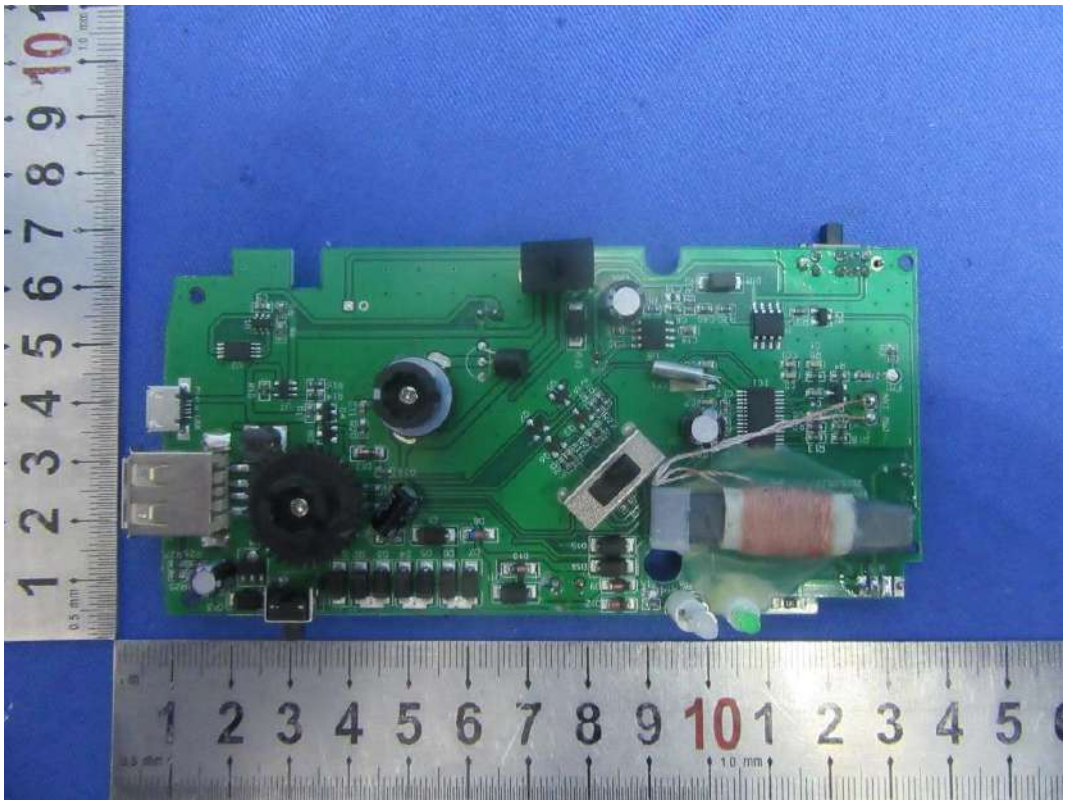
Internal

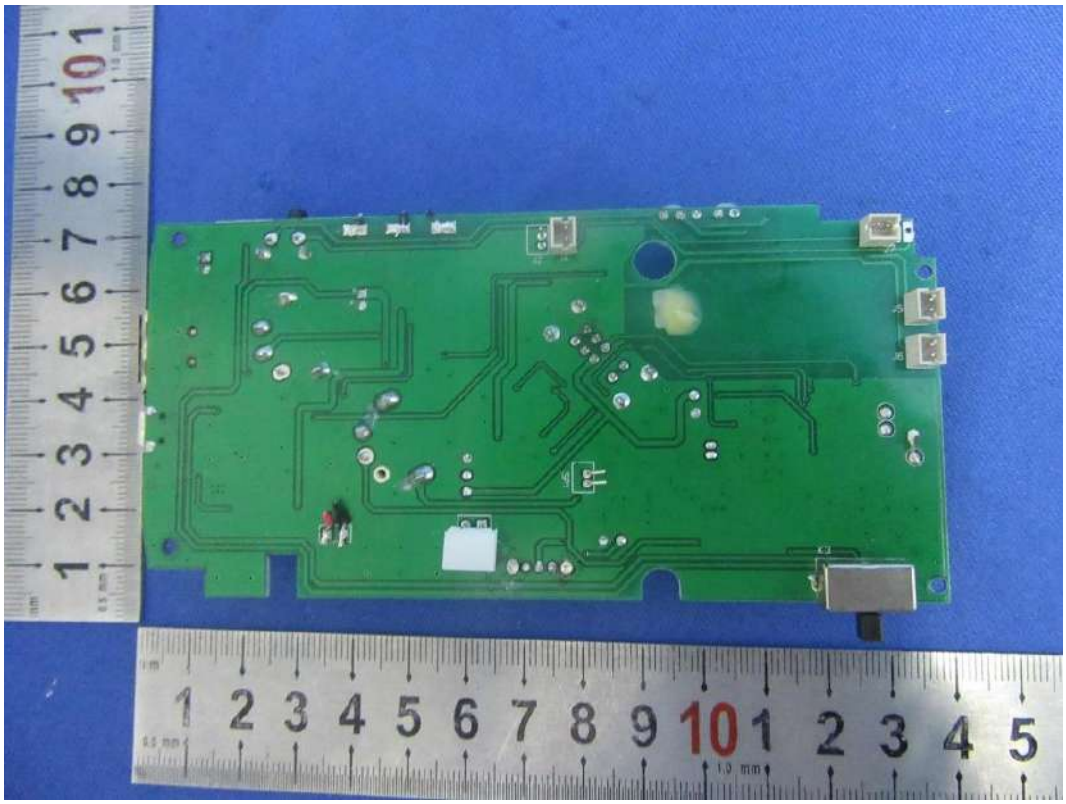




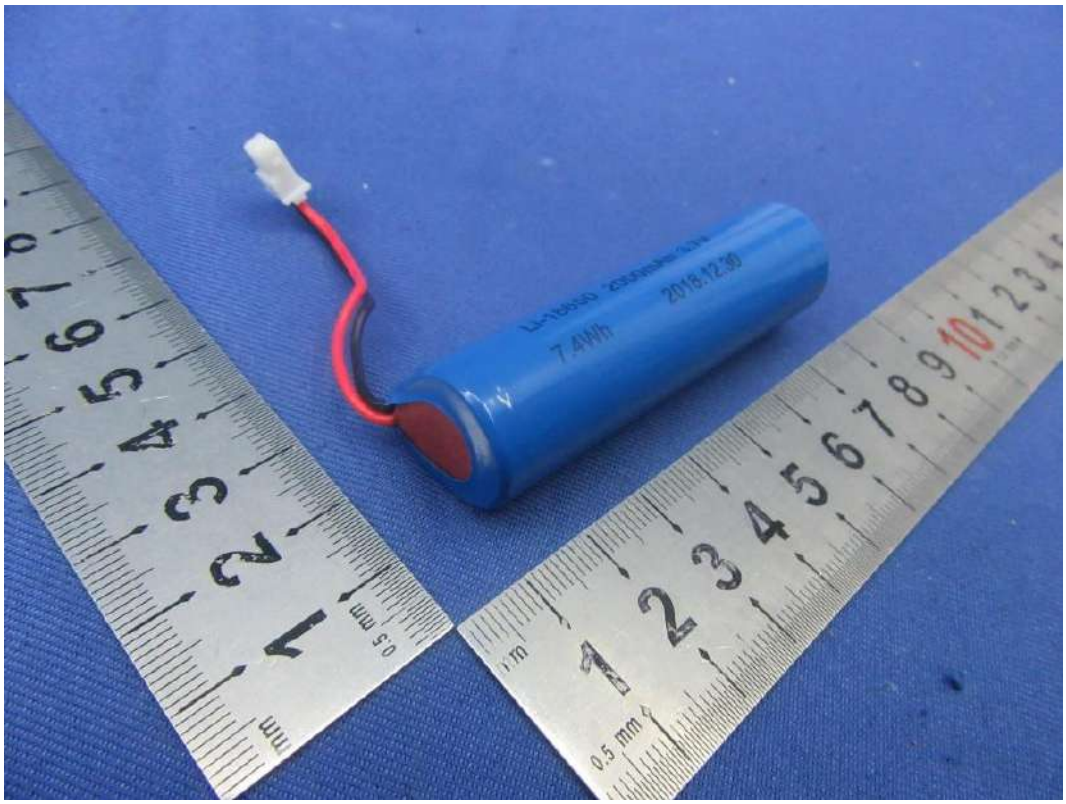


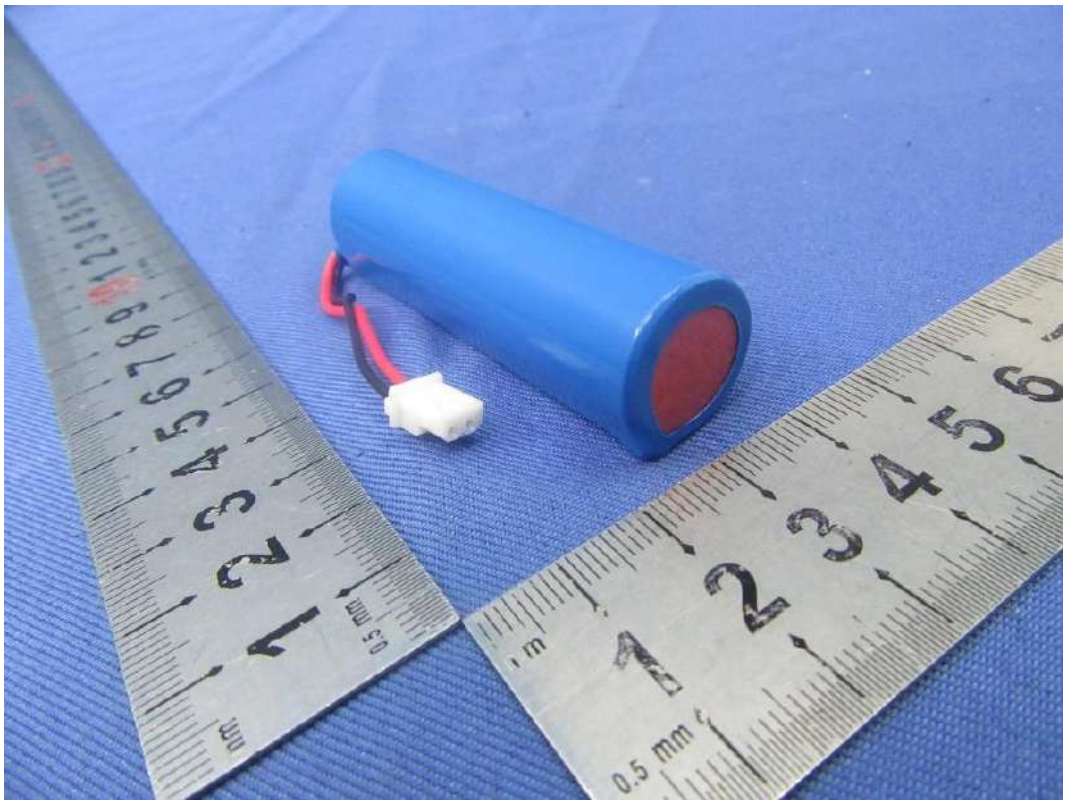
PWB

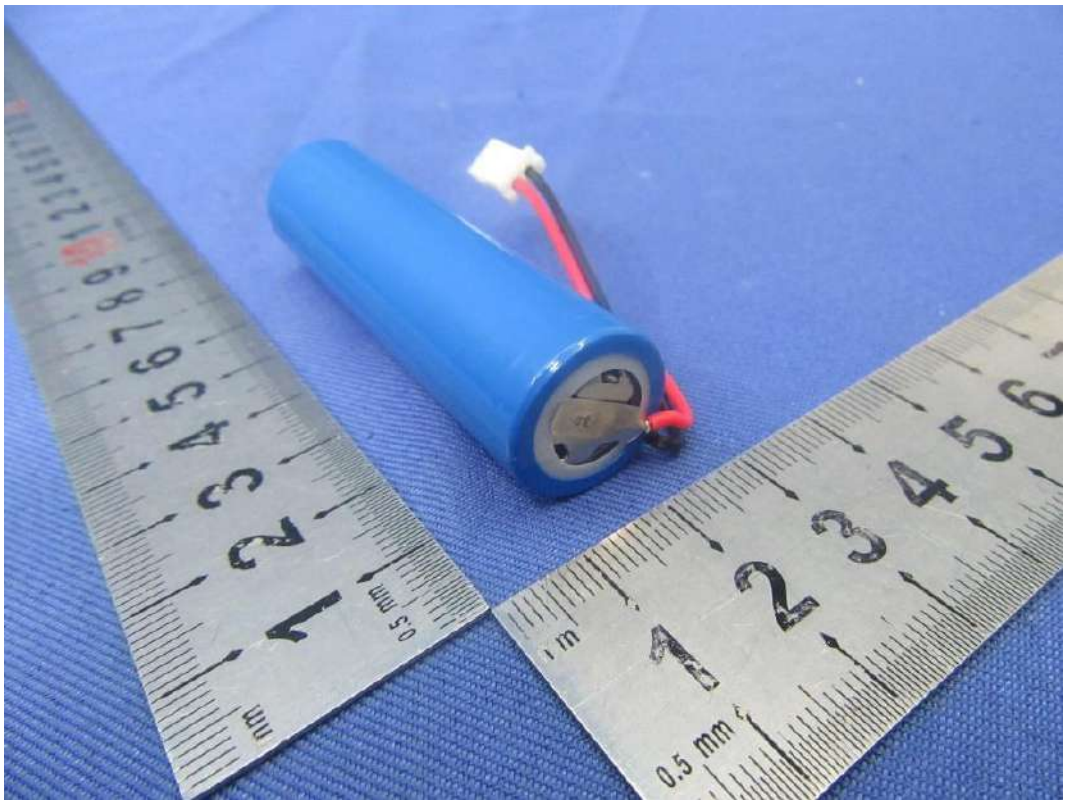


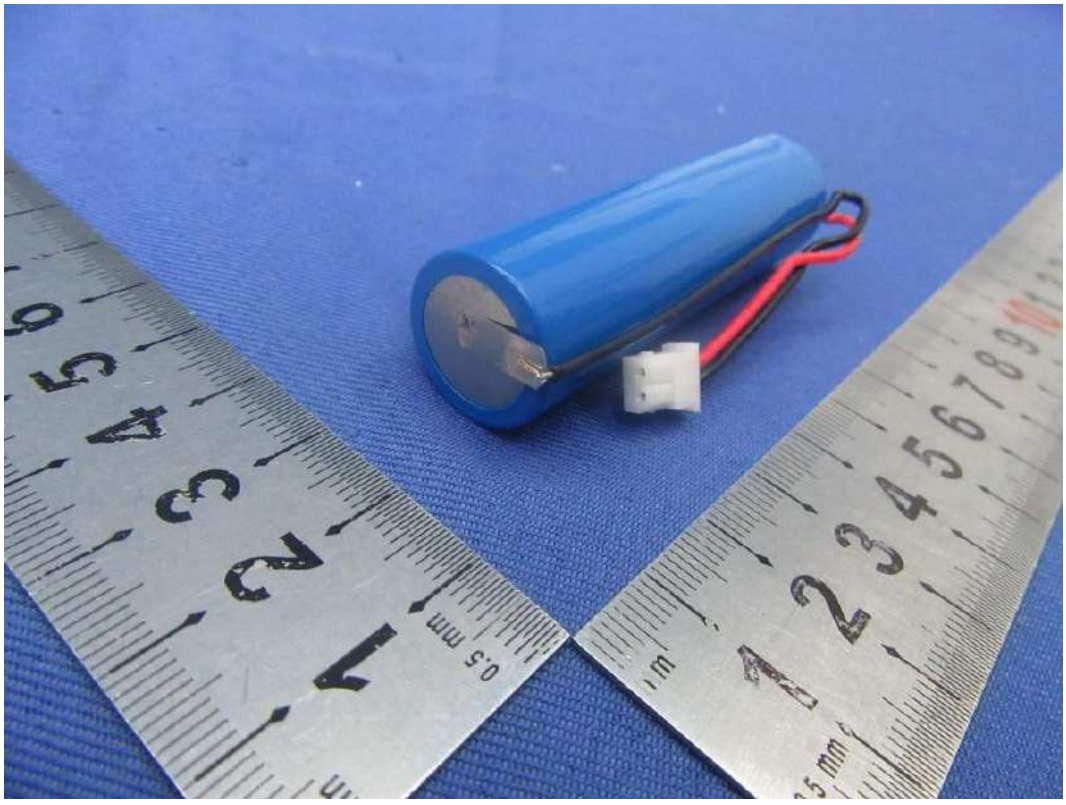


Cell









---End of report---