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. .....:	STRD1812071S
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Date of issue .....:	January 10, 2019
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Testing laboratory .....:	Shenzhen SEM Test Technology Co., Ltd.
Address .....:	1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road, Bao'an District, Shenzhen, P.R.C (518101)
Testing location .....:	As above
Applicant's name .....:	DNK Power Company Limited
Address .....:	Floor 7, 35 Building,Tongfuyu industry park, Hua Fan Road, Da Lang Street, Long Hua New District,Shenzhen City, Guangdong Province, China, 518109
Manufacturer's name ..... :	DNK Power Company Limited
Address .....:	Floor 7, 35 Building,Tongfuyu industry park, Hua Fan Road, Da Lang Street, Long Hua New District,Shenzhen City, Guangdong Province, China, 518109
Test specification ..... :	
Standard .....:	IEC 62133-2:2017
Test procedure .....:	Type approved
Non-standard test method .....:	N.A.

This test report is specially limited to the above client company and product model only, It may not be duplicated without prior written consent of SEM. Test.

Test item description .....:	Lithium polymer battery
Trade Mark .....:	DNK
Model/type reference .....:	DNK 483535

Ratings .....: 3.7V,1.85Wh (500mAh)

Particulars: test item vs. test requirements	
Classification of installation and use .....:	Build-in and use in portable applications
Supply connection.....:	Connecter
Chemistry.....:	☒ Lithium systems ☐ nickel systems
Shape .....:	☒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 .....:	December 18, 2018
Date(s) of performance of test .....:	December 19, 2018- January 2, 2019

General remarks:

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

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

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

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

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

General product information:

The Lithium polymer battery is constructed with one lithium polymer cells in 1S1P, 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.	DNK483535-500mAh	DNK 483535
Nominal voltage	3.7V	3.7V
Rated capacity	500mAh	500mAh

Max. Charging Current	250mA	250mA
Max. Charging voltage	4.20V	4.20V
End of discharge voltage	3.0V	3.0V
Charging temperature recommended by manufacturer	0-45℃	0-45℃
First charging procedure (20℃±5℃)	Charge at constant current 1000mA until voltage reaches 4.2V, and then charge at constant voltage 4.2V till charge current is 5mA.	Charge at constant current 1000mA until voltage reaches 4.2V, and then charge at constant voltage 4.2V till charge current is 5mA.
Second charging procedure	Stored at 45℃ or -5℃ for 1h-4h, then charge at constant current 1000mA until voltage reaches 4.25V, then charge at constant voltage 4.25V till charge current is 0.05C(25mA)	/
Dimension	34.6mm*34.5mm*4.8mm	36.5mm *35.0mm*4.8mm
Weight	10.0g	11.5g

Tests Performed (name of test and test clause):

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

Test items:

Cl.6 type test conditions

Cl.7.1 Charging procedures for test purposes

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.7.3.8.1 Vibration(battery)

Cl.7.3.8.2 Mechanical Shock(battery)

Testing Location:

Shenzhen SEM Test Technology Co., Ltd.

1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road, Bao'an District, Shenzhen, P.R.C (518101)

Test conclusion:

The Lithium polymer battery submitted by DNK Power Company Limited are tested according to IEC 62133-2:2017 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

Test result: Pass.

Copy of marking plate:

Lithium polymer battery
Model: DNK 483535
(1ICP5/35/35)
Rated value: 3.7V, 500mAh(1.85Wh)
Do not disassemble, crush, puncture, or short external wires
Do not dispose of in fire or water.
Date of manufacture: December 17, 2018
Red wire(+) Black wire(-)

DNK Power Company Limited
Made in China

Circuit diagram:

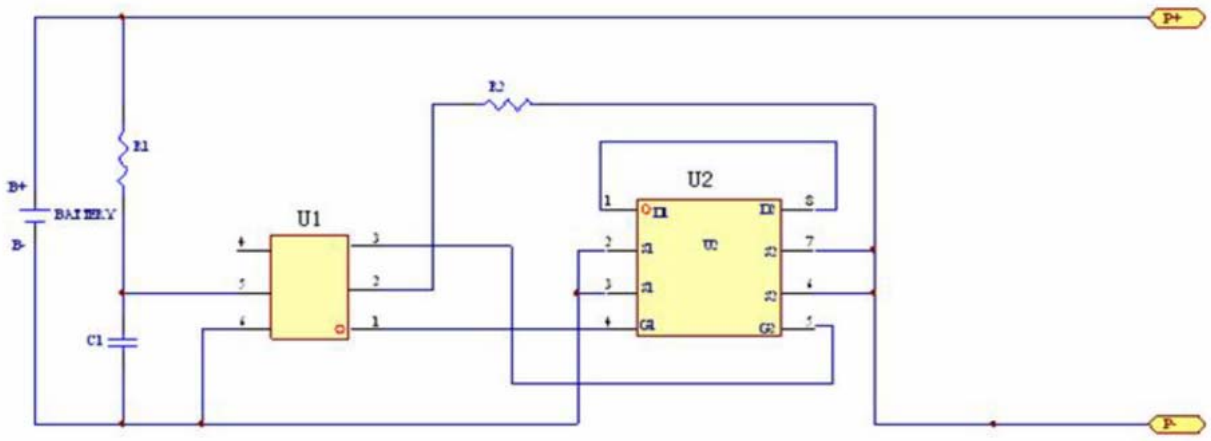

	TABLE: Critical components information				P
Object/part No.	**Manufacturer/ trademark**	**Type/ model**	**Technical data**	**Standard**	**Mark(s) of conformity**
Lead wire	SHENZHEN XINJUNHUA MATERIAL CO.,LTD	3302	30AWG, 120ºC, 30V, VW-1	UL 758	UL
Alternative	Interchangeable	Interchangeable	Min.30AWG, 120ºC, 30V, VW-1	UL 758	UL
PCM	SHENZHEN XINDONGTAI ELECTRONICS CO.,LTD	XDT-LN-1537	--	IEC62133-2: 2017	Tested with appliance
-PCB	Interchangeable	Interchangeable	V-0,130ºC	UL 796	UL
-Protect IC (U1)	Seiko Instruments Inc	S-8261ABJMD-G3JT2X	V_{CU}=4.28±0.05V, V_{DL}=2.4±0.1V	---	---
-MOSFET (U2)	Shenzhen Developer Microelectronics CO., LTD	8205A-TSSOP-6	V_{DS}=20V, V_{GS}=±12V, I_D=6A, Tj, Tstg: -55 ºC to 150 ºC	---	---
Cell	DNK Power Company Limited.	DNK483535-500mAh	3.7V, 500mAh	IEC62133-2: 2017	Tested with appliance
-Electrolyte	Guangzhou godsend high tech material company	TCE-201	$LiPF_6$ salt + EC solvent H_2O <20ppm HF<50ppm	--	--
-Separator	Shenzhen Senior Technology Material Co.,Ltd	12μm	PP, 16μm, Shutdown temperature: 130°C	--	--
-Positive Electrode	Soundon New Energy Co.,Ltd	SN2	Lithium (7.4%) + （Nickel+Cobalt+ Manganese ）(59.5%) + Oxygen (33.1%)	--	--
-Negative Electrode	Shenzhen Sinou Industrial Development Co.,Ltd	MAG-507	Graphite	--	--

IEC 62133-2: 2017			
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		N/A
	Orientation of wiring maintains adequate clearance and creepage distances between conductors		N/A
	Mechanical integrity of internal connections accommodates reasonably foreseeable misuse		N/A
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	Need to considered in end product	N/A
5.4	Temperature/voltage/current management		P
	Batteries are designed such that abnormal temperature rise conditions are prevented		P
	Batteries are designed to be within temperature, voltage and current limits specified by the cell manufacturer		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		P

IEC 62133-2: 2017			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
5.5	Terminal contacts		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
	Terminal contacts are arranged to minimize the risk of short-circuit		P
5.6	Assembly of cells into batteries	Single cell battery.	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		N/A
	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		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		N/A
	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		N/A
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		P

IEC 62133-2: 2017			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
	Table 2		
	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		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	Without rigid enclosure, considered in end product	N/A
	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		N/A
	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		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		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		P
	The manufacturer prepares and implements a quality plan that defines procedures for the inspection of materials, components, cells and	ISO 9001 certificate of battery manufacturer was provided	P

IEC 62133-2: 2017			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
	batteries and which covers the whole process of producing each type of cell or battery		
5.8	Battery safety components		P
	According annex F		P

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	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		P

7	**Specific requirements and tests**		**P**
7.1	Charging procedure for test purposes		P
7.1.1	First procedure		P
	Test is carried out at 20°C±5°C. Charging method declared by the manufacturer.		P
	Prior to charging, the battery shall have been discharged at 20 °C ± 5 °C at a constant current of 0,2 It A down to a specified final voltage.		P
7.1.2	Second procedure		P
	For clause 7.3.1, 7.3.4, 7.3.5, and 7.3.9 charging procedure After stabilization for 1 to 4 hours respectively at ambient temperature of highest test temperature and lowest test temperature, as specified in Table 2		P
	cells are charged by using the upper limited charging voltage and maximum charging current, until the charging current is reduced to 0,05 It A, using a constant voltage charging method.		P
	- Upper limit charging voltage	4.25 V/cell	P
	- Maximum charging current Specified by the manufacturer of cells		P

IEC 62133-2: 2017			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
	Charging temp. Upper limit	45℃	P
	Charging temp. Lower limit	0℃	P

7.2	Intended use		P
7.2.1	Continuous charging at constant voltage (cells)		P
	Fully charged cells are subjected for 7 days to a charge as specified by the manufacturer.		P
	Results:: No fire, no explosion, no leakage	See below table;	P

Sample No.	Recommended Charging Method, CC, CV, or CC/CV	Recommended charging voltage V_c, (Vdc)	Recommended Charging Current Irec, A	OCV at Start of Test, Vdc	Results
C01	CC/CV	4.20	0.1	4.20	NF,NE,NL
C02	CC/CV	4.20	0.1	4.20	NF,NE,NL
C03	CC/CV	4.20	0.1	4.20	NF,NE,NL
C04	CC/CV	4.20	0.1	4.20	NF,NE,NL
C05	CC/CV	4.20	0.1	4.20	NF,NE,NL

supplementary information:

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

7.2.2	Case stress at high ambient temperature(battery)			P
	Fully charged batteries according to the first procedure in 7.1.1, the batteries were placed in an air-circulating oven at a temperature of 70°C ± 2°C for 7 hours. Afterwards, they are removed and allowed to return to room temperature.			P
	Results: no physical distortion of the battery casing resulting in exposure if internal components.			P
Sample No.	B01	B02	B03	P
Status	No evidence of mechanical damage No physical distortion of the battery case resulting in exposure of internal components.			

IEC 62133-2: 2017			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**

7.3	Reasonably foreseeable misuse		P
7.3.1	External short circuit (cell)		P
	Fully charged each cell according to the second procedure in 7.1.2;		P
	Fully charged cells were subjected to a short circuit test at 55°C ± 5°C.		P
	The external resistance of 80±20 mΩ.		P
	The cells were tested for 24 h or until the case temperature declined by 20% of the maximum temperature rise.		P
	Results: no fire, no explosion.		P
	After the test	See below	P

Sample No.	Ambient temperature (At 55°C ± 5ºC)	OCV at start of test (Vdc)	Max. External Temperature(°C)	Resistance of Circuit (mΩ)	Charging temp. Upper limit (°C)	Results
C06	55.0	4.23	127.5	60	45	NF,NE
C07	55.0	4.24	128.4	60	45	NF,NE
C08	55.0	4.24	127.9	60	45	NF,NE
C09	55.0	4.23	124.1	60	45	NF,NE
C10	55.0	4.24	125.7	60	45	NF,NE
Sample No.	Ambient temperature (At 55°C ± 5ºC)	OCV at start of test (Vdc)	Max. External Temperature(°C)	Resistance of Circuit (mΩ)	Charging temp. Lower limit (°C)	Results
C11	55.0	4.11	126.6	60	-5	NF,NE
C12	55.0	4.10	123.7	60	-5	NF,NE
C13	55.0	4.11	122.7	60	-5	NF,NE
C14	55.0	4.12	124.5	60	-5	NF,NE
C15	55.0	4.10	126.7	60	-5	NF,NE

supplementary information

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

7.3.2	External short circuit (battery)		P
	Each fully charged battery according to the second		P

IEC 62133-2: 2017						
Clause	**Requirement – Test**			**Result - Remark**		**Verdict**
	procedure in 7.1.1;					
	Fully charged batteries were subjected to a short circuit test at 20°C ± 5°C.					P
	The external resistance of 80±20 mΩ.					P
	The cells were tested for 24 h or until the case temperature declined by 20% of the maximum temperature rise.					P
	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
	Results: no fire, no explosion.					P
	After the test			See below		P
Sample No.	Ambient temperature (At 20°C ± 5ºC)	OCV at start of test (Vdc)	Max. External Temperature(°C)	Resistance of Circuit (mΩ)	Single fault component	Results
B04	25.0	4.19	26.1	60	--	NF,NE
B05	25.0	4.19	95.8	60	U2 SC	NF,NE
B06	25.0	4.19	95.7	60	U2 SC	NF,NE
B07	25.0	4.19	95.6	60	U2 SC	NF,NE
B08	25.0	4.19	95.9	60	U2 SC	NF,NE

supplementary information

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

7.3.3	Free fall		P
	Ambient temperature of 20±5℃		P
	Fully charged cells or batteries were dropped 3 times from a height of 1.0 m onto a concrete floor.	Three times	P
	After the test, the cell or battery shall be put on rest for a minimum of one hour and then a visual inspection shall be performed.		P
	Results: no fire, no explosion		P

Sample No.	C16	C17	C18
Status	NF, NE	NF, NE	NF, NE
Sample No.	B9	B10	B11

IEC 62133-2: 2017			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
Status	NF, NE	NF, NE	NF, NE
supplementary information: - NF: No Fire - NE: No Explosion - Fire: the emission of flames from a cell or battery. - Explosion: failure that occurs when a cell container or battery case opens violently and major components are forcibly expelled.			

7.3.4	Thermal abuse (cells)		P
	Fully charged cells were placed in a gravity or circulating air-convention oven. The oven temperature was raised at a rate of 5°C/min ± 2°C/min to a temperature of 130°C ± 2°C. The cell remained at that temperature for 30 minutes before the test was terminated.		P
	- 30 minutes for large cell (gross mass of more than 500 g as defined in IEC 62281)		N/A
	Gross mass of cell(g)		P
	Results: no fire, no explosion		P

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

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

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

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

supplementary information:

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

7.3.5	Crush (cells)		P
	Each fully charged cell, charged according to the second procedure at the upper limit charging temperature in 7.1.2, is immediately transferred and crushed between two flat surfaces in an ambient temperature.		P
	Fully charged cells were crushed between two flat surfaces with a hydraulic ram exerting a force of 13 kN ± 0.78 kN.		P
	The crushing is performed in a manner that will	See below	P

IEC 62133-2: 2017			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
	cause the most adverse result.		
	- Once the maximum force has been applied,		P
	- or an abrupt voltage drop of one-third of the original voltage has been obtained,		N/A
	A cylindrical or prismatic cell was crushed with its longitudinal axis parallel to the flat surfaces of the crushing apparatus. Test only the wide side of prismatic cells.		P
	Results: no fire, no explosion.		P

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

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

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

Sample No.	C34	C35	C36	C37	C38
Status	NF, NE	NF, NE	NF, NE	NF, NE	NF, NE

supplementary information:

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

7.3.6	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			P
	- Returned to ambient			P
	Constant charging current (A)			P
	Supply voltage (Vdc)			P
	Results: No fire, No explosion;			P

Sample No.	OCV before charging (Vdc)	Maximum outer casing temperature,(℃)	Results	P
B12	6.0	34.8	NF,NE	P
B13	6.0	35.4	NF,NE	P
B14	6.0	33.1	NF,NE	P
B15	6.0	33.3	NF,NE	P

IEC 62133-2: 2017				
Clause	**Requirement – Test**		**Result - Remark**	**Verdict**
B16	6.0	34.8	NF,NE	P
supplementary information: - NF: No Fire - NE: No Explosion - Fire: the emission of flames from a cell or battery. - Explosion: failure that occurs when a cell container or battery case opens violently and major components are forcibly expelled.				

7.3.7	Forced discharge (cells)		P
	A discharged cell is subjected to a reverse charge at 1 It A for 90 min.		P
	Results: no fire, no explosion		P

Sample no.	OCV before application of reverse charge (Vdc)	Measured Reverse Charge It (A)	Measured Reverse Charge Voltage (V)	Time for reversed charge, (minutes)	Results
C39	3.11	0.5	4.20	90	NF,NE
C40	3.14	0.5	4.20	90	NF,NE
C41	3.14	0.5	4.20	90	NF,NE
C42	3.14	0.5	4.20	90	NF,NE
C43	3.14	0.5	4.20	90	NF,NE

supplementary information:

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

7.3.8	Mechanical tests (batteries)		P
7.3.8.1	Vibration		P
	Test batteries, fully charged in accordance with the charging procedure of 7.1.1.		P
	Batteries Shall be firmly secured to the platform of the vibration machine without distorting them in such a manner as to faithfully transmit the vibration. Test batteries shall be subjected to sinusoidal vibration according to Table 3.		P
	Results: No fire, no explosion, no rupture, no leakage or venting.		P

Sample No.	OCV at start of test, (Vdc)	Total test time(h)	Result
B17	4.19	9	NF,NE,NL
B18	4.20	9	NF,NE,NL
B19	4.19	9	NF,NE,NL

IEC 62133-2: 2017			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
- NF: No Fire - NE: No Explosion - NL: No Leakage - Fire: the emission of flames from a cell or battery. - Explosion: failure that occurs when a cell container or battery case opens violently and major components are forcibly expelled. - Leakage: visible escape of liquid electrolyte.			
7.3.8.2	Mechanical shock		P
	Test batteries, fully charged in accordance with the charging procedure of 7.1.1		P
	Each test battery shall be subjected to three shocks in each direction of three mutually perpendicular mounting positions of the battery for a total of 18 shocks. For each shock, the parameters given in Table 4 shall be applied		P
	Results: No fire, no explosion, no rupture, no leakage or venting.		P

Sample No.	OCV at start of test, (Vdc)	Peak acceleration(g_n)	Result
B20	4.20	150	NF,NE,NL
B21	4.20	150	NF,NE,NL
B22	4.19	150	NF,NE,NL

- NF: No Fire - NE: No Explosion - NL: No Leakage - Fire: the emission of flames from a cell or battery. - Explosion: failure that occurs when a cell container or battery case opens violently and major components are forcibly expelled. - Leakage: visible escape of liquid electrolyte.			
7.3.9	Design evaluation – Forced internal short circuit (cells)	Only applicable to France, Japan, Korea and Switzerland;	N/A
	1) Number of samples		N/A
	This test shall be carried out on five secondary (rechargeable) lithium-ion cells.		N/A
	2) Charging procedure		N/A
	i) Conditioning charge and discharge		N/A
	ii) Storage procedure		N/A
	iii) Ambient temperature		N/A
	iv) Charging procedure for forced internal short test		N/A
	3) Pressing the winding core with nickel particle		N/A
	No fire.		N/A

IEC 62133-2: 2017						
Clause	**Requirement – Test**			**Result - Remark**		**Verdict**
Sample No.	Model	Chamber ambient (℃)	OCV at start of test, (Vdc)	Particle location [1)]	Maximum applied pressure, (N)	Results

Supplementary information:

[1)] identify one of the following:

1: Nickel particle inserted between positive and negative (active material) coated area.

2: Nickel particle insterted between positive aluminium foil and negative active material coated area;

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

8	**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		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		P
	Systems analyses performed by device manufacturers to ensure that a particular battery design prevents hazards from occurring during use of a product		P
	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		P

IEC 62133-2: 2017			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
	adult supervision		
8.2	Small cell and battery safety information		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

9	**Marking**		**P**
9.1	Cell marking	Test with appliance	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		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	Not coin cells	N/A
	Terminals have clear polarity marking on the external surface of the battery		P
	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		P
9.3	Caution for ingestion of small cells and batteries		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		P

IEC 62133-2: 2017			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
	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 disposal instructions given in manufacturer's specifications.	P
	Recommended charging instructions	Information for disposal instructions given in manufacturer's specifications.	P

10	**Packaging and transport**		**N/A**
	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		N/A

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		P
A.3	Consideration on charging voltage		P
A.3.1	General	Upper limit charging voltage is 4.25V	P
A.3.2	Upper limit charging voltage		P
A.3.2.1	General	Upper limit charging voltage is 4.25V	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		N/A
A.4	Consideration of temperature and charging current		P
A.4.1	General	Charging temperature range is 0-45°C for both cell and battery	P
A.4.2	Recommended temperature range		P
A.4.2.1	General		P
A.4.2.2	Safety consideration when a different		**P**

IEC 62133-2: 2017			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
	recommended temperature range is applied		
A.4.3	High temperature range	45°C for both cell and battery	P
A.4.3.1	General		P
A.4.3.2	Explanation of safety viewpoint		P
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	0°C for both cell and battery	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 the low temperature range		P
A.4.4.4	Safety considerations when specifying a new lower limit in the low temperature range		P
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		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		P

IEC 62133-2: 2017			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
	procedure		
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**		**P**

Annex C	**Recommendations to the end-users**		**P**

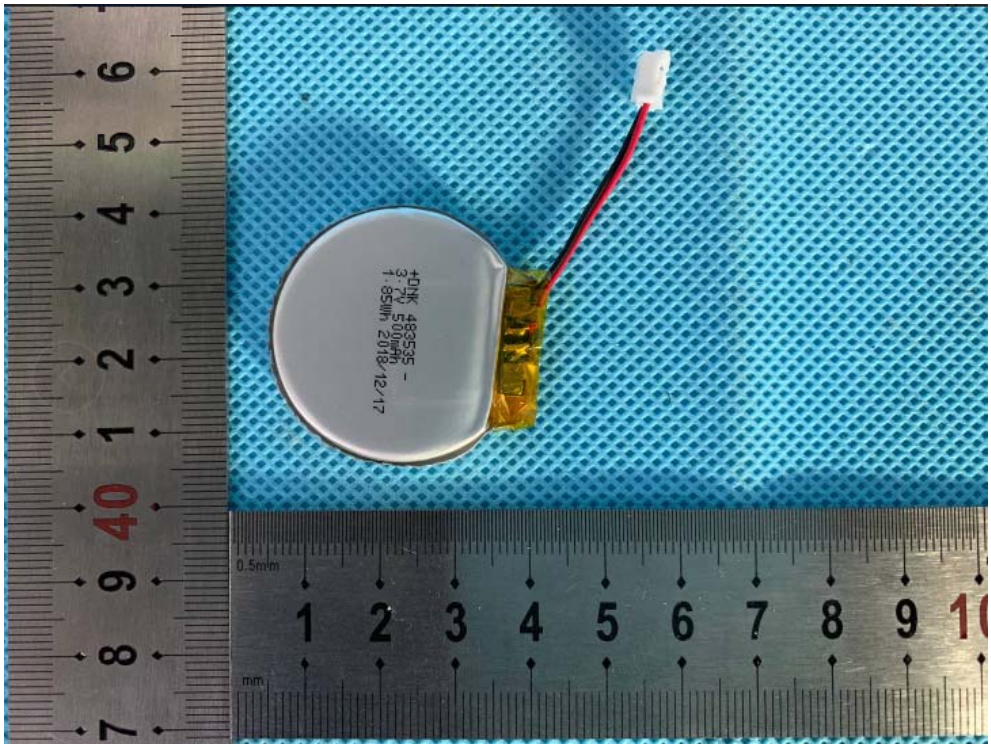
Annex D	**Measurement of the internal AC resistance for coin cells**		**N/A**
D.1	General	Not coin cells	N/A
D.2	Method		N/A
	A sample size of three coin cells is required for this measurement	(See appended table D.2)	N/A
	Coin cells with an internal resistance of less than or equal to 3 Ω are subjected 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

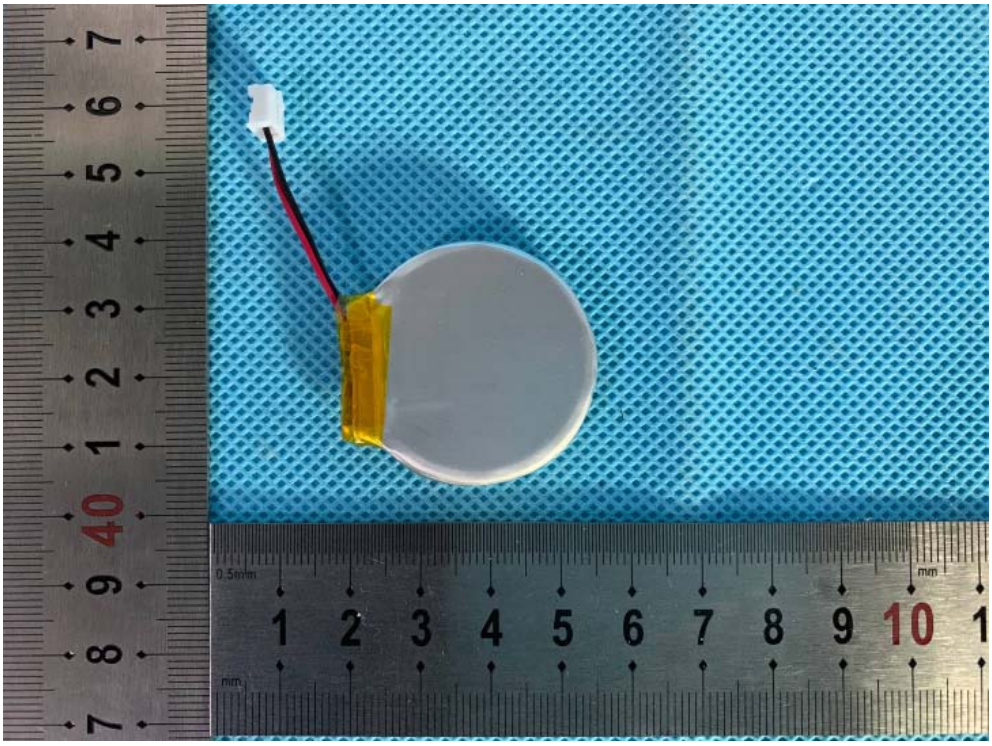
Annex E	**Packaging and transport**		**N/A**

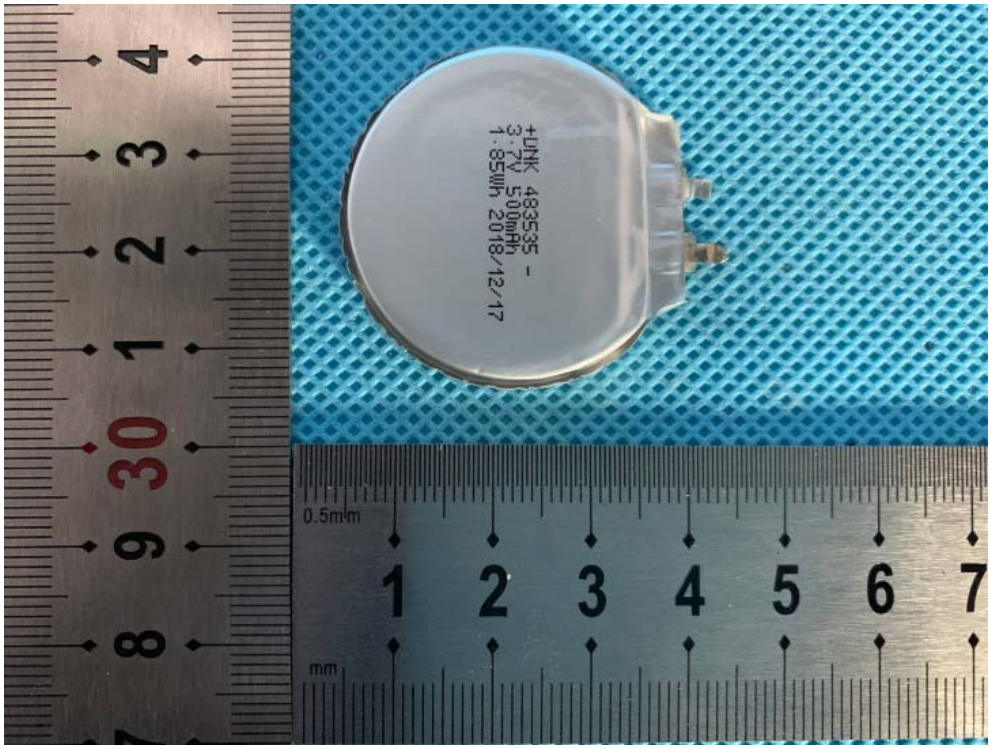
Annex F	**Component standards references**		**P**

Photos

Model: DNK 483535



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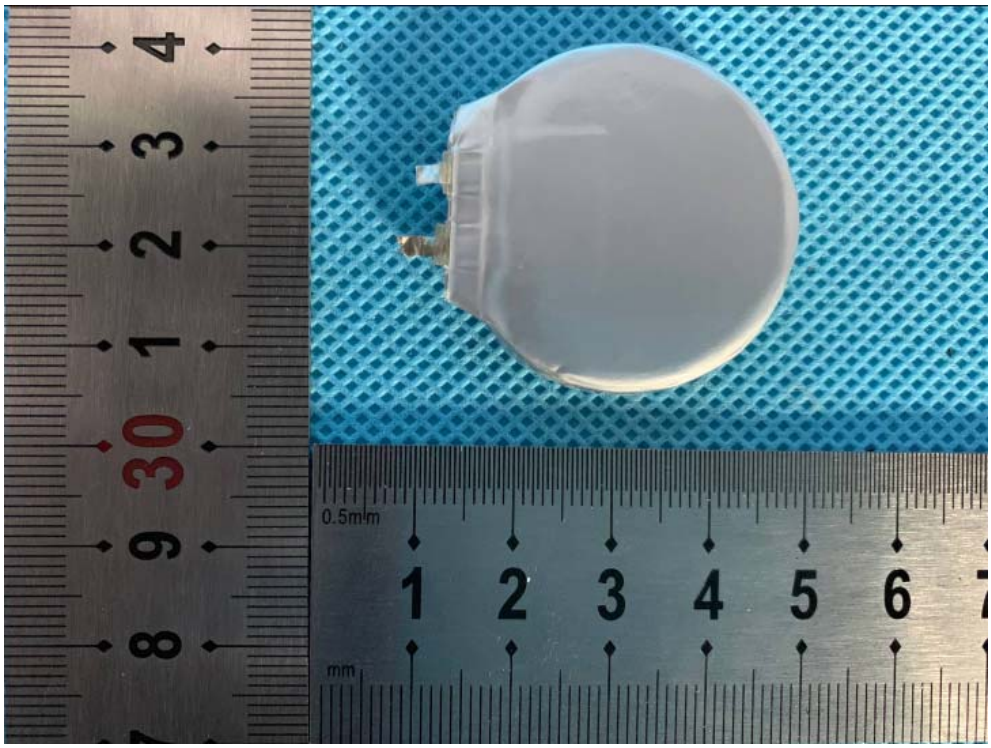
1.85Wh 2018/12/17
0.5mm
mm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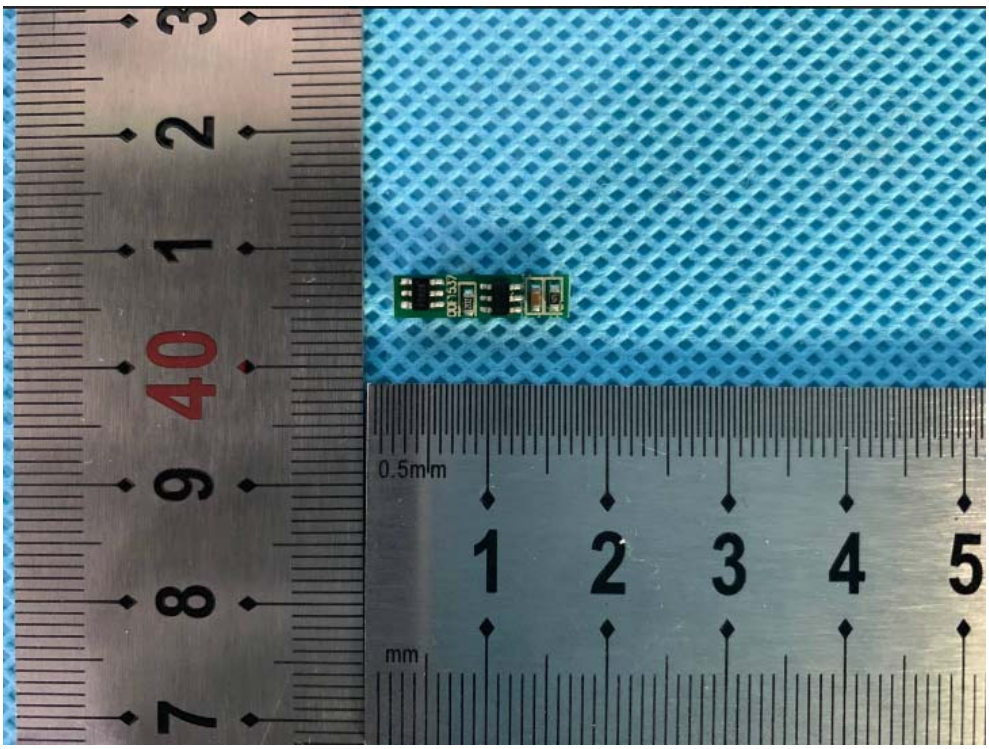

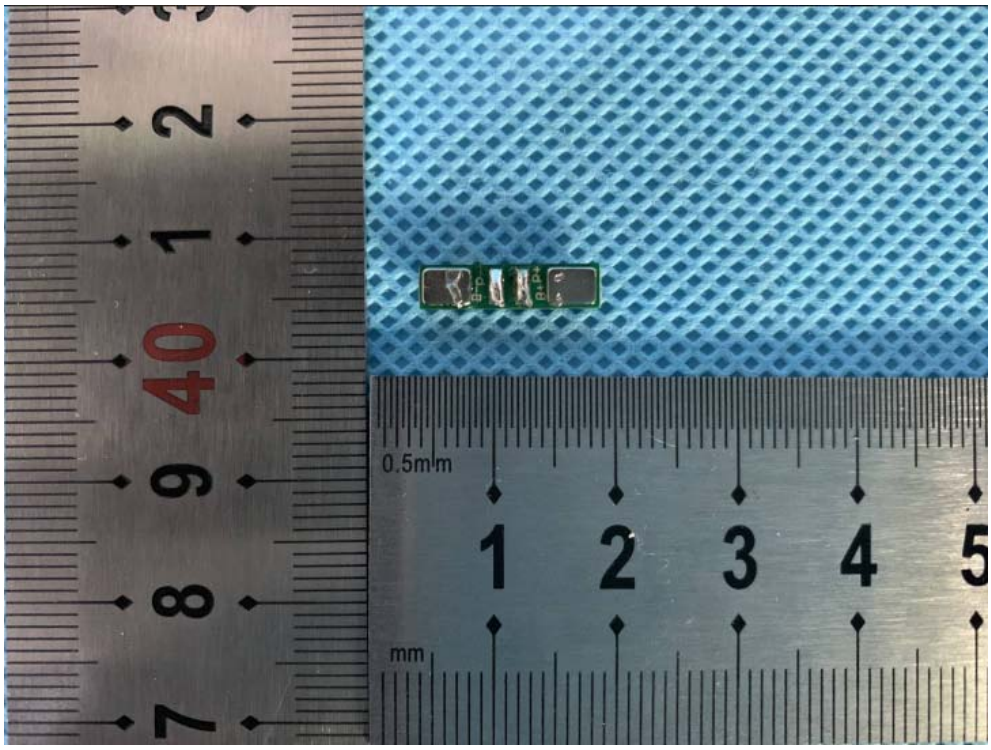

***** End of Test Report *****