

# TEST REPORT

Report No. : HE40021/2016

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Date : May 27, 2016

MOBILE ENERGY TECHNOLOGY CO., LTD  
NO.13, KONG 9<sup>TH</sup> ROAD, 2<sup>ND</sup> INDUSTRIAL PARK,  
LINKOU DISTRICT, NEW TAIPEI CITY, TAIWAN, R.O.C.

The following merchandise was submitted and identified by the vendor as:

Item	Information	Comments
Product Description	7S4P Li-ion Battery Pack	
Battery Manufacturer	Mobile Energy Technology Co., Ltd.	
Model No.	LES-2401PF	
Watt-Hour Rating	274.4 Wh	
Pack Voltage	25.2 V	
Charging Mode	CC-CV	
Charge Current	3 A	
Charge Voltage	29.4 V	
End of Charge Current	300mA	
Discharging Mode	CC	
Discharge Current	15 A	
End of Discharge Voltage	21 V	

We have tested the submitted sample(s) as requested and the following results were obtained:

Test Required : ☒ Section 38.3 Lithium metal and lithium ion batteries in UN ST/SG/AC.10/11/Rev.5/

Amend.1 Recommendations on the TRANSPORT OF DANGEROUS GOODS

Manual of Tests and Criteria.

Clause 6.4 Transport tests and Clause 6.5 Misuse tests in IEC 62281 Edition 2.0:2012

Safety of primary and secondary lithium cells and batteries during transport.

## Conclusion

Submittals samples comply with the requirement of Section 38.3 Lithium metal and lithium ion batteries in UN ST/SG/AC.10/11/Rev.5/Amend.1 Recommendations on the TRANSPORT OF DANGEROUS GOODS Manual of Tests and Criteria Fifth revised edition.

Clause 6.4 Transport tests and Clause 6.5 Misuse tests in IEC62281 Edition 2.0:2012 Safety of primary and secondary lithium cells and batteries during transport.

Signed for and on behalf of  
SGS TAIWAN Ltd.



Norman Wu  
Asst. Manager

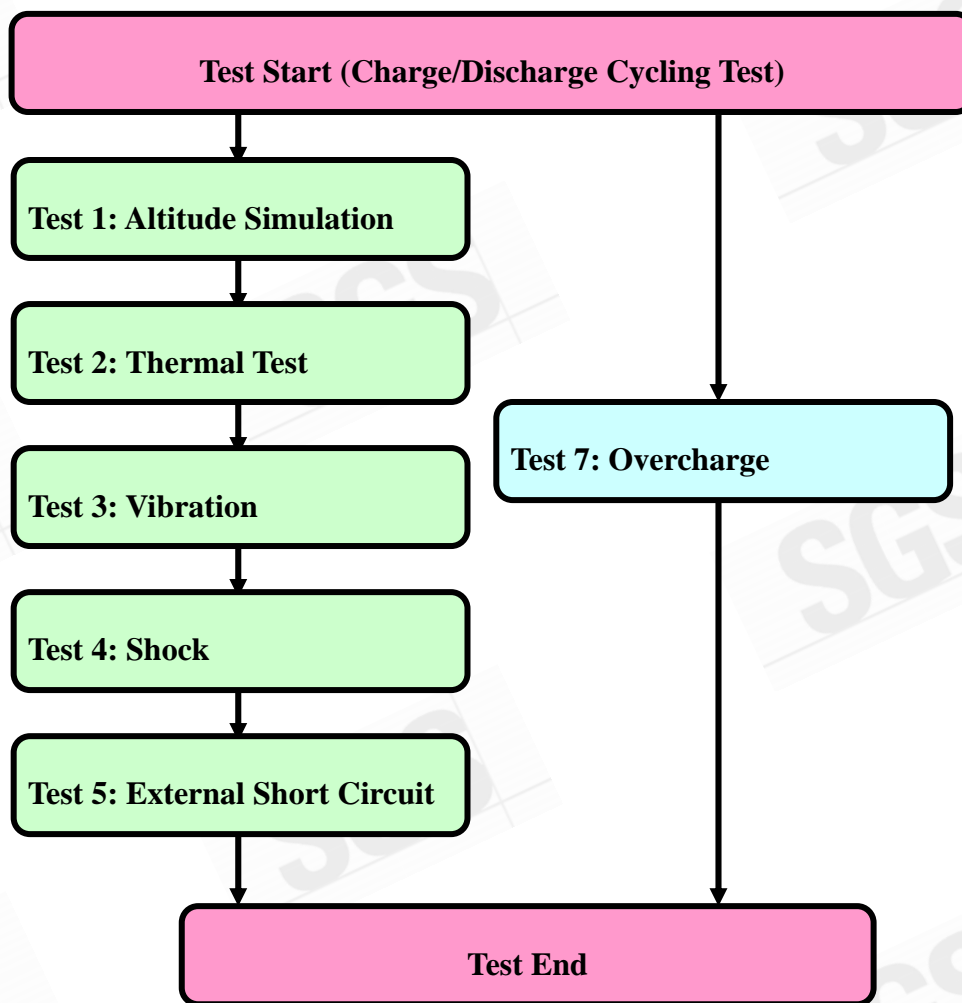
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### Test Flowchart:



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Date of Tests:

Test Started	Test Completed
Apr. 20 ,2016	Mar. 25 ,2016

Lab Environmental Conditions:

Ambient temperature: (20 ± 5) °C

Ambient humidity: (50 ± 20) % RH

Sample Condition:

Sample Status	Sample Size	Sample No.
1. First cycle in fully charged status	8 packs	No.1~No.4, No.9~No.12
2. After fifty cycles ending in fully charged status	8 packs	No.5~No.8, No.13~No.16

Test Equipment:

Name	Brand	Model	Serial No.
Vacuum-Temperature Cabinet	YEONG SHIN	DOBL-45	YSCB940280E
Thermal Shock Tester	KSON	TSK-C4T-150+RAMP	4295T
Vibration Test System	UNHOLTZ-DICKIE	SAI60-H560BAC/2/ST	474
Controller	Dactron	LASER	7110357
Control Accelerometer	PCB	353B34	143550
Shock Test System	LANSMONT	65-81 TTSII	M-13418
Data Acquisition & Analysis System	LANSMONT	103570-2-B	0503-73
ICP Accelerometer	PCB	353B14	79347
Data Acquisition/ Switch Unit	Agilent	34970A	MY44061199
Programmable Temperature & Humidity Chamber	Giant Force	GTH-960-40-CP-AR	MAA1410-009
True RMS Multimeter	Fluke	289	19360015
Electronic Precision Balance	Mettler Toledo	MS6002S/01	B116131743
Charge/Discharge Battery Test System	ChenTech	MCF60L4060A	D11139-1
Charge/Discharge Battery Test System	ChenTech	MCF60L4060A	D11139-2
Charge/Discharge Battery Test System	ChenTech	MCF60L4060A	D11139-3
Charge/Discharge Battery Test System	ChenTech	MCF60L4060A	D09174

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### Images:

	
Appearance of sample LES-2401PF	Appearance of sample LES-2401PF
	
T1: Altitude Simulation	T2: Thermal Test
	
T3: Vibration Test: X axis	T3: Vibration Test: Y axis

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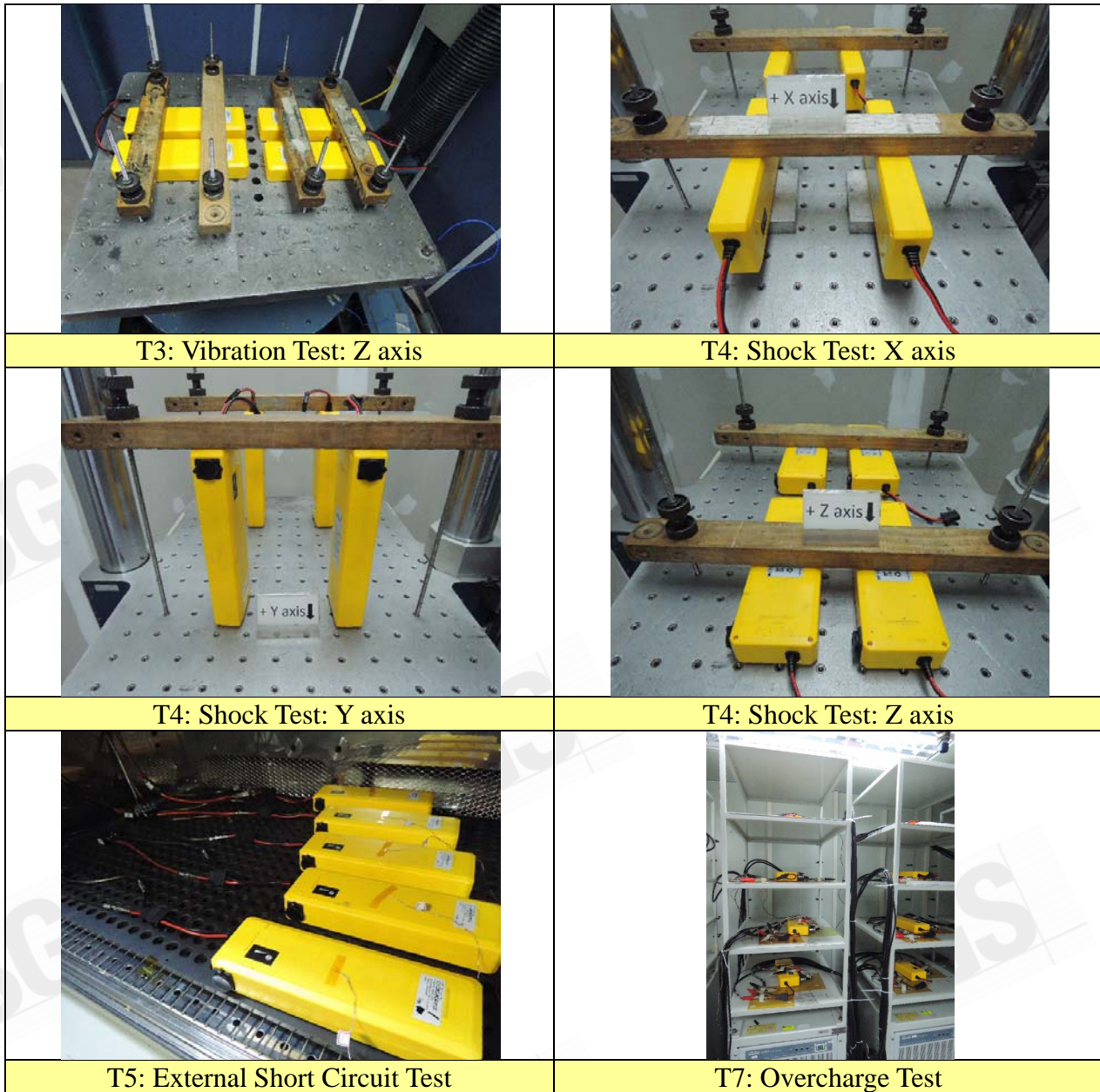


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### Images--Continued:



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**Test Method/ Specification:**

Test T.1: Altitude simulation	
Purpose:	This test simulates air transport under low-pressure conditions.
Test Procedure:	Test cells and batteries shall be stored at a pressure of 11.6 kPa or less for at least six hours at ambient temperature ( $20 \pm 5$ ) °C.
Requirement:	Cells and batteries meet this requirement if there is no mass loss, no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

Test T.2: Thermal test	
Purpose:	This test assesses cell and battery seal integrity and internal electrical connections. The test is conducted using rapid and extreme temperature changes.
Test Procedure:	Test cells and batteries are to be stored for at least six hours at a test temperature equal to ( $72 \pm 2$ ) °C, followed by storage for at least six hours at a test temperature equal to ( $-40 \pm 2$ ) °C. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated 10 times, after which all test cells and batteries are to be stored for 24 hours at ambient temperature ( $20 \pm 5$ ) °C. For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.
Requirement:	Cells and batteries meet this requirement if there is no mass loss, no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90 % of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

Test T.3: Vibration	
Purpose:	This test simulates vibration during transport.
Test Procedure:	Cells and batteries are firmly secured to the platform of the vibration machine without distorting the cells in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell. One of the directions of vibration must be perpendicular to the terminal face. The logarithmic frequency sweep is as follows: from 7 Hz a peak acceleration of 1 gn is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 8 gn occurs (approximately 50 Hz). A peak acceleration of 8 gn is then maintained until the frequency is increased to 200 Hz.
Requirement:	Cells and batteries meet this requirement if there is no mass loss, no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90 % of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

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**Test Method/ Specification--Continued:**

<b>Test T.4: Shock</b>	
Purpose:	This test simulates possible impacts during transport.
Test Procedure:	Test cells and batteries shall be secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test battery. Each cell or battery shall be subjected to a halfsine shock of peak acceleration of 150 gn and pulse duration of 6 milliseconds. Each cell or battery shall be subjected to three shocks in the positive direction followed by three shocks in the negative direction of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks. However, large cells and large batteries shall be subjected to a half-sine shock of peak acceleration of 50 gn and pulse duration of 11 milliseconds. Each cell or battery is subjected to three shocks in the positive direction followed by three shocks in the negative direction of each of three mutually perpendicular mounting positions of the cell for a total of 18 shocks.
Requirement:	Cells and batteries meet this requirement if there is no mass loss, no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

<b>Test T.5: External short circuit</b>	
Purpose:	This test simulates an external short circuit.
Test Procedure:	The cell or battery to be tested shall be temperature stabilized so that its external case temperature reaches $(55 \pm 2) ^\circ\text{C}$ and then the cell or battery shall be subjected to a short circuit condition with a total external resistance of less than 0.1 ohm at $(55 \pm 2) ^\circ\text{C}$ . This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to $(55 \pm 2) ^\circ\text{C}$ . The cell or battery must be observed for a further six hours for the test to be concluded.
Requirement:	Cells and batteries meet this requirement if their external temperature does not exceed $170 ^\circ\text{C}$ and there is no disassembly, no rupture and no fire within six hours of this test.

<b>Test T.7: Overcharge</b>	
Purpose:	This test evaluates the ability of a rechargeable battery to withstand an overcharge condition.
Test Procedure:	The charge current shall be twice the manufacturer's recommended maximum continuous charge current. The minimum voltage of the test shall be as follows: (a) when the manufacturer's recommended charge voltage is not more than 18 V, the minimum voltage of the test shall be the lesser of two times the maximum charge voltage of the battery or 22 V. (b) when the manufacturer's recommended charge voltage is more than 18 V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage. Tests are to be conducted at ambient temperature. The duration of the test shall be 24 hours.
Requirement:	Rechargeable batteries meet this requirement if there is no disassembly and no fire within seven days of the test.

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**Test Result:**

## 1. Altitude Simulation:

Model No.: LES-2401PF

Test Item Sample No.	Weight Measurement				Voltage Measurement				Appearance Check
	Unit:gram				Unit:Volt				No leakage, No venting, No disassembly, No rupture and No fire
	Initial (W <sub>0</sub> )	Final (W <sub>1</sub> )	Mass loss (W <sub>0</sub> -W <sub>1</sub> )/ W <sub>0</sub>	Mass loss < 0.1%?	Initial (V <sub>0</sub> )	Final (V <sub>1</sub> )	(V <sub>1</sub> /V <sub>0</sub> )	(V <sub>1</sub> /V <sub>0</sub> ) >90%?	
No.1	1848.74	1848.70	0.00%	Pass	29.321	29.212	99.63%	Pass	Pass
No.2	1849.26	1849.22	0.00%	Pass	29.331	29.231	99.66%	Pass	Pass
No.3	1849.79	1849.72	0.00%	Pass	29.442	29.334	99.63%	Pass	Pass
No.4	1849.49	1849.43	0.00%	Pass	29.433	29.321	99.62%	Pass	Pass
No.5	1848.66	1848.60	0.00%	Pass	29.215	29.191	99.92%	Pass	Pass
No.6	1849.62	1849.55	0.00%	Pass	29.196	29.184	99.96%	Pass	Pass
No.7	1845.21	1845.15	0.00%	Pass	29.215	29.203	99.96%	Pass	Pass
No.8	1848.20	1848.17	0.00%	Pass	29.187	29.161	99.91%	Pass	Pass
Conclusion	Meet the requirement of Test T.1: Altitude Simulation.								
Note									

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## Test Result--Continued:

### 2. Thermal test:

Model No.: LES-2401PF									
Test Item  Sample No.	Weight Measurement				Voltage Measurement				Appearance Check
	Unit:gram				Unit:Volt				No leakage, No venting, No disassembly, No rupture and No fire
	Initial (W <sub>1</sub> )	Final (W <sub>2</sub> )	Mass loss (W <sub>1</sub> -W <sub>2</sub> )/W <sub>1</sub>	Mass loss < 0.1%?	Initial (V <sub>1</sub> )	Final (V <sub>2</sub> )	(V <sub>2</sub> /V <sub>1</sub> )	(V <sub>2</sub> /V <sub>1</sub> ) >90%?	
No.1	1848.70	1847.66	0.06%	Pass	29.212	28.747	98.41%	Pass	Pass
No.2	1849.22	1848.26	0.05%	Pass	29.231	28.747	98.34%	Pass	Pass
No.3	1849.72	1848.70	0.06%	Pass	29.334	28.785	98.13%	Pass	Pass
No.4	1849.43	1848.33	0.06%	Pass	29.321	27.901	95.16%	Pass	Pass
No.5	1848.60	1847.74	0.05%	Pass	29.191	28.738	98.45%	Pass	Pass
No.6	1849.55	1848.59	0.05%	Pass	29.184	28.732	98.45%	Pass	Pass
No.7	1845.15	1844.39	0.04%	Pass	29.203	28.745	98.43%	Pass	Pass
No.8	1848.17	1847.27	0.05%	Pass	29.161	28.694	98.40%	Pass	Pass
Conclusion	Meet the requirement of Test T.2: Thermal test.								
Note									

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Test Result--Continued:

## 3. Vibration:

Model No.: LES-2401PF									
Test Item  Sample No.	Weight Measurement				Voltage Measurement				Appearance Check  No leakage, No venting, No disassembly, No rupture and No fire
	Unit:gram				Unit:Volt				
	Initial (W <sub>2</sub> )	Final (W <sub>3</sub> )	Mass loss (W <sub>2</sub> -W <sub>3</sub> )/W <sub>2</sub>	Mass loss < 0.1%?	Initial (V <sub>2</sub> )	Final (V <sub>3</sub> )	(V <sub>3</sub> /V <sub>2</sub> )	(V <sub>3</sub> /V <sub>2</sub> ) >90%?	
No.1	1847.66	1847.20	0.02%	Pass	28.747	28.715	99.89%	Pass	Pass
No.2	1848.26	1848.21	0.00%	Pass	28.747	28.706	99.86%	Pass	Pass
No.3	1848.70	1848.22	0.03%	Pass	28.785	28.749	99.87%	Pass	Pass
No.4	1848.33	1848.30	0.00%	Pass	27.901	27.900	100.00%	Pass	Pass
No.5	1847.74	1847.28	0.02%	Pass	28.738	28.698	99.86%	Pass	Pass
No.6	1848.59	1848.11	0.03%	Pass	28.732	28.690	99.85%	Pass	Pass
No.7	1844.39	1844.29	0.01%	Pass	28.745	28.706	99.86%	Pass	Pass
No.8	1847.27	1847.21	0.00%	Pass	28.694	28.620	99.74%	Pass	Pass
Conclusion	Meet the requirement of Test T.3: Vibration Test.								
Note									

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Test Result--Continued:

## 4. Shock:

Model No.: LES-2401PF									
Test Item	Weight Measurement				Voltage Measurement				Appearance Check
	Unit:gram				Unit:Volt				
Sample No.	Initial (W <sub>3</sub> )	Final (W <sub>4</sub> )	Mass loss (W <sub>3</sub> -W <sub>4</sub> )/W <sub>3</sub>	Mass loss < 0.1%?	Initial (V <sub>3</sub> )	Final (V <sub>4</sub> )	(V <sub>4</sub> /V <sub>3</sub> )	(V <sub>4</sub> /V <sub>3</sub> ) >90%?	No leakage, No venting, No disassembly, No rupture and No fire
No.1	1847.20	1847.17	0.00%	Pass	28.715	28.691	99.92%	Pass	Pass
No.2	1848.21	1848.18	0.00%	Pass	28.706	28.674	99.89%	Pass	Pass
No.3	1848.22	1848.11	0.01%	Pass	28.749	28.722	99.91%	Pass	Pass
No.4	1848.30	1848.24	0.00%	Pass	27.900	27.900	100.00%	Pass	Pass
No.5	1847.28	1847.24	0.00%	Pass	28.698	28.666	99.89%	Pass	Pass
No.6	1848.11	1848.10	0.00%	Pass	28.690	28.658	99.89%	Pass	Pass
No.7	1844.29	1844.05	0.01%	Pass	28.706	28.674	99.89%	Pass	Pass
No.8	1847.21	1847.13	0.00%	Pass	28.620	28.552	99.76%	Pass	Pass
Conclusion	Meet the requirement of Test T.4: Shock Test.								
Note									

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**Test Result--Continued:**

## 5. External Short Circuit:

Model No.: LES-2401PF			
Test Item	External Temperature		Appearance Check
	Unit: °C		
Sample No.	Temperature (T <sub>1</sub> )	T1 < 170°C ?	No disassembly, No rupture and No fire with in six hours
No.1	55.6	Pass	Pass
No.2	55.2	Pass	Pass
No.3	55.2	Pass	Pass
No.4	56.5	Pass	Pass
No.5	55.2	Pass	Pass
No.6	55.4	Pass	Pass
No.7	55.5	Pass	Pass
No.8	55.0	Pass	Pass
Conclusion	Meet the requirement of Test T.5: External short circuit.		
Note			

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**Test Result--Continued:**

## 6. Overcharge:

Model No.: LES-2401PF			
Test Item	Charge Voltage	Charge Current	Appearance Check
Sample No.	Unit: Volt	Unit: Amp	No disassembly and No fire within seven days of the test
No.9	35.28	7	Pass
No.10	35.28	7	Pass
No.11	35.28	7	Pass
No.12	35.28	7	Pass
No.13	35.28	7	Pass
No.14	35.28	7	Pass
No.15	35.28	7	Pass
No.16	35.28	7	Pass
Conclusion	There is no overcharge protection function of battery pack.		

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Test Summary:

Test Item	Test Result	Note
Test T.1: Altitude simulation	Pass	
Test T.2: Thermal test	Pass	
Test T.3: Vibration	Pass	
Test T.4: Shock	Pass	
Test T.5: External short circuit	Pass	
Test T.7: Overcharge	Pass	

— — — The End of Test Report — — —

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