Lithium-ion Battery UN38.3 Test Report

Recommendations on the TRANSPORT OF DANGEROUS GOODS

(Manual of Tests and Criteria, Fifth revised edition, Amend.1)

Customer: Lenovo
Model: L15M2PB4
Rating: 7.68V, TYP 5080mAh / 39Wh
MIN 4950mAh / 38Wh

Approved By	Checked By	Prepared By
Winel Zhao	Winel Zhao	Happy Gu.

SIMPLO TECHNOLOGY CO., LTD.
ADD : No.471, Sec.2, Pa Teh Rd., Hu Kou, Hsin Chu Hsien 303, Taiwan
TEL: +886-3-5695920 FAX: +886-3-5695931

SIMPLO ELECTRONICS (Changshu), LTD.
ADD : No.2 Dong Nan Avenue, Changshu, Jiangsu Province, China
TEL: +86-512-52302255 FAX: +86-512-52302277

SIMPLO ELECTRONICS (CHONGQING), LTD.
ADD : No.2 Zongbao Avenue, Shapingba District, ChongQing, China
TEL: +86-23-61718899 FAX: +86-23-61210488

HUAPU TECHNOLOGY (Changshu) CO., LTD.
ADD : No.2 Dong Nan Avenue, Changshu, Jiangsu Province, China
TEL: +86-512-52302255 FAX: +86-512-52302277

1. Purpose of the Test：

To test each cell/battery is of the type proved to meet the requirements in United Nations Recommendations on the TRANSPORT OF DANGEROUS GOODS, Manual of Tests and Criteria, Fifth revised edition, Amend.1, Section 38.3.

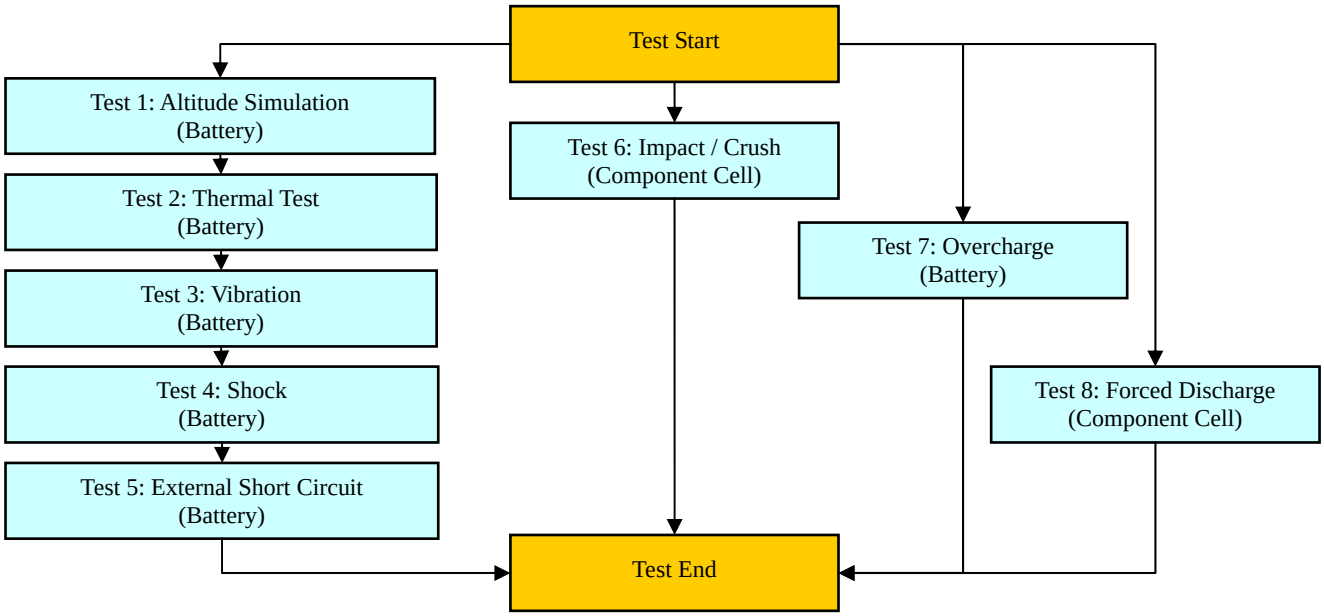
2. Test Quantity：

2.1 Four batteries, at first cycle, in fully charged states. (For T.1~T.5)
2.2 Four batteries, after 50 cycles ending in fully charged states. (For T.1~T.5)
2.3 Five component cells, at first cycle at 50% of the design rated capacity. (For T.6)
2.4 Four batteries, at first cycle, in fully charged states. (For T.7)
2.5 Four batteries, after 50 cycles ending in fully charged states. (For T.7)
2.6 Ten component cells, at first cycle in fully discharge states. (For T.8)
2.7 Ten component cells, after 50 cycles ending in fully discharged states. (For T.8)

3. Test Procedure：

3.1 All detailed test procedures must be based on United Nations Recommendations on the TRANSPORT OF DANGEROUS GOODS, Manual of Tests and Criteria, Fifth revised edition, Amend.1, Section 38.3.

3.2 Test flow shall be followed as below.



4. Test Result：

4.1 T.1 ~T.4 Test result: **Passed**

4.1.1 All batteries could meet the requirement of Table 38.3.1 Mass loss limit (M<1g: 0.5% ; 1g≦M≦75g: 0.2% ; M>75g: 0.1%) and residual OCV not less than 90% after the test.

4.1.2 No leakage, no venting, no disassembly, no rupture and no fire.

4.2 T.5 Test result: **Passed**

4.2.1 All batteries could meet the requirement, external temperature did not exceed 170℃.

4.2.2 All batteries were no disassembly, no rupture and no fire during the test and within six hours after the test.

4.3 T.6 Test result: **Passed**

4.3.1 All component cells could meet the requirement, external temperature did not exceed 170℃.

4.3.2 All component cells were no disassembly and no fire during the test and within six hours after the test.

4.4 T.7 Test result: **Passed**

4.4.1 All batteries could meet no disassembly and no fire during the test and within seven days after the test.

4.5 T.8 Test result: **Passed**

4.5.1 All component cells could meet the requirement, no disassembly and no fire during the test and within seven days after the test.

Conclusion: The samples had passed the test items of UN38.3.

5. Test Equipment：

SMP 新世电子(常熟)有限公司
Address : No.2 Dong Nan Avenue, Changshu, Jiangsu Province, China
TEL: 0512-52302255 FAX: 0512-52302277

Revised date: 2015/10/20 Page:1
Date:2015/10/12~2015/11/09
Model name: L15M2PB4

Test Instruments Reference List

Used	Instrument ID(New)	Instrument ID(Old)	Instrument Name	Type	Range of Use	Manufacturer	Calibration Date_Last	Calibration Date_Next	Remarks
	Pretest								
V	EE01-CA-I00002	C602M00/S0096	715 learning機	新普科技	18V/8A	新普科技	2014/12/30	2015/12/29	
V	EE03-CA-I00018	C602M00/S0107	720 learning機	新普科技	Chang:18V/17A Dischange:16V/18A	新普科技	2015/03/09	2016/03/08	
	EE01-CA-I00003	C602M00/S0099	715 learning機	新普科技	18V/8A	新普科技	2015/03/09	2016/03/08	
	EE01-CA-I00005	C602M00/S0098	715 learning機	新普科技	18V/8A	新普科技	2015/04/09	2016/04/08	
	EE03-CA-I00020	C602M00/S0163	720 learning機	新普科技	Chang:18V/17A Dischange:16V/18A	新普科技	2015/10/20	2016/10/19	
	Altitude Simulation								
V	EC15-CA-E00003	C602M00/0462	Altitude	SWT-110	Kpa: 0～99Kpa	HSIN JIANG	2015/09/08	2016/09/07	
V	EA02-CA-I00002	C602M00/0293	mΩ Hitester	3561	R:-10~310mΩ V:-20~20V	HIOKI	2015/9/16	2016/9/15	
V	EF03-CA-I00001	C602M00/C0604	Electronic Balance	XS1220M-SCS	1220g±0.001g	CHENGZHUN	2015/10/20	2016/10/19	
V	ED01-CA-I00007	C602M00/T0412	Thermo Meter	TA218	T：-10℃~70℃ RH ：25%～98%	KTJ	2015/8/27	2016/8/26	
	Thermal Test								
V	EC29-CA-E00002	C602M00/0671	Thermal Shock	TSK-A4C-150	T:-65℃ to 150℃	KSON	2015/06/09	2016/06/08	
V	EA02-CA-I00002	C602M00/0293	mΩ Hitester	3561	R:-10~310mΩ V:-20~20V	HIOKI	2015/9/16	2016/9/15	
V	EF03-CA-I00001	C602M00/C0604	Electronic Balance	XS1220M-SCS	1220g±0.001g	CHENGZHUN	2015/10/20	2016/10/19	
V	ED01-CA-I00007	C602M00/T0412	Thermo Meter	TA218	T：-10℃~70℃ RH ：25%～98%	KTJ	2015/8/27	2016/8/26	
	Vibration Test								
	EC08-CA-E00001	C602M00/0197	Vibration	EM-200F2K-25N50	F:3~2000Hz G:0.2~55G	King Design	2015/3/11	2016/3/10	
V	EC08-CA-E00002	C602M00/0052	Vibration	EM-200F2K-25N50	F:3~2000Hz G:0.2~55G	King Design	2015/9/23	2016/9/22	
V	EA02-CA-I00002	C602M00/0293	mΩ Hitester	3561	R:-10~310mΩ V:-20~20V	HIOKI	2015/9/16	2016/9/15	
V	EF03-CA-I00001	C602M00/C0604	Electronic Balance	XS1220M-SCS	1220g±0.001g	CHENGZHUN	2015/10/20	2016/10/19	
	Shock Test								
V	EC17-CA-E00001	C602M00/0570	Shock	HS 15/45	G:10~2000G	Lansmont	2015/09/08	2016/09/07	
V	EA02-CA-I00002	C602M00/0293	mΩ Hitester	3561	R:-10~310mΩ V:-20~20V	HIOKI	2015/9/16	2016/9/15	
V	EF03-CA-I00001	C602M00/C0604	Electronic Balance	XS1220M-SCS	1220g±0.001g	CHENGZHUN	2015/10/20	2016/10/19	
	External Short Circuit								
V	EA02-CA-I00002	C602M00/0293	mΩ Hitester	3561	R:-10~310mΩ V:-20~20V	HIOKI	2015/9/16	2016/9/15	
V	EA09-CA-I00004	C602M00/0207	Data logger	34970A	V:0~ 300V, T:-150℃~1200℃	Agilent	2015/9/16	2016/9/15	
V	EC26-CA-I00023	C602M00/0518	chamber	WIT TH-2P-E	-40℃ to 150℃	WIT	2015/08/11	2016/08/10	
V	ED01-CA-I00007	C602M00/T0412	Thermo Meter	TA218	T：-10℃~70℃ RH ：25%～98%	KTJ	2015/8/27	2016/8/26	
	Impact /Crush								
	EC17-CA-I00001	C602M00/1204	Impact test	100-372	H:60~80cm	JYI SHENG	2015/9/16	2016/9/15	
V	EC23-CA-E00001	C602M00/0743	Crush Test	BE-6047	1.0KN~15.0KN	BELL	2015/09/08	2016/09/07	
V	EA09-CA-I00005	C602M00/0588	Data logger	34970A	V:0~ 300V, T:-150℃~1200℃	Agilent	2015/9/16	2016/9/15	
V	ED01-CA-I00010	C602M00/T0581	Thermo Meter	TA218	T：-10℃~70℃ RH ：25%～98%	KTJ	2015/6/22	2016/6/21	
	Overcharge								
V	EA06-CA-E00003	C602M00/P0779	Power Supply	DS6024	0~60V 0~24A	MOTECH	2015/03/11	2016/03/10	
V	EA06-CA-E00002	C602M00/P0777	Power Supply	DS6024	0~60V 0~24A	MOTECH	2015/03/11	2016/03/10	
V	EA06-CA-E00001	C602M00/P0775	Power Supply	DS6024	0~60V 0~24A	MOTECH	2015/03/11	2016/03/10	
V	EA06-CA-E00004	C602M00/P0781	Power Supply	DS6024	0~60V 0~24A	MOTECH	2015/03/11	2016/03/10	
V	ED01-CA-I00007	C602M00/T0412	Thermo Meter	TA218	T：-10℃~70℃ RH ：25%～98%	KTJ	2015/8/27	2016/8/26	
	Froced Discharge								
V	EA06-CA-I00004		Power Supply	E3633A	0~8V,20A/0~20V,10A	AGILENT	2015/9/16	2016/9/15	
V	EA06-CA-I00016		Power Supply	E3633A	0~8V,20A/0~20V,10A	AGILENT	2015/5/10	2016/5/9	
V	EA06-CA-I00015	C602M00/P0481	Power Supply	E3633A	0~8V,20A/0~20V,10A	AGILENT	2015/5/10	2016/5/9	
V	EA05-CA-I00006		Electronic LOAD	3311D	60V/60A, 300W	PRODIGIT	2015/0512	2016/05/11	
V	EA05-CA-I00009		Electronic LOAD	3311F	60V/60A, 300W	PRODIGIT	2015/0512	2016/05/11	
V	EA05-CA-I00008	C602M00/L0402	Electronic LOAD	3311F	60V/60A, 300W	PRODIGIT	2015/08/13	2016/08/12	

Note 1: DC Voltage: 0.1~1000V; AC Voltage: 0.5~700V at 60Hz, 1kHz; Resistance: 10Ω~10MΩ; DC current:0.1mA~3A; AC current: 0.01mA~3A at 60Hz, 0.01mA~1A, at 1kHz

6. T.1~T.8 Detail Reports:

Control No.:LE-CU-15-11-013

UN 38.3 Test Datasheet

Customer: Lenovo Model Name:L15M2PB4 Test Duration: 2015/10/12~2015/11/09 Reviewer: Wind_Zhao

Test Sample Identification:

Battery Pack						Component Cell		
Used	Sample No.	Sample State	Used	Sample No.	Sample State	Used	Sample No.	Sample State
V	01~04	1 Cycle, Fully charged	V	05~08	50 Cycles, Fully charged	V	01C~05C	1 Cycle, 50% charged
V	09~12	1 Cycle, Fully charged	V	13~16	50 Cycles, Fully charged	V	06C~15C	1 Cycle, 0% discharged
		25Cycles, Fully charged			25Cycles, Fully charged	V	16C~25C	50 Cycles, 0% discharged

T.1 Altitude Simulation Start time:2015/10/26 08:20 Finish time:2015/10/26 17:30 Ambient temp.: 20.0 ℃ Operator: Happy_Gu

Sample No.: 01						Sample No.: 02					
	Before	After	Variation		Results		Before	After	Variation		Results
Mass (g)	150.127	150.125	Mass loss %	0.00%	P	Mass (g)	150.258	150.255	Mass loss %	0.00%	P
OCV (V)	8.740	8.732	Residual OCV %	99.91%		OCV (V)	8.746	8.737	Residual OCV %	99.90%	
Sample No.: 03						Sample No.: 04					
	Before	After	Variation		Results		Before	After	Variation		Results
Mass (g)	149.657	149.654	Mass loss %	0.00%	P	Mass (g)	150.657	150.655	Mass loss %	0.00%	P
OCV (V)	8.739	8.731	Residual OCV %	99.91%		OCV (V)	8.750	8.742	Residual OCV %	99.91%	
Sample No.: 05						Sample No.: 06					
	Before	After	Variation		Results		Before	After	Variation		Results
Mass (g)	150.751	150.749	Mass loss %	0.00%	P	Mass (g)	150.472	150.470	Mass loss %	0.00%	P
OCV (V)	8.735	8.726	Residual OCV %	99.90%		OCV (V)	8.743	8.735	Residual OCV %	99.91%	
Sample No.: 07						Sample No.: 08					
	Before	After	Variation		Results		Before	After	Variation		Results
Mass (g)	150.243	150.241	Mass loss %	0.00%	P	Mass (g)	150.871	150.869	Mass loss %	0.00%	P
OCV (V)	8.744	8.736	Residual OCV %	99.91%		OCV (V)	8.740	8.733	Residual OCV %	99.92%	

T.2 Thermal Test Start time:2015/10/26 17:40 Finish time:2015/11/02 08:20 Ambient temp.: 19.5 ℃ Operator: Happy_Gu

Sample No.: 01						Sample No.: 02					
	Before	After	Variation		Results		Before	After	Variation		Results
Mass (g)	150.125	150.123	Mass loss %	0.00%	P	Mass (g)	150.255	150.252	Mass loss %	0.00%	P
OCV (V)	8.732	8.610	Residual OCV %	98.60%		OCV (V)	8.737	8.615	Residual OCV %	98.60%	
Sample No.: 03						Sample No.: 04					
	Before	After	Variation		Results		Before	After	Variation		Results
Mass (g)	149.654	149.652	Mass loss %	0.00%	P	Mass (g)	150.655	150.651	Mass loss %	0.00%	P
OCV (V)	8.731	8.610	Residual OCV %	98.61%		OCV (V)	8.742	8.622	Residual OCV %	98.63%	
Sample No.: 05						Sample No.: 06					
	Before	After	Variation		Results		Before	After	Variation		Results
Mass (g)	150.749	150.747	Mass loss %	0.00%	P	Mass (g)	150.470	150.466	Mass loss %	0.00%	P
OCV (V)	8.726	8.605	Residual OCV %	98.61%		OCV (V)	8.735	8.612	Residual OCV %	98.59%	
Sample No.: 07						Sample No.: 08					
	Before	After	Variation		Results		Before	After	Variation		Results
Mass (g)	150.241	150.237	Mass loss %	0.00%	P	Mass (g)	150.869	150.867	Mass loss %	0.00%	P
OCV (V)	8.736	8.613	Residual OCV %	98.59%		OCV (V)	8.733	8.609	Residual OCV %	98.58%	

T.3 Vibration Start time:2015/11/02 08:10 Finish time:2015/11/03 08:20 Ambient temp.: 20.1 ℃ Operator: Happy_Gu

Sample No.: 01						Sample No.: 02					
	Before	After	Variation		Results		Before	After	Variation		Results
Mass (g)	150.123	150.120	Mass loss %	0.00%	P	Mass (g)	150.252	150.249	Mass loss %	0.00%	P
OCV (V)	8.610	8.602	Residual OCV %	99.91%		OCV (V)	8.615	8.604	Residual OCV %	99.87%	
Sample No.: 03						Sample No.: 04					
	Before	After	Variation		Results		Before	After	Variation		Results
Mass (g)	149.652	149.650	Mass loss %	0.00%	P	Mass (g)	150.651	150.649	Mass loss %	0.00%	P
OCV (V)	8.610	8.602	Residual OCV %	99.91%		OCV (V)	8.622	8.613	Residual OCV %	99.90%	
Sample No.: 05						Sample No.: 06					
	Before	After	Variation		Results		Before	After	Variation		Results
Mass (g)	150.747	150.745	Mass loss %	0.00%	P	Mass (g)	150.466	150.463	Mass loss %	0.00%	P
OCV (V)	8.605	8.597	Residual OCV %	99.91%		OCV (V)	8.612	8.604	Residual OCV %	99.91%	
Sample No.: 07						Sample No.: 08					
	Before	After	Variation		Results		Before	After	Variation		Results
Mass (g)	150.237	150.235	Mass loss %	0.00%	P	Mass (g)	150.867	150.865	Mass loss %	0.00%	P
OCV (V)	8.613	8.604	Residual OCV %	99.90%		OCV (V)	8.609	8.600	Residual OCV %	99.90%	

T.4 Shock

Start time:2015/11/03 13:50
Finish time:2015/11/03 17:10

Ambient temp.: 21.4 ℃

Operator: Happy_Gu

Sample No.: 01						Sample No.: 02					
	Before	After	Variation		Results		Before	After	Variation		Results
Mass (g)	150.120	150.117	Mass loss %	0.00%	P	Mass (g)	150.249	150.246	Mass loss %	0.00%	P
OCV (V)	8.602	8.597	Residual OCV %	99.94%		OCV (V)	8.604	8.601	Residual OCV %	99.97%	
Sample No.: 03						Sample No.: 04					
	Before	After	Variation		Results		Before	After	Variation		Results
Mass (g)	149.650	149.647	Mass loss %	0.00%	P	Mass (g)	150.649	150.646	Mass loss %	0.00%	P
OCV (V)	8.602	8.598	Residual OCV %	99.95%		OCV (V)	8.613	8.609	Residual OCV %	99.95%	
Sample No.: 05						Sample No.: 06					
	Before	After	Variation		Results		Before	After	Variation		Results
Mass (g)	150.745	150.742	Mass loss %	0.00%	P	Mass (g)	150.463	150.460	Mass loss %	0.00%	P
OCV (V)	8.597	8.594	Residual OCV %	99.97%		OCV (V)	8.604	8.600	Residual OCV %	99.95%	
Sample No.: 07						Sample No.: 08					
	Before	After	Variation		Results		Before	After	Variation		Results
Mass (g)	150.235	150.232	Mass loss %	0.00%	P	Mass (g)	150.865	150.862	Mass loss %	0.00%	P
OCV (V)	8.604	8.602	Residual OCV %	99.98%		OCV (V)	8.600	8.597	Residual OCV %	99.97%	

T.5 External Short Circuit

Start time:2015/11/03 17:10
Finish time:2015/11/04 09:10

Ambient temp.: 19.8 ℃

Operator: Happy_Gu

	Sample No.: 01		Sample No.: 02		Sample No.: 03		Sample No.: 04		Sample No.: 05		Sample No.: 06		Sample No.: 07		Sample No.: 08	
Resistance (<100mΩ)	56.8		59.2		57.3		56.6		55.7		57.9		58.8		57.3	
OCV before test/ after short circuit(V)	8.597	0.000	8.601	0.000	8.598	0.000	8.609	0.000	8.594	0.000	8.600	0.000	8.602	0.000	8.597	0.000
Max Temp. (< 170℃)	55.6		55.3		55.1		55.1		54.8		55.2		54.7		54.9	
Results	P		P		P		P		P		P		P		P	

T.6 Impact / Crush

Start time:2015/10/14 08:30
Finish time:2015/10/14 18:40

Ambient temp.: 19.1 ℃

Operator: Happy_Gu

☐ Impact-Cylindrical cells greater than 20mm in diameter

■ Crush- Prismatic, pouch, coin/button cells and cylindrical cells not more than 20mm in diameter

	Sample No.: 01C	Sample No.: 02C	Sample No.: 03C	Sample No.: 04C	Sample No.: 05C
OCV before test(V)	3.840	3.841	3.841	3.841	3.840
Max Temp. (< 170℃)	28.7	29.6	30.1	31.6	29.1
Results	P	P	P	P	P

T.7 Overcharge

Start time:2015/10/28 10:40
Finish time:2015/11/08 13:10

Ambient temp.: 18.9 ℃

Operator: Happy_Gu

	Sample No.: 09	Sample No.: 10	Sample No.: 11	Sample No.: 12	Sample No.: 13	Sample No.: 14	Sample No.: 15	Sample No.: 16
OCV before test(V)	8.738	8.740	8.581	8.742	8.741	8.740	8.738	8.740
Results	P	P	P	P	P	P	P	P

T.8 Forced Discharge

Start time:2015/10/29 08:30
Finish time:2015/11/08 09:30

Ambient temp.: 20.4 ℃

Operator: Happy_Gu

	Sample No.: 06C	Sample No.: 07C	Sample No.: 08C	Sample No.: 09C	Sample No.: 10C
OCV before test(V)	3.375	3.374	3.374	3.376	3.374
Results	P	P	P	P	P
	Sample No.: 11C	Sample No.: 12C	Sample No.: 13C	Sample No.: 14C	Sample No.: 15C
OCV before test(V)	3.377	3.375	3.373	3.374	3.373
Results	P	P	P	P	P
	Sample No.: 16C	Sample No.: 17C	Sample No.: 18C	Sample No.: 19C	Sample No.: 20C
OCV before test(V)	3.380	3.380	3.379	3.378	3.382
Results	P	P	P	P	P
	Sample No.: 21C	Sample No.: 22C	Sample No.: 23C	Sample No.: 24C	Sample No.: 25C
OCV before test(V)	3.382	3.379	3.383	3.384	3.382
Results	P	P	P	P	P

7. Test sample: