

# UN TRANSPORTATION TEST REPORT

FOR

# Fluke Electronics

**PROJECT NAME**

**U80228**

Totex Manufacturing, Inc. 2927 Lomita Blvd. Torrance, CA 90505

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## Certificate of Compliance

Certificate/Test Report Number: UNC U80228

Issue Date: 05/14/2009

The following product(s) have been evaluated and tested to comply with the Third Revised Edition of the United Nations Manual of Tests and Criteria, Section 38.3. Test report along with test specifications are given in the reference. Complete testing procedures for all tests are available upon request. The results obtained from this testing only relate to the actual products tested as described below.

Product Name:	U80228
Product Description:	Rechargeable Lithium Ion Battery
Cell Part Numbers:	Sanyo UR18650FM, Lithium-Ion Cell,2550mAh
Part Number:	3405566
Client Name:	Fluke Electronics
Client Address:	3550 Annapolis ,Lane North, Ste 70
Client City, State, Zip:	Plymouth, MN 55447
Testing Location:	Totex Manufacturing, Inc.
	2927 Lomita Blvd.
	Torrance, CA 90505

**Test Conducted**

Cells:

- T1 - Altitude Simulation Test
- T2 - Thermal Test
- T3 - Vibration Test
- T4 - Shock Test

- T5 - External Short Circuit Test
- T6 - Impact Test
- T7 - Overcharge Test
- T8 - Forced Discharge Test

Batteries:

- T1 - Altitude Simulation Test
- T2 - Thermal Test
- T3 - Vibration Test

- T4 - Shock Test
- T5 - External Short Circuit Test
- T7 - Overcharge Test

Prepared by:

Approved by:

Signature:	
Date:	5/14/2009
Typed Name:	Zainal Abideen
Title:	Technican

Signature:	George Gao <small>Digitally signed by George Gao DN: CN = George Gao, G = US, O = Totex, OU = Engineering Date: 2009.05.14 10:47:06 -07'00'</small>
Date:	5/14/2009
Typed Name:	George Gao
Title:	Project Engineer

Totex Manufacturing, Inc. 2927 Lomita Blvd. Torrance, CA 90505  
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**UN Lithium Battery Transportation Testing Report**

Report Number: UNT U80228 Reviewed by: George Gao

Product Number: UNT U80228 Date: 05/14/09

Product Description: Rechargeable Battery, Lithium-ion, 7.4 V, 2500mAh  
Sanyo UR18650FM Cell, 2500mAh, Lithium-Ion

Submitter's Name: Zainal Abideen Overall Results: Passed

Date Submitted: 05/14/09

**Comments**

All the batteries comply with the United Nation test standards.

Mass of Battery/Cell	$M_{min}$
$M < 1g$	0.5%
$1g < M < 5g$	0.2%
$M \geq 5g$	0.1%

$M_{min} \Rightarrow$  0.1%

Total Batteries Submitted 24

Battery Identification

T	O	T
E		
X		

Advanced Battery & Charger Solutions

Battery Status	Test 1 to Test 5	Test 7
New Battery Fully Charged	4	4
New Battery Fully Discharged	4	N/A
50 Cycles Battery fully Charged	4	4
50 Cycles Battery Fully Discharged	4	N/A

Battery Status	Test 1 to Test 5	Test 7
New Battery Fully Charged	A1-A4	E1-E4
New Battery Fully Discharged	B1-B4	N/A
50 Cycles Battery fully Charged	C1-C4	F1-F4
50 Cycles Battery Fully Discharged	D1-D4	N/A

TEST 1 --- ALTITUDE SIMULATION TEST ---

(11.6 Kpa, 6 hours, 20 ± 5 °C)

	Mass (g)		Pass If	Voltage (V)		Vmin (90% V <sub>1</sub> )	Pass If V <sub>2</sub> > V <sub>min</sub>	Initial Condition	Final Condition
	Before Test	After Test		Before Test	After Test				
	M <sub>1</sub>	M <sub>2</sub>	ML < M <sub>min</sub>	V <sub>1</sub>	V <sub>2</sub>			Note presence of leakage, venting, rupture, or fire.	Note changes from the initial condition and any leakage, venting, rupture, or fire.
A1	121.98	121.98	Pass	8.30	8.30	7.47	Pass	None	None
A2	121.72	121.72	Pass	8.30	8.30	7.47	Pass	None	None
A3	122.28	122.28	Pass	8.30	8.30	7.47	Pass	None	None
A4	121.94	121.94	Pass	8.30	8.30	7.47	Pass	None	None

B1	121.77	121.77	Pass	N/A	N/A	N/A	N/A	None	None
B2	122.24	122.24	Pass	N/A	N/A	N/A	N/A	None	None
B3	121.56	121.56	Pass	N/A	N/A	N/A	N/A	None	None
B4	122.34	122.34	Pass	N/A	N/A	N/A	N/A	None	None

C1	121.77	121.77	Pass	8.20	8.20	7.38	Pass	None	None
C2	121.93	121.93	Pass	8.20	8.20	7.38	Pass	None	None
C3	121.56	121.56	Pass	8.20	8.20	7.38	Pass	None	None
C4	121.45	121.45	Pass	8.20	8.20	7.38	Pass	None	None

D1	122.36	122.36	Pass	N/A	N/A	N/A	N/A	None	None
D2	122.12	122.12	Pass	N/A	N/A	N/A	N/A	None	None
D3	122.50	122.50	Pass	N/A	N/A	N/A	N/A	None	None
D4	121.85	121.85	Pass	N/A	N/A	N/A	N/A	None	None

Equipment Listing				
EQP #	Description	Serial #	CAL Date	CAL Due
1	Piab H40 Vacuum Pump	H40B6-EN	Mar-09	Mar-10
2	Air Supply	B07-202-A11KA	N/A	N/A
3	Pelican 1550 case	N/A	N/A	N/A
4	Fluke 115 True RMS Multimeter	98270622	Mar-09	Mar-10
5	Precisa XT2220M-DR (Scale)	2442-258	Apr-09	Apr-10

Comments

The mass losses were all less than 0.1%. For batteries that were charged, the open circuit voltages after the test were all greater than 90% of the pre-test. There was no leakage, venting, rupture, or fire outside of the specified tolerances.

Technician	Zainal	Technician	Zainal
Session 1	A1-A4 & B1-B4	Session 2	C1-C4 & D1-D4
Date Start	4/27/2009	Date Start	4/27/2009
Date Finish	4/27/2009	Date Finish	4/27/2009

**TEST 2 --- THERMAL TEST ---**

(75 ± 2 °C 6-hrs, transitions 30-min max, -40 ± 2 °C 6-hrs, repeat 10X, store 24-hrs before evaluation)

Mass (g)		Mass Loss (%)	Pass If	Voltage (V)		Vmin	Pass If	Initial Condition	Final Condition
Before Test	After Test			Before Test	After Test				
M <sub>1</sub>	M <sub>2</sub>	ML		V <sub>1</sub>	V <sub>2</sub>			Note changes from the initial condition and any leakage, venting, rupture, or fire.	
A1	121.98	0.07	Pass	8.30	8.16	7.47	Pass	None	None
A2	121.72	0.06	Pass	8.30	8.16	7.47	Pass	None	None
A3	122.28	0.06	Pass	8.30	8.16	7.47	Pass	None	None
A4	121.94	0.06	Pass	8.30	8.16	7.47	Pass	None	None
B1	121.77	0.05	Pass	N/A	N/A	N/A	N/A	None	None
B2	122.24	0.04	Pass	N/A	N/A	N/A	N/A	None	None
B3	121.56	0.05	Pass	N/A	N/A	N/A	N/A	None	None
B4	122.34	0.05	Pass	N/A	N/A	N/A	N/A	None	None
C1	121.77	0.07	Pass	8.20	8.10	7.38	Pass	None	None
C2	121.93	0.07	Pass	8.20	8.10	7.38	Pass	None	None
C3	121.56	0.05	Pass	8.20	8.10	7.38	Pass	None	None
C4	121.45	0.06	Pass	8.20	8.10	7.38	Pass	None	None
D1	122.36	0.05	Pass	N/A	N/A	N/A	N/A	None	None
D2	122.12	0.03	Pass	N/A	N/A	N/A	N/A	None	None
D3	122.50	0.07	Pass	N/A	N/A	N/A	N/A	None	None
D4	121.85	0.03	Pass	N/A	N/A	N/A	N/A	None	None

**Equipment Listing**

EQP #	Description	Serial #	CAL Date	CAL Due
1	Precisa XT220M-DR (Scale)	2442-258	Apr-09	Apr-10
2	Fluke 115 True RMS Multimeter	98270622	Mar-09	Mar-10
3	Tenney Environmental Chamber Model TUJR	28967-03	Jan-09	Jan-10
4	Watlow Process Controller, Model F-4	1324	Aug-08	Aug-09

**Comments**

The mass losses were all less than 0.1%. For batteries that were charged, the open circuit voltages after the test were all greater than 90% of the pre-test. There was no leakage, venting, rupture, or fire outside of the specified tolerances.

Technician	Zainal	Technician	Zainal
Session I	A1-A4 & B1-B4	Session 2	C1-C4 & D1-D4
Date Start	5/7/2009	Date Start	5/7/2009
Date Finish	5/13/2009	Date Finish	5/13/2009

**TEST 3 --- VIBRATION TEST ---**

(Logarithmic Sine Sweep, 7-200-7 Hz in 15 min; Control at 1G (7-18 Hz), 0.8mm (18-50 Hz), 8G (50-200 Hz). Repeat 12 cycles for a total of 3 hrs for each of 3 planes.)

	Mass (g)		Mass Loss (%)	Pass If	Voltage (V)		Vmin	Pass If	Initial Condition	Final Condition
	Before Test	After Test			Before Test	After Test				
	M <sub>1</sub>	M <sub>2</sub>	100*(M <sub>1</sub> - M <sub>2</sub> )/M <sub>1</sub>	ML < M <sub>min</sub>	V <sub>1</sub>	V <sub>2</sub>	(90% V <sub>1</sub> )	V <sub>2</sub> > V <sub>min</sub>	Note presence of leakage, venting, rupture, or fire.	Note changes from the initial condition and any leakage, venting, rupture, or fire.
A1	121.98	121.98	0.00	Pass	8.30	8.30	7.47	Pass	None	None
A2	121.72	121.72	0.00	Pass	8.30	8.30	7.47	Pass	None	None
A3	122.28	122.28	0.00	Pass	8.30	8.30	7.47	Pass	None	None
A4	121.94	121.94	0.00	Pass	8.30	8.30	7.47	Pass	None	None

B1	121.77	121.77	0.00	Pass	N/A	N/A	N/A	N/A	None	None
B2	122.24	122.24	0.00	Pass	N/A	N/A	N/A	N/A	None	None
B3	121.56	121.56	0.00	Pass	N/A	N/A	N/A	N/A	None	None
B4	122.34	122.34	0.00	Pass	N/A	N/A	N/A	N/A	None	None

C1	121.77	121.77	0.00	Pass	8.20	8.20	7.38	Pass	None	None
C2	121.93	121.93	0.00	Pass	8.20	8.20	7.38	Pass	None	None
C3	121.56	121.56	0.00	Pass	8.20	8.20	7.38	Pass	None	None
C4	121.45	121.45	0.00	Pass	8.20	8.20	7.38	Pass	None	None

D1	122.36	122.36	0.00	Pass	N/A	N/A	N/A	N/A	None	None
D2	122.12	122.12	0.00	Pass	N/A	N/A	N/A	N/A	None	None
D3	122.50	122.50	0.00	Pass	N/A	N/A	N/A	N/A	None	None
D4	121.85	121.85	0.00	Pass	N/A	N/A	N/A	N/A	None	None

Equipment Listing					
EQP #	Description	Serial #	CAL. Date	CAL. Due	
1	Fluke 115 True RMS Multimeter	98270622	Mar-09	Mar-10	
2	Precisa XT2220M-DR (Scale)	2442-258	Apr-09	Apr-10	
3	Unholtz-Dickie Shaker, Model TA250-S062	214	N/A	N/A	
4	Power Amplifier, Model TA250A	1017	N/A	N/A	
5	10.5m V/G Dytran Accelerometer, Model 3030B4	11588	May-08	May-09	
6	Current Source, Model 4102C	2985	Jun-08	Jun-09	

Comments	
The mass losses were all less than 0.1%. For batteries that were charged, the open circuit voltages after the test were all greater than 90% of the pre-test. There was no leakage, venting, rupture, or fire outside of the specified tolerances.	

Technician	Zainal	Technician	Zainal
Session 1	A1-A4 & B1-B4	Session 2	C1-C4 & D1-D4
Date Start	4/24/2009	Date Start	4/24/2009
Date Finish	4/29/2009	Date Finish	4/29/2009

**TEST 4 --- SHOCK TEST ---**

(Small Batteries: Half-Sine, 150g, 6ms, 3 shocks in 6 mutually perpendicular axis for a total of 18 shocks.)  
 (Large Batteries: Half-Sine, 50g, 11ms, 3 shocks in 6 mutually perpendicular axis for a total of 18 shocks.)

	Mass (g)		Mass Loss (%)	Pass If	Voltage (V)		V <sub>min</sub> (90% V <sub>1</sub> )	Pass If	Initial Condition	Final Condition
	Before Test	After Test			Before Test	After Test				
	M <sub>1</sub>	M <sub>2</sub>	ML	ML < M <sub>min</sub>	V <sub>1</sub>	V <sub>2</sub>			Note presence of leakage, venting, rupture, or fire.	Note changes from the initial condition and any leakage, venting, rupture, or fire.
A1	121.98	121.98	0.00	Pass	8.30	8.30	7.47	Pass	None	None
A2	121.72	121.72	0.00	Pass	8.30	8.30	7.47	Pass	None	None
A3	122.28	122.28	0.00	Pass	8.30	8.30	7.47	Pass	None	None
A4	121.94	121.94	0.00	Pass	8.30	8.30	7.47	Pass	None	None
B1	121.77	121.77	0.00	Pass	N/A	N/A	N/A	N/A	None	None
B2	122.24	122.24	0.00	Pass	N/A	N/A	N/A	N/A	None	None
B3	121.56	121.56	0.00	Pass	N/A	N/A	N/A	N/A	None	None
B4	122.34	122.34	0.00	Pass	N/A	N/A	N/A	N/A	None	None
C1	121.77	121.77	0.00	Pass	8.20	8.20	7.38	Pass	None	None
C2	121.93	121.93	0.00	Pass	8.20	8.20	7.38	Pass	None	None
C3	121.56	121.56	0.00	Pass	8.20	8.20	7.38	Pass	None	None
C4	121.45	121.45	0.00	Pass	8.20	8.20	7.38	Pass	None	None
D1	122.36	122.36	0.00	Pass	N/A	N/A	N/A	N/A	None	None
D2	122.12	122.12	0.00	Pass	N/A	N/A	N/A	N/A	None	None
D3	122.50	122.50	0.00	Pass	N/A	N/A	N/A	N/A	None	None
D4	121.85	121.85	0.00	Pass	N/A	N/A	N/A	N/A	None	None

**Equipment Listing**

EQP #	Description	Serial #	CAL Date	CAL Due
1	LAB/MTI, Model SD-10-114-30	5520130	N/A	N/A
2	Fluke 115 True RMS Multimeter	98270622	Mar-09	Mar-10
3	Precisa XT2220M-DR (Scale)	2442-258	Apr-09	Apr-10
4	10.5mV/G Dytran Accelerometer, Model 3030B4	11588	Jun-08	Jun-09
5	Current Source, Model 4102C	2985	Jul-08	Jul-09
6	Lecroy 9310AL Dual 400Mhz Oscilloscope	93105906	N/A	N/A

**Comments**

The mass losses were all less than 0.1%. For batteries that were charged, the open circuit voltages after the test were all greater than 90% of the pre-test. There was no leakage, venting, rupture, or fire outside of the specified tolerances.

Technician	Zainal	Technician	Zainal
Session 1	A1-A4 & B1-B4	Session 2	C1-C4 & D1-D4
Date Start	4/30/2009	Date Start	4/30/2009
Date Finish	5/5/2009	Date Finish	5/5/2009



**TEST 5 ---EXTERNAL SHORT CIRCUIT TEST ---** (Thermally stabilized to external case temp of  $55 \pm 2$  °C; 0.1 ohm short applied and held for at least 1-hr after external case temp returns to  $55 \pm 2$  °C; observed for additional 6-hrs.)

Pass if the case temperature remained below 170 °C within 6 hrs of the test.	
A1	Pass
A2	Pass
A3	Pass
A4	Pass

Pass if no disassembly, rupture, or fire within 6 hrs of the test.	
	Pass
	Pass
	Pass
	Pass

B1	Pass
B2	Pass
B3	Pass
B4	Pass

	Pass
	Pass
	Pass
	Pass

C1	Pass
C2	Pass
C3	Pass
C4	Pass

	Pass
	Pass
	Pass
	Pass

D1	Pass
D2	Pass
D3	Pass
D4	Pass

	Pass
	Pass
	Pass
	Pass

Equipment Listing				
EQP #	Description	Serial #	CAL Date	CAL Due
1	Tenney Environmental Chamber Model TUJR	8967	Jan-09	Jan-10
2	0.1Ω Short Circuit Fixture	FX0647	N/A	N/A
3	Fluke 115 True RMS Multimeter	98270622	Mar-09	Mar-10
4	Omega Thermometer, Model HH309	70701514	Jul-08	Jul-09

**Comments**

The temperature of all the batteries remained below 170 °C at all times. There was no disassembly, rupture, or fire outside of the specified tolerances within the 6-hour observation period.

Technician	Zainal	Technician	Zainal
Session 1	A1-A4 & B1-B4	Session 2	C1-C4 & D1-D4
Date Start	5/5/2009	Date Start	5/5/2009
Date Finish	5/6/2009	Date Finish	5/6/2009

