

**Wilson Engineered Systems, Inc.
11501 Columbia Park Drive West, Building 100
Jacksonville, FL 32258
904-880-0118**

**Sample, Inc.
Battery Integrity Testing Report
12/2/2010**

Executive Summary

On 12/2/10 Tom Wilson and Wayne Thompson conducted a battery integrity test following manufacturer recommendations. This is a 4 stage test incorporating,

1. Open Circuit Voltage Test
2. On Charge Current Acceptance Test
3. On Charge Voltage Test
4. Momentary Load Test

In addition, after completion of the above test an internal impedance test was performed.

The batteries were found to be in good condition per the test. Batteries #15 and 16 were found 0.04 volts below the 11.8 Volt criteria listed by the battery manufacturer. Given that rounding to the tenths value would result in a passing grade for these two batteries and watching their performance on the scope during testing provides the conclusion the batteries are in sound condition.

Results summarized for each test are as follows:

1. Open Circuit Voltage Test
 - a. Battery voltage ranged from 13.22 to 13.52 VDC representing percent charge values from 132% to 157%. All good values.
2. On Charge Current Acceptance Test
 - a. Anticipated expected charge current was 0.11 to 0.26 amps. Scope readings ranged from 0.390 to 0.600 amps. Waveshapes 1 – 4 show the charging current traces from the scope. The UPS transistors are providing a pulsed value, not a fixed number. The charging current value appears reasonably close to the anticipated calculated value. Further detail on the charge current readings would need to be provided by the manufacturer.
3. On Charge Voltage Test
 - a. Battery voltage ranged from 13.36 to 13.75. All good values.

4. Momentary Load Test

- a. A 10 second load of 71 to 85 amps was applied to each battery. With rounding of the above mentioned batteries 15 and 16, all performance was good. Waveshape 5 on the last page of this report is representative of the battery performance for each battery.

We performed an impedance check on the batteries after the test. The load testing affects the battery voltages as can be seen on the findings. In absolute terms an impedance test requires the batteries to be in a charged, normal state. Thus the voltage readings are of no concern at that point in the test. The impedance readings found, although not strictly valid, confirm there are not bad batteries in the battery string. The impedance test was not a formal requirement of the manufacturer based battery integrity test procedure.

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Battery Integrity Testing Form ©2010

Date: 12/2/2010

Site: Sample, Inc.
111 Main Street
Your Town, ST, Zip

Associated Power Equipment: UPS Model #, Serial #, ___ kVA, ___ kW

Batteries: (1) string of 40 Model _____

Battery Temperature: 72 F

Section 1 - Open Circuit Voltage Test

Batteries on charge 24 hours or longer: Yes

Open Charging Source for 5 minutes prior to starting test: Yes

#1 is most positive battery in string

Battery #	OCV	Percent Charge	Battery #	OCV	Percent Charge	Battery #	OCV	Percent Charge	Battery #	OCV	Percent Charge
1	13.48	153	11	13.47	153	21	13.42	148	31	13.44	150
2	13.50	155	12	13.50	155	22	13.36	143	32	13.41	148
3	13.52	157	13	13.51	156	23	13.44	150	33	13.47	153
4	13.44	150	14	13.51	156	24	13.43	149	34	13.43	149
5	13.44	150	15	13.44	150	25	13.45	151	35	13.45	151
6	13.43	149	16	13.45	151	26	13.43	149	36	13.44	150
7	13.42	148	17	13.42	148	27	13.44	150	37	13.41	148
8	13.43	149	18	13.44	150	28	13.45	151	38	13.41	148
9	13.41	148	19	13.51	156	29	13.44	150	39	13.45	151
10	13.44	150	20	13.52	157	30	13.42	148	40	13.22	132

Percent Charge when negative may be considered as zero effective charge.

Batteries in service with OCV 11.5 or less should be assumed to have shorted cell. DO NOT CHARGE, EXPLOSION RISK.

New batteries with OCV 12.0 or less should be assumed to have shorted cell. DO NOT CHARGE, EXPLOSION RISK.

Section 2 - On Charge Current Acceptance

Batteries on charge 24 hours or longer: Yes

Batteries on charge 48 hours or longer: Yes

Amp Hour Rating of Battery: 149 @ 20 Hr rate

At 77 degrees and 2.25 to 2.30 charge VPC expect

minimum charge current: 0.11175 amps

maximum charge current: 0.26075 amps

Measure mA charge current: 450 range 390-~600

Note the overall system DC voltage:

542

see scope saved 1 - 4 waveforms

Number of cells in system string:

240

1.6 VAC 0.04

Average Charge Voltage per cell is:

2.258333

Section 3 - On Charge Voltage Test

Battery #	V	Battery #	V	Battery #	V	Battery #	V
1	13.55	11	13.59	21	13.46	31	13.62
2	13.60	12	13.64	22	13.53	32	13.60
3	13.72	13	13.70	23	13.70	33	13.65
4	13.47	14	13.75	24	13.46	34	13.60
5	13.46	15	13.47	25	13.48	35	13.60
6	13.45	16	13.48	26	13.46	36	13.60
7	13.44	17	13.45	27	13.49	37	13.54
8	13.45	18	13.63	28	13.48	38	13.46
9	13.43	19	13.69	29	13.47	39	13.57
10	13.47	20	13.73	30	13.60	40	13.36

Section 4 - Momentary Load Test

waveform 5 is dc capture

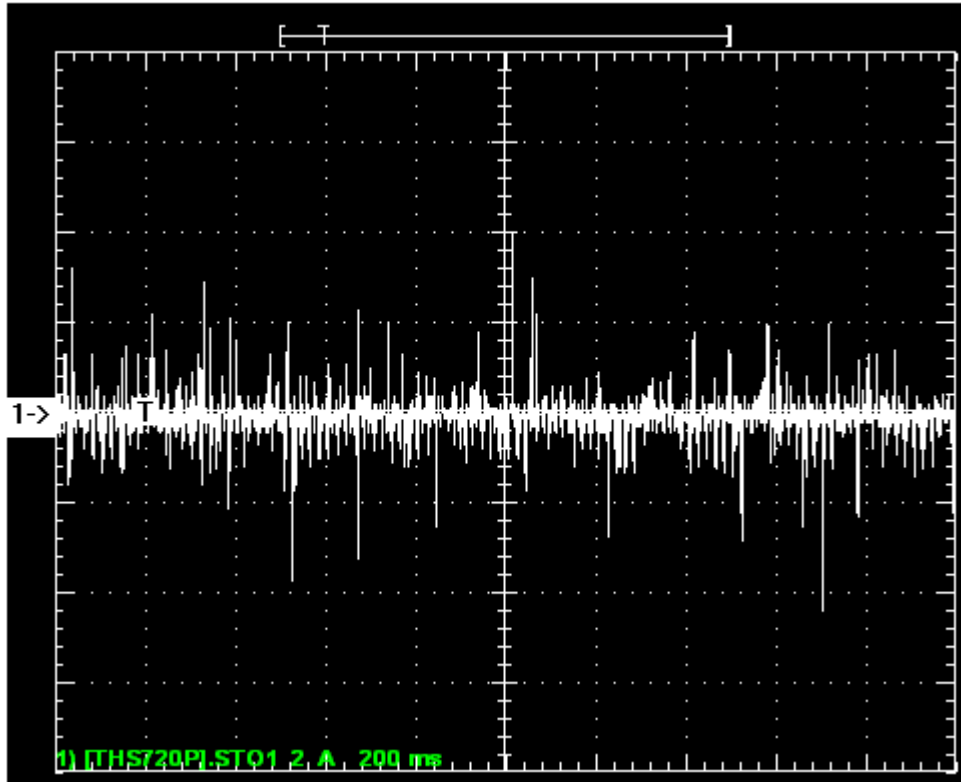
Battery #	Start V	End V	Amps	Duration
1	13.56	12.04	85	10
2	13.56	12.00	85	10
3	13.6	12.00	76	10
4	13.48	11.96	77	10
5	13.48	11.96	72	10
6	13.44	11.80	75	10
7	13.41	11.92	78	10
8	13.44	11.88	76	10
9	13.4	11.96	73	10
10	13.44	11.96	72	10
11	13.48	12.08	73	10
12	13.52	12.04	72	10
13	13.5	11.96	72	10
14	13.52	12.00	77	10
15	13.44	11.76	78	10
16	13.44	11.76	77	10
17	13.4	11.92	80	10
18	13.44	11.96	75	10
19	13.48	12.04	73	10
20	13.47	12.00	73	10

Battery #	Start V	End V	Amps	Duration
21	13.6	12.04	79	
22	13.52	12.04	77	
23	13.6	12.04	76	
24	13.6	12.00	77	
25	13.6	12.04	72	
26	13.56	12.04	75	
27	13.56	11.92	80	
28	13.6	12.04	72	
29	13.56	12.04	72	
30	13.52	12.00	71	
31	13.56	11.92	77	
32	13.52	11.96	74	
33	13.6	12.08	75	
34	13.52	12.00	73	
35	13.56	12.04	73	
36	13.56	12.00	78	
37	13.52	11.96	78	
38	13.52	12.12	73	
39	13.57	12.00	73	
40	13.32	11.92	73	

Note: 11.8 is low criteria for red on Section 4 testing.

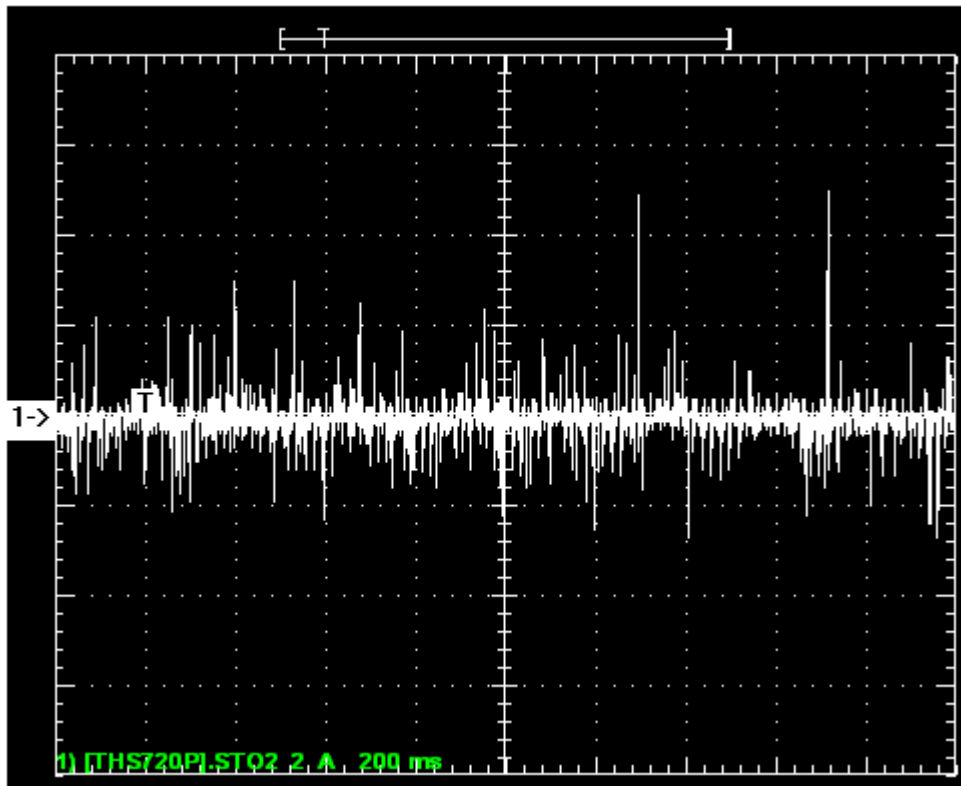
Wilson Engineered Systems, Inc.
Battery Integrity Test (12/2/10)

On Charge Current Acceptance Waveforms



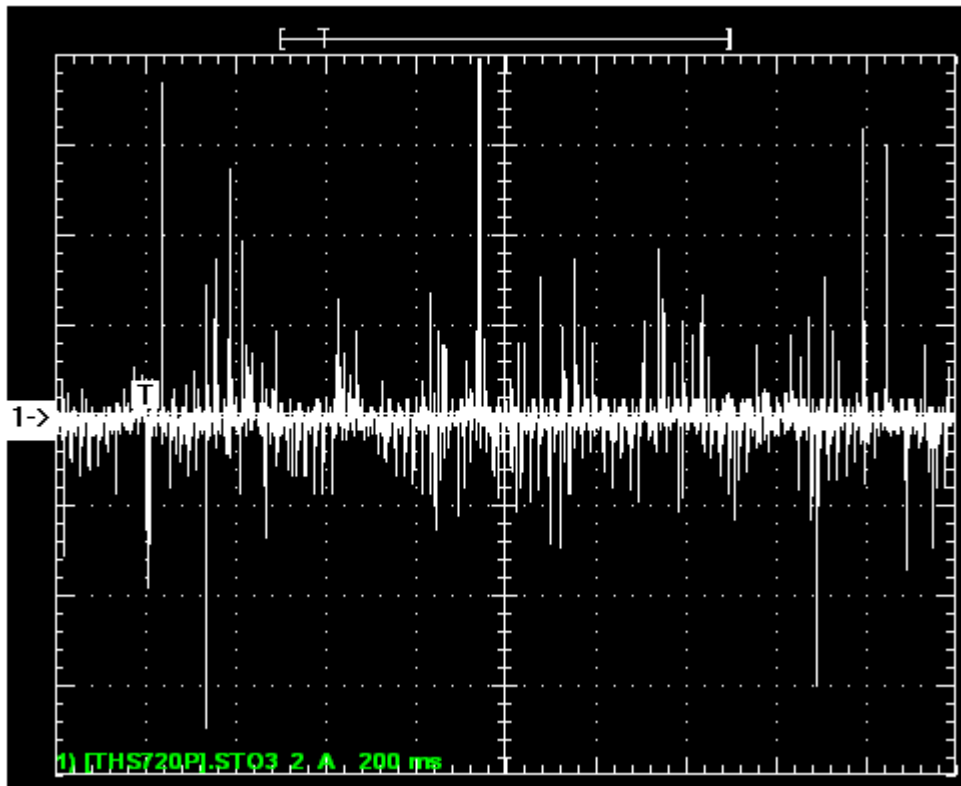
[20P].Data.Waveforms.Stored.		
Measurement Method	Automatic	
Measurement	Value	Units
Frequency	29.257	Hz
Pos. Pulse Width	6.1231m	s
Neg. Pulse Width	28.057m	s
Rise Time	488.59m	s
Fall Time	488.74m	s
Pos. Duty Cycle	179.14m	%
Neg. Duty Cycle	820.86m	%
Pos. Overshoot	0.0000	%
Neg. Overshoot	0.0000	%
Peak to Peak	8.4800	A
Amplitude	8.4800	A
High	4.0800	A
Low	-4.4000	A
Maximum	4.0800	A
Minimum	-4.4000	A
Mean	-76.158m	A
Cycle Mean	46.924m	A
RMS	445.43m	A
BurstWidth	1.9950	s
Period	34.180m	s
Energy	396.65m	
CEnergy	14.168m	
ACRMS	438.87m	A
CRMS	643.83m	A

Waveform # 1 above



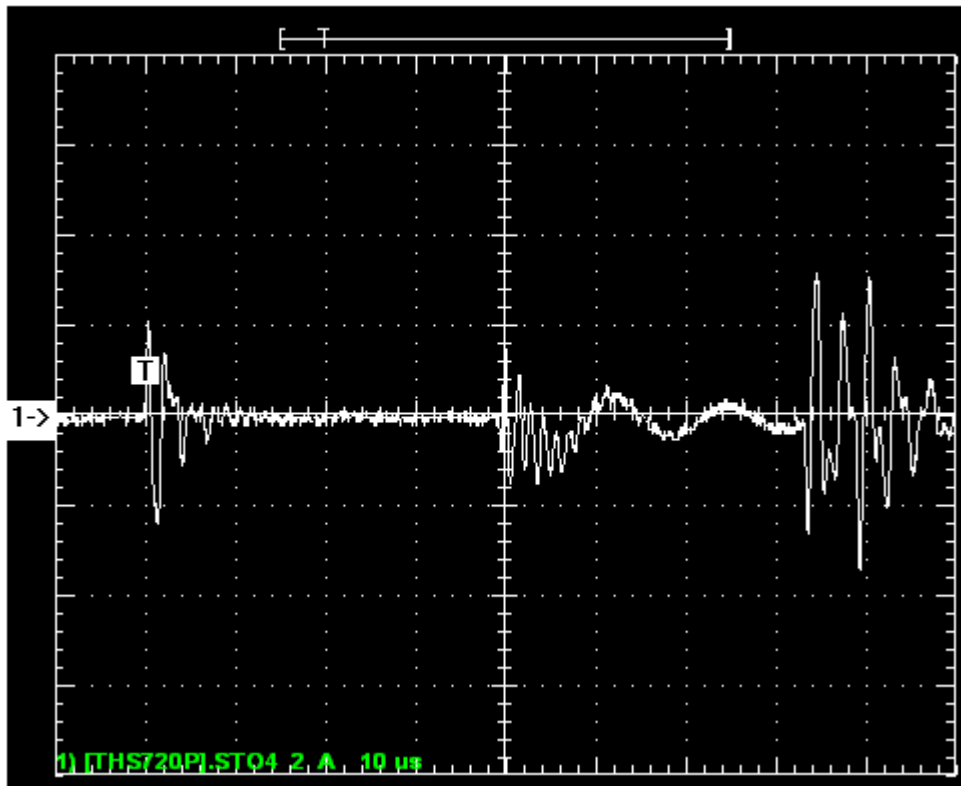
[20P].Data.Waveforms.Stored...		
Measurement Method	Automatic	
Measurement	Value	Units
Frequency	4.7607	Hz
Pos. Pulse Width	50.812m	s
Neg. Pulse Width	159.24m	s
Rise Time	95.697m	s
Fall Time	112.46m	s
Pos. Duty Cycle	241.90m	%
Neg. Duty Cycle	758.10m	%
Pos. Overshoot	0.0000	%
Neg. Overshoot	0.0000	%
Peak to Peak	7.7600	A
Amplitude	7.7600	A
High	5.0400	A
Low	-2.7200	A
Maximum	5.0400	A
Minimum	-2.7200	A
Mean	-71.581m	A
Cycle Mean	-72.027m	A
RMS	449.38m	A
BurstWidth	1.9434	s
Period	210.05m	s
Energy	403.72m	
CEnergy	30.322m	
ACRMS	443.64m	A
CRMS	379.94m	A

Waveform #2 above



✓ [P] Data Waveforms Store		
Measurement Method	Automatic	
Measurement	Value	Units
Frequency	4.9213	Hz
Pos. Pulse Width	176.68m	s
Neg. Pulse Width	26.520m	s
Rise Time	605.26m	s
Fall Time	99.753m	s
Pos. Duty Cycle	869.49m	%
Neg. Duty Cycle	130.51m	%
Pos. Overshoot	0.0000	%
Neg. Overshoot	0.0000	%
Peak to Peak	15.200	A
Amplitude	15.200	A
High	8.2400	A
Low	-6.9600	A
Maximum	8.2400	A
Minimum	-6.9600	A
Mean	-69.420m	A
Cycle Mean	-63.465m	A
RMS	620.69m	A
BurstWidth	1.9227	s
Period	203.20m	s
Energy	770.21m	
CEnergy	89.224m	
ACRMS	616.80m	A
CRMS	662.64m	A

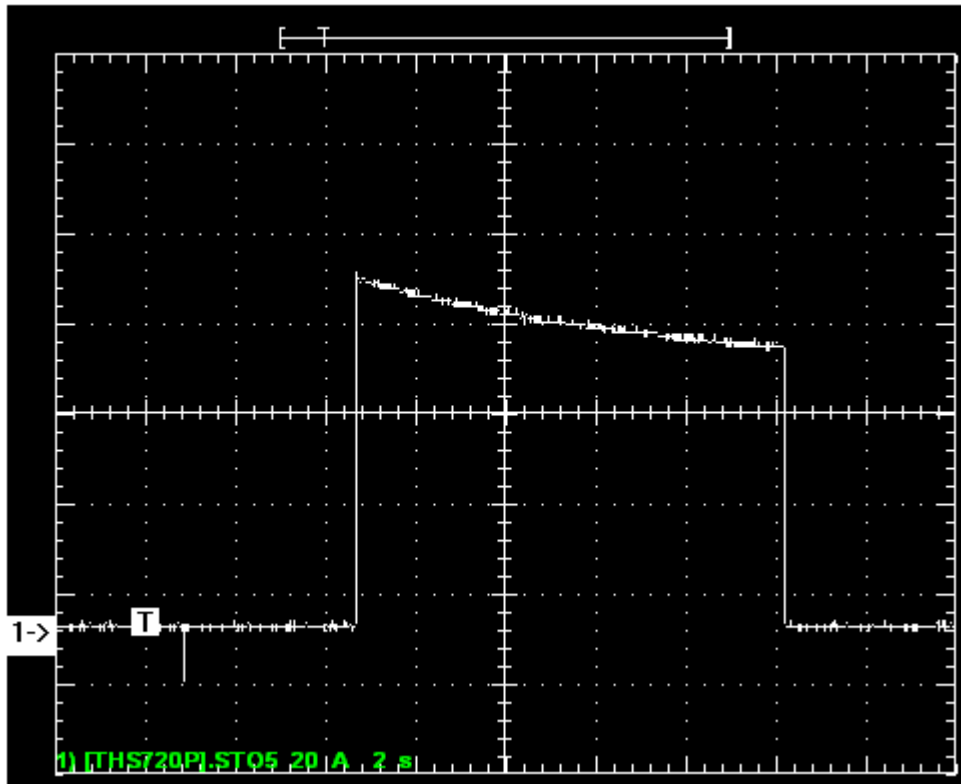
Waveform #3 above



Measurement Method	Automatic	
Measurement	Value	Units
Frequency	322.58k	Hz
Pos. Pulse Width	1.9620u	s
Neg. Pulse Width	1.1380u	s
Rise Time	727.60n	s
Fall Time	4.4386u	s
Pos. Duty Cycle	632.90m	%
Neg. Duty Cycle	367.10m	%
Pos. Overshoot	0.0000	%
Neg. Overshoot	0.0000	%
Peak to Peak	6.6400	A
Amplitude	6.6400	A
High	3.2000	A
Low	-3.4400	A
Maximum	3.2000	A
Minimum	-3.4400	A
Mean	-81.697m	A
Cycle Mean	-233.16m	A
RMS	658.31m	A
BurstWidth	85.320u	s
Period	3.1000u	s
Energy	43.320u	
CEnergy	4.7912u	
ACRMS	653.22m	A
CRMS	1.2432	A

Waveform #4 above, note time base 10microsec vs 200 millisecc on waveforms 1-3

Typical Momentary Load Test Battery Current Profile



✓ JP].Data.Waveforms.Store		Automatic	
Measurement Method	Value	Units	
Frequency	N/A	N/A	
Pos. Pulse Width	9.5444	s	
Neg. Pulse Width	N/A	N/A	
Rise Time	5.2898m	s	
Fall Time	6.9120m	s	
Pos. Duty Cycle	N/A	N/A	
Neg. Duty Cycle	N/A	N/A	
Pos. Overshoot	209.88m	%	
Neg. Overshoot	197.53m	%	
Peak to Peak	91.200	A	
Amplitude	64.800	A	
High	66.400	A	
Low	1.6000	A	
Maximum	80.000	A	
Minimum	-11.200	A	
Mean	33.762	A	
Cycle Mean	N/A	N/A	
RMS	48.063	A	
BurstWidth	9.5444	s	
Period	N/A	N/A	
Energy	46.182k		
CEnergy	N/A	N/A	
ACRMS	34.201	A	
CRMS	N/A	N/A	

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Battery Test Data Report
For: Sample, Inc.

reading taken after 100 amp load test voltage

Date 12/2/2010
 By: Tom Wilson

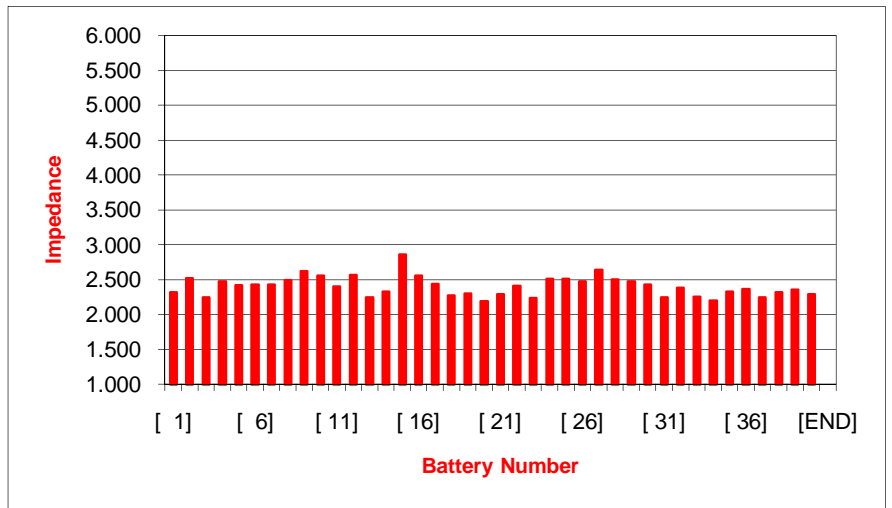
Values to use as comparison points

	Impedance	Voltage	Temp
Min	1.924	13.20	
Max	2.886	14.10	

Reading Summary

Count	40	40	
Min	2.190	13.09	
Max	2.860	15.07	
Average	2.405	13.57	

	Impedance	Voltage	Temp
[1]	2.320	13.10	--
[2]	2.520	13.70	--
[3]	2.250	13.76	--
[4]	2.480	13.62	--
[5]	2.420	13.63	--
[6]	2.430	13.61	--
[7]	2.430	13.59	--
[8]	2.490	13.57	--
[9]	2.620	13.63	--
[10]	2.560	13.61	--
[11]	2.400	13.69	--
[12]	2.570	14.43	--
[13]	2.250	13.71	--
[14]	2.330	13.98	--
[15]	2.860	13.61	--
[16]	2.560	13.63	--
[17]	2.440	13.54	--
[18]	2.270	14.17	--
[19]	2.300	14.63	--
[20]	2.190	15.07	--
[21]	2.290	13.43	--
[22]	2.410	13.33	--
[23]	2.240	13.40	--
[24]	2.510	13.34	--
[25]	2.510	13.34	--



[26]	2.480	13.39	--
[27]	2.640	13.30	--
[28]	2.500	13.35	--
[29]	2.480	13.37	--
[30]	2.430	13.35	--
[31]	2.250	13.28	--
[32]	2.380	13.33	--
[33]	2.260	13.38	--
[34]	2.200	13.37	--
[35]	2.330	13.34	--
[36]	2.370	13.31	--
[37]	2.250	13.27	--
[38]	2.320	13.31	--
[39]	2.360	13.09	--
[40]	2.290	13.15	--
[END]			

