

Smart Battery Accuracy Guidelines Working Group Meeting

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Agenda

- 1) Review of Working Group Goals
- 2) Accuracy Guidelines Status: Recent updates
 - Release Candidate “D” Comments & Updates
- 3) Accuracy Guidelines: Ratification and Publication
- 4) Future Battery Working Group Issues
- 5) Call to Action

1) Review of WG Goals

“Battery” Working Group Goals

- Develop an initial set of test guidelines to insure a minimum level of Smart Battery accuracy in data reporting.
- Clarify and document aspects of Smart Battery Data Specification for better industry use and standardization across manufacturers.

2) Accuracy Guidelines Status: Recent Updates

Test Equipment Timing

- The equipment necessary to complete the tests are:
...
- 2) A variable/programmable load that is capable of producing constant current, constant power, pulsed current and pulse power loads. The pulsed loading modes require pulse width resolution of better than **25ms**.
- 3) A programmable charge source capable of constant current, constant power, pulsed current and pulsed power. The pulsed charging modes require pulse width resolution of **25ms**.
- 4) Voltage, current, resistance and temperature measurement instrumentation capable of sampling each value at a **5ms** rate by command of the test controller.
- 5) A temperature controlled test environment capable of providing 0°C to 60°C temperatures on command of the test controller, with +/-5°C accuracy and stability. Relative humidity can be reported if measured.

2) Accuracy Guidelines Status: Recent Updates

3.1.1 LOAD-1

- Constant power $P/2$ load, where $P = \text{DesignCapacity}()$ [mWh]. Load current must not exceed manufacturer's recommended maximum discharge rate.
- **NOTE:** The Smart Battery Data Specification defines various capacity functions, such as `RemainingCapacity()`, `FullChargeCapacity()`, etc. at a **$P/5$ mWh** or **$C/5$ mAh** rate which is different than the **$P/2$ mWh** rate defined by this LOAD-1. This difference must be considered when comparing test equipment reported data with Smart Battery reported data.

2) Accuracy Guidelines Status: Recent Updates

3.1.3 END OF CHARGE CYCLE (Formerly “FULL”)

The battery is considered at an **END OF CHARGE CYCLE** when it has been charged until a combination of the following bits in the AlarmWarning() or BatteryStatus() values are set:

FULLY_CHARGED
and/or TERMINATE_CHARGE_ALARM
and/or OVERCHARGED_ALARM
and/or ChargingCurrent() value is zero.

- Any combination of the above bits may indicate that charging is complete. Note that the combination of bits used in the test may simply indicate that charging is to be stopped but that the Smart Battery is not yet “full.” Refer to the *Smart Battery Data Specification* for the correct way to set or clear BatteryStatus() values to specify a “full” battery.

The specific combination used for the particular Smart Battery being tested must be documented in the test report.



2) Accuracy Guidelines Status: Recent Updates

3.1.4 END OF DISCHARGE CYCLE (Formerly “EMPTY”)

The battery is considered at an **END OF DISCHARGE CYCLE** when it has been discharged until a combination of the following bits in AlarmWarning() or BatteryStatus() values are set:

FULLY_DISCHARGED

and/or

TERMINATE_DISCHARGE_ALARM

- Any combination of the above bits used in the test may indicate that discharging cycle is complete at the present discharge rate. Note that the combination of bits used in the test may simply indicate that discharging is to be stopped but that the Smart Battery is not yet “empty.” Refer to the *Smart Battery Data Specification* for the correct way to set or clear BatteryStatus() values to specify an “empty” battery.

The specific combination used for the particular Smart Battery being tested must be documented in the test report.

2) Accuracy Guidelines Status: Recent Updates

3.1.7 MEASURED VALUES

- Pack voltage, current and test environment temperature as measured by the test system. Pack voltage must be measured at the pack terminals. The test system must be able to supply and deliver the specified energy values. This value may be supplied by the test system itself or by a connected device such as a PC.

Accuracy requirements of the test equipment measured values:

Voltage: +/- 0.1 % of full scale

Current: +/- 0.2 % of full scale

Temperature: +/- 0.5 °C

Capacity Integration: +/- 0.5 % of full scale (requires accurate measurement and calculation)



2) Accuracy Guidelines Status: Recent Updates

- **3.1.8 REPORTED VALUES**

- The following Smart Battery Data Specification data functions must be reported for the tests, unless otherwise directed by each test: Temperature(), Voltage(), Current(), AverageCurrent(), RemainingCapacity() [mWh], FullChargeCapacity() [mWh], BatteryStatus(), RunTimeToEmpty(), AverageTimeToEmpty(), AverageTimeToFull(), CycleCount(), RelativeStateOfCharge(), and MaxError(). These values will be plotted as part of the test report.
- **NOTE:** Although not all Smart Battery Data Specification data value functions are required for these tests, they are still required for Smart Battery Data compliance. Data functions such as **AtRate(), AtRateTimeToEmpty(), etc. are important** for predictive power management in Smart Battery Systems. **Future versions of these guidelines may include tests for these functions.**

2) Accuracy Guidelines Status: Recent Updates

- **3.2.3 REST BATTERY**

- Disconnect only loads and sources between the battery and test system for specified time period and record and timestamp MEASURED and REPORTED values at a minimum rate of once per minute. The SMBus clock and data lines must be held high in the idle periods between communication transactions.

3) Accuracy Guidelines: Ratification and Publication

Proposal

- Final review by WG - End of January, 2001
 - Guidelines emailed to all “battery@sbs-forum.org” members
- February, 2001: Re-release to all SBS-IF members
 - Requires 45 days
- March, 2001: Public release publication

4) Future Battery WG Issues

- Battery WG to better define FULL & EMPTY and AlarmWarning vs. BatteryStatus bits
 - 1) Write a “white paper” to explain desired operation
 - 2) Indicate the Smart Battery Data Spec future versions will incorporate the definitions as explained in the “white paper”

White Paper Explanation ----> SBData Spec V1.x

4) Future Battery WG Issues

On & Off State Timing

- Off-state says to clear bits in BatteryMode between 250msec and 2.5 seconds
- On-state says SMBus Host can try to talk to Smart Battery within 1 msec
- Add delay to On-state or define better so no race condition occurs
- Action: Email “Battery” reflector for comment

5) Call to Action

Join the 'Battery' Working Group

Become involved...

- Participate in the SBS Implementers Forum

Email to 'battery@sbs-forum.org'

or visit www.sbs-forum.org for more membership information