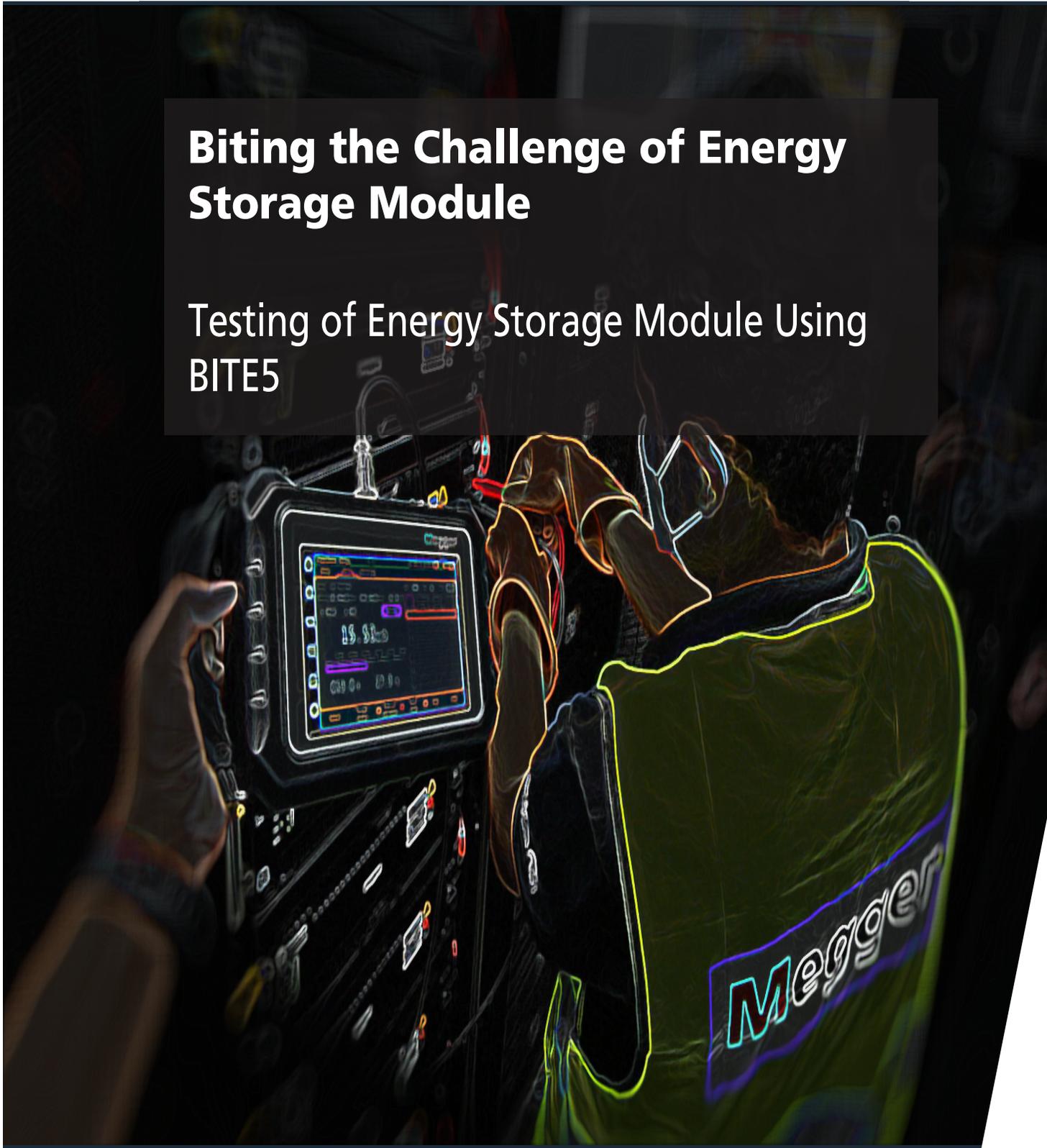


# Biting the Challenge of Energy Storage Module

Testing of Energy Storage Module Using BITE5



**Megger**<sup>®</sup>

## Case Study

Online Testing of Energy Storage Module using BITE5

**Overview:**

A Telecommunication company in Cambodia is having difficulty in testing their sets of batteries which are in parallel connection. These batteries are being used in a data centre application called Energy Storage Module (ESM). The total number of modules they need to test is 10 sets. Each individual set is composed of 10 cells. They are looking for a test set which can do online battery impedance test, cells in parallel connection and can test a 53 V DC system voltage.

**Description:**

This ESM plays an important role in a Telecommunication system. They supply power to critical systems such as computers, meters, servers and as backup power source during power failure.

The ESM is an energy storage unit composed of lithium batteries. It features better charge and discharge performance, longer service life and less self-discharge loss than ordinary batteries.

The ESM consists of electrochemical cells, an energy storage management unit (ESMU), a fire control module, power and signal terminals, and mechanical parts. It can be used as an independent 48 V unit, supporting the mixed use of old and new batteries as well as lithium and lead-acid batteries, and can collaborate with third-party power systems.

**Background:****The Lithium-Ion Battery**

Lithium-ion (or Li-ion) batteries are a family of batteries that consist of different types of chemistries, each with their own unique characteristics and configurations.

Aging of lithium-based batteries is due to both calendar aging and battery cycling. The overall rate of aging will be a combination of both the battery cycling and the calendar aging.

As lithium-ion batteries age, there will be a reduction of available capacity (fading) and an increase in internal battery impedance. For many Li-ion technologies, the aging will proceed at a relatively linear rate up to a certain point, typically 60 or 70 of rated capacity. At this point the rate of aging will accelerate.

**Lithium-ion Battery Maintenance**

In stationary applications, the battery is backing up the key asset. In these applications, it is preferable to lose the battery instead of the asset. Therefore, the battery needs to be configured to open only in the case of potential battery failure.

NOTE: This can still lead to an open battery string and a loss of backup. In critical applications that utilise lithium-ion batteries, a parallel string configuration is needed to provide redundancy.

In stationary applications, the batteries are not being discharged and charged on a regular basis. The batteries remain on float for extended periods of time.

In these applications, periodic testing is recommended along with visual inspection.

The battery voltage and impedance should be measured on a periodic basis. Trending test results over time will identify SEI build up.

For some materials, the internal resistance increase that occurs with age can be relatively small, and for others, a doubling or tripling of internal resistance is not unusual. Check with the manufacturer for your particular battery.

The BITE5 can perform the voltage and impedance measurements on all lithium-ion batteries. It will store the results and allow you to trend them over time for each cell. You can also transfer the data to the Power DB PC-based software. This will allow for automated analysis and customized report generation.

To learn more about the Li-Ion battery, please download and read the application from Megger entitled "Lithium-Ion battery maintenance".

**Problem:**

The telecommunication company needs to check and do a regular maintenance of their ESM. However, they are having some challenges:

- How can they check the status of the individual cells within the ESM?
- Can they do online test of these batteries as they cannot afford to have unscheduled downtime?
- Can any test set measure the impedance of a battery string in parallel connection with 53 V DC system voltage?

Furthermore, the EMS systems was just delivered less than a year ago and they are mindful that they need to have baseline for impedance measurement of individual cell. The existing tester they have can only handle up to 48 V DC and cannot do parallel string without the current clamp for escape current.

Figure 1 shows one set of ESM to test:

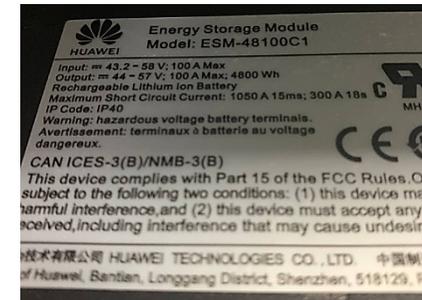


Figure 1: ESM

**Application Details:**

|                            |                        |
|----------------------------|------------------------|
| <b>ESM Voltage :</b>       | <b>53VDC</b>           |
| <b>Battery Connection:</b> | Parallel               |
| <b>Max Output:</b>         | 100 A; 4800 Wh per ESM |
| <b>Battery Type:</b>       | Lithium Ion            |

**Nameplate Data:**



**Action Taken:**



Figure 2: Easy Setup of BITE5



Figure 3: Testing of Individual Cell

BITE5 has battery type selection wherein recommended limits are shown accordingly:

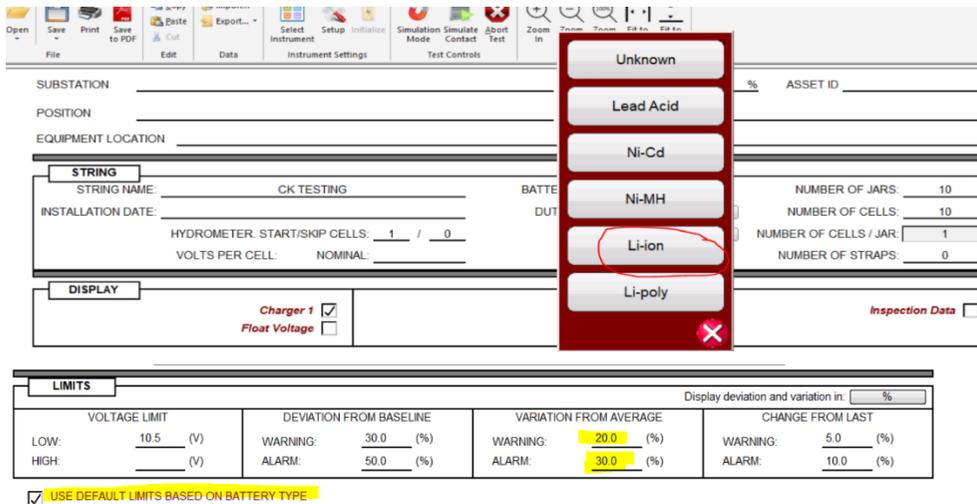
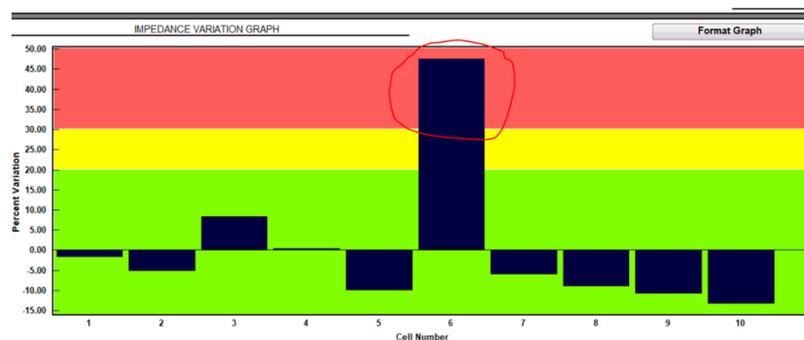


Figure 5: Bite5 Setup

BITE5 displays results with good information for analysis. In this example, it displays that cell number 6 exceeds the limit:



### Customer Feedback:

Customers found the BITE5 was easy to use and they truly needed such application. They found it a useful and important equipment to have. They have been trying to look for different equipment to use for many months, but they cannot find any. With just less than an hour, BITE5 managed to find weak cells for all 10 ESM Modules.

### Saving Value:

A telecommunication company plays an important role during this time of pandemic. They serve as a communication highway for internet and phone calls. During this pandemic, a lot of people use internet for work such as online meetings, presentations, trainings, conferences, etc. Hence, aside from loss of revenue when there is downtime, they will have to handle numerous angry customers who lose their opportunities due to problematic internet connections.

### Disclaimer:

In this test, we used BITE5 as a first step to find weak points on the ESM. A further test must be carried out (e.g. the Battery Discharge test) to confirm the problem on the cells found out of limits.

### Bibliography:

- [1] Boost Li Energy Storage Module ESM-48100C1  
Huawei Technologies Co., Ltd.
- [2] Megger Application Note: "Lithium-Ion battery maintenance"

Product Reference:



## BITE 5

- Supports battery discharge testing
- Measures impedance on cells up to 200 V
- Supports lead acid, NiCD and lithium-ion
- Measures DC voltages up to 1000 V
- Measures AC voltages up to 600 V
- Touch screen set-up and trending
- USB and micro SD card
- Measures AC and DC current



## BITE 3

- Determines health of lead-acid cells
- On-line testing with Pass/Warning/Fail calculations
- Measures impedance, interconnection resistance and cell voltage
- Measures float and ripple currents



## BITE 2P

- Determines condition of lead-acid and NiCd cells up to 7000 Ah
- On-board Pass/Warning/Fail indications
- Robust, repeatable instruments
- On-line testing



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