

Emulate the Battery for More Realistic Mobile Device Test Results

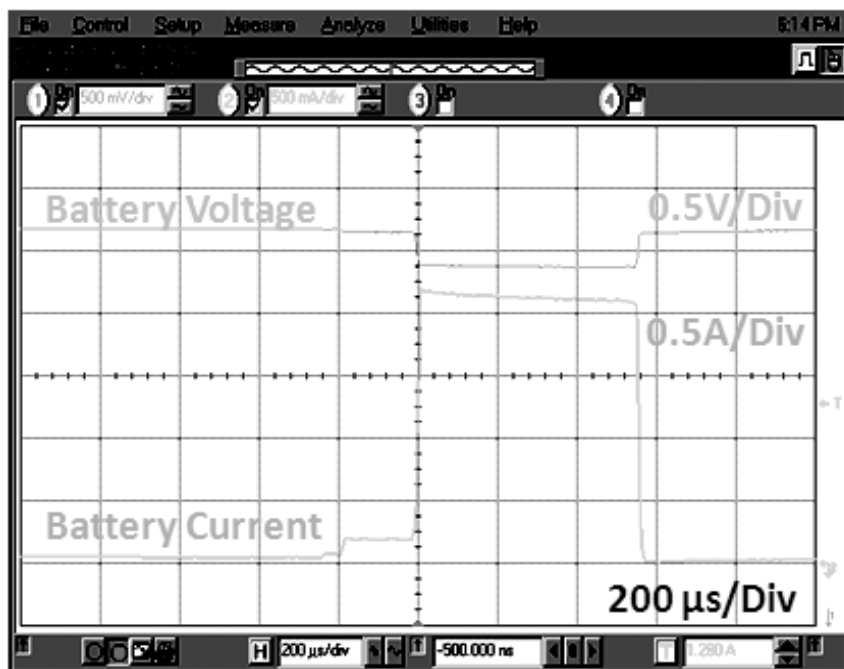
Introduction

A key consideration when powering a mobile device with a DC source is getting current drain test results comparable to that of using a battery, when optimizing battery run-time.

Batteries are very non-ideal energy sources. A battery's characteristics interact with a mobile device, influencing its resultant current drain. Accurate current drain results are essential when you optimize your mobile device's battery run-time. You need to take the battery's characteristics into consideration when powering your mobile device by a DC source, in order to assure your current drain results are comparable to that of using a battery.

When powered by a general purpose DC source, a mobile device's current drain is often not comparable to that of using an actual battery.

Figure 1 show the pulsed current drain and voltage response on a GSM mobile phone powered by its battery. As can be seen, a battery has substantial series output impedance, causing its output voltage to drop in direct proportion to the mobile device's current drain. Many mobile wireless devices adapt and adjust accordingly to compensate for the battery's characteristics.

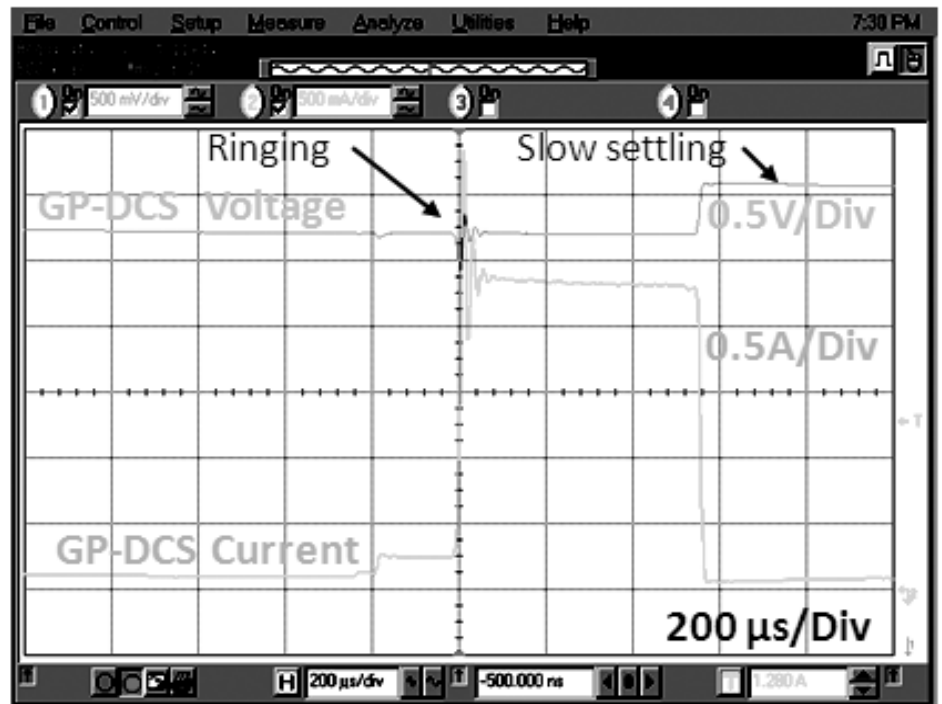


Battery response characteristics

- Battery voltage drops proportionally with current
- Battery resistance is 150 mΩ

Figure 1. Battery powering a GSM mobile phone

A general purpose DC source strives to be an ideal voltage source with zero output impedance by using feedback to regulate its output to a fixed voltage setting. Unlike a battery, its voltage does not drop proportionally with load current. Also, feedback regulation has finite response time. This leads to transient voltage drop and overshoot during loading and unloading transitions. If a transient voltage drop is large enough it can even trigger a mobile device's low battery voltage shutdown. The net result is a general purpose DC source does not behave like a battery. Figure 2 show the same measurements made in Figure 1 using a general purpose DC source in place of the battery. The voltage response is very different and the resultant current drain ended up being 10% higher than when using the battery.



General purpose DC source response characteristics

- Voltage response is not like battery
- Resultant current is 10% higher than the battery

Figure 2. General purpose DC source powering a GSM mobile phone.

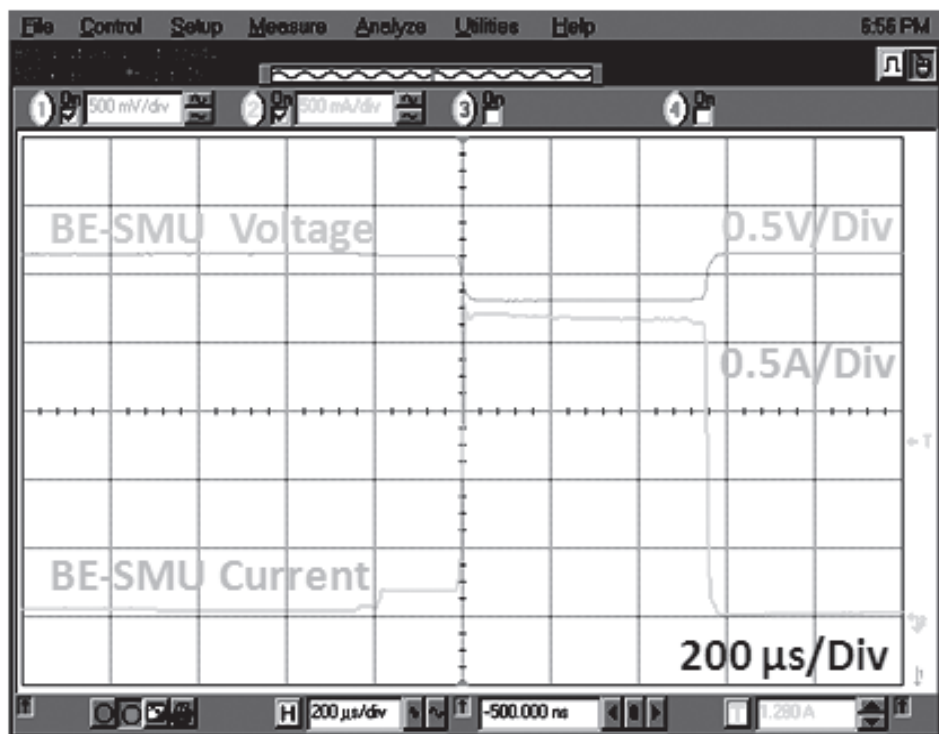
When powered by a battery emulator DC source, a mobile device's current drain is comparable to that of when using an actual battery.

DC sources tailored for powering mobile devices have capabilities for emulating batteries, including:

- Current sinking in addition to sourcing, to emulate a battery's charging current capabilities
- Programmable series output resistance to emulate a battery's impedance
- Extremely fast load transient response to minimize voltage drops and overshoots, and accurately emulate a battery's dynamic voltage response

Figure 3 shows the same measurements made in Figure 1 using a Keysight Technologies, Inc. N6781A SMU with battery emulation capabilities, in place of the battery. The N6781A's series output resistance was set to match the battery's 150 m Ω value. Both the voltage response and resultant current drain ended up being comparable to that of when using the battery respectively.

When powering your mobile device with a DC source do not ignore the battery's characteristics when evaluating its current drain. Your current drain results must be comparable to that of using a battery when optimizing your device's battery run-time. A general purpose DC source does not behave like a battery, often providing very different current drain results. Using a DC source with battery emulation capabilities helps assure you achieve more accurate results, comparable to that of when using a battery.



Battery emulator SMU response characteristics

- Battery emulator SMU set to 150 m Ω
- Voltage and current comparable to the battery

Figure 3. Keysight N6781A battery emulator SMU powering a GSM mobile phone.

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