Keysight Technologies
Software Tools for Battery Drain Analysis on Internet of Things (IoT) Devices

Application Brief

KEYSIGHT TECHNOLOGIES

Unlocking Measurement Insights

Introduction

As the Internet of Things continues its rapid growth, the need for inexpensive IoT devices with long battery life continues to increase. Depending on the type of device, the application, and the specific measurement challenge, many instruments can help engineers perform battery drain analysis (BDA). These devices include:

– Digital multimeter (DMM)
– Oscilloscope with current probe
– DC power analyzer with source-measure unit (SMU)
– Precision source-measure unit (SMU)
– Device current waveform analyzer

While these instruments are important tools, a complete BDA solution also involves software. Some of this software is embedded in instruments as firmware, and other software solutions run on PCs. This application brief describes six different software tools for BDA and discusses the relative advantages of each. These software tools include:

– 14585A Control and Analysis Software for Advanced Power Supplies
– Complementary Cumulative Distribution Function
– Automatic Current and Power Profiler
– Wireless Test Automation Platform
– BenchVue Software Platform
– IO Libraries Suite and Command Expert

You can find free trials of the 14585A and BenchVue software at **www.keysight.com/find/free_trials**.

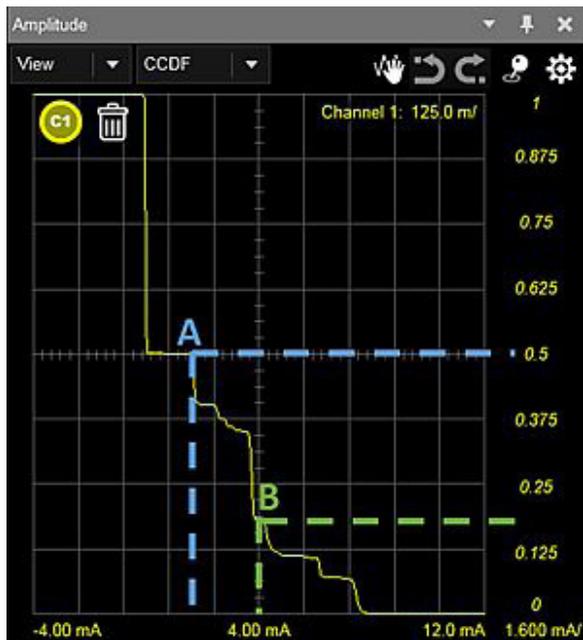## 14585A Control and Analysis Software for Advanced Power Supplies

The 14585A Control and Analysis Software provides easy access to the advanced features of instruments such as the N6705 DC power analyzer or Advanced Power System (APS) N7900 Series dynamic DC power supplies. You can control up to 16 modules in four N6705 mainframes to measure current in multiple DUT locations simultaneously. It runs on a PC, so you can use familiar controls and a large display to quickly perform BDA tasks without writing code.

The software has four operational modes: scope (short-term waveform capture), data logger (long-term waveform capture), CCDF (statistical analysis), and ARB (waveform creation). It can accurately measure and record current drain over periods from seconds to days at up to 200,000 measurements per second. You can perform statistical analysis within the program or export the data for use in a spreadsheet program.

For more information and demonstrations of the 14585A Control and Analysis Software, visit: www.youtube.com/playlist?list=PL2XuMA5AwNUywDZklpSmJZco72i8c5tOW

Complementary Cumulative Distribution Function

The complementary cumulative distribution function (CCDF) is a graphical feature included in other programs, such as the 14585A Control and Analysis Software and the CX3300 Series device current waveform analyzer firmware. A CCDF graph, shown below, illustrates how much battery charge is consumed at various current levels. The yellow line shows the fraction of charge consumed during the test that was consumed at or above a given current level.
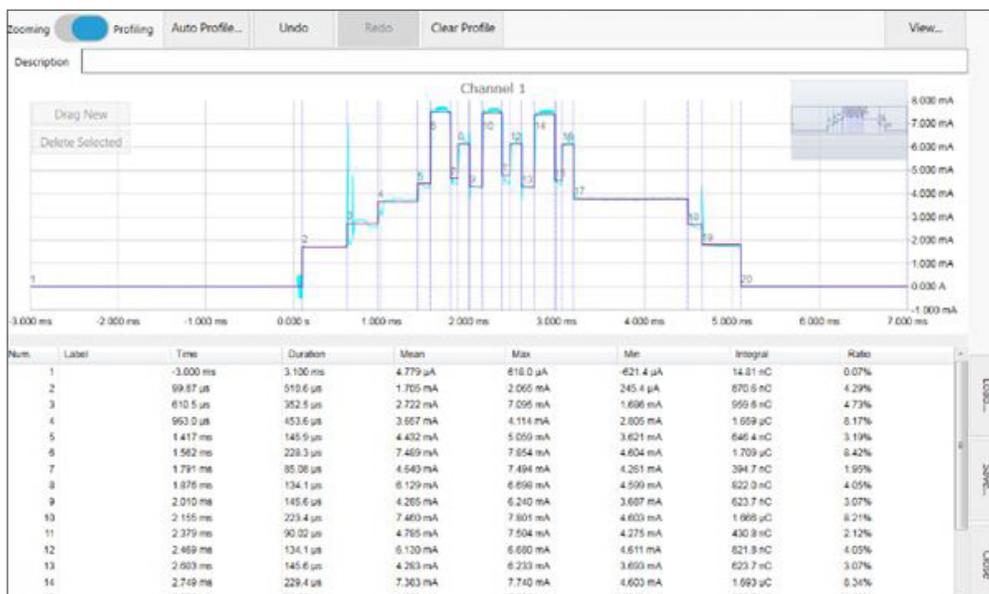

For example, at point A, the yellow line indicates that half of the charge is consumed at rates above 1.6 mA. At point B, the yellow line indicates that 18% of the charge is consumed at rates above 4 mA.

Automatic Current and Power Profiler

The CX3300 Series device current waveform analyzer includes an automatic current and power profiler. That automatically divides a current waveform into time-based segments based on configurable parameters. It then analyzes the waveform, and for each segment, it reports the following items:
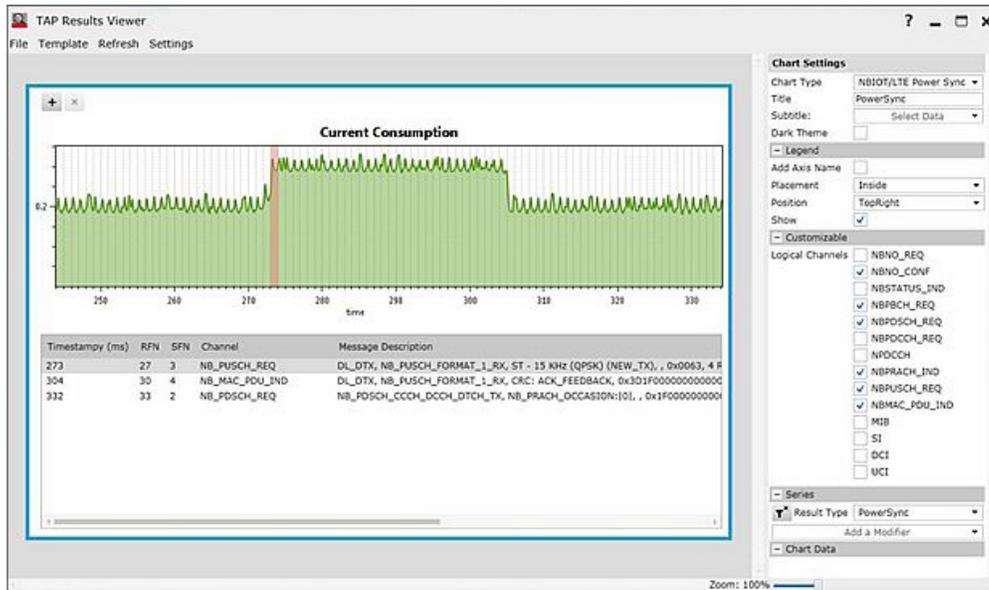
– Beginning time
– Duration
– Mean Current
– Maximum Current
– Minimum Current
– Total charge consumed
– Percentage of the total charge consumed

The automatic current and power profiler also allows the user to specify segment names and to manually move segment markers for re-analysis.

Wireless Test Automation Platform

Wireless Test Automation Platform is a Keysight software platform that automates tests and sampled measurements that require different instruments. In the Cellular-IoT (C-IoT) test scenario, it controls a Keysight UXM Network Emulator and an N6705 DC power analyzer. The UXM Network Emulator emulates a C-IoT cell, to which the device under test (DUT) connects. When the communication between the cell and the DUT begins, the DC power analyzer receives a trigger signal from the UXM Network Emulator and measures power consumption, as shown below.

For more information on the Wireless Test Automation Platform, see the *Keysight KS8400A Test Automation Platform 2017 Developer's System Software Technical Overview.*

BenchVue Software Platform

Keysight BenchVue software runs on a PC and makes it simple to discover, connect to, and control instruments. You quickly move past the test development phase and access results very quickly. The BenchVue Software Platform supports dedicated instrument apps that let you configure and control hundreds of Keysight instruments. This allows you to quickly set up multi-instrument test configurations, and you can log data on multiple instruments at up to nine readings per second.
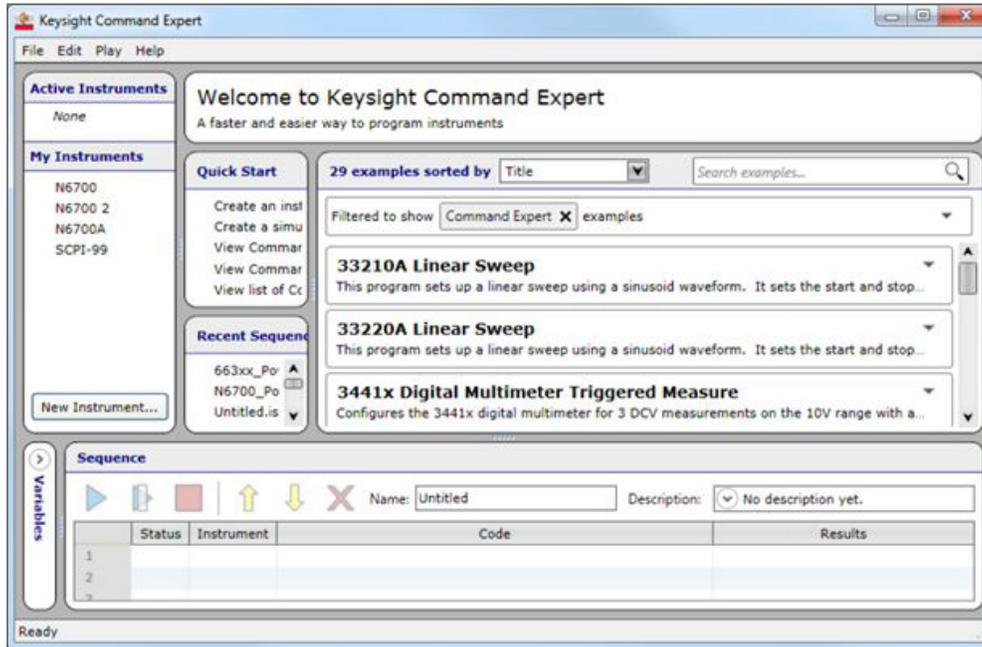
You can also use BenchVue to automate test sequences. In the context of battery drain analysis, you might want to set up simultaneous measurements on a DMM and a DC power analyzer while stimulating your DUT with a waveform generator to emulate a signal coming from a sensor.

For more information on BenchVue Software, see **www.keysight.com/find/benchvue.**

IO Libraries Suite and Command Expert

Finally, you have the option to write custom software that communicates with your instruments via Keysight IO Libraries Suite, which is available for free at **www.keysight.com/find/iosuite**. This software starts up quickly and auto-discovers instruments on the network. Keysight IO Libraries Suite also includes Command Expert, which makes it easy to find, use, and view full documentation for SCPI, IVI-C, and IVI-COM programming commands and queries. Command Expert simplifies the measurement retrieval process and seamlessly integrates with Excel, VEE, SystemVue, MATLAB, Visual Studio, Python, and LabVIEW.
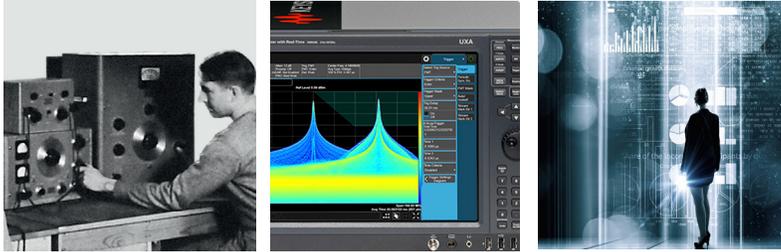
Summary

Keysight provides many software tools that can help you perform battery drain analysis on IoT devices. Some of them are standalone software packages, and others are features of instrument software or firmware. Use the table below to select the tool or tools that best meet your needs.

Name	Description	Benefit	Links
14585A Control and Analysis Software	PC software for N6705 DC power analyzer or N7900 Series dynamic DC power supplies.	Control advanced power analysis features, including CCDF and data logging, on up to 16 N6705 modules from a PC	14585A
Complementary Cumulative Distribution Function (CCDF)	Graphical tool included in CX3300 firmware and 14585A software.	See how much battery charge is consumed at various current levels	14585A CX3300
Automatic Current and Power Profiler	Graphical tool included in CX3300 firmware	See graphical representation of current waveform and detailed quantitative information for each waveform segment.	CX3300
Wireless Test Automation Platform	Software solution for wireless device testing	Automate testing of wireless devices in many real-world wireless communications scenarios.	Wireless Test Automation Platform
BenchVue Software Platform	PC software platform for configuring, controlling, and logging data from several instruments	Create a multi-instrument virtual bench, control the instruments, and log data from a familiar and easy-to-use PC interface	BenchVue Software
IO Libraries Suite and Command Expert	Software toolkit that auto-discovers instruments and connects to them	Create custom programs for controlling single instruments or multi-instrument setups.	IO Libraries Suite

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