IoT Device Battery Life Test Solutions

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KEYSIGHT
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Introduction

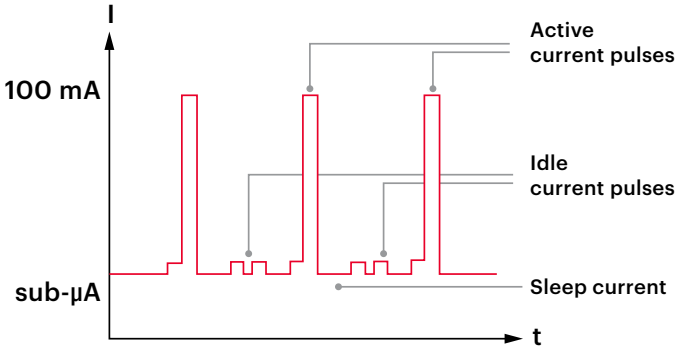
In mission-critical applications, failure of an IoT device battery is not an option. Finding the optimal balance between battery protocol and software functionality to get reliable performance and service life requires in-depth understanding of battery life and current drain.

With its many current and power measurement technology patents, Keysight Technologies has extensive experience in making these measurements.

Let's explore Keysight's hardware and software test solutions that can help extend the battery life in your designs.

Key Challenges in Battery Life Test

The ability to last a few years between battery replacement is no longer sufficient for most IoT devices. Instead, users now expect a ten-year battery life for many applications.



To meet these expectations, chipset designers structure ICs with deep sleep modes that consume minimal current. Standards groups are defining new low energy operating modes that combine low RF power levels and simple connection protocols to limit the active operation time. Engineers, however; may face design challenges when integrating the protocols into their devices, including:

- extreme low levels of current in sleep mode
- significant amplitude shifts in active mode
- narrow pulses requiring high bandwidth
- numerous connections to the DUT that can impact results
- complex power consumption analysis (event versus power consumption)

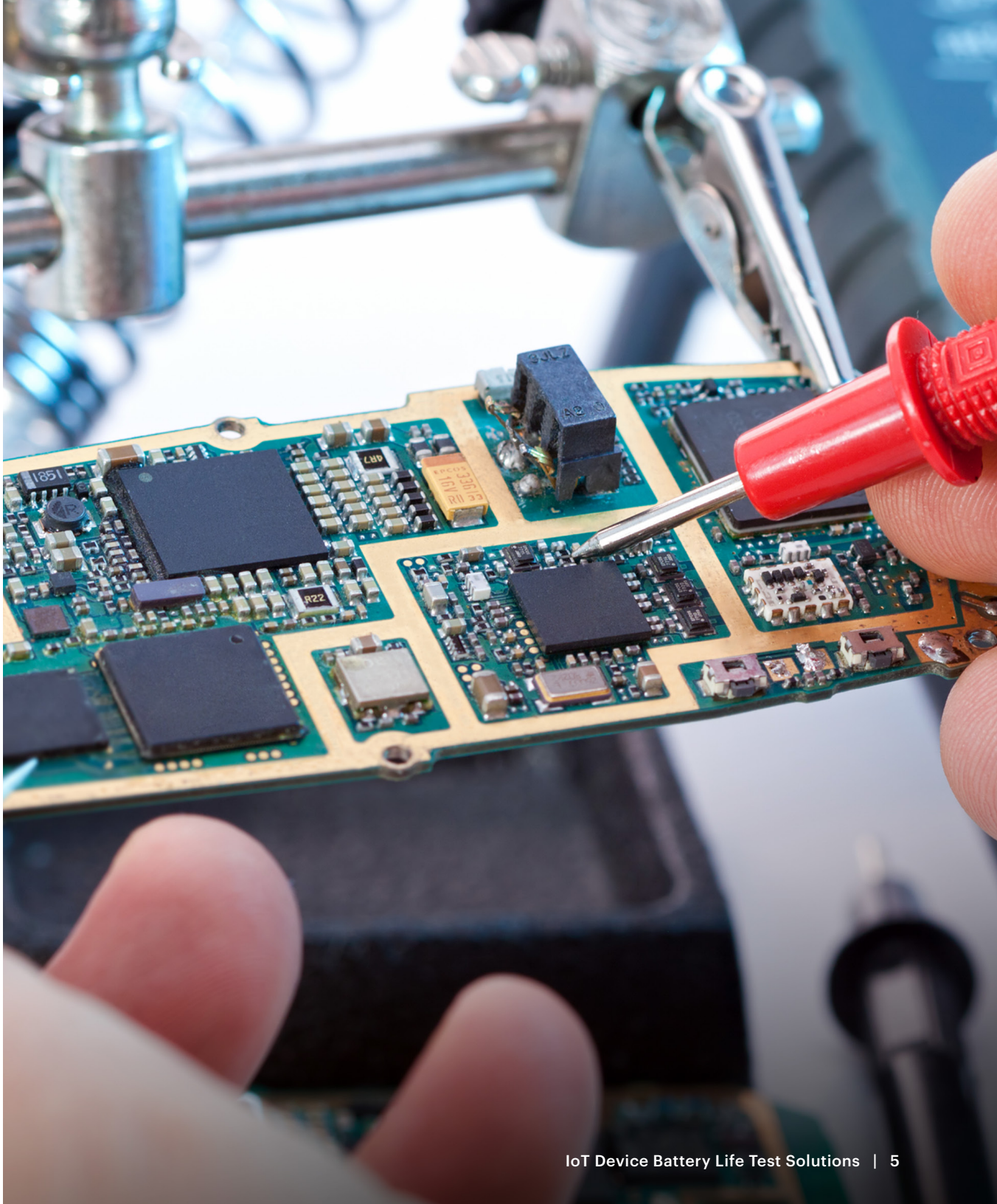
Current draw by a wireless blood pressure monitor

The Spectrum of Design and Test Needs

At different product lifecycles, diverse test needs arise.

- The chip or module designer requires a fast evaluation of power consumption in various device operating states or module firmware operations.
- The product designer must accurately know overall power consumption throughout the hardware and software development process for power supplies, analog and mixed-signal components, including digital and RF subsystems.
- The manufacturing test department must verify device functionality before it ships.

These different test scenarios challenge the engineer to make measurements with varying levels of detail at each step of the development process. What follows is information on the various Keysight products you can use for your battery life measurements, regardless of where you are in the product lifecycle.



Truevolt 34470A digital multimeter

Product designers can perform basic current measurements with an instrument already on their bench — a digital multimeter (DMM). In digitizing mode, the Keysight Truevolt 34470A digital multimeter can sample current at high rates and generate numerical or graphical results to analyze waveform features.

The Truevolt 34470A manages high common-mode voltages and brief, high-current transients. This capability enables you to measure circuits without ground reference and zooms in on low current states to make accurate sleep-mode measurements.

- Measure with confidence, with a high basic DCV accuracy at 16 ppm.
- Test low-power devices with a 1 µA range and pA resolution.
- View results using the histogram, bar, and trend charts on the 4.3-inch color graphical display for easy monitoring and statistical analysis.
- Get digitizing and advanced triggering to capture transient measurements.
- Receive a Keysight BV0001B PathWave BenchVue software license that comes with your instrument.

Precise current measurement and high-speed digitization give you waveform insights from a simple tool that is probably already on your bench.

Make Simple DC Power Measurements with a Digital Multimeter

Learn more

34470A 7.5-digit DMM

Request a quote

BenchVue digital multimeter control and automation software

Request a free trial

PathWave BenchVue digital multimeter control and automation application

Keysight's PathWave BenchVue Digital Multimeter Control and Automation software lets you easily control your DMM and acquire log measurements for quick analysis.

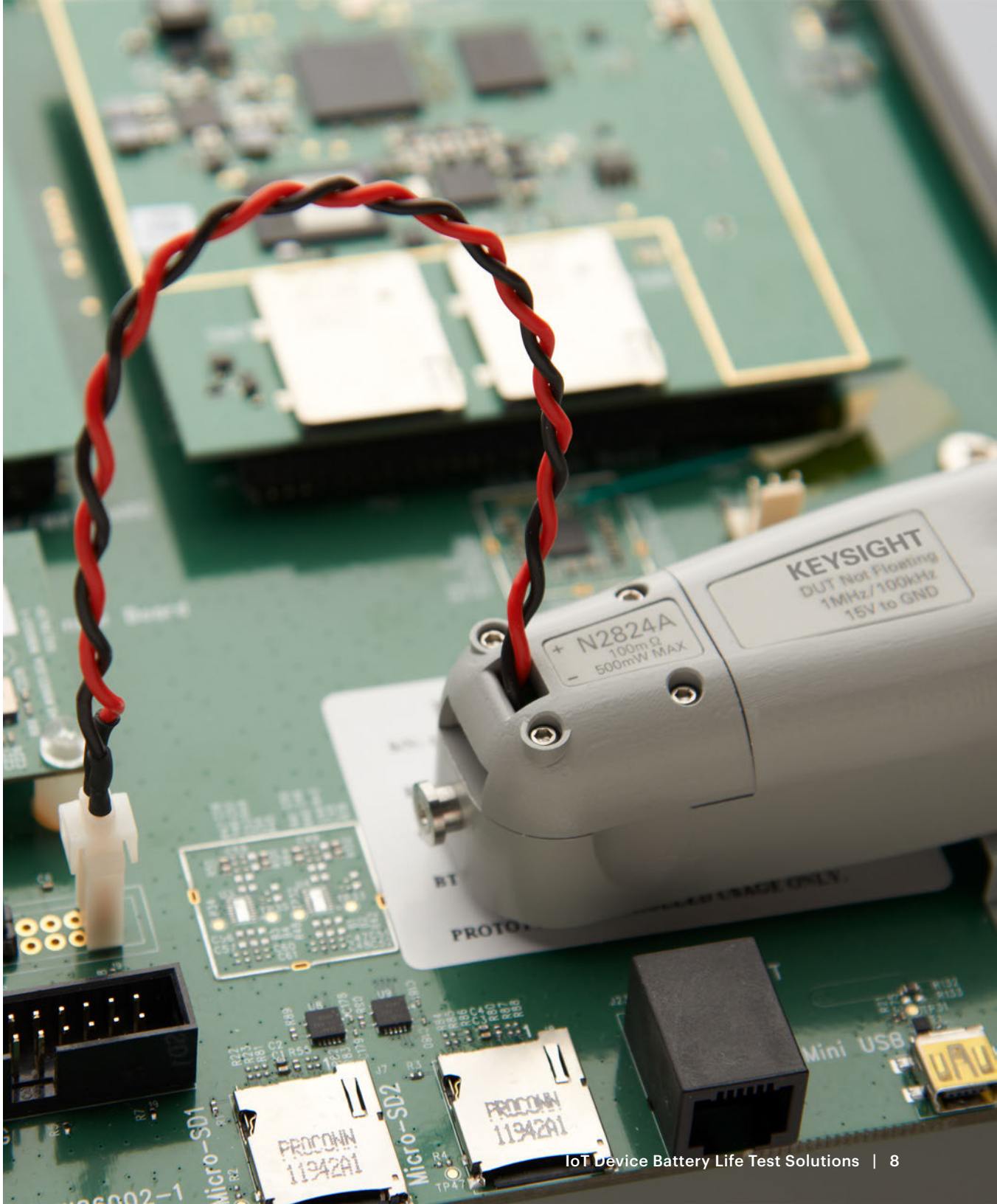
- Connect, control, and display measurements, charts, tables, or histograms quickly from a single instrument or multiple multimeters to correlate trends you might otherwise miss.
- Build custom test procedures or sequences rapidly.
- Log and export data rapidly to popular export tools, such as MATLAB, Microsoft Excel, or Word for further analysis in only a few clicks.
- Access your DMM remotely and control tests easily with the companion BenchVue mobile application to monitor or respond to long-running tests from anywhere, anytime.
- Experience deeper instrument controls with Keysight's Command Expert integration software.

N2820A high-sensitivity current probe + Keysight InfiniiVision MSOX6004A mixed signal oscilloscope

When used with a Keysight oscilloscope, the Keysight N2820A high-sensitivity current probe measures current at the circuit, subcircuit, or component level. More accurate and repeatable than a clamp-on current probe, you simply enter the current sense resistor's value, and the oscilloscope scales the signal and displays the results with appropriate units.

Coupling the measurements of the N2820A probe with the oscilloscope's triggering, digital bus monitoring, and protocol decoding results enable you to measure energy consumption in context with other system activities, such as component current consumption and firmware functions.

- Measure current as small as 100 nA or as large as hundreds of amps.
- Test sleep, active, and in-rush current quickly and simultaneously with a 20,000-to-1 dynamic range.
- Make measurements in extreme temperature environments from -55 to 150 °C.
- Use it with any Keysight oscilloscope with a 1 MΩ input.
- Gain flexibility by using the probe with any current sense resistor, from 1 mΩ to 1 MΩ.



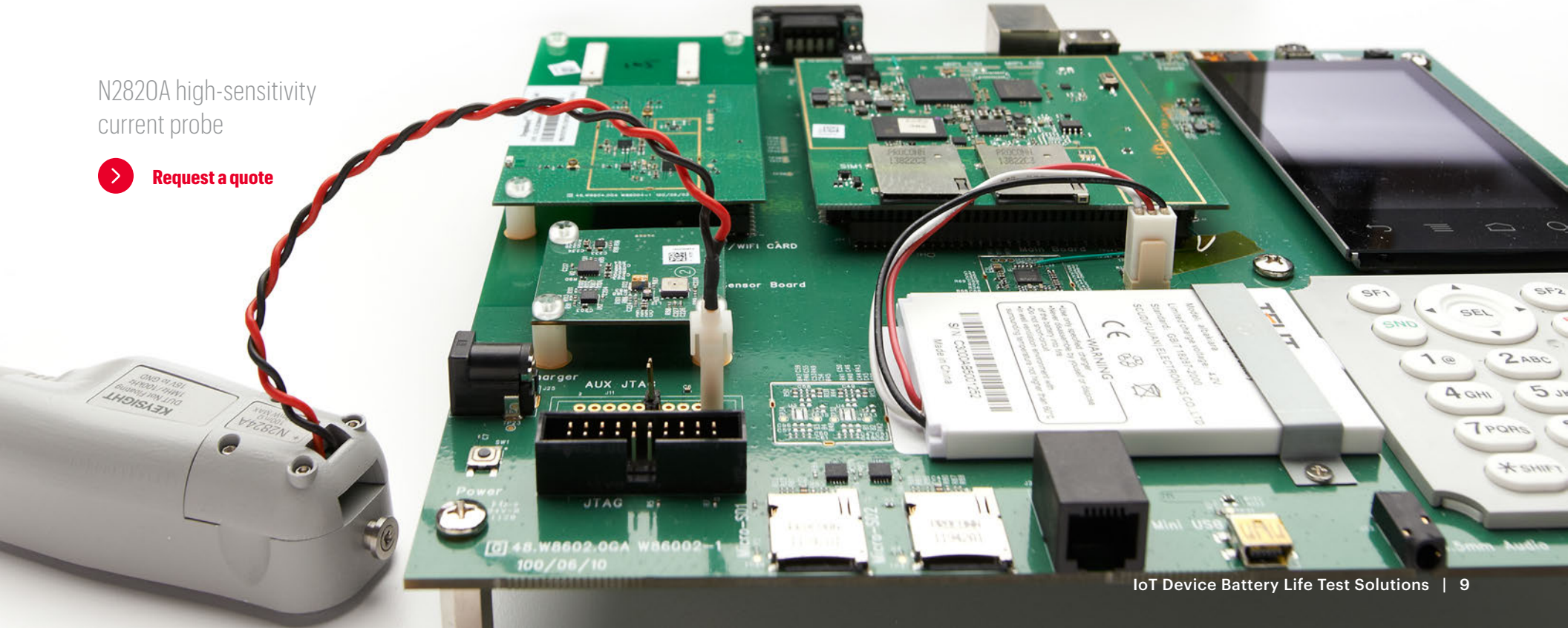
Add an easy-to-use current probe with make-before-break technology so you can quickly analyze current flow at various points in your circuit.

Battery Drain Analysis for Low Power IoT Devices

Learn more

N2820A high-sensitivity current probe

Request a quote



D9010UDAA user-defined application software

The Keysight D9010UDAA user-defined application (UDA) software is a fully customizable automated test application for your device's current analyzer or Keysight's Infiniium or InfiniiVision oscilloscope. It provides full automation, including the ability to control other test and measurement devices.

The D9010UDAA software provides a unique mix of flexibility and ease of use. For even greater convenience, the application software offers the same look and feel of Infiniium's world-class compliance applications such as USB 3.0 and SATA 6G.

User-defined application software

Request a free trial

B2900 Series precision source measure unit

The Keysight B2900 Series precision source / measure unit (SMU) is a cost-effective solution that provides precise measurement of low voltage and current. A two-channel B2900 Series precision SMU reduces wiring complexity as it replaces two DC voltage sources and two DMMs.

The design or validation engineer can develop tests using the SCPI programming language, which can then be reused when the B2900 SMU is integrated into production test systems. A limit test feature lets the instrument make automatic pass / fail judgments in production test without writing a PC-based test program.

- Flexible and integrated 4-quadrant sourcing and measuring capabilities.
- Extensive measurement range from ±210 V, ±3 A (DC), ±10.5 A (pulsed).
- Comprehensive source and measurement resolution down to 10 fA and 100 nV.
- User-friendly front panel graphical user interface (GUI) with a 4.3-inch color LCD display that supports both graphical and numerical view modes.
- Broad 10 µs digitizing capability.

A single instrument for sourcing and measuring low voltage and current with great precision and accuracy to use on a bench or in a production test rack.

Battery Drain Analysis for Low Power IoT Devices

Learn more

B2900 Series precision source / measure unit

Request a quote

Software for the B2900 Series precision source / measure unit (SMU)

Beyond SCPI, the B2900 Series precision source / measure SMU has several remote-controlled options available at a minimum or no cost.

Solution	Benefit	
BV0003B PathWave BenchVue software	• Create automated test sequences with minimal instrument knowledge quickly. • Control instruments, automate tests, and perform in-depth analysis with the intuitive interface.	Request a Free Trial >
B2900A quick IV measurement software	• Configure up to four SMUs easily and perform IV measurements that display results in tables and graphs without programming.	Request a Free Trial >
EasyEXPERT group+ device characterization software	• Perform complex device characterization immediately with the software and its ready-to-use measurements (application tests). • Organize and store test conditions automatically, including device measurement data in a unique built-in database.	Request a Free Trial >

N6705C DC power analyzer and N6781A / N6785A source / measure units

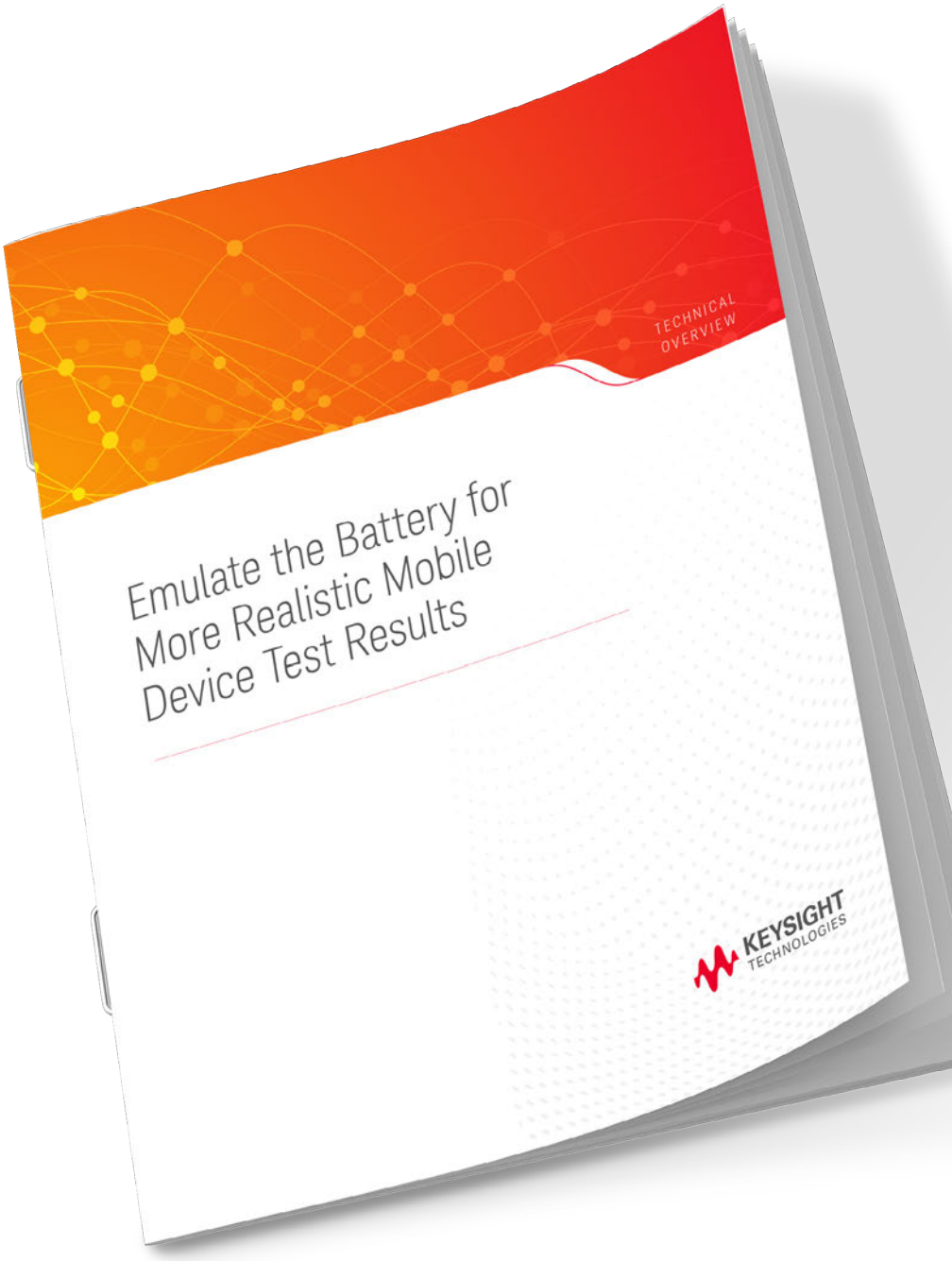
The Keysight N6705C DC power analyzer and N6781A / N6785A source / measure units (SMUs) enable fast and accurate power consumption analysis. The N6705C power analyzer provides a platform for power, waveform capture, and long-term current drain data logging. It then performs an analysis and displays the results in a large color display.

The N6705C power analyzer and N6781A / N6785A SMUs simplify the characterization of IoT device current consumption through patented, seamless current ranging technology to measure dynamic currents. This capability enables designers to make measurements without writing a single line of code.

- Measure a wide range of current from nA to A in one pass.
- Function as both a current / voltage source and e-load.
- Realize high accuracy for low current measurements; use with high-power IoT devices.
- Minimize transient voltage drop for pulsed currents drawn by wireless devices with a fast-transient response.
- Gain detailed measurement insight with a 200 kHz sampling rate.

Emulate the Battery for More Realistic Mobile Device Test Results

Learn more



A single instrument for sourcing and measuring current gives you insight into your signal quickly so you can move your test program into production using the same SMU module.

N6705C DC power analyzer

Request a quote

N6781A / N6785A source / measure units

Request a quote

PathWave BenchVue BV9200B and BV9201B advanced control and analysis software

Keysight's BV9200B and BV9201B lets you easily connect and access your power supply's advanced sourcing and measurement feature and enable short-term and long-term device current drain analysis with or without real battery

- Measure battery run-down performance with its accurate long-term current measurement.
- Configure graphically to create three modes of analysis: scope (short-term waveform capture), data logger (long-term waveform capture), and CCDF (statistical analysis).
- Create complex waveforms to stimulate or load down a device under test (DUT) by inputting a formula and choosing from built-in or importing waveform data.
- Choose options for a single instrument or four instruments.

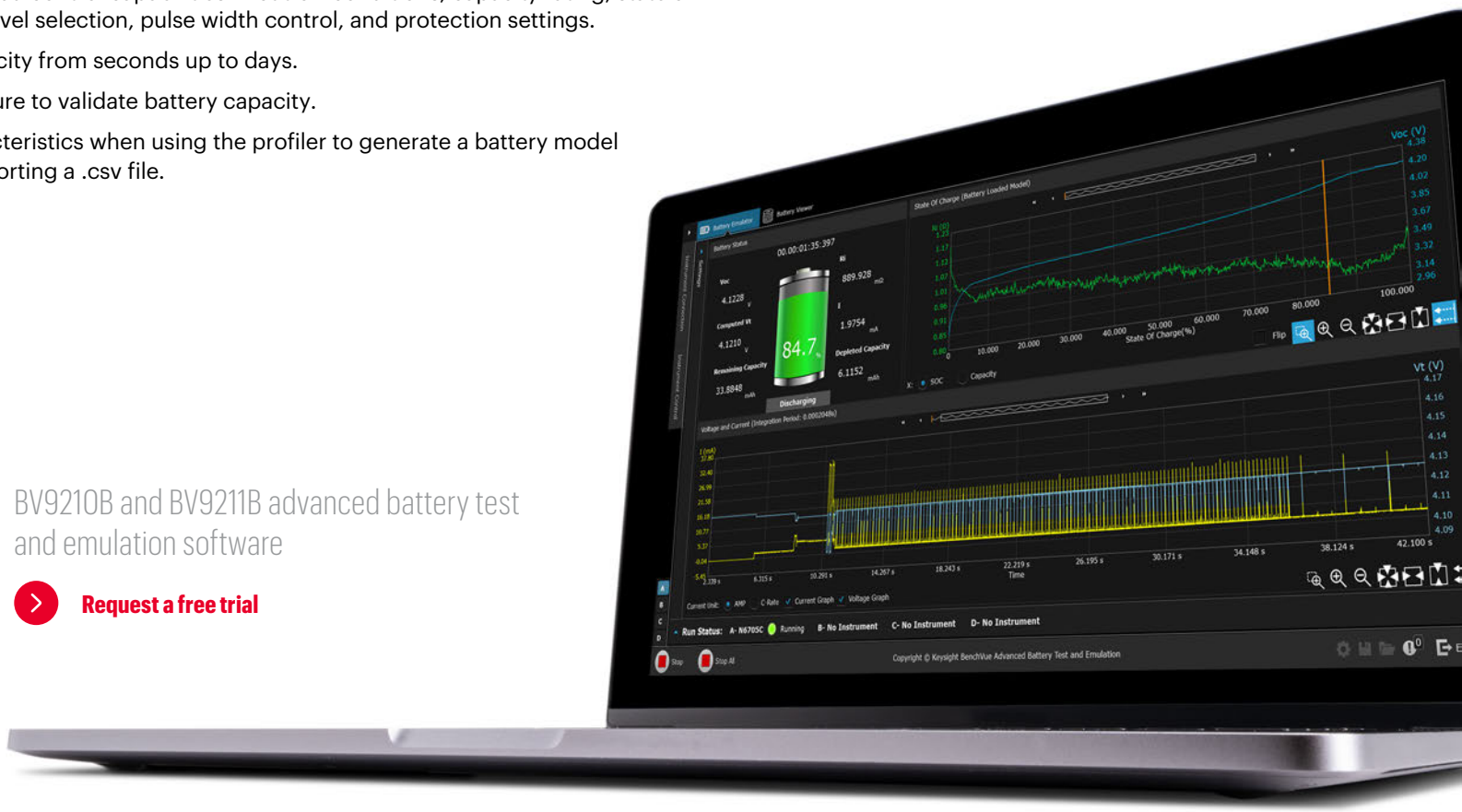
BV9200B and BV9201B advanced control and analysis software

Request a free trial

PathWave BenchVue BV9210B / BV9211B advanced battery test and emulation software

The Keysight Pathwave BenchVue BV9210B / BV9211B advanced battery test and emulation application software provides a test environment for you to easily run battery tests, generate battery models, and perform battery emulation using one or more of Keysight's two-quadrant power supplies.

- Control any combination of up to four N6705C DC power analyzers with N6781/82/84/85/86A SMU modules.
- Test your battery's characteristics with a wide emulation range — up to 200 kW and 2000 V.
- Benefit from a range of advanced control capabilities — cut-off conditions, capacity rating, state of charge, constant or dynamic level selection, pulse width control, and protection settings.
- Log voltage, current, and capacity from seconds up to days.
- Use the charge/discharge feature to validate battery capacity.
- Create complex loading characteristics when using the profiler to generate a battery model from built-in sequences or importing a .csv file.



BV9210B and BV9211B advanced battery test and emulation software

Request a free trial

Battery Life Solutions

Solution	Benefit	Tip
34470A digital multimeter	• Low-cost, readily available solution • High precision up to 7.5 digits • Quick measurements of static, low- or high-level currents • Fast digitizing mode for capturing waveforms up to 10 kHz at 4.5 digits • Compact form factor fits easily into rack	• Sample current at high rates for waveform insights • Use during manufacturing test for basic functionality test
N2820A current probe	• High sensitivity and high dynamic range • Excellent bandwidth for fast-changing signals up to 3 MHz • Flexible triggering	• Analyze current flow at various points in your circuit to understand the effects of software or firmware changes on power consumption
B2900 Series SMU	• Excellent precision; minimum 10 fA / 100 nV sourcing and measuring resolution • Convenient built-in source gives you: - Zero burden voltage - No droop - Simplified wiring • Compact form fact or fits easily into rack • Quick I/V measurement software provides measurement insights	• Simulate battery and measure battery current drain for deep insights into device applications • Develop tests using SCPI programming language during design stage • Reuse tests when integrated into production test systems.
N6705C DC power analyzer N6781A SMU	• Seamless patented ranging; measure nA to A in a single pass • Accurate emulation of a battery	• Use for battery drain analysis for your IoT device • Simulate battery and measure battery current drain with the built-in power supply • Reuse modules and programs during manufacturing test with the N6700 Series mainframe

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