KEYSIGHT

Green & Safe IoT Devices Contribute to Decarbonization

10 Sep 2024

01

IoT Battery Test Solutions

Measure battery life and efficiency of an IoT devices.

$1.27 trillions of global spending [IDC]	>500 zettabytes of data volume [Cisco]	26 smart objects per human [IDC, Intel, UN]	$117 billion of healthcare market [ACT]
			

IoT is Growing Rapidly

125 billion connected IoT devices in 2030 (12% CAGR) - IHS

$82.5 millions of wearables [IDC]	24.75 billions of smart clothing [Reportbuyer]	75% of cars built with connectivity [BI Intelligence]	87% of Healthcare Org with IoT system [Aruba Networks]
			

We Offer End-to-End Solutions Across Workflows and Markets

MARKETS

WORKFLOW

Design → Emulate → Prototype → Test → Manufacture → Optimize

Keysight Battery Solutions Overview

FOR DESIGN AND PRODUCT DEVELOPMENT PHASE

Design & Prototyping

- Determine power strategy
- Select battery
- Characterize battery

Product Development

- Emulate battery
- Validate battery
- Battery cycling
- Battery life test
- Certify battery

Our Solution

N6705C DC Power Analyzer/X8712A with 3 software tools

X8712A IoT Device Battery Life Optimization Solution/
N6705C DC Power Analyzer

BV9210/11B

PathWave BenchVue Advanced Battery Test and Emulation

- Purpose built for battery tests and battery emulation
- Easily create battery profiles to quickly and consistently validate device performance under various battery conditions

KS833A2A

PathWave Event-based Power Analysis

- Purpose built device battery life optimization and analysis software
- Enable automated event-based power analysis (especially useful for RF events) and easy battery life estimation

BV9200/01B

PathWave BenchVue Advanced Power Control and Analysis

- General purpose SW UI to allow easy access to sourcing and measurement functions of N6705C
- Enable short-term and long-term device current drain analysis with or without real battery

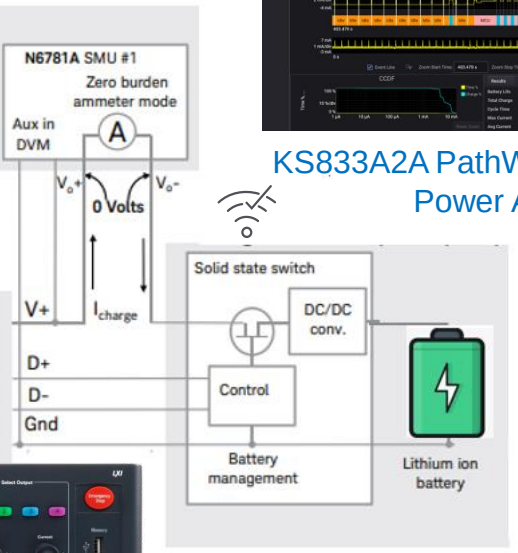
An integrated hardware plus software solution for
Battery Life, Battery Drain and Battery Emulation

Keysight Battery Solutions Overview

FOR DESIGN AND PRODUCT DEVELOPMENT PHASE

BV9200/01B
PathWave BenchVue Advanced
Power Control and Analysis

KS833A2A PathWave Event-based
Power Analysis



BV921xB
PathWave BenchVue Advanced
Battery Test and Emulation
+ N67xx/N79xx/RP79xx

All-in-One HW platform [X8712A/N6705C] plus SW for
Battery Life, Battery Drain and Battery Emulation

**CX3300 Device Current
Waveform Analyzer**

Evaluating Self-Discharge Behavior of Cell Designs

BT2191A/BT2192A Self-Discharge Measurement System and Software

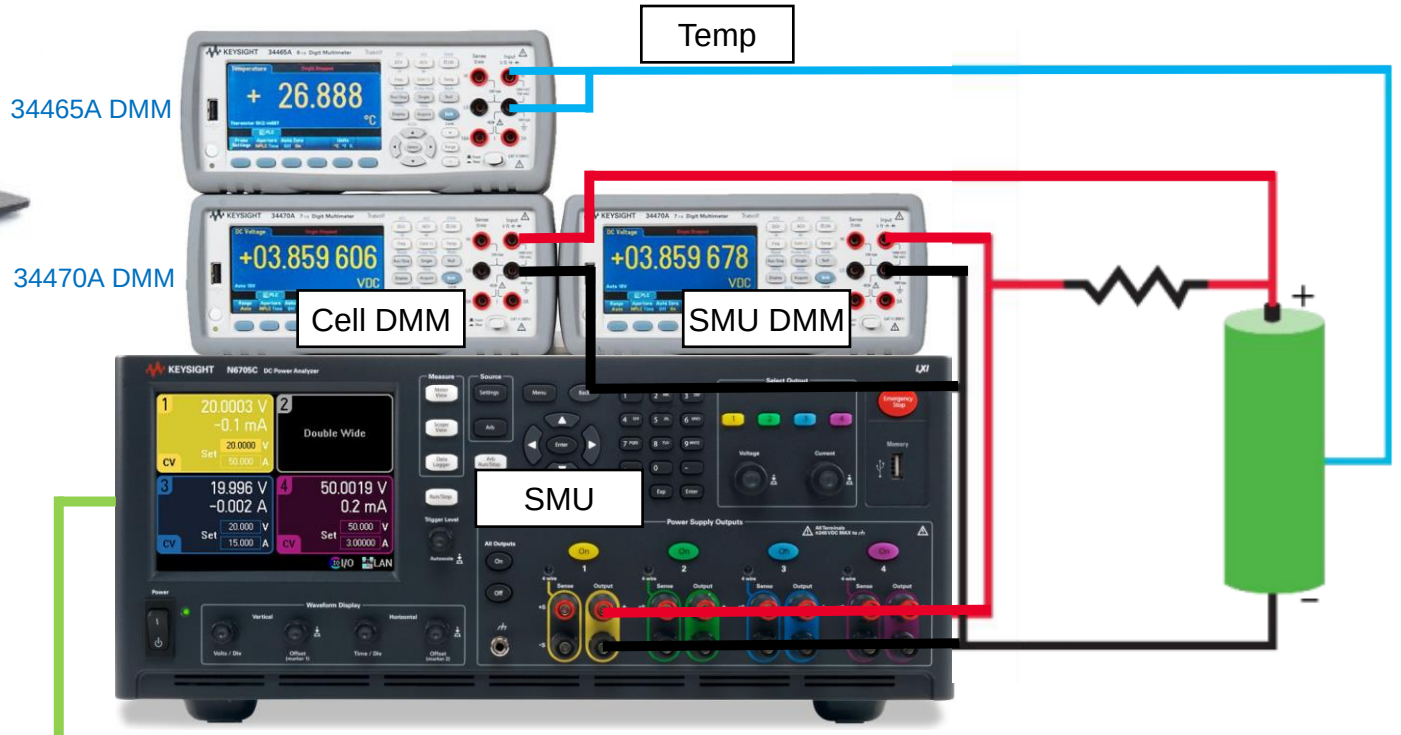
BT2192A Self-Discharge Measurement System Software

UI/visualization

Test control/ results logging

Measurement algorithm

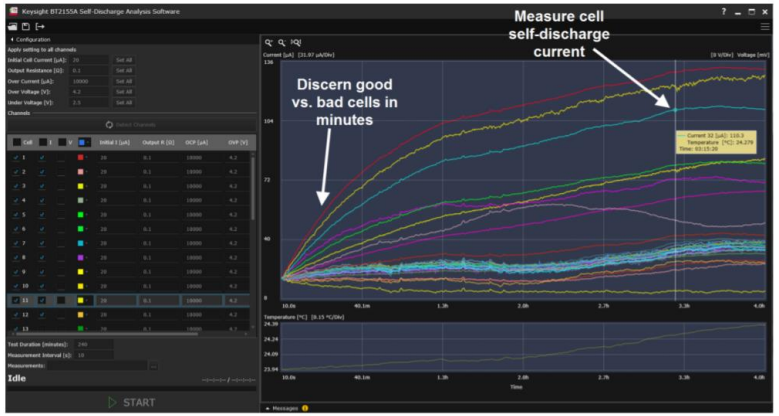
Instrument control



N6705C DC Power Analyzer with N6782A 2-Quadrant source measure unit

Reducing cell manufacturing process costs

BT2152B Self-Discharge Analyzer and BT2155A Self-Discharge Analysis Software



Get dramatic reductions in work-in-process, working capital and facility costs with revolutionary good vs. bad cell self-discharge performance test

Characterize self-discharge current in minutes or hours instead of days or weeks

Capabilities:

1. **Quickly & accurately measure self-discharge current** of up to **32 cells**
2. Measure **self-discharge current value in 1 to 2 hours**
3. Discern **good vs bad cells in < 30 minutes** with built-in noise reduction algorithms.
4. Select a total resistance value to **optimize the RC settling time** of the measurement and the test time

Useful resources:

BT2152B Self-Discharge Analyzer and BT2155A Self-Discharge Analysis Software

Evaluate Self-Discharge of Lithium-Ion Cells in a Fraction of the Time Traditionally Required YouTube videos: Li-Ion Self-Discharge Measurement

02

IoT Security

Security concerns on wireless and IT network

What Keysight IoT Security Assessment Has Found

1bn
Our software helped FDA identify vulnerabilities in 1bn Connected Devices

40+
CVE's first discovered with our solution

9/10
OWASP
IoT Top 10

Advisories from our solution's discoveries:

- **FDA Safety Communication** link
- **CISA Alert** (ICS-ALERT-20-063-01) link

- Used in discovery & validation of significant vulnerability classes:
  - **Sweyntooth** – causes crash/reboots in healthcare, industrial, and consumer devices
  - **Braktooth** – impacts over 1 billion deployed IOT devices
- Found both **known** (vulnerability scanning) and **unknown** (protocol fuzzing) **security flaws**
- **Used to find/validate 40+ CVEs**

KEYSIGHT

Security Is No Longer Optional

Growth in compliance and standards for consumer and enterprise IoT devices

01 Broad IoT Device Security Standards

ETSI EN 303 645

ISO/IEC 27402

NIST IR 8425

IEEE 1547.3-2023

ISA/IEC 62443

02 National Consumer IoT Labelling

US Cyber Trust Mark

Singapore CLS

The UK Product Security and Telecommunications Infrastructure

03 International Technology Standards

ORAN Alliance

Open Web Application Security Project (OWASP)

CTIA for cellular IoT

04 Sector Standards & Specifications

Transport | TSA | Pipeline Operators

Defense | CMMCv2.0 | Defense Contractors

Energy | UL 2941 | Distributed Energy Resources (DER)

Automotive | UN ECE WP.29 Vehicles

03

Challenges & Solutions

Keysight Is a World Leader In Test and Measurement

Helping To Shape The World of IoT

Member of multiple industry standard bodies

- Technological Advisory Council (TAC) for the Federal Communications Commission (FCC)
- O-RAN Alliance, 5G-Advanced and early 6G research
- Industry consortia (IOWN, NextG Alliance, QED-C)

Cyber Security Trust Mark

- White House announced Cyber Trust Mark for consumer IoT devices that pass cybersecurity tests and are transparent about data usage
- Keysight was one of a few select vendors and the only testing solution provider invited to participate

U.S. Cybersecurity Labeling Program for Smart Devices

U.S. CYBER TRUST MARK

Image Credits: FCC

Advancing Innovations for IoT Ecosystems

5Cs of IoT

Connectivity	Ensuring robust and reliable connections
Compliance	Complying to global standards and regulations for market access
Coexistence	Operating harmoniously in crowded IoT environment
Continuity	Optimizing power consumption to maximize battery life
Cybersecurity	Securing devices and infrastructure from cyber threat

Keysight Solutions

Connectivity

- IoT OTA Device Test
- High Speed Connectivity Solutions
- Advanced Design System Simulation Software

Compliance

- EMC Compliance Solutions
- Radio Equipment Directive Regulatory Solutions
- High Speed Digital Compliance

Coexistence

- IoT Device Coexistence Solution
- IoT Infrastructure Coexistence Test
- Field Coexistence Verification

Continuity

- Battery Life Optimizer
- IoT Current Waveform Analyzer
- Battery Drain Analysis

Cybersecurity

- IoT Device Penetration Test
- IoT Infrastructure Security Test

UNLEASHING MISSION CRITICAL IOT EVOLUTION

KEYSIGHT TECHNOLOGIES

Note: OTA: Over-the-Air; EMC: Electro Magnetic Compatibility.

Global Regulatory Landscape for Wireless IoT Devices in 2.4/5/6GHz Bands

XA5002A

IC

Canada:
IC/ISED

XA5002A

FC

US: FCC

XA5001 / 4 / 5A

CE

EU: CE/RED

EAC Russia, Belarus and Kazakhstan:
Eurasia (EAC)

XA5008A

SRRC

China: SRRC

XA5007A

Japan: MIC

South Korea: KCC

XA5003A DFS Software
applicable to all regions
under 5GHz

WPC

India: WPC

XA5006A

ICASA

South Africa:
ICASA/RED

Australia and
New Zealand:
C-Tick

IoT0047A Regulatory-Test Solution

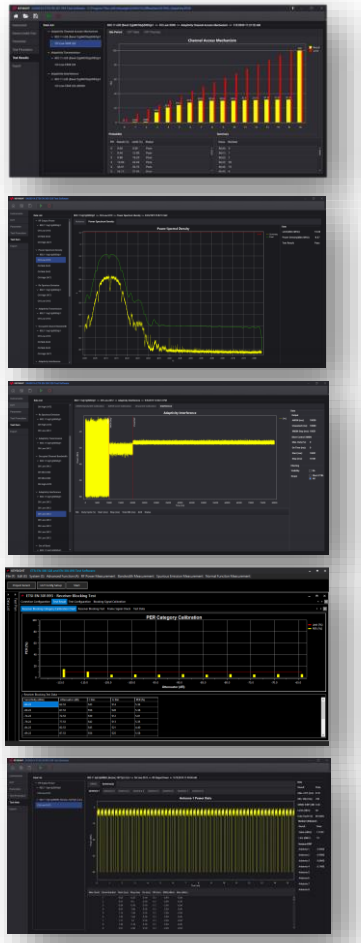
WHAT'S IN THE SOLUTION

XA5001A ETSI EN 300-328/301-893 Test Software

XA5002A FCC Part 15.247/407 Test Software

XA5003A DFS Test Software

Integrated automation software



N9020B MXA Signal Analyzer

N5173B EXG X-series Microwave Analog Signal Generator

N5182B MXG X-Series RF Vector Signal Generator

Metrology-grade instruments

X8749A Signal Conditioning Test Set

X8750A MIMO Power Test Set

Dedicated test sets for regulatory tests

Unlicensed 6 GHz Spectrum

Free, but not free...

- No license required for use of U-NII* bands 5-8
- Many users:
  - 5G ultra-wideband
  - Satellite links
  - Mobile TV broadcasts
  - Utility communication links
- Priority to incumbent carriers. Other unlicensed users have to share.
- Every wireless device MUST be certified or obtain approval before the product can be sold. *Medical device market has large potential…*

*** U-NII: Unlicensed National Information Infrastructure**

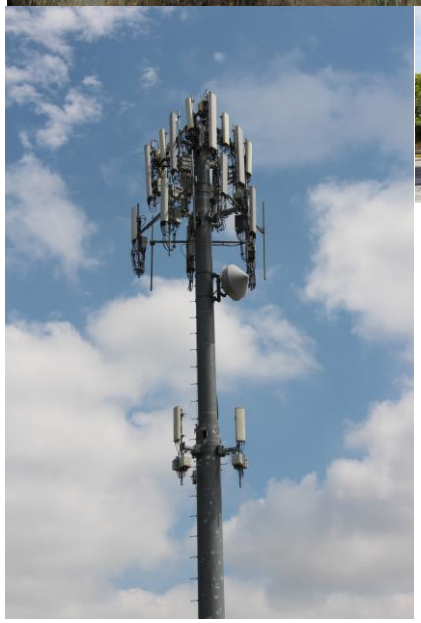


Photo Source: iStock Photos

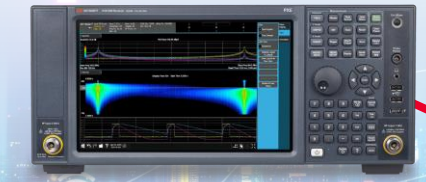
Installation, Maintenance, Service, and Repair Require Various Field Tests

Cable and antenna test

Vector network analysis

Power measurements

Spectrum analysis



And more…

?

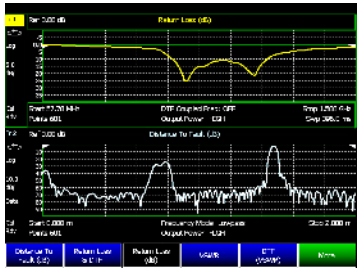
One communication network

The World's Most Integrated Handheld Analyzer

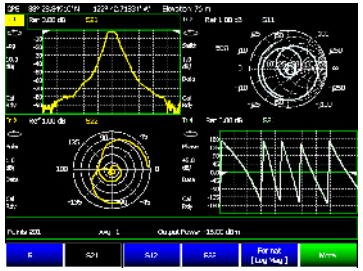
Keysight's FieldFox has 20+ RF and Microwave functions.

20+ Measurement Capabilities

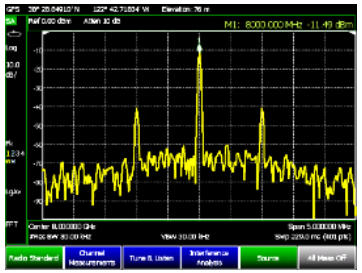
FIELD-UPGRADEABLE, SOFTWARE-ENABLED



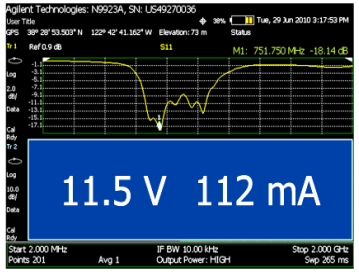
Cable & antenna analysis



Vector network analysis

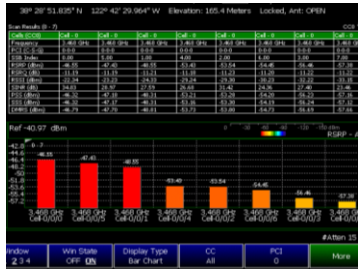


Spectrum analysis

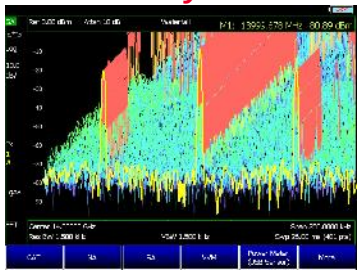


DC source & current monitor

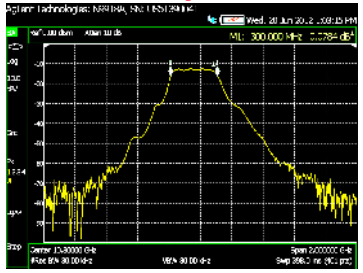
Built-in power meter



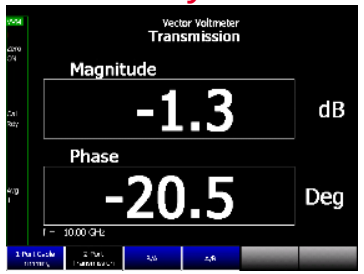
5GNR OTA & EVM



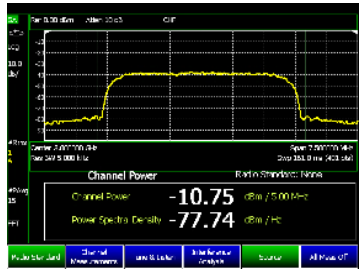
Interference analysis



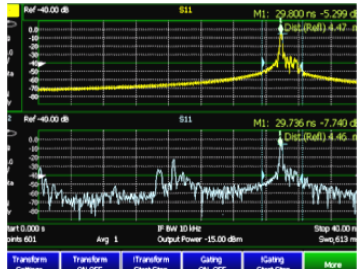
Full-band tracking generator



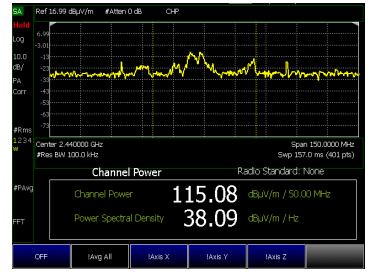
Vector voltmeter



Channel power measurement

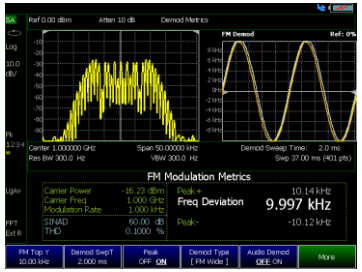


Time domain analysis

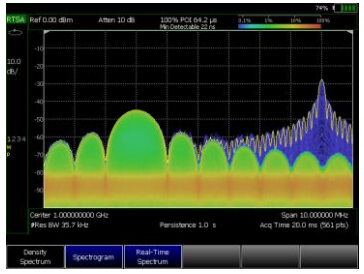


EMF measurement

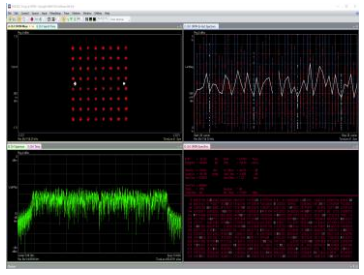
Channel scanner



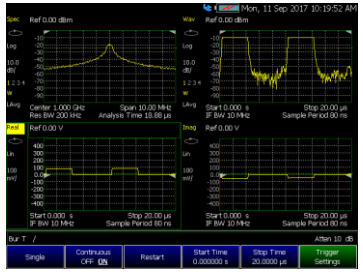
Analog demodulation



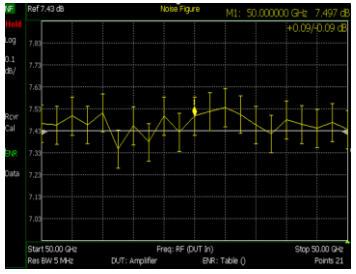
Real-time spectrum analysis



89600 VSA connection



I/Q analysis



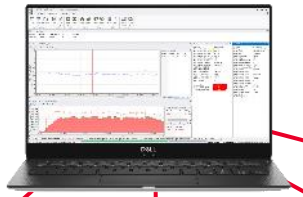
Noise figure

+ more!

Nemo Wireless Network Solutions

FOR FULL WIRELESS NETWORK LIFECYCLE

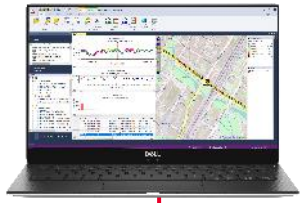
Nemo Outdoor



Nemo Network Benchmarking Solution

Nemo Industry Probe

Nemo Analyze



Lab Testing

Network Rollout

Network Optimization

Network Benchmarking

Network Monitoring

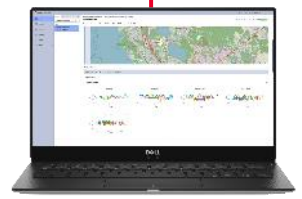
Control, Post-processing and Remote Management

Nemo Handy

Nemo Backpack Pro

Nemo Walker Air

Nemo Active Probe



Nemo Cloud

IoT Tests Throughout Product Life Cycle

A PLETHORA OF TESTS ARE REQUIRED TO SOLVE THE CHALLENGES

R&D → DVT → Compliance → Manufacturing → I&M

				
R&D debugs, block to system integration	**Functional & performance verification**	**Compliance test**	**Manufacturing tests**	**Field tests**
Circuit / system simulation	ETM, reliability, quality	Wireless regulatory (ETSI / FCC)	ICT & turn on test	Site spectrum survey
Block specific test (RF, power, SI, PI)	Verification and validation (FDA)	EMC and Safety	Functional & performance test	Installation verification
Protocol specific tests (WIFI, BT…)	Interference, coexistence, cybersecurity	Protocol specific test (SIG, WIFI Alliance)	Pre-test & final test	Maintenance and repair

KEYSIGHT

Thank you

LINE

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