KEYSIGHT TECHNOLOGIES

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HOW TO OVERCOME **IOT BATTERY LIFE** CHALLENGES

Why IoT Battery Life Does Not Meet Expectations and How To Fix

Battery life can contribute significantly to the cost and reliability of Internet of Things (IoT) infrastructure.

While for consumer electronic devices, battery life is often a critical purchase consideration. Therefore, the fact that the calculated battery life of IoT devices is often inaccurate is a significant issue for manufacturers.

One method to measure battery life is to divide the battery capacity in amp-hours by the average current drain in amps which gives you a time in hours. However, in the real world, this calculation is overly simplistic.

This formula can generate inaccurate results because devices use different power modes, including active, sleep, and hibernate.

Additionally, operating modes such as constant power and constant resistance will draw current from the battery differently and change the battery lifetime.

It is essential to fully understand how a battery responds to these different scenarios and the typical usage patterns of the device to predict battery life accurately. In addition to varying current drain, battery capacity is variable, depending on the average discharge current and usage patterns.

You can see in **Figure 1** that there is a considerable variation in discharge capacity based on the discharge current level for an alkaline cell. Furthermore, temperature can affect battery life, so it is critical to consider this. **Figure 2** shows how temperature can affect the capacity curves of a battery.
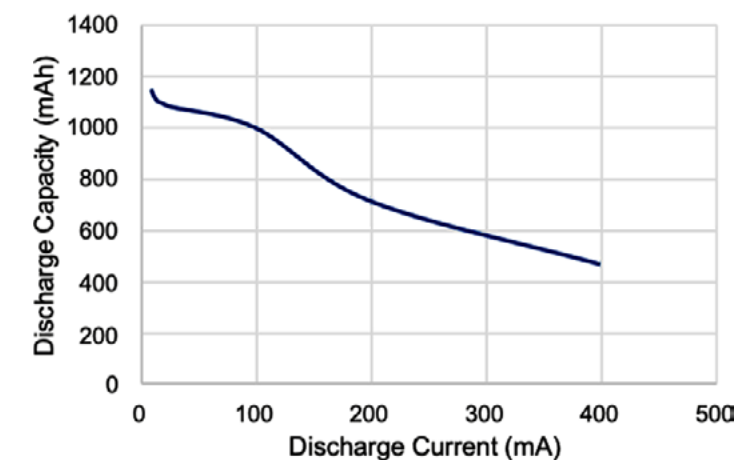

Figure 1 1,100 mAh alkaline cell, 0.9V cutoff voltage - discharge capacity variation
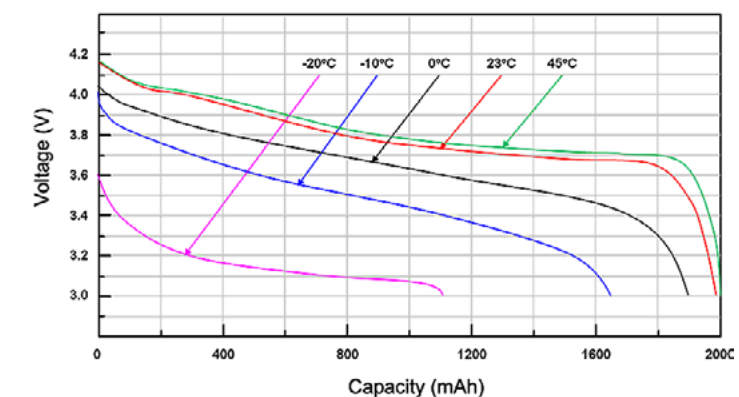

Figure 2 1,000 mAh Li-ion cell, 3 V cutoff voltage – temperature variation

The following are additional factors that can lead to a longer computed battery runtime as compared to real-world usage:

> Battery model / profile is not available to the engineer.
> Battery profiles are not generated with accurate device operating conditions.
> Current consumption measurements are not accurate.
> Voltage drops such as a device shutting down when the voltage reaches a cutoff range are not considered.

A solution to accurately predict real-world battery life is the use of battery emulation and test software. It can profile batteries through charging / discharging to create unique battery models. Test software can also emulate charge states to reduce test time, improve safety, and gain insight to extend battery life.

Another critical capability of test software is the ability for engineers to visually track charging / discharging batteries to determine capacity.

Finally, test software can cycle batteries to assess loss of capacity and reduction of battery life.

SUMMARY

Keysight's *Batteries and Power Management Webinar* provides more detailed information on the capabilities of battery emulation software, including a demonstration of *BV9210B PathWave BenchVue Advanced Battery Test And Emulation Software*. The whitepaper *Measuring IoT Battery Life with Test Software and Hardware* also discusses options for measuring battery life, including utilizing battery emulation software.