OVERVIEW

Wireless Wide Area Network (WWAN) Interface Cards (NICs) and devices are quickly being adopted to provide “anytime, anywhere” internet access for laptops. WiMAX™ and other broadband cellular format-based devices take over where most Wireless LANs end, no longer being tethered a short distance from a wireless access point.

The penalty of most first generation devices is considerably higher power consumption and current drain, reducing run time, especially for smaller laptops. Power consumption will continue to be a challenge with achieving greater data rates that are planned in the future. While USB and the laptop PC Cards are in common use today, ExpressCard™ format devices are now starting to supplant the PC Card. The ultimate objective however is to get the power consumption low enough such that the chipset reference design can be used in handheld devices. All of these things drive the need for ongoing power savings optimization. Efficient methods and tools for measuring, visualizing, analyzing, and reducing current drain of these WWAN devices during their development and evolution, as well as assess performance in use in actual networks, is of paramount importance to the device developers and network providers in their quest to optimize power savings.
Useful and efficient tools for measuring, visualizing, analyzing, and reducing the current drain of WWAN devices are generally not widely available. Tapping into the laptop’s internal power source for measuring the WWAN interface device’s current drain is often met with complications. Additional equipment to provide controlled RF and other stimulus and measurements is needed. It takes many months developing and integrating equipment and software for developing a test solution for measuring and evaluating the device’s current drain under controlled stimulus. Often the end result is inflexible and of limited capability. A lot of testing ends up being done manually, which can take weeks to perform. This can be time much better spent developing and optimizing the interface card’s performance while reducing its current drain and power consumption.

The Agilent 14565B Device Characterization Software, in conjunction with an Agilent 66321B/D or 66319B/D Mobile Communications DC Source, is a ready-to-use solution for long-term current drain measurement, visualization, analysis, and optimization. This dispenses with time consuming traditional approach of integrating DC sources, current shunts, digitizing measurement equipment, and creating custom application software.

Major capabilities of the 14565B software include:

- Three specialized modes of operation for measurement and analysis:
  1. Current waveform capture and analysis
  2. Long-term current drain data logging and analysis
  3. Long-term current drain capture and CCDF distribution analysis
- Programming interface layer for automated control from other programs.

Results in all three modes can be readily saved, recalled and compared for evaluating and quantifying differences in design changes and performance settings, for optimizing power savings. The programming interface allows the 14565B to be controlled from and return measurement results to other programs, enabling overall test system automation.

Key relevant features of the Agilent 66319B/D and 66321B/D DC sources include:

- A high-speed 16-bit DSP-based digitizing measurement system, similar to a digital scope, but with extended dynamic range and resolution.
- Three current measurement ranges suited for a device’s active, standby, idle, and off modes of operation.

These features eliminate the need to use multiple external current shunts or probes as well as a high speed digitizing data acquisition system, digitizing DMM, or digital oscilloscope, to measure and digitize a WWAN network interface device’s current drain.
By using an appropriate PC Card test extender as depicted in Figure 1 it is a simple matter to replace the laptop’s bias powering the WWAN PC Card with the Agilent DC source output. Some commercial test extenders are designed specifically for this purpose, having integrated switching to connect the external power supply to the DUT at the correct times. Having the external power for the PC Card turned on before digital signals are applied is important for correct operation and avoiding having it or the laptop hang-up.

Manually setting RF stimulus test conditions while making a number of corresponding current drain measurements is often very time consuming and laborious. In Figure 2 the Agilent N6422C WiMAX Wireless Test Manager (WTM) software is used to sequence the Agilent E6651A Mobile WiMAX Test Set through a series of RF settings. At the same time, the WTM software also sends commands to the 14565B software, treating it as a seamless solution with the 66319B DC source to set up, capture, and then return corresponding current drain measurements.
measurements on the WiMAX USB interface device, greatly simplifying this task. DC power is
provided by the 66319B DC source using a suitably modified USB extender cable. The N6422C
WTM is one of many RF software solutions are available from Agilent to test a variety of wire-
less formats, which interface with the 14565B software. The 14565B can also be controlled
from a variety of other programs, such as Agilent VEE, and National Instruments’ LabVIEW,
and programming languages, such as Microsoft® Visual Basic 6.0 and Visual Basic.NET,
for example, giving the test engineer flexibility to add automated current drain measurements
to most any test platform.

For this example the 14565B’s CCDF (Complementary Cumulative Distribution Function)
operating mode was used to profile the WiMAX USB interface device’s current drain for an
extended period for a variety of RF conditions, all under automated control of the N6422C
WiMAX WTM SW, in Figure 3. The resultant current drain CCDF profiles in Figure 4 are
for the device operated at different RF TX power levels.

FIGURE 3: N6422C WiMAX Wireless Test Manager
automating RF and DC stimulus and measurements

FIGURE 4: Automated 14565B
current drain
measurements
for a WiMAX
device
The complex task of battery current drain testing on WiMAX and other cellular WWAN interface devices for laptops is greatly simplified by using the Agilent 14565B software and Agilent 66319 B/D or 66321B/D DC source, serving as a ready-to-use solution tailored to battery current drain measurement, visualization, and analysis. A suitable adapter simplifies directly powering and measuring the devices’ current drain using the Agilent DC source. More importantly, the 14565B features programming automation so it can be easily integrated with test programs such as Agilent’s N6422C WiMAX Wireless Test Manager, creating a flexible and capable automated test solution for RF and DC stimulus and measurement. Instead of taking months for programming development and weeks for manual testing, setting up and running battery drain tests now take only hours to accomplish, resulting in dramatic improvements in test time and personal productivity.

**SUMMARY OF RESULTS**

- Device application software regression testing
- Device functional stress testing (real-world, in-network simulation)
- Current drain design validation tests
- Operating time use-model benchmarking

**RELATED APPLICATIONS**

| 14565B Device Characterization Software |
| 66321B/D and 66319B/D Mobile Communications DC Sources |
| 8960 Series Wireless Communications Test Set |
| E6651A Mobile WiMAX Test Set |
| N6422C/23C WiMAX Wireless Test Manager software |
| E656xC and N588xA Wireless Test Manager software |
| (a variety of cellular wireless formats are available) |
| N5970A Interactive Functional Test software |
| (for cellular wireless device real-world functional stress testing) |

**RELATED AGILENT PRODUCTS**

- E5515C wireless communications test set
- 66319D mobile communications DC source
- E6651A mobile WiMAX test set
Remove all doubt

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Agilent offers a wide range of additional expert test and measurement services for your equipment, including initial start-up assistance, onsite education and training, as well as design, system integration, and project management.

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