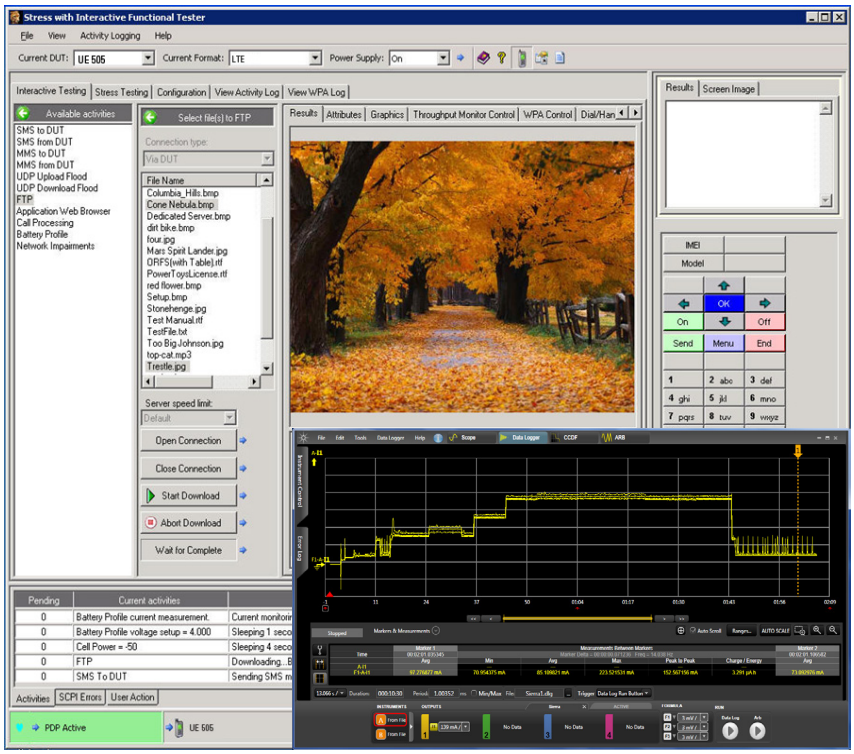
Agilent N5972A
Interactive Functional Test Software

Technical Overview

Comprehensive test suite to accelerate functional performance testing of cellular user equipment in a controlled laboratory environment



Optimize UE performance for real-world user scenarios

- Reduce design and validation cycles
- Create individual test sequences
- Develop comprehensive test scripts
- Create automated test plans to stress UE with simultaneous activities
- Measure the impact on UE performance, including battery drain

The ever-increasing complexity of cellular devices is driving the need to stress test phones and modems using scenarios that anticipate realistic use cases. Performing this testing, and making any necessary alterations during the design and verification stage prevents the cost of resolution from growing exponentially as the functionality-packed devices progress further downstream.

The Agilent Technologies N5972A interactive functional test (IFT) software provides an automated and simplified interface for testing cellular UE under real-world network scenarios experienced by end users. This software simultaneously performs functional and parallel testing of call processing, FTP, and SMS features, while monitoring current drain and changing the RF power to the UE. The N5972A provides the added benefit of simulating real-world conditions in a controlled environment, allowing UE designs to be optimized ahead of deployment on a real network.

Anticipate increasing UE performance demands

Network operators are motivated to ensure that performance of UE on their network results in a positive end-user experience. While signaling conformance test addresses certain aspects of functionality, operators typically want to conduct more representative performance testing to ensure reliable user services under different network conditions.

These real-world use scenarios supplement traditional conformance testing and are commonly formalized into operator-specific test plans. Such plans subject UE to demanding compliance testing before being approved for use on an operator's network, commonly described as functional performance test.

Accelerate time to market

By allowing earlier identification of design issues, which drives down time-to-market, N5972A software is ideal for both cellular phone and data-modem developers conducting functional validation of UE, and service providers performing acceptance tests.

Achieve shorter design and compliance test cycles

Running functional test scenarios early in UE development reduces the number of cycles between design and compliance.

Agilent offers a number of test solutions based on functional test demands. Our measurement knowledge and testing experience is built in to a range of test tools, so you can focus on UE verification testing rather than developing in-house test tools.

N5972A IFT software provides real-world testing capability earlier in the design cycle, enabling faster and easier design modifications. It also ensures that during validation the tester is able to find complex hardware, protocol, or software issues that are representative of how the cellular mobile device will function on a real network. Finding such user-experience issues before a device is rolled out to a network eliminates expensive validation cycles and the costs associated with re-releasing a device.

With the IFT software, you can run tests manually or automate them for unattended testing; and IFT now offers full automation capability for Android devices. Whichever option you choose, you will get reliable, repeatable verification and logged results that provide you with the information you need to progress rapidly to deployment.

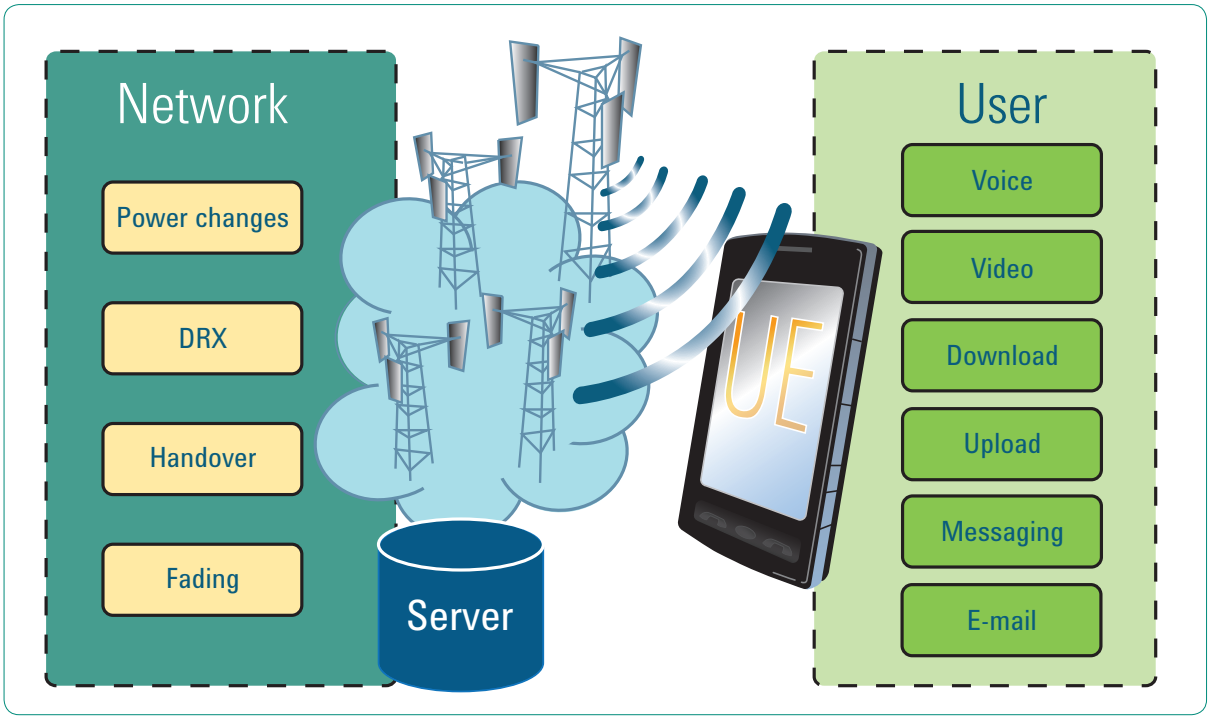


Figure 1. Examples of activities to consider for functional test of UE

Perform real-world stress testing

The IFT automated test software is used with Agilent wireless communications test sets, power supplies, and application servers in order to test real-world applications in a controlled laboratory environment. Highly-configurable, this performance test software allows you to tailor test plans to verify functionality that is important to you and your customers.

Traditionally, the method of testing a device's capabilities would be to sequentially test each feature. With IFT software you can perform tests simultaneously. For example, the software lets you characterize what happens when a user is performing an FTP download, receiving an SMS message, and moving away from the base station (when cell power is decreasing).

This capability allows you to more thoroughly test a design to reduce the number of issues that might be found downstream.

The IFT solution also provides the ability to set up a number of different user activities to repeat over time. These pre-defined, unique interactions allow the IFT software to find device design issues that normally do not surface until the device is tested on a real network—a very expensive stage in the design lifecycle to find defects.

Used with Agilent wireless test sets, IFT software allows you to create realistic UE usage scenarios in a controlled laboratory environment, so you can optimize UE design before deploying devices on a live network.

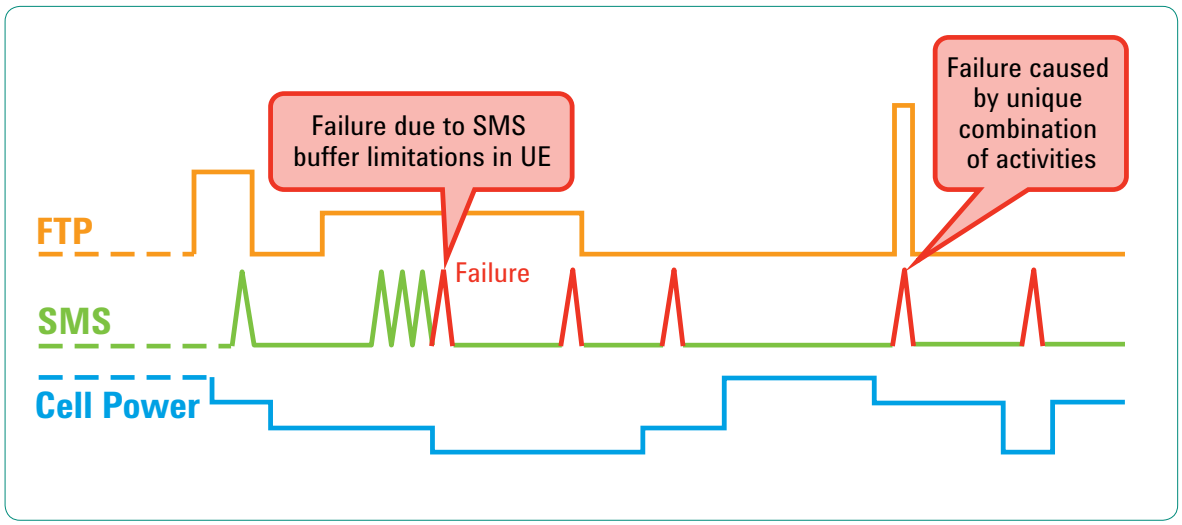


Figure 2. Interactions of multiple activities changing over time

Select the operation mode

The N5972A provides three distinct modes of operation:

Interactive mode

This mode allows you to manually set up and run activities through easy-to-use controls. It is the ideal mode for investigating test scenarios and troubleshooting design issues.

Any test sequence performed in interactive mode is easily made into a script to run automatically.

The interactive user interface allows you to configure the properties of each activity (such as which files to send, how often, and for how long) and then select which activities you want your device to perform.

This mode of operation does not require any programming and is an expedient way to make changes and run your configured tests as often as need.

Script development mode

Once a test process has been defined through the interactive mode, saving the setup as a script takes just a simple drag-and-drop. You can also enhance and modify the scripts to include other user-defined tasks, as well as use pre-defined snippets for common programming functions.

The IFT software's flexible and easy-to-use scripting tool lets you create scripts in a matter of seconds simply by dragging and dropping the desired activity to the scripting tool. You can also quickly add anything you did in interactive mode. Just drag it over to the scripting tool. This allows you to rapidly automate the features your device is capable of performing. Each script that you create can also be used as individual test steps in a stress-test plan.

Stress test mode

Stress test mode makes it simple to create a test plan that runs scripts and even combine multiple scripts. This mode also makes it easy to manage and automate the execution of stress test plans.

Using this test mode you can configure properties of the stress test such as what to do if a failure occurs and how many times to run the stress test. The TCP/IP API interface allows control of test plan execution through other programs and users can setup e-mail notification of test plan status and results.

Now you have an automated method to repeatedly and consistently run your functional test scenario, log results and compare them against predetermined pass fail criteria.

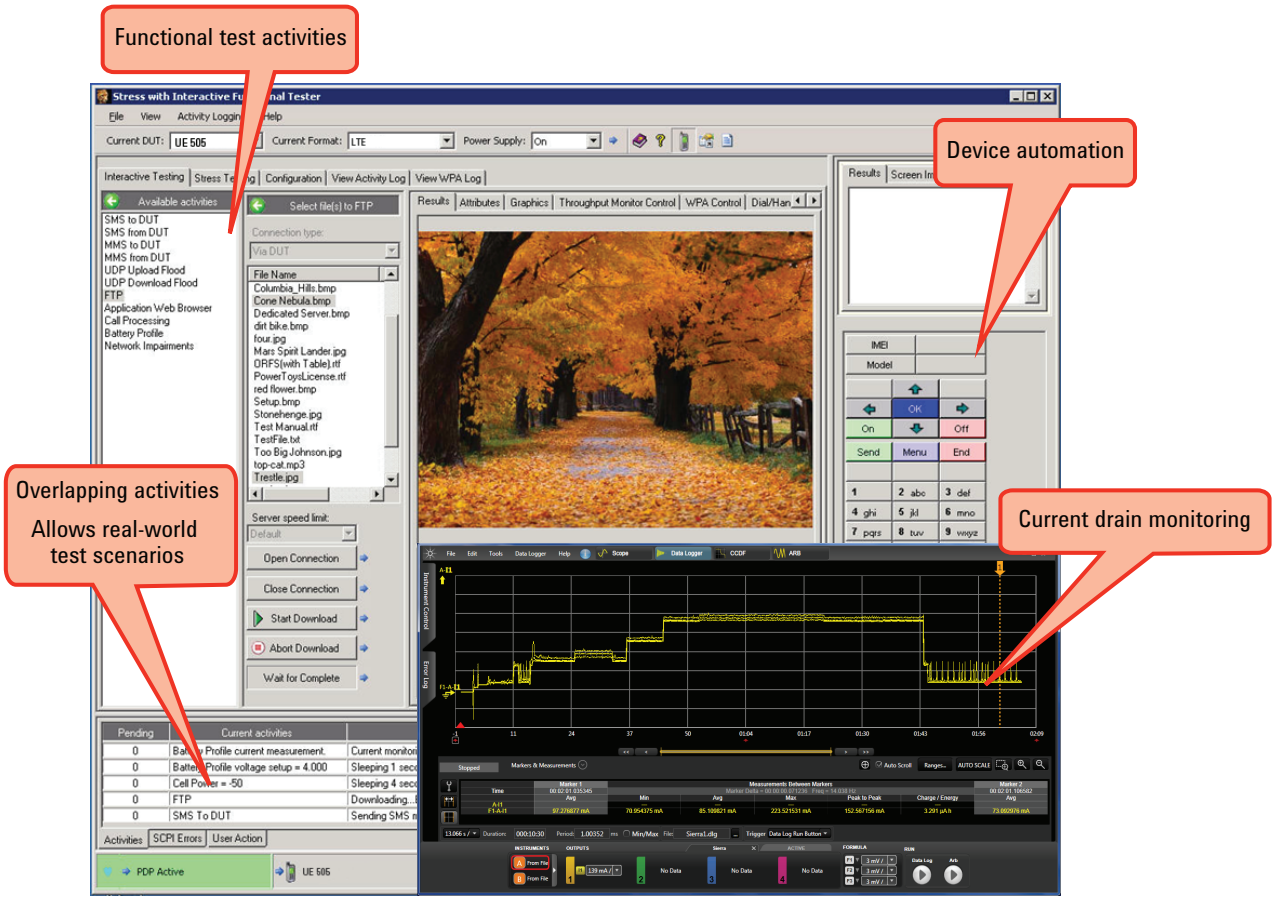


Figure 3. N5972A IFT software application with 14585A current drain monitoring

Fully automate Android device test

IFT now offers the ability to automate many functions of Android devices with the N5972A-5FP option. Used in conjunction with the Android Debug Bridge (adb) tool, this utility enables true unattended test, providing automation of device activities such as sending and reading SMS and MMS messages, playing music, taking videos, and receiving e-mail. Easily drag-and-drop UE commands into your test plan or script, allowing you to run hours, days, or even weeks of automated stress or regression testing with no manual intervention.

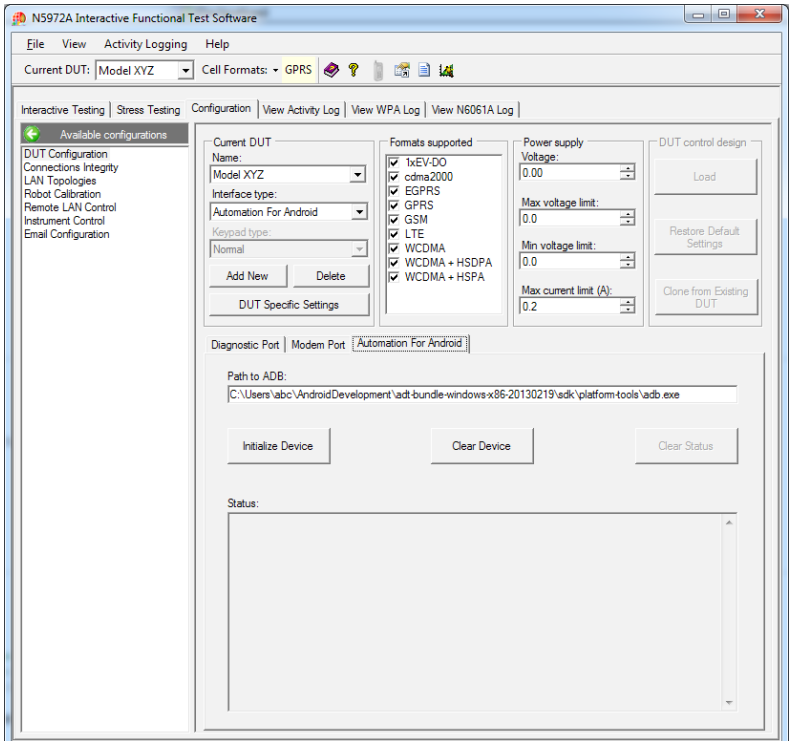


Figure 4. N5972A-5FP allows full automation of many Android device activities

Run parallel activities

There are many available activities within the software, all of which can be executed in parallel. Used in conjunction with appropriate servers, the available activities include:

- Call processing
- IMS-SIP voice/video/messaging[1]
- SMS, MMS
- UDP upload download
- FTP upload download
- Application Web browser
- Battery profiling
- MMS to the UE
- MMS from the UE
- Ping
- Network impairments

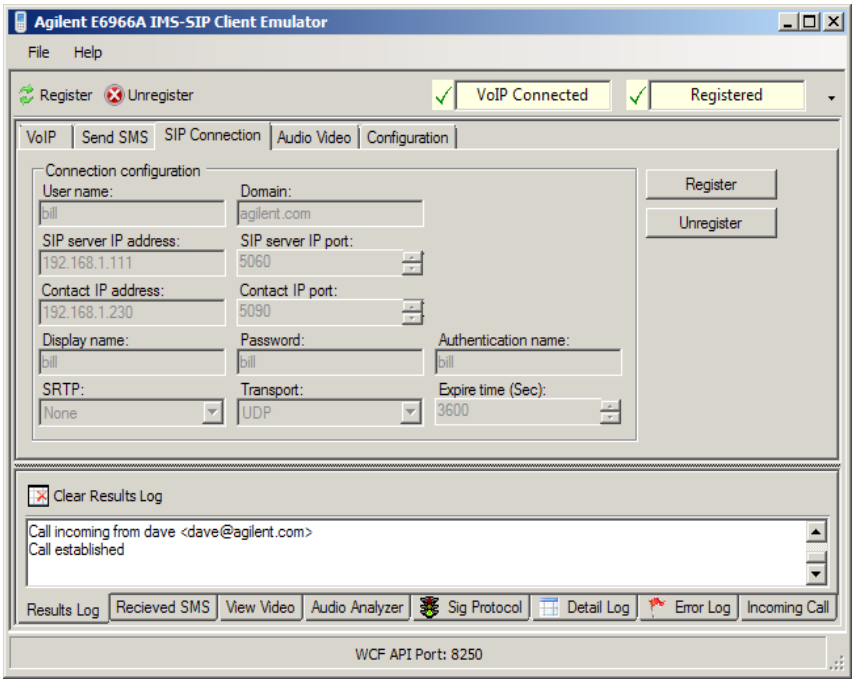


Figure 5. IFT integrates with the E6966A IMS-SIP client

1. *Requires E6966A IMS-SIP client and server emulator*

Test battery drain

Customers want to know how much use they can get from the mobile device between charges. Testing therefore needs to replicate different use models and the drain on the device's battery.

New methods of testing a battery's current drain performance must go beyond the traditional talk time and standby time.

Today's device hardware, firmware, and software applications interact in complex ways. Due to this and the ever-increasing number of radios and the system complexity of cellular wireless devices, it is crucial to test these devices to understand how a battery operates under real-world conditions.

Digital wireless devices operate in short bursts of activity to conserve power. They exhibit long periods of sleep or idle between bursts of activity. The resulting current drain is pulsed; high peak and low average, with current spanning up to four decades over range of operation. The challenge is capturing current drain details for future analysis that will allow you to optimize battery life.

Agilent offers dedicated hardware and software for DC power analysis that integrates with IFT and are capable of performing:

- Direct measurement of battery performance, or battery emulation to power UE
- Log peak and average current and power consumption, with high dynamic range and short time resolution
- Long term data logging to capture battery operating time for comparison with expected values
- Verification of UE low voltage shutdown

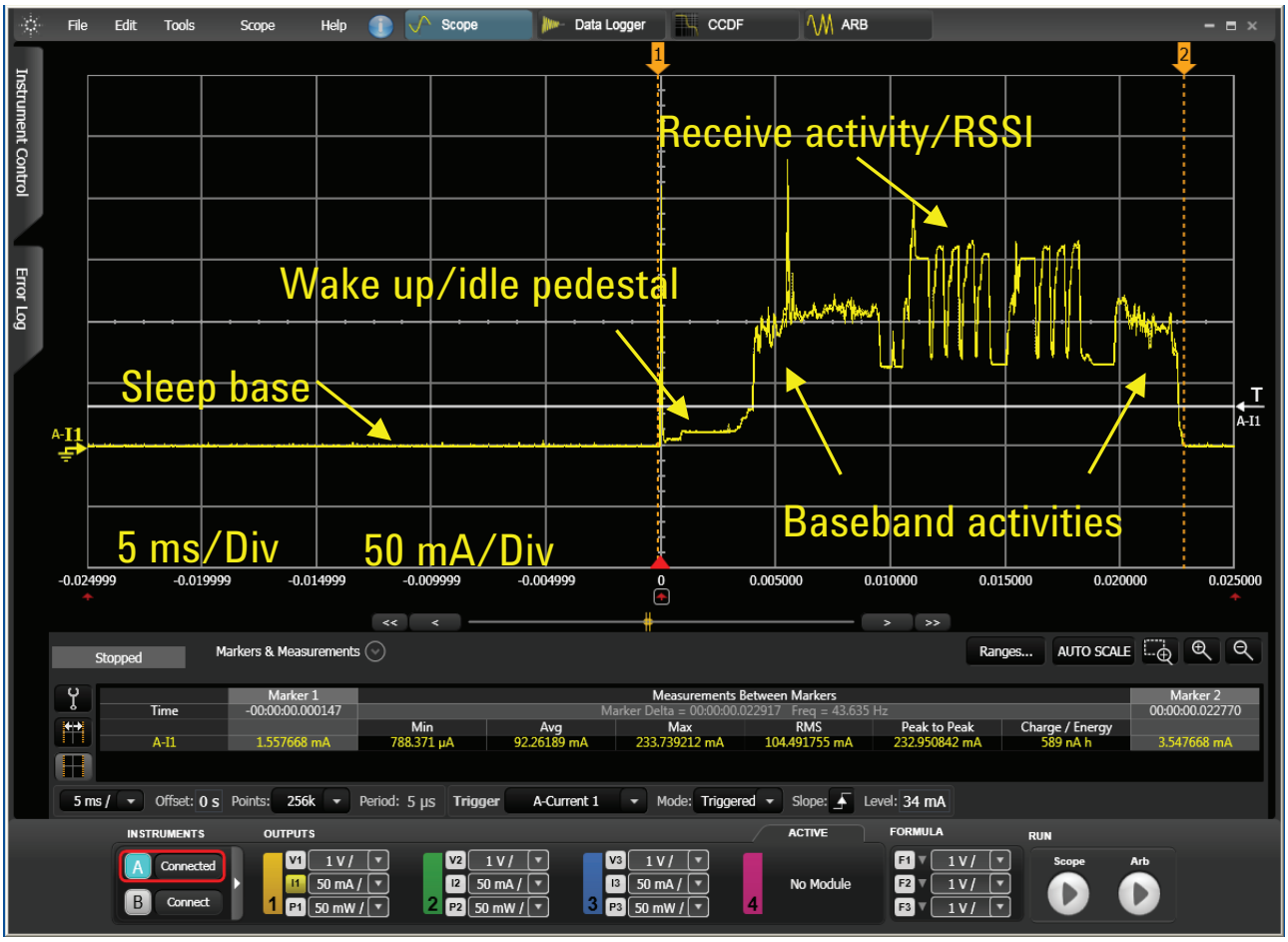


Figure 6. Example trace from 14585A battery drain analysis software, annotated with functional events

Configuration information

For full functionality, a test configuration requires

- Client PC for running IFT
- Server PC supporting required services
- Agilent PXT or 8960 Series 10 wireless communications test set
- Power supply for UE (optional)

IFT software

N5972A-1FP interactive functional test software

- Enables use of IFT on a single PC
- Includes software install for server PC including Now SMS, Apache, FileZilla, UDP, and MMS

N5972A-5FP IFT automation for Android

- Enables full automation of Android devices from within IFT

IMS-SIP network emulator (optional)

E6966A-1FP IMS-SIP server emulator

- Enables use of server and remote client on a single PC

E6966A-2FP IMS-SIP client emulator

- Client software for a standalone PC (co-resident on same PC as IFT)

PC requirements for running IFT server and client

Hardware/Operating system

- 1.8 GHz Pentium dual core processor or better
- Windows 7 Professional or Windows 7 Enterprise
- 2 GB RAM
- 2 GB of available hard disk space
- LAN port
- 2 available USB ports
- Audio interface (optional)
- Webcam (optional)

Wireless communications test sets

- E6621A PXT with appropriate software applications supporting required technologies
- E5515C/E 8960 Series 10 with appropriate software applications supporting required technologies

Battery performance test

- N6705B DC power analyzer with N6781A SMU and 14585A battery drain analysis software
- 66319D DC source with 14565B analysis software

Miscellaneous

- Agilent 82357B (or similar) USB/GPIB interface
- Gigabit LAN router/switch
- LAN cables
- RF cables
- GPIB cables
- UE control (as appropriate)
- UE battery breakout cable (as appropriate)

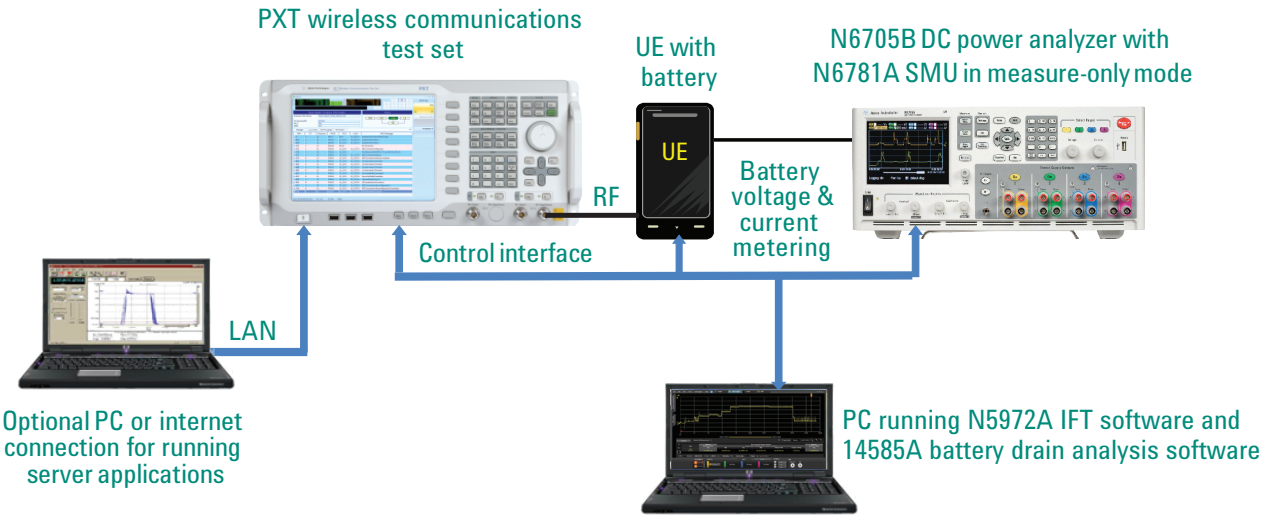


Figure 7. Example configuration for functional test with battery drain analysis

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