



Agilent N5970A UMTS Interactive Functional Test (IFT) and N5971A CDMA IFT Software

A Solution for Stress Testing Cellular Devices

Application Note

Functional test activities

- SMS (MO, MT)
- MMS (MO, MT)
- FTP, UDP, HTTP
- WAP push
- Call processing
- Network impairments
- Battery current drain
- Ping

Current drain monitoring

Overlapping activities

Allows real-world test scenarios

Data rate monitoring

Pending	Current activities	Status
0	Read current = 138.009 ma	Waiting 2.00 seconds before next current
0	Set voltage = 3.700 Volts	Waiting 2.00 seconds before next voltage
0	Cell 1 Power = -50	Waiting 3.00 seconds before the next Cell
0	SMS to DUT	Test message sent via 8960...
0	FTP Download	Downloading...Four.jpg

Improve cellular devices by finding issues earlier in the design lifecycle and testing more real-world scenarios!

The ever-increasing complexity of cellular devices is driving the need to stress test phones using scenarios that actual users perform. As designs progress to smaller devices with more capabilities, developers are finding too many issues much too late in the development lifecycle. The earlier defects are found in the cellular device design lifecycle, the less expensive it is to produce that design, as the cost of defect resolution grows exponentially the further downstream that issues are discovered.

There are several barriers that engineers encounter when testing their designs before sending the device on to the next stage in the cellular device design lifecycle. Many times this can be due to the worry of not meeting the important release schedule and that there is just not enough time to do thorough testing of the device. Limited resources to develop extensive stress tests that might find more issues can also be a factor. And, until now, it has been difficult to perform real-world stress tests on devices without actually being in a real network.

Cellular R&D Lifecycle

Figure 1 shows a very basic cellular device design lifecycle which primarily consists of a product development stage that includes design and integration, a validation stage, and an external testing stage. Each one of these areas, more specifically, the integration stage of product development, the stress test area of the validation stage, and external testing have a need for running real-world tests on a device.

The integration stage is where all the device's hardware, protocol, application and operating system are incorporated. Traditionally, in this stage cursory tests are run to make sure all these components interact with each other to verify that internal requirements are met before sending the device on to the validation stage. Real-world tests run at this stage would catch many of the issues that arise due to interactions between all the components when attempting to perform an activity or service.

The stress test area of the validation group's main responsibility is to find issues and test against standards and internal requirements in order to pass an internal release cycle. Defects found at this stage are sent back to developers so there are usually a number of iterations that occur internally in the validation process.

Real-world tests run at this validation stage would allow test managers to catch the largest number of defects possible before the device is released and sent to external testing.

The stress test area of the validation process has an external component as well. The external test group runs field tests to see how the device operates over a wide range of configurations and usage models. This is the last stage before the design is submitted for acceptance tests, which are tests required by service providers that must be passed in order to allow a device to operate on their networks. Consequently, there are also a number of iterations that can occur

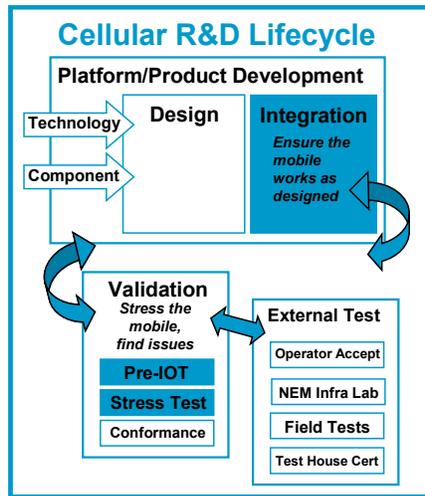


Figure 1: Cellular R&D lifecycle

between the validation and external stages to ensure the device is working properly. The number of cycles between validation and acceptance can be greatly reduced by running real-world tests before this external test stage.

Real-World Stress Testing

The IFT solution is automated test software used with the 8960 to provide a means of testing real-world applications in the lab. It is a complimentary method of testing to the typical physical layer RF testing and to RF, protocol, and

application conformance testing, but a completely new concept of traditional stress testing. The IFT solution enables real-world testing to stress test and find issues earlier by allowing you to test multiple, simultaneous activities (such as the ones listed below) on your device at the same time. That is, what happens when a user is performing an FTP download, receives an SMS message, and are moving away from the base station (cell power is decreasing) all at the same time?

Traditionally, the method of testing a device's capabilities would be to sequentially test each feature. IFT provides a very quick and easy method to test any combination of activities at the same time, allowing you to more thoroughly test a design to reduce the number of issues that might be found downstream.

Key Activities supported with IFT:

- SMS to/from DUT
- MMS to/from DUT
- UDP Upload and Download
- FTP Upload and Download
- WAP Push
- Ping
- Web Browsing
- Call Processing
- Battery Drain



Figure 2: Example results for an MMS message from the device under test

An important aspect of running real-world tests that the IFT solution provides is the ability to set up the activities to change over time. Figure 3 illustrates three activities (FTP, SMS, and cell power) that are changing over time. The FTP activity is downloading different files at irregular intervals, the SMS activity is also occurring at irregular intervals and the cell power is constantly fluctuating. It is unique interactions such as these that allow IFT to find the 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 be finding defects.

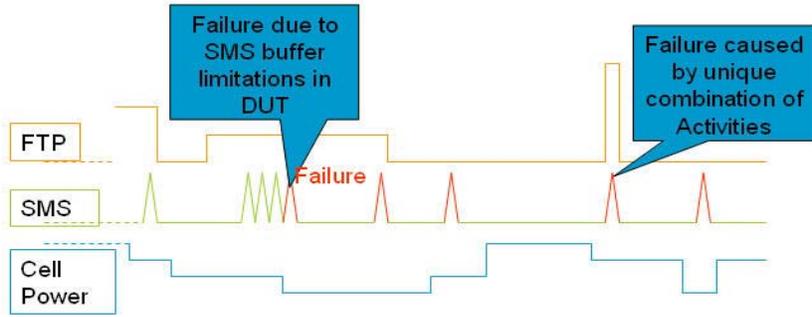


Figure 3: Interactions of multiple activities changing over time

IFT Solution for More Real-World Testing Earlier

Figure 4 is a diagram of the IFT system setup. The basic components that are required are a server PC to host the server applications that enable the various activities, a client PC that runs the IFT software, an Agilent 8960 with a lab application installed to emulate a base station, a router to create a LAN connection between the three, a GPIB connection between the 8960 and any other instruments, and a device under test.

In addition to the essential ability to run overlapping activities changing over time, finding the issues that arise from these interactions, the IFT software offers several modes of operation, described below, that further increases the ease of use and decreases the amount of time needed to set up and run tests.

Modes of Operation

Interactive mode of operation

The interactive user interface allows you to configure the properties of each activity (i.e. which file(s) 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. This is a very quick way to make as many changes as necessary and then run the tests that you have configured.

Script development

The IFT software provides a flexible and easy-to-use scripting tool. With this tool, scripts can be created in a matter of seconds by simply dragging and dropping the desired activity to the scripting tool. Anything that you do in the interactive mode can very quickly be dragged over to the scripting tool. This allows you to quickly automate the features your device is capable of performing. Each script that you create can also be used as individual test steps in a final stress test plan.

Stress test mode of operation

The stress test mode allows you to create final stress test plans from the scripts that you have developed. Scripts that you have created for your device can be added to your stress test plan in any order. This mode also allows you to configure properties of the stress test such as what to do if a failure occurs, if/when to send email notifications on the progress of the stress test, and how many times to run the stress test.

Additionally, the stress test mode has application programmable interface (API) commands to allow you to set up any of the stress test parameters remotely or via another software interface.

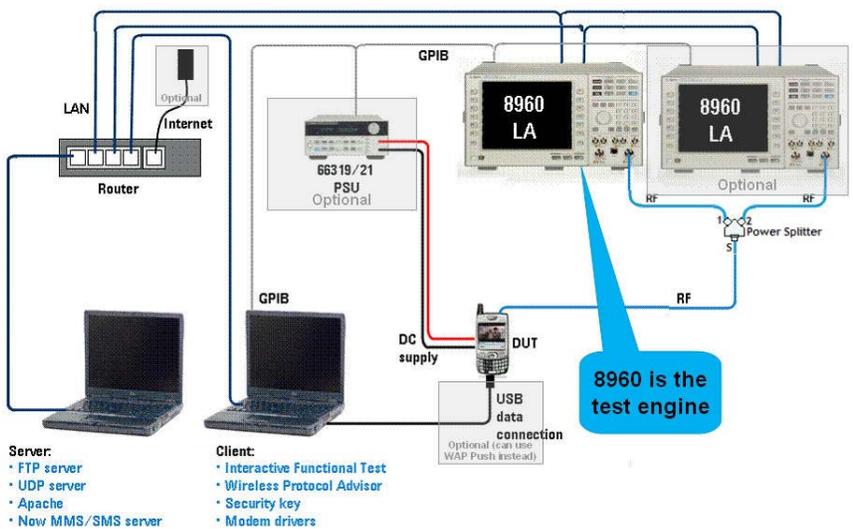


Figure 4: IFT solution setup diagram

Additional Time-Saving Features

Phone control

The IFT solution saves time by providing keypad automation for extended, operator-free testing. Several methods for this automated phone control are offered, including AT command control and robotic control.

IFT troubleshooting analysis tools

Result analysis tools included with IFT allow you to easily troubleshoot any issues that surface.

Tools incorporated into IFT include:

- an activity logger that logs if and when activities occur,
- the wireless protocol advisor that logs the protocol messages exchanged between the device and the 8960
- a data rate monitor to graphically display the data throughput rates (as shown in Figure 5), and
- battery current drain analysis to profile the current drain on the battery while various activities are run on the device. Depending on the depth of analysis needed, the IFT solution provides both a standard and advanced option for analyzing the battery current drain.

Summary

Finding and resolving issues early in the design cycle improves the efficiency of your release process. Issues that are fixed early in the lifecycle save time not only by eliminating costly validation cycles but also prevent the ripple affect of related defects that arise from a particular defect. Consequently, testing your device more thoroughly at early stages results in fewer resources needed to troubleshoot problems – so engineers can spend more time designing devices rather than fixing them.

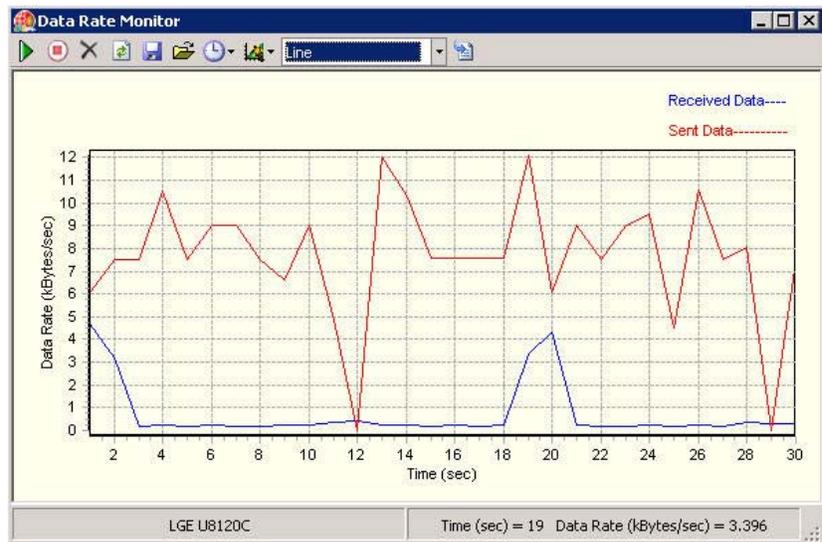


Figure 5: Example data rate monitor capture of an FTP download running at the same time as an FTP upload



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