

Mobile Radio Test System for Cellular Phones

by Mike Hynek, Project Leader,
Alliance Technologies Group, Inc.

The Challenge: Developing a flexible, easy-to-use, and expandable test system for evaluating the performance of global system mobile (GSM), code division multiplex access (CDMA), advanced mobile phone system (AMPS), and IS-136 cellular phones.

The Solution: Creating a LabVIEW-based software solution and a multiband radio frequency (RF)/microwave hardware platform that handles cellular call processing.

Introduction

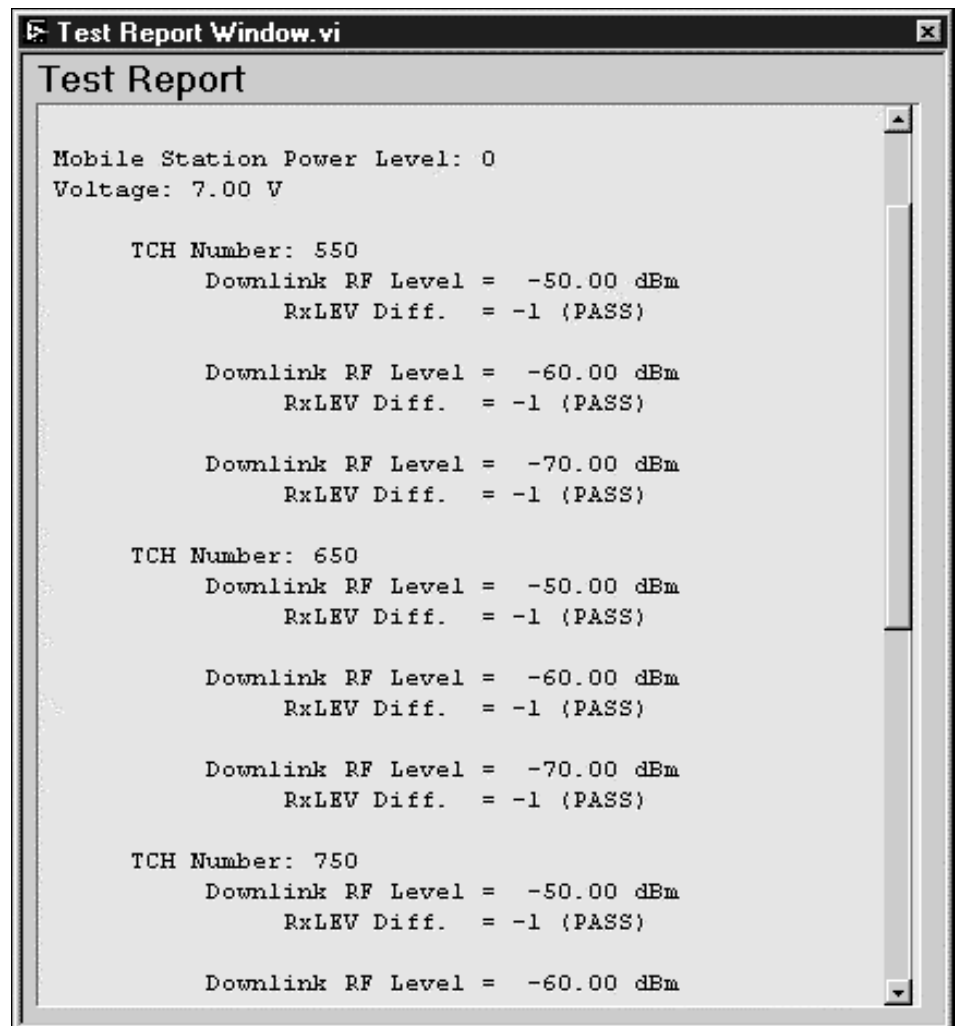
Most manufacturers of cellular phones perform end-of-line testing on 100 percent of the product. That is, every phone produced endures a suite of functional tests to ensure that the product is free of defects. The more extensive the tests, the higher the confidence of a properly functioning phone.

High-volume manufacturing such as in the cellular phone market mandates a short test time to increase production. As a result, a balance between test time and confidence of performance must be achieved. One solution is to perform very extensive performance testing on a sample population of the product. We developed the Mobile Radio Test System (MRTS) for this task.

The LabVIEW-based MRTS substantially increases the quality of the cellular products it tests.

System Features

The MRTS is a LabVIEW-based system that automates the detailed evaluation of the performance of portable cellular phones for several cellular communication formats and RF frequency bands. It verifies



The test system provides an intuitive user interface, test setup utilities, online calibration, alarm monitoring, and real-time response displays.

the conformance of the phones to appropriate air interface system specifications. It executes in-channel RF, out-of-channel RF, and baseband performance with easily configurable test conditions and pass/fail limits. For long-term quality control, test results are logged for future analysis. Thereby, the LabVIEW-based MRTS system substantially increases the quality of cellular products.

Extensive testing involves full characterization of the phone's transmitter, receiver, and logic circuitry. Some of the parameters that provide performance metrics include transmitter

output power, broadband RF output power spectrum, and receiver sensitivity. The ambient temperature of the electronic hardware may affect any of these parameters. Thus, the MRTS provides the capability of testing the units under test (UUTs) over a user-definable range of operating temperatures.

The key to testing several cellular formats in multiple frequency bands is the choice of instrumentation and appropriate RF signal routing. To minimize RF path losses throughout the system, we built a custom RF/microwave signal router to provide the appropriate

signal level to each of the instruments within the system. Because extensive testing of the phones is required, the test system incorporates a variety of instruments to generate multiple CW and modulated RF/microwave signals while measuring the spectral content (up to 13 GHz) of the signals transmitted by the UUT.

Controlled by LabVIEW, the system provides a flexible testing environment and increased reliability to the customer.

System Benefits

New cellular formats continue to develop as demand for wireless telecommunications capacity increases. The broadband RF system architecture of the MRTS provides for easy expansion to accommodate new standards because the architecture of the system software architecture is not dependent on any given set of existing cellular protocols.

Because the LabVIEW-based system software uses the high-level VISA architecture, it was easy to implement the communications with the various instruments within the MRTS. We designed the RF signal router to accommodate future testing needs. The control software must be equally flexible

– the NI-DAQ™ interface to the DIO-24 card used for controlling the RF signal router provides the system software designer with the flexibility to keep pace with hardware changes.

Because the suite of tests performed by the MRTS is extensive, test time can be significant. With the MRTS, users can view the results of tests that have completed while other tests are executing. This results in immediate feedback to the user so that action may be taken if an anomaly is noticed before the test sequence is completed. Implementation of a test report window that provides detailed information on a user-selected test was greatly facilitated by the graphical nature of LabVIEW.

Results

Controlled by LabVIEW, the system provides a flexible testing environment and increased reliability to the customer. These system attributes have saved the customer time and money through a reduced level of support needed for the systems, lower overall system maintenance, fewer test systems required, increased test reliability, and a simplified migration path for future upgrades.▼

For more information, contact Mike Hynek, Alliance Technologies Group, 1017 Butterfield Road, Vernon Hills, IL 60061, tel (847) 247-9284, fax (847) 247-9724, e-mail info@atgroupinc.com



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