LabVIEW and GPIB Automate RF Testing

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The Challenge: Refining the manufacturing test process of radio frequency (RF) communication systems by improving test repeatability, reducing test time, increasing measurement accuracy, and lowering the cost of troubleshooting.

The Solution: Building Mobile Automated Test Equipment (MATE) to fully automate all RF manual tests; implementing LabVIEW and GPIB to control both the test instruments and the communication system under test.

Introduction
Repeater Technologies of Sunnyvale, California, recently formed a staff of engineers to design wireless repeaters for both cellular and personal communication systems (PCS) markets. For the new products to win customer satisfaction, the repeaters must meet two important criteria - they must be defect free and meet customer expectations for delivery time. The task of providing a shipping product therefore relies on the manufacturing group and the testing process.

RF tests are traditionally performed with instruments such as network analyzers, spectrum analyzers, signal generators, power meters, noise figure meters, and results are manually recorded on a data sheet. However, the limitations of manual measurement, such as subjective interpretations by each test technician and lack of access to past test results over time, pose a risk when testing a new product.

System Description
In response to these concerns, Repeater Technologies built Mobile Automated Test Equipment (MATE). The setup is controlled using a PC and National Instruments AT-GPIB/TNT+ board to communicate with traditional RF test equipment. The switch module selects which instruments are used during a specific test; it also shifts between the forward and reverse direction of the repeater, which eliminates the need to manually switch RF cables when testing each direction. The front panel of the MATE also contains a serial port that is connected to the COM port of the PC and is used to control the repeater during the test. All repeaters are tested in an environmental chamber that has the capability of communicating via the GPIB bus, so that the MATE can control the temperature cycling of the chamber.

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We chose LabVIEW for programming the test because of its ease of use and superb representation of graphical objects. We developed each test by creating a generic VI program and defining its RF specifications. We cascade all test VIs under a top-level VI and they run when called. (This arrangement will change when we implement the National Instruments Test Executive to sequence the test VIs). With the National Instruments Application Builder, we turned the test program into an executable - users can easily run it independently of the development environment.

Results
The MATE application provided several benefits to our RF testing, including:

- **Repeatability**
- **Ease of design improvement because all data is stored electronically**
- **Lowered test and troubleshooting costs because of decreased test time and troubleshooting features within the test program**
- **Quality assurance**

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