

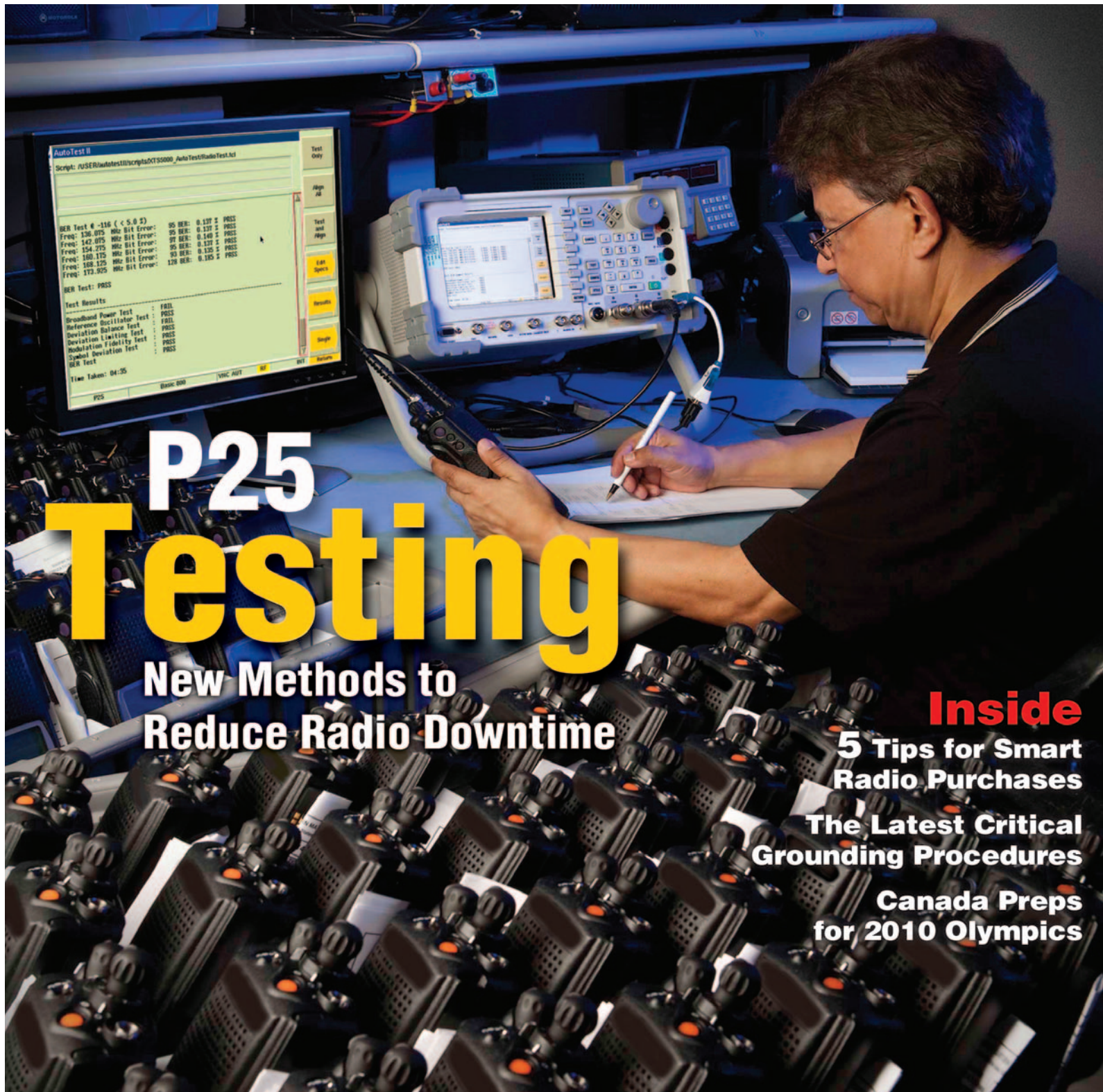
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C O M M U N I C A T I O N S



P25 Testing

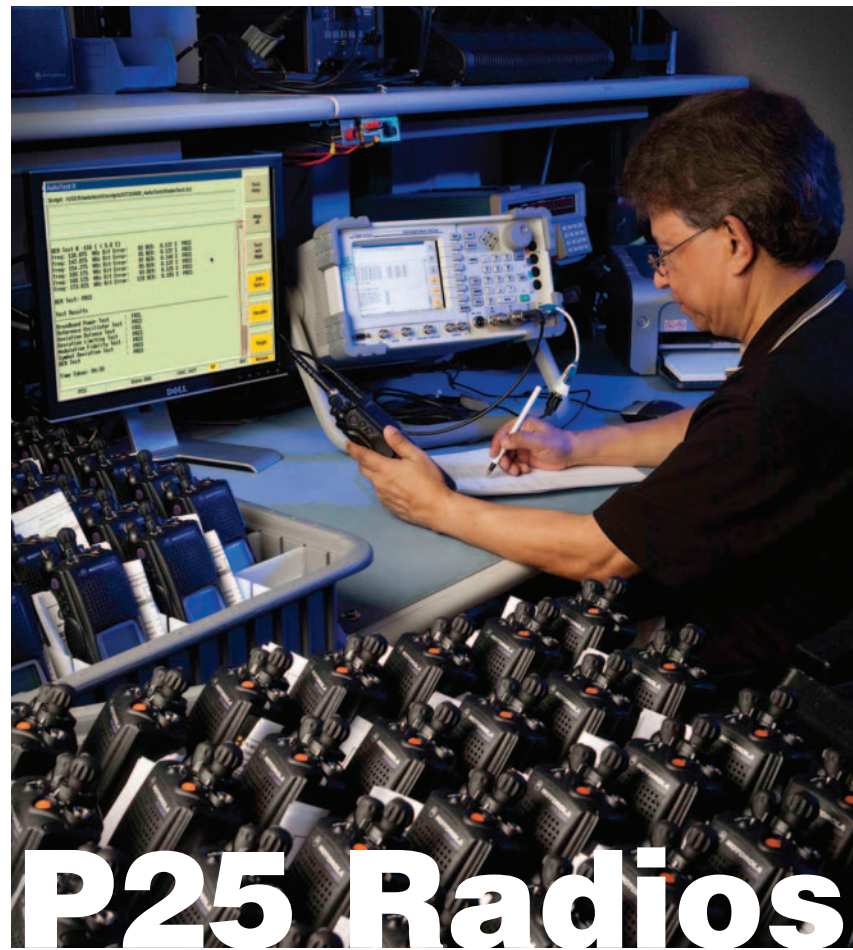
New Methods to
Reduce Radio Downtime

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P25 Radios Put to the Test

Photos courtesy Aeroflex

Using the latest methods for testing and aligning radios, the Motorola Federal Technical Center (FTC) supports federal agencies that use Project 25 (P25) digital radios.

By Rob Barden

With the deployment of new digital radio technologies such as Project 25 (P25), radio support operations are faced with new requirements for testing and validating radios. The critical nature of communications for federal law enforcement and others in the federal government requires that the radios are repaired and returned to service as quickly and efficiently as possible.

Using the latest methods for testing and aligning radios, the Motorola Federal Technical Center (FTC) in Lanham, Md., provides dedicated and continuous support for federal agencies. Equipped with state-of-the-

art processes and systems, the center provides rapid response for repair, maintenance and upgrade for federal radio operators, servicing 3,500 radios per month.

“With new P25 digital radios, our primary focus is to quickly verify the reported issue, perform preventative maintenance and upgrade radio firmware. We then perform an alignment of the radio to manufacturer specifications while also testing to the TIA/EIA-102 P25 technical standard,” says Jeff Hendricks, manager for FTC operations. “Radio trouble can include anything from a firmware upgrade to a radio that has been run over by a truck. The first step is to triage the

radio and then deal with the issue in the most appropriate manner.”

Troubleshooting Steps

The center’s combination of non-technical personnel, computer systems and test instrumentation sort and speed the initial determination of what needs to be fixed in a radio. The incoming process is critical to efficiently process the radio equipment received, during which the radios are logged into the service facility, inspected and sorted into groups. The sorting process is the most efficient use of personnel and speeds response time through the center. Some radios require firmware updates and preventive maintenance, while others require repair.

The next step is triage of the radio, where it’s sorted by contract and repair issue. If the radio needs simple cosmetic repair, it’s cleaned, and knobs and labels are replaced as needed by a technician assistant. A combination of the reported problem and physical inspection allows a technician assistant to sort radios for further testing and analysis. Once sorted, the radio is routed for further diagnostics and analysis by experienced technicians.

Junior technicians perform software upgrades; because many radios are software defined, new features and functions can be added via software upgrades. Radios identified as needing electronic repair are diagnosed by test equipment designed specifically for P25 analysis. Technicians look at a variety of performance indicators to determine whether the radio meets rigid OEM specifications and conforms to the P25 standard. This takes about 75 – 80 percent of a technician’s time and is critical to the radio’s overall operational performance.

While efficiency is important, performance is the primary objective for the FTC. The P25 digital radio standard includes a number of parameters to verify the digital performance of a radio’s RF transmission and receiver characteristics, including modulation fidelity, frequency error and power, and bit error rate (BER) to determine a



New systems automatically determine problems in a radio.

radio’s digital sensitivity.

The P25 radio transmits and receives digital data using a type of modulation called C4FM. This modulation imparts the 1s and 0s by using four distinct frequency states. For proper analysis of these signals, the FTC uses test instruments that can analyze four critical parameters of the C4FM modulation:

1. Symbol Clock Error. This is the primary reference to ensure that the digital data is encoded and decoded correctly. Errors in the symbol clock can cause digital jitter.
2. Symbol Frequency Error. Each of four frequency states has to occur at precise deviations at the symbol clock time. These frequency states occur at -1.8 GHz, -600 Hz, +600 Hz and +1.8 GHz in reference to the carrier.
3. RF Frequency Error. Because of the nature of P25 signals, conventional frequency counters can’t accurately measure RF error. Specific instruments are needed to verify proper operation in P25 mode.
4. Modulation Fidelity. This measurement shows how closely the overall modulation is performing.

Once reprogramming and repair are completed, the radio undergoes a final test and alignment and an over-the-air

test. Radios must be aligned to specification before being returned to the customer. This manual test previously took a technician several minutes.

“In today’s environment, finding qualified RF service technicians that meet our stringent requirement is difficult at best,” Hendricks says. “We hire the best techs in the industry, but we are also using new techniques and equipment to ensure these new digital radios perform to their absolute best. Instead of relying on older equipment that was used for analog technologies, we use test systems designed specifically to test the radio’s P25 parameters to verify the radio’s performance during initial testing.”

Hendricks is evaluating next-generation test systems to automatically determine problems in the radio. New test systems on the market can perform diagnostic analysis on a variety of performance parameters, isolating problem areas and allowing technicians more time for repairing radios.

“We are working with the Aeroflex 3920 for test and alignment using the onboard autotest program. Now the alignment of the radio can be accomplished by a junior tech or even a tech assist, allowing the technicians to process more repair per shift,” Hendricks says. “Because the 3920 replaces the computer and can directly control the radio and perform complete test and alignment in just a few minutes, we are looking at moving these units into earlier stages of our testing process. Using specific tests, we can automatically isolate different failure modes, such as power amplifier versus reference oscillator issues, where the repair entails different procedures.”

Cost savings is a major part of any radio service operation. Service organ-

4 Critical C4FM Modulation Parameters

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izations would rather have technical resources work on high-value testing and repair than routine radio testing. A streamlined process coupled with new test systems allow users to test and align P25 digital radios accurately without a technician or engineer.

Once serviced, the newly optimized radios are back in service with a variety of federal agencies that rely on secure communications. Border and other federal agents use these radios for security and operations coordination, as well as daily communications. These users count on reliable radios to protect themselves and the public. ■

Rob Barden, director of product marketing for Aeroflex, has 25 years of experience in the electronic test and measurement field. E-mail comments to editor@RRMediaGroup.com.

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