Application Note

AEROFLEX
A passion for performance.

The Aeroflex 3500

A Dynamic and New Instrument to Quickly Isolate Problems in Radio Installations.

The Aeroflex 3500 combines many features of a bench top radio test set into a lightweight, rugged and portable platform

Before we start to think about testing radios, and the Aeroflex 3500, we need to know where a new hand-held test set fits in the world of radio test sets. Aeroflex and other manufacturers manufacture a wide range of radio test sets as well as hand-held test devices to perform verification of radio performance and to isolate problems in radio systems. To understand the position of the Aeroflex 3500 in the radio test market we must first determine what a radio is.

In its most simple form, a radio is anything that transmits and receives RF signals. Even a cell phone is a radio just like the Amateur Radio Police Radio, Fire Radio, Military and Remote Sensor Radios. They all have one common attribute- they transmit and/or receive data or voice information via an RF link.

In addition to the radio itself, one must consider other aspects of the radio system- particularly the cable and antenna used in propagating the RF signal. Problems in cabling and antennas often act like radio problems, causing problems for RF technicians and engineers in isolating trouble spots. Figure 1.0 shows a typical radio system.

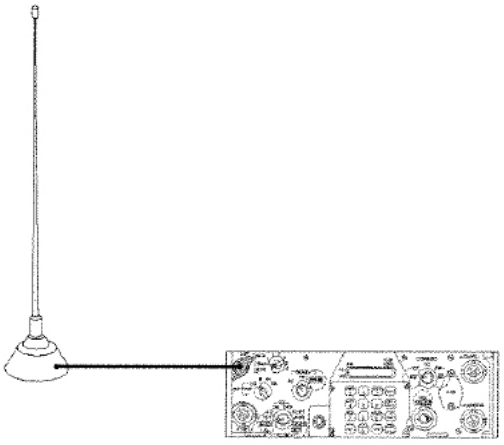

Figure 1.0 A radio transceiver with cable and antenna network

Manufacturers of radios tailor their products for different market segments. In a similar sense, Aeroflex engineers have designed radio test sets also tailored for various market segments. Whether transmitting or receiving digitally modulated data, FM signals or AM signals, virtually all radio test sets have similar attributes, varying in degree on the type of modulation and radio system being tested.

As an example, the Aeroflex 2945 Series of Radio Test Sets (RTS) are tailored for the analog radio test market. By analog, we mean AM or FM modulation. This was the standard modulation we all became familiar with when testing conventional two-way fire and police radios and older cellular technology (i.e AMPS and TACS cellular system). Combined with a spectrum analyzer and tracking generator, the 2945B Series provides extended testing of cable and antenna systems.

The 2945B Series analog radio test set

After many years of testing analog radios, it became necessary to change some test methods to handle new data and voice transmission devices that were transitioning from pure AM and FM modulation to complex digitally modulated waveforms. With this new technology came revisions and additions to RTS products to be able to test these new waveforms. An example of a 2975 for testing P25 technology using C4FM and other digitally modulated signals. The 2975 was also designed to support legacy analog test requirements for AM and FM radios. While supporting both analog and P25 digital technology this product was designed only to handle a specific aspect of the radio test market, particularly targeted to the AM/FM and P25 market. It, too, has the ability of testing cable and antenna systems with a built in spectrum analyzer and tracking generator.

The 2975 P25 and analog radio test set

With advances in digital radio technology, Aeroflex looked to newer means of testing complex digital radio tchnology, such as trunked radio systems and data specific technologies using a wide range of digital radio techniques. Out of this development effort came the 3900 Series. The 3900 Series is a new test platform for the future. Relying on software defined radio technology, the 3900 Series is truly a re-programmable radio test set, supporting both AM and FM modulation as well new digital technologies found in TETRA, P25, HPD, and other digital radio formats. Advanced spectrum analysis and tracking generator provides additional tests for isolating cable and antenna problems as well.

The Aeroflex 3900 Series software defined digital radio test set

Testing newer digital technology, however, takes a certain amount of processing power, especially when dealing with trunked radio systems and data specific technologies using a wide range of digital radio techniques. Out of this development effort came the 3900 Series. The 3900 Series is a new test platform for the future. Relying on software defined radio technology, the 3900 Series is truly a re-programmable radio test set, supporting both AM and FM modulation as well as new digital technologies found in TETRA, P25, HPD, and other digital radio formats. Advanced spectrum analysis and tracking generator provides additional tests for isolating cable and antenna problems as well.

Most radio sets on the market today reflect the fact that advanced test functions require a rather bigger and heavier test set compared to the 3500 and are designed to be used in either a bench-top or advanced field service application for isolating problems in radio systems. Most have limited battery life and/or run off AC power.

One thing that does remain constant, however, in radio systems, is the cable, filter and antenna transmit and receive network. They are designed to transfer thr RF energy from thr radio out to the atmosphere for reception by another radio, as well as receive signals off the air. Whether it is AM, FM of digitally modulated signals, this system performs the same purpose.

With this understanding of radio and radio test systems, we can now evaluate the Aeroflex 3500. The 3500 is a 8.5 pound RTS, with integral 4 hour battery, that is designed for use in adverse conditions where a rugged test set can perform transmitter tests, receiver tests and isolate problems in the rest of the system.

Portable, battery powered and capable of working with radios that have frequency ranges up to 1 GHz, the Aeroflex 3500 excels in testing radio systems used in a car, standing in front of a tank, sitting in a jeep, or sitting in a chair testing a radio in an airframe. The 3500 is to test radios at the "platform" level. This simply means wherever the platform happens to be, the 3500 is designed to take high power test capablility to that platform.

On a remote mountain site, in a service garage, out in the sand or rain, the environmental characteristics for the 3500 were designed to be able to stand the most stringent requirements for use whether in the desert or in Alaska, rain or shine, sunlight or dark. While very powerful, the 3500 is not designed to replace the test system for high accuracy AM/FM and advanced digital systems or for high volume radio test. Simply put, it is the wrong unit for some applications. There are other Aeroflex products that will provide the customer with a much more cost effective solution. However, it is the absolute right solution for portable, rugged, full featured testing of radio transmitter, receiver and cable/antenna systems.

Why do we need a product that will test radios while they are still mounted in the platform? Based on feedback from the police, fire and military operations, most technicians remove the radios from the platform if they are suspect of not working correctly. The typical radio system contains a Radio, Power Amplifier, interconnect cables, mount, antenna and cables connecting the antenna to the power amplifier. When the radios and power amplifiers tested are proven to have No Fault Found (NFF) or Can Not Duplicate (CND). Radios and Power Amplifiers are very expensive and having high percentage NFF and CND causes a significant amount of vehicle down time, wasted productivity in the transportation, test, installation and debug of the radio when the system fault is connector, antenna or cable.

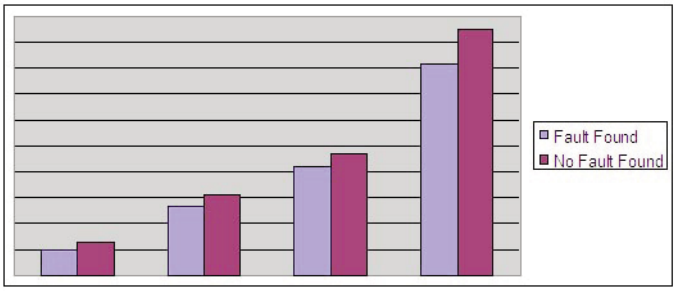

Figure 2.0 Over 50% of radios pulled are no fault found

The 3500 is a radio test set. Therefore, it can perform a series of fast, go/no go tests both over the air and direct connect to determine if the entire radio system is functioning properly. Typical operation starts with putting the suspect radio system into a single channel or test mode. The 3500 can then test the radio system over the air.

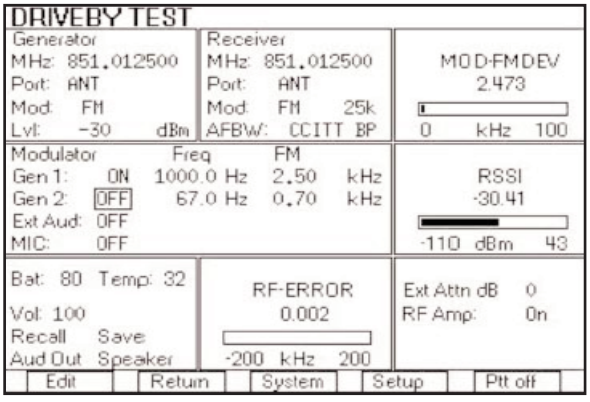

Figure 3.0 The 3500 over the air test screen

If for some reason the radio system is not functioning properly because of the frequency error, low power, receiver sensitivity or other parameters, the 3500 can then be used to go inside the platform and perform more extended tests.

The 3500 can be directly connected to the cable and antenna system. A built in VSWR and Distance To Fault (DTF) measurement can be made on the cable and antenna. If faults are found then the cable and antenna chain can be further tested, the problem isolated and then repaired. If no faults are found in the cable and antenna chain, then a direct connection of the 3500 to the output of the power amplifier or radio can isolate problems to the amplifier or radio

itself. A 20 dB attenuator pad may be installed for testing transmitters over 20 watts.

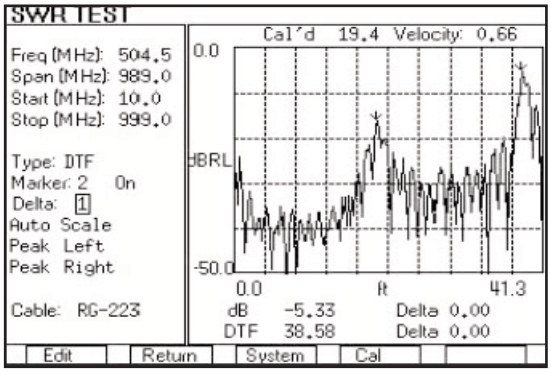

Figure 4.0 The 3500 distance to fault and VSWR test screens

If we find that the radio system failed an over-the-air test, but passed the cable and antenna system test, we can now move to testing to the radio, power amplifier and/or the interconnect cable. Simply disconnect the cable from the radio and then directly connect it to the 3500. Using radio test functions similar to a larger bench top test set, the 3500 can quickly isolate transmitter and receiver issues quickly and accurately- while the radio is still in the vehicle. If the radio fails then it can be removed and a new radio installed and then verified by running the test again. Or, it can be further tested to isolate a problem where replacement of the radio is not practical. After verification that the new/repaired radio works then reinstall the cable to the power amplifier or radio, move outside the platform and retest (over the air) the complete system.

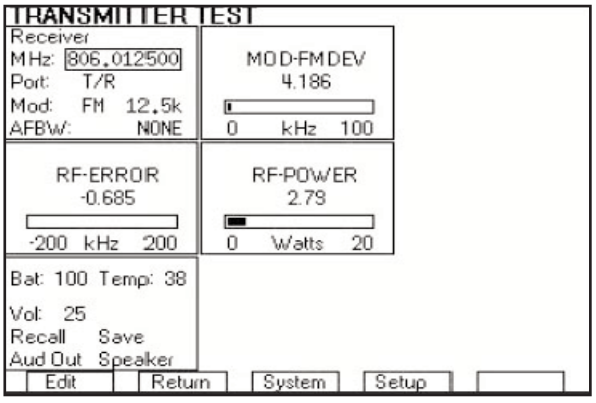

Figure 5.0 The 3500 transmitter test screen

While the 3500 is not a digital radio test set, it provides very quick and accurate of the entire radio system in a complete, portable package. In many cases, however, digital radio systems have analog test modes that can be used quickly to isolate problems.

For more information on the 3500 or to arrange a demonstration of the unit, contact your local Aeroflex sales office. Go to www.aeroflex.com for more information on the 3500 and your nearest Aeroflex sales office.

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A passion for performance.

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Our passion for performance is defined by three attributes represented by these three icons: solution-minded, performance-driven and customer-focused.

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