

## Fingerprinting Transmitters: MoTron's TxID-1

**T**his month we look at a computer and radio product that is quite interesting, but at \$800 is out of the price range of most casual radio listeners. The product, TxID-1, by Motron Electronics, claims to be able to identify different transmitters using the discriminator output of a radio, specialized hardware, and an IBM compatible running a DOS signal analysis program.

How does it "fingerprint" a signal? What is required for installation? Does it really work? These are a few of the questions we will answer; stick with us if you're curious.

### ◆ How does it "fingerprint"?

The principal of TxID's operation is based around the very careful "listening" to the first few hundred milliseconds (i.e., millionth of a second) when a transmitter is turned on. During this early turn-on period the signal does not just go from totally off to totally on. Rather, it is trying to reach a stable "on" state.

This initial turn-on waveform's shape and amplitude depend on a number of factors, including method of frequency generation. For example, if a phase lock loop oscillator circuit is used to generate the transmitter's signal, it has a unique "lock" time and lock-up signal. Without getting too technical, these are a function of a number of factors including the phase lock loop chip that is used, the idealized values of the loop components and their interactions, and the actual component values taking into account manu-

facturing tolerances.

Adding to the individuality of a transmitter are all the circuits and their components within the signal path to the antenna, subsequent to the frequency generating circuit. By the way, although in this case we have just considered a phase lock loop generator, the theory is just as valid for any circuit, be it crystal or a simple resistor/capacitor/inductor oscillator.

You can imagine that it is a bit of a trick to capture, digitize, filter, store, and compare the time and amplitude details of this initial signal. Motron has chosen a hardware approach using a CPU, RAM, EPROM, I/O control logic/ports and A/D and D/A converters. In short, it is a small, self-contained computer system.

The TxID-1 can also be used to control certain ICOM and AOR receivers, decode DTMF, CTCSS and DCS signals and control an audio tape recorder. However, these features were not tested since we were on the trail of a fingerprint!

### ◆ What is installation like?

TxID-1 consists of a PC Card, which installs in a PC, and an Interface Adapter, which connects to the PC Card via a connector. See Figure 1. The version of TxID-1 we received was the TxPorter, specifically made for use on laptop computers. This version comes with the PC Card installed in a metal box which is then connected to the laptop via the parallel (printer) port. In addition, 12 volts DC is re-

quired to power the card.

The Interface Box again connects to the PC Card, completing the TxPorter mobile/laptop configuration. See Figure 2.

### ◆ And now, the rest of the story

That's not quite the complete installation procedure. First, the radio that you will use must have a dc connection, via a 15K resistor, to the discriminator output. Since many factory-provided discriminator outputs are via capacitors for isolation, these require modification for use with the TxID-1. Since I was using my Yaesu FRG-9600 workhorse, I had to run a shielded cable from pin 9 of the discriminator chip (MC3357) to a little-used rear panel connector.

A connection to the receiver's AGC (automatic gain control) line is suggested by Motron, but is not essential. Being a minimalist, I chose to forgo the AGC connection hassles.

### ◆ OPAMP.exe – hope you can solder!

The software for TxID-1 comes on a floppy and includes a program called OPAMP.EXE which is critical for installation and setup. Remember the PC card? Well, on the PC Card is a 14-pin header, which MUST be configured via soldering resistors and jumpers. Those of you who cannot solder well can go to the last paragraph of the column! Careful, neat soldering is a must.

The input amplifier on the PC Card requires gain setting depending on the voltage swing of your receiver discriminator circuit. That's right: Hope you are also handy with a voltmeter. You're going to need the skill to measure the discriminator voltage when a signal is 8 kHz above the center frequency, and 8 kHz below the center frequency. For my receiver the swing was from 1.00 to 4.4 volts.

Armed with this data, running OPAMP.exe (in DOS) gives values of two required gain-setting resistors and the associated header pins for solder. Either a well-stocked resistor box or a nearby Radio Shack is required. Depending on which direction the voltage swings with increasing frequency, the soldering of a jumper between pins 7 and 8 may be required, as was the case for the FRG-9600.

Finally, the discriminator output is con-

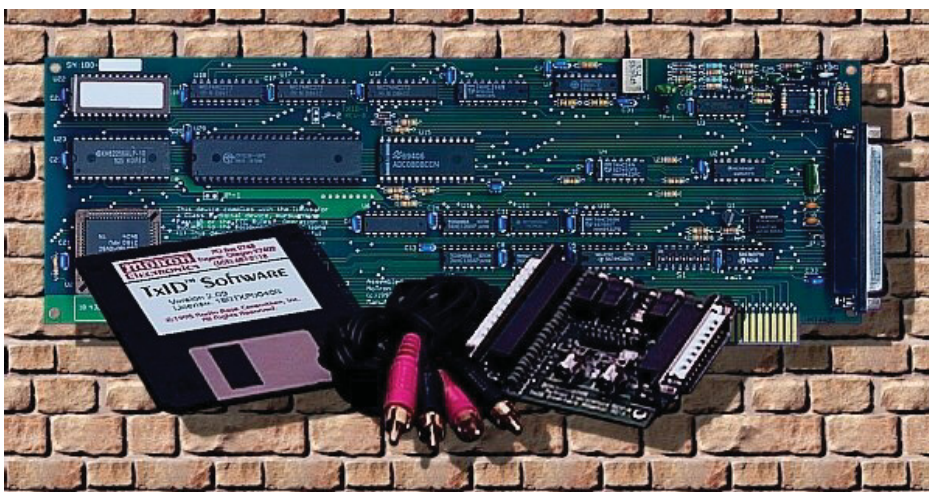


Figure 1 – MoTron's TxID-1 Hardware



Figure 2 – The TxPorter For Mobile Use With Laptop Computers

nected to the interface adapter using shielded cable.

### ◆ Are we there yet?

Almost. Since the TxID-1 control software, version 2.95, is DOS based, the basic software installation is as easy as copying the floppy to the hard drive. However, for customization, dig out your old DOS book, since modifications of BAT files via a text program is required. Although once very proficient with these methods, years of using Windows have left me DOS brain dead!

So I took the easy way out and used the generalized TxPorter.bat file to start the system. I ran the program on a Pentium II 350 MHz laptop under Windows 98 and had no problem with the TxID-1 DOS program.

There was a bit more calibration procedure that needed to be performed, but finally we were ready to “dust some ‘prints.”

### ◆ Leaving prints

I used three different FRS walkie-talkies for the test. Audiovox made two and the third was a Ranger (a WalMart special). All were tuned to channel 11 in the 460 MHz band. The FRG-9600 was connected to a back-of-set whip antenna and placed approximately five feet from the FRS units.

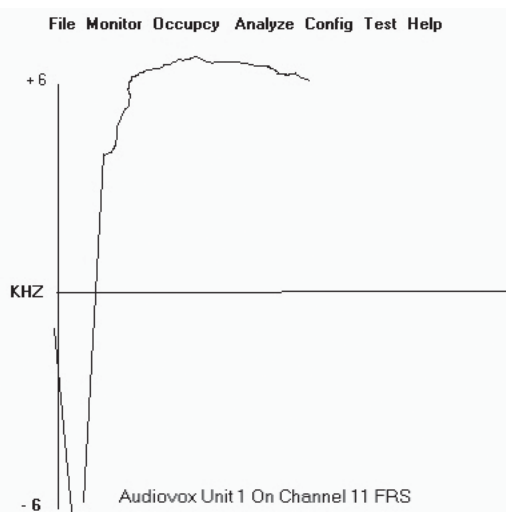


Figure 3 – Typical Transmitter “Fingerprint”

### ◆ Seeing is believing

Running the TxPorter.bat program displays a very simple DOS-type menu screen across the top. All the user needs to do is to key a transmitter and the program goes into action. The left side of the screen automatically displays a trace of the transmitter’s turn-on signal on the left of the screen. Using the menus, the trace can be captured, annotated, and then stored in a database. I did this for each FRS unit three times so that variations, such as transmit switch contact bounce, could be taken into account. Then I went to the compare screen and fired-up unit three, the Ranger.

Immediately, on the right side of the screen the new transmission was displayed as an overlay of the trace from the database which it most closely matched. TxID correctly identified it as the Ranger, unit three!

Even when this test was repeated with the two identical Audiovox units, TxID was able to pick out Audiovox unit 1 from Audiovox unit 2 eight out of ten tries! Based on such a small database sampling of only six traces (two for each unit) the results were excellent. A greater number of sample traces for each unit, which the program is capable of, would probably have resulted in close to a 100% match rate.

Interestingly, in many cases, the subtle difference in traces were not visually apparent; but TxID found them just fine.

### ◆ What, no screen shots?!

So let’s see the results, John. Although I tried for a few hours, I cannot show you the actual results, since my screen capture programs would not work while the TxID DOS program was running!! Sorry about that. Figure 3 is a drawing of a typical “fingerprint.” During the compare routine a second plot appears to the right. The real-time captured print, from the left, is overlaid with the closest match in the database.

### ◆ Fingerprinting is for real

This is my first experience with the Motron TxID and it has made me a believer. Due to its price (\$800 for the basic unit and \$300 additional for the TxPorter interface) plus the electronic measurement requirements, calibration procedures and soldering expertise, TxID is really aimed at a hard-core technical few and government agencies. Motron suggests one use is to provide positive identification of abusers on a repeater system.

For those of you who have wondered about the technology, now you know how transmitter fingerprinting works. For more information, check out Motron’s site and other products at <http://www.motron.com> or write P.O. Box 2748, Eugene, OR 97402-0280; 1-541-687-2118. Grove Enterprises also has the Motron TxID for \$799.95; check it out at <http://www.grove-ent.com/dec3.html> or call 1-800-438-8155.

### ◆ In closing

For those of you who are medium wave insomniacs you may recognize the shortwave program link sent to me by Elaine from Windham, Maine. The link is <http://www.artbell.com/shortwave.html>. Check it out for frequencies, shortwave on the web and other related links. Till next time ... get some sleep.

## Antenna Designer

New Version 2.1 for Microsoft Windows 95 and 98

Computer program helps you design and build 17 different antennas from common materials. Based on Antenna Handbook by W. Clem Small.

**Only \$39.95**

\$5 S/H on all orders  
CA residents add 8.5%  
Shipped on CD ROM

Send check or money order to:

Small Planet Systems  
623 Mangels Avenue  
San Francisco, CA 94127

[www.smallplanet-systems.com](http://www.smallplanet-systems.com) 415-337-9394

## ANTENNA OPERATION

explained like never before!

Gain an understanding of why your antenna radiates and receives. “THE SCIENCE OF ANTENNAS”, an enlightening book by MAX RESEARCH explains the “whys” of antennas. Easy to understand, this book is written in a clear manner so that radio hobbyists and experimenters can appreciate the lofty ideas of electromagnetic and antenna theory.

Learn why radiowaves leave an antenna and why they propagate...and why they affect a receiving antenna... and much more!

\$14.95...ppd. Orders or inquiries to  
MAX RESEARCH

PO. Box 1306, East Northport, NY 11731

MAX RESEARCH

**RadioCom**® DSP-filter analyzer, CAT with decoder of RTTY, Synop, CW PSK31, FAX and SSTV. CAT for more than 80 receivers and transceivers.

**BuTel-ARC**® Control software for ICOM (R2, R3, R10) and AOR (AR8000, AR8200, AR8600, AR5000)

**Wavecom**® Professional real time data decoder/ analyzer/ processor of radio communication transmissions, Audio-IN, variable IF-interfaces, all major HF, VHF, UHF, SFH and SAT modes/ codes.

**ARMAP** and **HAM-Label**

Logbook and QSL design.

**PCCardBox**® = ISA or PCI card BUS to PCMCIA. Use your ISA or PCI-card with your laptop. Works with Wavecom decoders and other internal radios.

**COMPUTER INTERNATIONAL**

St. Johns, MI 48879-1903

Tel/Fax: 1 877 977 6918

info@computer-int.com

**www.computer-int.com**

All major credit cards accepted