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BEGINNER TSCM EQUIPMENT ADVICE BY STEVE U SWS SECURITY

<http://www.swssec.com/used.html>

Hello all,

Following is a sanitized excerpt from a message exchanged with a gentleman starting in the field.

Since it might be general interest, I am copying some here.

No sales pitch intended; frankly I couldn't care less if anyone here buys anything from me or not, especially my precious extremely limited supply of unblocked receivers.

My initial advice to the gentleman was not to spend any money on anything, merely do a lot of homework and research and learn for free before dropping a penny into hardware. This is my universal advice to newcomers. All the used equipment I have originally was purchased new by someone, then sold to me usually at a large loss for many reasons. Much of the stuff comes from new enthusiasts who get carried away, from their widows or former spouses, or former employers who have a bunch of crap some idiot in security bought from a spy shop then left to get a job more suited to his abilities, like flipping burgers.

If you do want to make an invest-

ment, first put the money into something that goes between your ears, like training, basic electricity and electronics courses, or textbooks like the one described below if schooling is not practical or you aren't serious enough to make the commitment.

You can always get your money back out of a used receiver if you lose interest. This is not true of most sweep equipment bought new or used. Sweep equipment is much like new cars in a way. The instant you unpack it you have cut its value by a third, permanently. If it lays around and gets dust and fingerprints on it, there goes another third.

Then your ex sells it to me for 10% of what you paid for it, and I clean it up, replace the batteries, calibrate it and resell it for twice that, and someone gets a great deal because you spent money you shouldn't. You lose and everyone else wins.

Don't buy hardware until you know what you will do with it and can justify it. Unless you are a professional, and if you are you don't need my advice, dream about the equipment if you want to, but don't buy it.

Very, very few persons will ever earn enough sweeping to pay for their equipment. BUYING EQUIPMENT IS AN EXPENSE, NOT AN INVESTMENT, FOR MOST PEOPLE, AND THAT PROBABLY INCLUDES YOU. Don't fool yourself.

I hope everyone had a good holiday season, and is getting ready to bring in the Spring season by starting a new project, or learning a new skill. **Knowledge is power.** At Cybertech's R&D center, we are working on a few things, and you can expect to see some good articles on various technological-survival topics as a result.

If you haven't done so already, you should check out our web site at <http://www.ticom-tech.com/>. Over the next few months, we'll be expanding it with more information and features. If you want the latest Cybertech news and information, it'll appear first on our web site. We also maintain a mailing list on Yahoo Groups for Cybertech subscribers and supporters.

Work on the Cybertech technological survival DIY book is also progressing. We haven't decided on a name yet, but at this time we expect it to be out by Fall, 2002.

- Ticom <ticom@ticom-tech.com>

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Yes, I'm shouting.

When a guy who sells equipment tells you not to buy it, maybe he's actually telling you the truth.

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Once upon a midnight dreary,
a@b.c pondered, weak and weary:

I have an XXX back-ground and a pretty good set of ears and was just wondering if it was still a bad idea to maybe tinker around with an RF transmitter sweeper to get my ears used to combing through the key frequencies you specified in your articles; and if you do have a good, reliable used unit, i wouldn't mind having a new toy to play with!

The best universal tool for you, in my opinion, would be a decent general coverage shortwave/VHF/UHF receiver.

You can manually tune the spectrum and every practical bug frequency up to 2 gigs. This does not include the high threat 2.4 gig video stuff, but there are cheap ways to sniff them with separate equipment. You will read about them if you go through all the archives for this list, as I recommended.

You very likely would have a lot of fun doing some shortwave listening as well as learning in the process. And if you have kids, it's something you can do together and actually will drag many kids away from the web or the teevee. Have you ever spent an evening listening to Radio Moscow, or Radio Nederlands, or HCJB (Heralding Christ Jesus' Blessings, as they have been saying for at least 35 years) in Quito, Ecuador or Radio Havana? Fascinating. They still play music from

the 40s and 50s, and you can still find Green Hornet and Fibber McGee and Mollie shows. And a very different view of international news, especially during a crisis.

Manual tuning was the way it all was done until maybe 25 years ago when stuff like the Scanlock was introduced. Most of the government guys trained on and swear by Mason A2 or A3 receivers which were \$30K to the government 30 years ago, and today a modern \$2000 receiver is much better.

An ICOM R8500 would be a good choice. I have them full coverage (meaning they will receive U.S. cellular telephone frequencies; illegal to sell for about the last 15 years) for \$1850, or 'blocked' meaning cannot receive cell freqs, for \$1250, used in perfect condition. Read more about frequency coverage elsewhere before buying. Scanner newsgroups like rec.radio.scanner is worth the noise level from the education you will pick up.

Full coverage is important for sweeping. Listening to cellular calls is interesting for perhaps 30 seconds, then boring to most. Probably illegal to listen. Not illegal to sell the equipment secondhand or to possess it.

You can get by with real simple antennas, perhaps even make a simple 'coat hanger groundplane' as a learning experience out of a connector and some coat hangers which will work perfectly fine for casual listening and cost under \$5. Or you can buy a discone antenna which would work well and is what many/most of us use. I think I get \$125 for them. They ship in a reusable cardboard tube where you can disassemble and transport the thing. You would need some feedline which would be something you could assemble yourself also as a learning experience. I would talk

you through it.

If you buy anything from me, remind me to throw in a toy you can take apart to see how transmitters are built, or fire up to see how it works.

It will not transmit audio so it is not a bug and not illegal. It is a telemetry (data) transmitter which reads various weather conditions and transmits them down from a balloon. Good to use to teach kids about too. More description of them on my used equipment page <http://www.swssec.com/used.html>.

I would recommend any issue in the last 10 years of 'The Radio Amateur's Handbook' published by the American Radio Relay League aka ARRL. www.arrl.org. This is a universal handbook covering everything about communications theory from the very beginning to the most modern. Virtually everyone has one around for reference, formulas, charts, etc. Since theory doesn't change, yet they publish the thing annually, it doesn't much matter which issue you get. I think my newest one is a 1972 and I have one which belonged to my dad from 1942 which was before I was born.

The later editions have more about microwave and satellites and modern stuff, and older ones have more about stuff like teletype, vacuum tubes and earlier theory. Ideally you would want an older and a newer one, but for now anything you can find will be adequate. Check ebay for older ones. Don't pay collector's prices, though. You don't want an antique, you want a beat up reference book with coffee stains on it, for a decent price (like \$20-\$25 max). A new one from ARRL is \$35 softcover for a 2002, and \$32 for 2001 if they have any left. Either would be fine. You want the hard copy edition, NOT the CD. Nothing beats being able to carry the book to your bench, or photocopy a chart, or read it sitting on the potty.

BUILD A TURNKEY APRS TRACKER FOR ABOUT \$350 BY RICH, KA7IEN

For reference, pictures are at the end of this article.

1. Buy the equipment

Item	Make/model	\$\$\$	Source
GPS	Garmin GPS35-HVS	148	www.starlite-intl.com (Star Lite Intl) or www.gpsciv.com (GPS City)
TNC	Byonics Tiny-Trak II	35	www.byonics.com (Byonics)
Radio	Yaesu FT-1500M	145	www.aaradio.com (Austin Amateur Radio Supply) or www.randl.com (R&L Electronics)
Cable	Yaesu CT-39A	14	www.hammall.com (Radio Depot) or www.randl.com (R&L Electronics)
Box	(3x2x1") 270-1801	2	Radio Shack
Plug	(9-pin male) 276-1537	2	Radio Shack
Plug	(9-pin female)	2	Radio Shack
Cable	270-026	3	Radio Shack (you will need two of these)
Hood	276-1513	2	Radio Shack
Cap	.01uf capacitor		
Choke	Ferrite bead/clip-on		



2. Build the Tiny-Trak II. Do not install resistor R9.

On the bottom of the PC board add a .01uf capacitor between the base and emitter of Q1. This will decouple RF to ground preventing a potential transmitter lockup condition.

3. Download the Tiny-Trak config program, power up the Tiny-Trak unit (if 12 volts isn't handy by your PC a 9-volt battery will do) and connect the Tiny-Trak II to the serial port of your PC.

Configure as follows:

Callsign: WD7ABC-2 (your callsign & SSID, typically -2 or -3 for a mobile)

Digi Path: RELAY,WIDE3-3 (for mobile station)

WIDE3-3 (for a base station)

Digi Path settings vary in different areas.

Symbol:

Table Overlay: /

KeyUp Delay: 180ms

Transmit Every: 90 seconds (its not important, SmartBeaconing overrides this)

Quiet Time: 1500 ms

Calibration: 128 (adjust for your specific TinyTrak II)

Status Beacon Text: 52.525 146.52 446.0 (or whatever freqs you monitor)

Send Every: 1 transmissions (use a higher number if your APRS freq is congested)

Transmit Altitude: Y

Only Send Valid Position: Y

MIC-E Enable: N

(other MIC-E settings not important)

Time Slotting: Disabled

SmartBeaconing: Enabled

" Min Turn Angle: 20 degrees (these figures work good for corner-pegging)
Turn Slope: 50 mph-degrees
Min Turn Time: 3 seconds
Slow Speed: 3 mph
Slow Rate: 3600 seconds (60 minutes)
Fast Speed: 45 mph
Fast Rate: 90 seconds

4. Configure the radio

Connect 12 volts & power it up
Spin the dial to 144.39
Set power level to "Low3" (25 watts)
Hold down MHZ key to get into "set" mode
Spin dial to "PCKT", press MHZ key, spin dial to "PKT ON", press MHZ key
Spin dial to "TOT", press MHZ key, spin dial to "1M", press MHZ key
Spin dial to "BEEP", press MHZ key, spin dial to "OFF", press MHZ key
Spin dial to "PRATE", press MHZ key, spin dial to "1200", press MHZ key
Spin dial to "DIMR", press MHZ key, spin dial to "OFF", press MHZ key
Spin dial to "LOCK", press MHZ key, spin dial to "K+D", press MHZ key
Hold down MHZ key to get back to normal mode
Turn the volume knob all the way down
Disconnect 12 volts, do not use the power switch to turn it off

5. Connect cable to Tiny-Trak PC board

Note: The data jack on the Yaesu FT1500M is a 6-pin mini-din, which is the same kind of connector used for a computer keyboard or mouse (PS-2 style, not the older 5-pin DIN or 9-pin serial type). You may be able to cannibalize a cable from computer equipment provided it has wires going to the pins that you will be using.

The CT-39A instruction sheet has an error. There is no white wire. Its actually orange.

The CT-39A cable has 7 wires. The shiny black wire goes to pin 1 and the dull black wire is the shield.

FT1500		TinyTrak PC board
TXD	1	----Black (shiny)---- AUD+ (2nd hole over from top left)
Ground	2	----Brown----- AUD- (1st hole over from top left)
PTT	3	----Red----- PTT OUT (3rd hole over from top left)
RXD-9600	4	----Orange----- (no connection)
RXD-1200	5	----Yellow----- (no connection)
Squelch	6	----Green----- (no connection)
		Black (Dull)----- PTT- (4th hole over from top left)

6. Hook up the squelch

The squelch output (pin 6) provides 5 volts when a signal is present and 0 volts when there is no signal. This is incompatible with the TinyTrak-II because it operates opposite (5 volts for no signal, 0 volts with a signal). To make this work you could invert the signal with a transistor, or you could run an additional cord and use the speaker output on the radio.

The main difference between these two options is the radio speaker method is an audio-based squelch where the inverted signal method controls the squelch depending on whether or not a signal registers on the S-Meter.

To use the radio speaker (easy way):

Get a 1/8" "mini" plug and hook a pair of wires to it.

Connect the wire from the plug tip to the 4th hole over from the IC on the bottom right.

Connect the wire from the plug ring to the 5th hole over from the IC on the bottom right.

To invert the signal (hard way, but keeps everything in the 6-pin cable):

Get a 2N2222 transistor, a 4.7K resistor (Yel-Vio-Red), and a 470-ohm resistor (Yel-Vio-Brn).

Remove R9 and C2.

Put one leg of the 470-ohm resistor into the top hole of where R9 was.

Put the other leg of the 470-ohm resistor into the top hole of where C2 was.

(mount the 470 ohm resistor flat on the PC board)

Put one leg of the 4.7k resistor into the bottom hole of where C2 was.

(mount the 4.7k resistor upright and leave the other leg hanging up in the air for now)

Put the emitter of the 2N2222 into the bottom hole of where R9 was.

Put the collector of the 2N2222 into the middle hole of where R9 was

Bend the base lead of the 2N2222 up to your right and connect it to the top of the 4.7k resistor. Snip off any excess wire.

Connect the green wire from the 6-pin cable into the 4th hole over from the IC on the bottom right.

One nice thing about the FT1500 is that very weak signals will always register a notch or two on the s-meter, so this inverter circuit should function well.

I've had other brands/models of radios where weak signals wouldn't register on the meter.

7. Mount it in a box

To mount the Tiny Trak II into the little 3x2x1 box, you will need to trim the two bottom corners of the PC board. Just make a diagonal cut across the center of the hole.

Whatever you do, be careful doing this, as you don't want to damage the board.

Don't try to cut it off as one big chunk as this will likely stress the board, use a small pair of wire cutters and nibble through it with a number of small cuts.

Unsolder the 9-pin connector from the Tiny-Trak II, get three 2-inch pieces of wire, and extend the connector away from the PC board. You'll notice by now left you three holes on the PC board to do this.

Notch the side of the box for the 6-wire cable

Notch the side of the box for the power cable.

Notch the front of the box for the DB9 connector.

If you decided to use the speaker-squelch, drill a hole, notch the box, or add a connector for it.

When notching/drilling the box, make sure the cable entry points don't obstruct the pots or LED's on the PC board.

If you got the Radio Shack power cable, cut it into two sections of equal length (it comes out of the package with a connector on each end), take the connector that has the positive tip exposed and solder it to the power connections on the Tiny-Trak II. The + & - holes are on the bottom right of the TinyTrak.

Mount the 9-pin connector from the outside of the box. Make sure your notch (and the other notches for that matter) is deep enough to clear the lip on the lid of the box. Using the installed connector as a template, poke a couple of holes in the box with your soldering iron (yeah, I know, bad practice) and then secure the connector with a couple of short screws.

Once everything is in place, add a small wire-tie to the power cable on the inside of the box so it will act as a strain-relief.

8. Connect the GPS

The GPS35-HVS has 9 wires. We only need to connect 3 to a male DB-9 connector. Cut off the unused wires. The GPS is set up at the factory for 4800 baud and does not require any configuration.

Wire	Usage	Connect to
Red	+12	12-volt power connector (red)
Black	GND	DB9 pin 5, 12-volt power connector (black)
White	TXD1	DB9 pin 3
Blue	RXD1	no connection
Purple	TXD2	"
Green	RXD2	"
Gray	PPS	"
Yellow	PWRDWN	"
Shield		"

note: the red wire might be orange on some units

9. A few final things to do

Set TX Audio pot (middle left of PCB) to halfway point.

If you used the speaker connection for the squelch:

Set RX Audio pot 1/8 turn clockwise from the halfway point

Set volume knob on FT1500 to 1/4 (so the little notch on the volume dial is pointing straight to the left)

10. Hook it all up and watch it work. At least it worked for me. That is until I installed it in the car and it wasn't tracking. I listened to it with a handheld receiver and noticed a loud hum on the signal. Turned out to be RF getting into the TinyTrak's power cable. This was easily fixed by putting a clip-on ferrite onto the positive wire. These ferrites are easy to come by, I robbed mine from a computer monitor cable.

Later on the transmit audio hum came back intermittently. Adding two more ferrites to the power cable took care of the problem.

You might need to make miscellaneous adjustments as detailed in the TinyTrak manual,

mine worked ok with the settings in this document.

If you need to do further work with the unit, I recommend making a DB9 extension cable for your PC (its kind of hard to hang the box off the back of your computer). Also, you can use a 9-volt battery for programming/testing.

Since you have separate power leads for the GPS and radio you can run the GPS on constant 12 volts and run the radio on switched 12 volts. This will slightly increase performance because the GPS won't have to reacquire its position every time the car is started.

Why I used this equipment:

GPS35 chosen because its a turnkey unit. Give it power and it spits out NMEA lat/lon strings. Since it doesn't have a display it can be mounted anywhere, for example in the rear window or externally on a trunk-mount. The specific GPS35-HVS model is set up for an unregulated 6 to 40 VDC power source which makes it ideal for automotive use.

Tiny-Trak II chosen because of its small size, economical price, and proven reliability/compatibility.

FT-1500M chosen because of its small size, known compatibility with Tiny-Trak, great price (same price as the MFJ dataradio, but with the Yaesu you get a complete synthesized voice/data radio plus 50 watts!), and the Yaesu's capability of working on 12 volts. (The TX on both of my Kenwood 2-meter rigs cuts out on high-power at 12-volts when the engine is off but works fine at 13.5 volts. Since I want the tracker to work with the engine off I need a radio I can count on). I tested the FT1500M down to 11.3 volts on high power. The radio will cut out if the voltage drops into the 10 volt neighborhood during transmit.

Also, the FT-1500M has a data jack on the back so you don't need to fiddle around with interfacing the mike jack to the TNC.

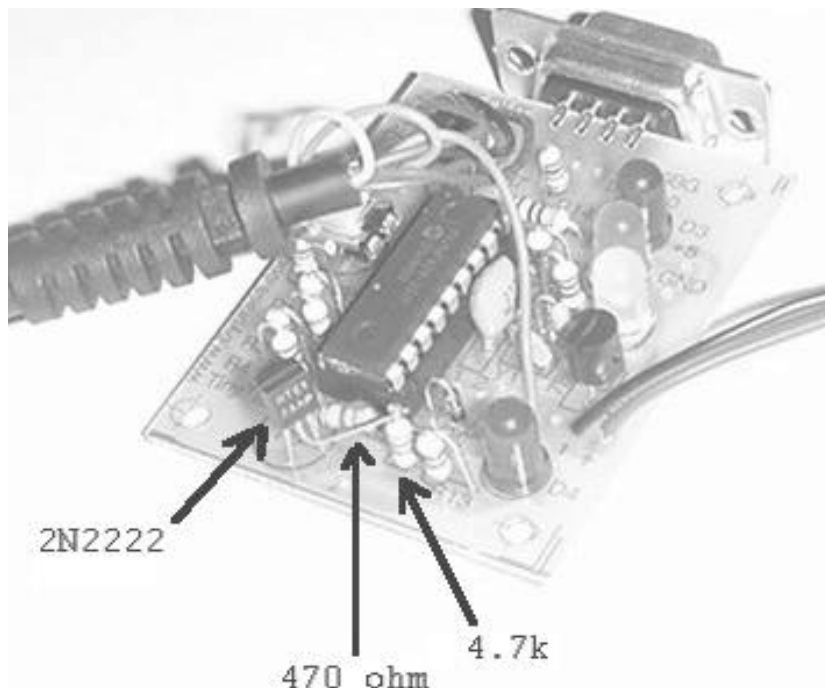
While the FT-1500M has one of those "soft" power on/off buttons, it does remember the on/off state after it loses power, so you can wire it into the vehicle "ignition-on" and expect the radio to power itself up when +12 is applied to its power leads.

Thanks to the following people for their advice & information:

Byon N6BG
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Paul KE7XT
Brad N7JGX
Mike KU4ZD

<http://www.northwestradio.com/>

Squelch mod:



PC board & box:



Programming setup:



Ferrite choke on power lead:

