



W1GHZ

## MICROWAVELENGTHS

# Assembling a Microwave Transverter System

In the last “Microwavelengths,” we discussed transverter system design, starting with system calculations and proceeding to breadboarding the system for testing. After we are satisfied that the system is working, it is time to package up the transverter for use. The package might be a nice cabinet for a home station, a weather resistant box for mounting on a tower, or a rugged enclosure for portable use.

### Size and Time

The two most important considerations at this point are making sure that the box is big enough and allowing enough time for assembly. Don’t buy a box until you are sure it is big enough. New enclosures are rather pricey, so take the time to do some planning first.

And allow plenty of time — I’ve found that it takes about 3 weeks of my spare time to do a proper job assembling and packaging up a transverter. Your first one might take longer, so don’t wait until the night before a contest. If it is the night before the contest and you’re thinking of packaging up your transverter: don’t. Use the breadboard. It works, you’ll find out what doesn’t work and you’ll get a better night’s sleep.

### 3D Jigsaw Puzzle

Assembling a transverter is like putting

together a 3D jigsaw puzzle inside a box, without a picture of the finished puzzle. Unless you are really good at 3D visualization, some trial and error is required.

First, estimate how big a box might be needed; then, tape some cardboard or foam-core together to make that size box. Next, start fitting the pieces inside, keeping in mind that they must be cabled together. Most microwave systems use semi-rigid coaxial

cable, which must be bent carefully with a minimum bend radius of perhaps  $\frac{1}{2}$  inch. Allow room for the cable bends and for access to tighten the connectors with a small wrench. If the estimate was too large or small, just cut some more cardboard and try again.

Once you get a configuration that looks like it might fit, take some pictures with your digital camera. Then mark the outlines and mounting holes on the cardboard — it may

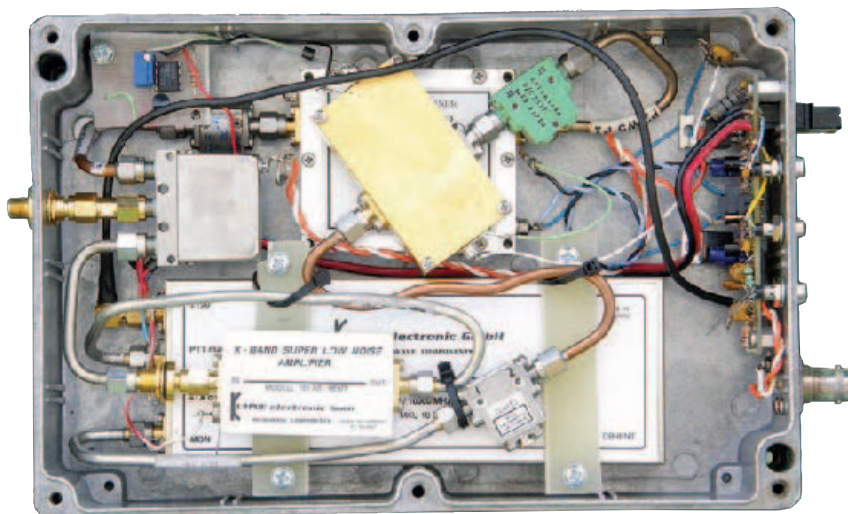


Figure 1 — Compact 10 GHz transverter in die-cast box.

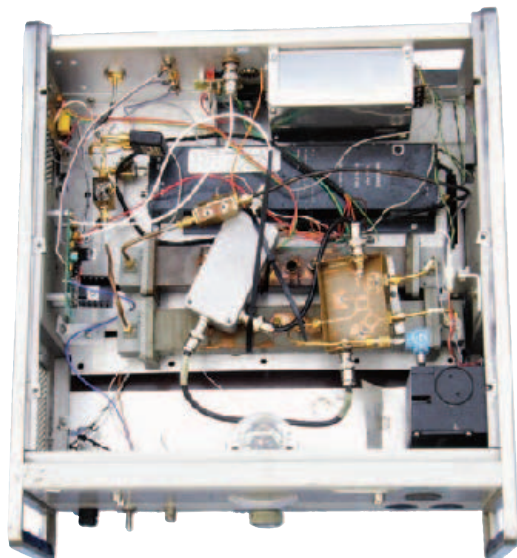


Figure 2 — Transverter for 5760 MHz packaged in recycled HP instrument cabinet.

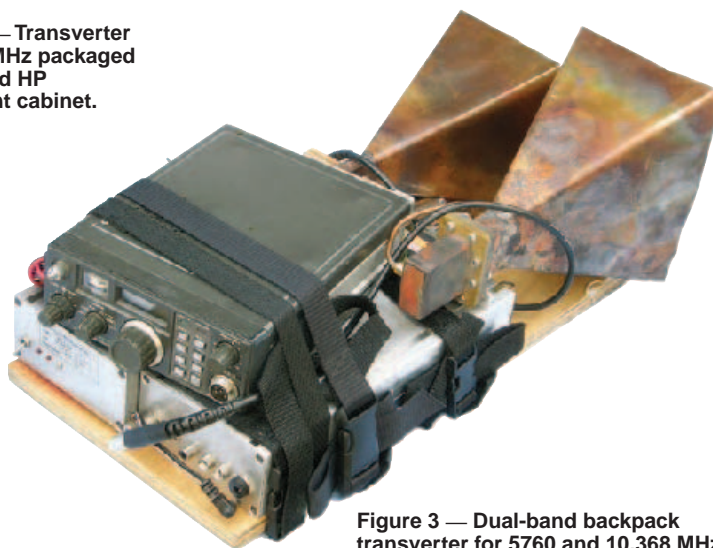
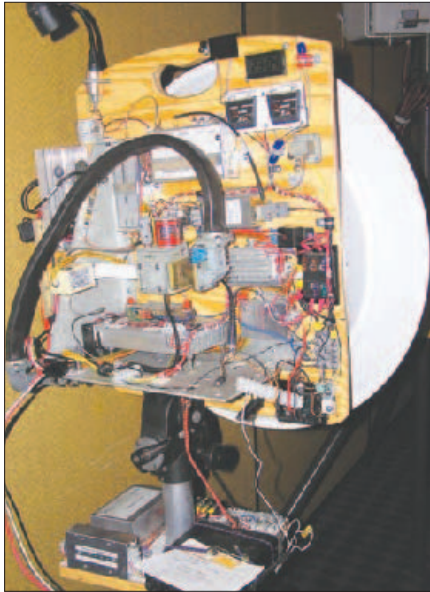


Figure 3 — Dual-band backpack transverter for 5760 and 10,368 MHz.



**Figure 4 — California-style transverter — open construction on back of dish.**

be useful as a template for drilling holes in a metal box.

### Tripod Mount

Most portable systems are mounted on a tripod for ease in aiming. A threaded hole on the bottom of the box with the standard 1/4-20 tripod thread will be convenient. If the metal is too thin for a robust thread, a T-nut mounted in some plywood is a good alternative. For balance, the threaded hole is usually centered, so place it before adding the other components and make sure the tripod bolt won't hit anything inside.

### Affordable Enclosures

Metal enclosures are preferred for RF shielding, but will have problems with internal condensation if left outdoors — there is always some moisture trapped inside. For tower mounting, some microwavers prefer weather-resistant PVC junction boxes, found in the electrical department of building supply stores. Others make sure that there is always enough power dissipated to keep the internal temperature above the dew point, either by the equipment or a small heater such as a light bulb.

For smaller transverters, aluminum die-cast boxes are ideal: rugged, yet easy to machine, even with hand tools. The prices are fairly reasonable and weather-resistant versions are available. My 10 GHz transverter, shown in Figure 1, is small and light enough to mount on the feed arm of an offset dish. It has a DB6NT transverter module and preamp, a DL2AM power amplifier and a sequencer at the far right. Getting everything in the box required a bit of work with a precision shoehorn, especially after I found that the transverter did not have enough drive for

the power amplifier. I had to build the intermediate amplifier (in the gold case) and fit it into the already crowded box.

Larger enclosures can be very expensive, so I suggest applying some creativity if one is needed. At most hamfests, a range of obsolete equipment and old test equipment is looking for new homes at low prices. Instead of thinking of them as large, heavy and useless, envision them as slightly used enclosures with some excess parts inside. I've acquired some usable cabinets this way, typically for less than \$5. Figure 2 is a 5760 MHz transverter I built a few years ago in the cabinet of a defunct TWT amplifier — and it puts out more power than the amplifier ever did. A combination of homebrew and surplus components is included. The enclosure has sufficient room for adding a few improvements over the years.

Hams with some metalworking skill can make an enclosure by bolting together a frame of angle aluminum and sheet metal skins, or even by welding. Those with woodworking skills can make a wooden box or frame. Figure 3 is a simple two band



**Figure 6 — WB6CWN handheld 10 GHz rig folded up.**



**Figure 5 — WB6CWN with handheld 10 GHz rig and severe case of dish envy.**

backpacking rig for 10 GHz and 5760 MHz I assembled on a sheet of plywood, complete with homemade copper horn antennas. The whole assembly is held together with nylon straps, for easy changes, and mounts on top of a tripod. Both transverters are from Down East Microwave. The problem with backpacking is that batteries adequate for extended operation are awfully heavy.

### Fair Weather Operation

If your portable operation is only during good weather (don't even consider operating from Mt Washington), no enclosure is necessary. Some of the California microwavers just mount the components on the back of the dish. The rig in Figure 4 is a fine example.

At the other extreme is the handheld 10 GHz rig in Figure 5 built by Frank Kelly, WB6CWN. Complete with NiCd batteries, everything folds right into the concave side of the 18 inch DBS dish when not in use (see Figure 6). Frank keeps the batteries charged from the cigarette lighter outlet in his car and the oscillator running continuously so he is always ready to operate.

### Your Transverter

Unlike a jigsaw puzzle, there is no single answer here. Each transverter may be unique. The available components are different, as are individual goals — one may prefer enough space to work comfortably, another might prefer a compact system and a few build electronics that is more like jewelry.

The important thing is to make a system that works and makes contacts. Take the time to do it properly and then get on the air. **QST**