10 Meter Base Station Antenna

Ready in two hours!

by Russ Stein WA6ZOS

Recently I converted a Hy-Gain CB board to 10 meters FM. I had heard about the growing activity on 10 meters, and I wanted to investigate it for myself. After the low-cost conversion, I needed an antenna to give my new 10 meter FM equipment a fair chance. I was interested not only in working distant stations on skip, but also in local ground-wave communications. A vertical antenna with a low radiation angle would be ideal.

Antenna Design

I had read that antennas manufactured for the CB market could easily be tuned for 10 meters. Unfortunately, I found no local source for new or used CB antennas. I knew I had to build one, but I needed to come up with a mechanically simple design. My first ideas revolved around the regular ground-plane antenna, with radials at the base. This proved to be too mechanically involved, so I examined a coaxial dipole, which promised to be more mechanically convenient.

The feedpoint impedance of this type of antenna is closer to 75 than 50 ohms, but on 10 meters the losses due to this mismatch would be negligible.

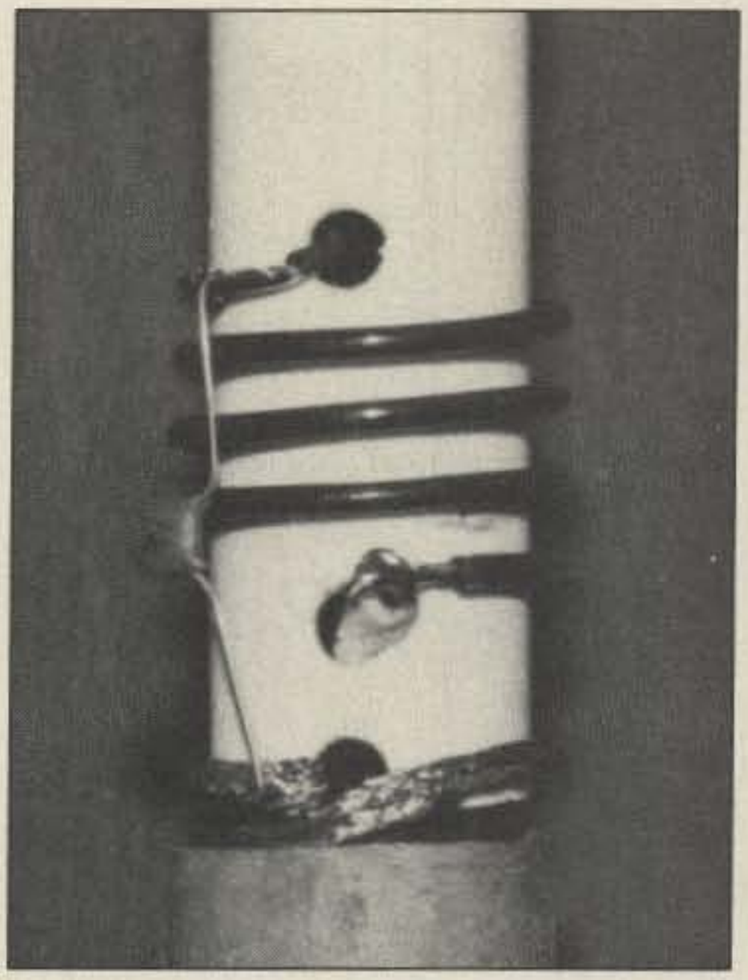

Photo A. Wrap the wire around the pipe, extending upward about an inch from the hole where the center conductor exits. Note the position of the 47 pF disc capacitor. The PVC pipe fits snugly inside the TV mast.

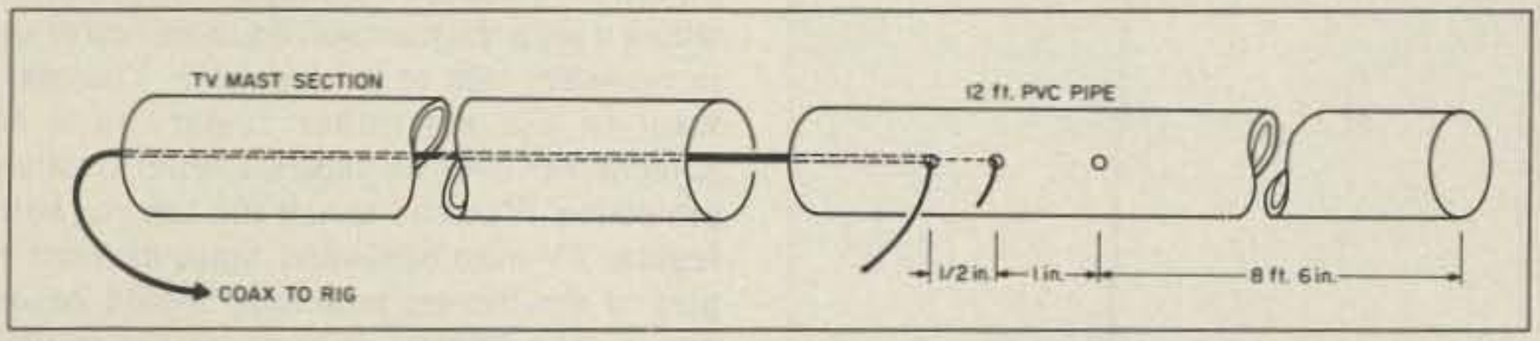

Figure 1. Snake the prepared end of the cable up through the TV mast section. Pull the braid through the first hole and the center conductor through the second.

The coaxial dipole seemed the best choice, so I set out to build one. I calculated the dipole, at 29 MHz, to be about 17 feet long. I found enough materials on hand to construct the antenna. For the coaxial part of the dipole, I used an old 10-foot TV mast section. Leftover Sch. 40 PVC sprinkler pipe provided support for the antenna's vertical radiator. For the latter, I used #14 solid insulated wire. To keep water out, I used a PVC end cap.

Ready for Testing in Two Hours

The antenna was very easy to build, and in about two hours I had it mounted on the roof of my single-story house. The SWR was about 2:1 at 29.6 MHz and increased to over 2.5:1 at 29.0 MHz. At 29 MHz, the feedline losses would not make a sizable difference in system performance, but would my solid state transmitter be able to handle the mismatch?

The transmitter tolerated the high SWR, but it put less power into the feedline than into a 50 ohm load. I decided to use the antenna to see how it would perform. The band was open and active, so I began calling CQ with my 3 watt "peanut whistle," on the chance I might make a contact.

The results were amazing. In a few hours I had worked stations in Texas, Mississippi, Illinois, Minnesota, New York, Florida, and Wisconsin, as well as a couple of local California stations, one 30 miles distant. Signal reports were very good, and I was pleased with how well the antenna worked.

Ten meter FM was so much fun, I left the antenna as it was for several weeks and just enjoyed myself. It was clear that this antenna design worked well, but I wanted to correct the impedance mismatch so I could run more power. This proved to be relatively easy to do by adding a simple LC matching network. After the change, the antenna had an SWR of 1.2:1 at 29.6 MHz, where I tuned it for lowest SWR, and it increased to only 1.5:1 at 29.0 MHz.

Construction Details

First, obtain a 10-foot metal mast. Using a hacksaw, cut it to 8′ 6″ in length. Use sandpaper to roughen and clean the inside, where you made the cut. Starting at the bottom, snake your feedline, RG-58/U or RG-8X, through the mast section. Cut six inches of insulation off of the coax and separate the braid from the center conductor. Cut the center conductor 1-½″ long, and remove ¼″ of insulation.

Next, obtain a 10-foot section of PVC pipe. Measure 8′6″ from one end of the PVC pipe, and drill three holes with a ¼″ drill. (See Figure 1.) Snake the prepared end of the cable up from the end of the PVC pipe closest to the holes, with the braid coming out the first hole, and the center conductor coming out the second hole. I found it helpful to insert

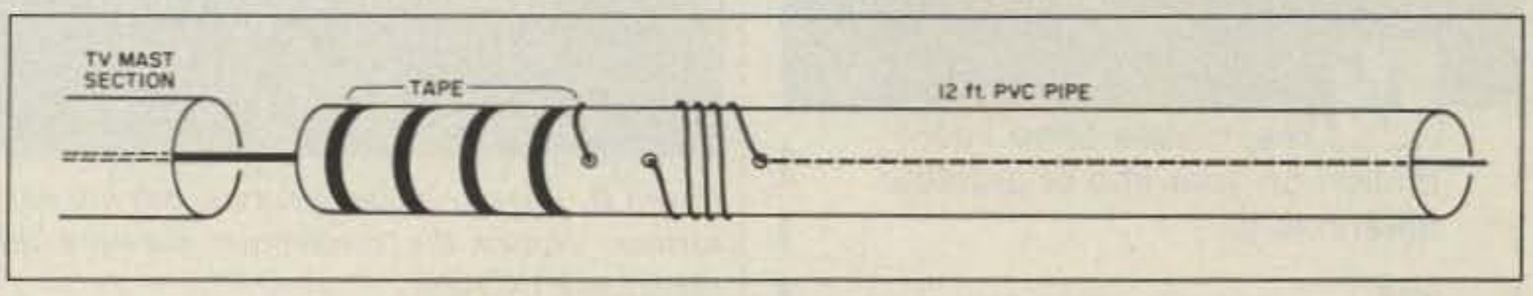

Figure 2. Connecting the TV mast to the PVC pipe.

a piece of small-gauge solid hook-up wire through each of the two lower holes and out of the mast end, then solder one to the braid and one to the center conductor. This allows you to pull the cable up inside the mast with the two parts of the cable coming out the correct holes. Use the same method to pull the #14 solid wire from the far end of the pipe and out through the last hole.

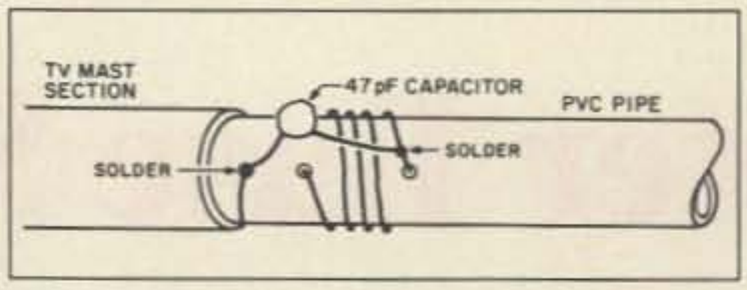

Figure 3. Position of the capacitor.

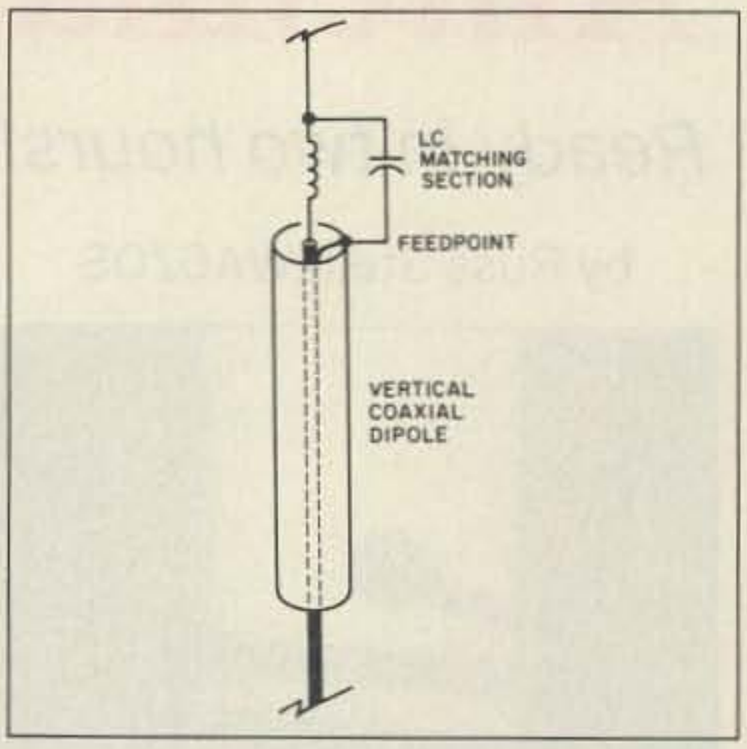

Figure 4. The vertical, coaxial dipole.

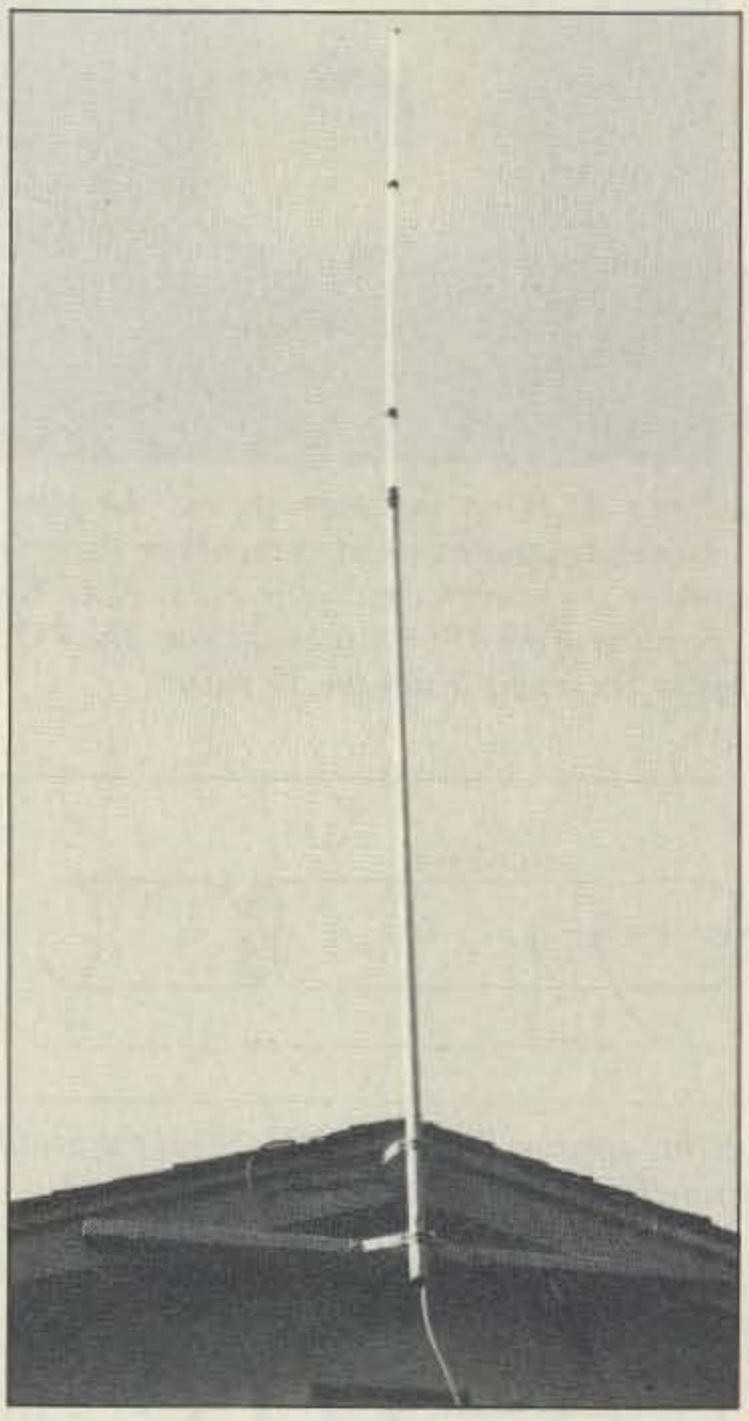

Photo B. A trim, inconspicuous, but hot performer. Notice the connectors between the pieces of PVC pipe.

Leave about six inches of extra wire at the end of the pipe, where the #14 wire exits the hole. Remove a section of insulation about ¼" long, and tin the bare section. Then wrap the wire around the pipe for four turns, evenly spacing it over the 1" of pipe to the middle hole, where the coax center conductor exits the pipe. (See Photo A.)

Remove the insulation from the end of the #14 wire, solder the wire to the coax center conductor, and tape the connection. Wind tape over the four coil turns to hold them in place, but don't cover the exposed bare wire section near the hole. Prepare the end of the PVC pipe nearest to the holes by wrapping it with four or five thicknesses of electrical tape one tape-width. Use just enough to fit it snugly inside the metal mast section.

Next, wrap one tape-width every six inches or so, up to six inches below where the coax braid comes out. Just below this, wrap three turns of electrical tape, one tape-width.

Insert the end of the PVC pipe into the metal mast section until you get to the last wrap of tape near the braid. Now, wrap the braid around the pipe and sandwich it in between the tape and the inside of the mast. Make sure the braid is in tight contact with the mast, then securely tape the junction of mast and PVC pipe. Drill a hole in the center of the PVC end cap just large enough for the #14 wire radiator.

At the end of the PVC pipe where the #14 wire comes out, push it through the hole in the cap, then seat the cap on the end of the pipe. Pull on the #14 wire to be sure it is straight inside the pipe, and bend it back down over the cap. Cut the wire so only about an inch extends down the side of the end cap. Tape the entire end cap to secure the wire and to seal against moisture.

The antenna is now complete, except for the addition of the 47 pF disc capacitor. (You could also use a 100 pF mica trimmer instead, to tune precisely for lowest SWR.) You will need to solder the capacitor from the bare section of wire radiator where it comes out of the pipe to the braid of the coax (see Figure 3). Wrap the PVC pipe with tape from where it joins the mast section to an inch or so to the other side of the last hole. You may want to use a weather sealer, such as Scotchkote® over the tape for better weather protection. You can mount the antenna with regular TV mast hardware. Since the mast is part of the dipole, mounting should be on non-metal surfaces, or you can use insulators, if needed. The antenna performs best with the feedpoint 16 feet or more above ground.

I've been using this antenna at 100 watts with absolutely no problems. Its performance has been impressive. Considering the low-cost and easy construction, this hot performer for 10 meter FM is is hard to beat. Why not put one together and enjoy? See you on 29.6! 73

Russ Stein WA6ZOS, 7593 Frederiksen Ct., Dublin CA 94568, has been a licensed ham since 1966. He is currently the Communications Technician Supervisor with the City of Berkeley, and is responsible for the design of radio, telephone, alarm, and computer systems, as well as their installation and maintenance.