Full-Wave VHF Vertical Antenna

Easy-to-build, good gain antenna.

by Don Norman AF8B

This full-wave vertical antenna grew out of a series of experiments with the vertical J antenna. The result is a full-wave antenna easily built by the average amateur. The final version of the antenna is matched by a form of gamma match, and features full RF decoupling from the feedline.

The antenna can be grounded and in fact may be a continuation of the supporting mast. The 52Ω coaxial feedline runs up inside (MUST be inside) the antenna. It emerges through a ⅜" diameter hole next to the feedpoint on the matching stub. The diameter of the radiator does not seem to be critical, as working models have been built with radiator diameters ranging from ⅝" to 1¼".

Antenna dimensions for 145 MHz (packet) are given in Figure 1. You can easily build the antenna from a 10-foot length of ½" electrical conduit. The insulators are fabricated by cutting a plastic pipe tee in half. This plastic pipe tee, used mostly with semi-flexible plastic pipe joined with molded fittings and hose clamps, is common in hardware stores. A single 1" tee cut along the line shown in Figure 2 will yield two insulators that will fit over the ½" EMT tubing.

Cut the matching rod from #10 copper wire, 3/32" brass brazing rod, or ⅛" copper tubing. Cut the radials from brazing rod or hard aluminum wire, and attach them to the radiator with self-tapping sheet metal screws.

The first step in building the antenna is drilling holes in the metal tubing for the coax and radial attachment. Mark one end of the tubing "Top." Drill a ⅜" hole through one side of the tubing 40½" from the top. Drill

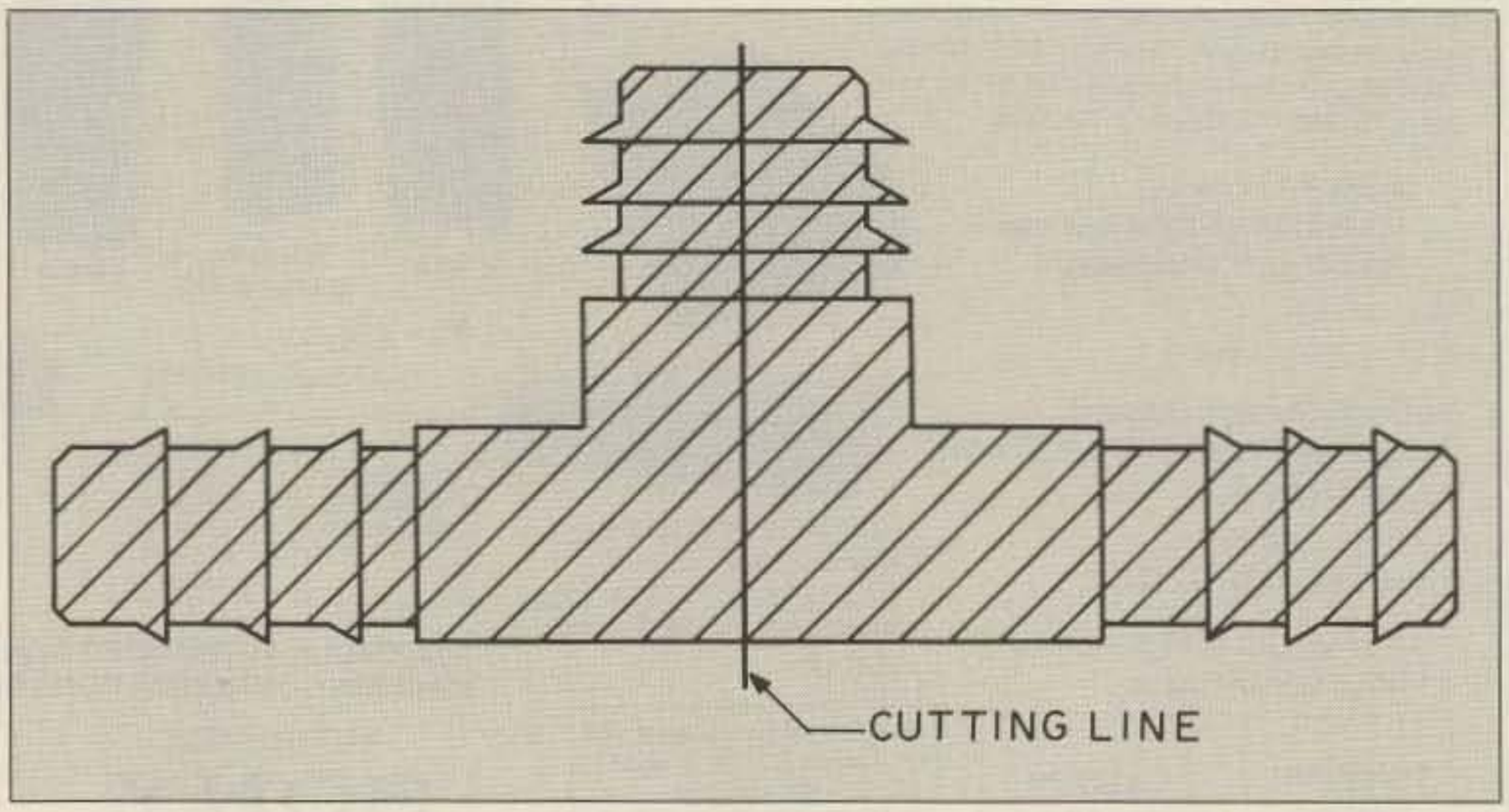

Figure 2. Make the insulators by cutting a plastic pipe tee in half.

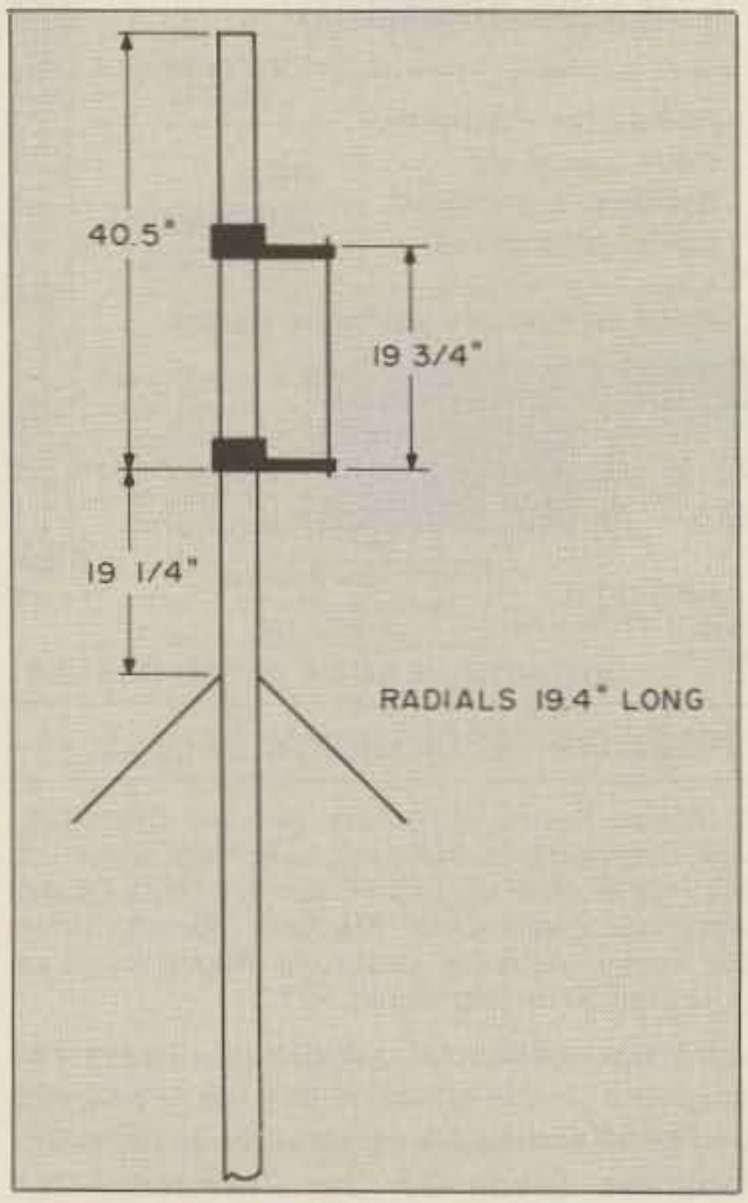

Figure 1. Full-wave vertical dimensions for 145 MHz.

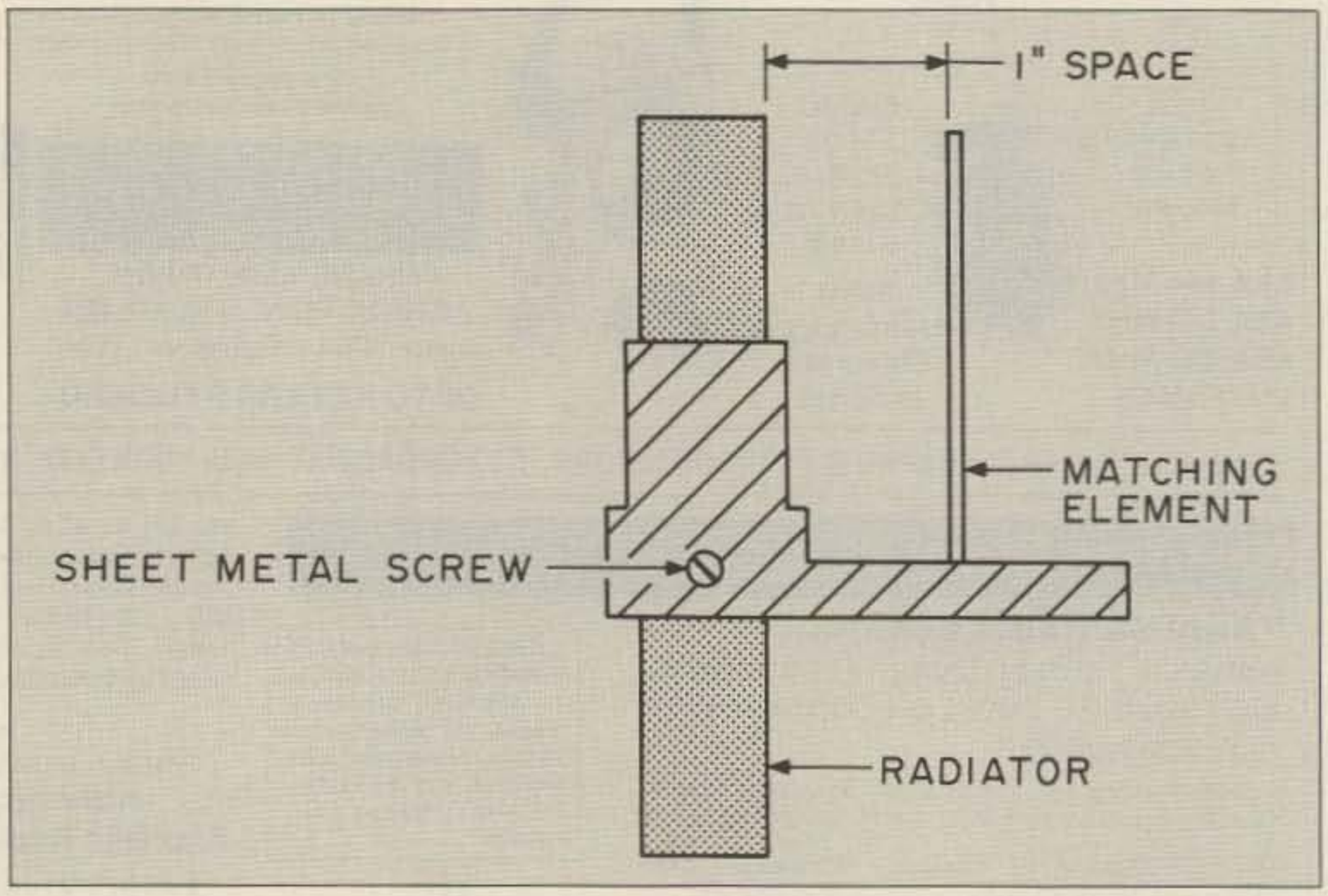

Figure 3. Matching element and bottom insulator attachment to vertical element.

three or four ⅛" holes for sheet metal screws 59¾" from the top. Use a round file to remove burrs and snags from the inside of the ⅜" hole. Fish the coax cable up through the tubing past the small holes and out through the ⅜" hole. Figure 3 shows the matching element and bottom insulator.

Cut the insulators. Measure and cut the gamma matching rod. Slip the insulators over the tubing and measure 1" from the main tubing, then drill small holes through the projecting part of the insulators large enough to accept the matching rod. The distance between the radiator and the matching rod is critical. Use your best concentration, and make the spacing as near to 1" as possible. Refer to Figures 3 and 4 for proper bottom insulator placement.

". . . the antenna is matched by a form of gamma match, and features full RF decoupling from the feedline."

Slip the bottom insulator over the radiator, place it as shown in Figure 4, and drill a small hole through the insulator and the radiator. Lock the insulator in place with a self-tapping sheet metal screw. Attach the shield of the coax under this screw. Cut a 3" piece of small bare wire. Wrap one end around the gamma rod an inch from the end and solder. Slip the second insulator over the radiator. Slip the matching rod through the holes in the insulators. Solder the center conductor of the coax to the end of the matching rod. Move the top insulator upward against the 3" wire soldered to the matching rod. Bend the wire around the insulator and wrap around the matching rod. Lock the insulator in place with a sheet metal screw.

Figure 4 shows the bottom insulator rotated 90 degrees from Figure 3. Notice that the coax end is protected by the semi-circular bottom of the insulator.

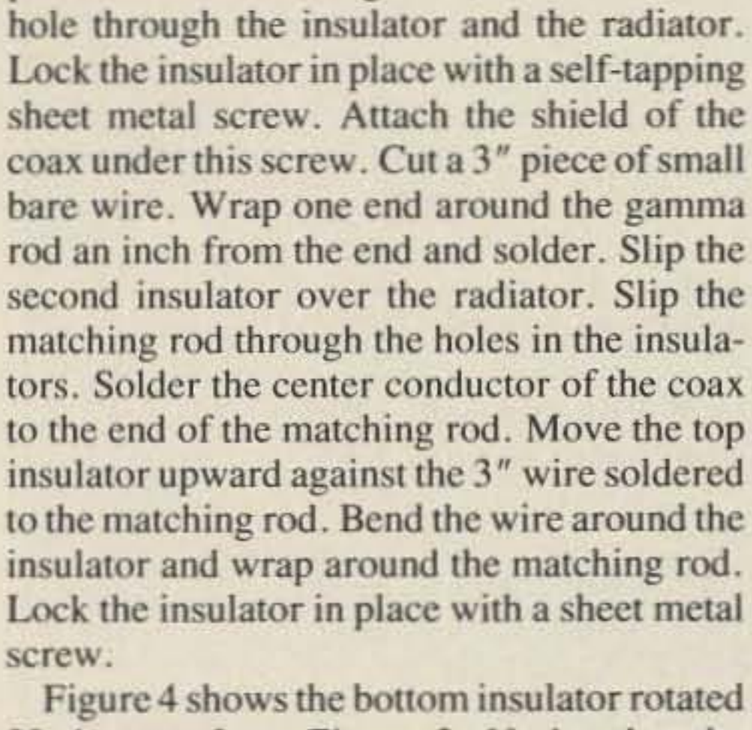

Figure 4. Bottom insulator placement. The coax end is protected by the semi-circular bottom of the insulator.

Install the radials. Cut the radials 1" longer than the correct dimension. Bend one end in a small circle and attach the radials to the radiator with sheet metal screws. CAUTION! Don't pinch the coax with the screws! The radials are clipped to the correct dimension after they are installed. The radials, an essential part of the antenna, decouple the RF from the support and feedline. Their dimensions are as critical as the rest of the antenna.

Performance

Checking the antenna with an absorption wavemeter indicates the presence of RF from the tips of the radials upward in the classic patterns depicted in the various antenna manuals.

On-the-air tests indicate it is equal to or better than a commercial ⅝-wave vertical.

Choose Your Resonant Frequency

Dimensions for frequencies other than 145 MHz may be calculated as follows: Radiator above the feedpoint, 5872/Frequency (MHz). Feedpoint to radial attachment point, 2790/Frequency (MHz). Matching rod length, 2865/Frequency (MHz). Radial length, 2810/Frequency (MHz). Matching rod spacing, 146/Frequency (MHz). The spacing of the matching from the radiator is the most critical measurement. A quarter-inch more or less makes a great difference in the performance of the antenna. Radial length and placement are somewhat critical and should be within a half inch of calculated dimensions.

That's all there is to it. Enjoy solid signals with this easy-build vertical! 73