

Try Copper for 2 Meters —The Cu Loop

Want a rugged antenna with decent bandwidth for 2 meters? Try this "plumber's delight."

After the construction article for a 6 meter squalo appeared in *QST*,¹ I received several requests for a similar antenna for 2 meters. The unit shown here is made of standard 3/4 inch thin-wall copper tubing available at nearly any hardware or plumbing supply store. This antenna is very sturdy, easily reproduced, performs well and can be built for about \$10. It can be used in the vertical plane with FM repeaters and mobile stations or it can be flipped 90° for horizontal polarization, making it suitable for CW or SSB operation at the low end of the 2 meter band. The weight of the antenna, including mounting hardware, is about 2 pounds. The completed antenna can be seen in Figure 1, while Figure 2 shows the antenna rotated 90° for the polarization change.

Although construction is fairly easy, some basic plumbing techniques are re-

quired. The copper tubing and fittings shown here were purchased from a local ACE hardware supply store. For reference, the thin-wall elbows used to build this example were marked "EPC." Carefully cut the tubing to the lengths shown and assemble into the copper elbows. Make sure the sides are parallel and the two top sections are in line.

Clean the ends of the tube that will engage the elbows with steel wool and apply a paste soldering flux to this area. Solder the corners with a propane torch; keeping in mind that it takes time to get this much copper hot enough to properly flow the solder. Sufficient heat and good soldering technique will reward the builder with a professional looking joint. After soldering, remove any excess flux and polish the antenna using steel wool. Any extra solder buildup at the seams can be removed with

a hand file, but proper soldering technique should avoid the need for this.

The bracket supporting the connector is made of 0.050 inch thick brass stock, as shown in Figure 3. The tubing is drilled and tapped at the center to accommodate the two 6-32 screws that attach the bracket. Sheet metal screws could also be used, if desired, but they should be stainless steel. The SO-239 coaxial connector is attached to the bracket with 4-40 stainless hardware. No aluminum is used in the signal path because dielectric action of the dissimilar metals could create electrical noise. The antenna mounting-bracket is not symmetrical, allowing additional clearance at the top, between the gamma match and the U-bolt.

The gamma-match shorting strap is made of 0.020-inch thin brass stock and is 1/2 inch wide. It is held in place with 6-32

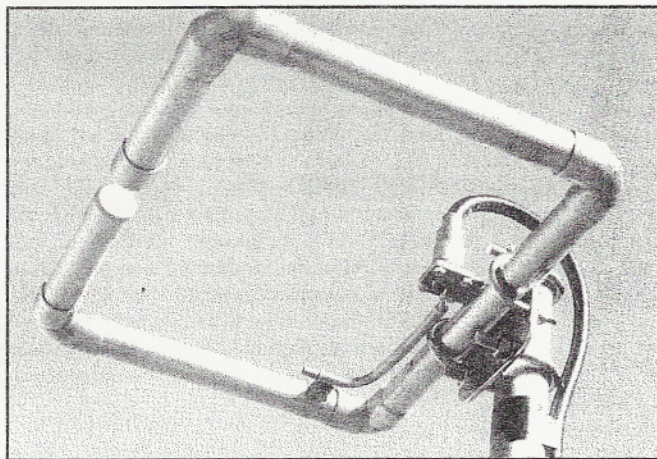


Figure 1—The Cu Loop mounted horizontally. Although not apparent from the photo, both the coax connector plug and socket are sealed to prevent moisture contamination.

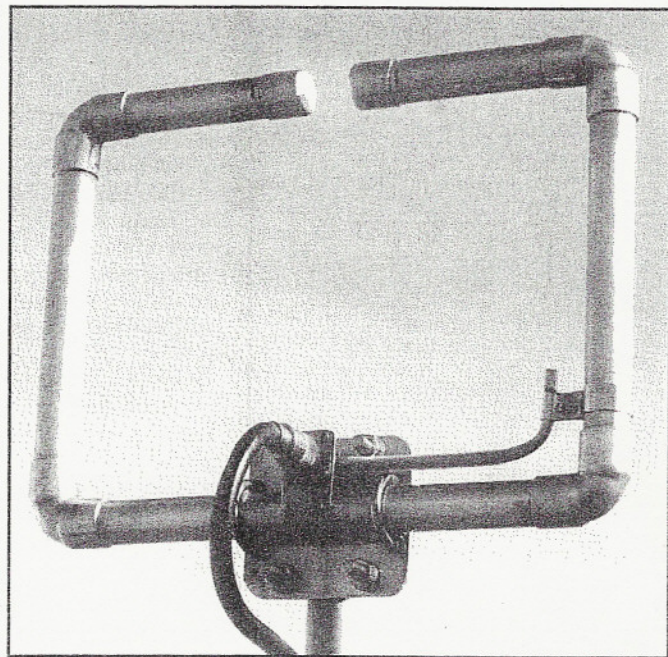


Figure 2—(right) The Cu Loop mounted vertically. Note the gamma match strap. Make sure it is securely fastened to both the antenna element and the gamma rod, as the RF current is high at this junction.

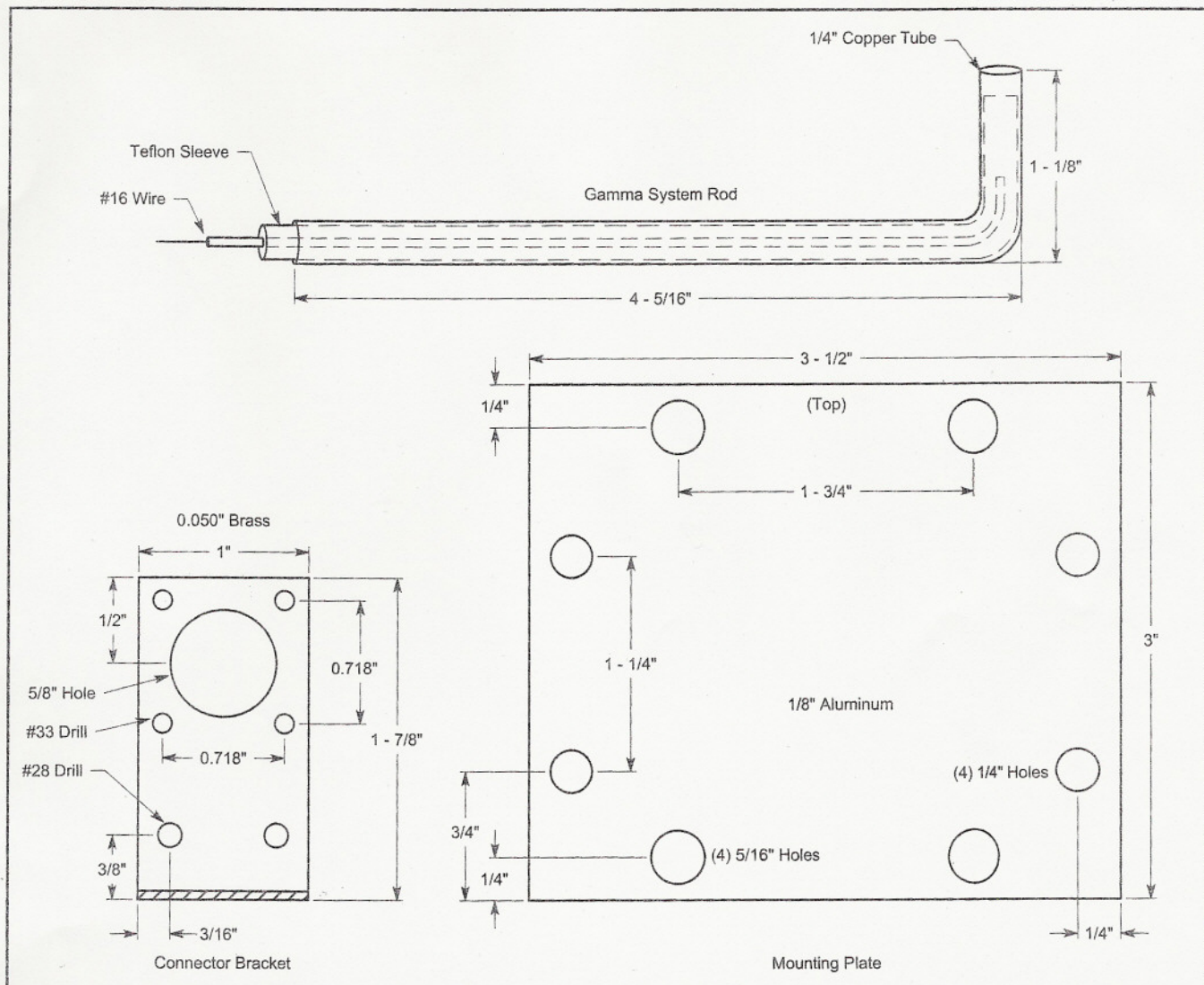


Figure 3—The gamma match, connector bracket and mounting plate details. The gamma rod to element connecting strap is not shown; it is described in the text. The hatched area of the connector bracket should be bent slightly to conform to the tubing radius.

stainless hardware. The gamma section is formed, as shown, from a $5\frac{5}{8}$ inch length of 0.250 inch OD soft copper tubing, available at most hardware or plumbing supply stores. A $5\frac{1}{2}$ -inch length of $\frac{5}{32}$ inch OD Teflon sleeving is inserted into the copper tube and a $5\frac{1}{2}$ inch length of #16 vinyl insulated wire is placed inside this sleeving. The sleeving and wire are available from Mendelson Electronics.² See Figures 3 and 4 for the gamma match assembly details. The completed gamma match assembly should fit together snugly, and the wire end is then soldered to the coaxial connector center pin. The 0.250 inch copper tube and wire form the gamma match series capacitor, which measures approximately 10 pF.

With the gamma rod and coax connector in place, the two end caps can be installed. With both caps fully seated over their tubing ends, place a felt-tip pen ink reference mark on the tubes at the edge of the caps, as shown in Figure 5. Adjustment of both caps should then be made equidistant from these reference marks.

An RF analyzer (such as the Autek Research RF5 or MFJ 259/269) can be used to check and adjust the completed antenna. The antenna should be at least 6 feet above ground and be clear of surrounding objects during these adjustments and it should be supported on a mast or a test stand. The center frequency can be adjusted over a range of 138-149 MHz by sliding the end caps in and out on the antenna elements. Moving the caps closer together will lower the center resonant frequency by lengthening the antenna; this will also increase the capacitance across the loop.

Adjust the end caps equally to the desired operating frequency. On this example, the 2:1 SWR bandwidth was found to be about 4 MHz, at a center frequency of 147.00 MHz. If the dimensions have been followed carefully, the SWR should be very low. If necessary, the gamma strap can be moved slightly to minimize the reflected power and the wire length can be changed in small increments to bring the SWR to 1:1. The SWR can be

adjusted to 1:1 anywhere in the band by adjustment of the end caps and the gamma section strap. After the adjustments are completed, both end caps should be secured to the antenna elements with #4 stainless steel sheet metal screws and the gamma strap tightened securely. The caps may be slotted to facilitate adjustment.

After testing and adjustment, a low-loss sealant should be placed over the back of the coax connector and at the ends of the gamma rod, to prevent moisture contamination. [Both the PL-259 connector and SO-239 socket are not waterproof. A preferred choice for continuous outdoor use would be a type N connector and socket. These are waterproof if properly installed.—Ed.] To preserve the finish and to keep the copper from oxidizing, the antenna can be coated with a clear protective finish, such as Krylon 1301.

This antenna has facilitated operation through many distant FM repeaters with gratifying results, while it was supported on a 20 foot test stand. It has also been used

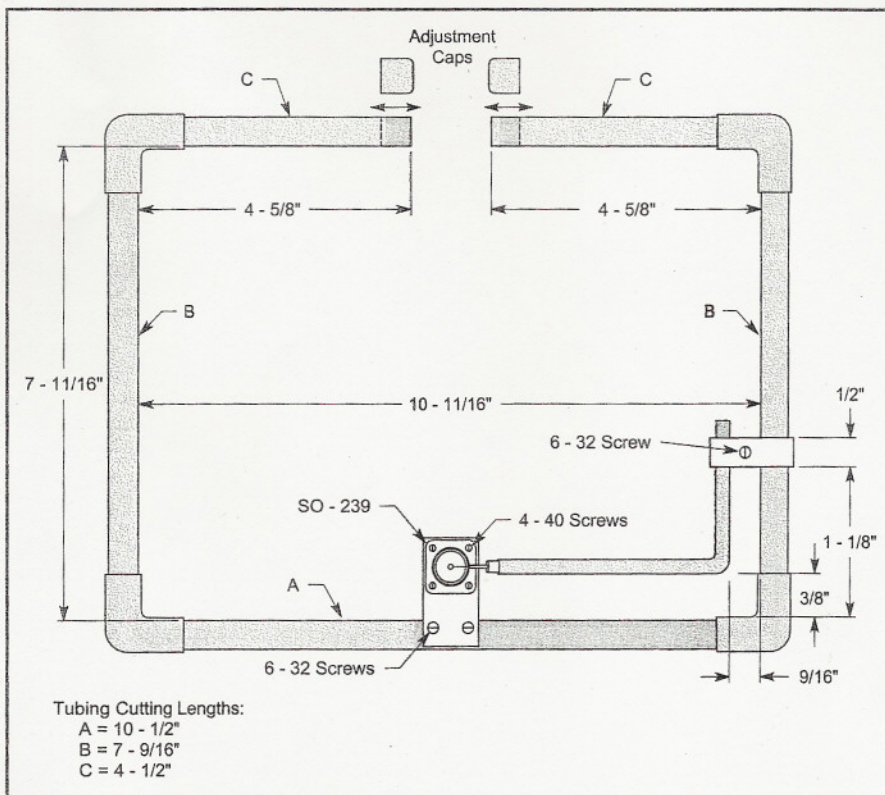


Figure 4—Construction details of the main antenna assembly. All hardware is stainless steel.

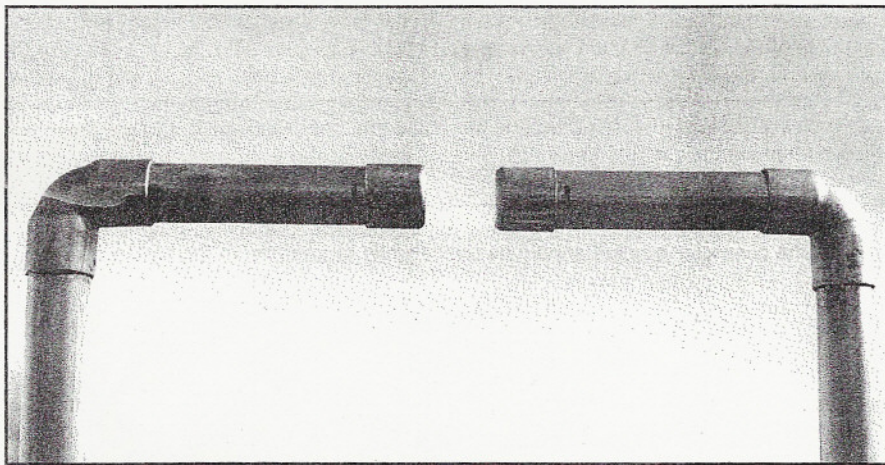


Figure 5—The adjustable tuning caps. Note the felt pen markings. Adjustments should be made equally from both end cap markings.

to make both CW and SSB contacts. The radiation pattern possesses a sharp null along a line drawn through the antenna's two sides. This characteristic, together with its small size and robust structure, makes it attractive for direction finding activities, in addition to general station use.

Notes

¹"Six Meters from your Easy Chair," *QST*, Jan 2002, pp 33-34.

²Mendelson Electronics Co Inc, 340 E First St, Dayton, OH 45402.