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A Backpacker's Delight— The Folding J-Pole

A new twist on the old J-pole.

Michael Heiler, KA0ZLG

As the Emergency Coordinator (EC) for Clay County, Minnesota, I wanted to make up a jump kit that I could just grab and head out the door with. I needed a good VHF/UHF antenna that would give me some gain and portability and my inclination was to use a J-pole, but these antennas are somewhat long and cumbersome.¹ I had made one out of 450 Ω ladder line and I also made one from 300 Ω twinlead, but I now needed a version for outdoor use that was physically strong and durable, yet easily transportable.

Building the Antenna

I like the copper J-pole, so I started a design using that antenna as a model. The idea of a folding version of the copper antenna appealed to me. I went to the local lumberyard and hardware store (a home building supply will work, as well)

¹Notes appear on page 33.

Table 1

Materials List: Folding Copper J-Pole Antenna

- 1 each, 10 feet of $\frac{1}{2}$ inch copper pipe.
- 3 each, $\frac{1}{2}$ inch copper end caps.
- 1 each, $\frac{1}{2}$ inch right angle (elbow).
- 1 each, $\frac{1}{2}$ inch T angle.
- 2 each, $\frac{1}{2}$ inch copper pipe clamps (wall clamps).
- 2 each, $\frac{1}{2}$ inch copper pipe couplings.
- 4 each, 6-32 bolts \times $\frac{3}{4}$ inch, depending on Plexiglas thickness.
- 4 each, external star washers, #6 and #8.
- 10 flat washers, #6 and #8.
- 2 each, $\frac{3}{16}$ inch eyebolts.
- 4 each, 10-24 brass nuts.
- 1 each, $2\frac{3}{4} \times 2\frac{3}{4}$ inch Plexiglas, $\frac{1}{8}$ to $\frac{1}{4}$ inch thick.
- 3 ring terminals for #14-16 wire for #6-#8 bolts.
- 5 feet of $\frac{5}{16}$ inch OD bungee cord.

and picked up what I needed to make the portable antenna project a reality. The necessary parts for this project can be found in Table 1, and Figure 1 can be used as a basic assembly guide for building the antenna.

The antenna components are shown in Figure 2. You will first need to cut five $19\frac{1}{4}$ inch sections and one $2\frac{3}{4}$ inch section from a 10 foot length of copper pipe. Soldering the pipe joints is the next step. Be aware that, when soldering to copper pipe, you will need to clean the area of the pipe sufficiently by sanding. 3M scouring pads also work well for this operation. Soldering paste/flux will have to be applied to the joint ends to ensure a good joint. Solder a coupling to one end of two of the longer pieces of copper pipe. Next, attach two brass nuts to each of the eyebolts and tighten them against each other. Place the eyebolt assemblies inside two of the end caps and solder them in place using a propane torch. Fill the end caps with solder to cover the brass nuts. Figure 3 shows the eyebolt assembly, anchoring the bungee cord. Make sure you use brass nuts because the solder will not adhere well to steel.

When all the pieces are cut, lay them out, unassembled, as if they were joined. That technique ensures that you don't make any mistakes when assembling everything. You can then start to assemble the antenna and solder the rest of the copper J-pole—two $19\frac{1}{4}$ inch pieces, one elbow (the elbow must be attached to the $\frac{1}{4}$ wave length side), a $2\frac{3}{4}$ inch piece for spacing, the T section and one other $\frac{1}{4}$ wave section. Refer to Figure 1 for guidance—that drawing shows you how the antenna components fit together.

Radiator and Mast Assembly

After basic soldering, what you have will look much like a squared off U. After all the soldering is completed, you will



need to tie a large enough knot in one end of the bungee cord so it won't pull through an eyebolt. Run the bungee cord through an eyebolt, through the other pieces of copper pipe, and place the eyebolt cap in the copper pipe, tapping the copper cap into place. Make sure that the couplings are facing down, so that when it rains the antenna doesn't fill with water.

A view of the bungee cord running through two of the elements can be seen in Figure 4. On the lower support section (below the actual J-pole radiator), you will want to add the last $19\frac{1}{4}$ inch length so you have plenty of room for mounting the antenna to a mast. Run the bungee cord through this section also, and pull it tight...so that it holds all the sections together. With the bungee cord tight, run it through the other eyebolt and tie a knot in it, stuff it back into the pipe, place the cap on the pipe, and tap it into place. *Do not* solder the caps when putting them on the copper pipe because the eyebolts will come loose. These should only be force fitted to the pipe ends.

Feed Point

For the feed point support, use a piece of Plexiglas, cut to $2\frac{3}{4} \times 2\frac{3}{4}$ inches and

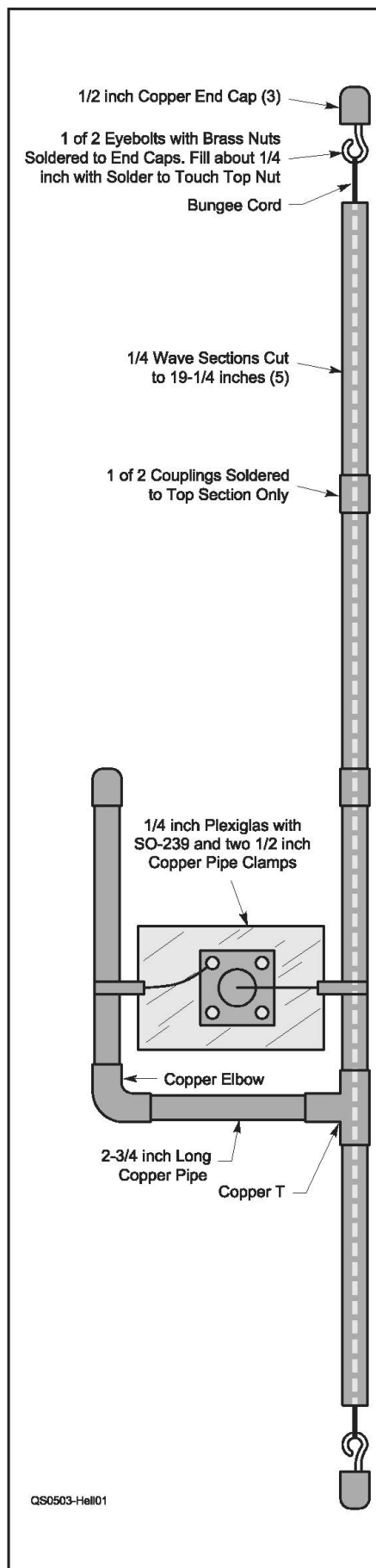


Figure 1—The assembly drawing for the VHF/UHF folding J-pole antenna.

drill a 1/2 inch hole in the center to mount the SO-239 coaxial socket. Refer to Figure 5, which shows the feed point assembly. Before you add the washers and nuts, you may want to clean them off with sandpaper to remove any oxidation. You'll need to place the SO-239 connector on the Plexiglas and mark it for the mounting bolts. Drill the mounting holes, and mount the SO-239 socket, using 6-32 bolts, washers and nuts.

Add the copper pipe clamps to the J-pole radiator (clean the copper pipe and the pipe clamps with sandpaper on the outside and inside, as well as the radiator and stub match), as shown in Figures 1 and 2. You will have to bend them

around the pipe so that you can attach them to the Plexiglas. Mark the location of the holes and drill them out. Replace the pipe clamps and attach them with 6-32 bolts, star lock washers, flat washers and nuts. Cut two short pieces of wire (no. 16 or 14)—I used no. 16 stranded wire. Attach ring terminals on one end of one wire and on both ends of the other wire. Make these wires long enough so that they can go from the center terminal of the SO-239 to a clamp (I used the clamp on the 3/4 wavelength section). Also connect one of the mounting bolts on the SO-239 socket to the other bolt on the second clamp (the matching stub). Keep the wires as short as possible. An

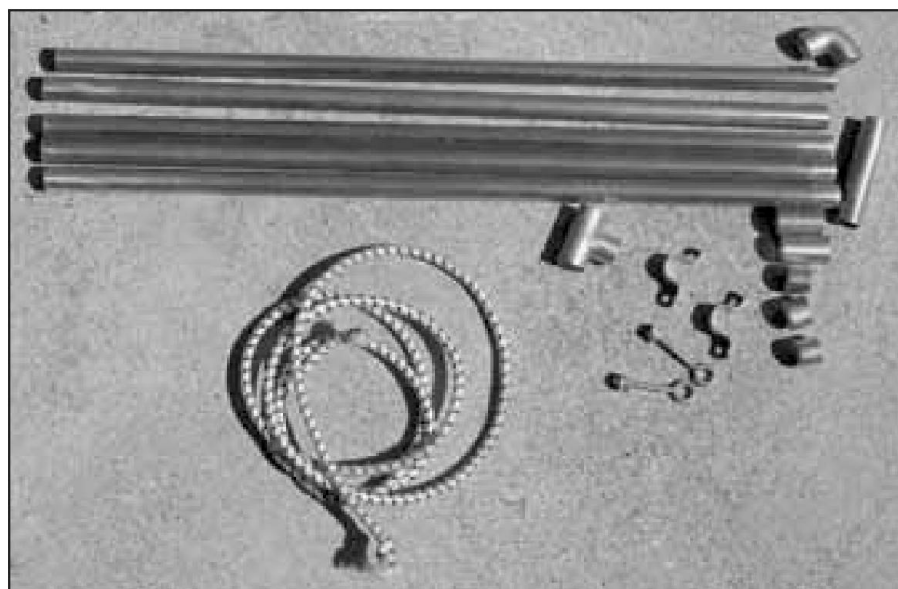


Figure 2—The antenna components—ready for construction.



Figure 3—A completed eyebolt assembly. These serve as an anchor point for the bungee cord.



Figure 4—The bungee cord runs through each of the antenna elements.

alternate method of attachment would be to solder the wire to the pipe clamps. Figure 6 shows the antenna in the process of being folded.

Tuning

Once the antenna is assembled, you can tune for minimum SWR. Start with

both pipe clamps about 3 inches up from the bottom of the radiator and the matching stub and work your way down. You will want to tighten the clamps reasonably well so you get a reliable RF analyzer reading when testing. I was able to get the SWR to 1:1 at 146.6 MHz using an MFJ-269 antenna analyzer. At

446.90 MHz the SWR was 1.1:1. Once the SWR is where you want it, tighten the clamp bolts. You should be able to duplicate these results without too much trouble.

After the antenna is away from surrounding objects, recheck the SWR to see if it has changed. If it has, you will have to adjust again, as surrounding objects and your own proximity to the antenna will affect the SWR. I found it best to loosely tighten the pipe clamps so they are loose enough to move downward by a slight tapping on the Plexiglas support after you make the SWR adjustments, tighten the clamps and recheck the SWR again. You'll want to seal the exposed parts of the SO-239 connector rear with liquid electrical tape to keep out any moisture.² When folded, the antenna measures less than 21 inches long. The completed antenna, ready for packing, can be seen in Figure 7.

The cost of the parts for the folding J-pole is less than \$15. All of the parts were obtained from a local lumberyard and hardware store. I used stainless bolts, nuts and washers because they were readily available. Stainless hardware was about \$6 a pound so I grabbed a small handful of each hardware variety for future J-pole projects. You'll enjoy the portability and ease of assembly of this transportable antenna that's ideal for Field Day, casual operating or emergency use.

Notes

¹The 2 meter J-pole is a third harmonic antenna on 70 cm (432 MHz). As such, it will have a higher radiation angle component on 70 cm than on 2 meters, so 70 cm repeater access will not be optimum for stations far from the repeater.—Ed.

²A cautionary note—the UHF series of connectors (the PL-259 and SO-239, among others) is not waterproof. Make sure you adequately insulate both the plug and socket assemblies of these connectors, especially at VHF and UHF. Scotch 33 electrical tape, liberally stretched over the connector and cable, works well for the PL-259 plug and epoxy or liquid electrical tape (as pointed out here) works well for the SO-239 socket rear.—Ed.

Photos by the author.

Michael Heiler, KA0ZLG, has been a ham since 1987. He is an ARRL member and is the Emergency Coordinator (EC) for Clay County, Minnesota. Mike has an electronics degree from Northwest Technical College in Moorehead, Minnesota, is a Volunteer Examiner and teaches Amateur Radio classes several times a year. Mike works on fire alarm systems for SimplexGrinnell in Fargo, North Dakota. He can be reached at ka0zlg@arrl.net.

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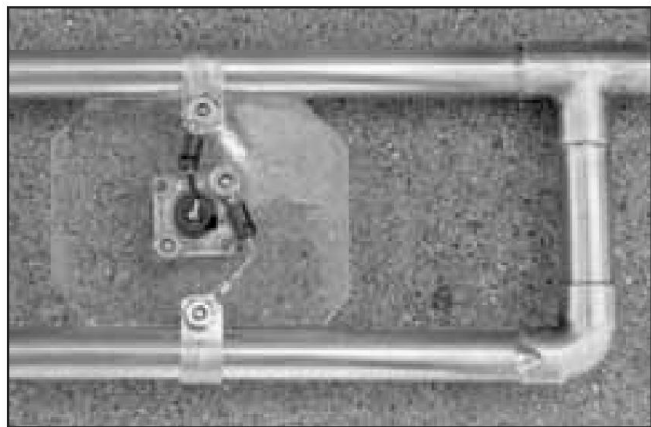


Figure 5—The antenna feed point assembly. The feed point can be slid up and down on the radiator and the matching section to adjust the SWR. The SO-239 socket rear needs to be weatherproofed.



Figure 6—The J-pole in the process of being “folded.”



Figure 7—The completed folding J-pole, ready for packing.