

# DIY

*Worthwhile projects you can build on your own*



## Copper J-pole antenna for 2 meters

One of the most recognized and home-brewed, and yet one of the most maligned 2-meter antennas is the *copper J-pole*, also called the *copper cactus*. This inexpensive and durable antenna is not unlike its successor, the open-stub J-pole (the "Pockrus" J-Pole), but supports only 2 meters, has a slightly longer history, and can be found on many homes throughout the US. The copper J-pole has received some bad press because it's known to produce a heavy amount of common-mode noise, but those effects can largely be reduced by installing an [RF choke](#).

Its construction is attractively simple, consisting only of a few pieces of copper tubing, associated copper joints, a coaxial cable connector, and a stiff wire. For many, this is their first home-made antenna, because it works so well. I've added a pair of copper caps, to give the ends of the tubes a finished appearance. The only challenge to building the copper J-pole is the soldering of the copper joints, which does tend to scare away some well-meaning do-it-yourselfers. Let's see what it's going to take, for us to build one.

The solder kit listed here contains the appropriate propane torch, copper pipe solder, the flux, and the flux brush, all necessary for this project, and yet just enough for a small project like this one. Of course, it can be replaced by the same items that you might already have.

### Parts list

- |  |   |
|--|---|
| 10 feet of <a href="#">1/2" copper pipe</a>          | One <a href="#">1/2" copper tee</a>   |
| Two <a href="#">1/2" copper caps</a>                 | One <a href="#">1/2" copper elbow</a>   |
| One <a href="#">copper solder propane torch kit</a>  | One <a href="#">SO-239 bulkhead connector</a>   |
| 2 inches of <a href="#">12 AWG solid copper wire</a> | One each M3 <a href="#">1" screw</a> , <a href="#">split washer</a> , <a href="#">nut</a> |
- One [pipe cutter](#) and some [sandpaper](#) will be useful tools. [Steel wool](#) is a good copper polisher.

### The construction

If you haven't worked with copper pipe before, 1) clean and polish (with steel wool), and flux all joining surfaces; 2) use a tube cutter to keep the tubing round; and 3) de-burr all cuts (with sandpaper.) Cut three pieces of the copper tubing, one 18 1/2", one 60 1/2", and one 2" long. Use the remaining copper tube as a mast.



Clean and polish about 1" of each end of each tube, including one end of the mast tube. Clean and polish about 1/2" inside the ends of the elbow, the tee, and the caps. Use the flux brush to smooth on a layer of flux over each cleaned surface, completely covering the join surfaces. Assemble all the copper pieces together, and solder-weld each joint. After the joints cool, scrub the solder with warm water (no soap), to remove the excess and burned flux.

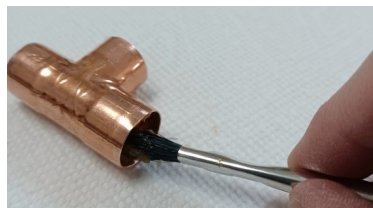


# DIY, continued

## Copper J-pole antenna for 2 meters



*Fluxed outside surface*



*Inside too*



*Solder-welded cap*



*Solder-welded joint*



*Solder-welds complete*



*Lay down the connector*



*Drill the hole*



*Solder the wire and bolt the connector*



*The finished product*



# DIY, continued

## Copper J-pole antenna for 2 meters



Cut a 2" piece of 12 AWG solid copper wire (can be insulated or bare). Bare about 1/4" off each end, and *quickly* solder one end into the solder cup behind the center pin of the SO-239 bulkhead connector. Soldering it *quickly* will require 1) a hot (greater than 60-watt) soldering iron, 2) tinning the iron before you apply the heat, and 3) applying the heat only long enough for the solder to flow between the wire and the solder cup. Afterwards, I slipped and heated a piece of heat shrink tubing over the solder cup joint to give it a slightly cleaner look.

Lay the side of the SO-239 bulkhead connector body on the 18 1/2" tube, with the wire laying on the 60 1/2" tube, and positioned about 2 1/4" away from the 2" tube. Many do-it-yourselfers tend to mount the SO-239 bulkhead connector such that the center conductor is attached to the shorter ("stub") tube, but **tests show the antenna tends to exhibit better gain with the center conductor attached to the longer side instead.**

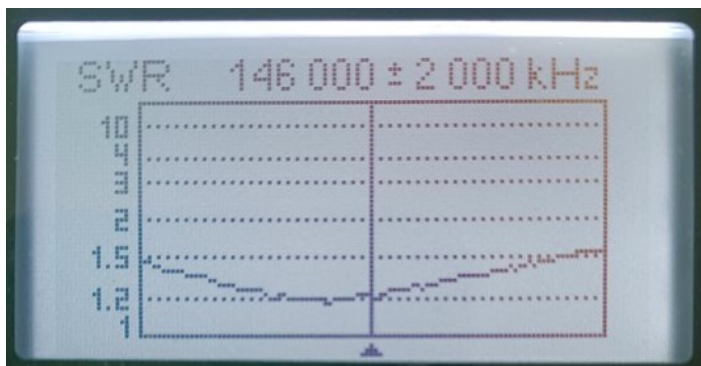
Rotate the bulkhead so that only one of the four mounting holes is over the 18 1/2" tube, as shown on the previous page. Drill a 1/8" hole through that mounting hole, and through both sides of the tube. Use the long M3 machine screw, lock washer, and nut to bolt the bulkhead to the 18 1/2" tube. Solder the wire to the 60 1/2" tube.

### Test time

Properly testing the copper J-pole will require two environmental modifications, installing an **RF choke** and moving away from conductive objects. To create an RF choke, simply coil up your coax into an eight-inch diameter of six turns of the coax. After creating and connecting the choke, make sure no part of the choke is higher than the 2" tube. The easiest way to move away from conductive objects is to go outside, drive a 3-foot piece of metal rod into your yard, and slip the mast of the copper J-pole antenna over the rod. Then, connect your analyzer or radio at least eight feet away from the antenna before testing.



*Almost ready for testing*



*I think that turned out alright*

### Summary

The copper J-pole antenna is a classical favorite homemade antenna, because it's easy to make and works well. But it does have some inherent issues to address before installing, using, or testing it. Be sure to form an RF choke with the coax when installing the antenna. Total cost is \$30 for the parts and \$35 for the propane torch kit.

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