# 450 Ω Ladder Line J-Pole for 144 and 440 MHz

## Build a J-pole that resonates in both the VHF and UHF bands.

**Fred Delaney, K1DU**

There are many applications for a dual-band antenna like this one. It could be used for special event stations or as an attic antenna for hams who can't put up an outside antenna due to deed restrictions. The list goes on. This antenna can be used on 2 meters and 440 centimeters, and it is inexpensive and easy to build.

### About the J-Pole

I built two J-poles out of 450 Ω ladder line (see the lead photo), one for home use and one backpack version for camping. This J-pole is a ¾-wavelength element with a ¼-wavelength matching stub that operates as an end-fed half-wave antenna. It does not require any radials, and when hung vertically, it has an omnidirectional gain of 2.2 dBi.

The ¾-wave element, in inches, is 8,856 times the velocity factor (VF) divided by the frequency in MHz.

The ¼-wave stub, in inches, is 2,952 times the VF divided by the frequency in MHz.

The VF is the ratio of the speed of propagation in the transmission line to the speed in free space. Here, the VF is 0.91, so the dimensions are:

The ¾-wave radiator is 8,856 × 0.91 / 146 = 55.198 inches, or 55 3/16 inches. The ¼-wave stub is 2,952 × 0.91 / 146 = 18.399 inches, or 18 3/8 inches.

### Construction

Cut a piece of ladder line to 57¾ inches long, as shown in Figure 1. Measure 4 inches up from the end and strip the ladder line down to bare wire. From the same end, measure up 20¾ inches, and cut one of the ladder line conductors. This is the stub. Cut out the wire and webbing above the cut, but leave a small piece of webbing near the top for hanging the antenna.

You should end up with 53¾ inches of insulated wire on one side (the radiator) and 16¾ inches of insulated wire on the other (the stub). Right at the point where insulation ends, attach 2 feet of RG-58. Solder the center conductor to the radiator and the shield to the stub. Take a

1-inch-diameter piece of PVC pipe and wind six to eight turns of the coax for an RF choke. Use electrical tape to hold it on the form. This choke will keep RF from traveling down your feed line (see Figure 2). Fit a PL-259 connector to the coax beyond the choke.

Cut a 3-inch piece of wire from the excess wire you cut off, and strip it clean. This is the shorting bar. Use a pair of needle-nose pliers to form a loop, and slide the wire on the 4-inch stripped wire on the antenna. Place it 2 inches down from where you attached the coax, and crimp it. Now, form a loop on the other side of the shorting bar around the other leg of the antenna, making sure it's the same length down from where the coax is connected, and crimp it. Do not solder at this time.

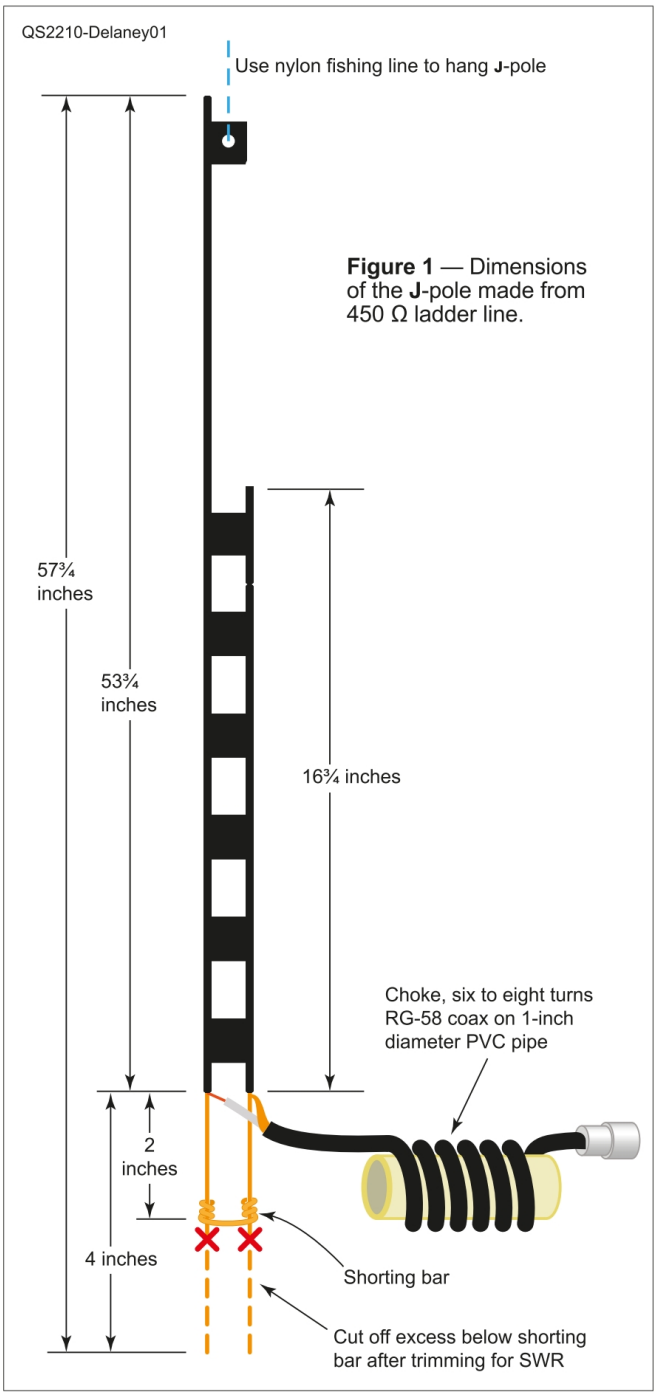


**Figure 1** — Dimensions of the **J**-pole made from 450 Ω ladder line.

## Adjusting for Low SWR

Now, adjust for the lowest standing wave ratio (SWR). The goal is to get a 1:1 SWR in the middle of the band at 146 MHz, so it will also match with SWR = 1.2:1 at 446 MHz. If you match with 1.1:1 at 144.300 MHz, it will also match at 435 MHz, which is below the 70-centimeter repeater band. There are two ways to match this antenna: trim the elements, and slide the shorting bar. I made a template diagram from my first antenna with correct dimensions, then cut my second **J**-pole to the template, and I didn't even need to move the shorting bar.

**Figure 2** — The **J**-pole feeding end is on the lower left, and the choke is on the right. [Fred Delaney, K1DU, photo]

When first cutting the ladder line to obtain a match, cut it longer than needed. Cut the elements at a 1:3 ratio. For example, cut ⅛ inch off the stub and ⅜ inch off the radiator until you are close, and then move the shorting bar for fine adjustment.

Connect an SWR meter at the antenna between the coax stub coming from the antenna and the feed line. Read the SWR at 144.300 MHz and at 147.300 MHz. For example, if you have a 1.1:1 SWR at 144.300 MHz and 1.6:1 at 147.300 MHz, then your antenna is long. Move the shorting bar toward the coax connection to shorten the antenna. If the opposite is true, then your antenna is short, so move the shorting bar toward the end of the antenna to lengthen it. When you have obtained a good SWR match, solder the shorting bar in place. Cut off the excess wire.

You can use any length of coax with the **J**-pole. When operating the **J**-pole, keep it away from other objects, because it will couple and degrade the performance. When I enclosed mine in a PVC pipe, the SWR degraded to 2.1:1, but you can still run up to 10 to 15 W with most radios. With the unenclosed non-degraded version (no PVC), there is no problem running up to 50 W. [Be sure to perform an RF exposure assessment with this antenna. — *Ed.*]

Fred Delaney, K1DU, has been a licensed amateur and ARRL member since 1980. He operates CW, RTTY, FT8, satellites, and some SSB. He has built many Heathkits, as well as his own circuits and antennas. Self-taught, he relies on his very big library of ARRL books. Fred has been an ARRL Field Day coordinator for two clubs for many years. Professionally, Fred has been a precision sheet metal tradesman and certified welder for more than 40 years. You can reach Fred at **1980k1du@gmail.com**.

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