

2 Meter Half-Wave J-Pole Antenna From 450 Ohm Ladder Line

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This is a good rainy day antenna project for those of you who would like to home brew a nifty low profile 2-meter antenna. Also, good to keep in the vehicle along with your go kit, in the event you are a volunteer emergency communications volunteer.

The antenna costs almost nothing to construct and should handle up to 50 Watts of power. The antenna is broad-banded and should therefore provide a low SWR across the entire 2-meter band.

A J-Pole antenna is a half-wave vertical fed at its base through a shorted quarter-wave stub acting as a transformer matching section. This is necessary because feeding a half-wave antenna at its end presents a very high feed point impedance of several thousand ohms – much higher than the 50 Ohm impedance required by a typical Amateur Radio transceiver. A shorted quarter-wave transformer section has the ability to match a low-impedance feed line (50 Ohm coax in this case) to the high impedance end feed point of the antenna, if the 50 Ohm feed line is tapped to the quarter-wave matching section at the appropriate 50 Ohm point (near the shorted end, which would be the low-impedance end of the shorted matching transformer).

The materials you will need are:

- 59 inches of 450 Ohm ladder line;
- Several wire-wrap ties;
- One ring terminal connector;
- One PL-259 connector and coax (RG-8X or RG-58) length to be determined by your specific needs;
- A small tube of clear silicone; and
- Electrical tape or cable ties for constructing feed line RF choke(s)

I used the 450-ohm ladder line that was stranded. Some articles call for solid conductor but I find the solid conductor doesn't hold up over time and use as well as the more flexible stranded line.

Step 1: Strip $\frac{3}{4}$ inch of insulation from both wires at one end of the 450 Ohm line and fold the copper wires toward each other, wrap and solder together.



Step 2: Measure $1\frac{1}{4}$ inch up from the shorted end of the 450 Ohm line and strip back the insulation, on both wires $\frac{1}{2}$ inch above and below the mark $1\frac{1}{4}$ inch from the shorted end. You'll use this area to connect the coax feed-line and you may have to move the feed-point up or down to achieve a good 1.5:1 or lower impedance match to the coax.

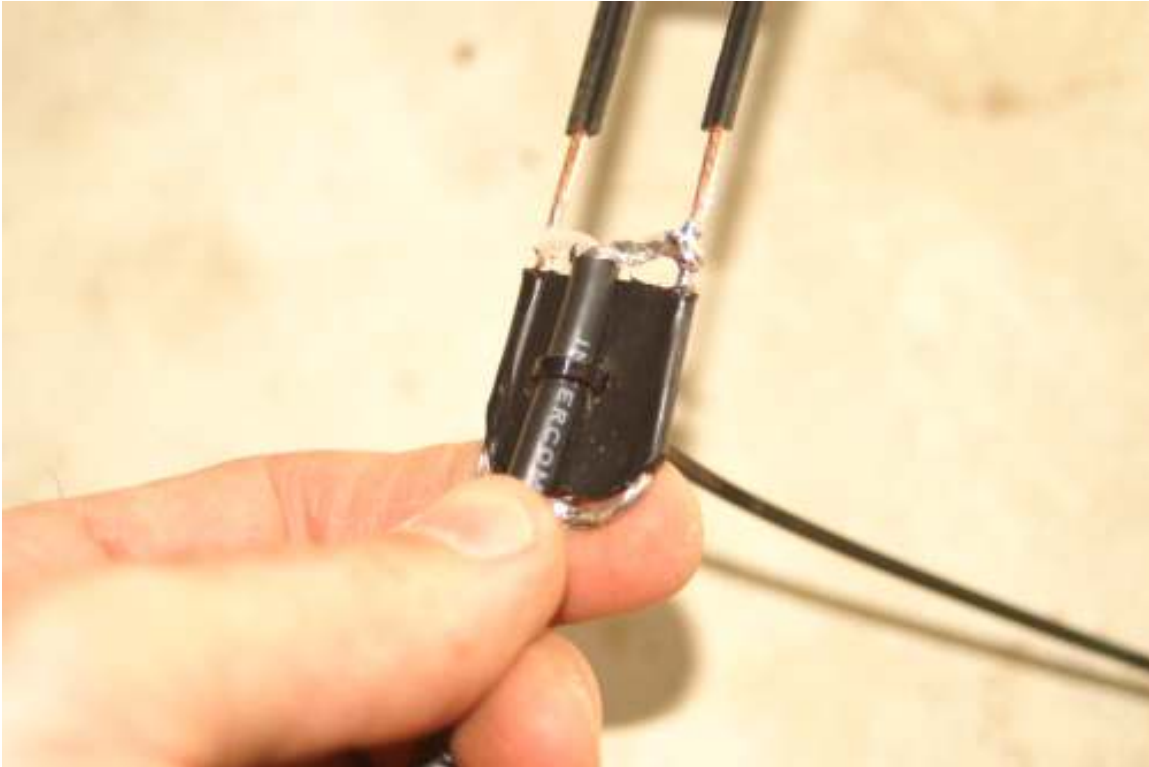
Step 3: Measuring from the shorted-end, go up $18\frac{1}{2}$ inches (this is the lower quarter-wave transformer matching section that will feed the half-wave radiating section of the antenna. At the point $18\frac{1}{2}$ inches from the shorted end cut one of the 450 Ohm balanced wire lines and remove it completely along with the ribbon insulator spaces so you are left with a single wire about $39\frac{1}{2}$ inches long. This is the half-wave element that will serve as the radiator.



Step 4: Solder a ring terminal connector onto the end of the radiator wire element (see photo below). Remember that this metal terminal becomes part of the antenna so slide the wire element into the terminal clasp so that the end of the terminal is flush with the wire. Crimp and solder the terminal. Remove the excess wire scrap. It is through this terminal that you can insert a piece of weed-whacker line to put the antenna up into a tree or you can use nylon cord or other non-metallic line. You can also use a nylon tie-wrap through the terminal connector for use with a larger rope.



Step 5: Install the coax feed-line, adjust for lowest SWR reading, solder, seal the coax with silicon and use a tie-wrap to secure the coax to the 450 Ohm matching section.



Step 6: A coiled coaxial RF choke should be formed in the coaxial feed line, hanging an inch or two below the feed point so it just clears the shorted bottom of the matching section. Since the antenna system is being balanced fed with unbalanced coax, it is highly likely that stray RF will travel back down the feed line. This will both distort the antenna's radiation pattern and possibly travel down to your radio. To form the inline choke, wind four 3 - 4" diameter turns of the feed line coax, taping the windings together. The choke should hang just clear the bottom of the matching section, keeping the length of coax between the feed point and choke as short as possible. A second choke could be fashioned in the feed line as it enters the shack to keep any remaining stray RF out.

Note: It has been published elsewhere that if you want a bit more gain you can increase the radiator section length to 49 1/4" to create a 5/8-wave antenna. Construction of an effective 5/8-wave antenna requires that the electrical length of the radiator not exceed 5/8 wavelength, as the percentage of high angle signal radiation increases rapidly as the radiator exceeds 5/8-wave electrical length, with most of the signal being radiated at uselessly high radiation angles at the expense of useful low-angle radiation. Since the J-Pole method of construction has no ground plane or radials at the junction of the matching transformer section and radiating element, the J-Pole antenna does not have a clean, easily determined radiating section length and the matching section can tend to radiate as well to some degree due to unequal opposing currents in the matching section. This tends to increase the radiating section's electrical length to be longer than the intended physical length, allowing a J-Pole antenna with a radiating section physically lengthened to 5/8-wave (49 inches) to actually be radiating over a considerably longer length, therefore radiating most of its power at useless higher angles and causing it to fall considerably behind the classic half-wave J-Pole design in performance. The classic

half-wave J-Pole design as described in this article is therefore recommended for creating a more dependable result.

L. B. Cebik W4RNL has an excellent discussion of J-Poles and this anomaly in his article *Some J-Poles That I Have Known (Part 4: Some Things We Can and Cannot Do With a J-Pole)* at <http://www.cebik.com/vhf/jpl.html>. At the conclusion of Part 4 regarding the construction of lengthened J-Poles he states, *“The upshot is that the possibility of making a longer J-pole in non-standard form does not yield the benefits of lengthening a vertical monopole over a buried ground plane. The J-pole configuration tends to increase high angle radiation so as to negate the value of the added radiator length.”*



Results with this J-Pole antenna may vary. ARPSC provides this material for informational purposes only and cannot guarantee results.