the SIMPLE 2m/440 Copper pipe "J"

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Can you use a pipe cutter or a hack saw, can you solder – then here is how to build a SIMPLE ”J” antenna that will more than double your 2 meter (and even 440) performance!

The "J" antenna goes back many years, long before I became a ham. There are a bunch of reasons why you're going to want to build one of these beauties:

“J” has the lowest angle of radiation,
“J” requires *NO* ground plane;
“J” is very easy and inexpensive to make;
“J” has great performance for mobile, marine, or base operations;
This “J” design can be used as a dual-band’er - 2m/440.

Technical:

The basic "J" is reported to have >3dB of gain over a ¼ λ ground plane antenna and 6dB over an isotropic (theoretical) antenna. The "J" can be made from almost any material: copper pipe, steel whips, and even 300 ohm TV twin-lead.

Technically, the "J" antenna is an end-fed ½ λ antenna that uses a ¼ λ matching stub. Old-timers call it an "end-fed Zepp", bent 90°. In actuality, the conductor is ¾ λ long and the matching section uses the bottom ¼ λ. The matching stub creates the tuned ½ λ length antenna.

Due to the matching section acting as the matching transformer, the ½ λ radiator sees the lower ¼ λ matching section as an image of a false ground plane. In best terms, the "J" is a balanced ¼ λ matching stub feeding an unbalanced ½ λ load.

The feed-lines to a "J" can be almost anything (ladder line to coax). However, in experimentation, I found RG-58/U coax to be best when used at odd ¼ wave multiples.

A “J” is the best for mobile and marine application where you want the most distance across relatively flat ground/water. A 5/8 or ¼ λ antennas have a higher angle of radiation and need to be centered on a good ground plane eliminating gutter or vehicle edge mounting to obtain optimal performance. A "J" requires NO additional ground plane.

A “J” has an exceptionally low, to nearly flat, angle of radiation of about 0-2 degrees. The 5/8 λ has about a 3-6 degree radiation angle and the highest radiation angle comes from the ¼ λ that has about 4-10 degrees. These two antennas are usually better for mountain top (a few thousand feet elevated) repeater site use but will fall far short of a “J” in overall flat-land transmitting distance.

The pictured “J” is at 60’ on top my tower in Manitowoc, WI. I can now hit repeaters across Lake Michigan, Milwaukee, or Upper Michigan that are well over 85 miles away.

Parts:

The antenna pictured here is made from one 10’ piece of thick wall ¾” rigid copper pipe, one ¾” copper pipe “T”, one ¾” copper pipe 90° elbow, and three ¾” copper pipe caps, one SO-239 connector, and a 3” piece of 1/8” solid brass brazing rod (from a local welding supply company). These parts, plumbers flux, plumbers solder, and propane torch can be obtained at most hardware stores. Using copper pipe makes it easy to solder and snap to assemble. These materials will withstand a lot of abuse and weather. **Total cost of this antenna was about $9.00.**

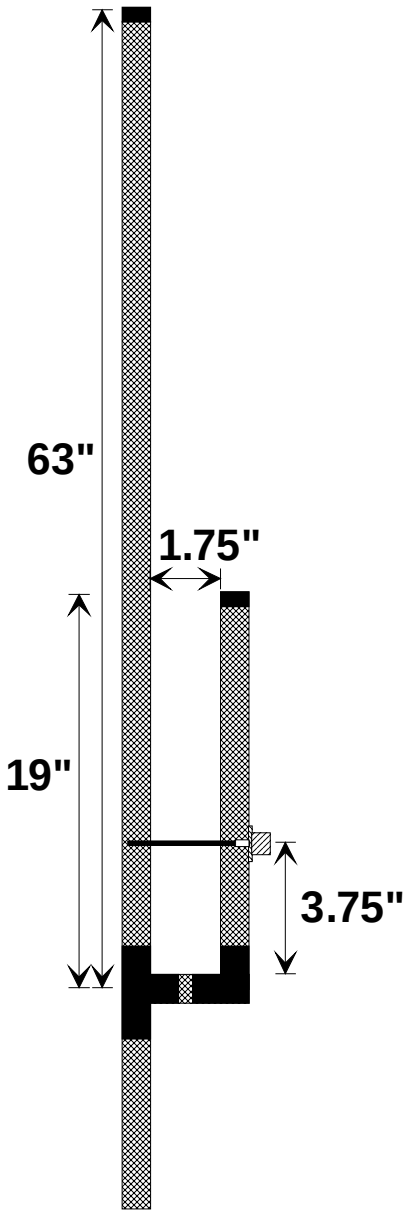
I use ¾” thick wall Type K or L) copper pipe due to my ½” copper pipe “J” was bent in a 59MPH wind gust. The ¾” thick wall is much stronger! Theoretically, the ¾” pipe should exhibit a broader bandwidth but I’ve not measured any difference from ½” pipe “J”.

NOTE - about dimensions:

I’ve seen numerous articles on “how-to” build a “J” antenna with various dimensions. Everyone seems to have the secret of the optimal “J” design dimensions. I’ve made many “J” antennas and nearly everyone I’ve ever made has NEVER operated like the previous built “J” – they all required some tweaking to obtain “my perfectionist requirements” near 1:1 VSWR as possible! However, in general if you follow the dimensions I’ve included here you will have an antenna that will be less than 2:1 VSWR and more like 1.5:1 VSWR across the 2 meter band.

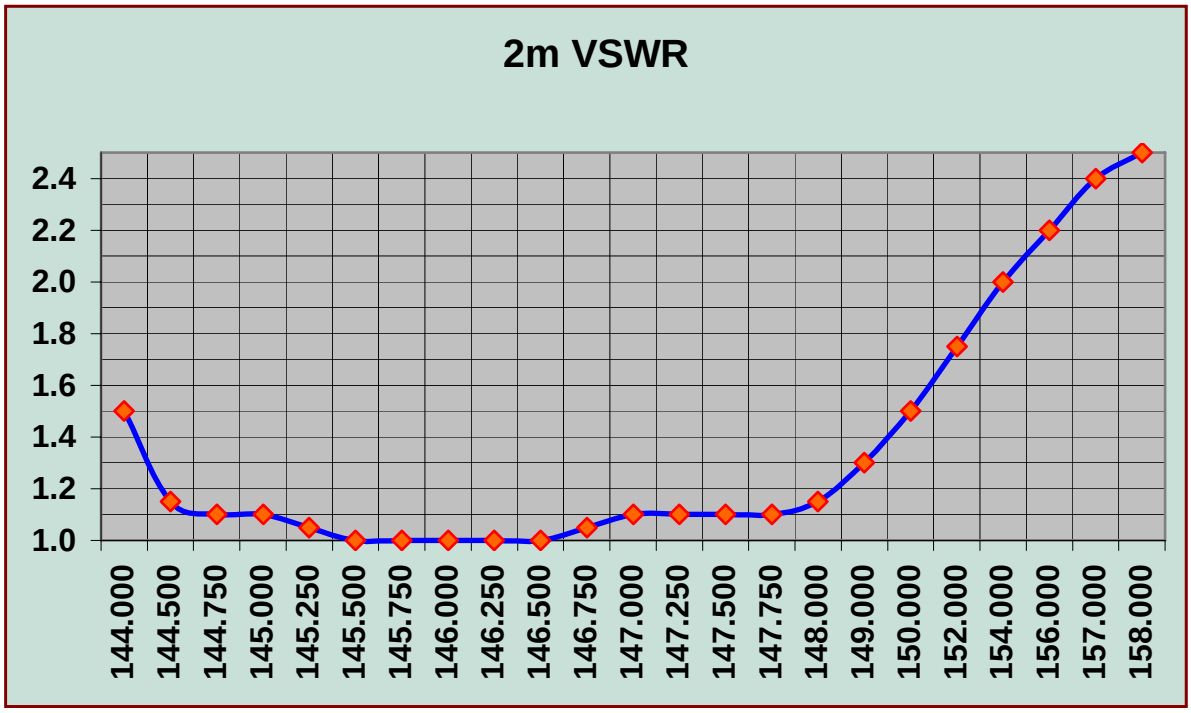
Recently, I’ve been experimenting with the basic “J” dimensions; I have found that a 2m J length of 63” really enhances the 440 band operation (63.1”=2.5λ at 445). The trade-off on 2m is an enhancement of a much wider bandwidth and an overall lower 2m VSWR. My J design dimensioned here is really great for single feed dual band operations!!!

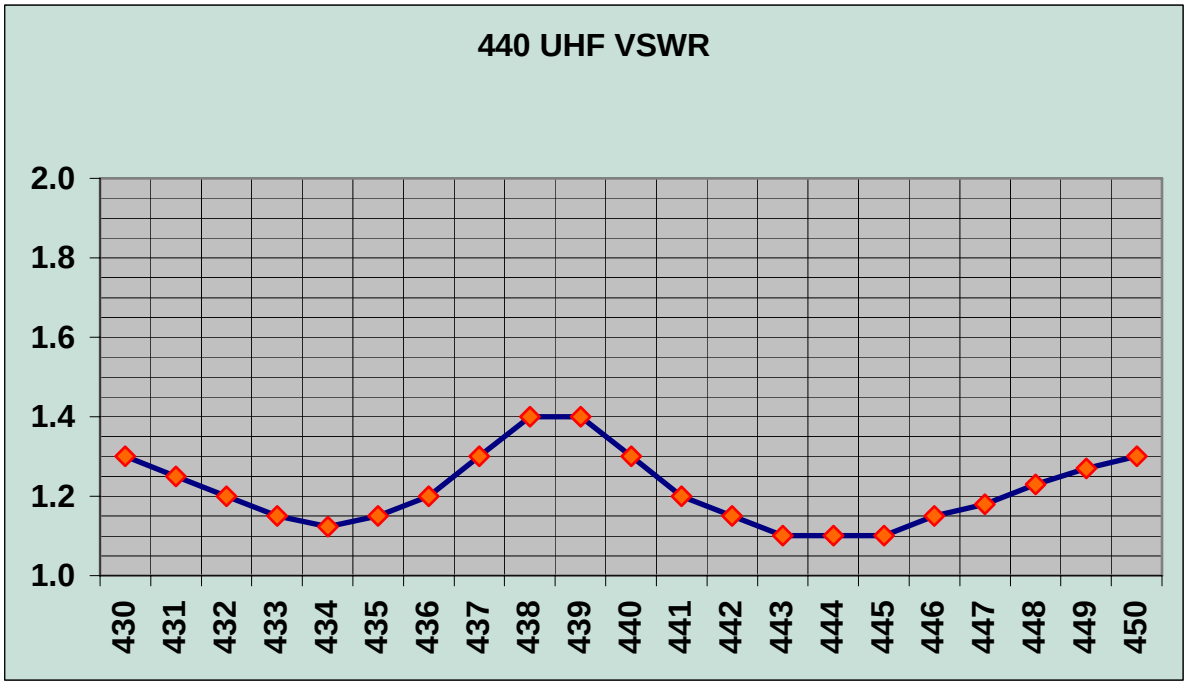
Building: Basic dimensions for a 146.000 MHz. ¾" rigid copper pipe "J"



NOTE: Additional testing after creating this article I found that flipping the connections will improve 440 performance. Connect the coax center (brass rod) to the "short" element and attach the SO-239 to the long element for optimal performance.

2m ¾” Copper pipe “J” Performance Data



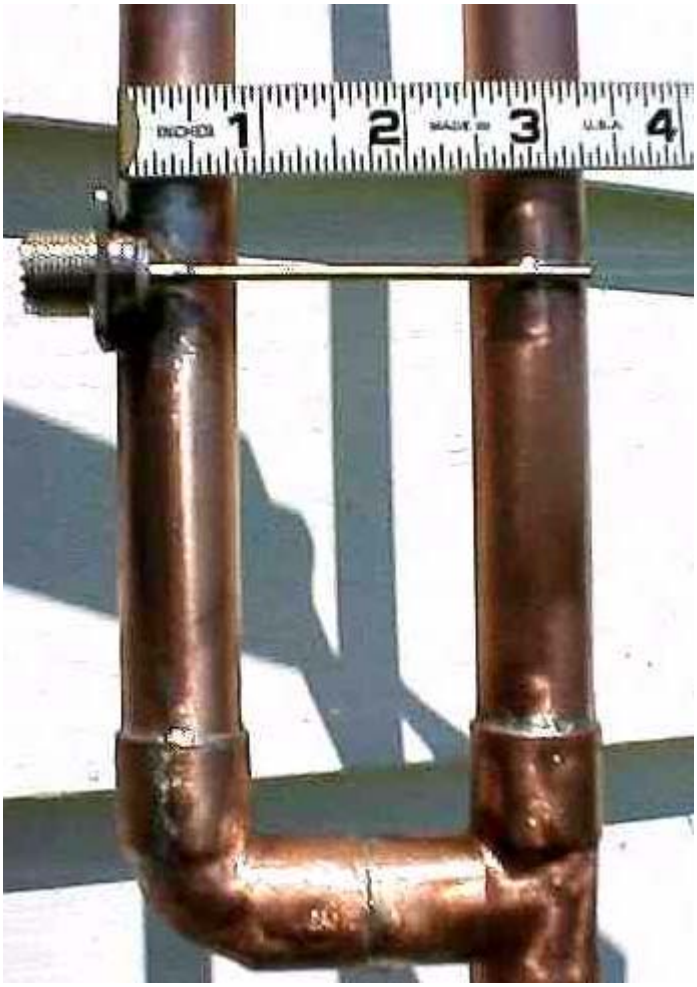


Feed point:

The difference of this design over my previous designs is the change to the feed point attachment method. I did not like soldering the coax wires directly to the copper pipe these wires were exposed to the elements. The coax got very brittle, the center dielectric crack, and the coax eventually got water logged.

I experimented using a brass brazing rod. I've seen designs with the coax center conductor attached to the ¼λ element or the ¾λ elements. I found the best performance was to attach the coax center/brass rod to the ¾λ element solder the brass rod to the ¾λ element. Place the SO-239 into position and measure the rod then cut the rod accordingly. Sand off the finish of the backside of the SO-239 and tin this area. Insert the brass rod into the center conductor of the SO-239. Solder the SO-239 to the ¼λ matching element. Make sure the brass rod/center conductor is NOT touching the ¼λ matching element. Finish by soldering the brass rod to the center conductor.

NOTE: BEWARE of your heat used when soldering the SO-239 to the "J" or the center conductor insulator in the SO-239 will melt away or go off center!!!



In conclusion:

I have found that the length of the attached coax does have an affect on the J's VSWR. Multiples of odd ¼λ lengths seem to minimize these coax affects. I have pruned off 3" pieces of coax in the HAM shack to bring the VSWR back to the 1:1 tuning the antenna was setup at. On VHF/UHF the VSWR variances are very susceptible to the *consistency* of the coax velocity factor and quality.

I've used copper pipe "J" in an apartment placing the antennas in the corners of the living room or hanging the "J" from curtain rods behind the curtains. I've even made a corner hat & coat rack from a copper pipe "J".

The "J" offers the foundation for a stealth antenna by placing the antenna in PVC with an angled mounting box - the antenna can look like a gas/sewer breather pipe on the roof of CCR restricted house. NOTE: PVC/ABS/plastic will affect the J's VSWR.

The TV twin lead "J" is the "BEST" hidden transmitter hiding antenna I've ever used. It can be wrapped around branches of a tree or laid on top tall grass next to a riverbed emitting complex angles of various polarizations that caused extreme multi-path. I've enclosed a TV twin-lead "J" inside a black ABS/white PVC pipe and buried the antenna and "T" just under the surface of the ground near a wire fence. The wire fence ran through the Puente Hills; the fence parasitically re-radiating the 2 Watt signal for considerable distances in either direction, add to this the limited access to the area and the hunters were totally confused for many hours. I've taken this same PVC antenna and "T" creation and put it underwater in a creek – now that was fun to watch the hunters not wanting to get wet but wanting to win. (Note: PVC will detune an open air tuned TV twin-lead J.)

I take a wire wheel and steel wool to make my copper "J" antennas giving them a near military shine. Then I put multiple coats of Varithane (non-UV type) spray or Marine Spar varnish over the entire antenna - this will keep the antenna bright and tarnish/rust free for years. I even do this to my aluminum beams.

Other very good "J" antenna designs published in 73 Magazine have been;

Copper Cactus (2m) J-Pole by KE7AX, February, 1992.
220 Super J-Pole Antenna by KA0NAN, May 1996.
440 Super J-Pole Antenna by KA0NAN, April 1996.
Simple J-Type 10m Vertical by W6IOJ, Sept. 1995.
Copper Dual-Band Super J-Pole Antenna by KA0NAN, April 1993.
(can not obtain good VSWR on 440 but the 2m gain is outstanding – about 6dbd worth!)

EXPERIMENT, create you own unique designs the "J" is a very forgiving, yet, robust and fundamentally versatile antenna that can let YOU put the technical design, development, and building accomplishments back into HAM radio.