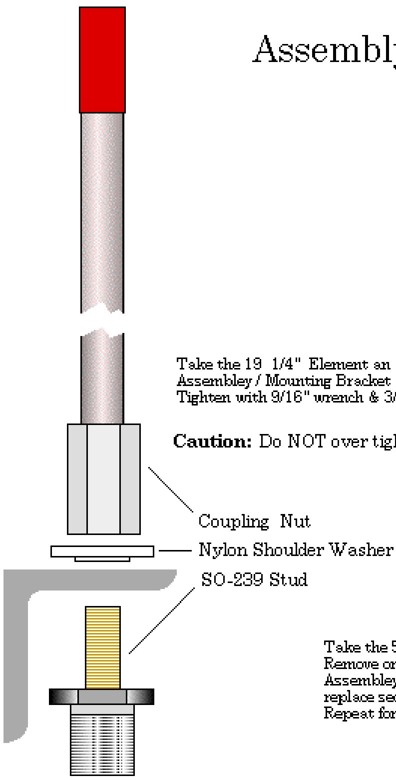
Chuck W4CLL

Open Stub J-Poles

Packing List

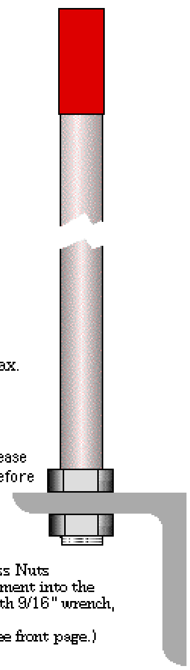
Part	Description
	3/8" X 19 1/4" Element with Coupling Nut
	3/8" X 6 1/4" Element with 2 Stainless Nuts
	3/8" X 57 1/2" Element with 2 Stainless Nuts
	1 1/2" X 1 1/2" X 5 1/2" Assembley / Mounting Bracket
	SO-239 Stud
	Nylon Shoulder Washer

Assembly Steps

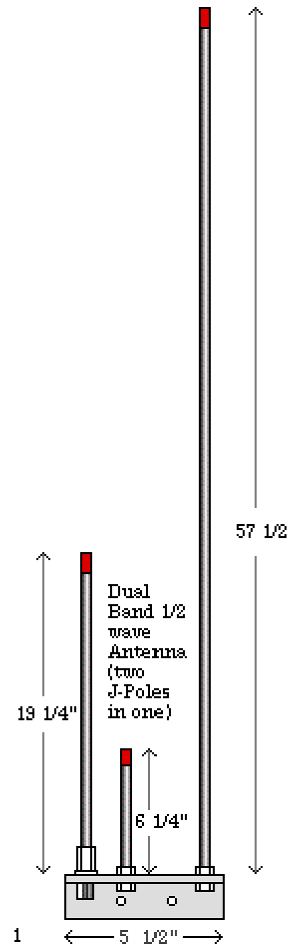


Take the 19 1/4" Element an attach it to the Assembley / Mounting Bracket
Tighten with 9/16" wrench & 3/4" wrinch.

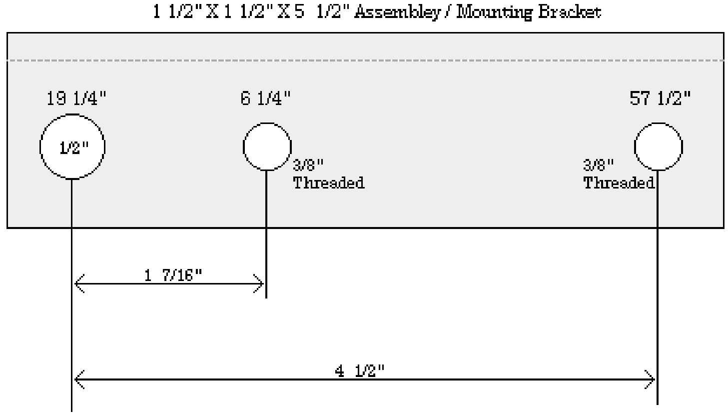
Caution: Do NOT over tighten. About 30 Ft. LB Max.



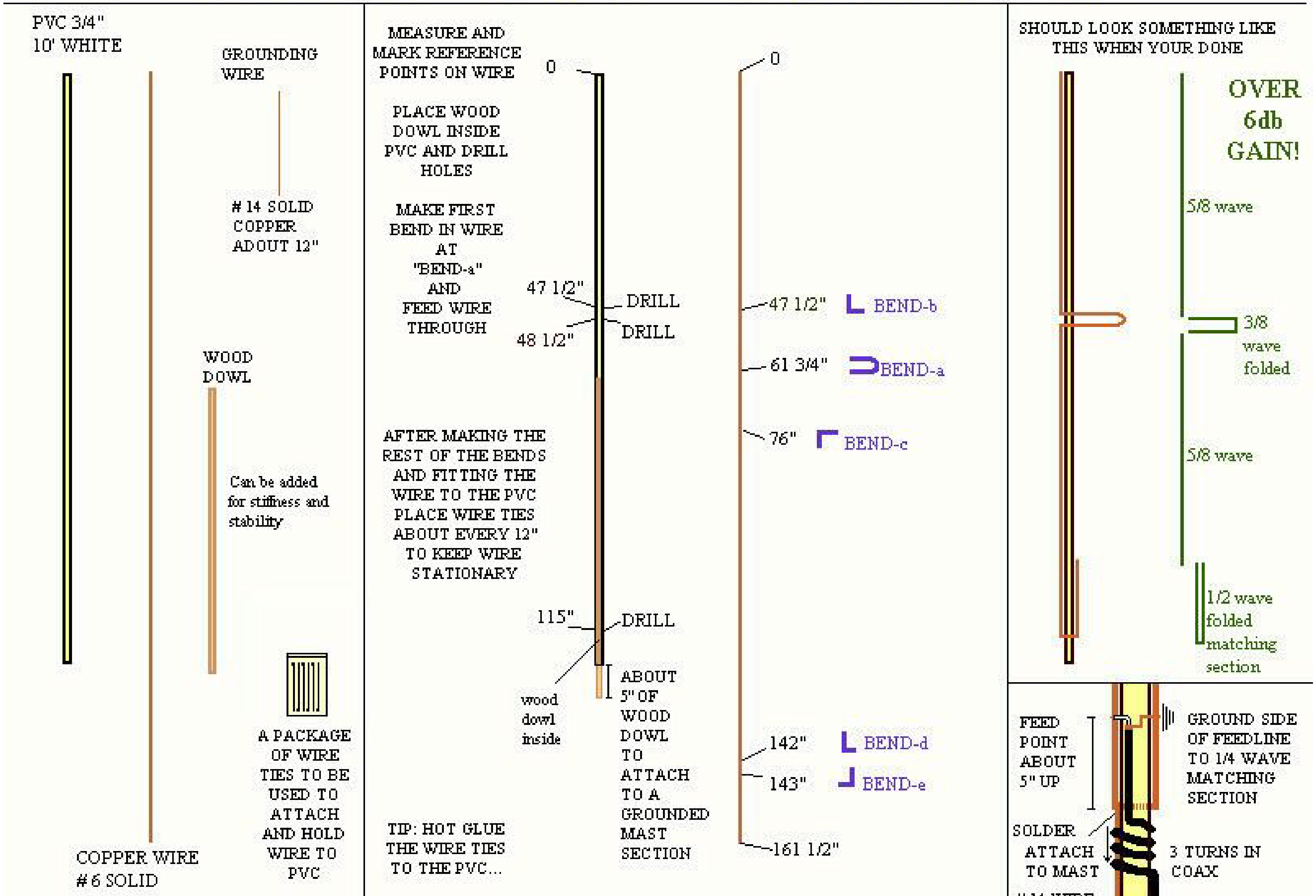
Take the 57 1/2" Element with 2 Stainless Nuts
Remove one of the nuts and screw the element into the Assembley/ Mounting Bracket, tighten with 9/16" wrench, replace second nut and tighten it.
Repeat for the 6 1/4" 440 element. (see front page.)



1 1/2" X 1 1/2" X 5 1/2" Assembley / Mounting Bracket



YOU CAN BUILD A 5/8th WAVE STACKED J-POLE FOR ABOUT $20.oo!



Steven W. Merrill KB1DIG E-mail: buckØ@mediaone.net

Build a 2 Meter, 5/4 Wave Antenna
By Mike Martell N1HFX

Many RASON members truly enjoyed last month's collinear antenna. This month I decided to build a 2 meter 5/4 wave antenna. This antenna is unique in that it is enclosed entirely in 3/4" PVC which makes the design a little more complicated. The primary problem is that PVC tubing has a significant velocity factor which causes RF to slow down. This means that an antenna encased in PVC will normally need to have it's physical length reduced by about 19%. To further complicate the design, a 5/4 wave antenna's impedance has a highly inductive component which must be tuned out to get a good match. Fortunately, the design in Figure 1 solves all of these problems.

This antenna is made with the following components:

- About 2 feet of outdoor type 300 ohm TV twin lead (Used for matching system.)
- About 5 feet of #18 stranded insulated wire (Used for radiating element.)
- About 5 feet of RG58/U coax
- One PL259 Connector
- One PL259 female to female coupler
- About 8 feet of 3/4" PVC tubing. (normally sold in 10 foot lengths)
- Two 3/4" PVC end caps
- About 8 feet of 1/4" hardwood dowel (normally sold in 4 or 5 foot lengths)
- About 25 small tie wraps
- Miscellaneous PVC cement, solder, small piece of tubing, etc.

The twin lead was originally cut for 20 inches with 4 7/8 inches cut back on the braid or ground side. The #18 insulated wire was cut to exactly 57 3/4 inches. The overall length of the antenna assembly is 77 3/4 inches. This indicates a velocity factor of about .81 compared to a normal 5/4 wave 146 Mhz antenna. See calculation below:

$$234 * 5 / 146 \times .81 = 6.49 \text{ feet or about } 77.88 \text{ inches}$$

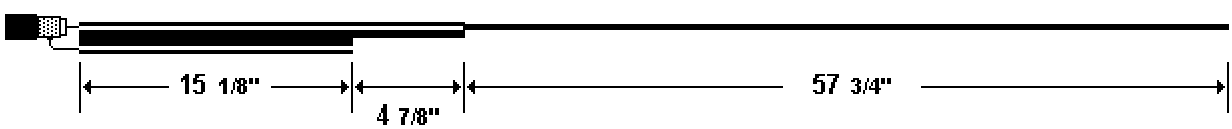


Figure 1

Now that we have all our parts, lets begin assembly by cutting back the insulation of the coax and the TV twin lead. We will need to cut back the coax to expose the center conductor as well as part of the braid. It is a good idea to lightly thin the braid with solder to prevent any strands from shorting out to the center conductor. Solder the center conductor to one end of the twin lead and solder the braid to the other end off the twin lead as in Figure 1. Notice the braid of the coax is soldered to the shorter part of the twin lead which is left open. This serves as our matching system which adds capacitance to our antenna to offset the inductive component of the antenna. Trim the twin lead to 20 inches and solder about 60 inches of #18 stranded wire to the twin lead as in Figure 1. The insulation should not be removed except as necessary for soldering.

Prepare the 1/4" hardwood dowel by joining two 4 or 5 foot lengths together. The ends can be joined by crimping a 1 inch length of 5/16" aluminum tubing or using a good quality wood glue. Now attach the coax, twin lead and wire assembly to the 1/4" dowel using tie wraps about every 3 inches. Pull the twin lead and wire to keep it as straight as possible. Before attaching the PL259 connector to the coax, drill a hole in one of the PVC end caps and slide it over the coax to prepare for permanent mounting in the PVC. Now attach the PL259 connector as well as any other connectors needed to check SWR. Cut back the open end of the twin lead to about 16 inches as in Figure 1.

Now we are ready for final tuning. Slide the antenna, dowel assembly inside the 3/4" PVC first. All SWR readings must be taken with the antenna, dowel assembly inside the PVC tubing or the antenna will appear electrically shorter than necessary. Check SWR on both the top and bottom edge of the band. If the SWR is higher at 147.995 Mhz than at 144.005 Mhz then the antenna is too long and should be shortened. Cut off no more than a 1/4" at a time of the #18 wire. Also, trim the open end of the twin lead by no more than 1/8" at a time to further lower SWR. Remember the twin lead is simply a matching system which changes impedance and has no real effect on the electrical lengh of the antenna. The final lenghs of the #18 wire and twin lead should very closely resemble those listed in Figure 1. The prototype antenna achieved SWR readings of less then 1.2 to 1 across the entire 2 meter band. Remember to keep the antenna away from metal objects when checking SWR.

After the antenna is properly tuned, trim the antenna dowel assembly to about 7 feet. Leave a few inches of coax attached to the bottom of the dowel so that the mast will be away from the twin lead portion of the antenna when mounted. Trim the PVC tubing to about 7' 2" and cement the top end cap. Double check SWR before cementing the bottom end cap. After SWR has been doubled checked, slide the antenna, dowel assembly into the PVC and cement the bottom end cap. If desired, styrofoam spacers may be used to get a very snug fit. Waterproof the bottom end cap where the coax leaves the antenna. When completed, the antenna should resemble Figure 2.

When mounting the antenna, use a PL259 female to female coupler. Do not use RG58/U for the entire feed line because it is too lossy. Use good quality RG8/U or similar coax for the feedline. Of course, do not forget to waterproof the female to female coupler. Mount to any mast using standard TV antenna clamps at the bottom of the antenna and keep it high and away from other metal objects for best performance and lowest SWR.

Completed 5/4 Wave Antenna

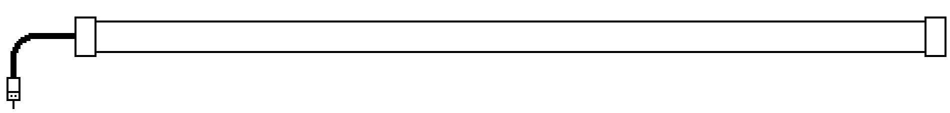
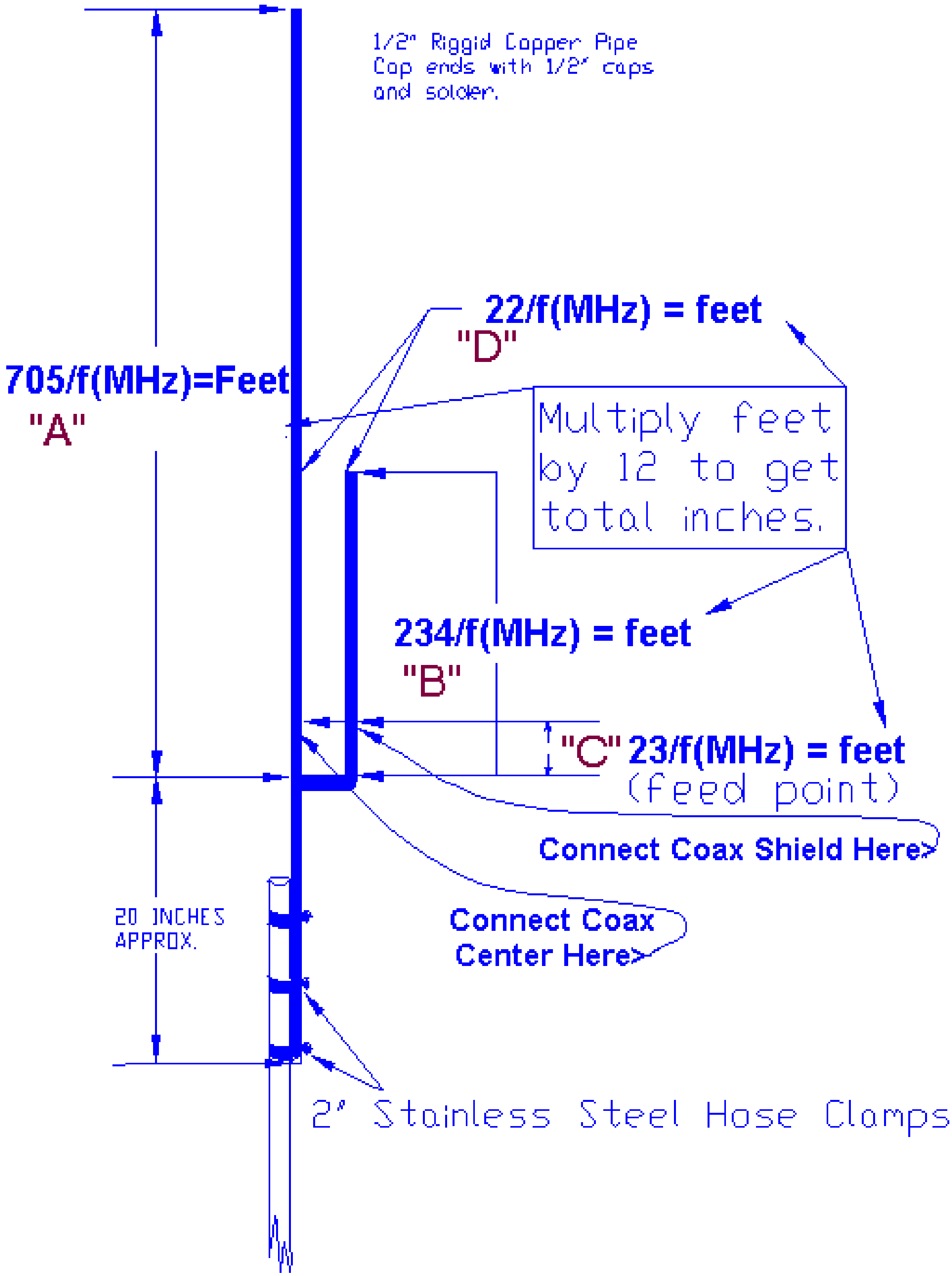


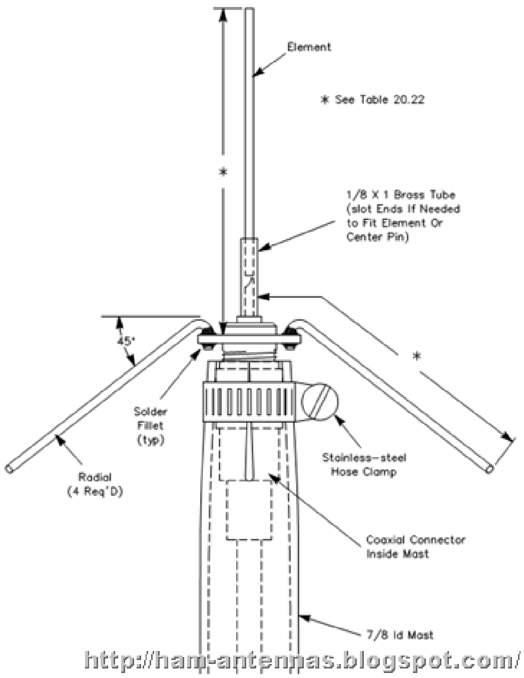
Figure 2

Although not actually measured, this antenna should give at least 6 dB gain if mounted high enough. Remember, the small diameter of the radiating element has no effect on the radiation resistance. The only real benefit with using a large diameter radiating element is durability and slightly improved bandwidth. This antenna should give many years of reliable performance for a fraction of the cost of a commercial antenna.

DE N1HFX



1/2" Riggid Copper Pipe
Cap ends with 1/2" caps
and solder.
22/f(MHz) = feet
"D"
705/f(MHz)=Feet
"A"
Multiply feet
by 12 to get
total inches.
234/f(MHz) = feet
"B"
"C" 23/f(MHz) = feet
(feed point)
Connect Coax Shield Here>
Connect Coax
Center Here>
20 INCHES
APPROX.
2" Stainless Steel Hose Clamps



$^1/_4$-Wavelength Vertical Antenna Element and Radial Sizes

		Band	
Lengths	*144 MHz*	*222 MHz*	*440 MHz*
ℓ†	$19^1/_4$"	$12^1/_2$"	$6^5/_{16}$"
Diameters			
Brass rod	1/8"	3/32"	1/16"
Stainless-steel rod	3/32"	1/16"	1/16"

† $\ell = \frac{234}{f}$

where

ℓ = length, in ft

f = frequency, in MHz

Quarter-wave vertical antennas are useful for local communications when size, cost and ease of construction are important.

The antennas shown are built on a coaxial connector. Use UHF or N connectors for the fixed station antennas. BNC connectors are good for mobile and portable antennas. BNC and N connectors are better than PL-259 connectors for VHF/UHF outdoor use because: (1) they provide a constant impedance over the frequencies of interest, and

(2) they are weatherproof when the appropriate connector or cap is attached. The ground-plane antennas require a panel-mount connector (it has mounting holes to hold the radials).
If the antenna is sheltered from weather, copper wire is sufficiently rigid for the element and radials.

Antennas exposed to the weather should be made from 1/16- to 1/8-inch brass or stainless-steel rod. Radials may be made from 3/16-inch aluminum rod or tubing and mounted on an aluminum sheet. Do not use aluminum for the antenna element because it cannot be easily soldered to the coaxial-connector center pin. Where the figures call for #4-40 hardware, stainless steel or brass is best. Use cadmium plated hardware if stainless steel or brass is not available.

To: All Amateurs
From: Gary - KG0ZP
RE: The COPPER CACTUS ANTENNA

Dear Fellow Hams
Here are the numbers for the Copper Cactus J-Pole antenna!
I hope you are already familiar with the construction of the standard J-Pole antenna, so I won't go into any unnecessary detail.

The antenna may be built as a MonoBander, DuoBander, TriBander, QuadBander or whatever with great success.
You can either feed it with separate coax's for each band or a single coax, however, separate coax's make it much easier to tune.

Theres no trick to building them, just remember the overall length is for the lowest frequency of operation. In other words, a MonoBander, DualBander and TriBander are all exactly the same length overall 58.09" on 2mtrs.
Feed the coax up the center of the pipes. Use T-Fittings at the proper distance below the top of the antenna for the desired frequency. The only problem is that the more bands you try to incorporate into the antenna, the harder it is to get the SWR flat on all bands.

Here are the numbers you are looking for:

Frequency	52MHz	146MHz	223.5MHz	435MHz	912MHz	1265MHZ
Pipe Dia.	1"	3/4"	1/2"	1/2"	3/8"	3/8"
Stub	54.70"	19.36"	12.65"	6.46"	3.02"	2.16"
Overall Length	163.92"	58.09"	37.94"	19.39"	9.07"	6.49"
Separation	5"	2"	1-1/4"	3/4"	1/2"	1/4"
Connect at	6"	2-1/4"	1-1/2"	1"	3/4"	1/2"

For best results, build the highest band first, for eg. the 435MHz antenna, If you really want it to look neat, use 3/8" copper for the vertical and 1/4" copper for the transformer section (stub). Naturally the finished product will be in the shape of a "J".

Now build the next band, for eg. the 223.5MHz antenna, by adding pipe to the T-connector that is the base (mast mount) of the 435MHz antenna, I use 1/2" for the vertical and 3/8" for the stub of this section.

Now build the 146MHz antenna, don't forget the overall length of the antenna is the lowest frequency you will be using. I use 3/4" for the vertical and 1/2 for the stub.

The stub must be parallel to the vertical, however you can point the base of each stub in any direction you like. I prefer 3 equal distant points, but you can make them all on the same side if you wish. I feel the three points make it look like a cactus.

My measurements on overall length, and stub length are from the centerline of the separation pipe (horizontal) to the top of the antenna. The Separation distance is technically from centerline to centerline, but inside measurements are fine and visually look better.

Some of the measurements are less than physically possible, in this case just push the T-Fitting and elbow as close together as you can get them, no need to trim the fittings.

The Connect at measurement is from the top of the horizontal member to the point of connection.

Final Note: If you use 1/2" pipe for all the construction, on the 2-meter stub, add 1/4" to its length, or use pipe-caps and adjust them up or down to get the 1/4" additional length.

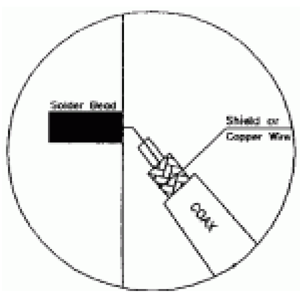
The antenna should be in perfect tune, SWR less than 1.2 - 1 on all bands, using separate coax for each band. Solder all the joints before installing the coax, any pipe you have left over can be used as the mast.
To install the coax, drill a 1/4" hole in the top of the horizontal part of each T-fitting closest to the vertical, then tilt the drill at an angle, so that the drill bit is sorta heading down the vertical.

Enjoy Building: If you have any questions just ask, or further instructions, just send me a message and I will promptly respond.

PS Until you are familiar with the construction techniques of the J-Pole, I wouldn't attempt any more than three bands the first time out. In fact, A dual-bander, using the above dimensions will be perfect every time.

73s de Gary - KGØZP

Document Revision Date 2/26/98 Applicable To This Page Only

- 

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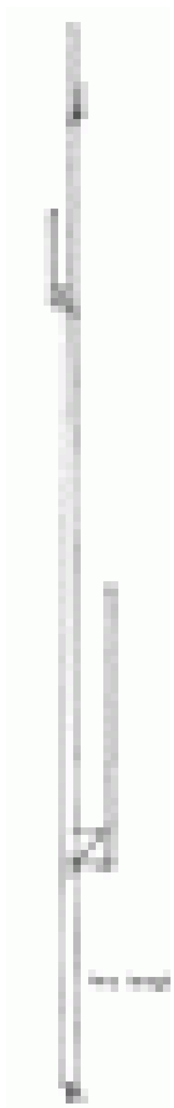
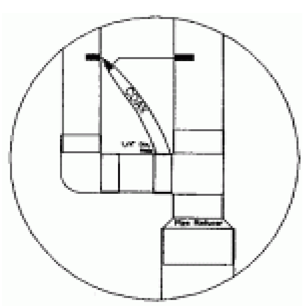
Copper Cactus antenna



- 

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