RDF^2 YAGI WITH TAPE MEASURE ELEMENTS

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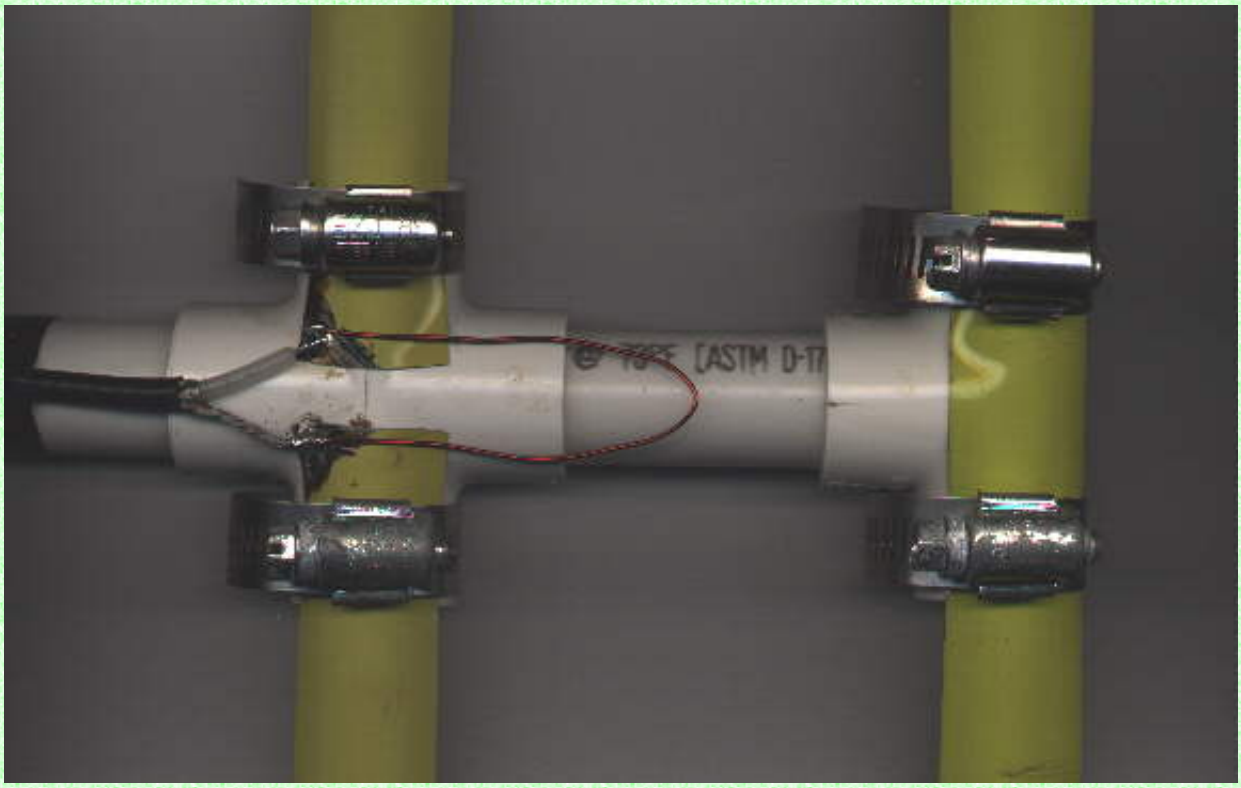


Figure 1. Close-Up view of RDF2 beam showing construction details

Description

This antenna is an adaptation of the RDF^2 two element, close spaced Yagi antenna described in the May, 1996 issue of 73 Amateur Radio Today Magazine.

The original design, developed by N6WZI and featured in the Homing In column of 73, used 1/4 inch solid aluminum rods for antenna elements. If you don't subscribe to 73, find someone who does and ask to see the original article.

My version of the RDF^2 antenna uses 1 inch wide steel "tape measure" elements. This is one antenna you can take into the woods without having to worry about *Yagi Eating Trees*. The flexible elements also make it very easy to get this antenna in and out of the car.

You do not need a machine shop to build this antenna. You only need common hand tools. It is much easier to construct than the original design and can be assembled in about 30 minutes once you gather the needed parts.

Performance Predicted by ELNEC	

GAIN	4.7 dBi
Front-to-Back Ratio	>8 db
3 db Beamwidth	E = 36 degrees
3 db Beamwidth	H = 70 degrees

N6WZI's original design used a "hairpin" matching network made from a length of TV antenna twinlead. I made a similar "hairpin match" but instead used a 5 inch length of wire connected across the feed points of the driven element. The antenna has some capacitive reactance without the matching network. The 5 inch length of wire has just enough inductance to cancel the capacitive reactance.

The wire I used for the hairpin match was enamel insulated 18 gauge solid. This results in a very good match across the two meter band once you have adjusted the distance between the halves of the driven element for minimum SWR at the desired frequency. (3/16 inch apart on my prototype). Experience has shown that the wire guage used for the hairpin match is not very critical. Use what you have on hand. 14 guage house wire works well, probably any insulated wire which will hold its shape will work just fine.

I used a pair of shears to cut the tape measure elements to length. An old pair of scissors will probably do as well. No matter how you cut the elements be very careful. Those edges are very sharp and will inflict a nasty cut if you are careless. Use some sandpaper to remove the really sharp edges and burrs resulting from cutting the elements to size. I put some vinyl electrical tape on the ends of the elements to protect myself from getting cut. I encourage you to do the same. It will probably be best if you round the corners of the elements once you cut them. Wear safety glasses while cutting the elements. Those bits of tape measure can be hazardous.

Replacement tape measure blades are available for reasonable prices at larger hardware stores. I found a 30 foot replacement blade at Sears for less than five dollars. If you use a replacement blade, be very careful when removing it from the package. The blade I purchased had a hard plastic cover which, when twisted, allowed access to the end of the replacement tape measure element. When you twist the cover, make sure you keep your fingers away from the "razor sharp" end of the blade. (I probably could have assembled this antenna in even less time if I didn't have to go upstairs to the medicine chest to get a band-aid. This is experience speaking. The spring steel popped out, inflicting a nasty cut on my thumb. I'll probably heal in a week or so...)

The RG58 coax feedline is connected directly to the driven element. No matter what method you use to attach the feedline, make sure you scrape or sand the paint off the tape measure element where the feedline is attached. Most tape measures have a very durable paint finish designed to stand up to heavy use. You do not want the paint to insulate your feedline connection.

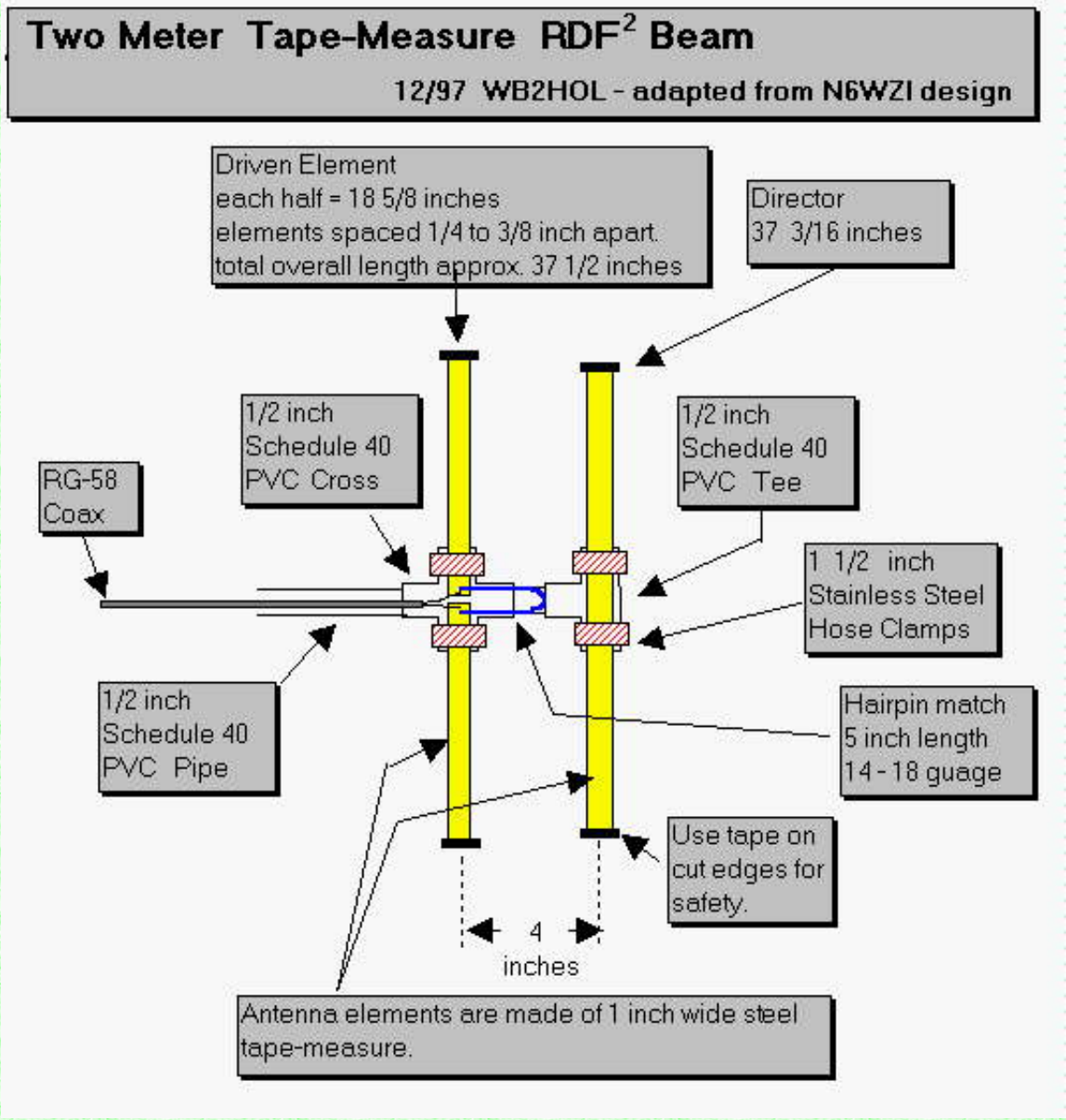
If you are careful, It is possible to solder the feedline to the element halves. Care must be taken

since the steel tape measure does not solder easily and since the PVC supports are easily melted. You might want to tin the tape measure elements before mounting them to the PVC cross. I used a bit of rosin flux to help with tinning the element connection points.

Stainless steel hose clamps are used to attach the driven element halves to the PVC cross which acts as its support. This has the added benefit of allowing you to fine tune your antenna for lowest SWR simply by loosening the hose clamps and sliding the halves of the driven element either closer or further apart. By using the dimensions specified, I found that the SWR was 1:1 at 146.565 Mhz (our Fox-Hunt frequency) when the two elements were spaced approximately 3/16 inch apart. Figure 1 shows the method used to attach the driven element to the PVC cross.

I used 1 1/2 inch hose clamps to attach all the elements on my prototype beam. if you do not use 1/2 inch PVC fittings but instead use 3/4 inch, make sure the hose clamps you buy are large enough to fit. Others who have duplicated my design have used self tapping screws to attach the elements to the PVC crosses and tees. Performance is the same using either method. The screws are much less expensive but they do not hold the elements as securely. In addition, the screws do not allow you to tune the antenna by sliding the halves of the driven element closer or further apart.

If you wish a slightly neater looking beam, use the self tapping screws. If you do not mind spending a few more dollars for the hose clamps, use them instead. If I were to build another beam I would use screws for the director, and hose clamps for the driven element. That would give me the best of both methods.



Construction:

Cut two lengths of tape measure to 18 5/8 inches. These will be used for the Driven element. Cut one length of tape measure to 37 3/16 inches. It will be used for the Director. Once you have cut the tape measure to length, put vinyl tape on the cut ends to protect yourself from the sharp edges. You will want to scrape or sand off the paint from one end of each of the driven element halves so you can make a good electrical connection to the feedline.

It is best to tin the elements first before attaching them to the PVC cross. If you don't, the PVC will melt as you apply heat to the element. It would be a good idea to also take the time to form the wire used for the hairpin match into a "U" shape with the two legs of the "U" about 3/4 inch apart. Tin the ends of the hairpin to make it easier when soldering it to the driven element halves. If you tin 1/4 inch of each end of the hairpin it will leave 4 1/2 inches to shape into the "U".

You will need to cut two lengths of PVC pipe. One should be cut to 3 inches. It is used to form

the boom between the Director and the driven element. The other piece of PVC should be cut to 6 1/2 inches. It will be used as a handle so you can hold the antenna from the rear. Just about any saw will cut through the soft PVC pipe. I used a hacksaw. Since the pipe is available in ten foot lengths, you can make a few beams from a single 10 foot length. In any case, you might want to cut a few extras lengths for your friends. They will want to duplicate this once they see your completed antenna.

At this time you can pre-assemble the PVC boom, cross and tee which will support the tape measure elements. I did not use any cement or glue when I assembled mine. The PVC pipe is secured in the fittings with a friction fit. When assembled, the cross and tee will be 4 inches from center to center.

The hose clamps I used are stainless steel and have a worm-drive screw which is used to tighten them. They are about 1/2 inch wide and are adjustable from 11/16 inch to 1 1/2 inch diameter. Attach the tape measure elements to the PVC fittings as shown in the accompanying drawing. It is normal for the Director element to buckle a bit as it is tightened to the PVC Tee. You can eliminate this buckle if you use washers and self tapping screws to attach this element instead of the hose clamps but I do not think the beam will withstand as rough a treatment as when hose clamps are used.

How does it perform?

Once you have completed your beam you probably will be interested to see if it performs as well as the computer predicted. My prototype antenna does seem to have a pretty good front-to-back ratio. It is real easy to get a peak on the "S" meter. It does not hear cross polarized signals very well. This is an advantage as most reflections will not have the same polarization as the original transmitter. Gain seems to be between 3 to 5 dB less than the three element RDF beam I designed. This is probably an advantage when close to the transmitter. You will need a bit less attenuation. The short boom and light weight make this antenna attractive if you have to use it for any length of time. It is light enough for youngsters to carry without tiring. As long as you put vinyl tape on the ends of the elements, this antenna is pretty safe to carry. Descriptions of the N6WZI RDF^2 Yagi performance when used on a foxhunt may be found at Jim Elmore's site.

Drawbacks

The curved, airfoil shaped, flexible elements will "flutter" and bend when in high wind situations. (Mobile flutter while stationary?) If you need additional support, you can add short lengths of PVC pipe to the TEE and CROSS and then tape the elements to the PVC pipe. I figure 6 to 12 inches of PVC would add lots of strength to the elements. The short boom does result in less gain than a more conventional Yagi. You may need more gain when starting on a foxhunt and still far from the fox transmitter.

Back to RDF Projects page