DIY

Worthwhile projects with MW0JWP

20-meter diamond loop antenna

Ever on the lookout for a portable antenna that's easy to make, I saw this 1924 photo to the right and thought, *Now, there's a guy who knows how to have a good time!* Although the design is a hundred years old, I've wondered how I can make one of these and test it for myself. After all, the equipment will be different, but RF (radio frequency) is RF.

After a bit of searching, I discovered that he was using a 20-meter variation of a multi-turn (spiral) magnetic loop, fashioned into a diamond shape. Turns out that, if you add a matching unun to the feed point, you can run 50-ohm coaxial cable (coax) to it, and bring the SWR down low for much of the 20-meter band.

The design I settled on was patterned after one by Harry Lythall SMØVPO. The feed line only connects to the half-loop near the center, and not the longer, main spiral, making this antenna a type of Yagi loop, if you will. This way, the smaller half-loop acts as the driven element and the long spiral the parasitic element.

I could have chosen plain old speaker wire for the main elements, but since the parasitic element is much longer than the driven element, it seemed to make more sense to use one wire, wasting less. At a mere 2´ x 2´ it'll easily fit in my car, but does seem a little awkward to pack around, yet it's a lot smaller than a 17-foot-long antenna. No idea how it'll perform, so let's build it and see for ourselves.

Parts list

One toroidal 22 mm ferrite core

One 4-position terminal block and terminals

Two #8 5/8˝ pan head screws

Two 24 foot 16 AWG stranded wire

One 10-foot RG-58 coax with SO-239 connector

6 feet of ½˝ PVC

One ½˝ PVC slip cross

3 colors of 18-inch 22 AWG wire

Hot glue to mount the terminal block and toroid onto the PVC

Construction

Let's start with the unun, by selecting three different insulation colors of the 22 AWG wire, to help keep them easily distinguished from each other and wrap seven turns of the bundle evenly through the toroid, cut the wires to about two inches outside the toroid, then bare all six ends. I'm going to use the red, green, and yellow wires, to

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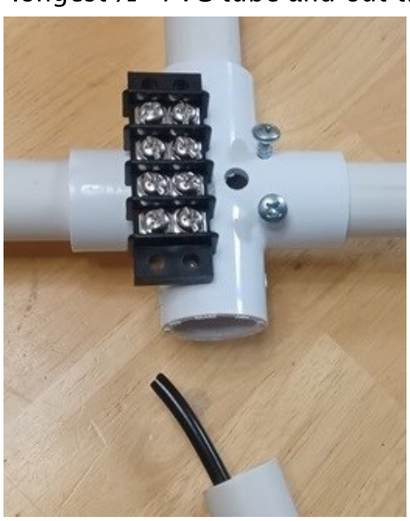
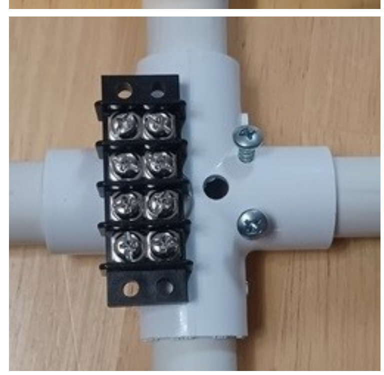
make referencing them easier in this article. For further reference, I'll orient the toroid axis vertically. This way, the braided bundle protrudes from the top and bottom of the toroid core, as shown.

Cut three 15-3/4˝ sections of the ½˝ PVC tubing. On these three, drill a 1/8˝ hole through both sides at ½˝, 2-1/8˝, 3-¾˝, and 5-¼˝ from one end of each. Cut a fourth section 36 inches long, and drill a 1/8˝ hole through both sides at 10-3/8˝, 12˝, 13-½˝, and 15-1/8˝ from the end you plan to insert into the PVC cross.

Drill a ¼˝ hole in the the PVC cross about ¼˝ to the right of its center. Drill two vertically aligned 1/8˝ holes into the PVC cross to the right of the ¼˝ hole. Install the two 5/8˝ screws into the two 1/8˝ holes, but not all the way in, leaving about ¼˝ between the screw head and the PVC cross. Mount the terminal block on the PVC cross lengthwise vertically, the longer side along the center of the cross, using hot glue or better.

Cut off the PL-259 end of the coax, leaving at least seven feet to work with on the SO-239 end. Slip the cut end up through the longest ½˝ PVC tube and out through the ¼˝ hole.





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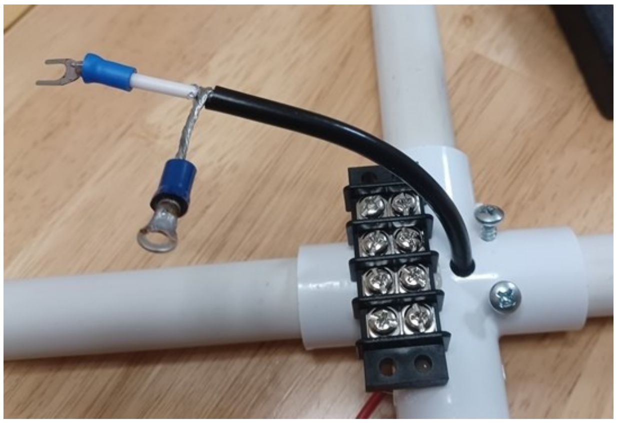
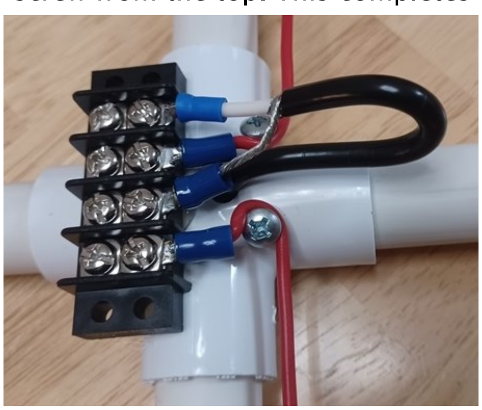
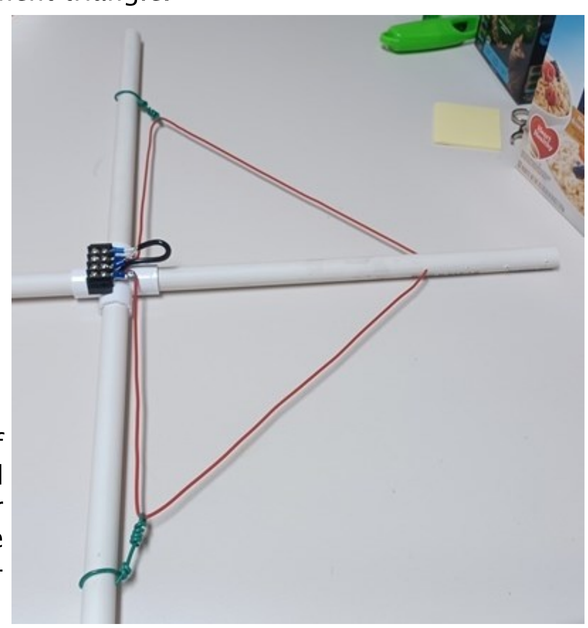
Strip the coax cut end and install the center conductor onto the top screw terminal and the shield conductor onto the second screw terminal from the bottom (third from the top).



Insert the ½″ PVC tubes into the PVC cross. Cut 52 inches of the 16 AWG stranded wire for the inner loop (driven element). Fashion two loop hooks that allow the inner loop to be suspended about ½″ from the PVC tubes, and tie them through the two holes closest to the PVC cross on the two vertical PVC tubes.

Solder a fork terminal connector to the end of the 16 AWG wire, and tighten it onto the top screw of the terminal block. Loop the wire under the top 5/8″ screw, through the top loop, through the innermost 1/8″ holes of the right tube, through the bottom loop, then over the bottom 5/8″ screw. Pull the wire tight, measure where to install a fork terminal connector, cut and strip the wire, solder a fork terminal, then install it to the third terminal block screw from the top. This completes the driven element triangle.





Install a fork or ring terminal connector to each of the six toroid wire ends. Connect the lower red wire to the bottom screw terminal and the upper red wire to the second screw terminal up from the bottom. Connect the lower green wire to the sec-

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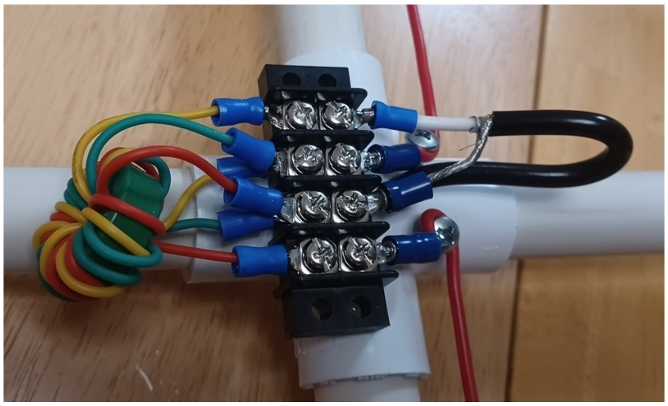
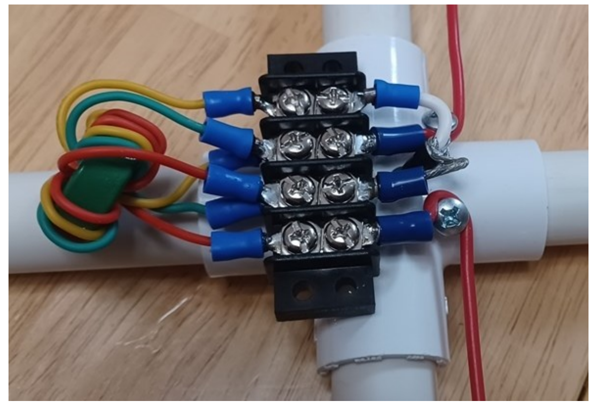
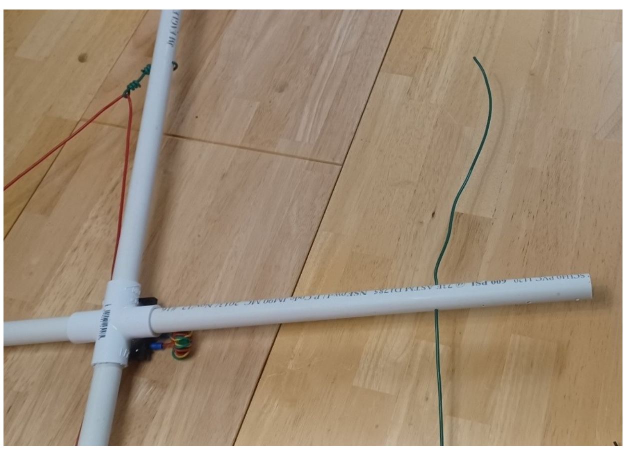
ond screw terminal from the bottom and the upper green wire to the third screw terminal from the bottom. Connect the lower yellow wire to the third screw terminal from the bottom and the upper yellow wire to the top screw terminal. Unscrew the coax terminals from the block, pull the coax through the tube to remove the slack, then re-install the coax terminals.





Use the 16 AWG wire to create the diamond spiral parasitic element. Leaving about ten to twelve inches of slack, tie off the start of the spiral, then string the wire through the remaining holes of the ½″ tubes, starting with the innermost holes of the side opposite that of the driven element triangle. Make sure the entire length of the spiral is tightly wound through the tubes, then securely tie off the end. Loosely twist the remaining wire ends together.



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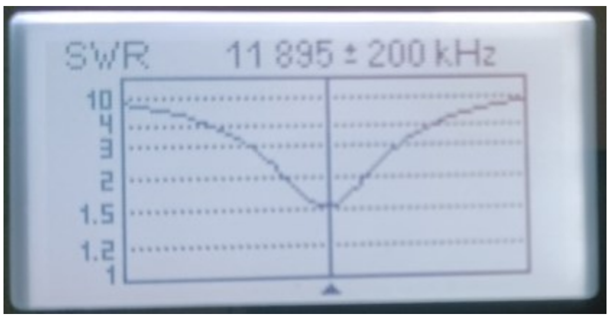
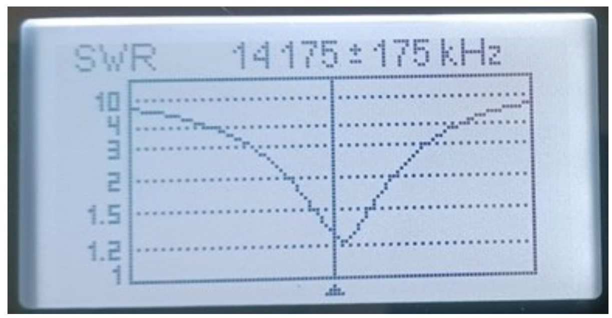
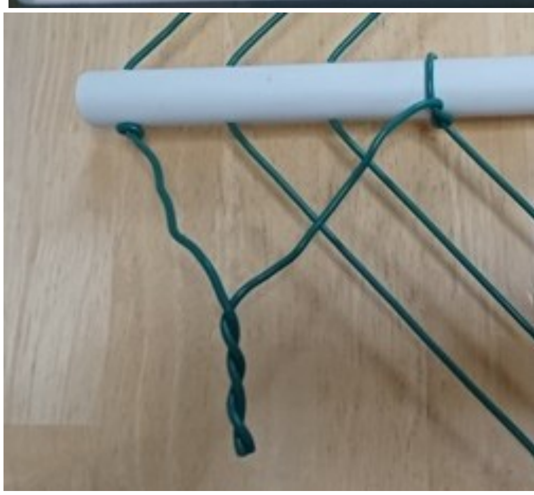
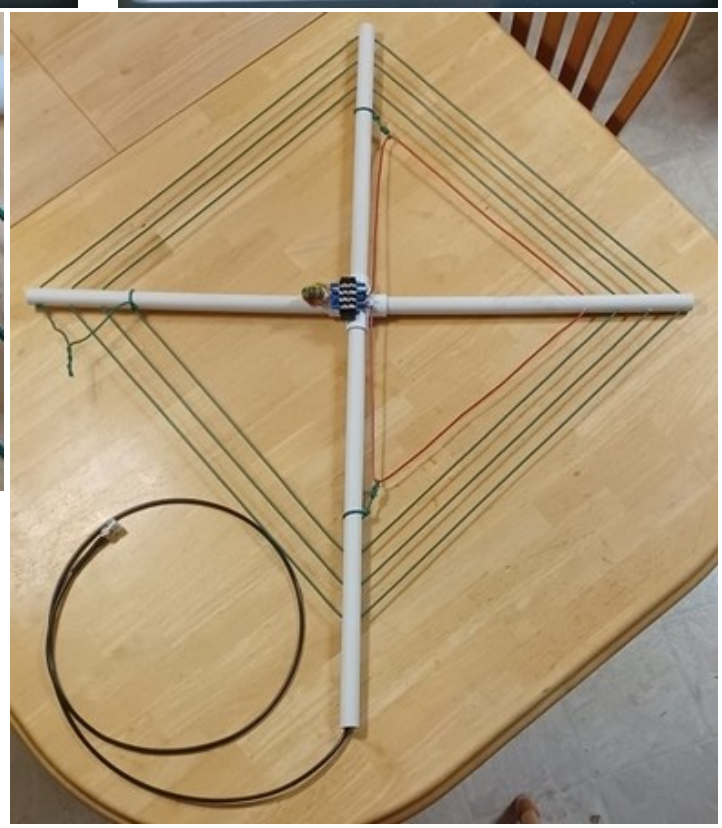
The left photo shows my first measurement with the analyzer, which left a lot to be desired for an antenna designed to work on 20 meters. It turns out that we can use the two twisted wires at the end of the diamond spiral as a tuning stub. Cutting it shorter made a huge difference, and got the resonant frequency a little closer to the 20-meter band. Eventually, by twisting the two wires into a symmetrical pair, then gradually experimenting with twisting, untwisting, and cutting, the photo on the right shows I was able to get the antenna's resonant frequency right near the middle of the band. The bandwidth is *very* narrow, but I would expect that.







Ideal for 20m Sota stations



The finished product