

The Tape Measure Antenna

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Are you looking for an easy kid friendly project? Are you looking for a project to encourage a new generation of ham radio operators?

This project is unusual, so it's something that will certainly capture the attention of anyone, particularly a kid. It's an antenna built out of PVC pipe, a tape measure and a handful of hose clamps.

This antenna is designed for two-meter operations, which, for a newbie ham operator, is one of the bands available under the Technician license in the US. Plus it's easy to build and gives a great opportunity to teach several subjects with a hands-on approach.

Disclaimer: This project isn't new; it's not even my idea or design. I used the design from Joe Leggios (WB2HOL). The plans to his antenna are [here](#).

Project Background

My nephew recently expressed interest in earning his Technician class amateur radio license. While some people discount the Technician level license of amateur radio as “ridiculously simple” (including a well known conservative talk radio personality) it’s not so easy for an eight-year old. It requires comprehension of concepts that they still have yet to cover in school. Topics like basic algebra and principals of electricity.

When I set out to find a project, I was looking for something unusual that would grab his attention but something that was easy, fast and required few tools or skills. And I wanted it to be cheap. There is a total of \$20 in materials in this antenna, assuming everything is purchased specifically for this project and not scavenged or salvaged parts.

The fundamentals of antennas is the one area I’ve been finding difficult to teach my nephew. Mostly because I refuse to “teach the test”. I want him to fully understand the material, not just pass a test. And I have found that I have had to teach him basic algebra in the process.

This project was perfect as I could scale it up or down as a lesson in a number of ways. Which is to say you can use the plans to build a perfectly workable antenna, or, you can use the formula for a Yagi antenna to modify the design. In my case, my nephew and I used the plans from WB2HOL, but we worked through the math to come up with element lengths.

And, in the end, we built something useable for when he earns his Technician class

license.

Materials List

3/4" Schedule 40 PVC Pipe - at least 25"

6 hose clamps big enough to fit around the PVC pipe

1 3/4" PVC tee

2 3/4" PVC crosses

8' RG-58 cable with a connector attached to one side. I soldered a female BNC to mine.

5" wire. I used 18 gauge solid copper wire, but I'm told anything works.

Rosin core solder

Tape measure with 1" wide tape

PVC glue

Tools Needed

Soldering iron

Tape measure

Pipe cutters

Wire stripper

Shears or scissors

Sand paper

SWR Meter

Screwdriver or wrench for tightening the hose clamps

Step 1: Cutting the Elements and Assembling the Boom



You'll need to cut two pieces of PVC pipe. One piece will be 17 1/2". The other 7". This, along with the PVC connectors, will form the frame of the antenna.

Assemble the pipe to form the frame ("boom") of the antenna. Gluing each piece together, the 17 1/2" piece connects between the tee and the first cross. The PVC tee is the front of the antenna. The 7" piece connects between the first and second tees.

Disassemble the tape measure by pulling the tape out of the case. If you pull the tape past it's end, you'll find that it's connected to a spring. Simply twist the tape so it disconnects from the spring.

Cut the tape at 35 1/8". This will be the director of the antenna and will attach to the front of the antenna.

Cut two 17 3/4" long pieces of the tape. These will serve as the driven elements.

Cut an additional element from the tape. This will need to be 41 3/8". This is the reflector element.

Sand all the ends of the elements so they are smooth to the touch. These are extremely sharp if left un-sanded. Also sand off about 1/2" of paint on the ends of the bottom side of the driven elements. This will be where you will solder the wires later.

Note: If you are going to mount the antenna, set it up so the antenna will be forward of the mounts. Yagi antennas may suffer in performance if mounted elsewhere, like the center of the boom.

Step 2: Installing the Elements of the Antenna

Slip the hose clamps over the PVC tee at the front and slip the Director element under it. Tighten the hose clamps so it is secure.

Attach each of the driven elements to the frame of the antenna with the sanded sides facing each other. Before securing the elements, space the elements 1" apart and tighten the clamps.

Finally, attach the reflector element at the rear of the antenna and tighten the clamps.

Step 3: Soldering the Wires



Now you will tin the ends of the driven element. Simply heat the soldering iron and apply solder to the tape measure at the sanded spots. Make small pads where you can solder two wires to each side of each driven element.

Strip the end of the RG-58 cable and isolate the outer and inner wire. Solder one side of the RG-58 to a driven element and the other to the opposite driven element.

Strip the 5" piece of 18 gauge (or whatever wire you have) and solder a side to each of the driven elements.

I chose to add an optional piece of PVC and an elbow at the rear of the antenna to make it easier to hold and/or mount. I also chose not to glue the PVC together so the antenna can be broken down for storage.

Step 4: Adjusting the Antenna

Adjusting the antenna is very simple. Simply attach a SWR meter between the antenna and the radio. Adjust your radio to 146.580 mhz and check your SWR reading. If the reading is more than 1.2 to 1, turn off your radio and adjust the driven elements by loosening the hose clamps and moving the elements toward each other. Turn on your radio and check your SWR again. Repeat until your SWR is at an acceptable level. I was lucky and my antenna registered extremely close to 1 to 1 without adjustment.

When adjusting the driven elements make sure your radio is off.

Step 5: Technical Notes

Software modeling programs show that this antenna should have a gain of 7.3 dBd.

Real world experience: Running a HT at 5 watts, my nephew and I were able to use a repeater 65.7 miles away, with reports of a clear signal. We were also able to access several other repeaters that are 40 to 50-miles away. Performance will vary based on your location.

While this antenna is designed for VHF two-meter operations, it can easily be redesigned for other frequencies like 1.25 meter, 70 cm or 33 cm. There are many websites that will calculate the length of and length between the elements on a Yagi-Uda antenna. You can try Martin Meserve's (K7MEM) online calculator [here](#).

Additional information on this antenna

The original plans for this antenna are available at Joe Leggios (WB2HOL) website. A link to the plans is [here](#).

Additional plans are available from KC0TKS' website [here](#), as well as from NT1K's website [here](#).