Building A 2 Meter Antenna

The Vertical Dipole

ABSTRACT
A favorite pastime of many amateur radio operators is building and testing antennas. A vast field, exotic materials, and piles of expensive gear are not required. In this document, materials are listed, steps for building are described, and testing of the final product is demonstrated. Components are inexpensive and readily available from several sources.

The 2 meter vertical dipole antenna is a very simple step up from the ‘rubber ducky’ or mobile mag mount. Performance is improved, building skills can be developed, and mounting and testing are easy. The antenna is easy to break down for storage or portable use.

MATERIALS
Experimenting with antennas shouldn’t break the bank. Many common household items are easy to work with and some radiate just fine. The most common radiator is the wire clothes hanger. These may be made of 12 to 14 gauge wire, with no real preference for this project.

Construction will be press-fit for the PVC and #10 1-1/2 inch pan head screws and nuts for wire to PVC.

PVC plumbing parts are strong, cheap, and readily available. The 1/2 inch PVC ‘cross’ connector will serve as the foundation of this antenna. A 1/2 ‘tee’ connector could be used, but the dipole will be reused as a component in another project. A 1/2 ‘tee’ connector is used to attach the antenna to the mast.

A ten foot length of 1/2 inch, Schedule 40 PVC pipe will be used for the mast. Cut it at 6 feet to get it home. The remainder will be used in later build projects. A four-foot section of iron rebar is used to stabilize the mast at home or on the road.

These materials are available at Home Depot or Lowe’s.

DESIGN
The wavelength in meters of the frequency of our favorite repeater, 146.94 mHz, is the speed of light divided by the frequency, or about 300/146.94, giving 2 meters. One quarter of 2 meters is 50 cm, or about 20 inches. Our design will include two 20-inch elements – one on the center conductor and one on the shield. Start long and trim to match.

A standard center-fed dipole cut for resonance will have an impedance of approximately 73 Ohms in free space, while the impedance of a 2-meter dipole is closer to 70 Ohms at the same conditions.

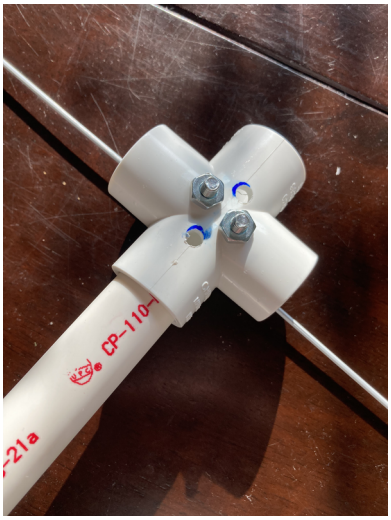
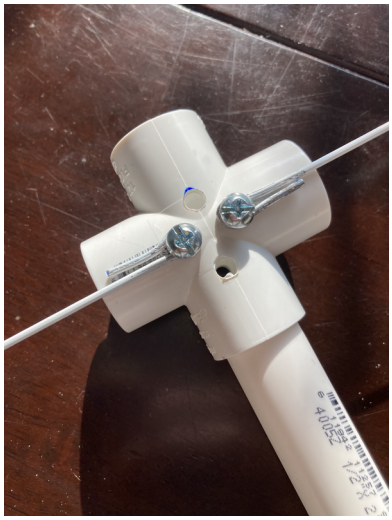
A perfect 1:1 SWR match may not be possible. We shall see.

CONSTRUCTION
The first step is to deconstruct the hanger. Clip just below the twisted area as this is too hard to straighten. Unfold the hanger and straighten as best you can. This can result in a section over 40 inches long – enough for both elements. Cut in half to allow for tuning.

Loops are made in the ends of the wire. Bend back and then loop around. Wrap around a #10 screw and form the loop with pliers. Be sure the remaining length is over 19 inches.

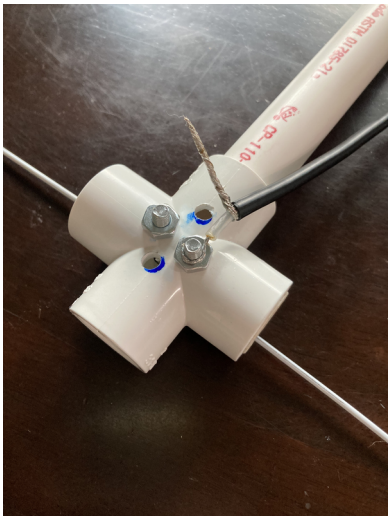


The wire sections will be attached to the PVC tee using #10 screws and washers. Drill holes to fit the screws.

The feed line will be attached with a second pair of nuts. Strip and solder tin 1 inch from the end. Loop around the screws and secure with nuts. Be sure to keep the two sections of the feed line from touching. Larger #10 ring terminals (to fit the screws) may be attached to allow for reuse, easy break down, and storage.

A scrap section of PVC is used as a horizontal mount.



MOUNT THE ANTENNA
A 1/2 inch tee connector will be used to clip on to the horizontal mast.

Using a hacksaw, remove the ‘top’ of the long side as shown below. The goal is to remove less than half of the section. Not enough and it is too hard to clip on. Too much and it won’t stay on. Trial and error is fine. Nibble away.

The tee is then fitted to the 6 foot mast section for a finished project.

Drive the rebar about a foot into the ground (or a five-gallon bucket of sand for apartment dwellers).

This will provide stability and height in a light weight and easy-to-setup and take-down solution.

TUNE THE ANTENNA
Straight off of the page, the design is stable and should work across the 2 meter band.

Readers with the NanoVNA can read SWR and impedance on the same chart. The use of other tools is left as an exercise for the reader.

The length of the radiating element affects the SWR. The opposite element should be cut to the same length.

The first reading shows SWR of 1.496:1 and impedance of 59 Ohms. Not bad. We see the SWR minimum is to the left of the markers. The driven element is too long.

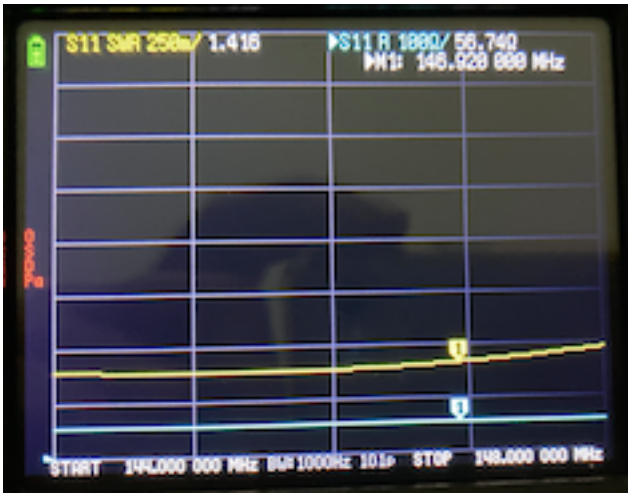
TESTING RESULTS

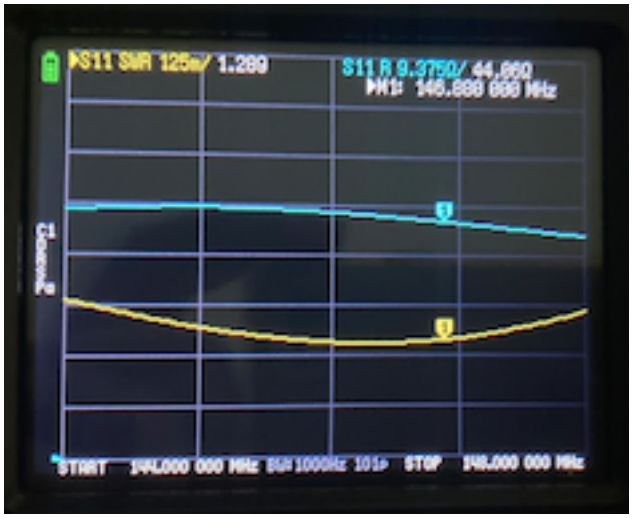
From the earlier quarter wave ground plane exercise, the elements in my yard, using my components, and my feed line give a driven element of about 19 inches.

Cut the driven element and opposing element to 19 inches for the next test.

The SWR minimum is still seen to the left. Cut another 1/4 inch from each end and measure.

Final SWR is shown to be 1.23:1 and impedance is 44 Ohms. Quite a mess.





FOOTNOTES

The vertical dipole is a very easy-to-build antenna. Commonly available parts and simple construction techniques make this a good starter project. Adding altitude, this antenna can provide improved performance on handhelds and mobile radios over supplied antennas.

Differences in materials and feed line may influence SWR and impedance. Lengths of different antennas may be different. It is important to learn and use antenna tuning skills.