Building a 2-Meter Vertical Dipole Antenna

A DIY Guide for Amateur Radio

Why a Vertical Dipole?

Optimized for repeaters: Most 2-meter FM and repeater traffic uses vertical polarization, making a vertical antenna the ideal choice.

Simple construction: Unlike more complex designs like the Yagi, a dipole is straightforward to build with minimal parts.

Excellent performance: A properly constructed dipole is an efficient radiator, providing significantly better performance than a stock "rubber duck" antenna.

Inexpensive: Materials can often be sourced from a local hardware store or salvaged from scrap.

The Science Behind the Design

Dipole Theory: A standard half-wave dipole consists of two quarter-wave radiating elements separated by an insulator.

Calculation: The total length of the antenna is based on the desired frequency. A simple formula is used to find the length of each element:

- Length (in feet) = 468 / Frequency (in MHz)
- For the 2-meter band (e.g., 146 MHz), the total length is approximately 3.2 feet, or about 19.3 inches per element.

Vertical Orientation: Mounting the elements vertically creates the desired vertical polarization. The coax is fed into the center of the dipole.

Materials and Tools

Radiating Elements: Two sections of rigid wire, such as 12- or 14-gauge copper wire, or coat hanger.

Center Insulator: A PVC ‘tee’ to hold the elements apart and serve as the feed point.

Feed Point: An SO-239 or BNC ended RG-58 or RG-8X coaxial cable with a connector for your radio.

Mounting: Length of PVC pipe.

Hardware: Screws, nuts, and washers to secure the elements to the insulator.

Sealant: Electrical tape, heat-shrink tubing, or silicone caulk to weatherproof the connections.

Tape measure

Wire cutters and strippers

Soldering iron and solder

Drill and bits

Screwdrivers and wrenches

Antenna analyzer or SWR meter for tuning

Construction Step 1 - Prepare the Elements and Insulator

Cut the Elements: Cut two lengths of your chosen element material to slightly longer than the calculated 19.3 inches. You will trim them to the final length later.

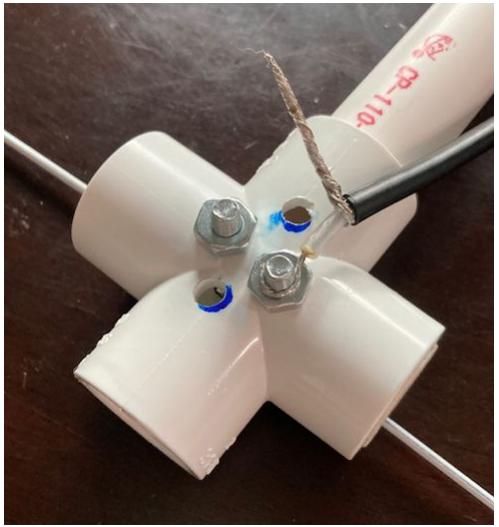
Prepare the Insulator: Drill holes in the PVC pipe ‘tee’ for the radiating elements.

Construction Step 2 - Solder the Connections

Connect Center Conductor: Strip and solder tin the center conductor of the coax. Crimp a #10 ring terminal to the wire. This will be the upper element.

Connect Shield: Strip and solder tin the shield of the coax. Crimp a #10 ring terminal to the wire. This will be the lower element.

Connect Coax: Bolt the ring terminals to the screws.



Construction Step 3 - Tuning and Testing

Initial Test: Attach the antenna to a non-conductive mast and run the coax to an antenna analyzer or SWR meter.

Measure SWR: Measure the antenna SWR (Standing Wave Ratio) across the 2-meter band (144–148 MHz).

Adjust and Trim: If the resonant frequency is too low, the elements are too long. Trim equal, small amounts (e.g., 1/8 inch) from each element until the best SWR is achieved in the center of the band.

Weatherproof: Once satisfied with the tuning, seal all exposed electrical connections with high-quality electrical tape or sealant to protect against moisture.

Mounting and Deployment

Mounting Location: Mount the antenna as high and in the clear as possible for best performance. A non-conductive mast, such as PVC pipe, is ideal for keeping the antenna away from obstructions.

Strain Relief: Use a cable tie to provide strain relief for the coax cable, preventing it from pulling on the soldered connections.

Enjoy! Connect your finished antenna to your radio and enjoy the improved signal and range on the 2-meter band.

Troubleshooting

High SWR: Check all soldered connections for shorts or poor contact. Ensure the element lengths are correct and have not been distorted.

RF in the Shack: Use a simple coax-choke balun by coiling 4–8 turns of coax near the feed point to prevent common-mode current from entering your radio room.

Performance Issues: Ensure the antenna is mounted vertically and is away from metal objects like gutters, siding, or other antennas.

Questions?

Building a 2-meter vertical dipole is a popular and effective project for amateur radio enthusiasts, especially for working with repeaters.

A vertical dipole is advantageous for VHF/UHF applications because it matches the vertical polarization of most local repeater and mobile signals.

Also, the vertical element may be used in a three element Yagi design.