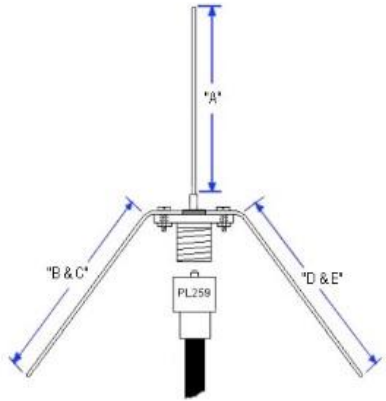
Building a Two-Meter Quarter-Wave Ground Plane Antenna

A Simple & Effective Amature Radio Project



Introduction to the Quarter-Wave Ground Plane Antenna

Key Points:

- A ground plane antenna is an excellent and inexpensive starter antenna.
- It is a good project for new and experienced amateur radio operators alike.
- This antenna can be used with both handheld and higher-power base radios.

What is a Ground Plane Antenna?

Key Points:

- **Concept:** The antenna consists of a vertical radiating element that is one-quarter wavelength long.
- **Ground Plane:** A set of sloping radials simulate an electrical ground, effectively creating a "virtual" half-wave dipole.
- **Performance:** The omnidirectional pattern allows for communication in all directions, which is ideal for working with repeaters.

The Basic Design Principle

- The vertical element and radials are each a quarter wavelength (1/4 λ) of the desired operating frequency.
- The radials are typically bent downwards at a 45-degree angle.

- SWR is determined by the length of the driven element
- Impedance is influenced by the angle of the radials

Calculate Element Lengths

- **Frequency:** The 2-meter band ranges from 144 to 148 MHz. We'll design for the center at 146 MHz.
- **Formula:** Length (in inches) = 234 / Frequency (in MHz).
- **Calculations:**

  Radiator length: 234 / 146 = 1.60 feet * 12 = 19.2 inches

  Radial length: The radials are also one-quarter wave, so they will be approximately 19.2 inches long.

  Always cut your elements a little long to allow for trimming during the tuning process.

Materials Needed

Key Points:

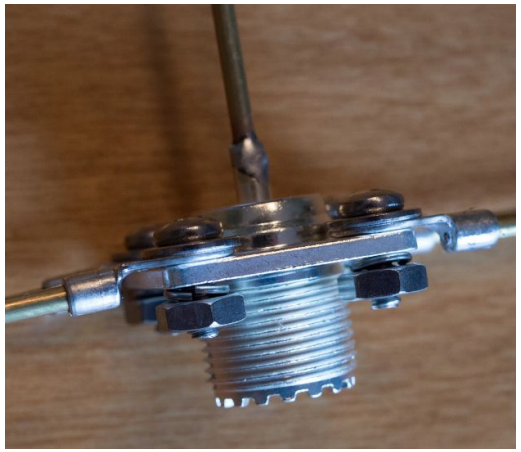
- **Radiator/Radials:** Solid copper or brass rod (12–14 gauge is common).
  You can also use materials like sanded wire coat hangers.
- **Connector:** SO-239 or BNC chassis mount connector.
- **Mounting Hardware:** Small nuts and bolts (#4-40 recommended).
- **Coaxial Cable:** A length of coaxial cable (e.g., RG-8X, RG-58) with a PL-259 or BNC connector to attach to the antenna.
- **Tools:** Soldering iron, wire cutters, stripper, and a measuring tape.

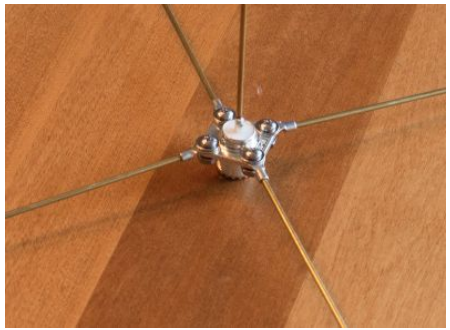
Construction Steps

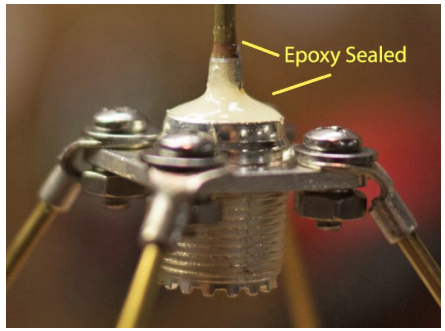
Key Points:

1. **Prepare the Wires:** Cut one piece of wire for the vertical radiator and four pieces for the ground radials to the calculated length.
2. **Attach Radiator:** Solder the vertical element to the center pin of the SO-239 connector. The element may need to be sanded slightly to fit.
3. **Attach Radials:** Crimp #6 ring terminals to the radials. Secure the ground radials to the mounting holes on the SO-239 or BNC chassis mount connector.
4. **Bend Radials:** Bend the radials down at a 45° angle. This will help achieve a closer 50-ohm impedance match.

Photo Notes







Tuning and Testing

Key Points:

- **Connect Equipment:** Attach the antenna to a mast and connect it to your radio.
- **SWR Meter:** Use a Standing Wave Ratio (SWR) meter to test the antenna performance. The goal is to achieve an SWR close to 1:1.
- **Adjust and Trim:** If your SWR is too high, trim a small amount (e.g., 1/8 inch) from the tip of the vertical element and test again.
- **Tuning Process:** Repeat the adjustment and testing process until you achieve the lowest SWR reading
- **Impedance:** The radials may be bent up or down to reach 50 Ohms.

  Remember: Adjust SWR first, then Impedance.

Mounting and Final Tips

Key Points:

- **Mast Material:** Use a non-conductive mast like PVC pipe or mount the antenna clear of obstructions.
- **Height is Key:** Mount the antenna as high as possible for the communication.
- **Weatherproofing:** Once tuned, seal the connector and connections with sealant or waterproof tape to prevent water from entering the coax.

Questions?

MANY articles and videos on the Internet on the topic.

Commonly available materials are great for this project - coat hangers, PVC

Other designs suitable for coat hanger and PVC include vertical dipole, 3 element Yagi, and J pole

If you have issues or questions, just ask. These designs and others have been built by many members of the club.