Get the Best Performance From Your Quarter-Wave Vertical Antenna

Ground Mounting vs. Roof-Top or Elevated Mounting

2008 Version

Ground Mounting

Ground mounting your quarter-wave vertical antenna will produce significantly improved long range results when your installation includes a good ground-level radial wire system. Seven decades of experiments show that ground mounting with many radials is your best choice.

Safety is another important consideration when comparing ground mounting to roof-top or elevated mounting of your quarter-wave vertical. The DX Engineering Tilt Base offers a safer and easier ground mounted installation. One person can walk-up and tilt-down the antenna for adjustments without a ladder. The new, more versatile Tilt Base models are also helpful when high winds are due. Order the Tilt Base model DXE-TB-3P for your Hustler BTV or the model DXE-TB-4P for other ground-mounted verticals.

The performance of any quarter-wave vertical antenna, multi-band or single band, is completely dependent upon the quality of its radial system. However, some manufacturers indicate their vertical will "work" when ground-mounted with no radials or if elevated above ground with as few as two quarter-wave resonant radials per band. A few local or medium range contacts may be possible using a minimal installation without radials. However, you will get more consistent results and much better performance with a complete radial system. The radial system required depends on whether it is for a ground-mounted or a roof-mounted vertical and on the number of radials you can install.

Many amateurs enjoy excellent quarter-wave vertical performance with only 20 to 30 radials. On ground-mounted quarter-wave verticals, the length of the radial wires is not critical. They can be as short as one-eighth wavelength, but one-quarter wavelength radials on the lowest band of operation are typical. Long lasting and high-efficiency radial wire connections are easy with the DX Engineering Radial Plate. Use model DXE-RADP-1P for a simple and neat way to install as many ground radial wires as you wish. Install 30 to 60 radials for higher performance using one or more model DXE-RADW-1000K kits. Insulated number 14 gauge stranded copper wire, which is part of our Bulk Radial Wire Kits, is easy to handle and will last far longer than bare wire or wire mesh. Included lawn staples, DXE-STPL-100P, known as Radial Wire Anchor Pins, are used to secure the radials to the ground. Grass will cover the radial wires within a few weeks. More information is in our article "Install Radial Wires Without Digging". Installing more than 60 radials will improve signal output if the radials are one-third to one-half wavelength or longer.

Why is such an extensive array of radial wires necessary? Simply put, it is the best way to increase your signal! The entire radial system must collect and carry currents equal to those flowing in the vertical section of the antenna. The ground-mounted vertical antenna needs many radial wires to prevent your RF power from being absorbed by the ground. Even if your radials cannot run in all directions, you still get improved signals and prevent ground losses by installing many symmetrically spaced radials. You can use wires of any convenient length. Just run your radials in as many directions as you can, straight away from the antenna base. Install your coax cable under the radials, a few inches in the ground, to minimize coupling between the radials and the coax shield. Decoupling the feedline with effective DX Engineering chokes instead of coiled coax, to reduce RF feedback, RFI and noise, is covered on the next page.

Ground-mounted antennas are less likely to cause TVI/RFI than roof-mounted antennas. Remember, a ground-mounted vertical antenna must be installed away from your house, metal structures and electrical wires. Enjoy safe operation, easier tuning, reduced interference and much more successful operation.

Elevated Mounting

In some situations, an elevated or roof-mounted vertical installation is the only option. Elevated installations are more difficult. Resonance-tuned radials must do the job of collecting RF currents. Imagine all of the quarter-wave resonant length wires attached to the base of the antenna, spreading *radially* (away from the base of the vertical) in all directions. For best DX performance, these radials should slope away from the vertical at a 45 degree angle. You can connect the ends of the long radials to support poles or trees. Use the same care as you would for a dipole antenna, keeping the ends insulated and clear of metal. We recommend four resonant radials per band to enhance low angle radiation. If you must elevate your antenna, Resonant Radial Wire Sets are also available from DX Engineering.

Elevated Mounting - continued

We recommend using an antenna analyzer or SWR meter to make resonant, elevated radials. For Hustler and most other quarter-wave vertical antennas, it is best to start with the highest band, usually 10 meters. Determine the frequency within the 10 meter band where you want the vertical to resonate. Construct two radials, as if you were making a dipole, to resonate on that frequency. Next, make two more radials the same length. Then, connect all four to the base of the vertical or Radial Plate. Tune the 10 meter section of the vertical for resonance on the same frequency as your radials. Repeat that procedure for the remainder of the bands your antenna covers, going from the highest frequency band to the lowest. In an elevated vertical installation, do not ground the radials, the mast, or the vertical mount. Grounding them will probably detune your resonant radial system!

Be careful - because the vertical will be high above the ground, be aware of any overhead power lines that may touch the vertical. The vertical should be at least its own height away from any wires or obstacles so if it falls, it cannot come in contact with electrical power. Proper guying of your elevated vertical requires planning. Find good guying anchor points before installing your antenna.

Lightning Protection - For Any Installation

Proper lightning protection and grounding is a prudent investment for any Amateur Radio antenna installation. DX Engineering offers general grounding information, specific examples with available components and PolyPhaser® protectors for safe and worry-free antenna installations.

Feedline Decoupling

In either a ground-mounted or roof-mounted vertical installation, decoupling the feedline from the antenna and the radial system is very important. Any unbalance in the vertical and radial system can cause feedline radiation, which is often the cause of TVI and RFI that disturbs television, phones, computers, and sound systems, not to mention the neighbors! Feedline radiation from the shield and near-field radiation picked up by the shield can hinder proper tuning and will distort the desired low-angle radiation pattern. Also, stray RF picked up from computers, televisions and other sources, as well as common-mode currents, combine to increase received noise because the feedline shield is acting as an antenna.

The use of an effective feedline choke at the base of the vertical will decouple the feedline from the antenna, preventing feedline radiation and reducing received noise. The vertical has a better pattern and will be quieter when the feedline is connected using a DX Engineering Vertical Feedline Choke Kit, model DXE-VFCC-H05-A. It is specifically designed with an insulated mounting shelf to isolate the feedline from your quarter-wave vertical antenna, and it provides a direct connection to the antenna and the radials. The DX Engineering Feedline Current Choke, the DXE-FCC050-H05-A, can also be used as a line isolator further down the feedline, away from the near field of the antenna, for additional decoupling. Remember to run the feedline under the radials by several inches to maintain effective decoupling.

Guying

Most verticals need at least one set of three or four guy ropes to survive moderate to high winds. If you roof mount, you will need two sets of guys, one set near the middle and another high on the vertical. Follow the manufacturer's recommendations for attaching guy ropes. Ultraviolet resistant Dacron/polyester rope is the best choice, such as model STI-DBR-94-100, but several sizes and lengths are also available from DX Engineering. Gentle stabilization is what's required, **not** a strong anchoring like a tower would need. For ground mounted verticals of any brand, DX Engineering offers guying kits that include the rope and ground anchors (DXE-GUY-4BTV or DXE-GUY-56BTV).

More information on DX Engineering products is available, with installation photos, at our website - www.DXEngineering.com.

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