



Make the Hustler BTV Series Antenna into a High Performance Vertical Antenna System

Hustler BTV Series High Performance Information

4 BTV, 5 BTV, 6 BTV

DXE-BTV-GUIDE Rev 3

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Note: DX Engineering is constantly upgrading information and developing new products to enhance your amateur radio experience.

Please check the DX Engineering web site
for the *latest* information available:

<http://www.DXEngineering.com>

Congratulations

on your purchase of one of the most versatile multi-band HF antennas available. To get optimum performance from this vertical design, install it according to these updated instructions which are in *addition* to the instructions supplied by the original manufacturer. By following these additional instructions, you will improve the performance of the Hustler BTV series of ground mounted Vertical Multi-band Antennas.

- For best results, DX Engineering recommends a ground-mount installation with many radials. Engineers and Amateurs have proven that installing a good ground radial wire system will significantly improve quarter-wave vertical antenna performance for transmitting and receiving.
- Mounting this antenna without radials will offer below average to poor performance resulting in only local contacts or a few medium range contacts. Due to ground losses, a vertical installation with no radials or only a few radials will have drastically reduced efficiency — a poor trade-off for a lower SWR. Plan to install radials for performance and results.
- Height is not a requirement for HF Vertical ground mounted antennas, but they need resonant, tuned radials to be efficient and functional. Safer ground-mounted installations can produce results superior to elevated verticals.

Ground Mounting Support Installation

- Install your new vertical antenna a minimum of 20 feet away from buildings, wires, metal fences, downspouts and gutters. Centering a vertical antenna in an open area is the best option. Installing the antenna near a wooden fence or on a wood post is okay as long as there is no metal within 20 feet of the antenna.
- Installing the antenna on a metal mounting pipe or a wooden post set in concrete is okay. Radial wires create the efficient ground return for RF currents so direct earth grounding (a ground rod) is not required at the antenna.
- The mounting support may be a galvanized metal pipe or thick walled steel tube from 1 inch to 1-3/4 inches outside diameter (OD) when using just the Hustler bracket, and 1 inch to 2 inches OD when using the **DXE-TB-3P** Tilt Base. A 4 to 6 inch wood post can also be used. Sink the support deep enough to hold the antenna steady in your soil, or in concrete, with only 24 inches sticking out of the ground. Aluminum mounting pipes are not recommended since they interact with concrete. Use steel or galvanized steel.
- The DX Engineering Tilt Base, model **DXE-TB-3P**, makes assembly and tuning an easy one-person task. The antenna can be easily stowed horizontally for periods of high wind or inactivity.

Radial System Considerations

- To avoid damage from radial installation and for proper RF decoupling, the coaxial cable should be buried several inches under the radial system.
- Performance of the antenna is directly proportional to the number and length of radials. Many short radials are better than a few long radials. The stainless steel DX Engineering Radial Plate, model **DXE-RADP-1P**, makes it easy to attach long-lasting radial wire connections.
- **DO NOT** bother to cut ground radials to resonant lengths because they are detuned by the ground. It is best to install many radials that are all the same length or lengths that fill a small irregular space.
- Radial wires should run in all directions straight from the base feedpoint of the antenna. Ground radials cannot be bunched together for any length. If your radials cannot cover 360 degrees, that is okay. The antenna performs nearly the same with an equal number of radials squeezed into directions that cover smaller arcs.
- Plan to install at least 20 radials using DX Engineering Radial Wire Kits

DXE-RADW-500K	Bulk Radial Wire Kit, 500 ft Spool of Wire, 20 Lugs, 100 Staples
DXE-RADW-1000K	Bulk Radial Wire Kit, 1000 ft Spool of Wire, 40 Lugs, 200 Staples

DXE-RADW-500KBD	Bulk Radial Wire Kit, 500 ft Spool of Wire, 20 Lugs, 100 Biodegradable Staples
DXE-RADW-1000KBD	Bulk Radial Wire Kit, 1000 ft Spool of Wire, 40 Lugs, 200 Biodegradable Staples

DXE-RADW-20RT	Package of 20 each 20 Ft Radials with 1/4" Ring Terminals Installed
DXE-RADW-32RT	Package of 20 each 32 Ft Radials with 1/4" Ring Terminals Installed
DXE-RADW-65RT	Package of 20 each 65 Ft Radials with 1/4" Ring Terminals Installed

(The following three kits are mainly used for elevated antennas)

DXE-RADW-1K	Pre-Cut Radial Wire Set for 10, 15, and 20m. Includes 1/4 in. Ring Terminals
DXE-RADW-40MK	Pre-Cut Radial Wire Set for 40m. Includes 1/4 in. Ring Terminals
DXE-RADW-80MK	Pre-Cut Radial Wire Set for 80m. Includes 1/4 in. Ring Terminals

Detailed information on the parts included in these kits can be found on page 12

You don't have to dig! Radial wires disappear under the grass when installed with our steel or biodegradable anchor pins. Good luck on your project!

**NEVER CUT THE ALUMINUM TUBING TO
TUNE THIS ANTENNA**

See "Tuning the Hustler BTV" instructions in this guide.



Get the Best Performance From Your Quarter-Wave Vertical Antenna Ground Mounting vs. Roof-Top or Elevated Mounting

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 expected. 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 to make using the stainless steel 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 DX Engineering radial wire kits. The relaxed black PVC insulated 14 gauge stranded copper wire, in our Radial Wire Kits is easy to handle and will last far longer than bare wire or wire mesh.



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 as many symmetrically spaced radials as you can. You may use wires of any convenient length. Just run your radials in as many directions as you can, straight away from the antenna base taking care not to bunch or cross over other radial wires. 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 elevated or 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 down 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 any metal. We recommend four resonant radials per band to enhance low angle radiation. If you must elevate your antenna, Pre-Cut Radial Wire Sets are also available from DX Engineering.



We recommend using an antenna analyzer such as the MFJ-259B or an SWR meter to make resonant, elevated radials. For the Hustler BTV series 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 the Radial Plate.

Tune the 10 meter section of the vertical for the lowest SWR 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 frequency band. 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 antenna or radial wires. 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 lines. Contact with power lines can be fatal! 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 antenna 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 by the antenna 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 current 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 including an insulated mounting shelf to isolate the feedline from your quarter-wave vertical antenna, and the VFCC 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 bury the feedline under the radials by several inches to maintain effective decoupling.



Guying

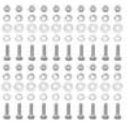

Most verticals need at least one set of three or four guy ropes to survive moderate to high winds. If you roof mount, you will need two sets of guys, one set near the middle and another high on the vertical. Follow the manufacturer's recommendations for attaching guy ropes. Ultraviolet resistant Dacron/polyester rope is the best choice, such as model **STI-DBR-94**. Several other 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 vertical antennas of any brand, DX Engineering offers guying kits that include the rope and ground anchors (**DXE-GUY100, 200, 400, 1000-KIT**).



Accessories for Your Hustler BTV

DX Engineering is proud to offer a comprehensive set of products specifically designed for an easy, safe and productive quarter-wave HF vertical antenna installation. We are certain that you will be pleased with your operating results from your properly planned and DX Engineering equipped Hustler BTV antenna project.

Here is our recommended list of accessories to order for your high performance installation of Hustler models HUS-6-BTV, HUS-5-BTV or HUS-4-BTV:

- | | | |
|----------------------------|--|---|
| 1 ea DXE-RADP-1P | Radial Plate, Stainless Steel, with 20 bolt set for radial wire attachment | |
| 1 ea DXE-RADP-1HWK | 20 sets of Stainless Steel bolts/washers/nuts for more radials | |
| 1 ea DXE-TB-3P | Tilt Base, Stainless Steel, for Hustler BTV models | |
| 1 ea DXE-RADW | Radial Wire Kit: 500 or 1000 ft Spool of Radial Wire, 20 or 40 terminal Lugs, 100 or 200 Lawn Staples - depends on Radial Wire Kit chosen - see page 12 for details. |  |
| 1 ea DXE-VFCC-H05-A | Vertical Feedline Current Choke Kit with insulated shelf and feedline connection braids | |
| 4 ea DXE-CAVS-2P | V-Bolt Saddle Clamp kits for 1 inch to 2 inch OD Mounting Pipes (1 each for Radial Plate, 2 each for Tilt Base, 1 each for VFCC) |  |

Feedline attachment to the Hustler BTV series, or any quarter-wave vertical, is handled best with DX Engineering's Vertical Feedline Current Choke Kit, model **DXE-VFCC-H05-A**. This kit includes an insulated shelf, the Vertical Feedline Current Choke, and tinned copper braids for the antenna and radial plate connections as shown on the next page in this guide book. With this system, the coaxial cable does not touch the radial plate, so the feedline is completely isolated from the antenna system. The benefits offered are the best possible current balance for a stronger radiation pattern and lower received noise.



Alternatively, order our new SO-239 connector Add-On Kit, model **DXE-AOK-DCF**. This feedline attachment device designed specifically for Hustler BTV is available **only** from DX Engineering. Featuring a stainless steel bracket and hardware, it allows the connection of a coaxial cable with a PL-259 directly to the base of the Hustler BTV. Proper feedline shield termination to the radial system, *only when not using the VFCC*, is made at the high power **DXE-363-SST** Silver-Plated Teflon® Bulkhead double SO-239 mounted on the Radial Plate, **DXE-RADP-1P**. A coaxial jumper model **DXE-CBC-8XU2** or **DXE-CBC-008U002** completes the connection to the **DXE-AOK-DCF**. The bulkhead SO-239 and the original DXE-8X19-RT 19 Inch Pigtail may be used instead of the **DXE-AOK-DCF**.



Your properly anchored galvanized steel ground mounting pipe should stick out of the ground 24 inches. It may be as large as 2 inches OD when using the **DXE-TB-3P** Tilt Base. Our 1 to 2 inch V-Bolt Saddle Clamps and the mounting holes on the DX Engineering Radial Plate, Tilt Base and VFCC Kit shelf bracket will accommodate the larger mounting pipe. Alternatively, wood may be

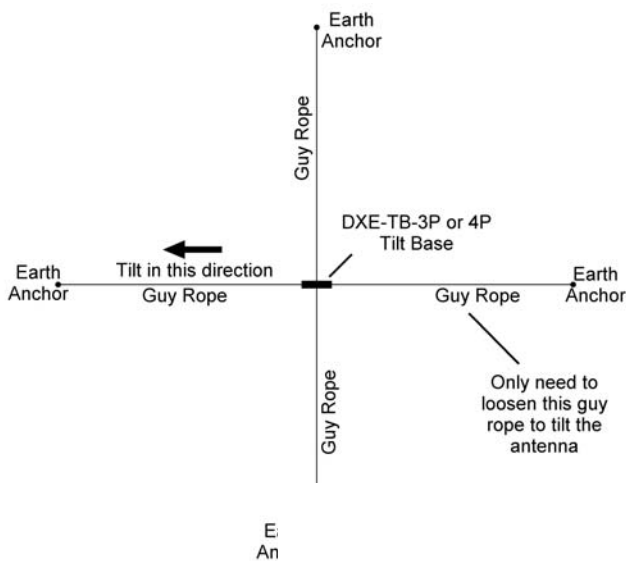
used for the ground mount support; you may attach these accessories to a 4 to 6 inch post with lag screws.

Additional items required:

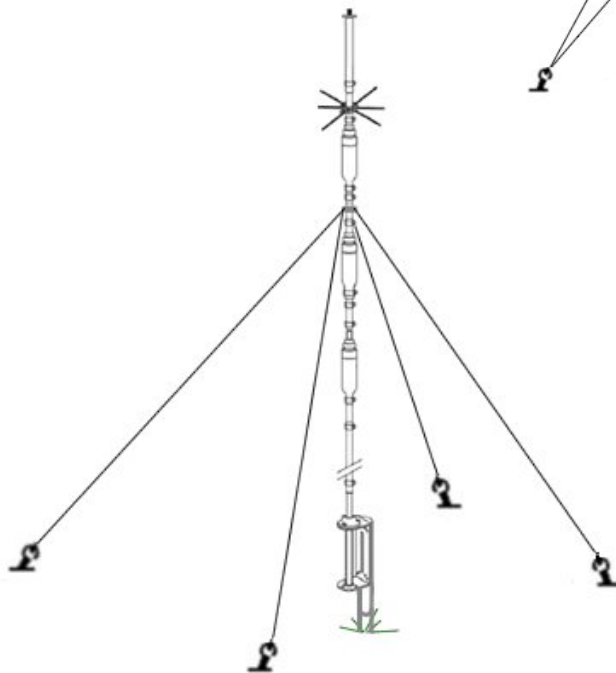
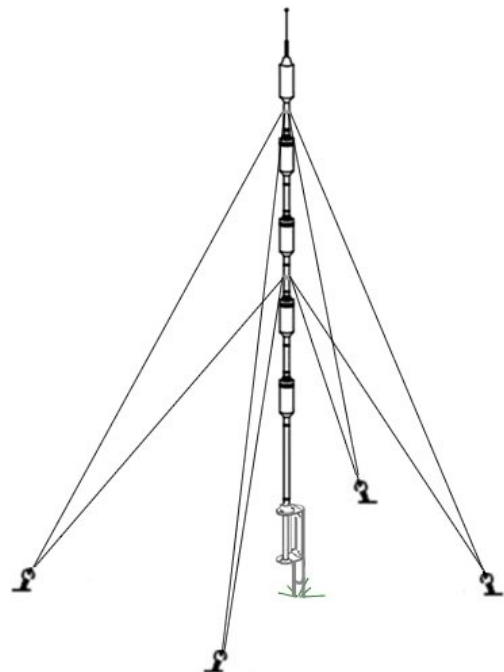
1 ea **DXE-81343** Anti-Seize - Thread grease for stainless steel hardware
(UPS Ground only)

1 ea **DXE-P8A** Penetrox A - Aluminum antenna conductive anti-oxidant
(UPS Ground only)

1 ea **DXE-GUY-100** or **DXE-GUY-200** Guying Kits for Hustler BTVs

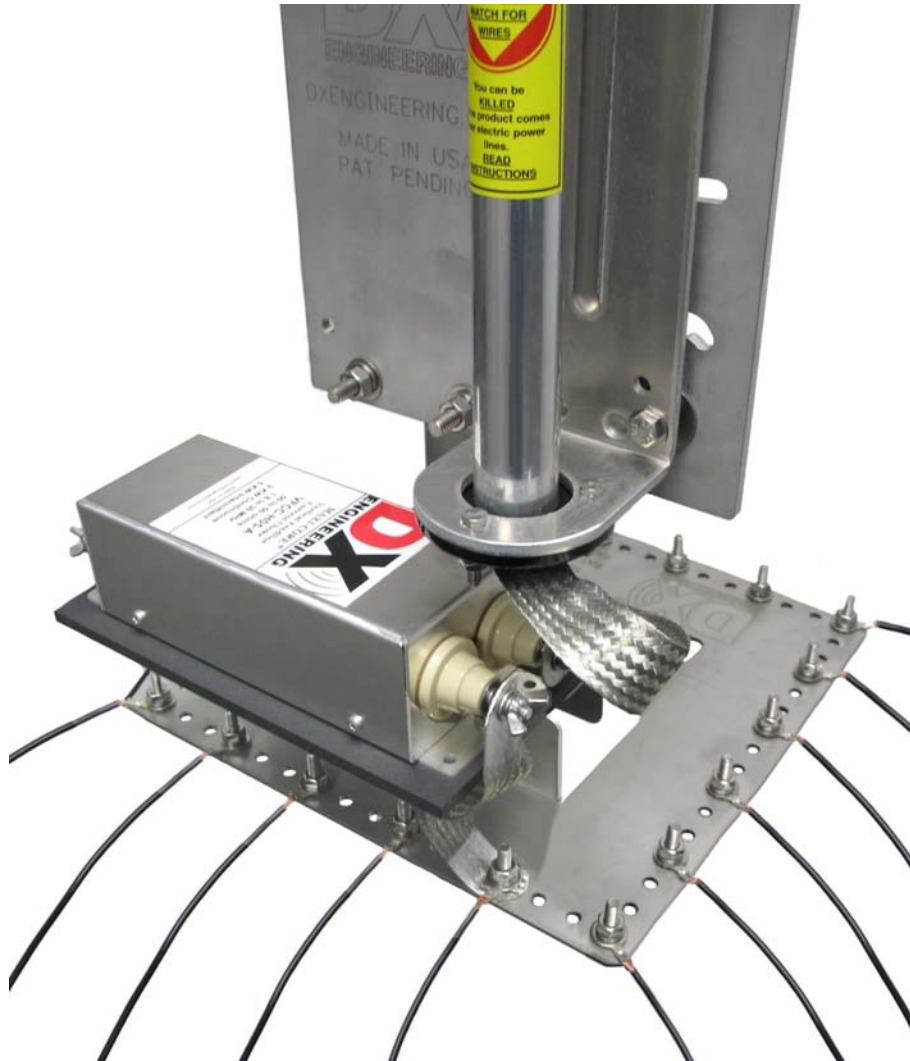


E.
An



Typical BTV Guying Schemes

DX Engineering manufactures sealed and tested coaxial cable assemblies of any length using Belden 9258/RG-8X type, 8267/RG-213 type, or 8214/RG-8U, hand soldered with quality silver Teflon® PL-259s.



Typical Hustler BTV series antenna using the optional DX Engineering Tilt Base, DX Engineering Radial Plate with stainless steel hardware, DX Engineering Radial Wires, DX Engineering VFCC with insulated shelf, braided feedpoint connections, and DX Engineering V-Bolt Saddle Clamps

Quick Tilt Action

DXE-AOK-TB1193 - Wing Nut No-tools Tilt Base Add-on Kit (pack of 2)

Wing nut knobs for tool-less quick release of the DX Engineering **DXE-TB-3P** or **DXE-TB-4P** Tilt Base - handy for lowering the antenna for tuning or daily stealth operation.

Simply remove the existing hex nuts and thread on the wing nuts. The old hardware stores on the tilt base for future use. Purchase two sets to also allow tightening of the lower mounting hardware without tools - and for extended periods of upright installation and use.



60 Meter and 17 Meter Add On Kits - Extend your Operations

DXE-AOK-60M - 60M Add-On Kit for the Hustler BTV Series Verticals

The DX Engineering **DXE-AOK-60M** kit adds 60 meter coverage to the Hustler BTV series of vertical antennas without giving up any existing band coverage. This kit will operate across the entire 60m band with an SWR of 1.5:1 or less.

Kit includes the 60 meter resonator and new capacitive compensator. No disassembly of the existing antenna is required, simply add this kit, make some minimal tuning adjustments and you're on the air with an additional band. The BTV will retain full performance on all bands.



DXE-AOK-17M - 17M Add-On Kit for the Hustler BTV Series Verticals

The DX Engineering **DXE-AOK-17M** kit adds 17 meter coverage to the Hustler BTV series of vertical antennas without giving up any existing band coverage. This kit will operate across the entire 17m band with an SWR of 1.5:1 or less.

No disassembly of the existing antenna is required; simply bolt this kit over the 10m trap, make some minimal tuning adjustments and you're on the air with an additional band.



Radial Wire Kits & Accessories

DXE-RADW - 500K or 1000K Bulk Radial Wire Kits and Components

To achieve optimal performance with a ground-mounted vertical, install as many radials as possible. These bulk radial wire kits use insulated wire that is UV resistant, hard to see and lays down easily, unlike the wire that is commonly available at the big box stores. It will last much longer in contact with soil than bare wire.

The DXE-RADW- 500K or 1000K kit provide everything you will need to build the perfect radial system!

- 500/1000 ft. spool of 14 AWG, stranded copper wire with vinyl insulation
- 20/40 lugs
- 100/200 radial wire anchor pins- Eliminating the need to bury your radials!
- Build up to 20/40 radials, 25 feet long



DXE-RADW-500K	Bulk Radial Wire Kit, 500 ft Spool of Wire, 20 Lugs, 100 Staples
DXE-RADW-1000K	Bulk Radial Wire Kit, 1000 ft Spool of Wire, 40 Lugs, 200 Staples

DXE-RADW-500KBD or 1000KBD - Bulk Radial Wire Kits and Components

To achieve optimal performance with a ground-mounted vertical, install as many radials as possible. These bulk radial wire kit use insulated wire that is UV resistant, hard to see and lays down easily, unlike the wire that is commonly available at the big box stores. It will last much longer in contact with soil than bare wire. The biodegradable anchors allow easy installation of radial wires, and will degrade and disappear in a year or so when they are no longer needed.

The DXE-RADW-500 or 1000KBD kit provide everything you will need to build the perfect radial system!

- 500/1000 ft. spool of 14 AWG, stranded copper wire with vinyl insulation
- 20/40 lugs
- 100/200 biodegradable radial wire anchor pins- Eliminating the need to bury your radials!
- Build up to 20/40 radials, 25 feet long



DXE-RADW-500KBD	Bulk Radial Wire Kit, 500 ft Spool of Wire, 20 Lugs, 100 Biodegradable Staples
DXE-RADW-1000KBD	Bulk Radial Wire Kit, 1000 ft Spool of Wire, 40 Lugs, 200 Biodegradable Staples

DXE-RADW-20RT/-32RT/-65RT Pre-Assembled, Radial Wire, w/ crimped 1/4" ring Terminals, 20 Pack

The DXE-RADW Radial Wire Kits include the highest quality 14 gauge stranded copper wire with a relaxed black PVC insulation for easy installation of your radial system. They allow fast and easy installation of your radial ground system, and permit you to mix and match different length to fit the available space. The stranded wire and relaxed insulation mean that the wire will lay flat as you place it on the ground - easy to install! The twenty pre-cut radial wires include 1/4" ring terminals professionally crimped on one end for quick and easy attachment to the radial plate. These Radial Wire Kits are designed for users of vertical antenna systems which have the need for a high quality radial system for optimum antenna performance. The 1/4" ring terminals are machine crimped for maximum grip. Soldering is not required for strength, but is recommended if installed in corrosive environments such as salt spray.



- Packed 20 Radial Wires per package
- 14 gage, stranded copper wire
- Black relaxed PVC insulation
- 1/4" Ring Terminal professionally crimped on each Radial Wire
- 3 lengths to choose from: 20 Ft (-20RT), 32 Ft (-32RT), 65 Ft (-65RT)

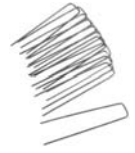
DXE-RADW-20RT	Package of 20 each 20 Ft Radials with 1/4" Ring Terminals crimped in place
DXE-RADW-32RT	Package of 20 each 32 Ft Radials with 1/4" Ring Terminals crimped in place
DXE-RADW-65RT	Package of 20 each 65 Ft Radials with 1/4" Ring Terminals crimped in place

DXE-STPL - Radial Wire Anchor Pins, 100/pack - No need to bury your radials!

DX Engineering Radial Wire Anchor Pins are perfect for fastening radials below the grass line to eliminate the risk of damaging your radials during lawn maintenance.

- 100 count - 6" Pins
- 11-Gauge

DXE-STPL-100P	Radial Wire Anchor Pins, 100/pack
DXE-STPL-300P	Radial Wire Anchor Pins, 300/pack



DXE-STPL-100BD - Radial Wire Staple, Biodegradable, 3", 100 pack

DX Engineering DXE-STPL-100BD is a 100-pack of 3" biodegradable anchors that are produced from recycled PLA (Polylactide Resin). Depending on the weather conditions, they will degrade in about a year. They are easily installed and will hold radial wires in place until lawn roots overtake them - and then disappear. Ecologically friendly!



DXE-225RT-20 - Ring terminal 16-14 Wire Gauge, 1/4" hole/20-pk

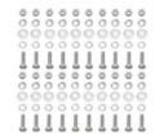
This is a set of 20 ring terminals for AWG #14 to 16 wire with a clearance hole for a 1/4" bolt. These are the same crimp terminals supplied with the DXE Radial Wire Kits for #14 Radial and Antenna Wire.



DXE-RADP-1HWK - Radial Plate Wire Attachment Hardware Kit - Stainless Steel

20 Sets of ALL Stainless Steel Radial Hardware for use with the DX Engineering Stainless Steel Radial Plate.

- (20) 1/4" Bolts - (20) 1/4" Nuts - (20) 1/4" Flat Washers - (20) 1/4" Split Washers - (20) 1/4" Star Washers



DXE-900031 - Automatic Wire Stripper/Crimper/Cutter, 24-10 Ga.

Our DX Engineering wire stripper uses a spring-loaded design to make quick work of wires ranging from 24 to 10 gauge. Just insert the wire, squeeze the handle, and listen for the click. That's the sound of another perfect wire stripping job performed in about 2 seconds- a fraction of the time it takes your pocket knife to do the same job. An adjustable wire length guide helps you make uniform strips, and a built-in wire cutter and crimper helps you complete your wiring job.

- Spring-loaded design
- Strips wires ranging from 24 to 10 gauge
- built-in wire cutter and crimper



DXE-RADW-1K - Pre-Cut Radial Wire Set for 10, 15, and 20m. Includes 1/4 in. Ring Terminals

For elevated feed verticals, use these pre-cut resonant radial wire sets for optimal performance on 10, 15, and 20m. Allows construction of four 1/4 wavelength resonant radial wires for each band. Includes 12 ring terminals for 1/4" bolts and 12 wires precut to correct length. Wire is 14 AWG stranded copper with vinyl insulation.

Radial wire lengths per band:

- 10m: 8 ft, 9 in.
- 15m: 11 ft, 9 in.
- 20m: 17 ft, 6 in.

For ground-mounted verticals, use one of our bulk radial wire kits.



DXE-RADW-40MK - Pre-Cut Radial Wire Set for 40m. Includes 1/4 in. Ring Terminals

For elevated feed verticals, use this pre-cut resonant radial wire set for optimal performance on 40 meters. Allows construction of four 1/4 wavelength resonant radial wires. Includes 12 ring terminals for 1/4" bolts and 4 wires precut to 35 ft. Wire is 14 AWG stranded copper with vinyl insulation.

For ground-mounted verticals, use one of our bulk radial wire kits



DXE-RADW-80MK - Pre-Cut Radial Wire Set for 80m. Includes 1/4 in. Ring Terminals

For elevated feed verticals, use this pre-cut resonant radial wire set for optimal performance on 80 meters. Allows construction of four 1/4 wavelength resonant radial wires. Includes 12 ring terminals for 1/4" bolts and 4 wires precut to 70 ft, 3 in. Wire is 14 AWG stranded copper with vinyl insulation.

For ground-mounted verticals, use one of our bulk radial wire kits



How To Put Radial Wires Down Without Digging

The best time to do this is early spring but it can be done other times, as well. I have even done it in the fall and had good success.

The idea behind this is to get the grass of your lawn to grow over the radials and protect them from the mower.

First, mow the grass pretty short in the areas where you will be laying the radials down. Notice, I didn't say "scalp" it. Just lower the mower until the grass is about 1 inch long after cutting. Readjust the height of the mower back to normal and put it away.

Next, connect the radials to the Radial Plate with wire terminal ends (which you can get at DX Engineering along with the radial wire) and stretch them out while arraying them evenly around the antenna. Some AM broadcast engineers tell us that the radials should be as long as you can make them up to about 1/2 wavelength. If you can only do 1/4 wave or 1/8 wave in certain directions then do that and don't worry about it. You will be surprised how much better your vertical will work. After you install 20 to 40 radials and see how much better your antenna performs you will have an urge to put in more of them. Don't resist. More really is better.



OK – back to the installation.

Starting from the antenna end of the radials, and about every 3-4 feet, hold the wire down with a Steel or Biodegradable Radial Wire Anchor Pin while pulling the radial out from the antenna to keep it taut. Push it in as far as possible to get the wire as close to the grass roots as possible. I typically use a rubber mallet to drive it home. If the radial wire is sticking up any place due to uneven ground or the wire is loose just put another staple there. The idea is to get all parts of the wire down as close as possible to the ground so that the grass can grow over it.



When you finish the last radial, your job is done. Mother Nature will do the rest. If you have done this in the early spring, the grass will grow up, surround the wire and pull it down firmly along its full length. If you do it in the fall after the grass has stopped growing, it will happen the next spring. This will be done so completely that in a few weeks you will have to actively look for the radials to see them.

Your mower will miss them completely, too; but you and your contacts will hear them right away!

73,

Paul - NO8D

Note: Radial Wires shown above have Red insulation so they would show up in the photographs. DX Engineering Radial Wire has a relaxed Black PVC insulation.



Tuning the Hustler BTV – Instructions for Trap Calibration After Installing a Good Radial System

A high efficiency quarter-wave vertical requires a good radial system. Installations with few or no radials are inefficient due to high ground losses. Therefore, removal of radials to achieve a lower SWR is not a tuning solution.

Hustler 4-, 5- and 6-Band Trap Vertical antennas can resonate at frequencies much lower than desired when installed on very good soil or with a good radial system. Readjusting antenna resonance is easy. If you can't get the tuning you want by making adjustments according to the Hustler instructions, retune the vertical for in-band resonance by adjusting the traps. Do this just as you would other parts of the antenna — loosen a stainless clamp, make a trap sleeve adjustment and tighten the clamp. Note that a slight movement of the trap sleeve will produce a rapid change in the SWR frequency. Follow the procedure described below carefully to make large frequency adjustments to any Hustler BTV HF antenna.

Trap calibration adjustment will not void the warranty of a Hustler antenna purchased from DX Engineering.

The antenna traps will not be harmed by performing this tuning procedure.

Never Cut the Aluminum Tubing — you can't properly adjust the frequency of the Hustler BTV antenna by cutting the traps or by cutting the aluminum tubing above or below the traps.

An antenna analyzer such as the MFJ-259B is the best tool to use for adjusting any antenna to the target frequency if it is connected directly to the feedpoint. Since that is never convenient, use a six foot piece of 50 Ω coax between the antenna and the analyzer and tune for minimum SWR. Your body can affect the tuning if you are too close to the antenna. If the coax length is too long, the analyzer SWR measurements may be incorrect. When adjusting antennas, your primary goal is to move the low SWR point to your target frequency. Perfect analyzer impedance readings near 50 Ω resistance and $X=0$ or $\pm j0$ reactance are not realistic. The frequency where lowest SWR occurs will likely result in analyzer readings that are not perfect. If you only have an SWR or power meter use it at the antenna. Use your transceiver and plot a chart of SWR measurements at several frequencies, repeating after every antenna adjustment. Starting at a low frequency, record SWR measurements at regular increments higher in frequency to determine where the lowest SWR occurs. When making antenna adjustments, DO NOT watch a certain frequency hoping for a minimum SWR to appear. Over-adjustment could cause you to miss the "dip" as it passes your target frequency. It is better practice to follow the minimum SWR point as you make adjustments to achieve low SWR at the correct frequency.

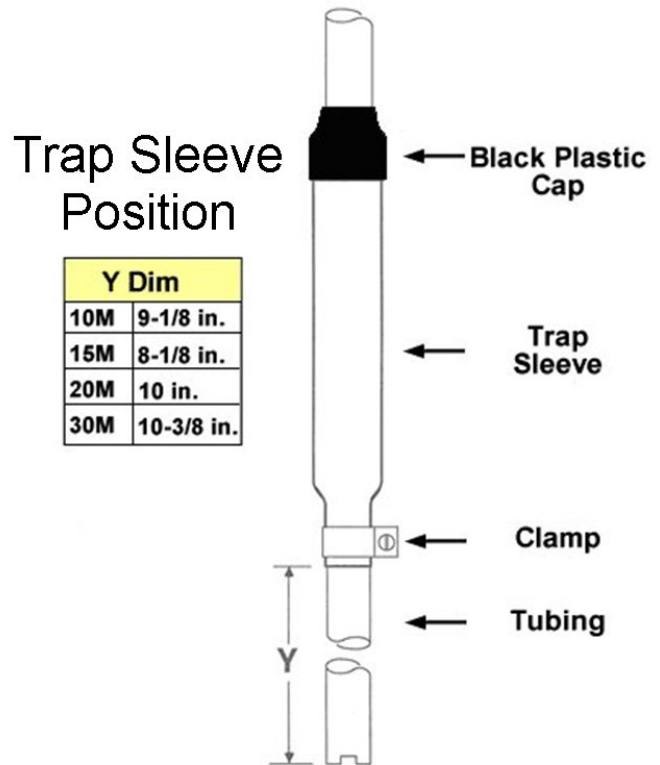
Hustler Trap Calibration Resonance Adjustment Procedure

The lettered dimensions charted in the Hustler assembly instructions are only starting points and may be changed for fine tuning. The manufacturer uses a silicone sealant inside the black plastic weather caps.

Twisting the trap sleeve while holding the black weather cap will loosen it. The silicone can be removed so the black weather cap and the trap sleeve can be repositioned.

When the low SWR dip is far from the correct frequency, use this coarse tuning adjustment procedure. You must adjust each trap with the antenna completely assembled – traps cannot be adjusted before assembly.

This chart shows the initial position of the trap sleeve measured from the end of the trap bottom tube to the bottom of the sleeve where it is clamped. It is not necessary to remove each trap from the larger tubing below it, or measure it, in order to make the trap sleeve adjustment to tune the antenna. Moving the trap sleeve on the trap's lower tubing has the effect of either increasing dimension Y when sliding upward, resulting in a lower frequency, or decreasing dimension Y when sliding downward, resulting in a higher frequency. This can be accomplished even though the trap lower tubing is installed inside the larger tubing below. You may need to increase the spacing between the trap sleeve and the tube below to complete recalibration. **Note:** Like other antenna adjustments, trap adjustments are not permanent and can be restored easily. Mark the position of the sleeve on the tubing before you start so returning to the starting point will be simple.



Start with the 10 meter trap, because any adjustment done there affects the rest of the antenna. Slightly loosen the clamp at the bottom of the trap sleeve, not the clamp on the larger tube, and adjust the trap sleeve position on the trap bottom tubing. Typical adjustment is about 1/4 to 1/2 inch for a shift of 500 kHz. Firmly tighten the trap sleeve clamp. With the entire antenna upright, re-test to track the SWR dip. Readjust to move the SWR dip to the desired frequency. After you adjust one trap, check all bands before adjusting other traps. Then, tune for the lowest SWR on each band, by readjusting the trap to support tubing dimensions. Reposition the black plastic cap onto the trap sleeve. New silicone sealer is not required, but if used, it will not affect the tuning.

Do not worry if you cannot tune the antenna to the lowest possible SWR of 1.0:1. A minimum SWR of 1.4:1 to 1.6:1 is acceptable for HF operations, representing a minor RF power reflection of only 3 to 5%. Your new high efficiency antenna system is now properly installed and tuned and will reward you with years of service.

The Quarter-Wave Vertical on a Metal Roof

Over the years, many Amateur Radio operators have successfully used a metal roof as the ground plane or radial system for their quarter-wave HF vertical. This is possible with a metal roof on a home, barn, garage, carport, RV, porch and metal sheds or awnings, and even on commercial buildings. The actual height of the metal roof above ground is not especially important for an HF quarter-wave vertical.

In order to take advantage of a metal roof as a ground plane, you cannot elevate a quarter-wave vertical high above a metal roof. The key is that the antenna feedpoint, which is usually at the mounting bracket, should be the same physical level as the metal roof to offer the best ground plane effect.

The feedpoint of the vertical should not be any more than 4 to 8 inches above the roof, even if the mechanical mounting would allow for a higher installation. In other words, raising a quarter-wave vertical antenna many feet above the metal roof does more harm than good with regard to impedance matching and tuning. Mounting the HF quarter-wave antenna at the top of a tall mast, without a feedpoint level radial system, does not function electrically, and is mechanically very difficult. If you must use a tripod for mechanical mounting reasons, use one that is as short as possible. With a tripod mount, you must use a basic wire radial system that emanates from that slightly elevated feedpoint and drapes down over the metal roof to make use of the coupling effect described below. You cannot make a direct connection of the coax shield to the metal, due to the distance of the feedpoint above the metal.

There are *two ways* that a quarter-wave vertical can be installed on a metal roof or large metal awning as a ground plane.

The potentially *less efficient* installation uses direct grounding of the coax shield and antenna bracket to the metal roof. This might work well for transceiving, and would probably "appear" to work well due to excellent receiving results. However, you may find that you aren't easily heard. This would be an indication that the sections of your metal roof are not well bonded. Remember, we are trying to provide the same low impedance RF current collection and distribution as a ground mounted system of 30, or more, straight copper wire radials that are about one-quarter wavelength long. Just because the metal panels of a metal roof are connected with a bunch of screws or nails, and even when a multi-meter shows DC continuity between the panels, does not mean that you have a good radial system for RF. You can try it and believe that it is working great, but you may not really know how efficient the directly connected metal roof is working for you. Measured at the antenna, a frequency range of over 400 kHz under a 2:1 SWR across and beyond the 40 meter band (7.0 to 7.4 MHz) would be a general indication of radial system or ground plane inefficiency, depending upon the size of the vertical. Conversely, a very efficient ground plane will narrow the SWR bandwidth of a vertical.

The *preferred installation* for your quarter-wave vertical using a metal roof or large awning as your ground plane is to connect the coaxial cable shield to several (6 to 16) insulated radial wires that are placed on, under, or are draped out over the metal roof. The radials must be attached to the antenna feedpoint, never at the bottom of a tall mast or tripod. Capacitive and inductive coupling between the radial wires and the metal roof accomplishes the collection of the RF currents. The number of these "coupling radials" that you need will vary from one installation to another, but you may need fewer than would be required for a high performance elevated mount or ground mount where there is no metal roof. They may be resonant lengths, unless space is a concern. Many short radials may get the job done for the lower frequency bands, too. In this installation, the antenna mounting bracket, the coax shield, and the radial system may need to be kept insulated from the mast and metal roof, to allow the coupling effect to work properly. Then again, actually connecting the metal roof to the radial system may work better for your installation. This is another example of the fun of HF; where changing a simple electrical antenna connection may dramatically improve your antenna system performance.

Ideally, a quarter-wave vertical is physically mounted in the center of a metal roof ground plane. This would provide the best omni-directional low angle radiation pattern. However, mounting a structurally sound vertical antenna at the center of a roof is not always possible. It is true that mounting the vertical at one end of the roof will affect the omni-directional pattern. However, the signal reduction of a few dB in the direction away from the metal roof, or any very good radial system, will not prevent you from enjoying the low angle pattern and resulting DXing benefits of quarter-wave vertical!

Consider the DX Engineering Vertical Feedline Current Choke kit model **DXE-VFCC-H05-A**, to make up for deficiencies in the metal "ground plane" or radial system. This choke and its properly mounted insulated shelf kit isolates the feedline, balances currents on the system for maximum signals, and offers the additional advantages of reduced noise and RFI/TVI.

The DX Engineering Tilt Base, model **DXE-TB-3P**, is designed specifically for the Hustler BTV mounting bracket. The **DXE-TB-4P** will work for other quarter-waves. Both are intended for ground-mounted quarter-wave verticals, allowing easy, one man, lift-and-lay, and walk up or down. For your roof top installation, this Tilt Base will only be helpful if you can safely walk on the roof, perhaps along the peak or on a flat roof, to tilt the antenna up and down. The antenna must then be supported in the horizontal position at a point away from the Tilt Base, while tuning adjustments are made, as the Tilt Base does not allow the antenna to tilt below horizontal.

Some vertical antenna manufacturers indicate their antennas do not need guying. During times of high winds or ice loading, some of these verticals may sustain damage or fail altogether. With the small amount of effort needed to install a four point guying system, the risk hardly seems worth taking. A four-point guying scheme provides the best mechanical advantage to prevent wind stress, regardless of direction. When using an optional **DXE-TB-3P** or **-4P** Tilt Base, a four point guying system is recommended for use with DX Engineering vertical antennas because just one of the guy ropes has to be loosened when you tilt the vertical down. The remaining guys help stabilize the vertical in three directions when being raised. The DX Engineering Vertical Guying Kits have been designed to be used with ground mounted vertical antenna systems. The guying kits are ideal for fixed or portable installations.

You can expect your large area metal ground plane or radial system to make a quarter-wave vertical resonate especially low in frequency and exhibit an impedance below 50 ohms at the feedpoint. IF that happens on your system, congratulations! You are the proud owner of a highly efficient quarter-wave vertical antenna system! Now, adjusting the antenna for minimum SWR at the desired frequency and re-matching the feedpoint to the feedline may require some additional adjustments or a simple matching network. These are not difficult to accomplish and are discussed in texts that cover the topic of quarter-wave vertical antenna systems.

Contact DX Engineering to receive your copy of the latest catalog of quality DX Engineering products!

Better yet - visit the DX Engineering website at:

<http://www.DXEngineering.com>



Technical Support

If you have questions about DX Engineering products, or if you experience difficulties during the installation, contact DX Engineering at (330) 572-3200. You can also e-mail us at:

DXEngineering@DXEngineering.com

Warranty

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