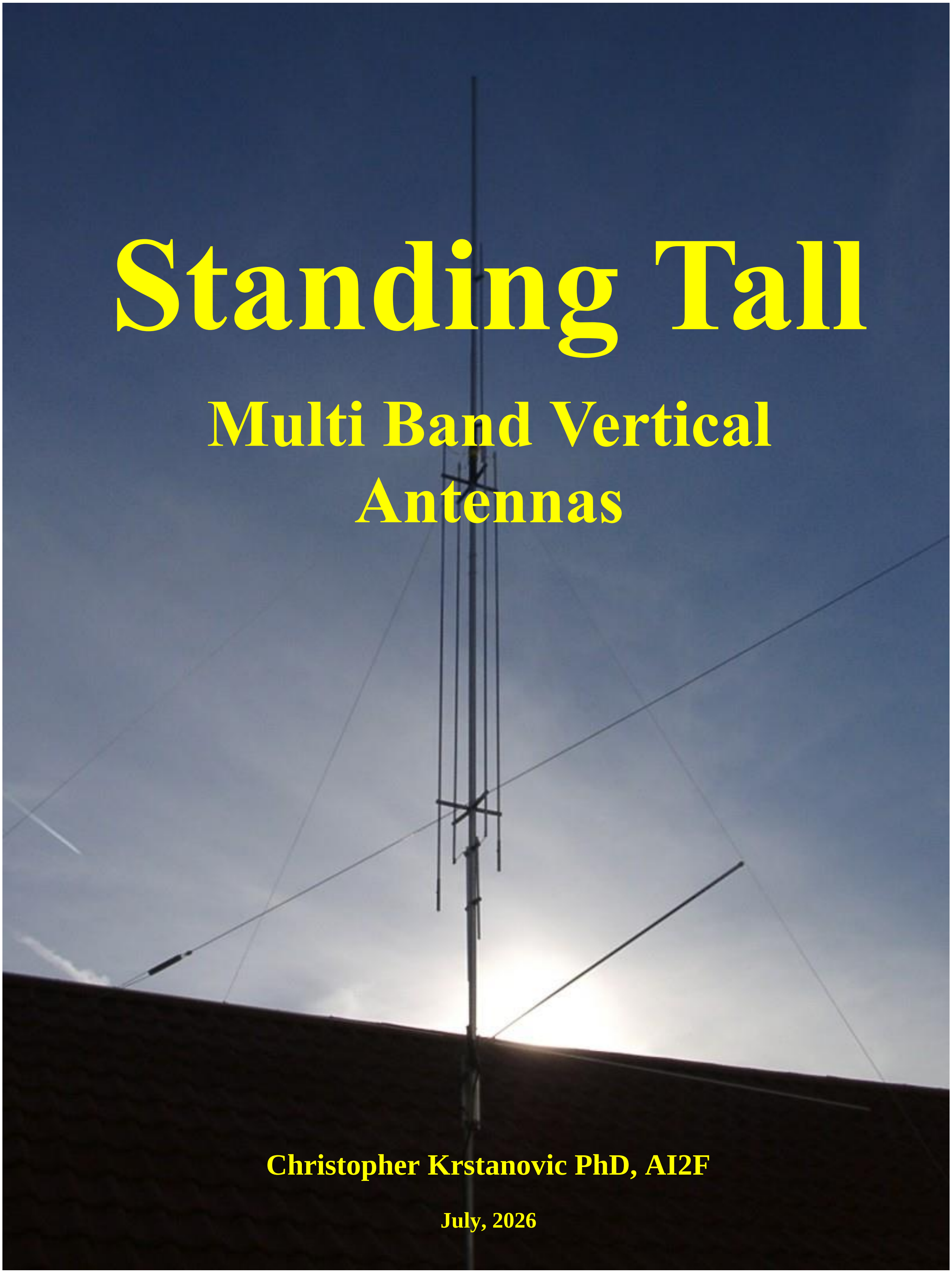


Standing Tall

Multi Band Vertical Antennas

Christopher Krstanovic PhD, AI2F

July, 2026

Standing Tall: Multi Band Vertical Antennas

By Christopher Krstanovic, AI2F

For many amateur radio operators, the ultimate antenna is one that covers several HF bands, occupies very little space, and performs well enough to make regular contacts around the world. Unfortunately, antenna design is always a series of compromises. An antenna that is compact, inexpensive, efficient, broadband, and easy to install simply does not exist.

Multi band vertical antennas come surprisingly close for many installations. They are especially attractive when space is limited or when erecting multiple full size antennas is simply not practical. While no multi band vertical is perfect, many provide excellent performance when properly installed and can put you on every major HF band with a single feed line.

We will look at a variety of commercially available resonant multi band vertical antennas. These are antennas that are designed to operate on their intended bands without relying on an external antenna tuner to make them usable. Non resonant designs, such as the popular 43-foot vertical that depends heavily on an antenna tuner, are outside the scope of this discussion.

"Verticals Radiate Equally Poorly in All Directions"

One of the oldest sayings in amateur radio is that *"vertical antennas radiate equally poorly in all directions."* It usually gets a laugh at club meetings, but like many old sayings, it is only partly true.

The joke originated because a vertical antenna has essentially no directional gain. Unlike a Yagi or even a dipole, it spreads its energy uniformly around the horizon. Since the available power is distributed over 360°, there is no concentration of energy in any one direction. Compared to a beam antenna, the peak radiated power is naturally weaker.

That does **not** mean a vertical is a bad or an inefficient antenna.

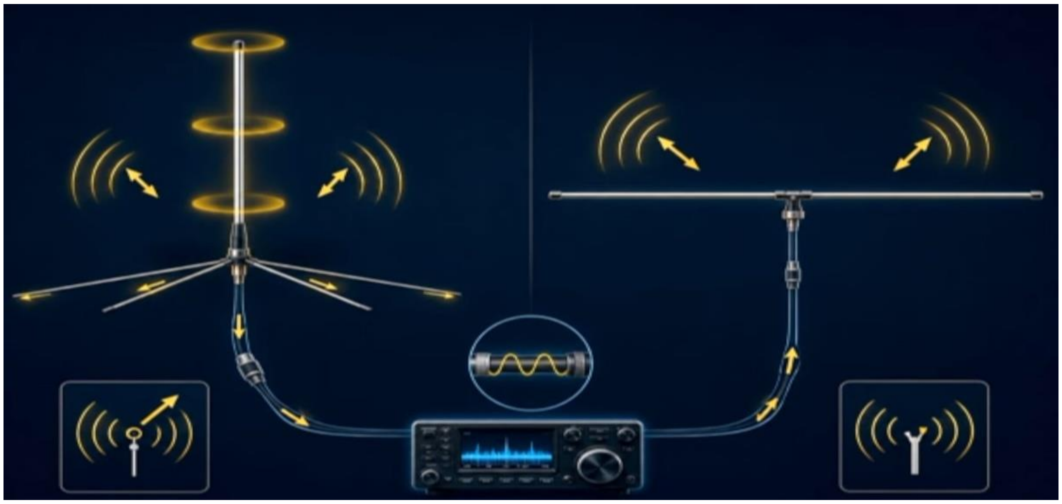
A properly designed quarter wave vertical installed over an excellent radial system can exceed ninety percent efficiency. In fact, commercial AM broadcast stations use vertical antennas almost exclusively because they are efficient, predictable, and provide uniform coverage.

Where the old saying does have some merit is that many amateur installations have poor radial systems. A vertical installed over only a few radials may lose several decibels in ground resistance before the signal ever reaches free space. Under those conditions, the antenna really does radiate poorly in every direction. The problem is not the vertical itself, but the installation.

How Does a Vertical Compare to a Dipole for DX?

This question comes up repeatedly whenever multiband verticals are discussed. The answer depends almost entirely on the height of the dipole.

A vertical antenna has two important characteristics that make it an excellent DX antenna. First, it is omnidirectional, allowing you to work stations in any direction without a rotator. Second, and more importantly, it naturally produces a very low angle of radiation. Since long distance communication depends on launching energy at low elevation angles, this gives the vertical a significant advantage over low horizontal antennas.



A dipole, on the other hand, becomes a progressively better DX antenna as its height increases. Raising the antenna lowers its takeoff angle while also increasing forward gain in the broadside direction. Once a dipole reaches about one wavelength above ground, it develops substantial gain at low angles and becomes an outstanding DX antenna.

The comparison below assumes a good quality multiband vertical installed correctly. Ground mounted antennas are assumed to have a substantial radial field, while elevated designs are assumed to have an effective counterpoise or resonant radial system.

Dipole at 1/4 Wavelength

A dipole mounted only one quarter wavelength above ground is an excellent antenna for regional contacts but is not particularly effective for long haul DX.

At this height, most of the radiated energy leaves the antenna at relatively high elevation angles, typically around 55° to 70° depending on ground conductivity. Those high angles are ideal for Near Vertical Incidence Skywave propagation, making the antenna excellent for contacts within several hundred miles. Unfortunately, relatively little energy is launched toward the horizon where most DX paths occur.

A good multiband vertical usually outperforms a quarter wavelength high dipole on long distance contacts. Operators often notice one to three S units of improvement on DX stations, especially on the lower HF bands where obtaining sufficient dipole height is difficult.

If your primary interest is working DX, a quality vertical is generally the better choice than a dipole only one quarter wavelength above ground.

Dipole at 1/2 Wavelength

At one half wavelength, the comparison becomes much more interesting. The dipole's radiation angle drops considerably, and its broadside gain begins to rival that of an efficient vertical. Depending on the operating band and terrain, both antennas often produce very similar results.

The vertical usually retains a slight advantage for very low angle radiation and provides complete 360° coverage without requiring rotation. The dipole, however, exhibits several decibels of broadside gain and tends to receive less man-made noise because it is horizontally polarized.

Many experienced operators consider this the crossover point. Under some propagation conditions the vertical wins. Under others, the dipole has the advantage. In practice, the difference is often only one S unit or less.

Dipole at One Wavelength

Once a dipole reaches approximately one wavelength above ground, the situation changes dramatically.

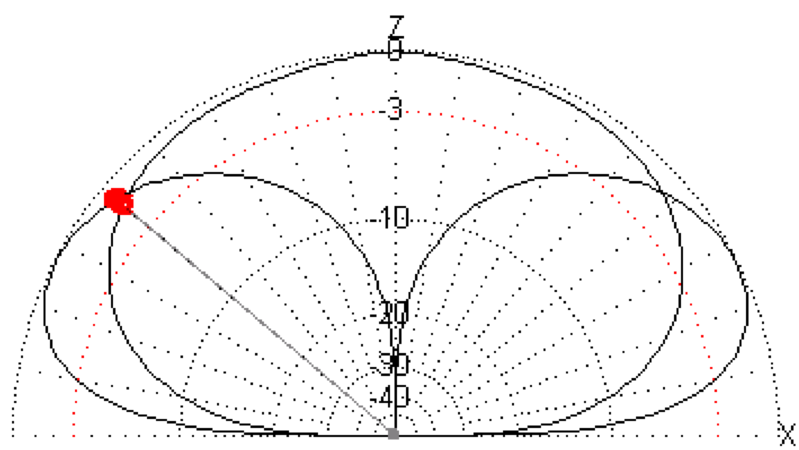
The main radiation lobe is now concentrated at very low elevation angles, often between 10° and 20°. This is exactly where lot of DX signals come from. In addition, the antenna develops several decibels of broadside gain.

At this height, a full size dipole generally outperforms even the best commercial multiband vertical in its favored directions. Signals are stronger, receive noise is often lower, and the antenna becomes extremely effective for long distance communication.

The only drawback is directionality. Unlike the omnidirectional vertical, the dipole favors two opposite directions while providing reduced performance off the ends.

If your desired DX lies broadside to the antenna, the high dipole is difficult to beat.

It is important to understand that this improvement is **not** because the dipole itself has become more efficient. A half wave dipole is already highly efficient when mounted close to the ground. The additional gain comes almost entirely from the interaction between the antenna and its reflected image in the Earth. At the proper height, the reflected wave reinforces the direct wave at low elevation angles instead of canceling it. This is why antenna engineers often refer to the phenomenon as **ground gain**.



I often describe vertical antennas as being particularly well suited for the lower bands. While many operators can install a dipole at ½-wave or even full-wave heights on 20 meters and above, achieving those heights becomes much more difficult on the 160m, 80m, and even 40m bands. The physical support requirements for efficient wire antennas on these bands can quickly exceed what most residential properties can accommodate. Therefore, I often recommend a vertical antenna as a transmit antenna solution for the lower HF bands.

So, is the old saying correct? Not really. A more accurate version might be:

"A vertical radiates equally well in all directions, but it has no free ground gain."

Or

"A vertical radiates equally well in all directions... provided you build an equally good radial system."

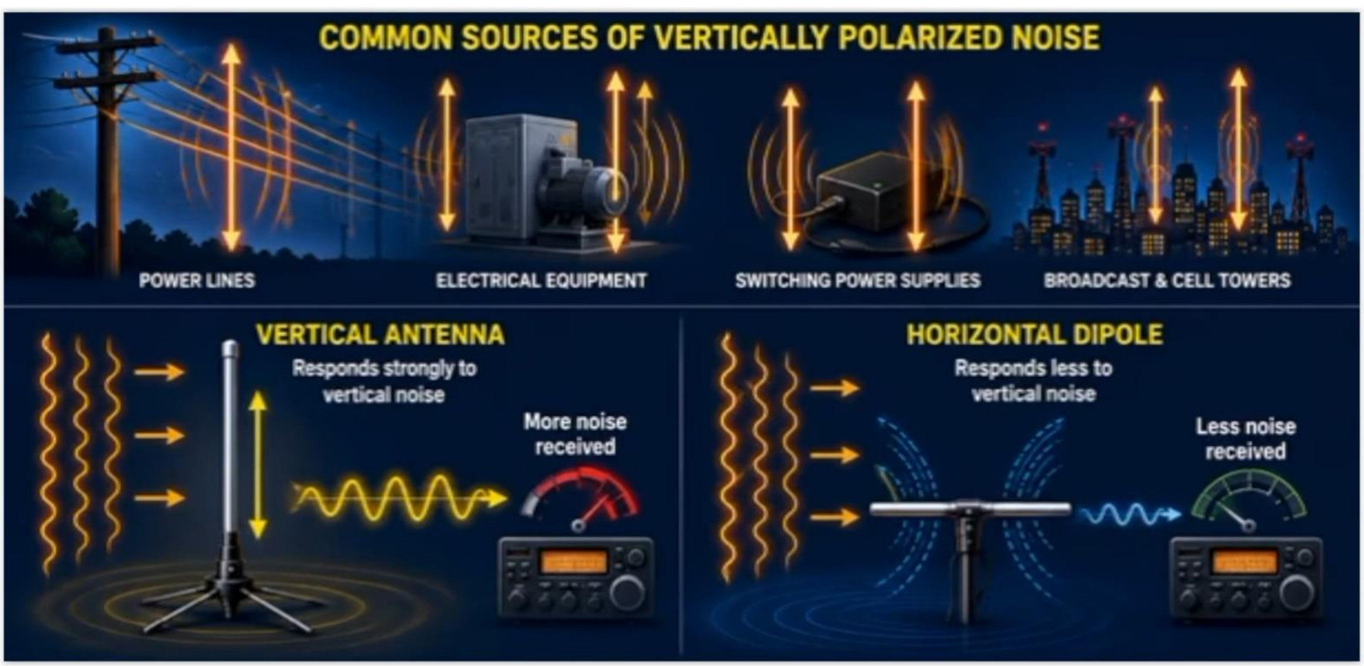
The low angle radiation of a vertical makes it an excellent DX antenna, especially on the lower HF bands where achieving a half wavelength or one wavelength high dipole is impractical. However, if you can install a horizontal dipole one wavelength above ground, you gain the benefit of constructive ground reflection and several additional decibels of broadside gain.

In other words, a well installed vertical is **not** a poor DX antenna. It simply reaches its performance limit much sooner than a dipole whose height can be increased. That is why serious DX stations often use both. The vertical provides omnidirectional low angle coverage, while the high dipole or beam takes advantage of ground gain and directivity to produce even stronger signals in selected directions.

Vertical's Noise Performance

Transmit performance is only part of the story.

Vertical antennas are well known for receiving more atmospheric (QRN) and man-made (QRM) noise than horizontal antennas. Being vertically polarized, they readily pick up noise from power lines, household electronics, utility equipment, and nearby electrical devices.



A horizontal dipole often has a noticeably quieter receive background, particularly when installed well above nearby structures. Many operators find that weak DX stations are actually easier to copy on the dipole, even when transmitted signal strengths are similar.

This is one reason serious DX stations frequently switch between verticals and horizontal antennas while listening.

Sidebar: Why is noise Vertically Polarized?

The dominance of vertically polarized HF noise, particularly local man-made interference (RFI)—is primarily driven by boundary conditions at the Earth's surface and the physical geometry of noise radiators

At the Earth's surface, the ground acts as a lossy dielectric plane. For horizontally polarized electromagnetic waves, the electric field vector is parallel to the ground plane. The boundary condition requires the tangential electric field at a conductor surface to approach zero. As a result, the Earth shorts out horizontally polarized waves near ground level, causing severe attenuation over distance.

Conversely, vertically polarized waves have their electric field normal to the Earth's surface. Rather than being shorted out, the wave can propagate along the ground boundary as a surface wave with significantly lower attenuation.

Most noise sources inherently act as vertical monopoles:

- Cloud-to-Ground Lighting Discharges**:** These main return strokes flow through predominantly vertical physical channels (connecting the cloud base directly to the Earth). Because the physical orientation of the radiating element determines its initial field orientation, these strikes radiate heavily **vertically polarized** electromagnetic pulses.
- Utility poles, ground drop wires, grounding rods, and vertical runs of conduit act as efficient vertical radiating elements for switching power supplies, arcing hardware, and digital electronics.
- Vertical electrical runs inside walls and conduits couple noise currents that radiate predominantly with vertical polarization.

Finally, because local RFI travels mainly via low-angle surface (ground) waves, the vertical component arrives at the antenna with far less ground-absorption loss than any horizontal component. This is why horizontal antennas (such as dipoles mounted at reasonable heights) generally exhibit a significantly better signal-to-noise ratio for local RFI compared to vertical antennas: they benefit both from the cancellation of horizontal fields near the ground boundary and from polarization cross-decoupling against vertically polarized surface-wave noise.

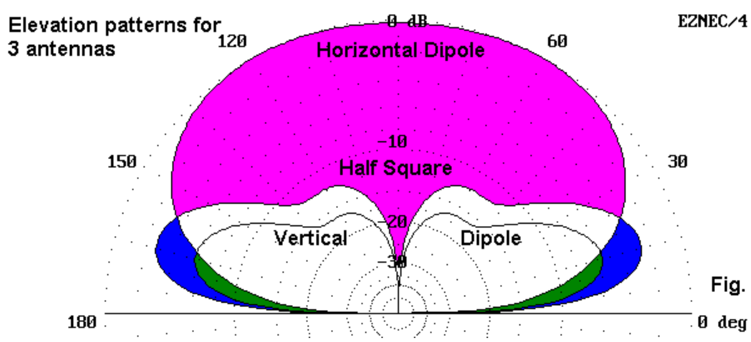


Fig. 9

The Importance of Radials

One topic that cannot be ignored when discussing vertical antennas is the radial system. Every vertical antenna requires some form of return path for RF current. That return path may consist of buried wires, elevated radials, or another conductive structure built into the antenna itself. Regardless of the approach, the antenna's efficiency depends heavily on the quality of that return path.

The simplest and most common solution is a field of ground mounted radials. These wires are normally not cut to resonance. Instead, they act as a low loss ground system that replaces the much higher losses found in ordinary soil. The more radials you install, the lower the ground losses become, and the better the antenna performs. A good starting number for a good installation is 32 radials. The disadvantage, of course, is that installing dozens of wires across a yard can be a significant project.

Another approach is to use elevated resonant radials. Because these are installed above ground, only a few are usually required. One elevated radial typically replaces 8 ground radials. The drawback is that each operating band needs its own set of resonant radials. Once several HF bands are involved, the installation quickly becomes crowded with wires running in every direction.

A clever alternative to radial field is the Off-Center-Fed vertical dipole. These antennas use a short set of fixed length radials that become part of the vertical antenna system rather than acting as a traditional ground plane. They require much less space (only a few feet) than a conventional radial field while still providing respectable performance. We will examine several examples later on.

There is also one modern design that approaches the problem from a completely different direction by incorporating a resonant ground plane directly into the antenna structure. It is one of the more interesting developments in multi band vertical design and deserves special attention.

Vertical Antennas That Use Ground Radials

Before looking at specific models, it is worth emphasizing that every antenna in this group depends on an effective ground radial system. Even the best engineered antenna will perform poorly if it is installed over a poor ground system. If you are investing several hundred dollars in a quality vertical antenna, spending extra time installing radials is one of the best performance improvements you can make. The ARRL Antenna Book contains an excellent discussion of radial design, including the tradeoffs between the number, length, and placement of radials.

DX Commander

Among the newer designs on the market, the DX Commander has developed an outstanding reputation. Rather than relying on traps or complicated matching networks, it uses multiple quarter wave wire elements connected in parallel. The concept is essentially the vertical equivalent of a fan dipole. Each wire resonates on its own band, allowing the antenna to provide good performance across a wide frequency range with remarkably little electrical complexity.

Plastic spacers keep the wire elements separated as they run alongside the fiberglass support mast. Some of the longer elements fold back on themselves or include small loading coils so they fit within the available height, but the overall design remains refreshingly simple.

DX Commander

Provided you install a good radial field, the DX Commander is an efficient antenna with excellent bandwidth on each band. One obvious disadvantage is its physical height. A 40 meter version stands roughly 33 feet tall, and an eighty meter version would be considerably taller without the optional loading kit. Even so, the combination of simplicity, efficiency, wide bandwidth, and high power capability makes this one of the most attractive multi band verticals currently available.

The DX Commander has become a favorite DIY project across the amateur radio community, with countless hams successfully building their own versions from plans available online. It’s an exceptionally approachable build—requiring little more than a sturdy fiberglass pole, some wire, a handful of basic hardware, and a good dose of ham ingenuity. With a bit of careful tuning, you end up with a highly capable, multi-band vertical system built entirely by your own hands.

Hustler

The Hustler series has been a familiar sight in amateur radio for decades and continues to be popular today. Now sold by DX Engineering, these antennas use a series of traps to provide operation on multiple bands while keeping the overall height manageable.

The six band model covers ten through eighty meters in a structure only about 24 feet tall. Five traps are distributed along the vertical element. At their resonant frequencies the traps isolate portions of the antenna, while at lower frequencies they behave primarily as inductors that electrically lengthen the remaining sections. This allows a physically shorter antenna to operate efficiently on the lower bands.

These antennas are rated for legal limit operation on CW and offer respectable SWR bandwidth on most bands. As expected, eighty meters is the exception. The reduced physical length means the usable bandwidth is only around eighty kilohertz at a two to one SWR, which is typical for shortened antennas.

My only concern with trapped antennas is that every trap introduces a small amount of loss, and over many years of outdoor exposure the traps themselves can become maintenance items. Even so, the Hustler remains one of the classic multi band vertical designs and has proven itself over decades of service.

Butternut

Another long established design is the Butternut series, also now marketed by DX Engineering. These antennas use an interesting combination of loading coils, traps, and transmission line matching sections to achieve multi band operation.

Butternut HF6V

Unlike many trapped antennas, the Butternut traps are substantial assemblies built from large diameter aluminum tubing and low loss ceramic capacitors. Their robust construction minimizes losses and easily supports high power operation.

Because the antenna is physically shortened, bandwidth naturally becomes more limited as you move to the lower frequencies. Forty meters provides about one hundred fifty kilohertz of usable bandwidth, while eighty meters is typically less than eighty kilohertz. This is simply the price paid for fitting a multi band antenna into a practical height.

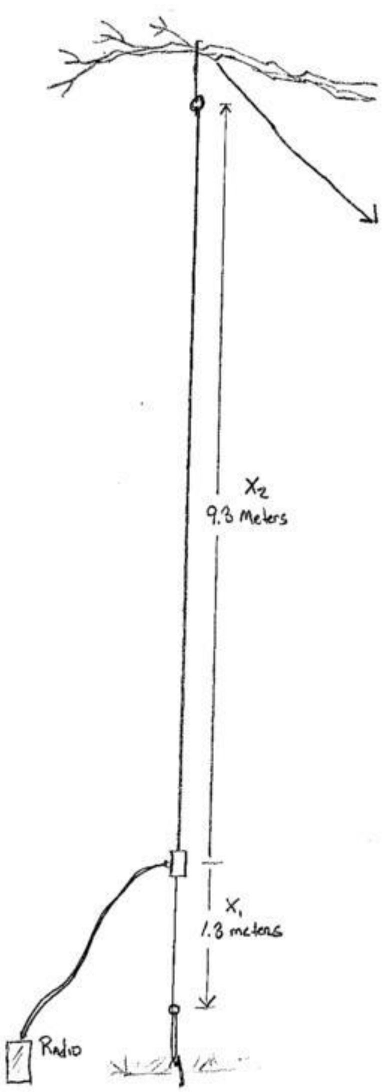
Tuning a Butternut requires patience. Like most complex multi band verticals, adjustments on one band often influence another. A good antenna analyzer becomes almost essential, and you should expect to raise and lower the antenna several times before achieving the best overall compromise. Fortunately, once properly adjusted, these antennas provide excellent long term performance and have earned a loyal following among HF operators.

The Off Center Fed Vertical Dipole

Several manufacturers have produced very successful multi band verticals based on the off center fed vertical dipole, often abbreviated OCFVD. Cushcraft and Hy Gain made some of the best known examples, including the R6000, R8, R9, and AV640. Unfortunately, with the disappearance of MFJ, these antennas are now available only on the used market. Fortunately, a few manufacturers continue to build antennas based on the same basic concept.

At first glance, these antennas appear almost mysterious. They seem to cover an impressive number of bands with relatively few radials, yet they are much shorter than a conventional quarter wave vertical. The secret lies in combining several different antenna techniques into a single design.

The first step is choosing an off center feed point. Instead of feeding the antenna at the very bottom, the feed point is located some distance above ground. The shorter section below the feed point is fitted with several relatively short radial rods or wires, often about six feet long. These are not simply ground radials. They become part of the antenna system itself.



In classic OCF designs (like the Cushcraft R5/R7/R8 series), the feed point is placed roughly 1/6λ to 1/4λ *above* the base matching box, and the lower tail (with the radial counterpoise array) forms the lower leg of the dipole.

Much like an Off Center Fed Horizontal Dipole, the feed point is selected experimentally so that the impedance remains reasonably consistent over several amateur bands. It is not exactly fifty ohms on any of them, but it is close enough that a carefully designed matching transformer can provide a good match to standard coaxial cable.

Even with the proper feed point, additional tuning is still required. This is where traps begin to play an important role.

A trap is essentially a resonant circuit inserted into the antenna. At its resonant frequency it behaves like an open circuit, electrically removing the portion of the antenna beyond it. On lower frequencies the same trap behaves primarily as an inductance, allowing the antenna to appear electrically longer than its physical length. By placing traps at strategic locations, the designer can make different portions of the antenna become active on different amateur bands.

Some designs even place traps in the radial system. Although this adds complexity, it allows the lower section of the antenna to contribute to the tuning process on several bands.

Capacitance hats provide another useful design tool. These are usually small horizontal wires or rods installed near the top of the antenna. They increase the effective electrical length without adding significant loss or requiring additional height. The length and placement of the capacitance hats become additional tuning variables. By positioning them between traps, the designer can fine tune individual bands with surprising precision.

Many antennas also include what are known as open sleeve or coupled resonator elements. These are usually quarter wave conductors located alongside the main radiator. Some are electrically connected while others rely entirely on electromagnetic coupling. When they reach resonance on a particular band, they draw RF energy from the main element and effectively become the active radiator for that frequency. This clever technique allows additional bands to be added without making major changes to the primary antenna structure.

When you look at the finished product, it can resemble a collection of tubes, rods, wires, and small horizontal elements extending in several directions. There is a great deal more engineering behind these antennas than first meets the eye.

The challenge for the antenna designer is getting all of these individual components to work together. Every trap, capacitance hat, sleeve element, and matching network influences the others to some degree. A small mechanical adjustment intended to improve one band often affects several others. Designing one of these antennas requires extensive computer modeling followed by a considerable amount of experimental testing.

This interaction also explains why field tuning can sometimes become frustrating. Moving a trap by half an inch may improve twenty meters while slightly shifting the resonance on forty and fifteen meters. Patience and a good antenna analyzer are essential.

One additional point deserves special attention. Because these antennas are fed away from the physical end of the radiator, common mode current on the outside of the coaxial feed line can become a serious issue. Unless this current is suppressed, the feed line itself becomes part of the antenna, causing unpredictable SWR readings, pattern distortion, and increased RF in the shack.

For that reason, virtually every commercial off center fed vertical includes a substantial common mode choke as part of the matching assembly. This choke isolates the feed line and forces the RF current to remain where it belongs, on the antenna itself.

The matching transformer also carries significant RF current and voltage, particularly when operating on the lower bands or at high power levels. Heat generated within the transformer and common mode choke often determines the antenna's maximum power rating. Operators running high power may notice the SWR gradually increasing during long transmissions as the matching components warm up. If the power rating is exceeded, overheating can permanently damage the matching unit.

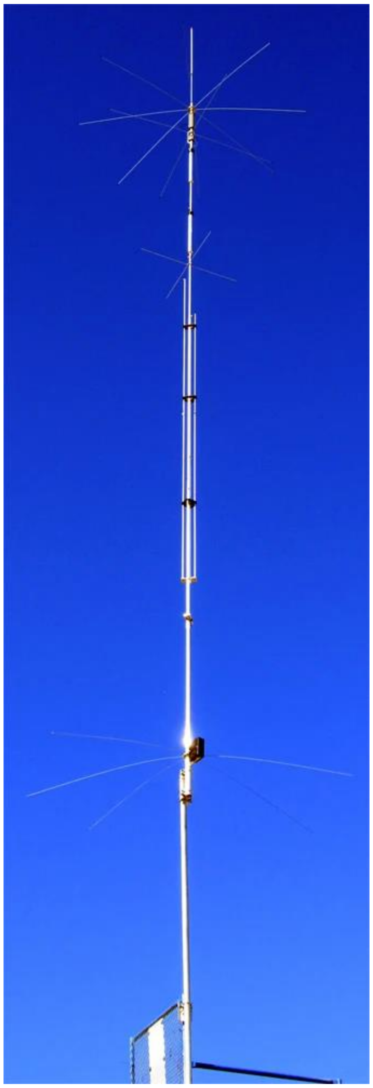
This is one of the reasons that antennas with very broad frequency coverage and compact physical dimensions often have lower power ratings than larger, simpler designs. The more work the matching network has to do, the more energy it must dissipate.

Commercial Off Center Fed Vertical Antennas

Several manufacturers continue to offer antennas based on the off center fed vertical concept, although each has taken a different engineering approach.

The Cushcraft R8 and R9

When discussing off-center-fed (OCF) vertical antennas, it is impossible to overlook the Cushcraft R8 and its successor, the R9. The Cushcraft R8 was one of the most influential multiband vertical antennas ever produced. Following the acquisition of the Cushcraft product line by ITU Corporation in 2026, the R8 and R9 have returned to production, continuing its long legacy among HF operators.

Cushcraft R8 and R9

Unlike a traditional quarter-wave vertical, which is typically designed for a single band and requires a radial system or ground plane, the R8 and R9 used an off-center-fed radiating element with carefully chosen element lengths and matching networks to provide multiband operation. By placing the feed point away from the electrical center of the radiator, the antenna was able to excite multiple current distributions, allowing operation across several HF bands without the need for an external tuner.

The Cushcraft R8 covered the 40m through 6m bands, while the later R9 extended coverage down to 80m. Both antennas used a combination of vertical radiating sections and horizontal or sloping elements, creating a hybrid structure that provided useful performance in a relatively small footprint. This made them especially attractive to operators with limited space who wanted a single antenna capable of covering most of the HF bands.

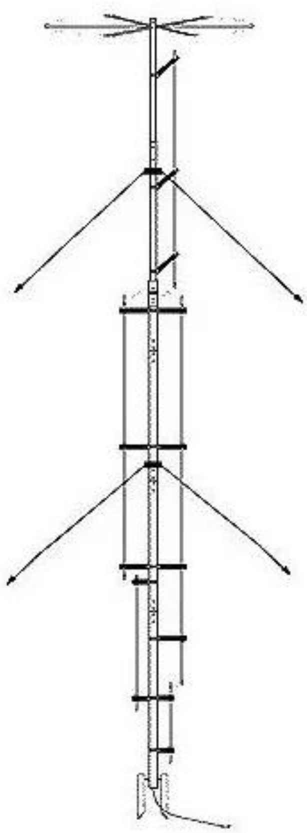
One of the major advantages of the R8 and R9 was their ability to provide reasonable efficiency without requiring the extensive radial systems often associated with vertical antennas. While they were not a replacement for a full-size dipole at optimal height or a large directional antenna, they offered a practical compromise: a compact, multiband antenna that could be installed in many residential locations.

Like all multiband verticals, the R8 and R9 involved compromises. The shorter elements required for lower-band operation resulted in reduced efficiency compared with full-size antennas, especially on 80 meters. The antenna also relied on traps, matching networks, and carefully designed element interactions, which meant that installation details such as mounting height, nearby objects, and grounding could significantly affect performance.

R8 and R9 antennas represent an important milestone in the development of practical multiband vertical antennas and demonstrated that an off-center-fed vertical could provide excellent utility for operators who needed broad frequency coverage in a limited space.

Gap Antenna Products

Gap Antenna Products has built an excellent reputation for producing rugged, high performance vertical antennas. Unlike many competing designs, Gap largely avoids the use of conventional traps. Instead, the antenna uses several directly driven resonant elements positioned along the main vertical radiator. Each element contributes to operation on one or more amateur bands.



This approach produces an antenna that looks quite different from most traditional verticals. The included matching box contains a specially designed transformer and common mode choke that provide the proper feed point impedance while isolating the coaxial cable from unwanted RF currents.

The Titan is the company's largest general purpose model. Standing about 25 feet tall, it covers eighty through ten meters using a single radial wire arranged in a square around the base of the antenna. This counterpoise system was developed by Roy Lewallen, W7EL (famous for EZNEC), and has proven to be remarkably effective in practical installations.

Gap also offers the Challenger, an ambitious design covering eighty meters through two meters without using conventional traps. Instead, it relies on several directly driven resonant elements clustered around the main radiator. The antenna stands approximately 31 feet tall and uses three 25 foot radial wires. It may be installed at ground level or elevated on a supporting mast.

The smaller Eagle follows the same general philosophy while covering forty through ten meters. Standing about 21 feet tall, it uses three rigid radial elements approximately eighty inches long, making it an attractive choice where installation space is somewhat limited.

GAP Titan and Challenger

Gap also produces the Voyager, which is optimized for the lower HF bands. It covers one hundred sixty, eighty, forty, and twenty meters using a 45-foot vertical radiator together with three 57 foot radial wires. As expected for a shortened antenna on one hundred sixty meters, the usable bandwidth is quite narrow, roughly twenty kilohertz. Buyers specify their preferred operating frequency when ordering so the antenna can be optimized for that portion of the band.

GAP Eagle and Voyager

Like many manufacturers of off center fed antennas, Gap refers to the radial system as a counterpoise. Regardless of the terminology, the conductors serve as the return path for RF current and form an essential part of the antenna system.

GXP Antennas

GXP Antennas, based in Poland, offers several off center fed vertical designs that will look familiar to anyone who has used the classic Cushcraft or Hy Gain antennas. Their antennas employ many of the same engineering techniques, including traps, capacitance hats, and open sleeve resonators to achieve multiband operation in a reasonably compact package.

Unlike other manufacturers, GXP provides only limited technical information on its website. Complete assembly manuals are generally not available for download, so it can be difficult to study the design before making a purchase. Even so, the published specifications suggest that these antennas follow the same successful design philosophy that made the older Cushcraft products so popular.

GPX GP-5-DX

Frankly, I’ve never been a fan of keeping design details under wraps. When you're making a significant financial investment in an antenna, you want to know exactly what you’re paying for. It’s clear the manufacturer is trying to protect their intellectual property and prevent others from cloning or refining their design—much like they did to Cushcraft and other legacy brands—but transparency matters to the buyer.

One advantage of these antennas is that they have retained the taller overall profile of the original American designs. That additional height generally translates into better efficiency and wider operating bandwidth, particularly on the lower HF bands. Prospective buyers should plan on contacting the manufacturer directly for detailed information, pricing, and availability.

Chelegance KC4

The Chelegance KC4 is one of the few modern off center fed verticals that is readily available in many parts of the world. It covers forty, twenty, fifteen, and ten meters while standing about 26 feet tall. Three traps are incorporated into the main vertical element, and several capacitance hats are used to optimize operation on the various bands. The antenna uses radial elements approximately nine feet long.

One of the KC4's attractive features is its relatively low weight. At only about sixteen pounds, it can be installed on a modest mast without requiring heavy support hardware. Raising the feed point above ground by mounting the antenna on a roof or elevated mast can noticeably improve its low angle radiation and overall DX performance.

The antenna is rated for approximately five hundred watts CW, which is adequate for most amateur stations but lower than some competing designs. That relatively modest power rating suggests that the matching transformer and common mode choke are working fairly hard. As with many compact multiband antennas, some RF energy is inevitably lost in the matching network. This is not unique to the KC4, but simply reflects the compromises required when a physically short antenna is expected to cover several amateur bands.

For operators running barefoot power or a moderate amplifier, the KC4 represents a practical solution where installation space is limited. It provides useful multiband capability in a package that is relatively easy to install and transport.

Diamond CP6AR

The Diamond CP6AR takes compactness even further. Despite standing only about thirteen feet tall, it covers 80, 40, 20, 15, 10, and 6 meters. Achieving this level of coverage in such a small package requires a number of engineering compromises.

Diamond CP6AR

The antenna uses three traps in the main radiator together with several capacitance hats. Unlike many competing products, it also employs tuned radial elements that incorporate their own traps. The result is an antenna that can fit into locations where almost no other HF vertical would be practical.

Unfortunately, physics always has the final word.

Because the antenna is so much shorter than a quarter wavelength on the lower bands, the usable bandwidth becomes extremely narrow. On 80 meters the two to one SWR bandwidth is only about twenty kilohertz. Forty meters is only slightly better at roughly thirty kilohertz. Frequent retuning is almost unavoidable if you operate across the entire band.

Power handling is also limited. The antenna is rated for only about seventy watts on CW, indicating that the matching network is dissipating a significant amount of RF power. Any energy converted into heat is energy that never reaches the antenna itself.

For that reason, I view the CP6AR primarily as an antenna for situations where no larger antenna can be installed. Apartment dwellers, homeowners with restrictive covenants, or portable operators may find it useful. However, if you have room for a taller antenna, you will almost certainly achieve better efficiency, wider bandwidth, and higher power capability with one of the larger designs. In my opinion, the older Cushcraft verticals were superior performers because they simply gave the antenna system more physical length to work with.

The Xiegu VG4: A Modern Compact Multiband Vertical

While the Cushcraft R8 and R9 helped establish the practicality of off-center-fed multiband verticals, newer designs have continued to refine the concept for today’s space-conscious and portable operators. One example is the Xiegu VG4, a compact multiband vertical designed to provide HF coverage with a much smaller physical footprint than traditional full-size antennas.

The VG4 is designed for operation on the 40m, 20m, 15m, and 10m bands, using a shortened vertical radiator with carefully selected loading and matching elements. Like many compact verticals, it achieves multiband operation by using electrical techniques to make a physically shorter antenna behave as a longer radiator. The tradeoff is that, especially on the lower bands, reduced physical size generally means reduced efficiency compared with a full quarter-wave vertical or a full-size horizontal antenna.

Xiegu VG4

One of the strengths of the VG4 is its simplicity and flexibility. Its relatively compact size makes it attractive for operators with limited space, portable stations, and situations where a large antenna installation is impractical. It can also serve as a useful field antenna for portable operations, emergency communications, and temporary installations where quick deployment is important.

As with any shortened vertical, installation details have a major impact on performance. A good radial system, adequate mounting height, and careful attention to nearby objects are important for achieving the best results. Although the antenna is compact, it still relies on the same fundamental principles as all vertical antennas: the efficiency of the antenna system depends heavily on how effectively RF current can flow and how well the return path is established.

The Xiegu VG4 represents the continuing evolution of the multiband vertical antenna. Designs like this demonstrate that modern verticals are not simply "short antennas," but carefully engineered systems that balance size, coverage, efficiency, and practicality. For many operators, especially those with limited space or a need for portability, a well-designed compact vertical can provide a surprisingly capable HF solution.

A Different Approach: The Grazioli Ground Plane Vertical

Among all of the multiband verticals currently available, one design stands apart from the rest. Rather than relying heavily on complicated matching networks and numerous traps, Grazioli Antenne of Italy has taken a much more straightforward engineering approach.

Instead of creating one radiator that is forced to operate on several bands through electrical tricks, Grazioli uses multiple resonant vertical elements connected in parallel. Each element is responsible for one or more amateur bands. At the same time, the antenna incorporates a carefully engineered system of horizontal ground plane elements that are themselves resonant across the supported frequencies. The result is remarkably elegant.

Because both the vertical radiators and the radial system are resonant, the feed point presents an impedance very close to fifty ohms over the intended operating bands. No large broadband matching transformer is required, eliminating one common source of loss and heating.

The construction quality is equally impressive. The antenna is built almost entirely from heavy wall aluminum tubing and precision machined hardware. The mechanical design reflects the same attention to detail as the electrical design, resulting in an antenna that should provide many years of reliable outdoor service.

One example is the MV7 model. Standing approximately thirty feet tall, it covers every amateur band from 40 through 6 meters. Most of the radial elements are less than nine feet long, making installation surprisingly practical. A longer wire associated with the 40 meter section wraps around the ends of the shorter radial structure to obtain the required electrical length without greatly increasing the antenna's footprint.

Grazioli MV7

Unlike many multiband antennas, the MV7 requires only a single trap, which is used on the 20 meter element that also participates in 40 meter operation. Fewer traps generally mean lower losses, higher efficiency, and greater long term reliability.

Another advantage is power handling. Because the feed system is inherently close to 50 ohms, there is far less stress on matching components. The antenna is capable of handling full legal limit power on nearly every supported band, with only forty meters having a somewhat lower rating.

From an engineering standpoint, I find this design especially appealing. It minimizes unnecessary complexity while maintaining excellent efficiency, broad operating bandwidth, and robust power handling. Although it is not the least expensive multiband vertical on the market, it represents one of the more thoughtfully engineered designs currently available.

As with any antenna purchase, the final decision depends on your operating goals, available space, and budget. However, if I were selecting a commercially manufactured multiband vertical today, the Grazioli would certainly be near the top of my list.

Installation Tips

Even the best multiband vertical antenna will disappoint if it is installed poorly. Fortunately, most installation problems can be avoided with a little planning. Paying attention to the support structure, feed line, and tuning process will usually produce far better results than trying to compensate for a poor installation with an antenna tuner or other accessories.

Guying the Antenna

Many multiband verticals are tall enough that guy wires are either recommended or required. Fortunately, their wind loading is usually modest because they are constructed from relatively small diameter tubing or fiberglass poles.

Guy anchors do not have to be elaborate. In many installations, a short length of galvanized pipe driven into the ground provides an excellent anchor point. Eye bolts mounted to a fence post, the side of a building, or even a healthy tree can also serve the purpose. The goal is simply to prevent the antenna from flexing excessively during strong winds.

For guy lines, UV resistant Dacron rope remains the preferred choice. It is strong, does not stretch significantly, and withstands years of exposure to sunlight without deteriorating. Ordinary nylon rope is less desirable because it stretches under tension and gradually weakens when exposed to ultraviolet light.

Properly guyed, most vertical antennas will survive weather that would otherwise shorten their service life considerably.

Invest in a Good Antenna Analyzer

Attempting to tune a modern multiband vertical without an antenna analyzer is an exercise in frustration.

Nearly all of these antennas require adjustments to traps, tubing lengths, capacitance hats, or matching components. Every adjustment influences one or more operating bands, so tuning often becomes an iterative process. You may improve twenty meters only to discover that fifteen or forty meters has shifted slightly.

Expect to raise and lower the antenna several times before reaching the best overall compromise. An antenna analyzer allows you to see exactly how each adjustment affects resonance and impedance, saving many hours of trial and error.

Trying to perform these adjustments using only the SWR meter built into your transceiver is certainly possible, but it is slow, inconvenient, and far less informative.

If you regularly build or experiment with antennas, an analyzer is one of the best investments you can make.

Raising the Feed Point

Whenever possible, avoid mounting an elevated radial or off center fed vertical directly at ground level.

Raising the antenna several feet above the ground generally reduces ground losses and lowers the radiation angle. Both improvements can increase signal strength on long distance paths. A roof mounted installation, a sturdy mast, or even a short tower section can noticeably improve performance.

Ideally, the supporting structure should be nonconductive so it does not interact with the antenna. In practice, however, most amateurs use steel pipe without serious problems. As long as the mounting arrangement follows the manufacturer's recommendations, the effects are usually small compared to the improvement gained by raising the antenna above surrounding objects.

Ground mounted quarter wave verticals that depend on an extensive radial field are a different matter. Those antennas are designed specifically to operate at ground level, and elevating them without redesigning the radial system can actually reduce performance.

Use a Good Common Mode Choke

Many commercial antennas include an effective common mode choke as part of the matching unit. If yours does not, adding one at the feed point is highly recommended.

Without adequate isolation, RF current can flow on the outside of the coaxial cable. The feed line then becomes part of the antenna, changing the radiation pattern, altering the feed point impedance, and sometimes bringing RF back into the shack.

A properly designed choke keeps the feed line electrically invisible and allows the antenna to perform as its designer intended.

Pay Attention to the Ground System

For antennas that rely on buried radials, the ground system deserves at least as much attention as the vertical radiator itself.

A beautifully constructed antenna installed over a poor radial field often performs worse than an average antenna with an excellent ground system.

If space allows, install as many radials as practical. They do not all need to be the same length, nor do they have to be perfectly straight. Every additional radial reduces ground loss and improves efficiency. Over time, the cumulative improvement can be surprisingly large.

Many experienced operators eventually discover that the radial system contributes more to performance than replacing one commercial vertical with another.

Advantages and Disadvantages

After examining the various designs, it becomes clear that every multiband vertical represents a different balance of compromises.

The greatest advantage is obvious. A single antenna can provide access to many amateur bands while occupying very little space. For operators with small lots, restrictive neighborhoods, or limited support structures, that alone may make a multiband vertical the best practical choice.

Another benefit is convenience. There is only one feed line, one support structure, and usually no need for switching between multiple antennas. Once properly adjusted, most commercial multiband verticals provide excellent day to day operating convenience.

Their principal disadvantage is efficiency.

Every trap, loading coil, matching transformer, and electrically shortened element introduces some degree of loss. Some designs manage these losses exceptionally well, while others sacrifice efficiency in exchange for reduced size or broader frequency coverage. Understanding those tradeoffs is essential when selecting an antenna.

Bandwidth is another consideration. The more an antenna is electrically shortened, the narrower its operating bandwidth becomes. This is especially noticeable on eighty and one hundred sixty meters, where physically compact antennas may require frequent retuning as you move across the band.

Power handling also varies considerably. Antennas that depend on elaborate matching networks often have lower power ratings because those components must dissipate heat. Simpler designs with resonant elements generally tolerate much higher power levels.

Finally, no discussion of vertical antennas would be complete without mentioning radiation pattern. A vertical is essentially omnidirectional, making it well suited for general operating and DX work. It does not provide the forward gain or directivity of a beam antenna, but it also does not require a rotator or tower. For many amateurs, that is a worthwhile tradeoff.

The old saying that vertical antennas radiate equally poorly in every direction, like many jokes in amateur radio there is a grain of truth hidden within it, but it should not be taken too seriously. A properly installed vertical with an effective radial system can be an excellent DX antenna, particularly on the lower HF bands where achieving a low radiation angle is important.

Ultimately, the best antenna is the one that fits your property, your operating style, and your budget. A carefully installed multiband vertical will never outperform a full size monoband beam mounted one hundred feet above the ground. On the other hand, it can provide years of reliable service, make thousands of contacts around the world, and fit into locations where larger antennas simply are not possible.

As another old saying goes, the only antenna that never makes contacts is the one that was never installed!

Summing It All Together

By now you have probably realized that there is no perfect multiband vertical. Every manufacturer has chosen a different path, and each design represents a compromise between efficiency, bandwidth, physical size, complexity, and cost. The good news is that most of the antennas discussed here are capable of excellent performance when installed correctly. The challenge is deciding which compromises best fit your operating style.

If your primary interest is DX, efficiency should be your first priority. Every decibel of loss in an antenna or ground system is one less decibel that reaches the ionosphere. Traps, loading coils, matching transformers, and electrically short elements all introduce some loss, although better designs minimize these losses very effectively. The difference between an excellent multiband vertical and a mediocre one is often only one or two S units, but those few decibels can determine whether a rare DX station hears your call.

One factor often overlooked is that a vertical antenna naturally produces a low angle of radiation, particularly when installed over a good radial system or elevated above nearby objects. Low angle radiation is exactly what is needed for long distance communication. In many situations, a properly installed vertical can outperform a low horizontal dipole for DX, even though the dipole may be more efficient. Height and installation quality are often just as important as the antenna design itself.

User reviews from eHam, QRZ, DX Engineering, and other amateur radio forums tend to agree on several general observations.

The **DX Commander** consistently receives some of the highest praise for actual on the air performance. Operators frequently report that it performs very much like a collection of individual quarter wave verticals rather than a compromise antenna. When installed over a substantial radial field, it is capable of excellent DX results on every supported band. Because there are no conventional traps and very little matching circuitry, efficiency remains high. The only significant drawback mentioned by users is its height, particularly on forty and eighty meters, and the need to install a good radial system.

The **Butternut HF6V** also enjoys an excellent reputation built over many decades. Users generally report that it performs very well on twenty through ten meters and remains surprisingly competitive on forty and eighty meters considering its compact size. The heavy duty traps contribute very little loss, and reliability has proven excellent. Initial tuning requires patience, but once adjusted the antenna rarely needs additional attention.

The **Hustler 6BTV** has probably worked more DX than almost any other commercial multiband vertical. Thousands remain in service around the world. Reviews consistently praise its rugged construction, simple maintenance, and good all-around performance. Operators almost universally agree that the antenna comes alive when installed over thirty two or more radials. Those using only a handful of radials often report disappointing performance, but the antenna itself is seldom the limiting factor.

The **Cushcraft R8** was one of the most influential multiband vertical antennas ever produced and helped popularize the concept of off-center-fed vertical designs. Covering 40m through 6m, it provided broad frequency coverage without requiring a large ground-mounted radial system, instead using an elevated feed point, tuned counterpoise wires, and carefully designed matching elements. Operators generally praised the R8 for its excellent DX capability, especially considering its relatively modest size. Like all compact multiband verticals, however, it requires careful installation and adjustment, and performance on the lower bands cannot match a full-size antenna. The R8 remains highly regarded as a practical high-performance vertical for operators with limited space.

The **Cushcraft R9** represented an evolution of the successful R8 design, extending coverage down to 80 meters while maintaining operation through 6 meters. With its larger physical size, higher CW power capability, and improved low-band performance, the R9 became one of the premier commercial multiband vertical antennas available to amateur operators. Its off-center-fed design, elevated counterpoise system, and carefully engineered matching network allowed it to deliver impressive DX results from a single vertical antenna. As expected, the 80-meter performance comes with tradeoffs: the antenna is taller, more complex, and requires careful installation for best results. Nevertheless, the R9 earned a reputation as one of the most capable no-radial multiband verticals ever produced.

The **Gap** antennas generate very positive comments regarding their low angle radiation and freedom from ground losses. Since they do not depend on a conventional buried radial system, many users find them easier to install. The Challenger and Titan models receive particularly favorable comments from operators working DX. Some reviewers note that tuning can be somewhat sensitive, but once adjusted they provide excellent multiband performance.

The **Grazioli MV7** is one of the newest designs discussed here, but the reports available are overwhelmingly positive. Users consistently praise the mechanical quality, excellent SWR across each band, and the absence of a complicated matching transformer. Many users report performance comparable to full size monoband verticals. Although the purchase price is higher than some competitors, owners generally feel the additional cost is justified by the antenna's efficiency and construction quality.

The **Chelegance KC4** receives favorable reviews from portable operators and those with limited installation space. It is lightweight, reasonably easy to assemble, and performs well considering its modest size. Users generally agree that it is not in the same performance class as larger antennas, but it offers a practical compromise where installation restrictions prevent the use of taller structures.

The **Diamond CP6AR** produces the widest range of opinions. Nearly everyone agrees that it is remarkably compact and can fit into locations where almost nothing else will. Unfortunately, many reviewers also point out its narrow bandwidth, limited power handling, and reduced efficiency on the lower bands. It can certainly make contacts, including DX, but expectations should remain realistic. The laws of physics simply cannot be ignored.

The **Xiegu VG4** is a modern compact multiband vertical designed for operators who need broad HF coverage in a small footprint. Covering 40m, 20m, 15m, and 10m, it provides an attractive solution for portable stations, restricted-space installations, and operators who cannot accommodate a larger antenna. Its relatively lightweight construction and simple deployment make it appealing, especially where a full-size vertical or beam antenna is not practical.

The table below summarizes the major characteristics of the antennas discussed in this article.

Antenna	Bands	Height	Power*	Overall DX
DX Commander Sig 9	80 through 2 m	33 feet	Legal limit	Excellent
Cushcraft R8	40 through 6m	28 feet	Legal limit	Very Good to Excellent
Cushcraft R9	80 through 6m	31 feet	Legal limit	Excellent
Hustler 6BTV	80, 40, 30, 20, 15, 10m	24 feet	1kW CW	Very Good to Excellent
Butternut HF6V	80, 40, 30, 20, 15, 10m	26 feet	Legal limit	Excellent
Gap Titan	80 through 10m	25 feet	Legal limit	Excellent
Gap Challenger	80 through 2m	32 feet	Legal limit	Excellent
Gap Eagle	40 through 10m	21 feet	Legal limit	Very Good
Gap Voyager	160, 80, 40, 20m	45 feet	Legal limit	Excellent
Grazioli MV7	40 through 6m	30 feet	Legal limit	Excellent
Chelegance KC4	40, 20, 15, 10m	26 feet	500W CW	Good
Xiegu VG4	40, 20, 15, 10m	26 feet	1kW PEP	Good
Diamond CP6AR	75, 40, 20, 15, 10, 6m	13 feet	200W PEP	Fair to Good

**Maximum power ratings are manufacturer specifications and may vary by operating mode and frequency. Check the product specifications for details.*

If I had to rank these antennas strictly on expected on the air performance, assuming each is installed correctly, my list would look something like this:

Tier 1
Grazioli MV7
DX Commander
Gap Challenger
Gap Titan

These antennas come closest to full size quarter wave vertical performance and involve the fewest electrical compromises.

Tier 2
Butternut HF6V
Hustler 6BTV
Gap Eagle
Gap Voyager

These are proven performers that have worked enormous amounts of DX over the years. Their performance is excellent, but they involve slightly more compromise than the Tier 1 designs.

Tier 3
Chelegance KC4
Xiegu VG4

Very respectable antennas for moderate power stations and installations where weight and simplicity are important.

Tier 4
Diamond CP6AR

This antenna fits where almost nothing else will, but only supports 70W power. If space restrictions leave no other choice, it is certainly capable of making contacts around the world. However, if you have room for one of the larger antennas discussed in this article, you will almost certainly achieve better efficiency, wider bandwidth, and greater operating flexibility.

Ultimately, no commercial multiband vertical can overcome poor installation practices. A well designed antenna mounted correctly with a quality feed line, an effective common mode choke, and, where required, a generous radial system will usually outperform a more expensive antenna installed carelessly. Spend as much effort on the installation as you do selecting the antenna, and you will be rewarded every time you turn on the radio.

Approximate 2026 Retail Price (USD)

Antenna	**2026 Price (USD)**	**Source**
DX Commander Signature 9	**$540**	DX Commander
Cushcraft R8	**$799**	MFJ Enterprises (current catalog)
Cushcraft R9	**$999**	MFJ Enterprises (current catalog)
Hustler 6BTV	**$430**	Typical U.S. dealers
Butternut HF6V	**$630**	Typical U.S. dealers
GAP Titan DX	**$590**	GAP Antenna Products
GAP Challenger DX	**$490**	GAP Antenna Products
GAP Eagle DX	**$500**	GAP Antenna Products
GAP Voyager DX	**$646**	GAP Antenna Products
Grazioli MV7	**$1,150**	Main Trading Company (US Price)
Chelegance KC4	**$460**	DX Engineering
Xiegu VG4	**$289**	radioddity.com
Diamond CP6AR	**$370**	Typical U.S. dealers

Prices are approximate U.S. retail prices as of mid-2026 and may vary by dealer, shipping costs, exchange rates, and availability.

The Bottom Line

If I had to summarize the comparison in a single table, it would look like this.

Antenna	Regional	DX	Noise	Directionality
Vertical	Good	Excellent	Highest	Omnidirectional
Dipole at 0.25 λ	Excellent	Fair	Low	Broadside
Dipole at 0.5 λ	Excellent	Very Good	Low	Broadside
Dipole at 1.0 λ	Very Good	Outstanding	Lowest	Broadside

The important point is that there is no universal winner. A multiband vertical is often the best practical DX antenna that many amateurs can install, especially on eighty and forty meters where a half wavelength high dipole may require heights of 132 feet and 66 feet. Few operators have trees or towers that tall.

On the other hand, if you can place a full size dipole one wavelength above ground, it will generally outperform even the best multiband vertical for long distance communication in its favored directions.

This explains why many experienced DX operators use both. The vertical provides excellent low angle omnidirectional coverage, while the high dipole or beam delivers additional gain and lower receive noise when working weak or rare stations. The two antennas complement one another remarkably well rather than competing with one another.

References

1. DX Commander website
   https://dxcommander.com/
2. Chelegance KC4 Antenna
   https://chelegance.com/products/cntou-kc4-shortwave-4-band-vertical-antenna/
3. Jim Brown, K9YC, "If I Could Put My HF Vertical On My Roof, Should I?"
   http://www.audiosystemsgroup.com/VerticalHeight.pdf
4. GAP Antenna Products website
   https://gapantenna.com/
5. GXP-Antennas website
   https://sp7gxp.pl/
6. Grazioli Antennas website
   https://www.graziolantenne.com/en/ Sold in the US by Main Trading Company:
   https://mtcradio.com/
7. Cushcraft R8/R9 Multiband Vertical Antennas
   https://mfjenterprises.com/
8. Xiegu Electronics website (VG4 Multiband Vertical Antenna)
   https://www.xiegu.com/
9. Hustler Antennas website (4-BTV / 5-BTV series)
   https://www.new-tronics.com/hustler/

10. Hy-Gain Antennas website
https://hy-gain.com/
11. Butternut Antennas website
https://www.bencher.com/butternut-antennas/
12. DX Engineering — Vertical Antenna Systems and Grounding Accessories
https://www.dxengineering.com/
13. ARRL, *The ARRL Antenna Book*
https://www.arrl.org/arrl-antenna-book
14. John Devoldere, ON4UN, *Low-Band DXing*
https://www.arrl.org/shop/Low-Band-DXing/

About Author

Christopher Krstanovic, AI2F, is a lifelong amateur radio operator, first licensed in the US in 1980s as WR1F. He holds degrees in Physics and a PhD in Electrical Engineering, and his career has spanned corporate engineering as well as technology entrepreneurship. After leaving corporate America, he founded and led three companies before returning to active amateur radio under his current call sign. His operating interests include HF, antenna design, practical radio engineering, and Astronomy.