

Newcomers and Elmers Net: Antenna Myths and Misunderstandings

Robert Gulley AK3Q

One of the things I have tried to do along the way in this hobby is to keep myself grounded (no pun intended!) in reality when it comes to antennas. I read a lot, and I do mean *a lot* of sources for antenna ideas and suggestions, particularly as they might have application to my situation. I do confess to occasionally reading about antennas I could only dream of having, but most often I stick with antennas I might realistically be able to use at my location. Along the way I have read some rather exaggerated claims concerning the capabilities of various antennas, and I have learned to approach anecdotal experiences with a bit of healthy skepticism.

Here are a few myths and misunderstandings which float around clubs, nets and message boards from time to time.

Myth #1: Small antennas can perform as well as or better than large antennas.

I learned a very hard lesson back in my photography days when 35mm cameras were all the rage. When buying my first serious camera I read all the reviews of various manufacturers concerning the quality of their lenses and of the 35mm films available. I bought into the lie which said even though the film size was significantly smaller than the 2-1/4 films of days gone by, the quality of the films and lenses were so good one really could not tell a difference between them. Wrong! I wasted a lot of time trying to make tack-sharp 8x10's and 11x14's from slides and negatives incapable of being enlarged that much without some fuzziness.

The same holds true for antennas. A full wavelength quad loop antenna or 1/2 wave dipole is going to out-perform a 1/4 wave or smaller antenna virtually every time. There are always those rare exceptions, but generally speaking when it comes to antennas, bigger really is better. This is not to say smaller antennas do not have their place. Just as a 35mm camera can be used where a medium format camera might be too big, small antennas may be required due to space constraints or other limitations. Compromise size only when necessary for physical, financial, or other considerations.

Myth #2: Higher power means stronger signals and therefore greater reach

While it is true a properly matched antenna system will reach further with more power (watts), merely increasing the power will not help a system which is designed poorly. I had an old Kenwood 3530A radio which outputs about 25 watts. On good days I could talk on simplex frequencies (meaning radio to radio without a repeater) with my friend Mike, and we hear each other pretty well. We both use 220 J-poles, and the height above ground for both antennas is about 25 feet. Another friend (Ben) who lived quite close to Mike joined in sometimes, and they could hear each other easily. Unfortunately I could barely hear Ben on the best of days and he could rarely hear me. What to do?

Well, being the kind of guy who looks for any excuse to get a better radio, I was tempted to buy something new. A better solution is replacing the lossy coax with more efficient coax. This not only allowed more of my signal to be transmitted, but I have improved

reception as well. Based on my calculations of feedline loss, the new coax is about 6-8dB better, far out performing the increase of 25 to 50 watts on the transmitter. Always strive to make the antenna system the best it can be and *then* try increasing the power to extend the signal (I added a 50 watt radio later after the coax was better). This will ensure the increased power makes it into the ether as opposed to being dissipated as heat along the feedline. Remember, you have to hear 'em before you can work 'em! This is why some old-timers recommend for every dollar spent on a radio, spend two dollars on the antenna system. While this ratio may seem a bit high given the price of today's radios, at least the principle behind it is sound. A good antenna *system* is an absolute must. This brings up a related myth . . .

Myth #3: Coax is coax—the feedline really isn't all that important

Not all coax is created equal, particularly when working above HF frequencies. I have discussed ladder-line and coaxial properties in the past, so I won't repeat them here. Just remember the feedline is a vital part of any antenna system. When transmitting above HF frequencies, use RG-213 or better; anything less loses too much power. While there is a significant difference in the price per foot between RG-58 and RG-213 or LMR-400, the higher performance more than makes up for the difference in cost. The best radio in the world cannot overcome a lossy feedline. Don't skimp on the coax!

Myth #4: Vertical antennas radiate poorly in every direction

Vertical antennas take a lot of criticism partly, I believe, because they are more unpredictable than dipoles. There are several reasons for this. First, they are more susceptible to ground noise than other types of antennas. This means the signal noise level (or clutter) will often be higher, making weak signals harder to hear and moderate signals less intelligible.

A second unpredictable aspect of verticals is the ground response. Verticals are generally designed as a ¼ wave antenna which use a system of radials to duplicate the effects of a standard dipole. The number of radials needed for an effective ground often raises passionate debates among hams, and the truth is, no one answer works for every situation. Earlier I mentioned half the fun of playing with radios and antennas is experimentation. Well, vertical antennas offer a wide range of opportunity for playing the "what if" game. Try different combinations of radial lengths, construction material, and base height combinations to see what happens.

This brings up an important point. For the true hobbyist antennas are always a work in progress. Of course, not everyone wants to play with antennas or change their setups on a regular basis. I sometimes hear folks say things like "I've been using this same antenna for 15 years or more." While there is nothing wrong with using the same antenna for many years, even the best of antennas require "tune-ups" and replacement parts, just like an automobile or an old washer and dryer. Problems can slip in and degrade performance over time, so yearly checks would not be unwarranted.

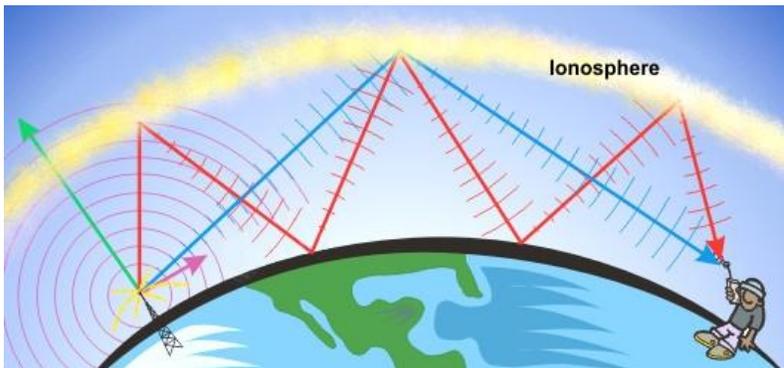
One other thought as to why multi-band verticals get criticized is because people often expect more performance out of them than they can reasonable give. (Of course,

advertiser's hype has nothing to do with this . . . no, not at all!) Some multi-band verticals are rated to go from 70cm all the way to 80-meters. Can these antennas actually work across such a wide range of frequencies? Technically yes they can, but with some severe limitations. The most common limitation is having a narrow bandwidth on the 80-meter band, but some antennas have less than desirable bandwidth on 40-meters as well.

Limitations are a part of every antenna system, so it is important to know those limitations and to decide which features are most important for a given station. Splitting the workload between two or more antennas whenever possible will usually produce better results than a "one size fits all" approach.

On the positive side, vertical antennas have at least two very important "pluses" over wire antennas. First, they work well in small places. There are some situations in which nothing else will do, and a good quality vertical will reach all over the world while taking up very little real estate. If placed in more rural areas the increase of ground noise mentioned above will be significantly less, and signal reception will be very good.

A second plus, and one which is often overlooked, is the relatively low takeoff angle of a properly grounded vertical. Since HF radio waves naturally bounce off the ionosphere, lower takeoff angles mean the signal will travel farther before being refracted back to earth (see illustration below). The greater (or higher) the takeoff angle, the more quickly the signal is bent back to earth. (This holds true up to a point—for those interested, a curious anomaly to this behavior is known as the *Pedersen Wave*, where high angle signals travel along the ionosphere for a time and then get refracted to earth). A low takeoff angle will improve DX reception and transmission, and under some conditions verticals can out-perform horizontal dipoles.



Blue line represents a *Low Takeoff Angle* and Red line represents a *High Takeoff Angle*
Less skips will usually produce a better distant signal

Myth #5: A resonant antenna will always put out the best signal

Resonance refers to the relationship between the radio and the transmission line and/or between the antenna and the transmission line. A system is said to be resonant when input impedance matches output impedance. Modern receivers are designed to output full power when the transmitter circuitry senses a near resonant condition, typically around 50 ohms. Resonance merely allows a transmitter to do its job at full strength. Good SWR

readings alone do not indicate an efficient antenna. By way of illustration, when 100 watts is sent into a dummy load (a device which can safely receive a transmitter's output without causing damage to the radio) an SWR meter will show a perfect reading of 1:1, even though the signal goes nowhere. Low feedline loss is a far better indicator of antenna efficiency than a low SWR reading, as was pointed out in Myth #3. The best scenario is to have a resonant system with a low-loss feedline and a usable SWR.

Misunderstandings: Sometimes A Little Knowledge Can Be A Dangerous Thing!

Call me weird, but I like being reminded from time to time of my limitations both in knowledge and in experience. As much as I like teaching others, I love to learn new things even more, so I am always on the lookout for people with helpful knowledge and experience in whatever area I take interest. Amateur Radio in particular is filled with people who are not only willing, but happy to share their experiences and I continue to learn from a lot of great people.

Unfortunately there are always those people in any hobby who have just enough knowledge to make them dangerous. They are usually the naysayers in life, more concerned about telling people what they can't do rather than what they can. These people often use sweeping generalizations to make their point, and their experiences are almost always anecdotal. After a while people like this are easy to spot, but for beginners receiving bad advice can rob them of some great learning experiences. I will share a few examples of things I have heard along the way which proved to be misguided or just plain wrong.

Misguided Advice #1: Tuners are of the Devil

Okay, I have never really heard someone actually say tuners are from the devil, but I think the thought may be lurking behind some people's hatred of them. Beginners are often told they need to build antennas which do not require a tuner if they are truly serious about getting on the air. For some the use of tuners is equated with either laziness or ineptitude, or both. Using a tuner is somehow cheating, something no self-respecting ham would do. These are also the people who talk about how tough it was in the old days as they walked to school uphill (both ways!) in the snow, with no shoes, and ate nothing but dirt everyday (and liked it!). Well, maybe I am exaggerating just a bit all in good fun, but the fact remains some people are dead-set against tuners for any reason.

Tuners function as a matching network, adjusting the antenna's input impedance to match the transmitter's output impedance. When the SWR is greater than 2:1 most modern rigs will sense this and cut back power or shut down altogether. Unless multiple antennas are used which have been cut to specific frequencies, a tuner is most likely going to be required to work multiple bands on one antenna.

Tuners can be used as a crutch to be sure, but they can also teach beginners some valuable lessons about real-world operating conditions as they make their first contacts. During our current minimal sunspot activity the best all-around band to be on night or day is the 40-meter band. This band offers the best compromise of activity and distance

throughout a good portion of the year, but it is also a band which displays a wide range of SWR movement from one end to the other. A tuner makes the whole band easier to use, especially if both CW and Phone are of interest. The same holds true for the 80-meter and 160-meter bands, only on these bands wide coverage requires a tuner.

On the receive end, tuners will not greatly enhance signal reception except under some conditions where interference from adjacent stations may be an issue. The problem is while the signal may sound louder when run through a tuner, so will the ambient noise unless conditions are particularly “quiet,” free from the usual effects of ground noise.

Misguided Advice #2: Multi-band Wire Antennas Are All But Useless

This is a variant of the multi-band vertical myth listed above, but it is one I almost bought into when I first started out. I spent much more time trying to figure out what I was going to do for an antenna given my small yard than I did which radio to buy. One group of people argued against antennas like the G5RV, while another argued against the multi-band verticals. Others insisted single-band antennas were the only way to go. The fact is either type of multi-band antenna could work, as could a number of mono-band options. Each style of antenna presents its own set of limitations, and each its own strengths. The most important thing is to get something in the air and start having some fun. This is a hobby after all, not the lunar landing!

Misguided Advice #3: All Antenna Rules Must Be Followed Perfectly

While no one really says these exact words, one could easily draw this conclusion as a beginner just entering the hobby. Rarely does someone say “Go ahead and give it a try; see what happens!” There are often many reasons given why something won’t work, and one is left with the impression getting a signal out is a rigorous process. It doesn’t have to be, or I would have never made my first contacts. I am not going to suggest to anyone they use the fence around their yard as their first antenna, but if someone came to me and said “What would happen if . . . ,” I hope my response would be “let’s try it!”

Misguided Advice #4: The Only Worthwhile Antenna Is The One You Build Yourself

Often this advice comes from a sincere desire for a beginner to enjoy the thrill of making contacts on something they built with their own hands. I will admit this can bring a real sense of accomplishment. Unfortunately sometimes this advice reveals a bit of snobbery toward anything not “homebrewed” as somehow less pure or less worthy of respect.

Given sufficient interest in the hobby I believe almost everyone will try their hand at making an antenna at some point just for the experience. One does not have to build an antenna to be a “real” Ham, however. Building antennas is just one aspect of the hobby like any other, no better no worse.

Commercial antennas offer the real advantage of having the bulk of the “trial and error” part already done. If assembled properly sometimes very little adjustment will be

required to tweak the antenna for best results. Conversely, without some real guidance homebrew antennas can lead to a lot of frustration when things don't go as planned!

Cost, complexity and experience will be the deciding factors when choosing between commercial and homemade antennas. Both have their place, and most people enjoy a combination of the two as I do. With more experience comes the desire to build more complex antennas, but I do not hesitate to buy a commercial product when so required. For me, it's all about the signal!

Some Closing Words Of Advice

One of the hardest things to accept as a newcomer to the radio hobby is just how unpredictable it all is on a day-to-day basis. While science is at the heart of the hobby, no one can take into account all of the possible variations and challenges each new situation presents. Even though we try to eliminate as much of the guesswork as possible, we are in the end at the mercy of things beyond our control. Changing weather, solar conditions, natural and man-made interference all combine to make listening and talking to someone else a daily, sometimes hourly challenge. To me this is not a negative thing, but rather part of the hobby's appeal. Digging out a signal during difficult conditions makes success all the more enjoyable. Logging a shortwave station I've not heard before or finding an open window to an unexpected part of the world is a thrill for me. Learning to expect the unexpected keeps the hobby fun!

There is an old saying, "chance favors the prepared mind," and nowhere is this more true than when working with radio signals. Never stop learning and always be willing to try something new. The next great radio adventure is awaiting just around the next corner!