

The Best Antenna for the Job

There is no such thing as a single antenna that's perfect for every station. Choosing an antenna depends on what you want to do with your station, how much money you can spend, and any restrictions you may encounter with your property. Here's a walk-through of what antenna types are best for certain types of operating.



Figure 1: A dual-band VHF/UHF mobile antenna.

VHF/UHF Mobile Operating

The best choice is a dual-band VHF/UHF mobile antenna (see Figure 1), even if you don't yet own a dual-band radio. You may buy a dual-band transceiver someday, so it makes sense to plan for that possibility now. Some mobile antennas use powerful magnets to secure themselves to your vehicle. While these are certainly convenient because they are easy to mount and dismount, you may enjoy better range from a larger model that attaches to your trunk lid or bumper. Larger antennas in this application tend to concentrate your transmit and receive energy in a slightly more focused pattern, which will help you communicate over greater distances.



Figure 2: A dual-band J-pole antenna.

VHF/UHF Home Operating

If you want to send and receive in all directions at once, an *omnidirectional* antenna such as a J-pole (see Figure 2) or ground plane is best. While J-poles are popular, you may find that a ground plane offers somewhat better range. You can purchase either single or dual-band models of both antennas.

However, if you want to concentrate your transmitting and receiving in a particular direction, you'll need a Yagi (see Figure 3), a *directional* antenna that behaves like a flashlight to focus your power in one direction. Yagis come in many sizes. The longer the Yagi, the tighter its focus and the greater its range.

The issue with Yagis, however, is that unless you don't mind communicating in the same direction all the time, you'll need to install a *rotator* — an electric motor that will turn your Yagi in any direction you wish. Rotators can be pricey, especially the models you'll need if you are considering a longer, heavier Yagi.



Figure 3: A Yagi antenna like this VHF/UHF model will focus your power in a particular direction.



Figure 5: A multiband HF vertical antenna.

Casual HF at Home

For casual HF operating, classic wire *dipole antennas* are hard to beat. Most hams start with a simple, inexpensive half-wave dipole, often referred to as a *center-fed dipole* because the antenna is constructed using two wires of equal length, and the coaxial cable is connected in the center of the antenna.

A drawback to dipoles is, that on lower frequencies, these antennas can be quite long. A full-sized dipole antenna for the 40-meter band, for example, is about 66 feet long. There are limited-space versions that are shorter, but these compromise on performance. Choose full-size models whenever possible. There is an old amateur radio adage that applies well to dipoles: *As much wire as possible, as high as possible.*

You often see dipole antennas strung horizontally between trees or posts, but this isn't a strict rule. You can, for example, support the center of a dipole on a tall



Figure 4: This wire dipole antenna is attached to a single support and the wires slope downward like an upside-down V. This is known as an *inverted V* configuration.

post and slope the “legs” of the antenna toward the ground like an upside-down V as shown in Figure 4. You can also install a dipole antenna at an angle with one end on a high tree branch and the other end about 6 feet off the ground.

Dipole antennas work best when they are well above the ground, say 40 to 60 feet. Dipoles *will* work at lower heights, but long-range performance will suffer.

If you don't have room for a long dipole, consider a *vertical antenna* (see Figure 5). These antennas consist of metal tubes (or sometimes wires) that are mounted on posts near ground level. The lower the frequency, the longer the tube. A full-sized vertical antenna for 40 meters is about 33 feet long.

Verticals can perform well, especially at lower frequencies, and they require little room. You'll find them offered in single and multiband models. However, they do require a system of wires known as *radials*. Radials form the “other side” of the antenna circuit and allow the antenna to radiate signals efficiently. For maximum performance, you may need to bury as many as 60 wires in your soil, each one as long as your antenna is tall. You really

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The Magic of Multiband Antennas

We refer to our ham bands in wavelengths — 80 meters, 20 meters, etc. The wavelengths of our ham bands tend to be multiples of one another; $40 = 2 \times 20$, $80 = 2 \times 40$, etc. This is called *harmonic relation*, and it permits us to design and construct antennas that can easily be adapted for use on more than one band.



Figure 6: A HF Yagi antenna can offer outstanding performance for competitive operating, but these antennas are often large and expensive. [F5IDM photo]

aren't required to plant 60 radials; even a dozen will work. However, you'll find that more radials usually give better overall performance.

It is also possible to install a vertical with just a few radial wires elevated several feet above the ground. As you can imagine, these radials present tripping hazards for members of your household, which is why in-ground radials are more common.

You'll find some vertical antennas that claim not to require radials. In many cases, these models will not perform as well as traditional verticals with radials.

You have probably seen advertisements for *end-fed antennas*. These designs rely on a single long wire with a matching device at its base. You can fit an end-fed into almost any yard, but these antennas use the outer shield of the coaxial cable as a radial. This means you may end up with unwanted RF energy inside your station, interfering with other equipment and even giving mild shocks. When it comes to performance, they are compromise designs that don't usually give the results you might hope for, but if you are dealing with space restrictions, they are worth considering.

Competitive HF at Home

For competitive HF hamming, such as contests or chasing long-distance (DX) contacts, the gold standard is the Yagi (see Figure 6), either one that works on a single band, or on multiple bands. These are high-performance antennas, but with a few exceptions they are large, heavy, and come with significant price tags. Plus, you'll need a heavy-duty rotator to turn them. They perform best when installed on rooftops or towers. Erecting a tower on your property can cost thousands of additional dollars.

HF Yagis are serious investments and aren't usually the first choices for new hams. That said, if money is no object, you'll never regret buying an HF Yagi. A well-installed Yagi can make even the cheapest transceiver sound like a winner.

A vertical antenna can also be a competitive choice, particularly at lower frequencies, but to get maximum performance, you'll need more than one antenna working within a system known as a *phased array*. A phased array requires more room on your property and can be complicated and expensive to install. On the low bands, however, phased arrays can create some of the strongest signals you'll hear. Best of all, their signal patterns can be electrically adjusted to aim in certain directions — all without rotators.

Avoiding Buyer's Remorse: Don't Forget the Antenna

Building your first station, whether in your car or in your home, is an exciting project. Assuming you have a limited budget (doesn't everyone?) for your first amateur radio station, there is an almost irresistible temptation to spend most of your money on the transceiver. After all, your enjoyment of amateur radio depends on the performance of your transceiver, doesn't it?

Let's take a step back for a moment. Imagine that you've just purchased an audio system for your home. You chose to spend most of your money on the gleaming amplifier. It was highly rated and seemed like an excellent choice. You didn't have a lot remaining to spend on the surround-sound speakers, but you decided that was okay, figuring that because an amplifier is the heart of any audio system, it deserves the lion's share of your investment.

So, you hook up all the cables, and press the amplifier's power button. The sound from your wide-screen television comes blasting out of the speakers, but it seems kind of tinny and flat. You were prepared for thunderous bass notes, but what you're hearing is underwhelming, to say the least.

Welcome to buyer's remorse. You sunk most of your money into the expensive amplifier, without realizing that the speakers are responsible for most of what you hear! With a limited budget, you should have spent the majority of your cash on the speakers rather than the amplifier.

The same holds true for your amateur radio station. Like an audio amplifier, the transceiver is a critical component, but the antenna is the device that is going to connect your station to the world. You could own the best transceiver money can buy, but it is the quality of your antenna that will determine how much enjoyment you get from it.