What's the best antenna?

If there were just one "best" antenna, everybody would use it. The best antenna for one particular situation may not work well somewhere else. There are three rules of antenna installation:

1) Any antenna is better than no antenna.

2) Bigger and higher are generally better. If small antennas really did work as well as big antennas, nobody would spend the time, money and effort to put up the big ones.

3) Every antenna installation is a compromise.

There are several factors that must be considered when engineering an antenna installation. Single-band or multi-band? Height? Size? Weight? Restrictions? Cost?

Now there is a factor that we all have to compromise on with every antenna, cost. Should I build it or buy it? Many antennas can be scratch built for a fraction of what they cost ready-made, but are they bargains? All-band dipoles are advertised for $89 to $125 but the same performance can be had from a home built dipole array costing less than twenty dollars. A single band vertical can be constructed from electrical conduit for a few bucks. Even fairly complex multi-band beam antennas can be home constructed for very little money, however they may be difficult to design and tune if the Amateur doesn't have a background in engineering or key pieces of test equipment. The truth is, when you buy a ready-made antenna, you aren't just buying a collection of aluminum tubing, you are also purchasing design expertise.

Do you get your money's worth? Is the kit of parts complete? Is the hardware stainless steel, or are you going to have to deal with a corroded mess after a couple of years? Are the directions clear, and detailed? Some antenna manufacturers provide a single sheet with a quick sketch whereas others provide a manual running to several pages. Usually the bulk of even a complex antenna is fairly straightforward in assembly, with a single part requiring tuning. When you get to the tuning, either (1) the manufacturer has designed the assembly so it could be tuned at the factory; or (2) he has provided detailed instructions on how to accomplish the procedure; or (3) the instructions are vague and misleading; or (4) you are left on your own. The author has experienced all of these conditions.

The quality of the instruction manual is of primary importance when selecting a ready-made antenna. Some engineer built a number of prototypes to come up with the design the manufacturer decided to market. Assuming they started with exact copies of the pieces of that antenna, the manual should lead you by the hand to assemble those pieces into a good enough copy of the original to equal the performance advertised. A low cost antenna is no bargain if you cannot properly set it up for peak performance.

When first introduced, the Cushcraft "Ringo Ranger" suffered from an inadequate manual. This antenna could be tuned up to be a great performer for its size and cost, but the book didn't make this process clear at all. So most of the installed antennas performed poorly, and the antenna got an undeserved bad reputation.

On VHF/UHF, polarization is a foregone conclusion, usually vertical for FM and horizontal for other SSB/CW. In any case, use the same polarity as the other stations you intend to work.

On HF, the choice of polarization is more complicated. Polarization is randomized by the Ionosphere, so you don't have to have antennas with matched polarization at the ends of the path. A vertical takes up little space in the backyard, but generally won't perform well without a good ground system. If the soil is moist all year, or mineralized, a few ground rods may suffice. If not, then an extensive radial system may be needed, and there goes the backyard. A vertical antenna likes an open area around it. Putting a vertical in a hole, or next to a house (or a chain-link fence) is less than optimal. Vertical antennas tend to have the disadvantage of being noisy. They also tend to have the advantage of a low angle of radiation, which makes for long range.

Many times, the roof is a good location to mount a vertical antenna. At HF, the extra height isn't significant, but getting away from other objects can make a big difference. Laying out ground radial wires on the roof may be easier and more acceptable than laying the same wires out in the yard. On a pitched roof, the angle of the radials can even improve SWR. Verticals can be ground mounted, or elevated, but in any case they must generally have a good quality ground system to work well. They also may need guys to support them, made from non-conducting material, like nylon parachute cord, if they are to survive winter.

Horizontal antennas tend to be less noisy, but must be elevated above ground to work effectively. A dipole one quarter wavelength or less above ground has its main lobe pointed straight up. In order to bring the angle of radiation anywhere near the horizon, the antenna must be a half wave or higher in the air. This is not so easy on the lower frequencies. Fortunately, most hams prefer the more local coverage on 75/80 and 40 meters afforded by a dipole mounted relatively low. This height sensitivity is true of all horizontal antennas, from the simple dipole to the most complex beam. Rule 2 applies to towers too! If you are unable to elevate a horizontal antenna at least 3/8 of a wavelength for the bands above 40-meters, a vertical may be a better choice.

Should I get a beam, or stick with a dipole? Well, once you have experienced the performance of a well-constructed gain antenna, the dipole does seem rather tame, but then, we don't all drive sports cars either. A large beam antenna implies a large tower, rotator, guy cables, concrete, and so forth, and a backyard to put it all in. This can be quite an investment, and a dipole hanging in the backyard beats the performance of nothing (Rule 1). In some cases, a tower isn't necessary. I know one Amateur who has a big two story wood house on the top of a hill. The electrical ground is probably 30 feet from his rooftop, and that is pretty good for 20 meters and shorter. He installed an eight-foot tripod on the roof, and his multi-band yagi works great. No two installations are quite the same. When you think "tower", remember that your house roof may already be a good percentage of that height already.

Multi-band antennas are far cheaper on a bands-per-dollar basis, and for the typical Amateur this is the route to go. The performance offered by mono-band antennas is superior, however, they only work one band and putting up several can chew up a lot of real estate, both geographically and vertically. Most multi-band antennas employ traps, devices that decouple different parts of the antenna at different frequencies. This allows for a compact design, but means that, generally, the performance on the lower frequency bands suffers

somewhat. While the average ham can probably put together a mono-band yagi, designing a multi-band beam is probably best left to the professionals.

One way to answer the antenna question would be to ask, "What does a 'typical' ham use?" I would have to say, from my experience, there is no 'typical' ham station; any more than there is a 'typical' ham. However, given the same engineering problem, the solutions tend toward a common theme. Many Amateurs, who routinely operate on several different HF bands have a tower. The most common height is in the 60-70-foot range. On the top of the tower is mounted a yagi antenna for the bands from 20-10-meters. The yagi is on a mast, turned by a rotator. Either off the side of the tower, or more commonly mounted on the top of the mast, is a VHF vertical antenna. Suspended from a point on the side of the tower near the top is either a 2-band dipole, or two single-band dipoles, for 40 and 75-meters. There are then three coaxial cables and a rotator cable running into the "shack". Is this the "best" antenna? Not necessarily. Many hams have to compromise this arrangement due to zoning laws, and deed covenants. This arrangement may not be possible in all locations.

The best antenna for you will be as personal as the best pair of shoes would be. Simple, easy antennas are a smart start. You can work the world on a dipole. More elaborate (and expensive) antennas should be carefully researched. The experienced Amateur should be able to decide what limitations his or her own situation imposes on the potential choices. Objects and landforms in the environment profoundly affect radio waves leaving from, and arriving at an antenna. Will the antenna be ground mounted or elevated? Close to a building or in the clear? Mounted on a tower, pole, building? How much will the whole installation cost? Will the neighbors (or spouse) object?

The more elaborate an antenna installation, the less likely it is to survive a disaster, when the need for Amateur communications might be most acute. Much of the emergency communication out of a disaster area is handled on hastily erected dipoles and trap verticals. Fortunately, the stations at the other end of the contact are usually 'big guns' able to bring lots of antenna gain to bear. The best antenna you ever erect may be a hunk of wire quickly strung up to whatever is handy. Every Amateur should know enough to put such an antenna into service, and there is no better time and place to hone the required skills than in day-to-day operation.

The antenna system is the single most important component of an Amateur station. It defines the performance of the entire station. It may be the most conspicuous object on your lot. You may lie awake on stormy nights wondering if the tower will still be in the backyard in the morning, or lying across your ruined living room. Consider the choices carefully, because only you can really answer the question:

What is the best antenna?

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