Antennas: What & Where - B

On-Air Training
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Tonight we're going to continue our discussion of antennas. Last week we talked about the antenna survey and about ground plan antennas. This week we'll cover j-poles and directional antennas.

Recap

Remember the purpose of a VHF or UHF antenna? We are not going to attach our handheld radio to 2 meter antenna and talk to Madagascar. No. The purpose of our VHF or UHF antenna is to talk with other operators in our general area. Given enough height and power, maybe 30 to 40 miles reliably.

We also talked about criteria to consider when selecting a VHF antenna. You suggested things like cost, deployment location, physical size, gain, function, durability, and the frequency.

Then we discussed a ground-plane antenna. [what is another name for a ground plane antenna?] The ground plane is omnidirectional, requires radials. Simply attach the vertical radiating element to the center conductor of the coax and the radials to the shield. If you can angle the radials downward, it will help to get the impedance of the antenna closer to 50 ohms.

Alright. Let's get on with it.

J-Poles

J-Poles were originally invented by the Germans who trailed them behind their air-ships. Around 1936 they had evolved into the characteristic J shape which is why we call them J-Poles today.

The J-Pole is an interesting animal. According to literature, they are second only to ground planes in terms of popularity. In our survey, 96 of you responded to the question about what VHF antenna you would recommend. 48 of you clearly recommended a J-Pole antenna. About half of those 48 recommended the Arrow J-Pole (OSJ-146/440) or its twin, the Deseret J-Pole by name.

J-Poles lack any sort of ground plane or ground return for RF currents. In the case of a J-Pole, the feed line shield usually ends up carrying the common-mode currents away from the antenna. The result can be an antenna that is tricky to tune for lowest SWR and one that tends to be sensitive to surrounding objects.

J-Poles exhibit slightly higher gain than a ground plane or vertical antenna, like 0.2 dB over a dipole. They are omnidirectional and have a low angle of radiation.

J-Poles, like most antennas, can be constructed out of just about any kind of conductive material. They are commonly assembled using copper pipe, but they can be easily made from twin-lead feed line or ladder line. When attaching the coax to the antenna, the center conductor should be connected to the long element of the antenna.

Bret Stoddard recently constructed a copper J-Pole. Bret, KG7KHG would you mind sharing a little bit about your experience?

When it comes to J-Poles, the Deseret J-Pole is an inexpensive option for a high-performing dual-band antenna. If you'd like more information about this system, you can send me or Steve Taylor an email or give us a call after the net.

Call for Jim KG7IOO, but he may not be on the net. Permission granted to read if he is not.

Just a little lesson from a newbie operator about taking care of our equipment.
We built, with help from a more-seasoned HAM, a nice little 2-meter J-Pole. Like most such J-poles, there was an insulated wire installed horizontally between the two vertical copper pipes. The antenna worked great. However, I noticed that I could use that horizontal wire to hang my handheld radio from in between nets--it kept the radio handy and kept it from cluttering up adjoining tables or flooring. I just slipped the loop over the shorter J-pole, and let the radio dangle off the horizontal wire.
Not surprisingly, we started having performance issues. Reception and transmissions were breaking up. We spent a few months troubleshooting--thinking it was our radios, or the settings on the radios, or maybe just gremlins or weather or local interference. Ultimately, after about 4 months...the antenna became completely non-functional because the wire completely disconnected!
At that point, I finally figured out what the root cause of the problem was...and learned the lesson that one shouldn't hang their radios from their antenna, no matter how strong we think it is.
Jim Rodgers, KG7IOO
Rigby Stake, Rigby 12th Ward

There are a number of variations of the J-Pole design. One more common iteration is the Slim-JIM. Contrary to popular belief, it is not named after a skinny guy named James. In fact, it was invented by Fred Judd G2BCX. The JIM is actually an acronym that stands for J Integrated Matching. The Slim-JIM resembles, in many ways, a folded dipole.

The Rexburg Region built some of these at one of their monthly meetings earlier this year. Operators with no or even a minimum amount of soldering and technical skills were able to assemble one out of twin lead in about 60 minutes for about $7 in new parts. We called them roll-up j-poles because they roll up into a very small foot print for storage. They are great for go kits and can be deployed in the field in seconds. I used mine hung on the wall in the shack for my packet station for several months.

J-Poles are easy to construct but they will not out-perform a ground-plane antenna. J-Poles can be used in a variety of situations: mounted on a roof or tower for base station operation or in the field hung from tree.

One individual commented in the survey, “Making my own j-pole antenna turned out to be a good experience, but I definitely did not save money, time or decrease some frustrations by doing so.” My experience has been similar. I’ve learned a lot about antenna theory by constructing them and experimenting and it is handy to have that knowledge so you can assemble something in a pinch or troubleshoot your own system, but I have little patience for devoting the appropriate time to fine-tuning homebrew systems on a regular basis.

Any other comments or questions about J-Poles before we move on?

Directional

Can someone tell me two reasons why we might use a directional antenna?

1. To hear better
2. To be heard better

A directional antenna focuses your transmitted signal in a particular direction and it is equally selective when it comes to receiving signals.

The radiation pattern of a directional antenna like a Yagi usually has one main lobe and at least three nulls – two side nulls and one rear null. If you know where each of those nulls is pointing, you can use them to block interfering signals. The main lobe usually points along the boom toward the front of the antenna. The side nulls will be at 90 degrees to either side. The rear null is usually aligned directly opposite to the direction of the main lobe. Being heard better by the station you’re contacting means that you need to point the main lobe at the station.[1]

There are a number of types of directional antennas: beverage, quad, and delta. Tonight we’ll focus our discussion on Yagis.

Directional antennas are used widely because they create gain as well as reject interference and noise from everywhere other than the desired direction. The Yagi remains the most popular of all directional antennas because of its simple construction and good performance. At minimum, it consists of a single ½ wavelength dipole element—the driven element—and a parasitic element (one without an electrical connection to the transmitter), that is typically about 5% longer and positioned “behind” the driven element. This element is known as the reflector.[2] Additional parasitic elements may be placed in front of the driven element to increase gain. These front elements are called directors. A three-element Yagi – consisting of the driven element and one reflector and one director--can produce as much as 17 dB gain over a dipole.

[1] General Class License Manual 8th Edition, ARRL, p. 7-7
[2] Small Antennas for Small Spaces, ARRL, p. 4-6

If I'm going to use a Yagi antenna for 2 meter FM contacts, should I have the elements oriented vertically or horizontally? If you think you know, please come now with your call sign.

The correct answer is vertically. The standard polarization for FM antennas is vertical.

So what did our survey have to say about directional antennas? Four of you mentioned that the VHF antenna you used the most was a directional antenna—three of you mentioned the Yagi by name, either a commercial or a homebrew design.

If any of you are on the net this evening and are willing to share, I would like to hear why you use a beam most often. Please come now with your call sign.

[Why do you use it?]
[Where is it deployed?]
[Do you have it on a rotator?]
[How well does it perform compared to others you might have tried, e.g. omnidirectional?]

Earlier this summer, the amateur radio society at BYU-Idaho assembled some three element Yagis. The parts list consisted of a 3' length of PVC pipe, some zip-ties or cable ties, a 6' foot length of RG-58 coax and an old metal tape measure.

[Directions can be found here: http://theleggios.net/wb2hol/projects/rdf/tape_bm.htm]

Measurements in the lab show that this design has a 7.3 dB gain over a dipole. Remarkable for some loose parts laying around the garage! Are there any operators on frequency that have built and would like to comment about the tape measure Yagi? Please call now.

These antennas are ideal, maybe even a necessity, if you live on the fringes of your region. A net control station can also employ a Yagi to better hear weak stations, assuming he knows approximately where they are transmitting from.

Are there any other comments about Yagi's before we wrap this up?

Okay. That should do it for tonight. Next week we'll continue this antenna discussion by touching on HF antennas. As always, I appreciate your participation. 73 to each of you. This is N7TMS, back to net control.