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A High Gain, Highly Directional Antenna for the Shortwave Bands

This month's antenna is a beam with a high degree of directionality. It is particularly effective at giving you the ability to concentrate on signals from one direction while more-or-less ignoring most other signals from other directions.

If you have never used such a beam, its performance will likely give you a pleasant surprise. A group of hams recently used this beam in an amateur-radio special event and received very good signal reports from country after country in the direction of the beam's main beam lobe, while experiencing almost no interference from stations in other areas.

Let's Design One

First, if you have limited space, you must decide whether the antenna will fit your available area. The higher the frequency for which it is designed, the smaller the antenna will be. The 21 MHz model I built is about 21 ft (6.4 m) wide and 80 ft (24.4 m) in length. If you use a free-standing pole or tower at each corner, it would take a rectangle about 21 ft x 80 ft to mount that antenna. But if you use guy ropes to steady the poles, the required space is somewhat more. To determine the space you will need for your antenna, sketch out the antenna on paper using the element length and spacing measurements you get from the formulas given below. Add in any guy wires you will need.

Second, determine the correct direction to point the antenna in order to get it aimed at the DX area with which you want to communicate. Ordinary rectangular maps can badly mislead you about the direction to far away places. A better way is to get a globe of the world and stretch a string between your location and the area with which you want to communicate. The string will show you the angle or "great circle" direction to use for orienting your antenna. There are also several computer programs available which give great circle bearings for antenna orientation.

Once you have the proper direction to point the antenna, get a good handle on where north is. If you use a magnetic compass, be sure to find the local correction necessary for its use. A better way is to go out at night and mark a north-south line by sighting on the North Star. Whatever method you use, it is important to point the antenna correctly.

It is best to erect the antenna a half wavelength or more above ground. The higher the better. A half wavelength is often higher than most of us can manage, so we mount the antenna as high as we can.

N1FPR, WX1O, KA1UMB and I used this beam, cut for 21.3 MHz, for the special event station mentioned earlier. It was mounted only 5-1/2 ft off the ground at the reflector end (about 1/8 wavelength high) and about 10 ft (not quite 1/4 wavelength high) at the end with the last director. As you can see, this was far from ideal height, but the beam worked quite well.

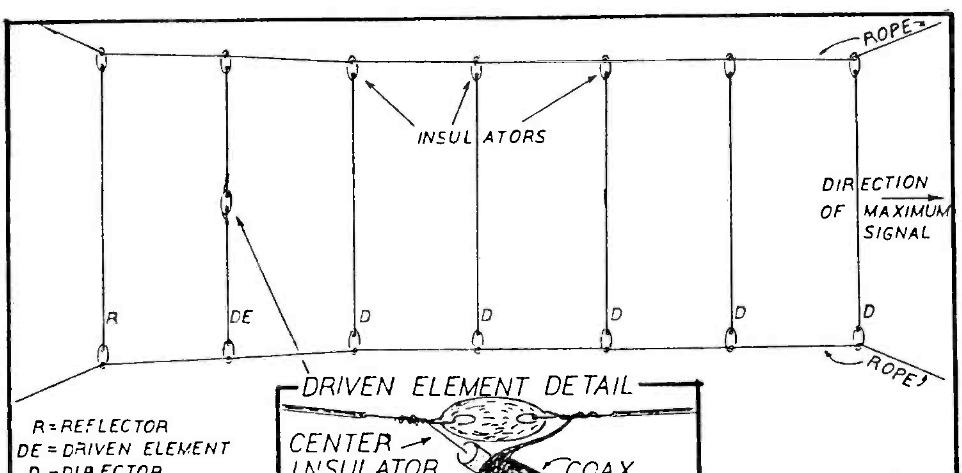

FIG.1 TOP VIEW OF A HIGH-GAIN, HIGHLY-DIRECTIONAL YAGI-UDA BEAM ANTENNA.

Determining Element Lengths

DRIVEN ELEMENT (in feet) =
426/F; (in meters) F = 130/F
For example, at 10 MHz,
DE=426/10 = 42.6 ft; or 130/10 = 13 m.
REFLECTOR, (in feet) =
445/F; (in meters) F = 136/F.
DIRECTOR, (in feet) =
411/F; (in meters) F = 125/F
SPACING, (in feet) =
295/F; (in meters) F = 90/F.

Let's Build One

1. Determine the element lengths and the spacing by using the formulas just given. Number 14 insulated house-wiring wire was used for my antenna. Bare wire or wire of a larger or smaller size is OK if it will take the stress of installation and weather.

2. Cut the elements to length leaving perhaps 5 in. extra on each end (10 in. per wire). This extra wire is for wrapping through the insulators at each end of the wire. For the driven element leave about 20 in. extra wire to use for attaching its end insulators and center insulator.

3. Cut the driven element at its center and remove the insulation from the wires at this cut for perhaps 6 in. This makes the wire ready for attaching the feedline later. Now insert the center insulator and attach the wires as shown in fig.1.

4. Put one insulator on each end of each element as shown in fig. 1. As you put the insulators on, make sure that each finished

element is the correct length. Snip off any excess wire.

5. Lay out the elements on the ground in the approximate position they will occupy in the beam as shown in fig. 1. Thread a small strong rope through the ends of the insulators on each side of the antenna as shown in fig. 1. Set the proper spacing between elements and fix them in place. One way to fix them in place is to put a loop of the small rope through the end-eye of the insulator, then fold the loop back over the same end of the insulator. This allows the fix to be moved easily later if necessary.

5. Although it is not a close match, either 50 or 75-ohm coax should work OK on this antenna. I used 75 ohm line and it worked fine for both transmitting and receiving. At the center connector, one side of the antenna is connected to the coax center conductor and one side to the coax shield. Make these connections good electrically, soldering them if possible. Then seal the coax-cable end with coax-type sealer to keep out the weather.

6. Tie the ends of the side ropes to the masts, trees, or whatever you have chosen to use to hold the antenna up. You may find at this point that the side ropes each need a support at about the middle of their length. Add guy ropes as needed.

7. Don't forget that the minimum lightning-induced damage protection, especially in lightning country, is to never use the antenna during a storm, and disconnect and ground the antenna when it is not in use.

8. Run the coax lead-in to your receiver or transceiver and the antenna is ready to use.

RADIO RIDDLES

Last Month

In last month's column I asked you: "What is a "radioist?" Well, as judged from the fact that you are reading *Monitoring Times*, the chances are very good that you are one! The July 1989 issue of *AntenneX*, an antenna journal which has since ceased publication, reported "radioist" to be a word used to describe those persons interested in such things as amateur radio, SWLing, or CB. Maybe this term should also cover those who love to tinker or experiment with radio equipment or to monitor radio for the fun of it.

Are you "radioist," or do you prefer a different title? Or maybe you can create a new term to fill this niche. Please drop me a line with your suggestion or to vote for the title of your choice. I'll tally the results of all the votes and suggestions and see what we can come up with.

This Month

Why is most coaxial cable which is commonly available for use in radio work either about 50-ohms or about 75-ohms in impedance? Why not 175-ohms or 2000-ohms, 3-ohms or some other value?

You'll find an answer to that, and much more, in your next issue of *Monitoring Times*. 'Til then, Peace, DX, and 73.

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