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A Log-Periodic Dipole Array for 220 to 450 MHz

One limitation of most beams is that they are only useful over a narrow band of frequencies; even multiband beams function well over only two or three narrow bands at most. However, for monitoring we often want general coverage of a very wide band of frequencies, and it would be nice to have a reasonably small beam antenna which would cover this wider range.

The best candidate for such a beam is the log-periodic dipole array (LPDA) which allows designs that cover up to a 10-to-1 frequency range (for example, 100 MHz to 1 GHz). The most broadband form of this antenna is constructed by sloping its elements in the forward direction (direction of maximum signal response). This technique also gives the antenna more gain. Most practical designs yield a bandwidth of 2-to-1 or so: still quite impressive when compared to the bandwidth of most other types of beams.

This month's featured antenna, the LPDA, was designed for use from 220 MHz to 450 MHz. This coverage includes both the 220 MHz and 440 MHz amateur bands as well as a wide stretch of military and federal government frequencies. The beam gives a good account of itself with 6 dB of gain compared to a halfwave dipole or about 8 dB referenced to the isotropic antenna standard.

Although this antenna was designed with monitoring in mind, it should also perform well as a low-power transmitting antenna.

Let's Build One

For this antenna you will need to get 10 ft. of 1/4 in. tubing or copper pipe, 31 in. of number 10 bare copper wire, and 6 in. of number 14 bare copper wire. You will also need a length of 50-ohm, foam dielectric, coaxial cable with a fitting at one end that mates with your radio's antenna socket. Take care to get coaxial cable which will fit inside the tubing you use for the boom, because that is necessary for the construction of the antenna's built-in balun feature (see fig. 1D).

1. Cut the elements from your wire and tubing stock to the lengths shown on the half-beam fig. 1A.

2. Solder the elements to the booms to make two half-beams; the elements are less likely to break off accidentally if you use silver solder rather than ordinary tin-lead solder. During construction of the LPDA, one half-beam is turned top-for-bottom and combined with the other; this makes the complete beam as shown in figs. 1B and 1D.

3. Expose about 3/8 in. of the center connector of the coax which will connect to the antenna; don't trim the braid (shield). To make insertion of the coax into the boom easier, you can trim the outside insulation from 25 in. of the feedline and thread the line into the rear of one of the boom tubes (the rear is the end with the longer elements).

If the beam is to be used outdoors, use some coax-type seal to seal both ends of the boom with the coax in it. Also seal the open end of the coax. Once the coax is through the boom, solder the coax's braid to the end of the boom from which it has just emerged. Then solder the coax center-conductor to the front end of the other boom as shown in fig. 1D.

4. The two half-beams of the antenna are now mounted in a plastic plumbing-pipe fixture by cutting slots in the threaded portion of the fixture as shown in fig. 1C. The pipe fitting which I used was a "Desanko" plastic adapter for chrome-to-plastic fitting of 1-1/4 inch to 1/2 inch trap pipes. Separation between the booms as they pass through the fitting is approximately 3/16 in.

Before gluing the elements in place adjust the boom members such that, when the fitting cap is screwed tight, there will be about 1/16 in separation between the boom tips at the far front end of the boom (end with shorter elements) and almost 5/8 in between the boom tips at the far rear ends (see fig. 1D). Once the booms are in place the cap is screwed tight to hold them in place and epoxy glue is used to fix them permanently in place.

5. Mount the beam with its elements vertically oriented to produce the vertical polarization commonly utilized at this frequency range. A piece of pipe which fits the fixture used in step 4 above is used as a mast. Bring the feedline away from the boom at a right-angle to the elements and loop it over to the mast. Secure it to the mast near the booms and run it down the mast.

6. If you live in lightning country and use this antenna outdoors be sure to use lightning protection; the minimum is to never use the antenna

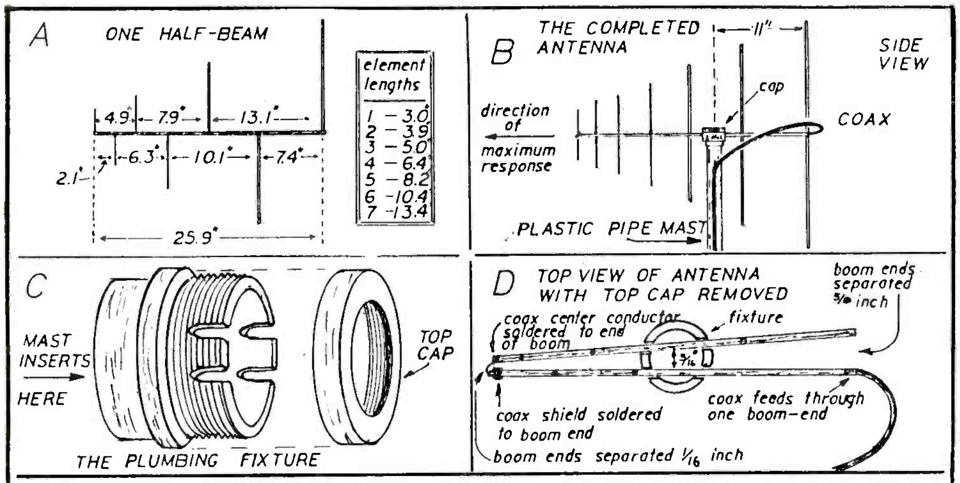

FIG. 1. VIEWS OF A LOG-PERODIC BEAM ANTENNA AND ITS COMPONENT PARTS

when it is stormy, and to disconnect and ground the antenna when it is not in use.

Using the Antenna

For best results the antenna should be mounted outside, high and in-the-clear. Point its small end in the direction from which you wish to receive signals. Inside mounting, far from wiring or other metal, may be satisfactory in non-metal buildings. The inside of a building with much metal used in its construction is not likely to be a good location for this or any other antenna.

A New Antenna Contest

We want to find the world's most unusual antennas: antennas that are quite different from those which we ordinarily encounter in the field of radio communications. Differences can be in terms of appearance, type of construction, application (the job the antenna has to do), the unusual place where the antenna is located or whatever makes the antenna strange or unusual.

I'll consider all entries, decide which are the most unusual, and report them in a future "Antenna Topics" column. Winners will each receive a copy of an interesting and useful book on radio communications. So what is the most unusual antenna you have ever seen, read or heard of? Let me hear from you.

World's Largest and Smallest Antennas?

Did you miss the results of our past contest to find the world's largest and smallest antennas? If enough readers are interested perhaps we can re-run the outcome or send $2 to *MT* and ask for a reprint of the April 1987 column. Just drop a card to me at *Monitoring Times* to indicate your interest in this or other topics.

Radio Riddles

Last Month

Last month I wrote: "If you have a shortwave beam antenna, and you want to receive signals from Ireland, you would point the beam toward Ireland. For signals from Japan you'd point it toward Japan." And then I asked: " But did you know that, for each location on earth, there is actually one other point on earth toward which your beam is always pointing, no matter what compass direction you choose to point it?" How can this be?

Well, think first of the North and South Poles; if you had a beam antenna at the North Pole it would point along an imaginary line that leads straight to the South Pole, no matter where on the horizon you pointed it. A look at a globe of the world will make this clear. The beam wouldn't always be pointing along a line that led to Africa, or to Peru, or to the USA, but you could always draw a straight line along the surface of the globe from your beam to the South Pole.

Now the South Pole is what is called the "antipode" of the North Pole. Any place that you might be on earth also has an antipode, a spot on the far side of the earth that is exactly opposite to the place you happen to be. And a beam antenna aimed at the horizon always points toward the antipode of its location, no matter where on earth the beam is located or what direction of the compass it is pointed!

This Month

What other very-wide-band beam antenna designs are available besides the LPDA? Why are they not much used outside of commercial, military, or government service?

You'll find an answer to this month's riddle, and much more, in your next issue of *Monitoring Times*. Till then, Peace, DX, and 73.

MT