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Title: Three-Band Log Periodic Antenna
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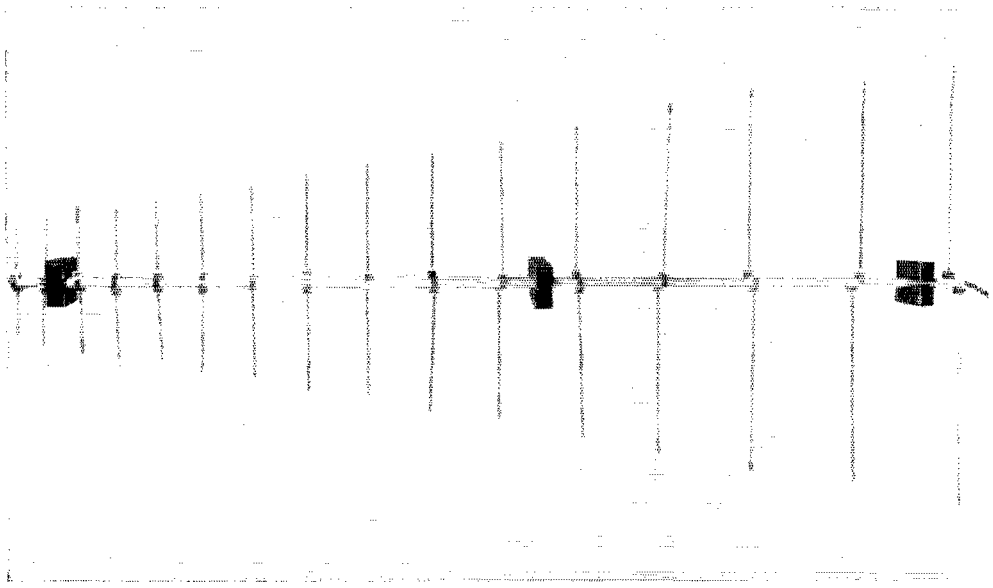

Top view of the three-band log-periodic antenna. The three black objects on the booms are the wood block spacers. From this angle only one boom is visible; the other is directly below it.

Three-Band Log-Periodic Antenna

BY ROBERT F. HESLIN,* K7RTY/2

One problem confronting the amateur who works several different v.h.f./u.h.f. bands is that of finding room for all the necessary antennas. The antenna described here is simple to construct, inexpensive, requires only one feedline, and covers three amateur bands. In addition, it will give approximately 6.5 db. gain over a dipole, with constant impedance and radiation-pattern characteristics *versus* frequency. The antenna can be fed by either 52- or 75-ohm coax line and will produce a standing wave ratio of under 2.4:1 over the entire frequency range from 140 to 450 Mc. The antenna can also be fed with open-wire line but with a high s.w.r., which would make it essential to use an antenna coupler at the input end of the line.

This type of antenna is not new; it is being used both commercially and by the military in many different forms. The correct name for this type of antenna is "transposed log-periodic dipole array" [1]. The term "log-periodic" simply means an antenna whose electrical characteristics vary periodically with the logarithm of the fre-

* 28 Eagle Lane, Hauppauge, New York.

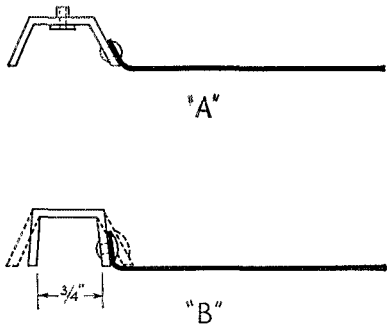

Fig. 1—TV strap-type stand-off insulators "A", are modified by removing the threaded insert and by bending the assembly to the dimensions shown in "B".

[1] Isbell, P.G.A.P., *IRE Transactions*, May 1960.

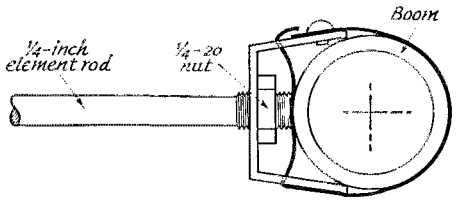

Fig. 2—This sketch shows how the elements are attached to the boom.

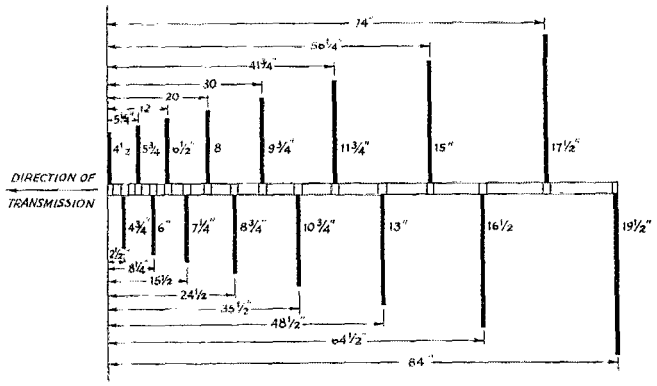

Fig. 3—Dimensions for one section of the log-periodic antenna. Dimensions along the boom are between element centers. The finished antenna consists of two of these sections, mounted one above the other as shown in the photograph.

quency. In other words, it is an antenna whose resonance transfers smoothly from one element to the next as the frequency is varied.

Several methods of construction were tried before the configuration shown here was obtained. The method described may not be the best, but it was felt that this was an antenna that could be built for a minimum of cost, time and effort. The only non-household tool required to build the antenna is a ¼–20 die.

Construction

The first step in constructing the antenna is to modify some stainless-steel TV strap-type single stand-off insulators. These will be used to hold the antenna elements to the booms. The sketch in Fig. 1 shows how the straps are modified. The small threaded insert in the stand-off usually comes spot welded in three places. If the strap is clamped edgewise in a vise and the insert given a sharp rap with a hammer, the insert will fall out without damaging the clamp. Thirty-two straps will be needed for the antenna.

Next, two standard 10-foot lengths of aluminum conduit, ½-inch in diameter, are cut to obtain two 7-foot sections. Aluminum rod, ¼-inch in diameter, is cut to give the required number of elements as shown in Table I. Each rod is then threaded with the ¼–20 die for a distance of about 1 inch on one end.

Fig. 2 shows the method of attaching elements and clamps to the booms. Fig. 3 shows the layout of one section. The complete antenna is made up of two of these sections, one above the other. Any convenient method of clamping the sections together can be used, as long as the booms are insulated from one another. The booms in the antenna shown here were held apart by three wood blocks, shown in Fig. 4. Two identical blocks are constructed of 4-inch pieces of 2 × 4

TABLE I

Parts list for the Three-Band Antenna

2 10-foot lengths of ½-inch rigid aluminum conduit
32 stainless-steel TV strip-type single stand-off insulators (Channel Master 9662)
2 12-foot lengths of ¼-inch diameter aluminum rod *
1 43-inch length of ¼-inch diameter aluminum rod *
32 ¼-20 aluminum or cadmium-plated nuts

* Place both 12-foot sections of ¼-inch aluminum rod together and cut in accordance with the following list so that two pieces of each length are obtained (dimensions are in inches): 19½, 17½, 15, 13, 11¾, 10¾, 9¾, 8¾, 8, 7¼, 6½, 6, 5¾, 4½. The 43-inch piece is cut to obtain two 16½ and two 4¾ inch pieces, a total of 32 elements.

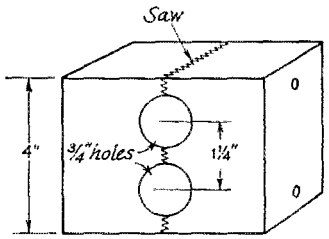

Fig. 4—The wood spacer-blocks maintain the proper spacing between the booms. Three blocks are required.

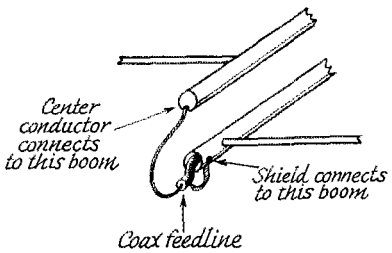

Fig. 5—The three-band antenna is fed at the short-element end of the boom. The coax shield connects to one boom and the center conductor connects to the other. The center conductor should be made as short as possible. It is shown here longer than necessary, in order to clarify the connections.

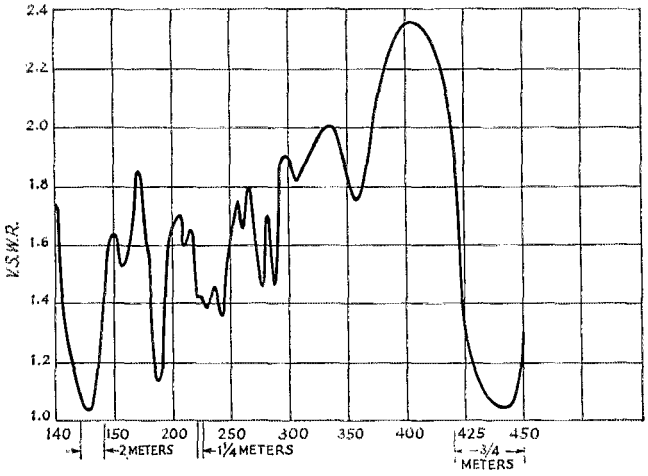

Fig. 6—Voltage standing wave ratio on a 50-ohm line does not exceed 2.4 to 1 over the entire frequency range of the antenna.

lumber. Two ¾-inch holes are bored through the blocks and then the blocks are sawed down through the center as shown in Fig. 4. The 1¼-inch spacing (between centers) between the two booms should be adhered to as closely as possible. These two blocks are placed near the ends of the antenna booms and clamped together with long bolts or wood screws. The third block is identical to the first two, except that 4 × 4 lumber is used. This permits the use of a mast which can be attached to a suitable coupling mounted on the 4 × 4 center block to support the antenna. All of the blocks should receive several coats of varnish to prevent warping and water absorption.

In assembling the antenna the second section is rotated 180 degrees about the boom axis before it is attached above the first section so that, looking at the completed antenna from the top, the elements of the same length will appear to be end-to-end.

Fig. 5 shows the method of feeding the antenna. The coax cable runs through the inside of one boom and is attached to the antenna at the short-element end, as shown. The shield of the coax is folded back and tightened under the clamp which holds the first short element. The center conductor is then run over to the other boom and it, too, is tightened under an element clamp. This method of feeding provides an "infinite balun" and presents a good match to either a 50- or 75-ohm coaxial line.

Performance

After construction of the antenna, it is only necessary to raise it to a suitable height; no final tuning should be necessary. As mentioned earlier, the antenna will give a gain of up to 6.5 db., and radiation patterns measured with the antenna on top of a 50-foot tower show a pattern similar to that of a Yagi with the main lobe off the short element end of the antenna. Impedance data for the antenna is given in the chart in Fig. 6.

The assistance of Mr. R. Logan, Section Head of Microwave and Antenna Laboratories, Fairchild Electronics Systems Division, Wyandanch, New York, in the preparation of this article is appreciated. QST

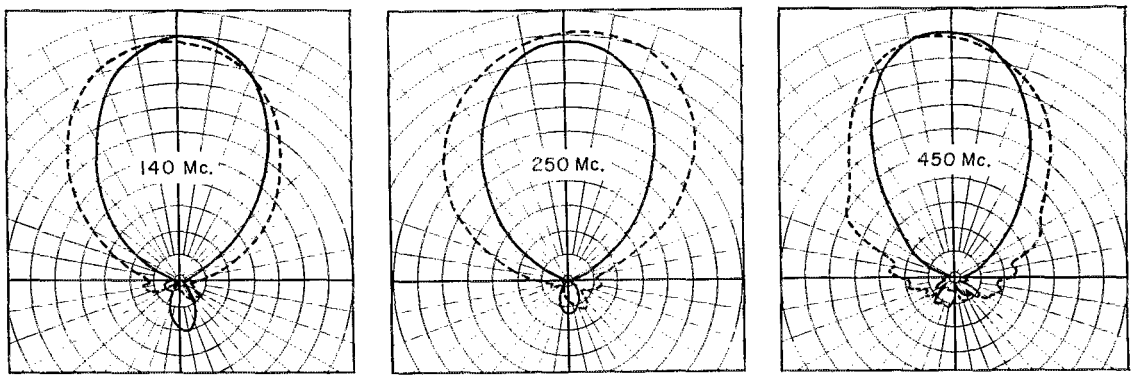

Fig. 7—Relative field strength for three frequencies covered by the log-periodic antenna. The solid lines are the horizontal and the dotted lines are the vertical field patterns.