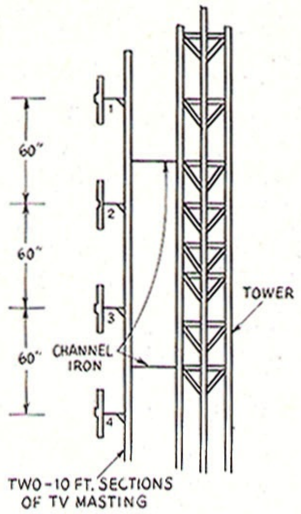


Fig. 6-11 — Spacing and arrangement of the four phased half-wavelength dipoles.

inner conductor up or down the stub until a match is obtained. At the point of matching, drill another hole to take a self-tapping screw for connecting the inner conductor.

The same procedure is used on six meters. However, on this band, the coax is brought up outside the mast in permanent installation. The dimensions shown in Fig. 6-10 will provide a starting point for adjustments. The antennas shown are used on 146.5 and 52.525 MHz.

The completed antenna can be mounted on the top of a tower or mast, providing omnidirectional coverage. Gain of these antennas is the same as that of a vertical half-wave dipole. The coax and feed points should be waterproofed with a good sealing compound.

MULTIELEMENT ARRAYS

Many of the repeater installations in the country use either stacked half-wave dipoles or stacked-coaxial elements. Also, most repeater owners use commercially manufactured antennas. There is no doubt that the antenna manufacturer has an advantage over the home constructor simply because of the tooling and material-procurement advantages. However, the home builder *can* make gain arrays which are as good as or better than manufactured antennas. The antennas described next are practical arrays that are not difficult to make and have been used in the field with excellent results.

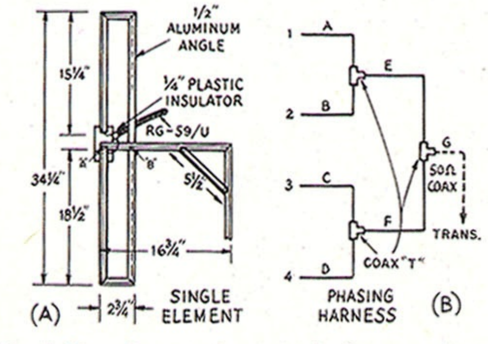


Fig. 6-12 — Constructional details for one of the dipole elements and the phasing harness layout for a four-dipole array. The bottom portion of the dipole is connected to the support arm at two places, "a" and "b."

A 6-DB GAIN OMNIDIRECTIONAL ARRAY

The antenna shown in Figs. 6-11 and 6-12 was designed by W2EWY and WB2ICP, adapting some of the more attractive features of commercial arrays. This antenna has been in use at the K2AE repeater and excellent results have been obtained.

Basically, the antenna consists of four stacked, grounded, half-wave dipoles, fed off-center, providing a 6-dB gain (omnidirectional) or 9 dB with an offset pattern. One problem in antenna installations is static-type noise. The grounded-dipole configuration has the advantage of reducing this type of noise appreciably.

Fig. 6-12 at A shows the details for one of the elements. The two sides and ends of the elements are made from 1/2-inch aluminum angle stock, available in eight-foot lengths from many hardware dealers. A single eight-foot section will make one element. The element supports are also made from the same type of angle stock.

Fig. 6-12 also shows the details of the phasing harness which is made from RG-59/U. Lengths A,

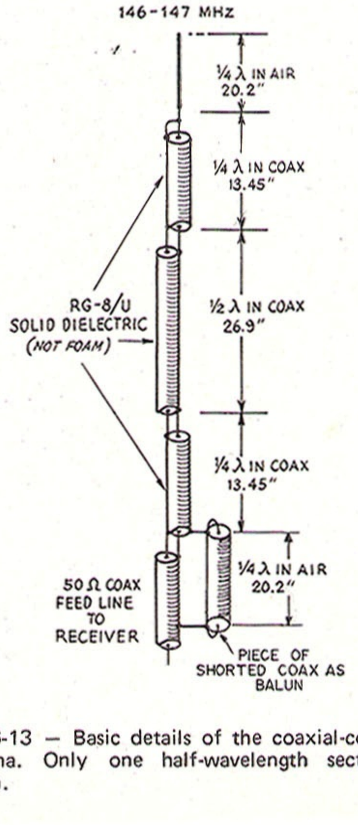
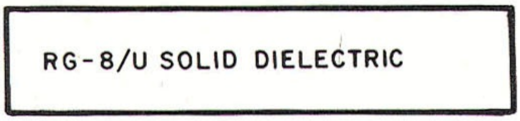


Fig. 6-13 — Basic details of the coaxial-collinear antenna. Only one half-wavelength section is shown.

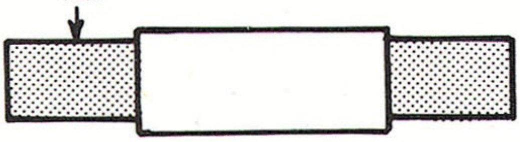
B, C, and D are each 40.8 inches long from the dipole feed to the center of the T. Lengths E and F are each 63.8 inches long from center of T to center of T.

If the four elements are mounted in line on the TV-mast section, the pattern will be offset with a null in the direction of the supporting mast. The four dipoles can be positioned *around* the mast to provide an omnidirectional pattern. No matching is needed with this antenna. Of several units built from the specifications given, the SWR was below 1.2 to 1.

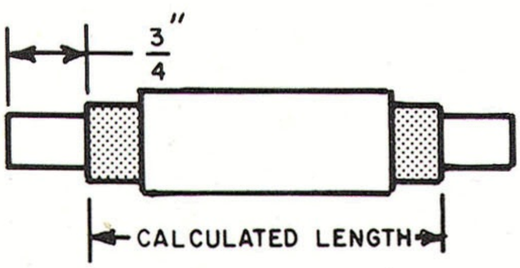
1. Cut to desired length + 2".



2. Cut insulation back 1" on each end. Flux and tin each end, allow to cool.



3. Using tubing cutter, cut shield off 3/4" from first end. Measure off final dimension from shield on cut end to other end, mark, and cut shield with tubing cutter.



4. Using single-edge razor blade, trim insulation leaving 1/16 to 1/8" remaining.

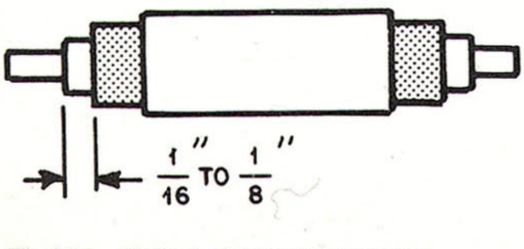


Fig. 6-14 — Method of element preparation.

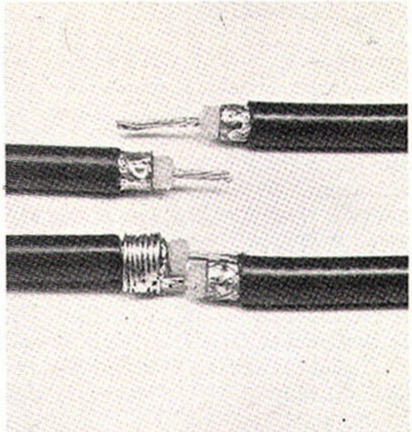


Fig. 6-15 — This shows the prepared end of one of the coax sections and also the method of joining two sections together.

A COLLINEAR-COAXIAL ARRAY

The antenna shown in Fig. 6-13 is an excellent array for home station or repeater use. The antenna will provide from 6- to 9-dB omnidirectional gain, depending on the number of elements used. This system is one that has been around for years. The refinements shown here were developed by K2CBA, K1DEU, and WA1KJI.

The antenna is a multiple of 1/2-wavelength elements with 1/4-wavelength sections on each end and a 1/4-wave stub at the feed point to reduce feed-line radiation. The dimensions shown are for 146 to 147 MHz, but the antenna can be made for other bands and frequencies.

In order to provide the same amount of gain as would be obtained with stacked dipoles, a larger number of half-wave sections are required. One of the reasons for antenna gain is the spacing between antenna sections. The four stacked dipoles previously described approach optimum spacing for maximum gain. In the coaxial collinear arrangement shown, there is always the problem that as sections are added, the antenna current decreases from one section to the next. In other words, one end of the antenna isn't radiating as much power as the other end. Slightly more than twice the number of elements are required to obtain the same amount of gain as with stacked dipoles. Where four stacked dipoles as described provided slightly less than 6 dB omnidirectional gain, it takes eight half-wave coaxial elements, connected end-to-end, to obtain the same gain figure.

However, the coaxial collinear antenna has certain advantages when installation problems are considered. The completed antenna is encased in either Plexiglas or PVC pipe and can be mounted *above* the supporting tower to get best omnidirectional coverage without the tower interfering with the antenna pattern.

Construction

From the formula 492 divided by the frequency in MHz, calculate a half-wavelength for the desired frequency. This comes out to 3.4 feet, or 40.8 inches for 146 MHz. Next, select the type of coax you plan to use and get the velocity factor (Table I or from the manufacturer.) Generally, the velocity factor for the solid dielectric lines is 0.66 and 0.82 for foam dielectric. The antenna shown in Fig. 6-13 is based on the solid-dielectric coax, 0.66 velocity factor. Using this type of coax provides a shorter overall length for the antenna.

The first step in fabricating the antenna is to make a 3-element version (3 half-waves plus the 1/4-wave top element, the 1/4-wave coax section and the bottom 1/4-wave section.) Fig. 6-14 shows the details for making the coaxial sections. The top section can be made from a piece of copper tubing or No. 12 wire.

When the antenna is completed, suspend it clear of any metallic objects. Using a low-power transmitter and SWR bridge make a check across the band to determine if the antenna is high or low in frequency. The lowest SWR reading will occur at resonance. If this is not within ±1 MHz of the desired frequency, trim the half-wave elements accordingly. More than likely, this will not be required. Also, don't be concerned about the specific SWR at this time. Look only for the minimum reading.

Depending on whether resonance is too high or too low in frequency, alter another pair of half-wave elements, making them 1/4- to 1/2-inch longer if the antenna is too high in frequency, or a like amount shorter if the antenna is too low in frequency. Continue this operation adding pairs of elements until you reach the desired length. Eight half-wave elements will provide about 6 dB of gain and 16 elements will give approximately 9 dB of gain.

Next, tape each connection with a good grade of electrical tape, applying several layers. This will provide mechanical strength and weatherproofing. With the several arrays that were built using this design, the SWR was always below 1.3 to 1 at the design frequency.

The antenna can be housed inside 1-3/4-inch diameter PVC pipe. Also, a new type of pipe has recently become available from plumbing supply dealers. This is Fiberglas pipe and is available in 25-foot lengths with diameters starting at 2-1/2 inches. The ends of this pipe are tapered so that it can be joined to another section. The Fiberglas pipe is extremely flexible without danger of breaking so it can be supported at one end, such as at the top of a tower, permitting the antenna to be in the clear.