CHAPTER 7

Large loop antennas

There are two basic classes of loop antennas: **small loops** and **large loops**. The small loop antenna has an overall length that is less than about 0.18λ. Large loop antennas, on the other hand, have overall lengths larger than 0.5λ, and some of them are two or more wavelengths. The small loops are used for radio direction finding and for certain AM broadcast band reception problems. The topic of this chapter is the large loop antenna, of which several varieties for both transmitting and receiving are covered. We will also look at some in-between size loops that I have dubbed 'smaller large loops' to distinguish them from small radio direction finding loops.

QUAD LOOPS

The quad loop antenna (Figure 7.1) is perhaps the most effective and efficient of the large loop antennas, and it is certainly the most popular. The quad loop consists of a one wavelength loop of wire formed into a square shape. It provides about 2 dB gain over a dipole. The views in Figure 7.1 are from the horizontal perspective looking at the broad side of the loop. The azimuthal radiation pattern is a figure '8', like a dipole, with the directivity in and out of the page.

The quad loop can be fed in either of two ways. Figure 7.1A shows the feed attached to the bottom wire segment, and this produces horizontal polarization. The same polarization occurs if the feedpoint is in the top

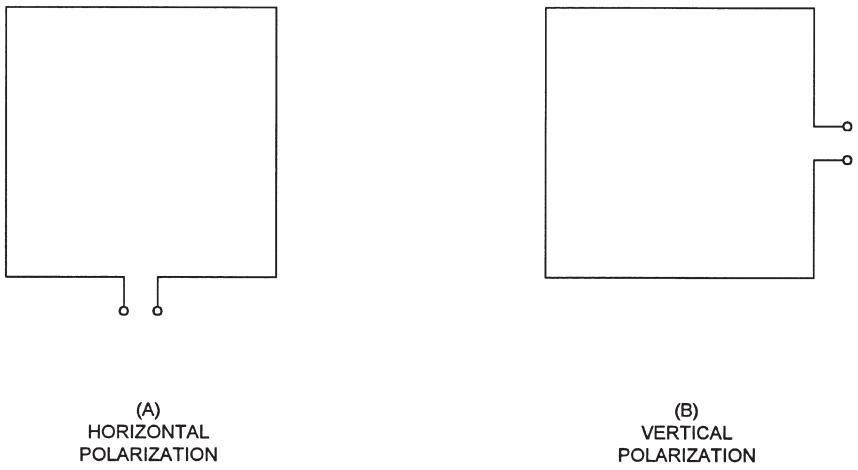

FIGURE 7.1

horizontal segment. If the feed is in either vertical segment (Figure 7.1B) then the polarization will be vertical.

The elevation pattern is shown in Figure 7.2. This pattern is found when the top horizontal segment of the loop is quarter wavelength from the ground. The directivity is in and out of the page. Note that there are two sets of lobes, one horizontally polarized (a minor lobe) and two vertically polarized. These lobes are derived by taking a slice out of the three-dimensional pattern that would be seen as a figure '8' pattern from above.

The overall length of the wire used to make the loop is found from

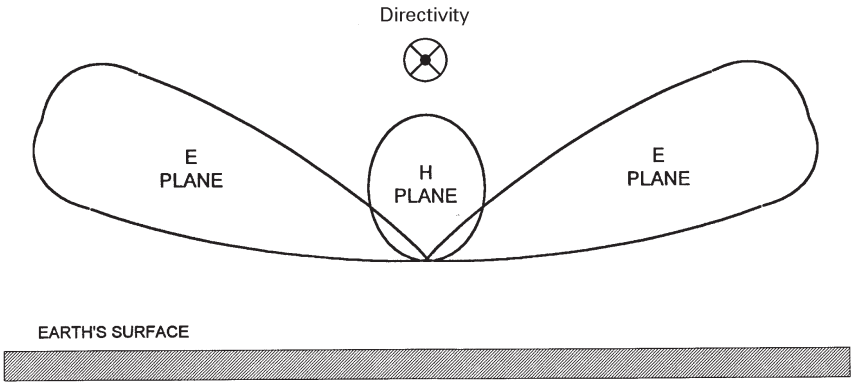

FIGURE 7.2

$$L_{\text{meters}} = \frac{306.4}{F_{\text{MHz}}} \text{ meters}$$

Examples of wire lengths for loops of various frequencies are given in Table 7.1. Each side is one-fourth of the total wire length.

There are several methods for constructing the quad loop. If you want a fixed loop, then it can be suspended from insulators and ropes from convenient support structures (tree, mast, roof of a building).

If you want to make the loop rotatable, then use a construction method similar to that of Figure 7.3A. This method uses a plywood **gusset plate**, approximately 30 cm square, to support a set of four **spreaders**. The gusset plate can be attached to a mounting pole or rotator pole with U-bolt clamps. Details of the gusset plate construction are shown in Figure 7.3B. The four spreaders are held to the gusset plate with two to four small U-bolts. The gusset plate is held to the mounting mast with two or three large U-bolts. In both cases, be sure to use a substantial size U-bolt in order to prevent breakage (use stainless steel wherever possible).

The spreaders can be made of wooden dowels at very high frequency (VHF). I have even seen larger cylindrical wooden dowels (2–3 cm diameter) used for quad loops in the upper end of the HF spectrum. For all other HF regions, however, you can buy fiberglass spreader specially manufactured for the purpose of building quad loops or quad beams. At one time, it was popular to build the quad loops from bamboo stalks. These were used as the core on which carpet was rolled, and carpet dealers would sell them for a modest price or even give them away. Today, however, carpet manufacturers use hard cardboard tubes for the roller, and these are unsuitable for building quad loops. Bamboo stalks of the right size (2.5–4 m) have all but disappeared from the marketplace.

The quad loop can be fed with coaxial cable, although it is a good idea to use a 1:1 BALUN transformer at the feedpoint if only coaxial cable is used. The impedance match is not exact, and a voltage standing wave ratio

TABLE 7.1

Center frequency (MHz)	*L* (overall length) (m)	*L*/4 (each side) (m)
3.75	81.70	20.43
5.00	61.28	15.32
7.20	42.56	10.63
9.75	31.43	7.86
14.20	21.58	5.39
21.30	14.39	3.59
24.50	12.50	3.13
29.00	10.57	2.64