

# Chapter 1

## Antennas

### 1.1 INTRODUCTION

An antenna is defined by Webster's Dictionary as "a usually metallic device (as a rod or wire) for radiating or receiving radio waves." The *IEEE Standard Definitions of Terms for Antennas* (IEEE Std 145-1973)\* defines the antenna or aerial as "a means for radiating or receiving radio waves." In other words the antenna is the transitional structure between free-space and a guiding device, as shown in Figure 1.1. The guiding device or transmission line may take the form of a coaxial line or a hollow pipe (waveguide), and it is used to transport electromagnetic energy from the transmitting source to the antenna, or from the antenna to the receiver. In the former case we have a transmitting antenna and in the latter a receiving antenna.

In addition to receiving or transmitting energy, an antenna is usually required to *optimize* or *accentuate* the radiation energy in some directions and suppress it in others. Thus the antenna must act as a *directional device in addition to a probing device*. It must then take various forms to meet the particular need at hand, and it may be a piece of conducting wire, an aperture, an assembly of elements (array), a reflector, a lens, and so forth.

### 1.2 TYPES OF ANTENNAS

We will now introduce and briefly discuss some forms of the various antenna types in order to get a glance as to what will be encountered in the remainder of the book.

#### 1.2.1 Wire Antennas

Wire antennas are familiar to the layman because they are seen virtually everywhere—on automobiles, buildings, ships, aircraft, spacecraft, and so on. There are various shapes of wire antennas such as a straight wire

\**IEEE Transactions on Antennas and Propagation*, vols. AP-17, No. 3, May 1969 and AP-22, No. 1, January 1974.

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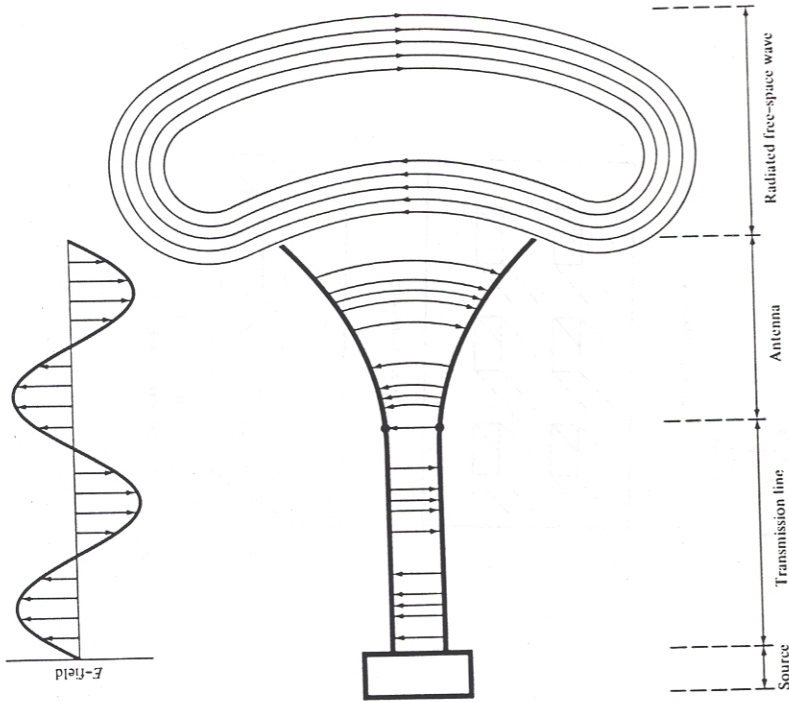


Figure 1.1 Antenna as a transition device.

(dipole), loop, and helix which are shown in Figure 1.2. Loop antennas need not only be circular. They may take the form of a rectangle, square, ellipse, or any other configuration. The circular loop is the most common because of its simplicity in construction.

1.2.2 Aperture Antennas

Aperture antennas may be more familiar to the layman today than in the past because of the increasing demand for more sophisticated forms of antennas and the utilization of higher frequencies. Some forms of aperture antennas are shown in Figure 1.3. Antennas of this type are very useful for aircraft or spacecraft applications, because they can be very conveniently

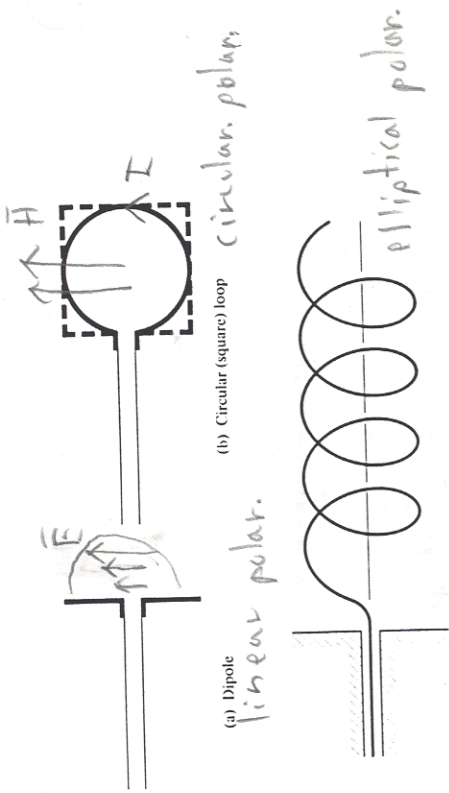


Figure 1.2 Wire antenna configurations.

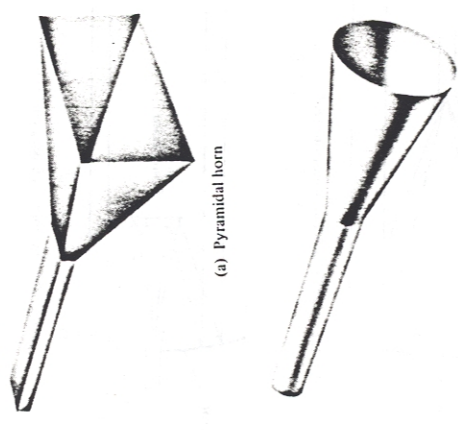


Figure 1.3 Aperture antenna configurations.