# ANTENNA AND WAVE PROPAGATION

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#### UNIT-I

An antenna is an electrical device which converts electric currents into radio waves, and vice versa. It is usually used with a radio transmitter or radio receiver.



### HISTORY

- The first antennas were built in 1888 by German physicist Heinrich Hertz in his pioneering experiments to prove the existence of electromagnetic waves predicted by the theory of James Clerk Maxwell.
- Hertz placed dipole antennas at the focal point of parabolic reflectors for both transmitting and receiving. He published his work in Annalen der Physik und Chemie (vol. 36, 1889).

## INTRODUCTION

An antenna is an electrical device which converts electric currents into radio waves, and vice versa. It is usually used with a radio transmitter or radio receiver.

• In transmission, a radio transmitter applies an oscillating radio frequency electric current to the antenna's terminals, and the antenna radiates the energy from the current as electromagnetic waves (radio waves).

- Transmitting Antenna: Any structure designed to efficiently radiate electromagnetic radiation in a preferred direction is called a *transmitting antenna*.
- In reception, an antenna intercepts some of the power of an electromagnetic wave in order to produce a tiny voltage at its terminals, that is applied to a receiver to be amplified. An antenna can be used for both transmitting and receiving.
- Receiving Antenna: Any structure designed to efficiently receive electromagnetic radiation is called a receiving antenna

#### **Basic Antenna Parameters**

It is a metallic conductor system capable of radiating and receiving em waves.

- Typically an antenna consists of an arrangement of metallic conductors ("elements"), electrically connected (often through a transmission line) to the receiver or transmitter.
- An oscillating current of electrons forced through the antenna by a transmitter will create an oscillating magnetic field around the antenna elements, while the charge of the electrons also creates an oscillating electric field along the elements.

• These time-varying fields radiate away from the antenna into space as a moving electromagnetic field wave.

• Conversely, during reception, the oscillating electric and magnetic fields of an incoming radio wave exert force on the electrons in the antenna elements, causing them to move back and forth, creating oscillating currents in the antenna.

• Antenna reciprocity : can be used as transmitter and receiver.In two way communication same antenna can be used as transmitter and receiver. Antennas may also contain reflective or directive elements or surfaces not connected to the transmitter or receiver, such as parasitic elements, parabolic reflectors or horns, which serve to direct the radio waves into a beam or other desired radiation pattern.

• Antennas can be designed to transmit or receive radio waves in all directions equally (omnidirectional antennas), or transmit them in a beam in a particular direction, and receive from that one direction only ( directional or high gain antennas).