Antennas & Wave Propagation

Electronic Dep.

3rd Stage

Lecture One

Introduction to Antennas

Prepared By

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Historical Advancement

Michael Faraday (1791-1867)

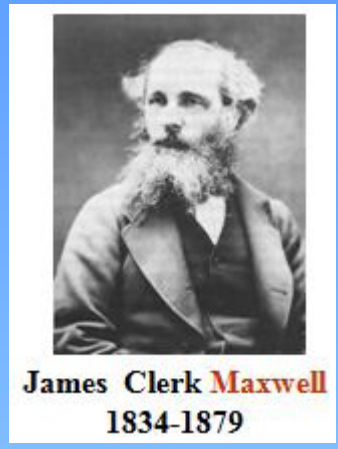
- Faraday developed the concept of electric fields.
- He believed that a charged particle
- creates an electric field about it in all directions.
- If a second charged particle is placed in the field, there is an interaction between the fields.
- This will result in an attraction or repulsion of the two fields.

Historical Advancement

Hans Christian Oersted

- In 1820, a Danish physicist by the name of Hans Christian Oersted, while experimenting with electric currents in wires, found that when a compass was placed parallel to a current carrying wire, the compass needle would rotate until it was perpendicular to the direction of current in the wire. Although trying to prove that there was no connection between magnetic and electric fields, this experiment indicated to Oersted that electric and magnetic fields were indeed connected.

Historical Advancement


James Clerk Maxwell
1834-1879

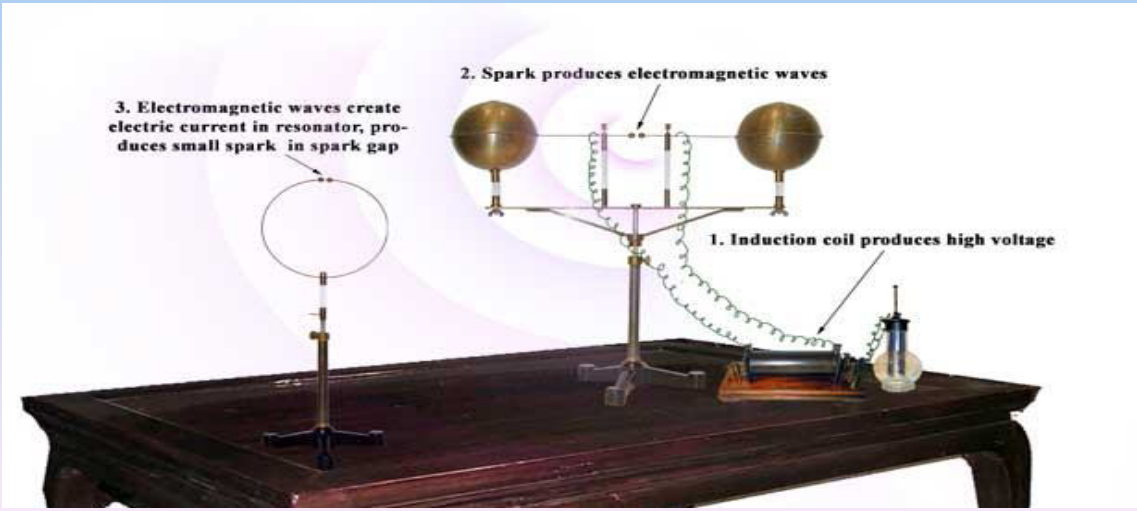
James Clerk Maxwell (1834-1879)

- The history of antennas dates back to James Clerk Maxwell who unified the theories of electricity and magnetism, and eloquently represented their relations through a set of profound equations best known as Maxwell's Equations.
- His work was first published in 1873. He also showed that light was electromagnetic and that both light and electromagnetic waves travel by wave disturbances of the same speed.

Historical Advancement

Heinrich Rudolph Hertz (1857-1894)

- In 1886, Professor Heinrich Rudolph Hertz demonstrated the first wireless electromagnetic system. He was able to produce in his laboratory at a wavelength of 4 m a spark in the gap of a transmitting λ/2 dipole which was then detected as a spark in the gap of a nearby loop as shown in Figure



Historical Advancement

Guglielmo Marconi (1874-1937)

- It was not until 1901 that Guglielmo Marconi was able to send signals over large distances. He performed, in 1901, the first transatlantic transmission from Poldhu in Cornwall, England, to St. John's Newfoundland. His transmitting antenna consisted of 50 vertical wires in the form of a fan connected to ground through a spark transmitter. The wires were supported horizontally by a guyed wire between two 60-m wooden poles. The receiving antenna at St. John's was a 200-m wire pulled and supported by a kite. This was the dawn of the antenna era.

Historical Advancement

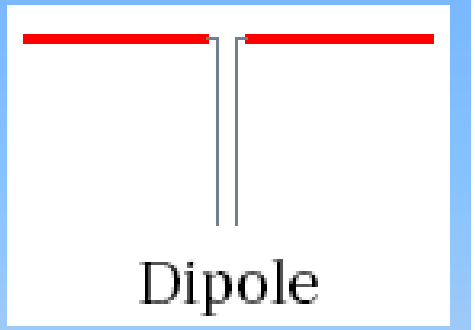
- From Marconi's inception through the 1940s, antenna technology was primarily centered on wire related radiating elements and frequencies up to about UHF. During World War II the modern antenna technology was launched and new elements (such as waveguide apertures, horns, reflectors) were primarily introduced. A contributing factor to this new era was the invention of microwave sources (such as the klystron and magnetron) with frequencies of 1 GHz and above.

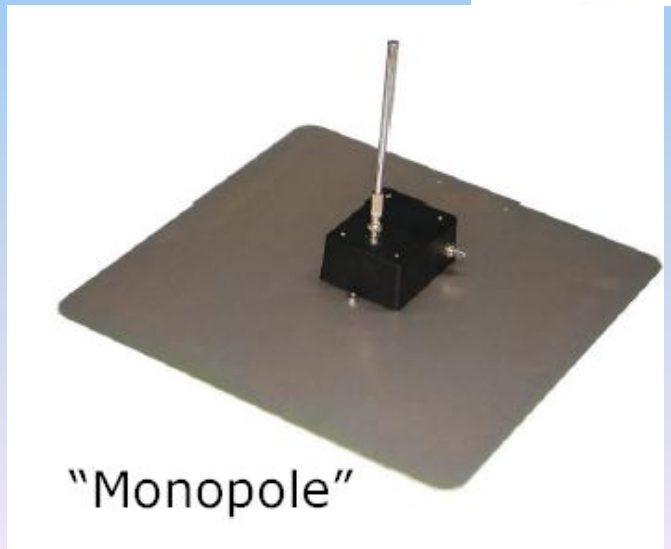
Historical Advancement

- World War II also launched a new era in antennas, advances made in computer architecture and technology during the 1960s through the 1990s have had a major impact on the advance of modern antenna technology. Beginning primarily in the early 1960s, numerical methods were introduced that allowed previously intractable complex antenna system configurations to be analyzed and designed very accurately.

Types of Antennas

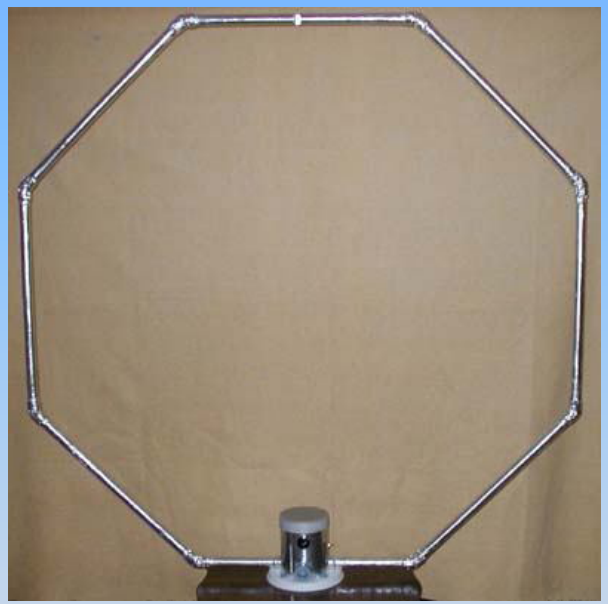
1.2.1 Wire Antennas

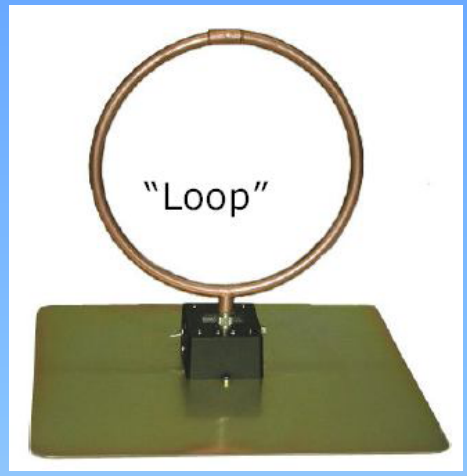


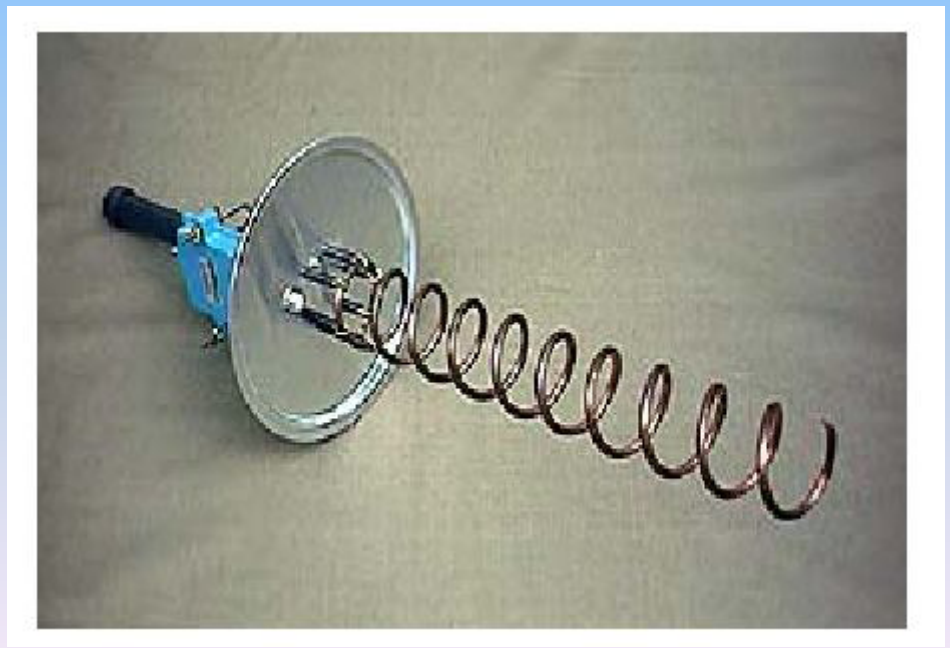


Types of Antennas

1.2.1 Wire Antennas

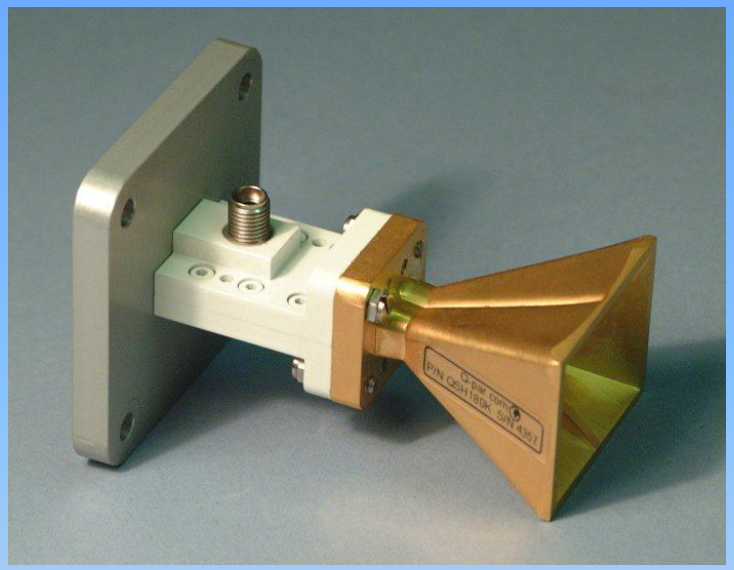






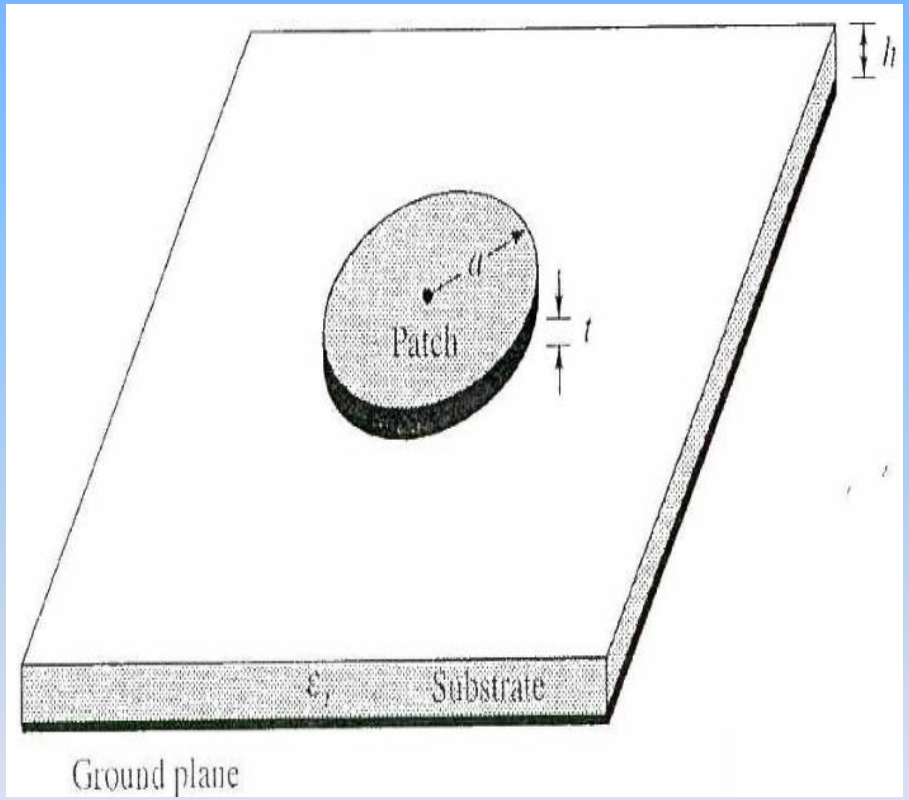
Types of Antennas

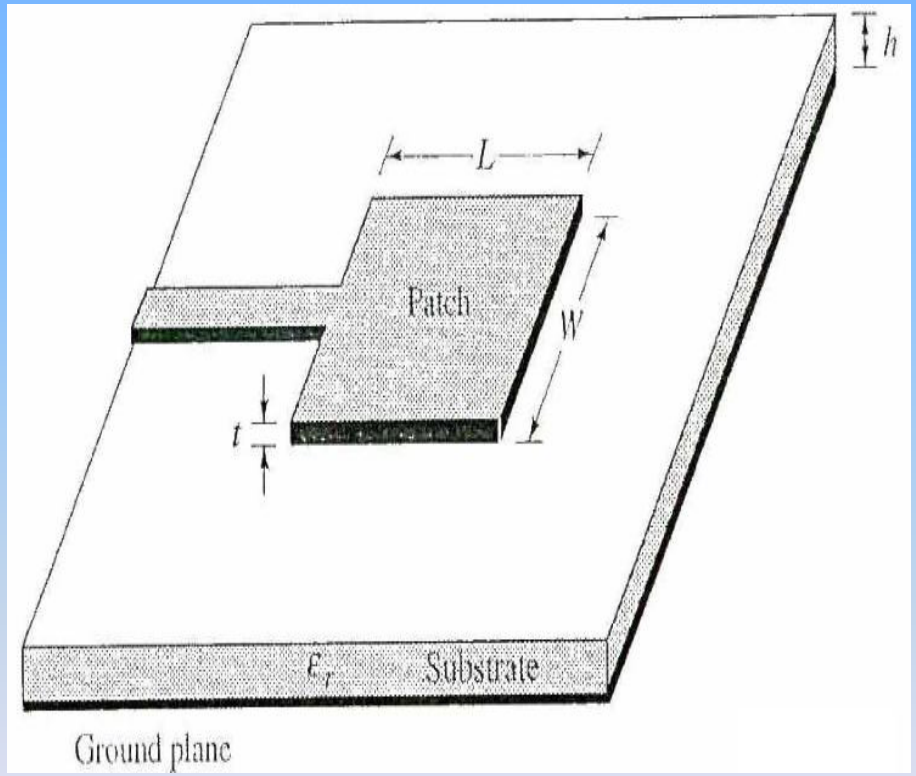
1.2.2 Aperture or Horn Antennas



Types of Antennas

1.2.2 Aperture or Horn Antennas





Types of Antennas

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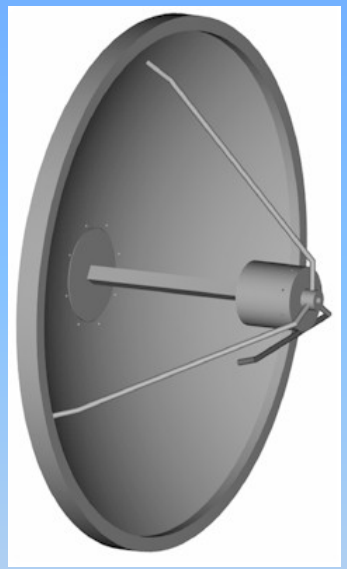

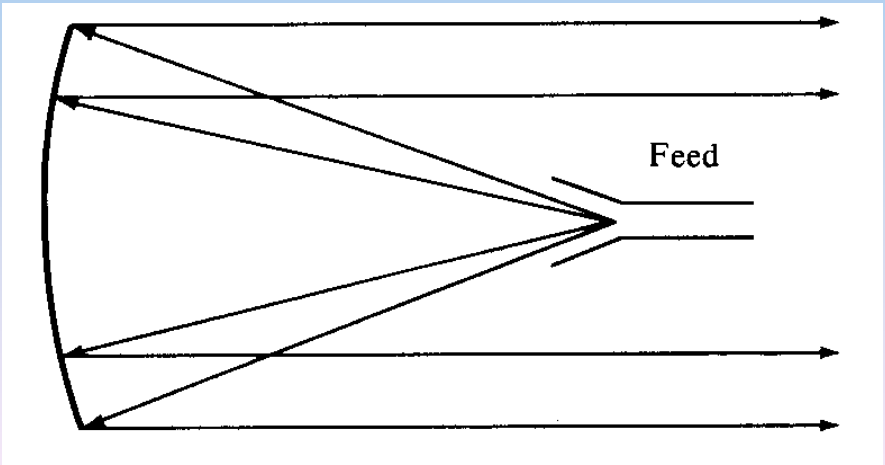

Types of Antennas

1.2.1 Wire Antennas

Types of Antennas

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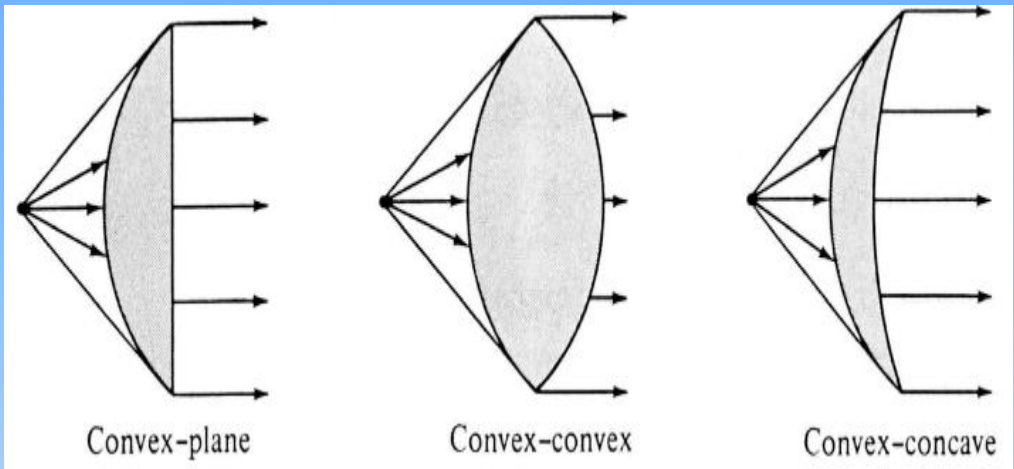
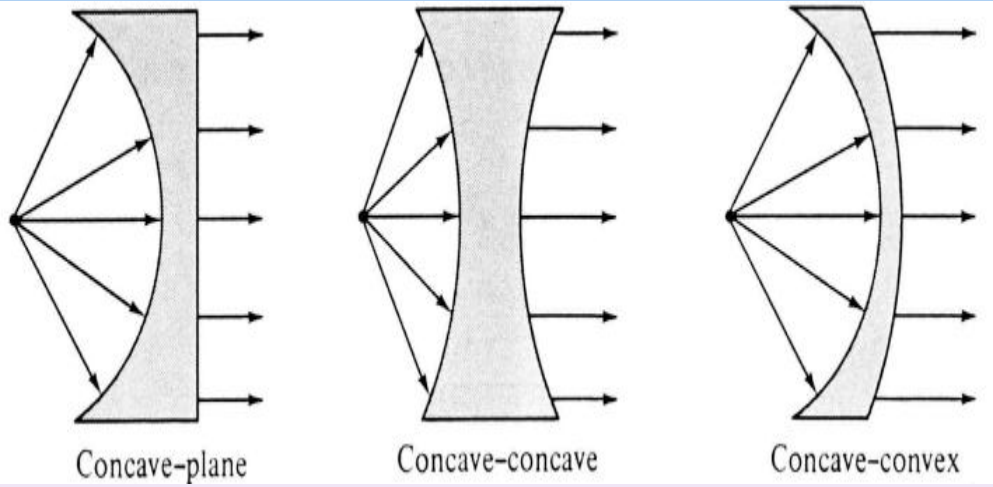
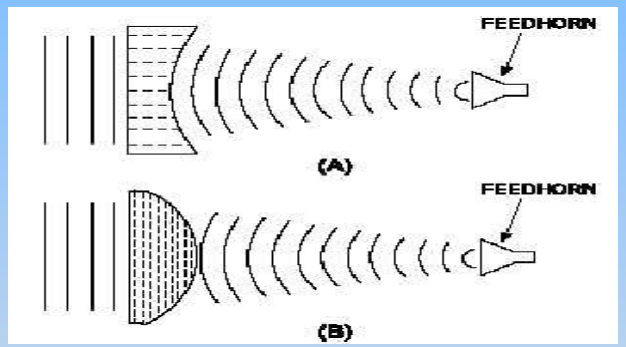
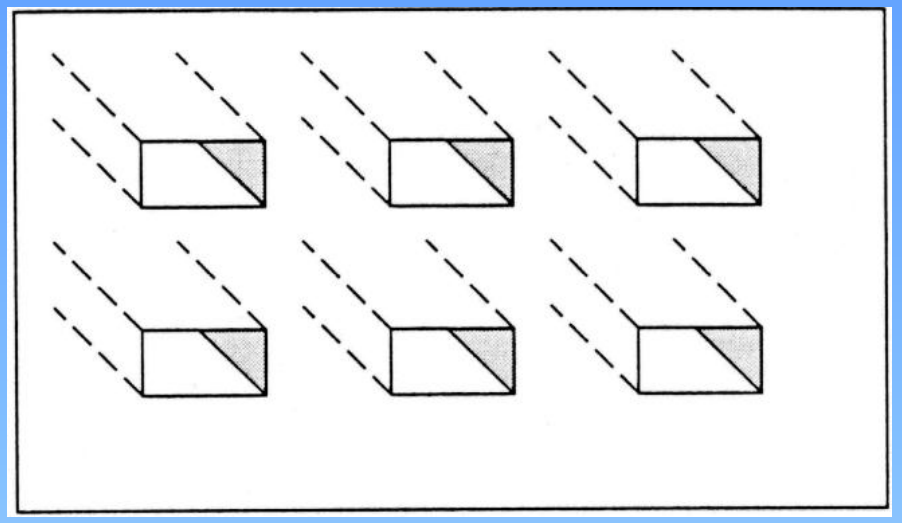


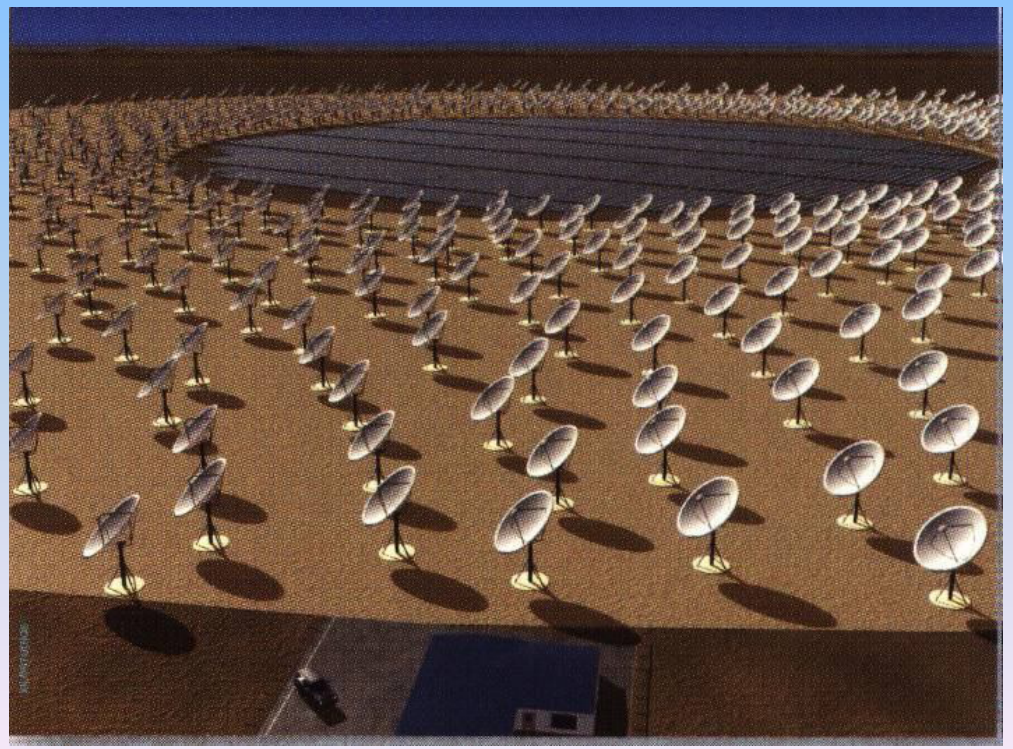




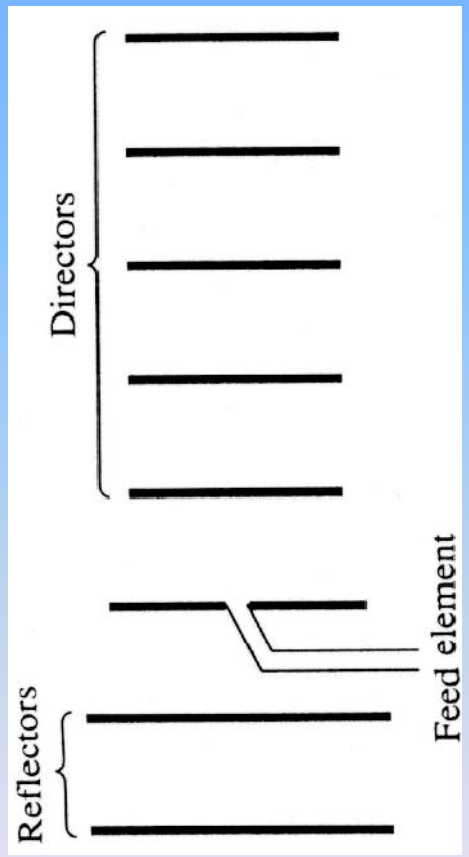
1.2.6 Array Antennas (Continued)

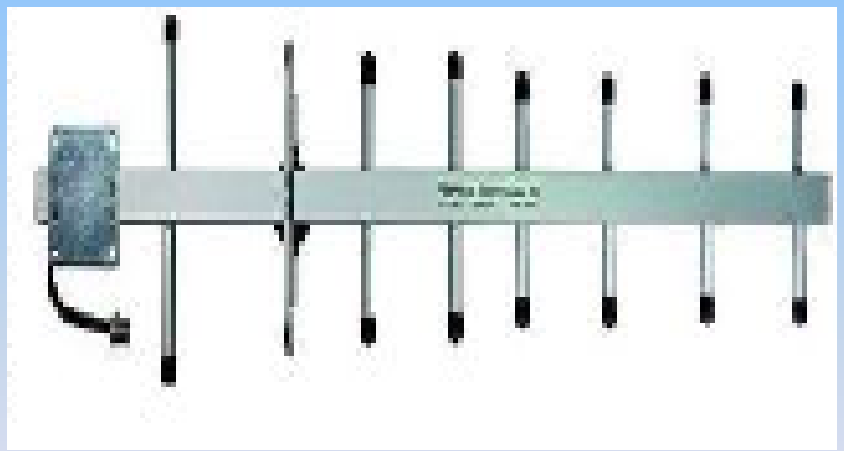
Reflector array





1.2.6 Array Antennas (Continued)

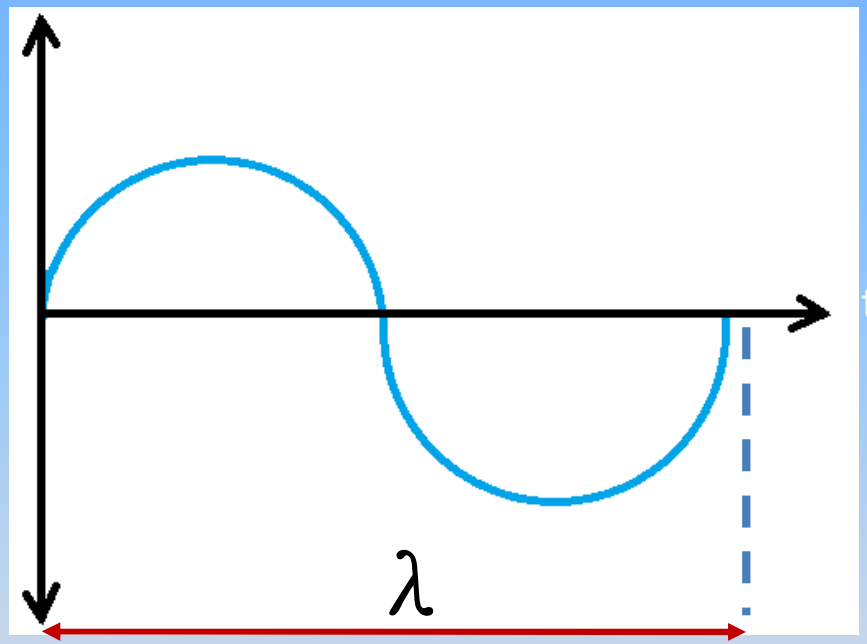




Yagi -Uda

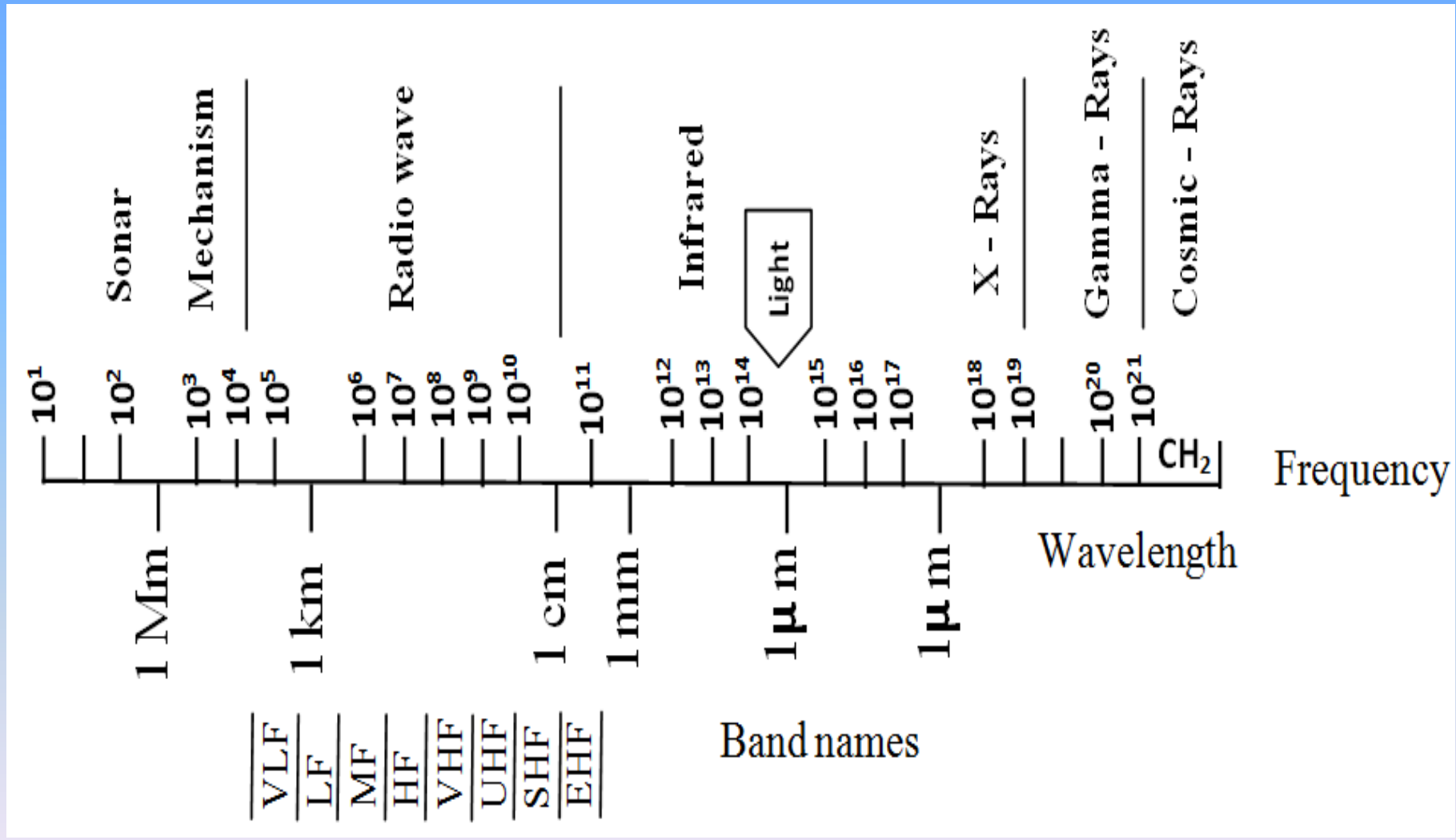
Electromagnetic Wave Spectrum

Amplitude



Wavelength = Wave Velocity / Frequency

Electromagnetic Wave Spectrum



Electromagnetic Wave Spectrum

Band No.	Frequency Range	Band	Typical Service
4	3 – 30 KH_z	VLF	World Wide Telegraphy
5	30 – 300 KHz	LF	Long distance point to point service. Marine and navigational aids Broad casting, Navigation...etc.
6	300 – 3000 KH_z	MF	Broad casting
7	3 – 30 MH_z	HF	Beamec communication services e.g. moderate and distance communication of all types, short wave broad casting to distant places.
8	30 – 300 MH_z	VHF	Radar, airplane, navigation, radio relay, Telephony.
9	300 – 3000 MH_z	UHF	Short distance communication, radar relay system, landing TV.
10	3000 – 30000 MH_z	SHF	Radar ratio and TV relay links satellite communication (8400-8500 MHz)
11	30000 – 300000 MH_z	EHF	Experimental, Amateur, government

Thanks 4 Listening

Any Question Please…