Topic 1
Introduction

ELC N405, 405A

Communications and Computer Engineering Program

Faculty of Engineering – Cairo University

Outline

1. Why Study Antenna Engineering?
   - Electromagnetic Spectrum
   - Electromagnetic Wave Propagation
   - This Course

2. Antennas?
   - Definitions of Antennas
   - Pictures of Antennas

Outline

Electromagnetic Spectrum

Applications

Band name	Abbr.	ITU Band	Frequency Wavelength	Example Uses
Low Frequency	LF	5	30–300 kHz 10–1 km	AM long-wave broadcasting.
Medium Frequency	MF	6	300–3000 kHz 1 km – 100 m	AM (medium-wave) broadcasts.
High Frequency	HF	7	3–30 MHz 100 m – 10 m	Shortwave broadcasts, amateur radio, aviation communications.
Very High Frequency	VHF	8	30–300 MHz 10–1 m	FM, television, ground-to-aircraft and aircraft-to-aircraft communications.
Ultra High Frequency	UHF	9	300–3000 MHz 1 m – 100 mm	Television, microwave ovens, mobile phones, wireless LAN, Bluetooth.
Super High Frequency	SHF	10	3–30 GHz 100–10 mm	Microwave devices, wireless LAN, most modern radars, satellite.

The antenna is an important component in any wireless communication system!

Electromagnetic Wave Propagation

Typical System

Electromagnetic Wave Propagation

Guided vs. Unguided Propagation

Guided Propagation

Transmission Lines,
Waveguides,
Optical Fibers, … etc.

Unguided Propagation

Propagation in Free-Space (Ideal)
Propagation in the Atmosphere.

This Course

Topics in This Course

- Introduction to Antennas and Radiation Mechanism
- Radiation Integrals
- Basic Antenna Parameters
- Types of Antennas
- Antennas in Receiving Mode
- Antenna Arrays
- Microwave Link Design

References

[1] C. A. Balanis, *Antenna Theory: Analysis and Design, 3rd Edition*, 3rd ed. Wiley-Interscience, 2005. (Text book)

[2] R. E. Collin, *Antennas and Radiowave Propagation*. Mcgraw-Hill College, 1985.

Outline

Antenna Definitions

What is an Antenna?

An antenna is a device that launches/picks up electromagnetic power.

Wikipedia: An antenna (or aerial) is a transducer designed to transmit or receive electromagnetic waves.

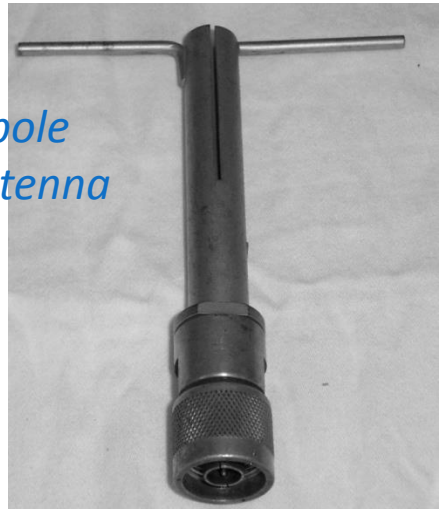
IEEE: antenna (aerial). A means for radiating or receiving radio waves.

Pictures of Antennas

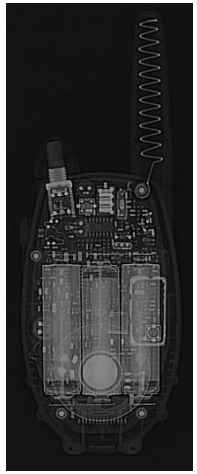
Wire, Horn and Conical Antennas

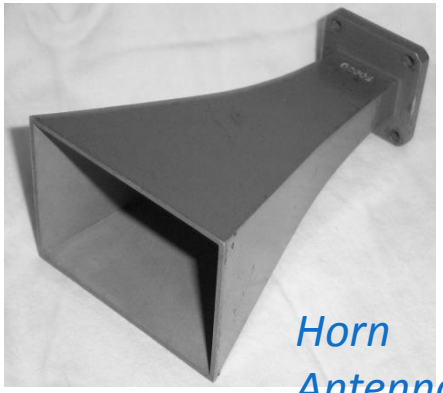
Monopole Radio Conical Antenna

Dipole Antenna



Helical Antenna





Horn Antenna

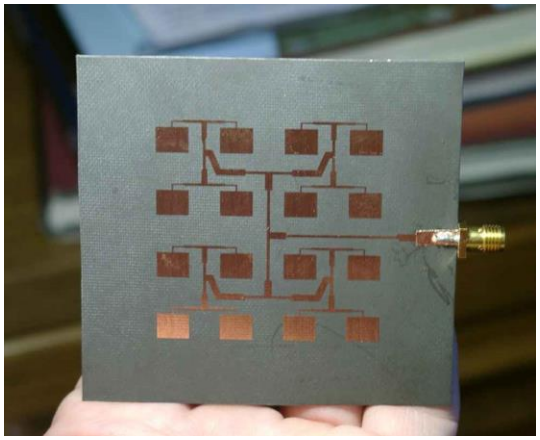
Conical Spiral Antenna

Disc-Cone Antenna

Pictures of Antennas

Printed Antennas and Yagi Arrays

Printed Vivaldi Antenna



Microstrip Antenna Array

Three-Sector Telephone Site

Yagi Antenna

Pictures of Antennas

Reflector Antennas

Arecibo Observatory Reflector – The largest reflector on Earth (305 m)

Conclusion

- Applications operating in different RF bands.
- Guided and unguided propagation.
- Antenna miniaturization, efficiency improvement and multiband/wideband operation.
- Definitions of antenna.
- Pictures of some antenna types.