CHAPTER 2 NOTES

Page 2-1

Classically, electromagnetic radiation consists of **electromagnetic waves**,

which are synchronized oscillations of electric and magnetic fields that propagate at the speed of light, which, in a vacuum, is commonly denoted *c*.

In homogeneous, isotropic media, the oscillations of the two fields are perpendicular to each other and perpendicular to the direction of energy and wave propagation, forming a transverse wave.

The wavefront of electromagnetic waves emitted from a point source (such as a light bulb) is a sphere.

The position of an electromagnetic wave within the electromagnetic spectrum can be characterized by either its frequency of oscillation or its wavelength.

Electromagnetic waves of different frequency are called by different names since they have different sources and effects on matter. In order of increasing frequency and decreasing wavelength these are: radio waves, microwaves, infrared radiation, visible light, ultraviolet radiation, X-rays and gamma rays.[3]

The effects of these radiations on chemical systems and living tissue are caused primarily by heating effects from the combined energy transfer of many photons. In contrast, high frequency ultraviolet, X-rays and gamma rays are called *ionizing radiation*, since individual photons of such high frequency have enough energy to ionize molecules or break chemical bonds.

These radiations have the ability to cause chemical reactions and damage living cells beyond that resulting from simple heating, and can be a health hazard.

Page 2-3

- The radio wave continually varies in strength or amplitude. This continual change is called oscillation.
- Each complete up and down sequence is a **cycle**.
- The number of cycles per second is the frequency "**f**".
- The unit of measurement of frequency is Hertz "**Hz**".
- The distance the wave travels in one cycle is the wavelength "**λ**"

CHAPTER 2 NOTES

- The duration of the cycle is the period "**T**"
- Position within a cycle is called phase and can be used to compare how waves are aligned in time (out of phase) and is measured in degrees "**º**"

2-4

- Audio frequencies <20,000 Hz, **AF**.
- Radio frequency >20,000 Hz, **RF**.
- RF ranges from 20kHz to many GHz – the radio (electro-magnetic)spectrum.
- A range of frequencies used for a common purpose or exhibiting similar characteristics are a **band**.

Pages 2-5 – 2-6

Figure 2.4

- AM Broadcast stations are identified by their frequency (and their call letters of course!), ie "Mighty ten-ninety" or 1090 kilohertz (thousands of cycles per second , abbreviated kHz.
- Figure 2.4 shows us that radio signals occupy a range of frequencies in the radio frequency spectrum, not just the center identifying frequency.

Frequency and Wavelength

- Understanding the relationship between frequency and wavelength is very important and is nicely illustrated in Figure 2.5.
- The elements of the formula are:
  - Wavelength - represented by the Greek letter lambda - λ – and expressed in units of meters.
  - Frequency - represented by the lower case f and expressed in cycles per second.
  - The speed of light, 300,000,000 meters per second
- The formula for wavelength at a specific frequency is:

Wavelength equals the speed of light divided by the frequency and is written:

$$\lambda = c/f$$

CHAPTER 2 NOTES

- If we refer to frequency in millions of cycles per second or megahertz we can lose six of the zeros in the speed of light and simplify the formula to

  Wavelength in meters= 300 divided by frequency in megahertz

Page 2-7

Figure 2.6

In earlier times, an amateur station consisted of two electronic devices – a receiver and a transmitter - connected to a common antenna through an antenna switch. The purpose of the antenna switch was to ensure that the receiver was not connected directly to the transmitter when transmitting. Contemporary transceivers combine the receiver and transmitter with the antenna switch replaced by circuitry.