CWNA Chapter 2—Radio Frequency Fundamentals

What is a Radio Frequency signal?

- A RF signal starts out as an electrical Alternating Current (AC) signal generated by a transmitter
- AC signal is sent through a copper conductor and radiated out of an antenna element in form of an electromagnetic wave
    - The electromagnetic wave is the wireless signal
- An RF electromagnetic signal radiates away from the antenna is a continuous pattern that is governed by certain properties such as wavelength, frequency, amplitude, and phase

+Key Terms:

1. Electromagnetic (EM) Spectrum—the range of all possible electromagnetic radiation
2. Wavelength—the distance between the two successive peaks or two successive valleys of a wave pattern
3. Propagation Behavior—the manner in which wireless signal moves

Radio Frequency Characteristics

- Characteristics of a RF Signal:
    - Wavelength
    - Frequency
    - Amplitude
    - Phase
- There is an inverse relationship between wavelength and frequency; the components are frequency, wavelength, and the speed of light

- Majority of Wireless LAN radios operate in either 2.4 GHz frequency range or the 5 GHz range
- Frequency is measured in hertz (Hz)
    - When we say 2.4 GHz WLAN, it means the RF signal is oscillating 2.4 billion times per second!
- Amplitude can be defined as the maximum displacement of a continuous wave
    - With RF signals, amplitude corresponds to the electrical field of the wave
- Signals that have 0 degree phase separation actually combine their amplitude, which results in much greater signal strength
    - Two RF signals that are 180 degrees out of separation cancel each other out and the effective received signal strength is null

Radio Frequency Behaviors

- RF Propagation Behaviors include:
    - Absorption, Reflection, Scattering, Refraction, Diffraction, Free Space Path Loss, Multipath, Attenuation, and Gain.

+ Wave Propagation: The way which the RF waves move through materials of different mediums

- The most common RF behavior is absorption
- Reflection is one of the most important RF propagation behaviors
    - Sky wave reflection and Microwave reflection
        - Sky wave reflection occur bellow 1GHz, signal bounces off the charged particles in the atmosphere
    - Microwave signals exist between 1GHz and 300GHz
        - Bounce off all things basically
            - This may cause multipath… which is no good apparently
                - 802.11n/ac take advantage of multipath with digital signal processing techniques
- Scattering is basically multiple reflections
- Refraction happens when an RF signal is bent when passing through a medium
    - Most common causes: water vapor, changes in air pressure, and changes in air temp.
- Diffraction is the bending of an RF signal around an object
- Loss (attenuation) is the decrease of amplitude or signal strength
    - Now a days, attenuation can be desired to remain compliant with power regulations
- Both LOSS and GAIN can be gauged in a relative measurement of change in power called Decibels (dB)
- Four possible results of multipath: Upfade, Downfade, Nulling, and Data Corruption
    - Data corruption is the most common occurrence of destructive multipath.

+Questions: Chapter Two: 2, 4, 5, 6, 7, 8, 9, 12, 15, 17, 18, 19, And 20

1. What term best defines the linear distance traveled in one positive-to-negative-to-positive oscillation of an EM signal?
    a. Wavelength
2. A standard measurement of frequency is called what?
    a. Hertz
3. When an RF signal bends around an object, this propagation behavior is known as what?
    a. Diffraction
4. When the multiple RF signals arrive at a receiver at the same time and are with the primary wave, the result can be of the primary signal?
    a. 180 degrees out of phase, cancellation
5. Which of the following statements are true?
    a. When DOWNFADE occurs, the final received signal will never be stronger than the original transmitted signal
    b. When UPFADE occurs, the final received signal will never be stronger than the original transmitted signal
6. What is the frequency of an RF signal that cycles 2.4 million times per second?
    a. 2.4 MHz
7. What is the best example of time domain tool that could be used by an RF engineer?
    a. Oscilloscope
8. Which behavior can be described as an RF signal encountering a chain link fence, causing the signal to bounce into multiple directions?
    a. Scatter
9. Which of the following are true about free space path loss?
    a. RF signals will attenuate as they travel, despite the lack of attenuation caused by obstructions
    b. Path loss occurs at a logarithmic rate
10. What is an example of a frequency domain tool that could be used by an RF engineer?
    a. Spectrum Analyzer
11. Using knowledge of RF characteristics and behaviors, which options should a WLAN engineer be most concerned about during an indoor site survey?
    a. Brick walls, and Wood-lath plaster walls
12. What are the three properties that are interrelated?
    a. Frequency, Wavelength, and the speed of light
13. Which RF behavior best describes a signal striking a medium and bending in a different direction?
    a. Refraction