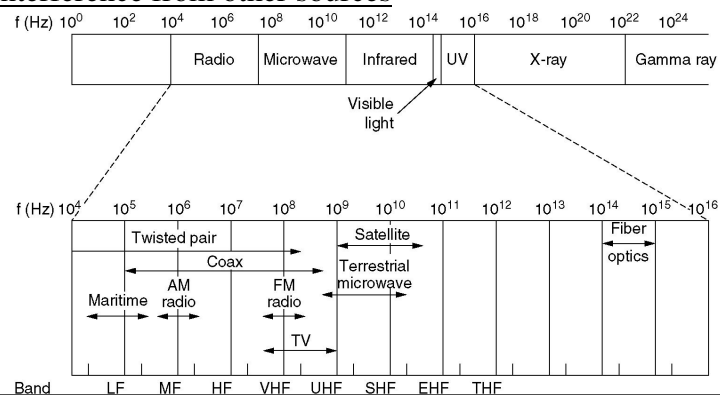


# Wireless Transmission

- Electromagnetic Spectrum
  - Data transmission
- Types of waves
  - Radio
  - Microwave
  - Infrared
  - Light

# Electromagnetic Spectrum

- Electromagnetic waves
  - Advantages: Useful when difficult to lay down wire or fiber connection or when the user is mobile
  - Disadvantages: Low bandwidth and is susceptible to interference from other sources

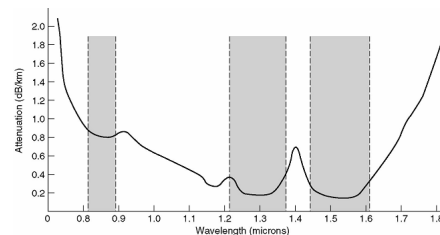


## Electromagnetic Spectrum (2)

- Frequency (f) number of oscillations per second
- Wavelength ( $\lambda$ ) distance between two consecutive maxima
- Speed (c) speed of light in vacuum  $3 \times 10^8$
- $\lambda f = c$
- Transmission
  - Frequencies: The radio, microwave, infrared and visible light portions of the spectrum can all be used for transmitting information
  - Methods: Modulate the amplitude, frequency or phase of the waves
- Why not others?
  - Production hard to produce
  - Propagation Do not propagate well through building
  - Danger Dangerous to living things

## Information transmitted

- How much information?
  - Bandwidth An EM wave's information capacity is related to its bandwidth
  - Bits per Hertz possible to encode a few bits per Hertz
  - Frequency the higher the frequency, the more we can encode
    - Fiber Optics very popular as they operate in high frequencies
  - Example Consider the 1.30micron band used in fiber optics

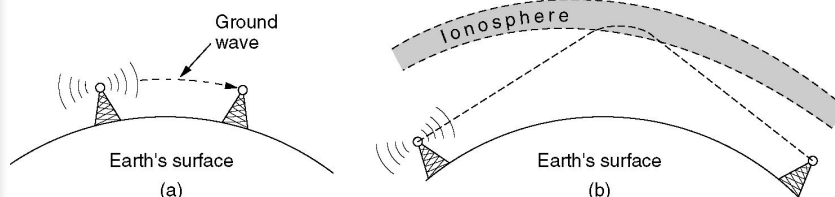


## Frequency bands

- Narrow frequency bands are used to get best reception
- Wide bands are used
  - Frequency Hopping Spread Spectrum mainly used by the military. Transmissions are hard to monitor and provides increased resistance to multipath fading
  - Direct Sequence Spread Spectrum spreads the signal over a wide frequency band

## Radio

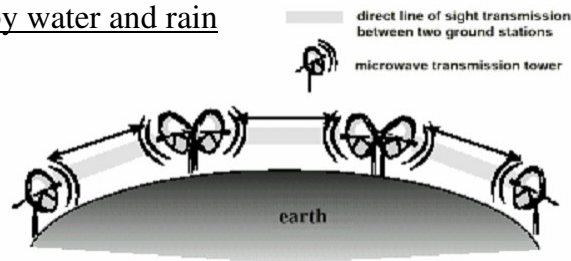
- Properties
  - Distance travel long distances
  - Penetration penetrate through buildings easily
  - Omnidirectional go in 360° from the source
  - Bandwidth fairly low bandwidth
  - Curvature VLF,LF,MF follow the earth's curvature, HF and VHF bands are refracted



## Microwave

### ■ Properties

- Curvature travels in straight line and does not follow earth's curvature
- Alignment of sender and receiver is necessary
- Distance for 100 ~~not~~ high towers, repeaters can be spaced 80km apart
- Multipath fading fluctuations in signal strength at the receiver, due to interference between multiple signal copies
- Absorption by water and rain



## Infrared & Millimeter waves

- Uses: short range comms (remotes, infrared laptops, etc)
- Properties
  - Curvature relatively directional
  - Penetration cannot pass through solid objects
  - Cheap to produce

# Lightwave

- Coherent optical signalling is unidirectional with each building having its own laser and photoreceptor.
  - Laser beams must be very accurately sighted.
  - Atmospheric conditions: cannot penetrate rain or thick fog

