

# Radio Communications and Propagation Effects



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# Radio Communication

- ✓ Radio Waves
- ✓ Micro Waves
- ✓ Satellite Waves

# Radio Waves

- ✓ Easy to generate
- ✓ Can travel long distances
- ✓ Can penetrate buildings

# Radio Waves

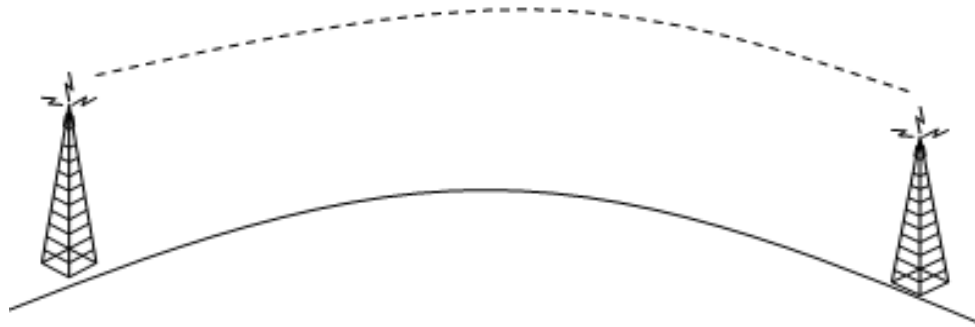
- ✓ They are both used for indoor and outdoor Communication
- ✓ They are omni-directional: can travel in all directions
- ✓ They can be narrowly focused at high frequencies (greater than 100MHz) using parabolic antennas (like satellite dishes)

# Properties of Radio Waves

- ✓ Frequency dependent
- ✓ At low frequencies, they pass through obstacles well, but the power falls off sharply with distance from source
- ✓ At high frequencies, they tend to travel in straight lines and bounce off obstacles (they can also be absorbed by rain)
- ✓ They are subject to interference from other radio wave sources

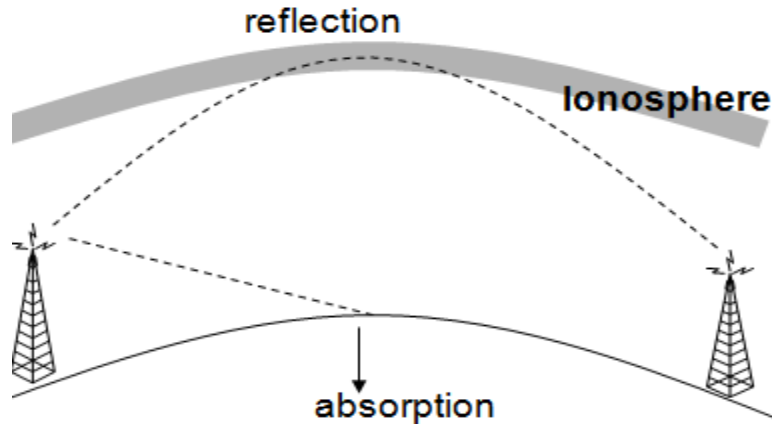
# Radio Propagation Effects

- ✓ At VLF, LF and MF bands, radio waves follow the ground
- ✓ AM radio broadcasting uses MF band



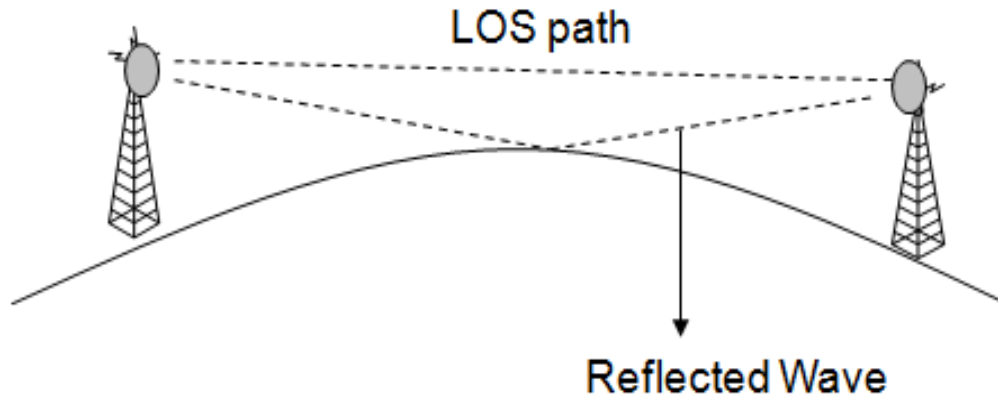
# Radio Propagation Effects

- ✓ At HF bands, the ground waves tend to be absorbed by the earth
- ✓ The waves that reach ionosphere (100-500km above earth surface), are refracted and sent back to earth



# Radio Propagation Effects

- ✓ At VHF Transmission, Waves follow more direct paths
- ✓ Directional antennas are used
  - ✓ LOS: Line-of-Sight Communication
  - ✓ Reflected wave interfere with the original signal





# Frequency

- ✓ Waves behave more like light at higher frequencies
  - ✓ Difficulty in passing obstacles
  - ✓ More direct paths
- ✓ They behave more like radio at lower frequencies
  - ✓ Can pass obstacles

# Wavelength

- ✓ Reflection
  - ✓ Propagation wave impinges on an object which is large as compared to wavelength
  - ✓ Ex: The surface of the Earth, buildings, walls, etc
  - ✓ These reflections may interfere with the original signal constructively or destructively

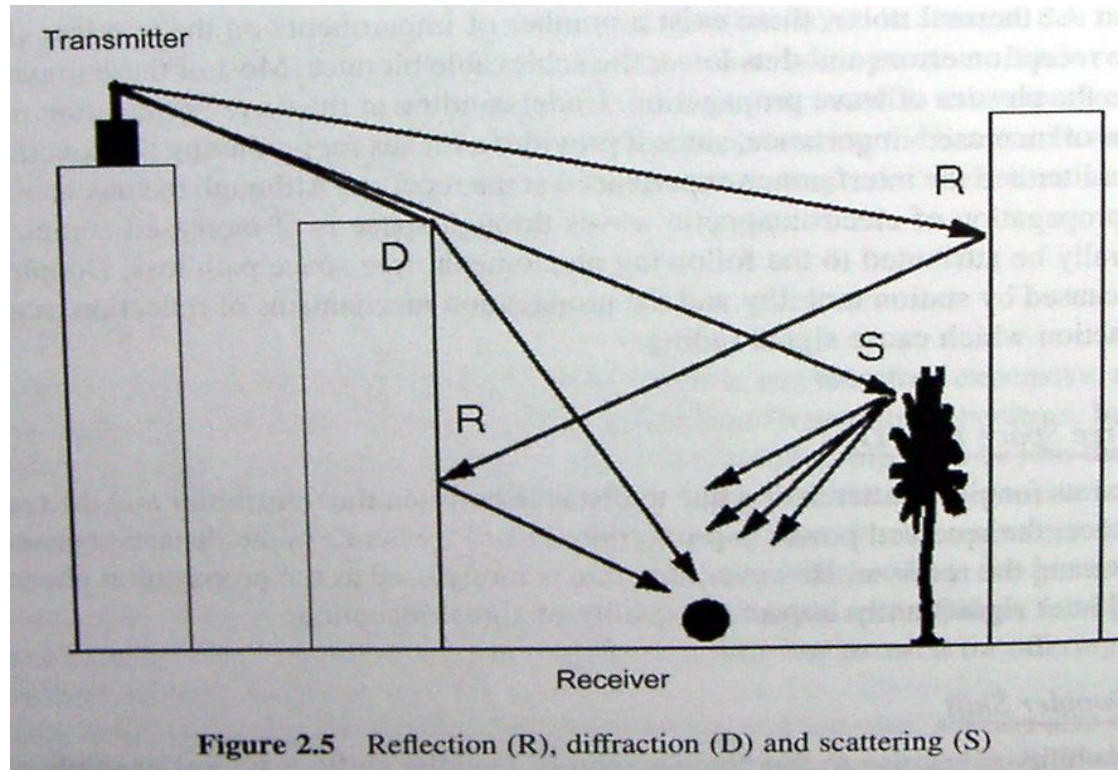
# Wavelength

- ✓ Diffraction
  - ✓ Radio path between transmitter and receiver obstructed by surface with sharp irregular edges
  - ✓ Waves bend around the obstacle, even when LOS (line of sight) does not exist

# Wavelength

- ✓ Scattering
  - ✓ Objects smaller than the wavelength of the propagation wave
  - ✓ And also when the number of obstacles are quite large
  - ✓ They are produced by small objects, rough surfaces and other irregularities on the channel
  - ✓ Follows same principles with diffraction
  - ✓ Causes the transmitter energy to be radiated in many directions
  - ✓ Ex: foliage, street signs, lamp posts

# Wavelength



# References

- ✓ Books:
  - ✓ Data communication and Networking, 4<sup>th</sup> Edition, Behrouz A Forouzan
  - ✓ Computer Networks, 4<sup>th</sup> Edition, Andrew S. Tanenbaum
- ✓ Various relevant Websites

Thank You