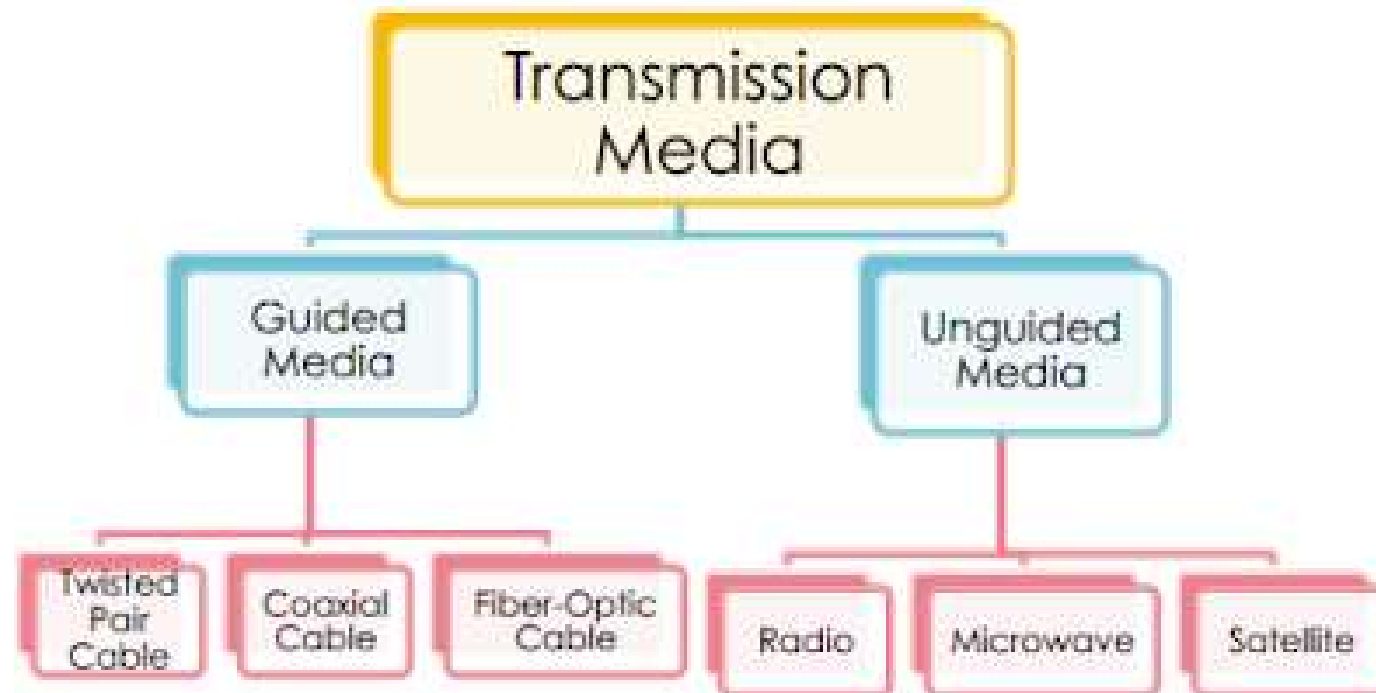


# Chapter 7

## Transmission Media

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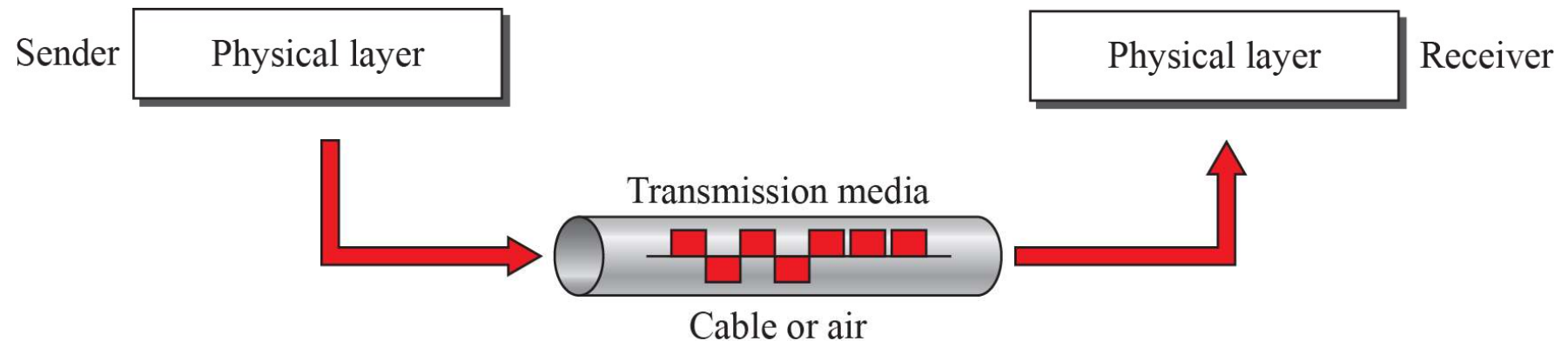
# Objective

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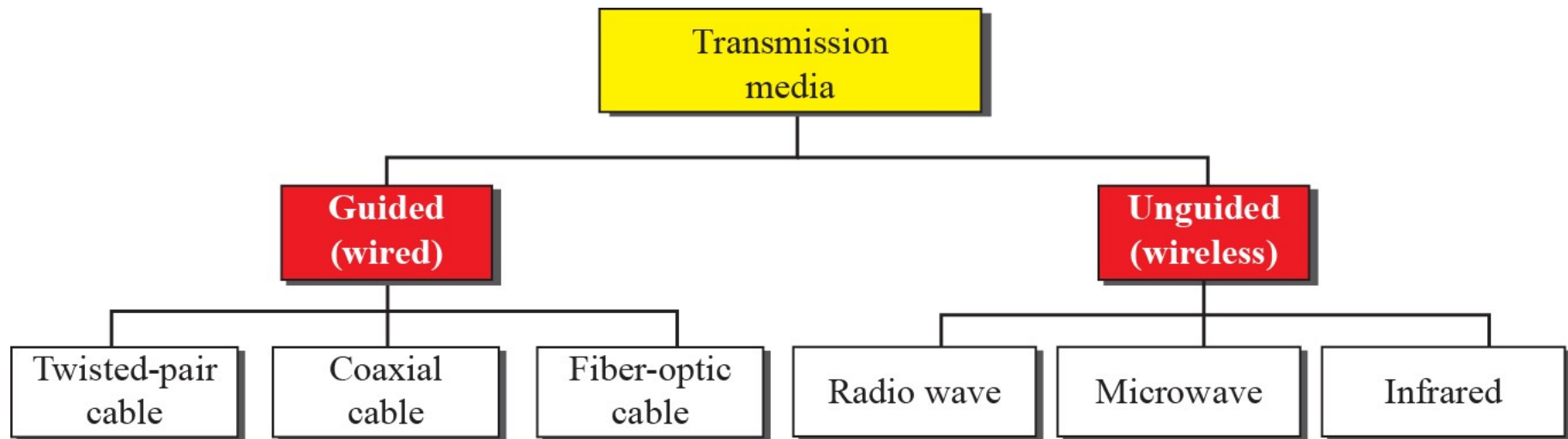
- Transmission media into two broad categories: guided and unguided media.
- Guided media : twisted-pair cables, coaxial cables.
- Unguided media : radio waves and microwaves.

# INTRODUCTION

- Transmission media are actually located below the physical layer and are directly controlled by the physical layer. We could say that **transmission media belong to layer zero**.



*Transmission media and physical layer*



*Classes of transmission media*

# GUIDED MEDIA

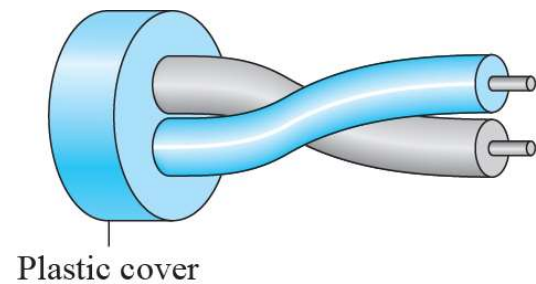
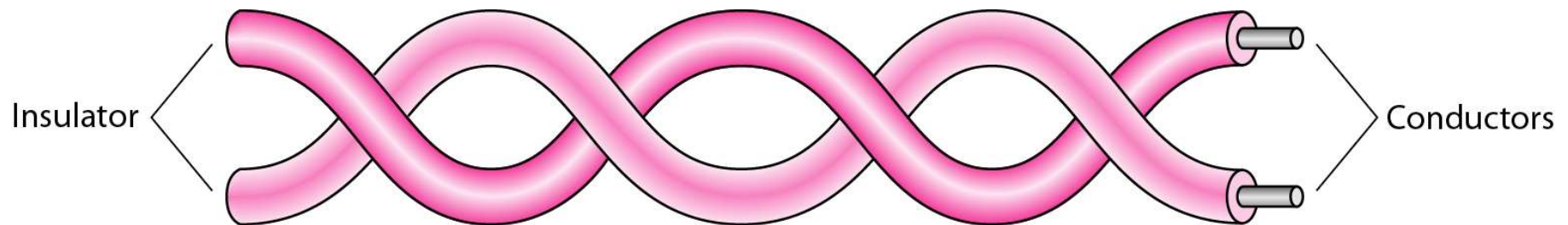
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- Guided media, which are those that provide a conduit from one device to another, include **twisted-pair cable, coaxial cable, and fiber-optic cable.**
- A signal traveling along any of these media is directed and contained by the physical limits of the medium.



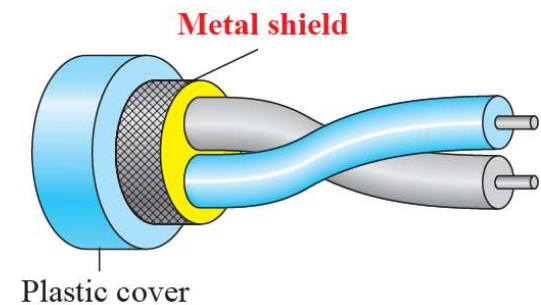
# Twisted-Pair Cable

- A twisted pair consists of two conductors (normally copper), each with its own plastic insulation, twisted together.



a. UTP

## *Twisted-pair cable*

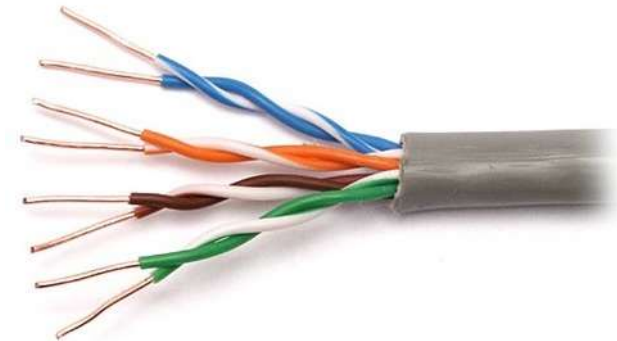


b. STP

# Twisted-Pair Cable

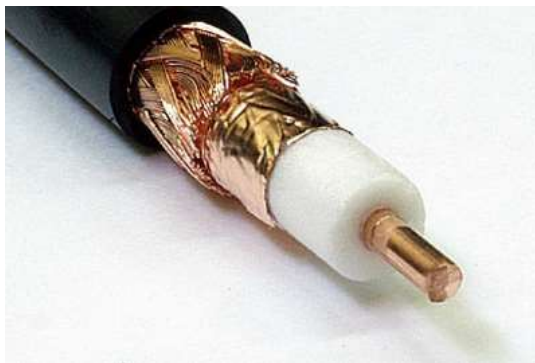
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- Twisted pair cabling is a type of wiring in which two conductors of a single circuit are twisted together for the purposes of **improving electromagnetic compatibility**.
- It reduces electromagnetic radiation from the pair and crosstalk between neighboring pairs and improves rejection of external electromagnetic interference.



# Coaxial Cable

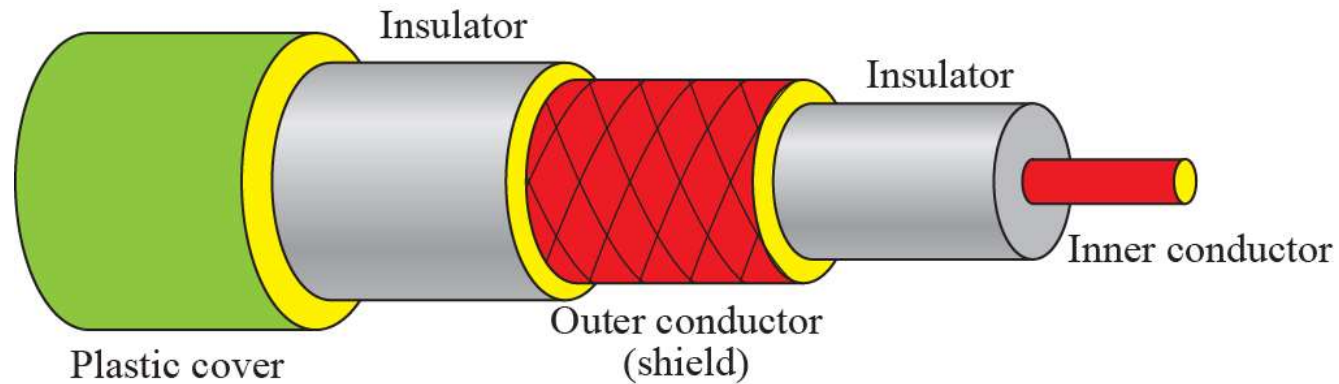
- Coaxial cable (or coax) carries signals of **higher frequency ranges** than those in twisted pair cable, in part because the two media are constructed quite differently.
- Instead of having two wires, coax has a central core conductor of solid or stranded wire (usually copper) enclosed in an insulating sheath.





# Coaxial Cable

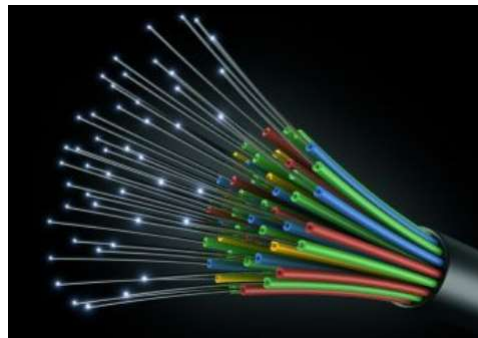
- The outer metallic wrapping serves both as a shield against noise and as the second conductor, which completes the circuit.

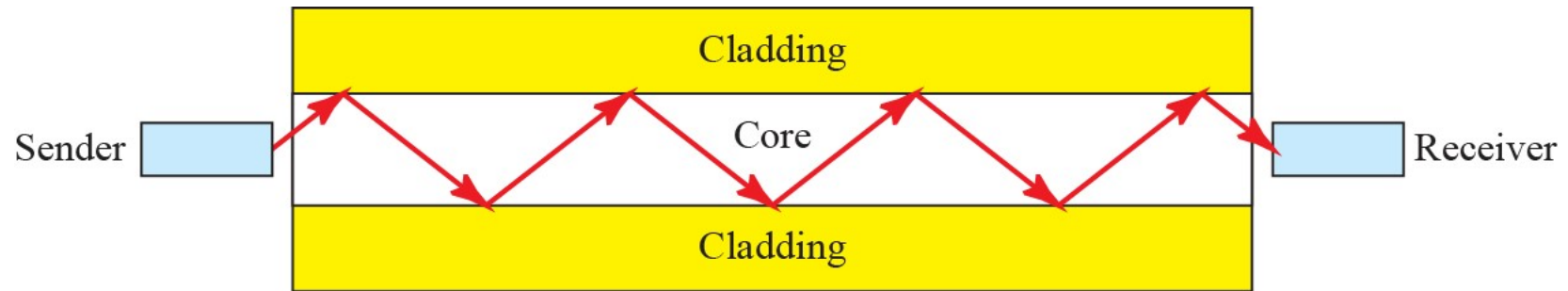


*Coaxial cable*

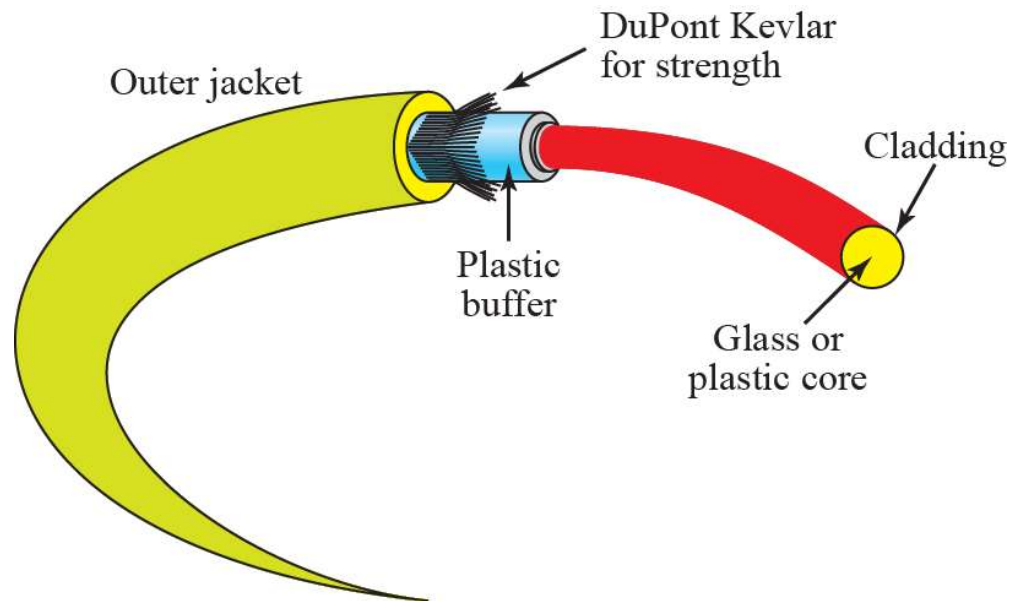
# Fiber-Optic Cable

- A fiber-optic cable is made of glass or plastic and transmits signals in the form of light.
- Light travels in a straight line as long as it is moving through a single uniform substance.
- If a ray of light traveling through one substance suddenly enters another substance (of a different density), the ray changes direction.





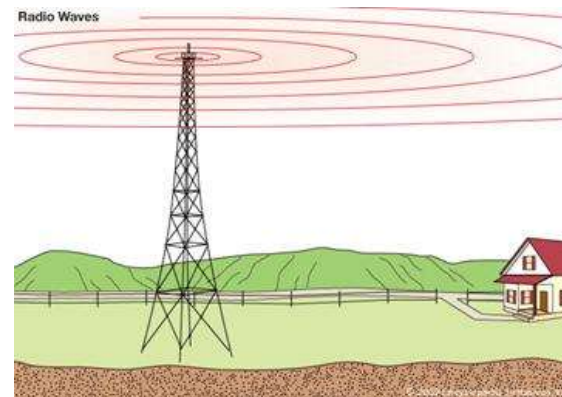
***Optical fiber***

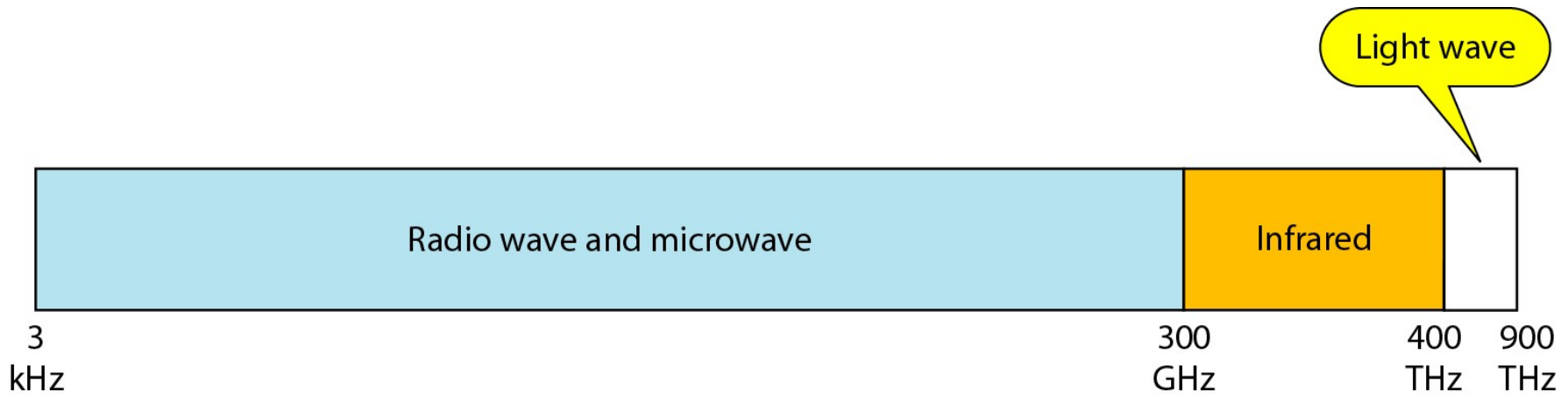


***Fiber connection***

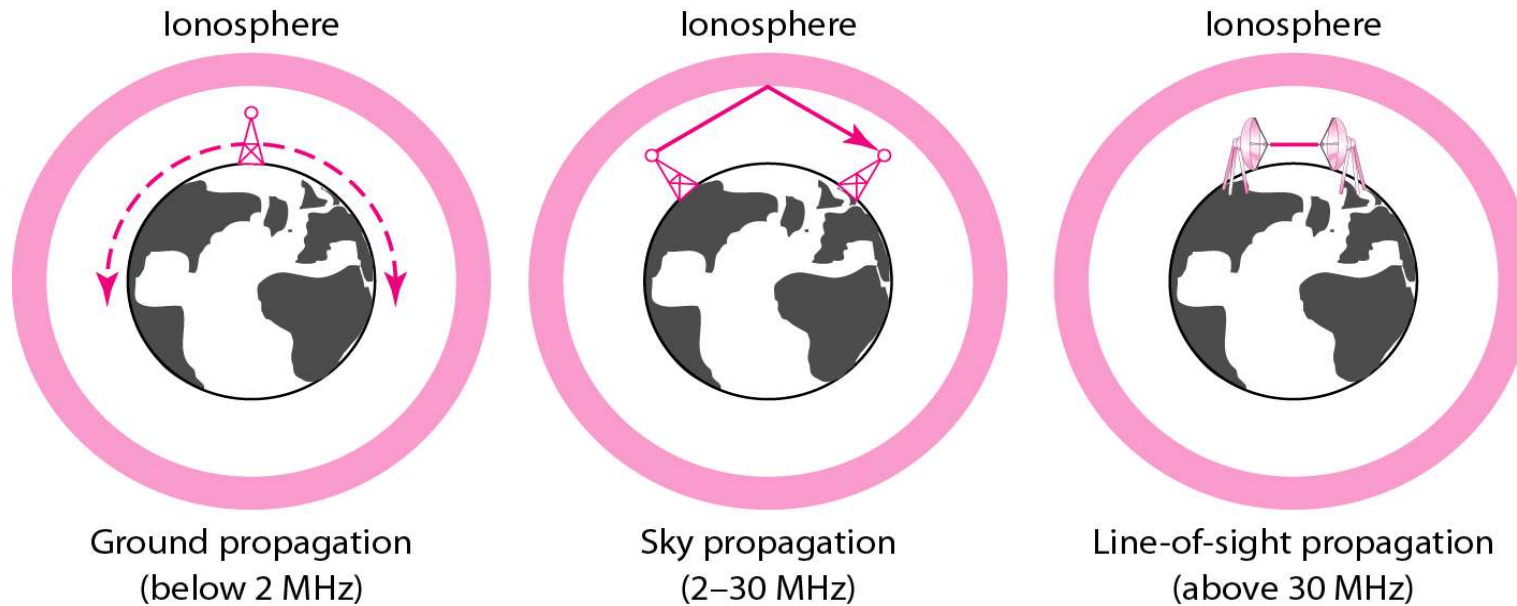
# UNGUIDED MEDIA

- Unguided medium transport waves without using a physical conductor. This type of communication is often referred to as **wireless communication**.
- Signals are normally broadcast through free space and thus are available to anyone who has a device capable of receiving them.





***Electromagnetic spectrum for wireless communication***



***Propagation methods***

# Radio Waves

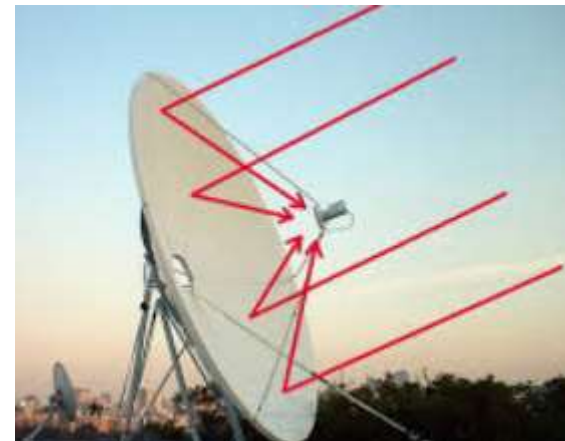
- Although there is no clear-cut demarcation between radio waves and microwaves, electromagnetic waves ranging in frequencies between 3 kHz and 1 GHz are normally called radio waves; waves ranging in frequencies between 1 GHz and 300 GHz are called microwaves.
- However, the behavior of the waves, rather than the frequencies, is a better criterion for classification.



# Microwaves

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- Electromagnetic waves having frequencies between 1 GHz and 300 GHz are called microwaves. Microwaves are **unidirectional**.
- When an antenna transmits microwaves, they can be narrowly focused. The sending and receiving antennas need to be aligned.
- A pair of antennas can be aligned without interfering with another pair of aligned antennas.



# Infrared



- Infrared waves, with frequencies from 300 GHz to 400 THz (wavelengths from 1 mm to 770 nm), can be used for short-range communication.
- Infrared waves, having high frequencies, cannot penetrate walls.
- This characteristic prevents interference between one system and another; a short-range communication in one room cannot be affected in the next room.