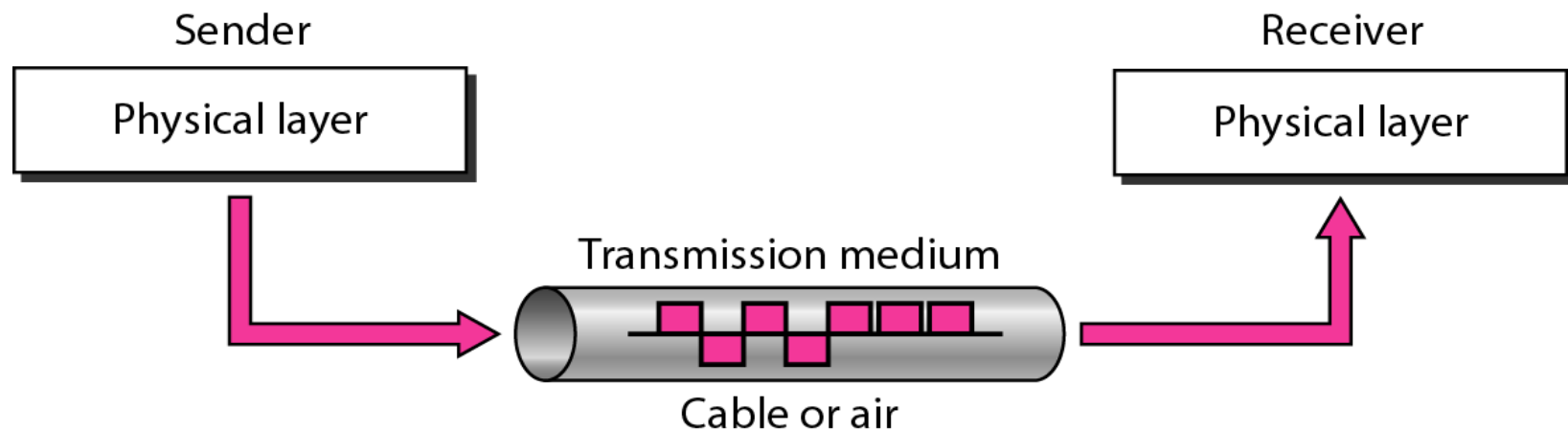


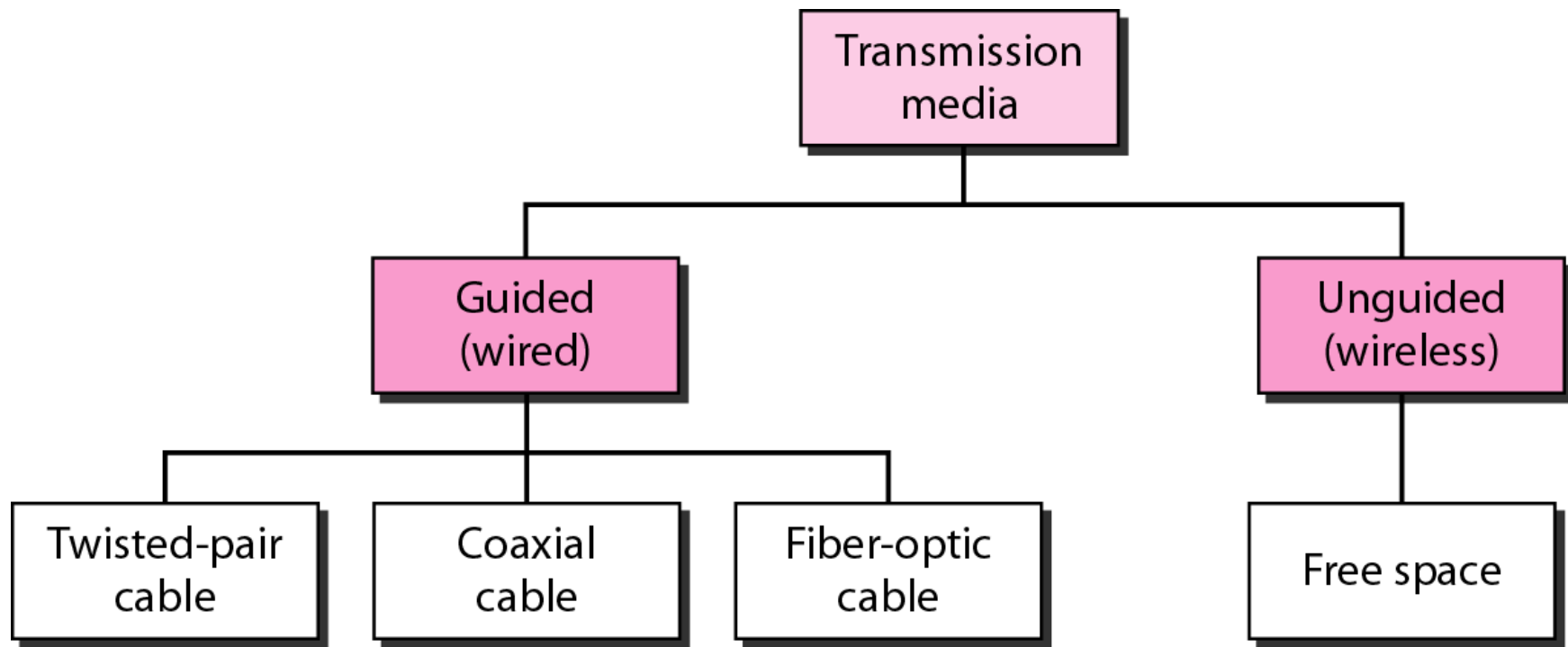


TRANSMISSION MEDIA

TRANSMISSION MEDIUM AND PHYSICAL LAYER



CLASSES OF TRANSMISSION MEDIA



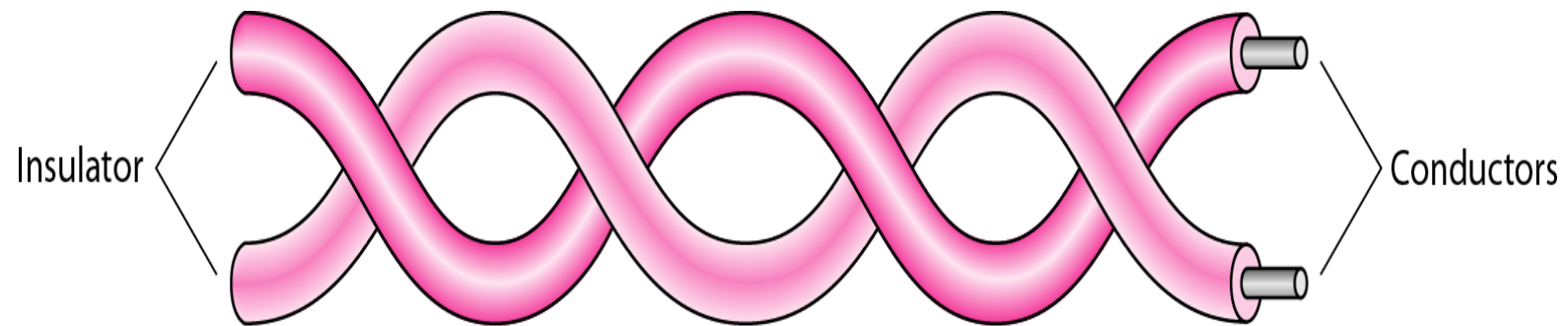
GUIDED & UNGUIDED MEDIA

- Guided media, which are those that provide a conduit from one device to another, includes
 - Twisted-Pair Cable
 - Coaxial Cable
 - Fiber-Optic Cable

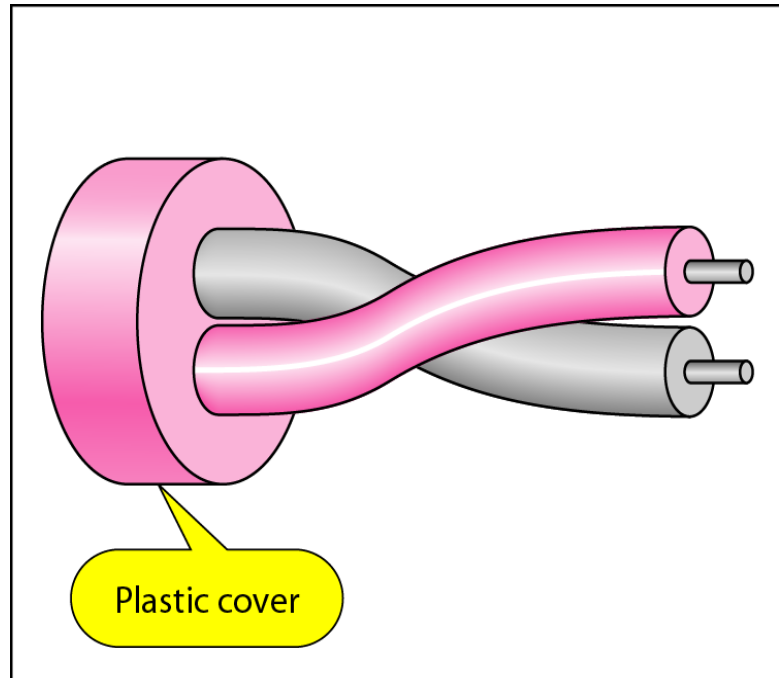
- Unguided media transport electromagnetic waves without using a physical conductor. This type of communication is often referred to as wireless communication.
 - Radio Waves
 - Microwaves
 - Infrared



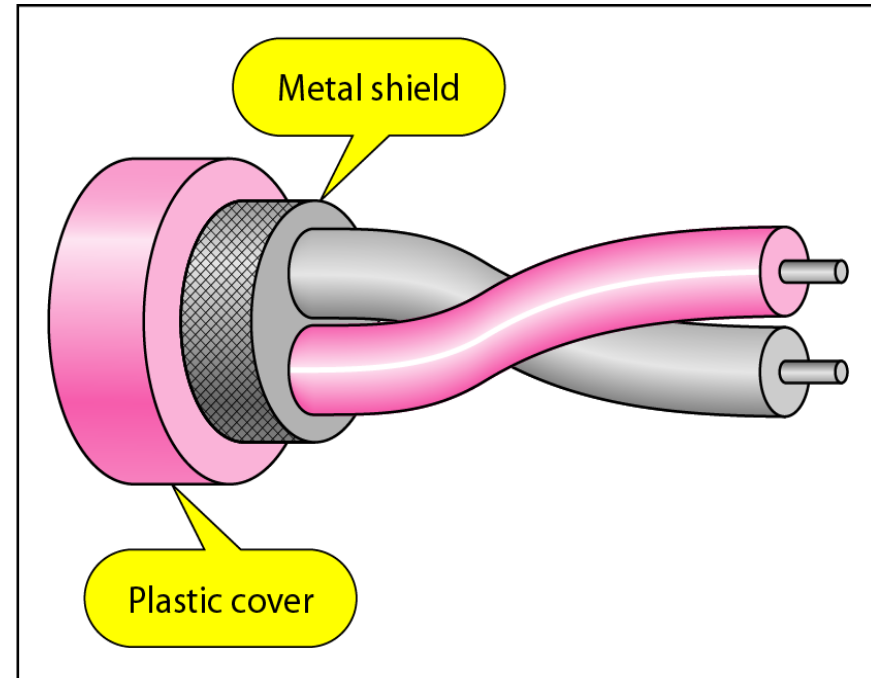
TWISTED-PAIR CABLE



UTP AND STP CABLES



a. UTP



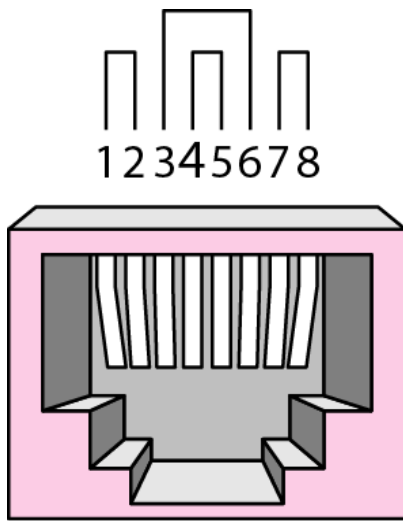
b. STP



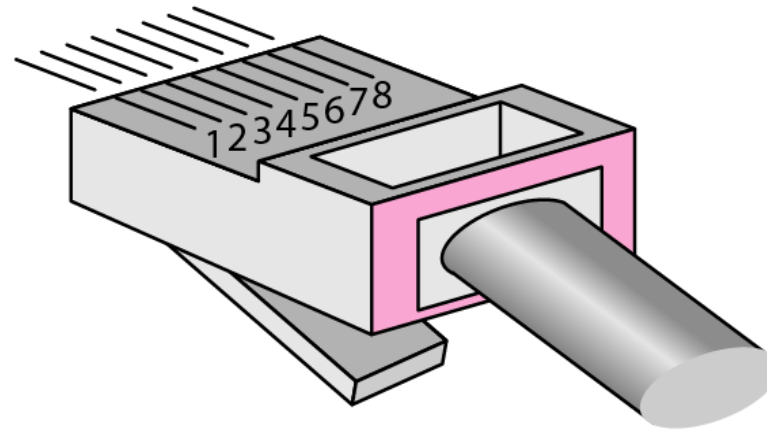
CLASSIFICATION OF UTP

<i>Category</i>	<i>Specification</i>	<i>Data Rate (Mbps)</i>	<i>Use</i>
1	Unshielded twisted-pair used in telephone	< 0.1	Telephone
2	Unshielded twisted-pair originally used in T-lines	2	T-1 lines
3	Improved CAT 2 used in LANs	10	LANs
4	Improved CAT 3 used in Token Ring networks	20	LANs
5	Cable wire is normally 24 AWG with a jacket and outside sheath	100	LANs
5E	An extension to category 5 that includes extra features to minimize the crosstalk and electromagnetic interference	125	LANs
6	A new category with matched components coming from the same manufacturer. The cable must be tested at a 200-Mbps data rate.	200	LANs
7	Sometimes called SSTP (shielded screen twisted-pair). Each pair is individually wrapped in a helical metallic foil followed by a metallic foil shield in addition to the outside sheath. The shield decreases the effect of crosstalk and increases the data rate.	600	LANs

UTP CONNECTOR



RJ-45 Female



RJ-45 Male

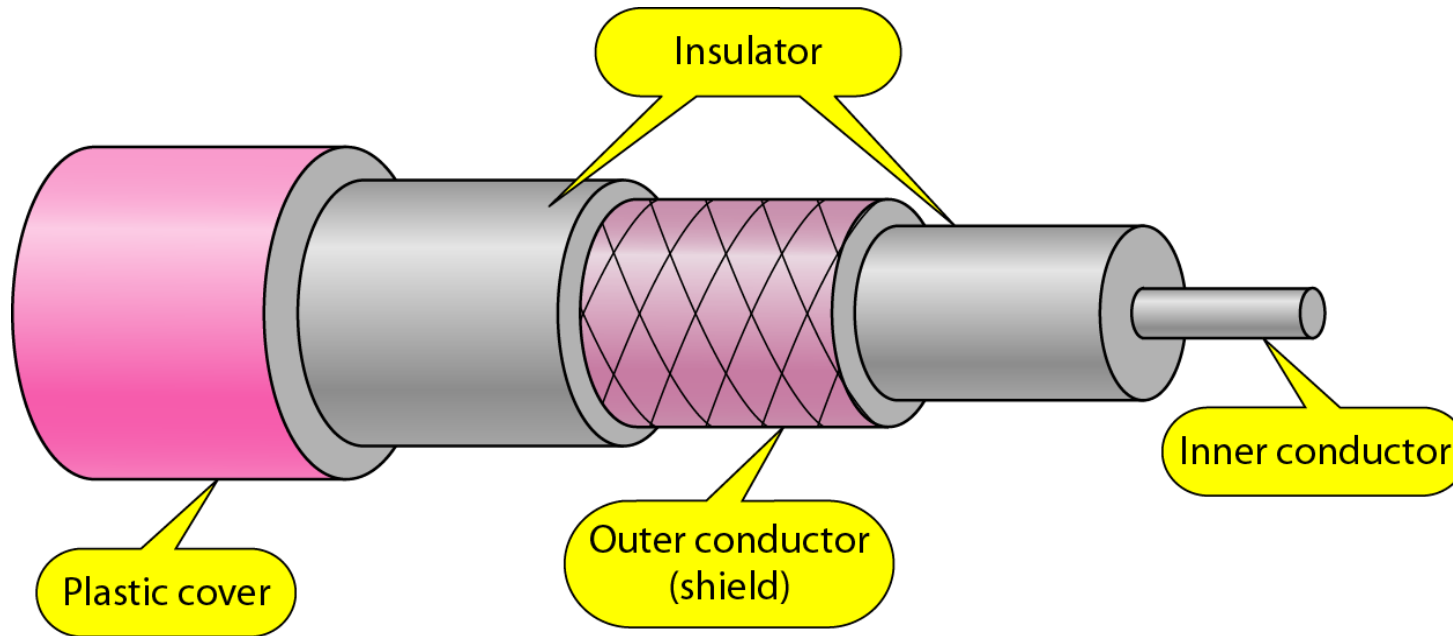


APPLICATIONS OF TWISTED PAIR CABLE

- Used in telephone lines to provide voice and data channels.
- DSL lines used by telephone companies to provide high-data-rate connection.
- LANs such as 10Base-T and 100Base-T.



COAXIAL CABLE



It can carry signals of higher frequency range than twisted pair cable.

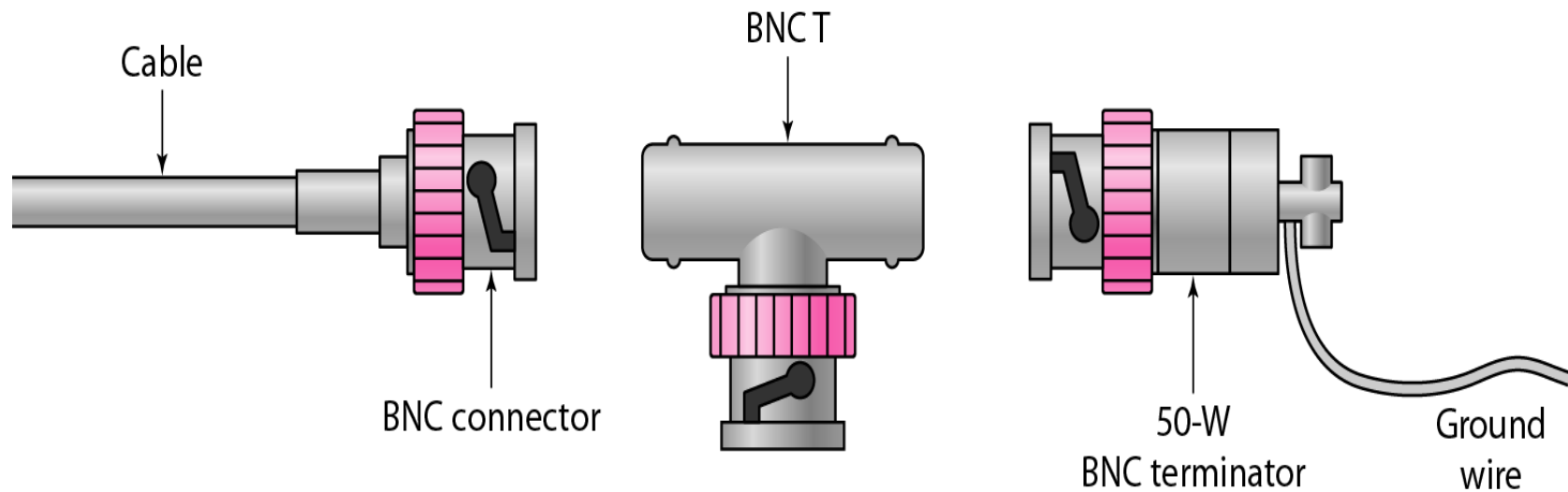


Categories of Coaxial cable

<i>Category</i>	<i>Use</i>
RG-59	Cable TV
RG-58	Thin Ethernet
RG-11	Thick Ethernet



Coax Connectors



Bayone-Neill-Concelman (BNC)

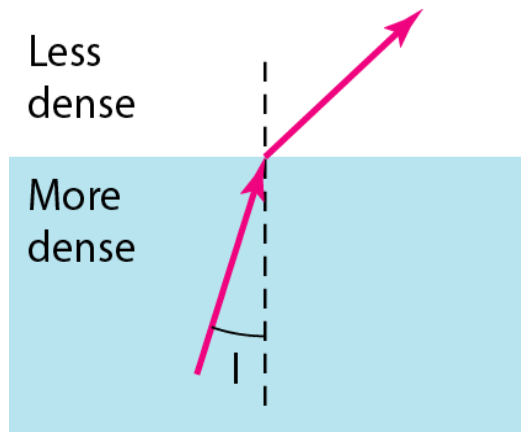


APPLICATIONS OF COAX

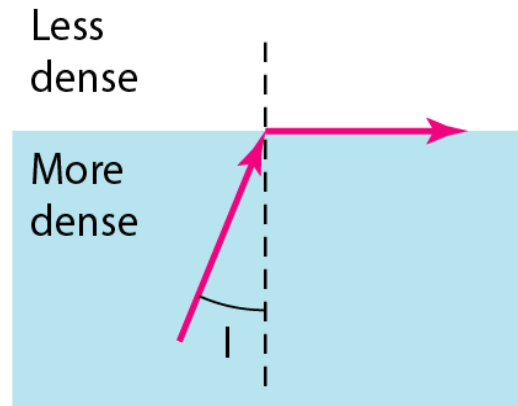
- In analog telephone network, a single coax can carry 10000 voice signals.
- Later it was used in digital telephone networks, to support 600Mbps.
- Cable TV network.



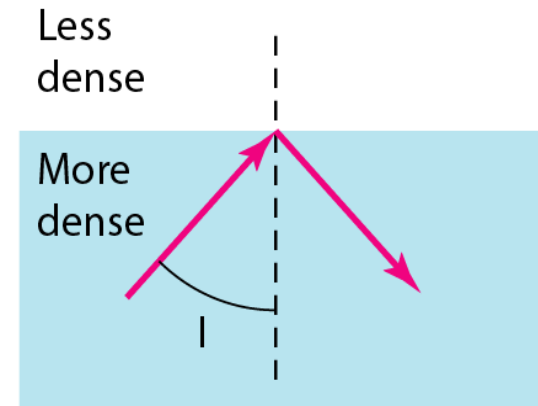
Bending of light ray



$i < \text{critical angle,}$
refraction



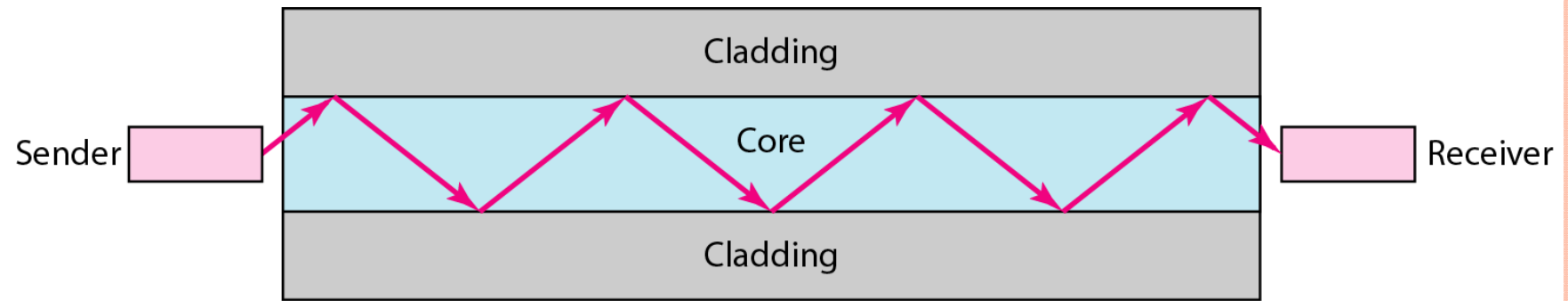
$i = \text{critical angle,}$
refraction



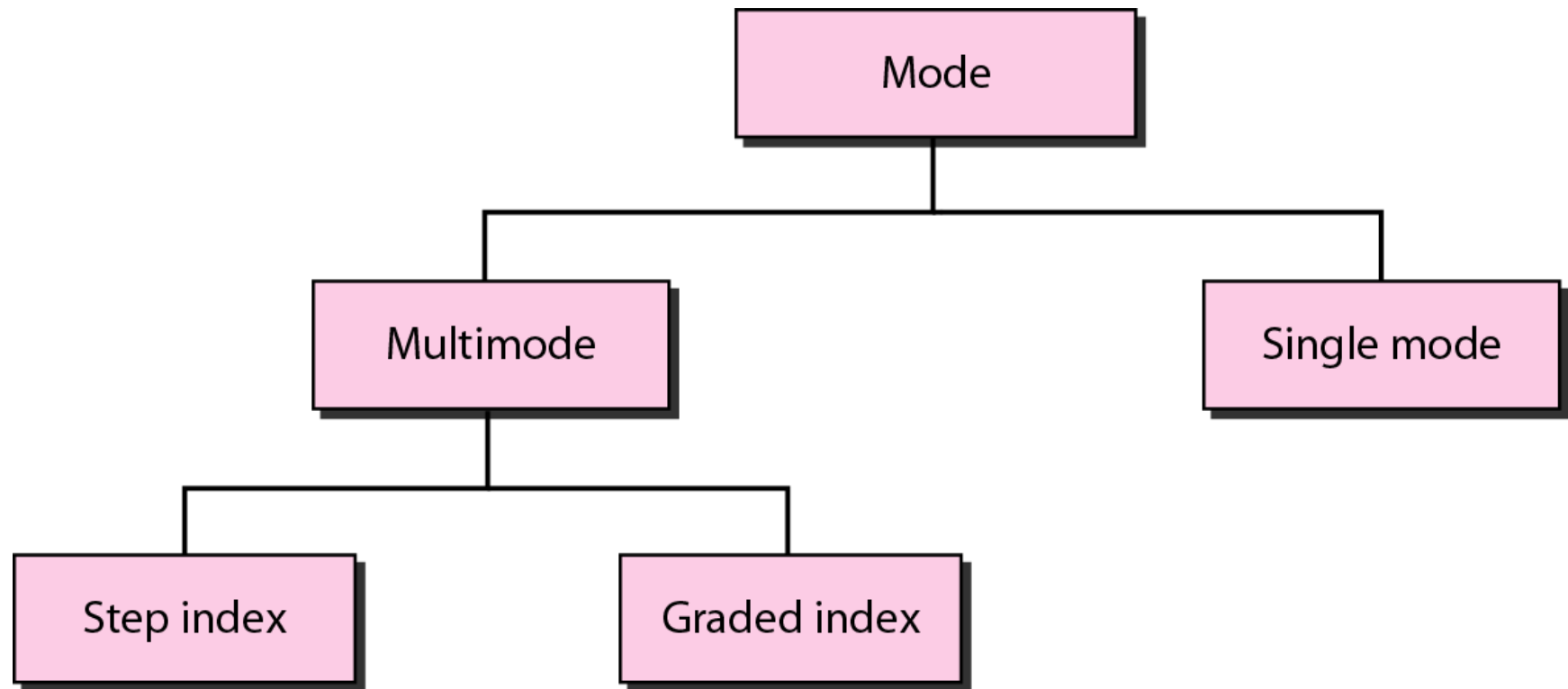
$i > \text{critical angle,}$
reflection



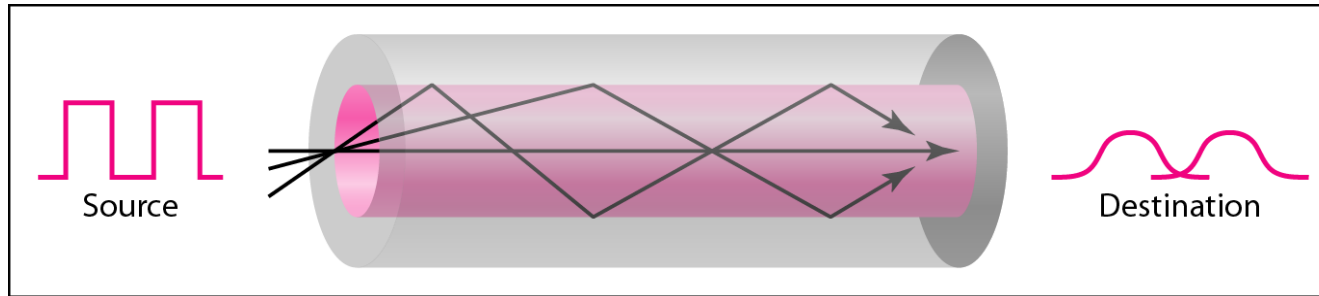
OPTICAL FIBER



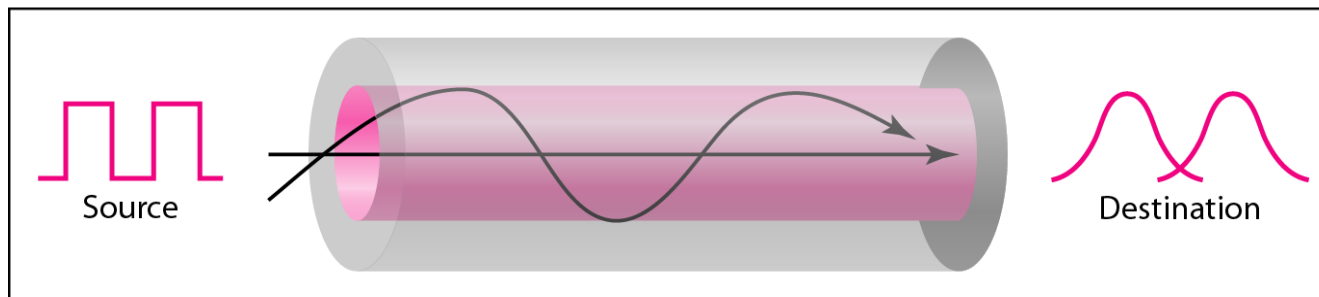
PROPAGATION MODES



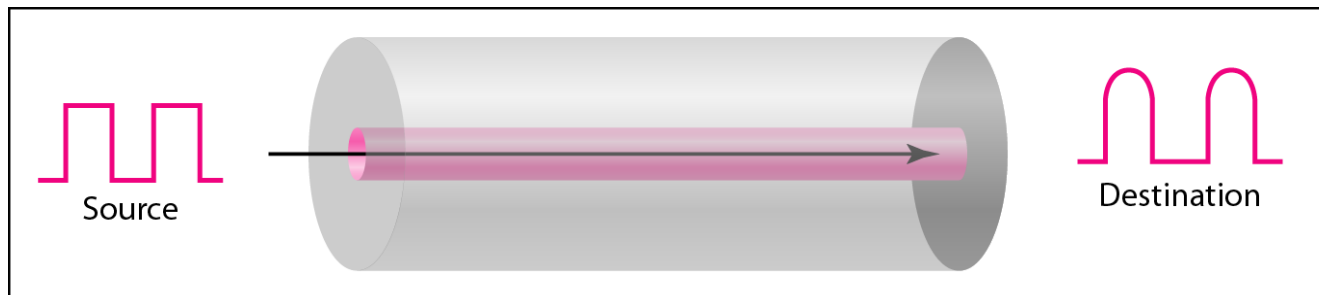
MODES



a. Multimode, step index



b. Multimode, graded index



c. Single mode

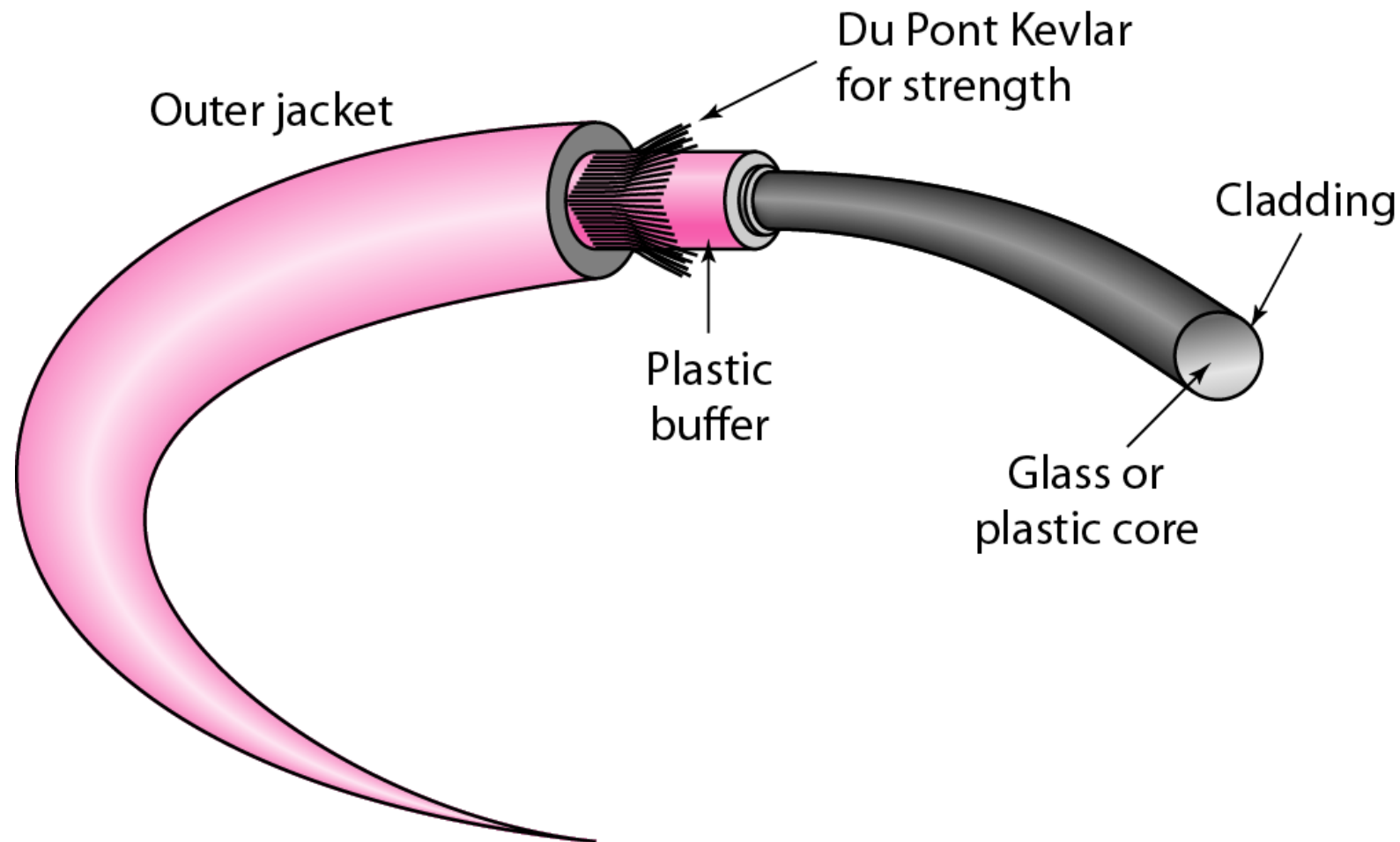


FIBER TYPES

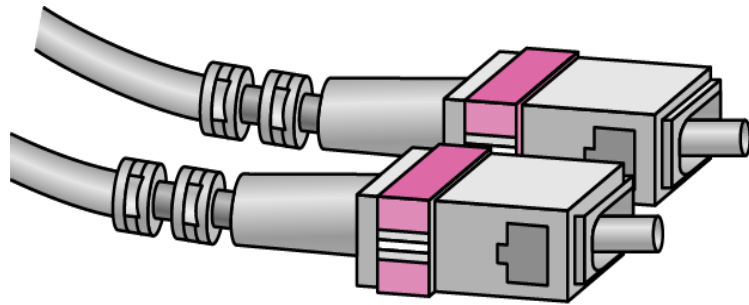
<i>Type</i>	<i>Core (μm)</i>	<i>Cladding (μm)</i>	<i>Mode</i>
50/125	50.0	125	Multimode, graded index
62.5/125	62.5	125	Multimode, graded index
100/125	100.0	125	Multimode, graded index
7/125	7.0	125	Single mode



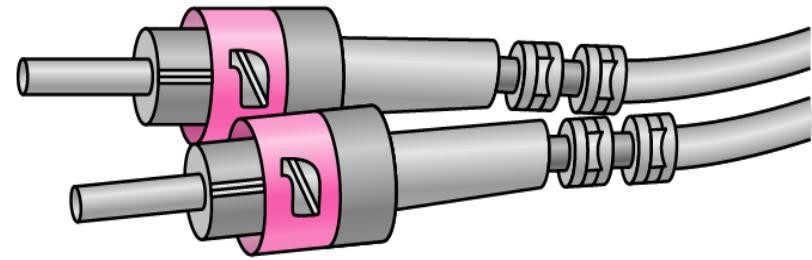
FIBER CONSTRUCTION



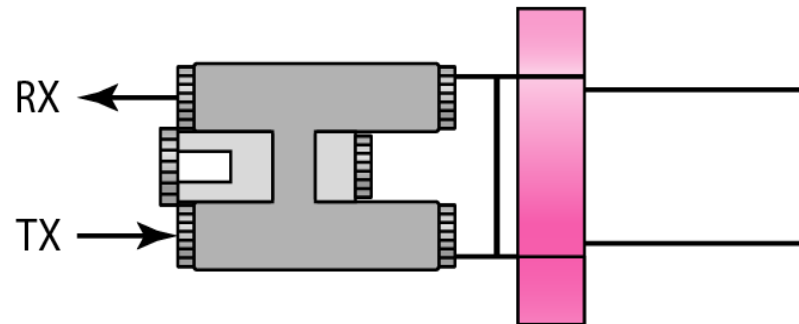
FIBER-OPTIC CABLE CONNECTORS



SC connector



ST connector

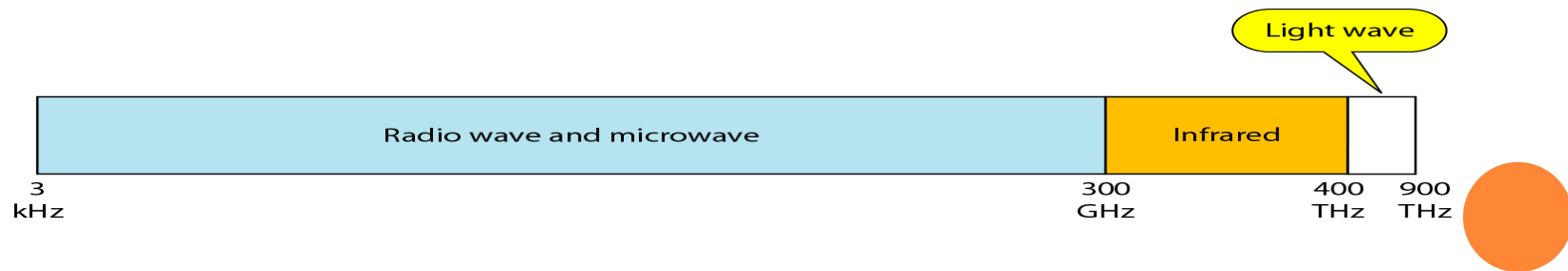


MT-RJ connector

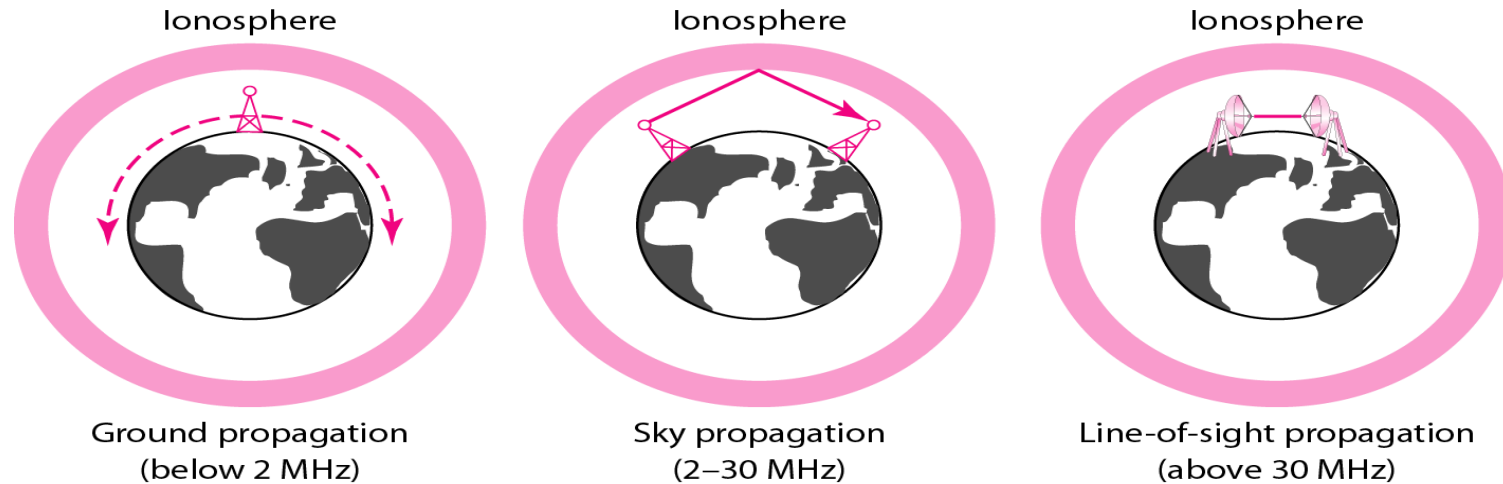


UNGUIDED MEDIA: WIRELESS

- Unguided media transport electromagnetic waves without using a physical conductor.
- This type of communication is often referred to as wireless communication.
- Electromagnetic spectrum ranging from 3KHz ~ 900 THz

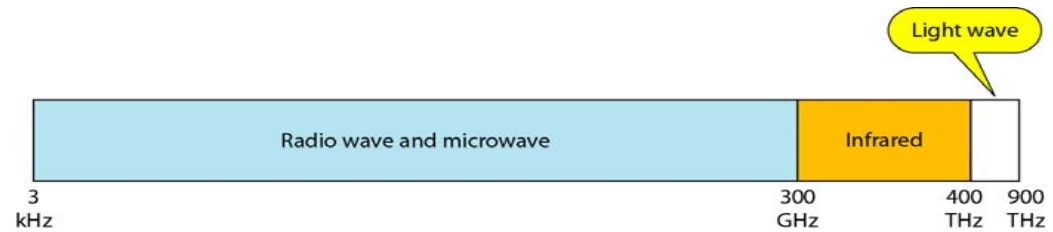


PROPAGATION METHODS



- Unguided signals can travel in several ways:
 - **Ground propagation:** radio waves travelling through the lowest portion of the atmosphere. These low frequency signals emanate in all directions and follow the curvature of the planet.
 - **Sky propagation:** Higher frequency radio waves radiate upward into the ionosphere where they are reflected back
 - **Line of sight propagation:** very high frequency are transmitted in straight lines directly between antennas.

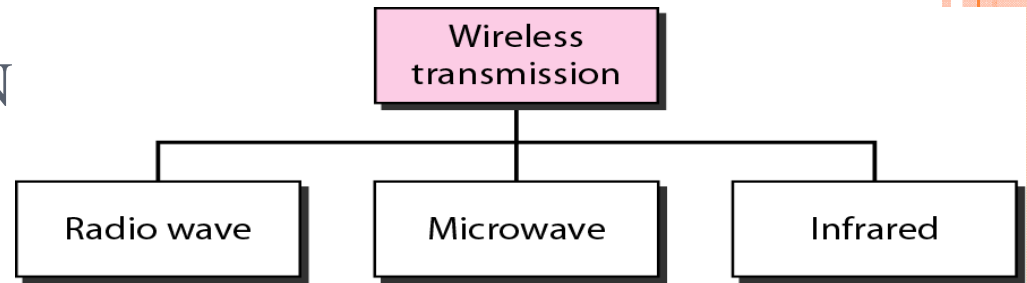
BANDS



The radio and microwaves is divided into right ranges, called bands, rated from very low frequency (VLF) to extremely high frequency (EHF)

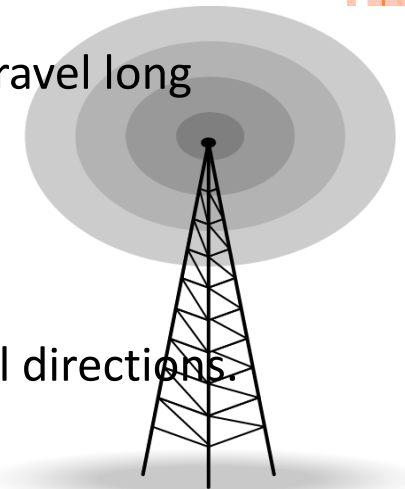
<i>Band</i>	<i>Range</i>	<i>Propagation</i>	<i>Application</i>
VLF (very low frequency)	3–30 kHz	Ground	Long-range radio navigation
LF (low frequency)	30–300 kHz	Ground	Radio beacons and navigational locators
MF (middle frequency)	300 kHz–3 MHz	Sky	AM radio
HF (high frequency)	3–30 MHz	Sky	Citizens band (CB), ship/aircraft communication
VHF (very high frequency)	30–300 MHz	Sky and line-of-sight	VHF TV, FM radio
UHF (ultrahigh frequency)	300 MHz–3 GHz	Line-of-sight	UHF TV, cellular phones, paging, satellite
SHF (superhigh frequency)	3–30 GHz	Line-of-sight	Satellite communication
EHF (extremely high frequency)	30–300 GHz	Line-of-sight	Radar, satellite

WIRELESS TRANSMISSION WAVES



○ Radio Waves:

- No clear demarcation between radio and microwaves, normally frequencies between 3KHz to 1 GHz are called radio waves.
- Radio waves, for the most part are omnidirectional. That is, when an antenna transmits radio waves, they are propagated in all directions.
- The sender and receiver antenna do not have to be aligned.
- The radio waves transmitted by one antenna are susceptible to interference by another antenna that may send signals using same frequency.
- Radio waves, particularly those propagating in sky mode, can travel long distances, such as AM radio.
- Low and medium range radio waves can penetrate walls.
- Radio waves use omnidirectional antennas to send signals in all directions.

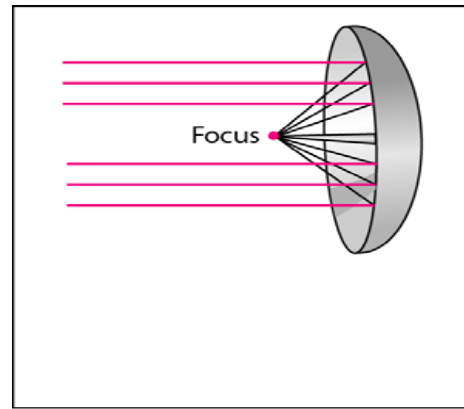


WIRELESS TRANSMISSION WAVES

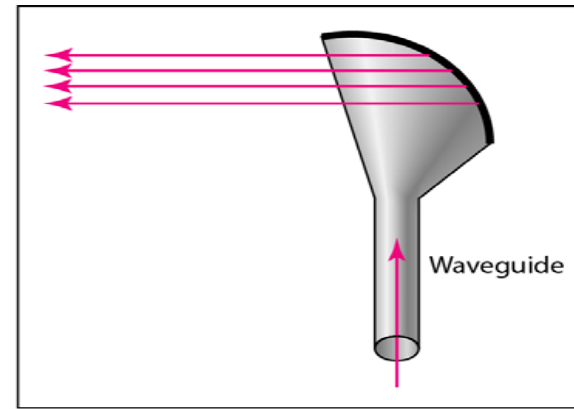
○ Microwaves:

- Frequencies between 1 and 300 GHz
- Microwaves are unidirectional. When an antenna transmits microwaves they are narrowly focused. Thus the sending and the receiving antennas needs to be aligned.
- A pair of antenna can be aligned without interfering with the another pair of aligned antennas
- Line of sight propagation.
- The curvature of the earth or other obstacles do not allow too short towers to communicate using microwaves.
- Very high frequency microwaves cannot penetrate walls
- The microwaves bands is relatively wide, almost 299 GHz. Therefore wider subbands can be assigned, and a high data rate is possible.

WIRELESS TRANSMISSION WAVES



a. Dish antenna



b. Horn antenna

- Unidirectional Antennas (for microwaves)
 - Parabolic dish antenna:
 - Every line parallel to the line of symmetry reflects off the curve at angles such that all lines intersect at a common point called focus.
 - It catches wide range of waves and direct them to the focus.
 - Horn Antenna:
 - Outgoing transmission is broadcast up a stem and reflects outward in a series of narrow parallel beams by the curve head.
- Applications:
 - They are used in cellular phones, satellite networks and wireless LANs



WIRELESS TRANSMISSION WAVES

- Infrared:

- Frequencies from 300 GHz to 400 THz
- Used for short-range communication
- Infrared waves with high frequencies cannot penetrate walls.

