



Computer Networks (ITPC-205) Dr Aruna Malik

Physical Layer
Transmission Media

Transmission medium

- A transmission media can be defined as anything that can carry information from source to destination.
- The transmission medium is usually free space, metallic cable or fiber-optic cable.

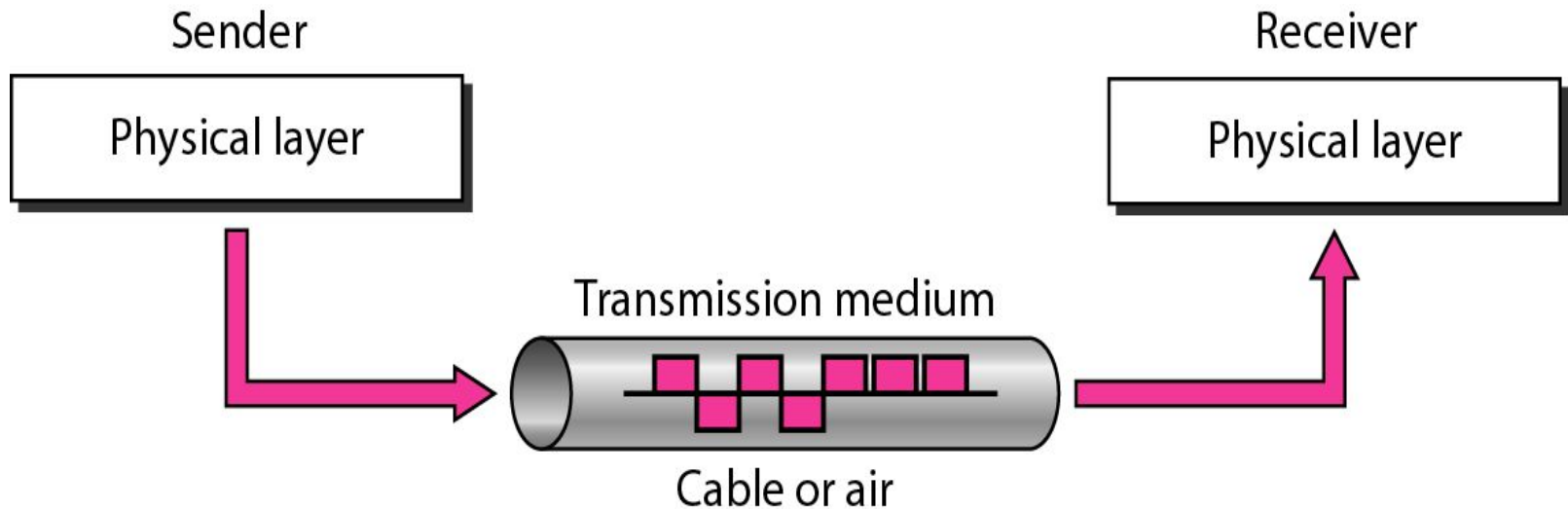


Figure: Transmission media

Transmission Media: Guided and Unguided Media

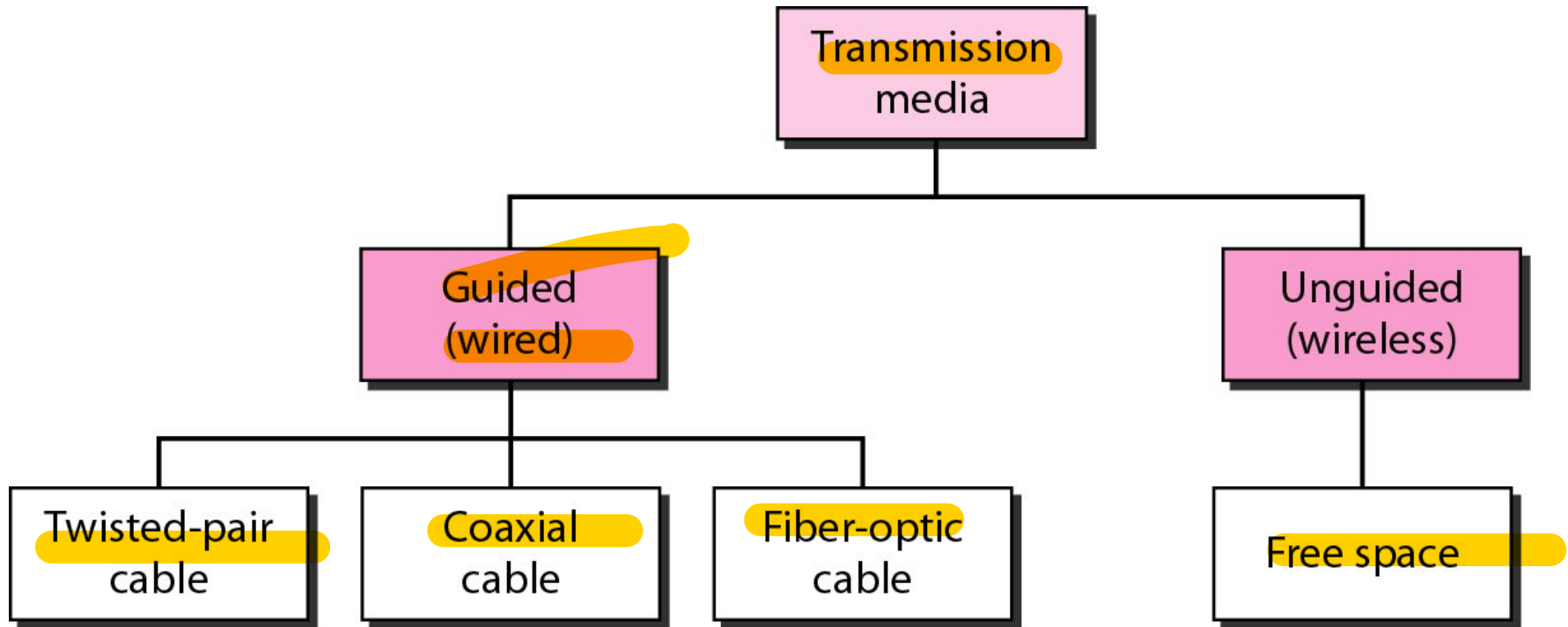


Figure: Transmission media types

Guided Transmission media

- Twisted pair cable
- Coaxial cable
- Fiber-optic cable

A signal traveling along any of these media is directed and contained by the physical limits of the medium.

Types of signals in medias:

- Twisted-pair and coaxial cable use metallic (copper) conductors that accept and transport signals in the form of electric current.
- Optical fiber is a cable that accepts and transports signals in the form of light.

Twisted-pair cable

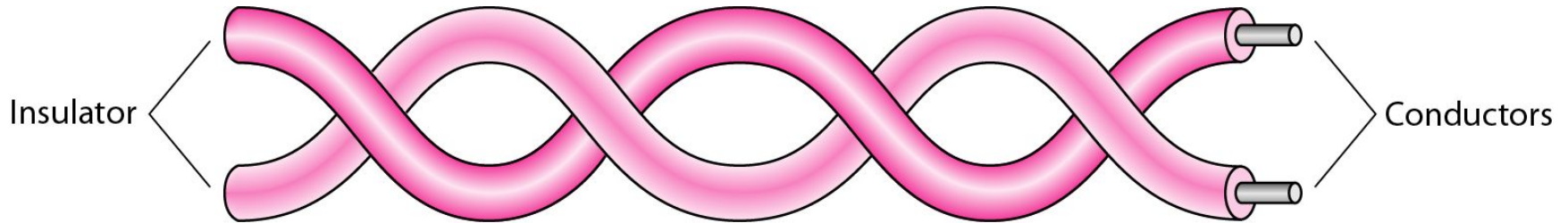
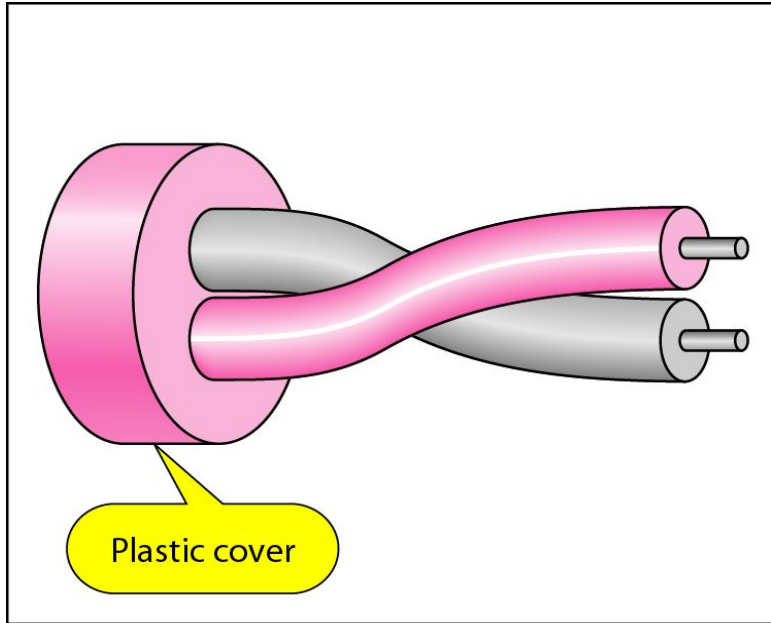


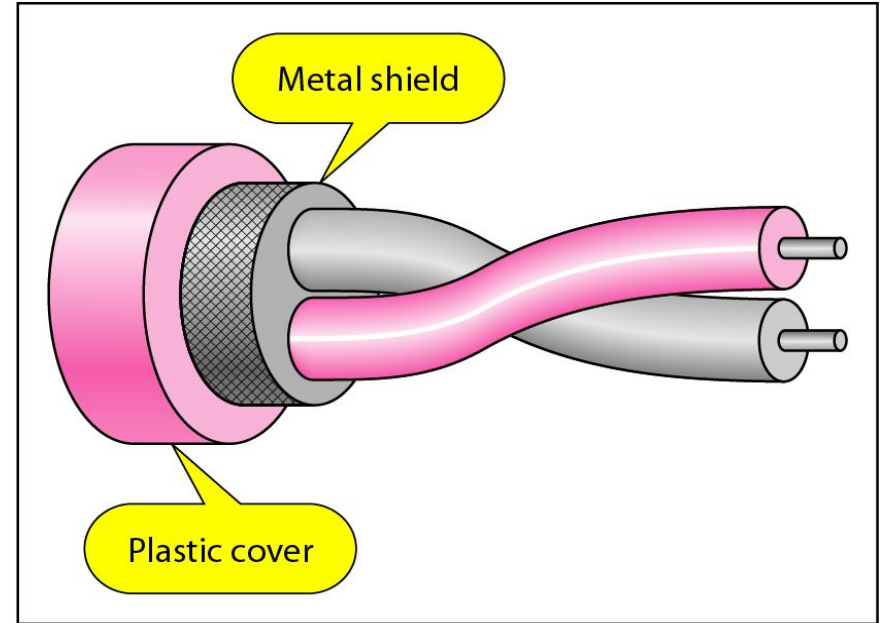
Figure: Twisted-pair cable

- A twisted pair consists of two conductors (normally copper), each with its own plastic insulation and twisted together.
- One of the wires is used to carry signals to the receiver, and the other is used only as a ground reference.
- The receiver uses the difference between the two.

UTP and STP cables



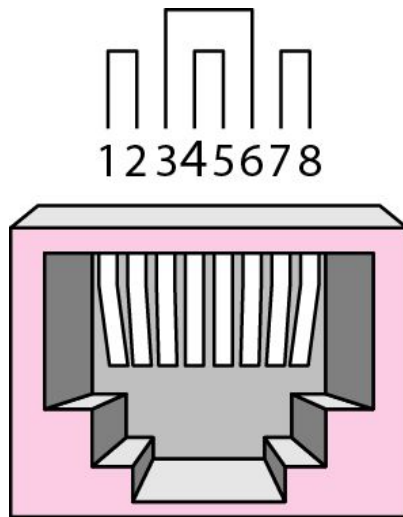
a. UTP



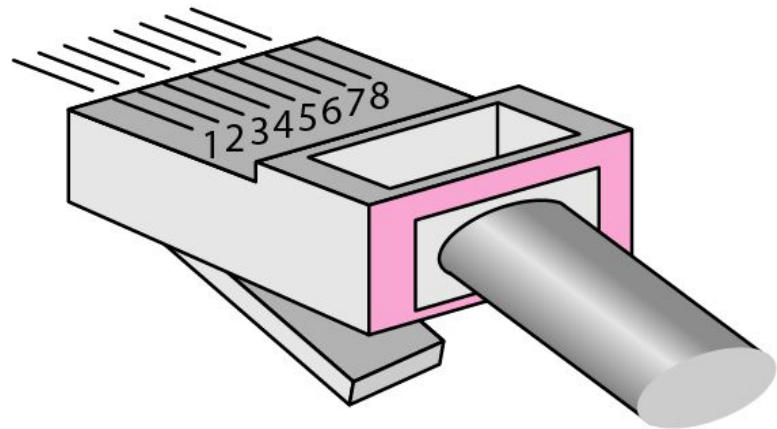
b. STP

Figure: Shielded and unshielded Cables

UTP & STP Connector



RJ-45 Female



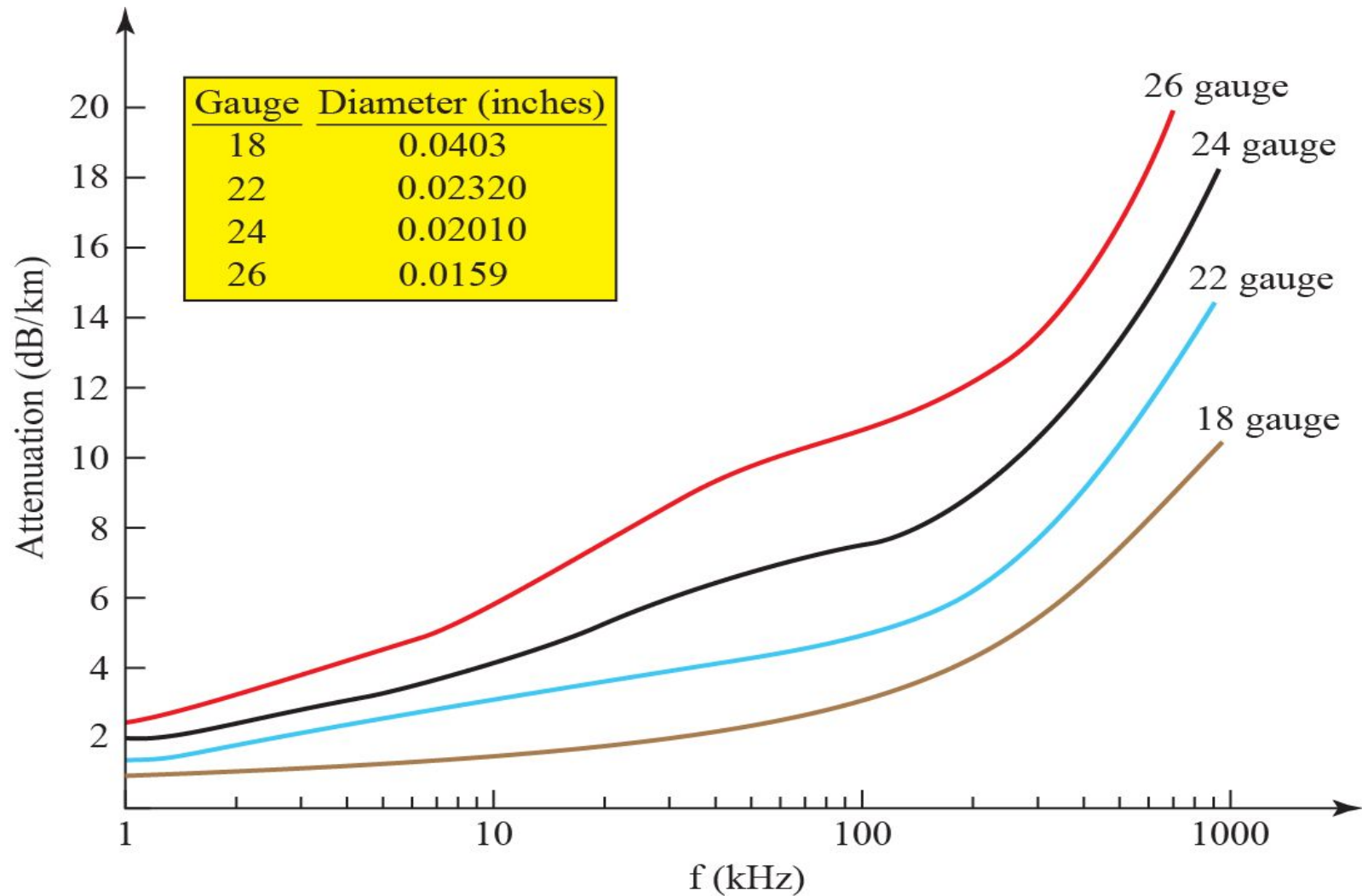
RJ-45 Male

Figure: Shielded and unshielded Cable Connector

Categories of unshielded twisted-pair cables

<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

Performance



Coaxial cable

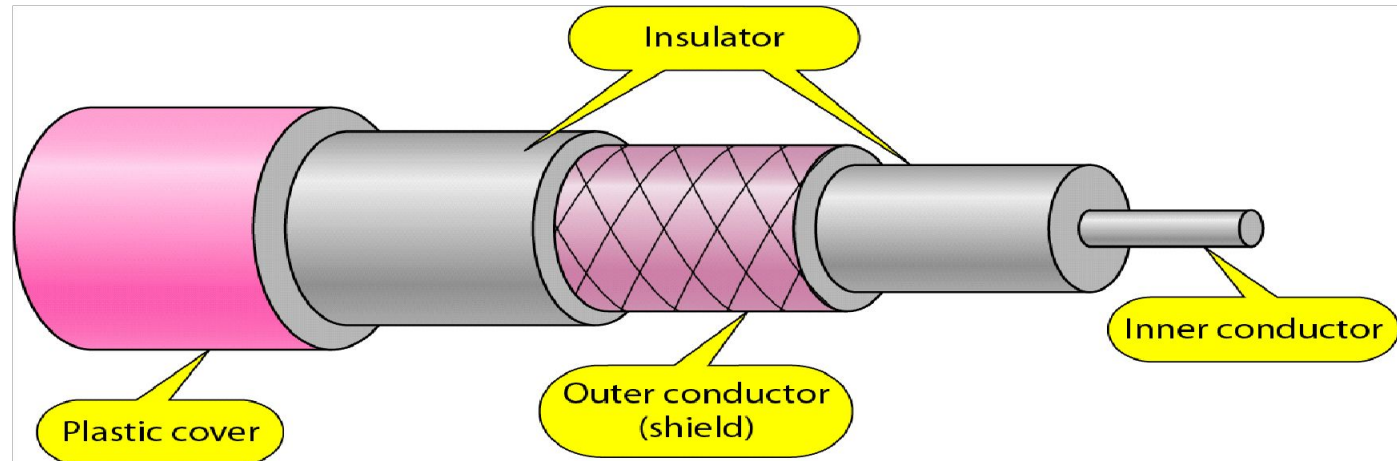
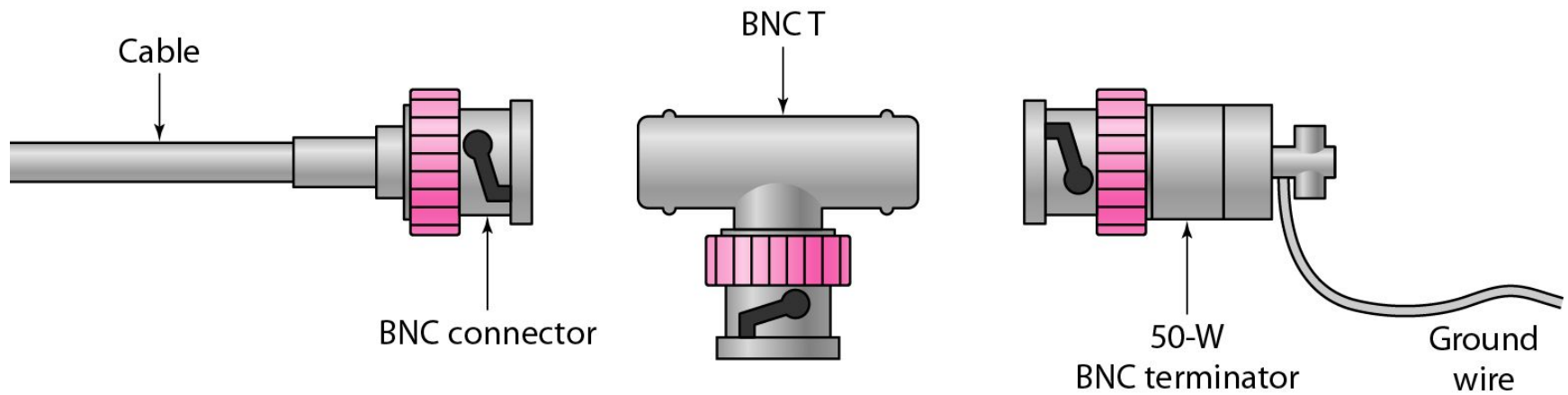


Figure: Co-axial cable

- Coaxial cable has a central core conductor of solid wire (usually copper) enclosed in an insulating sheath, which is, in turn, encased in an outer conductor of metal foil, braid, or a combination of two.
- The outer metallic wrapping serves both as a shield against noise and as the second conductor.
- The outer conductor is enclosed in an insulating sheath, and the whole cable is protected by a plastic cover.

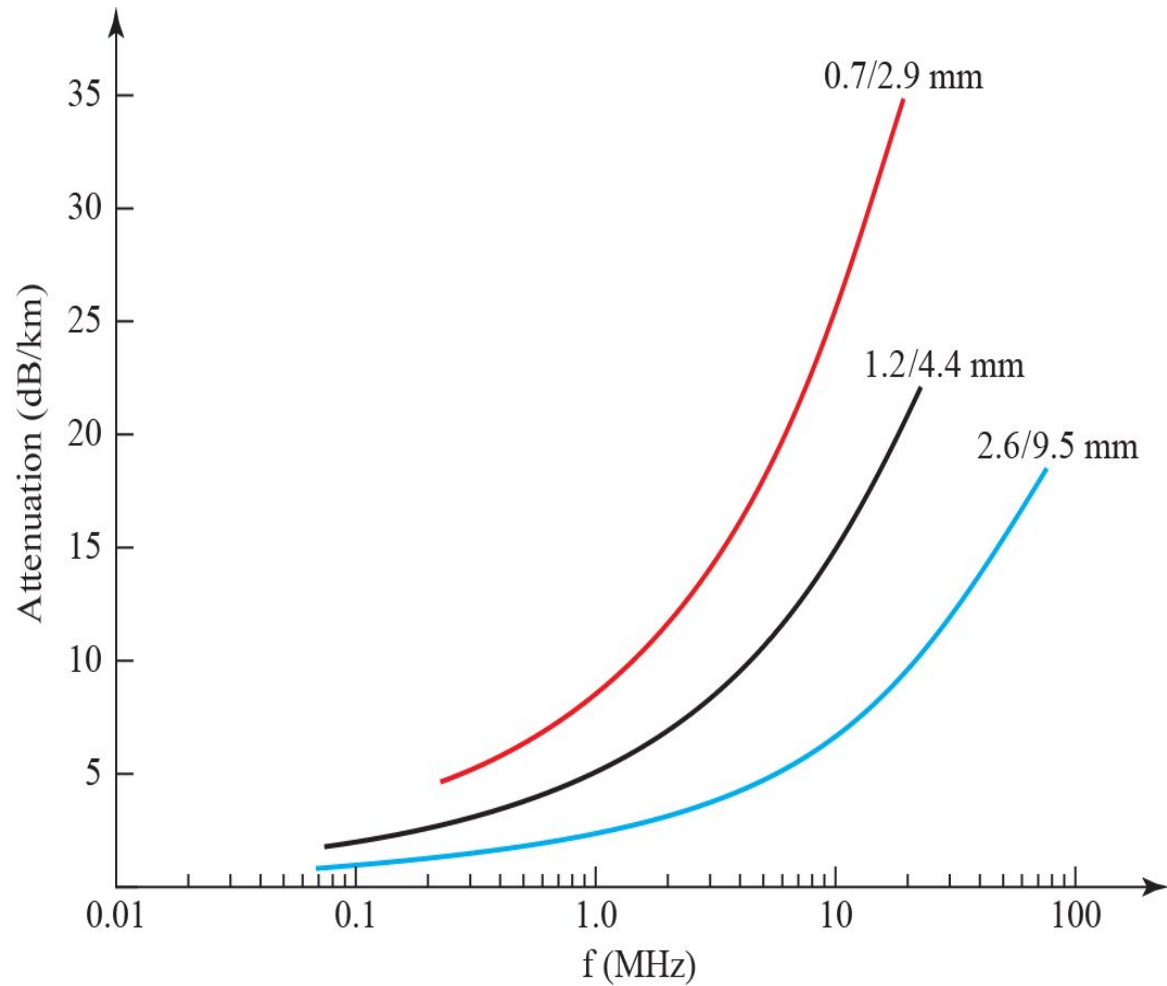
BNC connectors



Categories of coaxial cables

<i>Category</i>	<i>Impedance</i>	<i>Use</i>
RG-59	75 Ω	Cable TV
RG-58	50 Ω	Thin Ethernet
RG-11	50 Ω	Thick Ethernet

Performance



Optical fiber

- Optical fiber based communication is based on the phenomenon of total internal reflection

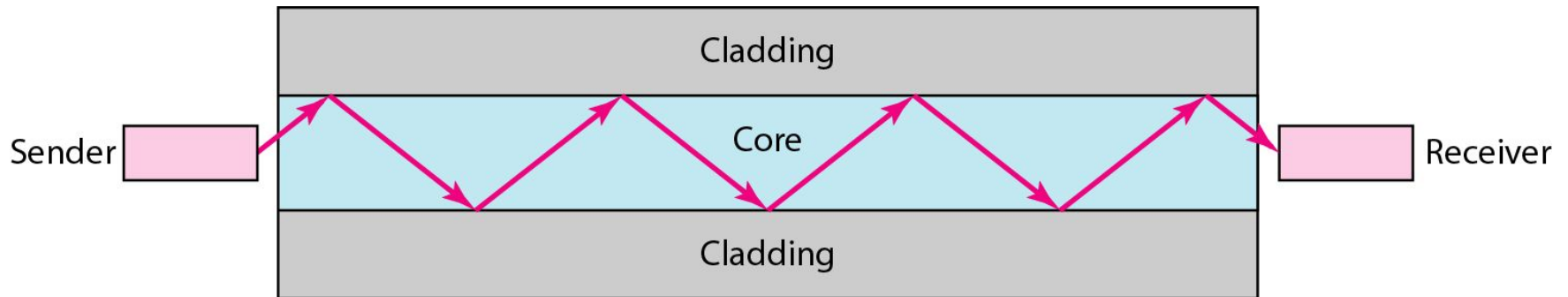
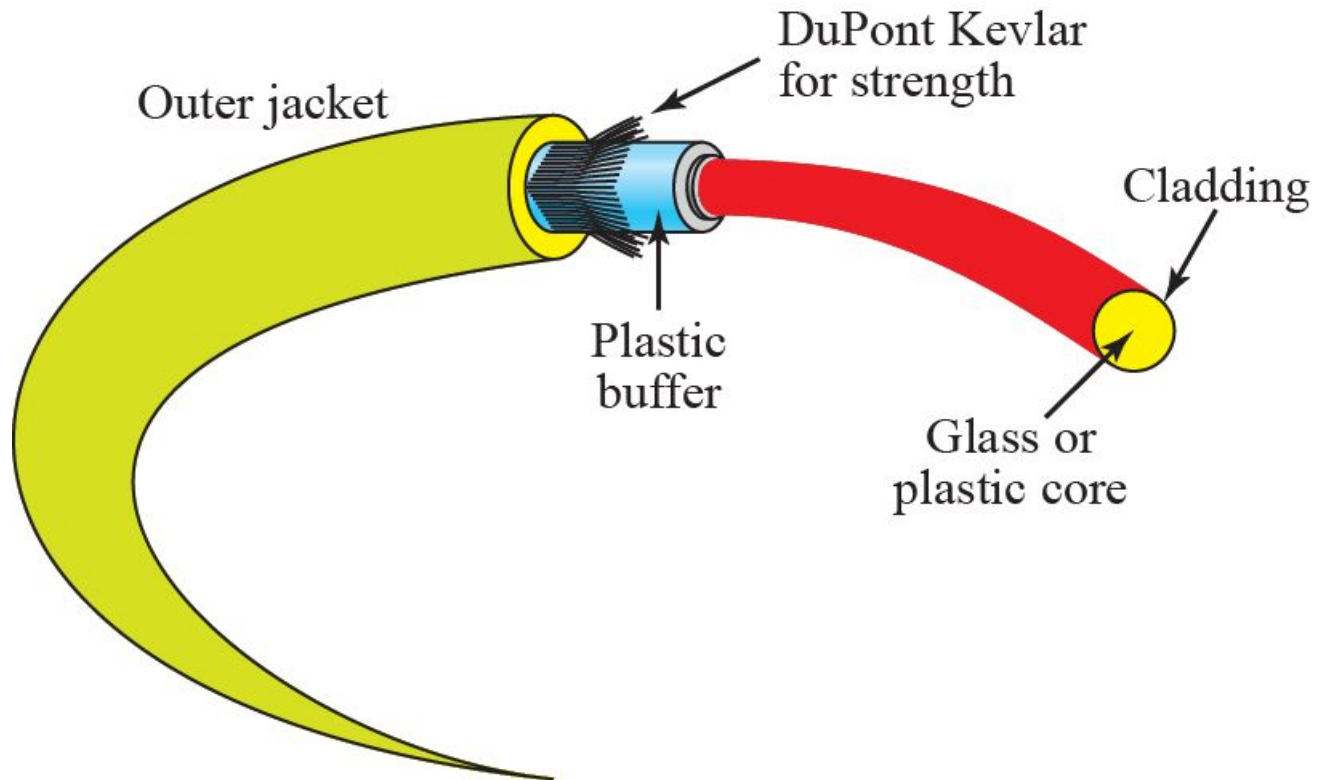
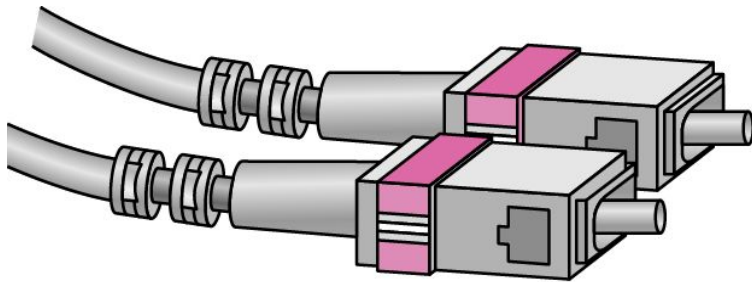


Figure: Internal view of an Optical fibre

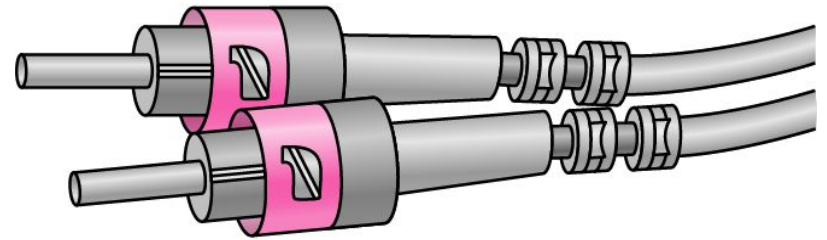
Fiber connection



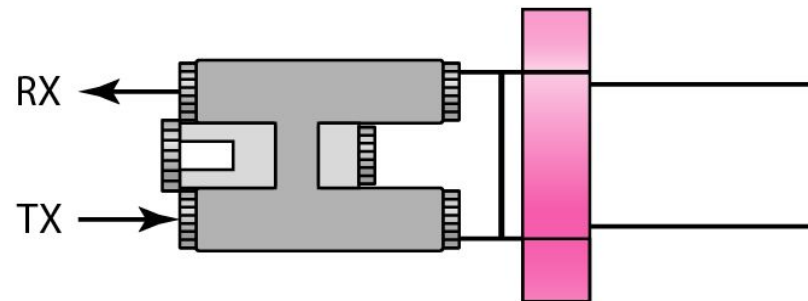
Fiber-optic cable connectors



SC connector



ST connector

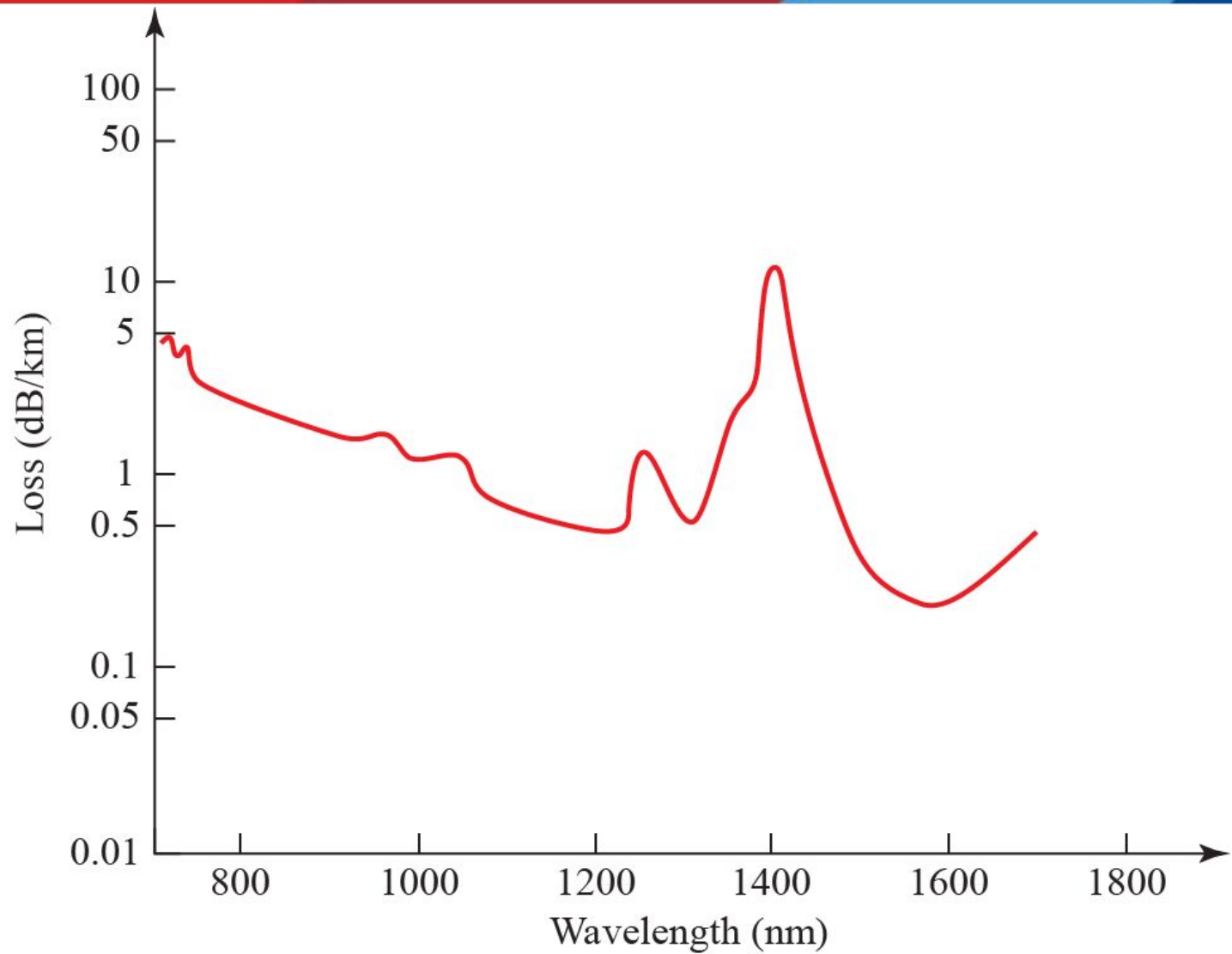


MT-RJ connector

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

Performance



UNGUIDED MEDIA: WIRELESS

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

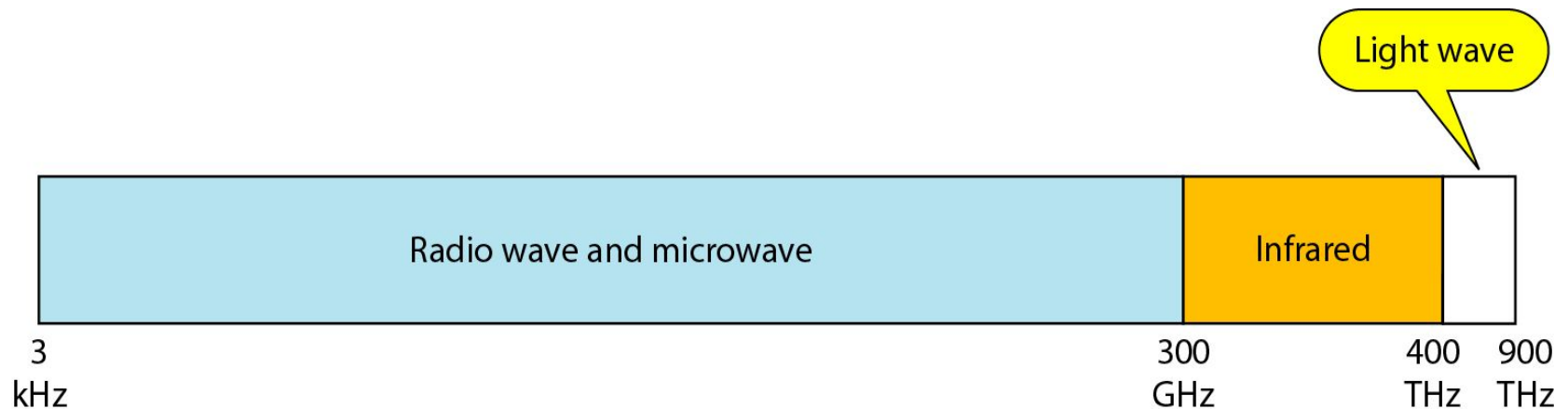


Figure: Electromagnetic spectrum for wireless communication

Bands

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

Wireless transmission waves

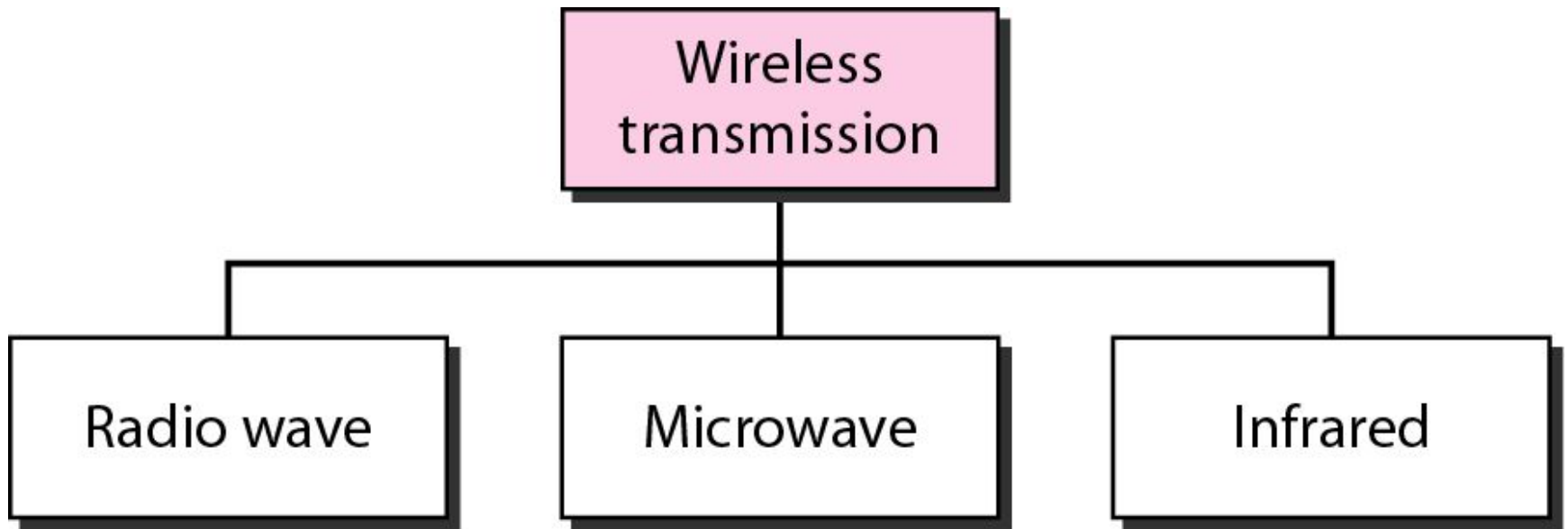
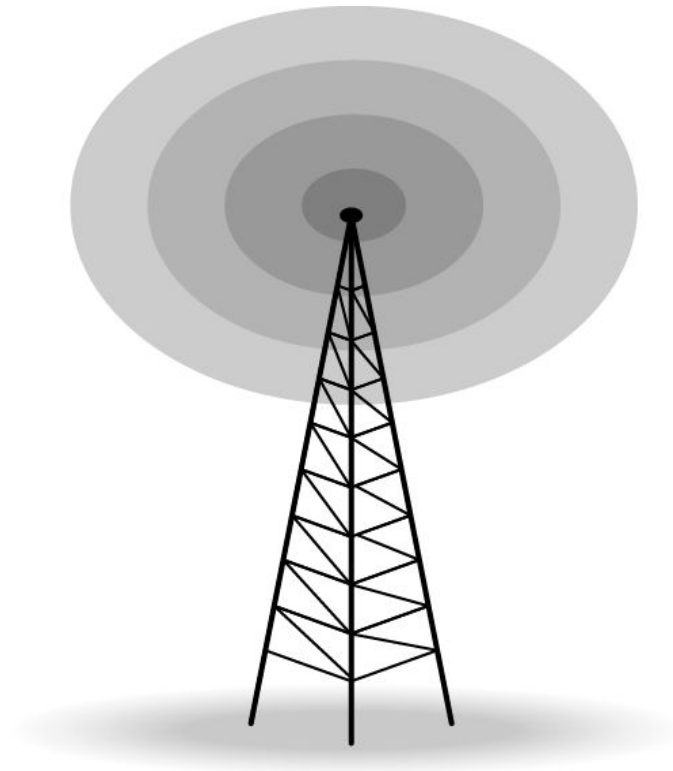


Figure: Categories of wireless transmission

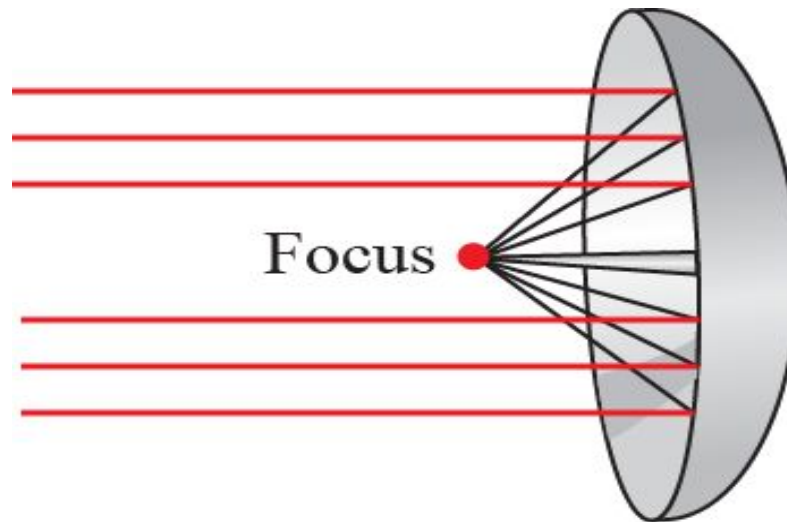
Categories of wireless transmission

- Radio waves (3KHz to 1GHz) are used for multicast transmission like radio, television etc.
 - RW are omnidirectional hence antenna alignment is not necessary.
 - Low frequency RW can penetrate walls.
- Microwave (1 – 300 GHz) is used for unicast transmission like cellular telephone, satellite networks and wireless LANs.
 - Microwave based communication is unidirectional.
- IR signals are used for short distance communication like TV remote etc.

Omnidirectional antenna



Unidirectional antenna



a. Parabolic dish antenna