# Computer Network Devices and Media

Munesh Singh

Indian Institute of Information Technology, Design and Manufacturing Kancheepuram,
Chennai, Tamil Nadu 600127

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# Various devices in Computer Networks

## Hardware devices

- Communication media
- Repeaters
- Hubs


## Hardware/Software devices

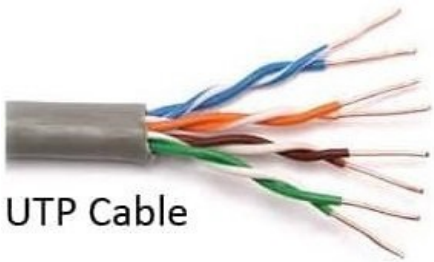
- Bridges
- Switches
- Routers
- Gateway
- Modem
- Firewall

# Types of Transmission media

- **Guided Media**: High Speed, Secure, and Used for Shorter Distance
  - Twisted Pair Cable
    - Unshielded Twisted Pair (UTP)
    - Shielded Twisted Pair (STP)
  - Coaxial Cable
  - Optical Fiber Cable
- **Unguided Media**
  - Radio waves
  - Microwaves
  - Infrared

# Twisted Pair Cable

- Unshielded Twisted Pair (UTP):
  - Least expensive
  - Easy to install
  - High speed capacity
  - Susceptible to external interference
  - Lower capacity and performance in comparison to STP
  - Short distance transmission due to attenuation
- Shielded Twisted Pair (STP):
  - Better performance at a higher data rate in comparison to UTP
  - Eliminates crosstalk
  - Comparatively faster
  - Comparatively difficult to install and manufacture
  - More expensive
  - Bulky

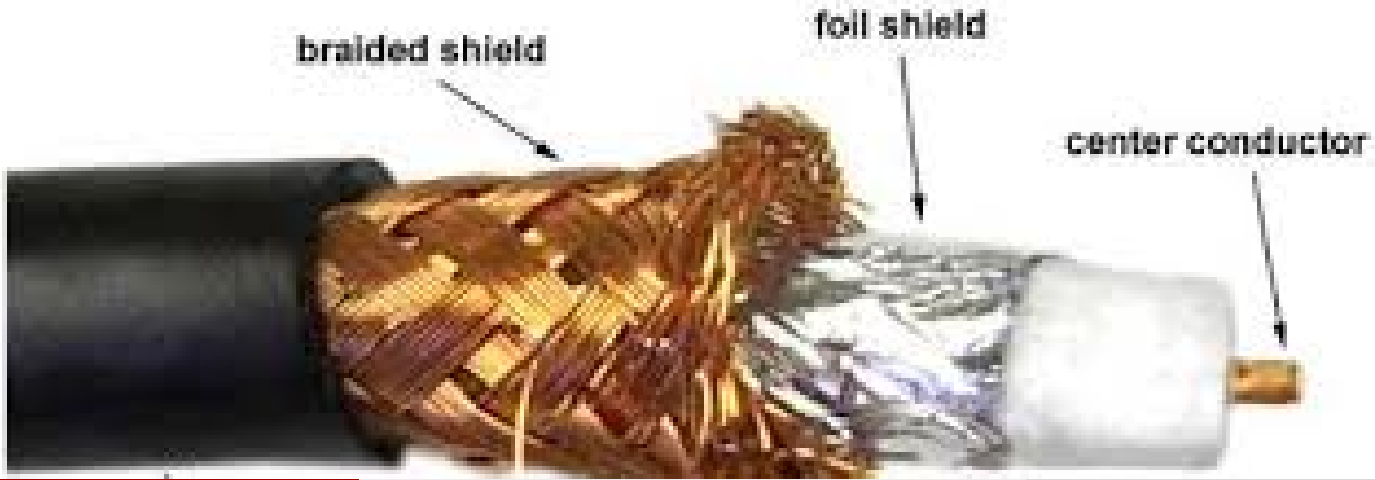

UTP Cable


STP Cable

| Name | Cable Type | Max. Data Rate | Bandwidth | Application |
|---|---|---|---|---|
| Cat1 | Twisted Pair | 1 Mbps | 0.4 MHz | Telephone and modem lines |
| Cat2 | Twisted Pair | 4 Mbps | 4 MHz | Older terminal systems, e.g. IBM 3270 |
| Cat 3 | Twisted Pair | 10 Mbps | 16 MHz | 10BASE-T and 100BASE-T4 Ethernet |
| Cat 4 | Twisted Pair | 16 Mbps | 20 MHz | 16Mbit/s Token Ring |
| Cat 5 | Twisted Pair | 100 Mbps | 100 MHz | 100BASE-TX & 1000BASE-T Ethernet |
| Cat5e | Twisted Pair | 1 Gbps | 100 MHz | 100BASE-TX & 1000BASE-T Ethernet |
| Cat 6 | Twisted Pair | 10 Gbps | 250 MHz | 10GBASE-T Ethernet |
| Cat 6a | Twisted Pair | 10 Gbps | 500 MHz | 10GBASE-T Ethernet |
| Cat 7 | Twisted Pair | 10 Gbps | 600 MHz | 10GBASE-T Ethernet or POTS/CATV/1000BASE-T over single cable |
| Cat 7a | Twisted Pair | 10 Gbps | 1000 MHz | 10GBASE-T Ethernet or POTS/CATV/1000BASE-T over single cable |
| Cat 8/8.1 | Twisted Pair | 40 Gbps | 1600-2000 MHz | 40GBASE-T Ethernet or POTS/CATV/1000BASE-T over single cable |
| Cat 8.2 | Twisted Pair | 40 Gbps | 1600-2000 MHz | 40GBASE-T Ethernet or POTS/CATV/1000BASE-T over single cable |

# Coaxial Cable

- Coaxial cable are the guided media that cranes the signal of higher frequency range compared to twisted pair cable.
- Types of Coaxial Cables
  - **Baseband**
  - **Broadband**
- A baseband coaxial cable transmits a single signal at a time at very high speed.
- A broadband coaxial cable can transmit many simultaneous signals using different frequencies.
- It provides better immunity than twisted pair.

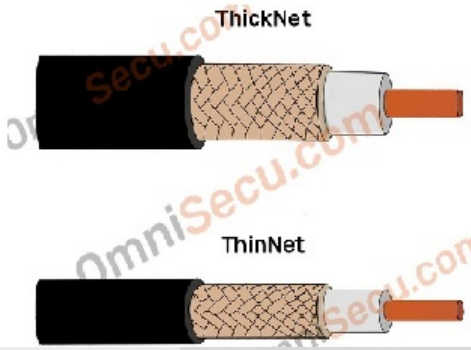


# Coaxial Cable standard

- Advantages:
  - It can be used for both analog and digital transmission.
  - It offers higher bandwidth as compared to twisted pair cable and can span longer distances.
  - Because of better shielding in coaxial cable, loss of signal or attenuation is less.
  - Better shielding also offers good noise immunity.
  - It is relatively inexpensive as compared to optical fibers.
  - It has lower error rates as compared to twisted pair.
  - It is not as easy to tap as twisted pair because copper wire is contained in plastic jacket.
- Disadvantage:
  - It is usually more expensive than twisted pair.

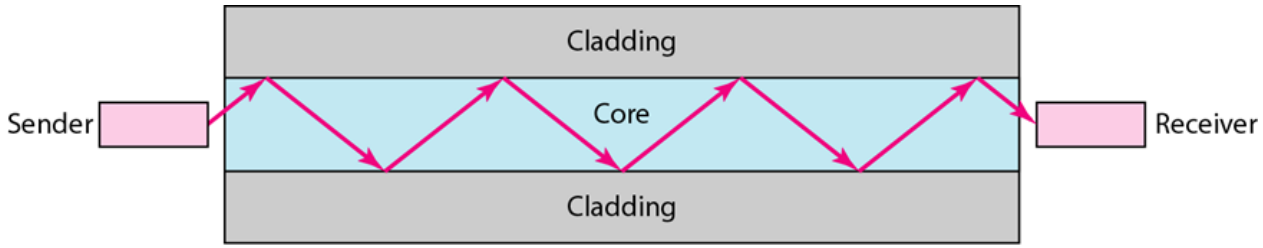
IEEE-802.3-Specification-for-10Mbps-baseband-co-axial cable Bus Lan

| Sr.No. | Parameter | 10 BASE 5 | 10 BASE 2 |
|---|---|---|---|
| 1 | DataRate | 10 Mbps | 10 Mbps |
| 2 | Maxium segment | 500m | 185m |
| 3 | length | 2500m | 1000m |
| 4 | Network span | 100m | 30m |
| 5 | Nodes per | 2.5m | 0.5m |
| 6 | segment | 1 cm | 0.5cm |
| | Node spacing | | |
| | Cable Daimeter | | |



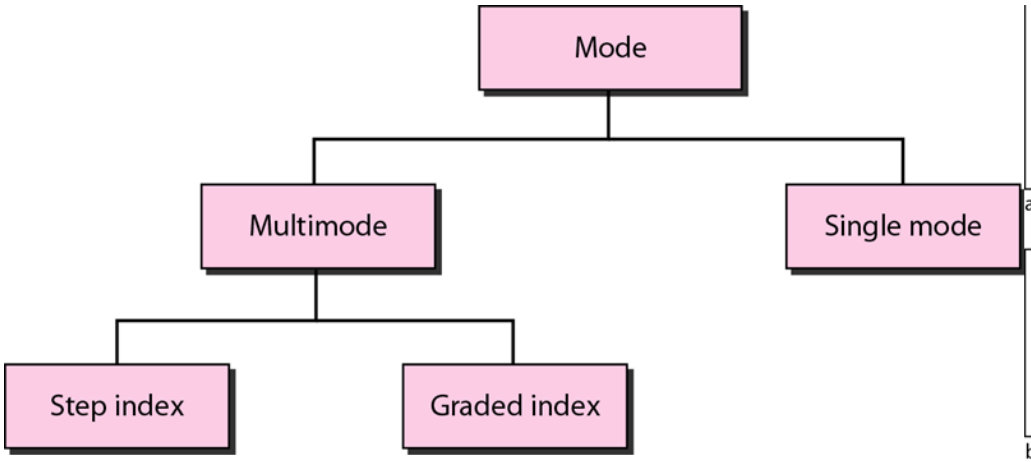
# Fibre Optics

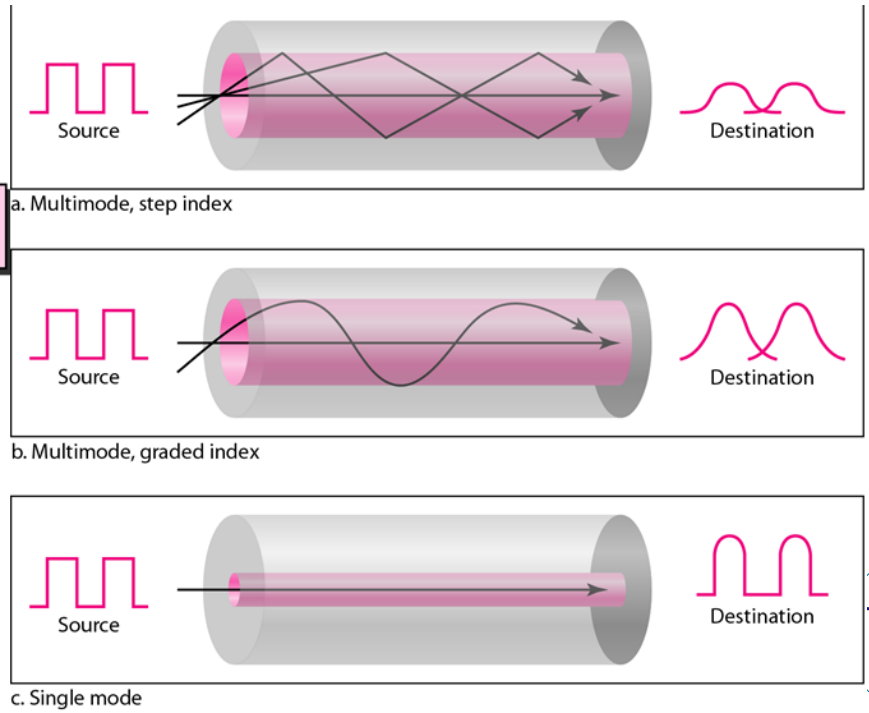
- It uses the concept of reflection of light through a core made up of glass or plastic
- The core is surrounded by a less dense glass or plastic covering called the cladding
- The cable can be unidirectional or bidirectional
- WDM (Wavelength Division Multiplexer) supports two modes.
- **Advantages & Disadvantages**:
  - Increased capacity and bandwidth
  - Light weight
  - Less signal attenuation
  - Immunity to electromagnetic interference
  - Resistance to corrosive materials
  - Difficult to install and maintain, High cost, Fragile



# Propagation modes

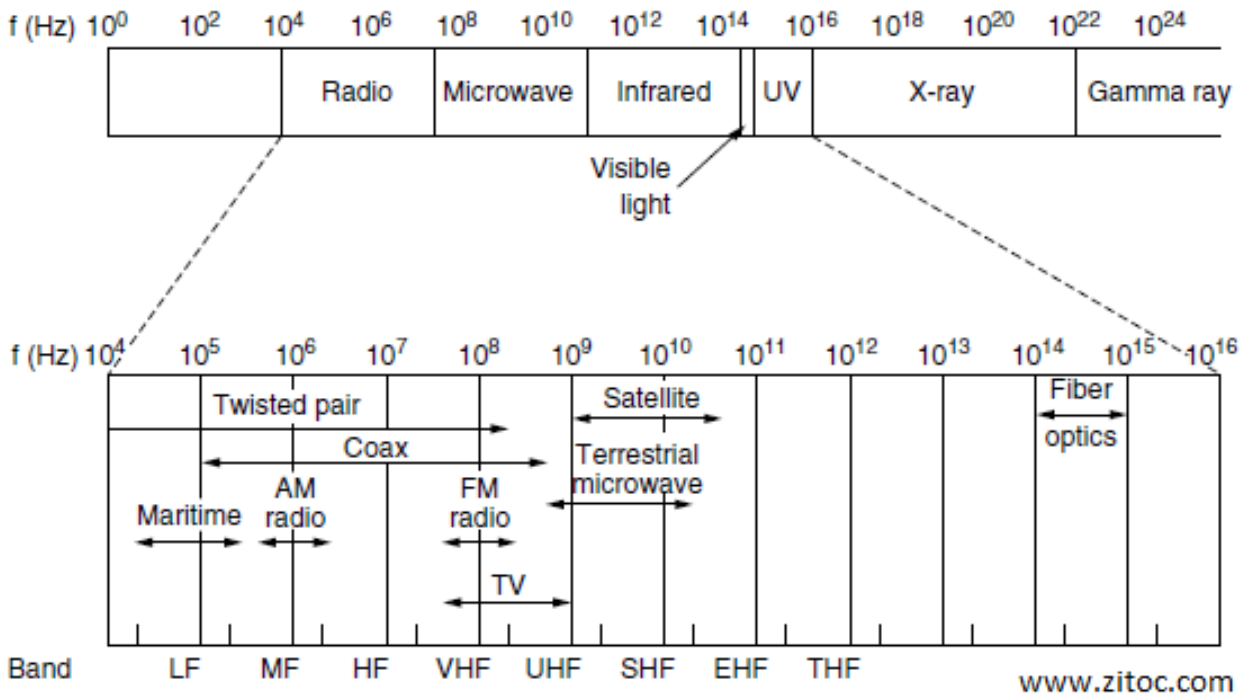
- 100BaseFX is simply Fast Ethernet over fiber
- 100BaseFX & 1000BaseF runs over multi-mode fiber
- Index here refers to the index of refraction
  - **step index fiber**:the density of the core remains constant from the center to the edges.
  - **graded index fiber**: the density of the core higher than the edges.



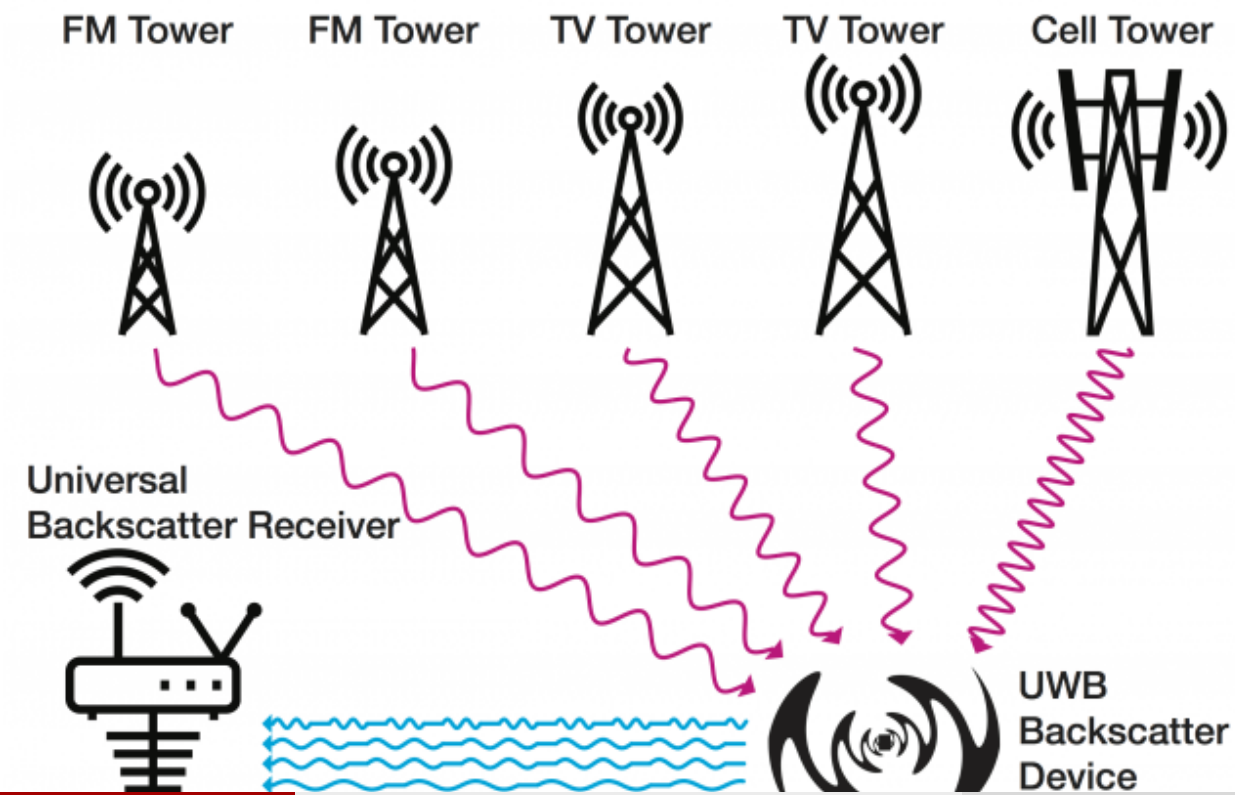
# Unguided Media

- Unguided media transport electromagnetic waves without using a physical conductor
- This type of communication is often referred to as wireless communication.
- Signal is broadcasted through air, less Secure, and used for larger distances



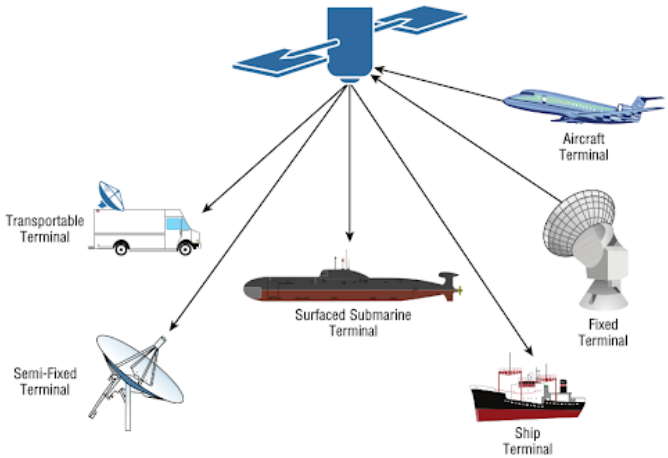
# Radiowaves

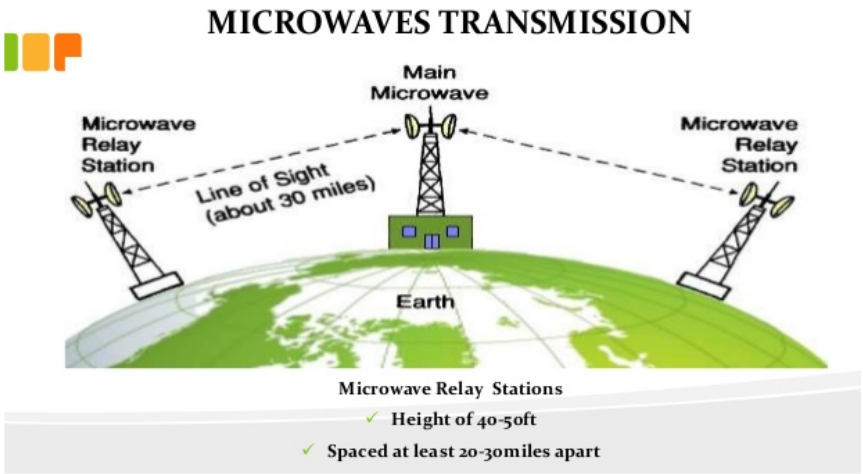
- These are easy to generate and can penetrate through buildings
- The sending and receiving antennas need not be aligned
- Frequency Range:3KHz  1GHz. AM and FM radios and cordless phones use Radiowaves for transmission
  - Terrestrial
  - Satellite.



# Microwaves

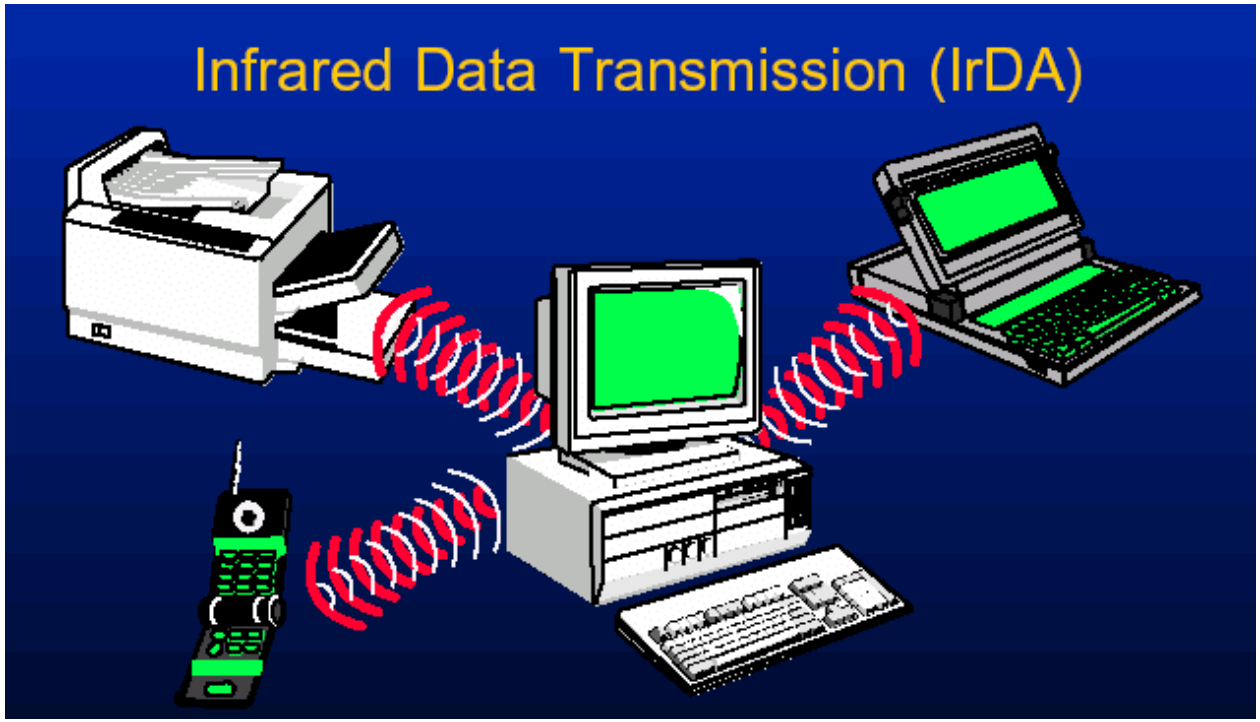
- It is a line of sight transmission i.e. the sending and receiving antennas need to be properly aligned with each other
- The distance covered by the signal is directly proportional to the height of the antenna
- Frequency Range:1GHz  300GHz. These are majorly used for mobile phone communication and television distribution
- Higher frequency range cannot penetrate walls



# Infrared

- Infrared waves are used for very short distance communication
- They cannot penetrate through obstacles.
- This prevents interference between systems
- Frequency Range:300GHz  400THz.
- It is used in TV remotes, wireless mouse, keyboard, printer, etc.



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