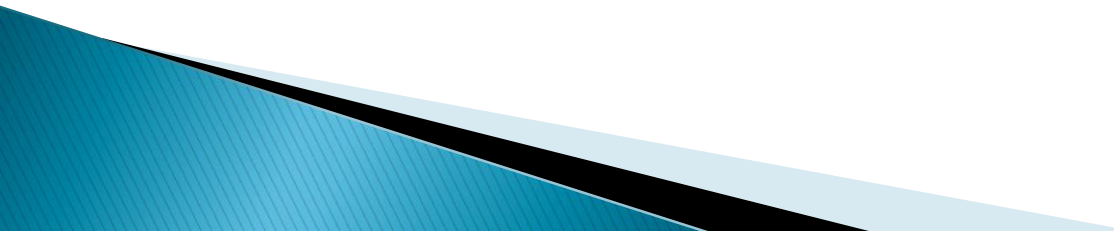
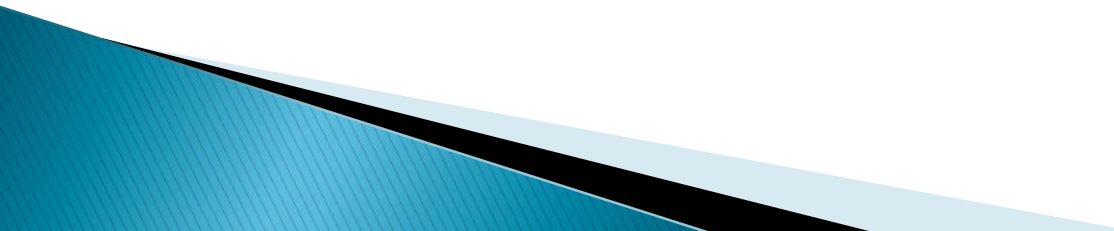


Unguided/Wireless Media

- ▶ Wireless media transports electromagnetic waves without using a physical conductor.
 - ▶ Signals are broadcast through air and are available to anyone who has a device of capable of receiving them.
 - ▶ Ranges from 3kHz to 900 THz.
 - ▶ Radio, Microwave and Satellite.
- 

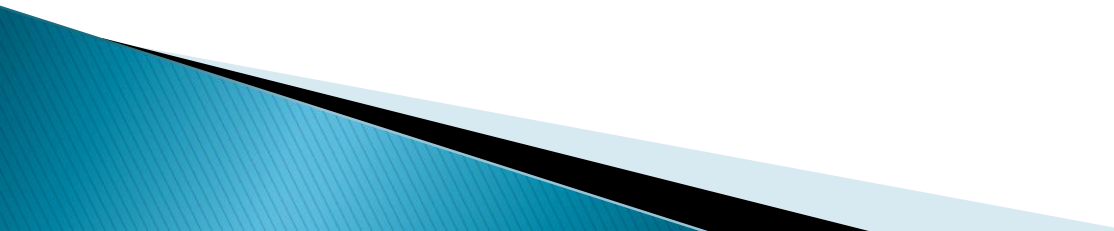
Ways of Transmit signals

- ▶ Ground Propagation
 - ▶ Sky Propagation
 - ▶ And, Line of Sight Propagation
- 

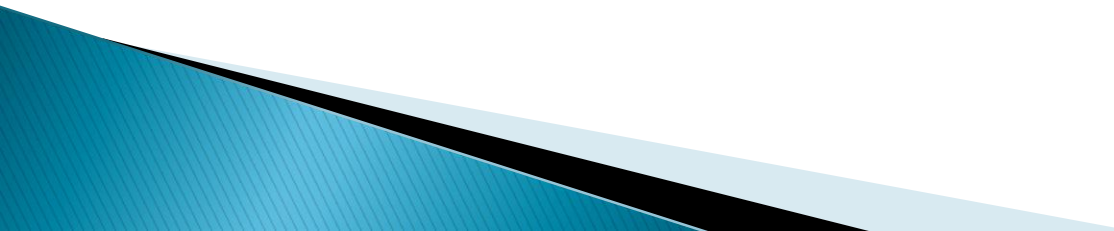
Ground Propagation

- ▶ Radiowaves travel through lowest portion of atmosphere close to the earth.
- ▶ These are LF signals that travel in all the directions from transmitting antenna and follow the curvature of earth.
- ▶ More the Power = More the Distance covered.
- ▶ For e.g. Radio Transmission (Akashwani Jalandhar.)

Sky Propagation

- ▶ HF radiowaves are sent upward into ionosphere.
 - ▶ From ionosphere these signals are reflected back to the surface of earth.
 - ▶ Less Power is needed and IONS are present in Ionosphere.
- 

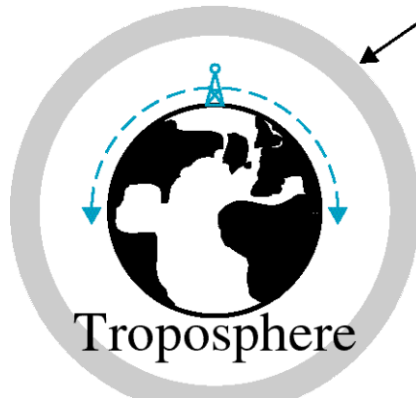
Line of sight Propagation

- ▶ It uses VHF signals that are transmitted in a straight line path from one antenna to another.
 - ▶ It requires proper placement of antennas in terms of their *heights* and *distance*.
 - ▶ For e.g. Mobile Towers.
- 

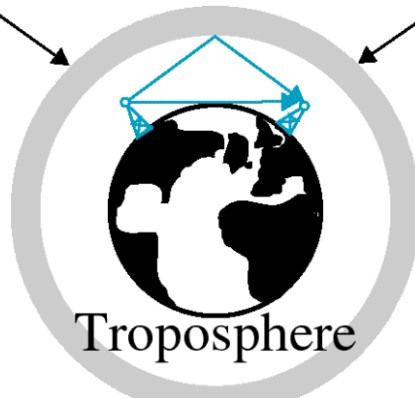
Propagation Types

Ionosphere

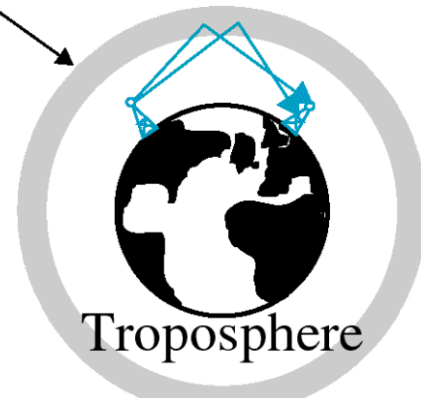
Ionosphere



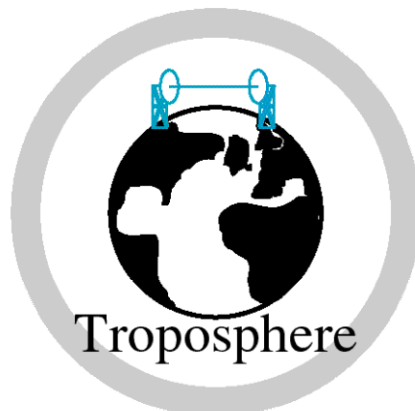
Surface



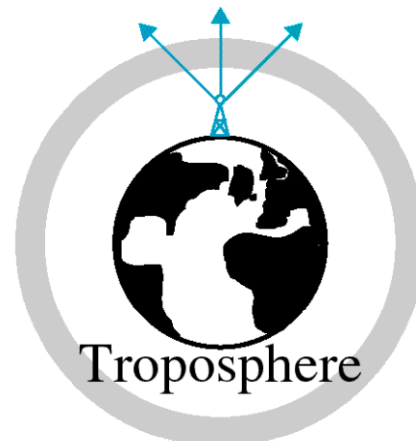
Tropospheric



Ionospheric



Line-of-sight



Space

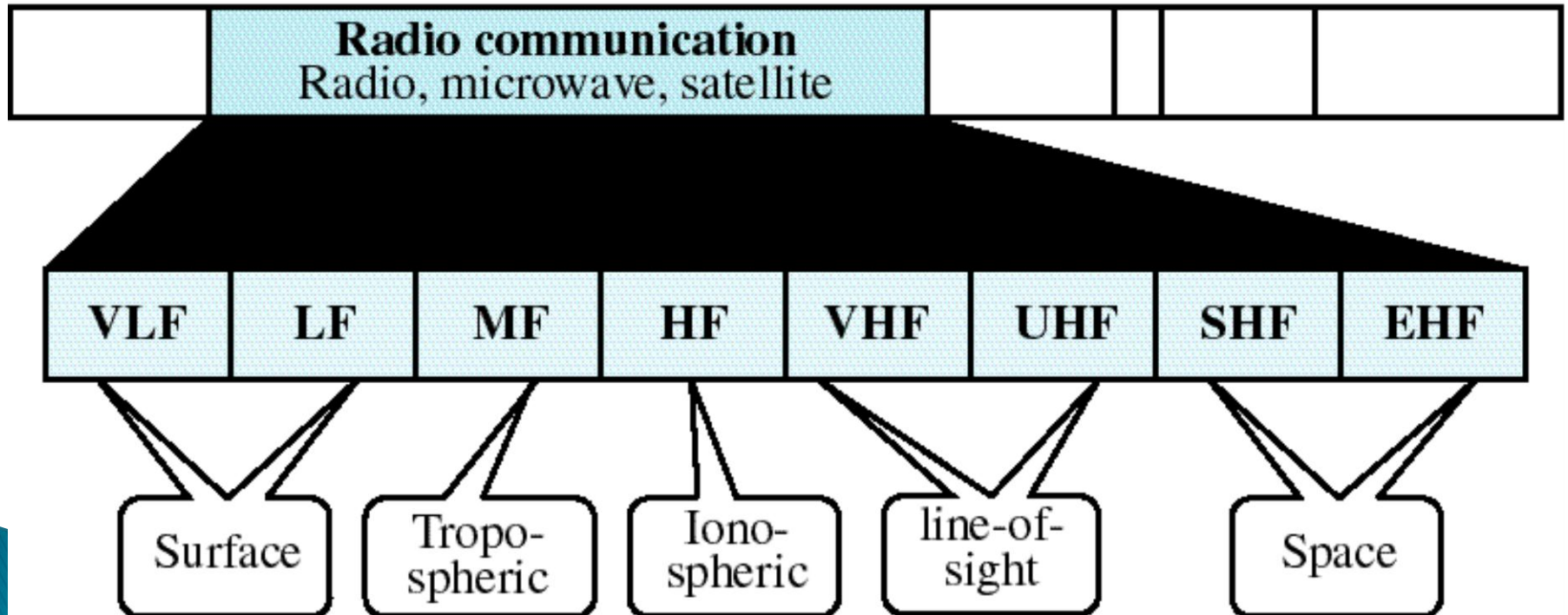
Radio Communication Band

VLF Very low frequency
LF Low frequency
MF Middle frequency
HF High frequency

VHF Very high frequency
UHF Ultra high frequency
SHF Super high frequency
EHF Extremely high frequency

3 KHz

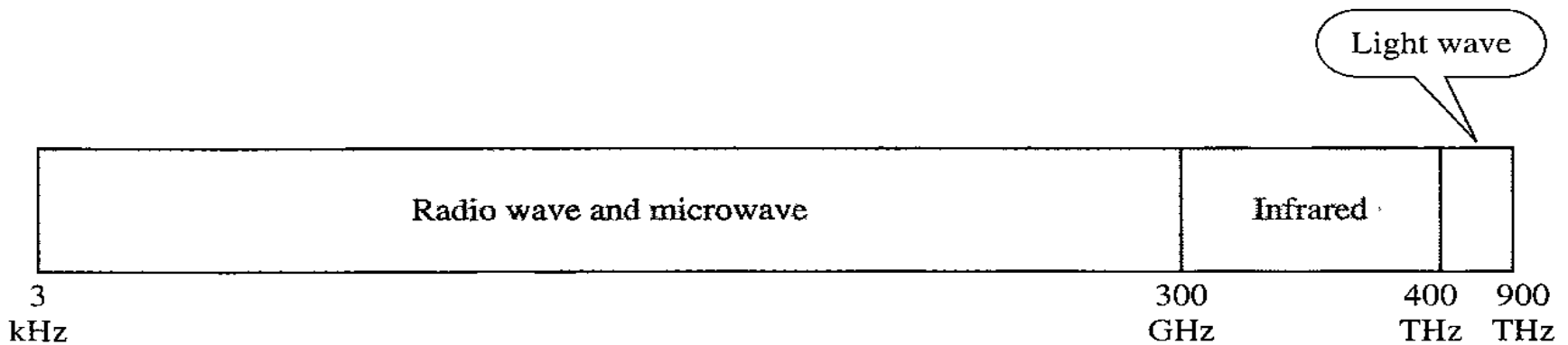
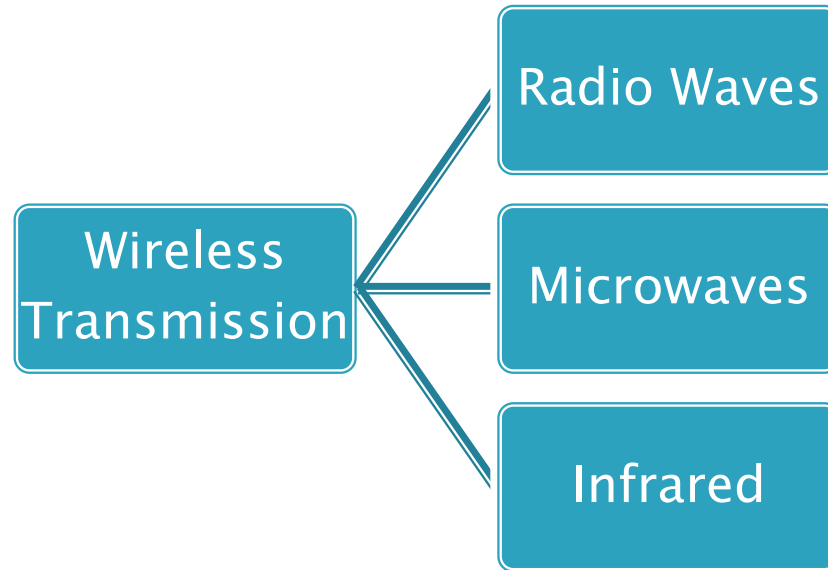
300 GHz



Frequency Range

Band	Range	Propagation	Application
VLF	3-30 kHz	Ground	Long Range radio navigation and submarine comm.
LF	30-300 kHz	Ground	Radio beacons & navigational locators
MF	300 kHz-3MHz	Sky	AM Radio
HF	3-30MHz	Sky	Ship/Aircraft comm., Telephone, Fax.
VHF	30-300MHz	Sky & Line of Sight	VHF TV, FM radio.
UHF	300 MHz-3GHz	Line of Sight	UHF TV, Mobile Telephone, Cellular Radio.
SHF	3-30 GHz	Line of Sight	Satellite Comm., Radar Comm.
EHF	30-300 GHz	Line of Sight	Radar, Satellite Comm., Experimental Comm.

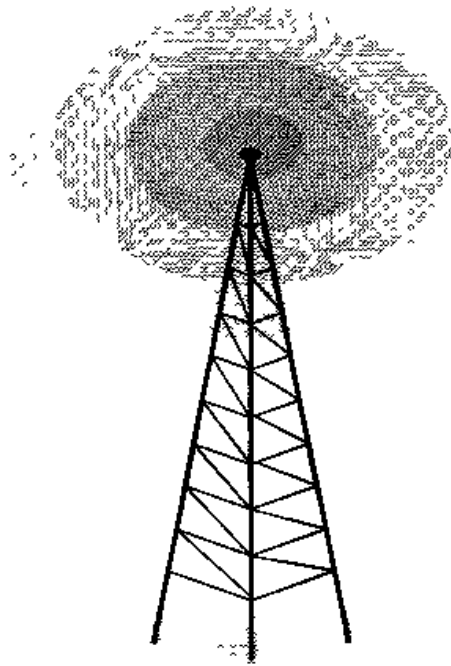
Frequency Range...



Radiowaves Transmission

- ▶ The radio wave have frequencies between 3kHz and 1GHz.
- ▶ Radiowaves are omni directional.
- ▶ These waves can penetrate through buildings.
- ▶ Radio waves are subject to interferences from motors and other electrical equipments.
- ▶ They are also absorbed by rain.
- ▶ In VLF, LF, MF bands radiowaves follow the ground.
- ▶ In HF and VHF bands radiowaves are send upward into ionosphere where they are reflected back to earth.
- ▶ Radio waves are widely used for AM and FM radio, Television, Cellular Phones and Wireless LAN.

Radiowaves Transmission...



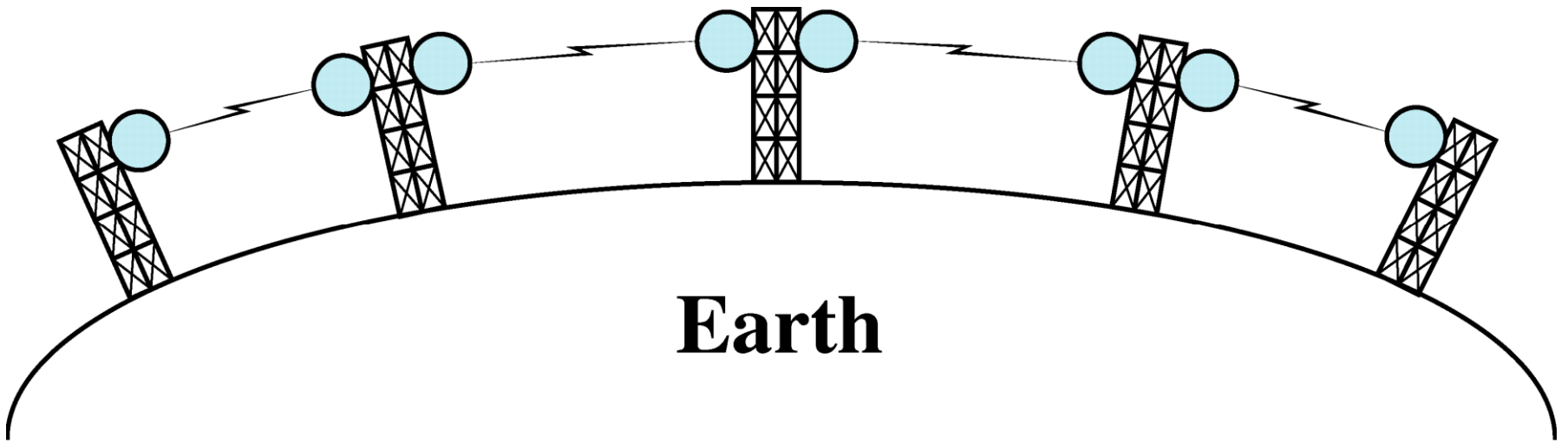
Microwave Transmission

- ▶ These are electromagnetic waves having frequencies between 1GHz and 300 GHz.
- ▶ There are two types of microwave transmission:
 - Terrestrial
 - Satellite

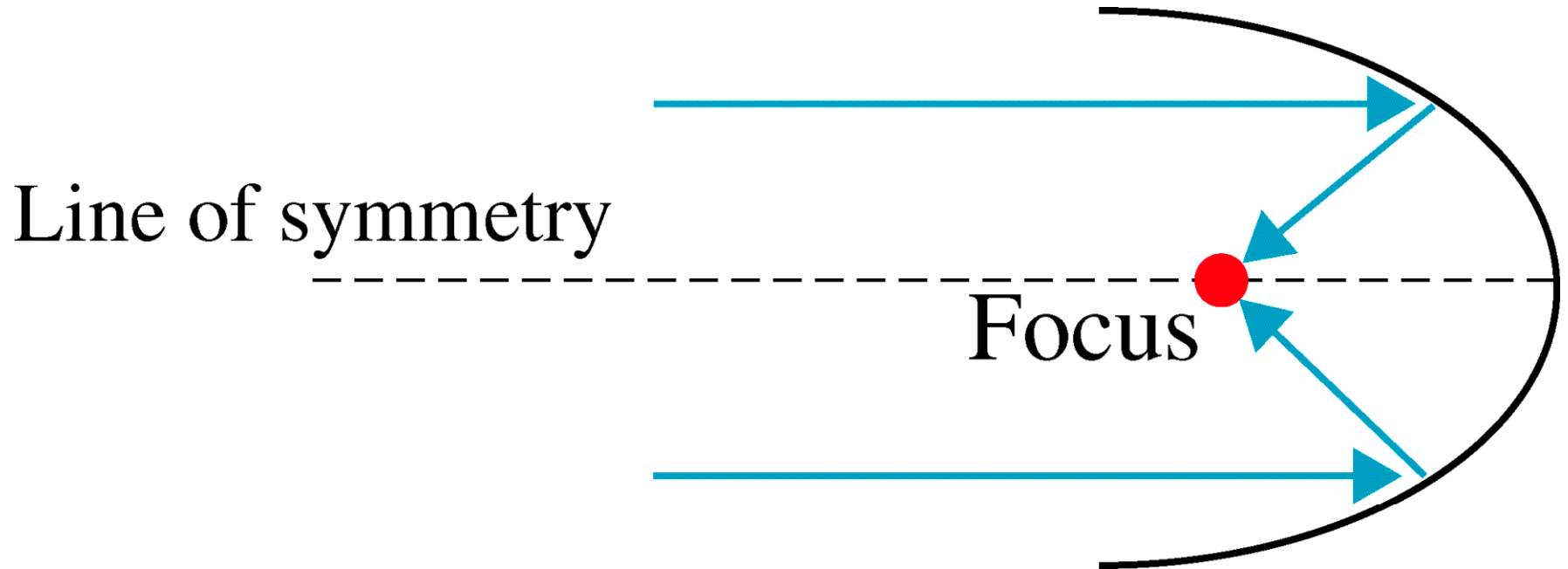
Terrestrial Microwave System

- ▶ It is unidirectional i.e. travel in straight line.
- ▶ Repeaters are required to strengthen the signals.
- ▶ Requires line of sight propagation.
- ▶ Distance covered by a line of sight signal depends upon the height of antenna.
- ▶ In it Transceivers are used which are capable of both transmitting and receiving the signals.
- ▶ Very high frequency microwaves cannot penetrate walls.
- ▶ High data rate transfer should be possible due to its relatively wide band property, almost 299 GHz and that needs permission to use from government authorities.
- ▶ Mainly used for one to one communication.
- ▶ For. e.g. Campus 1 connected with Campus 2 with Microwave Antennas *or* Mobile Tower 1 to Mobile Tower 2.

Terrestrial Microwave

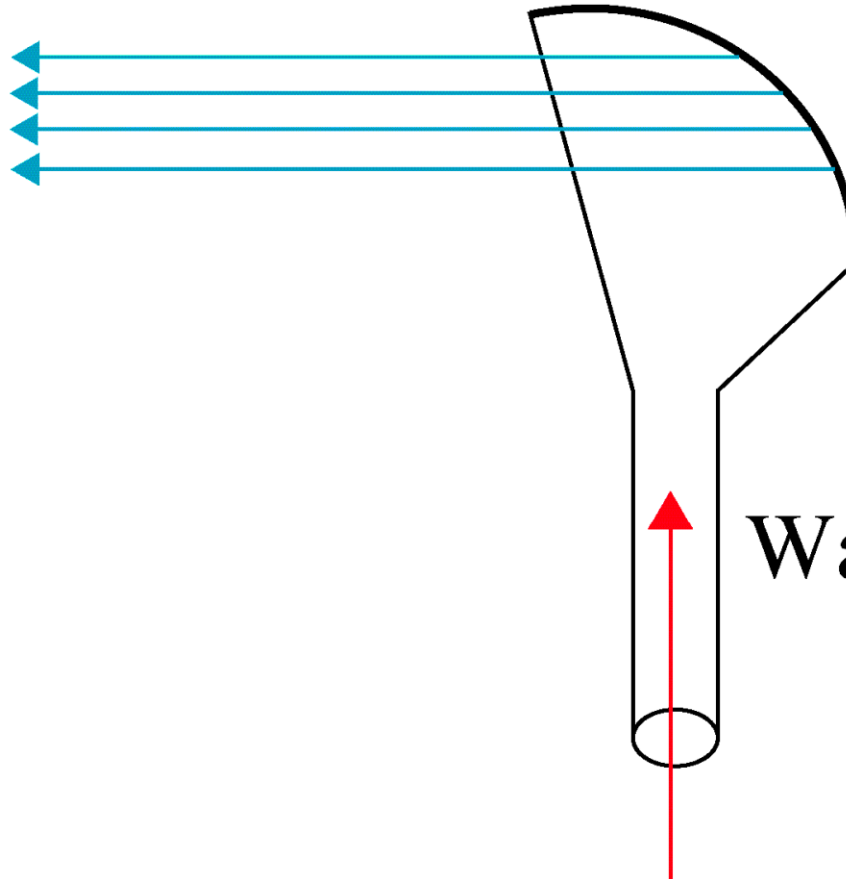


Parabolic Dish Antenna



Horn Antenna

Narrow beam of
microwave
transmission

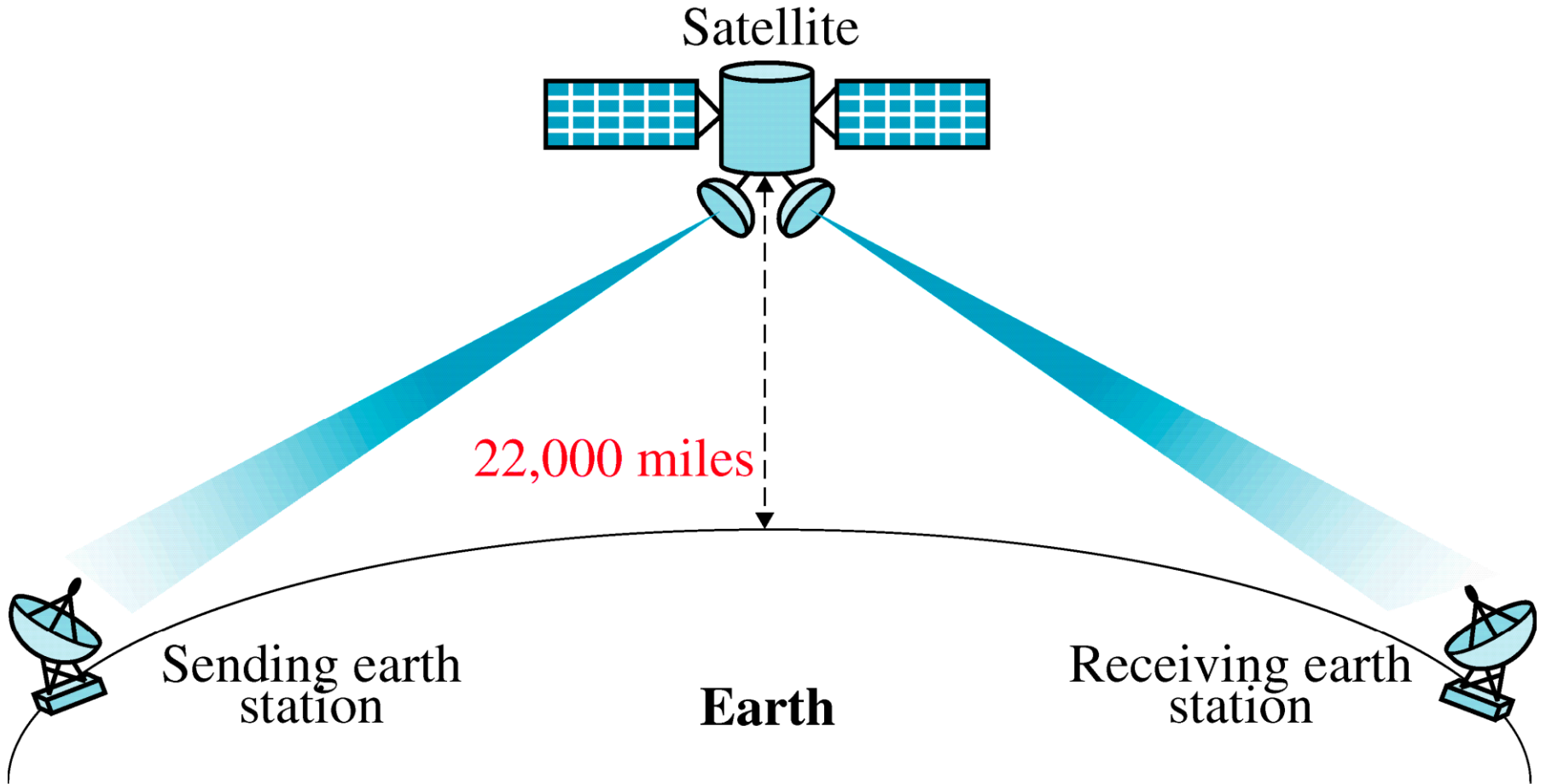


Wave guide


Satellite Transmission

- ▶ A satellite is a body that revolves around the earth.
- ▶ Natural or Artificial/Man-made
- ▶ Man-made satellites are used for communication purposes
 -
- ▶ The paths in which satellites move are called Orbits.
- ▶ A communication satellite acts as a big microwave repeater in the sky.
- ▶ Satellite communication makes use of Geostationary satellites (placed at 36,000 km approx. above equator Exact=35,800).
- ▶ Geostationary satellite contains many Transponders i.e. receives signals from 1 earth station, Amplifies it and sends the signal back to other earth station.
- ▶ Signal Transmitted upward to satellite = UPLINK.
- ▶ Signal Transmitted back to receiving earth station = DOWNLINK.
- ▶ Both UPLINK & DOWNLINK frequencies are different.

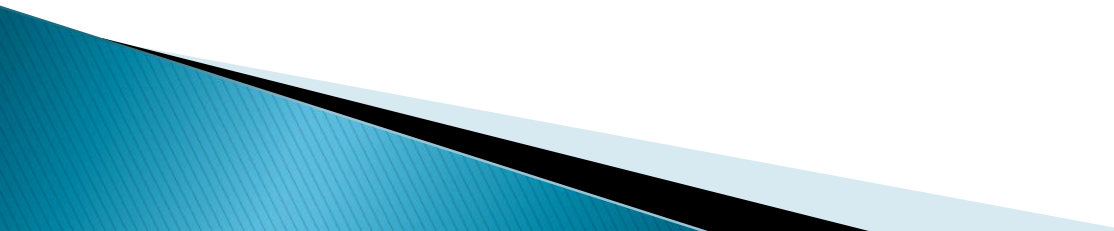
Satellite Communication



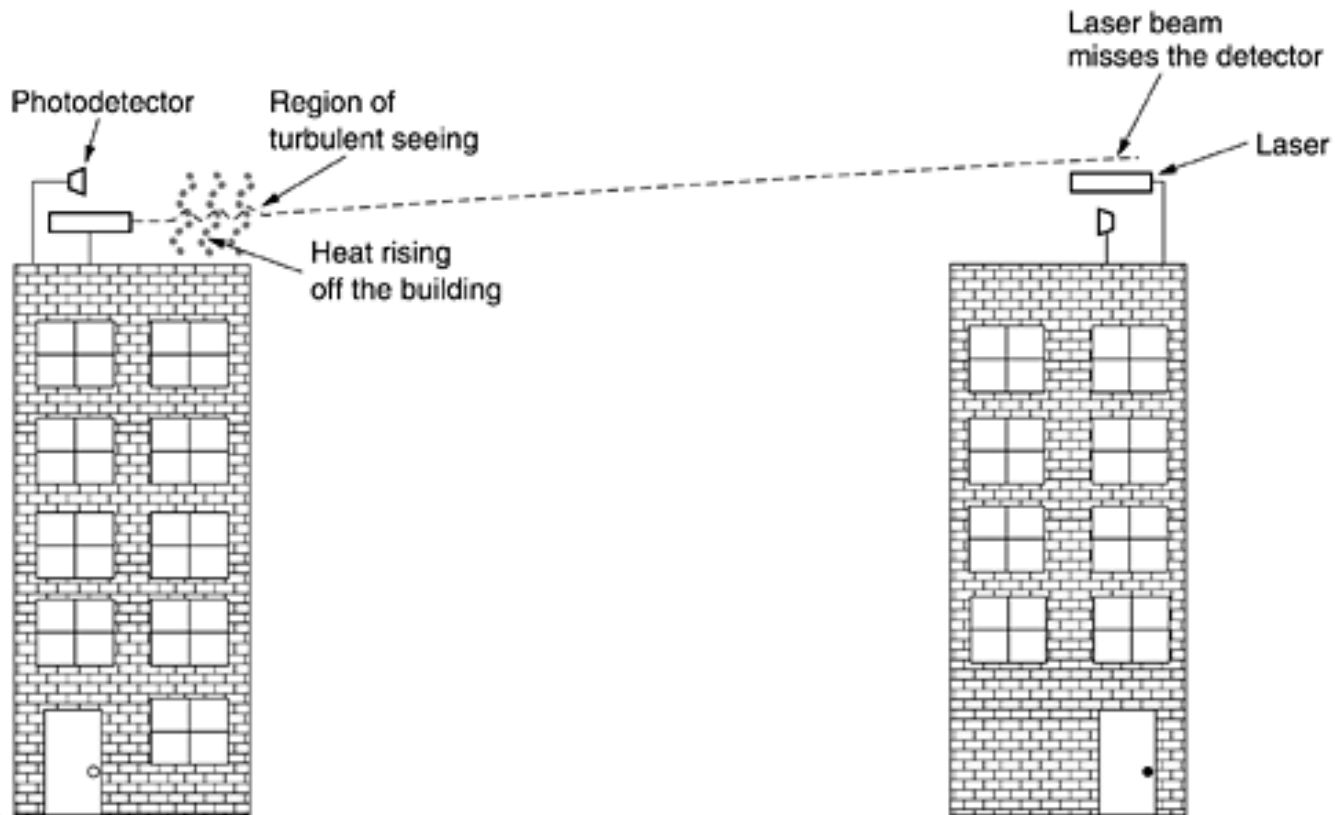
Infrared Waves

- ▶ Electromagnetic waves having frequencies from 300 GHz to 400 THz.
 - ▶ They are used for short range communication and use line of sight propagation.
 - ▶ Infrared waves cannot pass through solid objects like walls (disadvantage).
 - ▶ IR waves offer very large bandwidth for use.
 - ▶ For e.g. Remote controls used for TV, DVD players, Communication between keyboard, mouse, printers.
- 

Laser/Light Wave Transmission

- ▶ It uses thin laser beams to transfer data up to few kilometers.
 - ▶ It is unidirectional and uses line of sight propagation.
 - ▶ In this a photo detector and laser is set up on both send and receiver side.
 - ▶ High bandwidth at a very low cost.
 - ▶ For e.g. Escalators.
- 

Laser/Light Wave Transmission...



Geosynchronous Orbit

