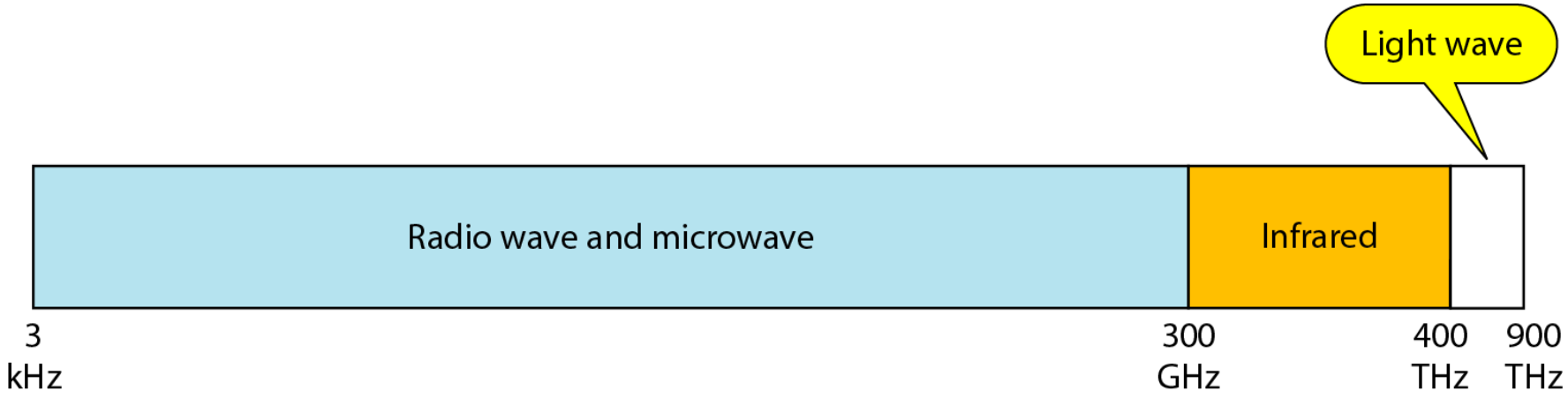
Transmission Media

UNGUIDED MEDIA: WIRELESS

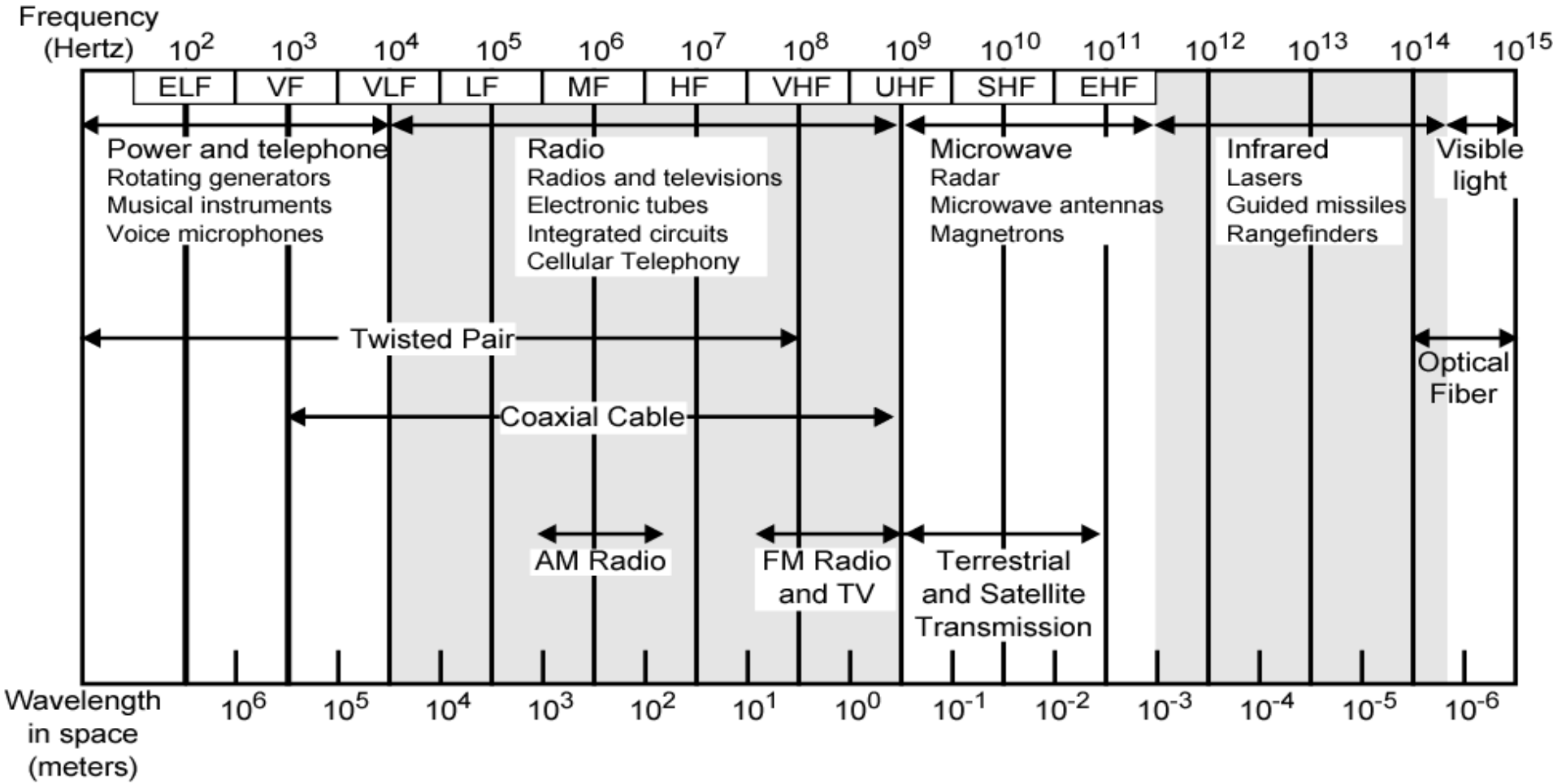
Unguided media transport electromagnetic waves without using a physical conductor.
This type of communication is often referred to as wireless communication.

Radio Waves
Microwaves
Infrared

Electromagnetic spectrum for wireless communication

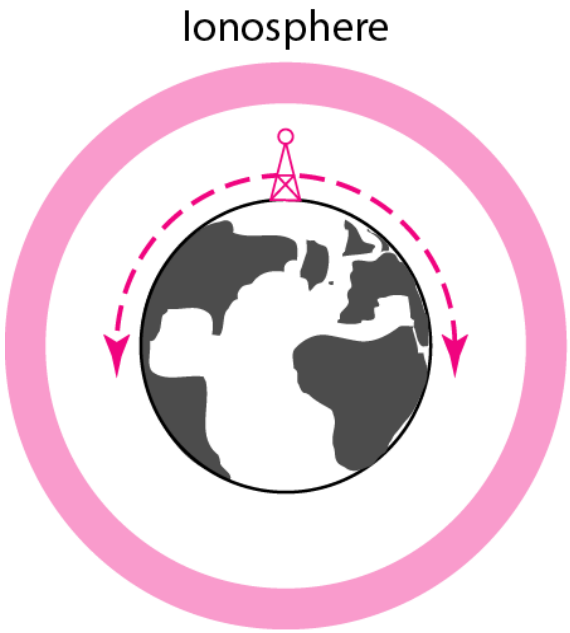


Electromagnetic Spectrum

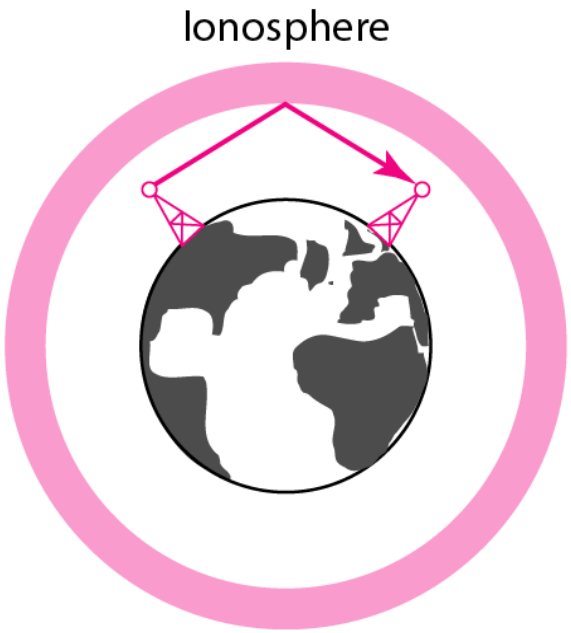


ELF = Extremely low frequency
VF = Voice frequency
VLF = Very low frequency
LF = Low frequency
MF = Medium frequency
HF = High frequency
VHF = Very high frequency
UHF = Ultrahigh frequency
SHF = Superhigh frequency
EHF = Extremely high frequency

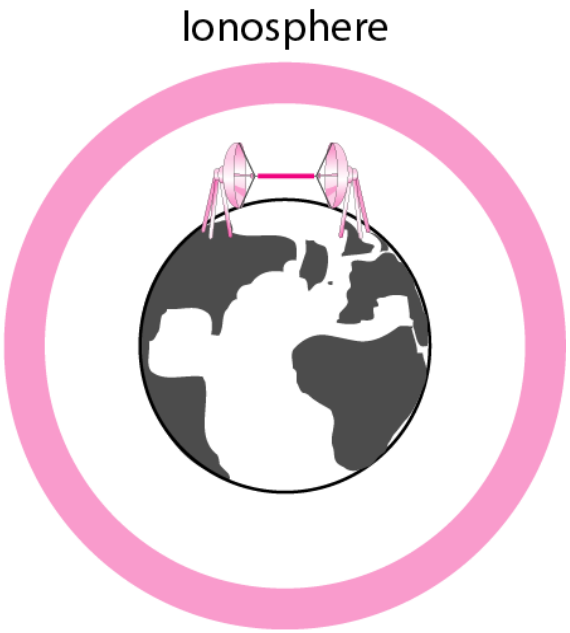
Propagation methods



Ground propagation
(below 2 MHz)



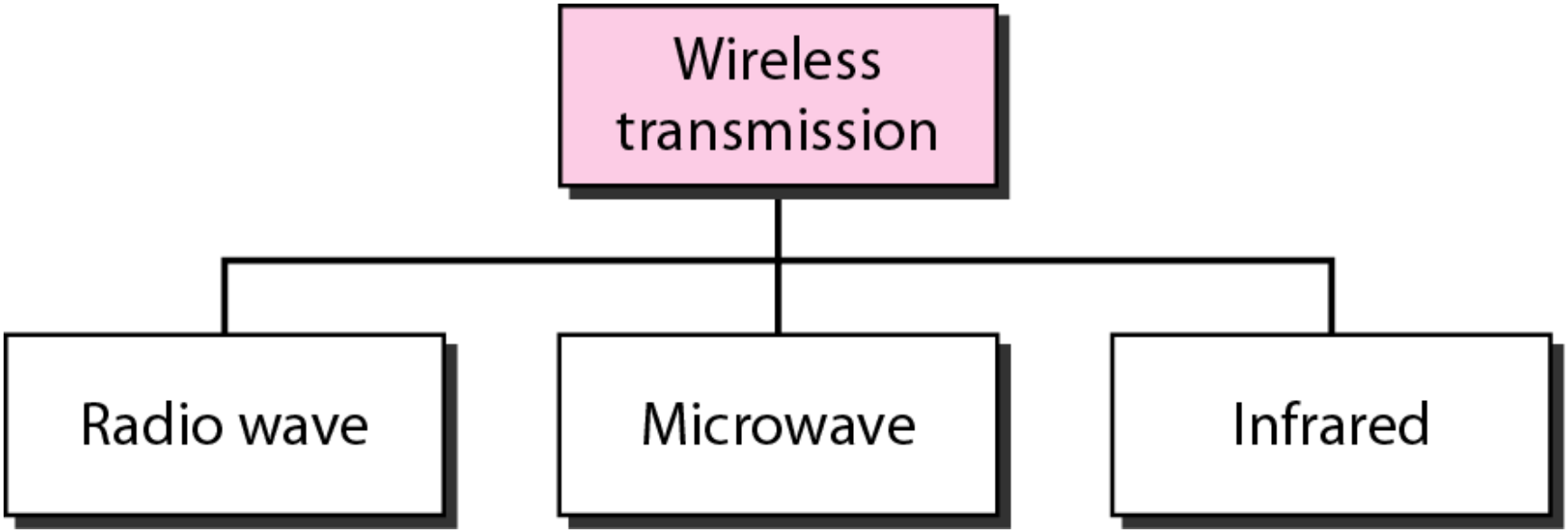
Sky propagation
(2–30 MHz)



Line-of-sight propagation
(above 30 MHz)

Band	*Range*	*Propagation*	*Application*
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

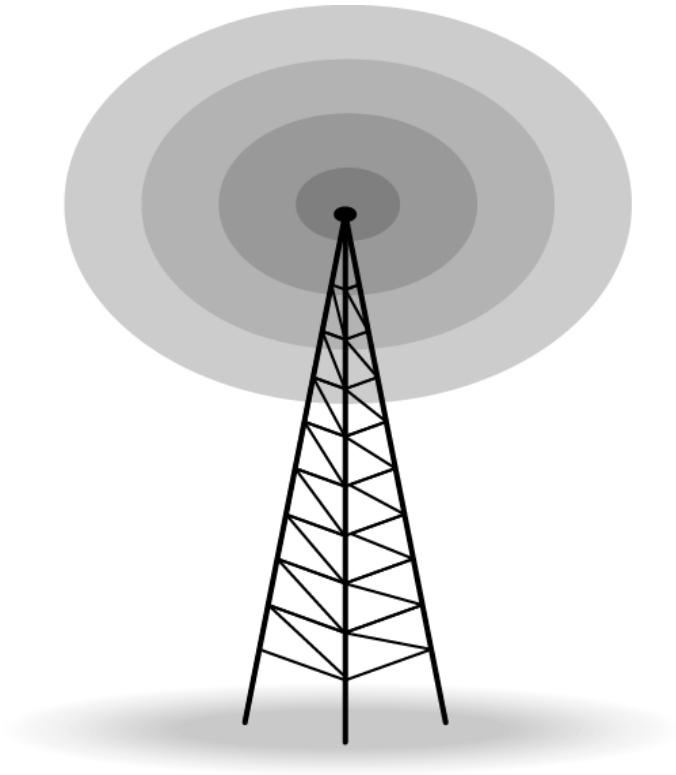


Radio Waves

- **Radio waves are used for multicast communications, such as radio and television, and paging systems**
- **They can penetrate through walls**
- **Use omni directional antennas**
- **Frequency ranges from 3KHz to 1 GHz**
- **An example of the radio wave is FM radio**
- **Radio waves cover a large area and provides a higher transmission rate.**

https://www.britannica.com/video/214986/How-radio-works-overview-radio-waves-frequency-amplitude-modulation

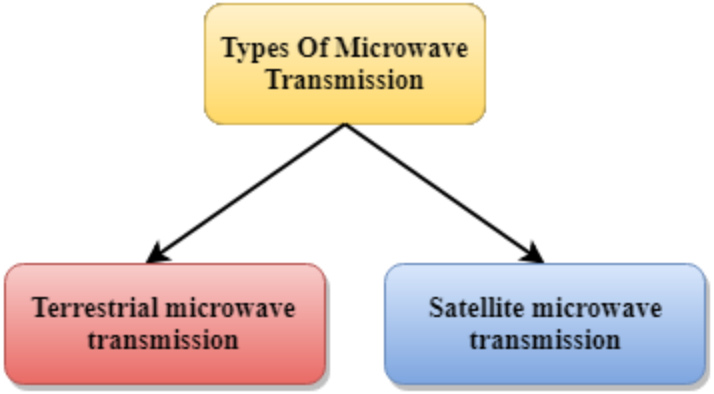
Omnidirectional antenna



Microwaves

- **Microwaves are used for unicast communication such as cellular telephones, satellite networks, and wireless LANs.**
- **Higher frequency ranges cannot penetrate walls.**
- **Use directional antennas - point to point line of sight communications.**
- **Frequency ranges from 1KHz to 300 GHz**

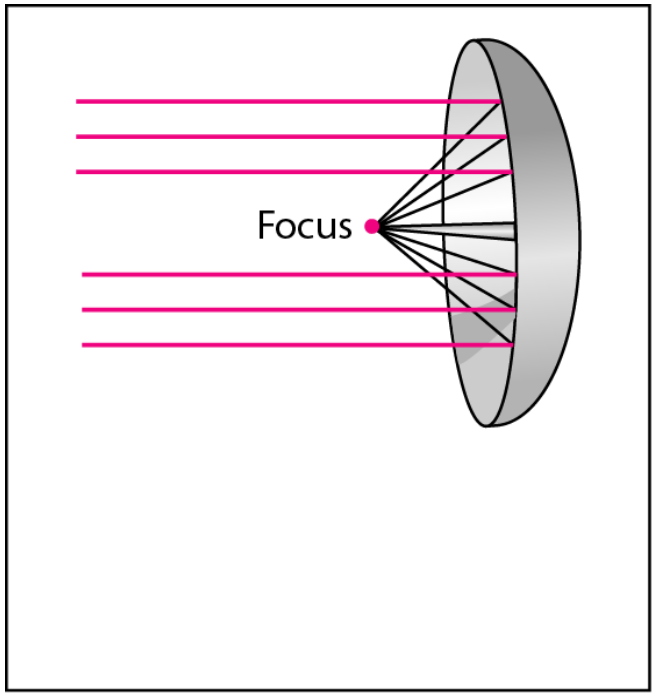
Microwaves cont.



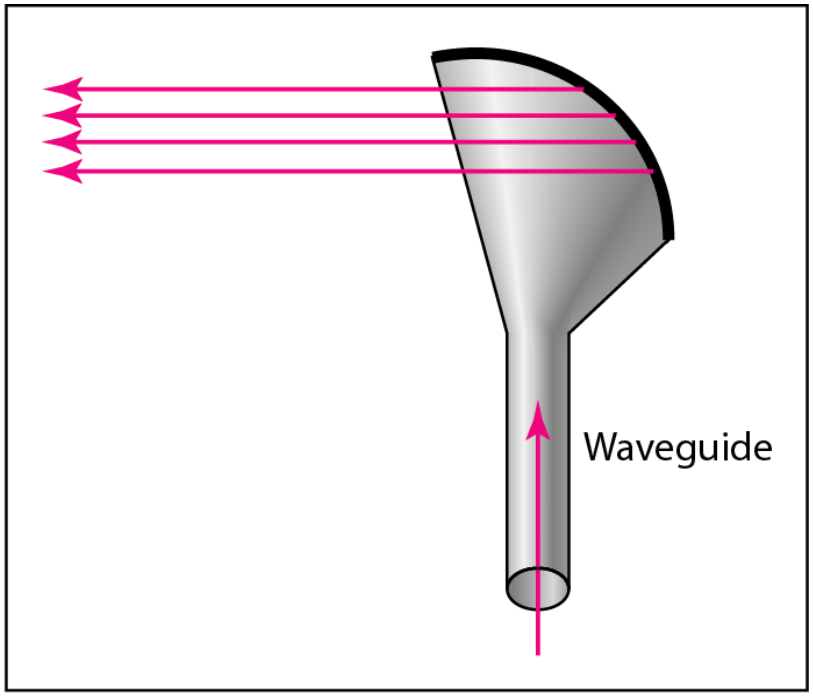
- Terrestrial Microwave transmission uses a focused beam of radio signal from one ground-based microwave transmission antenna to another which require LoS
- In satellite microwave transmission , satellite accepts the signal that is transmitted from the earth station, amplifies the signal and retransmitted to another earth station.
- The coverage area of a satellite microwave is more than the terrestrial microwave.

https://www.youtube.com/watch?v=OpkatIqkLO8

Unidirectional antennas



a. Dish antenna



b. Horn antenna

Infrared

- Infrared signals can be used for short-range communication in a closed area
- Using line-of-sight propagation.
- Frequency ranges from 300GHz to 400 THz
- It supports high bandwidth, and hence the data rate will be very high
- Infrared communication is unreliable outside the building because the sun rays will interfere with the infrared waves.

IR remote working -https://youtu.be/hD9jT24oE40

Phone as remote control -https://youtu.be/OB9tnVOrUmI