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Course Title: Data Communication

UNIT 2

Wireless or Unguided Transmission Media

- Wireless transmission is a form of unguided media.
- Wireless communication involves no physical link established between two or more devices, communicating wirelessly.
- In unguided media, air is the media through which the electromagnetic energy can flow easily.

Unguided transmission is broadly classified into three categories:

1. Radio Waves

2. Micro Waves

3. Infrared Waves

Unguided signals can travel from the source to the destination in several ways:

- **Ground propagation**
- **Sky propagation**
- **Line-of-sight propagation**

- **Ground Propagation:**

In this, radio waves travel through the lowest portion of the atmosphere. These low-frequency signals flow in all directions from the transmitting antenna and follow the curvature of the planet.

- **Sky Propagation:**

In this, higher-frequency radio waves radiate upward into the ionosphere where they are reflected back to Earth. This type of transmission allows for greater distances with lower output power.

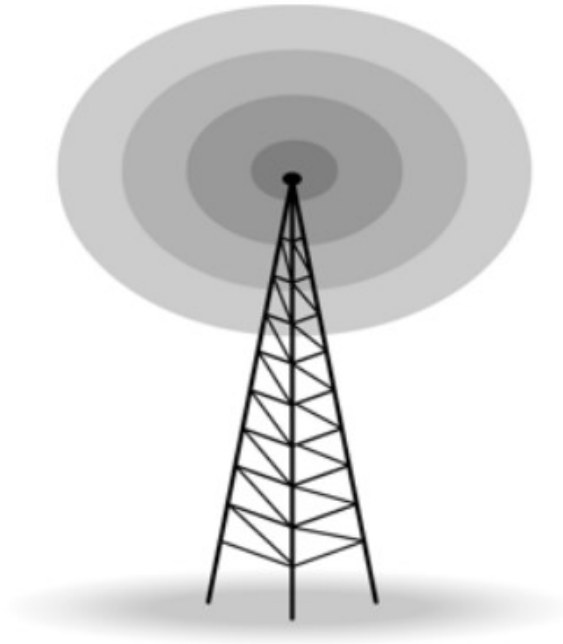
- **Line-of-sight Propagation:**

In this type, very high-frequency signals are transmitted in straight lines directly from antenna to antenna.

1. Radio waves

- Radio waves are the electromagnetic waves that are transmitted in all the directions of free space.
- Radio waves are **omnidirectional**, i.e., the signals are propagated in all the directions.
- The range in frequencies of radio waves is from 10Khz to 1Ghz.
- In the case of radio waves, the sending and receiving antenna are not aligned, i.e., the wave sent by the sending antenna can be received by any receiving antenna.
- An example of the radio wave is **AM, FM radio, TV, Cordless Phone**.

Omnidirectional Antenna for Radio Waves



Applications of Radio waves:

- A Radio wave is useful for multicasting when there is one sender and many receivers.
- An FM radio, television, cordless phones are examples of a radio wave.

Advantages of Radio transmission:

- Radio transmission is mainly used for wide area networks and mobile cellular phones.
- Radio waves cover a large area, and they can penetrate the walls.
- Radio transmission provides a higher transmission rate.

2.Microwaves

- Microwaves travels at very high frequency than radio waves .
- It's frequency range is in between **1 GHz to 300 GHz**
- Microwaves are **unidirectional**.
- Very High frequency microwaves can not penetrate walls.
- Microwave transmission is **Line of Sight** transmission .

i.e. The transmit station must be in visible contact with the receive station. This sets a limit on the distance between stations depending on local geography.

- Microwave circuits considered a broad band communication channel.

Microwaves are of two types:

1.Terrestrial microwave

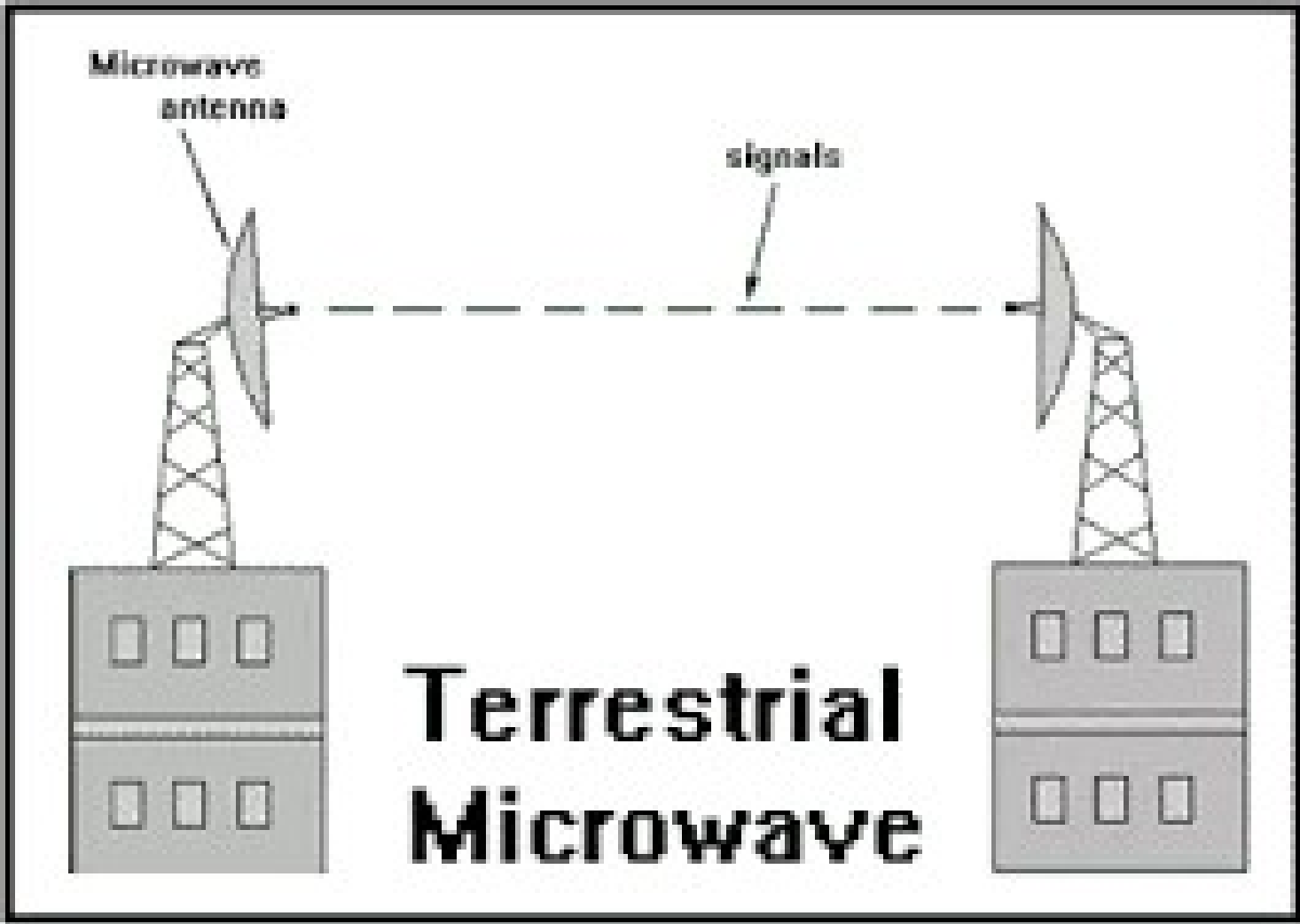
2.Satellite microwave communication.

Terrestrial Microwaves

- Terrestrial Microwaves are used to transmit wireless signals across a few miles.
- Terrestrial system requires that direct parabolic antennas can be pointed to each other.

Characteristics of Terrestrial Microwaves

1. Moderate to high cost
2. Difficult to install
3. 1 mbps to 10 mbps capacity
4. Low immunity to EMI
5. Used for long distance telephone service
6. It has parabolic dish transmitter which is mounted high.
7. It is used by common carriers as well as private networks.



Satellite Communication

- A satellite is a physical object that revolves around the earth at a known height.
- They are positioned precisely **36,000 km** above the earth's equator.
- Satellite communication is more reliable nowadays as it offers more flexibility than cable and fibre optic systems.
- We can communicate with any point on the globe by using satellite communication.
- Each satellite can receive and retransmit signals.
- Hundreds of satellites are now in an orbit to handle international and domestic data, voice and video communication needs.
- The INSAT series of Indian satellite are positioned in outer space in a manner to be accessible from any place in India.
- In satellite communication, microwave signal at **6 GHz or 14 GHz(Up link)** is transmitted from a transmitter on earth to satellite positioned in space.
- A transponder mounted on satellite amplifies the weak signal and transmits it back to the earth at frequency **4 GHz or 11 GHz(Down link)**. This signal is received at Receiving stations on Earth.
- Use of **4 GHz and 6 GHz** band of frequencies for transmission and retransmission of microwave signals in a satellite communication is called **C-band** transmission and use of **11 GHz and 14 GHz** band of frequencies is called **Ku-band** transmission.

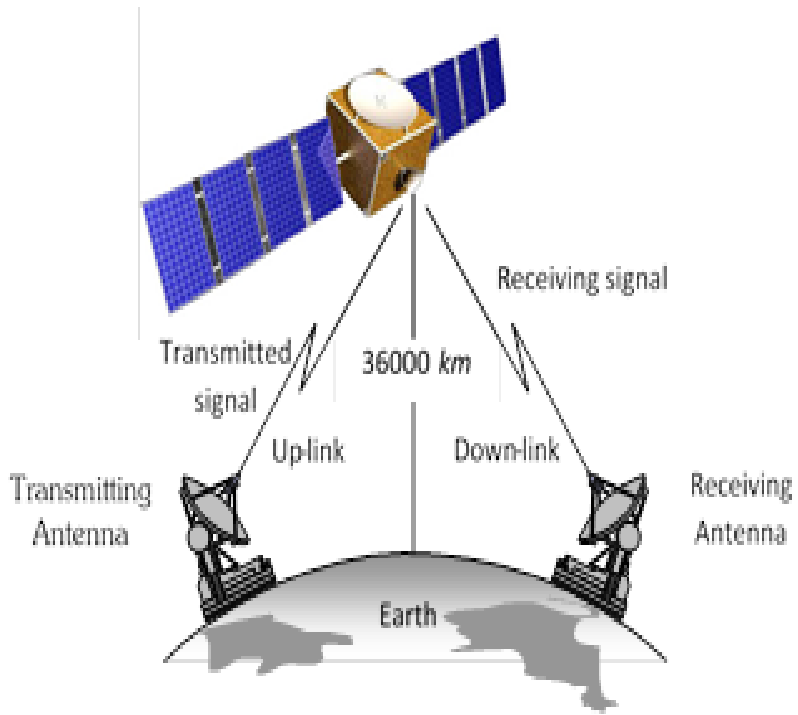
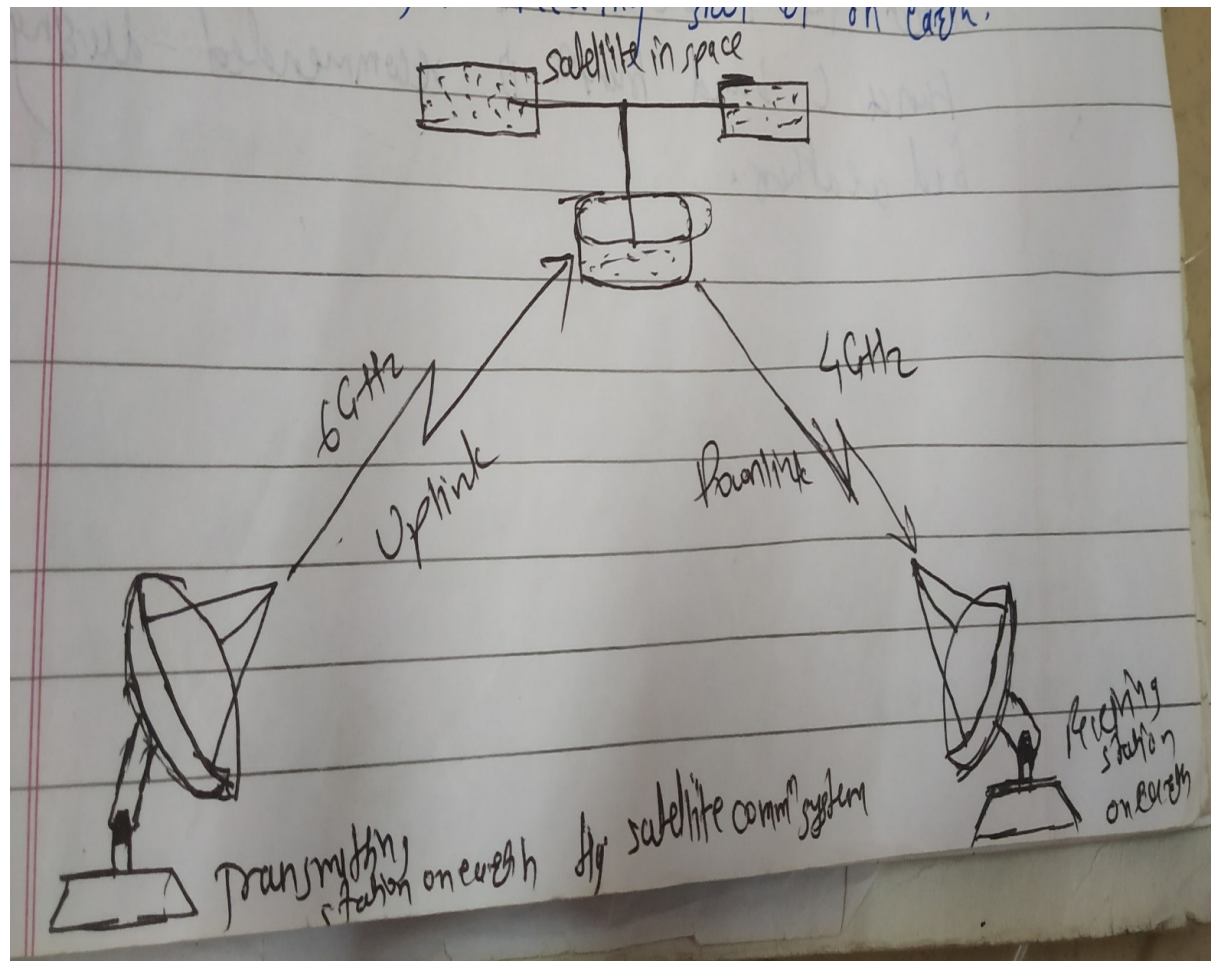


Fig .Satellite Communication System

a)

OR



b)

Advantages of Satellite Microwave Communication:

- The coverage area of a satellite microwave is more than the terrestrial microwave.
- The transmission cost of the satellite is independent of the distance from the centre of the coverage area.
- Satellite communication is used in mobile and wireless communication applications.
- It is easy to install.
- It is used in a wide variety of applications such as weather forecasting, radio/TV signal broadcasting, mobile communication, etc.

Disadvantages of Satellite Microwave Communication:

- Satellite designing and development requires more time and higher cost.
- The Satellite needs to be monitored and controlled on regular periods so that it remains in orbit.
- The life of the satellite is about 12-15 years. Due to this reason, another launch of the satellite has to be planned before it becomes non-functional.

3. Infrared Waves (IR)

- An infrared transmission is a wireless technology used for communication over short ranges.
- The frequency of the infrared is in the range from 300 GHz to 400 THz.
- IR transmission also requires a line of sight transmission.
- Computer devices such as a mouse, printer and digital camera which have special port called IrDA (Infrared Data Association) port that allows transfer of data from one device to another using infrared light waves.
- Infrared frequencies are higher than microwaves but lower than those of visible light.
- IR allows only on-to-one type of connection.
- It can be used for remote control devices, wireless mouse and keyboard.

Advantages of Infrared waves

- The main advantage of infrared technology is its simple and extremely cheap senders and receivers which are integrated into nearly all mobile devices available today.
- No licenses are required for infrared and shielding is very simple.
- They are easy to build.
- Electrical devices cannot interfere with infrared transmission.

Disadvantages of Infrared waves

- Disadvantages of infrared transmission are its low bandwidth compared to other LAN technologies.
- Limited transfer rates to 115 Kbit/s and we know that even 4 Mbit/s is not a particular high data rate.
- Their main disadvantage is that infrared is quite easily shielded.
- Infrared transmission cannot penetrate walls or other obstacles.
- Typically, for good transmission quality and high data rates a LOS (Line of sight), i.e. direct connection is needed.

THANK YOU...