Satellite Communication

⊛ How do Satellites work:

→ Two stations on earth want to communicate through radio broadcast but are too far away to use conventional means.

→ The two stations can use a satellite as a relay station for their communication.

→ One earth station sends a transmission to the satellite. This is called a uplink.

→ The satellite Transponder converts the signal and sends it down to the second earth station. This is called a downlink.

⊛ Advantages of Satellite:

The advantages of satellite communication over terrestrial communication are:

→ The coverage area of a satellite greatly exceeds that of a terrestrial system.

→ Transmission cost of a satellite is independent of the distance from the center of the coverage area.

→ Satellite to satellite communication is very precise.

→ Higher bandwidths are available for use.

Disadvantages of Satellites:

→ Launching satellites into orbit is costly.

→ Satellite bandwidth is gradually becoming used up.

→ There is a larger propagation delay in satellite communication than in terrestrial communication.

How Satellites are used:

Service types:

→ fixed service satellites (FSS)
Example: point to point communication

→ Broadcast service satellites (BSS)
Example: Satellite Television / Radio
Also called Direct Broadcast Service (DBS)

→ Mobile service satellites (MSS)
Example: Satellite phones

Types of Satellites:

Satellite Orbits

→ GEO (Geostationary Earth Orbit)

→ LEO (Low Earth Orbit)

→ MEO (Medium Earth Orbit)

Geostationary earth orbit (GEO):

→ These satellites are in orbit 35,863 km above the earth's surface along the equator.

→ Objects in Geostationary orbit revolve around the earth at the same speed as the earth rotates. This means GEO satellites remain in the same position relative to the surface of earth.

Advantages of GEO:

→ A GEO satellites distance from earth gives it a large coverage area, almost a fourth of the earth's surface.

→ GEO satellites have a 24 hour view of a particular area.

⊛ Disadvantages of GEO:

→ A GEO satellite's distance also cause it to have both a comparatively weak signal and a time delay in the signal, which is bad for point to point communication.

→ GEO satellites, centered above the equator, have difficulty broadcasting signals to near polar regions.

⊛ Low Earth orbit (LEO):

→ LEO satellites are much closer to the earth than GEO satellites, ranging from 500 to 1500 km above the surface.

→ LEO satellite don't stay in fixed position relative to the surface, and are only visible for 15 to 20 minutes each pass.

→ A network of LEO satellites is necessary for LEO satellites to be useful.

⑭ Advantages of LEO:

→ A LEO satellites proximity to earth compared to a GEO satellite gives it a better signal strength and less of a time delay which makes it better for point to point communication.

→ A LEO satellites smaller area of coverage is less of a waste of bandwidth.

⑮ Disadvantages of LEO:

→ A network of LEO satellites is needed, which can be costly.

→ LEO satellites have to compensate for Doppler shifts cause by their relative movement.

→ Atmospheric drag effects LEO satellites, causing gradual orbital deterioration

(b) Medium Earth Orbit (MEO)

→ A MEO satellite is in orbit somewhere betⁿ 8000 km and 18000 km above the earth's surface.

→ MEO satellites are similar to LEO satellites in functionality.

→ MEO satellites are visible for much longer periods of time than LEO satellites, usually between 2 to 8 hours.

→ MEO satellites have a larger coverage area than LEO satellites.

(b) Advantages of MEO:

→ A MEO satelites longer duration of visibility.

→ Wider footprint means fewer satellites are needed in a MEO network than a LEO network.

(b) Disadvantages of MEO:

→ A MEO satellites distance gives it a longer time delay.

→ Weaker signal than a LEO satellite, though not as bad as a HEO satellite.