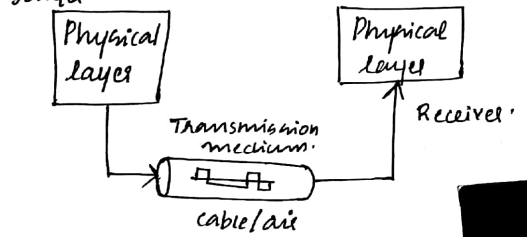
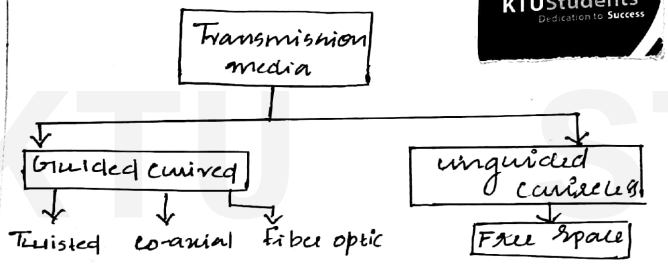
MODULE-2

TRANSMISSION MEDIA:

Sender





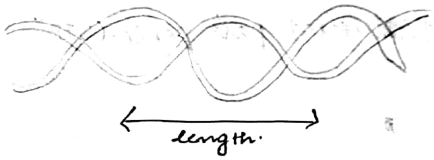
→ DESIGN FACTORS

* Bandwidth
* Transmission impairement
* Interface
* No: of receivers.

Guided Transmission media:

assignment
* Twisted pair
* co-axial
* optic fiber

→ TWISTED PAIR:



→ Physical description.

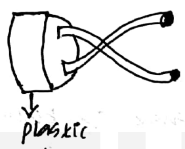
A twisted pair consist of two twisted insulated copper wire arranged in a regular spiral pattern. A wire pair act as a single communication link. A no: of these pairs are bundled together into a cable by wrapping them tough protective sheath. Twisting lessed to the the crosstalk interference blw neighbouring pairs in a cable. on long distant links the twist length varies from. The wires in a pair of have thickness 0.4 to 0.9 mm

→ Applications:

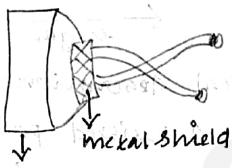
Most common transmission medium for both analog and digital signal commonly used medium in the telephone network and communication within buildings

→ Transmission characteristics

1) Unshielded twisted pair cable (UTP)



UTP



STP.

Categories

1) category 3 : 16 MHZ
2) category 4 :
3) category 5 : 100
4) Category 5E / class D : It support 1 GbPS Ethernet
5) category 6 / class E : It " " " "
with better performance
6) Category 6A / Class EA - Supports 10 GbPS
7) category 7 / class F : beyond 10 Gbps ethernet
8) category 7A / class FA : It supports 10 Gbps "
Frequency - 1 GHz

Insertion loss :-

It refers to the amount of attenuation across the link from the transmitting s/m to receiving s/m.

Near End Crosstalk loss :-

It is the cupling of the signal from one pair of conductors ~~from one pair of conductor~~ to another pair. The near end refers to cupling that takes place when the transmits signal entering the link cuples back to the receiver conductor pair at the same end of the link i.e near end transmitted signal picked by the near receiver pair

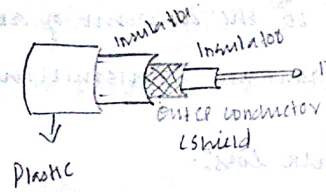
Attenuation to crosstalk Ratio (ACR):

It is a measure of how much larger the received signal strength is compared to the crosstalk on the same pair.

Insertion loss $A_{dB} = 10 \log_{10} \frac{P_t}{P_r}$

$Next_{dB} = 10 \log_{10} \frac{P_t}{P_c}$

$ACR_{dB} = NEXT_{dB} - A_{dB}$.



Wireless transmission.

The general range of frequencies are

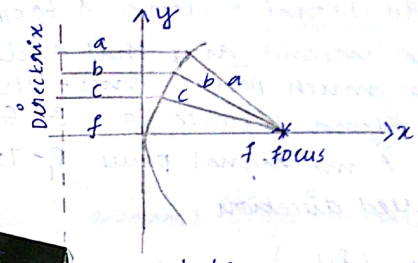
- 1GHz – 40GHz (microwave)
- 30MHz – 1GHz
- $3 \times 10^{11} - 2 \times 10^{14}$ Hz – (Infrared frequency)

For transmission of ~~the~~ signal Radio-frequency electrical energy from the transmitter is converted into electro magnetic energy by the anttenna radiated into the surrounding ~~ground~~ envmt

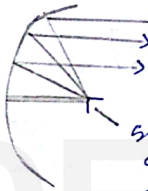
For reception of a signal electromagnetic energy hitting on the atenna is converted into radio frequency electrical energy & fed into the receiver.

→ Antenna :-

- parabolic-reflective antenna



parabola.



Transmitting waves.

source of electromagnetic energy cross section of Parabol antenna showing reflective Property.

Antenna Gain

Is a measure of directionality of an antenna it can be defined as the power of o/p in a particular direct^{n} compared to that produced in any direct^{n} by a perfect omni direction antenna.

$$G_{dB} = 10 \log_{10} (P_2/P_1)$$

G- antenna gain, P_1 - radiated power of the directional antenna.

P_2 - Radiated power from the reference antenna

Q) Consider a directional antenna of 60 dB over a reference antenna and that radiates 600 volt. How much power must the reference antenna radiate to provide the same signal power in the preferred direction $G = 60\,dB$ $P_1 = 700\,W$

A) $G_{dB} = 10 \log_{10} (P_2/P_1)$

$60 = 10 \log_{10} \left(\frac{P_2}{700}\right)$

$6 = \log 10$

$\therefore P_2 = 27.86\,W$

→ Effective gain of antenna depends on the effective area and shape of the antenna. Relation b/w G and A.

$G = \frac{4\pi A_e}{\lambda^2} = \frac{4\pi f^2 A_e}{c^2}$

$G_{dB} = 10 \log G$

Terrestrial microwave:

1) Physical description.
- parabolic ~~dish~~ antenna
- line to line sight
- kept at a height to avoid obstacle
- different location.

2) Application: tele
- long distant communicath.

Voice television transmission possible.

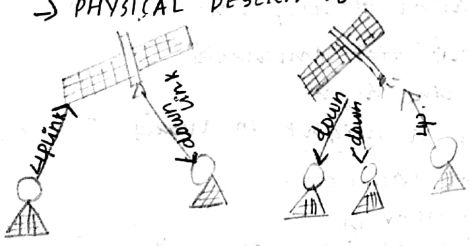
3) Transmission characteristics
- 1–40 GHz
- Attenuation loss $L = 10 \log \left(\frac{4\pi d}{\lambda}\right)^2 q_B$.

d - distance
λ - wavelength

→ Classification of 1–40 Hz
- 4 – 6 GHz (or 11 GHz): Long distance communicath
- 12 GHz band: cable TV transmission.
- 22 GHz: Short point-point links b/w buildings.

Satellite Microwave.

→ PHYSICAL DESCRIPTION



point-to-point Broadcast link.

APPLICATIONS:

1. TV distributions
2. long distance telecommunication.
3. Private business n/w
4. Global positioning

1. TV distribution.

- public
  - Cable TV
  - distributed to local
- Direct
  eg: DDH.

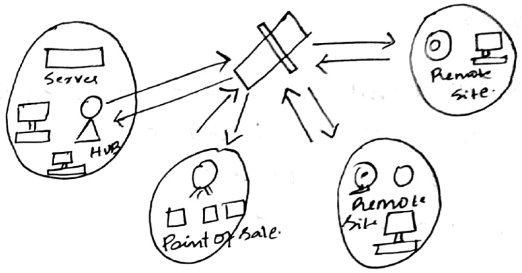
2. long distant Telecommunication.

- Voice.

3. Private business network

Taking different bandwidth frequencies from a satellite.

- Receiving antenna should be strong.
- VSAT- Very small aperture terminal



Typical VSAT configuration.

4. Global Positioning System.

- positioning
- Group of satellites. (27- satellites)
- Ground station
- Receiver/users

→ TRANSMISSION CHARACTERTICS

~~1-100Hz~~ optimum range 1-10GHz

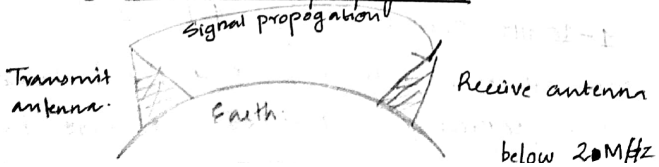
Most satellite provide a point to point service in a frequency band 5.925-6.425 GHz for uplink

3.7 to 4.2GHz ~~for~~ for downlink (4/6 GHz band width)

- 12 to 14 GHz uplink supports 14 – 14.5 GHz
  downlink – 11.72 to 12.2 GHz
  In this band attenuation problems must have overcome.
- In 20-30 GHz band attenuation is very high but will allow greater bandwidth.
  upink 27.5 – 30.05 GHz
  downlink 17.72 – 20.2 GHz
- Wireless propogation: A signal radiated from antenna travel ~~from~~ along one of three ~~using antenna~~ modes.
  1) Groundwave propogation
  2) Skywave propogation
  3) Line of sight propogation

Refer frequency band table in text

① Groundwave propogation

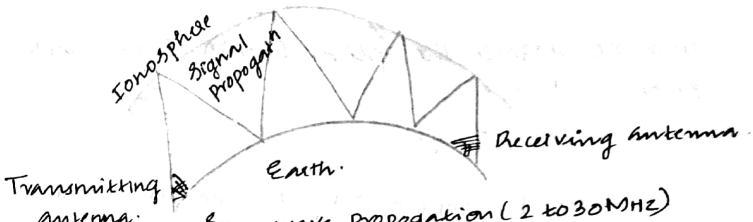


below 2 MHz

~~dur~~ Transmitting signal will have arc shape due to

- ~~Ref~~raction, scattering at atmosphere
- due to the energy induced by the signal.

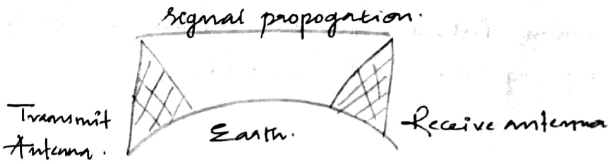
② Skywave propogation:



Sky wave propogation (2 to 30 MHz)

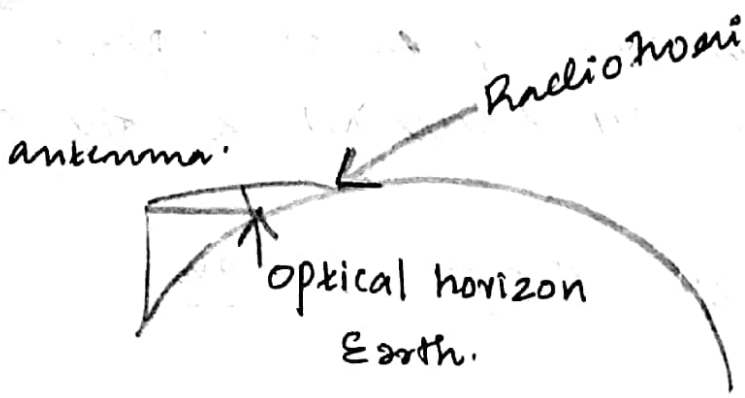
- long distance communication
- Reflects from Ionosphere
- Refraction reason behind Skywave propogat

③ Line of Sight propagation: (LOS)



~~Lig~~ Line of Sight propagation (above 30 MHz)

a) optical and Radio line of sight.



with no obstacle the optical line of sight can be represented as

$$d = 3.57\sqrt{h}$$

d = distance b/w antenna and the horizon in km.
h = Antenna height in meter.

The effective / radio line of sight to the horizon is

$$d = 3.57\sqrt{Kh}$$

K adjuscent factor to ~~upcount~~ upcome for the refraction

$K = 4/3$

Maximum distance b/w two antennas for line of sight propogation $3.57(\sqrt{Kh_1} + \sqrt{Kh_2})$