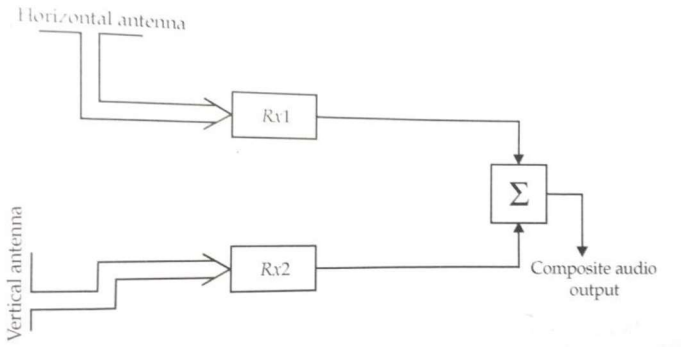

Fig 5.20: Polarity diversity

4. **Time diversity**: In this, the same signals are transmitted at different times. As fading is time-dependent, some signals may be strong and fading is less.

TWO MARK QUESTION

1. What are the various modes of radio wave propagation.

(i) Ground waVe propagation (or) Surface wave propagation.

(ii) Space wave propagation (or) tropospheric wave propagation.

(iii) Sky wave propagation (or) ionospheric propagation.

2. What are the main factors which influence the direction of propagation.

1. Earth characteristics in terms of conductivity, permittivity and permeability.

2. Frequency of operation.

3. Height and polarisation of the transmitting antenna.

4. Distance between the transmitter and receiver.

5. Type of earth like hilly terrain, forest, sea water (or) river water. I 6. Earth's magnetic field.

3. What is meant by ground wave propagation ?

The wave which propagate along the surface of the earth is called as ground wave propagation or surface wave propagation.

4. Why ground waves are always vertically polarized waves?

The ground waves are always vertically polarized because the horizontally polarized wave will be shorted by the conductivity of the earth.

5. Define wave tilt of the ground wave.

Wave tilt is defined as the change of orientation of the vertically polarised

ground wave at the surface of the earth.

6. What are the features of ground wave propagation ?

1. Ground waves propagate by gliding over the surface of the earth.

2. It exists for vertically polarized antennas.

3. Ground wave field strength varies with the characteristics of the earth.

4. Ground wave require relatively high transmitting power.

5. They are not affected by the changes in atmospheric conditions.

7. *Write the Frit's formula for power received in free space propagation.* The power received is given by the Frii's formula

$$\mathbf{P}_r = \frac{P_t G_t G_r \lambda^2}{(4\pi R)^2}$$

where P_r = transmitting power G, and

G_r = transmitting and receiving antenna gains .

R= distance between transmit and receive antenna

8. Is it possible to transmit horizontal polarized wave as surface wave? Why?

No. Horizontal polarized wave would be shorted by the conductivity of the ground.

9. Define diffraction of an EM wave.

The Bending of the path of EM waves around sharp edges and corners of obstacles is known as diffraction,

10. What are the recent models used to predict the propagation of EM wave in complex environments?

1. Path loss model and

2. Okumura, Hata and COST-231 models are used to predict the propagation in complex environments.

11. Explain what is meant by fading.

Fading is a loss of EM signal due to changes in electrical characteristics of troposphere.

It occurs due to

1. Variation of dielectric constant.

2. Variation of refractive index.

3. Variation of effective earth radius factor (K).

12. Explain what is meant by duct propagation.

In Duct propagation, the ray which is parallel to the earth's surface travels round the earth in a series of hops with successive reflections from the earth.

13. Define Line of Sight (LoS).

Line of Sight is defined as the distance that is covered by a direct wave from the transmitting antenna to the receiving antenna.

14. Define optical horizon and radio horizon.

Optical horizon is defined as the maximum distance between the two antennas along the surface of the earth.

Radio horizon is the maximum distance over which a direct radio wave link can be established.

15. What are the uses of troposcatter?

1. ***Troposcatter is used to establish communication links in the UHF and*** **microwave frequency bands.**

2. **Distance** coverage is upto 1000 km.

3. Bandwidth utilized is few MHz**.**

16. What are sky waves?

Sky wave is the electromagnetic wave propagating in the ionosphere by refraction.

17. What is Ionosphere?

Ionosphere is the upper portion of the atmosphere that extends from about 60 km to 400 km above the earth. Here, ionization of atoms or gas molecules occurs due to the absorption of large quantities of radiation energy from the sun.

"18. Which layer is suitable for propagation of high frequency signals? Why?

The 'F' layer. Because the electron density is very thin in this layer. Due to this the critical frequency of this layer is 5 to 7 MHz even upto 10 MHz.

19. Define dielectric constant. How it is related to the refractive index.

The dielectric constant is a measure of the extent to which a medium concentrates electrostatic lines of flux. It is the ratio of permittivity of a medium to the permittivity of free space.

The relationship between refractive index to the relative dielectric constant is given by

$$\eta_r = \sqrt{\varepsilon r}$$

20. Give the expression for refractive index in an ionosphere medium.

$$\eta_r = \sqrt{1 - \frac{81N}{f2}}$$

where, N = Number of charged particles
f= Frequency of radio wave.

1

21. State the mechanism of refraction.

When the EM wave enters from one medium to another, the speed of propagation will be changed. In order to match the incident and transmitted wave at the boundary, the transmitted wave will change the direction of propagation. This concept is called as refraction.

22. What are all the factors which affects the refraction ?

(/) The density of the ionospheric layer.

(if) The frequency of the radio wave.

(Hi) The angle at which the wave incident on the layer.

23. Define plasma frequency.

Plasma is a completely ionised gas at very high temperature consisting of the charged nuclei and negative electron

24. Define critical frequency.

It is the highest frequency of the wave that is reflected back from ionospheric layer and it is determined by the maximum electron density of that layer.

Critical frequency, $f_c = 9\sqrt{N_{max}}$

where, N_{max} = maximum electron density of the layer

25. Define skip distance.

It is the minimum distance from the transmitter at which a sky wave of given frequency is returned to the earth by the ionosphere.

Skip distance $d_s = 2h\sqrt{muf}$ -1

where h = f the layer from earth

f_{uf} = Maximum usable frequency

f = Critical frequency

26. What is meant by maximum usable frequency?

It is the highest frequency of a wave that is reflected by the ionospheric layer at an angle of incidence other than normal incidence. It depends on time of a day, distance, direction, season and solar activity.

$$f_{muf} = f_c\sqrt{\frac{d2}{4h^2} + 1}$$

where, $h \rightarrow$ height of the layer

$d \rightarrow$ distance between transmit and receive antenna

$f_{c\rightarrow}$ Citical freauency