



DIVERSITY

PRINCIPLE OF DIVERSITY

Can you tolerate if your call disconnects when you are discussing important matter on call while you travel?

- Deep fade : strong destructive interference that results in temporary failure of communication due to severe drop in SNR.
- This happens in Single link between TX and RX.

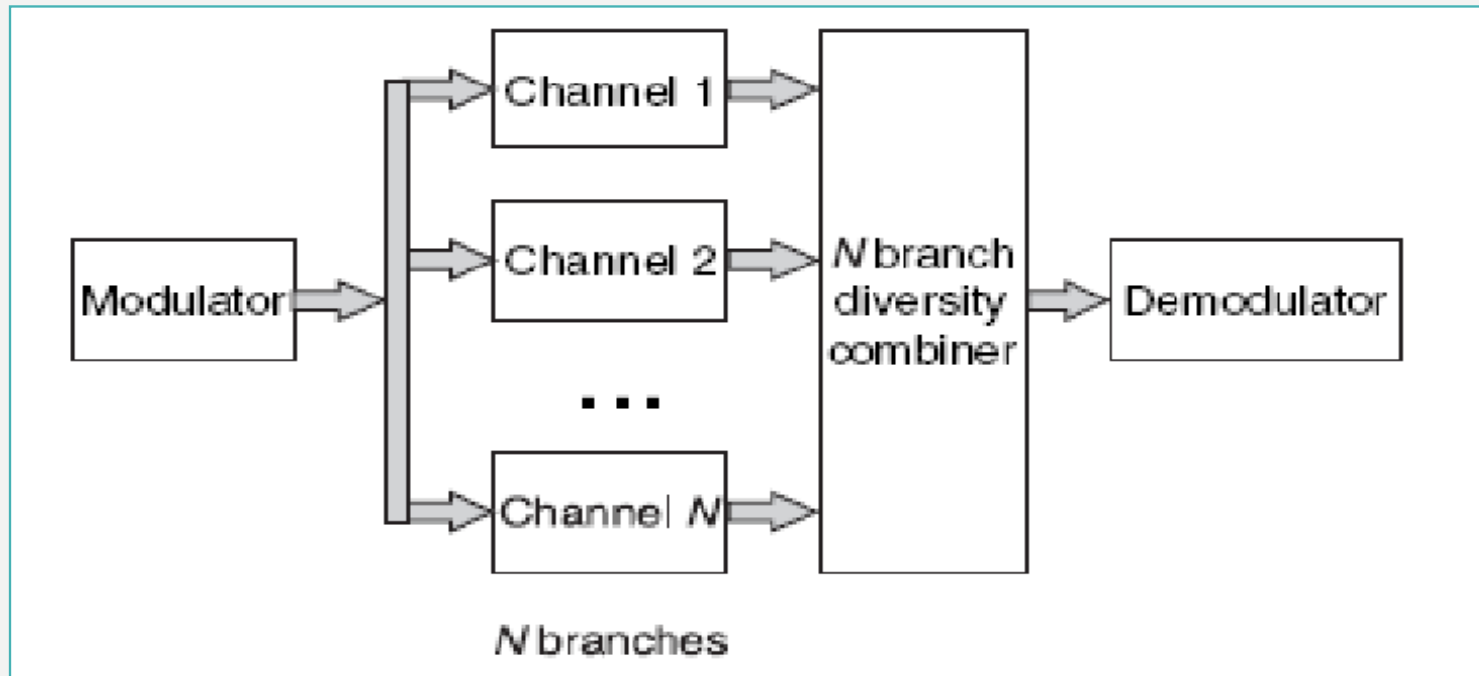
WHAT DO WE DO?

AN ALTERNATE SOLUTION IS **DIVERSITY**

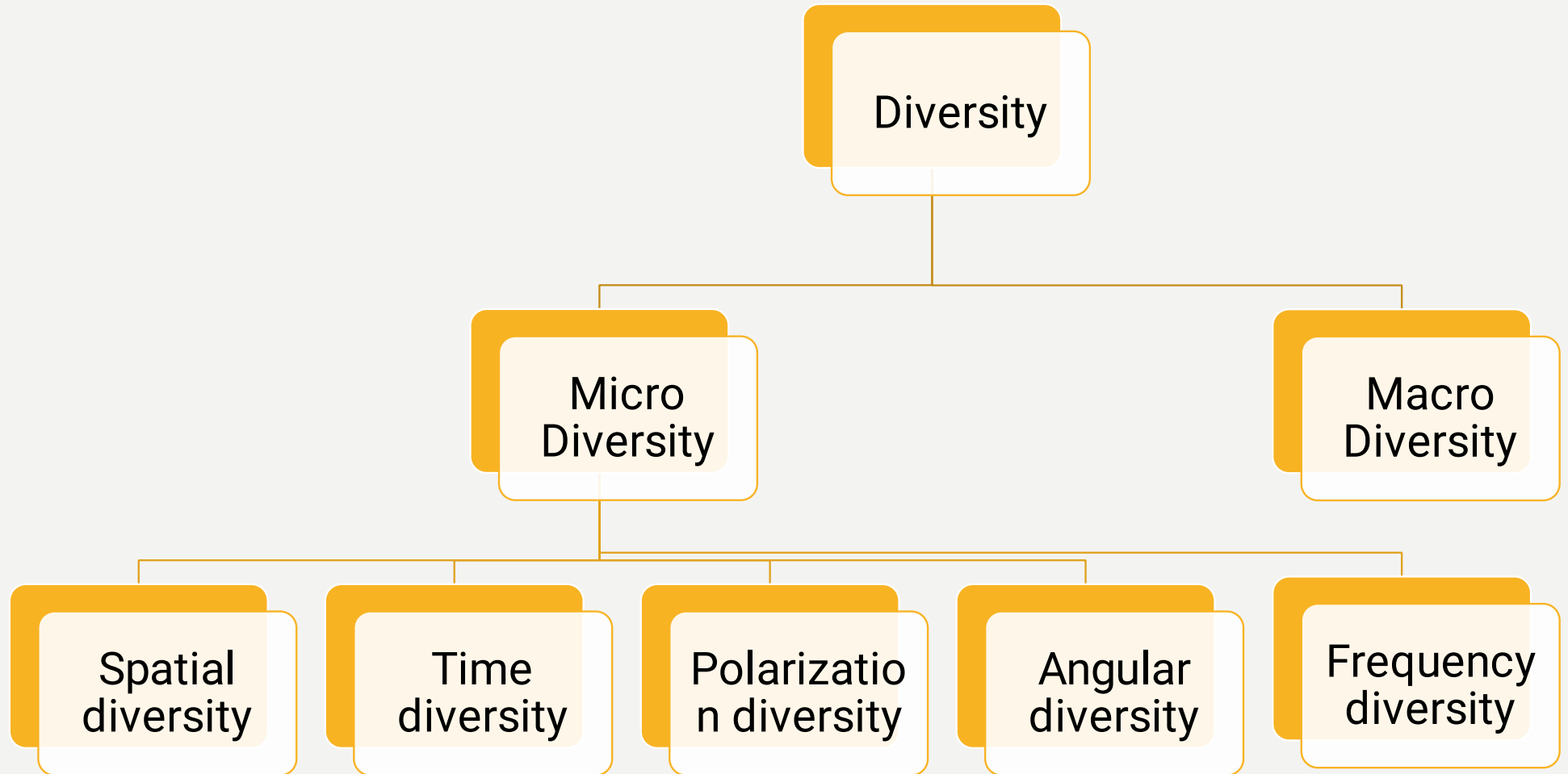
- *Provide multiple link such that receiver gets redundant copy of same signal and selects the best signal with greater power.*
- *Achieved at higher cost – needs more antenna*
- *Ensure information reaches receiver on statistically independent channels*

MODIFICATION IN THE RECEIVER SYSTEM

- ⊠ If one radio path undergoes a deep fade another independent path may have a strong signal.



TYPES OF DIVERSITY



MACRO-DIVERSITY

- Prevents Large Scale fading.
- Large Scale fading is caused by shadowing due to variation in both the terrain profile and the nature of the surroundings.
- This fading is prevented by selecting an antenna which is not shadowed when others are, this allows increase in the signal-to-noise ratio.
- *Simulcast* is used to implement this. In simulcast, the same signal is transmitted simultaneously from different BSs. In cellular applications the two BSs should be synchronized, and transmit the signals intended for a specific user in such a way that the two waves arrive at the RX almost simultaneously.

MICRO - DIVERSITY

- Prevents Small Scale fading.
- Small Scale fading is caused by multiple reflections from the surroundings. It is characterized by deep and rapid amplitude fluctuations which occur as the mobile moves over distances of a few wavelength.
- This fading is prevented by selecting an antenna which gives a strong signal that mitigates this small signal fading effect.

SPATIAL DIVERSITY

- A method of transmission (transmit diversity) or reception (reception diversity), or both, in which the effects of fading are minimized by the simultaneous use of two or more physically separated antennas, ideally separated by a distance to ensure independent fading.
- Ex: Site based Diversity where receiving antennas are located at different sites. (vehicle mounted and hand held radios communicate with base station)

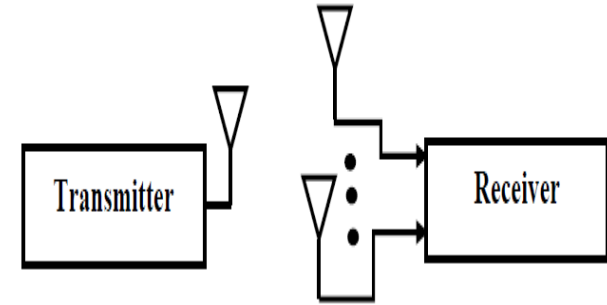


Fig. 9 (a) Space Diversity: One Transmitter – N Receiver Antennas

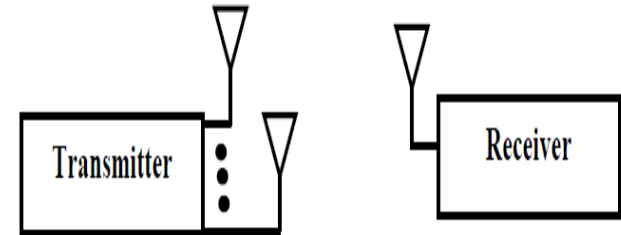
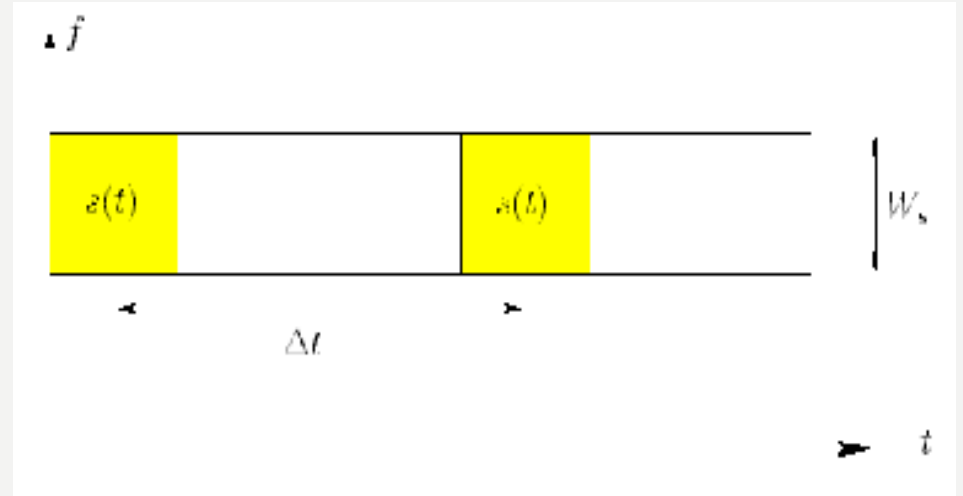


Fig. 9 (b) Space Diversity: N Transmitter – 1 Receiver Antennas

Fig. 9 Space Diversity schematics for different number of transmitter and receiver antennas.

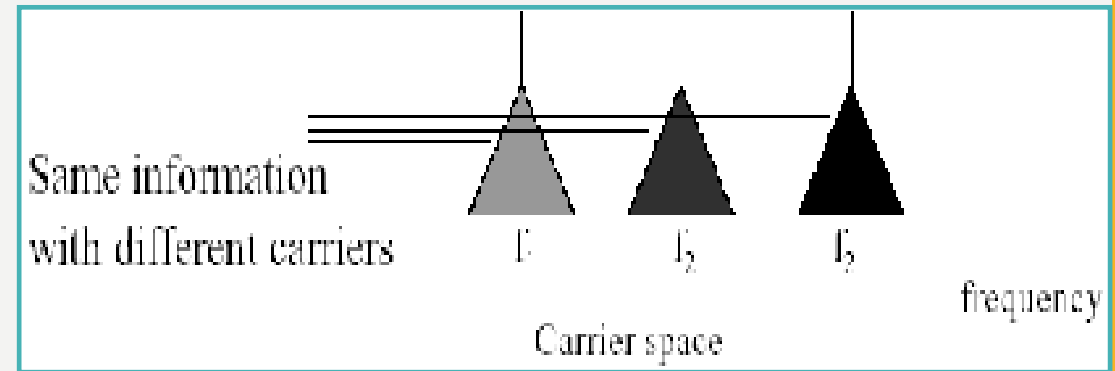
TIME DIVERSITY

- The signals representing the same information are sent over the same channel at different times with significant time difference between different transmissions.



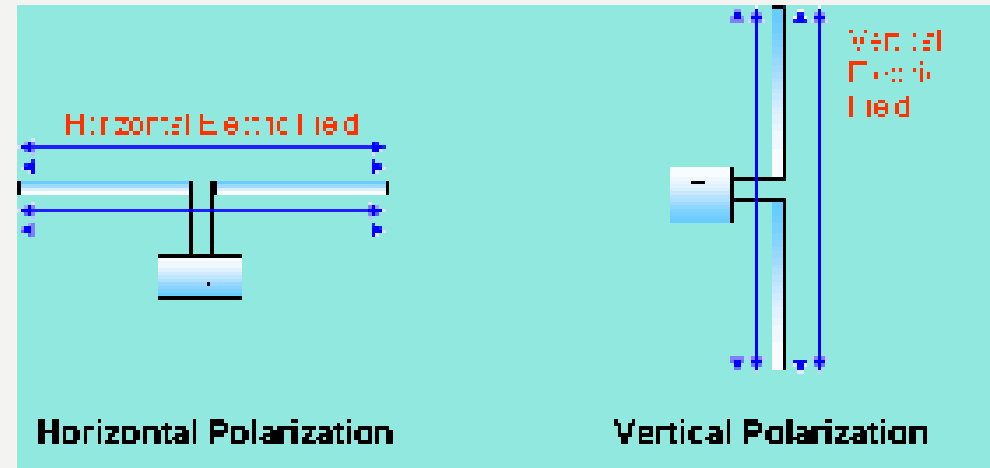
FREQUENCY DIVERSITY

- The same information signal is transmitted and received simultaneously on two or more independent fading carrier frequencies.



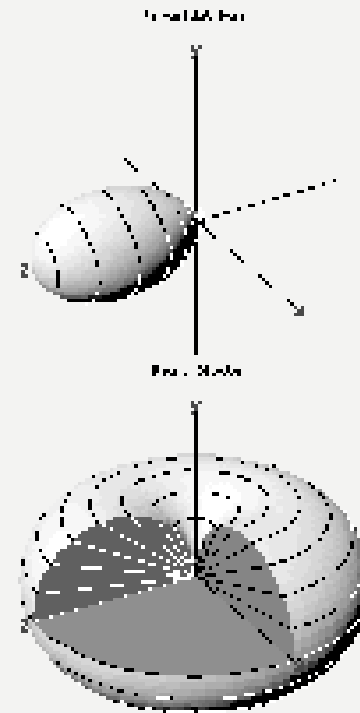
POLARIZATION DIVERSITY

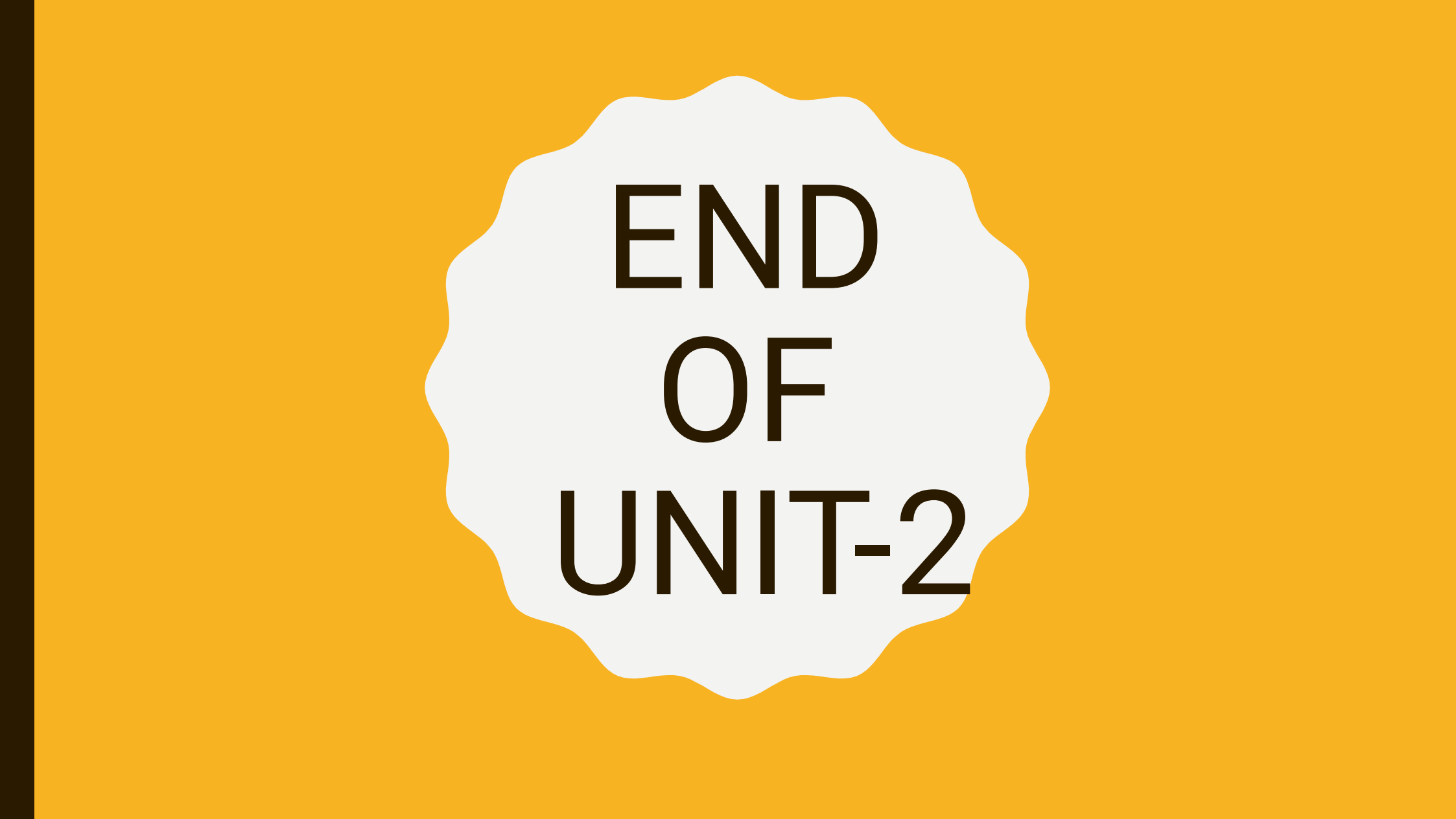
- ⊠ Polarization diversity uses antennas of different polarizations i.e. horizontal and vertical.
- ⊠ The antennas take advantage of the multipath propagation characteristics to receive separate uncorrelated signals



ANGLE DIVERSITY

- Involves multiple antennas with different antenna patterns (Received Signal arrives at different paths each with different angle of arrival).





**END
OF
UNIT-2**