

Experiment - 4: Effect of Small Scale Fading Parameter on System Capacity.

1.Aim: To observe the effect of velocity and direction of arrival of a vehicle on Doppler and receiver carrier frequency frequency when a base-station transmitter operating at 900 MHz and a mobile moving at a speed of 72 km/h and in a direction

Directly away from the base-station transmitter

Directly towards the base-station transmitter

In a direction which is 60 degrees to the direction of arrival of the transmitted signal

In a direction perpendicular to the direction of arrival of the transmitted signal

2 .Requirements: Matlab/Scilab/Phyton

3. Pre-Experiment Exercise

3.1Brief Theory

Doppler effect occurs in the shift of the received carrier frequency. Doppler effect results in the inaccurate operation of the system. Multipath propagation, speed of mobile unit, speed of reflecting objects, and Doppler shift are the main causes of fading. Doppler frequency or Doppler shift is given by

$$f_d = (1/\lambda_c) V_m \cos \theta$$

Where

λ_c is the wavelength of the carrier signal,

V_m is the relative velocity of the mobile,

the angle θ is between the motion of the mobile and direction of arrival of the scattered waves, and $V_m \cos \theta$ represents t.

4 Laboratory exercise

Part 1:

1. What do you understand by fading? Specify the factors responsible for fading
2. What do you understand by small scale fading?

Part 2:

Relative motion of MS	Theta (θ)	Doppler Frequency (f_d)	Received Carrier Frequency (f_r)
Directly away from the base-station transmitter			
Directly towards the base-station transmitter			
60 degrees to the direction of arrival of the transmitted			

signal			
Direction perpendicular to the direction of arrival of the transmitted signal			

5. Post-experiment Exercise

5.1 Conclusion

5.2 Questions

Q1 What is the Effect of relative motion between the cell-site transmitter and the mobile receiver, particular speed of a vehicle and operating transmitter carrier frequency on doppler frequency?

Q2 what is the Effect of doppler frequency on the shift of the receiver carrier frequency?

References

- 1) Consider a single high power that can support 40 voice channels over an area of 140 square Km with the available spectrum. If the area is equally divided in to seven smaller cells, each supported by low power transmitters so that each cell supports 30% of the channels, then determine
 - A) Coverage area of each cell
 - B) Total number of voice channels available in cellular system
- 2) Consider that a geographical service area of a cellular system is 4200 sqkm. A total of 1001 channels are available for handling traffic. Suppose the area of a cell is 12 sq km. How many times would the cluster size of 7 have to be replicated in order to cover the entire service area? Calculate the number of channels per cell and the system capacity. If the cluster size is decreased from 7 to 4, then does it result into increase in system capacity? Comment on the results obtained