

Multipath Fading

Exercise 1: What fraction of the time is a Rayleigh-distributed signal 10 dB below the mean? 20 dB? 30 dB? This is a useful result to remember.

Exercise 2: A receiver in a car receives a 1.8 GHz signal while travelling on a road at 50 km/h. The road is at an angle of 30 degrees relative to the direction of arrival of the signal. What is the velocity relative to the direction of arrival of the signal? By how much does the path length change each second (in meters)? In wavelengths? What is the Doppler shift?

Exercise 3: How often will the signal drop 10 dB below the mean if the carrier frequency is 1.8 GHz and the velocity is 100 km/h? On average, how long will each of these fades last?

Exercise 4: What is the product of N_R and $\bar{\tau}$? How does this compare to $P(r \leq R)$?

Exercise 5: A channel has three multipath components with delays of 1, 2 and 3 μs and amplitudes of 10, 6 and 0 dBm respectively. What are the excess delays, the power delay profile, the normalized power delay profile, the mean excess delay and the RMS delay spread?

Exercise 6: Imagine a receiver traveling in a straight line towards a transmitter but with no LOS path. How could you arrange reflecting objects such that there was no time dispersion (flat fading)? What arrangement would result in no time-varying fading? Neither?