TD4
Advanced digital communication

Exercise 1: Calculating Rician PDF

Consider a Rician fading channel with the following parameters given Line-of-sight amplitude A=4 and variance of the scattered components σ2=1

1. Derive the general form of the Rician probability density function (PDF) P(r) for the given parameters.
2. Using the formula for the Rician PDF, calculate the value of P(r) at r=3
3. Calculate the Rician PDF when the amplitude of the LOS component is increased to A=6, and compare the results to the value at A=4.
4. For a Rayleigh fading model, what would be the PDF P(r), and how does it compare to the Rician PDF for A=0?
5. Explain the physical meaning of r, A, and σ^2 in the context of Rician fading.

Exercise 2

Consider a wireless communication channel with power of the LOS component PLOS=8 mW and the total power of the scattered components ∑Pscattered=2 mW

1. Develop the formula to calculate the Rician factor K in terms of the LOS power and the scattered component power.
2. Using the given parameters, calculate the Rician factor K in dB. K(dB)=10log10(PLOS/∑Pscattered)
3. If the LOS power increases to 16 mW, recalculate the Rician factor and compare it with the previous value.
4. What happens to the Rician factor K if the LOS component is absent? How does this affect the nature of the fading?
5. Explain the significance of the Rician factor K in terms of the channel's behavior in urban environments.

Exercise 3

A wireless signal with bandwidth B=200 kHz is transmitted over a channel with an RMS delay spread τrms=2 μs.

1- Compute the coherence bandwidth Bc
2- Does the channel will exhibit flat fading or frequency-selective fading,
3- What are the values of RMD delay so the channel exhibit selective-frequency fading