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ECSE413B: COMMUNICATIONS SYSTEMS II

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Assignment 1: Propagation & Channel Characterization, due date: Monday, February 18/2008

1. $Z=X+jY$ where X, Y are independent zero-mean Gaussian random variables with variance σ^2, show that $Z^2 = X^2+Y^2$ and $|Z| = [X^2+Y^2]^{1/2}$ are exponentially-distributed and Rayleigh-distributed, respectively.

2. Calculate the overall gain and noise figure in dB of the receiver shown in page 24 of Lecture Notes *B2 Radio Transceiver* for
   - $L_{BPF1}= L_{BPF2}=$ 1dB, L_{MIXER1} =7dB G_{LNA}=10dB G_{IF}=20dB, F_{LNA}=3dB, F_{IFAMP}=6dB, F_{DEMOD}=8dB
   - $L_{BPF1}= L_{BPF2}=$ 1dB, L_{MIXER1} =7dB G_{LNA}=20dB G_{IF}=10dB, F_{LNA}=3dB, F_{IFAMP}=6dB, F_{DEMOD}=8dB

   Based on the results of the above 2 cases, discuss the effects of gain distribution on the overall receiver noise figure.

3. Consider the terrain profile shown in page 19 of Lecture Notes *B1 Radio Propagation & LOS*. Establish the LOS 100Mb/s heavy-route link with K=4/3, operating at 2GHz for a minimum required E_b/N_o of 10dB and availability of A% in an area with environmental parameters K, Q, B, and C (as discussed in page 23 of Lecture Notes *B1*). The total microwave cable feeder/branching losses (L_b) are 2dB and receiver noise figure (NF) is 4dB.
   - Calculate the heights of the 2 antenna towers, identify the 1st Fresnel zone and required clearance at different points on the link, and plot the LOS path between two antennas.
   - Calculate the required minimum received power (C_{min}), free-space loss (L_{FS}), required fade margin (FM).
   - Select the required transmitted power (P_T), transmit and receive antenna gains (G_T, G_R) and beam-widths (as discussed in pages 30-33 of Lecture Notes B2 Radio Transceiver).

Name:	**Values for Prob. 3:**
Benboubker, Halima	A%=99.99%, K=1.2E-6, Q=1, B=1, C=3
Canonne-Velasquez, Loïc J.	A%=99.999%, K=9E-7, Q=1, B=1, C=3
Carrier, Mark	A%=99.99%, K=0.97E-9, Q=0.4, B=1.2, C=3.5
Mohajerani, Reza	A%=99.999%, K=0.97E-9, Q=1, B=1.2, C=3.5
Muwaddat, Syed Muhammad	A%=99.99%, K=1.2E-6, Q=3.35, B=1, C=3
Sikander, Mueid	A%=99.99%, K=6E-7, Q=0.27, B=1, C=3