

ELEG 5693 Assignment # 3

1. A receiver must capture the power of at least -100dBm for proper operation. The power at transmitter is 3W. The transmitter and receiver antenna gain is 1dB. The system is operating at 1800MHz. What is the service radius? (Use the free space model).
2. Assume the pathloss at a reference distance $r_0 = 1$ km is equal to 10, and power loss exponent is 3.5. If the power at transmitter is 1W, use the general pathloss model
 - (a) Find the pass loss L_p (dB) at a distance $r = 10$ km.
 - (b) Find the received power at a distance $r = 10$ km (in the unit of dBm).
 - (c) Use Matlab to plot the received power in dBm from 1 to 20 km (increment of 0.1 km).
3. For a lognormal RV X , the logarithm $Y = 10 \log_{10} X$ is Gaussian distributed with mean μ_{dB} and standard deviation σ_{dB} , *i.e.* $Y \sim \mathcal{N}(\mu_{dB}, \sigma_{dB}^2)$.
 - (a) In Matlab, generate 100,000 lognormal RV with parameters $\mu_{dB} = 0$ and $\sigma_{dB} = 9$.
 - (b) By considering the effects of both path loss and lognormal shadowing, calculate the average received power for each of the 100,000 lognormal RV. Use the result from step 2b for path loss. (After this step, you should have 100,000 average received power.)
 - (c) Assume a receiver must operate with signal power of at least -30dBm. With the results from the previous two steps, find out the probability that the receiver couldn't work properly. (Hint 1: From the 100,000 power values, use Matlab to find out

the percentage that the power is below -30dBm.)
(Hint 2: the command `sum(X > 10)` will give you the total number of elements in **X** with values greater than 10.)