Home Assignment - 1

1 Introduction

In this assignment we are trying to understand the concept of cellualar coverage area. As we know, that for each cell there is base station through which the mobile users are served. The base station provides desired connectivity to the mobile terminals in its cellular area. To deliver a particular service there are some constraint which are to met, these constraints are termed as quality of service (QoS). In this assignment we shall explore the effects of fading on the coverage area while delivering a particular QoS

2 Description

The cellular coverage area depends on the transmitted power. We can increase/decrease the coverage area by adjusting the transmitted power. However, the transmitted power is limited by the regulatory authorities as the RF power also pose health hazards to human as well as other fellow living beings. The transmitted power is also adjusted so that the amount of interference it would create in the ambient cells, termed as co-channel interference is minimized.

Decreasing the cellular area, increases the user capacity (more number of users can be served) but increases the rate of hand-off. Additionally it reduces the power consumption in mobile terminal so it would gives longer talk-time and reduces the health hazards.Gradually, we are moving towards smaller cell from macro cell to femto cell and heterogeneous network having simultaneously smaller and larger cell.

Now, here in this assignment, we shall first fixed the cellular area and then adjust the transmitted power so that the whole cellular area could be served. There are various multimedia services that requires some minimum QoS to be served. The QoS are usually described in the form of bit-error-rate (BER) and BER depends on the received signal-to-noise ratio (SNR). In wireless communication, the received SNR at the mobile terminal is fluctuating depending upon the user mobility and channel conditions. So we have to consider the reliability of the wireless link, for example if we say 90% reliability, then it means that 90% of the time we shall have the desired QoS. Reliability can be increased by providing additional margin in the received SNR, it means that we shall keep the minimum required SNR above the one that is desired for requisite QoS.

Table : Quality of Service		
Sr. No	Service	BER
1	VoIP/Voice	0.01
2.	Live Video Streaming	0.001
3.	Email/File Transfer(FTP)	0.000001

3 Useful Data

1. We shall be considering two types of environment viz. rural and urban.Consider a cell radius of 2 kilometer for rural and 500 meter for urban environment. Also the value of variance (σ i.e. the standard deviation for log normal shadowing in dB) is 6 for rural and 9 for urban environment.
2. SNR Calculation : Choose anyone of the modulation scheme viz. BPSk/4-QAM/16-QAM
In calculating the transmitted power requirement, first calculate the minimum SNR required for voice services (so as to cover the whole cell) and add it to the receiver sensitivity of mobile. Take the receiver sensitivity to be -96 dBm
3. Reliability : Consider the reliability in the range of 75-90 % (you can take some suitable value)
4. QoS : Consider the table of QoS 5. Mathematical Tool : You can use any of the mathematical tool, say MATLAB/Python etc.

4 Problem Statement

1. Evaluate the amount of power that the base station needs to transmit
2. Estimate and plot the coverage area for VoIP services
3. Estimate and plot the coverage area for remaining two services for the same transmitted power
You have to do this for both rural and urban environment.
Finally submit a report (must be in .pdf format) that would include the results/plots. You can assume some value if anything is missing by giving suitable justification for the assumption.