Radio wave Propagation

Problem 1

A receiver in a digital mobile communication system has a noise bandwidth of 200 kHz and requires that its input Signal to Noise (SNR) should be at least 10 dB when the input signal is -104 dBm.

a. What is the maximum permitted value of the receiver noise figure?
b. What is the equivalent input noise temperature of such a receiver?

Problem 2

A base station transmits a power of 10 Watts into a feeder cable with a loss of 10 dB. The transmits antenna has a gain of 12 dBd in the direction of a mobile receiver with antenna gain 0 dBd and a feeder loss 2 dB. The mobile receiver has a sensitivity of -104 dBm.

a. Determine the effective isotropic radiated power
b. Determine the maximum acceptable path loss
c. Assume the system is operational under free space propagation conditions at 900 MHz, determine its maximum range

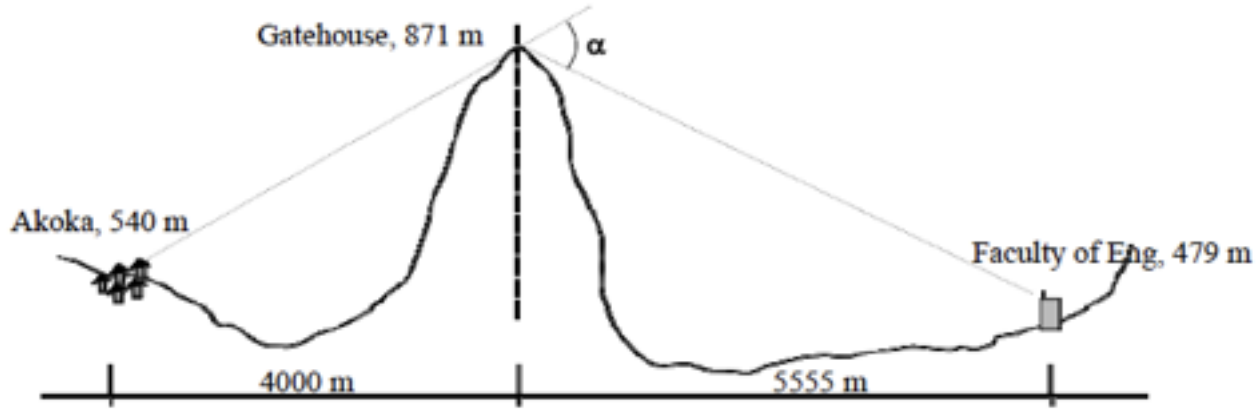
Problem 3

Calculate the maximum range of the communication system of Problem 2, assuming $h_m = 1.5m$, $h_b = 30m$ and $f = 900$ MHz , and that the propagation takes place over a plane earth.

How does this range change if the base station antenna height is trebled?

Problem 4

An important and direct communication channel is being established between Faculty of Engineering of the University of Lagos and the community of Akoka, on the other side of the University gate house. The Figure below, not drawn to scale, shows the distances between the transmitter, receiver and the obstacle, and their respective elevations. The communication frequency is 27 MHz



1. Using a knife edge diffraction model, determine h , the excess height above the line of sight, and α , the pitch angle
2. Determine the excess path length
3. The peak of the mountain comes closet to which Fresnel ellipsoid?
4. Evaluate the Fresnel-Kirchoff diffraction parameter
5. What is the approximate knife edge diffraction gain in dB
6. Is it possible to achieve half power transmission (compared to the obstacle free case) by adjusting the transmission frequency? Explain. If not, how man meters would be required to be removed from UNILAG gate house to achieve half power transmission? If so, at which transmission wavelength(s) would this be possible (Note: half power transmissions corresponds to a diffraction parameter of 0)