2. (2 pts.) COST231-Hata propagation model gives the following expression for the average radio path loss:

$$L = 157.3 - 13.82 \log (h_{eff}) + [44.9 - 6.55 \log (h_{eff})] \log(d)$$

at 1800 MHz. h_{eff} is effective antenna height above terrain in meters and d is the distance between the base station and mobile in meters. How many times does the possible path length increase with 100 m base station antenna height if the radio path loss is allowed to increase by 6 dB?

$h_{eff} = 100\,m$

$L_1 = 157.3 - 13.82 \log(100) + [44.9 - 6.55 \log 100] \log d$ (dB)

$L_2 = L_1 + 6 =$ " " $+ [$ " " $] \log(\alpha d)$ "

$\therefore 6 = (44.9 - 6.55 \log 100) \log \alpha$

$\therefore \alpha = 1.54$ times

Ans:

3. A police traffic control radar has the following properties:

TX power: 100 mW
Antenna gain: 20 dB
Frequency: 10.55 GHz

A motorist uses a small microwave receiver to detect the presence of police radar. The receiver uses an antenna with a gain of 15 dB and has a minimum detectable signal sensitivity of −60 dBm.

(a) (3 pts.) At what range can the police radar be detected?

(b) (1 pt.) What is the electric field amplitude at this range? (units please!)

(a) $P_r = \dfrac{P_t G_t G_r}{(4\pi)^2} \dfrac{\lambda^2}{R^2}$

$G_t = 20\,dB \doteq 100$

$G_r = 15\,dB = 31.6$

$\lambda = 0.028\,m$

$P_t = 100\,mW$, $P_r = -60\,dBm = 10^{-6}\,mW$

$\therefore R^2 = 1.57 \times 10^6\,m^2$

$R = 1.25\,km$

(b) $\dfrac{P_t G_t}{4\pi R^2} = \dfrac{|E|^2_{rms}}{Z_0} = \dfrac{|E|^2_{rms}}{120\pi}$

$E_{rms} = 13.9\,mV/m$ (rms)

or $E_p = 19.6\,mV/m$ peak

Ans:(a)

(b)