Statistical Models of Average Path Loss

$$\lambda = \frac{c}{f} = \frac{3\times10^8}{1.5\times10^9}$$

$$\lambda = 0.2\,m$$

Exercise 1: What is the free-space path loss, in dB, at 10 m for $f = 1500$ MHz? What is the value of $PL(1\text{ km})$?

$$PL(10m) = \left(\frac{\lambda}{4\pi d}\right)^{-2} = \left(\frac{0.2}{4\pi 10}\right)^{-2} = 2.5\times10^{-6}$$

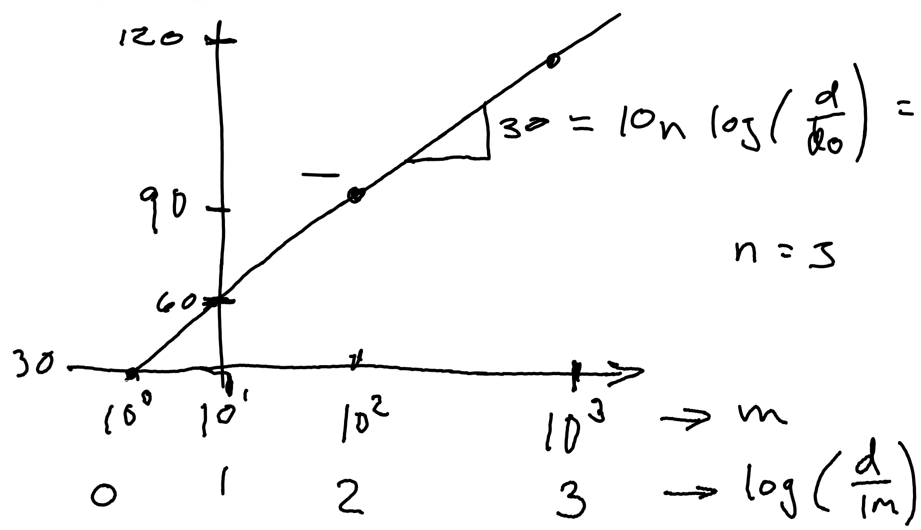
$$= +56\,dB$$

at 1km:

using $d_0 = 10m$: $10\cdot 2 \cdot \log_{10}\left(\frac{1km}{10m}\right)$

$$= +56 + 40 = 96\ dB$$

Exercise 2: If the path loss is 90 dB at 100 m and 120 dB at $d = 1$ km, what are n and $PL(d_0 = 1\text{ m})$?



$$30 = 10n\log\left(\frac{d}{d_0}\right) = 10n\cdot 1$$

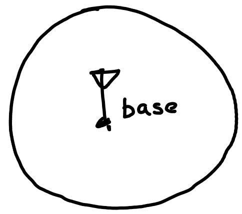
$$n = \frac{30}{10} = 3$$

$$n = 3$$

$$PL(1m) = 30$$

Exercise 3: What path would you have to travel if you wanted to measure the average path loss at a given distance from a particular transmitter?

a circle:



Exercise 4: Compute the median path loss predicted by the Okumura-Hata model at $f = 900\text{MHz}$, base station and mobile antenna heights of 30m and 1m respectively, and a distance of 2km.

$$L_b = 69.55 + 26.16 \cdot \log \frac{f}{\text{MHz}} - 13.82 \cdot \log \frac{h_{Base}}{\text{m}} - a(h_{Mobile})$$

$$+ (44.9 - 6.55 \cdot \log \frac{h_{Base}}{\text{m}}) \cdot \log \frac{d}{\text{km}}$$

where:

$$a(h_{Mobile}) = (1.1 \cdot \log \frac{f}{\text{MHz}} - 0.7) \frac{h_{Mobile}}{\text{m}} - (1.56 \cdot \log \frac{f}{\text{MHz}} - 0.8)$$

fill in these numbers

$f = 900$

$h_{Base} = 30$

$h_{Mobile} = 1$

$d = 2$

homework!