

ITS323 – Transmission Media Notes

$$\begin{aligned} \text{SNR} &= \frac{\text{signal power}}{\text{noise power}} \\ S &= 502 \text{ mW} \\ N &= 2 \text{ mW} \\ \text{SNR} &= \frac{S}{N} \\ &= \frac{502 \text{ mW}}{2 \text{ mW}} \\ &= 251 \end{aligned} \quad \begin{aligned} \text{SNR}_{\text{dB}} &= 10 \log_{10}(\text{SNR}) \\ &= 10 \log_{10}(251) \\ &= 24 \text{ dB} \end{aligned}$$

Figure 1: SNR as dB; Lecture 06

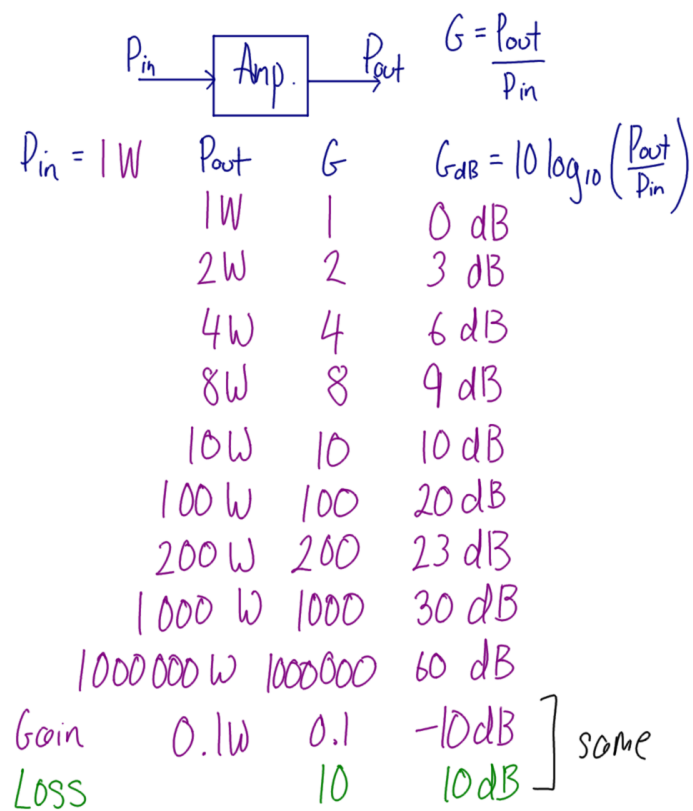


Figure 2: Gain and Loss in dB; Lecture 06

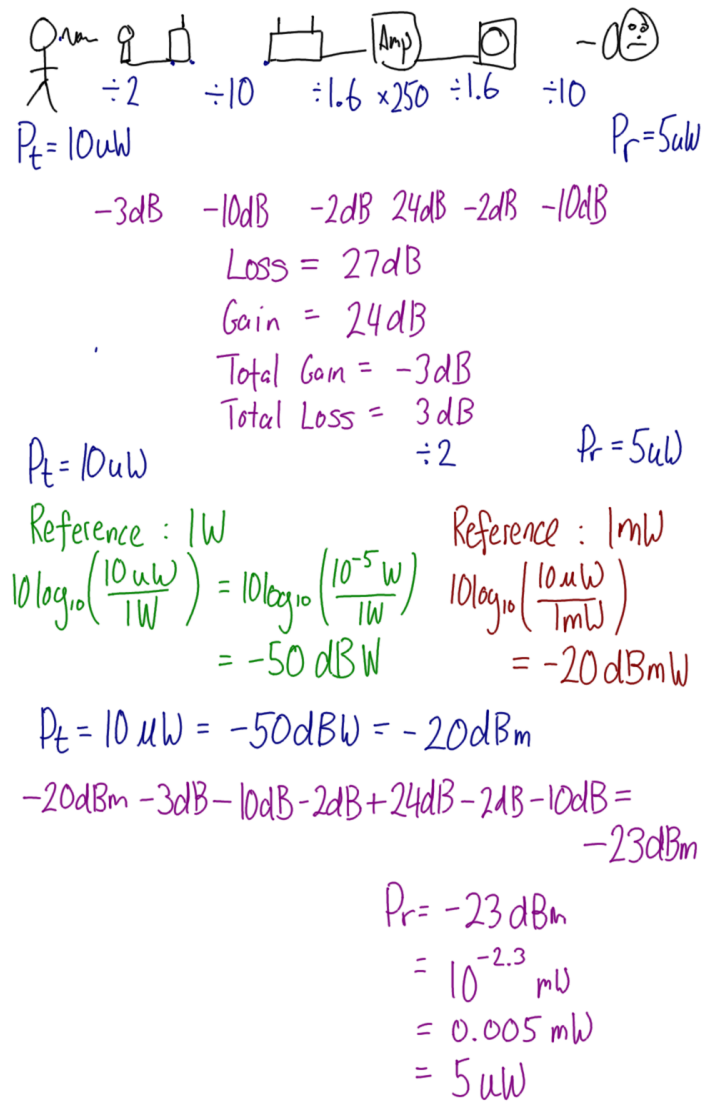


Figure 3: System Gain, dBW and dBm; Lecture 07

P	dBW	dBm
1W	0 dBW	30 dBm
10W	10 dBW	40 dBm
100W	20 dBW	50 dBm

Figure 4: dBW and dBm Values; Lecture 07

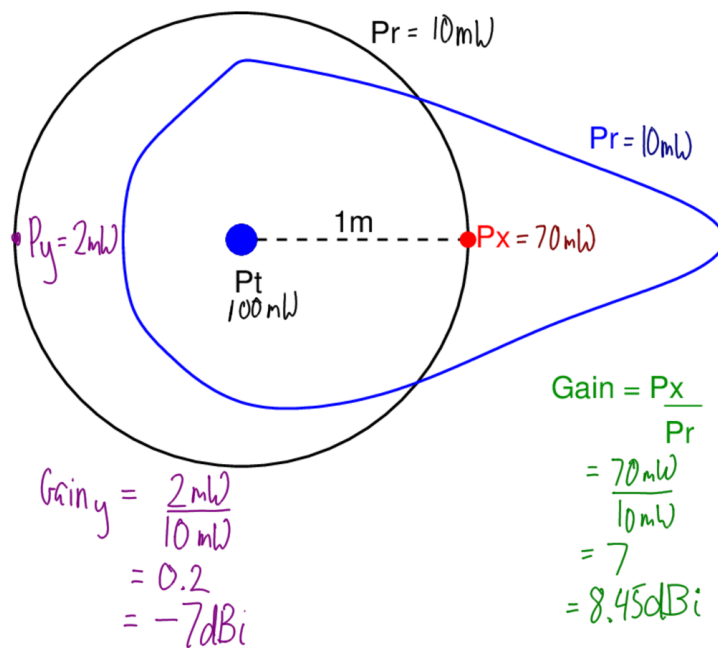


Figure 5: Gain compared to isotropic antenna; Lecture 07

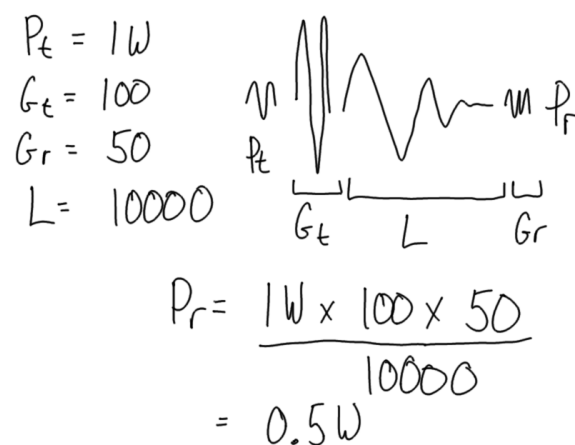


Figure 6: Path Loss Calculation; Lecture 08

$$\begin{array}{l}
 \begin{array}{c} \text{|||} \\ \boxed{\text{Tx}} \end{array} G_t = 2.2 \text{dBi} \quad G_r = 2.2 \text{dBi} \begin{array}{c} \text{|||} \\ \boxed{\text{Rx}} \end{array} \\
 P_t = 20 \text{dBm} \quad P_r = -77 \text{dBm} \\
 f = 2.4 \text{GHz} \\
 \\
 P_r = P_t + G_t + G_r - L \\
 L = P_t + G_t + G_r - P_r \\
 = 20 \text{dBm} + 2.2 \text{dBi} + 2.2 \text{dBi} - (-77 \text{dBm}) \\
 = 101.4 \text{ dB} \\
 = 10^{10.14} \\
 \\
 L = \left(\frac{4\pi d}{\lambda} \right)^2 \quad \lambda = \frac{c}{f} = \frac{3 \times 10^8 \text{ m/s}}{2.4 \times 10^9 \text{ Hz}} \\
 = 0.125 \text{ m} \\
 \\
 d = \frac{\sqrt{L} \lambda}{4\pi} \\
 = 1169 \text{ m}
 \end{array}$$

Figure 7: Wifi, Dipole Antenna and Free Space Path Loss; Lecture 08

$$\begin{array}{l}
 \begin{array}{ccc}
 \text{|||} & G_t = 2.2 \text{ dBi} & G_r = 2.2 \text{ dBi} & \text{|||} \\
 \boxed{\text{Tx}} & & & \boxed{\text{Rx}} \\
 P_t = 20 \text{ dBm} & & & P_r = -77 \text{ dBm} \\
 f = 2.4 \text{ GHz} & & &
 \end{array} \\
 \\
 P_r = P_t + G_t + G_r - L \\
 L = P_t + G_t + G_r - P_r \\
 \\
 \text{Parabolic dish, diameter} = 50 \text{ cm} \\
 A = \pi \times 0.25^2 \\
 A_e = 0.5 \times A \\
 G = \frac{4\pi A_e}{\lambda^2} \\
 = 79 = 19 \text{ dBi} \\
 L = 20 \text{ dBm} + 19 \text{ dBi} + 19 \text{ dBi} - (-77 \text{ dBm}) \\
 = 135 \text{ dB} = 10^{13.5} \\
 d = \frac{\sqrt{L} \lambda}{4\pi} = 56 \text{ km}
 \end{array}$$

Figure 8: Wifi, Parabolic Antenna and Free Space Path Loss; Lecture 08

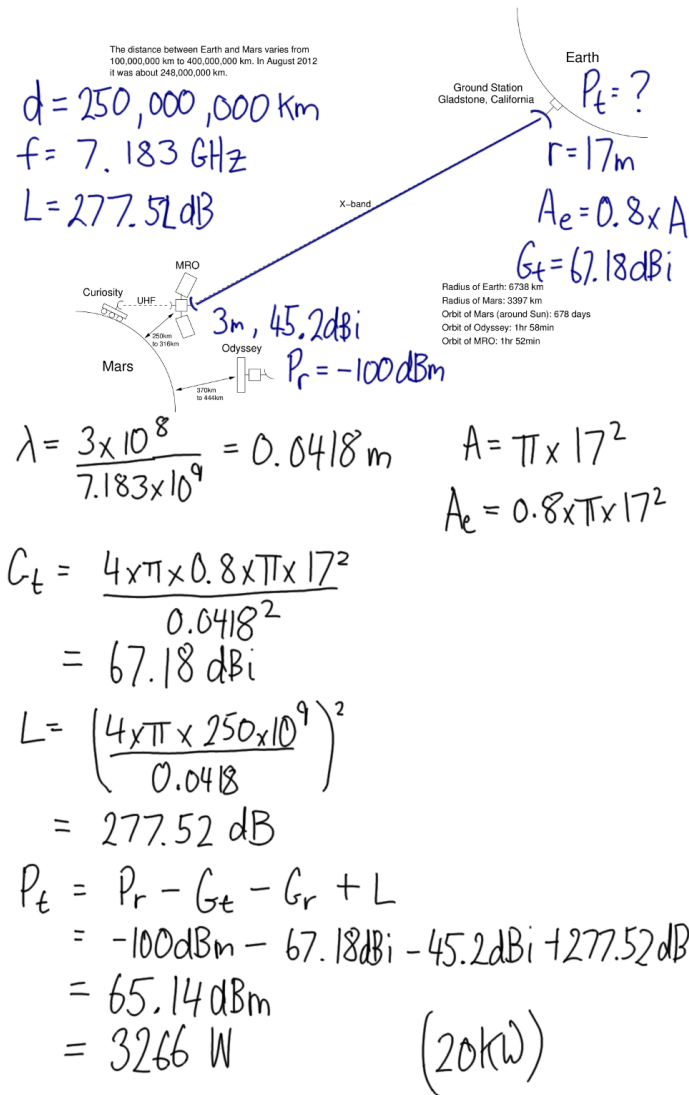


Figure 9: Mars Communications Example; Lecture 09