Antenna Theory and Design

Homework 5

4.5-1) given frequency $f = 1.62\,GHz$, $R = 500\,km$

Gain $= 29\,dB$

Receiver power $P_r = -100\,dBm$

$G_{Gr} = 1\,dB$

We have Free Transmission formulae as

$$P_r(dBm) = P_t(dBm) + G_t(dB) + G_r(dB) - 20\log R(Km) - 20\log f(MHz) - 32.44$$

$$-100 = P_t(dBm) + 29 + 1 - 20\log 1500 - 20\log(1620) - 32.44$$

$$-100 = P_t(dBm) + 30 - 63.52 - 64.19 - 32.44$$

$$-100 = P_t(dBm) - 130.15$$

$$P_t(dBm) = 30.15\,dBm$$

4.5-2) given frequency $f = 85\,MHz$

$G_t = 10\,dB$

$P_t = 20\,W$

$G_r = 3\,dB$

$R = 20\,km$

Calculating P_r

Converting $P_t = 20W$ to $P_t(dBm)$

$$P(dBm) = 10\log_{10}\left(\frac{P_{watt}}{1\,watt}\right) + 30$$

$$= 10\log_{10}\left(\frac{20}{1}\right) + 30$$

$$= 10(1.301) + 30$$

$$P_t(dBm) = 43.01\,dBm$$

Using same formulae we used in 4.5.1)

$$P_{Gr}(dBm) = P_t(dBm) + G_{Tx}(dB) + G_{Rx}(dB) - 20\log R(km) - 20\log f(MHz) - 32.44$$

$$P_{Gr}(dBm) = 43.01 + 10 + 3 - 20\log 20 - 20\log 850 - 32.44$$

$$= 43.01 + 10 + 3 - 26.02 - 58.5 - 32.44$$

$$= -60.95\,dBm$$

P_{Gr} in watts can be given by

$$P(watts) = 1W \cdot 10^{[(P_{dBm} - 30)/10]}$$

$$P_{Gr} = 1W \cdot 10^{[(-60.95 - 30)/10]}$$

$$P_{Gr}(watts) = 7.88 \times 10^{-10}\ watts$$