$P_0 = 55\,W$

$ERIP = 51\,dBW$

$F_0 = 10.5\,GHz$

$R = 36\,000\,km$

$D_p = 0.9\,m$

$\eta_p = 0.9$

$\eta_0 = 0.7$

a) $A_{ef} = ?, \quad D_0 = ?$

$$A_{ef} = \frac{\lambda^2}{4\pi} \cdot G_0 \rightarrow \text{nemam } \lambda, G_0$$

$$\lambda = \frac{c}{F_0} = \frac{3 \cdot 10^8}{10.5 \cdot 10^9} = 0.029$$

dBW u W

$$ERIP = P_0 G_0$$

$$G_0 = \frac{ERIP}{P_0} = \frac{10^{\frac{51}{10}}}{55} = 2289$$

$$A_{ef} = \frac{\lambda^2}{4\pi} \cdot G_0 = \frac{0.029^2 \cdot 2289}{4\pi} = 0.1532\,m^2$$

$$G_0 = \eta_0 \left(\frac{\pi}{\lambda} D_0\right)^2 \Big/ \sqrt{}$$

$$\sqrt{\frac{G_0}{\eta_0}} = \frac{\pi}{\lambda} \cdot D_0 \Big/ \cdot \frac{\lambda}{\pi}$$

$$D_0 = \frac{\lambda}{\pi} \sqrt{\frac{G_0}{\eta_0}} = \frac{0.029}{\pi} \sqrt{\frac{2289}{0.7}} = 0.53\,m$$

b) $P_p = ?$

$$P_p = P_0 G_0 G_p \left(\frac{\lambda}{4\pi R}\right)^2 \rightarrow \text{nemam } G_p$$

$$G_p = \eta_p \left(\frac{\pi}{\lambda} \cdot D_p\right)^2 = 0.9 \left(\frac{\pi}{0.029} \cdot 0.9\right)^2 = 8555$$

$$P_p = P_0 G_0 G_p \left(\frac{\lambda}{4\pi R}\right)^2$$

$$P_p = 55 \cdot 2289 \cdot 8555 \cdot \left(\frac{0.029}{4\pi \cdot 36 \cdot 10^{10}}\right)^2$$

$$P_p = 4.43 \cdot 10^{-12} \text{ W}$$

$$P_p = 10 \log_{10}\left(4.43 \cdot 10^{-12}\right) \text{ dBW}$$

$$P_p = -113.54 \text{ dBW}$$

$$P_p = -113.54 \text{ dBW} + 30$$

$$P_p = -83.53 \text{ dBm}$$