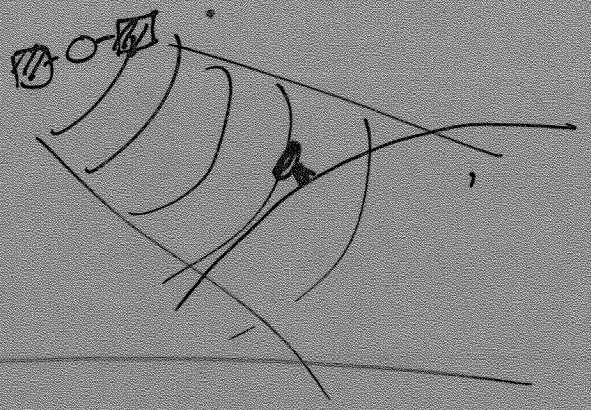
Ch 16 Prob 63

$E_0 = 7.50 \mu\frac{V}{m}$

$= 7.50 \times 10^{-6} \frac{V}{m}$

$D_{dish} = 2.50\,m$



a) Find the intensity of the wave

$I = \frac{EB}{2\mu_0}$ $\quad c = \frac{E}{B}$, Then $B = \frac{E}{c}$

so $I = \frac{E}{2\mu_0}\left(\frac{E}{c}\right) = \frac{E^2}{2\mu_0 c} = \frac{\left(7.50\times10^{-6}\frac{V}{m}\right)^2}{2\left(4\pi\times10^{-7}\frac{Tm}{A}\right)(3.0\times10^8 m/s)}$

$$\boxed{I = 7.46\times10^{-14}\frac{W}{m^2}}$$

b) Power receive by the antenna

The antenna is circular, so $A = \pi r^2 = \pi\left(\frac{D}{2}\right)^2 = \frac{\pi}{4}D^2$

Since $I = \frac{P}{A} \Rightarrow P = I\cdot A = I\frac{\pi}{4}D^2$

$$P = \left(7.46\times10^{-14}\frac{W}{m^2}\right)\frac{\pi}{4}(2.50m)^2 = \boxed{3.66\times10^{-13}W}$$

c) Find power for transmission from the satellite

$A = 1.50\times10^{13}\,m^2$

so $P = I\cdot A = \left(7.46\times10^{-14}\frac{W}{m^2}\right)\left(1.50\times10^{13}\,m^2\right)$

$$\boxed{P = 1.12\,W}$$