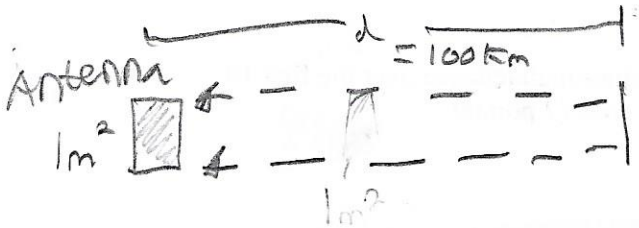
Tx-antenna: 50 KW at 10 GHz

Transmission is in a narrow beam, $1m^2$ in area.

Wave is reflected but only 1% of the power propagates in the direction of the antenna. If the reflection point is 100 Km away from antenna, calculate the total power received by the antenna



$\sigma = 10^{-7}\ [\frac{S}{m}]$

$\varepsilon = \varepsilon_0$

$\mu = \mu_0$

$P_{Tx} = (50\times10^3)e^{-\alpha d} = (50\times10^3)e^{-1.885\times10^{-5}(100\times10^3)} = 7591.45\ [W]$ at reflective surface

$\alpha = \frac{\sigma}{2}\sqrt{\frac{\mu}{\varepsilon}} = \frac{10^{-7}}{2}(377) = 1.885\times10^{-5}\ [\frac{Np}{m}]$

$P_{ref} = P_{Tx}(0.01) = 7591.45(.01) = 75.91\ [W]$

$P_{ant} = 75.91e^{-1.885\times10^{-5}(100\times10^3)} = (11.52\ [W])$ not same Ans as book (0.266W)

NOTES

$\frac{\sigma}{\omega\varepsilon} << 1$ thus assumed low-loss dielectric

α = attenuation constant

P_{Tx} = Power transmitted

P_{ref} = Power received

P_{ant} = Power at antenna (after reflection)