

$$P_{TX} = E \times H = \frac{E_{0TX}^2}{\eta_0} \Rightarrow E_{0TX} = \sqrt{P_{TX}(\eta_0)} = \sqrt{(50 \text{ W})(377)} = 4341.65 \left[\frac{\text{V}}{\text{m}} \right]$$

• assuming low-loss dielectric

from $\frac{\sigma}{\omega \epsilon} \ll 1$

$$\alpha = \frac{\sigma}{2} \sqrt{\frac{\mu_0}{\epsilon_0}} = \frac{10^{-7} (377)}{2} = 1.885 \times 10^{-5} \left[\frac{\text{Np}}{\text{m}} \right]$$

• Electric field intensity at reflective point:

$$E_{0ref} = E_{0TX} e^{-\alpha d} = 4341.65 e^{-(1.885 \times 10^{-5})(100 \times 10^3)} = 659.19 \left[\frac{\text{V}}{\text{m}} \right]$$

• only 1% is reflected back towards antenna.

$$E_{0ref} = 659.19 (0.01) = 6.59 \left[\frac{\text{V}}{\text{m}} \right]$$

• thus electric field at antenna is:

$$E_{0ant} = E_{0ref} e^{-\alpha d} = 6.59 e^{-(1.885 \times 10^{-5})(100 \times 10^3)} = 1.03 \left[\frac{\text{V}}{\text{m}} \right]$$

• Power density at antenna:

$$|\vec{P}_{ant}| = |\vec{E} \times \vec{H}| = \frac{E^2}{\eta_0} = \frac{1.03^2}{377} = 0.0028 \left[\frac{\text{W}}{\text{m}^2} \right]$$

$$P_T = P_{ant} = 0.0028 (1) = 0.0028 \text{ [W]}$$