

$$\lambda = \frac{c}{f} \quad | \quad c = \frac{1}{\mu \epsilon \epsilon_r} c_0$$

$$(n + 1/2) \frac{c}{f} = n \frac{c_0}{f} \Rightarrow n = \frac{1}{2(\sqrt{\mu \epsilon \epsilon_r} - 1)}$$

$$\lambda = \frac{1}{2(\sqrt{\mu \epsilon \epsilon_r} - 1)} \frac{c_0}{f} \approx 2.8 \text{ mm}$$

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a) $Z = \sqrt{\frac{\omega \mu}{2\sigma}} (1+j) = 2.74 (1+j) \Omega$

b) $H = \frac{E}{Z} = 0.027 (1-j) \text{ T}$

c) $P = \frac{1}{2} \cdot E \cdot H \cdot A = 0.027 (1-j) \text{ W}$

d) $t = \frac{d}{v} = 86 \text{ ns}$

e) $E = E_0 \cdot e^{-\frac{z}{\delta}} \Rightarrow Z = -\delta \ln\left(\frac{E}{E_0}\right) = 5.9 (1-j) \text{ mm}$

$\left(\frac{\sigma}{\omega \epsilon}\right)^{\frac{1}{2}} = \frac{10^{-1}}{2\pi \cdot 10^9 \cdot 10^{-9} \cdot 2\pi \cdot 10^8} = 1000 > 1$

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A3.3

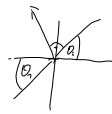
$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

$$\frac{n_1}{n_2} = \frac{\sin(90^\circ - \theta_1)}{\sin \theta_2}$$

$$= \cot \theta_2$$

$$\Rightarrow \theta_2 = \arctan\left(\frac{n_1}{n_2}\right)$$

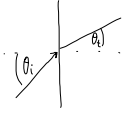
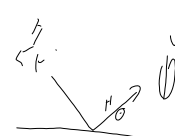
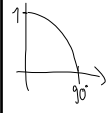

$\theta_2 = 90^\circ - \theta_1$



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$\theta_t < \theta_i$

$\cos(\theta_t)$

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