ECE 4320/5230

TOPIC 1

Ex.1

(a) in free space

$$\lambda_{86MHz} = \frac{300 * 10^6}{86 * 10^6} = 3.49\ m$$

the size of circuit / structure wrt λ is

$$\underbrace{K}_{\text{size}} = \frac{3.6\ (m)}{3.49\ (m)} = \frac{L\ (\text{max dimention of structure})}{\text{operating wavelength}}$$

$$= \underline{\underline{1.03\,\lambda}}$$

(b) in PVC

$$\lambda = \frac{v}{f} \qquad v_0 = \frac{1}{\sqrt{\epsilon_0 \mu_0}}$$

$$= \frac{v_0}{f\sqrt{\epsilon_r \mu_r}}$$

$$= \frac{\lambda_0}{\sqrt{3.5 * 1}} = \frac{3.49}{\sqrt{3.5}} = 1.865\ m$$

$$\rightsquigarrow K = \frac{3.6}{1.865} = \underline{\underline{1.93\,\lambda}}$$

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Ex2

$V_{out} = 120\,\mu V = 41.6\ dB\mu V$

$P_{out} = \frac{V^2}{R_L} * \frac{1000\ mW}{1W}$

$= \frac{(120 \times 10^{-6})^2}{50} \cdot \frac{1000\ mW}{1W}$

$= 2.88 \times 10^{-7}\ mW$

$= -65.4\ dBm$

Ex3 first (1) determine V_{oc} of source
(2) Compute V_{out}

(1) assume $R_L = 50\Omega$ (meter assumption)

$-26\ dBm = 0.002512\ mW$

$= 2.512 \times 10^{-6}\ W = P_{out}|_{50\Omega}$

$V_{out}|_{R_L=50} = \sqrt{50 \cdot P_{out}}$

$= 11.2\ mV$

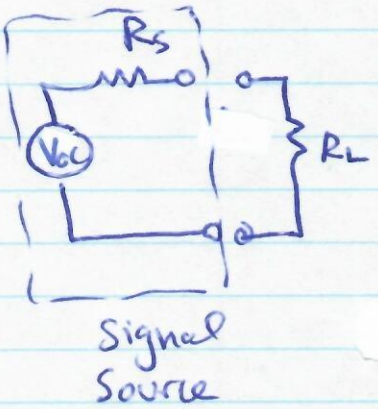
$= 80.99\ dB\mu V$

When $R_S = R_L$

$V_{OC} = 2 * V_{out}|_{R_L=50}$

$= 22.3\ mV$

$= 87\ dB\mu V$



now, substituting $R_L = 150\ \Omega$ instead of 50

$$V_{out} = \frac{150}{50+150} * 22.4\,mV$$

$$= 16.8\,mV$$

$$= 84.5\ dB\mu V$$

Ex4