P4

$$V = \frac{1}{\sqrt{\varepsilon_r \varepsilon_0 \mu_0}} \qquad \mu_0 = 1{,}2566 \times 10^{-6} \qquad \varepsilon_0 = 8.8541 \times 10^{-12}$$

$L_{1,2} \Rightarrow \varepsilon_r = 4$ y $L_3 \Rightarrow \varepsilon_r = 9$

$L_1 = 0{,}2125\,m$
$L_2 = 0{,}5\,m$
$L_3 = 0{,}15\,m$

REEMPLAZANDO

$V_{1,2} = 1{,}499 \times 10^8$ y $V = \frac{2\pi f}{\beta}$ con $f = 1\,GHz$

$V_2 = 9{,}9933 \times 10^7$

CONSTANTE DE PROPAGACIÓN $\gamma = \alpha + j\beta$

COMO LAS LINEAS NO TIENEN PERDIDAS

$\alpha_1 = \alpha_2 = \alpha_3 = 0$

Reemplazando

$$\beta_1 = \frac{2\pi \cdot 1\,GHz}{1{,}499 \times 10^8} = 41{,}9158 \quad \text{y} \quad \beta_1 = \beta_2 \Rightarrow \beta_2 = 41{,}9158 \left[\frac{rad}{m}\right]$$

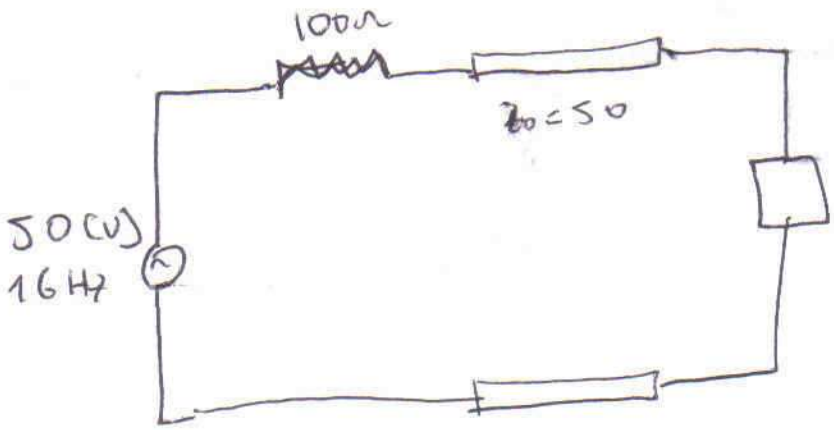
$$\beta_3 = \frac{2\pi \cdot 1\,GHz}{9{,}9933 \times 10^7} = 62{,}874 \left[\frac{rad}{m}\right]$$

$$\Rightarrow \gamma_{1,2} = j\,41{,}9158 \quad \text{y} \quad \gamma_3 = j\,62{,}874$$

Con $Z_{01} = 50\,\Omega$ y $Z_L = 75 - j\,150\,\Omega$

$$Z_{L2} = Z_{01}\left[\frac{Z_2 + j Z_{01} \tan(\beta_2 \cdot 0{,}5)}{Z_{01} + j Z_2 \tan(\beta_2 \cdot 0{,}5)}\right] = 12{,}6608 + 50{,}0953j$$

$$Z_{L3} = j\, z_{02} \tan(\beta_3 \cdot 0{,}15) = 0{,}4742\,j$$



$$z_{eq} = z_{L2} \,//\, z_{L3}$$

$$z_{eq} = 0{,}001 + 0{,}47\,j$$

$$\rho_1 = \frac{z_{eq} - 50}{z_{eq} + 50} = -0{,}9998 + 0{,}0188\,j$$

$$\boxed{\rho_1 = -0{,}9998 + 0{,}0188\,j}$$

$$V^- = V^+ \rho_1 \quad \text{con} \quad V^+ = \frac{50 \cdot 50}{50 + 100} = 16{,}6667\,[V]$$

$$\Rightarrow$$

$$V^- = -16{,}6633 + 0{,}3133\,j$$

$$ROE = \frac{V_{MAX}}{V_{MIN}} \quad \text{o} \quad ROE = \frac{1 + |\rho_1|}{1 - |\rho_1|}$$

$$\Rightarrow \boxed{ROE = 4{,}7731 \times 10^{4}}$$

$$z_{INPUT} = z_0 \left[\frac{z_{eq} + j\, z_0 \tan(\beta_1 \cdot 0{,}2125)}{z_0 + j\, z_{eq} \tan(\beta_1 \cdot 0{,}2125)} \right] = 0{,}0014 - 27{,}8545\,j$$

$$V_{2L} = \frac{50 \cdot z_{INPUT}}{z_{INPUT} + 100} = 3{,}6006 - 12{,}8241\,j \Rightarrow P_{2L} = \frac{1}{2} Re\left(\frac{V_{2L}^2}{z_{INPUT}^*} \right)$$

LÍNEAS SIN PÉRDIDAS

$$\boxed{P_{2L} = 1{,}624 \times 10^{-4}}$$