Si $Z_L \to \infty$:

$$Z_e = \frac{Z_0}{j\,tg(\beta x)} \quad \text{(II)}$$

$$Z_e = Z_0 \cdot \frac{Z_L + jZ_0 \cdot tg(\beta x)}{Z_0 + jZ_L \cdot tg(\beta x)}$$

$$Z_0 \cdot Z_e + jZ_L \cdot Z_e \cdot tg(\beta x) = Z_0 \cdot Z_L + jZ_0^2 \cdot tg(\beta x)$$

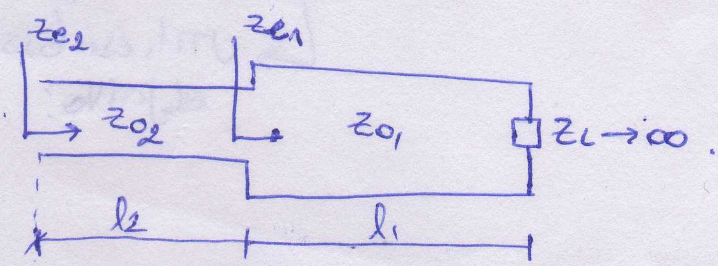
$$Z_0(Z_e - Z_L) = tg(\beta x) \cdot (jZ_0^2 - jZ_L Z_e)$$

$$\boxed{tg(\beta x) = \frac{Z_0(Z_e - Z_L)}{j(Z_0^2 - Z_L Z_e)}}$$

$$Z_0 = \frac{60}{\sqrt{\varepsilon_r}} \cdot \ln\left(\frac{b}{a}\right)$$

$$\beta = \frac{2\pi}{\lambda} = \frac{2\pi}{\frac{c}{\sqrt{\varepsilon_r} \cdot f}} = \frac{2\pi\sqrt{\varepsilon_r} \cdot f}{c}$$

$$\cancel{tg\left(\frac{2\pi\sqrt{\varepsilon_r} \cdot f}{c} x\right) =}$$



$$Z_{e_2} = Z_{0_2} \cdot \frac{Z_{e_1} + jZ_{0_2} \cdot tg(\beta_2 \cdot l_2)}{Z_{0_2} + jZ_{e_1} \cdot tg(\beta_2 \cdot l_2)} \quad y \quad \beta_2 = \frac{2\pi\sqrt{\varepsilon_{r_2}} \cdot f}{c}$$

La incognita es Z_{e_1}:

$$Z_{e_2} \cdot Z_{0_2} + jZ_{e_2} \cdot Z_{e_1} \cdot tg(\beta_2 \cdot l_2) = Z_{0_2} \cdot Z_{e_1} + jZ_{0_2}^2 \cdot tg(\beta_2 \cdot l_2)$$

$$Z_{e_1} \cdot \left[jZ_{e_2} \cdot tg(\beta_2 \cdot l_2) - Z_{0_2}\right] = jZ_{0_2}^2 \cdot tg(\beta_2 \cdot l_2) - Z_{e_2} \cdot Z_{0_2}$$

$$\boxed{Z_{e_1} = \frac{jZ_{0_2}^2 \cdot tg(\beta_2 \cdot l_2) - Z_{e_2} \cdot Z_{0_2}}{jZ_{e_2} \cdot tg(\beta_2 \cdot l_2) - Z_{0_2}}} \quad \text{Formula (I)}$$

~~Ahora utilizo formula (II) ya que $Z_L \to \infty$.~~

$$\cancel{tg(\beta_1 l_1) = j\,(Z_{0_1}^2 - Z_L \cdot Z_{e_1}) = jZ_{0_1}^2 - jZ_L Z_{e_1}}$$

Caso $Z_L \to \infty$: utiliza la formula (II):

$$\cancel{tg(\beta_1 l_1) = \frac{-j Z_L \cdot Z_{e1}}{-Z_{01} \cdot Z_L}}$$

$$\cancel{tg(\beta_1 l_1) = \frac{j Z_{e1}}{Z_{01}}}$$

$$Z_{e1} = \frac{Z_{01}}{j\, tg(\beta_1 l_1)}$$

$$Z_{e1} = \frac{\frac{60}{\sqrt{\varepsilon_{r1}}} \cdot \ln\left(\frac{b}{a}\right)}{j\, tg\left(\frac{2\pi \sqrt{\varepsilon_{r1}} \cdot F}{c} \cdot l_1\right)}$$

Formato $k_1 \cdot tg(k_2 \cdot x) = \frac{1}{x}$ ¿Cómo despejo x?

→ ¡Utilizar buscar objetivo!

$$\Gamma_e = \frac{Z_e - Z_0}{Z_e + Z_0} \Longrightarrow \Gamma_e \cdot Z_e + \Gamma_e \cdot Z_0 = Z_e - Z_0$$

$$Z_e(\Gamma_e - 1) = Z_0(-\Gamma_e - 1)$$

$$Z_e = \frac{-Z_0(\Gamma_e + 1)}{(\Gamma_e - 1)}$$

$$Z_e = Z_0 \frac{(1 + \Gamma_e)}{(1 - \Gamma_e)}.$$
