

Lab 3

- valid frequency range for the TRL kit

$$f = \frac{3 \cdot 10^8}{\sqrt{3.103} \cdot 6.44} \left(\frac{\theta}{360} \right) =$$

$$f_{20} = \frac{3 \cdot 10^8}{\sqrt{3.103} \cdot 6.44} \left(\frac{20}{360} \right) = 1.469 \text{ GHz}$$

$$f_{160} = \frac{3 \cdot 10^8}{\sqrt{3.103} \cdot 6.44} \left(\frac{160}{360} \right) = 11.75 \text{ GHz}$$

- effective dielectric constant of the material

Eff: line-Thru: 6.44 mm
from raw data, S_{21} phase, @ 3 GHz: -40.839°

$$\frac{360}{40.839} \cdot 6.44 = 56.77 \text{ mm}$$

$$\lambda_0 @ 3 \text{ GHz} = 100 \text{ mm}$$

$$\Rightarrow \sqrt{\epsilon_{\text{eff}}} = \frac{100}{56.77} = 1.76 \Rightarrow \epsilon_{\text{eff}} = 3.103$$

- propagation velocity of the medium

$$v_p = \frac{3 \cdot 10^8}{\sqrt{\epsilon_{\text{eff}}}} = 1.703 \cdot 10^8 \text{ m/s}$$

- attenuation coefficient in Np/m

α :
from raw data S_{21} (dB) @ 3 GHz: -0.02936

$$\frac{-0.02936}{0.00644} = -4.4 \text{ dB/m}$$

$$1 \text{ dB} = 0.11513 \text{ Np}$$

$$\Rightarrow \alpha = 4.4 \frac{\text{dB}}{\text{m}} = 0.5 \frac{\text{Np}}{\text{m}}$$