11.59 A 50 Ω air-filled slotted line is applied in measuring a load impedance. Adjacent minima are found at 14 cm and 22.5 cm from the load when the unknown load is connected, and $V_{max} = 0.95$ V and $V_{min} = 0.45$ V. When the load is replaced by a short circuit, the minima are 3.2 cm to the load. Determine s, f, Γ, and Z_L.

(11.38) $s = \frac{V_{max}}{V_{min}} = \frac{0.95\,V}{0.45\,V} = \underline{2.11 = s}$

↳ plot on Smith Chart

$|\Gamma| = \frac{2.11-1}{2.11+1} = \underline{0.357}$

$\lambda/2 = 22.5\text{cm} - 14\text{cm} = 8.5\text{cm} \quad \lambda = 17\text{cm}$

$u = f\lambda \rightarrow f = u/\lambda = \frac{2.9979\times10^8}{17\times10^{-2}}$

$\underline{f = 1.7635\ \text{GHz}}$

$\frac{\ell}{\lambda} = \frac{3.2\text{cm}}{17\text{cm}} = 0.1882$ ← move "Toward Load" from V_{min} / r_{min}

Read $z_L = 1.4 - j0.8\ \Omega$

$\underline{Z_L = z_L Z_0 = 70 - j40\ \Omega}$

$\measuredangle \Gamma_L = -44.5°$

$\underline{\Gamma_L = 0.357\angle -44.5°}$

Simple Smith Chart

$Z_o = 50\Omega$

$u = c, \lambda = 17\text{cm}$