A lossless transmission line (75 Ω, 1.98 × 10^8 m/s) has a load of 16.5 – *j*34.5 Ω at 2.2 GHz. Design and sketch a quarter-wave transformer (QWT), using a Smith chart, to match the load with the QWT placed as close as possible to the load. Assume that the QWT section has a phase velocity of 2.08 × 10^8 m/s.

→ Calculate $z_L = \frac{Z_L}{Z_0} = \frac{16.5 - j34.5\,\Omega}{75\,\Omega} = 0.22 - j0.46\ \Omega/\Omega$

→ Draw circle of $|\Gamma| = 0.695$ through z_L

→ Note $\underbrace{z_{min} = 0.18\ \Omega/\Omega}_{\text{closest}}$ & $z_{max} \simeq 5.5\ \Omega/\Omega$

→ Find distance from z_L to z_{min} using WTG Scale $\ell_{min} = 0.5 - 0.429\lambda = \underline{\underline{0.071\lambda}}$

where $\lambda = \frac{v_p}{f} = \frac{1.98\times10^8}{2.2\times10^9} = 9\,cm = \underline{\underline{0.639\,cm}}$

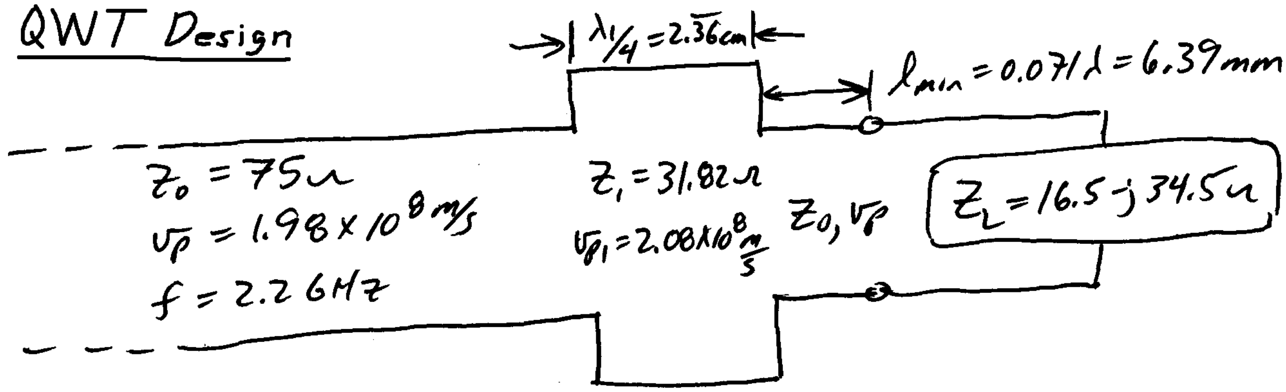
→ Use $Z_1 = \sqrt{Z_0 Z_{min}} = \sqrt{75(0.18)75} = \sqrt{75(13.5)}$

$\underline{\underline{Z_1 = 31.82\,\Omega}}$ for $\lambda/4$ section

where $\lambda_1 = \frac{2.08\times10^8}{2.2\times10^9} = 0.09\overline{45}\,m = 9.\overline{45}\,cm$

$\hookrightarrow \lambda_1/4 = 2.\overline{36}\,cm$

<u>QWT Design</u>



Simple
Smith Chart

$Z_0 = 75\Omega$

$v_p = 1.98 \times 10^8$ m/s

$f = 2.2$ GHz