You have an antenna with input impedance $Z_A = 12.5 + j\,40\ \Omega$ at 200 MHz. Match it to a feeding transmission line ($Z_0 = 50\ \Omega$ & $u = 2.5 \times 10^8$ m/s) using a discrete inductor connected in series as close to the antenna as possible. Draw a fully labeled sketch of the final design.

- The wavelength is $\lambda = c/f = 2.5\times10^8/200\times10^6 = 1.25$ m = 125 cm.

Steps

1) Calculate normalized impedance $z_A = Z_A/Z_0 = (12.5 + j\,40)/50 \Rightarrow$ **$z_A = 0.25 + j\,0.8\ \Omega/\Omega$** and plot on **Smith chart** (see Figure 2).

2) Draw circle, centered on Smith chart, through z_A point. This circle of constant $|\Gamma|$ includes the locus of all possible z_{in} (and y_{in}) along the transmission line with this load.

3) The two match points are $z_{m,i} = 1 \pm j2.2\ \Omega/\Omega$. To use a discrete series inductor for matching, **select $z_{m,2} = 1 - j2.2\ \Omega/\Omega$** as it has a capacitive reactance. Note, the match point impedance is $Z_{m,2} = z_{m,2}\,Z_0 = (1 - j2.2)\,50 = 50 - j110\ \Omega$.

4) Find the distance d_2 from z_A to $z_{m,2}$ using scales on Smith chart, $d_2 = (0.309 - 0.11)\,\lambda \Rightarrow$ **$d_2 = 0.199\lambda$** or $d_2 = 0.199(125\text{ cm}) \Rightarrow$ **$d_2 = 24.875$ cm**.

5) At d_2, add a discrete inductor in series with reactance $Z_{ind} = j\omega L = j110\ \Omega$. Solving for L yields $L = 110/(2\pi\,200\times10^6) = 8.7535\times10^{-8}$ H $\Rightarrow$ **$L = 87.535$ nH**.

6) As shown on Figure 1, everywhere toward the source from the location of L will be matched, i.e., $Z_{in} = 500\ \Omega$.

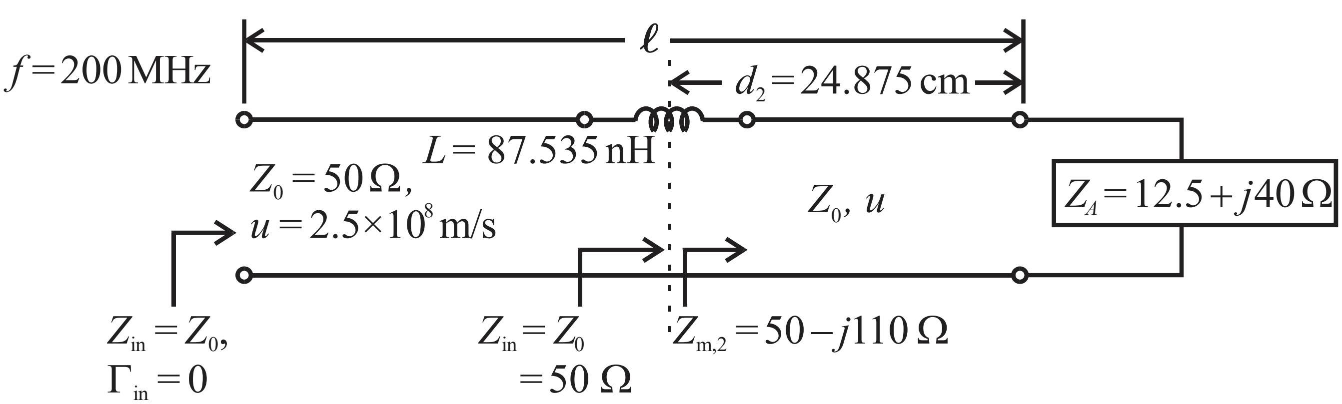

Figure 1 Matching antenna using discrete series inductor.

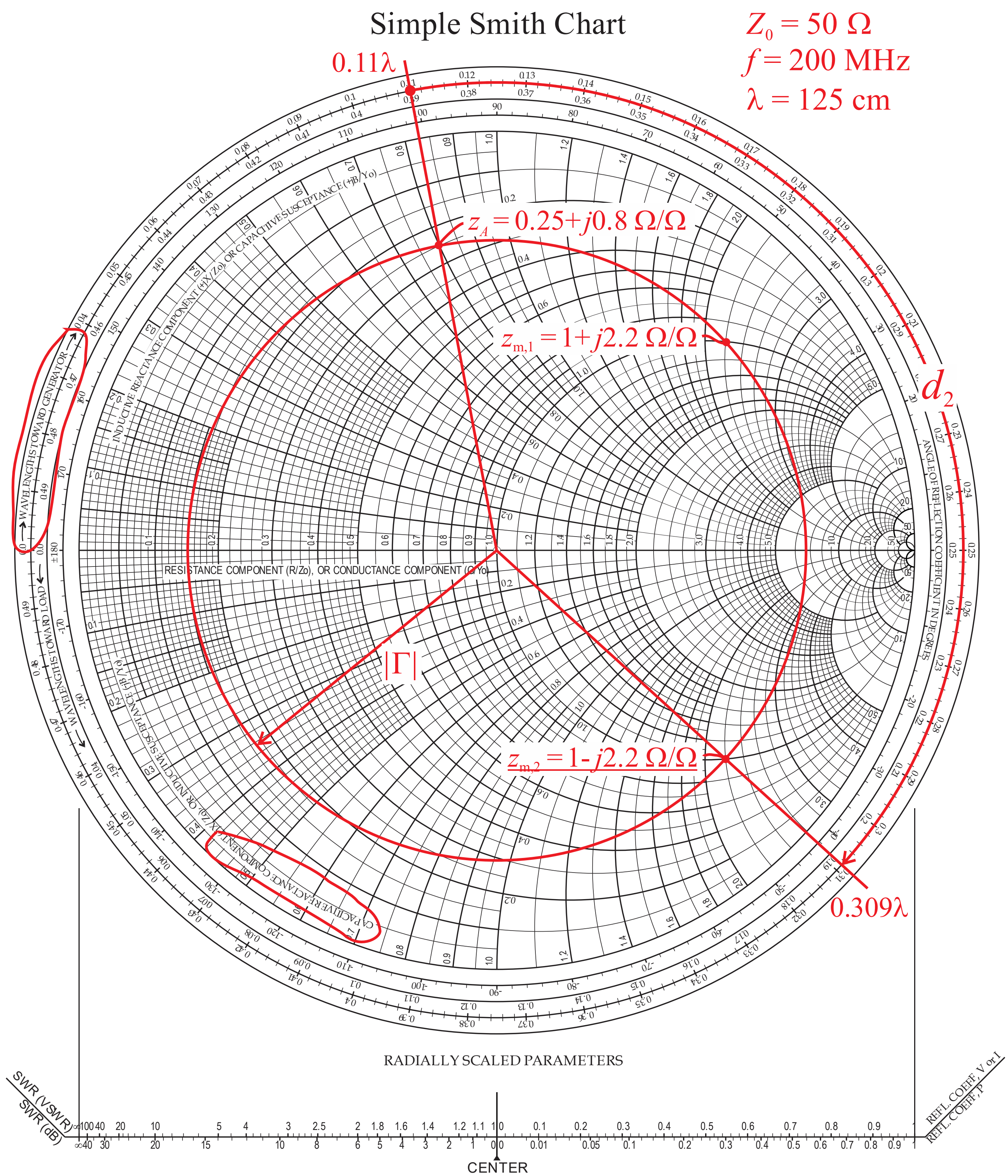

Figure 2 Smith chart for matching an antenna using discrete <u>series</u> inductor.