Homework 4 (back before Midterm)

The S-parameters of an active two-port network (GaN power HEMT) measured at 10 GHz are given below (Z_0 at both ports is 50 Ω)

1. Is this network lossless, reciprocal?
2. Calculate the input impedance if the 2nd port is loaded by 10-j20 Ohm.
3. Design a microstrip matching network (using series line and open shunt stub) to 50 Ω for this input impedance using Smith chart, calculate the length and width of the microstrip lines for alumina board with ε_r=9.8 and thickness d=0.127 cm (assume other parameters ideal).
4. Calculate the input impedance if the 2nd port is loaded by 100+j50 Ohm. Is it still possible to use lossless matching network to match this impedance

$$\boldsymbol{S} = \begin{bmatrix} \mathbf{0.75 - j0.4} & \mathbf{-0.04 + j0.04} \\ \mathbf{-6 + j} & \mathbf{0.65 - j0.2} \end{bmatrix}$$