

Lab #1

ADS investigation of S-parameters for 2-port networks

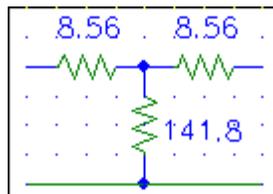
ECEn 464

Introduction: S-parameter analysis is essential to wireless communication circuit design and analysis. The Agilent ADS Software has become a standard that is used to aid in the design and analysis of complex RF and microwave circuits. This lab is designed to reinforce the student's understanding of S-parameters by using the Agilent ADS Software to explore the properties of simple two-port networks.

Laboratory objective: Encourage students to explore the significance of S-parameters in the analysis of two port networks.

Laboratory exercises:

1. **Review ADS basics learned in ECEn 360/362:** You may need to review the first ADS lab from the ECEn 360 laboratory class pages. In particular, study the “Sinusoidal Steady State Simulation Section” of the first ADS lab.
2. **S-parameters of a matched transmission line:** Use ADS to investigate the scattering matrix for a matched microstrip transmission line. In your simulation choose a line length of 4 inches having characteristic impedance of 50 ohms. Assume the system impedance is also 50 ohms. Set the dielectric constant to 3.26, the conductor thickness to 1 mil, and the substrate thickness to 30 mils. (Hint: Use *line calc.* from the *Tools* menu)
 - a. Record a plot of the magnitude of S11 and S12 as a function of frequency from 100 MHz to 4 GHz.
 - b. Record a plot of the phase of S11 and S12 as a function of frequency over the same frequency range
 - c. Write the 2 by 2 scattering matrix for this line at a frequency of 1 GHz
3. **S-parameters of an unmatched T-line:** Repeat the procedures in (2) above for a 100 ohm transmission line.
4. **S-parameters of the following circuit:**
Show that you can use ADS to find the S-matrix for the circuit shown below:



Conclusion: Make a statement about the value of S-parameters and the usefulness of ADS in finding S-parameters.