RF Lab 1 Report

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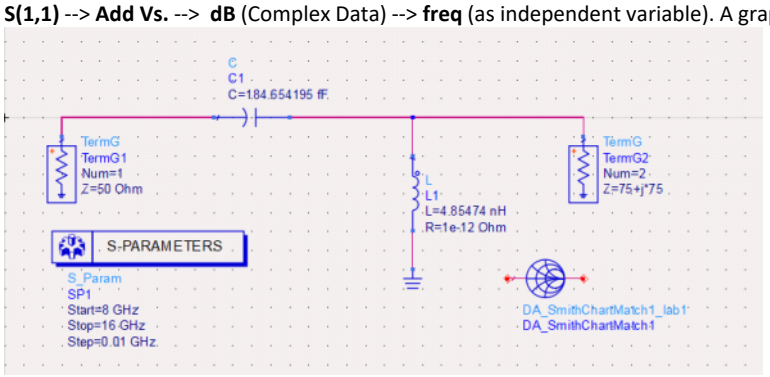
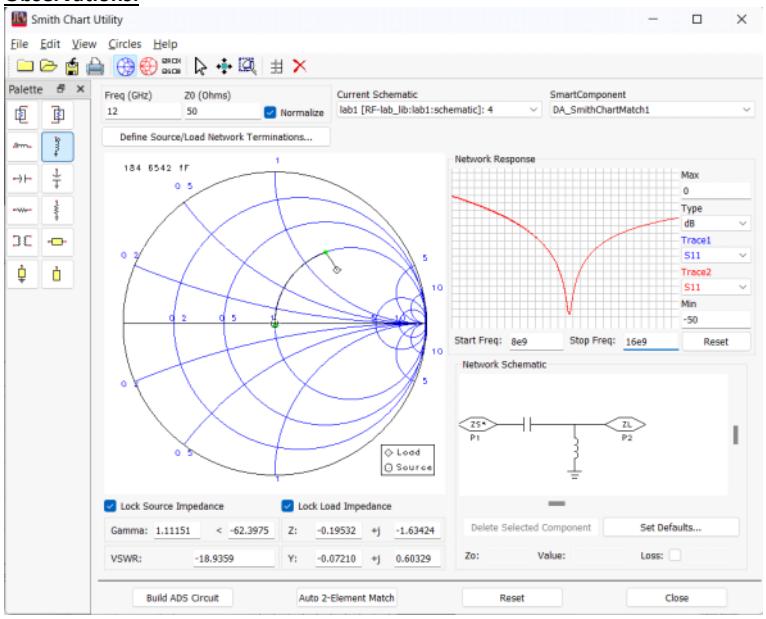
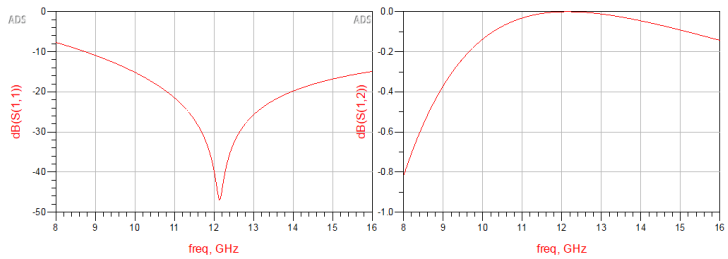
(SC22B146)

1. **Given a load impedance of 75 + j*75, design a 2-element lumped matching port circuit to match with a source impedance of 50 ohms at 12 GHz.**
   Procedure:
   a. Place two **TermG** components from Basic Components palette and assign them the values of 50 ohms and 75+j75 ohms.
   b. Place a **Smith Chart Matching Network** from the **Smith Chart Matching** palette.
   c. Go to **Tools -> Smith Chart…** to open **Smith Chart Utility** by selecting the smith chart in the workspace.
   d. In the **Smith Chart Utility** window, specify the matching frequency (12 GHz), Z0 (50 Ohms), source impedance (50+j*0), load impedance (75+j*75), Max (1), Type (dB), Trace1 (S11), Trace2 (S11), Min (0), Start Freq (0) and Stop Freq (14.0e9). Optionally lock the source and load impedances.
   e. Design a two element matching circuit by clicking on the lumped elements (Inductors and Capacitors) with the help of smith chart. Finally, click **Build ADS Circuit**.
   f. To open the circuit, select the smith chart and click on **Push into Hierarchy** (in the toolbox). Select and copy the relevant circuit and **Pop Out**.
   g. Then join the circuit with the **TermG**s.
   h. Now search and place **S_Param** component and set its Start, Stop and Step-size frequencies.
   i. Click on **Simulate**. A simulation window will open. Then, place a **Rectangular Plot** from the **Palette**. In **Plot Traces & Attributes** window, plot **S(1,1)** --> **Add Vs.** --> **dB** (Complex Data) --> **freq** (as independent variable). A graph will be plotted. Repeat this for **S(1,2)**.



Observations:





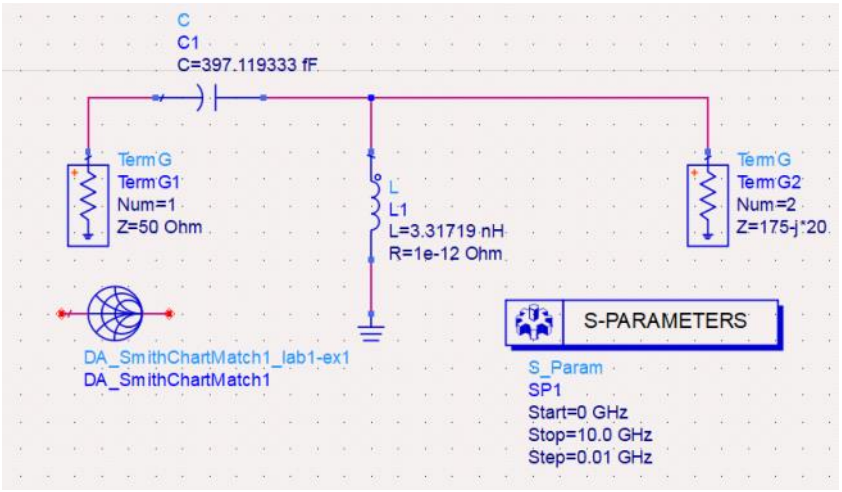
For the matching network, we get the following values for inductance and capacitance:

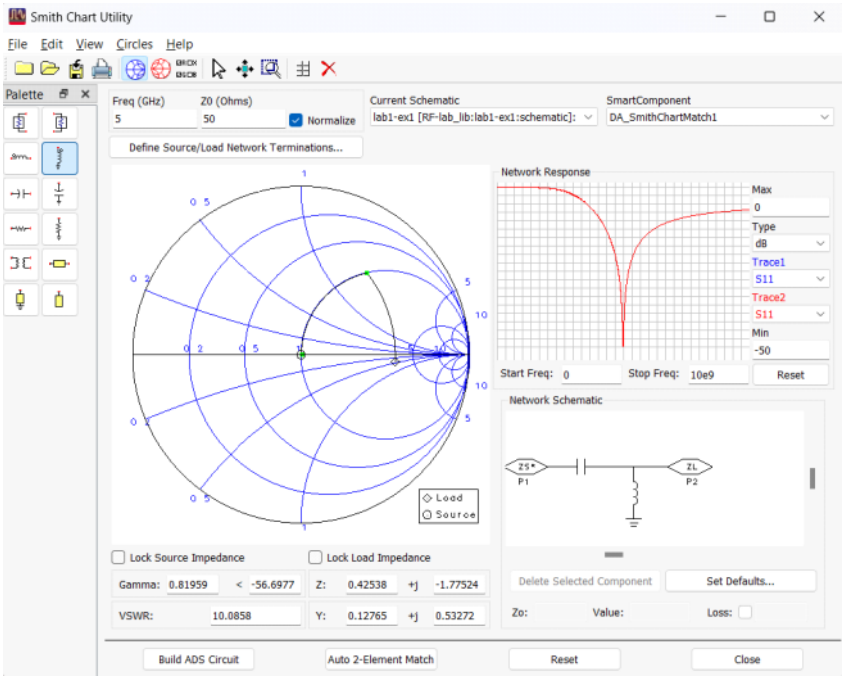
L = 184.654195 fF (shunt)
C = 4.85474 nH (series)

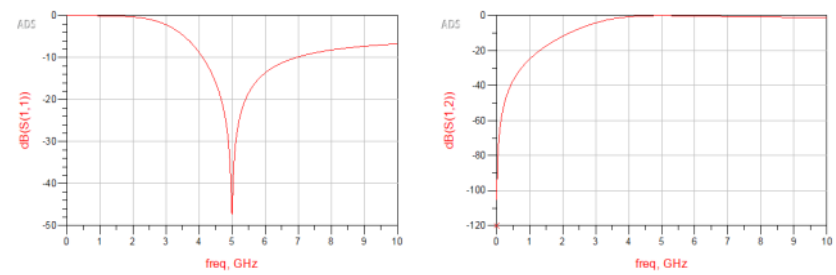
2. **Design a Lumped element matching circuit to match a 50 Ohm load to a complex load of 175 -j20 Ohm with an impedance Bandwidth of 5GHz. (The operating frequency is also 5 GHz).**

Procedure:

a. Place two **TermG**s: 50 ohms and 175-j20 ohms.
b. Place a **Smith Chart Matching Network** from the **Smith Chart Matching** palette.
c. Go to **Tools -> Smith Chart…** to open **Smith Chart Utility** by selecting the smith chart in the workspace.
d. In the **Smith Chart Utility** window, specify the matching frequency (5 GHz), Z0 (50 Ohms), source impedance (50+j*0), load impedance (175-j* 20), Max (0), Type (dB), Trace1 (S11), Trace2 (S11), Min (-50), Start Freq (0) and Stop Freq (10.0e9).
e. Design a two element matching circuit and click **Build ADS Circuit**.
f. Copy and join the circuit with the **TermG**s.
g. Now search and place **S_Param** component and set its Start, Stop and Step-size frequencies.
h. Click on **Simulate** and plot **S(1,1)** and **S(1,2**) vs frequency.







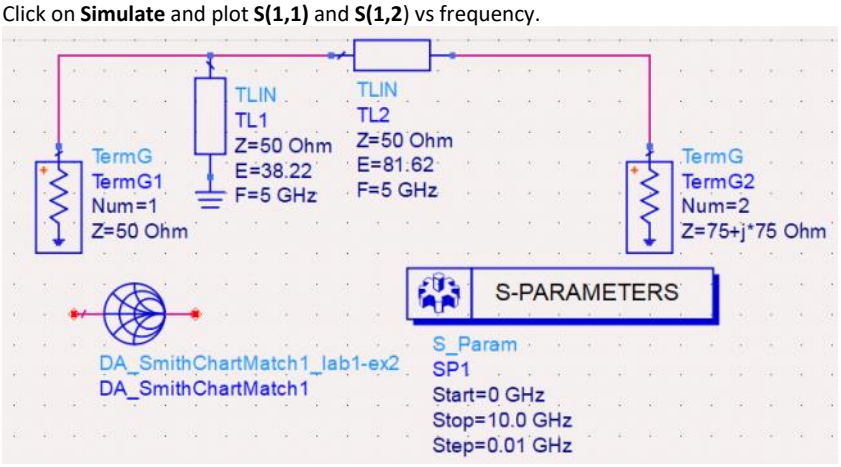
For the matching network, we get the following values for inductance and capacitance:

L = 3.31719 nH (shunt)
C = 397.119333 fF (series)

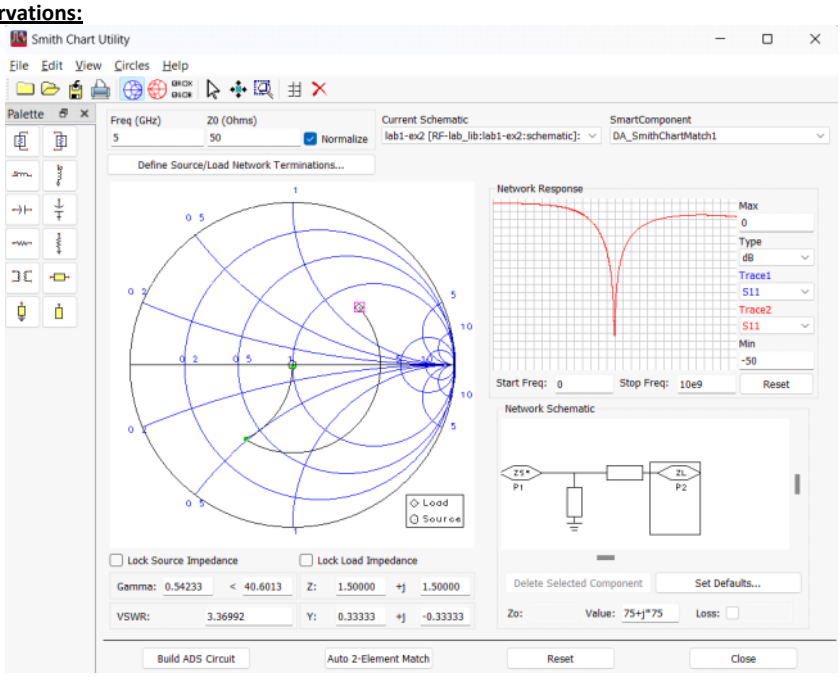
3. **Design a Matching circuit using Stubs to match a 50 Ohm source to any complex load of your choice.**

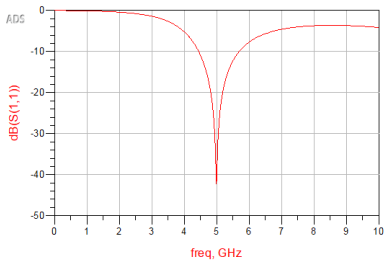
Procedure:

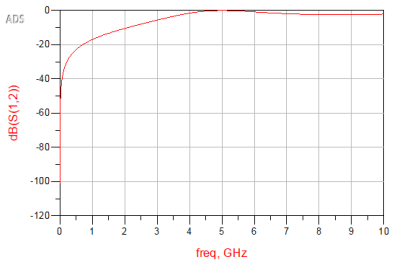
a. Place two **TermG**s: 50 ohms and 75+j75 ohms (choice).
b. Place a **Smith Chart Matching Network** from the **Smith Chart Matching** palette.
c. Go to **Tools -> Smith Chart…** to open **Smith Chart Utility** by selecting the smith chart in the workspace.
d. In the **Smith Chart Utility** window, specify the matching frequency (5 GHz), Z0 (50 Ohms), source impedance (50+j*0), load impedance (75+j*75), Max (0), Type (dB), Trace1 (S11), Trace2 (S11), Min (-50), Start Freq (0) and Stop Freq (10.0e9).
e. Design a two stub element matching circuit and click **Build ADS Circuit**.
f. Copy and join the circuit with the **TermG**s.
g. Now search and place **S_Param** component and set its Start, Stop and Step-size frequencies.
h. Click on **Simulate** and plot **S(1,1)** and **S(1,2)** vs frequency.



Observations:







For the matching network, we get the following values for stub impedances:

Short line impedance = 50 Ohm
Line impedance = 50 Ohm