

**Operation: Learn Microwave Office**  
**Assignment 2**

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**Watch video tutorials**

AWR Design Environment (Microwave Office) tutorials are found at the following link:

[http://www.aaronscher.com/Microwave\\_office\\_video\\_tutorials/Microwave\\_office\\_video\\_tutorials.html](http://www.aaronscher.com/Microwave_office_video_tutorials/Microwave_office_video_tutorials.html)

This assignment is based on the following tutorials (found by clicking the link above)

*Video 5: How to use Microwave Office's TXLine to design a 50 Ohm microstrip line*

**Simulate a bandpass filter (based partly on Video 5)**

Figure 1 shows the layout of a microstrip bandpass filter. In this problem you will use Microwave Office to simulate the insertion loss ( $|S_{21}|$ ) and return loss ( $|S_{11}|$ ) of this circuit. The properties of the microstrip substrate are as follows:

Substrate thickness  $h = 1.27$  mm

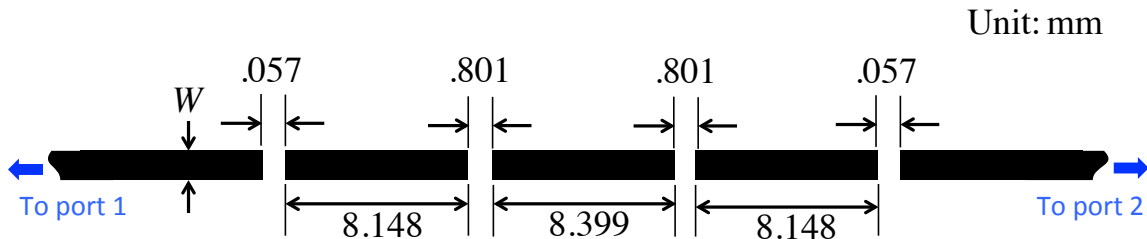
Relative dielectric constant  $\epsilon_r = 10.8$

Loss tangent = 0.0001

Conductor = Copper (1oz thickness)

Width of microstrip lines  $W = 1.15$  mm. What characteristic impedance  $Z_0$  does this width correspond to (at 6 GHz)? Use Microwave Office's TXLine to find out.

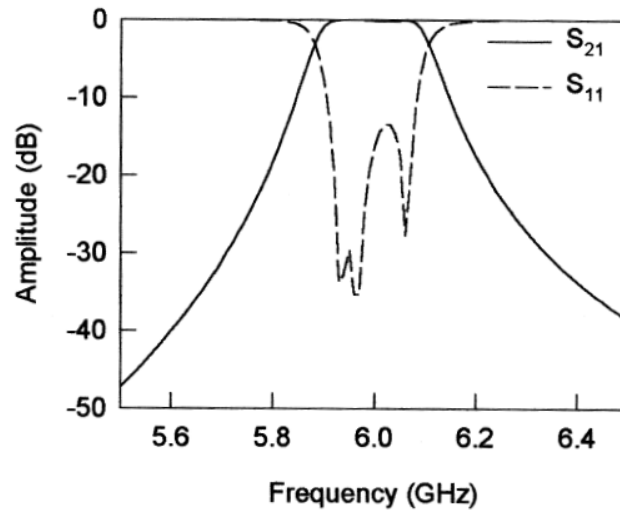
To model the gaps in this circuit use the "MGAPX" model. To model the microstrip lines use the "MLIN" model. Set the lines that lead from the filter to ports 1 and ports 2 to be both 5 mm. Simulate from 5 to 6 GHz with a step size of 0.01 GHz.



**Figure 1.** Bandpass filter

*What to turn in for this problem:* For this problem, please turn in a screen capture of your plot of  $|S_{21}|$  and  $|S_{11}|$  (both quantities in dB, and both on the same plot). Also turn in a screenshot of your schematic in Microwave Office. Also note the characteristic impedance  $Z_0$ .

If you would like to confirm that you are on the right track, your plots of  $|S_{21}|$  and  $|S_{11}|$  should look something like that shown in Figure 2. Don't worry if your plots do not match exactly.



**Figure 2.** Your simulated response should look something like this (i.e. it's a bandpass filter with a midband frequency around 6 GHz and a fractional bandwidth around 2.8 %)