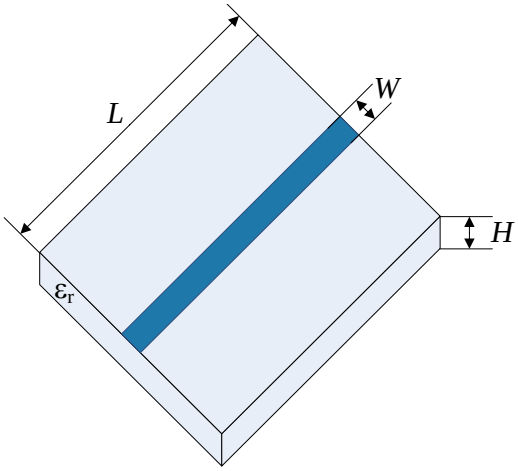
Dr. J. E. Rayas-Sánchez

LOSSLESS MICROSTRIP LINE



Consider the microstrip line shown to the left. A dielectric substrate with thickness H = 0.66 mm and relative dielectric constant ε_r = 9 is used. A width W = 0.7 mm is used to achieve a 50-Ω line. The microstrip length is L = 10 mm.

Both metallic and dielectric losses are neglected. Metals are considered infinitesimally thin.

This microstrip line is used in [1]- [6], with some small variations.

Create a Sonnet project using the following setup:

Parameters related to Sonnet box:

Sonnet box size: L by $(W + 2y_{gap})$

Bottom and top box cover: lossless metal.

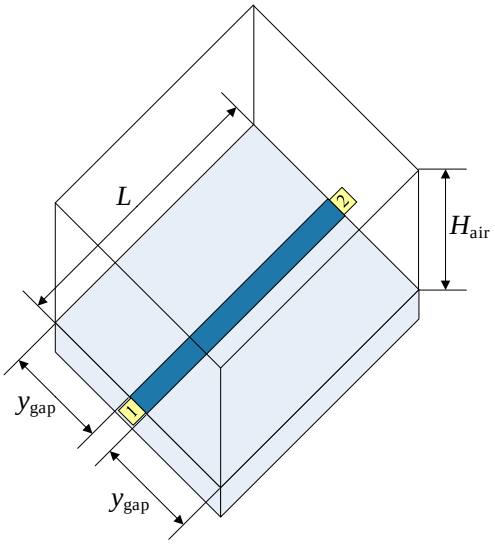
$y_{gap} = 4W = 2.8$ mm $\approx 4.24H$

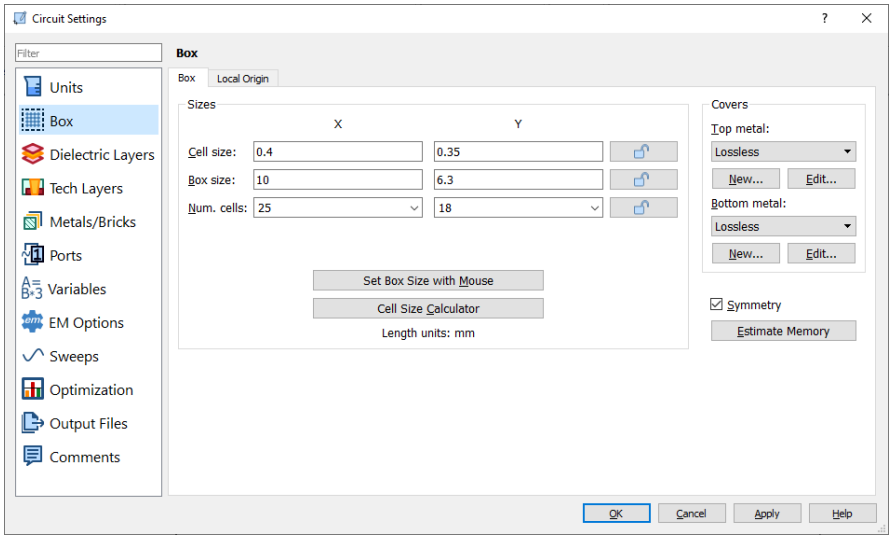
$H_{air} = 5H = 3.3$ mm

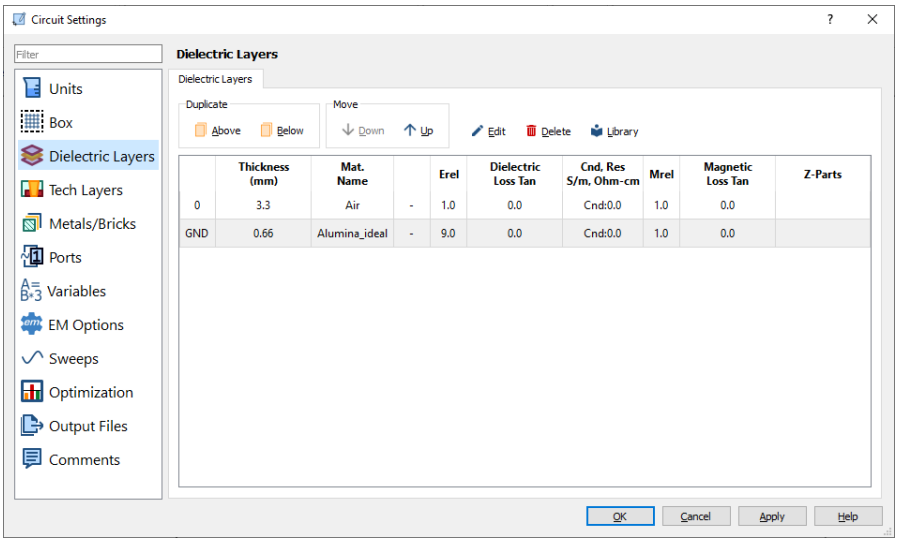
Initial resolution (cell sizes):

$C_x = L/25 = 0.4$ mm

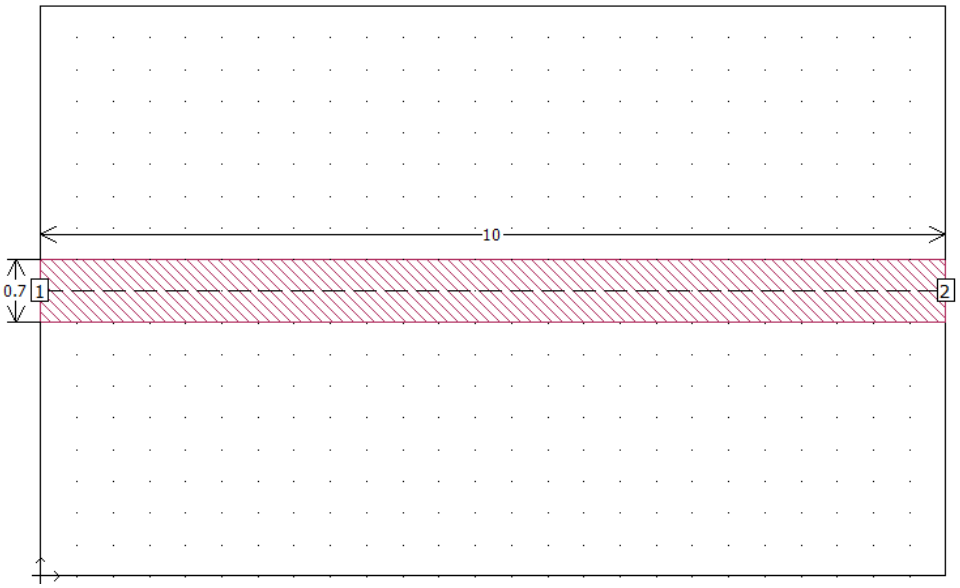
$C_y = W/2 = 0.35$ mm

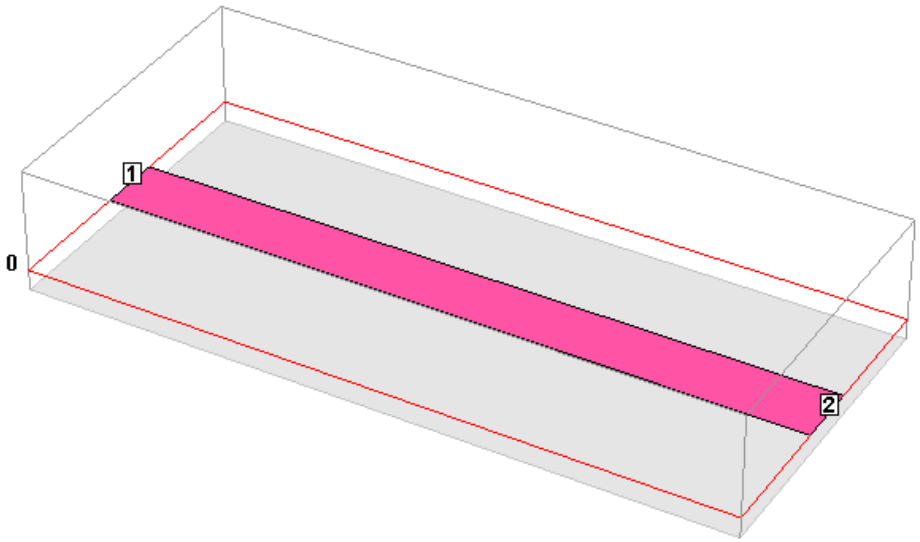


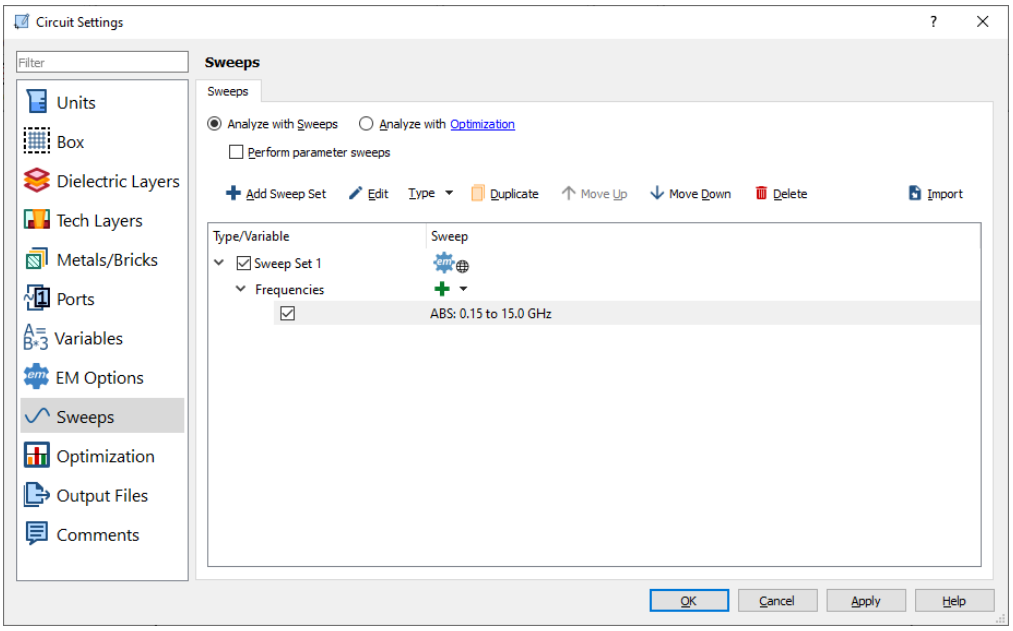




Sonnet geometry:







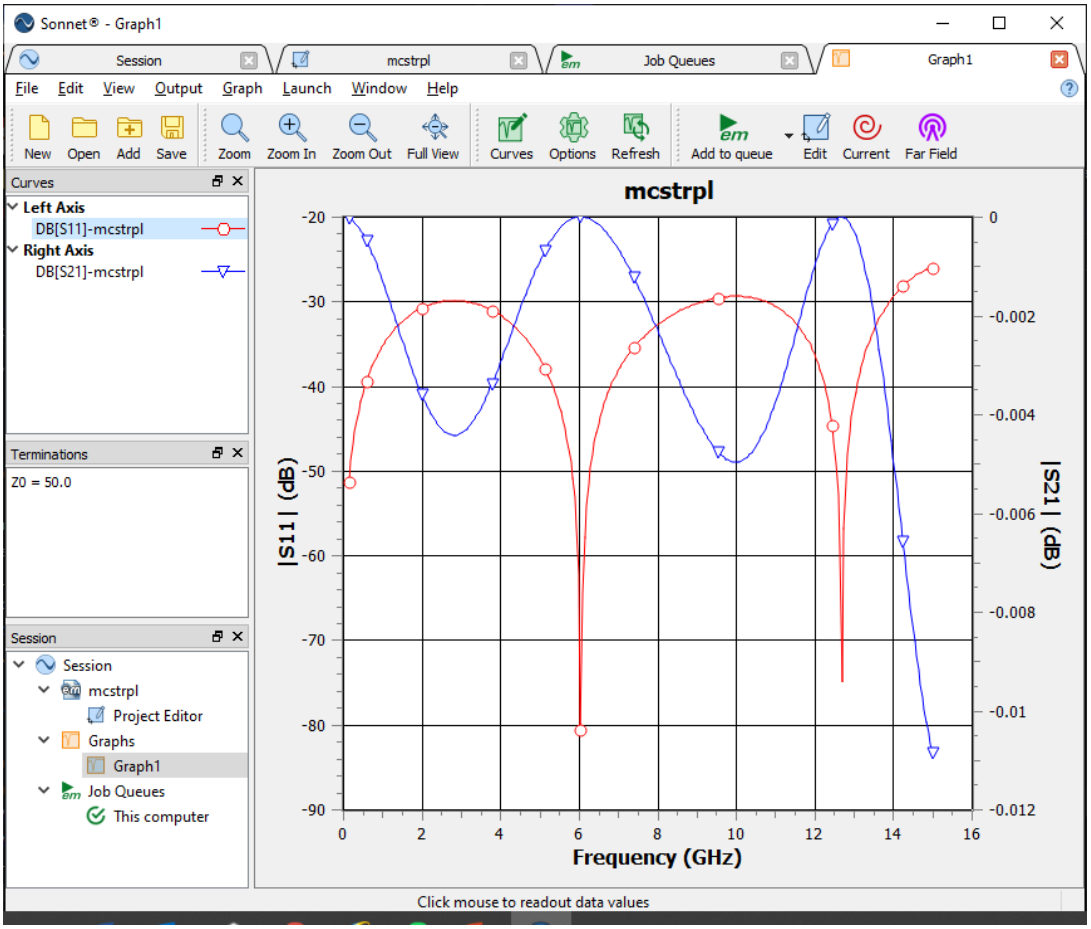
Estimate memory:

```
Estimated memory: 1 MB
Subsection total: 26
```

Estimate box resonances:

```
Possible box resonances, given the
presently enabled frequency sweep(s): None
```

EM responses:



Increasing the resolution to the following cell sizes:

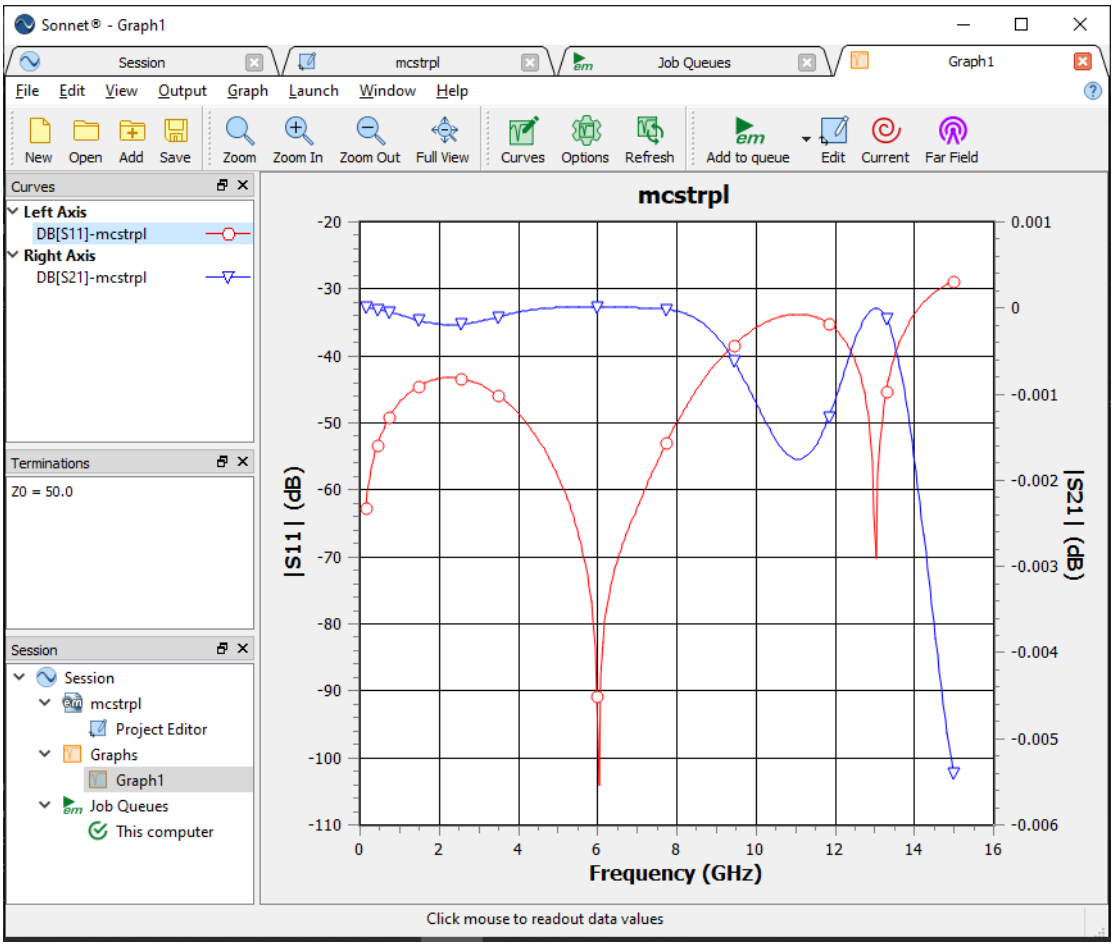
$C_x = L/50 = 0.2$ mm

$C_y = W/4 = 0.175$ mm

Estimate memory:

```
Estimated memory: 3 MB
Subsection total: 83
```

New EM responses (more accurate):



[1] A. Hennings, E. Semouchkina, A. Baker, and G. Semouchkin, "Design optimization and implementation of bandpass filters with normally fed microstrip resonators loaded by high-permittivity dielectric," *IEEE Trans. Microwave Theory Tech.*, vol. 54, no. 3, pp. 1253–1261, Mar. 2006.

[2] S. Koziel, J. W. Bandler and K. Madsen, "A space-mapping framework for engineering optimization - theory and implementation," *IEEE Trans. Microwave Theory Tech.*, vol. 54, pp. 3721-3730, Oct. 2006.

[3] V. Gutiérrez-Ayala and J. E. Rayas-Sánchez, "Neural input space mapping optimization based on nonlinear two-layer perceptrons with optimized nonlinearity," *Int. J. RF and Microwave CAE*, vol. 20, pp. 512-526, Sep. 2010.

[4] Z. Brito-Brito and J. E. Rayas-Sánchez, "EM simulation of a lossless microstrip bandpass filter using COMSOL with lumped ports," Internal Report *CAECAS-12-07-R*, ITESO, Tlaquepaque, Mexico, May 2012.

[5] J. E. Rayas-Sánchez and Z. Brito-Brito, "Optimal configuration of lumped ports in COMSOL for non-resonant planar structures," Internal Report *CAECAS-12-11-R*, ITESO, Tlaquepaque, Mexico, Jun. 2012.

[6] J. L. Chávez-Hurtado and J. E. Rayas-Sánchez, "Four benchmark microstrip line models," Internal Report *PhDEngScITESO-14-03-R (CAECAS-14-04-R)*, ITESO, Tlaquepaque, Mexico, Jul. 2014.