

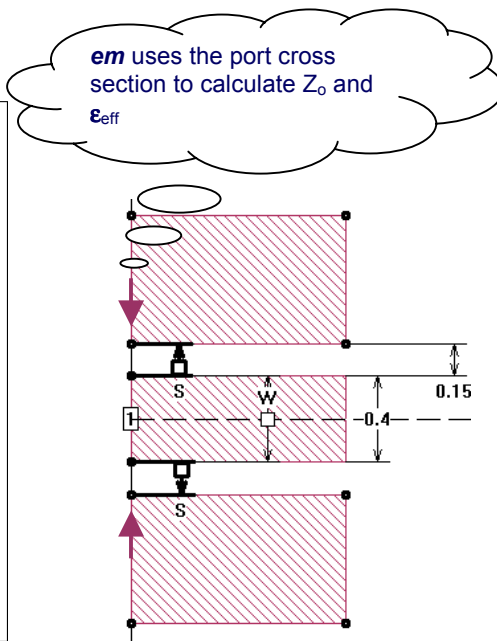
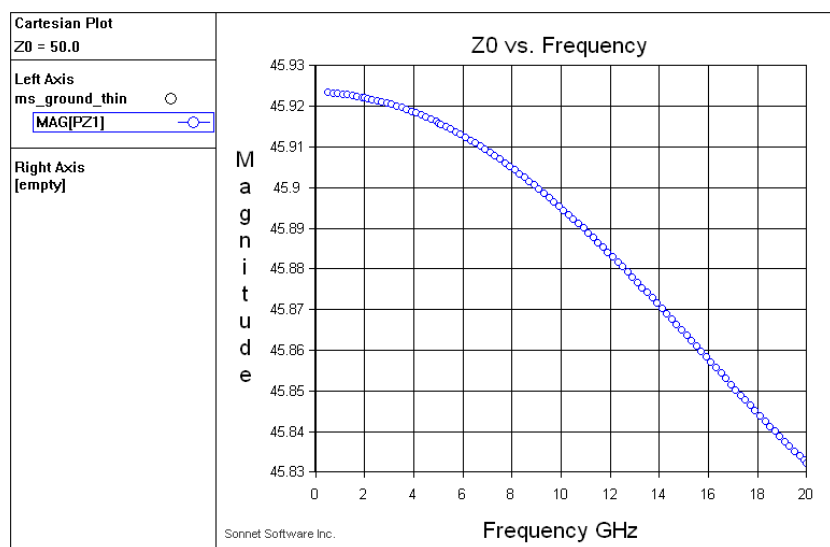
## Calculate transmission line impedance diagrams in Sonnet 7.0

Often, the design engineer is interested in the characteristic impedance of a transmission line configuration. This data can be found in text books for typical configurations, but results for complex layer stackup and complex conductor configurations are usually not available. This document describes an easy method to generate such data with Sonnet (Lite) 7.0.

As a result of port de-embedding, Sonnet determines the  $Z_0$  and  $\epsilon_{\text{eff}}$  values at each port. This  $Z_0$  is the characteristic impedance of the line attached to the port, and is determined from the cross section at the port. This means that a very short line stub is sufficient to determine the  $Z_0$  and  $\epsilon_{\text{eff}}$  results. As always, the discretization of the line has a strong effect on the achievable accuracy, as it can be seen from the well known Sonnet stripline benchmark. It is recommended to choose a Sonnet grid size which is suitable for the desired  $Z_0$  accuracy. For example, 16 cells across the line width will provide an analysis error in  $Z_0$  of  $\sim 1\%$ , 256 cells will reduce the  $Z_0$  error to less than 0.1%.

### Plot $Z_0$ vs. frequency

In Sonnet 7.0, results for  $Z_0$  and  $\epsilon_{\text{eff}}$  can not only be obtained as numbers, but also plotted in the emGraph data display tool, as a function of frequency or geometry parameters. To plot  $Z_0$  on the vertical axis instead of the usual S/Y/Z parameters, choose *Port  $Z_0$*  from the *Data Type* listbox, and then select the port which you want to investigate.



### Plot $Z_0$ vs. parameter

A parameter sweep provides a very nice method to plot  $Z_0$  results as a function of geometry parameters, instead of frequency. This way, you can easily plot a set of design curves for line impedance  $Z_0$  versus geometry variation. As opposed to textbook tables, these curves can be calculated for your specific process and geometry configuration and for any required port excitation, including push-push and push-pull configurations.

It is often sufficient to run the parameter sweep at a single frequency and just vary the geometry parameter. To use the parameter value as the x axis, select *Graph > Plot Over > Parameter* from the menu. This brings up the *Edit Curve Group* dialog, where the choice of the desired x axis parameter is available when you click the *Select Combinations...* button. The screenshot on the next page illustrates these settings.

