

ECEN 452: ULTRA HIGH FREQUENCY TECHNIQUE
LAB03: TRL Line
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BACKGROUND:

TRL calibration is used for measuring network parameters in an accurate manner. DUT (Device Under Test) is usually measured from this technique. However, the error terms generated from this technique must be measured first in order to remove the effects of transition between them. The error terms can be measured from the two error boxes connected to the DUT box. Each calibration condition can be set by connecting it to a reference plane. Detailed description can be shown in the following diagram.

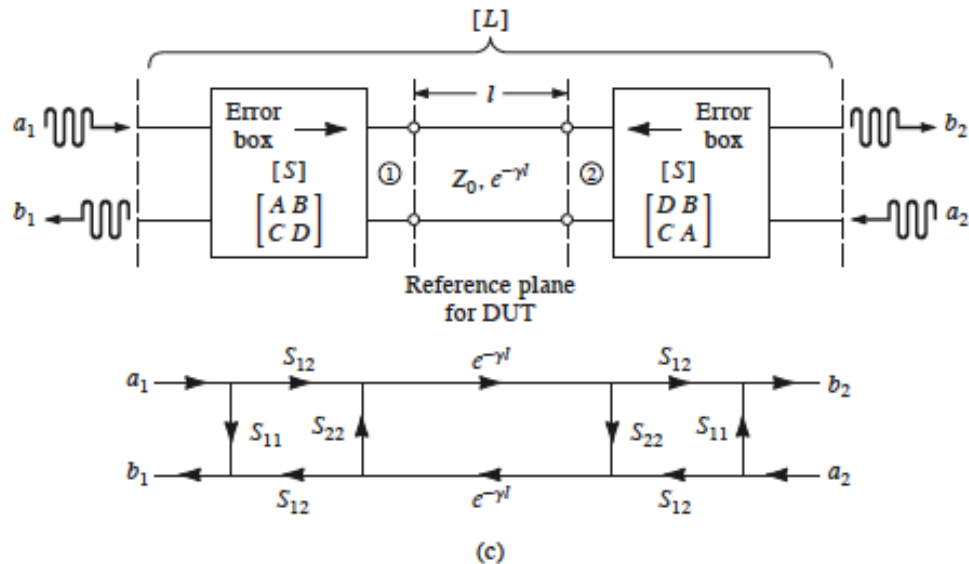


FIGURE 4.21c Block diagram and signal flow graph for the *Line* connection.

Figure

Calculated the error box parameters will be used to measure the S parameters for the DUT at the reference planes.

EQUATION:

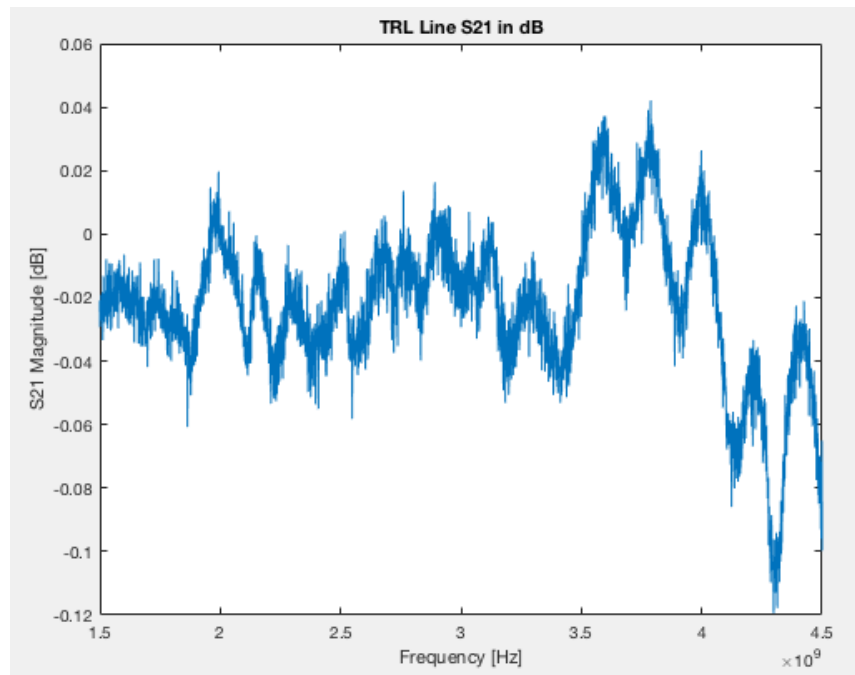
$$l = \frac{c}{f\sqrt{\epsilon_{eff}}} \left(\frac{\theta}{360} \right)$$

Figure

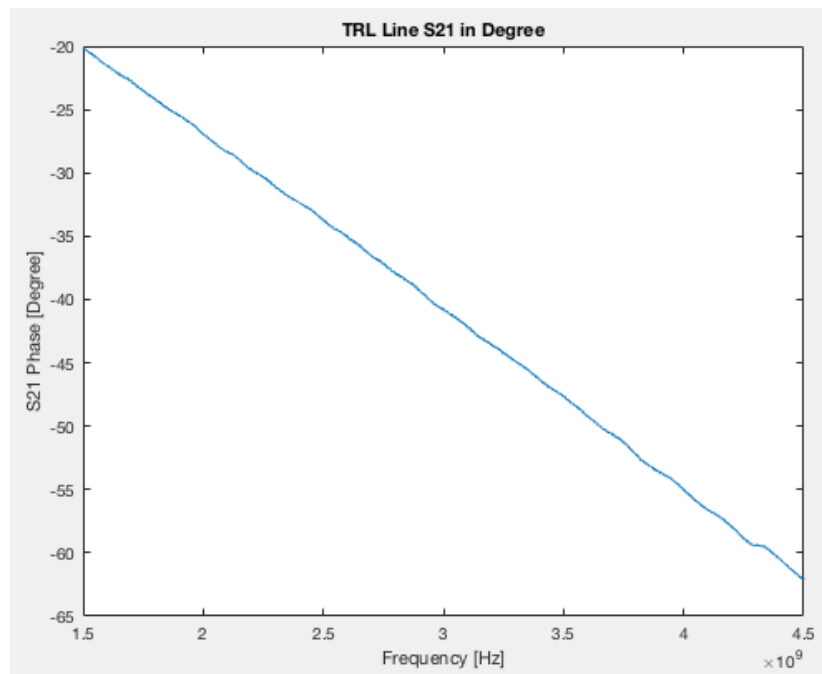
Thickness of Substrate = 62mil = 1.5748mm

Reflection length = 11mm
Thru length = 22mm
Line Length = 28.4mm
Line-Thru Length = 6.4mm

LAB MEASUREMENT:



Figure



Figure

Phase shift around 3GHz is around 40 degrees in this plot.

Hence,

$$\lambda = \frac{360}{40} \cdot 6.4mm = 57.6mm = \frac{\lambda_0}{\epsilon_{eff}}$$

$$\epsilon_{eff} = 3.173$$

It seems it is a straight line, which is hard to obtain in practice. Within a certain range of the bandwidth, the slope is nearly straight.