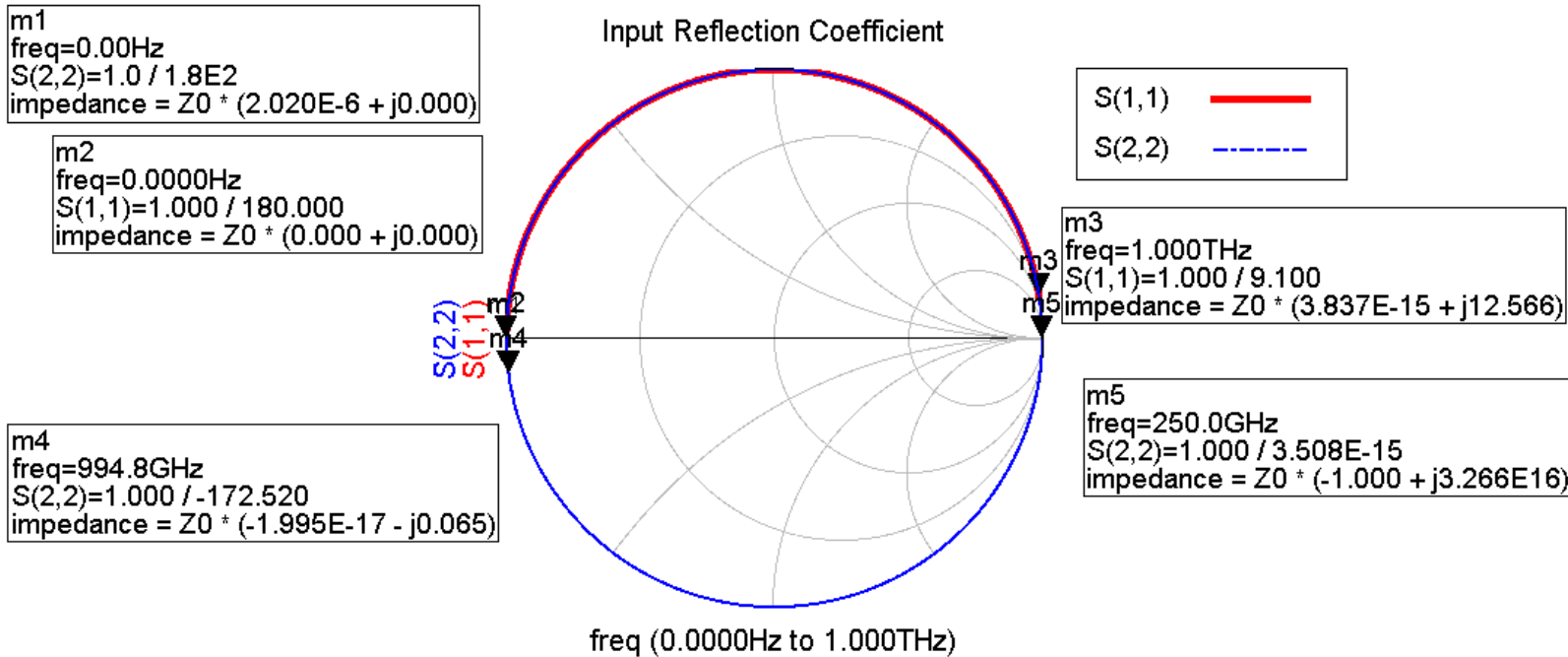


Smith Chart Plots (HW1)

Problem #5



In the above Smith Chart, the impedance of the 0.1nH inductor is plotted as S11, and the impedance of an ideal transmission line as described by the problem is plotted as S22.

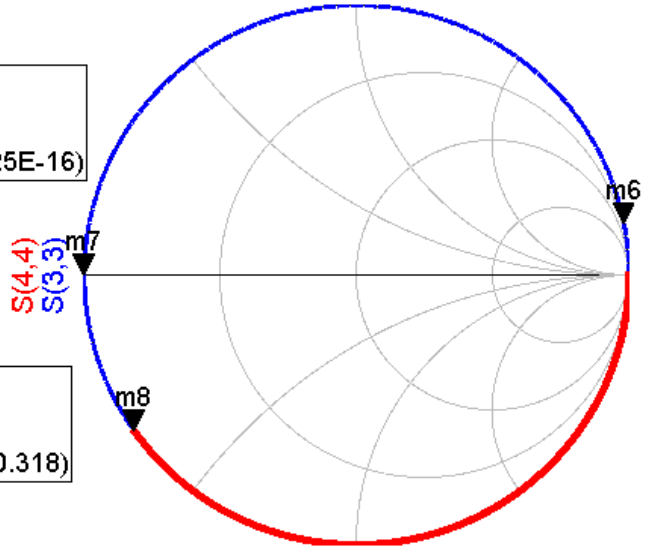
The inductor starts as an short circuit (Marker M2, far left on real axis) at DC, and as frequency increases it approaches an open circuit (M3, almost to real axis on right). This is consistent with what we expect from an inductor: an impedance increasing with frequency.

The transmission line starts off as an short circuit at DC (M1), at 250GHz it is an ideal open cricuit (M5), and it will loop around the entire smith chart twice, reaching an open circuit again. Note that at 1THz the line is 1 wavelength long: $\lambda = \frac{v_P}{f} = \frac{3E8}{1\text{THz}} = 300\mu\text{M}$, and its impedance is periodic every $\lambda/2$. We see the same periodicity in the next problem.

Problem 6

m7
 freq=250.0GHz
 $S(3,3)=1.000 / -180.000$
 impedance = $Z_0 * (2.000E-10 - j1.225E-16)$

m8
 freq=1.000THz
 $S(4,4)=1.000 / -144.686$
 impedance = $Z_0 * (-1.388E-17 - j0.318)$



S(3,3) - - - - -
 S(4,4) - - - - -

m6
 freq=970.2GHz
 $S(3,3)=1.000 / 10.823$
 impedance = $Z_0 * (5.772E-9 + j10.556)$

freq (0.0000Hz to 1.000THz)

In the above Smith chart, the impedance of both the shorted capacitor and open transmission line acts like an open circuit at DC, and for the capacitor it will approach but never reach a short circuit at higher frequencies. For the open line, it will loop around the outside of the chart twice, reaching short circuit at 250GHz and 750 GHz, and open circuit at 0, 500GHz, and 1THz.