1 $\frac{\lambda}{4}$ transformer

A power amplifier with an input impedance of $Z_{in} = 25\Omega$ is to be matched to a 50Ω line. Dimension a $\frac{\lambda}{4}$ impedance transformer. Derive the matching capability of a $\frac{\lambda}{4}$ line length using the impedance transformation formula from transmission line theory. Calculate the characteristic impedance of the $\frac{\lambda}{4}$ matching element.

2 Matching with a single lumped element

A RF transmission line ($Z_c = 50\Omega$) is terminated with a ohmic load of 40Ω. Determine the length of the line connected to the load, so that $\Re\{Z_1\} = 50\Omega$. Determine the reactance of a series element, for $Z_{in} = 50\Omega$. Examine the matching procedure using the Smith Chart. Double-Check your results using analytic solution.

3 Matching with lumped elements (LC-Network)

Design a LC-Matching network using lumped elements at a frequency of 2 GHz for the following configuration: A RF transmitter with a driving output impedance of $Z_T = (150 + j75)\Omega$ shall deliver maximum power to an antenna $Z_{Ant} = (75 + j15)\Omega$.

4 LC-Network Configurations

Design all possible LC matching networks for a source impedance of $Z_S = (50 + j25)\Omega$ to be matched to a load $Z_L = (25 - j50)\Omega$ at f=2 GHz.

5 Single Stub Tuner

Design a single stub tuner to match a load of $Z_L = 100\Omega$ to a 50Ω line. Give the parameters for the series single stub tuner and the parallel stub tuner.

6 Parallel Stub Tuning

A load impedance of $Z_L = (15 + j10)\Omega$ is to be matched to 50Ω by a parallel stub tuner. Determine the length of the line and the length for a

- short-circuited stub
- open stub

7 Single Stub Tuner

Design a single stub tuner to match a load impedance $Z_L = (60 - j45)\Omega$ to $Z_{in} = (75 + j90)\Omega$ input impedance. Stub and transmission line have a characteristic impedance of $Z_0 = 75\Omega$.

8 Double Stub Tuner

Match a normalized load admittance of $\bar{y}_L = 0.5 + j$ to 50Ω. The distance between the two stubs is $\frac{\lambda}{4}$. Determine the length l_1 and l_2 of the short-circuited stubs.

9 Double Stub Tuner

Discuss the "forbidden region" (e.g. the region in the smith chart, where a a matching is not possible) of the double stub tuner. Discuss explicitly for the cases, when the distance between the two stubs is $\frac{\lambda}{8}$ and $\frac{3\lambda}{8}$

10 Triple Stub Tuner

Explain the working principle of a triple stub tuner.

11 Pi-type matching

Design a π type matching network for a 2.4 GHz broadband amplifier to match $Z_L = (10 - j10)\Omega$ to $Z_{in} = (20 + j40)\Omega$. Find the LCL configuration with the broadest bandwidth (i.e. the lowest nodal quality factor).