ECEN452: ULTRA HIGH FREQUENCY TECHNIQUE
LAB02
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Reference:

"Learn Stub Tuning with a Smith Chart" by Benjamin Crabtree, October 09, 2015

Microwave Engineering 4th Edition, David M. Pozar

Quarter Wave Transformer

$$\varepsilon_r = 2.2 \ (Duroid \ 5880)$$
$$h = 1.5748mm \ (thickness \ of \ substrate)$$
$$f = 2.45GHz$$

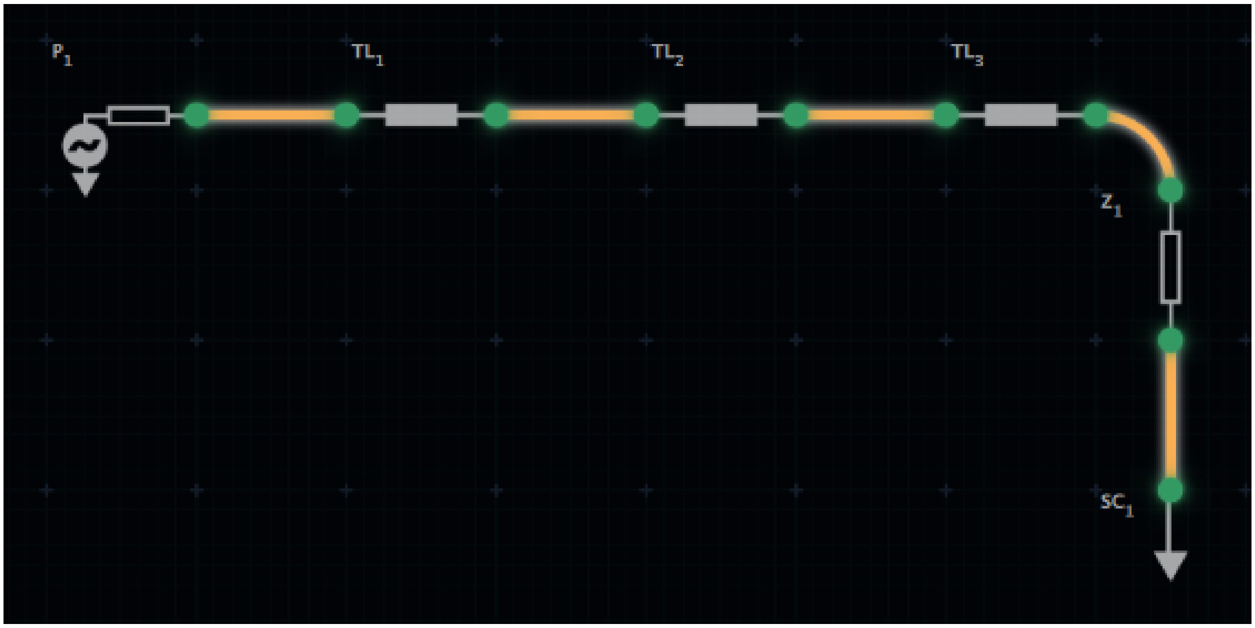
Z_0 [Ω]	W [mm]	λ [mm]	$\lambda/4$ [mm]	ε_{eff}
50	4.7725	89.068		1.8899
100	1.396		22.993	1.773
200	0.1654	94.268		1.6877

Figure. Microstrip line Calculation

CURRENT NETLIST

Component	Real Impedance	Imag Impedance	Length	Physical Length	Capa
P1					
TL1	50 none		89.10 m	7.95 m	
TL2	100 none		23.00 m	2.12 m	
TL3	200 none		94.25 m	8.90 m	
Z1	200 none	0 f			
SC1					

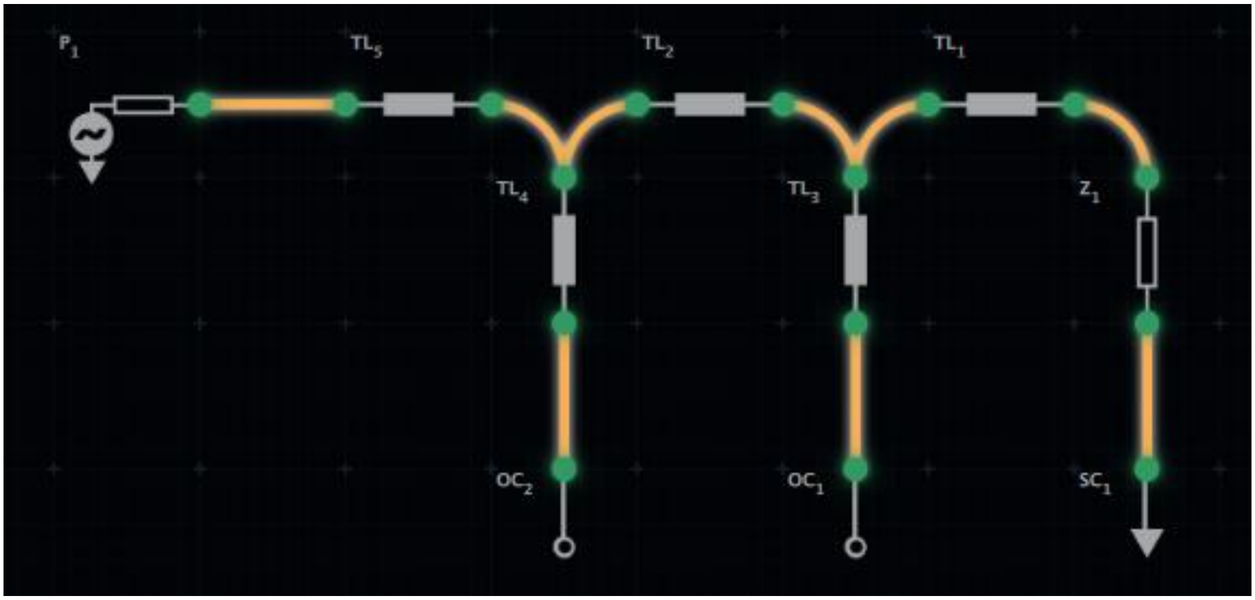
Figure



Figure

DOUBLE STUB MATCHING

BACKGROUND:
From single stub matching technique, we can obtain impedance matching on that particular frequency that we started with and perhaps, quite a small range of bandwidth around that particular frequency due to an addition of a single stub to cancel out the reactive component of the load.
In double stub matching, we can end up with a fairly larger bandwidth. In addition, we can place the first stub at an arbitrary location from the load. However, there is forbidden zone when it comes to double stub matching which means not double stub tuning technique cannot match every load.



Figure

CURRENT NETLIST

Component	Real Impedance		Imag Impedance		Length		Physical Length	
P1								
TL1	50	none			33.59	m	2.32	m
TL2	50	none			8.40	m	0.58	m
TL3	50	none			10.86	m	0.75	m
TL4	50	none			13.47	m	0.93	m
Z1	100	none	-50	none				
OC1								
OC2								
SC1								
TL5	50	none			16.80	m	1.16	m

Figure

CALCULATION:

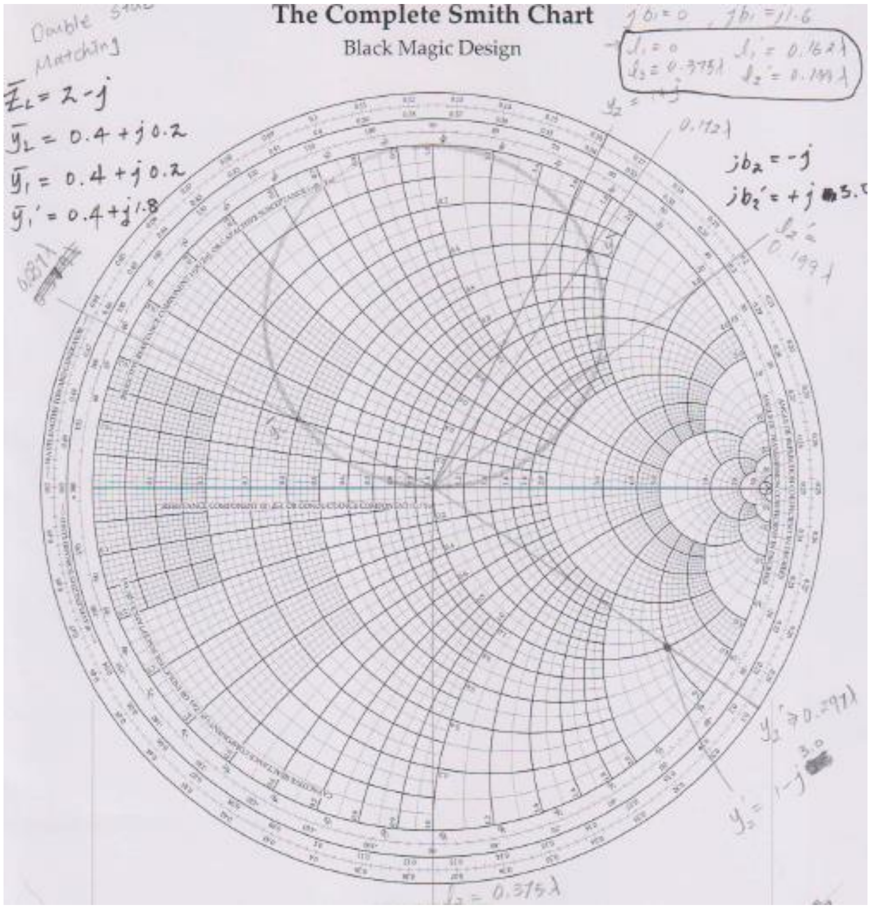


Figure. Double Stub Matching on Smith Chart

$$jb_1 = Im(y_1) - Im(y_L) = j0.2 - j0.2 = 0$$
$$jb_1' = Im(y_1{}') - Im(y_L) = j1.8 - j0.2 = j1.6$$

Thus, we are using the following design parameters:

$$d_1 = 0.5\lambda\,; d_2 = 0.125\lambda$$
$$l_1 = 0\lambda\,; l_2 = 0.375\lambda$$
$$l_1' = 0.162\lambda\,; l_2{}' = 0.199\lambda$$

$$d_1 = 33.5968mm\,; d_2 = 8.3992mm$$
$$l_1 = 0\,; l_2 = 25.1976mm$$

but we can’t simulate hfss with these values because it won’t let you enter 0 for l_1 so we are using the following values:

$$l_1' = 10.885mm\,; l_2' = 13.371mm$$

where

$$\lambda = 67.1936mm$$
$$W = 1.4975mm$$

I have noticed that the dielectric constant designed in hfss was 4.4