Values for Discrete Component Branch Line Coupler (Type-2)

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This page calculates the circuit values for a branch line coupler. The equations are adapted from "Microwave Engineering using Microstrip", Fooks, Zakarevicius, P158. In this coupler the wanted power goes from port 1 to port 2; coupled to port 3.

$Freq := 2.0 \cdot 10^{9} Hz$

$c := -2, -4 .. -16$ Coupling Ratio (power to port 3 wrt 2)

$Zo := 50ohm$

$nH := 1 \cdot 10^{-9} H$

$k2(c) := 10^{\left(\frac{c}{10}\right)}$ $k3(c) := 1 - k2(c)$ $k(c) := \frac{k2(c)}{k3(c)}$

$Z1(c) := \left(\frac{1}{k(c)^{0.5}}\right) \cdot Zo$ $Z2(c) := \left(\frac{1}{k(c) + 1}\right)^{0.5} Zo$

$LosstoP2(c) := 10 \cdot \log(k3(c))$

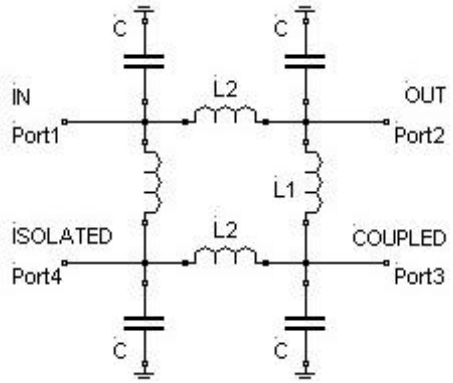
$L1(c) := Z1(c) \frac{1}{2 \cdot \mathbf{p} \cdot Freq}$

$L2(c) := Z2(c) \frac{1}{2 \cdot \mathbf{p} \cdot Freq}$

$CL1(c) := \frac{1}{Z1(c)} \cdot \frac{1}{2 \cdot \mathbf{p} \cdot Freq}$

$CL2(c) := \frac{1}{Z2(c)} \cdot \frac{1}{2 \cdot \mathbf{p} \cdot Freq}$

$C(c) := CL1(c) + CL2(c)$



c =	Z1(c) =		Z2(c) =	
-2	38.24	·oh	30.37	·ohm
-4	61.48		38.79	
-6	86.33		43.27	
-8	115.21		45.87	
-10	150.00		47.43	
-12	192.67		48.4	
-14	245.55		48.99	
-16	311.49		49.37	

Z1 = port 1 to 4 (shunt)
Z2 = port 2 to 3 (series)

Coupling (dB)

$c = \begin{pmatrix} -2 \\ -4 \\ -6 \\ -8 \\ -10 \\ -12 \\ -14 \\ -16 \end{pmatrix}$

Component values

L1(c) =		L2(c) =		C(c) =	
3.04	·nH	2.42	·nH	4.70	·pF
4.89		3.09		3.35	
6.87		3.44		2.76	
9.17		3.65		2.43	
11.94		3.77		2.21	
15.33		3.85		2.06	
19.54		3.90		1.95	
24.79		3.93		1.87	

Loss (dB)

LosstoP2(c) =
-4.329
-2.205
-1.256
-0.749
-0.458
-0.283
-0.176
-0.110

10dB coupler design