Values for Discrete Component Branch Line Coupler (Type-1)

Chris Haji-Michael
http://www.sunshadow.co.uk/chris.htm

This page calculates the circuit values for a branch line coupler. The equations are from "Practical Microstrip Circuit Design", Trinogga, Kaizhou, Hunter, P363. In this coupler the wanted power goes from port 1 to port 3; coupled power goes to port 2.

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

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

$Zo := 50ohm$

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

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

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

$LosstoP3(c) := 10 \cdot \log(k3(c))$

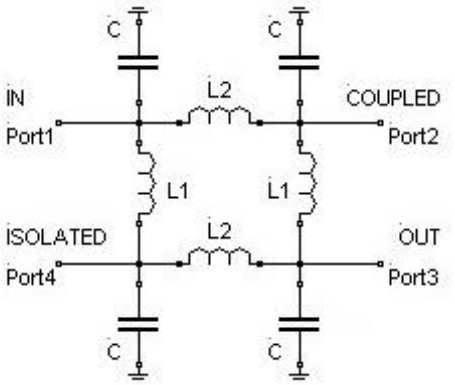
$L1(c) := Z1(c) \frac{1}{2 \cdot \pi \cdot Freq}$

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

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

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

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



c =	Z1(c) =	·ohm	Z2(c) =	·ohm
-2	65.38		39.72	
-4	40.66		31.55	
-6	28.96		25.06	
-8	21.70		19.91	
-10	16.67		15.81	
-12	12.98		12.56	
-14	10.18		9.98	
-16	8.03		7.92	

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) =	·nH	L2(c) =	·nH	C(c) =	·pF
5.20		3.16		3.22	
3.24		2.51		4.48	
2.30		1.99		5.92	
1.73		1.58		7.67	
1.33		1.26		9.81	
1.03		1.00		12.47	
0.81		0.79		15.79	
0.64		0.63		19.96	

Loss (dB)

LosstoP3(c) =
-4.329
-2.205
-1.256
-0.749
-0.458
-0.283
-0.176
-0.110

Simulations for a 10dB coupler