

ECE 435

MEASUREMENT OF THE PROPERTIES OF A BRANCH LINE COUPLER

Latest revision: October 2000

I. Introduction

In this lab you will design a branch line coupler.

A branch line coupler is a type of directional coupler often used for power-splitting purposes. It is simple to design and easy to fabricate as a microstrip circuit. In this lab you will design a 3-dB branch-line coupler and lay out the coupler using Sonnet. In a later lab you will measure its characteristics with the network analyzer.

II. Design

BEFORE coming to lab, your group is to design:

1. A 3-dB (equal power split) branch line coupler for operation at 1 GHz. Use the attached sheets to determine the necessary impedances of the coupler arms.

Your design must include the physical lengths and widths of the microstrip elements. These depend on the properties of the board you are using. See below for the appropriate board properties for each design. Your group must turn in a copy of these designs to your lab instructor before the beginning of class.

III. Layout

You will lay out your designs using PUFF during the regularly scheduled lab period. In order to lay out the circuit you will need to know the parameters of the circuit board. For the branch line coupler use:

Size:	15.25 cm x 4.2 cm
Substrate thickness:	1.65 mm
Dielectric constant:	3.91
Layout type:	microstrip

Be sure to use the value of λ_g corresponding to the appropriate board parameters!

Lay out each circuit and get a printout of S_{11} , S_{21} , S_{31} and S_{41} for the branch-line coupler. For the branch line coupler plot the S-parameters in the range 0.5-1.5 GHz.

IV. Procedure

Get the fabricated branch line coupler from your lab instructor. How does the artwork you generated from the computer program compare to this layout? Make measurements of S_{11} , S_{21} , S_{31} , S_{41} , S_{14} and S_{32} using the network analyzer over the same range of frequencies simulated in PUFF. Save the data to disk and get plots of both magnitude and phase.

Be very careful with the small SMA connectors on the circuit board. They are very fragile and can be easily torn from the board if too much stress is applied.

V. Report

Prepare a report comparing the measured results with those obtained from Sonnet. Is the branch line coupler symmetric? Assuming the appropriate symmetry, write down the S-parameter matrix at the design frequency. Discuss your results.