Design of Microstrip Coupler

Sidde Punith Reddy  
UG Student  
Department of Electronics & Communication Engineering  
Saveetha School of Engineering

Usha Kiran Patnaik  
UG Student  
Department of Electronics & Communication Engineering  
Saveetha School of Engineering

P. Venkateshwar Reddy  
UG Student  
Department of Electronics & Communication Engineering  
Saveetha School of Engineering

G. Lavanya  
Assistant Professor  
Department of Electronics & Communication Engineering  
Saveetha School of Engineering

Abstract

In this paper a simple design procedure is used with accurate formulation. It comprises a complete design of symmetrical four port microstrip directional coupler including physical length at desired optional frequency. The design procedure doesn’t require prior knowledge of physical geometry of the coupler but requires only the information of the port impedances, coupling and optional frequency. The validation of design concept is done by observing a negative insertion loss in the output.

Keywords: Microstrip, Directional Coupler, Impedance, Insertion Loss

I. INTRODUCTION

Couplers are passive three or four port devices that are commonly used in RF and microwave design. In a coupler, a known percentage of power from a transmission line is coupled to another output. Furthermore, couplers have a phase shift between the transmitted and the coupled port. This is one of the major differences between couplers and power splitters. This kind of microstrip couplers have a phase shift of 90-180 degrees. Their ease of fabrication and useful phase shifts made them ideal choices. These are maximum of 3db which means that half of the power should be output at the transmitted and the coupled port each. These couplers use the proximity of the microstrip transmission lines to achieve the coupling.

II. TYPES OF COUPLERS

A. Couplers are Normally of Various Types:

1) Two Ports: It Has One Input Port And Only Output Port.

2) Dividers:

a) Power Divider: It Has One Input and Many Outputs

b) Power Combining: It Has Many Inputs and One Output
3) Four Port Coupler: It Has One Input Port, One Output Port, One Coupled Port

![Diagram of a four-port coupler](image)

III. BLOCK DIAGRAM

Fig. 1: block diagram

The modulator gets two inputs, the carrier and the message signals. This output is given as infrared frequencies to the mixer wherein a local oscillator is connected. The output forms the input for the filter circuit which is followed by the amplifier. The output of the amplifier is given to the coupler where the signals are coupled together and at a very short distance another amplifier is placed inorder to avoid interference. This output goes to the base station from where the signals are further generated.

IV. CIRCUIT DESCRIPTION

![Circuit diagram](image)

Fig. 2: Circuit diagram

The circuit is designed in the sonnet lite software. The circuit consists of four port microstrip coupler. Top and ground level materials are selected and the required values for the materials are given based on our requirements. Ports are assigned and the numbering for the ports is given. Numbering should be given carefully because the result is analysed based on the port numbering s-parameters.
After the circuit design is complete then circuit is analysed using “analyze project”. After analyzing output s-parameters are obtained by using “view response”. Finally current distribution is checked by “view currents”.

V. RESULT ANALYSIS

This is the obtained output which shows the graph of insertion loss. The insertion loss of the coupler should be negative which says that the current loss is low and the output is nearly equal to the input.

![Graph showing negative insertion loss](image)

Fig. 3: Showing negative insertion loss

VI. CONCLUSION

Thus output signal shows very low insertion loss. Insertion loss obtained is negative. If the signal has negative insertion loss then the loss message during the transmission is less. So output signal at the receiving end is similar to the signal sent at the transmission end with less data loss.

ACKNOWLEDGEMENT

We heartily thank our institution “Saveetha school of engineering”, Saveetha university and our director mam Mrs. Ramya Deepak and Dr. P. Shankar our principal, Dr. P. Kishore raja, HOD of electronics and communication department for giving us this excellent opportunity to expose our views and we also thank them for being a great support and encouraging us throughout this work.

REFERENCES