MINIATURE SIZE BRANCH LINE COUPLER

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The GOD has blessed me
with a wonderful family
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ABSTRACT

The Branch Line Coupler (BLC) is one form of hybrid coupler. The structure consists of four quarter-wavelength transmission lines. The power to the input port is split into two equal output ports where the phase difference between the output ports is 90 degree. Due to its simple structure, the equal power split (3 dB) coupler is a very important element in RF front end system. In this project, miniature size Branch Line Coupler operating at 2.45 GHz will be designed and fabricated on FR4 Board and the performance analyzed by comparing the simulation and measurement results.

ABSTRAK

The Branch Line Coupler (BLC) merupakan salah satu bentuk coupler hibrida. Struktur ini terdiri daripada empat pusat penghantaran seperempat panjang gelombang. Kekuatan untuk port masukkan dibahagikan menjadi dua port output yang sama di mana perbezaan fasa antara output port adalah 90 darjah. Kerana struktur sederhana, pemisahan kuasa yang sama (3 dB) coupler adalah unsur yang sangat penting dalam sistem end RF depan. Dalam projek ini, saiz Cabang miniatur Line Coupler beroperasi pada 2,45 GHz akan dirancang dan dibuat pada Majlis FR4 dan prestasi dianalisa dengan membandingkan hasil simulasi dan pengukuran

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LIST OF ABBREVIATIONS

PANs	Personal Area Networks
BANs	Body Area Networks
ISM	Industrial, Scientific and Medical
CST	Computer Simulation Technology
FR4	Fire-Retardant glass laminate substrate material
WLAN	Wireless Local Area Network
WiMAX	Worldwide Interoperability for Microwave Access
CPW	Commercial Processing Workload
TMM-4	Thermoset Microwave Materials
RMA	Rate-Monotonic Scheduling
IEEE	Institute of Electrical and Electronics Engineers
RF	Radio Frequency
SISO	Single Input, Single Output
SIMO	Single Input, Multiple Output
MIMO	Multiple Input, Multiple Output
MISO	Multiple Input, Single Output
EM	Electro Magnetic Field
ERP	Effective Radiated Power
VSWR	Voltage Standing Wave Ratio
FIT	Finite Integration Technique
PBA	Perfect Boundary Approximation

CHAPTER 1

INTRODUTION

1.1 Background

Branch line couplers are an important part of microwave integrated circuits and can be used as a power divider/combiner or a part of a mixer. In order to make the wireless communication systems, especially for the portable devices, compact and cost effective, components with smaller size are preferred. Thus, size shrinkage becomes an important figure of merit for the development of radio frequency components [1].

One of the simplest and least expensive methods of microwave power division and directional coupling is by the direct coupled or branch line type of structure. This method of construction is particularly suitable to a single plane configuration and has the advantage of dc continuity. The simplest of branch line couplers is the two section version. It consists of a mainline which is coupled to a secondary line by two quarter wave long sections spaced one quarter wavelength apart. Thus, it has a circumference of approximately one wavelength. The coupling factor is determined by the ratios of the impedances of shunt and series branch arms and it is adjusted to

maintain a proper match over frequency. The impedance ratios necessary for proper coupling are widely known [1].

A wide variety of waveguide couplers and power dividers were invented and the MIT radiation laboratory in the 1940s. There included E- and H-plane waveguide tee junctions, the Bethe hole coupler, multirole directional couplers, the Schwinger coupler, the waveguide magic-T, and various types of coupler using coaxial prober. In the mid-1950s through the 1960s, many of these couplers were reinvented to use stripline or microstrip technology. The increasing use of planar line also led to the development of new type of coupler and divider, such as the Wilkinson divider, the branch line hybrid, and the coupler line directional coupler.[2]

Some practical applications of branch line couplers include such as Power division for image rejection mixers and single sideband modulators, Circuits requiring reflection of mismatches into a terminated fourth port load [2].

1.4 Problem Statement

In recent years, the wireless communication market has had an explosive growth. There is increasing demand to make communication systems lighter, more compact and portable, with better functionality and longer battery lifetime. So that, they may reduce size branch line coupler to Match with demand to market, consume less power and have lower noise, saving-cost components for wireless communication market, reduce consume area of designing and manufacturing

So it is important to minimize the size of Branch Line Coupler to the maximum extent possible.

1.5 Objective

The objective of this project is to design and fabricate a Miniature Size Branch Line Coupler at frequency 2.45 GHz and the performance is analyzed by comparing the simulation and measurement results.

1.6 Scope of Work

The scope of this project describes the design of a Miniature Size Branch Line Coupler operating at 2.45 GHz and the power to the input port is split into two equal output ports (3dB) where the phase difference between the output ports is 90 degree. The reduce size of branch line coupler by using CST microwave STUDIO and the design will be fabricated on FR4 Board. After that a comparison will be conducted between the simulation results and the fabrication results.

1.7 Expected Result

The measured parameters for the proposed branch line coupler using a centre frequency of 2.45 GHz. The measured S_{11} and S_{41} at 2.45 GHz are less than -10dB and the measured S_{21} and S_{31} at 2.45 GHz are -3 dB. The Measured phase should be difference between port 2 and port 3 is 90^{o} at operating bandwidth.

Summary

This chapter is an introduction for objective and research scope of the project. The research background and importance of the project also be explained. Besides, the

thesis structure is highlighted. The research work performed will be reported in the following chapters.