

**INVESTIGATION OF MICROSTRIP PARALLEL COUPLE WIDEBAND
FILTER (WCDMA APPLICATION)**

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**This report is submitted in partial fulfillment of requirements for the award of
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**PENGAJIAN PENAPIS JALUR LEBAR MIKROSTRIP GANDINGAN
SELARI(APLIKASI WCDMA)**

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**Laporan ini dikemukakan untuk memenuhi sebahagian daripada syarat
penganugerahan Ijazah Sarjana Muda Kejuruteraan Elektronik (Elektronik
Telekomunikasi) dengan kepujian**

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Specially for my loving mum, dad and to my young brothers.

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ABSTRACT

This report provides the reader with a detailed and comprehensive study of theory , design , fabrication, result and problem encountered in the designing bandpass RF microwave filter. The approaches used to achieve this project are through literature review, dimensional calculation and computer software simulation. These approaches are used to analyze the characteristic and the required specification before fabricating the microstrip bandpass filter. Computer simulation is the best technique to get the solution because it is fast and economical. To achieve this purpose, a computer software Microwave Office is used to analyze the characteristic of the microstrip bandpass filter and to determine its suitable parameters. The filter implementation that is chosen is parallel couple and the type is Chebyshev. This research generally is divided into three stages which literature review and dimensional calculation followed by software simulation and lastly fabrication, testing and analysis of the result. The filter design operating at center frequency 1.95GHz using FR4 (epoxy glass) as a substrate.

ABSTRAK

Laporan ini memberi maklumat secara terperinci kepada pembaca mengenai teori, rekabentuk, proses fabrikasi, keputusan dan permasalahan yang wujud dalam proses merekabentuk penapis lular jalur gelombang mikro. Pendekatan yang telah dilaksanakan untuk menjayakan projek ini ialah menggunakan kaedah kajian secara ilmiah, pengiraan dimensi dan simulasi perisian computer. Ketiga – tiga pendekatan ini adalah perlu untuk menganalisa sama ada ciri-ciri penapis lular jalur bagi memenuhi spesifikasi yang diperlukan sebelum proses fabrikasi dilakukan. Simulasi perisian computer adalah cara penyelesaian yang terbaik kerana ianya cepat dan ekonomik. Untuk tujuan ini, perisian computer Microwave office telah digunakan untuk menganalisa ciri ciri dan seterusnya menentukan jenis parameter penapis lular jalur yang sesuai untuk proses merekabentuk. Kajian ini secara amnya terbahagi kepada beberapa peringkat iaitu, kajian ilmiah, pengiraan dimensi, membuat simulasi litar, fabrikasi litar penapis yang direkabentuk dan selanjutnya mengukur serta menganalisa keputusan ujikaji. Kaedah merekabentuk yang digunakan adalah dengan menggunakan penapis gandingan selari dan jenis penapis gandingan selari adalah Chebyshev. Rekabentuk penapis ini akan beroperasi pada frekuensi tengah 1.95 GHz dengan bahan dielektrik FR4 (kaca epoksi).

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CHAPTER I

INTRODUCTION

1.1) Introduction

Filters are some sort are essential to the operation of most common system. It is therefore set interest of anyone involved in electronic circuit design to have the ability to develop filter circuits capable of meeting a given set of specifications. Unfortunately, many in the electronics field are uncomfortable with the subject, whether due to a lack of familiarity with it, or a reluctance to grapple with the mathematics involved in a complex filter design.

Generally, filter is a frequency changed circuit who fail and pass the signal in some frequency range. Microwave frequency is in SHF (Super High Frequency) range who is in 900MHz till 300GHz. In this project, the operating frequency of the filter is from 1.92GHz till 1.98Ghz. This frequency is acceptable for WCDMA application and WCDMA has two modes characterized by the duplex method: FDD (frequency division duplex) and TDD (time ITXC- duplex), for operating with paired and unpaired bands, respectively. WCDMA has a flexible multirate transmission scheme that enables transmission of different types of services using different data rates and quality of service parameters. For example, channel coding type, interleaving depth, and data rate

can be varied achieve the desired quality of service. The simulation of this filter is use Microwave office 2000 to tested the filter and get expected result before make the fabrication.

Filter is a basic type for electronic circuit design. Filter specification who fail and pass the signal in some frequency range is a best solution for all the electronic system especially in microwave communication. Receiver , transmitter , microwave tester need filter to operates their system to filter the unstable signal. The specific filter application is ESM receiver , satellite communication, GSM , satellite live television system and microwave multiple FM.[10]

1.2) Bandpass microwave filter design propose

Bandpass filter for microwave frequency is the filter who use widely in communication system in world. This is because it can filter unknown signal and give the best signal to demodulation. The purpose of this project is to design a bandpass filter who can pass and barred signal in high frequency (GHz) so that it can use widely for communication system in future. For this project, microstrip filter is chosen because this filter have small size , light, and useful for high frequency.

To design this filter, one computer software, Microwave Office 2000 is need to calculate and determine the absolute value of filter parameter. Analysis of this simulation needed for equation analysis so the specification design of this filter , is exactly same with filter characteristic, microstrip line, and absolutely frequency for WCDMA.

1.3) Objective

The technology of filter for microwave frequency is become large everyday so that, this project is to simulate and design the bandpass filter for microwave application (WCDMA) . The objective for this project is :

- To design the microwave parallel coupled bandpass filter by using microstrip transmission line
- To optimize the bandpass filter response by changing important parameter such as space , length and width of each resonator

1.4) Scope Of Work

This project is design of wideband filter (WCDMA) and it means the research and attention is for bandpass filter who have center frequency 1.95Ghz, and the bandwidth is 60 MHz.

The scope of work is :

- Make a research of method of microstrip filter, microstrip transmission line and electromagnetic wave. It's important to find the value of filter dimension, dielectric material characteristic, impedance matching, and the filter can limit and have better frequency range.
- Develop an applicable equation to calculate microstrip filter dimension impedance to make prototype filter.

- Design in microwave office and MATLAB to make a simulation of the circuit filter
- Optimize the filter when obtain an applicable circuit.
- Fabricate a band pass filter with center frequency 1.95GHz.It is applicable to WCDMA system.
- Testing the fabricate filter result when all the fabricate process is finish.
- Make a comparison of filter fabricate result and the filter simulation result.

1.5) Methodology

This project is started with make an early investigation and analysis for method to simulate and design the bandpass filter in microwave frequency. The reference is from books, journal, and from internet. Next, from the result of literature review and research, one microstrip bandpass filter is designed and the filter is simulate using microwave office 2000. After that, this filter is fabricated , tested and the result of measurement approximate with the simulation result.

Generally, this project is focus to 4 important step and the step is :

- For the 1st step, planning and literature review is important because both is how to find information and research from a lot of way. The book, journal , magazine, information from internet is important in this part.
- For the 2nd step, simulation , is to know and prove that information from 1st step is correct and test the simulation to obtain the exact value.
- For 3rd step, fabrication, measure / calculate is to make project layout and measured / calculate to know the expected result compared to simulation result.

- For 4th step, when the project working, make a thesis of project although write all data and information from beginning the project until the project reach the objective.

Methodology (Flow Chart)