A DESIGN OF MINIATURIZE MMIC LOWPASS FILTER

Thesis presented in partial fulfillment for the award of the
Bachelor in Electrical Engineering (Hons)
UNIVERSITI TEKNOLOGI MARA

NURUL HUSNA MD YUSOH
Faculty of Electrical Engineering
UNIVERSITI TEKNOLOGI MARA
40450 Shah Alam, Malaysia
NOV 2008

ACKNOWLEDGEMENT

Praised be to Allah for His blessings and giving me the strength along the challenging journey of completing the project as well as this thesis writing, for without it, I would not have been able to come this far.

First and foremost, I would like to take this opportunity to express my heartfelt gratitude to my supervisor of this project, Mrs Robiatul A'dawiyah Awang who has relentlessly and tirelessly assisted me in completing this project and has been a good mentor for me, giving me moral supports and patiently guided me throughout the project. My utmost thanks also go to my family who has given me endless support and encouragement throughout my academic years in UiTM. My special thanks to these individuals, Mr Asaari Sulaiman and Miss Raudah who have brought me into the world of telecommunication and *Sonnet Lite* which is something that really new to me. I may have stumbled and tripped along the way, however your dedication and patience has made my learning ladder an easier one to climb.

To all my friends, especially to Hanisah, Muhanin, Illia, Nana, Ikhram and Firdaus who have helped and supported me along the way and have willingly offered their help despite their tight schedule, thank you from the bottom of my heart. Finally yet importantly, to those who have, in a way or another contributed to the pleasant months of my final year project. Your presence and your countless effort and support had given me great strength and confidence.

Thank you.

ABSTRACT

In this paper, a new miniaturized MMICs low pass filter with reduce size design is being discussed. The multilayers configured with gallium arsenide (GaAs) as a substrate while the polyimide layer as dielectric. The filter consists of buried coplanar layer and a polyimide overlay and has overall area of 160 x 120 μm^2. An electromagnetic simulator *Sonnet Lite* is used to characterize and predict the filter response. The results of this simulation show that the filter well operates without spurious in the passband or stopband. The results also revealed that these miniaturized structure are appropriate for low cost and low loss which are smaller than that of conventional equivalents. By using the same structure three different cut-off frequencies has been obtained with three different sizes of transmission line. The simulation results show all the values of insertion (S11) and return losses (S21).

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND STUDY

Multilayer MMIC filter technology employing multilevel dielectrics and metals which found increasing an application in compact and high performance circuits. This is one of the most popular filters in communication systems due to its advantages of ease in manufacture, ease of synthesis method, low cost, and high practicality [1-2]. The goal of this paper is to design and optimize a multilayer coplanar waveguide (CPW) lowpass filter on the three different structures of polyimide dielectric layers and semi-insulating GaAs substrate. Important parameters of monolithic filter include S21 (Insertion Loss), S11 (Return Loss) and the area which all need to be optimized or comprised in the RF circuit design

1.2 PROBLEM STATEMENT

Newly developed and powerful integrated circuits are widely expansion to the wireless industry in microwave communication system. The filter is an essential component, which is usually used in both receivers and transmitters. Thus, the quality of filters is extremely important. Besides, the demands for device miniaturization together with the advances of microelectronics manufacturing technology lead to system on chip; this is a process by which an entire communication system can be built on a small-size (less than 1 cm by 1cm) semiconductor-wafer packaged as a chip. In addition to miniaturize them, they have to be faster and consume less power. In order to reduce the size of MMIC filter a new technique from the previous researcher has been applied.