DIFFERENT SHAPE OF VIAS USED ON SUBSTRATE INTEGRATED WAVEGUIDE

This thesis is presented in partial fulfillment for the award of the
Bachelor of Engineering (Hons) Electronics Engineering (Communication)

FACULTY OF ELECTRICAL ENGINEERING

UNIVERSITI TEKNOLOGI MARA

MALAYSIA

MUHAMMAD HAFIDZI BIN ZULKARNAIN

2012809852

FACULTY OF ELECTRICAL ENGINEERING

UNIVERSITI TEKNOLOGI MARA

40450 SHAH ALAM, SELANGOR DARUL EHSAN

ACKNOWLEDGEMENT

In the Name of Allah, the Compassionate, the Merciful, Praise be to Allah, Lord of the Universe. Alhamdulillah, first and foremost, I would like to thank our Creator for a giving functioning body and mind in order to live, life and learn, and particularly to work on our project.

First and foremost, I would like to express my gratitude and deepest thanks to Pn. Norhayati Binti Hamzah, in guiding and supporting from zero until the final touch of this project as well as my group members, Mohammad Naim Bin Ahmad Shamsuddin and Muhammad Azahar Bin Rosdi for their continuous cooperation in completing the project by giving out a valuable information, brilliant suggestions and guidance in the compilation and preparation of this report.

Last but not least, special dedication towards my parents who have contributed in giving our moral support, encouragement and understanding, patient in carrying out this project to such great degree. Thank you for being there whenever we need all of you

ABSTRACT

Recently, there has been a lot of interest in the substrate integrated waveguide (SIW) technology concept allowing the integration of waveguides in the substrate, replacing the rectangular metal waveguide sidewalls by two rows of metal rods. For the next coming decade SIW technology is the most potential candidate for the implementation of millimeter-wave (mm-wave) integrated circuits. In this paper, the design and modeling of SIW using different vias has been analyzed and designed to investigate the effect of changing shape of vias on the SIW on its operating parameters. Parameters that have been evaluated in these works are electric field, return losses and the transmission gain. The Ku-band SIW is conceived. FR4 is used as a dielectric substrate to evaluate the results in the frequency domain at 12 GHz. The circuit has been designed using finite element method based design software and simulated in HFSS software.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1 OVERVIEW OF STUDY

From the last few years, there is rapidly increase in interest for Substrate Integrated Waveguide (SIW) based antennas SIW has emerged as a new concept for millimeter-wave (mm wave) integrated circuits and systems for the next generation due to their various advantages. A waveguide based on SIW is considered as a dielectric filled waveguide (DFW) whose metallic walls are formed by cylindrical via arrays with diameter d and separation p between vias (pitch). The densely arraying metallized posts or via-holes which connect the upper and lower metal plates of the substrate will formed a synthetic rectangular electromagnetic waveguide in a dielectric substrate. The waveguide can be easily fabricated with through-hole techniques for low-cost and mass-production. DFW is transformed to SIW by the help of vias for the side walls of the waveguide. This is because there are vias at the sidewalls, transverse magnetic(TM) modes do not exist; Transverse electric (TE) TE_{10} therefore is the dominant [1].

SIW is the combination of waveguide and microstrip. The width and height of rectangular waveguide dimension are represented by letter "a" and "b" respectively. The width must be larger than height as shown in Figure 1.1 below.