PHYSICAL PARAMETRIC ANALYSIS OF THE TERAHERTZ PHOTONIC CRYSTAL CAVITIES SUBSTRATE MICROSTRIP ANTENNA ON THE PERFORMANCES

Thesis is presented in partial fulfillment for the award of
Master Of Science & Engineering Telecommunications and Information
UNIVERSITI TEKNOLOGI MARA (UITM)

NOR HIDAYAH BINTI ROSLAN
FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM, SELANGOR, MALAYSIA
JANUARY 2017

ACKNOWLEDGEMENT

First and foremost, all praises to Allah the All-Mighty for the strengths and His blessing for me in continuing this learning process and completing this thesis. My research project would not have been completed without the help of many people. First of all, I would like to express my deepest gratitude to my beloved supervisor Dr. Aziati Husna Binti Haji Awang for her supervision, caring, patience and constant support.

My special thanks also go to my partner Nuralinawati Binti Baharom for helping in completing this thesis. Her support also was the factors of my spirit. I would like to express my appreciation to all the lecturers and UiTM staffs for the kindness and moral support during study. Deepest gratitude to all my friends especially my class member for invaluable assistance.

Last but not least, I would like to thank my parent to give me full support during the completion of this thesis. Thank you for your support and love.

Thank you so much

ABSTRACT

This thesis study about the photonic crystal cavity (PCC) as a substrate and microstrip patch antenna in Terahertz (THz) frequency has been simulated and analyzed. The objectives are to simulate and analyze the performances changes when the parameters of PCC and microstrip patch antenna are varied. THz PCC substrate microstrip antenna is a most simple way to generate THz frequency. However, they are limited studies that have been done in terms of its fundamental physical analysis. Therefore, this parametric analysis is proposed. The design of the PCC and rectangular microstrip patch antenna of the electromagnetic spectrum on the 2-D photonic crystal was simulated using Computer Simulation Technology (CST) CAD Package. The effective permittivity, 2.08 with host material PTFE and copper annealed at 0.6THz. We varies the radius of the via, thickness of PCC,spacing between via and the width of the PCC. For the patch antenna the thickness and the material are varied. The performances are monitored through its resonant frequency, S-parameter return loss (S11), Gain, Radiation pattern, E-field H-filed and current density.

TABLE OF CONTENT

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND OF STUDY

Terahertz (THz) regime spans the electromagnetic spectrum approximately from 100GHz to 10 THz frequencies [1]. Currently, THz band has appealed a significant research interest in various applications because of its unique attributes including a wide free-license BW and high spectral resolution. THz radiation cannot be seen, but it can be feel as it share some of the characteristics of infrared radiation. This region has long been studied in the field of astronomy and analytical science [2]. THz technologies now have find a variety of way to be use in other fields. For example it have been used in hospital as replace the X-ray that is harmful to human. THz are safer than X-ray because of the non-ionizing characteristics. It is the best characteristics that THz have.

The THz sources, from optical techniques are quantum cascade laser (QCL) [3-5], lasers, and switching diode [6] and for the microwave techniques are microwave photoconductive antenna (PCA) [7]. Photoconductive antenna is widely used in THz frequency, it is antenna that must a laser shine at the excitation spot. This way it will radiate THz radiation from the antenna. Furthermore using photoconductive antenna as emitters and detectors of the THz radiation are good, this is because of one can achieve relatively high signal-to-noise ratio and perform fast scan for imaging or spectroscopy[8]. In photoconductive antenna, the antenna frequency response and the carrier lifetime of the photoconductive material are the factors that limited the bandwidth and detected THz signals [9].