UNIVERSITI TEKNOLOGI MARA

DEVELOPMENT OF MULTIBAND RECTANGULAR SHAPED PARASITIC ELEMENTS (RSPE) PLANAR INVERTED-F ANTENNA FOR WIRELESS APPLICATIONS

FATIMAH NUR BINTI MOHD REDZWAN

Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Electrical Engineering

February 2016

CONFIRMATION BY PANEL OF EXAMINERS

I certify that a Panel of Examiners has met on 2th December 2015 to conduct the final examination of Fatimah Nur Binti Mohd Redzwan on her Master of Science thesis entitled "Development Of Multiband Rectangular Shaped Parasitic Elements (RSPE) Planar Inverted-F Antenna for Wireless Applications" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examiners recommends that the student be awarded the relevant degree. The panel of Examiners was as follows:

Mohd Asri Haji Mohd Mansor,PhD
Associate Professor
Faculty of Electrical Engineering
Universiti Teknologi MARA
(Chairman)

Ahmad Asari Sulaiman, PhD
Associate Professor
Faculty of Electrical Engineering
Universiti Teknologi MARA
(Internal Examiner)

Mohd Faizal Jamlos, Ir,PhD
Associate Professor
School of Computer and Communication Engineering
Universiti Malaysia Perlis (UniMAP)
(External Examiner)

SITI HALIJJAH SHARIFF, PhD
Associate Professor
Dean
Institute of Graduates Studies
Universiti Teknologi MARA
Date: 17th February, 2016

AUTHOR'S DECLARATION

I declare that the work in this thesis/dissertation was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student	:	Fatimah Nur Binti Mohd Redzwan
Student I.D. No.	:	2013443648
Programme	:	Master of Science (Electrical Engineering)
Faculty	:	Electrical Engineering
Thesis/Dissertation Title	:	Development of Multiband Rectangular Shaped Parasitic Elements (RSPE) Planar Inverted-F Antenna for Wireless Applications
Signature of Student	:	.....
Date	:	February 2016

ABSTRACT

In this project, the multiband PIFAs for wireless applications were designed and constructed, which were Single-Band PIFA (SB-PIFA), Dual-Band PIFA (DB-PIFA) with one rectangular-shaped parasitic element, and Triple-Band PIFA (TB-PIFA) with the introduction of two rectangular-shaped parasitic elements that were placed under the main radiating patch of the PIFA in order to obtain a triple-band operation. The size of ground plane of the proposed PIFA is 50 x 30 mm^2 which has been reduced by 50% from the size of conventional PIFA. This can be achieved by adjusting the width and the height of shorting plate. The SB-PIFA operates at 2.6 GHz for LTE Application. In DB-PIFA, two frequency spectrums operating at 2.6 GHz and 3.5 GHz frequency band for LTE and WiMAX application has been proposed. The dual-band operation is obtained after introducing a rectangular shape parasitic element to generate new resonant frequency at 3.5 GHz. The best location of parasitic element is placed on the right edge of the ground plane due to the existing of high current distribution. Meanwhile, the third design TB-PIFA operating at 2.1 GHz for UMTS2100, 2.6 GHz (LTE) and 3.5 GHz (WiMAX) frequency band is presented. This design adopted the same technique as the DB-PIFA to generate triple-band frequencies, where one more parasitic element is added and placed at the left edge of the ground plane. In TB-PIFA, the main radiating patch controlled the upper band frequency at 3500 MHz, while the first parasitic element excited at the middle band frequency (2600 MHz), and the second parasitic element contributed to lower band frequency at 2100 MHz. Besides, this parasitic element technique also useful for bandwidth enhancement and increase the antenna gain. These multiband antennas have a simple mechanical construction and could be a good candidate to be used as mountable antenna in mobile devices. In these frequency bands, the antennas gave nearly omni-directional radiation pattern with the peak gained between 2 dBi to 5 dBi and measured antenna efficiencies from 40% to 70%.

ACKNOWLEDGEMENT

"In the name of ALLAH S.W.T, The Most Gracious and The Most merciful. Peace is upon the Holy Prophet, Muhammad S.A.W."

Firstly, I wish to thank ALLAH SWT, the merciful and kind of all the blessing upon me. Alhamdulillah, thanks to ALLAH SWT again. For his blessing and give me this opportunity to complete my MASTERS of Science in Electrical Engineering.

My first thanks is for my main supervisor, Assoc. Prof. Dr. Mohd Tarmizi Ali, whose constant support, patience and unbounded enthusiasm were of invaluable help. His devotion to the needs of students and the encouragements has worked with his a true delight. Thanks for helping me to kick start and finish this valuable research project. Special thanks also to my co-supervisor Mr. Mad Noor Md. Tan for his help and advices throughout my Master research study.

I am deeply obliged to the Institute for Universiti Teknologi MARA (UiTM) and MOHE for the generous financial support I have received for my Master program about two years. I would also like to acknowledge all my beloved colleagues at Antenna Research Group (ARG) laboratory. Thanks to ARG's technician Mr. Khalim Bin Kamisan who's professionally give his cooperation in many aspects and made the whole project possible. Not to forget to MPWS Rich Proofreading Sdn Bhd, for their willingness to proof read my thesis. I would like to thank those who had helped me either directly or indirectly for their constant encouragement, suggestions and comments throughout this research.

Last but not least, a special thanks to my parents and family members for their consistent encouragement and concern over time that made the journey enjoyable and meaningful. Without their unwavering sacrifice, support, love and devotion, this achievement would not have progressed as far as it did. May Allah bless all of us.