AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Electronics Engineering and Electrical Communications

DESIGN AND IMPLEMENT OF MULTIFUNCTION MULTIPLE-INPUT-MULTIPLE-OUTPUT PASSIVE CIRCUITS

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE DEGREE OF

Master of Science In Electrical Engineering

(Electronics Engineering and Electrical Communications)

By

Amany Mostafa Ahmed Abd El Rahman

Bachelor of Science In Electrical Engineering

(Electronics Engineering and Electrical Communications)

Thebes Higher Institute for Engineering, 2009

Supervised By

Prof. Dr. Abdelhalim Zekry

Professor, Department of Electronics and Communication Engineering,
Faculty of engineering Ain Shams University, Cairo, Egypt

Prof. Dr. Adel Ezzat El-Hennawy
Electronics and Communications EngineeringDepartment,
Faculty of Engineering, Ain Shams University

Dr. Reda Salama Ghoname

Faculty of Engineering Girls' Campus King Abdul-Aziz University,
Jeddah, Saudi Arabia (1)
Electronics Research Institute, Cairo, Egypt (2)

Cairo - (2017)

AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Electronics and Communications

DESIGN AND IMPLEMENT OF MULTIFUNCTION MULTIPLE-INPUT-MULTIPLE-OUTPUT PASSIVE CIRCUITS

By

Amany Mostafa Ahmed Abd El Rahman

Bachelor of ScienceinElectrical Engineering

(Electronics Engineering and Electrical Communications)

Thebes Higher Institute for Engineering, 2009

Examiners' Committee

Name and Affiliation	**Signature**
Prof.	…….
Choose an item., University	
Prof.	…….
Choose an item., University	
Dr.	…….
Choose an item., University	

.

Date:22 January 2017

Statement

This thesis is submitted as a partial fulfillment of Master of Science in Electrical Engineering, Faculty of Engineering, Ain shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

Amany Mostafa Ahmed Abd El Rahman

Signature

……...…….

Date: 22 January 2017

Researcher Data

Name	: Amany Mostafa Ahmed Abd El Rahman
Date of birth	: 20/08/1988
Place of birth	: Egypt
Last academic degree	: Bachelor of Science
Field of specialization	: Electrical Engineering
University issued the degree	: Thebes Higher Institute for Engineering
Date of issued degree	: May 2009
Current job	: Instructor

Thesis Summary

Nowadays, wireless communication systems are increasingly developed to support demands of people. Many current communication systems are coming with several operating bands. Therefore, the multifunction microwave circuits design are Rapid developments in modern communication systems have imposed requirements such as small size and multifunction operation for RF / microwave components.

The thesis is divided into five chapters, as listed below:

- **Chapter One:** This chapter is an introduction to the thesis that clarifies the multifunction circuits, multifunction techniques and describes the types of multifunction circuits beside explanation of the RF Front-end of 4G mobile systems and the organization of this thesis.

- **Chapter Two:** This chapter explains the microstrip antenna, we proposed a design of a microstrip antenna but this design did not achieve the resonance frequency of the fourth generation of mobile communication system then we applied three techniques (the stub length, separation and via technique) to achieve our target. Finally, we introduced the design of the antenna that resonates at 5.2 GHz (4G) by using ready–made software package Zeland then we fabricated and measured this design. A comparison between the simulated results and measured results is introduced.

- **Chapter Three:** This chapter explains the compact microstrip diplexer with Bandpass filter. We applied the same three techniques of the antenna on the microstrip diplexer to achieve the best design with resonance frequency 5.2 GHz (4G) by using software package Zeland IE3D.

  Also, we explained the microstrip bandpass filter-antenna (Filtenna). We applied the three techniques (stub length technique, separation technique and via technique) on the structure of the microstrip filter and designed the compact bandpass filter with resonance frequency 5.2 GHz (4G) by using software package Zeland IE3D then we fabricated and measured this design. A comparison between the simulated results and measured results is introduced.

- **Chapter Four:** we presented a design of multifunction circuit antenna, filter, and diplexer in one board (Anfilplexer) at resonance frequency 5.2GHz (4G) then we fabricated and measured this design. A comparison between the simulated results and measured results is introduced.

We proposed a design of multifunction circuit has a 3G resonance frequency at (2.42GHz), and another design has a 2G resonance frequency at (1.82GHz). Finally, we presented the library for front-end receiver of mobile generation in communication system by using the multifunction circuits.

- **Chapter Five:** This chapter discusses conclusion and future work for this research point.

- **Last Part:** it discusses appendices and references for this thesis.

Key Words: Front-end subsystem of mobile, 4G, Microstrip antenna, Microstrip BPF, and Microstrip Diplexer.

ACKNOWLEDGMENT

All praise and glory to Allah the Most Merciful the Most Kind.

My deepest gratitude and appreciation to my thesis advisors Prof. Dr. Abdelhalim Zekry, Prof. Dr. Adel Ezzat El-Hennawy and Dr.Reda Salama Ghoname for their continuous guidance, encouragement and support throughout my work and in the writing of the dissertation. I am truly indebted and thankful for their great efforts that helped bring this thesis to fruition.

I would like to thank Prof. Dr. Abdelhalim Zekry and Dr. Reda Ghoname for the technical assistance on the work presented in this dissertation. Many hours of discussions we have spent on analysis, modeling, measurements, programming, education, and teaching were very enlightening.

Finally, I must express my very profound gratitude to my parents and to my spouse for providing me with unfailing support and continuous encouragement throughout my years of study and through the process of researching and writing this thesis. This accomplishment would not have been possible without them. Thank you.

January 2017

Table of Contents

List of Figures