BANDWIDTH ENHANCEMENT OF U-SLOT MICROSTRIP PATCH ANTENNA

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I certify that all the material in this thesis that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this thesis reflect my own personal views, and are not necessarily endorsed by the University.

(Signature) ____________________________________________________________

(Date)  ______________________________________________________________
First of all, thanks to our creator, “Allah” for the continuous blessing and for giving me the strength and chances in completing this thesis.

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ABSTRACT

Microstrip patch antennas are popularly used in wireless communications due to its several well known advantages over other antenna structures, which includes their low profile, conformal nature, light weight, low cost of production, robust nature, and compatibility with microwave monolithic integrated circuits (MMICs) and optoelectronic integrated circuits (OEICs) technologies, but it has a significant drawback of narrow bandwidth and it is necessary to be enhanced for these applications. There are many techniques that can be used to improve the bandwidth. In this thesis, the bandwidth of the designed U-slot microstrip patch antenna is enhanced by adjusting the U-slot dimensions and adding two shorting walls. Two modified designs are proposed to achieve a wide bandwidth operating in wideband communications. The first modified design is by increasing the U-slot dimensions and adding two shorting walls which their dimensions are optimized. The first modified design gives a bandwidth about 28%. The second modified design is by increasing the U-slot dimensions, also by increasing the patch dimensions and adding two shorting walls in order to give a bandwidth about 40%. While the bandwidth of the reference antenna of K. F. Tong is about 9% which is narrow. The analysis is carried out by using the finite element method and satisfied results are obtained.
# TABLE OF CONTENTS

DECLARATION ........................................................................................................II
ACKNOWLEDGEMENTS .................................................................III
ABSTRACT ...............................................................................................IV
TABLE OF CONTENTS ..............................................................................V
LIST OF FIGURES ................................................................................VII
LIST OF TABLES .....................................................................................VIII
LIST OF SYMBOLS ....................................................................................IX
LIST OF ABBREVIATIONS .....................................................................X

Chapter 1: GENERAL INTRODUCTION

1.1 OVERVIEW ON MICROSTRIP ANTENNAS .........................2
1.2 ORGANIZATION OF THE THESIS ........................................2

Chapter 2: INTRODUCTION TO MICROSTRIP ANTENNAS

ANTENNAS

2.1 INTRODUCTION ..............................................................................5
2.2 VARIOUS MICROSTRIP ANTENNA CONFIGURATION ...6
2.3 BASIC CHARACTERISTICS ..........................................................7
2.4 RADIATION FIELD .................................................................10
   2.4.1 Radiation Mechanism of a Microstrip Antenna ....10
   2.4.2 Radiation Field Evaluation of Microstrip Patch Antenna ........10
2.5 FEEDING METHODS ...............................................................19
   2.5.1 Microstrip Feed Line ......................................................19
   2.5.2 Coaxial Feed ...............................................................20
   2.5.3 Microstrip Aperture Coupled Feed .........................20
   2.5.4 Microstrip Proximity Coupled Patches .................21
2.6 ADVANTAGES OF MICROSTRIP ANTENNAS ..............22
2.7 DISADVANTAGES OF MICROSTRIP ANTENNAS ..........22
2.8 APPLICATIONS OF MICROSTRIP ANTENNAS ............23
Chapter 3: INTRODUCTION TO WIDEBAND COMMUNICATIONS

3.1 INTRODUCTION .......................................................... 25
3.2 WIDEBAND SYSTEMS ..................................................... 26
  3.2.1 Wireless Local Area Networks (WLANs) .................. 28
  3.2.2 Bluetooth ............................................................ 29
  3.2.3 ZigBee ................................................................. 30

Chapter 4: THE FINITE ELEMENT METHOD

4.1 INTRODUCTION .......................................................... 33
4.2 BRIEF HISTORY OF FINITE ELEMENT METHOD ........ 33
4.3 FUNDAMENTAL CONCEPTS OF FINITE ELEMENT METHOD .......................................................... 35
4.4 ADVANTAGES OF THE FINITE ELEMENT METHOD .... 38
4.5 DISADVANTAGES OF THE FINITE ELEMENT METHOD .......................................................... 39

Chapter 5: BANDWIDTH ENHANCEMENT OF U-SLOT MICROSTRIP PATCH ANTENNA

5.1 INTRODUCTION .......................................................... 41
5.2 THE REFERENCE ANTENNA ........................................ 42
5.3 THE FIRST MODIFIED DESIGN .................................... 43
5.4 THE SECOND MODIFIED DESIGN ................................ 45
5.5 RESULTS AND DISCUSSION ....................................... 46
  5.5.1 Return Loss and Bandwidth .................................. 46
  5.5.2 Radiation Pattern .................................................. 50
  5.5.3 Gain ................................................................. 51

Chapter 6: CONCLUSIONS AND FUTURE WORK

6.1 CONCLUSION ............................................................. 54
6.2 FUTURE WORK .......................................................... 54

REFERENCES .................................................................

ARABIC SUMMARY ..........................................................
LIST OF FIGURES

Figure 2.1: Geometry of typical microstrip patch antenna.
Figure 2.2: Representative shapes of microstrip patch elements.
Figure 2.3: Schematic diagram of arbitrarily shaped microstrip patch antenna.
Figure 2.4: Bandwidth versus substrate thickness at some values of dielectric constant.
Figure 2.5: Directivity versus substrate thickness at some values of dielectric constant.
Figure 2.6: Efficiency versus substrate thickness at some values of dielectric constant.
Figure 2.7: Radiating fields of rectangular microstrip antenna
Figure 2.8: Three surface current source formulations which produce the same far field.
Figure 2.8 (a) K and M.
Figure 2.8 (b) M alone plus perfect electric conductor.
Figure 2.8 (c) K alone plus perfect magnetic conductor.
Figure 2.9: Another three equivalent surface current source formulations which produce the same far field.
Figure 2.9: (a) K and M.
Figure 2.9: (b) M alone plus perfect electric conductor.
Figure 2.9: (c) 2M alone, since h<<λo.
Figure 2.10: Far field components.
Figure 2.10: (a) Arbitrary current source.
Figure 2.10: (b) Rectangular current sheet.
Figure 2.10: (c) Circular current sheet.
Figure 2.11: Microstrip feed line.
Figure 2.12: Probe feed.
Figure 2.13: Aperture-coupled feed
Figure 2.14: Proximity-coupled feed.
Figure 3.1: The transition from narrowband to wideband and UWB in the time and frequency domains.
Figure 3.2: Overview of the IEEE 802.11 wireless LAN standard.
Figure 3.3: Bluetooth devices.
Figure 4.1: Finite element mesh of a fighter aircraft.
Figure 4.2: (a) A general two dimensional domain.
Figure 4.2: (b) A three-node finite element defined in the domain.
Figure 4.2: (c) Additional elements showing a partial finite element mesh of
the domain.
Figure 5.1: The geometry of the reference antenna.
Figure 5.2: The geometry of the first modified design.
Figure 5.3: The geometry of the second proposed design.
Figure 5.4: Return loss for the reference antenna.
Figure 5.5: The two resonant modes generated.
Figure 5.6: Return loss for the first modified design.
Figure 5.7: Return loss for the second modified design.
Figure 5.8: Radiation E and H plane patterns for the first modified designed
antenna at 2.91 GHz.
Figure 5.9: Radiation E and H plane patterns for the second modified designed
antenna at 2.84 GHz.
Figure 5.10: Gain of the first proposed modified antenna.
Figure 5.11: Gain of the second proposed modified antenna.

**LIST OF TABLES**

Table 3.1: Licensed spectrum allocations in the U.S.
Table 3.2: Unlicensed spectrum allocations in the U.S.
Table 3.3: Capabilities of WLAN, Bluetooth, and Zigbee.
Table 5.1: The dimensions of the reference antenna.
Table 2: The dimensions of the first modification design.
Table 5.3: The dimensions of the second modification design.
### LIST OF SYMBOLS

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>E</td>
<td>Electric Field Intensity</td>
</tr>
<tr>
<td>$f$</td>
<td>Frequency</td>
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<td>$G$</td>
<td>Gain</td>
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<tr>
<td>$H$</td>
<td>Magnetic field</td>
</tr>
<tr>
<td>$I$</td>
<td>Current</td>
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<tr>
<td>$J$</td>
<td>Current Density</td>
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<tr>
<td>$K$</td>
<td>Wave number</td>
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<tr>
<td>$U$</td>
<td>Radiation Intensity</td>
</tr>
<tr>
<td>$U_{\text{max}}$</td>
<td>Maximum radiation intensity</td>
</tr>
<tr>
<td>$Z_0$</td>
<td>Characteristic impedance</td>
</tr>
<tr>
<td>$Z_L$</td>
<td>Load impedance</td>
</tr>
<tr>
<td>$Z_{\text{in}}$</td>
<td>Input impedance</td>
</tr>
<tr>
<td>$D$</td>
<td>Directivity</td>
</tr>
<tr>
<td>$h$</td>
<td>Substrate height</td>
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<tr>
<td>$c$</td>
<td>Velocity of light in free space</td>
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<tr>
<td>$\Psi$</td>
<td>Progressive phase</td>
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<tr>
<td>$\lambda$</td>
<td>Wavelength</td>
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<td>$\varepsilon_{\text{eff}}$</td>
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<td>$\Phi$</td>
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<td>Permeability</td>
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<td>$\mu_r$</td>
<td>Relative Permeability</td>
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<td>Description</td>
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<td>--------------</td>
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<tr>
<td>ACL</td>
<td>Asynchronous Connection-Less</td>
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<td>AM</td>
<td>Amplitude Modulation</td>
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<td>CCK</td>
<td>Complimentary Code Keying</td>
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<tr>
<td>DSSS</td>
<td>Direct Sequence Spread Spectrum</td>
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<td>FCC</td>
<td>Federal Communications Commission</td>
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<tr>
<td>FEA</td>
<td>Finite Element Analysis</td>
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<td>IEEE</td>
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<td>HIPERLAN</td>
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<td>HFSS</td>
<td>High Frequency Structural Simulator</td>
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<td>LR-WPAN</td>
<td>Low Rate Wireless Personal Area Network</td>
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<tr>
<td>MMIC</td>
<td>Microwave Monolithic Integrated Circuit</td>
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<tr>
<td>OEIC</td>
<td>Optoelectronic Integrated Circuit</td>
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<td>SCO</td>
<td>Synchronous Connection Oriented</td>
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<td>TDD</td>
<td>Time Division Duplex</td>
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<tr>
<td>U-NII</td>
<td>Unlicensed National Information Infrastructure</td>
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<tr>
<td>UWB</td>
<td>Ultra Wide Band</td>
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<tr>
<td>VSWR</td>
<td>Voltage Standing Wave Ratio</td>
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<td>WLAN</td>
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