UNIVERSITI TEKNOLOGI MARA

DESIGN OF MINIATURIZED PLANAR INVERTED-F ANTENNA (PIFA) FOR LTE700M

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ABSTRACT

In 2008, FCC has auctioned 700 MHz band for commercialize and public safety usage. The 700 MHz has been boosting to mobile services such as for long term evolution (LTE) application. The benefits of 700 MHz band for LTE application are lower path loss, higher coverage range and lower design cost. However, the challenges of this band are larger antenna design and its complexity to achieve higher bandwidth. PIFA is a potential candidate to support 700 MHz band as it is known for its low profile, low cost and easy built in for portable devices. Yet, the major challenges for PIFA are its larger size for lower operating band and its narrow bandwidth nature. In this research, miniaturized PIFA will be designed for lower band application; LTE700M. The major challenges of PIFA for LTE700M are narrow bandwidth and larger antenna design. This study presents the impact of step stairs and slotted ground techniques for bandwidth enhancement and miniaturization process. The main radiators of PIFA have been branched into several radiating arms which provide optimized dimensions. Then, stair-shaped geometry has been added near main radiator which enhanced bandwidth for both lower band and higher band. Finally, the size of the finite ground is gradually reduced and optimized using slotted ground in order to achieve optimum size reductions. The optimized PIFA dimension for LTE700M is 100 mm by 55 mm with respect to length and width. Hence, this miniaturized size of proposed PIFA is a promising candidate for as LTE700M, GSM850/900, WLAN2.45G and WiMAX3.5G and 5 GHz applications.

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CHAPTER ONE
INTRODUCTION

1.1 Research Background

The mobile technologies have been rapidly evolving and enabled new services to emerge. The mobile technologies started with analogue communication which called as first-generation (1G). The technologies then evolved to second-generation (2G) which introduces digital communications and followed by the third generation (3G) which providing internet access to mobile devices. 3G technology can be considered as steppingstone for mobile communication system in introducing internet access for mobile devices. However, 3G system are limited with several shortcomings such as lower data speed, unable to roam and data simultaneously, not capable of supporting for wireless fidelity (Wi-Fi) application such as web based mobile services. 4G technology has been introduced in order to provide comprehensive solution and all Internet Protocol (IP) based mobile broadband solution which include application such as mobile web access, online gaming, IP telephony and many more [1, 2, 3, 4].

4G system consist of two technologies; Mobile Worldwide Interoperability for Microwave Access (WiMAX) and LTE [4, 5, 6]. Long Term Evolution (LTE) is introduced to provide support to WiMAX [4, 5, 6]. LTE is a new standard which designed to provide higher data rate, more efficient use of spectrum and to succeed existing standard; Universal Mobile Telecommunication System (UMTS). LTE has various spectrum frequencies and recently 700 MHz bands has been opted for LTE application as well [7, 8]. The 700 MHz band has capability to provide more coverage range and eventually optimize the design cost [9, 10].

However, recent mobile devices require ultra-slim, compact design and capability to support as many applications as possible. This phenomenon has challenged many researchers to improve the antenna design to be fitted into modern wireless communication devices. In conjunction to this, it is highly necessary for any antenna designers to produce a compact, multiband frequency and low-cost antenna in order to meet the mobile communication needs.