Chapter 65
Recent Trends in Antennas for Modern Wireless Communications

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ABSTRACT

The rapid development in wireless communications has demanded multiband or wideband antennas to support wireless communication devices such as smart phones, tablets, laptop computers, radar system, satellite communication, airplane, and unmanned airborne vehicle (UAV) radar. It has also demanded compact wireless devices that allow more space to integrate other electronic components. The aim of this chapter is to provide an idea of current R&D trends and novel approaches in design, analysis and synthesis of broadband, multiband and reconfigurable antennas for the new generation of mobile communication devices, as well as for UWB communications, radars and so on.

1. INTRODUCTION

The world is undergoing a major wireless revolution both in terms of wireless and mobile technology that provides ubiquitous communication access to citizens (Matin, 2012). As the society moves forward to the information centricity, the wireless communication industry brings new product with advance feature to support wireless services at any where, any time. The huge competition in the wireless industry and the mass acceptance of wireless devices have caused costs associated with the terminals and air time to come down significantly in the last 10 years. However, the rapid development of the communication technology such as wearable computers, cell phone technology, Personal Area Networks (PANs) for remote retrieval and monitoring of surroundings information has demanded for antennas suitable to operate with dual or multi-bands characteristics in wireless communication devices. For example, mobile communication system which operates in different frequency ranges require multiband antenna. Concurrently, ultrawideband (UWB) systems used in short range communications, remote sensing, and through-the-wall radar imaging require wideband antennas with stable gain and linear phase charac-

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teristics which creates a new arena of antenna design. Moreover, recently, there has been tremendous research interest in designing compact size of antenna in order to offer more space to integrate other electronic components for reduction the volume of wireless devices. All these desirable attributes push the researcher into challenge in designing new broadband, multiband and reconfigurable antennas for the new generation of mobile communication devices, as well as for UWB communications, radars and so on. This chapter provides an idea of current R&D trends in design, analysis and synthesis of broadband, multiband and reconfigurable antennas for modern wireless communications.

To facilitate the idea of current R&D trends towards different wireless applications, this chapter is organized as follows. In section 2, different design approaches are discussed for mobile and wireless applications. A low-profile multiband loop antenna design is presented for wireless routers and access points to cover the operation bands of 3G, 4G, WiMAX, and WLAN. This section also describes MIMO antenna on laptop for multiband LTE services. For radar applications, few antenna prototypes are presented in section 3. Section 4 describes the features of most recent antennas for UWB applications. In addition, this chapter also describes wearable antennas. The wearable antennas have gained a lot of attention due to its potential applications in healthcare, entertainment, identification systems, sport, smart home, and space in section 5. The presented antenna offers good integration features that make it suitable for on-body devices.

2. ANTENNAS FOR 3G, 4G, WiMAX AND WLAN

2.1 Antennas for Mobile Handheld Devices

Mobile phones available in the current markets support more and more features and applications that combine work, leisure and commercial aspects in an attractive way. This handheld device is becoming slimmer and lighter weight and has a large display with touch screen but still be small enough to fit inside a pocket. Moreover, it provides high data rate services and operates in numerous bands. Thus, this device creates challenges in implementing antenna for multiple RF bands with a wide range of frequencies. Furthermore, external to internal multiband antenna designing in a limited space is also desired. To incorporate the multiband functions, more than one antenna is required to cover the whole communication bands. However, antennas have restrictions in size and function. For these reasons, conventional planar inverted-F antenna (PIFA) has been received attention for mobile handsets. As a result, most of the conventional multiband internal antennas are in the form of monopoles or PIFAs (Guo et al., 2004; Wong et al.,2006;Martinez-Vazquez et al. 2006), but usually narrow-banded and hard to cover the whole communication bands. Other techniques are, loops (Wong & Huang, 2008) slots (Lin &Wong, 2007; Wu & Wong, 2008), balanced antennas (Collins et al., 2006), and combinations (Lin &Wong, 2007; Anguera et al., 2010) for multiband operations.

Multiband antennas can support numerous standards for mobile communication systems which are in use of different frequency ranges. For example the CDMA800/GSM900 systems operate in the 824 -960 MHz band, while the WCDMA/CDMA2000 systems operate in the 1880-2170 MHz. The future LTE system will operate in the 2300-2400 MHz and 2550-2690-MHz bands (3GPP, 2010). More standards are integrated into antennas of the device, such as GSM, 3G, 4G, WLAN, WiMAX, etc. Therefore, antennas that simultaneously cover the 806-960-MHz and 1880-2690-MHz bands, which can provide