Chapter 8
Reconfigurable Antenna: Narrowband Frequency Reconfigurable Antenna

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ABSTRACT
Reconfigurable antennas have attracted a lot of attention especially in future wireless communication systems. Superior features such as reconfigurable capability, low cost, multi-purpose functions and size miniaturization have given reconfigurable antennas advantage to be integrated into a wireless systems. In this chapter, two types of reconfigurable antennas are discussed. First, frequency reconfigurable narrowband microstrip slot antenna (FRSA) is presented. The proposed antenna is designed to operate at six reconfigurable frequency bands from 2 GHz to 5 GHz with bidirectional radiation pattern. The second antenna design is frequency reconfigurable narrowband patch-slot antenna (FRPSA) is presented. The antenna is a combination of a microstrip patch and slot antenna. Nine different narrow bands are produced by tuning the effective length of the slot. The performances of the antenna in term of simulated and measured results are presented. In conclusion, good agreement between the simulated and measured results has been attained.

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INTRODUCTION

The rapid development of electronics and wireless communication systems create multiple and different wireless applications and standards. In order to provide multi functionality for wireless communication systems, reconfigurable antenna is proposed. The fundamental characteristics such as frequency, radiation pattern and polarization are reconfigured to accommodate the changes in an operating system. Reconfigurable antenna has potential significant advantages compare to the typical standard antenna. For instance, the ability to tune the antenna operating frequency could be utilized to change operating bands, filter out interfering signals, or tune the antenna to account for a new environment.

Reconfigurable antenna is an antenna that capable to reconfigure its characteristic such as frequency, pattern, bandwidth, and polarization to adapt to the environment. The reconfiguration is not limited to a single characteristic but it can be a combination of characteristics depending to the application. Recently, frequency reconfiguration has attracted significant attention due to the introduction of future wireless communication concept such as cognitive radio which employs wideband sensing and reconfigurable narrowband communication. Moreover, frequency reconfigurable antennas have the potential to reduce the size of front end system and allow pre-filtering at the receiver. Thus, it can support many wireless applications in one single terminal system.

BACKGROUND

As described in Bernhard, J. T. (2007), the idea of reconfigurable antenna has been started in early 1930s. In 1979, a pattern reconfigurable antenna has been designed for satellite communication. The proposed antenna is capable to reconfigure to six different beam angles. A pattern reconfigurable antenna with multi beam reconfiguration for satellite communication is also been reported in Capone, E. & Pelaca, R. (1986). In 1999, a reconfigurable leaky patch antenna using PIN diode has been presented in Chang, B. C. C., Qian, Y., & Itoh, T. (1999). From 1999 until the present day, microstrip antenna has been used as a platform to design reconfigurable antenna.

Instead of multiple or multiband antennas, narrowband reconfigurable antenna offers significant advantages which smaller in size and offers pre-filtering at the receiver. Narrowband reconfiguration is potentially useful for cognitive radio system. Cognitive radio is a system that can change its transmitter parameters based on interaction with it environment which it operates. In general, cognitive radio has the capability to sense an available channel and used to establish communication link. Cognitive radio architecture concepts have been summarized in Haupt, R. L.,
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