Chapter 4

Design and Analysis of a Tunable Rectangular Microstrip Slot Antenna for Narrow Band Internet of Things Applications at 1800 MHz

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ABSTRACT

This chapter presents a tunable rectangular slot antenna on a Rogers RT/duroid 5880 (tm) substrate for narrowband internet of things applications. The proposed antenna has an operating frequency from 1601.20 MHz to 2051.90 MHz (tunable operating frequency range). The resonant frequency can be tuned by adjusting the length of the antenna as the application requirement. At each tuning step, the

DOI: 10.4018/978-1-7998-9315-8.ch004

proposed antenna has sufficient bandwidth to fulfil the requirement of narrow band internet of things. The amount of power transmitting from the proposed antenna has been investigated at different aspects of the antenna. The proposed antenna has the ability to transmit above 99% at resonating frequency. All the analysis of the proposed antenna has been carried out in high frequency structural simulation. For the performance validation of the proposed antenna, it has been simulated in FEKO tool and its return loss behavior has been compared with HFSS results.

INTRODUCTION

The Narrow band Internet of Things (NBIOT) antenna has becoming a famous technology in making things automation as well as for the smart industries. Mainly the available operating frequency for NBIOT applications are from 825 MHz to 960 MHz (at lower band) and 1725 MHz to 1860 MHz (higher band). As per antenna theory for making antennas at low frequency required really high dimensional geometries. Hence in this chapter to propose the antenna for the higher band operating frequency of NBIOT (1725 MHz to 1860 MHz) has consider into account.

The fundamental idea of this chapter is to design and analysis of a simple antenna at less in the dimensions than (Zhuo et al., 2020) to satisfy the application requirements in the field of narrow band internet of things applications. In the literature many antennas has been proposed to achieve the narrow band application by using different shapes of slots on the patch surface to resonate antenna at desired frequency band such as U-shaped, G-shaped, P-shaped. But in this research a rectangular slot were introduced on the patch surface to make antenna to resonate at within the operating frequency band i.e 1725 MHz-1860 MHz. the significant difference of the proposed antenna with the literature is that the size of the antenna has been reduced 45.88% than (Zhuo et al., 2020). But (Zhuo et al., 2020) has the dual band operating frequency performance.

Many methods are available in the literature (Chou & Ku, 2015; Choukiker et al., 2014; Fan et al., 2012) to adopt a technque to create input feeding to the antennas such as coaxial line, microstrip line. In the proposed antenna a rectangular microstrip line has been used as a feeding method to provide the input power to the mounted antenna. Since the position of the antenna can be change easily in according to match or deal with impedance matching (Li et al., 2013; Li et al., 2016; Pan et al., 2005). As well changing of the feeding position is much simpler than the designing a co-axial probe feeding.

Later a tuning approach has been analysed based on the length of the patch and investigated its bandwidth and amount of transmitting power (%) under different lengths of the provided antenna. Later the influence of the slot on the patch surface