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Design and performance of two-sleeve low profile antenna for bio-medical applications

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Abstract

In this paper, a microstrip patch antenna is proposed which is suitable for bio-medical applications. The antenna is designed to operate in the Industrial, Scientific and Medical band at 2.45 GHz. Analysis of two sleeve microstrip patch antenna is presented using parametric variation. It is found that resonant frequency highly depends on sleeves dimensions. The performance of the antenna is analysed by comparing the measured and simulated results and found to be in good agreement with each other. The antenna characteristic impedance is 50 Ω and is fabricated on FR4 substrate. The simulation results are obtained on finite-difference time-domain based Empire XCcel simulator.

Keywords: Microstrip patch antenna; VSWR; Bandwidth; Bio-medical applications; Return loss; ISM band

1. Introduction

Recently, the antenna technology is growing at much faster rate in every field of communication. Besides its applications in commercial and military areas, an antenna has now become a vital player in the medical sector too. The antenna is being used for many kinds of medical applications such as hyperthermia and cancer treatment, tumour detection, head and neck cancer treatment, remote health monitoring, speech sensing, self-monitoring, digestive monitoring etc. (Lo and Lee, 1988). Microstrip antennas have recently received much attention in remote health monitoring systems (Hall and Hao, 2006; Wong and Lin, 2005; Ogawa et al., 2000; Scanlon and Evans, 1997). It is now replacing the long stay in the hospitals with the use of remote health monitoring system by which the patient has no need to consult the doctor face to face. This remote health monitoring system has the ability to monitor the medical data of a patient in the home, facilitating the diagnosis, treatment, prediction of disease and control of the condition also.

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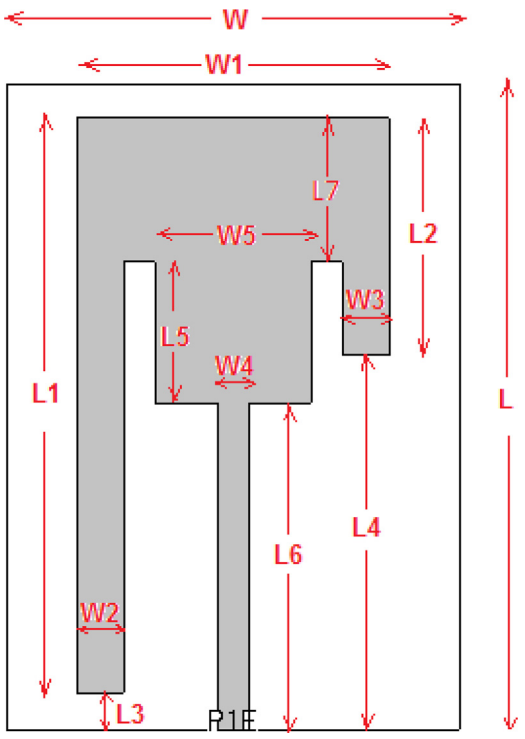

Fig. 1. Proposed antenna design.

Table 1
Parameters and their values.

Parameters	Values in mm
W	29
W1	20
W2	3
W3	3
W4	2
W5	10
L	41.50
L1	36.98
L2	15.30
L3	2.37
L4	24.05
L5	9.05
L6	21
L7	9.30

Several designs for antennas used in health monitoring have been published in the past research work (Karacolak et al., 2008; Beach et al., 1999; Warty et al., 2008; Hao et al., 2005; Haga et al., 2009; Xia et al., 2009; Tak et al., 2013; Malika et al., 2014; Conway and Scanlon, 2009; Asimakis et al., 2009; Rahman et al., 2013; Nornikman et al., 2013). Many wireless systems are used for monitoring various physiological parameters like blood pressure monitoring, glucose monitoring, temperature etc. (Karacolak et al., 2008; Beach et al., 1999; Warty et al., 2008). Measurements have also been carried out at 2.45 GHz for the body worn antennas (Hao et al., 2005). Cavity slot radiators are presented in Haga et al. (2009) and Xia et al. (2009) operate in ISM (Industrial, Scientific and Medical) band with the frequency range of 2.4–2.5 GHz for on body and in body applications. Microstrip patch antenna has been found to have other applications of self-monitoring and digestive monitoring too in biomedical sector (Tak et al.,

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