Chapter 9
Optimization of Textile Antennas Using Flexible Dielectric Material

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ABSTRACT

In this chapter, bendable textile antenna with partial ground plane is proposed. The anticipated antenna is made of jeans substrate which acts as a flexible material. The anticipated antenna is compared with some earlier published papers. The CST microwave studio is used to model the anticipated antenna, and after simulation, various results are obtained. The anticipated antenna has been provided the bandwidth from 1.90 GHz to 6.81 GHz having wide bandwidth of 112.74%. The designed antenna is suitable for wideband and Bluetooth application.

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1. INTRODUCTION

The pliable materials reduces the heaviness of antenna due to their low dielectric constant and is therefore responsible for the enhancement of the bandwidth. The antenna size varies inversely with the permittivity of the substrate that's why substrate of low permittivity is chosen for the fabrication of antenna (Bangari et al., 2018; Gao et al., 2017; Jain et al., 2019; Singh Nikhil & Singh Vinod, 2018; Wu et al., 2015). The characteristics of antenna e.g. the reflection coefficient, VSWR and radiation are investigated for suitable planning of antenna (Jamshed, 2015; Mourad & Essaaidi, 2014; Rachana et al., 2018; Rashmi et al., 2018; Sharma et al., 2018; Singh Nikhil et al., 2018).

The most of the existing antenna are not flexible and bendable and is identified as microstrip antenna. The lower and upper part of conventional textile antenna is made of copper (Abhishek et al., 2018; Grilo & Correra, 2015; Naresh & Singh, 2020; Poornima et al., 2018; Rahul & Singh, 2018; Rawat & Sharma, 2014; Xu & Li, 2012). Textile antenna is fabricated using copper tape and jeans is placed in between them. The development of textile antenna has been become easy because of miniaturization and usage of flexible materials (Jain et al., 2013; Kunal et al., 2018; Manju & Singh, 2018; Niharika et al., 2018; Pathak et al., 2012; Princi et al., 2018). When laptop, PC, and phone are in communication with the human body then the far field characteristics plays an important role. (Ashish et al., 2018; Deepak & Pathak, 2013; Jiang et al., 2014; Singh et al., 2010; Singh et al., 2013). The anticipated antenna acts as a receiver and can receive RF power at 2.163 GHz.

The anticipated bendable antenna is exclusive in terms of bandwidth and directivity The primary intention of designing a novel flexible antenna using a textile material for flexibility, compatibility and provide higher bandwidth that can be used for many applications such as Bluetooth, and other wireless applications The presented bendable textile antenna is applicable in broadband application in frequency range 1.90 GHz to 6.81 GHz.

2. DESIGN OF TEXTILE ANTENNA

The flexible antenna was recreated in CST microwave studio 2010 using Jeans substrate of the dimension 53.2mm×59.8mm. The patch comprised of three circles on the substrate in circle shape having radius 18 mm, 14mm and 8mm respectively. A strip line of length 2 mm & breadth 35 mm is fabricated inside the circle. The two annular rings are designed in such a manner that both rings could be interconnected by feed line. The sickle slot has been introduced to get broad band bandwidth. The CST software is used to model the anticipated antenna which is shown in Figure1