Chapter 10
Slotted Wearable Antenna for WLAN and LTE Applications

Nupr Gupta
Bundelkhand Institute of Engineering and Technology Jhansi, India

Rishabh Kumar Baudh
https://orcid.org/0000-0003-1026-2373
Bundelkhand Institute of Engineering and Technology Jhansi, India

D. C. Dhubkarya
Bundelkhand Institute of Engineering and Technology Jhansi, India

Ravi Kant Prasad
Bundelkhand Institute of Engineering and Technology Jhansi, India

ABSTRACT

Slotted wearable antenna is designed at frequency 2.4 GHz due to its application for wireless application and radiolocation. Proposed antenna is used for radiolocation through which detection of objects is possible using a tracking system of radio waves by analyzing the properties of received radio waves. Proposed design employs denim material as a substrate with copper patch as conducting layer. Denim fabric layer of 1mm thickness with permittivity of 1.7 and loss tangent of 0.025 is used as substrate. Dimensions of proposed antenna are calculated using a transmission line model. Proposed antenna has bandwidth percentage of 46% with center frequency 2.42 GHz, and it has high radiation efficiency 93.69%. It covers the frequency range between 2.18 GHz and 3.49 GHz, which works on WLAN applications (2.4-2.484 GHz) and LTE band (2.17 GHz).

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I. INTRODUCTION

The growth of wearable antenna is enhancing rapidly which is fabricated with clothes, due to low power consumption and its flexibility (Salonen et. al, 2012). Textile antenna finds its different applications in wireless body area networks (WBAN) at operating frequency 2.4 GHz (Samal, Soh, and Vandenbosch, 2014 & Wang et. al, 2012). Due to compact dimensions and low profile it can be easily hidden in garments therefore plays vital role in military applications . Conventional antenna uses hard substrate which creates discomfort to human body, so textile substrates are extensively used presently to fabricate over garments for WIMAX and WLAN (Shahid et. al, 2012). Conductive textiles are used as a dielectric substrate commercially in textile antennas. Bending effect on impedance and radiation characteristics is also studied (Amaro, Mendas, and Pinho, 2011).

In today's electronics world, awareness about location is salient feature of many mobile applications. Radiolocation is used with radar for allocated frequencies of different band for tracking individual as a security feature in different applications. Antenna characteristics are largely affected by its parameters like thickness and permittivity (Roy, Bhaterchya, and Chaudhary, 2013 and Locher et. al, 2006). Textile substrates are characterized by their permittivity and thickness, so it is taken according to applications (Sankaralingam and Gupta, 2010).

A. Antenna Material and Design

Textile antenna is designed at frequency 2.4 GHz using transmission line model. Denim fabric is employed as a nonconductive dielectric substrate while Copper tape is employed as a conductive finite ground plane and radiating metallic patch. Textile antenna mainly consists of denim substrate sandwiched between the conductive layers of copper tape and electromagnetic excitation is given to it using microstrip line feed. Denim substrate is used because of its flexibility, inelastic and planar structure which can be easily worn over garments. Parameters of denim fabric are calculated using a technique explained in (Shahid et. al, 2012) and these parameters are extracted as permittivity $\varepsilon = 1.7$ and loss tangent $\delta = 0.01$.

Rectangular patch has dimensions (47.3×53.8) with three slots cut over it to enhance the bandwidth efficiency of antenna. First slot is cut at the