Radiation Characteristics of a Textile Antenna
Designed for Apparel Application

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Abstract

The development of wearable intelligent textile systems has altered the concept of apparel. Traditionally, clothes are meant to protect our vulnerable body for environmental influences, together with aesthetic aims. However, the new generation of garments are capable of monitoring the wearer’s vital signs and activity as well as environmental changes. Therefore, textile material is not only used as carrier but also as basic material for the required components such as sensors. By doing this, additional functionalities can be added to the garment without affecting the wearer’s level of comfort. In this context, research into textile antennas for providing wireless communication to the textile systems, commenced.

A textile antenna that is designed to be integrated into apparel will have additional requirements, some of which will be analysed in this paper.

A multilayer microstrip patch antenna operating in the 2.45 GHz ISM\(^6\) band was chosen to perform the short range communication to transmit the wearer’s data to a nearby base station. The antenna was designed to provide a sufficiently large impedance bandwidth for communications based on e.g. the Bluetooth, IEEE 802.11b, Zigbee and Wireless USB protocols. By carefully choosing the electrotextiles, which are used for the antenna patch and ground plane, together with the conventional textile materials, as antenna substrate, a light-weight antenna with low radiation losses is obtained. The microstrip topology is ideal for wearable antenna applications since such a planar antenna has a low profile and the antenna ground plane shields the body from the antenna radiation. However, when integrated into a garment, the ground plane will have finite dimensions and the antenna characteristics can be influenced by the presence of the body. These effects are taken into account in the study. Furthermore, in real-life applications, the antenna will be subjected to bending. A rectangular ring topology ensures sufficient bandwidth to account for a potential frequency shift due to this curving.

Due to the promising results, this research contributes to the upcoming generation of apparel.

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\(^6\) Internationally reserved part of the radio spectrum for noncommercial Industrial, Scientific and Medical purposes
IEEE Galveston Bay Section
Symposium for Space Applications of Wireless & RFID 2007
May 8-9, 2007, Houston, TX

Clear Lake Council of Technical Societies