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Textile antenna integrated with compact AMC and parasitic elements for WLAN/WBAN applications

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Abstract A wearable antenna fully designed and fabricated using textile is presented. Both antenna and artificial magnetic conductor plane are designed for operation in the wireless local area network (WLAN)/wireless body area network (WBAN) band from 2.4 to 2.5 GHz. The AMC unit element is designed based on the rectangular patch structure, which is then integrated using slots and slits for bandwidth broadening. Meanwhile, the combination of the slits and L-shaped parasitic elements applied at four edges of the rectangular antenna structure enabled unidirectional radiation outwards from the body. The structure is coaxially fed using a rectangular ring slot centered on the radiating element. Simulated and measured reflection and radiation performance indicate a satisfactory agreement, fulfilling the requirements for WLAN/WBAN applications both in free space and on body. The shielding effectiveness provided by the AMC plane is also evaluated numerically in terms of specific absorption rate, indicating levels below the European regulatory limit of 2 W/kg.

1 Introduction

In recent years, wearable systems are becoming increasingly significant due to their promising features in applications such as tracking, navigation, mobile computing and public safety: conformity, flexibility and ease of use. Besides being spurred by the recent standardization of Body Area Networks (BANs) via IEEE 802.15.6, research in wearable systems is becoming popular also due to the ease of integration on the human body. One of the main components of such systems is the antenna, which is most suitable to be realized using textiles or other flexible materials.

The application of wearable antennas requires them to be located close to the human body. Due to the lossy nature of the human body, electromagnetic interaction with the antenna must be minimized. A high front-to-back ratio (FBR) of the radiation is beneficiary to reduce this interaction. A popular method to realize this is to ensure that the chosen planar antenna topology features a ground plane between the antenna and human body to avoid the absorption of large amounts of radiated power, besides affecting the matching due to coupling. In addition to