Appl. Phys. A (2017) 123:32
DOI 10.1007/s00339-016-0626-2

Applied Physics A
Materials Science & Processing

Conformal dual-band textile antenna with metasurface for WBAN application

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Received: 2 August 2016 / Accepted: 3 December 2016 / Published online: 19 December 2016

Abstract This paper presents the design of a dual-band wearable planar slotted dipole integrated with a metasurface. It operates in the 2.45 GHz (lower) and 5.8 GHz (upper) bands and made fully using textiles to suit wireless body area network applications. The metasurface in the form of an artificial magnetic conductor (AMC) plane is formed using a rectangular patch incorporated with a diamond-shaped slot to generate dual-phase response. This plane is then integrated with the planar slotted dipole antenna prior to its assessment in free space and bent configurations. Simulations and measurements indicated a good agreement, and the antenna featured an impedance bandwidth of 164 and 592 MHz in the lower and upper band, respectively. The presence of the AMC plane also minimized the backward radiation toward the human body and enhanced realized gains by up to 3.01 and 7.04 dB in the lower and upper band.

1 Introduction

rescue [1–9]. Enabling seamless accessibility between the 2.4 GHz WBAN frequency and the widely used Industrial, Scientific, and Medical (ISM; 5.2 GHz) band [2] requires WBAN devices to be capable of operating in both frequencies using a single hardware. Besides that, a wearable system is envisioned to be conformal, lightweight, miniature in size, low profile, inexpensive, and easy to fabricate to ensure its attractiveness. In recent years, textile antenna has been widely investigated as the main enabling technology for wearable devices. The choice of such material is mainly due to its ease of integration on clothing. Any fabric such as felt [1–5], silk, tween, panama, moleskin, fleece, PTFE, Perspex [5], denim jeans [6–8], nylon [9], etc., are potentially suitable as its substrate. Meanwhile, e-textiles are generally used to form its conducting elements and are required to be low in resistivity and flexible. They should preferably not be elastic due to the proneness of such antennas to easily degrade when deformed (stretched or bent). Meanwhile, metasur-