Mechanically Flexible All-Textile Cavity-Backed Slot Antenna for Body-Worn UWB Localization

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A full-textile cavity-backed slot antenna has been developed as a wearable antenna for impulse radio ultra-wideband localization purposes. The antenna has been designed for operation in the [3.744 – 4.7424] GHz band, spanning channels 2 and 3 of the IEEE802.15.4a standard. The dedicated fabrication methodology from [1, 2] has been applied to realize the antenna in a reliable and accurate way. Its light weight, mechanical flexibility and compact dimensions (35 x 56 x 4 mm), together with its stable figures of merit in on-body measurements make this antenna a suitable candidate for integration in clothing in a wide range of applications. Examples comprise the provision of communication, monitoring and/or localization infrastructure for uniformed personnel such as first aid responders, the military, operators in hazardous environments or medical and paramedical personnel and their patients.

Free space measurements show that the magnitude of the antenna's reflection coefficient with respect to 50 Ohm remains below -10 dB over a frequency range from 3.67 GHz to 4.86 GHz, resulting in a fractional bandwidth of 27.9 %. The antenna's radiation pattern exhibits a -3 dB beamwidth of 120°, a gain larger than 6.3 dBi for all frequencies and a front-to-back ratio of 11 dB. The measured radiation efficiency is higher than 75 % for all frequencies. Measurements show that these figures of merit remain sufficiently stable when the antenna is bent over diverse bending radii that are frequently encountered on the human body, as well as when deployed on the torso or upper right arm of a test person. Hence, the antenna is suitable as an integration platform for body-worn communication and localization modules.

1. D. Van Baelen, S. Lemey, J. Verhaevert and H. Rogier, "A Novel Manufacturing Process for Compact, Low-weight and Flexible Ultra-Wideband Cavity-Backed Textile Antennas," *Materials*, **11**, 1, January 2018, doi: 10.3390/ma11010067.

2. D. Van Baelen, S. Lemey, J. Verhaevert and H. Rogier, "Improved Fabrication Methodology for Foldable All-Textile Cavity-Backed Slot Antennas", in URSI AP-RASC 2019, New Delhi, India, 2019.