Truly Wearable RFID Tags for Wireless Body-Centric Identification and Sensing Systems

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Radio Frequency Identification (RFID) and wireless sensor systems are emerging rapidly in real-time bio-monitoring and healthcare engineering applications. This calls for an efficient wearable RFID tag and wearable sensor antennas for body-centric communication. In electromagnetic point of view, the human body constitutes a challenging environment for the operation of antennas. Biological tissues absorb RF energy and degrade severely the overall antenna performance. Embroidered tag antennas composed of conductive sewing thread integrated with clothing are believed to be a strong candidate for body-centric RFID and sensor systems. Thanks to their flexibility, lightweight, and good electrical functionality, they are suitable for body-worn electronics. This new compelling technology will provide multi-functional daily garments integrated with wearable antennas, sensor and power harvesting devices to enable body-centric wireless communication (Fig. 2). We have explored the on-body performance of passive UHF RFID embroidered tag antennas by accurate modeling of embroidered dipole-type RFID tags and human body. Even though the dipole antennas are generally greatly affected by the presence of the human body due to the absence of any isolation between the antenna and the body, they present relatively simple structures which are easily integrated into clothing.

The human arm simulation model (Fig. 1) which we have developed can hereby be used as a powerful tool for future wearable antenna design and optimisation. In the future, issues such as humidity and tag bending effects on wearable tag performance will be addressed. Exploration of suitable antenna types for wearable applications will be broadened and different types of flexible high-permittivity and low-loss substrate materials will be investigated.

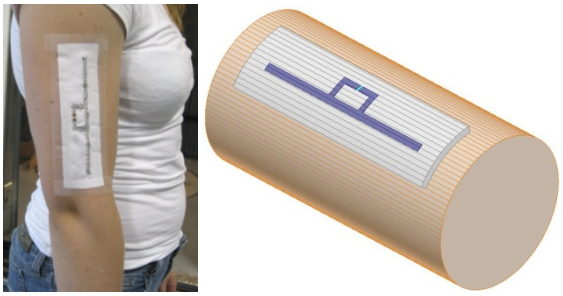

Fig. 1 Modeling of the human arm for body-centric communication

Fig. 2 Multi-functional garment with wearable antenna