



On the detection of UHF RFID tag embedded into boots

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In the framework of the Industry 4.0 applications, UHF RFID systems are largely used for logistics and for tracking of goods and human operators. Workers are often equipped with UHF RFID wearable devices such as smart gloves [3]-[4], helmets or boots to be supported during their daily work [1]-[4]. In this context, there are challenges in the development of wearable antennas while maintaining the expected performance, because the electrical properties of the human body affect the performance of the near antennas. Moreover, RFID systems must be integrated without modifying the wearable device like helmets or safety boots, since the latter devices must fulfill both ergonomic and safety constraints. For example, safety footwear meets all the minimum requirements to the latest EN ISO 20345 standard which defines both the basic and additional requirements for safety shoes for commercial use. Footwear in accordance with EN ISO 20345 is intended to protect the wearer from bumps, crushing, falling or rolling objects, from walking into sharp or pointed objects, heat or cold, and hot substances. Thus, the integration of UHF RFID tag inside the safety boots may represent a challenge. If an UHF RFID tag embedded into standard footwear can be detected up to few meters of distance, the presence of a protective midsole significantly limits the tag and system performance because of the stainless steel or aluminum insert in the sole.

The aim of this paper is to propose a possible solution to improve the system performance (e.g. in terms of reading range) of an UHF RFID access gate by properly designing and embedding a tag into safety boots. Given the small distance between the tag and the reader antenna, which are in the near-field region each other [5], an analysis with a specific model and performance parameters is carried out to design both the reader antenna and the tag in the boots.

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