UHF RFID Tags for electrical cables

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Tagging power cords is not only useful for tracking insulated or hidden electrical cables. Implementing sensory functionalities to the UHF RFID tag in addition to its unique ID is of great interest in the wireless sensing of house electrical appliance activities. Tags dedicated to electrical cables for read distances of 10-12 feet are commercially available (Sentry cable RFID Tag, Vizinex company). The core of the tag is a fiber-reinforced composite material and the mounting uses zip ties or metal banding which makes these tags bulky. Therefore, this type of tags can only be fixed on cables once the electrical installation is complete.

This paper studies a new concept of low profile UHF RFID tag (thickness lower than 100 μm) which can be wrapped and stuck around the cord. This first prototype paves the way to new designs of RFID tags fully integrated into the cable structure during the manufacturing process. A priori, the key parameters are the tag antenna coupling with the electrical wires, the power cord length and the relative position of the tag with respect to the copper wires. The efficiency drop must also be anticipated at the design stage.

The tag topology and the power cord geometry are described in Figures 1 and 2. The AK5 label manufactured by Tagsys is essentially the series connection of a rectangular 12×9mm aluminium loop with the UHF RFID chip Impinj Monza 5. Once the loop is magnetically coupled to a dipole-like antenna of larger radiation resistance, the tag performs well in the far-field at distances up to 10 m as the dipole enhances the radiation resistance and the radiation efficiency of the loop.

In the final paper, the influence of the coupling between the excitation module and the dipole is first evaluated through parametric studies on the coupling gap G. Then, the effects of the cable length and the tag orientation are studied in terms of mismatching between the chip and the tag antenna and pattern distortion. Finally, tag prototypes on power supply cords are realized and their reading ranges are measured with the help of a dedicated commercial equipment.

Fig. 1. Left: Photograph of the AK5 module working in the UHF RFID 860-960 MHz band. Right: Tag picture showing the AK5 module and the dipole etched on Kapton (U-meander hidden by the label surface).

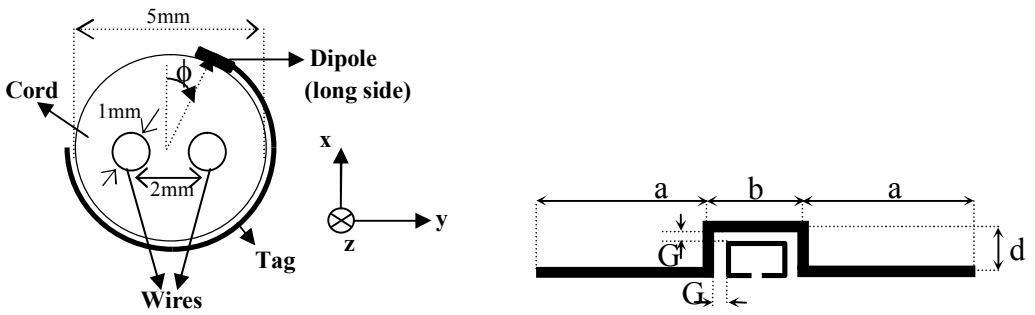

Fig. 2. (Left) Cut view of the power cord and the tag. (Right) Geometry of the meandered dipole coupled to the loop module.