Towards Green RFID Systems

Claudia Vasanelli, Student Member, IEEE, Luciano Tarricone, Member, IEEE

Abstract—This project aimed at realizing an UHF reader antenna on cheap and eco-friendly substrates. Numerical and experimental results are briefly discussed demonstrating that the antenna here presented is an optimum candidate to be used as reader antenna of ultra-high frequency RFID systems.

Index Terms—Radiofrequency identification, patch antennas, eco-friendly substrate.

I. INTRODUCTION

In the last years a great interest in green electronics has raised; many studies focused the attention on the use of biopolymer in electronics, which can be used for example as electrolyte in batteries or as a substrate for fabricating PCBs [1-3].

At the same time, there was a growing use of Radio Frequency Identification (RFID) systems, and in the next few years, an even more capillary distribution of such a technology is expected. As a consequence, the use of paper as substrate is very appealing, as paper is fully recyclable, cheap, and its properties (electric parameters, thickness and so on) can be ad-hoc customized.

Moreover, paper is easy to use in making prototypes, gives the possibility to fabricate electronic circuits on disposable products and packaging and can be made hydrophobic or fire retardant with the application of appropriate coating. Furthermore, the use of paper can enable the utilization of inkjet technology to print electronics [4].

In this project, a fully-3D Ultra-High Frequency (UHF) reader antenna on cheap and eco-friendly substrates has been realized. Compared to standard reader antennas, the solution here presented has several advantages: it is cheap and environmentally friendly, it has compact dimensions and it allows the integration of electronic equipment thanks to its cubic structure. Furthermore, it exhibits an almost omnidirectional radiation pattern.

This report is structured as follows. In sect. II the geometry of the proposed antenna is briefly described and some numerical and experimental results are given and discussed. Finally, conclusions are drawn in sect. III.
It is worth underlining that the use of the microstrip technology guarantees the absence of any problem of electromagnetic compatibility between radiating elements placed on the external surface of the structure and the electronic devices potentially located in the cube’s hollow. In fact, the ground-plane on the back of the antenna works as electromagnetic shield for the inner volume of the cube.

A prototype was realized for the antenna of Fig. 1, a photograph is given in Fig. 3. The patch antennas and the feeding network were realized by using adhesive copper. The measured reflection coefficient is in a good agreement with numerical data, as shown in Fig. 4.

III. CONCLUSION

A novel reader antenna for radio frequency identification applications has been presented. The main features of the proposed antenna are the use of a cardboard substrate, resulting in a low impact on the environment of the overall antenna, combined with compact dimensions, circular polarization and an almost omnidirectional radiation pattern.

The outcome of this project has been published in the Proceedings of the 42nd European Microwave Conference [4].

The MTT-S scholarship program was a great opportunity for me to improve my theoretical and technical knowledge by working on a small but real research problem. Moreover, thanks to the scholarship, I discovered IEEE and especially IEEE student activities: with some fellow students of my University, we decided to establish an IEEE Student Branch indeed.

Finally, thanks to the scholarship travel grant, I attended the 42nd European Microwave Conference in Amsterdam on November 2012, where I attended the Student Challenge too. It was an exciting experience, because I could listen to several interesting sessions about emerging topics and present to several students and researchers the results obtained during this research project.

I am currently a Master student at the University of Salento in Lecce, Italy, and then I would like to pursue a Ph.D. program.

ACKNOWLEDGMENT

The authors gratefully acknowledge Giuseppina Monti and Luca Catarinucci, who provided support and helpful insight in this project.

REFERENCES