IC1301 -WiPE

Wireless Power Transmission for Sustainable Electronics

March 2015

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WIPE

COST IC1301

EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

Journal papers 2014

1. E. Kampianakis, J. Kimionis, K. Tountas, C. Konstantopoulos, E. Koutroulis and A. Bletsas, "Wireless Environmental Sensor Networking with Analog Scatter Radio & Timer Principles", *IEEE Sensors Journal (SENSORS)*, Vol. 14, No. 10, pp. 3365 – 3376, Oct. 2014. **Conference version selected as one of the best papers in IEEE Sensors Conference, November 2013, Baltimore, USA.**
2. A.G. Dimitriou, S. Siachalou, A. Bletsas and J.N. Sahalos, "A Site-Specific Stochastic Propagation Model for Passive UHF RFID", *IEEE Antennas & Propagation Letters (APL)*, Vol. 13, pp. 623-626, March 2014.
3. J. Kimionis, A. Bletsas and J.N. Sahalos, "Increased Range Bistatic Scatter Radio", *IEEE Transactions on Communications (TCOM)*, Vol. 62, No. 3, pp. 1091 – 1104, March 2014.
4. F. Alimenti. L.Roselli, S. Kawasaki, “Guest Editorial,” IEEE Trans. Microw. Theory Tech., vol. 62, no. 4, pp. 2012–2014, 2014.
5. M. Virili, H. Rogier, F. Alimenti, P. Mezzanotte, and L. Roselli, “Wearable Textile Antenna Magnetically Coupled to Flexible Active Electronic Circuits,” IEEE Antennas Wirel. Propag. Lett., vol. 13, pp. 209–212, 2014.
6. L. Roselli, N. Borges Carvalho, F. Alimenti, P. Mezzanotte, G. Orecchini, M. Virili, C. Mariotti, R. Goncalves, and P. Pinho, “Smart Surfaces: Large Area Electronics Systems for Internet of Things Enabled by Energy Harvesting,” Proc. IEEE, vol. 102, no. 11, pp. 1723–1746, 2014.
7. F. Alimenti, M. Virili, P. Mezzanotte, L. Roselli, V. Rericha, M. Pokorny, F. Iorio, R. Gaddi, and C. Schepens, “A RF-MEMS Based Tunable Matching Network for 2.45 GHz Discrete-resizing Cmos Power Amplifiers,” RADIOENGINEERING, vol. 23, no. 1, pp. 328–337, 2014.
8. M. Poggiani, F. Alimenti, P. Mezzanotte, M. Virili, C. Mariotti, G. Orecchini, and L. Roselli, “24-GHz Patch antenna array on cellulose-based materials for green wireless internet applications,” IET Sci. Meas. Technol., no. June, pp. 1–8, Sep. 2014.
9. S. Kim, Y. Kawahara, A. Georgiadis, A. Collado, M. Tentzeris, ‘Low Cost Inkjet-Printed Fully Passive RFID Tags for Calibration-free Capacitive/Haptic Sensor Applications,’ IEEE Sensors Journal, Nov. 2014.
10. S. Kim, R. Vyas, K. Niotaki, A. Collado, A. Georgiadis, M. M. Tentzeris, ‘"Ambient RF Energy-Harvesting Technologies for Self-Sustainable Standalone Wireless Sensor Platforms," Proceedings of the IEEE , vol.102, no.11, pp.1649,1666, Nov. 2014.
11. K. Niotaki, F. Giuppi, A. Georgiadis and A. Collado, ‘Solar/EM energy harvester for autonomous operation of a monitoring sensor platform,’ Wireless Power Transfer, vol. 1, no. 1, pp. 44-50, Mar 2014.
12. A. Takacs, H. Aubert, L. Despoisse, S. Fredon, “Microwave energy harvesting for satellite applications”, IET Electronics Letters, Issue 11, Vol. 49, pp. 722-723, 23 May 2013.
13. A. Takacs, H. Aubert, L. Despoisse, S. Fredon, “Broadcast energy”, IET Electronics Letters, Volume 49, Issue 11, 23 May 2013, p. 682.
14. A. Takacs, H. Aubert, S. Fredon, L. Despoisse, H. Blondeaux, "Microwave power harvesting for satellite health monitoring," IEEE Trans. on Microwave Theory Tech, Vol.: 62, Issue: 4 , pp. 1090 - 1098, April 2014.

Conference papers 2014

1. S.N. Daskalakis, S.D. Assimonis, L. Kampianakis and A. Bletsas, "Soil Moisture Wireless Sensing with Analog Scatter Radio, Low Power, Ultra-Low Cost and Extended Communication Ranges", *IEEE Sensors Conference (SENSORS)*, November 2014, Valencia, Spain.
2. P. Alevizos, N. Fasarakis-Hilliard, K. Tountas, N. Agadakos, N. Kargas and A. Bletsas, "Channel Coding for Increased Range Bistatic Backscatter Radio: Experimental Results", *IEEE International Conference on RFID-Technology and Applications (RFID-TA),* September 2014, Tampere, Finland.
3. S. D. Assimonis, S.N. Daskalakis, and A. Bletsas, "Efficient RF Harvesting for Low-Power Input with Low-Cost Lossy Substrate Rectenna Grid", *IEEE International Conference on RFID-Technology and Applications (RFID-TA),* September 2014, Tampere, Finland.
4. A.G. Dimitriou, S. Siachalou, A. Bletsas and J.N. Sahalos, "Automated RFID Network Planning with Site-Specific Stochastic Modeling and Particle Swarm Optimization", *IEEE International Conference on RFID-Technology and Applications (RFID-TA),* September 2014, Tampere, Finland.
5. S.D. Assimonis, E. Kampianakis and A. Bletsas, "Microwave Analysis and Experimentation for Improved Backscatter Radio", *IEEE European Conference on Antennas & Propagation (EUCAP)*, April 2014, Hague, Netherlands.
6. E. Kampianakis, S.D. Assimonis and A. Bletsas, "Network Demonstration of Low-cost and Ultra-low-power Environmental Sensing with Analog Backscatter", *IEEE Radio Wireless Week Conference*, January 2014, Newport Beach CA, USA.
7. S.D. Assimonis and A. Bletsas, "Energy Harvesting with a Low-Cost and High Efficiency Rectenna for Low-Power Input", *IEEE Radio Wireless Week Conference*, January 2014, Newport Beach CA, USA.

Conference papers 2014

8. **A. Takacs**, **H. Aubert**, M. Bafleur, J.M. Dilhac, F. Courtade, S. Fredon, L. Despoisse, C.Vanhecke, G. Cluzet, “Energy harvesting for powering wireless sensor networks on-board geostationary broadcasting satellites”, in *Proc. of IEEE international conference on Green Computing and Communications (GreenCom’2012)*, 20-23 Nov. 2012, Besançon, France, pp. 637 - 640.
9. **A. Takacs**, **H. Aubert**, L. Despoisse, S. Fredon, “Design and implementation of a rectenna for satellite application”, in Proc. of *IEEE Wireless Power Transfer Conference (WPTC’2013)*, 15-16 May’2013, pp.183 – 186.
10. **A. Takacs**, **H. Aubert**, L. Despoisse, S. Fredon, “K-band energy harvesting for satellite application”, in *Proc. of IEEE IMS’2013,* Seattle, USA, 2-7 June’ 2013.
11. **A. Takacs**, **H. Aubert**, S. Fredon, L. Despoisse, “K-band energy harvesting circuits for satellite application”, *In Proc. of European Microwave Conference (EUMC'2013)*, Nuremberg, Germany, Oct. 2013, pp. 991-994.
12. **G. Vigneau, M. Cheikh, A. Takacs**, R. Benbouhout, S Bouguern, “Power Source Evaluation of a Wireless Power Transfer System”, in *Proc. of Wireless Power Transfer Conference (IEEE WPTC’2014)*, Jeju, Korea, 8-9 May’2014, pp. 9-12.
13. **A. Takacs**, **H. Aubert**, S. Charlot, S. Fredon, L. Despoisse, “Compact Rectenna for Space Application”, in *Proc. of IEEE IMS’2014,* Tampa, USA, 1-6 June, 2014.
14. **A. Takacs**, **H. Aubert**, **A. Luca**, S. Charlot, S. Fredon, L. Despoisse, “Rectenna Design for K Band Application”, in *Proc. of IEEE European Microwave Conference (EUMC'2014)***,** Rome, Italy, Oct’2014**.**

Conference papers 2014

15. B. S. Cook, C. Mariotti, R. Cooper, D. Revier, B. K. Tehrani, L. Aluigit, L. Roseuit, and M. M. Tentzeris, “Inkjet-printed, vertically-integrated, high-performance inductors and transformers on flexible LCP substrate,” in IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM DIGEST, 2014, pp. 3–6.
16. M. Dionigi, M. Mongiardo, L. Roselli, and D. Ingegneria, “Multi – Band Design of Matched Wireless Power Transfer Links,” in IEEE Wireless Power Transfer Conference, 2014, pp. 224–227.
17. M. Virili, A. Georgiadis, K. Niotaki, A. Collado, F. Alimenti, P. Mezzanotte, L. Roselli, and N. B. Carvalho, “Design and Optimization of an Antenna with Thermo-Electric Generator (TEG) for Autonomous Wireless Nodes,” in IEEE RFID-TA, 2014, pp. 21–25.
18. W. Su, B. Cook, M. Tentzeris, C. Mariotti, and L. Roselli, “A novel inkjet-printed microfluidic tunable coplanar patch antenna,” in 2014 IEEE Antennas and Propagation Society International Symposium (APSURSI), 2014, pp. 858–859.
19. M. Virili, G. Casula, C. Mariotti, G. Orecchini, F. Alimenti, P. Mezzanotte, and L. Roselli, “7.5-15 MHz Organic Frequency Doubler Made with Pentacene-Based Diode and Paper Substrate,” in IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM DIGEST, 2014.
20. R. Goncalves, N. B. Carvalho, P. Pinho, and L. Roselli, “Smart Environment Technology as a Possible Enabler of Smart Cities,” in IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM DIGEST, 2014, pp. 14–16.
21. Przemyslaw Kant, Jerzy Julian Michalski, “Wireless Power Transfer Approach for Wireless Sensor Network” in review. To be published during EuMW conference in Paris, September 2015
22. Przemyslaw Kant, Jerzy Julian Michalski, “Concept of Wireless Power Distribution System for Wireless Sensor Networks” accepted for publication. To be published during 1st International Conference on Innovative Research and Maritime Applications of Space Technology, Gdansk, Poland, April 2015

Horizon2020 proposals

1. ***Proposal submitted on Sept. 30 2014 to Research and Innovation actions Future and Emerging Technologies (FETOPEN), entitled:***

   BAtteryless WIreless Sensor NetworkS Monitoring ElectroPHysiOLogy and CommunIcatIon of PlantS (AMPHIPOLIS)

   University of Crete (Prof. A. Bletzas), CTTC (Dr. Georgiadis, Dr. Collado), Univ. of Aveiro (Prof. Carvalho), Univ. of Nicosia (Prof. Polycarpou and Prof. Sahalos).

2. ***Proposal submitted on Sept. 30 2014 to Research and Innovation actions Future and Emerging Technologies (FETOPEN), entitled:***

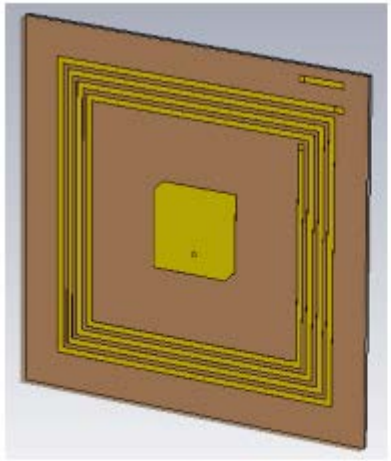
   In-Door Self-Adaptive Dual-Mode Wireless Powering (HOUSEPOWER)

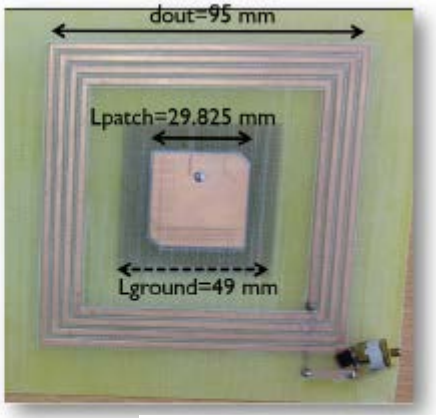
   University of Leuven (Prof. D. Schreurs) and Univ. of Aveiro (Prof. Carvalho), Univ. of Perugia (Prof. L. Roselli).

STSM impact

1. STSM-IC1301-17134: Ph.D. student Chiara Mariotti 5-weeks scientific mission at Prof. Nuno Carvalho laboratory, (Institute of Telecommunication, University of Aveiro, Portugal). The work focuses on the development of distributed indoor localization and wireless energy transfer systems embedded into floor materials (like cork and wood). This activity has produced two accepted papers for conferences that will take place during 2015 (in particular ECTC and IMS).

STSM impact





(a)

Figure 5.2: Patch antenna on FR4 at 2.45 GHz su
and (b) prototype.

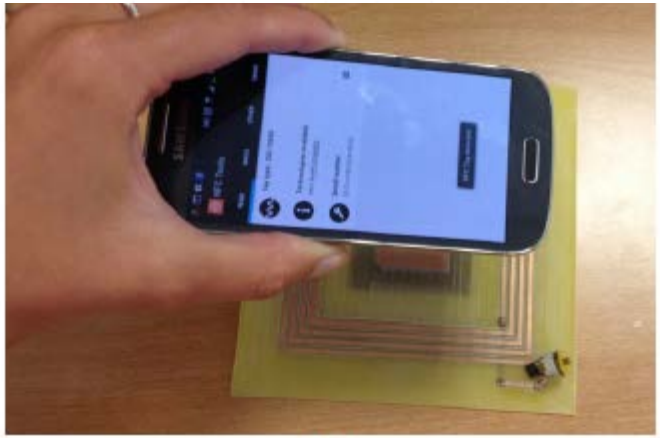
(a) (b) (c)

Figure 5.3: Tests of the patch antenna surrounded by the coil: (a) with air on top, (b) with cork on top and (c) with wood on top.

STSM impact

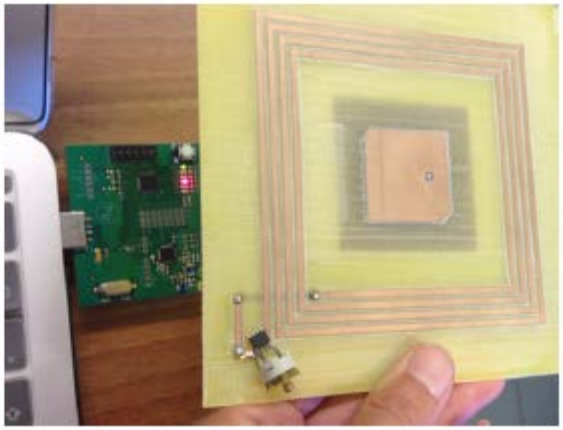
"Energy Evaporation": the New Concept of Indoor Systems for WPT and EH Embedded into the Floor

Chiara Mariotti*, Ricardo Gonçalves†, Luca Roselli*, Nuno B. Carvalho†, Pedro Piño‡



(a)

(b)



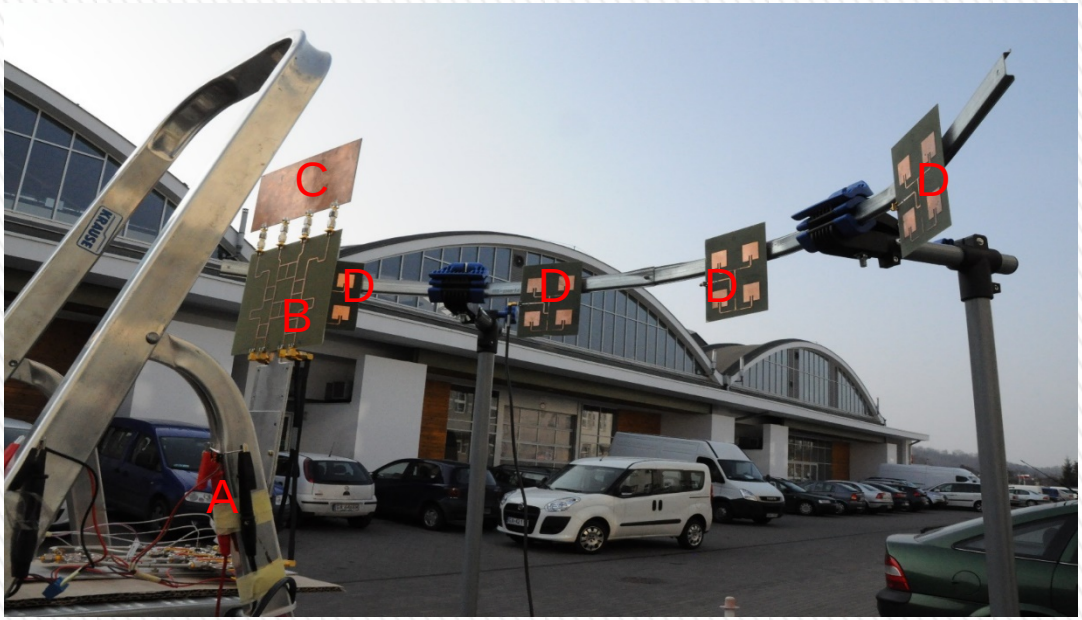
(c)

Special sessions and Workshop organization

1. L. Roselli, F. Alimenti, C. Mariotti, M. Virili, G. Orecchini, P. Mezzanotte "Chipless Tag Evolution Toward RFID-sensors for IoT", invited talk at the WS RF Energy Harvesting: Challenges and Applications within RWW 2014 Newport Beach, 19 - 22 January 2014.
2. L. Roselli, "Green Electronics, enabling technologies for Internet of Things," Invited seminary in Padova, 11-11-2014 and Florence, 05-12-2014.
3. L. Roselli, F. Alimenti, P. Mezzanotte, G. Orecchimi, M. Virili, C. Mariotti, "Smart Surfaces: A Tile to Pave Smart Cities," Invited talk at the WS Wireless Concurrent Technologies for the Smart Evolution of Cities within the EuMW 2014 , Rome, October 2014.
4. L. Roselli, "Materials and technologies for WPT", invited seminary within the COST IC1301 Doctorate School in Aveiro, 23-06-2014.
5. L. Roselli, C. Mariotti, F. Alimenti, P. Mezzanotte, G. Orecchini, M. Virili, "System in Package on Paper (SiPoP) implementation of RF/MF-ID circuits," invited talk at the WS Inkjet-Printing: The Next Generation of Multilayer Fabrication, Integration & Packaging for RF and mm-Wave Communication, Sensing and Radar Systems within IMS, Tampa, June 2014.
6. L. Roselli, A. Costanzo, "RFID Applications: present, future and futuristic ones", RWW, San Diego, 2015.
7. L. Roselli, M. Virili, G. Orecchini, C. Mariotti, F. Alimenti, P. Mezzanotte, presentation about the University of Perugia research activity within COST IC1301 WG4 topics, COST IC1301 Meeting, Edinburgh, March 2014.
8. [1] 2014 EUMW, Workshop WM4 (EuMC) Wireless Concurrent Technologies for the Smart Evolution of Cities, co-organizer. UNIPG n collaboration with other COST Members.
9. [2] Accepted workshop "Non Linear RFID Systems, Characterization and Exploitations" IMS/RFIC/ARFTG 2015. UNIPG in collaboration with other COST Members.

Others (SpaceForest)

SF works on the WPT system where electromagnetic power can be transmitted in desired (designed) direction. The beam steering is realized by Butler matrix cooperated with microwave switch. Picture of the system is below.



A) Microwave Power generator
B) Butler matrix
C) Antenna Array
D) Receiving systems including antennas, rectifiers and ZigBee modules.

Others (UNIPG-CTTC)

1. Erasmus placement of PhD student Marco Virili at CTTC (Centre Tecnològic Telecomunicacions Catalunya), Barcelona, Spain: the research activity has been conditioned by COST IC1301 and was focused on hybrid systems for WPT and EH. This activity has produced two papers presented at conferences, with two awards (best paper award, 2nd place student competition), and a journal paper submitted to Cambridge WPT Journal accepted with minor revisions.