

# JOHN KIMIONIS

PhD Candidate - Research Assistant  
ATHENA Group  
School of Electrical and Computer Engineering  
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## EDUCATION

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- **Doctor of Philosophy**

School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, USA  
(Exp. Summer 2017)

Thesis: *“Low-cost and low-energy-footprint RF sensors”*

Research summary: Low-cost sensor networking with spectrally-efficient backscatter communication. Design of the sensors’ physical layer communication scheme and implementation of reader with Software Defined Radio. Design of low-power sensor RF front-ends and optimization of communication range capability and bandwidth occupancy with pulse shaping. Packaging and integration using additive manufacturing techniques (inkjet printing and 3D printing) for reducing fabrication time and cost.

PhD Advisor: Prof. Manos M. Tentzeris

- **Master of Science** (2-year program)

School of Electronic and Computer Engineering, Technical University of Crete, Chania, Greece, Aug. 2013

Thesis: *“Bistatic Scatter Radio for Increased-range Environmental Sensing.”*

Brief Description: “Derivation of the complete scatter radio signal model, and study on bistatic scatter radio system architectures. Complete description of modulation schemes and design of their corresponding receivers. Performance analysis and discussion on the impact of RF tag parameters on receivers BER performance. Evaluation of the designed system with Software Defined Radio and custom radio modules.”

MSc Advisor: Associate Prof. Aggelos Bletsas

GPA: 9.5/10.0

- **Diploma of Engineering** (5-year program)

School of Electronic and Computer Engineering, Technical University of Crete, Chania, Greece, Dec. 2011.

Thesis: *“Design and Implementation of Backscatter Links with Software Defined Radio for Wireless Sensor Network Applications.”*

Brief Description: “Study of backscatter radio systems and implementation of a backscatter testbed for experimentation and research. Design of a low-cost, low-power semipassive sensor tag for dense environmental sensor networks. Implementation of a fully functional receiver with Software Defined Radio and backscatter signal processing in MATLAB environment.”

Thesis Supervisor: Associate Prof. Aggelos Bletsas

GPA: 8.06/10.0

## RESEARCH INTERESTS

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- Low-cost and Low-energy Wireless Systems
- RFID and Backscatter Radio Communication
- RF Engineering, Physical Layer, and Software-Defined Radio
- Embedded Sensors hardware and firmware for Wireless Sensor Networks
- Rapid Prototyping & Inkjet-printed electronics

## AWARDS AND DISTINCTIONS

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- **Gerondelis Foundation Fellow**, scholarship for academic year 2016–2017.
- **Student Travel Grant Award and Nomination for Best Student Paper Award**, for the IEEE MTT-S International Microwave Symposium (IMS) 2015, Phoenix, AZ, USA, May 2015.
- **First Prize for the Best Student Paper Award**, for the paper “RF Tag Front-end Design for Uncompromised Communication and Harvesting,” coauthored by J. Kimionis and Manos M. Tentzeris, presented at the IEEE International Conference on RFID Technologies and Applications (RFID-TA) 2014, Tampere, Finland, Sep. 2014.
- **Student Travel Grant Award**, for attending the IEEE International Conference on RFID Technologies and Applications (RFID-TA) 2014, Tampere, Finland, Sep. 2014.
- **Texas Instruments Sponsorship** for mentoring undergraduate student teams for the “Opportunity Research Scholars” (ORS) program, School of ECE, Georgia Institute of Technology, Fall 2014 – present.
- **Second Prize for the Best Student Paper Award**, for the paper “Inventory Time Reduction in Gen2 with Single-Antenna Separation of FM0 RFID signals,” coauthored by J. Kimionis, A. Bletsas, A.G. Dimitriou, and G.N. Karystinos, presented at the IEEE International Conference on RFID Technologies and Applications (RFID-TA) 2011, Sitges, Barcelona Spain, Sep. 2011.
- **Finalist**, at the IEEE VTS & AESS Joint Greece Chapter Final/Diploma Thesis Competition in the field of “Advanced Wireless Systems,” Feb. 2012, Thessaloniki, Greece.
- **Graduate Fellowship Award**, Special Graduate Studies Scholarship (EMY), Technical University of Crete, Dec. 2011 - Aug. 2012.
- **ECE Fellowship Award**, School of ECE, Technical University of Crete, Dec. 2011 - Aug. 2012.
- **Undergraduate Fellowship Award**, Office of Sponsored Research, awarded to the top 10% of class. Technical University of Crete, for the academic year 2009-2010.
- **Undergraduate Fellowship Award**, Office of Sponsored Research, awarded to the top 10% of class. Technical University of Crete, for the academic year 2006-2007.

## ACADEMIC & WORK POSITIONS

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1. AHENA Lab Researcher, *Georgia Institute of Technology*, Aug. 2013 – present.  
*National Science Foundation-EFRI Project "ORIGAMI"*  
*Defense Threat Reduction Agency Project "Remote Chemical Sensing"*
2. Mentor of undergraduate student teams for the "Opportunity Research Scholars" (ORS) program, *School of ECE, Georgia Institute of Technology*, Fall 2014 – present.
3. Telecom Lab Researcher, *Technical University of Crete, Greece*, Sep. 2010–Aug. 2013  
*ERC-04-BLASE Research Project "Backscatter Networks for Large-Scale Environmental Sensing,"* executed in the context of the Education & Lifelong Learning Program of General Secretariat for Research & Technology (GSRT) of Greece, and funded through European Union and national funds.
4. Lab Manager, *Telecom Lab, School of ECE, Technical University of Crete*, Sep. 2010 – Aug. 2013.
5. Graduate Researcher, *Telecom Lab, School of ECE, Technical University of Crete*, Dec. 2011–Aug. 2013.
6. Teaching Assistant for the "Communication Systems II" course, *School of ECE, Technical University of Crete*, Spring 2012.
7. Teaching Assistant for the "Communication Systems I" course, *School of ECE, Technical University of Crete*, Fall 2011.
8. Teaching/Lab Assistant for the "Analysis and Design (Synthesis) of Telecom Modules" course, *School of ECE, Technical University of Crete*, Fall 2011–Fall 2012.
9. Graduate Assistant, K-12 STEM Outreach program, *Center for Education Integrating Science, Mathematics, and Computing (CEISMIC), Georgia Institute of Technology*, Fall 2015.
10. Reviewer for the IEEE Microwave & Wireless Components Letters (MWCL), IEEE Wireless Communications Letters (WCL), IEEE Transactions on Microwave Theory and Techniques (TMTT), IEEE Transactions on Wireless Communications (TWC), IEEE Transactions on Antennas & Propagation (TAP), IEEE Sensors Conference 2014, IEEE Vehicular Technology Conference (VTC) 2015.

## ENGINEERING EXPERIENCE

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- **Athena Lab Researcher, Georgia Tech, Aug. 2013–Present**
  - **Patent Pending:** Demonstrated the first **reduced-bandwidth backscatter** radio & RFID front-end with pulse shaping.
  - Designed minimal-power (nW- $\mu$ W) RF front-ends for **increased-range backscatter** sensor communication and accompanying **receivers with software-defined radio**.
  - Developed 3-dimensional RF systems with **increased energy harvesting efficiency** and **communication diversity** in randomized deployments; **reduced fabrication time and cost by 90%** with new rapid prototyping processes.
- **Team Mentor, Opportunity Research Scholars, Georgia Tech, Aug. 2014–Present**
  - Developed **minimal cost humidity sensors** for climate monitoring. Built inkjet-printed sensor elements with humidity-sensitive polymers and interfaced to wireless-enabled embedded platforms.

- **Telecom Lab Researcher, Technical University of Crete, Aug. 2013–Present**

- Implemented complete low-power wireless sensor network with embedded sensors and RF front-ends on custom PCBs.
- Designed **custom physical layer** backscatter radio with **noncoherent receivers & signal processing** on software-defined radio.
- Boosted sensor **communication ranges** from 3 meters to 100+ meters with non-conventional transmitter/receiver topologies.

## PATENTS

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1. “Pulse Shaping for Backscatter Radio and Radio Frequency Identification Tags,” US Patent Pending

## JOURNAL PUBLICATIONS

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1. J. Kimionis and Manos M. Tentzeris, “Pulse Shaping: The Missing Piece of Backscatter Radio,” *IEEE Transactions on Microwave Theory and Techniques (TMTT)*, to appear, Dec. 2016.
2. J. Kimionis, M. Isakov, B.S. Koh, A. Georgiadis, M.M. Tentzeris, “3D-printed Origami Packaging with Inkjet-printed Antennas for RF Harvesting Sensors,” *IEEE Transactions on Microwave Theory and Techniques (TMTT)*, vol.63, no.12, Dec. 2015.
3. J. Hester, S. Kim, J. Bitto, T. Le, J. Kimionis, D. Revier, C. Saintsing, W. Su, B. Tehrani, A. Traille, B.S. Cook, and M.M. Tentzeris, “Additively Manufactured Nanotechnology and Origami-enabled Flexible Microwave Electronics,” *Proceedings of the IEEE*, vol.103, no.4, pp.583–606, Apr. 2015.
4. J. Kimionis, A. Georgiadis, A. Collado, and M.M. Tentzeris, “Enhancement of RF Tag Backscatter Efficiency with Low-power Reflection Amplifiers,” *IEEE Transactions on Microwave Theory and Techniques (TMTT)*, vol.62, no.12, pp.3562–3571, Dec. 2014.
5. 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*, vol.14, no.10, pp.3365–3376, Oct. 2014.
6. 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, Mar. 2014.
7. A. Bletsas, A. Vlachaki, E. Kampianakis, G. Sklivanitis, J. Kimionis, K. Tountas, M. Asteris and P. Markopoulos, “Building a low-cost digital garden as a telecom lab exercise,” *IEEE Pervasive Computing*, vol.12, no.1, pp.48–57, Jan. 2013.
8. A. Bletsas, J. Kimionis, A. G. Dimitriou, and G.N. Karystinos, “Single-Antenna, Coherent Detection of Collided FM0 RFID Signals,” *IEEE Transactions on Communications (TCOM)*, vol.60, no.3, pp.756–766, Mar. 2012.

1. J. Kimionis and M.M. Tentzeris, "Pulse Shaping for Backscatter Radio," in *IEEE MTT-S International Microwave Symposium (IMS) 2016*, San Francisco, CA, USA, May 2016.  
**Patent Pending.**
2. J. Kimionis and M.M. Tentzeris, "Software-defined Reader for Multi-modal RFID Sensing," in *IEEE MTT-S International Microwave Symposium (IMS) 2016*, San Francisco, CA, USA, May 2016.
3. R. Bahr, J. Hester, J. Kimionis, and M.M. Tentzeris, "A Review of Additive Manufacturing Techniques for Fabricating RF Sensors," in *GOMACTech Conference*, St. Louis, MO, March 2016.
4. S.A. Nauroze, J. Kimionis, J. Bito, W. Su, J. Hester, K. Nate, B. Tehrani, and M.M. Tentzeris, "Additive Manufacturing Technologies for Near- and Far-field Energy Harvesting Applications," in *IEEE Radio Wireless Week (RWW) 2016*, Austin, TX, Jan. 2016.
5. J. Kimionis, A. Georgiadis, M. Isakov, H.J. Qi, and M.M. Tentzeris, "3D/Inkjet-printed Origami Antennas for Multi-direction RF Harvesting," in *IEEE MTT-S International Microwave Symposium (IMS) 2015*, Phoenix, AZ, USA, May 2015.  
**Best Student Paper Award Finalist.**
6. R. Martinez, J. Kimionis, A. Georgiadis, A. Collado, M.M. Tentzeris, G. Goussetis, J.L. Tornero, "Circularly Polarized Shorted Ring Slot Rectenna with a Mesh Design for Optimized Inkjet Printing on Paper Substrate," in *9th European Conference on Antennas and Propagation (EuCAP)*, Lisbon, Portugal, Apr. 2015.
7. J. Kimionis, A. Georgiadis, A. Collado, and M.M. Tentzeris, "Inkjet-printed Reflection Amplifier for Increased-range Backscatter Radio," in *European Microwave Conference (EuMC) 2014*, Rome, Italy, Oct. 2014.
8. A. Traille, S. Kim, A. Coustou, H. Aubert, M.M. Tentzeris, J. Kimionis, A. Georgiadis, and A. Collado, "Novel Inkjet Printed Modules for Sensing, Radar and Energy Harvesting Applications," in *European Microwave Conference (EuMC) 2014*, Rome, Italy, Oct. 2014.
9. J. Kimionis and M.M. Tentzeris, "RF Tag Front-end Design for Uncompromised Communication and Harvesting," in *IEEE International Conference on RFID-Technology and Applications (RFID-TA) 2014*, Tampere, Finland, Sep. 2014.  
**Distinguished with the First Best Student Paper Award.**
10. J. Kimionis, S. Nikolaou, and M.M. Tentzeris, "Inkjet-printed UHF RFID Folded Dipole Antennas for Remote Sensing Applications," in *IEEE International Symposium on Antennas and Propagation (APSURSI) 2014*, Memphis, TN, USA, Jul. 2014.
11. J. Kimionis, A. Georgiadis, S. Kim, A. Collado, K. Niotaki, and M.M. Tentzeris, "An Enhanced-Range Passive RFID Tag Using an Ambient Energy Powered Reflection Amplifier," in *IEEE MTT-S International Microwave Symposium (IMS) 2014*, Tampa Bay, FL, USA, Jun. 2014.
12. J. Kimionis, A. Bletsas, and J.N. Sahalos, "Bistatic Backscatter Radio for Power-limited Sensor Networks," in *IEEE Global Telecommunications Conference (GLOBECOM)*, Atlanta, GA, USA, Dec. 2013.
13. E. Kampianakis, J. Kimionis, K. Tountas, C. Konstantopoulos, E. Koutroulis, and A. Bletsas, "Backscatter Sensor Network for Extended Ranges and Low Cost with Frequency Modulators: Application on Wireless Humidity Sensing," in *Proceedings of the IEEE Sensors Conference 2013*, Baltimore, MD, USA, Nov. 2013.  
**Selected among the best papers of the conference for publication in IEEE Sensors Journal.**

14. E. Kampianakis, J. Kimionis, K. Tountas, and A. Bletsas, "A Remotely Programmable Modular Testbed for Backscatter Sensor Network Research," in *Fifth Workshop on Real-World Wireless Sensor Networks (REALWSN)*, Como Lake, Italy, Sep. 2013.
15. J. Kimionis, A. Bletsas, and J.N. Sahalos, "Bistatic Backscatter Radio for Tag Read-Range Extension," in *IEEE International Conference on RFID-Technology and Applications (RFID-TA) 2012*, Nice, France, Nov. 2012.
16. A.G. Dimitriou, J. Kimionis, A. Bletsas, and J.N. Sahalos, "A Fading-Resistant Method for RFID-Antenna Structural Mode Measurement," in *IEEE International Conference on RFID-Technology and Applications (RFID-TA) 2012*, Nice, France, Nov. 2012.
17. J. Kimionis, A. Bletsas, and J.N. Sahalos, "Design and Implementation of RFID Systems with Software Defined Radio," in *6th European Conference on Antennas and Propagation (EuCAP)*, Prague, Czech Republic, Mar. 2012.
18. J. Kimionis, A. Bletsas, A.G. Dimitriou, and G.N. Karystinos, "Inventory Time Reduction in Gen2 with Single-Antenna Separation of FM0 RFID signals," in *IEEE International Conference on RFID-Technology and Applications (RFID-TA) 2011*, Sitges, Barcelona, Spain, Sep. 2011.  
**Distinguished with the *Second Best Student Paper Award*.**
19. A. Bletsas, A. Vlachaki, E. Kampianakis, G. Sklivanitis, J. Kimionis, K. Tountas, M. Asteris and P. Markopoulos, "Towards precision agriculture: Building a soil wetness multi-hop WSN from first principles," invited paper, in *Second International Workshop in Sensing Technologies in Agriculture, Forestry and Environment (ECOSENSE) 2011*, Belgrade, Serbia, Apr. 2011.

## BOOK CHAPTERS

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1. J. Kimionis and M.M. Tentzeris, "Inkjet-printed smart skins and wirelessly-powered sensors for wearable applications," in "Electromagnetics of Body-Area Networks: Antennas, Propagation, and RF Systems," pp. 351-374, John Wiley & Sons, 2016.

## ARTICLE/PRESENTATIONS/WORKSHOPS

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1. J. Kimionis, "Spectrally-efficient RFID and backscatter sensors," in *RFID Components and Devices for the Next Generation of 5G IoT Devices Workshop*, MTT-S International Microwave Symposium (IMS) 2017, Honolulu, HI.
2. J. Kimionis and M.M. Tentzeris, "Origami antennas and packages using 3D printing technologies," SPIE Newsroom, 2015.
3. J. Kimionis, A. Bletsas, and J.N. Sahalos, "Backscatter Sensor Networks with Commodity Software-Defined Radio," in *COST IC1102 1st Technical Workshop*, Naples, Italy, Apr. 2012.
4. J. Kimionis, A. Bletsas, and J.N. Sahalos, "Demonstration of Backscatter Sensor Network with Commodity SDR Reader," invited talk, in *European Microwave Week (EuMW) 2011*, Manchester, UK, Oct. 2011.



## OTHER INTERESTS - EXTRA CURRICULAR ACTIVITIES

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- President of GaTech Hellenic Society, 2015–2016, Social Chair of GaTech Hellenic Society, 2014–2015.
- Representative of the TUC ECE Graduate Student Union, 2011-2013.
- Representative of the TUC ECE Undergraduate Student Union, 2009-2011.
- Volunteer for the Science Olympiad (K-12) at GeorgiaTech.
- Digital Arts and Media.
- Agriculture/Farming.