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S E M I N A R

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Low-Input Power-Level CMOS RF Energy-Harvesting Front End

by

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Abstract: RF energy-harvesting front ends consist of LC matching networks and RF rectifiers. The minimum detectable power (sensitivity) is dependent on the losses of both parts. In this presentation, RF energy-harvesting sensitivity limits at steady state and design tradeoffs for matching networks and rectifiers are introduced. These limits and tradeoffs are examined for standard CMOS 0.18-μm technology. Two designs, one with off-chip matching network and the other with on-chip matching network, are presented, compared, and measured for an output voltage of 1 V. The sensitivity of the off-chip design is -27.3 dBm while taking 180 × 90 μm^2 die area and off-chip high quality inductor and capacitor, which takes an extra 7.28 mm^2 printed circuit board area. The fully integrated on-chip design has a sensitivity of -21.7 dBm while taking 820 × 450 μm^2 die area. The sensitivity of the former proved superior while the latter is more attractive in terms of compactness, low cost, and easier to tune.

Mohamed Abouzied received his B.Sc. and M.Sc. degrees, both in electrical engineering, from Cairo University, Cairo, Egypt, in 2008 and 2011, respectively. From 2008 to 2011, he was a Teaching and Research Assistant with the Faculty of Engineering, Cairo University. Since 2012, he started the Ph.D. program and joined Analog and Mixed Signal Center, Texas A&M University. In summer 2013, he was a Design Intern with RFIC team of Nvidia, Richardson, TX. In 2014, he was a Design Intern with the RFIC team of Qualcomm, San Diego, CA, USA. His research interests include energy harvesting front ends, power amplifiers, power management ICs, battery charging systems and wireless transceiver systems.