0.5-Gram Dual-Frequency Low Power Rectenna

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Wireless power harvesting has been gaining market momentum and thought to be a good method to power or charge low-powered and/or low duty-cycle, embedded sensors for "internet-of-things" and active RFID applications.

A printed Yagi-Uda antenna array is demonstrated for ultra-low power duel-frequency wireless power harvesting. The ISM bands of 915 MHz and 2.45 GHz are targeted for power harvesting due to the abundant use and therefore non-negligible incident power densities. Above 50% RF-DC conversion efficiency is measured for the 2.45 GHz band and 45% RF-DC conversion efficiency us measured for the 915 MHz ISM band using the same rectenna element at an incident power density of 1 uW/cm^2. The entirety of the wireless energy harvester weighs 0.5 grams, is flexible, and has only two lumped elements; a capacitor and a Schottky diode.

A novel rectenna design is presented using a balanced feed, DC bias/feed line, and the bypass capacitor value to match the Yagi-Uda array to the diode at two frequencies to maximize power transfer and both frequencies. The diode impedance was found at each frequency using load pull simulations in AWR Microwave Office. The Yagi-Uda array antenna parameters were found using an ANSYS HFSS full wave simulator. The rectenna gain and RF-DC conversion efficiency was measured in an anechoic chamber as well as independently at the 2013 International Microwave Symposium in Seattle, Washington in an active RF environment such as a conference hall. The results from each environment will be presented.