SINGLE-DIODE RECTENNAS WITH HIGH CONVERSION EFFICIENCIES AT VERY LOW INCIDENT POWER DENSITIES

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This paper presents an overview of several rectennas operating in the 900MHz, 2GHz and 2.4GHz bands, fabricated on either flexible or extremely light-weight substrates and maximized for high efficiency at incident power levels on the order of 1μW/cm^2. All of the rectennas use a single low-cost Schottky diode in order to minimize complexity, weight, part count and maximize efficiency at low power.

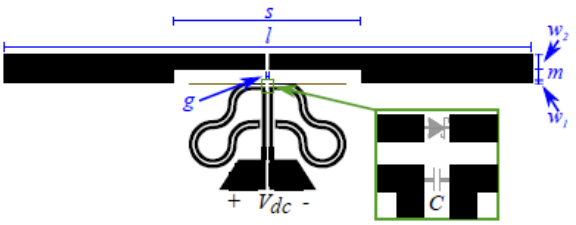
Some examples, referring to the figure below, include:

a) A 900-MHz flexible folded dipole rectenna with 2.7 dB RF-to-DC conversion loss and mass of only 2 grams. The rectification efficiency is improved by harmonic terminations resulting in class-F waveform shaping achieving an estimated efficiency of 53% efficiency at 8μW/cm^2 incident power density.

b) A 2.45-GHz rectangular patch antenna 58 x 10 mm^2 in area, and 3mm thick, with a minimized ground plane and a foam substrate. The rectenna achieves a gain of 7.2dB and an efficiency of 30 % at 1μW/cm^2 incident power density into an optimal load of about 1kΩ.

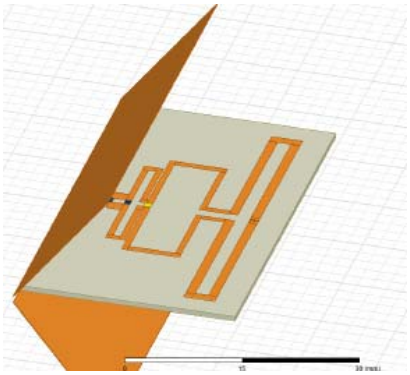
c) A 2.45-GHz printed folded-dipole Yagi antenna with a non-orthogonal reflector which demonstrates 60% conversion efficiency at 1μW/cm^2.

d) A dual-frequency 915-MHz and 2.4-GHz Yagi antenna fabricated on a flexible substrate with a mass of only 0.5 grams, and an efficiency of over 40% at 1μW/cm^2 incident power density with a DC load of 2.2kΩ.

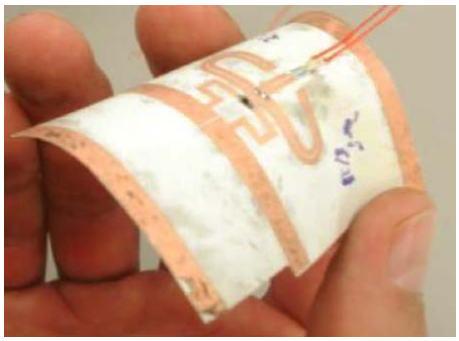


(a)

(b)



(c)



(d)