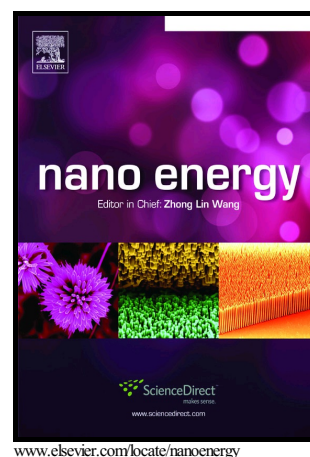


Fully Printed 3D Cube-Shaped Multiband Fractal Rectenna for Ambient RF Energy Harvesting

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PII: S2211-2855(18)30666-9
DOI: <https://doi.org/10.1016/j.nanoen.2018.09.022>
Reference: NANOEN3027

To appear in: *Nano Energy*

Received date: 3 August 2018
Revised date: 5 September 2018
Accepted date: 10 September 2018

Cite this article as: Azamat Bakytbekov, Thang Q. Nguyen, Cuong Huynh, Khaled N. Salama and Atif Shamim, Fully Printed 3D Cube-Shaped Multiband Fractal Rectenna for Ambient RF Energy Harvesting, *Nano Energy*, <https://doi.org/10.1016/j.nanoen.2018.09.022>

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Fully Printed 3D Cube-Shaped Multiband Fractal Rectenna for Ambient RF Energy Harvesting

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Abstract

The Internet of Things (IoT) is an emerging paradigm that requires billions of wirelessly connected devices in a complex radio-frequency (RF) environment. With such a huge number of devices in this scenario, recharging or replacing batteries becomes impractical. Therefore, powering IoT devices by harvesting energy from ambient sources, such as that available in the RF spectrum, is an attractive solution. The antenna for the RF energy harvester must work on multiple bands to capture as much power as possible. This paper presents a fully printed 3D cube triple band Cantor fractal rectenna based on the system-on-package (SoP) concept; the antenna is realized on the package that houses a rectifier circuit and a multiband matching network. The combination of additive manufacturing and SoP ensures a lower cost and the efficient use of available space. The rectenna harvests RF power from GSM900, GSM1800, and 3G 2.1 GHz frequency bands. Field tests of the RF energy harvester conducted in a real ambient environment confirm that up to 200 mV output voltage can be harvested. Also, 550 mV is harvested when the rectenna is near a smartphone during a live phone call. The promising results and lower cost make this design a suitable candidate to power IoT devices.

Graphical abstract

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