

The very idea: Kitchen gadgets powered by microwave leaks

September 22 2013, by Nancy Owano

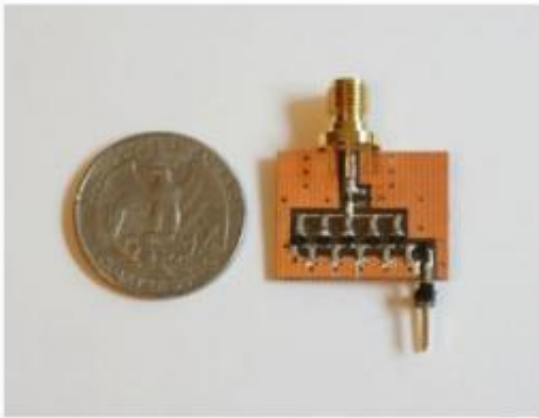


Figure 5. 2.4 GHz rectifier fabricated on FRP4 board (Type A).



Figure 6. Measurement setup.

Credit: Yoshihiro Kawahara et al.

(Phys.org) —Can your microwave oven power other gadgets in your kitchen? That is the question explored in the paper, "Power Harvesting from Microwave Oven Electromagnetic Leakage," by researchers from the University of Tokyo in Tokyo and Georgia Institute of Technology in Atlanta. They presented their work at the Conference on Ubiquitous Computing in Zurich earlier this month. "In this paper," said Yoshihiro Kawahara, an associate professor in the field of ubiquitous computing at the University of Tokyo. and colleagues, "we present the feasibility of harvesting and storing a small amount of leaked energy from a

microwave oven and operate low-power devices without battery in a domestic environment."

Their experiment actually did show that it was possible to [harness energy](#) from the microwave and use it for other appliances. "Our experimental results showed that the leakage received by a [dipole antenna](#) was about 0 dBm (1 mW) at a point 5 cm in front of the door. A rectenna consisting of a dipole antenna and charge pump can convert the leaked [microwave energy](#) into a DC current. When a microwave oven is operated for 2 min, 9.98 mJ of energy was harvested."

[A [rectenna](#) is an antenna which is used to convert microwave energy into direct current electricity.]

They demonstrated that this energy was enough. They said, "The energy accumulated over 2 min was found to be sufficient for the operation of some of low-power kitchen tools for a few minutes and operate wireless [sensor node](#) for 2.5 hours."

Reporting on their work, *Scientific American* noted that "A microwave oven uses a device called a magnetron to generate [electromagnetic](#) waves with a wavelength of 12.5 centimeters and a frequency of 2.4 gigahertz – enough for vibrating [water molecules](#) to heat food. Although a waveguide delivers the microwaves into the food chamber some still escape through the gap around the oven door and through the metal-meshed window."

In the bigger picture of power consumption today, the authors noted that, because of the reduced power consumption of electronics devices, quite a few battery-operated devices such as kitchen tools only consume a few dozen microwatts. The reduced power requirements are accelerating power harvesting from various ambient energy, they wrote. "As energy efficiency continues to improve, the energy requirements to power

electronic devices will continue to drop; this in turn means it is feasible to power more devices by a small amount of energy of about a few dozen microwatts."

Authors of the paper are Yoshihiro Kawahara, Xiaoying Bian, Ryo Shigeta, Rushi Vyas, Manos M. Tentzeris and Tohru Asami. The paper appears in UbiComp 13 Proceedings of the 2013 ACM International Joint Conference on Pervasive and Ubiquitous Computing.

More information: Power harvesting from microwave oven electromagnetic leakage: dl.acm.org/citation.cfm?id=2493500
www.ubicomp.org/ubicomp2013/program.php
www.newscientist.com/article/d...kitchen-gadgets.html

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