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RF harvesting from ambient sources

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Researchers at Intel, Seattle, have demonstrated harvesting RF power from a TV transmission tower to power a commercially available thermometer/hygrometer with LCD display. From a balcony at the Intel Research Laboratory in Seattle the researchers harvested RF power from the KING-TV tower at a distance of 4.1km using a standard television aerial. With the antenna manually pointed toward the transmission tower, the ambient RF harvesting system was then attached to the battery terminals of a commercially available indoor/outdoor temperature and humidity meter with an LCD display which is normally powered by a 1.5V AAA battery. The researchers found that the device function was normal using power harvested from the tower and that the display was as good as when the system was powered by a battery. The voltage was found to drop when the antenna was directed away from the tower.

With a different approach of deliberately sending out an interrogatory signal, Intel researchers have demonstrated the WISP (Wireless Identification and Sensing Platform). WISPs are not really energy harvesting because they do not employ preexisting ambient energy. They have the capabilities of RFID tags, but also support sensing and computing. Like any passive RFID tag, WISP is powered and read by a standard off-the-shelf RFID reader, harvesting the power it uses from the reader's emitted radio signals. WISPs have been used to sense quantities such as light, temperature, acceleration, strain, liquid level, and to investigate embedded security. Intel predicts the next phase of WISP work will involve the interaction of many WISPs resulting in a new battery-free form of wireless sensor networking. With RFID technology, the tag and the tag reader have to be in very close proximity but with the technique described above the weather station can get its power from a TV antenna pointed at a local TV station antenna that is 4km away.

Powercast has also developed so called Powerharvester Modules which are high efficiency RF energy harvesting devices that convert received RF energy into DC power. Powercast is a radio frequency that is transmitted over a small area, and its energy is harvested wirelessly to power to small devices like cell phones. A feature of the receiver is that, while the transmitter is highly focused in the power range it broadcasts (either in the 900MHz or 2.4GHz bands); the receiver can pick up and convert any RF energy regardless of frequency. Batteries or other energy storage devices can be recharged in close proximity or remotely, or low power devices can be driven directly from the received power.

RF harvesting from ambient sources has great potential to impact on the cellular phone industry and the portable electronic device industry as a whole.

Top image: Intel's demonstration aerial and thermometer/hygrometer. Source: Crunchgear

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