Sandia National Laboratories

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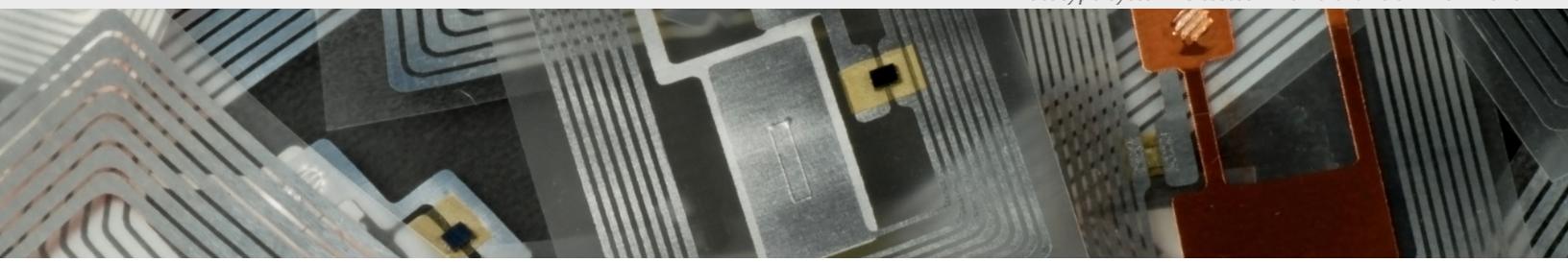
ZERO-POWER RADIO RECEIVER

U.S. Patent No. U.S. 7,397,301; 8,687,674, Additional Patents Pending
Technology Readiness Level: 6

Prototype system is tested in a relevant environment



Sandia has developed a miniature, zero-power radio receiver that can be easily integrated in a wide range of devices to provide continuous wireless connectivity. The underlying principle behind the Zero-Power Receiver is that the powered radio frequency electronics that are used in most wireless receivers can be replaced with electronics that require no power supply or battery. Using this technology, a short range radio receiver (< 100m) can be built that uses no power other than the received RF signal. A longer range radio receiver can also be built that uses only DC amplification, for a total power consumption that is about 10,000x lower than a conventional radio receiver operating at a comparable range.

The Zero-Power Receiver directly demodulates an amplitude modulated wake-up signal sent from a transmitter. The amplitude modulation can be sent using pulse coding to provide a unique device selective turn-on signal to the Zero-Power Receiver. It uses Sandia's patented pyroelectric demodulator to provide direct RF-to-baseband conversion over a wide RF input frequency range and modulation bandwidths. The input impedance of the pyroelectric demodulator provides a match to 50 Ohm circuitry over a very wide bandwidth, ultimately only limited by the electronics packaging that contains the device.

This technology solves multiple communication issues. When incorporated into a cellular phone or GPS, it eliminates the need for the device to constantly power on and off waiting for contact—greatly extending battery life. It can also greatly increase range and decrease size of currently available RFIDs.

TECHNOLOGICAL BENEFITS

- Completely unpowered operation for short range receivers
- Ultra-low power for long range receivers
- Extremely wide input bandwidth

POTENTIAL APPLICATIONS

- Cellular devices
- Wearable electronics
- Home automation
- Automotive control & sensing
- Biomedical devices
- Wireless RFID tags
- Animal tracking studies
- National security

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