Purely Passive Radio-Frequency Identification

Innovative RF thermoelectric generator enables long-distance RFID without a power supply

This innovation leverages a radio frequency (RF) thermoelectric generator to demonstrate a possible pathway to purely passive radio-frequency identification (RFID) tags that could accommodate distances greater than 100 meters. A thermodynamic analysis on RF-to-DC (direct current) energy conversion indicates that state-of-the-art energy harvesting circuitry is not operating anywhere close to the fundamental physical limits of these processes. At low RF voltage and power levels, this solid-state RF thermoelectric generator (RFTG) device is predicted to outperform conventional circuits at 915 megahertz, with efficiency and output voltage for RF inputs of -30 decibel-milliwatts or less.

This Georgia Tech RFTG illustrates the benefits of considering RF energy harvesting techniques that are not all-electrical in nature. In an age of limitless nanotechnological devices and micro-electromechanical machines (MEMS), other unconventional forms of RF-to-DC conversion with non-electrical intermediary forms may exist that have similar benefits to the RFTG.

Summary Bullets

- **Powerfu**l: Projected to support energy harvesting sensors at distances over 100 meters from readers and/or radio transmission sources
- **Efficient**: Enables conversion of RF energy at higher efficiency and at higher output voltages than current electronic energy harvesting methods
- **Widely applicable**: May advance RFID applications in a wide range of fields including computing, sensing, and communication

Solution Advantages

- **Powerfu**l: Projected to support energy harvesting sensors at distances over 100 meters from readers and/or radio transmission sources
- **Efficient**: Enables conversion of RF energy at higher efficiency and at higher output voltages than current electronic energy harvesting methods
- **Widely applicable**: May advance RFID applications in a wide range of fields including computing, sensing, and communication

Potential Commercial Applications

- Internet of Things devices and systems
- Energy harvesting electronics
- Wireless sensors

Background and More Information

Despite recent gains in turn-on sensitivity, passive RFID tags are approaching fundamental limits imposed by diode conversion of RF-to-DC power. The overall paradigm of RF harvesting for RFID – electrical rectification using low-threshold diodes and transistors – has not changed over recent decades. An RF-to-thermal-to-DC energy conversion process, however, can be shown to outperform existing diode conversion techniques at very low power levels. This Georgia Tech RFTG leverages the inherent scalability of thermoelectric generation devices and has demonstrated significant voltage gain during the conversion process.

Inventors

- Dr. Gregory Durgin
  Assistant Professor - Georgia Tech School of Electrical and Computer Engineering

IP Status

: 62/453,036

Publications

, -

Images

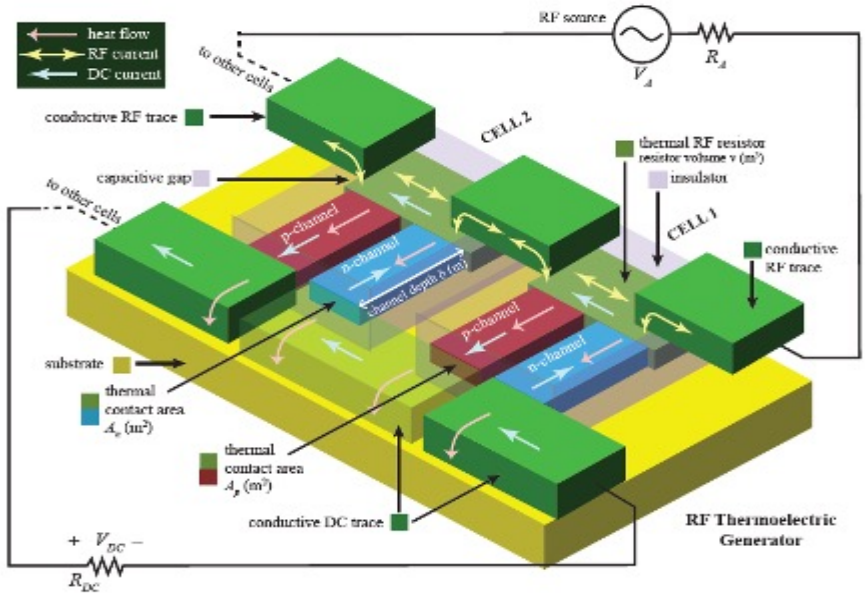

Diagram of the two-cell RF thermoelectric generator.

Visit the Technology here:
Purely Passive Radio-Frequency Identification
