Docket #: S17-403

RF-Ultrasound Relay for Wireless Power and Signaling to Implanted Devices

Researchers in Prof. Amin Arbabian's laboratory have developed a modular RF-Ultrasound architecture to download data, upload data or wirelessly charge devices implanted deep in the body. With this system, an exterior RF power unit transmits signal to an internal RF transceiver which then converts the energy to ultrasound that can propagate deeply into tissue with lower loss than electromagnetic energy. This platform could deliver data as well as generate power to a wireless node via piezoelectric materials. With appropriate tuning, this system could efficiently transmit a focused beam of ultrasound to a deeply situated implant without wires or batteries. In addition, the platform could be used in Internet of Things (IoT) applications.

Overview of using ultrasound technology to signal and power microsized implants inside the body.

Stage of Research
The inventors have begun to implement the technology with theoretical calculations, simulations and measurements.

Applications

- **Implanted medical devices** such as simulators, sensors or drug delivery devices
- **Internet of things (IoT)** devices

Advantages

- **RF can transmit energy and data,** providing power and communication
- **Adds degree of freedom** - radio frequency can be tuned to match ultrasound transducer to adjust to varying conditions
- **Modular system** - single RF-ultrasound platform can be adapted for a variety of applications implemented by specific devices
- **Advantages of ultrasound-based wireless power:**
  - no intrusive batteries or wires
  - ultrasound is known to be safe and effective
  - can be focused to specific location in the body

Publications

- How implants powered by ultrasound can help monitor health *Stanford Engineering* Dec. 4, 2017

Patents

- Published Application: 20200257136
- Issued: 11,601,019 (USA)

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