Title

Stacked Metamaterial Based Wireless Power Transfer System for Biomedical Implant Applications

Abstract

Achieving a high-efficiency wireless power transfer (WPT) to a compact biomedical implant is quite challenging. Generally, when using a compact receiver (RX), most of the generated magnetic flux by the transmitter (TX) is wasted in the body tissue leading to a degraded efficiency as well as the risk of unnecessary exposure to electromagnetic fields. A new type of metamaterial is proposed for near-field focusing. This metamaterial is stacked in a three-dimensional configuration to achieve high transfer efficiency to a compact WPT-RX and operate within the safety level defined by specific absorption rate (SAR) standards. The resulting system promises the elimination of the need for a bulky battery, and it is replaced by a tiny rechargeable battery, which reduces the health hazards.

Adel Barakat received the B.Sc. degree from Mansoura University, Mansoura, Egypt, and the MSc. and Ph.D. degrees from Egypt-Japan University of Science and Technology (E-JUST), Alexandria, Egypt in 2008, 2012, and 2015, respectively, all in electronics and communications engineering. He attended the Graduate School of Information Science and Electrical Engineering, Kyushu University, Fukuoka, Japan as a special research student as a part of his Ph.D. program at E-JUST. He worked at Microstrip Circuits Department, Electronics Research Institute, Giza, Egypt from February 2009 to September 2015. He joined Kyushu University, Fukuoka, Japan in October 2015, where he has been an assistant professor since March 2021. His current research interests are in the fields of low-cost CMOS components and systems for millimeter-wave and terahertz applications, and compact metamaterial-inspired wireless power transfer systems for biomedical implants.

Dr. Barakat was a recipient of the Egyptian Government Scholarship from February 2010 to February 2015, the prestigious JSPS postdoctoral fellowship of the Japanese government from April 2019 to February 2021, and the Best Student Paper Award at the 2012 Japan-Egypt Conference in Electronics, Communications, and Computing.