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Abstract

The energy harvesting technique can be used to collect ambient energy and convert it into electric power. This technique is continuously improved and was used to harvest energy from the environment in alternative energy sources. Recently, various wireless electronic devices radiate electromagnetic waves but with low power. The radio-frequency (RF) shows some significant energy losses leading to trends of improving the rectenna to harvest the low-power energy from this range in the environment. The objectives of this project are to design the Quad-band bowtie antennas that capture the RF energy from the ambient surrounding for four difference frequencies: 0.9, 1.8, 2.1, and 2.45 GHz, to optimize the conditions and parameters for providing efficient energy transformations by using MATLAB program, and to rectify the signal by turning alternating current into direct current. The multi-operating frequencies are obtained by inserting slots on a bow-tie antenna without increasing the overall antenna area. Finally, the designed slotted bowtie antennas were connected to the complex circuits, which contain two designed dual-band matching network circuits and two four-stage rectifiers. The rectenna efficiency is simulated over frequency for different input power levels (316 nW to 0.3 mW). The result shows that the designed rectenna operates specifically at four different frequencies and yields a higher efficiency with larger input power levels at the maximum efficiency of 49.5 % at 0.1 mW. This work provides a better understanding of the circuit design of low-power energy harvesting that will be useful for energy harvesting technologies in the near future.

Keywords: Low power energy harvesting, antenna, radio frequency

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