

ABSTRACT

The need for flexible and environmentally friendly energy sources is becoming increasingly urgent as the demand for lighting grows in various regions, especially in areas with limited access to electricity and unstable power quality. The reliance of Light Emitting Diode (LED) lights on conventional power sources is the main obstacle to the utilization of LED lights, compounded by the environmental impact of fossil fuel-based power plants. The primary issue in this research is how to design and implement an efficient antenna-based Wireless Power Transfer (WPT) system to power LED lights stably without cables.

The solution offered in this study is the design of a rectenna system consisting of a microstrip antenna as an RF signal receiver and a rectifier circuit to convert electromagnetic waves into DC current. This system is designed to operate at frequencies ranging from 1.8 GHz to 2.4 GHz with the aim of improving the efficiency of electromagnetic wave reception, optimizing the antenna design for adequate gain and low return loss, and ensuring the manufacturability of the system. The rectifier circuit is designed in stages using Schottky diode components for efficient signal rectification at high frequencies.

The antenna simulation results show a return loss of -16.423 dB at a frequency of 1.8 GHz and -15.695 dB at a frequency of 2.4 GHz, as well as a gain of 2.076 dBi at a frequency of 1.8 GHz and 2.007 dBi at a frequency of 2.4 GHz, which meet the specifications. However, the antenna realization results show a decrease in gain to 1.7131 dBi at a frequency of 1.8 GHz and 1.6913 dBi at a frequency of 2.4 GHz, as well as a change in polarization from linear to elliptical. Rectenna testing demonstrated the ability to generate output voltage; however, it was insufficient to power the LED stably due to limitations in the rectifier diodes within the rectifier circuit. Therefore, the system has potential for wireless power transfer applications for LED lighting; however, further optimization of the rectifier circuit design is required to ensure the output meets the load requirements.

Keywords: Antenna, LED, Rectifier, Rectenna, Wireless Power Transfer