

## Rectifier for RF energy harvesting using stub matching

I. Adam<sup>1</sup>, M. N. M. Yasin<sup>2</sup>, M. E. A. Aziz<sup>3</sup> and Sulaiman M. I.<sup>4</sup>

<sup>1</sup>Bioelectromagnetics Research Group (BioEM), Malaysia

<sup>2</sup>School of Computer and Communication Engineering, Universiti Malaysia, Malaysia

<sup>3</sup>School of Microelectronic Engineering, Universiti Malaysia, Malaysia

<sup>4</sup>Universiti Kuala Lumpur & British Malaysia Institute, Malaysia

### Article Info

#### Article history:

Received Oct 1, 2018

Revised Dec 10, 2018

Accepted Dec 25, 2018

#### Keywords:

Dickson Multiplier  
Energy Harvesting  
Stub Matching

### ABSTRACT

One of challenge in rectenna design is the impedance matching of the antenna to the rectifier load. Rectifier exhibits complex impedance while antennas are normally designed to match either  $50 \Omega$  or  $75 \Omega$  loads. For the optimum power transfer between antenna and the rectifier circuit, both impedances should be matched. This paper presents the design and development of the 7-stages Dickson multiplier in energy harvesting. The objective of this paper is to analyze the performance of the designed multiplier together with matching circuit. An improvement of 60% output voltage is achieved by feeding  $-30\text{dBm}$  of low input power at the multiplier circuit.

Copyright © 2019 Institute of Advanced Engineering and Science.  
All rights reserved.

### Corresponding Author:

I. Adam,  
School of Computer and Communication Engineering,  
Universiti Malaysia Perlis, Malaysia.  
02600 Arau, Perlis.  
Email: ismahayati@unimap.edu.my

## 1. INTRODUCTION

Energy harvesting has been topic of interest by many researchers' years before as world are looking for renewable energy to replace current energy source [1]-[10]. Radio frequency (RF) became a more popular source in harvesting energy for its availability and easy scavenging system compared to others source such as wind, solar, vibration, piezoelectric and thermal. All this source are far beyond our control, for example thermal needs heat, solar requires light present and vibration needs motion [7].

RF energy can be harvested either from ambient or from dedicated source. A device designed to collect the electromagnetic energy in the free space and transform into direct current (DC) is called rectenna. Figure 1 shows general block of rectenna where it is basically a combination of rectifier and antenna. Matching circuit is applied between the antenna and the rectifier circuit.



Figure 1. General block diagram of Rectenna