

## DESIGN AND ANALYSIS OF A HIGH PERFORMANCE 915 MHz RF RECTIFIER WITH ENHANCED POWER CONVERSION EFFICIENCY FOR AMBIENT ENERGY HARVESTING IN WIRELESS SENSOR NETWORKS

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### ABSTRACT

Wireless Sensor Networks find their applications in places where it is hard to keep, maintain and provide continuous power. The ambient radio energy turns out to be the best source of power as it is natural and sustainable and thus supports very long operation without the need for battery replacement. The presented work is a compact rectifier designed specifically for the 915 MHz band which is predominant in low power communication standards. The circuit is based on the arrangement of HSMS2850 Schottky diode which is selected for its fast response and low barrier features which are important for low-level energy extraction. The design is laid on FR4 substrate having a thickness of 1.6 mm and relative permittivity of 4.4. Rectifier matched excellently at the target band with a return loss of about minus sixty point five six one decibel. The output voltage remains constant under varying load conditions and the conversion efficiency reaches 76.703 percent at an input power of 0 dBm which is the maximum for this case. The results authenticate that the proposed circuitry is perfect for the wireless sensor platforms for the ambient radio fields method of powering the devices as it provides uninterrupted activity.

**Keywords:** *RF rectifier, Ambient energy harvesting, Wireless Sensor Networks, Power conversion efficiency, Schottky diode*

### 1. INTRODUCTION

Wireless sensor networks support real time monitoring in structural systems smart farming industrial control and home automation, yet many nodes rely on limited battery reserves that restrict long duration operation. Ambient radio fields present a consistent source of energy in modern communication environments and allow sensor nodes to function for long periods without manual maintenance. The 915 MHz band is very common within the field of industrial, scientific and medical applications, and, due to its stable propagation, it is considered suitable for energy harvesting. The rectifier's performance at this band relies upon precise impedance matching and the operation of the nonlinear element. Among the various diodes available, Schottky ones are the most popular due to their capability of low-voltage conduction and fast response to weak signals. The increasing deployment of wireless sensor networks has led to greater interest in sustainable power systems that reduce reliance on traditional batteries [1]. RF energy harvesting is a technology that serves this purpose by transforming electromagnetic fields that are otherwise unusable into usable power for devices with very low energy consumption [2]. Among various frequency bands, the 915 MHz ISM band is the most sought-after for its extensive usage and good propagation characteristics [1–4]. One of the major concerns, however, is to achieve high power conversion efficiency at low input which is the typical real world scenario. A very recent study has unveiled cutting-edge rectifier configurations, better matching networks and more efficient IC layouts all targeted towards increasing the overall